SEPTEMBER 2004

Comprehensive Everglades Restoration Plan

FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

PICAYUNE STRAND RESTORATION PROJECT

(formerly Southern Golden Gate Estates Ecosystem Restoration)

COLLIER COUNTY, FL



US Army Corps of Engineers®

Jacksonville District

South Atlantic Division

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COMPREHENSIVE EVERGLADES RESTORATION PLAN
PICAYUNE STRAND RESTORATION
(Formerly SOUTHERN GOLDEN GATE ESTATES ECOSYSTEM RESTORATION)
FINAL INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT

Lead Agency: The lead agency is the U.S. Army Corps of Engineers, Jacksonville District. South Florida Water Management District is the non Federal partner. This is a Comprehensive Everglades Restoration Program project.

Abstract: This Integrated Final Project Implementation Report and Environmental Impact Statement (PIR/EIS) documents the selection and recommendation, after public and agency coordination of the Draft PIR/EIS from May 14 through July 13, 2004, of Alternative 3D as the preferred plan for the restoration of Picayune Strand (SGGE) in Collier County, FL. The recommended plan would rehydrate a failed 1960's residential subdivision through land acquisition, blocking drainage canals, pumping to force overland flow, and building protective structures. Alternative 3D would replace the conveyance capacity of the existing 44 miles of canals with three pump stations at the north end of the Project Area, plugging the canals and removing 227 miles of roads. The pump and spreader canal system would provide drainage conveyance from Northern Golden Gate Estates and avoid adverse backwater effects. Protective levees are proposed around inhabited areas that would otherwise be susceptible to project induced water level increases. Expected project benefits include restoration of historic wetland communities, sheetflow towards the coastal estuaries, reduction of harmful surge flows through the Faka Union Canal into Faka Union Bay, improved freshwater overland flow and seepage into other bays of the Ten Thousand Islands Region, improved aquifer recharge, decreased frequency and intensity of forest fires, improved habitat for fish and wildlife and threatened and endangered species, reduced invasion of exotic species, and increased spatial extent of wetlands. The approximate cost estimate for this ecosystem restoration project is $349,422,000.

This final Report integrated the contents of an EIS with the project planning report, including as well an Operations Plan for the proposed structures and a long term Monitoring Plan to assure project ecosystem benefits are obtained. The project includes construction of the Tamiami Trail Culverts in the stretch of U.S. 41 between FL 92 and Big Cypress Preserve, a project previously documented in the Critical Project Program. The culverts will provide additional conveyance capacity under US 41 (Tamiami Trail) for the flows generated by the Picayune Strand Restoration.

THE OFFICIAL CLOSING DATE FOR THE RECEIPT OF COMMENT IS 30 DAYS FROM THE DATE ON WHICH THE NOTICE OF AVAILABILITY FOR THIS FINAL PIR & EIS APPEARS IN THE FEDERAL REGISTER.

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COMPREHENSIVE EVERGLADES RESTORATION PLAN
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FINAL
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SUMMARY

Purpose and Need for the Study

This recommended plan would lead to successful ecosystem restoration of the area of western Collier County, Florida, known as Picayune Strand. This location has also been known by the name of the failed residential development that greatly disturbed the area, Southern Golden Gate Estates (SGGE). This report presents the results of intensive problem identification, modeling, and alternatives analysis. A multi-agency team evaluated suites of components combined together to form alternatives, and has identified Alternative 3D as the recommended plan.

The Draft Integrated Project Implementation Report and Environmental Impact Statement for this project was titled "Southern Golden Gate Estates Ecosystem Restoration Plan." This Final report changes the name to Picayune Strand Restoration. The new name for the project refers to the name of the wetland complex that existed prior to human disturbance and the wetland complex that the project will restore. The old name referred to the disturbance factor rather than the significant environmental resource that would be restored.

The Picayune Strand Restoration Project encompasses an area of sensitive environmental land located in southwestern Collier County, Florida. It is located southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands National Wildlife Refuge, east of the South Belle Meade State Conservation and Recreation Lands (CARL) project, west of the Fakahatchee Strand State Preserve, and northeast of Collier-Seminole State Park. The South Belle Meade CARL project, known simply as "Belle Meade", and the SGGE CARL project have been combined by the State of Florida to form the Picayune Strand State Forest. The central location of the Project Area among all of these nature preserves and wildlife areas reflects its importance to the ecosystem connectivity of the entire region. The ecological condition of Project Area affects not only the immediate project area but also significant regional resources. The Picayune Strand project is a unique restoration opportunity. It is located in Collier County, one of the fastest growing counties

in the nation. The plans for the project would remove the infrastructure of a 55,247-acre subdivision and restore its pre-drainage hydrology and ecology. There are enormous environmental benefits to completing the project. The Picayune Strand Project Area, centered within surrounding affected public uplands and draining into affected portions of the Ten Thousand Islands estuary, makes up the largest restoration opportunity in southwest Florida. It offers one of the few locations in southern Florida where large areas of cypress forests can be restored. For future generations, the restoration of this part of Southwest Florida would tie all of these critical natural habitats together. Restoration of the Picayune Strand would generate positive effects on the hydrology, vegetation, and wildlife of the Project Area and surrounding public lands.

Golden Gate Estates (GGE) was planned as an extensive residential subdivision by Gulf American Corporation (GAC) beginning in the 1950s. GAC constructed roads and canals in the 1960s and early 1970s, but the residential development failed before many of the planned houses were built. These roads and four large canals have over-drained the area resulting in the reduction of aquifer recharge, greatly increased freshwater point source discharges to the receiving estuaries to the south, invasion by upland vegetation, loss of ecological connectivity and associated habitat, and increased frequency of forest fires. The construction of Interstate 75, also known as Alligator Alley, split the GGE subdivision in half forming Northern Golden Gate Estates (NGGE) and Southern Golden Gate Estates (SGGE).

Relationship of the CERP and the Picayune Strand Project

The "Central and Southern Florida Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement" (USACE 1999) presented a conceptual plan for the restoration of the Everglades. The overarching objective of this plan, known as the Comprehensive Everglades Restoration Plan (CERP), is the restoration, preservation, and protection of the South Florida ecosystem while providing for the other water-related needs of the region. The Water Resources Development Act (WRDA) of 2000 approved the CERP as a framework for modifications to the Central and southern Florida Project necessary to restore the South Florida ecosystem.

Initial screening efforts of the CERP revealed a pressing need to capture more water in south Florida to restore the Everglades, protect the estuaries, and to provide adequate water supply for urban and agricultural needs in the future. Due to its size and complexity, implementation of the CERP required that it be divided into smaller packages that are referred to as projects. Each project is

studied in a finer level of detail than was possible in the conceptual CERP report.

The *Water Resources Development Act* (WRDA) *of 2000* requires completion of a Project Implementation Report (PIR) prior to implementation of a CERP project. The PIR is a new type of reporting document. The PIR is similar to a traditional feasibility report, which addresses the project's economic and environmental benefits, engineering feasibility, and plan formulation and evaluation.

In addition, WRDA 2000 requires additional studies for a PIR not traditionally included in a feasibility report. These include the Savings Clause and the determination of water to be reserved for the natural system requirement. The Savings Clause requires that, "until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water…" The Savings Clause also requires that implementation of the plan will not reduce levels of service for flood protection that were in existence on date of enactment of WRDA 2000 (December 11, 2000) and in accordance with applicable law.

Additionally, Florida State Law, Chapter 373.470 (3)(c), Florida Statutes, requires the completion of a PIR prior to the South Florida Water Management District entering into a Project Cooperation Agreement with the U.S. Army Corps of Engineers. Chapter 373.026 (8)(b), of the Florida Statutes requires the South Florida Water Management District to submit a PIR to the Florida Department of Environmental Protection. Chapter 373.1501(5), Florida Statutes, requires the South Florida Water Management District to analyze and evaluate water supply, water quality, flood protection, threatened and endangered species, and other natural system and habitat needs and to determine that components of the Plan are feasible, efficient, cost-effective, and consistent with the purposes of the Comprehensive Everglades Restoration Plan (CERP).

Elements of the Recommended Plan

Alternative 3D, the recommended plan, has many similarities to the conceptual plan described in CERP. The concept was to construct a series of pump stations and spreader channels to slow water flowing through existing canals and distribute it across the landscape. This would serve to restore the wetland communities in Picayune Strand and improve the timing and volume of fresh water flows to the downstream estuaries of the Ten Thousand Islands Region.

Construct Spreader Channels and Pump Stations. Spreader channels and pump stations would be constructed together on the Miller, Faka Union, and Merritt Canals. Spreader channels would redirect the water from flowing southward within the canal to east and west directions perpendicular to the canal. As the water rises within the spreader channels, the water would overtop the southern, downstream bank of the channel and then flow over the land as sheet flow southward. The pump stations would ensure that the water would continue to flow southward and would prevent water from flowing back (north) to NGGE. The capacities of the pump stations, 1,250 cubic feet per second (cfs) at the Miller Canal, 2,630 cfs at the Faka Union Canal, and 800 cfs at the Merritt Canal, were designed to be large enough so that the spreader channels and other construction features would not reduce the drainage of NGGE that is provided by the canals. A 100 cfs pump station would be constructed for interior drainage at the private lands levee system.

Degrade Roads and Fill Ditches. Most of the roads in Picayune Strand are elevated six inches to a few feet higher than the surrounding ground. 260 of the 279 miles of roads would be graded to lower their elevations to the same level as the surrounding ground. 227 miles of these degraded roads would be abandoned and allowed to revegetate. Degrading the roads would greatly increase the sheet flow across the landscape because these roads act like small levees and are barriers to sheet flow. The roads and their associated drainage ditches and swales also redirect water back toward the canals. The non-asphalt materials from the degraded roads would be used to construct the canal plugs. The asphalt would be disposed or recycled in accordance with State regulations. The roads are habitat for invasive and exotic vegetation, particularly Brazilian pepper. The remaining roads would be used for ongoing land management actions by the Florida Division of Forestry. Some of the roads would be available to the public.

Construct Canal Plugs. Canal plugs would be placed south of the pump stations in the Miller, Faka Union, and Merritt Canals. Plugs also would be placed in the entire length of the Prairie Canal. The plugs would prevent the canals from transporting water southward to the estuaries. Once the water is no longer being conveyed, the canals would no longer over-drain the landscape and surface aquifer, and the entire area near the plugs would become much wetter for several months of the rainy season.

Flood Protection Levees. A total of five levee systems would be constructed around certain developed areas to prevent these areas from being flooded as a result of the plan. The levees would be constructed around the 6L agricultural area located at the western edge of the restored area, three Port of the Islands developments located at the southern end of the restored area, and

the private lands residential area in northern Belle Meade at the northwest edge of the restored area.

Culverts. Culverts would be placed in each of the levee systems to allow for interior drainage. Nine additional culverts would be placed under U.S. 41 to allow the water sheet flowing across the landscape to continue flowing southward to the estuaries of the Ten Thousand Islands Region.

Monitoring. Baseline, pre-construction monitoring of hydrology, vegetation, fish and wildlife, endangered and threatened species, oyster reefs, fish communities, and water quality would continue. These resources would also monitored during and after completion of construction. Monitoring would determine whether the benefits of the project are being achieved and support the adaptive assessment process.

Cost. The cost of construction and real estate for the tentatively recommended plan is estimated to be $349,422,000. Annual operation and maintenance is estimated to be $2,129,000. Annual monitoring is estimated to be $887,000.

Major Effects

- Over 55,000 acres in Picayune Strand would be ecologically restored
- Over 36,200 acres increase of wetland vegetation communities (cypress, marsh, wet prairie, and wet pine) in SGGE, compared to the future without project condition.
- 42 of the 48 miles of canals in SGGE would be plugged.
- 260 of the 279 miles of roads would be degraded, and 227 of the 260 would be allowed to revegetate naturally.
- An increase of over 29,000 hydrology habitat units and 11,800 biotic habitat units within SGGE, compared to the future without project condition.
- An additional increase of over 5,000 hydrology habitat units and 3,800 biotic habitat units in the lands adjacent to SGGE – Fakahatchee Strand State Preserve, Florida Panther National Wildlife Refuge, Belle Meade CARL, and Collier-Seminole State Park.
- Discharge of fresh water from the canal system into Faka Union Bay would be reduced from 35,300 acre feet per month to 8,300 acre feet per month during September, the peak of the wet season. This 76% reduction will greatly improve oyster reefs and open water fish habitat.
- An increase of 7.3 habitat units of oyster reef in three of the estuaries most affected by SGGE, a 1200% increase over the future without project condition.
- An increase of over 500 habitat units for open water fish in three of the estuaries most effected by SGGE, a 1400% increase over the future without project condition.

- The Federal and State preserves and parks surrounding SGGE would be linked and enhanced by the restored conditions within SGGE. The combined natural area would be able to function as one regional ecosystem. Currently, SGGE creates drainage and fire impacts to the adjacent lands and acts as a barrier to movement and growth of populations of plants and animals between the adjacent lands.

What is Expected to Happen Without the Recommended Plan?

If no restoration plan were implemented, the Picayune Strand ecosystem would continue to deteriorate. Over-drainage by the canals would continue. The vegetation communities would continue to adjust to the dry conditions and the severe and frequent fires. Cypress forests, marshes, wet prairies, and other wetland communities would continue to decline. The Florida Panther population would continue to avoid using the area. Palmetto, Sabal palm and Brazilian pepper would continue to expand throughout the area. Forest fires would continue to occur at rates much higher and intensities much greater than during pre-drainage conditions. Some of the over 19,000 parcels may become developed for residential use. This would likely prevent large-scale restoration efforts in the future. The existing roads would remain. Picayune Strand would continue to be heavily used by off-road vehicles. Illegal dumping would continue along many of the less-traveled roads. Estuaries downstream of Picayune Strand would continue to be stressed by the excessive quantities of fresh water delivered by the canal system.

Alternative Plans Considered

Twenty-two alternatives plans were considered during this study. These alternatives considered many combinations of pump station sizes and locations, adjustable Obermeyer Weirs on some canals, widening canals, and doing nothing to some canals. All but three, plus the No Action alternative, were removed from further consideration during three rounds of screening prior to the final detailed comparison. They were screened if they provided less than 50 percent of restoration to pre-drainage conditions, if they provided no reduction of the point source discharge of Faka Union Canal into Faka Union Bay and estuary, if the construction cost was very high relative to the other alternatives, and if they were not cost effective relative to the other alternatives. The alternatives that were retained for final analysis are the No Action Alternative, Alternative 3D (the recommended plan described above), Alternative 6 and Alternative 12. Under Alternative 6, Prairie Canal would be plugged along its entire length, and the southern one-third of the other three canals would be plugged. These canals would be unmodified north of the plugs. There would be no pump stations under Alternative 6. Under Alternative 12, Prairie Canal would be plugged. The Faka Union canal would receive a 2000 cfs pump station, a spreader channel, and

canal plugs starting immediately south of the spreader. The Merritt Canal would receive an 800 cfs pump station, a spreader channel, and canal plugs starting immediately south of the spreader. Miller Canal would receive a set of Obermeyer Weirs and a small 100 cfs pump station to provide a measure of restoration along the canal and provide conveyance during storm events. The pump stations and Obermeyer Weirs under Alternative 3D and 12 are able to maintain drainage in NGGE during storm events. Alternative 6 does not have these structural features to maintain conveyance through Picayune Strand, and as a result would induce higher water levels in NGGE during large, infrequent storm events.

Issues Raised by the Public and Agencies

The public has frequently raised three issues at various times during the study of SGGE. One is that since the canals that over-drain Picayune Strand (SGGE) also provide drainage to Northern Golden Gate Estates (NGGE) located north of Interstate 75, the residents of NGGE have expressed concern that the restoration of Picayune Strand (SGGE) may retard the drainage of NGGE and result in increased flooding within NGGE. The second, related concern is that the large pump stations have the capacity to draw down the water in the canals of NGGE and potentially increase drainage of existing wetlands in NGGE. The project delivery team has performed extensive hydrologic and hydraulic modeling and analysis of the area and the results are presented in the PIR. The recommended alternative, Alternative 3D, would maintain drainage in NGGE and would not result in any increased flooding or increased drainage.

A third issue raised by a portion of the public has been the extent of hunting and recreational off-road vehicles that would be allowed in Picayune Strand once the project has been constructed. People are concerned that degrading the roads and increasing water levels in Picayune Strand would reduce the opportunities for off-road vehicle use in the area. There would be fewer roads in the area after restoration, but there would still be public access. The Florida Division of Forestry (DOF) would be the manager of the land once the project has been turned over to SFWMD after construction is complete. The DOF management plan for the Picayune Strand State Forest would address a variety of potential outdoor recreational uses, such as hiking, horse riding, bird watching, hunting, and vehicle use.

Implementation Process

Successful implementation of a complex ecosystem restoration project such as Picayune Strand requires several steps. If the final report is approved at Federal and State levels, and authorized by Congress, then next step of the process is to prepare detailed designs and plans and specifications for

construction. It is expected that additional modeling will be performed to optimize the pump stations and refine the draft operating manual during this phase.

As soon as construction activities – pump stations, spreader channels, road degrading, canal plugs, levees, and culverts – are complete, ecosystem benefits to Picayune Strand and the adjacent public lands would occur. These benefits include reversing the excessive drainage of over 55,000 acres of ecologically diverse land, dramatically increasing the acreage of wetlands, reducing the frequency and intensity of wild fires, decreasing the abundance of exotic and invasive species, restoring the quantity and distribution of fresh water discharges to estuaries of the Ten Thousand Islands region, and improving the ecological connectivity among adjacent public preserves, refuges, and parks, all while maintaining drainage for the people of NGGE.

COMPREHENSIVE EVERGLADES RESTORATION PLAN
PICAYUNE STRAND RESTORATION
(FORMERLY SOUTHERN GOLDEN GATE ESTATES ECOSYSTEM RESTORATION)

FINAL
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Southern Golden Gate Estates Hydrologic Restoration Project
Prepared by the RECOVER Regional Evaluation and Water Quality Teams
March 3, 2004

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SECTION 1

STUDY PURPOSE AND NEED

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SECTION 1

STUDY PURPOSE AND NEED

1.1 INTRODUCTION

The Southern Golden Gate Estates (SGGE) Restoration Project encompasses an area of sensitive environmental land located in southwestern Collier County, Florida. It is located southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands National Wildlife Refuge, east of the South Belle Meade State Conservation and Recreation Lands (CARL) project, west of the Fakahatchee Strand State Preserve, and northeast of Collier-Seminole State Park. The South Belle Meade CARL project, known simply as "Belle Meade", and the SGGE Project Area have been combined by the State of Florida to form the Picayune Strand State Forest. The central location of the SGGE Project Area among all of these nature preserves and wildlife areas reflects its importance to the ecosystem connectivity of the entire region. The ecological condition of SGGE Project Area affects not only the immediate project area but also significant regional resources. The SGGE project is a unique restoration opportunity. It is located in Collier County, one of the fastest growing counties in the nation. The plans for the SGGE project will remove the infrastructure of a 55,247-acre subdivision and restore its pre-drainage hydrology and ecology. There are enormous environmental benefits to completing the SGGE project. The SGGE Project Area, surrounding affected public uplands, and the affected portions of the Ten Thousand Islands estuary make up the largest restoration opportunity in southwest Florida. For future generations, the restoration of this part of Southwest Florida needs one more piece of the puzzle that will tie all of these critical natural habitats together (Figure 1-1). Restoration of the SGGE Project Area will complete the puzzle and will generate positive effects on the hydrology, vegetation, and wildlife of the SGGE Project Area and surrounding public lands.

Golden Gate Estates (GGE) was planned as an extensive residential subdivision by Gulf American Corporation (GAC) beginning in the 1950s. GAC constructed roads and canals in the 1960s and early 1970s, but the residential development failed before many of the planned houses were built. These roads and canals have over-drained the area resulting in the reduction of aquifer recharge, increased freshwater shock load discharges to the receiving estuaries to the south, invasion by upland vegetation, loss of ecological connectivity and associated habitat, and increased frequency of forest fires. The construction of Interstate 75, also known as Alligator Alley, split the GGE subdivision in half forming Northern Golden Gate Estates (NGGE) and Southern Golden Gate Estates (SGGE) (Figure 1-2).

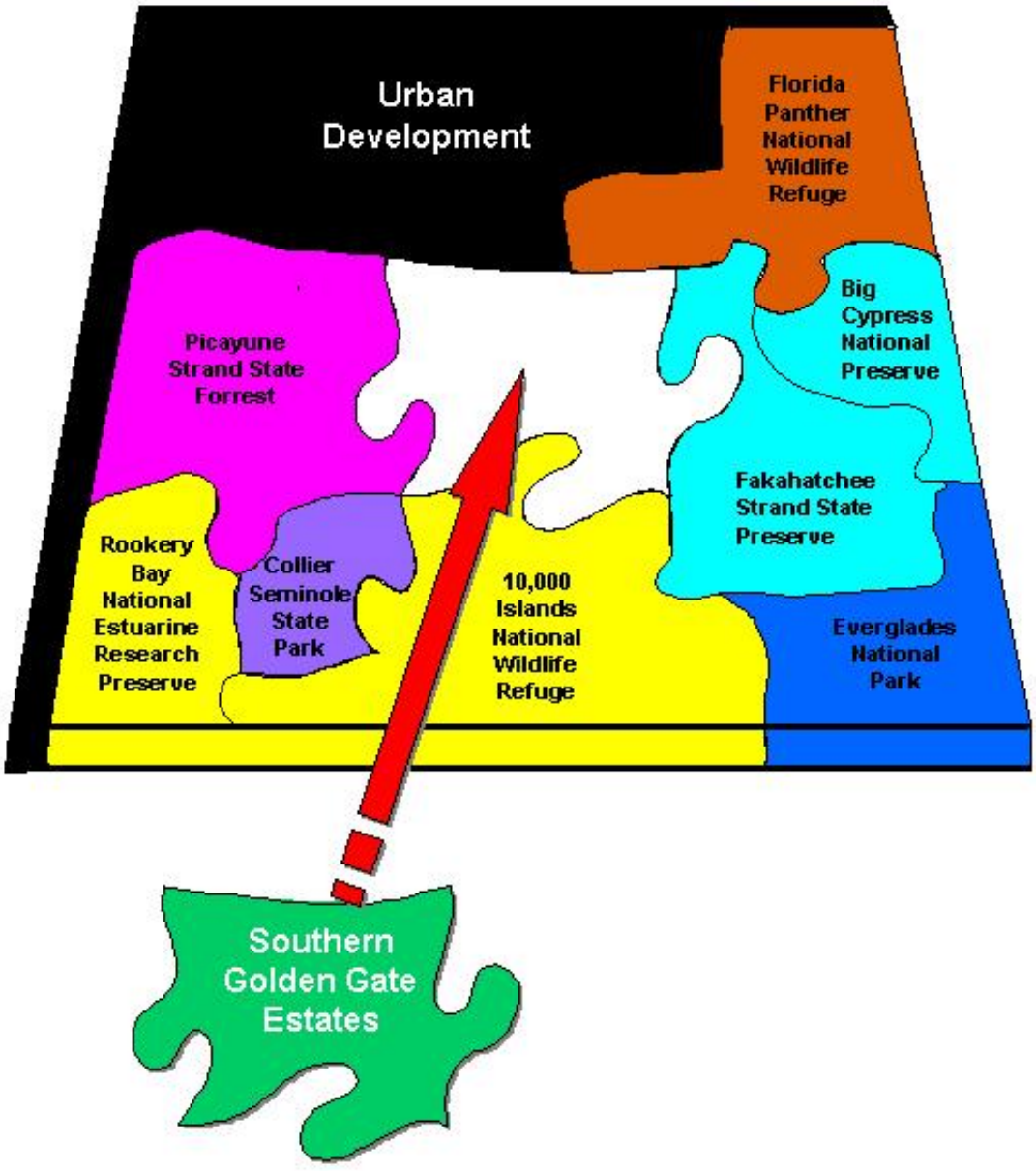

FIGURE 1 - 1 REGIONAL CONNECTIVITY PUZZLE MAP

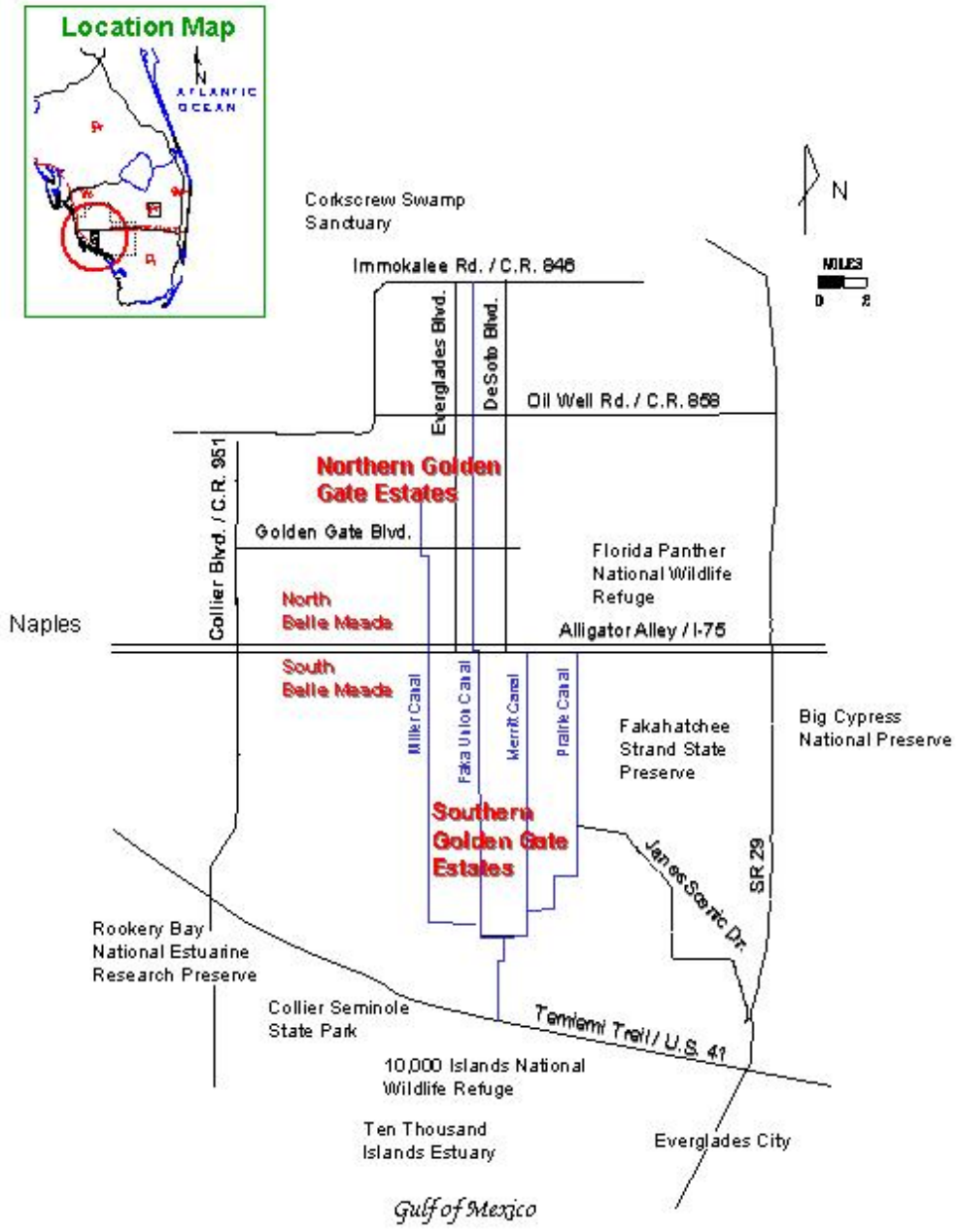

FIGURE 1 - 2 SGGE LOCATION MAP

The State of Florida in 1985 established the Southern Golden Gate Estates Conservation and Recreation Land (CARL) project. Land acquisition for this project began in 1985 by the Florida Department of Environmental Protection (FDEP). The Belle Meade CARL project and the SGGE CARL project were combined to form the Picayune Strand State Forest. Between 1985 and 1997, FDEP had acquired only 31% of the 55,247 acres in SGGE. Acquisition was accelerated beginning in early 1998 as a result of the settlement of a lawsuit, and after the receipt by FDEP of Federal funds from the Department of Interior pursuant to Section 390 of the Federal Agriculture Improvement and Reform Act of 1996 (also known as the "Farm Bill"). FDEP now has acquired almost 98% of the 55,247 acres in fee.

The *Water Resources Development Act* (WRDA) *of 2000* requires completion of a Project Implementation Report (PIR) prior to implementation of a Comprehensive Everglades Restoration Plan (CERP) project. The PIR is a new type of reporting document. The PIR is similar to the traditional feasibility report, which addresses the project's economic and environmental benefits, engineering feasibility, and plan formulation and evaluation. In addition, WRDA 2000 requires additional studies not traditionally included in a feasibility report. These include the Savings Clause and the determination of water to be reserved for the natural system requirement. These requirements specifically differentiate the PIR from traditional Corps of Engineers feasibility studies. The Savings Clause requires that, "until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water…" The Savings Clause also requires that implementation of the plan will not reduce levels of service for flood protection. Further, the identification of water to be reserved for the natural system is another WRDA requirement to be completed during the PIR planning phase.

Additionally, Florida State Law, Chapter 373.470 (3)(c), Florida Statutes, requires the completion of a PIR prior to the South Florida Water Management District entering into a Project Cooperation Agreement with the U.S. Army Corps of Engineers. Chapter 373.026 (8)(b), of the Florida Statutes requires the South Florida Water Management District to submit a PIR to the Florida Department of Environmental Protection for approval. Chapter 373.1501(5), Florida Statutes, requires the South Florida Water Management District to analyze and evaluate water supply, water quality, flood protection, threatened and endangered species, and other natural system and habitat needs and to determine that components of the Plan are feasible, efficient, cost-effective, and consistent with the purposes of the Comprehensive Everglades Restoration Plan (CERP), which is described in Subsections 1.2, Study Authority, and 1.4, Purpose and Scope.

1.2 STUDY AUTHORITY

Along with the C&SF Restudy, the SGGE Restoration PIR is authorized by *Section 309(l)* of the *Water Resources Development Act of 1992* (Public Law 102-580) which states:

> *"(1) CENTRAL AND SOUTHERN FLORIDA. -- The Chief of Engineers shall review the report of the Chief of Engineers on central and southern Florida, published as House Document 643; 80th Congress, 2nd Session, and other pertinent reports, with a view to determining whether modifications to the existing project are advisable at the present time due to significantly changed physical, biological, demographic, or economic conditions, with particular reference to modifying the project or its operation for improving the quality of the environment, improving protection of the aquifer, and improving the integrity, capability, and conservation of urban water supplies affected by the project or its operation."*

This study is also authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated September 24, 1992. The first resolution states:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, Eightieth Congress, Second Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply and other purposes."*

The second resolution states:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, Eightieth Congress, Second Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply and other purposes for Florida Bay, including a comprehensive, coordinated ecosystem study with hydrodynamic modeling of Florida Bay and its connections to the Everglades, the Gulf of Mexico, and the Florida Keys Coral Reef ecosystem."*

The *Water Resources Development Act of 1996* was enacted on October 12, 1996. *Section 528* of the Act (Public Law 104-303) entitled "Everglades and South Florida Ecosystem Restoration" authorizes a number of ecosystem restoration activities and also provides specific direction and guidance for the CERP.

(b) RESTORATION ACTIVITIES-

(1) COMPREHENSIVE PLAN-

(A) DEVELOPMENT-

(i) PURPOSE- The Secretary shall develop, as expeditiously as practicable, a proposed Comprehensive Plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem. The Comprehensive Plan shall provide for the protection of water quality in, and the reduction of the loss of fresh water from, the Everglades. The Comprehensive Plan shall include such features as are necessary to provide for the water-related needs of the region, including flood control, the enhancement of water supplies, and other objectives served by the Central and Southern Florida Project.

(ii) CONSIDERATIONS- The Comprehensive Plan shall—

(I) Be developed by the Secretary in cooperation with the non-Federal project sponsor and in consultation with the Task Force; and

(II) Consider the conceptual framework specified in the report titled "Conceptual Plan for the Central and Southern Florida Project Restudy," published by the Commission and approved by the Governor.

(B) SUBMISSION- Not later than July 1, 1999, the Secretary shall—

(i) Complete the feasibility phase of the Central and Southern Florida Project comprehensive review study as authorized by section 309(l) of the Water Resources Development Act of 1992 (106 Statue. 4844), and by two resolutions of the Committee on Public Works and Transportation of the House of Representatives, dated September 24, 1992; and

(ii) Submit to Congress the plan developed under subparagraph (A)(i) consisting of a feasibility report and a programmatic environmental impact statement covering the proposed Federal action set forth in the plan.

(C) ADDITIONAL STUDIES AND ANALYSES- Notwithstanding the completion of the feasibility report under subparagraph (B), the Secretary shall continue to conduct such studies and analyses as are necessary, consistent with subparagraph (A)(i).

Further, the *Water Resources Development Act of 1999* included specific language on the in-kind work accomplished by the local sponsor. *Section 208(d)(2)* of the *Water Resources Development Act of 1999* states:

> *(2) IN-KIND WORK –*
>
> *(A) IN GENERAL - During the pre-construction, engineering, and design phase and the construction phase of the Central and Southern Florida Project, the Secretary shall allow credit against the non-Federal share of the cost of activities described in subsection (b) for work performed by non-Federal interests at the request of the Secretary in furtherance of the design of features included in the comprehensive plan under that subsection.*
>
> *(B) AUDITS - In-kind work to be credited under subparagraph (A) shall be subject to audit.*

A design agreement to perform project engineering and design (PED) activities including adaptive assessment and monitoring in support of CERP was executed on May 12, 2000 between the U.S. Army Corps of Engineers (Corps) and South Florida Water Management District (SFWMD). This agreement provides for the SFWMD to receive in-kind credit for design work. A Master Program Management Plan (MPMP) for the CERP was executed on August 24, 2000, outlining the protocols and procedures by which project management plans for all projects included in the agreement would be completed. This document conforms to the guidance provided within the MPMP.

In *Section 601* of the *Water Resources Development Act of 2000* (PL 106-541), Congress approved the Central and Southern Florida (C&SF) Project Comprehensive Review Study Integrated Feasibility Report and Programmatic Environmental Impact Statement (known as the "Yellow Book"), which describes and outlines the Comprehensive Everglades Restoration Plan (CERP):

> *(b) Comprehensive Everglades Restoration Plan -*
>
> *(1) Approval -*
>
> *(A) IN GENERAL. —Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.*

Finally, WRDA 2000 requires that a PIR:

> *(4) PROJECT-SPECIFIC ASSURANCES-*
> *(A) PROJECT IMPLEMENTATION REPORTS-*
> *(i) IN GENERAL- The Secretary and the non-Federal sponsor shall develop project implementation reports in accordance with section 10.3.1 of the Plan.*
> *(ii) COORDINATION- In developing a project implementation report, the Secretary and the non-Federal sponsor shall coordinate with appropriate Federal, State, tribal, and local governments.*
> *(iii) REQUIREMENTS- A project implementation report shall--*
> *(I) be consistent with the Plan and the programmatic regulations promulgated under paragraph (3);*
> *(II) describe how each of the requirements stated in paragraph (3)(B) is satisfied;*
> *(III) comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);*
> *(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system;*
> *(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement, under State law, subclauses (IV) and (VI);*
> *(VI) comply with applicable water quality standards and applicable water quality permitting requirements under subsection (b)(2)(A)(ii);*
> *(VII) be based on the best available science; and*
> *(VIII) include an analysis concerning the cost-effectiveness and engineering feasibility of the project.*

1.3 STUDY PARTNERS

The South Florida Water Management District (SFWMD) is the non-Federal sponsor for this project. The Florida Department of Environmental Protection (FDEP), Florida Department of Forestry (DOF), The Natural Resources Conservation Service (NRCS), U. S. Fish and Wildlife Service (FWS), Florida Fish and Wildlife Conservation Commission (FFWCC), United States Geological Survey (USGS) and other state and local agencies are supportive of all efforts to restore Southern Golden Gate Estates.

During the 1999 legislative session, Florida lawmakers created Section 373.1501 of the Florida Statues and amended Section 373.026 of the Florida Statutes. Section 373.1501 of the Florida Statues provides a legislative finding that the

Comprehensive Plan is important for restoring the Everglades ecosystem and for sustaining the environment, economy, and social well being of south Florida. Its purpose is to facilitate and support the Comprehensive Plan through an approval process concurrent with Federal government review and congressional authorization. Further, this section ensures that all project components are implemented through appropriate processes and are consistent with the balanced policies and purposes of Chapter 373 of the Florida Statutes, specifically Section 373.026. Section 373.026 (8)(b) directs the Florida Department of Environmental Protection to collaborate with the SFWMD and to approve each project component, with or without amendments, within a specified period.

In the 2000 legislative session, the Florida Legislature created an act relating to Everglades restoration and funding, amending Section 215.22 of the Florida Statutes and creating Section 373.470 that is cited as the "Everglades Restoration Investment Act." The purpose of this act is to establish a full and equal partnership between the state and Federal governments for the implementation of the Comprehensive Plan. This act requires that a PIR be approved in accordance with Section 373.026 of the Florida Statutes before the SFWMD and the Corps execute a Project Cooperation Agreement.

1.4 PURPOSE AND SCOPE

1.4.1 Purpose

WRDA 2000, Section 601(h)(1) provides a statement of the purpose of CERP:

> *"The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure protection of water quality in, the reduction of loss of freshwater from, the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment."*

The 68 components of CERP were formulated so that the plan as a whole would achieve these objectives. Few, if any, of the individual components attempt to address all of the objectives of CERP.

Chapter 9 of the C&SF Project Comprehensive Review Study Book report has a description of objectives and features of each of the 68 components. The text for the SGGE project follows:

"*9.1.9.1 Southern Golden Gate Estates Restoration (OPE)*

This feature includes a combination of spreader channels, canal plugs, road removal and pump stations in the Western Basin and Big Cypress, Collier County, south of I-75 and north of U.S. 41 between the Belle Meade Area and the Fakahatchee Strand State Preserve.

The purpose of this feature is to restore and enhance the wetlands in Golden Gate Estates and in adjacent public lands by reducing over-drainage. Implementation of the restoration plan would also improve the water quality of coastal estuaries by moderating the large salinity fluctuations caused by freshwater point discharge of the Faka Union Canal. The plan would also aid in protecting the City of Naples' eastern Golden Gate well field by improving groundwater recharge." (page 9-26)

1.4.2 Planning Area

The Southern Golden Gate Estates (SGGE) "Planning Area" is defined as the extent of the 1,150 square mile Big Cypress Basin (BCB) hydrologic model plus the 98 square mile area of the Ten Thousand Islands estuary region that may be affected by the project hydrologic changes (Figure 1-3). These 1,248 square miles contain all or parts of various hydrologic basins, administrative units, state or federal preserves, and political jurisdictions. The "Planning Area" is the largest area looked at by the Project Delivery Team (PDT) for possible solutions to the SGGE ecosystem restoration.

1.4.3 Study Area

The SGGE "Study Area" is defined as that acreage which may be hydrologically or ecologically impacted directly, indirectly, or cumulatively by the physical construction of any particular alternative plan. The Study Area boundary includes SGGE, NGGE, South Belle Meade, North Belle Meade, Fakahatchee Strand State Preserve, Florida Panther National Wildlife Refuge, Collier Seminole State Park, and the Ten Thousand Islands National Wildlife Refuge (Figure 1-4). The Picayune Strand State Forest includes both South Belle Meade and SGGE.

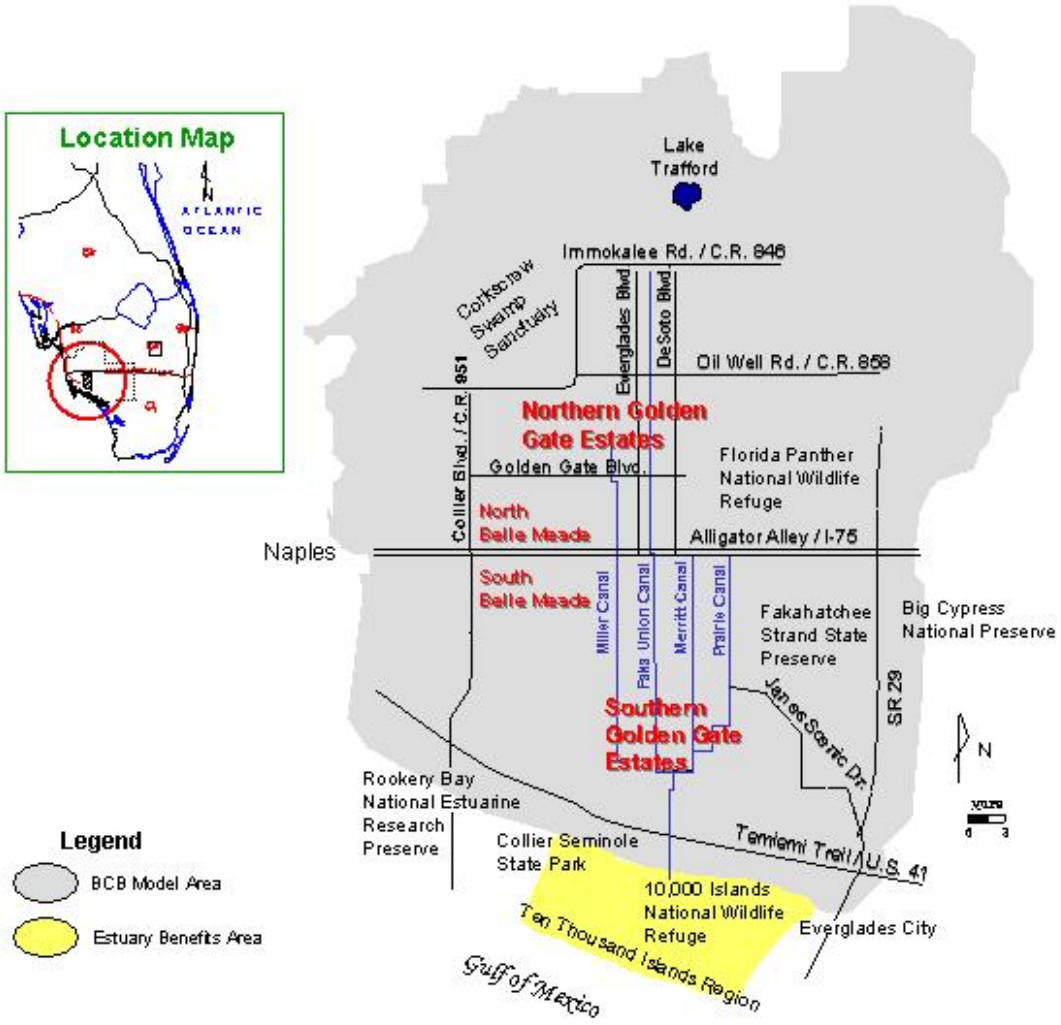

FIGURE 1 - 3 SGGE PLANNING AREA

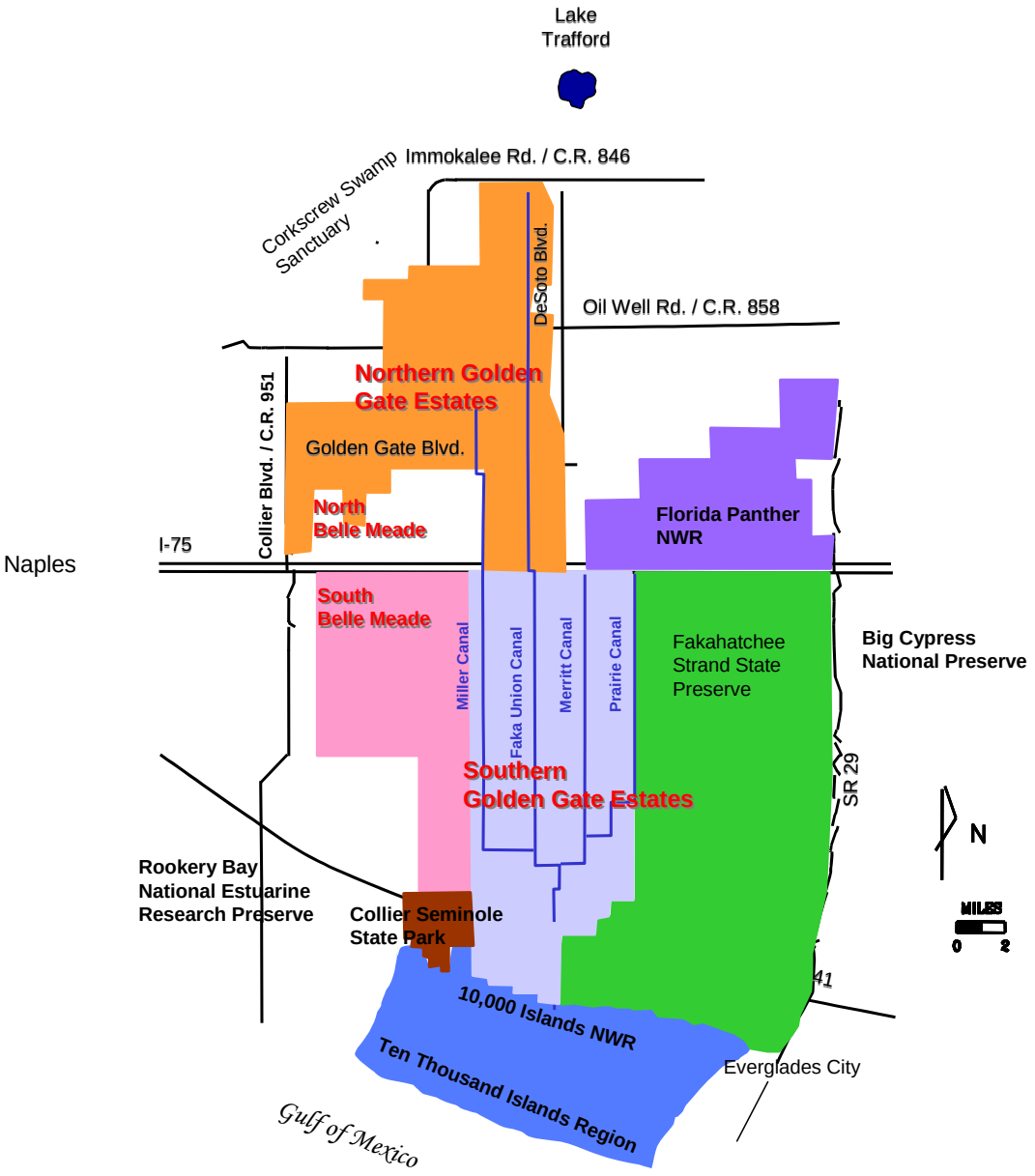

FIGURE 1 - 4 SGGE STUDY AREA

The Ten Thousand Island National Wildlife Refuge was established in December 1996 and is comprised of 35,000 acres located in Collier County located south of the SGGE Project Area and south of U.S. Highway 41. It is situated in the lower end of the Fakahatchee and Picayune Strands of Big Cypress Swamp. It has concentrations of wood storks and other wading birds, and many shorebirds. There is year round use by manatees and sea turtles. The Refuge is part of one of the largest expanses of mangrove estuary in North America. Approximately 8,000 acres is mangrove forest. There are 16,000 acres of marine habitat and 11,000 acres of freshwater marsh and other habitat. The estuaries are extensively used by interjurisdictional fisheries and is a renowned saltwater fishing area. Management tools include prescribed fire, exotic plant control through mechanical and chemical means, education/interpretation, law enforcement for resource protection and implementation of public use controls. Public use opportunities include fishing, hunting, wildlife observation, photography, a hiking trail and camping. The Refuge is also further protected throughout most of its area by the state, as the Cape Romano – Ten Thousand Islands Aquatic Preserve. There is much overlapping of jurisdictional boundaries between the Refuge and the Aquatic Preserve, and other administrative units. For this reason, for the purposes of this report, the Ten Thousand Islands estuary region which includes all or parts of the Ten Thousand Islands National Wildlife Refuge and the Cape Romano – Ten Thousand Islands Aquatic Preserve, as well as the Rookery Bay National Estuarine Research Reserve and the Rookery Bay Aquatic Preserve, is referred to as the "Ten Thousand Islands Region".

The Florida Panther National Wildlife Refuge was established in June 1989 and is comprised of 26,400 acres located northeast of the SGGE Project Area, north of Interstate 75. The Refuge is situated in the upper segment of the Fakahatchee Strand of the Big Cypress Swamp. Florida panthers den, hunt, and travel over the Refuge and 5-11 panthers use the Refuge over a given month. There are concentrations of various water birds and wading birds, including wood storks. There are concentrations of rare tropical orchids. The Refuge contains 15,000 acres of woodland and 11,400 acres of swamp and prairie. The Refuge is closed to general public use, though limited tours account for 500 annual visits. The Refuge provides optimum habitat conditions for the Florida panther, an endangered species. Management tools include prescribed fire, exotic plant control through mechanical and chemical means, education/interpretation and law enforcement. Public use opportunities include an interpretive trail and limited refuge tours.

The Collier-Seminole State Park is located southwest of the SGGE Project Area and is comprised of 6,430 acres which feature a wealth of vegetation and wildlife that is typical of the Everglades region of Florida. One special feature of the

park is a tropical hammock dominated by trees that are characteristic of coastal forests of the West Indies and the Yucatan peninsula. The rare Florida royal palm is a common species here. Much of the park is extensive mangrove swamp. Also found in the park are cypress swamps, salt marshes and pine flatwoods, which further add to the park's botanical diversity. Many species of wildlife have been seen in the park, including several of the state's threatened and endangered species. The brown pelican, wood stork, bald eagle, red-cockaded woodpecker, American crocodile, Florida black bear and Big Cypress fox squirrels are among the animals that make the park their home. The official state animal, the Florida panther, and the official state marine mammal, the West Indian manatee, may also be seen occasionally. Collier-Seminole is home to a 4,760 acre wilderness preserve located in the mangrove swamp. The preserve is a prime example of how this region looked before the arrival of the first European explorers. A limited number of visitors are allowed to visit the preserve each day by canoe. It is a 13.5-mile canoe trip to the preserve, which offers primitive camping for overnight stays.

The Fakahatchee Strand State Preserve is located east of the SGGE Project Area and lies adjacent to the western border of the Big Cypress National Preserve. The Strand's 74,000 acres are part of the main drainage slough of the Big Cypress Swamp. Although human actions have had a serious impact on the swamp, it is still one of the state's most unusual natural features. Its forest of mixed bald-cypresses, royal palms and abundant epiphytic plants is unique. The flow of water through the Fakahatchee Strand is essential to its continued health and that of the estuaries to the south of it. The natural values of the Fakahatchee Strand may be greater than those of any area of comparable size in the state of Florida. It contains the largest stand of native royal palms and largest concentration and variety of orchids in North America, as well as other species of plants that are extremely rare. The unusual wildlife of the Fakahatchee Strand includes some state and federally listed species. The Florida panther, wood stork, Florida black bear, Big Cypress fox squirrel and the Everglades mink have all been documented within the preserve area.

1.4.4 Project Area

The Project Area is defined as those 59,294 inland acres (approximately 93 sq mi) used in the MIKESHE model to define the extant of SGGE. This area includes the Conservation and Recreation Lands (CARL) north of US Highway 41. South of the highway, the Project Area includes the Port of the Isles development and a small portion of Ten Thousand Island National Wildlife Refuge (Figure 1-5).

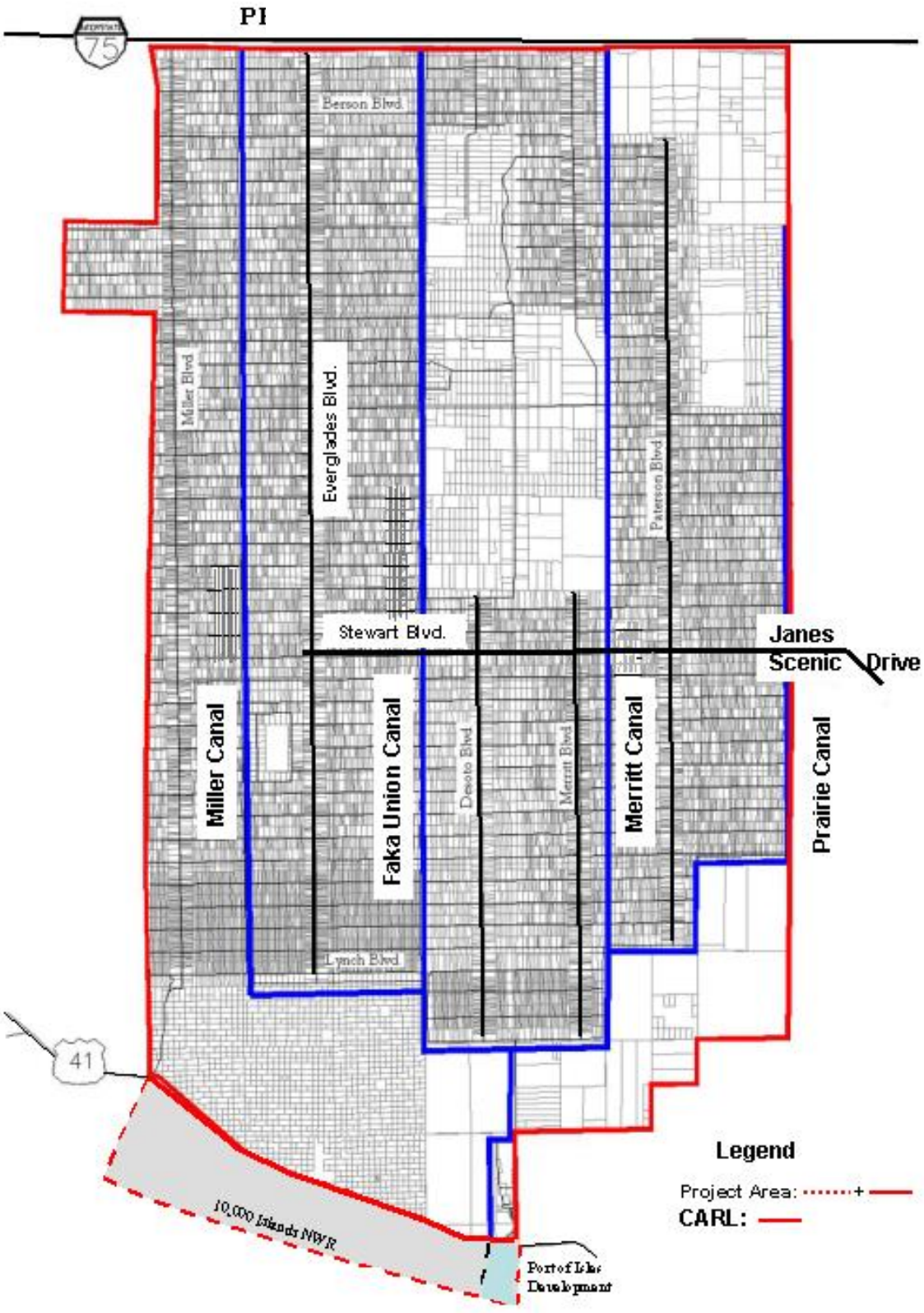

FIGURE 1 - 5 PROJECT AND CARL AREA BOUNDARIES

1.4.5 Conservation and Recreation Lands Area (CARL)

The Conservation and Recreation Lands Area (CARL) is defined as the 55,247 acres (approximately 86 sq mi) that was platted for subdivision by Gulf America Corporation in the 1960's and has been disturbed by infrastructure construction activities associated with the development. This acreage was purchased for restoration by the Florida Department of Environmental Protection (DEP) under their CARL program and with cost share money from the US Department of Interior (DOI) through the Farm Bill. This area is north of Highway 41 and contains the vast majority of the subdivision infrastructure that has been disturbed by the late60's and early 70's construction associated with the development of SGGE by Gulf America Corporation. The completed subdivision included 19,992 platted parcels and 279 miles of roads, 251 culverts, 10 bridges, 48 miles of drainage canals, and 8 weirs (Figure 1-5).

1.5 PRIOR STUDIES AND REPORTS

A number of studies have been conducted over the past 20 years regarding the Golden Gate Estates (GGE) Development and canal network. These studies have been reviewed and were referred to periodically as this project progressed for hydrological, biological, and ecological information of the study area. All of these studies assumed some limited development in SGGE. Brief summaries of some of the studies are described below.

1.5.1 Corps Water Resources Studies, Reports and Projects

The first Federal study of Golden Gate Estates originated on April 25, 1978 with a resolution by the Committee on Public Works and Transportation of the United States House of Representatives that reads as follows:

> *"Resolved by the Committee on Public Works and Transportation of the House of Representatives, United States that the Board of Engineers for Rivers and Harbors is hereby requested to review the report of the Chief of Engineers on water resources for Central and Southern Florida, published as House Document No. 39, 90th Congress, and other pertinent reports, with a view to determining whether any modifications of the recommendations contained therein are advisable at the present time, with particular reference to developing a plan for the Big Cypress Basin and Golden Gate Estates which would provide for flood control, water supply, recreation, and the restoration of environmental benefits within the parameters of sound water management."*

As a result of this study resolution, the Corps of Engineers conducted a reconnaissance study of six alternatives, which would address the water resource problems resulting from the extensive canal systems of Golden Gate Estates. The Reconnaissance Report released in 1980 concluded that there was a Federal interest in conducting a second phase study of Golden Gate Estates based on the ecological benefits and the restored flow to the project area, despite the benefit-cost ratios, which were below unity.

The Golden Gate Estates Final Feasibility Study, completed in 1986, included a preliminary analysis of the six alternatives evaluated in the 1980 reconnaissance report in addition to three newly evaluated conceptual plans for a 173 square mile area consisting of both Northern and Southern Golden Gate Estates. The alternatives evaluated did not qualify for Federal implementation under the then current guidelines that stated that a plan recommending Federal action is to be the plan with the greatest net economic benefit, consistent with protecting the nation's environment. Plans evaluated in this report, while generally beneficial for environmental concerns, did not contribute to the nation's economic development. No net National Economic Development (NED) benefits were identified with implementation of the evaluated canal modifications. The recommendations were based on the investigations performed during the study, review of the Federal policies and guidelines, and being cognizant of the publicly expressed concerns and issues, concluding that there was no basis for Federal participation.

1.5.2 CERP

The Central and Southern Florida (C&SF) Project Comprehensive Review Study is known as the Restudy. It was authorized by Section 309(l) of the Water Resources Development Act (WRDA) of 1992 (Public Law 102-580). The C&SF Project Comprehensive Review Study is also authorized by two resolutions by the Committee on Transportation and Infrastructure, United States House of Representatives dated September 24, 1992. The Water Resources Development Act of 1996 Section 528 (Public Law 104-303) entitled "Everglades and South Florida Ecosystem Restoration" authorized several ecosystem restoration activities and also provided specific direction and guidance for the C&SF Project. Quotations of these four authorities are provided earlier in this report – Section 1.2 Study Authority.

The product of the Restudy is the Central and Southern Florida (C&SF) Project Comprehensive Review Study Integrated Feasibility Report and Programmatic Environmental Impact Statement, April 1999 (The Yellow Book). The recommended plan described in this 1999 report was designated by Section 601 of WRDA 2000 as the Comprehensive Everglades Restoration Plan (CERP).

1.5.3 Critical Project Status

Section 528 of the WRDA of 1996 (Public Law 104-303) authorized the Secretary of the Army to expeditiously implement restoration projects that were deemed critical to the restoration of the south Florida ecosystem. The Act reads:

> *"(b) RESTORATION ACTIVITIES. –*
> *(3) CRITICAL RESTORATION PROJECTS. –*
> *(A) IN GENERAL. – In addition to the activities described in paragraphs (1) and (2), if the Secretary, in cooperation with the non-Federal project sponsor and the Task Force, determines that a restoration project for the South Florida ecosystem will produce independent, immediate, and substantial restoration, preservation, and protection benefits, and will be generally consistent with the conceptual framework described in paragraph (1)(A)(ii)(II), the Secretary shall proceed expeditiously with the implementation of the restoration project."*

The Everglades and South Florida Ecosystem Restoration – Critical Restoration Projects Program was authorized under Section 528. These projects are also referred to as "Critical Projects". This authority allows the Corps of Engineers to expeditiously implement projects that provided immediate and substantial benefits to the ecosystem in advance of completion of the Central and Southern Florida Project Comprehensive Review Study (the Restudy). The South Florida Ecosystem Restoration Task Force – Working Group completed a review of over 100 potential candidate restoration projects through extensive coordination and they recommended and prioritized 35 candidate Critical Projects for implementation. The Critical Projects program has an overall Federal cost limitation of $75 million and all work is cost shared 50 percent Federal and 50 percent non-Federal. Each project implemented under the Critical Project program is allowed a maximum expenditure limit of $25 million in Federal funds.

The Southern Golden Gate Estates Hydrologic Project was ranked number seven by the Working Group. The Critical Project Letter Report was submitted to Headquarters, U.S. Army Corps of Engineers in March of 1998 and was approved in the same month. While the Corps was compiling and reviewing the Project Cooperation Agreement, a letter was received from the Florida Department of Environmental Protection in March of 1999 that the estimated total cost of lands acquired and to be acquired was $128.4 million, which brought the project's cost up to $144 million. Since the Federal 50 percent share of this project would be well above the legislative maximum of $25 million Federal funds per project, the SGGE project would be too expensive for the Critical Project program. The Corps and SFWMD evaluated the possibility of deducting

land cost from the project cost but determined that this was not possible. Thus, this project could no longer be handled as a Critical Project.

During the planning process of the Restudy, it was recognized that the cumulative cost estimate for the Critical Projects exceeded the legislated mandated limit. Therefore, it was anticipated that only a fraction of these projects would actually be implemented under the Critical Project authority. Hence, to ensure that all of the other critical projects received full consideration, the Restudy included the Critical Projects that had not been approved for construction into its planning process. Some of these Critical Projects were included in alternative projects. The other Critical Projects, including SGGE, were considered as "Other Project Elements" of the Restudy. The Restudy addressed all of the Critical Projects nominated by the Working Group to ensure they would be implemented.

1.5.4 Non-Corps Water Resources Studies, Reports, and Projects

A variety of studies and reports were prepared by non-Federal parties in response to the adverse changes induced by the GAC canal system. The information in many of the early reports was incorporated into the Corps of Engineers' 1986 feasibility study. **Table 1-1** lists some of these studies and their contributions to the SGGE study.

The Southern Golden Gate Estates area was identified in 1985 as a component of the Governor of Florida's Save Our Everglades program. Various studies were conducted in the past to assess the feasibility of modifying the existing water control works to reduce and reverse the environmental and water resource impacts created by past overdrainage activities.

Subsequent to the Corps of Engineers feasibility study of 1986, the "Committee on the Restoration of Golden Gate Estates" was established in 1987 by the Kissimmee River-Lake Okeechobee-Everglades Coordinating Council to keep the restoration of Southern Golden Gate Estates on the agenda of the State's important environmental projects. The committee recommended accelerated acquisition of the lands of Southern Golden Gate Estates in the State's Conservation and Recreation Lands (CARL) acquisition program. Under the auspices of the CARL program initiative, the Florida Department of Environmental Protection (FDEP) would purchase land in the project area for conservation and restoration.

TABLE 1 - 1 EARLY NON-CORPS STUDIES OF GOLDEN GATE ESTATES

Report	Contribution to This Study
Soil Survey (Detailed Reconnaissance) of Collier County, Florida (Leighty et. al 1954)	NRCS Soil Survey; soil and vegetation types
A Hydrologic Study of the GAC Canal Network (1974) by Black, Crow, and Eidsness, Inc	Identify hydraulic deficiencies of canal network; alternations of surface flow; inability to convey 10-year flood
Golden Gate Estates Redevelopment Study. (Golden Gate Estates Study Committee (GGESC) 1977)	Geographical, hydrological, and biological information regarding the study area. Land use strategy for creating flowways that resemble the historic flow pattern and creating conservation areas
Proposed Interim Modifications, Golden Gate Estates Canal System (CH2M Hill 1978)	Installing earthen plugs to separate the west flowing Golden Gate Canal drainage basin from the south flowing Faka Union Canal drainage basin
Canal Discharge Impacts of Faka Union Bay (Browder & Wang, 1987)	Three inputs to Faka Union Bay (groundwater seepage, canal discharge, and rainfall) have a high interrelation, and all three may be significant factors for determining salinity. Groundwater levels may better represent actual discharge rates than the recorded canal discharges.
A Hydraulic Study of the South Golden Gate Estates Canal Network, Collier County, FL (Connell, Metcalf & Eddy 1978).	Hydrologic and hydraulic study that determined the lower portion of SGGE runoff using the Soil Conservation Service (SCS) method and an event-based model
Golden Gate Estates Groundwater and Septic Tank Investigation (Environmental Science and Engineering, Inc 1979)	Map of the major litho logic unit profiles
Impacts of Surface Drainage on Groundwater Hydraulics (Wang & Overman, 1981)	The canals have increased surface runoff by approximately 50 percent and caused a drawdown of the water table of approximately two feet at a distance of one mile from the canal
The Big Cypress National Preserve (Duever et al., 1986)	Information about the regional wetland ecosystems and, in particular, hydroperiod regimes of wetlands.
Soil Survey of Collier County Area, Florida (Luidahl et. al 1998)	NRCS Soil Survey; soil and vegetation types

In February 1992, Governor Lawton Chiles issued a directive to the South Florida Water Management District to "develop a conceptual hydrologic restoration plan for Southern Golden Gate Estates using the Corps Feasibility Report as a primary reference." In February 1996, the South Florida Water Management District prepared a Hydrologic Restoration of Southern Golden Gate Estates – Conceptual Plan (Abbott and Nath 1996), which was a detailed hydrologic restoration plan focused on reducing the overdrainage and restoration historic sheetflow patterns while maintaining the existing levels of flood protection for the areas north of the project. Five alternative configurations of structural measures were developed and their performances at meeting the objectives of the project were evaluated by the simulation model. The alternative measures evaluated ranged from partial/incremental restoration to full-scale approach with spreader channels, swale and road removal, placement of canal blocks, and flood control pumpage from areas north of Interstate 75.

In October 1996, the South Florida Water Management District entered into a cooperative agreement with the U.S. Department of Agriculture, Natural Resource Conservation Service (NRCS) to procure data and analysis of the soils, vegetation, topography, and water table fluctuations in that portion of the Big Cypress Basin watershed known as the Southern Golden Gate Estates (SGGE). This report also encompassed receiving waters south of the SGGE to the estuarine boundary of the Ten Thousand Islands National Wildlife Refuge. The information in the report was used by the District to enhance and expand on data and analyses contained in its "Hydrologic Restoration of Southern Golden Gate Estates – Conceptual Plan" (Abbott and Nath 1996). The NRCS study was used to update the hydrologic restoration alternatives proposed in the Conceptual Plan using more detailed site-specific data and to predict the effects of the proposed alternative on the existing plant communities. Federal, tribal, state, and local agencies were involved in the preparation of this report.

1.5.5 Department of the Interior Land Acquisition Funding

On April 4, 1996, Congress enacted the Federal Agriculture Improvement and Reform Act of 1996 (Public Law 104-127, 110 Stat. 1022). This act is sometimes known as the "Farm Bill". Section 390 of the Farm Bill provided:

> *SEC. 390. EVERGLADES ECOSYSTEM RESTORATION.*
>
> *(a) IN GENERAL.--On July 1, 1996, out of any funds in the Treasury not otherwise appropriated, the Secretary of the Treasury shall provide $200,000,000 to the Secretary of the Interior to carry out this section.*

(b) ENTITLEMENT.--The Secretary of the Interior (referred to in this section as the "Secretary")--

(1) shall be entitled to receive the funds made available under subsection (a);

(2) shall accept the funds; and

(3) shall use the funds to--

(A) conduct restoration activities in the Everglades ecosystem in South Florida, which shall include the acquisition of real property and interests in real property located within the Everglades ecosystem; and

(B) fund resource protection and resource maintenance activities in the Everglades ecosystem.

The South Florida Ecosystem Restoration Working Group, in June 1996, listed the Southern Golden Gate Estates project as the fourth priority for receipt of federal Farm Bill land acquisition funds. Estimated total cost of the first three priority projects for federal Farm Bill funds totaled over $490,000,000. In June 1996, it was not determined which of the land acquisition projects would receive federal funds.

In April 1998, the Department of Interior and FDEP executed a Federal Grant in which Interior provided $25,000,000 to FDEP for the acquisition of 20,250 acres, more-or-less. In December 1999, an amendment was signed to add an additional $13,000,000 making the total Federal funding received by FDEP $38,000,000. FDEP was not required to provide non-federal matching funds for receipt of the $38,000,000. Since the signing of the Agreements, land acquisition was accelerated by the State of Florida through FDEP.

1.5.6 Chronology

Table 1-2 presents a list of the development activities, legislation, restoration investigations, and agency actions leading up to the current study. Some of the studies in this table are presented in additional detail in Sections 1.5.1 through 1.5.5, above.

TABLE 1 - 2 CHRONOLOGY OF GOLDEN GATE ESTATES DEVELOPMENT AND RESTORATION ACTIVITIES

Time Period	Action
Late 1950s	• Gulf America Corporation (GAC) begins acquiring land in Collier County.
Early 1960s	• Golden Gate Estates (GGE) subdivision plan submitted to and approved by Collier County Government. • Subdivision platted for commercial, multifamily, and single family residential use.
August 1963	• Construction of the first GAC canal (lower portion of the Golden Gate Canal) completed.
1960s – early 1970s	• Extensive land sales program by GAC. • Estimated GGE owners in excess of 50,000 worldwide.
Late 1960s	• General awareness developed regarding the need for careful management of natural resources, particularly South Florida's water resources.
1968–1971	• Construction and completion of the Faka Union canal system.
1972	• Amendments to Federal Water Pollution Control Act signed into law by President Nixon. • Corps of Engineers (Corps) begins regulation of discharge of dredged and fill material in navigable waters. • Corps begins forming a program to permit development in wetlands.
1972	• State of Florida (State) enacts Chapter 373 (Water Resources), Florida Statutes (Florida Water Resources Protection Act of 1972) establishing the regulation of the management and storage of surface waters. • State begins a program requiring storm water management permits for developments.
1974	• "Hydrologic Study of the GAC Canal Network" by Black, Crow and Eidsness, Inc. is the first engineering study to address environmental aspects of the GAC canal system. Also evaluated flood protection. Prepared for Collier County Water Management Advisory Board.
March 1975	• GGE Study Committee established by the Board of County Commissioners. • Represented formal county government movement to address GGE issues. • Purpose: To re-evaluate the GGE in terms of appropriate long-term urban planning and resource management.
1977	• GGE Redevelopment Study report. • Showed general nature of redevelopment plan. • Major changes in drainage plan and land ownership feasible. • Recommended that a hydrologic engineering plan be prepared.
1978	• Authorization of GGE Feasibility Study by Congress.
1980	• U.S. Army Corps of Engineers Reconnaissance Report, GGE.
1984	• State of Florida enacts major amendments to Chapter 403, Florida Statutes (Environmental Control) broadening the regulation of activities in wetlands (Warren Henderson Wetlands Protection Act). • State begins permitting development in wetlands.
1985	• Southern Golden Gate Estates (SGGE) included in "Save Our Everglades" portion of the CARL program.
1986	• U.S. Army Corps of Engineers (Corps) GGE Feasibility Report. • Evaluated three alternatives for modifying the canal network. • Alternative C offered greatest attainment of multipurpose objectives. • Recommended no federal involvement (no economic benefit to nation), state and local problem.

Time Period	Action
August 1986	• Committee for Restoration of GGE established by the Kissimmee River—Lake Okeechobee Everglades Coordinating Council (KOECC). Purpose: Keep restoration of SGGE on agenda of important state environmental issues.
October 1991	• Agreement between Big Cypress Basin and Florida Department of Environmental Protection (FDEP) to fund land acquisition personnel.
February 1992	• Governor Chiles' directive to SFWMD: "…develop a conceptual hydrologic restoration plan for SGGE, using the Corps' Feasibility Report as a primary reference."
February 1996	• Big Cypress Basin/South Florida Water Management District submits "Hydrologic Restoration of Southern Golden Gate Estates – Conceptual Plan" to the Governor of Florida.
June 1996	• FDEP's Office of Ecosystem Management institutes interagency coordination.
June 1996	• South Florida Ecosystem Restoration Working Group ranks project no 4 on priority projects for FARM bill appropriations by Department of Interior
October 1996	• Cooperative Watershed Planning Assistance Study agreement with USDA-NRCS to enhance database on soils, vegetation, topography and hydrologic-ecologic assessment of the restoration plan
January 1997	• Interagency Technical Advisory Committee convened with representatives from Corps, U.S. Fish and Wildlife Service, U.S. Geological Survey, FDEP, FL Game & Fresh Water Fish Commission and others, to provide input and assistance for duration of study.
June 1997	• South Florida Ecosystem Restoration workgroup ranks the project no. 7 among the South Florida Critical Restoration Projects recommended for funding under WRDA 1996 initiative.
February 1998	• Assistant Secretary of Army approved letter report for funding under WRDA 1996.
April 1998	• U.S Department of Interior provides Federal Farm Bill funds totaling $25M to FDEP to enhance land acquisition efforts.
July 1998	• Settlement Agreement of prolonged lawsuit by SGGE landowner's group (representing more than 2,000 landowners) under which FDEP acquires 2,968 acres of land.
October 1998	• Governor and Cabinet approved purchase of 8,526 acres from Avatar Properties, Inc., the largest landowner in SGGE project area.
August 1999	• COE HQ ruled that the implementation of the proposed SGGE hydrologic restoration plan cannot be funded as a Critical Restoration Project due to $25M limit of Federal involvement under WRDA 1996 criteria, but funding will be considered as an element of the Comprehensive Everglades Restoration Plan (CERP).
December 1999	• U.S Department of Interior provides additional Federal Farm Bill funds totaling $13M to FDEP to enhance land acquisition efforts, bringing total Federal funds provided to $38M.
July 2000	• Florida Cabinet approved accelerated land acquisition mechanism by authorizing state to offer 25% more than the appraised value of land to willing sellers.
September 2000	• COE-SFWMD jointly initiated Master Program Management Plan development for restoration project implementation as a CERP element.
January 2001	• Florida Cabinet approved proceeding with Eminent Domain for remaining land acquisition in SGGE.
March 2001	• Project Management Plan agreement signed by COE and SFWMD, and Project Implementation Report effort initiated.

*This table has been adapted from the SGGE Watershed Planning Assistance Cooperative Study (NRCS, 2001)

1.6 NATIONAL ENVIRONMENTAL POLICY ACT REQUIREMENTS

The National Environmental Policy Act (NEPA) of 1969, as amended, is the Nation's charter for environmental protection. NEPA establishes policy, sets goals, and provides means for carrying out the policy. Section 102(2) of the Act contains action-forcing provisions to make sure that federal agencies act according to the letter and spirit of the act, including a provision to prepare an Environmental Impact Statement (EIS) on the effects of a proposed Federal action. Compliance with NEPA will be accomplished in accordance with ER 200-2-2, and the Council on Environmental Quality regulations (40 CFR Parts 1500-1508).

This report employs two concepts, which were established to reduce duplication and paperwork. These concepts, integration and tiering, are not frequently used, but are appropriate to the planning and design process of this project. Integration allows for the combining of documents. In this case, the draft EIS is combined with the draft Project Implementation Report (PIR). In other words, discussions that would normally appear in an EIS were included as part of this integrated report. These discussions, required by NEPA, are marked with an asterisk in the Table of Contents to assist readers in identifying such material.

This SGGE report also follows the original intent of tiering, which encourages agencies to build on sequential EISs to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review. The SGGE project was first proposed in the CERP Comprehensive Review Study Integrated Feasibility Report and Programmatic Environmental Impact Statement. Due to the conceptual nature of that CERP report and it's associated uncertainties, site-specific documents such as this PIR/EIS are needed to address problems and solutions at a level of sufficient detail for the final decision making and for full compliance with NEPA requirements.

The stakeholders involved in the Project Delivery Team (PDT) process have agreed that the complexity and size of the SGGE project requires an EIS.

The public involvement process required by NEPA is documented in Section 10. Section 11.1 addresses this project's compliance with federal law. Section 12 deals with state law relevant to implementation of the project.

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SECTION 2

PRE-DRAINAGE CONDITIONS

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SECTION 2
PRE-DRAINAGE CONDITIONS

2.1 SECTION INTRODUCTION

This section of the Project Implementation Report/Environmental Impact Statement (PIR) provides an overall characterization of the environmental conditions that existed in the Southern Golden Gate Estates (SGGE) (Picayune Strand) watershed prior to logging, subdivision development, drainage, and other anthropogenic activities. For this report "historic", "pre-drainage" and "natural" are synonymous and defined as the Pre-1940 condition.

2.2 PRE-DRAINAGE SETTING

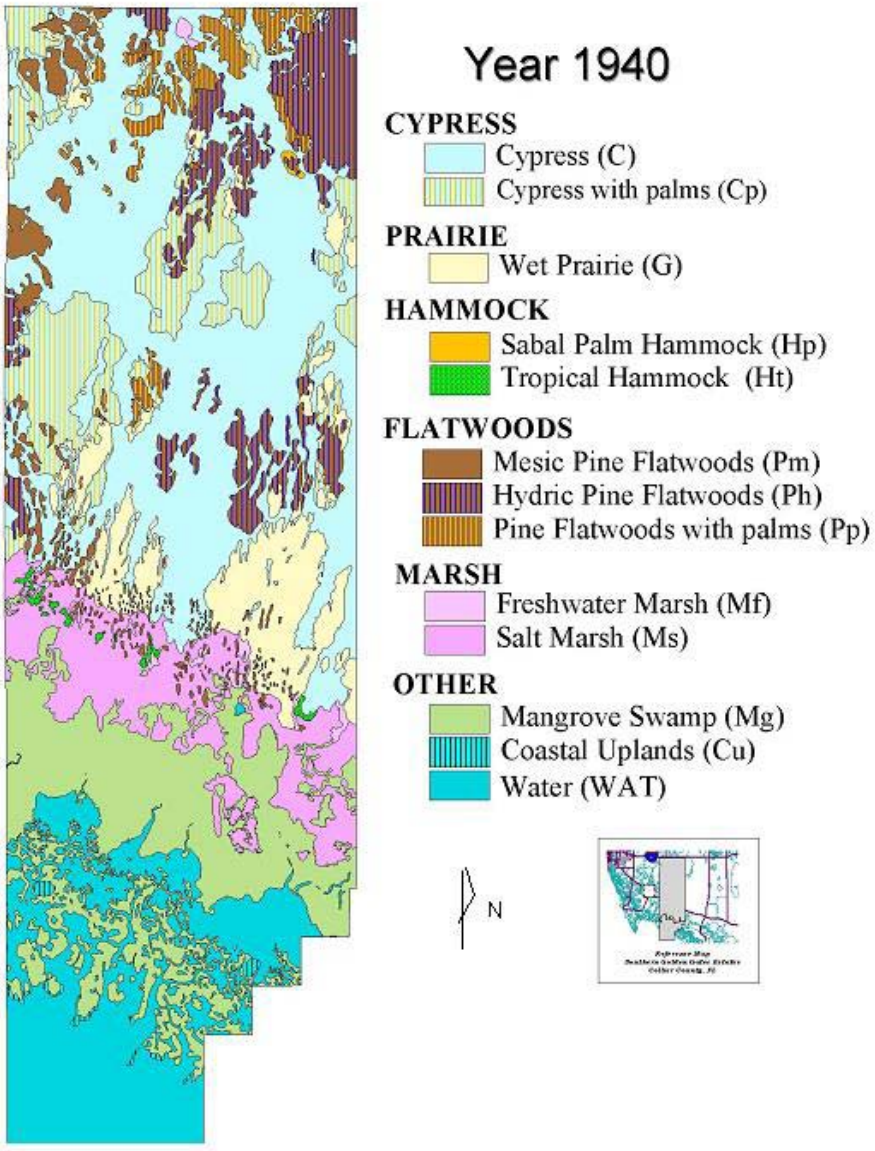
Prior to anthropogenic impacts, the Study Area was characterized by seasonal flooding several months of the year. During this wet season from June through October, rainfall was drained as a gentle, broad, slow moving surface water flow. This natural sheet flow system absorbed floodwater, promoted groundwater recharge, sustained wetland vegetation, rejuvenated freshwater aquifers, assimilated nutrients, and removed suspended materials. Overland sheet flow within the Study Area contributed freshwater inflow across a broad front to the bays and estuaries of the Ten Thousand Islands Region.

2.2.1 Infrastructure

Infrastructure as used in this report is defined as the basic underpinnings needed for modern society to function. Examples of contemporary infrastructure are roads, bridges, canals, logging trams, and dwellings. For purposes of this section there is no infrastructure in the pre-drainage conditions of the Project Area.

2.3 PLANT COMMUNITIES

In July 2001 the Natural Resources Conservation Service (NRCS) provided a detailed map, based on 1940 aerial photographs, of the pre-drainage distribution of major plant community types in the Picayune Strand Project Area (Figure 2-1). Although this retrospective map obviously cannot be ground truthed and may contain some errors, it represents a valuable baseline with which to compare future change following restoration, particularly where a return to a more natural or pre-drainage condition is the restoration target. However, while



Produced by the Natural Resources Conservation Service - 2001.

FIGURE 2 - 1 1940 VEGETATION MAP OF THE SOUTHERN GOLDEN GATE ESTATE PRE-DRAINAGE AREA

the NRCS maps provide good estimates of plant community acreages for natural and current (see Section 3) conditions, they are not able to provide estimates for future conditions. Those acreage estimates can only be calculated based on a hydrologic model. The South Florida Water Management District (SFWMD) used the MIKESHE model to produce a "natural systems" base condition for the pre-drainage hydrology. Plant community distributions were predicted using the relationship between the hydrologic characteristics of each major community type (***Table 2-1***) and the average wet season water depths (July 1 through October 1) as predicted by the model. A more in depth assessment of the NRCS maps and the MIKESHE model can be found in the SFWMD "Resource Assessment" (RA) located in Appendix D of this document.

The ecological communities of southwest Florida are a mosaic of pine forest, cypress strands, hardwood hammocks, sawgrass plains, wet prairies, brackish marshes, and coastal mangrove forests (Carter *et al*. 1973). Pre-drainage cover in the Project Area appears to have been largely bald cypress swamp and short grass prairies (short-hydroperiod wetlands), with occasional mesic hammocks or pine flatwood communities (Leighty *et al*.1954). In the natural or pre-drainage condition, the major native plant communities in the Project Area were cypress-dominated forests, wet prairies, and pine flat woods. ***Table 2-1*** illustrates the relationships of each plant community to various hydrologic and fire regimes. Even those sites normally designated as uplands, particularly islands of pine flatwoods, often had water at or above the ground surface for at least short periods during wetter portions of the year.

More detailed descriptions of the Project Area plant communities can be found in the SFWMD document entitled *Resource Assessment of Southern Golden Gate Estates Hydrologic Restoration Plan* attached in Appendix D.

2.3.1 Cypress Forest

Natural or pre-drainage Cypress forests (C) in the Project Area were dominated by dense stands of bald cypress *(Taxodium distichum*), and occasional hardwoods such as red maple (*Acer rubrum*), pop ash (*Fraxinus caroliniana*), or pond apple (*Annona glabra*). These hardwoods provided less than 30 percent canopy cover. Ground cover was sparse to dense and emergent in standing water during normal wet season conditions. Epiphytic bromeliads and orchids were common in trees, and ferns were common on palm trunks. Pre-drainage wet season water depths were relatively deep (12 to 24 inches) and hydroperiods were long (6 to 10 months) (***Table 2-1***). This community may occur on any type of soil, including sand, marl, rock, and organic. One variation of the cypress forest was cypress-with-palms (Cp), which were typically shallow cypress communities in 1940.

TABLE 2 - 1 FACTORS SHAPING MAJOR PLANT COMMUNITY TYPES

Average Wet Season Water Level (inches)	Hydroperiod (months)	SGGE Non-Tidal Plant Communities	Non-Hydrologic Influences	Relative Abundance in SGGE (Pre-Drainage)
<-6	0	Tropical Hammock	No Fire	++
<2	<1	Mesic Pine Flatwoods	Fire	+++
		Palmetto Prairie	>>>Fire	0
		Mesic Hammock	No Fire	0
		Brazilian Pepper	Exotic	0
		Palms in Flatwoods	Soils	+++
		Palms in Hammock	Soils	+
2 – 6	1-2	Hydric Pine Flatwoods	Fire	+++
		Hydric Hammock	No Fire	0
		Palms in Flatwoods	Soils	+++
		Palms in Hammock	Soils	+
6 – 12	2-6	Wet Prairie	Fire	+++
12 – 24	6-10	Marsh	Fire	++
		Cypress Forest	< Fire	++++
>24	>10	Open Water		0

Relative abundance of plant communities is indicated by the number of pluses from low abundance (+) to high abundance (++++). A zero (0) indicates no community present under pre-drainage conditions. Hydrologic indicators for brackish marsh communities are not included because the MIKESHE model does not account for tidal flux, and the model domain does not extend into regions dominated by tidal effects.

2.3.2 Freshwater Marsh

Freshwater marsh communities (Mf) are low diversity freshwater herbaceous communities dominated by tall, dense stands of grasses and forbs. They have relatively long hydroperiods (6 to 10 months) and deep wet season water depths (12 to 24 inches) (***Table 2-1***). They are found primarily on organic soils. Fires are frequent and retard the invasion of woody vegetation. However, marshes can have occasional bald cypress trees, which produce less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940 there were only a few small marshes in the Project Area, with most of them located in the northern portion of the brackish marshes near the coast (Figure 2-1).

2.3.3 Wet Prairie

Wet prairies (G) are high diversity herbaceous communities dominated by short, open stands of grasses, sedges and forbs. They have relatively short hydroperiods (2 to 6 months) and shallow wet season water depths (2 to 6 inches) (***Table 2-1***). They are found on mineral soils, including sand, marl, and rock. Fires are frequent and retard the invasion of woody vegetation. However, wet prairies can have occasional slash pine (*Pinus elliottii*) or bald cypress trees, which produce less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940, wet prairies originally were most extensive just upstream of the brackish marshes along the coast, with smaller scattered areas in the northern and eastern portions of the Project Area (Figure 2-1).

2.3.4 Pine Flatwoods

In 1940, the upland communities present in the SGGE Project Area were islands of pine flatwoods (P). This community type was scattered throughout the area and decreased in both size and areal coverage as one moved from north to south through SGGE (Figure 2-1). Pine flatwoods have an open canopy dominated by slash pine. They typically have short hydroperiods (<2 months) and water levels slightly (<6 inches) above or belowground during the peak of the wet season. Pine flatwoods can occur on sand or rock substrates. Compared to hydric pine flatwoods (Ph), which have deeper wet season water depths (>6 inches) and a longer hydroperiod (>2 months), mesic pine flatwoods (Pm) are more elevated with shallower wet season water depths (<2 inches) and a shorter hydroperiod (<1 month). Mesic flatwoods are more likely to be dominated by a dense saw palmetto (*Serenoa repens*), while hydric pine flatwoods are more likely to be dominated by a dense and diverse herbaceous ground cover of grasses,

sedges, and forbs. Pine flatwoods with an abundance of sabal palms (Pp) in the subcanopy were also common, particularly in the northern portion of Project Area. Intense and frequent fires maintain the open character of the canopy and shrub strata and the dense ground cover. Epiphytes are not common due to the small number of trees and their limited branching, as well as the frequent fires.

2.3.5 Hardwood Hammocks

The term 'hammock' as used in South Florida generally refers to stands of trees dominated by broadleafed, or hardwood species, or palms. Picayune Strand had very few hammocks in 1940, most likely because of frequent fires in areas dry enough to support these communities. Hammock communities typically have water slightly (<6 inches) above or belowground during the peak of the wet season, and short hydroperiods (<2 months). They can occur on sand or rock substrates. Those dominated by hardwoods are relatively intolerant of fire, while the sabal palm hammocks are not only tolerant but thrive with frequent severe fires. In 1940, there was only a small area of sabal palm hammock (Hp) near the northeast corner of the Project Area (Figure 2-1). This community has an almost monospecific canopy of palms with few shrubs and little ground cover. Epiphytic ferns are common on the trunks of the sabal palms.

Numerous small tropical hammocks (Ht) were originally found scattered in the more upstream portions of the salt marshes along the coast (Figure 2-1), where proximity of the warm Gulf waters moderates freezing temperatures associated with winter cold fronts. These forested communities are dominated by a variety of hardwoods with tropical affinities, such as gumbo limbo (Bursera simaruba), mastic (Mastichodendron foetidissimum), or strangler fig (Ficus aurea). Sabal palms and live oaks (Quercus virginiana) may be common but are not dominant. Shrub density is moderate and includes small hardwoods such as myrsine (Rapanea punctata), wild coffee (Psychotria nervosa), or indigo berry (Randia aculeata), and seedlings of the canopy species. Ground cover is usually sparse because of the dense canopy. Epiphytic ferns, bromeliads and orchids are common on the hardwoods and palms.

2.3.6 Coastal Wetlands And Estuaries

Pre-drainage in the SGGE Study Area flow ways drained into the Ten Thousand Island Region and its associated acreages of salt marsh (Ms), mangrove swamp (Mg), and water (WAT). Freshwater flows from the Study Area were delivered to these coastal communities through sheet flow and groundwater during the wet season and springs in the dry season. The amount and timing of these flows helped determine the extent and type of coastal vegetation.

2.4 FIRE

Fires were a common occurrence on the pre-drainage SGGE Study Area landscape. They were an important ecological factor in the historic health and survival of many terrestrial communities. Wade suggested that a naturally occurring fire frequency in saw grass (*Cladium jamaicense*) prairies may range from three to twenty-five years, typically much more frequent than the latter figure. He also reported that cypress sloughs would have seldom experienced fires, except for the areas adjacent to prairies during dry years (Wade et al., 1980). Lightning strikes commonly caused most fires although Native Americans may have been responsible for starting a few. Because of the seasonal nature of rainfall in southern Florida, wet prairies, hydric pine flatwoods, depressional marshes, and cypress strands are inundated during the summer/fall wet season. In winter and early spring the dried wetlands became susceptible to fire.

2.5 FISH AND WILDLIFE RESOURCES

The seasonal nature of rainfall in southern Florida is pronounced. Because of this, wetland systems in the SGGE Study Area contain water during the wet season of summer and fall and may dry out completely in the winter and early spring. The wet/dry cycles that occur in these communities allow for a duality of function. For part of the year they function as wetlands, while other times they act as uplands. These cycles increase the diversity of wildlife that can utilize these wet/dry communities. Plant communities have been established in recent geological times in frequently flooded nutrient-poor coral, marl, and sand substrates. The project's location on the South Florida peninsula subjects the flora and fauna to natural invasion and migration of plants and animals from the West Indies and has elements of flora and fauna that have evolved after isolation from populations in western states during post glacial periods. The project area is also located within and upstream of the largest mangrove swamp in North America.

Large wildlife species present in the region include white tailed deer, wild boar, black bear and the endangered Florida panther, which will be discussed below.

2.5.1 Wading Birds

The over-drainage of South Florida's Everglades has resulted in a 90-95 percent drop in wading bird populations. During favorable years in the 1930's, up to

250,000 wading birds, including white ibises (*Eudocimus albus*), wood storks (*Mycteria americana*), great egrets (*Casmerodius albus*), snowy egrets (*Egretta thula*), and tricolored herons (*E. caerlea*), nested in the central and southern Everglades (Ogden 1994). Maximum numbers had decreased to 54,000 by the 1970's and further to 22,000 by the 1980's (Ogden 1994). During the 1930's, approximately 90% of the wading birds nested along the interfaces between the freshwater Everglades and the mangrove-estuaries (Ogden 1994). By the 1980's, the majority of nesting wading birds had shifted to nesting in the interior freshwater Everglades, principally in the Water Conservation Areas (WCA) (Ogden 1994). These changes were presumably the result of extensive hydrological alterations (to water flow and volume) in the Everglades system (Ogden 1994, Bancroft 1989). These historical Everglades wading bird numbers can be assumed, though on a lesser scale, to be consistent with the populations present in the predrainage Study Area.

2.6 THREATENED AND ENDANGERED SPECIES

Federally listed species that historically occupied the SGGE Study Area are the threatened eastern indigo snake (*Drymarchon corais couperi*), endangered wood stork (*Mycteria Americana*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered Florida panther (*Felis concolor coryi*), endangered snail kite (*Rostrhamus sociabilis plumbeus*), endangered American crocodile (*Crocodylus acutus*), threatened bald eagle (*Haliaeetus leucocephalus*), and endangered West Indian manatee (*Trichechus manatus).* Estuarine fishes that historically occupied the estuaries and bays of that part of the Ten Thousand Islands Region (TTIR) into which the Study Area drains include the endangered smalltooth sawfish (*Pristis pectinata*) and three candidate fish species; the goliath grouper (*Epinephelus itajara*), mangrove rivulus (*Rivulus marmoratus*), and sand tiger shark (*Odontaspis taurus*). Sea turtles that may occupy the TTIR are the threatened loggerhead sea turtle (*Caretta caretta*), endangered Kemp's ridley sea turtle (*Lepidochelys kempi*), endangered Atlantic green sea turtle (C*helonia mydas mydas*), and endangered Hawksbill sea turtle (*Eretmochelys imbricata*).

2.6.1 American Crocodile

Historic distribution is difficult to determine, as the American crocodile (*Crocodylus acutus*), was often mistaken for the alligator. The primary cause for endangerment of the crocodile is historic over-hunting. It is found primarily in mangrove swamps, low-energy mangrove-lined bays, creeks, and inland swamps (Kushlan and Mazzotti 1989). The high use of inland waters suggests crocodiles prefer less saline waters (Mazzotti 1983). The Study Area contains habitats in

the Ten Thousand Islands Region that are suitable for the crocodile, and crocodiles appear to be slowly expanding their range into the region.

2.6.2 Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) was historically found throughout the North American continent. In Florida, eagles were widely distributed across the state. They were probably most abundant along large rivers, estuaries, and lakes. Nests are often in the ecotone between forest and marsh or water, and are constructed in dominant or co-dominant living pines or bald cypress (McEwan and Hirth 1979). The eagle feeds primarily on fish and water-dependent birds. Wetlands within the pre-drainage Study Area landscape provided the eagle with suitable high quality nesting and feeding habitats. Bald eagles are considered a water-dependent species typically found near estuaries, large lakes, reservoirs, major rivers and some seacoast habitats (Service 1999). Their distribution is influenced by the availability of suitable nest and perch sites near large, open water bodies, typically with high amounts of water-to-land edge. The bald eagle is an opportunistic feeder, but in South Florida the bulk of its diet is fish.

2.6.3 Eastern Indigo Snake

The eastern indigo snake (*Drymarchon corais couperi*) is a large, black, non-venomous snake found in the southeastern U.S. It is widely distributed throughout South Florida. The snake is not commonly found in great numbers in the wetland complexes of the Everglades region, even though it occurs in pinelands, tropical hardwood hammocks, and mangrove forests in extreme South Florida (Duellman and Schwartz 1958, Steiner *et al.* 1983). Historic natural habitat conditions in the Study Area were similar to those of the rest of the Everglades region. Indigo snakes are known to exploit gopher tortoise burrows, and would have favored more elevated, dry areas in habitat mosaics.

2.6.4 Florida Panther

Historically the Florida panther (*Felis concolor coryi*), a subspecies of mountain lion, ranged throughout most of the southeastern United States, including southern Florida. The Project Area provided and still provides habitat for this large wide ranging mammal. The vast extent of habitat that was available to the panther during pre-drainage times has disappeared.

2.6.5 Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW) is one of 22 species of woodpeckers native to North America. Throughout the 20th century, the species' distribution within its historic range has become fragmented, and its population numbers have decreased drastically due to the destruction of its habitat. The red-cockaded woodpecker population in Lower Peninsula of Florida, from Orlando and to the south, is limited to about 244 occupied clusters. In 1992, approximately 25 occupied, 10 undetermined, and 11 abandoned clusters occurred in the east Naples area including the Belle Meade Tract (Service 1999). The loss of habitat on private lands has demographically isolated red-cockaded woodpeckers remaining on public lands, which could affect the genetic viability of these birds. Historically, and even as recently as 30 years ago, there was probably genetic interchange among red-cockaded woodpecker clusters in South Florida. Increasing isolation from current rates of habitat loss could lead to inbreeding and genetic depression.

Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse understory and many large old-growth pines, constitute primary nesting and roosting habitat for the woodpecker. The pine flatwoods of the pre-drainage Project Area provided this habitat for the woodpecker.

2.6.6 Estuarine Fishes and Sea Turtles

In the historic Picayune Strand region, the endangered smalltooth sawfish and the candidate fish species the goliath grouper, mangrove rivulus, and sand tiger shark inhabited the bays and estuaries of the Ten Thousand Islands Region. Grass beds and managrove estuaries provide juvenile habitat for the goliath grouper, which inhabits reefs in deeper water as an adult. Sea turtles that historically occupied the TTLR are the threatened loggerhead sea turtle, endangered Kemp's ridley sea turtle, endangered Atlantic green sea turtle, and endangered Hawksbill sea turtle. Sea turtle habitat includes seagrass beds, mud banks and shallow reefs.

The Picayune Strand pre-drainage hydrology slowly delivered fresh water across a broad front of flowways to the estuaries of the TTLR. These estuaries provide important habitat for the young of many fish species and their prey. The quantity and timing of freshwater inflows determined many characteristics of estuarine habitat by establishing salinity, other aspects of water chemistry, and the dynamics of currents and water exchange. This slow year-round influx of fresh water maintained salinity in the natural range these estuarine fishes evolved in and required.

2.6.7 Snail Kite

The snail kite is a wide-ranging, New World raptor species found primarily in lowland freshwater marshes in tropical and subtropical America. It is nomadic in response to water depths, hydroperiod, food availability, and other habitat changes (Sykes 1978, 1983a; Beissinger and Takekawa 1983; Bennetts *et al.* 1994). Everglades snail kites are restricted to South and Central Florida, including the pre-drainage SGGE Study Area. Snail kite habitat consists of deep, relatively long hydroperiod freshwater marshes and the shallow vegetated edges of lakes (natural and man-made), where apple snails (*Pomacea paludosa*) can be found. The combination of a restricted range and a highly specific diet (composed almost entirely of apple snails) makes the snail kite's survival directly dependent on the hydrology and water quality of a watershed (Service 1999). The open, marshy wetlands of the pre-drainage Study Area provided this habitat.

2.6.8 West Indian Manatee

Manatees have been year-round residents in Collier County since at least 1930 (Hartman 1974; Beeler and O'Shea 1985). Habitat features essential to survival of manatees include access to freshwater sources, warm water refugia, and preferred forage areas (seagrass beds) adjacent to relatively deeper waters. Manatees utilize coastal, estuarine, and some riverine habitats that allow access to aquatic plants, sources of freshwater, and deeper (1-2 m) channels. The slow release sheet flow hydrology of the pre-drainage Picayune Strand Study Area landscape was key to providing the year round fresh water needed by the manatees.

2.6.9 Wood Stork

Wood storks are one of two species of storks that breed in North America. The historic seasonal wet/dry hydrologic cycles of southern Florida and the SGGE Study Area landscape provided the wood storks with the habitat they needed to survive. Under the pre-drainage conditions of the 1930s and 1940s, storks were observed to form large nesting colonies in the Big Cypress basin of which the Study Area is a part. Wood storks are tactile feeders, capturing fish by wading in shallow water with open bills. They are attracted to and utilize drying wetland edges where fish may be highly concentrated. The historic project area would have contained large expanses of standing water wetlands at the end of each rainy season, which would have provided forage for pre-nesting and nesting wood storks as they shrank during the winter early dry season. The drainage works installed in the area during the mid-20th Century caused the historic

wetlands to shrink and dry much faster than under historic conditions, greatly reducing forage opportunities for wood storks and other wading birds.

2.6.10 Endangered Plants

In the natural world of pre-drainage conditions, the term "endangered plants" has no meaning. There may have been some species of plants that were naturally rare, or few in number, but in the 1940's there were no plants officially listed as "endangered" in the strict legal sense because there was no legally recognized endangered species list at that time.

2.6.11 Essential Fish Habitat

In the natural world of pre-drainage conditions, the term "Essential Fish Habitat" has no meaning.

2.7 GEOLOGY AND SOILS

2.7.1 Geology

The SGGE Study Area lies within the lower coastal lowlands topographic division, in the Big Cypress physiographic region. Dominant geomorphic features are the gradual southwestern slope and reticulated coastal swamps. There is exposed limestone in the northeastern section of the Project Area, while the remainder of the area is shallow to limestone. Limestone and marine deposits underlying the area were formed during the pleistocene epoch.

2.7.2 Soils

Because of the strong correlation between soil type and vegetation under unaltered conditions, observations of soil types in the Project Area provide information about pre-development natural flow-ways and vegetative land cover.

Duever (1984) classified four major soil groups (rock, sand, marl, and organics) in the Big Cypress National Preserve. These major soil groups are found in the SGGE Study Area and historically were subject to intermittent or prolonged flooding and are characterized as poorly or very poorly drained. Soils throughout the Study Area vary in thickness over limestone. If the thickness of the soil layer above the limestone is greater than four feet, soil-forming processes occur to either form stain layers or cause mineral movement within clay layers above the

limestone. South of the four major canals that drain the Study Area, soils in the wet prairies have marl over sandy deposits on rock.

2.8 AIR QUALITY

Historical air quality is defined as pristine.

2.9 CLIMATE

Typical of humid subtropical regions, the SGGE Study Area undergoes about a 7-month dry season and a 5-month wet season. The average annual temperature is about 75 degrees Fahrenheit, with record extremes ranging from 105 degrees in summer to 25 degrees in winter. Annual rainfall for nearby Naples averages 53 inches. Within Collier County, annual rainfall varies from a low of 30 inches to a high of 105 inches. Nearly 80 percent of the annual rainfall occurs during the May through October wet season. Much of the rainfall is returned to the atmosphere by evaporation from soil and free water surfaces, as well as transpiration through plants. Under natural conditions, the combined process of evapotranspiration accounts for an approximate loss of 45 inches of water per year. Thus, only about eight inches of average annual precipitation were and area available for surface runoff and groundwater recharge. Pre-drainage, natural surface runoff in the Study Area has been reported to be on the order of 0 to 10 inches annually (Kenner, W.E. 1966).

2.10 HYDROLOGY

In addition to climate, the flat topography, marly soils and the seaonsal rainfall cycle were the principal influences on pre-development hydrology in the project area. The flat topography created minimal gradients, resulting in slow runoff that occasionally created very poorly defined first-order streams but typically resulted in sheetflow patterns. Water depths in natural hydric pine flatwoods varied throughout the seasonal hydrologic cycle. Extreme ranges were from 3 feet above ground surface to 5 feet below ground surface. Typical ranges were from 1 to 2 feet above ground surface at the height of the wet season to 3 feet below ground surface in the late dry season. For most of the year, hydric pine flatwoods had water within 1 foot above or below the ground surface. With the onset of the wet season, habitats of the historic Picayune Strand were quickly saturated. As the rate of precipitation exceeded the rate of runoff, standing water appeared in depressions in May-June. By July, historic SGGE habitats were uniformly wet. Deep water levels were attained by the late rainy season, in September/October. As the dry season began in November, the pattern would

reverse with a shift to runoff exceeding precipitation. This would cause formation of isolated pools as sheetflow receded below the ground surface. By March, only the depressional areas of SGGE habitats would have retained standing surface water.

2.10.1 Watershed Flow Patterns

The Faka Union Canal watershed, including the SGGE Project Area, SGGE, and part of NGGE, in the pre-drainage condition encompassed an area of approximately 234 square miles (Black, Crow, and Eidsness, Inc. 1974). The topography of the basin is characterized by low relief and poorly defined drainage patterns. Elevations range from 24 feet NGVD in the extreme north end, with a gradual slope in the central and southern part, to elevations of 2 feet NGVD, near the outlet of the basin some 28 miles to the south. Over the basin, the water flowed in a general southwest direction. Generalized historic overland flow patterns for western Collier County are illustrated in Figure 2-2. SGGE and Picayune Strand are encompassed within the Camp Keasis Basin. The historic watershed that drained the Project Area is depicted in Figure 2-3.

2.10.2 Hydrologic Cycle

In the pre-drainage condition, the general water movement can be characterized by slow, overland sheet flow a few inches to a few feet deep and up to several miles wide. Much of the drainage was concentrated in slightly lower sloughs and strands. Several feet of water regularly inundated the Project Area

during the wet season from June through October. This overland runoff was stored in depressions. Peak flows were attenuated, and a longer hydroperiod was maintained well into the dry season. The storage within these wetlands is a part of the hydrology of the watershed. Subsurface flow, groundwater recharge and evapotranspiration are major components in the hydrologic cycle. As the wet season ended and throughout the dry season, water stored in depressions was slowly depleted as it recharged the shallow water table aquifer and was used by vegetation in the evapotranspiration process.

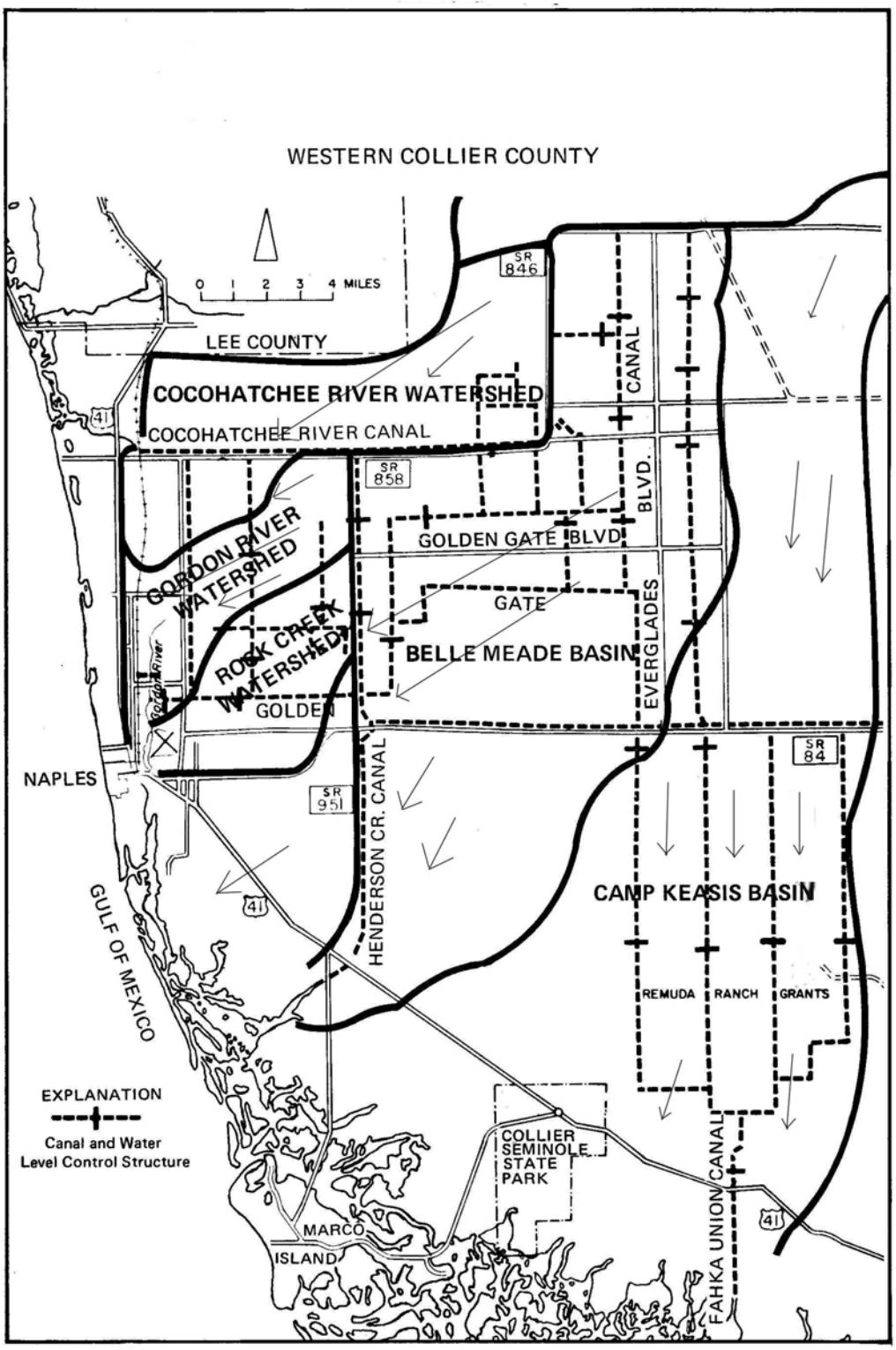


FIGURE 2 - 2 HISTORIC STUDY AREA WATERSHEDS

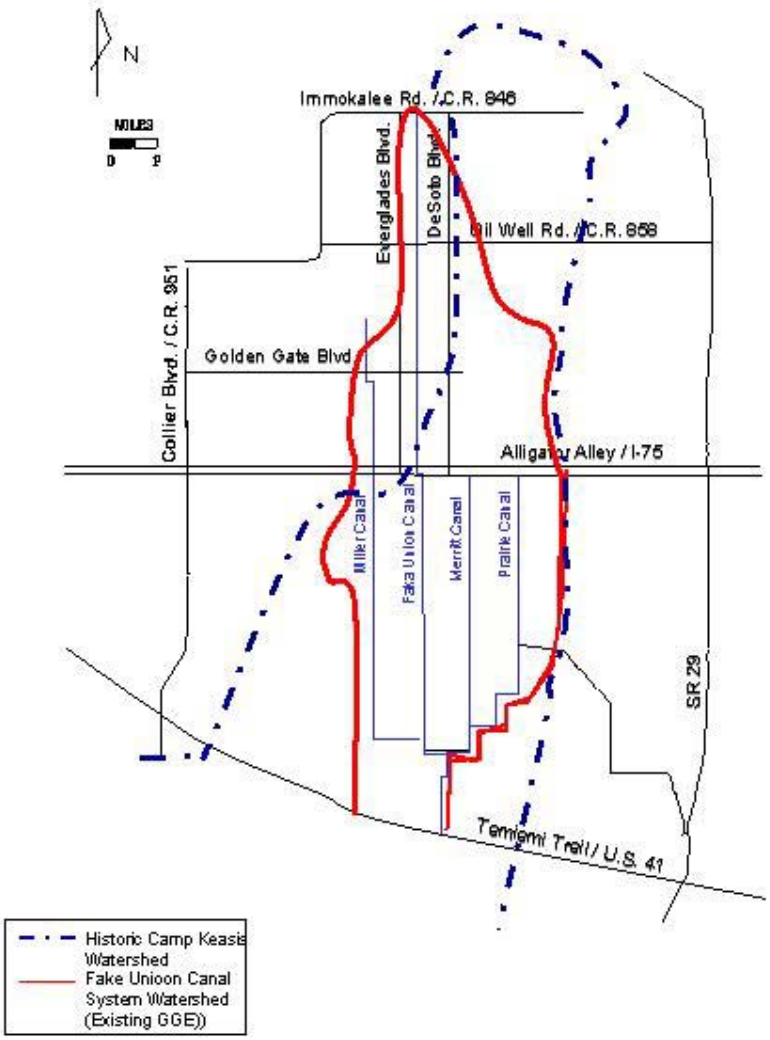


FIGURE 2 - 3 HISTORIC AND EXISTING WATERSHED BOUNDARIES

2.11 ESTUARINE RESOURCES

The following are the pre-development conditions that would have been found in the natural estuarine system that was fed by drainage from the Picayune Strand. The Ten Thousand Islands Region included the tidally influenced lower rivers, the receiving bays, and the shallow coastal islands offshore, which extended to the limit of significant freshwater influence. Under pre-drainage conditions, freshwater reached the estuaries through a combination of overland sheet flow and groundwater seepage. Shorelines were generally mangrove lined. Mangroves supported productivity of the creeks, bays and islands by producing large masses of leaf litter and dissolved organic matter that was exported by outgoing tides to the bays and channels. Red mangrove roots provided substrate for settling of crustaceans, mollusks, particularly oysters, algae, tunicates, and annelids, as well as shelter for juvenile fish. Sand and mud bottoms sheltered mollusks, crustaceans and other invertebrates, as well as fish. Plankton and nekton, organisms living suspended in the water, provided food for the filter-feeding fish, oysters and other invertebrates. In the middle reaches of the estuarine zone (salinities between 15-30 ppts), oyster reefs provided additional shelter, substrate, and developmental and feeding habitat for a wide range of organisms. As filter feeders, oysters remove small particulate matter from the water column, leading to better light penetration thereby indirectly facilitating the colonization of appropriate substrates by seagrasses. Submerged aquatic vegetation (SAV), or "seagrass", may have covered significant parts of the bay bottoms under natural conditions. Both oyster reefs and SAV are important fish habitat in southwest Florida. All estuarine habitats, including sub-aquatic vegetation beds, oyster reefs, soft-bottom embayments, sand or mud shoals, fringing mangrove forests, and the open water nekton, depend upon fresh and marine water mixing. Brackish water conditions provided nutrients and dissolved oxygen enrichment, which promotes productivity. These conditions also provided a refuge from predation and an ideal setting for reproduction and juvenile growth and development.

2.12 SOCIO-ECONOMICS

In the natural world of pre-drainage conditions this term has no meaning.

2.13 AESTHETIC RESOURCES

In the natural world of pre-drainage conditions this term has no meaning.

2.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

In the natural world of pre-drainage conditions this term has no meaning.

2.15 CULTURAL RESOURCES

We are only beginning to comprehend the way prehistoric man lived in south Florida by studying the archaeological record left behind. The following presents existing information about historical properties within and cultures that used the SGGE Project Area. This information was collected from the Florida Master Site Files (FMSF) in the Florida Division of Historical Resources and other documents.

The earliest widely accepted date of human occupation of Florida is from around 12,000 years Before Present (B.P.), during the end of the Pleistocene Period. This earliest cultural period is termed the Paleo-Indian period and lasted until about 9,500 B.P. Few Paleo-Indian archeological sites are recorded in Florida and none have been identified in the FMSF records as being in or near the Project Area.

The Archaic Period (ca. 10,000 B.P.– ca. 2,500 B.P.) is thought to be a reflection of man's adaptation to the changing environment at the start of the Holocene, when our modern climate and biota were established. The Archaic people changed from a nomadic population to a more sedentary lifestyle. They concentrated along the coastal and river estuaries and utilized a wider range of resources than the Paleo-Indians. Food sources were seasonal, with foraging and hunting of deer and shellfish as the primary subsistence activities. The Archaic Period is further subdivided into Early Archaic (10,000 B.P.-7,000 B.P.), Middle Archaic (7,000 B.P.-5,000 B.P.) and Late Archaic (5,000 B.P.-2,500 B.P.) (Russo 1990). Few Early or Middle Archaic Period archaeological sites are recorded in south Florida, and the known sites are clustered along the Atlantic and Gulf coasts and inland waterways (Milanich 1994). Archaic sites become more numerous during the Late Archaic Period, when modern climatic conditions had been established, and the population exploited a larger territory and wider variety of aquatic and terrestrial resources. Crude fiber-tempered pottery first appears in the Late Archaic. By 2,500 B.P., sand replaced or augmented fiber as a ceramic-tempering agent. An increase in stone tool types and ceramic styles is indicative of population migration and social interaction, with a more complex political and religious infrastructure (Army Corps of Engineers 1999).

During the early historic period, beginning with the First Spanish Colonial period (1513–1763), the Calusa inhabited the coastal area of southern Florida. They were hunters and gatherers whose primary subsistence was fishing and collecting shellfish and wild plants. The initial population of the Calusa was estimated at 10,000 but was decimated by European-introduced diseases, warfare, enslavement, and migration out of Florida (Archaeological Consultants Inc 1991; Milanich 1994).

Initial contact between the Calusa and the Spanish and French explorers began during the 16th century and was limited to the coastal areas where the Europeans attempted to convert the indigenous population to Catholicism and alter their infrastructure. By 1570, when the Spanish withdrew from the area, the Calusa population had decreased to approximately 6,000. During the 17th Century, disease and the occasional European invasion continually reduced the Calusa population to extinction (Army Corps of Engineers 1999).

Present day Seminoles and Miccosukee are descendents from Creek Indians who migrated to north Florida in the 18th and 19th centuries from Georgia and Alabama in search of new lands after conflicts with Europeans. By the early 19th century, Florida's Native American population had increased to about 5,000. Throughout the mid 1800s, the United States relentlessly pursued a policy of Indian removal in Florida, relocating them to territories west of the Mississippi under the guise of the Indian Removal Act of 1830 and the Seminole Wars. The remaining Seminole and Miccosukees resisted removal and eventually established themselves in the Everglades, Big Cypress Swamp, and Ten Thousand Islands. Most of the population lived on tree hammocks and utilized dugout canoes for transportation, hunting and trading. Dwellings were chickee huts constructed of cypress logs and palm fronds. To a certain extent, this lifestyle still exists presently. Today the Miccosukee and Seminole Indian tribes are Federally recognized Indian Tribes, with an ethnic distinction mainly of linguistic differences.

2.16 NOISE

In the natural world of pre-drainage conditions this term has no meaning.

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SECTION 3

EXISTING CONDITIONS

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SECTION 3
EXISTING CONDITIONS

3.1 INTRODUCTION

This section describes the existing environmental resources of the Southern Golden Gate Estates Project Area landscape. It does not describe the entire existing environment. For Comprehensive Everglades Restoration Plan (CERP) projects, "existing conditions" are defined as the landscape present as of December 2000. In conjunction with the description of the future without project (no-action) alternative, "existing conditions" forms the base line conditions for determining the environmental impacts of the proposed action and reasonable alternatives. Future "without project conditions" are described in Section 4 of this document.

3.2 GENERAL ENVIRONMENTAL SETTING

The Southern Golden Gate Estates (SGGE) Project Area is located in Collier County, Florida. It lies east of the city of Naples, between Interstate 75 and U.S. Highway 41. Combined with the Belle Meade State Conservation and Recreation Lands (CARL) area to the west, the SGGE Project Area constitutes the heart of what is now called the Picayune Strand State Forest. This forest is located south of Northern Golden Gate Estates (NGGE) and Interstate 75, southwest of the Florida Panther National Wildlife Refuge, north of the marine preserves and refuges that constitute the Ten Thousand Islands Region, and west of the Fakahatchee Strand State Preserve. It contains some of the most diverse plant and wildlife communities on the North American continent and could provide habitat for several Federally listed endangered species, including the critically endangered Florida panther. Currently the SGGE Project Area canal system has a hydrologic influence over all the surrounding private, state, and federal lands (Figures 1-1 and 1-2). The estuarine area of influence of the SGGE Project Area canal drainage within the coastal communities covers four major embayments, which are, from west to east, Blackwater River, Pumpkin Bay, Faka Union Bay and Fakahatchee Bay (Figure 3-2).

3.2.1 Infrastructure

The SGGE Project Area subdivision as it currently exists has an infrastructure of roads, bridges, canals, weirs, and other infrastructure. By the early 1970's, all of the roads and canals had been constructed. The current road infrastructure is essentially the same as it was in the 1970's. There are a total of 279 miles of

roadway of which, 60 miles are paved with asphalt and 219 miles are surfaced with a crushed limerock surface. 251 culverts and ten bridges, two of which are newer construction, are part of the road system.

There are 125 "improved" sites within the SGGE Project Area. These range from hunting camps and trailers to permanent homes. Nearly all of the sites were constructed without county building permits, do not have electric or telephone service, and very few have septic systems. The exceptions are on 52 and 54th Ave SE and at Port of the Islands. All properties, except those at Port of the Islands, are being purchased by the state. Five structures will be retained to assist with the restoration, law enforcement, and management of the area; and the reminder will be demolished. The canal system is 48 miles in length, with three fixed-crest weirs and four adjustable weirs. The newest weir was constructed on Merritt canal south of Interstate 75, to minimize drainage flowing from the Florida Panther National Wildlife Refuge.

Interstate 75 (I-75) is located at the northern edge of the SGGE CARL boundary and divides SGGE from NGGE. State Road 29 runs north and south along the eastern edge of Fakahatchee Strand State Preserve. It is approximately 8 miles east of SGGE. U.S. 41 runs generally west northwest to east-southeast. It is located aloang the southern edge of the SGGE CARL boundary and near the southern edge of the SGGE Project Area. See Figures 1-3, 1-4, and 1-5 for locations of these roads.

3.3 PLANT COMMUNITIES

In July 2001 the Natural Resources Conservation Service (NRCS) provided a detailed map, based on recent soil survey field data and aerial photographs, of the 1995 distribution of major plant community types in the SGGE Project Area (Figure 3-1). This NRCS map represents a valuable baseline of real world plant community acreages for current conditions. Using the MIKESHE model, South Florida Water Management District (SFWMD) produced an "existing conditions" model run of hydrologic conditions. Plant community distributions were predicted using the relationship between the hydrologic characteristics of each major community type (Table 3-1) and the average wet season water depths (July 1 through October 1) as predicted by the model. A more in depth assessment of the NRCS maps and the MIKESHE model can be found in the SFWMD "*Resource Assessment of the Southern Golden Gate Estates Hydrologic Restoration Plan*" (RA) located in Appendix D of this document.

Major changes to the hydrology and biology of the SGGE Project Area landscape began between 1968 and 1971, when the four canals that comprise the Faka Union Canal system and the 279-mile road system were completed. This

construction led to a significant decline in the landscape's ecology, which is still occurring to this day. Historic plant community composition changed from that of wetland and transitional vegetation to more upland, invasive, and exotic dominated systems (such as Cx, Hp, Hx, and Pp) as shown in Figure 3-1 and evaluated in Table 3-2. As historic cypress strands within the SGGE Project Area became drier due to the canal-induced draw down, there was a shift in vegetative succession toward a mixed cypress-hardwood-sabal palm system. Additionally, as a result of these abnormally dry conditions, hotter fire now frequently burns farther from prairies and flatwood communities into adjacent cypress strands or other hydric forested systems. Pines, sabal palms and saw palmettos that are adapted to drier conditions and more intensive fire regimes have replaced the cypress forest communities. Often invasive exotic species like Brazilian pepper (*Schinus terebinthifolius*) and melaleuca (*M. quinquenervia*) have become dominant or co-dominant in many of these formerly hydric communities.

The native sabal palm (*Sabal palmetto*), also commonly called the cabbage palm, has become dominant throughout much of the SGGE Project Area during the past few decades. These palms form dense populations of similar sized, apparently young trees, beneath widely spaced individuals that appear to be very old. Ages of sabal palms here have been subjectively estimated, as features of their growth do not conform to annual or seasonal events, and ages cannot be accurately determined from their physical characters. Most areas with dense sabal populations do not appear to have had dense sabal palm populations on aerial photographs taken in 1940 and 1953. This suggests a sparse parent population that has given rise to a successful population of offspring, all at about the same time. The younger palms appear to be 2-3 decades old (again, ages determined subjectively), suggesting that the population increase occurred as the hydrology of the area changed. The sabal palm forest has now become almost a pure biotype within many areas of the SGGE Project Area. The Florida Division of Forestry (DoF) now considers this palm an invasive species by that needs to be controlled in order to maintain diversity in the ecosystem.

More detailed descriptions of the SGGE Project Area plant communities can be found in the SFWMD documents entitled "*Resource Assessment of the Southern Golden Gate Estates Hydrologic Restoration Plan*" attached in Appendix D.

TABLE 3 - 1 FACTORS MAINTAINING MAJOR PLANT COMMUNITY TYPES

Average Wet Season Water Level (inches)	Hydroperiod (months)	SGGE Non-Tidal Plant Communities	Non-Hydrologic Influences	Relative Abundance in SGGE (Existing)
≤-6	0	Tropical Hammock	No Fire	++
≤2	≤1	Mesic Pine Flatwoods	Fire	+++
		Palmetto Prairie	>>>Fire	0
		Mesic Hammock	No Fire	++
		Brazilian Pepper	Exotic	++
		Palms in Flatwoods	Soils	+++
		Palms in Hammock	Soils	+++
2 – 6	1-2	HydricPine Flatwoods	Fire	+++
		Hydric Hammock	No Fire	+++
		Palms in Flatwoods	Soils	+++
		Palms in Hammock	Soils	+++
6 – 12	2-6	Wet Prairie	Fire	+++
12 – 24	6-10	Marsh	Fire	++
		Cypress Forest	< Fire	++++
>24	>10	Open Water	Canals	+

Relative abundance of plant communities is indicated by the number of pluses from low abundance (+) to high abundance (++++). A zero (0) indicates the community is not present under existing conditions.

FIGURE 3 - 1 CURRENT SOUTHERN GOLDEN GATE ESTATES AREA VEGETATION MAP

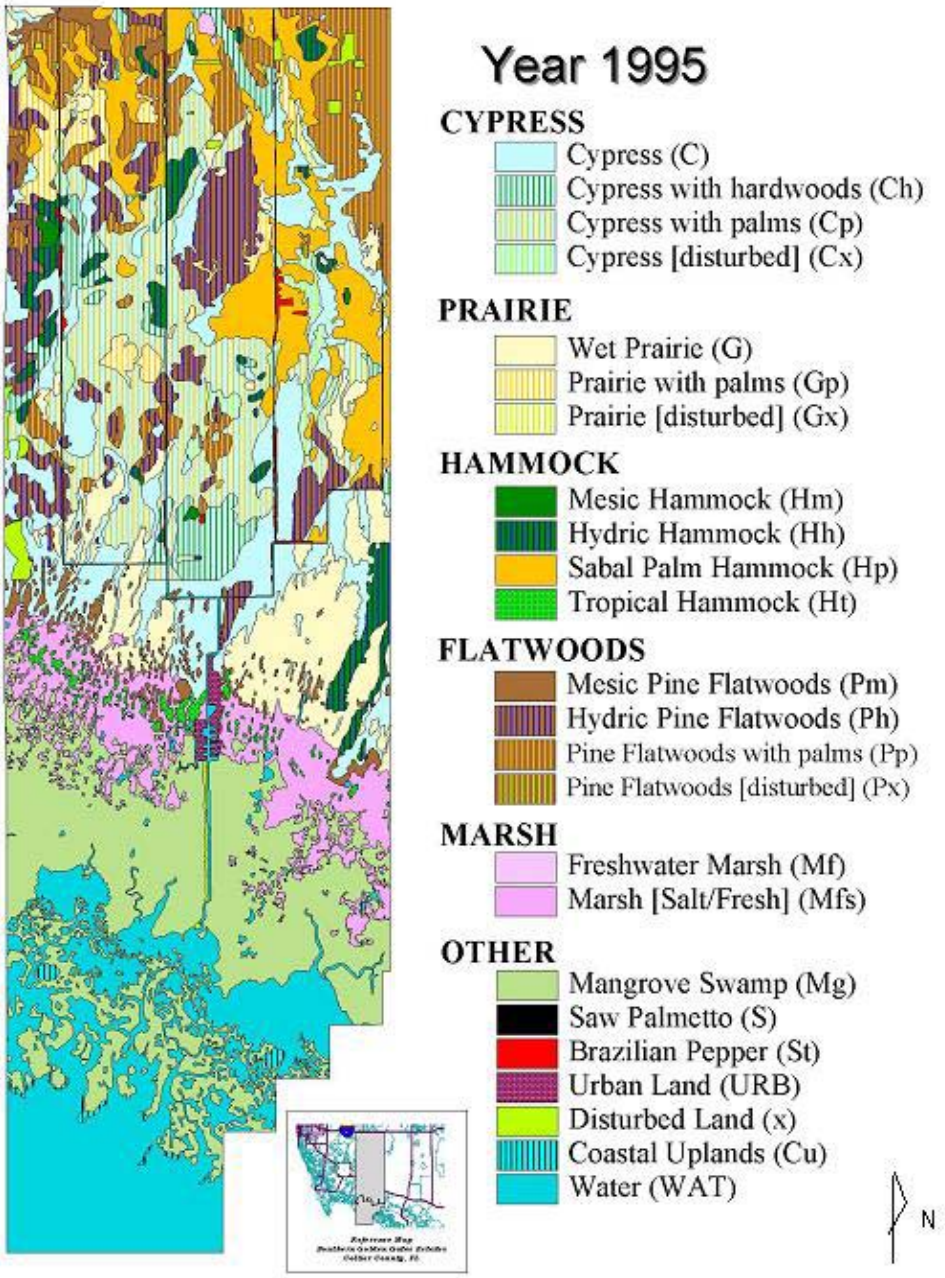


FIGURE 3 - 2 ESTUARIES, RIVERS, AND BAYS AFFECTED BY SGGE CANAL DRAINAGE PATTERN

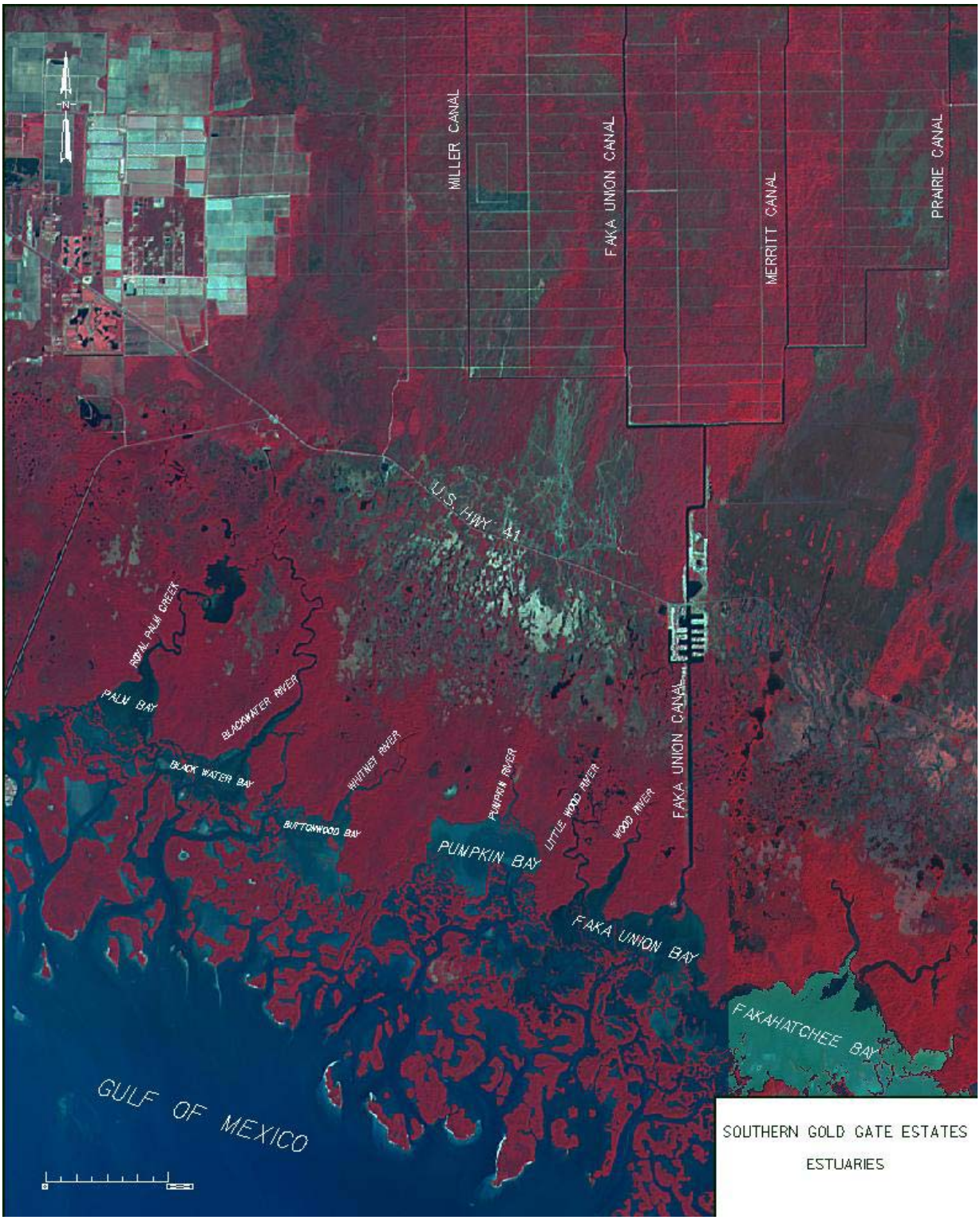


TABLE 3 - 2 SOUTHERN GOLDEN GATE ESTATES AREA PLANT COMMUNITY CHANGES FROM NRCS 1940 & 1995 MAPS

(Compares the difference between Figure 3-1 and Figure 2-1)

Name	Plant Community Symbol	Percent Historic (1940)		Percent Current (1995)		Difference Current minus Historic (1995-1940)
Cypress	C	30.5%		10.5%		-19.9%
Cypress with hardwoods	Ch	0.0%		2.8%		2.8%
Cypress with palms	Cp	8.7%		9.0%		0.3%
Coastal Uplands	Cu	0.3%		0.3%		0.0%
Cypress (disturbed)	Cx	0.0%		1.2%		1.2%
Wet Prairie	G	7.6%		7.0%		-0.6%
Prairie with palms	Gp	0.0%		2.0%		2.0%
Prairie (disturbed)	Gx	0.0%		0.2%		0.2%
Hydric Hammock	Hh	0.0%		2.6%		2.6%
Mesic Hammock	Hm	0.0%		0.1%		0.1%
Sabal Palm Hammock	Hp	0.1%		7.3%		7.2%
Tropical Hammock	Ht	0.3%		0.7%		0.4%
Freshwater Marsh	Mf	0.5%		0.1%		-0.4%
Marsh (Salt/Fresh)	Mfs	8.5%		6.5%		-2.1%
Mangrove	Mg	16.5%		18.3%		1.8%
Hydric Pine Flatwoods	Ph	7.1%		5.8%		-1.3%
Mesic Pine Flatwoods	Pm	2.9%		2.0%		-0.9%
Pine Flatwoods with palms	Pp	2.4%		6.5%		4.1%
Pine Flatwoods (disturbed)	Px	0.0%		0.0%		0.0%
Saw Palmetto	S	0.0%		0.0%		0.0%
Brazilian Pepper	St	0.0%		0.3%		0.3%
Urban Land	URB	0.0%		0.3%		0.3%
Water	WAT	14.7%		15.8%		1.1%
Disturbed Land	x	0.0%		0.7%		0.7%
Total:		100.0%		100.0%		

3.4 FIRE

The extensive system of drainage canals and roads in the SGGE Project Area have had a profound impact on surface water hydrology. Thirty years of anthropogenic alterations to the hydrological cycle caused by the SGGE Project Area canals have resulted in more frequent wildfires with greater intensity. Fires that occur today may burn closer to or below the soil surface, as surface water and moisture levels are likely to be lower than levels before drainage. Wildfires in Collier County increased dramatically after completion of the Golden Gate Estates (GGE) drainage system (Gore, 1988). The year following its completion in 1971, four times as many acres burned as the cumulative total of acres burned from 1963-1971. Furthermore, for the following five years, the mean acreage burned per year exceeded this cumulative total. In the years from 1980 through 2002, the Division of Forestry (DoF) has tracked the number and total average acreage of wildfires within the SGGE Study Area. For this time period, the number of fires per year averaged 17.4, with a total average acreage burned per year of 2654 acres. The average size of each fire was 153 acres. It is anticipated by DoF that this trend will continue.

Fires today commonly burn farther from prairies and pine flatwoods into adjacent cypress sloughs or other hydric forest communities. This alters species compositions in communities formerly more hydric, as most resident wetland species are not well adapted to withstand fires (Wade et al., 1980). These fires often burn through wetlands that, before the construction of the canals, experienced fires only during periods of extreme drought. The intensity of the fires has burned out the soil organic matter that is associated with many of the hydric plant communities. The increased frequency and intensity of wildfire favors a less diverse plant community dominated by fire tolerant species, primarily sabal palm (*Sabal palmetto*).

Due to rapid drainage by the canals, the window for prescribed burning is often reduced to the time between the end of the rainy season and when the water table drops out of the root zone of the South Florida Slash (*Pinus elliotti var. densa*). The speed with which the land dries out severely limits the number of days that prescribed burns can be accomplished. There are only a few days during a burn season when the wind speed, wind direction, humidity, rainfall, water levels, manpower, and helicopter availability will all occur at the same time. Due to the excessive drainage, many areas will not be burned before the drought index will force prescribed burning to cease for that season. Fewer prescribed burns lead to fuel build up, more intense wildfires, and a reduced ability to control exotic species.

3.5 FISH AND WILDLIFE RESOURCES

By their nature, the hydroperiods of wetland systems are highly susceptible to the impacts of drainage projects. The shortened hydroperiods currently present in the SGGE Project Area clearly demonstrate the profound impacts of drainage projects on the shallow wetlands and the associated fish and wildlife in this part of SW Florida.

The drainage of the SGGE Project Area has increased fire frequency, accelerated the invasion of exotic and nuisance species, and degraded resources for vertebrates within and adjacent to the project area. A reduction in those species dependent on wetland systems for all or part of their life cycle, such as amphibians, some reptiles, and forage fish, is confirmed by ongoing surveys (Dave Addison 2001). Plant diversity has been reduced as a result of replacement of historic cypress communities by monocultures of cabbage palm and non-native plant species. Radio telemetry information for the Florida panther indicates significantly less use of the project area than adjacent public lands to the east and west, possibly due to reduced prey availability and the disturbance related to human presence, which is exacerbated by a grid road system (Darrell Land 2001). Increased high intensity wildfire has eliminated pine canopy that could be utilized by migratory birds, the state-listed Southeastern American kestrel (*Falco sparverius paulus*) and Big Cypress fox squirrel (*Sciuris niger avicennia*), and the state and federally listed red-cockaded woodpecker (*Picoides borealis*), which is present on adjacent public lands with greater pine forest density.

The shortened hydroperiods and the rapid drainage that now occurs in the SGGE Project Area with the onset of the dry season have also impacted aquatic and terrestrial wildlife. For example, much of the decline in wading bird populations throughout South Florida is directly attributable to the loss of wetland function resulting from drainage. In the SGGE Project Area, the acreage of wetlands that once supported large populations of fish and aquatic invertebrates well into the dry season are now impaired in their ability to function as forage areas. While they can serve as foraging areas, the period of time that they can function in this capacity has been truncated. Areas that once retained water even in time of drought, no longer do so. Further, these wetlands can no longer function effectively as refugia for alligators, turtles, amphibians, and fish during droughts. The extent of this loss of function in the SGGE Project Area was demonstrated during the drought in 2001. No natural wetlands in the SGGE Project Area retained any water whatsoever. In the adjacent Fakahatchee Strand State Preserve, an area that has not been as seriously impacted by drainage, some of the deeper wetlands retained water and were refuges for wildlife (Nelson et al. 2001).

The Florida Department of Forestry provided a list of species known to inhabit the study area as of 2001. The list can be found in Appendix D of this report under *Species of the Picayune Strand State Forest*.

The effect of excessive drainage of freshwater through the Faka Union canal system on fish species of part of Ten Thousand Islands Region is under study by the Florida Department of Environmental Protection's (FDEP) Rookery Bay National Estuarine Research Reserve (NERR). The NERR is defined as that part of Ten Thousand Islands Region between Cape Romano and the border of Everglades National Park. Pat O'Donnell has provided a list of NERR fish species gleaned from his in-progress project, called Rookery Bay/10,000 Islands Fisheries Monitoring Project. This list, titled *Fish Species of the Upper 10,000 Islands*, can be located in Appendix D of this report.

3.5.1 Wading Birds

As part of this study, monthly aerial surveys of the SGGE Project Area were conducted during the first six months of 2001. The survey documented numbers and locations of wading birds, wading bird activity, and surface water cover within the project area. Recorded wading bird numbers were generally very low throughout the study area during all survey months; however, 2001 drought conditions probably contributed somewhat to the low counts. The only water present on the SGGE Project Area was in canals with steep banks and deep water, which made them inaccessible to wading birds (Nelson et al. 2001). In contrast during this same survey, relatively undisturbed wetlands adjacent to the SGGE Project Area, including Fakahatchee Strand State Preserve, Big Cypress National Preserve, and Ten Thousand Islands National Wildlife Refuge supported significant concentrations of foraging and nesting wading birds during the same time period.

3.5.2 Small Mammals

Preliminary data from an ongoing small mammal trapping survey in the SGGE Project Area seems to indicate that the drainage may have had some impact on the distribution of cotton mice, rice water rats, and cotton rats. Areas that are in the southern (wetter) portion of the SGGE Project Area seem to have higher catch rates for these species. During the dry season, few or none of these rodents were captured in the dryer northern study sites. As the rainy season began, some of the previously dry study sites began to retain some water, and trapping success began to increase on some of these areas, particularly with respect to cotton mice. These data are still being compiled and have not been analyzed, but, at this point, they seem to suggest that these rodents may

respond positively to wetter conditions. An increase in the small mammals population, if indeed their numbers have been depressed by the drainage, would provide more food resources for predators such as hawks, snakes, bobcats, etc. (Addison 2001).

3.6 THREATENED AND ENDANGERED SPECIES

In accordance with Section 7 of the Endangered Species Act, the U.S. Fish and Wildlife Service (FWS) was contacted concerning federal threatened and endangered (T&E) species. In an October 27, 1999 Planning Aid Letter (PAL), the FWS responded with the following information (U. S. FWS 1999). Federally listed species that are known to occur in the vicinity of, may occur in, or may be affected by the SGGE project are the threatened eastern indigo snake (*Drymarchon corais couperi*), endangered Wood stork (*Mycteria Americana*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered Florida panther [*Felis* (=*Puma*) *concolor coryi*], endangered snail kite, *(Rostrhamus sociabilis plumbeus)*, endangered American crocodile (*Crocodylus acutus)*, and endangered West Indian manatee (*Trichechus manatus).* In a PAL dated January 17, 2003, FWS reaffirmed this list of species and added the threatened bald eagle *(Haliaeetus leucocephalus).* Additional information about these listed species can be found in the *South Florida Multi-Species Recovery Plan* (U. S. FWS, 1999b).

In southwest Florida, all of the above listed upland and marine species are vulnerable to the same significant threats to their survival. Collier County, in which SGGE is located, has one of the fastest growing human populations in the United States. Residential and commercial construction, agriculture, and timbering have caused widespread habitat loss, degradation, and/or fragmentation. The SGGE Project Area is bordered on three sides by large expanses of federal and state owned public lands dedicated to the preservation of natural ecosystems (Figure 1-1). The restoration of the SGGE Project Area is the key to providing the extensive home ranges needed by these and many other species.

Marine species are affected when these human activities require site drainage that cuts off and funnels sheet flow into canals and sends the water to the ocean as point sources. The Faka Union canal system degrades marine habitat in Faka Union Bay by sending it too much fresh water too fast. Other bays in the Ten Thousand Islands Region are effected by receiving too little fresh water. More information about the affects of the canal system on estuarine salinity can be found in Section 3.11, 9.11, and Appendix D.

3.6.1 American Crocodile

The U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC) list the American crocodile as endangered. This species occurs in extreme South Florida primarily in Biscayne and Florida Bays. Crocodiles have been observed as far north as the coasts of Lee and Collier Counties, but Collier County is not thought to support a significant resident population of crocodiles. Drainage canals associated with the SGGE Project Area have changed the seasonal timing and discharge of sheet flows to bays and estuaries of the Ten Thousand Islands Region, which has altered the salinity of the intertidal creeks, marshes, and mangrove forests used by crocodiles. Pumpkin and Blackwater Bays now receive less freshwater discharge, whereas Faka Union Bay has become less saline due to increased and "flashier" surge discharges. Changes in the distribution, timing, and quantity of water flows have affected the crocodile, although the specifics of these effects are not clear. The SGGE Project Area does not include designated American crocodile critical habitat.

3.6.2 Bald Eagle

The U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC) list the bald eagle as threatened. Currently, Florida has the highest number of breeding bald eagles of any southeastern state, supporting approximately 70 percent of the occupied territories in this region. Eagle sightings within the SGGE Study Area are common in particular along the edges of the Ten Thousand Islands Region. However, intensive conversion of natural plant communities to agricultural, residential, and commercial uses has encroached, and continues to encroach, on bald eagle nesting and foraging habitats. The drainage and development of the SGGE Project Area destroyed most of the wetlands that were bald eagle habitat. Eagle use varies in the SGGE Project Area but is primarily confined to foraging activities. No known bald eagle nests are located in the SGGE Project Area although one nest is located approximately 5 miles west of the project site in the Belle Meade tract of Picayune Strand State Forest.

3.6.3 Eastern Indigo Snake

The threatened eastern indigo snake (*Drymarchon corais couperi*) is present throughout the state, but its abundance is reduced to a point where it is uncommon.

The snake is listed as threatened by the U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC). It was listed as a threatened species as a result of dramatic population declines caused by over-collecting for the domestic and international pet trade, as well as mortalities caused by rattlesnake collectors, who gas gopher tortoise burrows to collect snakes. Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation. Residential and commercial expansions within the SGGE Study Area have become very significant threats to the snake.

There is no quantitative data with which to evaluate the trend of eastern indigo snake populations in South Florida. The population, as a whole, is most likely declining because of current rates of habitat destruction and degradation. Even with continued habitat destruction in southwest Florida, this species will probably persist in most localities where large, unfragmented pieces of natural habitat remain. Unfortunately, current and anticipated future habitat fragmentation will probably result in a large number of isolated small groups of indigo snakes that probably cannot support a sufficient number of individuals to ensure viable populations.

3.6.4 Florida Panther

"The Florida panther is one of the most endangered large mammals in the world. A small population in South Florida represents the only known remaining wild population of an animal that once ranged throughout most of the southeastern United States. The most recent verifiable population estimate is 60 panthers, including adults and subadults" (McBride 2000). At this time, panthers are not confirmed as to be occupying the SGGE Project Area. The SGGE project area is utilized primarily by sub-adult male panthers, which disperse through the site to the Belle Meade portion of Picayune Strand State Forest from Fakahatchee Strand. The SGGE Project Area does not include any established home ranges for adult (breeding) female panthers (Land, pers. comm. 2001). Telemetry data for the SGGE project area indicate reduced occurrence, possibly consistent with degraded habitat and human disturbance associated with 279 miles of primary and secondary roadways (Land pers. comm. 2001). The core panther population is in the Florida Panther National Wildlife Refuge and Fakahatchee Strand State Preserve, which border the SGGE Project Area to the northeast and east (Figure 1-2).

3.6.5 Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW) was federally listed as endangered in 1970 and, currently, is classified as threatened by the State of Florida. Statewide protection and restoration efforts focus on acquiring, managing, and restoring habitat surrounding these populations. Lands identified for acquisition should be contiguous with publicly owned conservation lands that contain red-cockaded woodpecker clusters (Beever and Dryden 1992). The acquisition and restoration of the SGGE Project Area would establish a contiguous block of public land (Figure 1-1) adjacent to the existing active red-cockaded woodpecker clusters in the South Belle Meade portion of the Picayune Strand State Forest. Approximately 40 clusters are located 15 miles east of the project in the Big Cypress National Preserve.

Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse under story and many large old-growth pines, constitute primary nesting and roosting habitat for the woodpecker. The drainage of the SGGE Project Area has caused an increase in the number and intensity of wildfires. These fires and the lack of hydrology have caused the displacement of most of the pines in the pine flatwoods and allowed the understory to be invaded by sable palms and other invasive and exotic species thus destroying most of the red-cockaded woodpecker habitat.

3.6.6 Estuarine Fishes and Sea Turtles

On May 1, 2003 the smalltooth sawfish (*Pristis pectinata*) was added under the Section 7 heading when the National Marine Fisheries Service (NMFS) listed it as an endangered species. In their draft Coordination Report (dCAR) dated February 2004 the FWS added the threatened loggerhead sea turtle (*Caretta caretta*), endangered Kemp's ridley sea turtle (*Lepidochelys kempi*), endangered Atlantic green sea turtle (C*helonia mydas mydas*), endangered Hawksbill sea turtle (*Eretmochelys imbricate*) and the following three candidate fish species: the goliath grouper (*Epinephelus itajara*), mangrove rivulus (*Rivulus marmoratus*), and sand tiger shark (*Odontaspis taurus*).

The smalltooth sawfish, the three candidate fishes, and the sea turtles use habitats in shallow coastal areas and estuaries of the Ten Thousand Islands Region, with some specimens moving upriver in freshwater. Although these species are excluded from entering the Faka Union Canal system by a weir located just north of Highway 41, they are affected by the concentration of freshwater drainage from the SGGE Study Area into the Faka Union Canal system. This concentration lowers salinity as it discharges into Faka Union Bay. The canal system also affects the area of optimum-salinity habitat in nearby

bays of the Ten Thousand Islands Region by diverting to Faka Union Bay this fresh water that otherwise would have entered these other systems as surface or groundwater flows. Browder *et al.* (1989) noted a reverse salinity gradient into Pumpkin Bay (a neighboring bay to the west) during part of the year, probably due to the large amount of fresh water exiting the Ten Thousand Islands Region through Faka Union Bay. These alterations in the timing and quantity of freshwater flowing into the estuaries has an impact on natural biodiversity by affecting food availability, predation pressure, reproductive success, and most likely has caused chronic and acute stress to these fishes and turtles. Additional information about these species can be found in the FWS draft Coordination Report located in Appendix D.

3.6.7 Snail Kite

The Florida subspecies of snail kite was first listed as endangered pursuant to the Endangered Species Conservation Act in 1967. The common name used in the original listing was "Everglade snail kite." This remains unchanged in the FWS Code of Federal Regulations, even though the official name for the species is now simply "snail kite" (AOU 1983). Both the U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC) list the snail kite as endangered. Snail kite habitat consists of freshwater marshes and the shallow vegetated edges of lakes (natural and man-made), where apple snails can be found. Drainage of Florida's interior wetlands has reduced the extent and quality of habitat for both the snail and the kite. The severely altered hydrology of the present day SGGE Project Area has drained most of the freshwater marshes that provided habitat for the snail kite.

3.6.8 West Indian Manatee

Both the U.S. Fish and Wildlife Service (FWS) and the Florida Fish and Wildlife Conservation Commission (FWC) list the West Indian manatee as endangered.

The 1960s and early 70s development of the SGGE Project Area disrupted the historic seasonal timing and discharge of sheet flow into Faka Union Bay. What was once a slow discharge across a broad front is now a point source surge at the mouth of the Faka Union Canal system. Aerial surveys conducted in the mid 1970s through the early 1980s documented manatee distribution throughout the region, particularly in the Faka Union Canal below US Highway 41 (Beeler and O'Shea 1985). Radio tracking data for manatees shows animals traveling extensive distances (10's of kilometers) to and from the Faka Union canal area to forage on offshore seagrass beds (Service 2002). These animals show a pattern of multiple days of feeding on seagrass beds followed by rapid, directed

movement to a distant source of freshwater, where manatees remain only briefly before moving back to offshore areas. These movements suggest that the availability of freshwater may be an important determinant of manatee distribution and abundance in this region.

The Port of the Islands Marina basin, located within the Faka Union Canal system directly south of the last weir structure and including areas underneath and slightly north of U.S. 41, is the second largest warm water refugia in southwest Florida. This marina basin can support up to 300 manatees during periods of cold stress. The marina's depth is probably the key feature responsible for creating a "passive" warm water refugium for this species.

3.6.9 Wood Stork

The U.S. Fish and Wildlife Service (FWS) listed the wood stork population in Florida as endangered. in 1984. It is also designated as endangered by FWC. The listing occurred because stork populations had declined by more than 75 percent since the 1930s. The original listing recognized the relationship between the declining wood stork population, the loss of suitable foraging habitat, and colony nesting failures, particularly in the breeding colonies in South Florida, where human actions have reduced wetland areas by about 35 percent (Ogden 1979).

Corkscrew Swamp Sanctuary, which is located approximately 23 km northeast of the SGGE Project Area, is the largest wood stork rookery in the United States. Fledgling production at the Sanctuary declined from a high of 17,000 fledglings in 1962 to less than 1,000 fledglings in 1998. Wetlands within 30 km of rookery sites have been described as core forage areas for wood storks; however, they may forage as far as 75 km from rookery sites. Storks nesting in the Big Cypress basin, under 1930s pre-drainage conditions formed colonies between November and January regardless of annual rainfall and water level conditions (Ogden 1994). In response to deteriorating habitat conditions in South Florida, wood storks in this region have delayed the initiation of nesting by approximately two months, to February or March in most years, since the 1970s. This shift in the timing of nesting is believed to be responsible for the increased frequencies of nest failures and colony abandonment in this region over the last 20 years. Colonies that start after January in South Florida risk having young in the nests when May-June rains flood marshes and disperse fish.

The SGGE subdivision and other human caused changes in the distribution, timing, and quantity of water flows have dramatically reduced the spatial extent of habitat surrounding the Corkscrew Sanctuary. The 1960s development of the SGGE Project Area is a classic example of severe landscape alteration affecting the wood stork foraging during fledgling production. Construction of 279 miles of

roads and 4 large drainage canals disrupted the overland sheetflow and destroyed most of the wetland habitat that is required for the unique feeding method of the wood stork.

3.6.10 Endangered Plants

During Florida Natural Area Inventory (FNAI) surveys of October 2000, March 2001, and May 2001, no federally listed plant species were documented on the SGGE project site. The record search did reveal nine plant species of management concern to the US Fish and Wildlife Service (FWS). The FNAI report and discussions with local land managers (Durrwatcher 2001) failed to document the potential for occurrence of any federally listed plant species. However the FNAI record search did document the presence, on the SGGE Study Area, of seventy-five plant species listed by the State of Florida as state threatened or endangered.

3.6.11 Essential Fish Habitat

The existing Faka Union Canal system collects rainfall runoff from both NGGE and the SGGE Project Area. This water, which would have been shallow slow moving sheet flow under natural conditions, is channeled through the system as surge flows into Faka Union Bay. Fish habitat in Faka Union Bay is damaged by the high flows and all bays are damaged by the reduction in slowly infiltrating freshwater that is needed to maintain optimal salinities. The shallows, and feeder creeks that make up the estuaries of the six bays located within the Ten Thousand Islands Region are displayed in Figure 3-2. These estuaries provide Essential Fish Habitat (EFH) for both adult and juvenile brown shrimp (*Penaeus aztecus)*, gray snapper (*Lutjanus griseus)*, gulf stone crab *(Menippe adina)*, pink shrimp *(Penaeus duorarum)*, red drum (*Sciaenops ocellatus)*, Spanish mackerel *(Scomberomorus maculates)*, spiny lobster *(panulirus argus)*, stone crab *(Menippe mercenaria)*, and white shrimp *(Penaeus setiferus).* The EFH consists of shallow open waters, mangrove-lined tidal fringes, seagrasses, macroalgal assemblages, and oyster reefs.

Mangroves are considered EFH because of their role as exporters of large quantities of particulate detritus (leaf litter) and dissolved organic matter into the embayments, and because they provide tremendous shelter and forage within the prop root communities that line the shores and creek banks. Seagrass beds and shallow oyster reefs likewise provide structure and shelter for juvenile life stages and small prey fish. Small "forage" fishes of many species are prey for larger individuals of commercially important species. Some 80-90+ percent of all commercially important fish and shellfish species in southwest

Florida depend on these shallow, highly productive habitats for completion of at least one stage of their life cycles.

3.7 GEOLOGY AND SOILS

3.7.1 Geology

The geology of the SGGE Project Area has not changed substantially from the pre-drainage conditions present in the 1940.

3.7.2 Soils

In the 1954 Collier County Soil Survey (Leighty, et. al 1954), the deepest of these flow-ways and basins are identified as a generic map unit labeled as Cypress Swamp (Cf). The survey names several soils that might be found within this map unit. Most of them have black or dark-gray mucky fine sand or peaty muck; in others it is brown peat. According to the current Soil Survey of Collier County Area, Florida (Luidahl, et. al. 1998), areas mapped as Cf in the 1954 survey have soils with sandy or mucky fine sands. A close study of 1940 and 1953 aerial photography also verifies the presence of these plant communities within this map unit.

Duever (1984) classified four major soil groups (rock, sand, marl, and organics) in the Big Cypress National Preserve. These major soil groups are found in the SGGE Study Area and historically were subject to intermittent or prolonged flooding and are characterized as poorly or very poorly drained. Soils throughout the SGGE Study Area vary in thickness over limestone. If the thickness of the soil layer above the limestone is greater than four feet, soil-forming processes occur to either form stain layers or cause mineral movement within clay layers above the limestone. South of the four major canals that drain the SGGE Project Area, soils in the wet prairies have marl over sandy deposits on rock.

The drainage of the SGGE Project Area landscape and the consequent increase in wildfires has caused the oxidation of much of the organic soil. Lost organic soils in some of the deeper wetlands would require centuries to replace. In the meantime, either deeper wetland communities, such as pop ash or pond apple sloughs, or open water would dominate these sites. The detailed map units from the modern soil survey seem to indirectly qualify that oxidation through drainage or fire activity has thinned the organic surface layers.

3.7.2.1 Prime and Unique Farmland

The Natural Resources Conservation Service (NRCS) was contacted by telephone on August 4, 2001. Mr. Tony Polizos, District Conservationist for the NRCS Naples Field Office, stated that he was unaware of any prime or unique farmland within the SGGE project boundaries. A letter dated January 15, 2003 from NRCS State Soil Scientist Mr. Warren Henderson confirms that there is no land within the SGGE Project Area that meets the current criteria for prime or unique farmland. Based on the above information "Prime and Unique Farmland" will be dropped from discussion in the remainder of this document.

3.8 AIR QUALITY

Air quality within the SGGE Project Area is in compliance with the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection (FDEP) air standards. There are no non-attainment basins in the area or its immediate surroundings.

3.9 CLIMATE

The construction of the canal network has resulted in an average estimated 17 inches of annual runoff from the Faka Union watershed (Black, Crow and Eidsness, Inc. 1974). This water is no longer moving into the groundwater nor across the land in slow shallow sheet flow. The lack of standing water on the land has the microclimate affect of eliminating the freeze protection for plants such as orchids, which can be found in the adjacent Fakahatchee Strand State Preserve.

3.10 HYDROLOGY

Land drainage activities began in southwest Florida with the diversion and channelization of the Caloosahatchee River. Significant anthropogenic alterations of the hydrologic regime and vegetative communities have occurred within the SGGE Project Area since the cypress logging operations in the 1940s and 1950s. The greatest changes to the SGGE area began with the 1960s development. The area was subdivided into rectangular plots. A network of 279 miles of roads was laid out on a quarter mile grid. Roads were built above surrounding ground by excavation of borrow ditches on each side. The roads and ditches, oriented north-south and east-west, intercepted historic shallow flow paths, which were generally oriented in a NNE-SSW direction. To maintain a lower groundwater table and provide flood drainage, 48 miles of large artificial

channels were built. The Merritt, Faka Union, Miller, and Prairie canals ultimately delivered all drainage to the lower end of the Faka Union (central) canal. These canals additionally provided conveyance for water drained from Northern Golden Gate Estates, located outside the main study area, north of Interstate 75. The operation of these large canals lowered groundwater throughout the SGGE Project Area landscape. Pre-drainage sheet flow was virtually eliminated; aquifer storage was reduced due to the generally lowered water table. Channeling all of the flow caused "shock load" discharges to the estuaries, releases of very large quantities of freshwater over a relatively small cross-sectional area of Faka Union Bay, during a relatively short time. Subdivision and road construction, as well as some land clearing on purchased lots inside the SGGE Project Area further changed the landscape by promoting invasion of upland and exotic vegetation, changes in species dominance in native communities, and increased wildfire. Beginning in 1985, the State of Florida started purchasing the SGGE Project Area lands with the purpose of restoring the hydrology and ecology of the area and combining the surrounding natural preserve units.

It is estimated that the Golden Gate and Faka Union Canal systems have increased drainage 16 times faster than historic conditions, lowered water tables by 2 to 4 feet, and reduced hydroperiods by 2 to 4 months, resulting in a dramatic increase in forest fires and annual runoff (Gore 1988). Table 1-2 outlines a chronology of the development of the SGGE Project Area.

3.10.1 Water Supply

The major freshwater aquifers underlying the SGGE Study Area region are the water table, the Lower Tamiami, and the sandstone aquifers. The water table and Lower Tamiami are the primary sources of water supply and occur within the surficial aquifer system. Presently, the NGGE area is not served by any public water or sewerage utility. Potable water is self-supplied primarily from the Lower Tamiami Aquifer. The sandstone aquifer, a part of the intermediate aquifer system, is separated from the surficial system by low permeability sediments and is present only on the northern part of the watershed. Rainfall is the primary source of recharge to the surficial aquifer system. Downward movement of water through the leaky confining beds underlying the water table recharges the Lower Tamiami aquifer. Since most of the SGGE Study Area canals are located in areas where the limestone of the shallow aquifer is within ten feet of the land surface, there is a direct hydraulic connection between the canal system and the upper portions of the surficial aquifer.

The City of Naples Eastern Golden Gate Well field is located along the Faka Union Canal between weirs Faka Union No. 4 and Faka Union No. 5, in the

Northern Golden Gate Estates area. With a maximum daily allocation of 21.0 million gallons per day, this well field provides the lion's share of the potable water for Naples and its unincorporated service area. Recharge from the canal influences the yield of the well field. Protection of the long-term sustained yield of this well field is one of the city's primary issues related to hydrologic restoration of the SGGE Project Area.

3.10.2 Water Quality

The SGGE Project Area comprises of the southern portion of the Faka Union Canal system. The construction of canals, levees and roads within the Faka Union Basin have eliminated the historical freshwater sheet flow and resulted to changes to the timing and quantity of flow within the system that have influenced water quality conditions in the project area and impacted the downstream estuaries of the Ten Thousand Islands Region. The large centralized freshwater inputs through the Faka Union Canal contribute to large fluctuations in the salinity levels in the Faka Union Bay and extended hyper-saline periods within the surrounding estuaries. This results in enormous shocks to the aquatic biota of the Faka Union Bay.

There are several monitoring efforts currently being conducted within the sphere of influence of this project area. The Collier County Pollution Control Department (CCPCD) monitors surface waters from at least eight sites that are classified as inflows or outflows to the SGGE Project Area. The Southeast Environmental Research Center of Florida International University (FIU) maintains an extensive monitoring network within the estuarine waters of the southwestern coast of Florida, including a site within the Faka Union Bay, located at the mouth of the canal. The FDEP Rookery Bay National Estuarine Research Reserve (NERR) is also collecting continuous data for the Faka Union Bay and Fakahatchee Bay.

The physical and chemical conditions of surface waters in the Class III freshwater bodies (recreation, fish and wildlife propagation) of the SGGE Study Area generally meet the water quality state standards. The quality of groundwater is also within the Florida Department of Environmental Protection's (FDEP) drinking water standard for potable supply. According to the FDEP Impaired Waters Rule Assessment, the Faka Union Canal and the estuaries receiving flow from the Faka Union Basin meet standards for dissolved oxygen, fecal coliform and turbidity. However, in addition to also meeting the standard for chlorophyll, the receiving estuaries from the Faka Union Basin are listed as impaired water bodies due to the concentrations of bacteria found in shellfish.

Data from monitoring sites located at the inflows of the project area along the Faka Union and Merritt Canals indicate mean phosphorus concentrations of 15 parts per billion (ppb). The estuarine sampling site located at the outfall of the Faka Union Canal weir averaged 20 ppb. An outlying concentration of 150 ppb was also obtained at the estuarine site. While there have been no indications that these concentrations have caused algal blooms within the study area (chlorophyll is used as an indicator of nutrient enrichment, and no violations for chlorophyll were found at the Faka Union site going into the estuary or in monthly data collected within the estuaries), the downstream estuarine systems are classified as extremely oligotrophic and impairments from sustained high levels of nutrients would be a concern. Total coliform have been detected in increasing concentrations at upland watershed monitoring sites associated with the Faka-Union Canal. These trends may be due in part to the approximate 20% increase over the past two years in the number of individual homeowner estates being developed in the Northern Golden Gate Estates (CCPCD, 2002). The majority of existing and new housing occurring in this basin uses septic systems and not municipal sewer. Upland land use in this portion of the watershed is also suspected of causing the presence of mean concentrations of chromium, greater than the national status and trend (NS&T) 85th Percentile, to be found within the tissue of oysters collected from a site located within Faka-Union Bay (Cantillo et. al., 1999).

The current agricultural activity in the watershed, as well as the numerous fallow agricultural fields within the western portion of the SGGE project area have been identified as areas of concern for future hydrologic restoration activities. The active fields to the west (Belle Mead) and the fallow fields along the western boundary of the project area have been identified as sources for high levels of residual pesticides in the soil samples collected from these areas. The pesticide Chlordane was found to be of particular concern in these areas and its elevated presence in soils collected at the ends of accessible roads within the western portion of the SGGE project area indicate that illegal dumping is also at play. Reflooding of these farmlands for hydrologic restoration could lead to the mobilization of these persistent organochlorines and result in food web contamination in the reflooded marsh area and the downstream estuaries. Many organochlorine pesticides and PCBs have been linked to hormone disruption and reproductive problems in aquatic animals (Colborn, et. al., 1993). In order to prevent the introduction of these biologically damaging contaminants to the 10,000 Islands estuary, the level of decontamination necessary for these soils needs to be clearly addressed before sheetflow is restored.

USGS and FDEP have performed, and continue to conduct, significant groundwater and water quality studies within the SGGE project boundaries and downstream estuaries. A water quality monitoring plan has been developed as part of this project and is included in Appendix D. Scientifically based

performance measures will also be developed and hydrodynamic models for salinity in the downstream estuaries will be run, if necessary, during the Detailed Design Report (DDR) level in order to predict the benefits to water quality.

3.10.3 Water Management

In the SGGE Study Area, the management of surface and groundwater resources for drainage, flood control, protection of water supply, and water quality is regulated, operated, and maintained by the Big Cypress Basin (BCB) office of the SFWMD under the authority of Chapter 373, Florida Statutes. The operations and maintenance activities primarily consist of maintaining canal conveyance capacity by regular control of aquatic weeds, shoal removal, operation of the water control structures, according to specified schedules, to release floodwaters during the wet season, and storage of water to reduce overdrainage during the dry season. BCB also performs long-term planning and capital improvement construction activities to enhance functional capabilities of the canals and structures.

The existing canal system in Northern Golden Gate Estates (NGGE) drains water into the SGGE Project Area via the Miller and Faka Union Canals. Continued maintenance of the existing drainage is of prime concern to the residents of NGGE. Rapid urban growth into historic lowlands has resulted in occasional "flooding" (natural inundation) of some NGGE properties. The "Recommended Level of Service Standard for Stormwater Management" in Collier County's Growth Management Plan uses the 10-year, 3-day storm for the NGGE area. The Growth Management Plan's "level of service" relates to how well a stormwater management facility or system addresses water quantity, quality, and groundwater recharge. Based on their consultant's study, the drainage sub-element of both the Oct. 1997 and the May 2000 Growth Management Plan rated two of the four canal sub-basins in NGGE as "D," unacceptable, on a scale of A to D, because existing facilities couldn't handle the 10-year storm adequately. The other two canal sub-basins were rated "C."

3.11 ESTUARINE RESOURCES

An essay by Carl Hiaasen (2002) on the SGGE and Thousand Islands Region describes the southwest Florida coastline south of the SGGE study area as "fractal." It is a coast consisting of a great deal of shoreline and large expanses of very shallow water. There are a series of short, meandering tidal rivers, flowing generally NNE-SSW, each of which opens into a more or less funnel-shaped bay (with the narrow neck of the funnel pointing upriver). The lower

rivers and bays are mangrove-lined. Located at the southern end of each of the bays are many low-relief islands with highly sinuous shorelines. Passes between the islands eventually empty into the Gulf of Mexico. The estuarine sub-team of the Project Delivery Team identified the following river/bay systems as located in the historic SGGE flowways, from west to east:

- Blackwater River/Blackwater Bay
- Whitney River/Buttonwood Bay
- Pumpkin River/Pumpkin Bay
- Wood River and Little Wood River/Santina Bay
- Faka Union Canal/Faka Union Bay

At the extreme east and receiving drainage primarily from the Fakahatchee Strand State Forest is Fakahatchee Bay. This bay is considered relatively unchanged from its historic condition and is used as a basis for comparison. Figure 3-2 illustrates the location and relationship of the above bays.

Unlike most of South Florida, Collier County's estuarine areas remained virtually unaltered until the 1960's when severe pressure for residential and agricultural development occurred. An extensive network of canals was constructed to drain the watershed. The dredge and fill of mangrove areas to create residential development hit a feverish pace (FLDNR 1988). Development of Marco Island and construction of the Gulf America Corporation (GAC) canal network, which included NGGE and SGGE, were particularly devastating to adjacent estuarine areas.

When the Faka Union drainage project was completed, the canals in SGGE effectively lowered the groundwater table over large expanses of land, reducing the stored water available for seepage to the estuaries. At the same time, nearly all of the overland flow originating north of US-41 was captured by Faka Union Canal, and released into Faka Union Bay. Blackwater River, Whitney River, Pumpkin River, Wood River and Little Wood River experienced greatly reduced inflows, while virtually all of this freshwater was discharged directly through Faka Union canal.

Curtailment of both flow and groundwater seepage from the Golden Gates region has caused a reduction in oyster reef and submerged aquatic vegetation (SAV) in tidal rivers and affected bays, and also to changes (displacement) in location and cover of the mangrove zones and oyster reefs. The drainages deprived of sheetflow and seepage are believed to show inland-trending displacement of the mangrove/tidal zone, as well as some vegetation and oyster reef die-off. In these estuaries, reduction of the slow pulse of the combined sheet flow/seepage during the early dry season is believed to have led to hypersaline conditions in late spring. In contrast, the lines of equal salinity have been displaced down-current

in Faka Union Bay. Oysters making up reefs that previously flourished within the inner bays have suffered high rates of mortality and low rates of growth and recruitment, and the loci for reef development has shifted to a more downstream position (Savarese and Volety 2001). Estuarine plankton and nekton have been flushed out, SAV cover is reduced or absent, and sport and commercial fisheries have declined, according to anecdotal accounts.

Oysters are considered a good indicator of overall ecosystem health in the estuaries and embayments. While tolerant of a wide range of water salinity concentrations, they are very sensitive to timing and duration of salinity variations outside their normal range of tolerances. As filter feeders, they are also sensitive to turbid water. Therefore, oyster reef occurrence and development are considered indicative of general estuarine ecosystem health and have been used as a surrogate for ecosystem improvements (Savarese and Volety 2001).

The present day discharge from the Faka Union Canal experiences extreme seasonal variations, resulting in large fluctuations in the salinity levels of the receiving bays. Canal discharge records measured at the USGS gauging station, located upstream from the outfall weir of the Faka Union Canal, are available starting in 1969. The average discharges for the period of record are 115 cfs during the dry season (November through May) and 460 cfs during the wet season (June through October), with an extreme discharge of 3,200 cfs occurring right after the canals were built.

Current point source discharge patterns cause enormous shocks to the aquatic biota of Faka Union Bay and deliver too little freshwater input to the saline areas in surrounding bays. During drainage pulses, estuarine salinity rapidly declines to near freshwater conditions. These conditions have caused prolonged salinity stresses and have eliminated or displaced a high proportion of the benthic, midwater, and fish plankton communities from the Bay. Such suppressed plankton development has resulted in very low relative abundance of midwater fish and also a considerable drop in shellfish harvest levels. The impact on commercial and recreational fisheries has been very significant. Comparisons of oyster physiology and ecology clearly demonstrate that water management practices, specifically the impacts of freshwater inundation from the uncontrolled draining and channeling of the wetlands within SGGE, have adversely affected oysters and the development of reefs. Sea grass meadows are no longer a prevalent habitat type in the Bay. Instead, bare, sandy mud and algal areas predominate.

3.12 SOCIO-ECONOMICS

3.12.1 Land Use And Population

Collier County comprises approximately 2,032 square miles and is the second largest county in the state of Florida. In the county, rapid population growth began in the 1950's. By the 1970's, Collier County was distinguished as the fastest growing county in the state as well as the nation.

COLLIER COUNTY POPULATION 1950-2000*

YEAR	POPULATION	% INCREASE
1950	6,488	-----
1960	15,753	143
1970	38,040	141
1980	85,971	126
1990	152,099	77
2000	251,377	65

*SOURCE: U. S. Census Bureau

Growth in Collier County has been much faster than for the state as a whole. The Hispanic population percentages are greater than on a statewide basis, but the African American population percentage is a good deal lower. For the census tract in the immediate area of the project site, the percentage of African Americans in residence there is greater than for the rest of the county. The census tract was located using the Census Bureau's *American Fact Finder* software.

The State of Florida, in a cost share arrangement with the US Department of Interior, is in the process of purchasing the lands within the SGGE Project Area. The SGGE Project Area does not coincide exactly with the census tract. The census tract provides a convenient area for which data is available and is closer to the relatively small sub-county component site footprint. This census tract data provides a blueprint for the surrounding area, not exact characteristics of the project site. The SGGE Project Area is located in a rural setting, with few permanent residents or existing businesses. Most of the owners of the land do not occupy the property and, in many instances, reside outside of the region, and, therefore, may not mirror the demographics of the local area residents. The most current information regarding the detailed demographics of the SGGE census tract was published in 1990. There has been little, if any, change in this census tract during the past 10 years.

Describing the demographic characteristics for the project site's census tract, Collier County, and the State of Florida, helps to provide a basis for

understanding the existing socio-economic context. Some of these characteristics are outlined below.

Based on the comparative profile data delineated below, people at the poverty level make up a smaller share of the population in the SGGE Project Area than in the State of Florida as a whole. The Hispanic population percentage is very close to the state average as a whole (higher at the county level, lower at the census tract level). The non-white population share is similar but lower in the project area.

Florida:

Population 2000	15,982,378
Change in population, 1990-2000	23.5%
Below poverty level, 1999 estimate	12.5%
White, 2000	78.0%
Black, 2000	14.6%
Other, 2000	7.4%
Hispanic origin, 2000	16.8%

Collier County:

Population 2000	251,377
Change in population, 1990-2000	65.3%
Below poverty level, 1997 estimate	11.2%
White, 2000	86.1%
Black, 2000	4.5%
Other, 2000	9.4%
Hispanic origin, 2000	19.6%

Southern Golden Gate Estates 1990 Census Tract Profile (Census Tract 0111.02)

Population	2,945
Percent below poverty level	11.8%
White	90.1%
Black	8.9%
("Non-white other" share of population negligible)	
Hispanic origin	8.5%

3.12.2 Water Demand

The total annual average water use for 2000 in Collier County is estimated at 230 million gallons per day (MGD), with 202.5 MGD coming from groundwater and 27.5 MGD coming from surface water. These figures, compiled by the USGS, include domestic, commercial, industrial, recreational, agricultural and power generation demands. These figures do not include the environmental

demand for water, which accounts for a majority of the water demanded in the SGGE Study Area. There are currently only a small number of residents residing in the SGGE Study Area, and they are utilizing private wells to fulfill their water demands. The Port of the Isles community is located outside the southern boundary of the Project Area and currently uses a community well field for water supply.

The SGGE Study Area is not currently suffering from a shortage of water, except for environmental concerns. Due to the relatively low number of persons and businesses in the existing area, the supply is sufficient for the demand.

The Northern Golden Gates Estates currently has a well field that supplies public water. There have been no unmet demands for water being supplied by the well fields. Most of the residents in NGGE have private wells to supply their water. There are shortages of water and saline problems during excessive droughts.

3.13 AESTHETIC RESOURCES

The SGGE Project Area is a subdivision where few lots were actually developed for housing. There exists an infrastructure of 279 miles of roads laid out on a quarter mile grid. This easy access enables the indiscriminate use of all types of vehicles. Illegal dumping of trash, poaching, and the irresponsible use of firearms are existing realities.

3.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

An Environmental Site Assessment (ESA) was conducted to assess and identify areas of concern and confirm the presence, or absence, of soil/groundwater contamination or contaminated media associated with the previous and current activities conducted within the SGGE project area. The Phase I ESA was performed in general accordance with American Society for Testing and Materials Standard Practice for Environmental Site Assessments (ASTM Practice E 1527-00). This method has been used as a guide to ensure appropriate inquiry into the environmental characteristics and conditions of the site consistent with good commercial/customary engineering and environmental practices.

The SFWMD contracted with URS Corporation for Hazardous, Toxic, and Radioactive Waste (HTRW) Phase I, II, & III assessments on the SGGE Project Area and immediate surrounding area. The contract was completed on September 30, 2003 by delivery of the report entitled *Phase I/II Environmental*

Site & Ecological Risk Assessment. Additionally the District contracted with Environmental Consulting & Technology, Inc (ECT), to delineate impacts in a portion of the SGGE project and prepare a supplemental assessment a report entitled *Additional Scope Sampling Program*. Executive summaries for the URS and ECT reports, including instructions for accessing an electronic copy of each document, can be found in Appendix D.

The URS report delineates the project area into 4 zones. In addition to the Interior Area of the SGGE Project Area, three former agriculture zones were identified within the project footprint. These former agricultural areas comprise approximately 2,800 acres or 5% of the SGGE Project Area**.** The following is a brief overview of the potential HTRW risks within each zone. Each of these specific zones can be located on Figure 3-3.

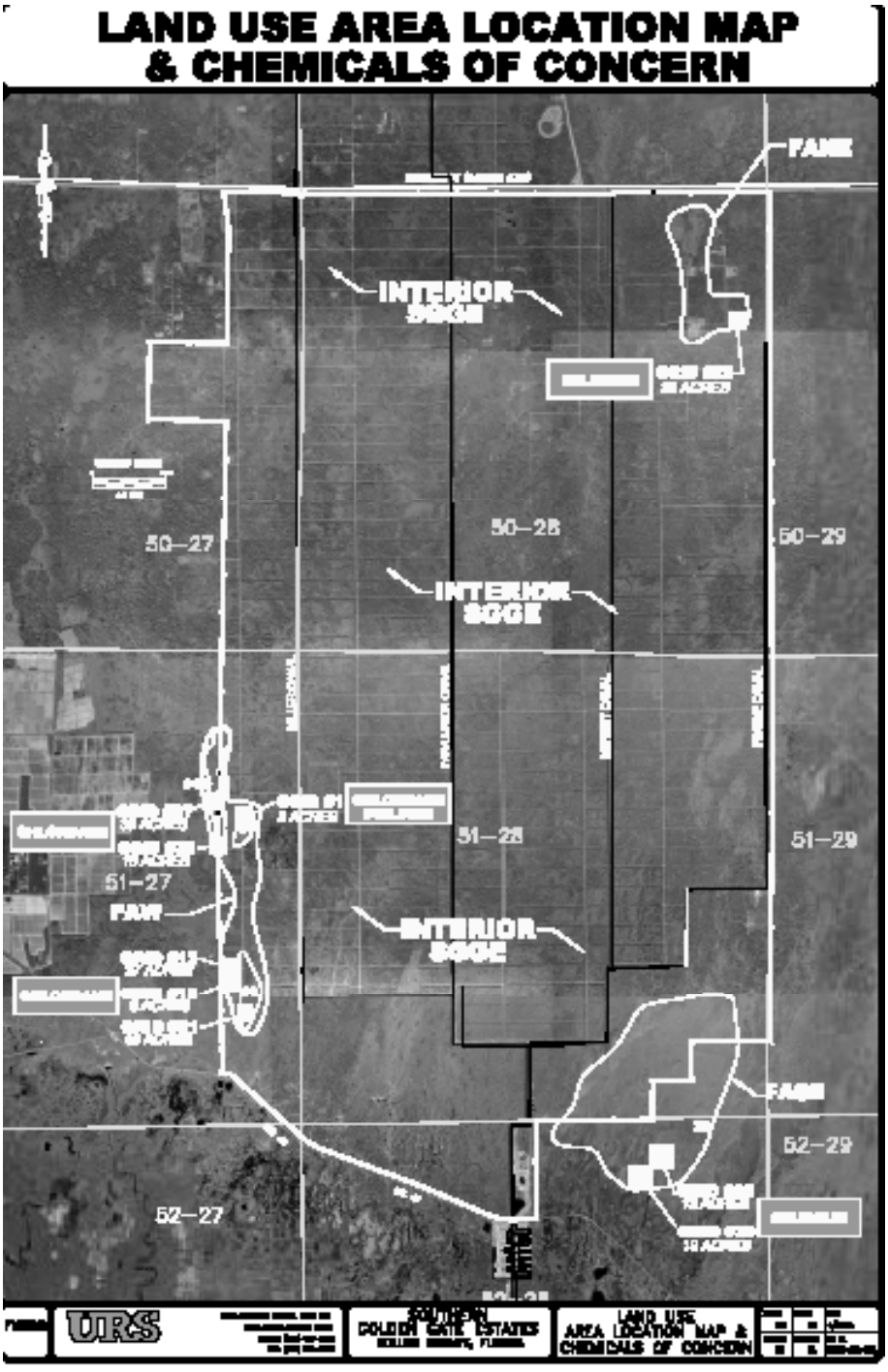
(1) Interior Area

The Interior Area represents approximately 50,000 acres of the SGGE or 91% of the SGGE. Ninety-three (93) soil samples were collected from six landscape nursery/grove areas and 10 soil samples were collected from smaller farm operations within the interior portion of the SGGE. In addition to the cultivated areas, soil samples were collected from areas of potential point sources (i.e. irrigation pump wells, agrochemical mixing areas, etc). Soil samples were analyzed for organochlorine pesticides and chlorinated herbicides. The results of Phase I/II and Phase III Environmental Risk Assessment (ERA) for the Interior Area indicated that the residual levels of pesticides exhibited in the Interior Area do not appear to pose a significant risk to aquatic animals or terrestrial animals and it is not anticipated that it will affect the trustee species. Therefore, no significant HTRW impacts would inhibit the proposed restoration activities within this zone. However, it is recommended that the homesteads be surveyed for potential asbestos containing materials, the potable wells abandoned, and the septic systems decommissioned prior to the proposed restoration.

(2) Former Agricultural Area – Southeast (FASE)

The FASE zone is located in the southeast section of the SGGE Project Area. The FASE represents approximately 1,450 acres of cultivated land that was reportedly used for the cultivation of tomatoes in the 1930s. Soil sampling in this zone identified selenium above the FWS interim 1 mg/kg guideline concentration established for screening agriculture property proposed for conversion to restored wetland or storm water treatment areas. The ERA results indicates that selenium as well as the organochlorine pesticides does not appear to pose any significant risk potential to aquatic plants or animals. Groundwater samples from two monitor wells installed in the FASE did not exhibit elevated concentrations of organochlorine pesticides or metals.

FIGURE 3 - 3 HTRW ZONES AND CHEMICALS OF CONCERN



(3) Former Agricultural Area - Northeast (FANE)

The FANE zone is located in the northeast section of the SGGE Project Area. The FANE represents approximately 600 acres of cultivated and uncultivated land, which was used for the cultivation of landscape plants and groves from the 1970s to 2000. Soil sampling within the FANE identified the presence of 4,4-DDT and toxaphene. Confirmation soil samples collected indicated that residual organochlorine pesticides were not consistently applied over the FANE, and are limited to localized areas and at low concentrations. Groundwater samples collected from the FAW did not exhibit detectable concentrations of organochlorine pesticides. Concentrations of metals were detected in groundwater samples below their respective GCTLs. Additionally; levels of selenium above the FWS 1 mg/kg guideline were detected. Based on the ERA, the levels of selenium in soils found in the FANE may pose a minimal risk potential for certain small ground foraging mammals but it is not likely to affect the trustee species.

(4) Former Agricultural Area – West (FAW)

The FAW zone is located in the western section of the SGGE Project Area. The FAW represents approximately 750 acres of cultivated and uncultivated land, which was cleared in the early 1960s and used for the cultivation of row crops. Soil sampling within the FAW indicated that organochlorine pesticides chlordane and dieldrin were detected above their SQAG. The impacted soils make up approximately 150 acres. Based on the sediment desorption, toxicity, and bioaccumulation tests, the levels of chlordane and dieldrin at the FAW does appear to pose a significant risk potential for sediment dwelling organisms, however, the residual organochlorine pesticides do pose some risk potential to aquatic receptors and piscivorous birds.

ECT conducted a supplementary assessment of FAW to confirm the extent of impacted soil that will require corrective action. Since no selenium was detected above the 1.0 mg/kg USFWS guidance concentration, ECT proposed no further action with respect to selenium impacts. Nevertheless, as discussed with the USFWS, ECT will re-sample grids 29 and 30 (25 acres each) with the USFWS to confirm results in these two grids. It is anticipated that the selenium re-sampling will return results less than the guidance concentration. In the event the guidance concentration is exceeded, corrective action may be required.

Based on the results of the supplementary assessment, 36 acres of chlordane-impacted soil will require additional assessment or corrective actions. Three levels of impacts were identified, based on the concentration of chlordane:

- 8 acres low-level chlordane (e.g., between 100 ug/kg and 200 ug/kg);
- 21 acres medium level, (e.g., between 200 ug/kg and 1,000 ug/kg); and
- 7 acres for high level (e.g., greater than 1,000 ug/kg).

Section 9.14 HTRW and Appendix D contain remediation recommendations.

Groundwater samples collected from the FAW did not exhibit detectable concentrations of organochlorine pesticides.

3.15 CULTURAL RESOURCES

A review of the Florida Master Site Files shows 13 known prehistoric sites within the Southern Golden Gate Estates area. A site visit, review of topographic maps and consultation with local informants indicates the location of approximately 750 acres of high probability areas, which have the potential to contain sites. Due to the existence of known historical properties, and the high probability of unrecorded sites within the project area, an archaeological survey is necessary, which has been concurred to by the Florida State Historical Preservation Officer. This determination has been made in compliance with Section 106 of the National Historic Preservation Act of 1966 (PL89-665), as amended in 2000; its implementing regulations (36 CFR Part 800) and the Archaeological and Historic Preservation Act of 1974 (PL93-291), as amended. Consultation with both the Miccosukee and Seminole tribes addressing potential cultural concerns within the Southern Golden Gate Estates is currently underway.

Based on a literature review in the Florida Master Site File (FMSF), a study of satellite photographs, topographic maps, and several site visits, there are 13 known archaeological sites within the Golden Gate Estates study area. An estimated 600 acres of high probability areas were identified in the SGGE Project Area, which have the potential to be historically significant. The U.S. Army Corps of Engineers (USACE) has determined that there is a potential for historic resources, eligible for the National Register of Historic Properties, to be affected by the SGGE Project Area. A cultural resources survey is necessary to determine the impact. No project specific cultural resource surveys have been conducted to date; however, because of the site density and project locations, it is expected that additional sites will be located within the SGGE Project Area. This determination is made according to the guidelines established by the 106 Process (36 CFR 800) of the National Historic Preservation Act of 1966 (NHPA), as amended through 2000 (PL-89-665), the Archaeological and Historic Preservation Act of 1974 as amend (PL 93-291), and Executive Order 11593.

Presently, coordination with the State Historic Preservation Officer (SHPO) is ongoing and project construction will not commence until coordination with SHPO is completed. A review of the FMSF was made of the SGGE Project Area to evaluate both the historical significances and the potential impact by the

projects to each area. The exact locations of the SGGE projects have not yet been determined and the site review was limited to the topography maps of the general areas. The SGGE Project Area has been heavily impacted by residential planning and both road and canal construction. The 1994 Conservation and Recreation Land (CARL) Survey located 13 known archaeological sites within the SGGE Study Area, of which four were relocated and three were tested during the survey. Testing was limited to soil removal with a posthole digger and recording the presence of faunal, shards, and shell. All sites are classified as prehistoric, although one has a possible Seminole component (Weisman and Newman 1994). The National Environmental Policy Act of 1969 requires that potential impacts to cultural resources and historic properties be identified prior to a Federal undertaking. Despite the fact that most of the SGGE Project Area has been impacted by human activities, the existence of previously recorded historic properties, and the existence of high probability archaeological sites necessitate a detailed survey. Both a Phase I and Phase II archaeological survey are being coordinated with the SHPO and the Advisory Council on Historical Places (ACHP), in accordance with the Archaeological and Historic Preservation Act of 1974 as amend (PL 93-291), the National Historic Preservation Act of 1966 as amended through 2000 (PL-89-665) and in accordance with the Section 106 process. Site file reviews, consultation with the SHPO and other concerned parties, determinations of significance, and surveys will continue until the Section 106 process is completed. If research identifies historic properties that are determined to be eligible or potentially eligible for the National Register of Historic Places, further measures will be taken to avoid, minimize or mitigate adverse impacts to such sites.

A Phase I Survey was conducted in September 2003, in the Prairie Canal Corridor of the Southern Golden Gate Estates Project, as part of the Prairie Canal Early Start Project. New South Associates conducted this survey under contract from the South Florida Water Management District. No previously unrecorded archaeological sites or historical properties were located during this survey. Due to extreme flooding of the survey area, two sites in the survey area, 8CR720 and 8CR721, were not tested as originally planned. The two sites will be tested at a future time in the Southern Golden Gate Estates Survey, scheduled to occur during the Detailed Design Report (DDR) phase of this project

3.16 RECREATION

The Picayune Strand State Forest and the Fakahatchee Strand are the two main recreational resources in the study area. SGGE comprises the eastern half of the Picayune Strand State Forest, which is a popular area for hunting, off-road vehicle use, mountain biking, camping, and horseback riding. The Florida

Department of Agriculture and Consumer Services estimates that there are approximately 40,000 user days per year of prohibited ATV usage. The DOACS estimates that there are 2000 user days of camping per year and 6,000 user days of horse back riding per year. There is an estimated 500 user days of legal hiking in the forest. The Fakahatchee Strand borders the SGGE on the east. The following Table includes annual visitation estimates for the years 1995-2003. In contrast to the State totals, the usage has been decreasing since the late 1990's. The South Golden Gate Estates tract has 48 miles of canals that are available for fishing and small boats. A boat ramp is located on the Faka Union Canal.

Annual Visitors to Fakahatchee Strand State Park (1995-2003)

YEAR	Annual Visitors
1995	80,518
1996	80,662
1997	127,325
1998	139,069
1999	56,570
2000	52,342
2001	42,931
2002	57,470
2003	57,065

Recreational use in SGGE is managed by the Division of Forestry as part of the Ten Year Management Plan for Picayune Strand State Forest. This management plan is due to be updated upon completion of the hydrologic restoration plan. Permitted public use of state lands managed by the Division of Forestry (DOF) is outlined in section 5I-4 of the Florida Administrative Code. A Memorandum of Understanding (MOU), between DOF and Collier County, sets out recreational opportunities that will remain on the SGGE Project Area. Both of these documents are available at the WEB site listed in Appendix D.

3.17 NOISE

Noise occurs from the general traffic on 279 miles of road. Swamp buggies, all terrain vehicles (ATV), and outdoor recreational vehicles (ORV) are used off road. Indiscriminate shooting sometimes occurs.

SECTION 4

FUTURE WITHOUT PROJECT CONDITION

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SECTION 4
FUTURE "WITHOUT PLAN" CONDITION

4.1 "WITHOUT PLAN" DESCRIPTION

This section describes the most likely status of year 2060 conditions in the Southern Golden Gates Estates (SGGE) Study Area if no Federal action is taken to solve the problem at hand. For the SGGE project, the date for both "future with" and "future without" project conditions is administratively fixed at the year 2060. The *U.S. Water Resources Council's Principles and Guidelines*, the *National Environmental Policy Act of 1969* (NEPA), and the *Corps of Engineers regulation ER 1105-2-100* all require formulation of a "without plan" condition. This condition is vitally important to the evaluation and comparison of alternative plans and to identifying the impacts (both beneficial and adverse) attributable to proposed federal actions. The "without plan" condition is the same as a "no action" condition.

The "without plan" differs from the existing conditions in that it represents a forecast into the future rather then what is current. For CERP projects, "existing conditions" are defined as the landscape present as of December 2000. Existing conditions are described in Section 3 of this document.

During plan formulation and alternative evaluation found in Section 6 of this document, the future "without plan" conditions are compared to future "with plan" conditions for each alternative. The tentatively recommended alternative is described in Section 8. The environmental impacts and effects of the future "with plan" conditions of the tentatively recommended alternative can be found in Section 9 of this document.

4.1.1 "With-and-Without" Versus "Before-and-After"

Many people typically think about the effects of alternative plans in terms of "before and after"; that is, they compare the condition that exists now, before it is changed by a plan, to the condition they expect to exist in the future after it has been changed by an alternative plan. A with and without project analysis looks at the future conditions without the plan, instead of existing conditions, and compares against the future condition with the project in place. In other words, "with" and "after" project are the same. The difference exists in evaluation of the "without" and "before" conditions. See Figure 4-1 for a graphic explanation.

In the CERP program, of which this project is a part, "with project" conditions are evaluated as of the 2060 base year. Ecological benefits, impacts, and effects, such as change in vegetative habitats, will have had time to occur. Existing (before) conditions for SGGE are forecast to change radically between Dec 2000 and 2060 if no Federal project is implemented. In order to compare apples to apples, "with-and-without" project produces a valid evaluation, where "before-and-after" project would be a skewed assessment with little meaning.

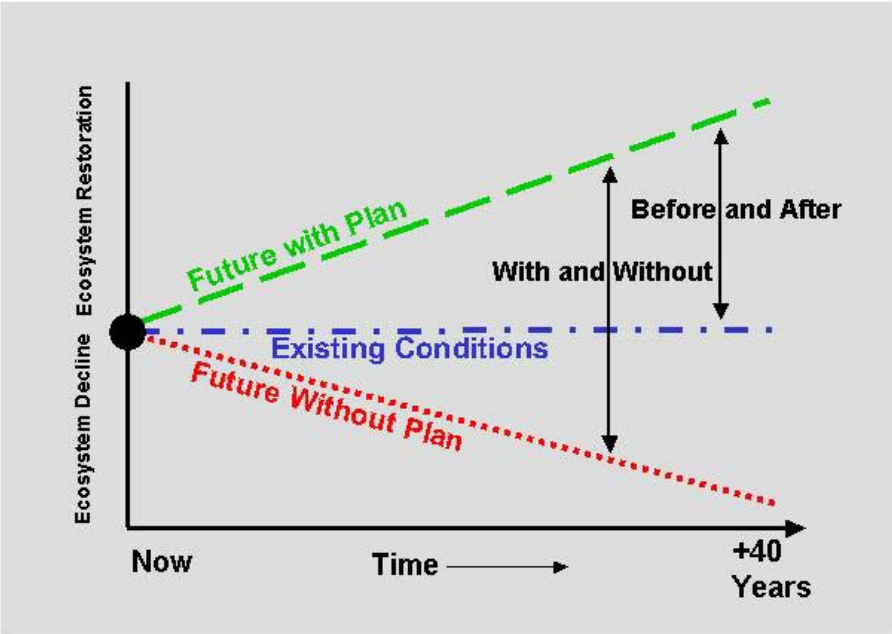

FIGURE 4 - 1 EXAMPLE: BEFORE (B) AND AFTER (A) VS. WITH (W) AND WITHOUT (WO)

4.1.2 Planning Horizon

The planning horizon encompasses the study period, the construction period, the economic analysis period, and the effective life of the project. The period of economic analysis, or the period of analysis, is the time period for forecasting future without-plan and with-plan conditions, and for considering the impacts of alternative plans. It is the period of time over which we think it is important to extend our analysis of plan impacts. This time period is frequently confused with the planning horizon, which is a longer and more encompassing concept.

The period of analysis for water resources projects is usually 50 years and never over 100 years. Forecasting conditions and impacts beyond 100 years is pure guessing, even if some structural projects may last more than 100 years. One of the most common measures of impacts has to do with the time value of money. Future dollar values, whether benefits or costs, are worth less than current dollar values. Discounting is the process used to place dollar values incurred at different times on an equivalent time basis. After 50 years, the discount factor alone reduces monetary values to a mere fraction of their former value. Unless the future dollar values being discounted are large, there is no apparent point to continue to include these values among project impacts.

For SGGE, the estimated completion of construction is 2010. Combining this with a 50-year period of analysis produces the year of 2060 for the future "without plan" condition.

4.2 GENERAL ENVIRONMENTAL SETTING

The Southern Golden Gate Estates (SGGE) Project Delivery Team (PDT) determined that the state of the SGGE Project Area without the authorization of the federal project would have been a Without Project situation where 60% of the land area is owned by the state and 40% is in private ownership. The 40% private ownership would be expected by 2060 to develop into a low-density residential pattern involving about 8,000 built out parcels. Distribution of state owned versus privately held parcels would be in a "checkerboard" configuration reflecting the historical acquisition pattern in the area (Figure 4-2). The decision to use the 60/40 split was based on an analysis of the history of land acquisition by the Florida Department of Environmental Protection (FDEP) from 1985 through the end of 1997. Acquisition of lands in the SGGE Project Area by FDEP began in 1985 when the State approved a plan to purchase these lands using Conservation and Recreation Lands (CARL) funds under the State's "Save Our Everglades" program. The CARL program required the land to be purchased from willing sellers for not more than the appraised fair market value. If the private landowner was unwilling to sell to FDEP, then FDEP could not condemn the land without express approval from the Trustees of the State of Florida. Acquisition of the land in the SGGE Project Area was an incredible undertaking because it involved approximately 19,995 parcels spread across 55,247 acres. Between 1985 through the end of December 1997, FDEP had acquired approximately 17,183 acres from 8,543 landowners.

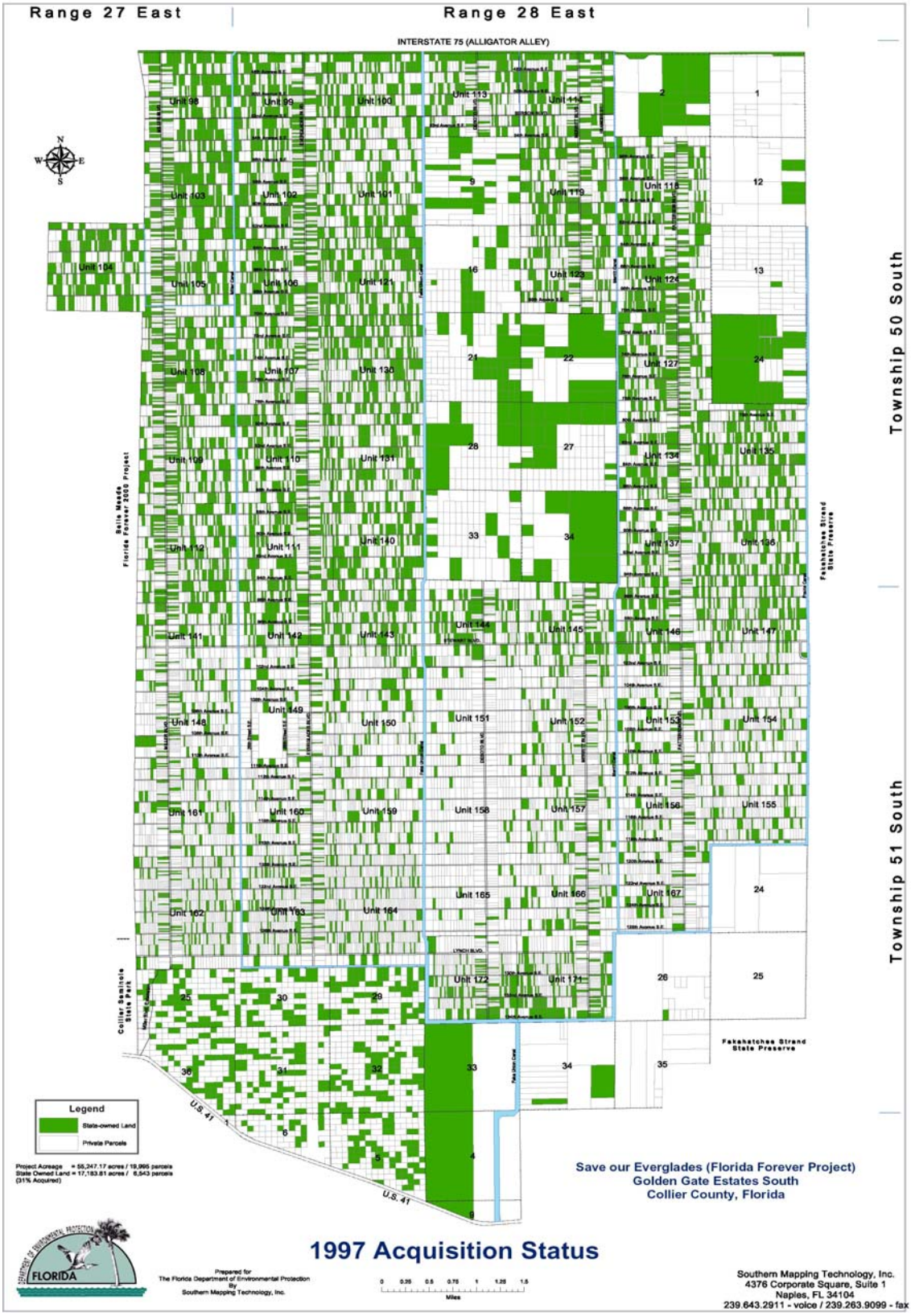

FIGURE 4 - 2 SGGE 1997 ONWERSHIP MAP

At the end of 1997, Southern Golden Gate Estates project was selected as a Critical Restoration Project by the U.S. Army Corps of Engineers pursuant to Section 528 of the Water Resources Development Act of 1996 (Public Law 104-303). (See Section 1.5.3 for history of the Critical Projects.) Southern Golden Gate Estates had also been ranked number 4 on June 4, 1996 by the South Florida Ecosystem Restoration Working Group as a priority project for receipt of Department of Interior funds authorized under Section 390 of the Federal Agriculture Improvement and Reform Act of 1996 (Public Law 104-127). Section 390 of the Federal Agriculture Improvement and Reform Act of 1996 (also known as the Farm Bill) provided the Secretary of Interior the authority to expend $200,000,000 to conduct restoration activities in the Everglades ecosystem including the acquisition of real property and interest therein. The Secretary could provide these funds to the State or other entities for restoration activities in the Everglades ecosystem including the acquisition of real property and interest therein. (See Section 1.5.5 for history of the Farm Bill appropriations). Without either of these activities, approval of the SGGE as a Corps' Critical Restoration Project and receipt by FDEP of Federal Farm Bill funds, land acquisition by FDEP from the end of 1997 through 2060 would have continued only from willing sellers and at a pace so that by 2060 only an estimated 60% of the area would have been in public ownership. Without federal participation it is questionable whether the state would have been able to acquire land at anywhere near the current existing rate.

A 60% state forest/40% private land ownership pattern would effectively prevent a return to natural sheet flow over the SGGE Project Area It would not be possible given the necessity to protect private landowners from flood damage impacts and to maintain road access to their properties. The 279-mile system of raised roads would eliminate any possibility of water flow across the SGGE Project Area and would present impediments to the environmental management of the state land. Under the Without Project alternative, the 48 miles of the Faka Union canal system would continue to over drain the natural hydrology and send the water in damaging surges to Faka Union Bay. The capture of all hydrology by this canal system eliminates the pre-drainage/natural flow of much needed freshwater to other estuaries in the Ten Thousand Islands Region (Figure 3-2). The rapid drainage caused by the canal system would continue to inhibit recharge to the ground water aquifer. Population increase and build out of most of the 40% private ownership would produce political pressure to improve the canal and road systems. Management functions on the 60% state land, such as law enforcement, wildlife management, invasive and exotic species control, prescribed burns, forest products harvest, and off road vehicle regulation would be gravely hampered by the public-private ownership pattern. Educational and research opportunities would be limited by the ownership pattern.

4.2.1 Infrastructure

Presently, Collier County has one of the highest population growth rates in the nation. It could therefore be predicted that by 2060 the vast majority of the 40% private lots would have homes constructed on them. The "checker board" pattern of the public/private parcels would require that most of the 279 miles of existing roads be cleared of exotics, repaired, upgraded for safety, and maintained on a regular schedule. 251 existing culverts would be cleaned, replaced as needed, and maintained on a similar schedule. Larger blocks of private land in the "Boot" and the "Hole in the Doughnut" would likely be sold off in smaller lots as plated and require additional roads and services to accommodate residential build out. Utilities would be expanded across the area. The 48-mile canal system would have to be maintained to provide existing flood protection for private property owners. By 2060 political pressure would most likely be brought to bear to improve the canals, and the road drainage system for better flood protection.

Law enforcement on State lands to prohibit public intrusion or damage would be nearly impossible due to the difficulty and high cost of surveying and legally posting 1 to 5 acre lots. Without proper posting of state land boundaries, it would be difficult to get a conviction if a reasonably prudent person were unable to tell if they were on state or private land. Even with state of the art GPS/GIS systems, the person would be warned, and would have to be apprehended a second time to receive a notice of violation.

4.3 PLANT COMMUNITIES

Under 2060 "without project" conditions, hydroperiods within the SGGE Project Area would not sustain wetland vegetation. The landscape would continue to succeed to poor quality upland habitats dominated by palmetto, cabbage palm, and exotics species, such as Brazilian pepper. Wildfires would use the increased number of cabbage palms as ladder fuel to reach the crowns of the native pines, reducing their populations to a few remnant stands. Mesic community types would become mostly populated by exotic and invasive species. Melaleuca and cogon grass would spread into the few remaining wet areas as continued wildfires damaged the native cypress stands. Exotic and invasive infestations would gradually grow worse over time, as excessive drainage further dries the SGGE Project Area. Brazilian pepper would continue to negatively affect prescribed burning, as the plants' density prevents fire from carrying through the stand. Herbicide treatment would need to be repeated into perpetuity, due to reinfestation of the treated areas by wildlife and human vectors. The few if any epiphytic orchids and bromeliads would disappear because of illegal

collecting and wildfires, low humidity, and increased chances of freezing caused by a lack of standing water.

4.4 FIRE

The 60/40 ownership patterns in the 2060 base year would lead to extremely dry conditions brought on by an increase in both impervious surface and over-drainage for flood protection. The Florida Division of Forestry (DoF) would continue to attempt a program of prescribed burning meant to reduce fuels for potential wildfires and to restore fire dependent communities and wildlife habitat. The window of opportunity for conducting safe prescribed burns would be greatly reduced by the canal systems quick drainage of soil moisture and the ground water table. Prescribed burning on private land could be accomplished through the Hawkins bill; however, increasing numbers of private residences would increase the difficulty of accomplishing large acreage burns. Private residences would need to be protected during prescribed burns, which would make the burns logistically challenging. With the window of opportunity so dramatically shortened, conducting many small burns near residences would require a big budget to pay for a large number of trained personnel and equipment for a short period of time. The number of uncontrolled fires caused by man would increase as the number of people using the area increases.

It is, therefore, predictable that during some future drought cycle, devastating wildfires would occur. Besides threatening public health and safety, these wildfires would severely damage organic soils and continue to reduce native pine and cypress over story species. Even in prescribed burns, pine and cypress in the SGGE Project Area have, and will continue to have, a higher mortality than in undrained areas due to a lower water table and the high number of sabal palms (*Sabal palmetto*), also known as the cabbage palm. Although the sabal palm is a native species it can become an invasive that drives out all other natives to the point that it becomes virtually a monotypic stand covering the landscape. Under the very dry ”without project” conditions the sabal palms would act as a ladder fuel into the pine and cypress canopy. They would encroach into all vegetation types, further increasing future wildfire intensities and mortality of the other native species. Palm fronds increase the frequency and distances for spot ignition during a wildfire. Wildfire also encourages other invasive and exotic vegetation to spread, particularly Brazilian pepper, Melaleuca, and cogon grass.

4.5 FISH AND WILDLIFE RESOURCES

Under “without project” conditions, the 60/40-ownership pattern would lead to over drainage caused by continued or even enhanced use of the canals, which in

turn would result in a loss of habitat diversity. These continued hydrologic changes would eliminate most wet prairie, marsh, and cypress communities the edges of which provide forage during dry down for prey species, such as deer, raccoons, and hogs. Mesic and Hydric Flatwood habitats would dry out further and be taken over by invasive and exotic plants that would reduce wildlife habitat quality. Succession of wetlands to uplands would eliminate those species that require pond conditions for breeding, such as fish and amphibians. Habitats that could support the Florida panther, migratory birds, the Big Cypress fox squirrel, the red-cockaded woodpecker, and many other species would be severely reduced and fragmented by the "checkerboard" 40% residential build out under the "without project" condition. Some residents on the 8,000 private parcels might allow their dogs and cats to run free, which would be difficult to control and would have a very negative effect on wildlife. The release of no longer wanted exotic pets by some residents could be devastating to native wildlife species. Continued succession of the ecosystem to poor quality uplands would increase the population of exotic species harmful to fish and wildlife. Panther use would continue to decline, due to human disturbance, low prey base, and poor quality habitat. Bear encounters with humans would increase as people encroach into the animal's natural habitat. An improved 279-mile road system would see an ever-increasing number of vehicles and wildlife road kills. The road system would allow easy human access and under the "without project" condition, wading birds that utilize wetland habitat will virtually disappear.

4.6 THREATENED AND ENDANGERED SPECIES

Federally listed species that are known to occur in the vicinity of, may occur in, or may be affected by the SGGE Project Area are the threatened eastern indigo snake (*Drymarchon corais couperi*), endangered Wood stork (*Mycteria Americana*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered Florida panther [*Felis* (=*Puma*) *concolor coryi*], endangered snail kite *(Rostrhamus sociabilis plumbeus)*, endangered American crocodile (*Crocodylus acutus)*, threatened bald eagle *(Haliaeetus leucocephalus)*, endangered West Indian manatee (*Trichechus manatus)*, smalltooth sawfish (*Pristis pectinata*), the threatened loggerhead sea turtle (*Caretta caretta*), endangered Kemp's ridley sea turtle (*Lepidochelys kempi*), endangered Atlantic green sea turtle (C*helonia mydas mydas*), endangered Hawksbill sea turtle (*Eretmochelys imbricate*) and the following three candidate fish species: the goliath grouper (*Epinephelus itajara*), mangrove rivulus (*Rivulus marmoratus*), and sand tiger shark (*Odontaspis taurus*).

Under the "without project" conditions, interspersed private developments within the SGGE Project Area would impact wildlife and their associated

habitats. Lack of consolidated State ownership and the additional drainage of the SGGE Project Area would make it difficult to stabilize or begin recovery of these listed species. Wide ranging wildlife, such as the Florida panther (*Felis concolor* coryi) and Florida black bear (*Ursus americanus floridanus*), would be especially hard hit. Low panther use of the SGGE Project Area would continue to decline due to human disturbance, low prey base, and poor quality habitat. Bear/human encounters would increase as development encroaches on their natural habitat. Continued development would require an improved infrastructure. Construction of electric and telephone lines would be hazardous to wading birds and waterfowl. With an improved road system, the number and speed of vehicles would increase road kills of a wide variety of wildlife. Under "without project" conditions, federal and state listed species would decrease over time due to increased human presence, easy vehicular access, limited refuge areas, and a decrease in suitable habitat. Under "without project" conditions, there would be no restoration of the hydrology, which would reduce already low populations of wading birds to near zero.

4.6.1 American Crocodile

Freshwater point source discharges to the Faka Union Bay would continue and probably increase due to development and water management practices under the "without project" condition. Rapid salinity changes and potential increases in nutrients and contaminants associated with a developing watershed would further impact Faka Union Bay and downstream estuaries. Adjacent bays and estuaries would continue to receive less water from the watershed than under natural conditions. Although the direct effects of these estuarine alternations on the American crocodile are not known, a reduction in the amount and quality of estuarine habitat would be expected to further reduce the populations of this species. As natural habitats of the SGGE Study Area are destroyed and replaced with landscapes that benefit humans, American crocodiles will become increasingly subjected to the public's intolerance of human/crocodile conflicts.

4.6.2 Bald Eagle

Continued hydrologic over drainage of the "without project" conditions would eliminate almost all of the few existing wetland habitats that might be used by the bald eagle for nesting or hunting. The human presence caused by the approximately 40% residential build out would further reduce the use of the area by the bald eagle.

4.6.3 Eastern Indigo Snake

The eastern indigo snake will use most of the habitat types available in its home range but prefers open, undeveloped areas. Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation. Under the "without project" condition, pre-drainage habitats in the SGGE Project Area for the eastern indigo snake would be forever lost. The "without project" conditions include a 40% residential build out on about 8,000 parcels, no hydrologic restoration, improved roads with higher speeds, and increased likelihood of human/snake encounters. This "without project" condition will have a very devastating effect on any eastern indigo snake populations that exist today in the SGGE Project Area.

4.6.4 Florida Panther

The "without project" alternative would further reduce an already very limited use of the SGGE Project Area by the panther. Further loss of habitat diversity, increased human presence, further reduction of the prey base, and improved roads with additional faster traffic would eliminate the SGGE Project Area as a piece of the puzzle that would be connecting surrounding public lands into habitat of sufficient size to support the large home ranges needed by panthers. It is possible that the residential development of 40% of the SGGE Project Area land might cause an increase in deer, raccoons, and hogs, since residents may begin protecting these prey species as their pets. In this case, panther/human encounters might increase as panthers are lured into the subdivision by the presence of prey. The panther would eventually lose in these interactions. The "without project" condition could be expected to reduce the panther population on the project site and adjacent public lands managed for panther recovery.

4.6.5 Red-Cockaded Woodpecker

The "without project" condition would lead to the further loss of mesic and hydric pine flatwood habitats suitable for the red-cockaded woodpecker. Woodpeckers require mature stands of pine with relatively open ground cover beneath. Residential construction on 8,000 parcels, improved over-drainage, more intense crowning wildfires, and the increase of invasive and exotic species would have a devastating effect on woodpecker habitat and the chances for the expansion of new clusters into the SGGE Project Area. Under the "without project" condition, the red-cockaded woodpecker would most likely continue to decline in the SGGE Study Area, as has been the recent pattern in southwest Florida.

4.6.6 Estuarine Fishes and Sea Turtles

The "without project" alternative with its 40% residential build out of SGGE would continue and probably increase the detrimental effects of the Faka Union Canal system on the timing and quantity of freshwater flows to the estuaries and bays of the Ten Thousand Islands Region. The Threatened and Endangered (T&E) fish and sea turtles, and the candidate fishes would continue to be impacted not only by these unnatural flows but also by the reduced water quality that would follow the installation of 8,000 new septic systems, additional traffic, improved canals, residential construction, and irresponsible dumping in SGGE. Similar impacts caused by residential build out in NGGE will add to the problems in the affected estuaries and bays.

4.6.7 Snail Kite

The increased hydrologic over drainage of the "without project" conditions would eliminate almost all of the wetland habitats that might be able to support both the snail kite and the apple snail on which it depends for food. Snail kite usage of the SGGE project area would further decrease under the "without project" conditions.

4.6.8 West Indian Manatee

Freshwater point source discharges to the Faka Union Bay would continue and probably increase due to development and water management practices under the "without project" condition. Rapid salinity changes and potential increases in nutrients and contaminants associated with a developing watershed would further impact Faka Union Bay and downstream estuaries. Adjacent bays and estuaries would continue to receive less water from the watershed than under natural conditions. Impacts to the West Indian manatee under the "without project" condition would include: 1) potential changes in temperature and freshwater input conditions that support the warm water refugia within the Port of the Islands marina basin in the Faka Union canal, 2) displacement of manatees further down the estuary during the wet season in reaction to increased point source discharges, and 3) new or additional loss of manatee critical habitat (seagrass) in downstream estuaries associated with effects of increase freshwater point discharges, and associated nutrients and pollutants. Although effects on critical habitat would be difficult to quantify, changes in manatee distribution or use of the marina basin as a warm water refugia might expose manatees to additional boat-related mortality or cold stress.

4.6.9 Wood Stork

The wood stork appears to be experiencing human population pressure throughout its entire New World range. Although specific information on the status and trends of breeding colonies is not available throughout its range, information that has been collected on specific colonies suggests that breeding and foraging habitats of the wood stork are declining in area and quality. Prognosis of the future U.S. wood stork population is partially dependent on the success of the overall South Florida Ecosystem restoration efforts. Under the "without project" condition, freshwater sheet flow and the wetlands that sustain the prey base so critical to wood storks during the breeding season would be eliminated within the SGGE Study Area. In the "without project" condition, there is much less hope for the continued existence of the wood stork in the Study Area.

4.6.10 Endangered Plants

Increased overdrainage, more frequent and intense wildfires, infrastructure construction, residential build out on 8,000 parcels, landscaping, and illegal collecting would have a negative effect on all native plant communities including those listed by the state as endangered.

4.6.11 Essential Fish Habitat

An increase in the impervious surface caused by build out in both NGGE and 40% residential build out of SGGE would cause surge flows of greater volume to discharge through the Faka Union Canal a greater distance into Faka Union Bay. These flows would contain contaminants that normally increase with human habitation. A further decline in Essential Fish Habitat for all species would be expected in the already damaged Faka Union Bay.

4.7 GEOLOGY AND SOILS

Barring some cataclysmic event, 2060 geologic conditions would not be expected to change from existing conditions.

Under without project conditions, overdrainage caused by the canal system would continue to allow the destruction of organic soils through oxidation and the increasingly intense wildfires.

4.8 AIR QUALITY

The "without project" condition would likely cause a lowering of air quality due to more wildfires, residential chemical use, construction activities, increased traffic, and other human activities in the developed 40% of the SGGE Project Area.

4.9 CLIMATE

The "without project" condition will eliminate all sheet flow and most wetlands in the SGGE Project Area. The overdrainage caused by a canal system needed to protect the 8,000 residential parcels would have the microclimate affect of reducing freeze protection for various tropical and sub tropical plants such as orchids.

The 17 October 2003 draft CERP Guidance Memorandum titled "*Sea Level Rise Considerations for Design of CERP Projects*" states that the Project Delivery Team should consider sea level rise as a future without project condition. This guidance was not available during the building of the MIKESHE model used to evaluate the SGGE Study Area hence the model does not contain a sea level rise component. Tables 1 & 2 in the above memo were used to calculate a 50% probability of an 8" rise in sea level for the Naples area in 2060. Although elevations in the study area vary between 2 and 28 feet it is probable that an 8" rise may have some effects. The without project effects of sea level rise will be addressed during the Detailed Design Report (DDR) phase of this project.

4.10 HYDROLOGY

The following hydrologic forecasts are a best professional judgment of "without project" conditions in 2060. Since Collier County is one of the fastest growing counties in the nation, the 40% of the SGGE Project Area still in private ownership is assumed to be built out in a low-density residential development pattern. Having about 8,000 residences scattered throughout the SGGE Project Area would continue the overdrainage of the 60% state owned land. Consequently, the SGGE Project Area would be drier than it is today, with the majority of the vegetation having transitioned from wetland types to upland types with heavy invasive and exotic species encroachment. Most likely by the year 2060, a "natural event," such as an extremely heavy rainstorm, would occur that causes significant property damage on the private land. Political pressure would be used to develop a program of canal improvement to protect life and property. Therefore, over drainage of the SGGE Project Area would be intensified.

4.10.1 Water Supply

Under the "without project" conditions, the surficial aquifers would continue to recede as 8,000 private wells were developed on the 40% private parcels in the SGGE Project Area. Overdrainage caused by an improved canal system and an increase in impervious surface from development would further reduce recharge to the fresh water aquifer. By the year 2060, lack of recharge in combination with sea level rise and private well withdrawal could cause an undetermined contamination of aquifers from saline water intrusion. Analysis to determine the probable regional extent of saline intrusion in 2060 would take separate funding, years of work, and is outside the scope of this project.

4.10.2 Water Quality

Under "without project" conditions, water quality in the SGGE Study Area would continue to be degraded as over drainage of the Faka Union canal system basin intensifies. Escalations in the development of NGGE and the 40% residential build out of the SGGE Project Area would increase the quantity of freshwater flows through the canals to Faka Union Bay. This type of concentrated point discharge coming in heavy flushing surges would further change the unnatural timing and distribution of salinity in the Faka Union estuary. These substantial variations in salinity would continue to shock the estuarine macrobenthic communities further reducing their long-term viability. Other nearby estuaries and bays would continue to receive less water than the natural pre drainage watershed provided. Lack of freshwater also causes salinity problems for the macrobenthic communities.

Runoff from the increased development in the Faka Union canal system would be expected to contain pollutants from roads and other impervious surfaces. The dramatic increase in septic systems to service the residential development in NGGE and the SGGE Project Area may pose water quality problems.

4.10.3 Water Management

Under "without project" conditions in the SGGE Study Area, the management of surface and groundwater resources for drainage, flood control, protection of water supply, and water quality would continue to be regulated, operated, and maintained by the Big Cypress Basin (BCB) unit of South Florida Water Management District (SFWMD). It is predictable that prior to 2060 a large rain event will occur which will flood the 40% residential properties in the SGGE

Project Area. Such an event would cause political pressure to be brought to expand flood protection for the life and property of the 8,000 residences in the SGGE Project Area. An "improved" canal system would further overdrain the 60% public lands and send even more fresh water in point source discharges to Faka Union Bay.

4.11 ESTUARINE RESOURCES

The 40% residential build out of SGGE in the "without project" condition would maintain the estuary degrading freshwater surge flows through the Faka Union Canal system to Faka Union Bay. This point source discharge would continue to deprive estuaries in other surrounding bays of the Ten Thousand Islands Region (Figure 3-2) of much needed freshwater deliveries. Too little and poorly timed freshwater input causes increases in salinity that are beyond the natural conditions.

Faka Union Bay has already been damaged extensively by the freshwater point-source discharge from the canal system. For example, oyster health and reef distribution are at their poorest levels within the inner reaches of the estuary, where reef development has been concentrated historically (Savarese and Volety 2001). The health of the Faka Union estuary, therefore, is not expected to depreciate much if the restoration project were not implemented.

The estuaries west of Faka Union Bay should respond differently to the "without project" alternative. The beheading of the freshwater to the western bays would continue without grossly affecting the volume of water entering the system. Unlike the effects of freshwater inundation, however, the consequences of prolonged higher salinity have a more protracted effect on estuarine ecology. In general, estuarine organisms are more tolerant of higher salinities than low. This is particularly true for oysters. Oyster growth and reproduction are favored by more normal marine salinities, but are subjected to greater selective pressures associated with predation and disease susceptibility (Savarese and Volety 2001). Consequently, health of the western estuaries is predicted to degrade further if the restoration project was not implemented.

4.12 SOCIO-ECONOMIC CONDITIONS

4.12.1 Land Use/Population

The 60% public land in the SGGE project area would not be used for developmental purposes in the "without project" conditions, but would be lacking

of any environmental benefits and would suffer from severe degradation as compared to the present condition. The surrounding residential areas will experience a significant population increase with an accompanying increase in infrastructure. It is expected that based upon existing and projected rates of growth in Collier County, as discussed below, the privately held parcels in the SGGE Project Area would be built-out well before 2060 and would experience minimal if any growth between 2050 and 2060. The Collier County urban area build out estimate is at 800 thousand persons, as estimated in the 1995 Collier County Urban Area Build-out Study. The development pattern in the SGGE Study Area area would be low density residential, one unit per 2.5-acre parcel, as per Collier County growth management regulations in place prior to 1996.

The SGGE Technical Committee, formed in 1997, consisting of local, state, and Federal agencies would continue to endorse a restoration effort for this area in an effort to restore the degraded ecosystem.

Current statistics demonstrate that Collier County, including the SGGE Study Area, is characterized by a much greater population growth rate than the rest of the State and the Nation as a whole. Collier County had a 2000 census population of 251,377 persons. The population of this county had an enormous increase of 65.3 percent from 1990 to 2000, and the estimate percentage change between 2000 and 2001 was 5.7 percent. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectfully during the same period. The state of Florida added over three million persons from 1990 to 2000, ranking third in the nation in numerical change.

Population in Collier County is expected to more than triple from 2000 to 2060. Due to this anticipated population growth, the county is expected to have one of the largest populations in the Lower West Coast. The dense urban area of southwestern Florida has contributed to development pressure and population increases in Collier County.

Table 4-1 summarizes existing and projected population in the SGGE Study Area. The 2000 figures are from the U.S. Census. The future estimates are based on Collier County's April 1, 2001 publication of population projection to the year 2030. The Bureau of Economic and Business Research at the University of Florida (BEBR) medium estimates ("high" and "low" estimates are also shown) growth trends evident between 2020-2030 were utilized to extend Collier County's population projection out to 2050. These population projections were calculated for the South West Florida Feasibility Study. Table 4-2 displays the population rates of growth for each decade from 2000 to 2060. Table 4-3 indicates the population growth rate of the study area is expected to exceed that of the State from 2000-2050.

TABLE 4 - 1 STUDY AREA POPULATION ESTIMATES, 2000-2060

Population (1,000's)							
	Year						
	2000	2010	2020	2030	2040	2050	2060
Collier	251.3	383.7	529	689.3	740.9	792.6	800
Share of Florida Total	1.60%	2.00%	2.20%	2.40%	2.60%	2.90%	N/A
Florida Total	15,982.40	18,866.70	21,792.60	24,528.60	27,118.70	29,714.50	N/A

TABLE 4 - 2 STUDY AREA POPULATION RATES OF GROWTH, 2000-2060

	Average (% Per year) Population Growth					
	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050	**2050-2060**
Collier	5.3%	3.8%	3.0%	>1%	>1%	>1%
Florida Total	1.8%	1.55%	1.26%	1.06%	0.96%	N/A

TABLE 4 - 3 STUDY AREA POPULATION GROWTH, 2000-2050

	% Change 2000-2050*
Collier	215%
Florida	85.9%

* Note: Florida population projections are only published until 2050

4.12.2 Water Demand

Under the "without project" condition, the water demands will increase due to an increase in population. Water demand calculations are being conducted for 2000-2050 by Gulf Engineers in conjunction with the Southwest Florida Feasibility Study. The results of these projections are in draft form, but the final figures are not expected to significantly change. Preliminary water demand projections estimate Collier County's most likely population scenario, conservation–adjusted water use in 2050 at 295.3 MGD. Due to the exceptionally small rate of growth projected between 2050 and 2060, it is not expected that 2060's water demands will be substantially higher than in 2050,

after taking into account conservation measures. Collier County is expected to be using 60% of the total water demanded in the Lower West Coast.

Under the "without project" condition, the groundwater levels would continue to decrease, leading to increased shortages of water and increased salinity levels in private wells in the NGGE. With more persons drawing water and less water available for recharge, shortages to private wells would become more prevalent.

The SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, required use of rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

4.13 AESTHETIC RESOURCES

With 40% of the SGGE Project Area subdivided into a checkerboard pattern, it would be expected that little of the existing infrastructure of 279 miles of roads would be eliminated. Because of this continued easy access for motor vehicles, the existing reality of illegal dumping, poaching, careless use of off-road vehicles (ORVs), and the irresponsible use of firearms would most likely persist on the state owned lands.

4.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTES

Under the "without project" condition, the 60% of the SGGE Project Area parcels owned by the state would require remediation of HTRW sites only if they posed an immediate hazard. The impacted soils on approximately 36 acres of the 750-acre FAW area that were identified through the ESA investigations would continue to pose potential ecological risks to aquatic receptors and piscivorous birds. Since the "without project" condition scenario maintains and most likely expands the 279-mile road system, it is expected that the illegal dumping of trash and hazardous substances on public lands would continue.

4.15 CULTURAL RESOURCES

The "without project" condition assumes a year 2060 condition of 60% state land interspersed with 40% private properties. Under this scenario, residential

construction, improvement of roads, landscaping, and installation of utilities would directly impact cultural resources. Although the majority of the SGGE Project Area would be under public land management, the lack of complete State control of the SGGE Project Area would allow an ever-increasing population to explore these public areas by pedestrian and mechanized off-the-road vehicles. Vehicular traffic would have an adverse effect on archaeological properties by disturbing the ground surface. Wildfires would expose cultural resource sites that had been camouflaged by vegetative cover making detection by vandals easier. Fire control methodologies such as the plowing of firebreaks have the potential to expose and damage sites. Under this alternative, most roads would be maintained allowing easy human access to any exposed sites.

4.16 RECREATION RESOURCES

Under the "without project" conditions, the resulting "checkerboard" ownership pattern, 60% public and 40% private, would limit both the availability and quality of the recreation uses compatible with resource protection on the public land. Trails for horseback riding, hiking, off road bicycling, wildlife viewing and nature study would be difficult to establish with the unconsolidated ownership pattern and the extensive road system. Providing hunting and camping opportunities would be challenging given a 40% residential build out. Uncontrolled use of firearms would continue to be a major public safety concern. The ownership pattern would make control of irresponsible ORV use very difficult. Since the Faka Union canal system would remain in place under "without project" conditions, there would be opportunities for fishing and boating.

4.17 NOISE

Most of the existing 279 miles of road would continue to exist and possibly even be expanded in the without project alternative. As subdivision build out occurs, noise from general traffic, construction, and other vehicles would be expected to increase.

4.18 GENERAL ENVIRONMENTAL SETTING FOR OTHER LANDS

Within the SGGE Study Area the following lands would be affected by the "with out" project alternative: Fakahatchee Strand State Preserve (FSSP), Florida Panther National Wildlife Refuge (FPNWR), South Belle Meade CARL lands, Collier Seminole State Park, and the Ten Thousand Islands Region, including the Ten Thousand Islands National Wildlife Refuge and the Rookery Bay

National Estuarine Research Reserve. As with the SGGE Project Area these adjacent lands would continue to be degraded from the overdrainage caused by the Faka Union canal system. The estuarine degradation caused by the point source discharge of freshwater from the canal system into Faka Union Bay and the lack of freshwater distribution to other bays in the Ten Thousand Islands Region would likely increase due the build out of the 40% private lands in SGGE. The interconnectivity of regional wildlife habitat, prescribed burning, and exotic species control would all be increasing difficult to manage as the "without plan" build out occurs. In general an increasingly degraded ecosystem in the surrounding public lands would be the result of this no action alternative.

SECTION 5

PROBLEMS AND OPPORTUNITIES

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SECTION 5
PROBLEMS, OPPORTUNITIES, AND OBJECTIVES

5.1 PUBLIC CONCERNS

There are a number of public concerns that are addressed within the framework of this study. Residents, land users, State and Federal landholders and land managers, and other stakeholders involved with the Southern Golden Gate Estates (SGGE) Study Area have been given the opportunity to express their views in order to have them considered and incorporated into this Project Implementation Report (PIR).

The Public and Stakeholder concerns dealt with the following:

- Flooding Impacts to the Northern Golden Gate Estates Area;
- Misunderstanding of the SGGE Project Area;
- Private property rights for landowners in the SGGE Project Area;
- Land Usage in the SGGE Project Area after the Restoration Project.
- Agency Responsible for the SGGE Project

The canals going through the SGGE Project Area provide drainage and flood conveyance for the residents of Northern Golden Gate Estates (NGGE), one of the most rapidly developing areas within Collier County. Any project feature that would include a reduction in conveyance within these canals concerns the residents of NGGE. In spite of a very aggressive canal maintenance program, the expansive rates of urban growth and accompanying encroachment into the existing low-lying water storage areas have resulted in occasional flooding in the natural lowlands throughout parts of NGGE.

With a restoration project to the south of Interstate 75 (I-75), the opportunities to develop further flood damage reduction measures for NGGE is limited. This is viewed by some as a loss of potential opportunities to further develop land in NGGE because of the difficulties in increasing the drainage conveyance for the area.

Hydric soils, topographic depressions, and wetland vegetation are distributed throughout NGGE. There is concern that features of some restoration project alternatives for SGGE, such as pump stations, may be operated in a manner that would increase the drainage in NGGE and adversely impact the existing wetlands. The wetlands in NGGE are under pressure for development.

With other environmental projects under consideration in areas adjacent to the Golden Gate Estates area, there was confusion over the boundaries of the Study Area and Project Area for the SGGE Hydrologic Restoration Project.

Additional concerns lie with the SGGE property owners south of I-75 that may be impacted by this project. The protection and management of the environmental resources is being achieved by public acquisition and restoration of the lands outlined within this study. A major portion of the area has already been purchased by the State through a Conservation and Recreation Lands (CARL) Program acquisition. Further acquisition is in progress and current owners want to ensure that they are fairly compensated. Others are concerned with the Government owning such large tracts of undeveloped lands within the county.

This area is currently used extensively for hunting and off-road recreational vehicles. The proposed changes in land use with the restoration project have the potential to significantly impact this recreational use. This is a concern for a portion of the community. In addition, some of the roads through the SGGE Project Area provide travel corridors between NGGE and U.S. Highway 41 (U.S. 41); closure of these roads would impact the individuals using these routes.

The large-scale development of SGGE has played a large role in the draining of pristine forested and emergent wetlands. This has degraded the productivity of the wetlands due to shortened hydroperiods and allowed the introduction of exotics. With this change in the ecosystem, other plants and animals have become established in the area; some environmental organizations are concerned with the loss of habitat of some endangered species.

5.2 PROBLEMS AND OPPORTUNITIES

Problem statements are descriptions of existing undesirable or objectionable conditions. Opportunities are future desirable conditions. They are descriptions of what could or should be.

As suggested in the Pre-drainage Conditions, Existing Conditions and Future Without Project Conditions chapters of this PIR, the canal and road systems within the SGGE Project Area have caused significant environmental problems in the area. The problems and opportunities are listed below and are further described in the following paragraphs.

List of Problems and Opportunities

Problems

- High runoff rate and over drainage of the SGGE Project Area

- No sheet flow across the SGGE Project Area
- Pulses of low salinity discharges to Faka Union Bay
- Loss of wetland communities in the SGGE Project Area
- Invasion by non-native species such as Brazilian pepper

Opportunities

- Increase surface aquifer recharge
- Increase ecological connectivity
- Restore habitat for threatened and endangered species

The canals and roads have intercepted pre-drainage patterns of groundwater flow, surface water sheet flow and sloughs, accelerated run-off rate from the watershed, and therefore over-drained the watershed. The canals have increased the drainage from the area, reducing sheet flow, decreasing wetlands and lowering the water table within the area; this significantly adversely impacts the ecosystem. The total area and quality of wetland vegetation communities have declined, the abundance of fish and wildlife populations and habitat have declined, publicly owned adjacent lands have become drier, the recharge rate of the surficial aquifer has been reduced, and non-native species have become much more abundant.

The 279-mile road network, of which 60 miles are paved, not only affects the groundwater infiltration rate, but it also enhances channelized runoff with the drainage swales, and the roads act as berms, which block natural flow ways. The roads are laid out on a quarter mile grid that provide easy access for the indiscriminate use of all types of vehicles, which can potentially impact wetlands through excessive rutting and disturbance to vegetation. Additional impacts caused by the road network include criminal activities; these roads allow access to a large secluded area, which promotes drug trafficking, poaching (animals and vegetation), vandalism, and the illegal dumping of solid waste. The extensive use of firearms is also an existing reality.

The drier conditions have made the SGGE Project Area more prone to larger and more intense wild fires then under pre-drainage conditions. These fires are accelerating the change in vegetation communities from cypress swamps and wet prairies to flatwoods and hammocks dominated by fire tolerant species such as cabbage palm. These different communities, predicted by modeled water depths, can be seen in Table 5-1.

TABLE 5- 1 SGGE AREA PLANT COMMUNITY ACREAGE CHANGES

Plant Community	Water Depth	Pre-Devel	Existing	Without Project
Mesic Pine Flatwoods Mesic Hammock	<0.2	10,123	55,575	54,594
Hydric Flatwoods Hydric Hammock	0.2 - 0.5	11,001	2,118	3,099
Wet Prairie	0.5 - 1.0	18,750	826	981
Cypress Forest Freshwater Marsh	1.0 - 2.0	16,166	723	620
Open Water >2.0 ft	>2.0	3,254	52	0
		59,294	59,294	59,294

The canal and road system has resulted in the loss of contiguous lands for Florida panther habitat as well as other threatened and endangered species. The SGGE Project Area is located among several publicly owned lands--the Florida Panther National Wildlife Refuge to the northeast, the Fakahatchee Strand State Preserve and the Big Cypress National Preserve to the east, the Belle Meade CARL Project to the west, Everglades National Park to the southeast, and the Ten Thousand Islands National Wildlife Refuge, Cape Romano – Ten Thousand Islands Aquatic Preserve, and Collier-Seminole State Park to the south. The SGGE Project Area lands are critical for ecological connectivity across the region. Restoration of the SGGE Project Area would benefit all of these public lands as well as wildlife species such as the Florida panther that depend on large tracts of land.

The altered hydrology of the SGGE Project Area has also caused problems in the estuaries south of SGGE. The rapid run-off rate from the watershed results in extreme variation of discharge to the Faka Union Estuary. Discharges are much higher than natural during the wet season and during storms. Discharges are much lower than normal during the dry season since over drainage reduces surficial aquifer recharge. This results in an unnaturally large range of fluctuations of salinity in the estuary. This puts stress on the biological components of the estuary and reduces the abundance of many species as well as the biodiversity of the communities. During the low flow dry season, salt water moves up the canal and disrupts the adjacent vegetation communities. In addition, with the interception of the natural/pre-drainage flow ways by the roads and canals, other marshes and bays south of U.S. 41, including Pumpkin, Buttonwood, and Blackwater Bays, are no longer receiving the fresh water input

required to maintain their equilibrium. This has facilitated the northward invasion of salt-tolerant species and changes to wetland communities.

5.3 PLANNING GOALS AND OBJECTIVES

5.3.1 Planning Goal

A Planning Goal is the broad overarching general statement of the purpose of the project. The goal of this project is to restore the predevelopment ecosystem of the area known as Southern Golden Gate Estates and to adjacent publicly owned and managed lands. Restoring the hydrology will restore vegetation communities, wildlife populations, protected species populations, and the downstream estuary conditions to a more natural, less degraded state.

5.3.2 Planning Objectives

Planning objectives are more specific than the Planning Goal. They elaborate and expand on the broad goal of restoring the SGGE Project Area. Planning Objectives come from the problem statements and the planning goal. The objectives are the specific items to be accomplished by the project. They give direction to developing alternatives that will solve the problems of the SGGE Study Area. If the objectives are achieved, then the planning goal will have been achieved.

During the initial planning phase of this study, several planning objectives were formulated in an effort to restore sheet flow, natural flow ways, fish and wildlife resources, and water supply/water quality in the basin.

This section of the PIR contains statements of objectives for Southern Golden Gate Estates. The multi-agency PDT formulated and reach consensus on these objectives. Objectives were developed from the CERP goals and objectives on one hand and the regional and site-specific problems on the other hand. The final list reflects a focused review of the project objectives as they have evolved during the study. The earlier sources of statements of objectives include the 1999 C&SF Comprehensive Review (Yellow Book, CERP), the May 2001 SGGE Project Management Plan, and the minutes of several PDT meetings and workshops. The current statements of objectives (Table 5-2) are very similar to the initial objectives and have changed only slightly throughout the course of the study.

TABLE 5- 2 CORRESPONDENCE BETWEEN OBJECTIVES FOR CERP AND OBJECTIVES FOR THE SOUTHERN GOLDEN GATE ESTATES HYDROLOGIC RESTORATION

CERP Objectives / SGGE PIR Objectives		**Increase habitat and functional quality**	**Increase availability of fresh water**	**Increase species abundance and diversity**	**Increase spatial extent**	**Provide recreational and navigation opportunities**
1	Reestablish natural freshwater flows to estuary	✓				
2	Restore natural hydropatterns, including sheet flow and flow ways	✓				
3	Reestablish natural plant distribution and composition	✓				
4	Increase surface aquifer recharge		✓			
5	Restore habitat for listed species	✓		✓		
6	Increase fish and wildlife resources	✓		✓		
7	Restore ecological connectivity and provide contiguous habitat protection to adjacent public lands			✓	✓	
8	Provide resource based recreational opportunities compatible with the protection of the natural systems					✓
9	Restore natural fire regime	✓				

5.3.3 Planning Constraints

A constraint is basically a restriction that limits the extent of the planning process. Constraints describe things that the study is unable to accomplish and things that the study wants to avoid occurring. While the goal of this restoration project is to restore a more natural hydrologic regime, several planning constraints were considered during plan formulation.

Three constraints are written into the law authorizing the Comprehensive Everglades Restoration Plan, of which the SGGE restoration project is a component. Section 601 of the Water Resources Development Act (WRDA) 2000 (PL 106-541), subparagraph (h)(5), includes a Savings Clause. Section 601(h)(5)(A) of this clause refers to existing sources of water:

> *(A) NO ELIMINATION OR TRANSFER- Until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water, including those for:*
>
> > *(i) an agricultural or urban water supply;*
> > *(ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);*
> > *(iii) the Miccosukee Tribe of Indians of Florida;*
> > *(iv) water supply for Everglades National Park; or*
> > *(v) water supply for fish and wildlife.*

Section 601 (h)(5)(B) of the Savings Clause states:

> *(B) MAINTENANCE OF FLOOD PROTECTION- Implementation of the Plan shall not reduce levels of service for flood protection that are:*
>
> > *(i) in existence on the date of enactment of this Act; and*
> > *(ii) in accordance with applicable law.*

Section 601(h)(5)(C) on tribal rights states:

> *(C) NO EFFECT ON TRIBAL COMPACT- Nothing in this section amends, alters, prevents, or otherwise abrogates rights of the Seminole Indian Tribe of Florida under the compact between the Seminole Tribe of Florida, the State, and the South Florida Water Management District,*

defining the scope and use of water rights of the Seminole Tribe of Florida, as codified by section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e).

There are questions about whether, or if, the Savings Clause applies to situations like the SGGE project. First, the Programmatic Regulations for the CERP program set up a process to provide six formal guidance memoranda and a pre-CERP baseline by December 2004 to resolve, among other things, Savings Clause questions. This process will require consultation with the public, other agencies, and Tribes, and formal consultation by the Secretary of Interior and the Governor.

Second, it is not clear from the following facts if there was a level of service in accordance with applicable law in existence on the date of enactment of WRDA 2000. The canal system in the SGGE Project Area extends into Northern Golden Gate Estates, and provides drainage to this residential community located north of I-75. Although the canals were privately dug, South Florida Water Management District took over maintenance of the canals in the early 1990s. The "Recommended Level of Service Standard for Stormwater Management" in Collier County's Growth Management Plan uses the 10-year, 3-day storm for the NGGE area. The Growth Management Plan's "level of service" relates to how well a stormwater management facility or system addresses water quantity, quality, and groundwater recharge. Based on their consultant's study, the drainage sub-element of both the Oct. 1997 and the May 2000 Collier County's Growth Management Plan rated two of the four canal sub-basins in NGGE as "D," unacceptable, on a scale of A to D, because existing facilities couldn't handle the 10-year storm adequately. The other two canal sub-basins were rated "C." The County is also doing a study to determine whether residences throughout the area are elevated enough to meet FEMA flood insurance standards.

Since this Project Implementation Report will be finished before completion of the formal guidance memoranda and the pre-CERP baseline, this PIR compares the effect of the three leading alternatives on flooding to the flooding conditions that existed at the time of enactment. It then considered, if the Savings Clause applied, whether there would affect any of these alternatives.

Finally, laws protecting threatened and endangered species also constrain the project. Several Federally listed threatened and endangered species are known to inhabit the SGGE Study Area. A Federal project must not jeopardize the continued existence of any listed species.

SECTION 6

PLAN FORMULATION AND ALTERNATIVE EVALUATION

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SECTION 6
PLAN FORMULATION AND ALTERNATIVE EVALUATION

6.1 BACKGROUND AND INTRODUCTION

Section 6 of the PIR provides a very brief general description of the planning process, then describes the specific steps performed by the SGGE PDT. The team went through several rounds, or iterations, of management measures, alternatives, analysis and screening. Each of these iterations is presented. The initial screening analyses allowed the study team to drop some alternatives early in the study. This section then describes the results of a detailed analysis on three alternatives. The alternatives are evaluated against the predicted future without project conditions and against the pre-development conditions. Finally, the alternatives are compared against each other and one alternative, Alternative 3D, is identified as the recommended plan.

6.2 PLAN FORMULATION EVALUATION METHODOLOGY

6.2.1 General

The planning process used by the SGGE project delivery team reflects a frequently used 6-step model. These steps are 1) identify problems and opportunities, 2) inventory and forecast resources, 3) formulate alternative plans, 4) evaluate plan effects, 5) compare effects of alternative plans, and 6) select the recommended plan.

Step 1, problems and opportunities, is discussed in Sections 1 and 5 of this report.

Step 2, the inventory of resources is covered in three sections of this report. Section 2 discusses the historic or pre-development resources. Section 3 discusses existing resources. Section 4 discusses the forecasted future without project conditions.

Steps 3 through 6 are addressed in this Section 6 of the PIR. This chapter starts by describing the processes used to develop the SGGE alternatives. This section also includes a detailed presentation of the alternatives and their components, then briefly presents the computer simulation models and other tools that were used to evaluate the alternatives. Following that, it presents the evaluation of alternatives by assessing their effects versus the future without project conditions and versus the pre-development conditions. Lastly, this section also compares the alternatives against each other and identifies the recommended plan.

This planning process is presented as a simple sequence of six steps. However, it was not that easy. Planning for SGGE was very much an iterative process. Steps were repeated as new information became available, as evaluation tools improved, and as new ideas were tried during the study team's efforts to increase restoration benefits and reduce costs.

6.2.2 Iterations

This section describes some of the processes and steps that the project delivery team went through as alternatives were proposed, initially analyzed, and rejected or retained for additional evaluation. Plan formulation and evaluation is an iterative or cyclic process. During the development and evaluation of alternatives, new information becomes available, new issues become known, some management measures or alternatives are discovered to be less effective than initially believed, and some components are more expensive than initially assumed. For these and many other reasons, the project team "went back to the drawing board" and repeated some of the steps. The iterative process helps ensure that the alternative plan that is recommended for implementation is the best that can be developed. At the same time that the newer and improved alternatives were being developed, the hydrologic model used to evaluate the alternatives was also being improved. Each newer version of the model was better calibrated and provided more detail for restoration benefits and adverse flooding impacts than the previous version. ***Table 6-1*** summarizes the plan formulation iterations. Each of the three rounds of initial analysis is discussed in more detail in separate subsections that follow the table.

TABLE 6 - 1 SUMMARY TABLE OF ITERATIONS FOR SGGE FORMULATION

Start with	Procedures	Result
Previous SGGE studies, CERP	Identify problems, goals, objectives, measures, alternatives (1, 2, 3A, 3B, 3C)	Statements of goals & objectives, measures & components, alternatives.
Alts 1, 2, 3A, 3B, 3C 1st Iteration	Develop and run hydrologic models. Evaluate restoration performance.	Alts do not maintain drainage in NGGE. Roads still cause problems for ecosystem restoration.
Alts 1, 2, 3A, 3B, 3C, 3D 2nd Iteration	Analyze the alternatives. Explore larger pump sizes	3D eliminates problems from roads and has pump sizes large enough to maintain existing drainage. High construction cost. Develop more alternatives.
Alts 3D, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 3rd Iteration	Hydrologic model ten alts (3D, 6, 7, 8, 9, 11, 12, 13, 17, 19). Review all alts. Screen based on previous model results, flood impacts, lack of estuary benefits, cost efficiency, and cost.	Retire Alts 4, 7, 8, 9, 10, 11, 13, 14, 15, 16, 17, 18, 19 Retain Alts 3D, 6, 12
Alts 3D, 6, 12 Final evaluation and comparison	Use model results, hydrologic performance measures, ecosystem benefits, economic analysis, and professional judgment.	Alt 3D is the recommended plan.

6.2.3 Formulation Process and the Programmatic Regulations

The SGGE draft PIR complies with most of the requirements of the December 2003 Final Programmatic Regulations for the Comprehensive Everglades Restoration Plan (CERP), including project specific assurances and savings clause analyses. This SGGE Project Implementation Report does not follow this three-step formulation and evaluation process described in the Programmatic Regulations. These procedures were developed because of the significantly complex interactions, dependencies, and geographic overlaps among many of the planned components (projects) of CERP, particularly in southeast Florida, and because the individual components would be implemented over many years. SGGE is located in southwest Florida. SGGE is geographically and hydrologically separated from the other components of CERP and is outside of the regional model developed for CERP system-wide evaluation. Success of SGGE restoration does not depend on the implementation of any other component of CERP, and no other component of CERP depends on implementation of SGGE. Most other CERP PIRs are expected to use the three-step evaluation.

6.2.4 Overview

The Golden Gate Estates area has been studied since the mid 1970s, shortly after it was clear that the canal and road system completed in 1971 was generating significant environmental damages. Major reports include 1986 Golden Gate Estates Final Feasibility Report by the U.S. Army Corps of Engineers, the 1996 Hydrologic Restoration of Southern Golden Gate Estates Conceptual Plan by the South Florida Water Management District, and the 2001 Southern Golden Gate Estates Watershed Planning Assistance Cooperative Study Final Report by the South Florida Water Management District and the Natural Resources Conservation Service. The momentum and direction of these earlier studies influenced the identification of management measures and the development of initial alternatives of this PIR.

The alternatives were developed from the Management Measures described above so that the alternatives would meet the objectives and avoid the constraints of the project. The alternatives ranged from minimal restoration, to partial/incremental restoration to complete backfilling of all canals and complete removal of all roads. Features were added to the alternatives in an effort to balance restoration goals and maintenance of existing drainage to NGGE. Alternative 3D was added to the evaluation in this PIR to determine the changes in benefits from partial roads removed to most roads removed. Alternative 4 looked at the effects of the sizes of the bridges at I-75. Alternatives 6 and 7 limit construction to the southern half of SGGE. Alternative 6 has plugs but no pump stations, and Alternative 7 has canal plugs and pump stations. Alternatives 8

and 9 have plugs but without pump stations, and allowed two (Alt 8) or one (Alt 9) canals to be open during storms to maintain existing flood protection for NGGE. Alternatives 10 through 19 consist of many of the possible combinations for the four canals, east to west, of canal blocks with pump stations for restoration and maintaining flood protection, canals with adjustable weirs for restoration and maintaining flood protection, and unmodified canals.

6.2.5 Historic Restoration Plans

There have been several studies that have addressed restoration of SGGE. Summaries of these reports can be found in Section 1.5 of this PIR. The key report is Hydrologic Restoration of Southern Golden Gate Estates Conceptual Plan by the South Florida Water Management District (Abbott and Nath, 1996). Some of the major structural and non-structural management measures, as well as Alternatives 1, 2, 3A, 3B, and 3C of this PIR were described in the 1996 report. Alternative 3C was identified as the Recommended Plan in the 1996 report. This Alternative 3C is also the SGGE component that was described and analyzed in the Restudy and is the initial proposed SGGE component in the Comprehensive Everglades Restoration Plan.

6.3 FIRST ITERATION

Initially, the project delivery team decided to use the five alternatives described in the 1996 Conceptual Plan. These alternatives ranged from restoring only a small part of the southernmost section of SGGE to completely filling all of the canals south of I-75. These initial alternatives used combinations of plugging or filling canals, spreader channels, pump stations, and road removal. The pump stations were sized from 160 to 500 cubic feet per second (cfs). The sizes were based on the predicted flow during a 10-year storm event, the same event used by Collier County to analyze drainage in its Growth Management Plan. The alternatives were identified with numbers 1, 2, 3A, 3B, 3C. For consistency, these labels from the 1996 report were retained for this SGGE study. The alternative plan from the 1999 Comprehensive Plan is Alternative 3C from the 1996 report.

The project delivery team identified the individual management measures that were combined to make up these alternatives. The management measures are presented in Section 6.3.1. Descriptions and pictures of these first alternatives are in Section 6.3.2.

6.3.1 Management Measures Considered

A management measure is a feature or activity that can be implemented at a specific place to address one or more planning objectives or constraints. Features are usually structural and often require construction. Activities are

usually nonstructural measures and often are actions, procedures, or policies. Management measures are the building blocks of alternative plans. Measures for the restoration of SGGE were developed to meet at least one of the planning objectives and to avoid constraints. The following measures were considered.

1. Spreader Channels and Berms

The purpose of the spreader channel is twofold. First, it must receive southbound flow from the existing canal and redirect this flow in an east-west direction. Secondly, it must redistribute the flow in a broad shallow front across the land surface, usually by overtopping its downstream bank and discharging evenly onto the land surface. If only the first purpose was important, a channel cross-section similar to the current SGGE canals could be used. However, the backwater effects of raising the water surface elevation in the spreader channel high enough to allow overtopping and discharging onto the land surface would compromise drainage for the upstream portions of the north-south canals. In order to maintain drainage north of Interstate 75, two water levels must be maintained and separated in the canal with the downstream or south end at the necessary higher level (i. e. slightly above ground) and the upstream or north end at the lower level.

The proposed spreader is a relatively shallow channel. ***Figure 1*** shows a typical cross section. The water surface elevation is "stepped up" by pumping into the spreader channel and the water then flows by gravity onto the land surface by overtopping the spreader banks. The bed of the spreader channel is sloped to allow the water to reach the remote ends of the spreader channel. Water is prevented from backing up to the north by a northern berm and by natural topography. A seepage ditch collects the seepage and returns it to the spreader channel. Spreader channel and berm systems must be constructed with pump stations. They cannot operate without pumps.

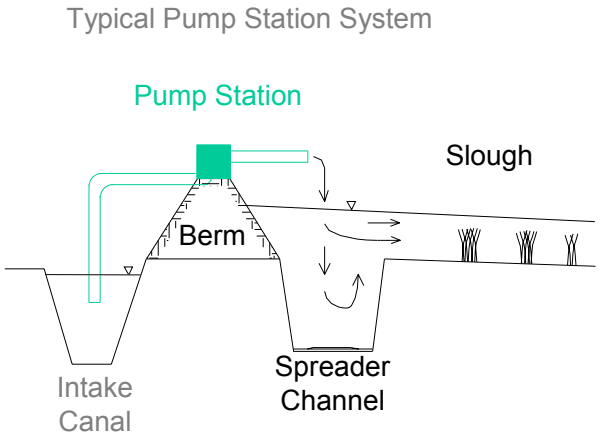


FIGURE 6 - 1 TYPICAL SPREADER

2. Pump Stations

The pump stations are an integral part of the spreader channel system. The pumps are the method to move the water from the low elevation of the canals that enter SGGE from the north to the southern side of the spreader berm. Initially the pump stations in the different alternatives were sized based on the flows entering SGGE through the Miller, Faka Union, and Merritt Canals during a 10-year storm. The 10-year storm size was based on the alternative from the Hydrologic Restoration of Southern Golden Gate Estates, Conceptual Plan (Abbott and Nath 1996) that was incorporated into the CERP. It was also based on the Collier County Growth Management Plan and supporting reports, which evaluate drainage for NGGE based on a 10-year storm. (Later, during the third iteration, the pumps were sized based on flows through the canals during a 100-year storm. The 100-year storm size was used because it is a baseline for flood plain management and the National Flood Insurance Program.)

Pump stations would be constructed and operated in association with spreader channels and berms. The pump stations would operate to provide flows for restoration during much of the year. During storms, the pump stations would be operated to ensure that there are no adverse impacts to the existing drainage for NGGE. The pump stations would be operated so that they would maintain drainage that existed in December 2000. They would not be operated to increase drainage.

3. Road Demolition

The roads in SGGE are elevated a few inches to a foot above the adjacent ground. Most of the roads have ditches along their sides. There are also ridges of rock called spoil ridges that are located parallel to some of the roads. These roads, roadside ditches, and spoil ridges intercept water that would otherwise flow across the surface of the ground. Ditches parallel to the roads also intercept ground water. The road surfaces reduce percolation and increase runoff rates. Roads and ridges provide disturbed upland habitat for exotic species such as Brazilian Pepper. The roads provide extensive access to unauthorized off-road vehicles and illegal dumping. Road demolition is defined as reducing the elevation of the road to match adjacent lands, discontinuing maintenance, and allowing vegetation to grow on the former road. The road material would be used for canal plugs. The roads crossing major flowways were considered top priority for removal. All asphalt material removed from the paved roads would be disposed of in a manner consistent with all applicable DEP and EPA rules, regulations, and guidance.

4. Canal Plugs/ Swale Blocks

The canals in SGGE have been more responsible than the roads for the overall degradation of the hydrology and ecology of the area, due to their ability to

intercept the upper part of the water table aquifer. Canal plugs would eliminate channelized flow south of Interstate 75. The mild slopes of the plugs provide stability when overtopping occurs during the wet periods. Additional plugs would be placed in the swales (ditches) adjacent to some roads. Different numbers and locations for canal plugs were considered. Material from the existing roads would be used for the fill, as will the existing spoil banks along the canals.

5. Canal Backfill

The canals would be filled to adjacent ground levels. Material from the existing roads would be used for the fill, as will the existing spoil banks along the canals. This approach would be more effective than canal plugs in eliminating channelized flow and interception of ground water.

6. Elimination of Canal Maintenance South of the Spreader Channels and Removal of Existing Weir Structures

Elimination of the ongoing aquatic weed control activities for canal maintenance in the major canals would restrict the conveyance capacity of the remnant canals and help to reduce channelized flow over time. Since the canals south of Interstate 75 would cease to act like canals, the weir structures would become obsolete. Five internal weirs would remain unaffected. The concrete portion and the sheet piles of these structures could be left intact if they pose no environmental problem, however, the steel walkways and gates may be salvaged.

7. Gated Culverts

The purpose of the culverts is to divert some of the existing flow from canals to the spreader channel. This dissipated flow will be conveyed through public lands owned by the Fakahatchee Strand State Preserve to distribute flow through the bridges under U. S. Highway 41 (U.S. 41). Flows would be dissipated and filtered through wet prairies as sheet flow to the Faka Union and Fakahatchee Bays.

8. Exotic Plant Removal

Berms and portions of roads that are degraded will have the Brazilian pepper removed as part of the restoration of those areas. Some of the remaining roads will have Brazilian pepper treated with herbicide whereas other roads will be mechanically cleared down the middle to allow access for herbicide application.

9. Culverts Under U.S. Highway 41

Culverts would allow the sheet flow water of the restored SGGE land to flow under U.S. 41 (Tamiami Trail) to the estuaries. New culverts would be constructed between County Road 92 and State Road 29. These culverts would be constructed in association with measures that increase sheet flow and would

allow the restored sheet flow in SGGE and adjacent lands to proceed to the estuaries. The locations and dimensions of the new culverts under U.S. 41 were developed and assessed under the Tamiami Trail Culverts Critical Project. Only the subset of the culverts from the Critical Project that are necessary for the SGGE restoration would be constructed as part of SGGE.

10. Acquire Real Estate Interest

An appropriate real estate interest, such as flowage easement, conservation easement, or fee, would be purchased. Such interests serve multiple purposes. Some interests would ensure that the project could be built, operated, and maintained so that it produces the ecosystem benefits that are predicted. They would also prohibit existing owners from performing certain actions on the land that would prevent or undo predicted ecosystem benefits. All alternatives include real estate interests for these purposes. Other real estate interests would allow the project to allow water to flow to locations that the PDT could not otherwise avoid and which may be generally regarded as adverse impacts.

6.3.2 Alternatives Analyzed

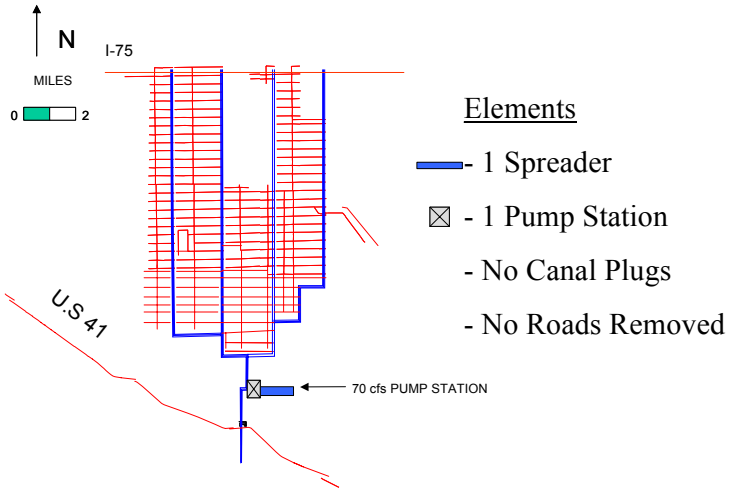
Alternatives No Action

This alternative is also the Future Without Project condition or the "No-Build" Alternative. Under No Action, no features would be constructed and no operational changes would be initiated. This alternative or condition assumes that the other components of the CERP are in place. Even with these programs and features in place, degradation of the SGGE would continue to occur. Refer to ***Section 4*** for a more thorough description of the without project condition.

Alternative 1 – Diversion Structure Plan

This alternative includes a 70 cubic feet per second (cfs) pump station, three 48-inch diameter gated culverts, and one long spreader channel north of U.S. 41. The pump station and culverts would divert up to 50 percent of the existing base flow of the Faka Union Canal to the spreader channel. The diverted flows would be conveyed by the spreader channel to the Fakahatchee Strand State Preserve (Florida Department of Environmental Protection) and distributed through the bridges and culverts under U.S. 41. These diverted flows would dissipate and filter through wet prairies as sheet flow to the Faka Union and Fakahatchee Bays. The existing roads and canals within SGGE would remain in place without any modifications. Five internal weirs would remain unaffected.

Alternative 1

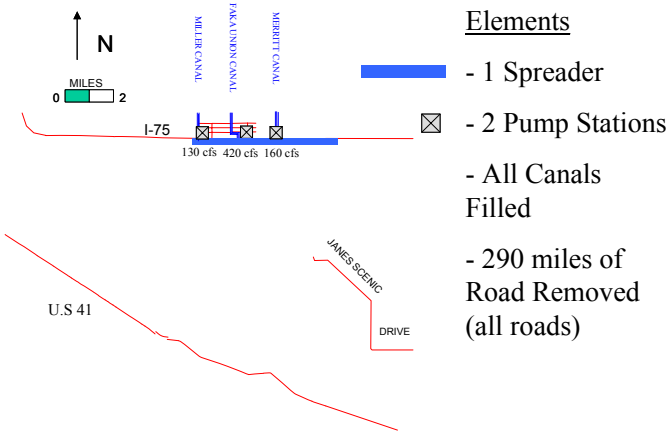


Alternative 2 – Remove All Roads and Backfill Canals Plan

This alternative plan contains one 6.5-mile long spreader channel immediately south of Interstate 75 (I-75), extending from the western boundary of the SGGE study area eastward nearly to the eastern boundary of SGGE. All roads would be removed or graded down. All canals south of I-75 would be filled. Pump stations would be located on the Miller, Faka Union, and Merritt Canals, at the spreader channel immediately south of I-75. The pump stations would be sized to handle the average wet season flows within the canals and for the 1 in 10 year frequency storm. Pump station sizes would be Miller 130 cubic feet per second, Faka Union 420 cubic feet per second, and Merritt 160 cubic feet per second.

This alternative would rehydrate all of SGGE, the western portion of Fakahatchee Strand State Preserve, and the eastern portion of Belle Meade, as well as increase aquifer recharge in a portion of NGGE. Flows to the estuaries would approach those of pre-development conditions.

Alternative 2



Versions of Alternative 3 – Spreader Channels and Canal Blocks Plans

The concept of these plans originated from earlier studies done by the Golden Gate Estates Redevelopment Committee. The concept was later evaluated by the U. S. Army Corps of Engineers in the 1986 feasibility study, in which a few strategically placed plugs were suggested and more recently in the Hydrologic Restoration of Southern Golden Gate Estates, Conceptual Plan (Abbott and Nath 1996). This 1996 report addressed alternatives referred to in this report as 3A, 3B, and 3C. This PIR maintains the same numbering system for these alternatives as was used in 1996. Alternatives 3A, 3B, and 3C have some common key components. These are spreader channels on each of the three major north-south canals which contribute drainage from NGGE, pump stations on each of the three major north-south canals, canal plugs below the spreader channels and pump stations, canal plugs in the fourth canal (Prairie Canal), and the removal or grading down of the selected roads and roadside swale blocks, and culverts under U.S. 41.

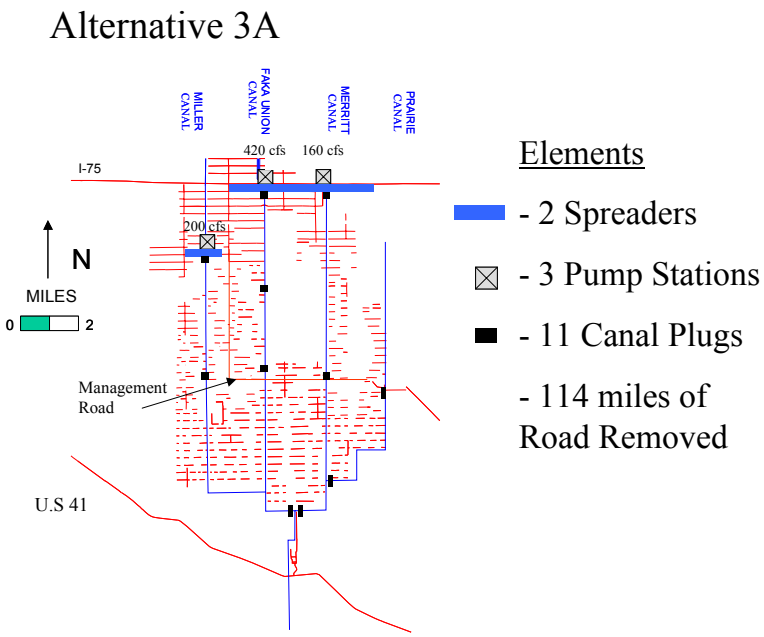
Alternative 3A – 11 Plugs Plan

This alternative would include two spreader channels, three pump stations, removal of 114 miles of roads, installation of 11 canal plugs, and culverts under U.S. 41. Non-structural elements would include eliminating canal maintenance south of the spreader channel locations.

One spreader channel would be located approximately 200 feet south of I-75. It would extend in an eastward direction from Everglades Boulevard to the eastern boundary of SGGE. It would collect water from the Faka Union and Merritt Canals. The second spreader channel would collect flow from the Miller Canal and extend from the western boundary of SGGE to Everglades Boulevard. It would be located along 58th Avenue, approximately three quarters of a mile south of I-75.

Several upland areas exist just south of I-75 within a mile of Miller Canal. Locating the spreader channel south of these uplands would prevent water from backing up to the west.

Pump stations would be located on the Miller, Faka Union, and Merritt Canals, at the spreader channels. It is expected that these pumps would operate approximately four months of the year. The pump stations were sized to handle the 1 in 10 year frequency storm. Pump station sizes would be 200 cfs on the Miller Canal, 420 cfs on the Faka Union Canal, and 160 cfs on the Merritt Canal. The Miller pump station sizes differs from the Miller pump station in Alternative 2 because it is located farther south in Alternative 3A.

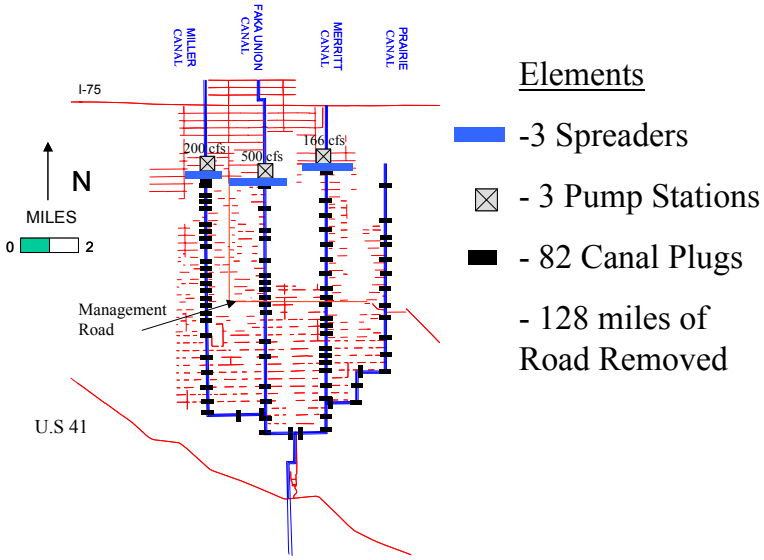


Alternative 3B – Spreader Channels, Canal Blocks, And Partial Road Removal Plan

This alternative would have spreader channels located farther south than the spreader channels in Alternative 3A, approximately two and one quarter miles south of I-75. The main reason for shifting the spreader channels south were 1) the concern of the effects of the groundwater mound generated by the spreader on I-75 and 2) presence of non-hydric soils near I-75. Three spreader channels will run in an east-west direction across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 62nd Avenue. A pump station would augment each spreader channel. It is expected that these pumps will operate approximately four months of the year. This plan requires slightly larger pumps than Alternative 3A or 3C (below) because the pumps are the farther south. The pump stations were sized to handle the 1 in 10 year frequency storm. Pump station sizes would be 200 cfs at Miller, 500 cfs at Faka Union, and 166 cfs at Merritt.

This plan includes the removal of 128 miles of road, a slight increase over the 114 miles under Alternative 3B. The number of canal blocks is significantly increased from 11 to 82. Under Alternative 3A, with only 11 canal plugs, there would be stretches of open water canal sections that would be several miles long. These open stretches would provide localized drainage, especially during the dry season and early in the wet season when canal stages are low. Therefore, increased canal blocks would inhibit drainage notably. Canal maintenance south of the spreader channels would be eliminated. This alternative includes plugging Prairie Canal along its entire length. Culverts would be constructed under U.S. 41.

Alternative 3B



Alternative 3C - Spreader Channels, Canal Blocks, And Partial Road Removal Plan

This alternative is very similar to 3B except the pump station and spreader channel for the Merritt Canal is located approximately three quarters of a mile farther north, at 54th Avenue instead of 62nd Avenue. This reduces the size of the pumps but requires an additional canal plug and two more miles of road removal.

Three spreader channels would run in an east-west direction, across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The pump stations were sized to handle the 1 in 10 year frequency storm. Pump station sizes would be 200 cfs at Miller, 500 cfs at Faka Union, and 160 cfs at Merritt. It is expected that these pumps would operate approximately four months of the year.

This plan involves 130 miles of road removal, a slight 2-mile increase from Alternative 3A, and installation of 83 canal plugs. This alternative includes plugging Prairie Canal along its entire length. Culverts would be constructed under U.S. 41.

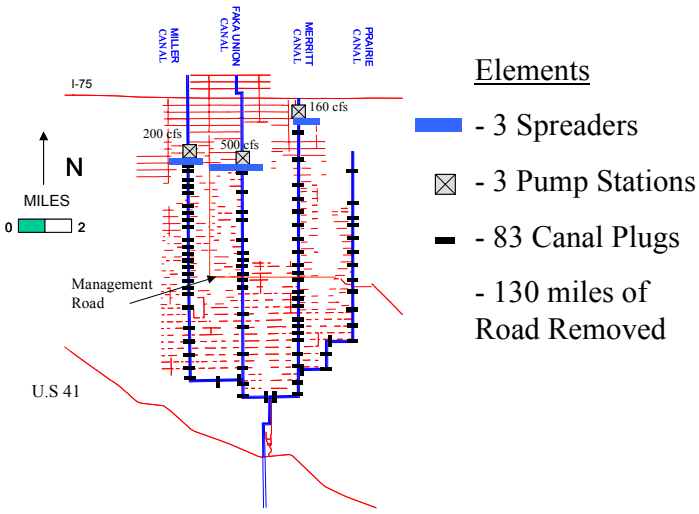
6.3.3 Analysis, Screening and Concerns - First

Once the Corps of Engineers' and South Florida Water Management District's hydraulic and hydrologic models were operating, it became clear that the alternatives from the 1996 report, including the plan from the 1999 C&SF Comprehensive Review Study, would generate increased flooding in large areas north of I-75 during most large storm events relative to conditions in existence in December 2000 when the Comprehensive Plan was adopted by Congress. These initial alternatives would not be consistent with existing law and policy regarding increased flooding.

The alternatives had to be modified or replaced with new alternatives. One option considered was to target the impacted lands for flowage easements or fee purchase. Acquisition of lands that contain residences and utilities would be very expensive – for some alternatives up to $253,000,000 for 24,000 acres of land in NGGE. Costs for buildings and relocation expenses would be in addition to these land costs. The controversy generated if such an acquisition were pursued would have been so large that it is likely that the project would not have been able to be implemented. The project delivery team chose to modify the alternatives by increasing the sizes of the pump stations or other methods to maintain drainage during storm events.

A second major problem with these initial alternatives is that most of them incorporated removal of only about half of the nearly 300 miles of roads in SGGE. The initial analysis demonstrated that the remaining road sections would still be barriers to sheet flow and would also channel some water back toward the canals. The remaining elevated road sections and associated drainage ditches and side castings, would remain suitable for colonization and growth of invasive exotic vegetation, especially Brazilian pepper. It would be difficult and costly for land managers to access the isolated unmodified remnant sections of road in order to perform plant control measures. As long as these sections would be higher than the adjacent lands and flooded infrequently, they would continue to be suitable habitat for the Brazilian pepper. Since the invasive exotic plants would not be able to be effectively controlled, they would continue to be sources of colonization of other suitable areas. The remnant road sections may also invite and provide enough access for ATV enthusiasts to lands otherwise suitable for the Florida Panther, that panthers may avoid the areas. Removal of more of the road sections would make the lands more suitable and welcoming habitat for the Florida Panther as well as other threatened or endangered species.

Alternative 3C



6.4 SECOND ITERATION

In response to the problems of the first set of alternatives, Alternative 3D was developed.

6.4.1 Measures

The same ten management measures considered in the first round of analysis were reconsidered in this second iteration. The only change is that Alternative 3D included larger pump sizes and a larger quantity of roads demolished. The measures are listed below. Refer to Section 6.3.1 for descriptions of each.

1. Spreader Channels and Berms
2. Pump Stations
3. Road Demolition
4. Canal Plugs/ Swale Blocks
5. Canal Backfill
6. Elimination of Canal Maintenance South of the Spreader Channels and Removal of Existing Weir Structures
7. Gated Culverts
8. Exotic Plant Removal
9. Culverts Under U.S. Highway 41
10. Acquire Real Estate Interest

6.4.2 Alternatives – Second

The same alternatives considered in the first round of analysis – No Action, Alt 1, Alt 2, Alt 3A, Alt 3B, Alt 3C were reconsidered in this second iteration.. See Section 6.3.2 for descriptions of these six alternatives. One new alternative, 3D, was also considered.

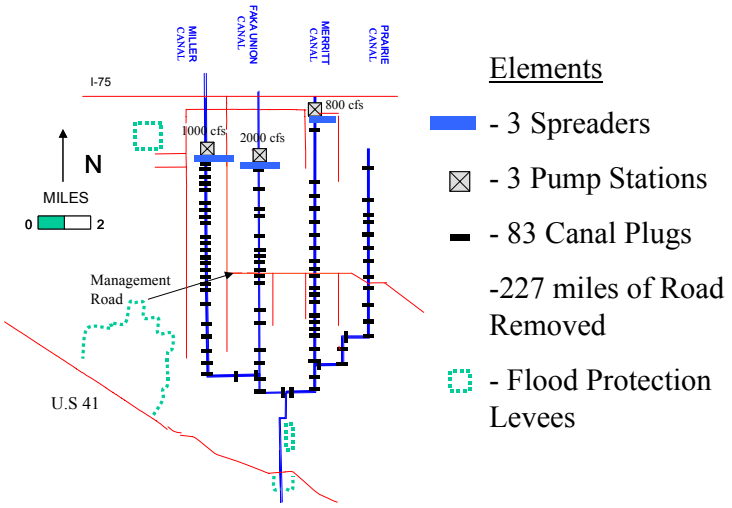
Alternative 3D - Spreader Channels, Canal Blocks, And Most Roads Removed Plan

This alternative includes the demolition of 227 miles of roads rather than 128 miles of Alternative 3B or 130 miles of Alternative 3C. Three spreader channels would run in an east-west direction, across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The pump stations would be 1,000 cfs on the Miller Canal, 2,000 cfs on the Faka Union Canal, and 800 cfs on the Merritt Canal. Spreader channels and pump station would be in the same locations as in Alternative 3C. These pump stations would be larger than the pump stations in Alternative 3C. The pump stations in Alternative 3D were sized so that the existing drainage in NGGE would not be reduced by this alternative.

The same 83 canal plugs would be installed in Alternative 3D as in Alternative 3C, including plugging Prairie Canal along its entire length. Stewart Boulevard would remain to connect Janes Parkway and Everglades Boulevard. Portions of Berson Boulevard would remain. These east-west roads would be modified to allow water to flow over or under them. Everglades Boulevard would remain between Stewart Boulevard and I-75. Portions of the north-south Miller, DeSoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but would remain available for use during the dry season.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

Alternative 3D



6.4.3 Analysis, Screening and Concerns – Second

The larger pump stations were large enough to maintain drainage to areas north of I-75. The larger pump stations would not change the hydrologic restoration benefits of the alternatives, since during non-storm periods, only a portion of the pump stations' total capacities would be used. Alternative 3D's additional benefits, relative to the earlier alternatives, came from removing most of the roads in SGGE.

Alternative 2 provided the most ecosystem benefits, and Alternative 3D provided the second most benefits. However, the estimated construction cost of Alternative 2 was three times as high as Alternative 3D. The additional ecosystem benefits of Alternative 2 could not be justified by the significant increase in cost, and Alternative 3D was the best overall of the alternatives analyzed.

These large pump stations greatly increased the cost of the alternatives relative to the $12-15 million cost of the alternatives described in the 1996 plan and the alternative contained in the Comprehensive Review Study. The 1999 Comprehensive Review Study cost estimate was actually much too low even for the small pump stations that were shown to be inadequate in the first round of analysis. For plans with the same size small pump stations as the 1999 Comprehensive Review Study, more realistic construction cost estimates range $35-55 million. To construct a plan with sufficient pump stations that would avoid altering drainage in NGGE, the initial estimates range $70-90 million. Operations and maintenance costs would also be higher. Neither the State of Florida, the South Florida Water Management District, nor the Corps of Engineers had planned for these much more expensive alternatives. While some of the pumps in each pump station would be operating most of the year, the full capacity of these large pump stations would only be used during infrequent, large storm events. The project delivery team then proceeded to develop and consider other alternatives for restoration in SGGE while maintaining existing drainage in NGGE.

6.5 THIRD ITERATION

Due to the cost concerns with Alternative 3D and having only one alternative that provided substantial ecosystem restoration of SGGE as well as maintained drainage for NGGE, the project delivery team went back to develop more options. The team identified twelve new management measures and developed sixteen additional alternatives (numbered 4 through 19).

6.5.1 Measures - Third

The following list contains the measures considered during this third iteration. The first ten measures are identical to the measures considered during the first and second iterations. Measures 11 through 22 are new. ***Table 6-2*** summarizes the relationships between the planning objectives and each of the 22 management measures.

1. Spreader Channels and Berms
2. Pump Stations
3. Road Demolition
4. Canal Plugs/ Swale Blocks
5. Canal Backfill
6. Elimination of Canal Maintenance South of the Spreader Channels and Removal of Existing Weir Structures
7. Gated Culverts
8. Exotic Plant Removal
9. Culverts Under U.S. Highway 41
10. Acquire Real Estate Interest
11. Reservoir

A reservoir could be constructed to hold stormwater flows from heavy storm events, to prevent a large amount of freshwater from being quickly discharged directly into the estuary following the rain event. Pumps would send the water into the reservoir, which would be released gradually to the existing canals and then to the proposed spreader system, or to the water supply for the City of Naples. The rest of the construction features for an alternative featuring a water storage reservoir would be similar to Alternative 3C (pump stations for 10 year flow, spreader system, canal plugs, road demolition).

Constructing a reservoir would provide minimal benefits for habitat restoration and would do little to meet the planning objectives for SGGE, listed in Section 5.3.2 of this report. There is little or no land area available for the construction of a large water storage reservoir. The area that would be used for a reservoir would be more efficiently utilized as wetland habitat for wildlife and for the restoration of the historic sheet flow and flow ways hydropatterns. This would help provide more natural freshwater discharges to the estuary ecosystem to improve the quality of the estuarine habitat as well as the quality of wildlife habitats in the SGGE.

TABLE 6 - 2 OBJECTIVES/MEASURES MATRIX. THIS TABLE ILLUSTRATES THE PLANNING OBJECTIVES THAT ARE ADDRESSED BY EACH OF THE MANAGEMENT MEASURES (COMPONENTS).

OBJECTIVES / MEASURES	Flow to Estuary	Sheet Flow in SGGE	Plant Communities	Aquifer Re-charge	Listed Species	Fish and Wild-life	Eco-logical Connectivity	Recreation	Fire	Flood Protection
Spreader Channel	✓	✓	✓	✓						
Pump Stations	✓	✓	✓	✓		✓				
Road Demolition	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Canal Plugs	✓	✓	✓	✓		✓	✓			
Fill Canals	✓	✓	✓	✓		✓	✓			
Eliminate Canal Maintenance	✓	✓	✓	✓		✓				
Gated Culverts	✓									
Exotic Plant Removal			✓		✓	✓				
Culverts Under U.S. 41	✓		✓			✓				
Real Estate Interest		✓	✓		✓	✓	✓	✓	✓	✓
Reservoir				✓				✓		
ASR				✓						
Adjustable Weirs	✓	✓	✓	✓					✓	✓
Berms along Canals	✓	✓	✓	✓						
Lining Canals		✓	✓	✓						
Levee at Belle Meade Ag area	✓	✓								✓
I-75 Bridges		✓								✓
Widen Canals										✓
Connector Canal										✓
Levee at Port of the Islands	✓	✓								✓
Culvert under Everglades Blvd		✓								✓
Levee at NW Belle Meade										✓

12. Aquifer Storage and Recovery (ASR)

ASR is a method of storing water by pumping it through a well into an aquifer. In order to recover the water, it is pumped back to the surface using the same well. The ASR method can be used during times when water is readily available, such as in the wet season, in anticipation of times when water is needed, such as in the dry season.

In order to be an effective water storage method, water must be impounded in large quantities for a period of time at the surface, such as in a reservoir. Prior to being pumped into the aquifer for storage, the water is treated to meet primary drinking water standards by a Water Treatment Plant, which would be built on site. After treatment, the water is pumped into the aquifer at a rate of about 5 mgd.

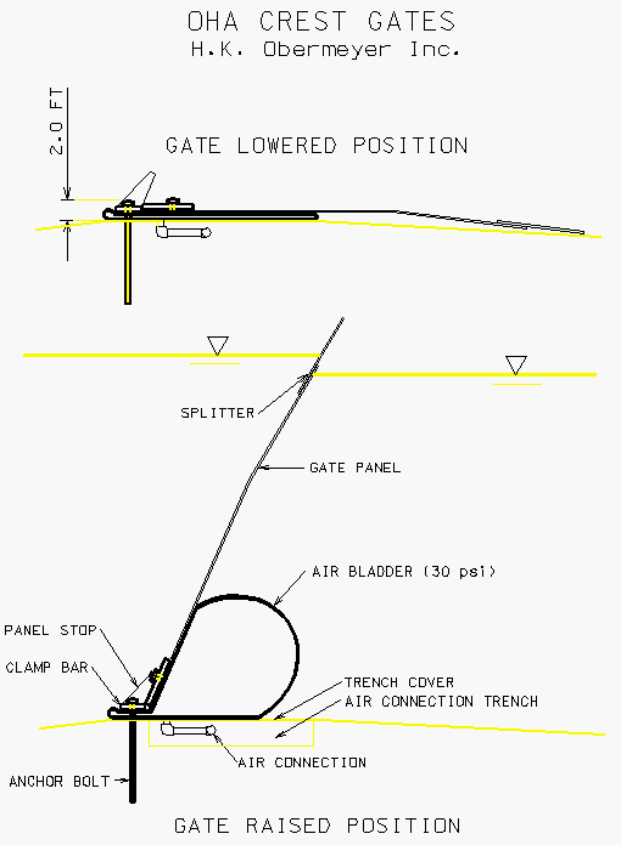
In order for ASR to be considered useful and pertinent for application in the ecological restoration of SGGE, the heavy rush of water that currently passes through the canals right after a heavy rain event must be caught and made to slowly sheetflow through the wetlands for ultimate discharge into the estuary over a longer period of time. ASR's basic strategy and method of operation does not function in the way required for the restoration of SGGE.

ASR is an alternative to surface water storage, where land costs or availability preclude it. This alternative would provide minimal benefits for habitat restoration. There is little or no available land area for construction of a storage reservoir that would be needed to impound water prior to treatment and pumping into the aquifer. For the SGGE Project, lands will be needed for the restoration of historic hydropatterns, including sheet flow and flow ways, which will help provide more natural freshwater flows to the estuary ecosystem to improve the quality of the estuarine habitat as well as the quality of habitats in the SGGE. The ASR alternative does little to meet the planning objectives listed in Section 5.3.2 of this report, and was dropped from further consideration.

13. Adjustable Weirs

Adjustable weirs would be constructed in the canals. Obermeyer gate systems are proposed. The Obermeyer Spillway Gate system is a patented bottom hinged steel spillway gate panel, lifted and supported on the downstream side by an inflatable air bladder. By controlling the pressure in the bladder, the gate panel's position can be adjusted within the system control range of full inflation to full deflation. The system can be remotely controlled and includes an air compressor, receiver tank, and various control valves for venting of air from the air bladder. All automatic systems include provision for local manual control. Obermeyer Spillway Gates are custom designed to conform to the canal cross-section with a minimum profile when in the lowered position. These structures would be held in the upright (closed) position most of the year, so that they would retain water within the canal. They would be opened during large storms to enable the large flows of water from NGGE to move southward without causing flooding that would be any more severe than would occur under existing conditions.

Obermeyer Pneumatically Operated Gate System



14. Berms along Canals

These berms would be an earthen wall which would be constructed parallel to the canals. This measure requires that other measure(s) be implemented to initially get the water out of the canals and establish the sheet flow in SGGE. These berms would help maintain the sheet flow by preventing the sheet flow of water from returning into the canals.

15. Lining of Canals

Placing a low permeability liner within the canals or sections of the canals would reduce the infiltration of ground water into the canal.

16. Levee near the Belle Meade Agricultural Area

This levee would serve to protect the Belle Meade agricultural area and adjacent residential properties from adverse impacts due to increased water levels and durations that are desired for most of SGGE and eastern Belle Meade. A privately owned levee exists, but it was designed and constructed for lower water levels in eastern Belle Meade than are expected under most of the restoration alternatives. Multiple separate agricultural operations and residential

properties are located in this area. The 6L Farm is the largest single operation in this area, and occasionally this proposed levee will be identified in this PIR as the 6L levee.

17. Modify Interstate-75 Bridges

Water in the Miller, Faka Union, and Merritt canals flows from NGGE under bridges for Interstate-75 (I-75), and into SGGE. Initial modeling suggested that the bridges might be small enough that they restrict the flow of water during storm events when the flow is largest. Increasing the width of these bridges would then allow the water in NGGE to be at lower elevation or to leave faster than under existing conditions, and counteract the effects of other management measures which would cause flood waters in NGGE to be higher or to stay longer than under existing conditions.

18. Widen Canals

One or more canals would be widened in order to convey floodwaters during storm events. If a canal was plugged and no pump station and spreader was constructed, then an adjacent canal would have to be widened to accept the floodwater. A connector canal would also have to be constructed.

19. Connector Canal

This would be a generally east-west canal or channel between the existing canals. It would function to allow storm water to move from one canal to another. Construction of this measure would normally require that the receiving canal be widened.

20. Levees Surrounding Port of the Islands

This levee would protect the Port of the Islands developments from adverse flooding, both during the normal wet season and during storm events. Port of the Islands is located at the southern end of SGGE, where the Faka Union Canal crosses under U.S. 41. This levee will also reduce the flow of surface water into the lower end of the Faka Union Canal.

21. Culvert Under Everglades Boulevard near Interstate-75

One or more culverts under the ramps leading to the Everglades Boulevard bridge over I-75 would allow water in the I-75 borrow canals to flow in east – west directions. This may reduce the likelihood of flooding in NGGE along one of the canals by giving storm water within a specific canal an alternate discharge location from continuing down the canal.

22. Levee near Private Lands in Northeast Belle Meade

A levee would be constructed around the neighborhood of private homes that has been constructed in northeast Belle Meade. This approximately 600-acre area is located west of the intersection of 52nd Avenue and Miller Boulevard, and is

accessed though SGGE. The berm would protect the neighborhood from elevated surface water during average wet season conditions and during infrequent large storm events under some alternatives. An interior drainage system would also be constructed.

6.5.2 Alternatives – Third

This section describes the additional alternatives developed to meet the restoration objectives and the flood protection constraint.

Alternatives 4 and 5 investigated variations of conveyance and pump size relative to Alternative 3D. Alternatives 6 and 7 moved construction activities and restoration actions to the southern one-third of SGGE. Alternatives 8 and 9 used adjustable Obermeyer weirs to raise water levels and connector channels to transfer water between canals. These also focused restoration to the eastern portion of SGGE. Alternatives 10 through 14 included combinations of adjustable weirs on some canals and pump stations / canal blocks on other canals. Alternatives 15 through 18 included combinations of leaving some canals unmodified while placing pump stations / canal blocks on the remaining canals. These alternatives also focused restoration to the eastern portion of SGGE. Alternative 19 included pump stations, canal widening, and connector channels.

No Action Alternative

This alternative is also the Future Without Project condition or the "No-Build" Alternative. Under No Action, no features would be constructed and no operational changes would be initiated. This alternative or condition assumes that the other components of the CERP are in place. Even with these programs and features in place, degradation of the SGGE would continue to occur. Refer to ***Section 4*** for a more thorough description of the without project condition. This No Action alternative is the same as was considered during the earlier iterations.

Alternative 3D

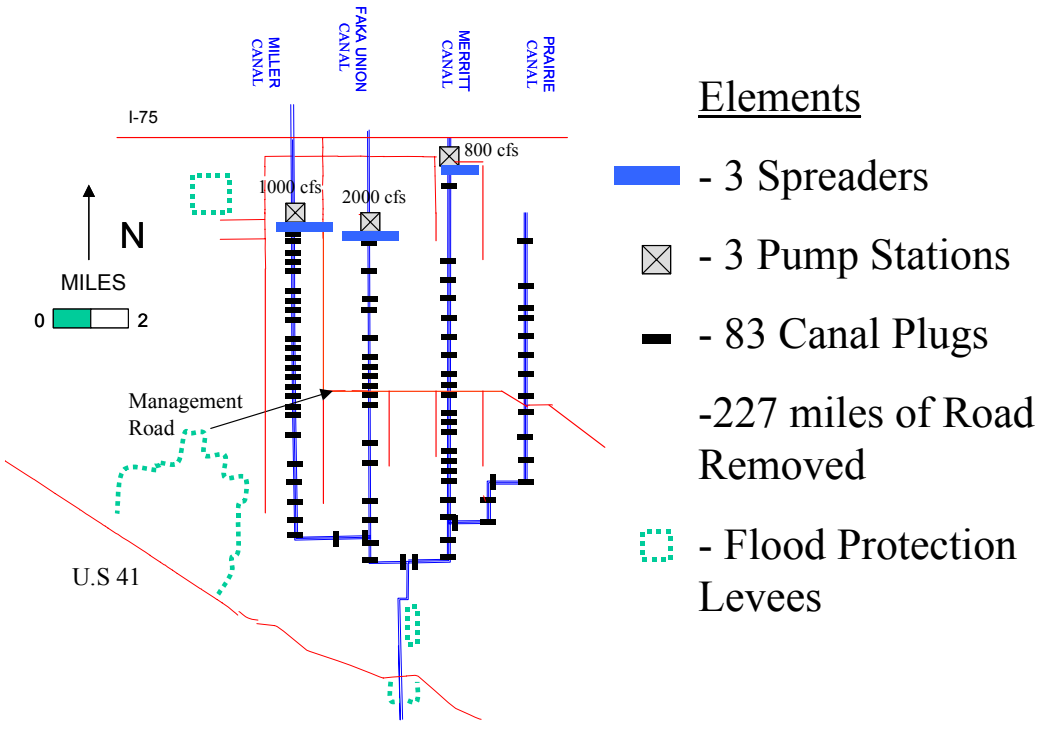
This alternative includes the demolition of 227 miles of roads rather than 128 miles of Alternative 3B or 130 miles of Alternative 3C. Three spreader channels would run in an east-west direction, across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The pump stations would be 1,000 cfs on the Miller Canal, 2,000 cfs on the Faka Union Canal, and 800 cfs on the Merritt Canal. Spreader channels and pump station would be in the same locations as in Alternative 3C. These pump stations would be larger than the pump stations in Alternative 3C. The pump

stations in Alternative 3D were sized so that the existing drainage in NGGE would not be reduced by this alternative.

The same 83 canal plugs would be installed in Alternative 3D as in Alternative 3C, including plugging Prairie Canal along its entire length. Stewart Boulevard would remain to connect Janes Parkway and Everglades Boulevard. Portions of Berson Boulevard would remain. These east-west roads would be modified to allow water to flow over or under them. Everglades Boulevard would remain between Stewart Boulevard and I-75. Portions of the north-south Miller, DeSoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but would remain available for use during the dry season.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

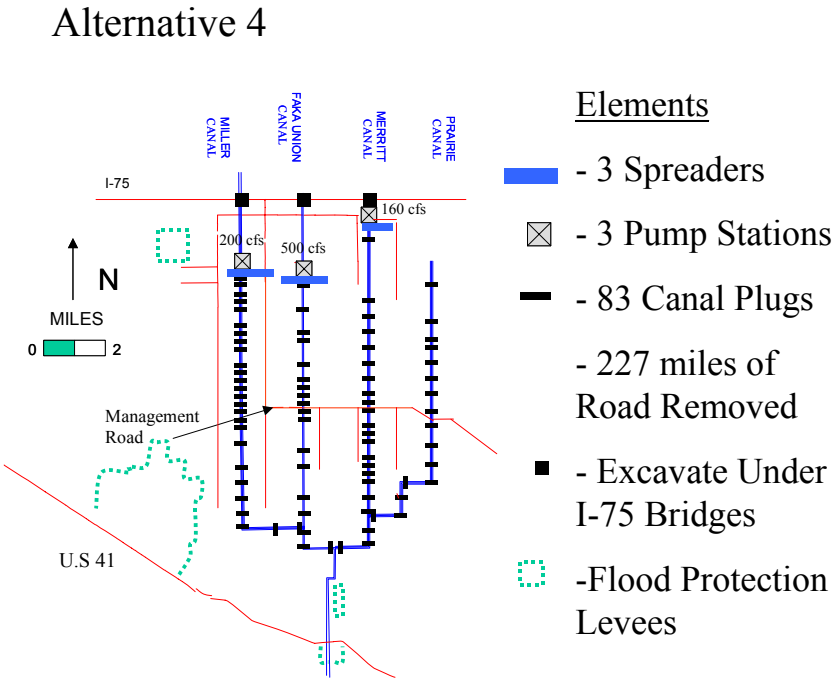
Alternative 3D



Alternative 4 – Interstate-75 Bridges

This alternative started with the same spreader channels, pump stations, and canal plugs as alternative 3C. Spreader channels would be at the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The pump stations were initially 200 cfs on the Miller Canal, 500 cfs on the Faka Union Canal, and 160 cfs on the Merritt Canal. The same 83 canal plugs would be installed. The 227 miles of road demolished is the same as for Alternative 3D.

The major modification unique to this alternative was to enlarge the three I-75 bridges over the canals. This modification was investigated to determine whether the bridges were contributing to the flooding conditions in Northern Golden Gate Estates. If the bridges were inhibiting flows southward, then it was envisioned that enlarging the bridges would allow the pump stations to be smaller and less costly than in Alternative 3D.



Alternative 5

There is no alternative called Alternative 5. When the project delivery team began to analyze what was called Alternative 5, it was discovered that it was not substantially different from Alternative 3D. Since several other alternatives with higher numbers had already been described, labeled and analyzed, it was simpler to halt analysis of Alternative 5 rather than add potential confusion by having two substantially identical alternatives or renumbering all of the newer alternatives.

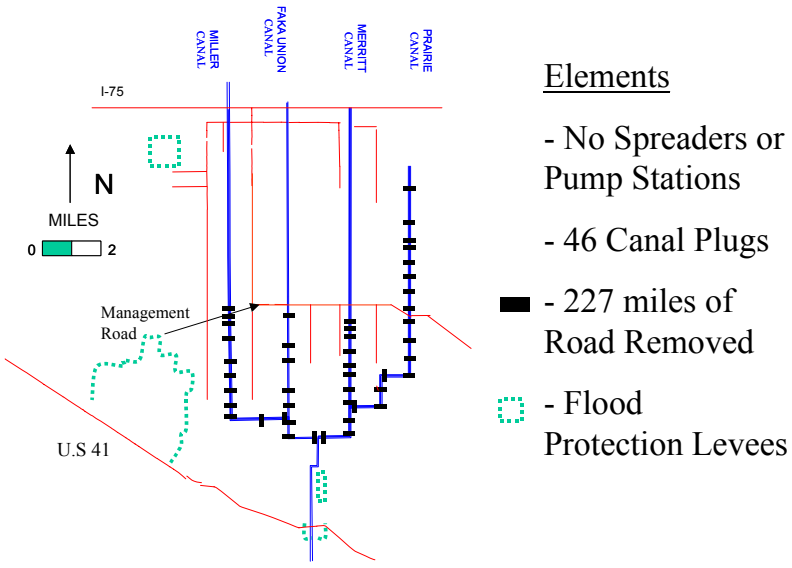
Alternative 6 – No Pumps Plan

This alternative was designed as a low cost low technology alternative. Initial evaluations of earlier alternatives disclosed that blocking canals in SGGE near I-75 tended to increase stages and duration of high water for some distance into NGGE during storm events. By moving the whole construction area southward, the area of induced flooding in NGGE would also be moved southward. By installing canal blocks only in the southern half of SGGE, it was expected that the backwater induced flooding would be contained within the northern half of SGGE and not extend north of I-75 into NGGE.

Plugs would be placed in the Miller, Faka Union, and Merritt canals starting just south of 100th Avenue (Stewart Boulevard). There would be no spreader channels or pump stations. Prairie Canal would be plugged along its entire length. A total of 46 canal plugs would be constructed. Approximately 227 miles of roads would be demolished. Canal maintenance south of the plugs would be eliminated. Culverts would be constructed under U.S. 41.

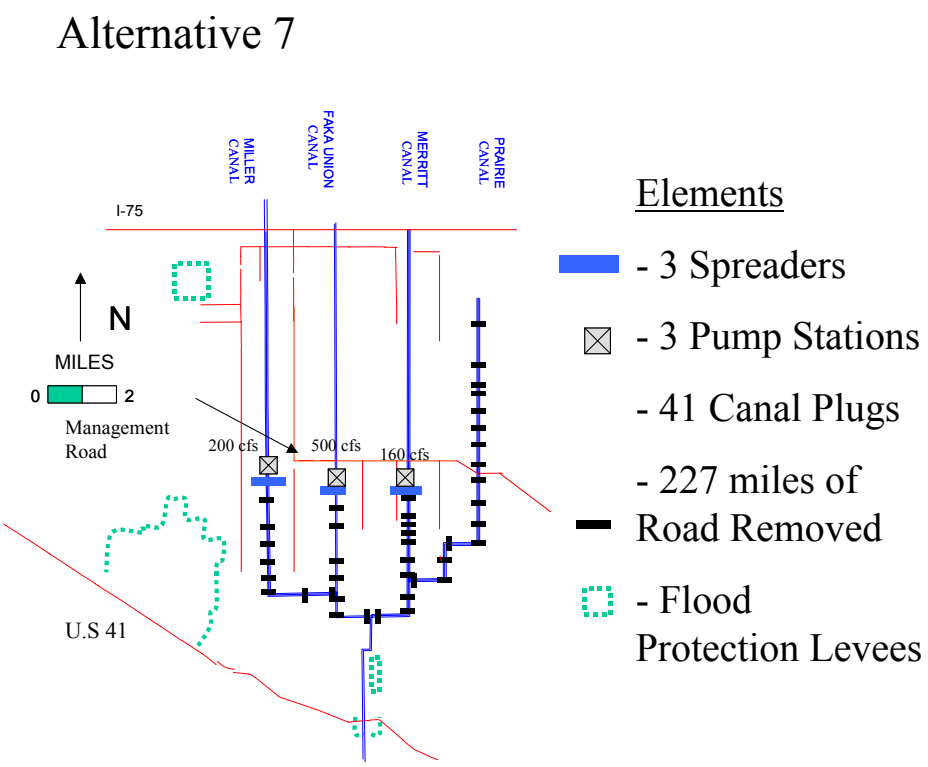
Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

Alternative 6



Alternative 7 – Southern Pumps Plan

Alternative 7 can be considered as a combination of Alternative 3C and Alternative 6. It contains the spreader channels and pump stations on the Miller, Faka Union, and Merritt Canals much like Alternative 3C. It also moves the locations of the spreader channels and pump stations to locations just south of 100th Avenue (Stewart Boulevard), much like Alternative 6. Alternative 7 was developed in an effort to retain reduced pump station sizes and costs by allowing any induced water levels during storms to be contained south of I-75 and not extend into NGGE. Canal maintenance south of the spreader channels would be eliminated. Culverts would be constructed under U.S. 41. This alternative includes plugging Prairie Canal along its entire length. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.



Alternative 8

Under Alternative 8, Prairie and Merritt Canals would be permanently plugged. The storm flows that would normally be carried by Merritt Canal would be directed to the Faka Union Canal by a connector channel constructed between these two canals. This connector channel would be located along the southern side of I-75. Faka Union Canal would be widened by 100 feet so that it could handle the additional flows from Merritt Canal and not induce flooding north of I-75.

A series of 10 Obermeyer Spillway Gates would be installed within Miller and Faka Union Canals. Obermeyer Spillway Gates are adjustable weirs that can be operated remotely and can be automated to change depending on conditions. They consist of a foundation and a large metal plate attached to the foundation by a hinge. They are further described in Section 6.5.1 Management Measures.

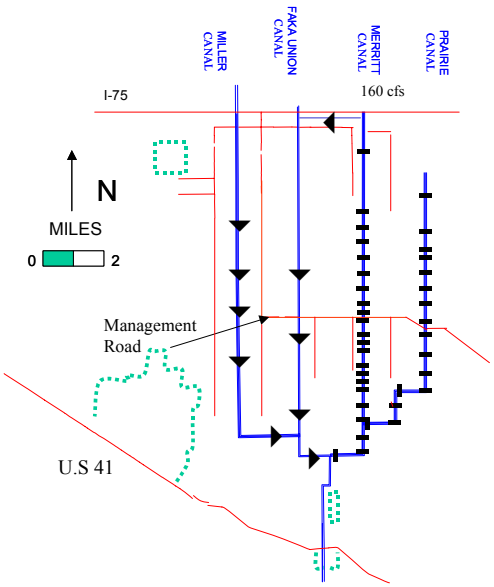
These Obermeyer weirs would be kept closed (up) during much of the wet season and throughout the dry season. This would keep water levels in the canals as high as possible, to minimize the ability of the canals to intercept surface water and draw ground water from adjacent land. The canals would be a series of long linear pools while the Obermeyers were closed. During storms, the Obermeyers would be opened (down) to allow the storm water to flow from NGGE through SGGE to the Gulf of Mexico. This operation would be automated and based on sensors installed along canals in NGGE.

An approximately 1 mile long section of the Faka Union Canal between 118th Avenue S.E. and 124th Avenue S.E. (Lynch Boulevard) would be lined to prevent groundwater infiltration into the canal. This section would also have low berms along each side to keep the sheet flow on the nearby ground surface from entering the relatively dry channel.

As in Alternatives 3D, 4, 6, and 7, approximately 227 of the 279 miles of roads would be demolished under Alternative 8. Most of the excavated material would be pushed into the roadside ditches and spread out across the land, eliminating barriers to sheet flow across the landscape.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

Alternative 8



Elements

- No Spreaders or Pump Stations
- 38 Canal Plugs
- 10 Obermeyer Weirs, in Faka Union & Miller
- Widen Faka Union
- 227 miles of Road Removed
- Flood Protection Levees

Alternative 9

Under Alternative 9, Prairie Merritt, and Miller Canals would be permanently plugged. The storm flows that would normally be carried by the Merritt and Miller Canals would be directed to the Faka Union Canal by connector channels constructed between these two canals. These connector channels would be located along the southern side of I-75. Faka Union Canal would be widened by 140 feet so that it could handle the additional flows from Merritt and Miller Canals and not induce flooding north of I-75.

A series of 6 Obermeyer Spillway Gates would be installed within the Faka Union Canal. Obermeyer Spillway Gates are adjustable weirs that can be operated remotely and can be automated to change depending on conditions. They consist of a foundation and a large metal plate attached to the foundation by a hinge. They are further described in Section 6.5.1 Management Measures.

These Obermeyer weirs would be kept closed (up) during much of the wet season and throughout the dry season. This would keep water levels in the canals as high as possible, to minimize the ability of the canals to intercept surface water and draw ground water from adjacent land. The canals would be a series of long linear pools while the Obermeyers were closed. During storms, the Obermeyers would be opened (down) to allow the storm water to flow from NGGE through SGGE to the Gulf of Mexico. This operation would be automated and based on sensors installed along canals in NGGE.

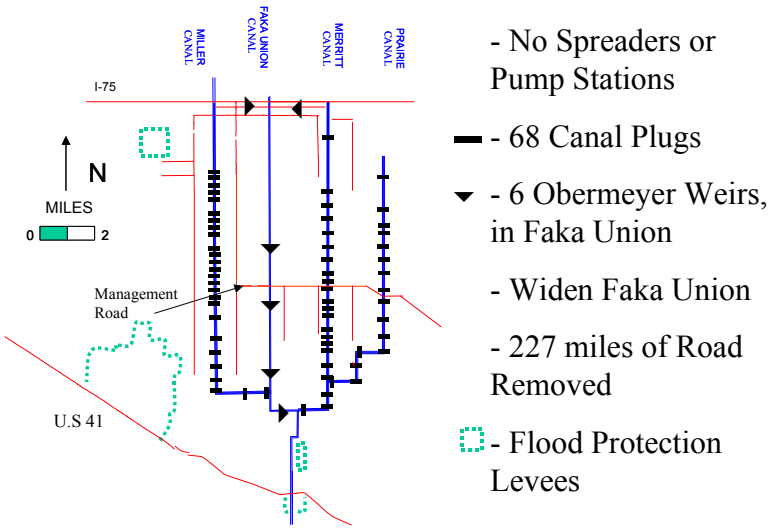
An approximately 1 mile long section of the Faka Union Canal between 118th Avenue S.E. and 124th Avenue S.E. (Lynch Boulevard) would be lined to prevent groundwater infiltration into the canal. This section would also have low berms along each side to keep the sheet flow on the nearby ground surface from entering the relatively dry channel.

As in Alternatives 3D, 4, 6, and 7, approximately 227 of the 279 miles of roads would be demolished under Alternative 8. Most of the excavated material would be pushed into the roadside ditches and spread out across the land, eliminating barriers to sheet flow across the landscape.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

Earlier alternatives call for permanently plugging each of the canals and installing large pump stations to convey periodic storm flows (Alternatives 2 and 3D) or moving the plugs far south so that induced flooding would not enter NGGE (Alternative 6). Alternatives 8 and 9 allow canals to be opened to convey storm flows. In Alternative 8, one canal would be closed and two, Faka Union and Miller, would remain. The Faka Union Canal would be widened 100 feet. In Alternative 9, two canals would be closed and only one canal, the Faka Union Canal, would remain. This canal would be widened 140 feet. Alternatives 8 and 9 are identical in all other respects.

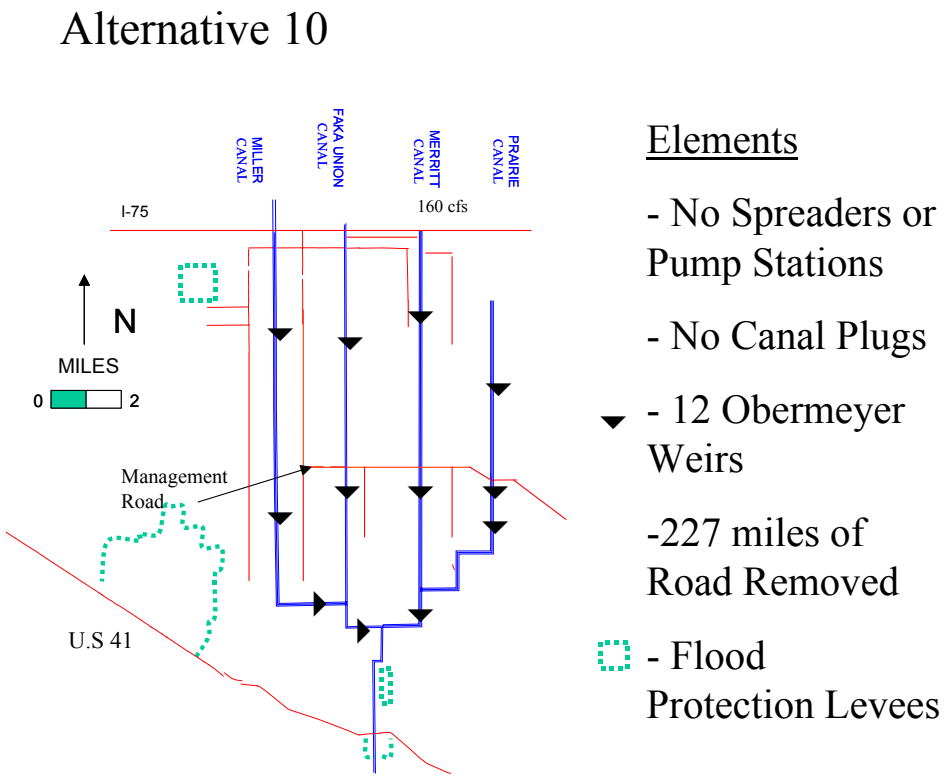
Alternative 9



Alternative 10 –Adjustable Weirs All Canals Plan

Under this alternative, adjustable Obermeyer Weirs would be constructed in all four canals. There would be a total of 16 weirs. No canals would be widened; no pump stations or spreader canals would be constructed. As in Alternatives 8 and 9, approximately 227 of 279 miles of roads would be demolished.

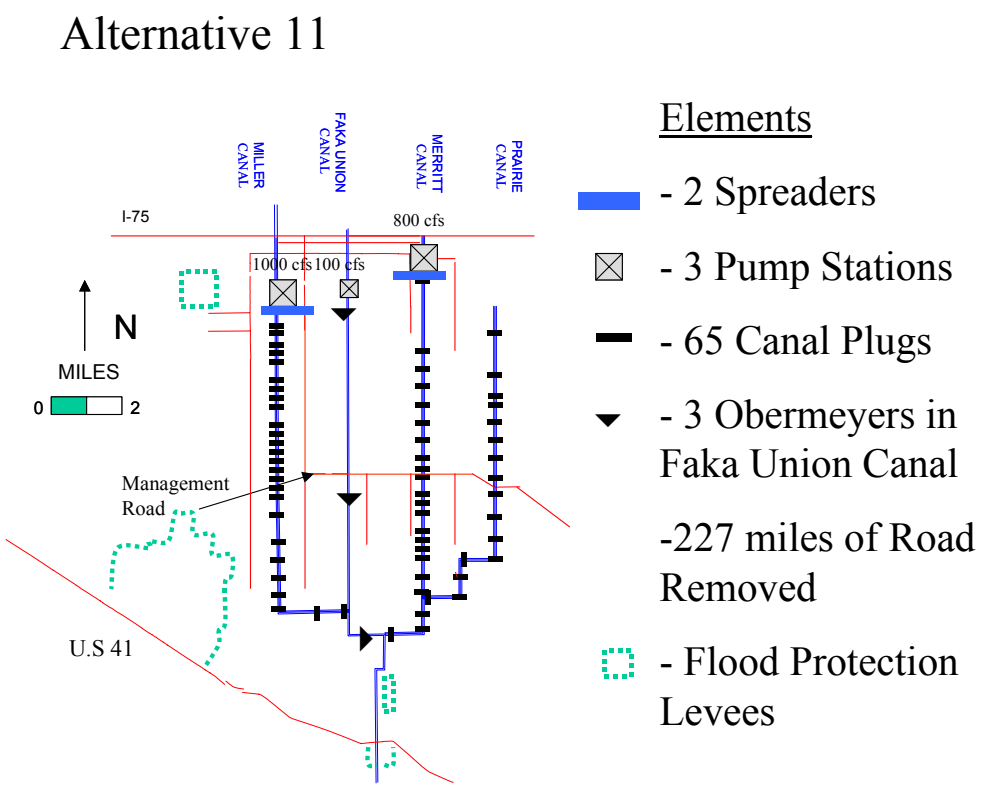
Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.



Alternative 11

This alternative contains components of Alternative 3D and Alternative 9. As in Alternative 3D, Miller, Merritt, and Prairie Canals would be permanently plugged and there would be pump stations and spreader channels in the Miller and Merritt Canals. As in Alternative 9, the Faka Union Canal would contain two adjustable Obermeyer weirs, and a third adjustable Obermeyer weir would be located in the east-west section of the Faka Union Canal. Culverts would be constructed under U.S. 41.

Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area. This alternative avoids some features of Alternative 9 - the widening and lining of Faka Union Canal and the construction of northern connector canals between Miller and Faka Union and between Merritt and Faka Union. This alternative also avoids the large pump station on Faka Union that is included in Alternative 3D.

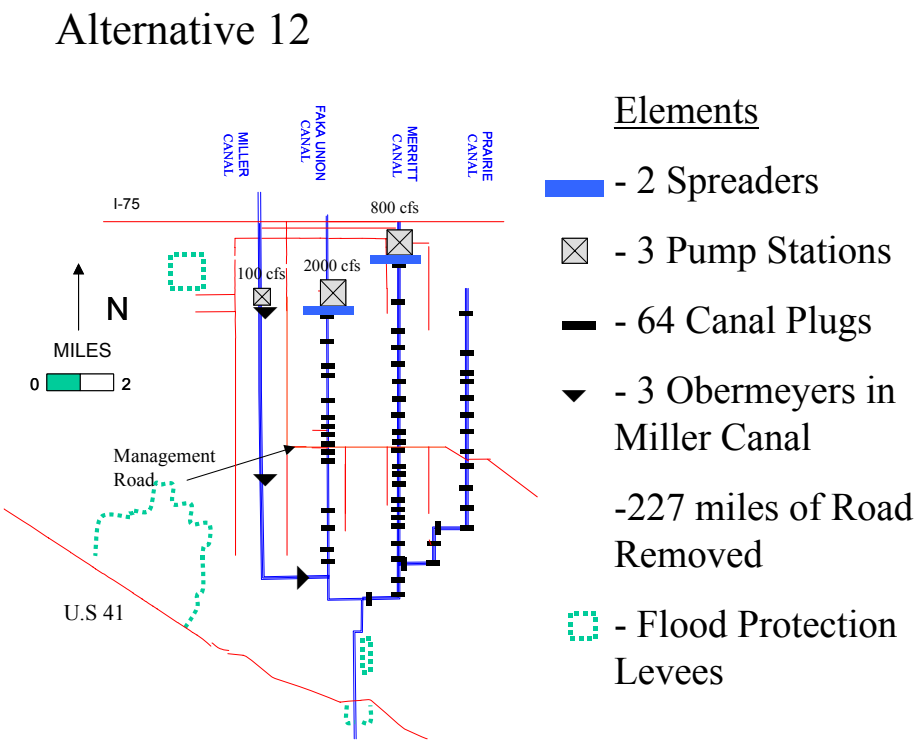


Alternative 12

Like Alternative 11, Alternative 12 is a different combination of Alternative 3D and Alternative 9. Alternative 12 permanently plugs three canals, but the canal that would remain open and receive adjustable Obermeyer weirs is Miller Canal, rather than the Faka Union Canal as in Alternative 11.

Faka Union, Merritt, and Prairie Canals would be permanently plugged. A 2000 cfs pump station and spreader channel would be constructed on the Faka Union Canal and a 800 cfs pump station and spreader channel would be constructed in the Merritt Canal. There would be a small, 100 cfs pump station near the northern end of Miller Canal. Two adjustable Obermeyer weirs would be constructed in the south flowing section of Miller Canal. One adjustable Obermeyer weir would be constructed in the east-west section of Miller Canal.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

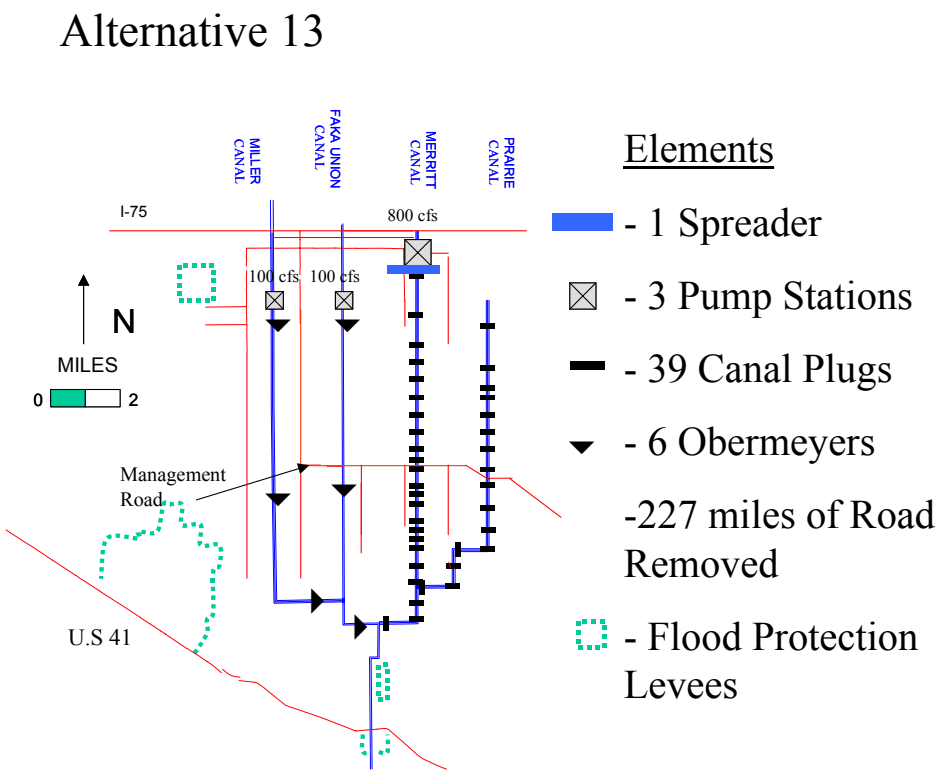


Alternative 13

This alternative is a variation of Alternatives 11 and 12, and incorporates features from Alternative 8 and Alternative 3D. Under Alternative 13, two canals would be plugged and two canals would remain open and contain adjustable Obermeyer weirs. Alternatives 11 and 12 each had three canals plugged and one canal open with Obermeyer weirs.

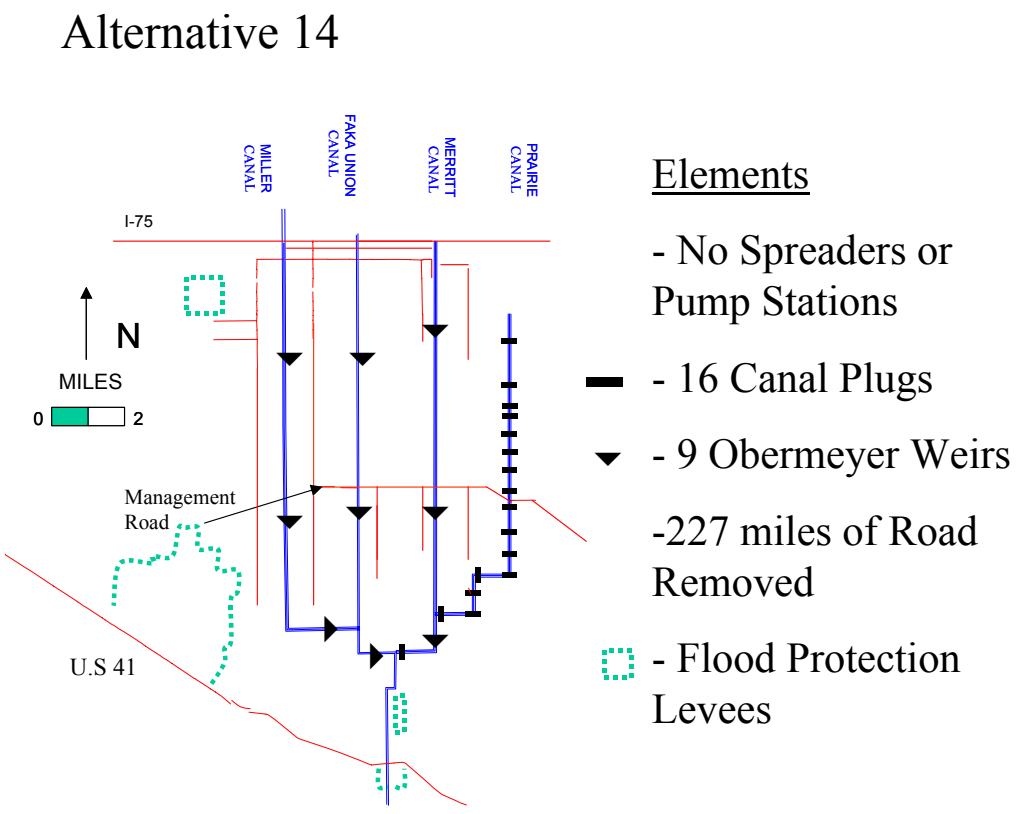
Merritt and Prairie Canals would be plugged. There would be a 800 cfs pump station and spreader on Merritt Canal. The north-south sections of Miller and Faka Union Canals would each receive two adjustable weirs. There would be an additional adjustable Obermeyer weir on the east-west section of Miller Canal and one adjustable Obermeyer weir on the east-west section of Faka Union Canal.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.



Alternative 14

This alternative is a continuation of the series of alternatives 10 through 13. Under Alternative 14, one canal, Prairie Canal, would be plugged and the remaining three canals would contain a total of 13 adjustable Obermeyer weirs. Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.

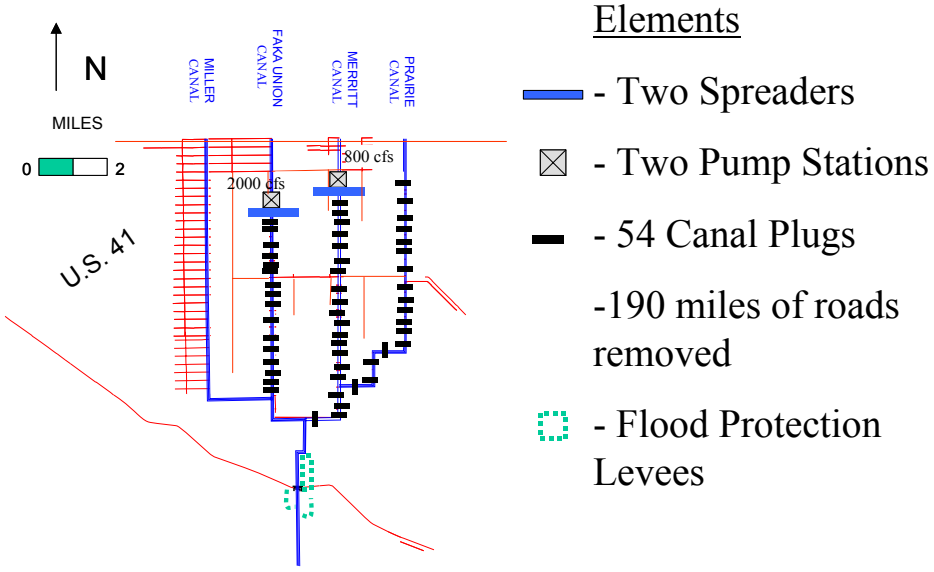


Alternative 15

Under Alternative 15, Faka Union, Merritt, and Prairie Canals would be plugged. Pump stations and spreaders would be added to the Faka Union and Merritt Canals. There would be no change to the Miller Canal. This alternative is comparable to Alternative 12 except that Miller Canal would be unchanged

rather than contain adjustable Obermeyer weirs. Approximately 190 of 279 miles of roads would be demolished. There would be a protective berm surrounding Port of the Islands. Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, and the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41.

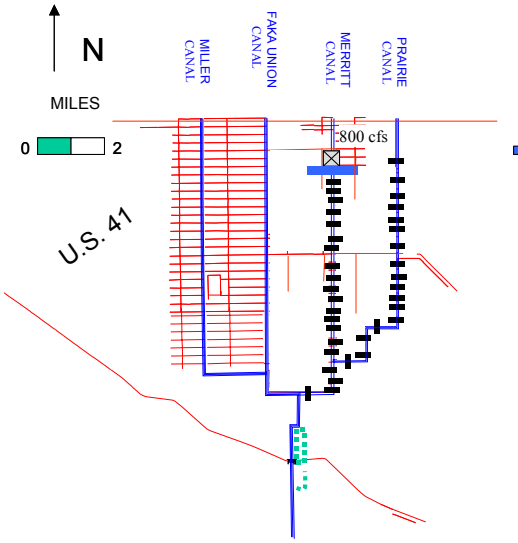
Alternative 15



Alternative 16

Under Alternative 16, Merritt and Prairie Canals would be plugged. A pump station and spreader channel would be added to Merritt Canal. There would be no change to the Miller or Faka Union Canals. This alternative is comparable to Alternative 13 except that Miller and Faka Union Canals would be unchanged rather than contain adjustable Obermeyer weirs. Approximately 125 of 279 miles of roads would be demolished. Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, and the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41.

Alternative 16



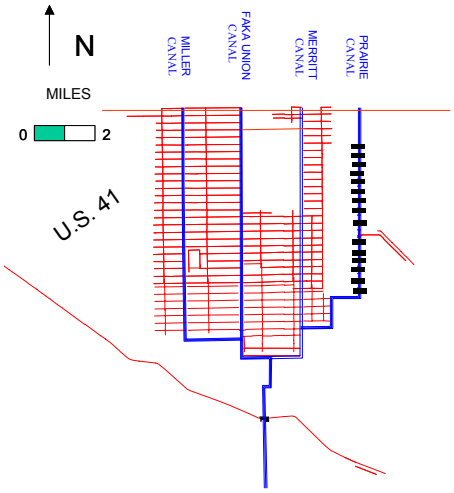
Elements

- One Spreader
- One Pump Station
- 39 Canal Plugs
- 125 miles of roads removed

Alternative 17 – Prairie Canal

Under Alternative 17, the Prairie Canal would be plugged. There would be no change to the other three canals. Approximately 26 of 279 miles of roads would be demolished. Culverts would be constructed under U.S. 41.

Alternative 17

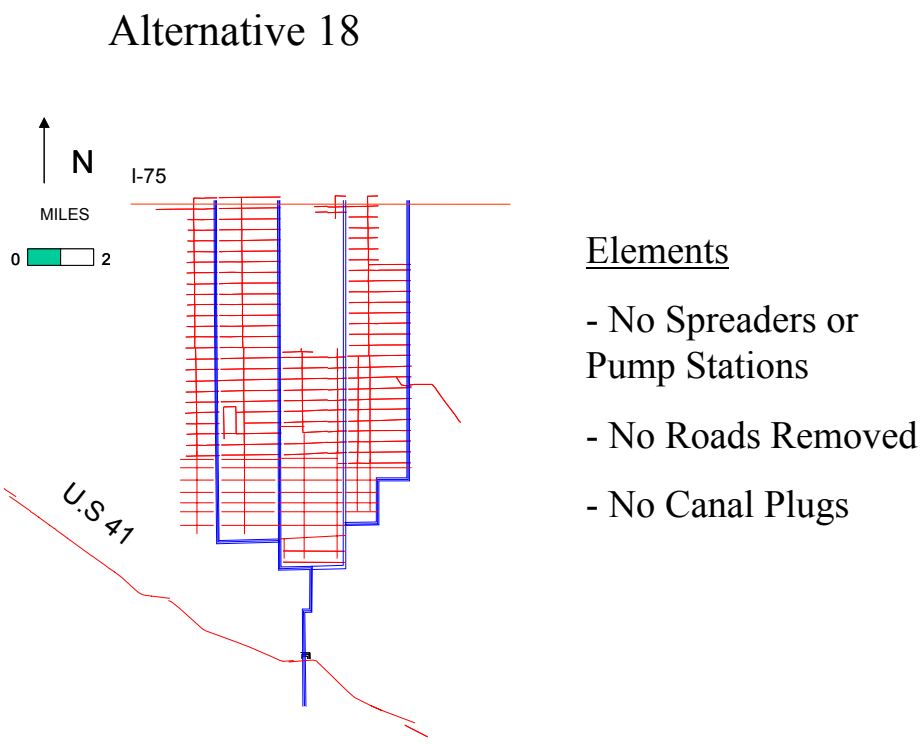


Elements

- No Spreaders or Pump Stations
- 15 Canal Plugs
- 26 miles of roads removed

Alternative 18 – Land Acquisition

Under this alternative, all of the land within SGGE would be acquired. No construction would be performed. Hydrology would be unchanged. Prescribed fire, exotic vegetation controls, and possibly other operational management procedures would be performed by the Florida Division of Forestry.



Alternative 19

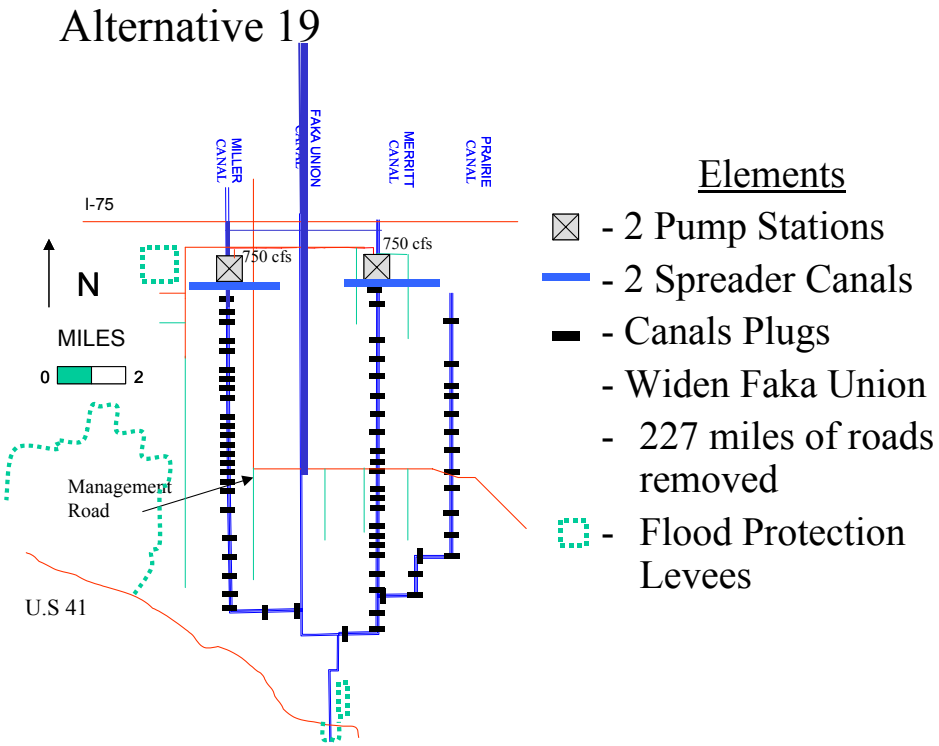
This alternative was developed as a modification of Alternative 9.

Prairie Canal would be plugged. Merritt Canal would be plugged. Miller Canal would be plugged. The plugs would be 100 feet long and be spaced 0.5 miles apart. There would be a total of 64 plugs (22+22+20). There would be a 750 cfs pump station and a 4.5-mile long spreader channel at the Merritt Canal near 54th Avenue SE and a 750 cfs pump station and a 3.5-mile long spreader channel at the Miller Canal near 54th Avenue SE. There would be a connector canal from Merritt Canal to Faka Union Canal and Miller Canal to Faka Union Canal. This canal would convey water from the canals that is above the capacity of the Miller and Merritt pump stations. It would be located just south of I-75 and would be 4 miles long.

Faka Union Canal would be enlarged to a bottom width of 60 foot for 6.8 miles, from 52nd Ave SE northward to a point 3.0 miles north of Faka Union #4 in NGGE. The canal would be widened to a bottom width of 100 feet for 6.0 miles from 52nd Ave SE southward to Stewart Boulevard.

Existing weir FU#4 would be removed. Existing weirs FU#2 and FU#3 would be removed and replaced with vertical gate control structures. These new structures would be located at 52nd Ave SE and Stewart Boulevard.

Culverts would be constructed under U.S. 41. Protective earthen levees would be constructed to prevent induced flooding to several private properties: the Port of the Islands Waterfront RV Resort located on the eastern side of the Faka Union Canal north of U.S. 41, the Port of the Islands development along both sides of the Faka Union Canal south of U.S. 41, the residential neighborhood in northwest Belle Meade adjacent to SGGE, and the Belle Meade agricultural area.



6.5.3 Analysis and Screening- Third

Hydrologic modeling was performed on ten alternatives (3D, 6, 7, 8, 9, 11, 12, 13, 17, 19) and the No Action Alternative. The modeling results contributed to an evaluation of ecosystem benefits. Details of the procedures to estimate benefits are described in Section 6.6 – Evaluation Tools. ***Table 6-3*** summarizes some of the information used during screening, including indices and average annual benefits for hydrology in SGGE, biota in SGGE, oysters in Faka Union Bay, and fish in Faka Union Bay. The indices are derived from model outputs and professional judgment. Each index values range from 1.00 for undisturbed, pre-development conditions to 0.00 for highly disturbed, poor quality conditions. The table also displays estimated construction cost ($million) and whether the alternative would induce flooding in NGGE. Real estate cost estimates were not available during this screening analysis.

Index values are unavailable for Alternatives 10, 14, 15, 16, and 18 because they were not modeled. The decision to not model some alternatives was based on the large amount of time and money needed to model, and on the knowledge gained from previous results for alternatives that were modeled. As presented below in the descriptions for each alternative, alternatives that leave Miller Canal completely open, Faka Union Canal completely open, or Faka Union Canal with only Obermeyer weirs produce no estuary restoration and only a small amount of restoration within the inland area of SGGE.

The PDT used several decision criteria to screen both modeled and unmodeled alternatives from further analysis and to retain some alternatives for additional study. The specific criteria can be grouped within four Planning Criteria required by the Corps of Engineers' planning regulations (ER 1105-2-100) – effectiveness, efficiency, completeness, and acceptability.

For effectiveness, the PDT determined whether alternative plans achieved the planning objectives for restoration and avoided the planning constraint for flood protection. If an alternative was not able to achieve 50 percent restoration of the pre-drainage conditions, as defined by the SFAM indices and the estuary indices (**Table 6-3**), then the alternative was not retained. Less than 50 percent was considered insufficient to make the plan worth pursuing. If the alternative did not remove the point discharge to Faka Union Bay, then the alternative was not retained. If the model predicted that the alternative would result in adverse flooding so that there would be takings in NGGE, then the alternative was not retained.

TABLE 6 - 3 SCREENING INFORMATION FOR SGGE ALTERNATIVES

Alternative	**Future W/O**	**3D**	**6**	**7**	**8**	**9**	**11**	**12**	**13**	**17**	**19**	**10**	**14**	**15**	**16**	**18**
Hydrology Index	0.36	0.83	0.74	0.65	0.61	0.66	0.69	0.75	0.64	0.42	0.69	-	-	-	-	-
Biota Index	0.49	0.85	0.84	0.79	0.77	0.78	0.81	0.85	0.79	0.54	0.84	-	-	-	-	-
Oyster Index	0	0.94	0.94	0.50	0	0	0	0.50	0	0	0.88	-	-	-	-	-
Fish Index	0.03	0.69	0.73	0.65	0.56	0.55	0.45	0.71	0.36	0.11	0.76	-	-	-	-	-
Hydrology Benefits	-	27870	22533	17196	14825	14232	19568	23126	16603	3558		-	-	-	-	-
Biota Benefits	-	14979	14618	12816	12095	12455	13537	14979	12816	3805		-	-	-	-	-
Oyster Benefits	-	15	15	8	0	0	0	8	0	0		-	-	-	-	-
Fish Benefits	-	882	882	781	668	655	529	857	416	101		-	-	-	-	-
Construction cost (million)	$0	$101	$47	$75	$261	$252	$78	$94	$75	$17	-	-	$71	$82	$39	$0
Flooding	No	No	No*	Yes	No	No	No	No	No	No	Yes	No	No	No	No	No

* The model results used for screening analysis showed no significant flooding in NGGE. Subsequent analysis with an updated model showed flooding.

Efficiency was represented by the concept of cost effectiveness. If one alternative provided fewer benefits for the same cost as a second alternative, then the first alternative was not cost effective. Habitat unit benefits are plotted against construction cost in **Figure 6-2**. If one alternative provided the same or fewer benefits but at a higher cost than a second alternative, then the first alternative was not cost effective. Alternatives determined to be not cost effective were not retained for additional analysis.

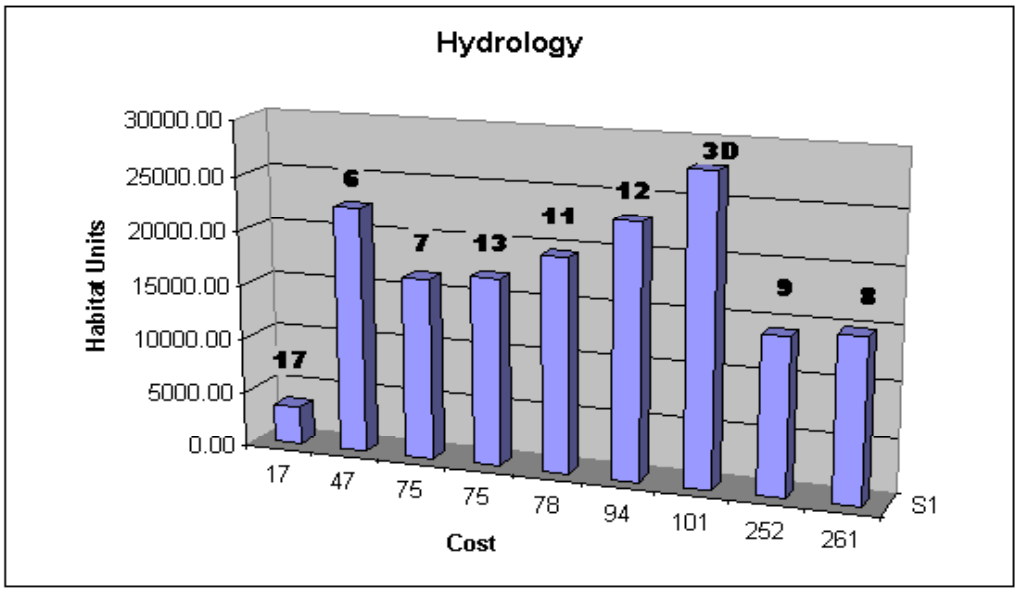
Completeness is whether an alternative plan contains all of the construction, management, and operational measures necessary for the plan to function as expected. The alternatives were assembled with this criterion in mind.

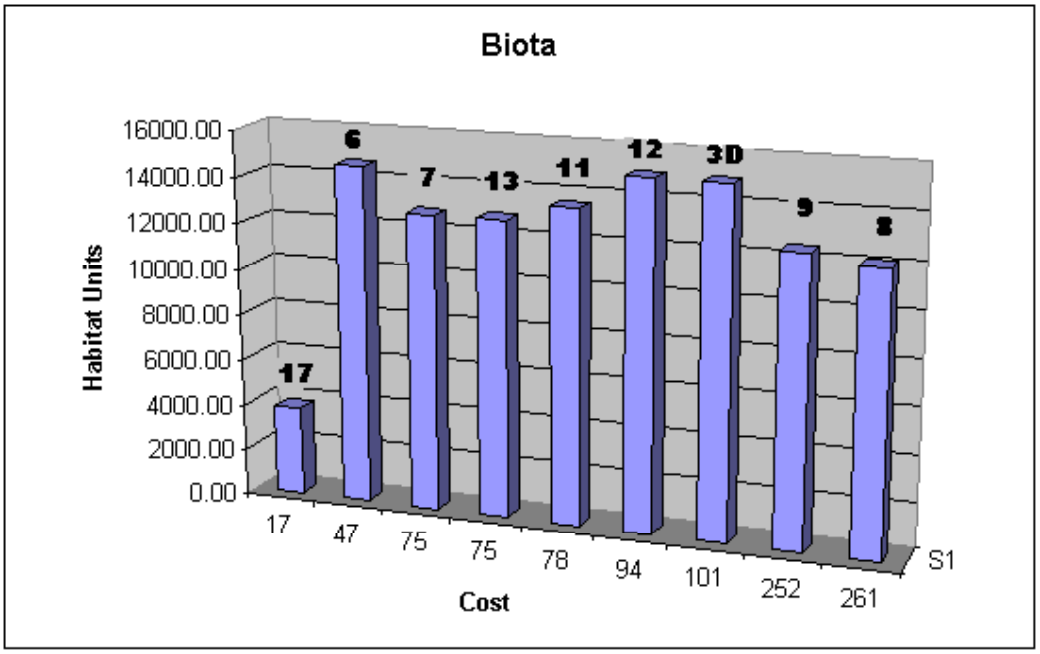
Acceptability is the workability and viability of the alternative plan with respect to acceptance by Sate and local entities and the public and compatibility with existing laws, regulations, and public policies. One aspect of acceptability is whether the alternative is feasible or doable with regard to technical, environmental, economic, social, or similar reasons. Alternative plans that would induce flooding in large areas of NGGE, including appropriate compensation to landowners, would be technically acceptable and would comply with existing laws and regulations, but would be very expensive and would likely generate substantial public opposition. Thus these alternatives would have low acceptability because of economic and social considerations.

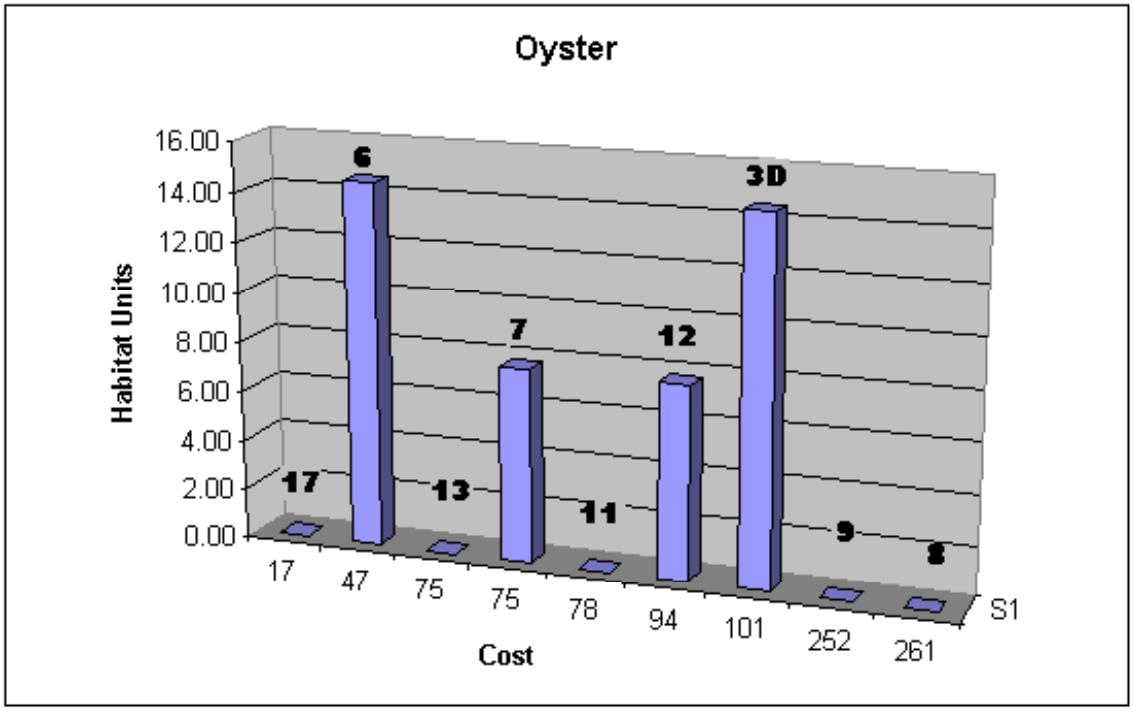
Alternative 3D contained plugs and pump stations in Miller, Faka Union, and Merritt Canals, and plugs in Prairie Canal. The plugs forced water to move over the land and not in the canals. Modeling results showed significant restoration of hydrology and vegetation in SGGE and very good restoration in the estuaries (Table 6-3). All of the restoration indices exceeded 50 percent of pre-drainage conditions. The point source discharge of the lower Faka Union Canal was removed. The pump stations were effective in preventing additional flooding in NGGE. This alternative was retained for additional detailed analysis.

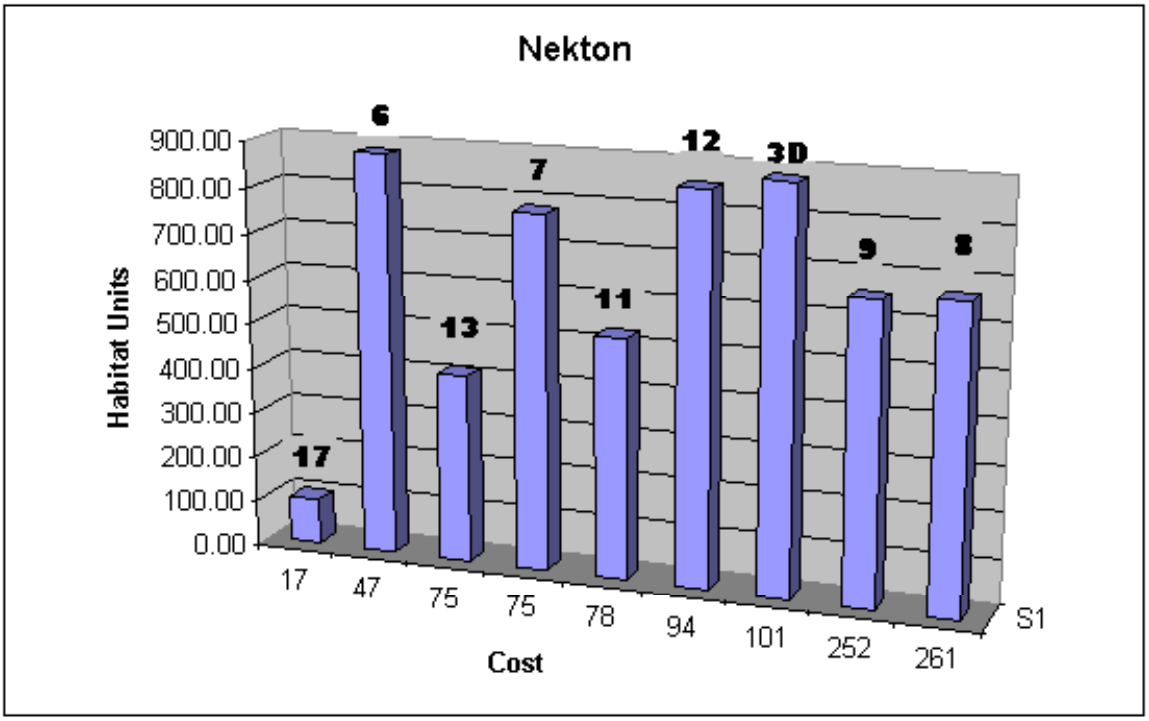
Alternative 4 included increasing the conveyance under I-75 so that water would be better able to leave NGGE and enter SGGE. Analysis showed that widening the I-75 bridge openings did not affect the flooding in NGGE. The additional cost of modifying I-75 would not generate any additional restoration benefits to SGGE relative to alternatives that were identical except without changes to I-75. This alternative was not cost effective. Thus this alternative was not given any additional analysis.

FIGURE 6 - 2 COST EFFICIENCY GRAPHS OF SGGE HABITAT UNITS VERSUS CONSTRUCTION COST FOR SCREENING ANALYSIS.






Oyster
Habitat Units
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
6
3D
7
12
17
13
11
9
8
17
47
75
75
78
94
101
252
261
S1
Cost


Nekton
Habitat Units
900.00
800.00
700.00
600.00
500.00
400.00
300.00
200.00
100.00
0.00
6
12
3D
7
13
11
9
8
17
17
47
75
75
78
94
101
252
261
S1
Cost

Alternative 5 was not substantially different from Alternative 3D. Thus, this alternative was eliminated and not given any additional analysis.

Alternative 6 involved plugging the canals only in the southern third of SGGE rather than throughout all of SGGE. It was expected that the backwater induced flooding from the plugs would occur entirely within the 4 +/- miles of SGGE between the spreaders and I-75, and not extend north of I-75 into NGGE. Under average wet season conditions there was no increased flooding in NGGE. The information available from this screening analysis did not clearly demonstrate that increased flooding would occur in NGGE during storm events. (Subsequent modeling during the final analysis ultimately did show flooding.) Of the alternatives that showed any possibility of flooding in NGGE, Alternative 6 showed the least amount. Since Alternative 6 provided much restoration and was otherwise relatively inexpensive, it was retained for additional, detailed analysis.

Alternative 7 included spreader channels and pumps. The structures would be located in the southern portion of SGGE (as for Alt 6). These pumps were expected to be smaller and less expensive than the pump stations for Alternative 3D and the backwater flooding induced at the spreader channel was expected to occur entirely south of I-75 and not enter NGGE. Initial modeling indicated that the spreader structures and small pump stations would induce flooding north of I-75. The predicted increased flooding in NGGE was of sufficient depth, duration, or frequency that a taking would have occurred and mitigation or compensation to land owners would have been required. If the pump stations were increased so that they would prevent additional flood impacts north of I-75, then the pump stations would be approximately the sizes of the pump stations in Alternative 3D. The cost of Alternative 7 would then be similar to the cost of Alternative 3D. Since the costs, either small pumps plus land in NGGE, or large pumps without land in NGGE, would be similar to Alternative 3D, and the restoration much less than Alternative 3D, Alternative 7 was not cost effective and was not retained for any additional analysis.

The project delivery team chose to explore adjustable Obermeyer weirs as an alternative to pump stations and fixed plugs or fill in canals. The Obermeyer weirs would hold water levels as high as possible for most of the year, particularly in the dry season. This would reduce over drainage of the land. The Obermeyer weirs would be lowered during select times of the wet season so that the canal(s) would provide conveyance for storm water to leave NGGE through SGGE.

Alternative 8 includes plugs in Prairie Canal and plugs but no pump stations in Merritt Canal. Storm water flows in Merritt Canal would be diverted to the Faka Union Canal, which would be widened to handle the increased storm flows.

Faka Union and Miller Canals would have adjustable Obermeyer weirs that would be elevated most of the year, to provide restoration benefits, and would be lowered during storm events to allow flood waters to leave NGGE and flow southward. Analysis of Alternative 8 demonstrated that connector channels between the main canals, widening the receiving canals, and operation of adjustable Obermeyer weirs were able to provide ecosystem restoration in SGGE and avoid increasing flooding in NGGE (Table 6.3). However, the alternative would provide no benefits to oyster beds in Faka Union Bay and the widening of the Faka Union Canal forced the construction cost estimate very high. This alternative was not acceptable because of the continued point source discharge through Faka Union Canal during storm events. The high construction cost also made Alternative 8 not cost effective relative to Alternative 3D. For these reasons, Alternative 8 was not retained for any additional analysis.

Alternative 9 is similar to Alternative 8. Three canals (Merritt, Prairie, and Miller) would have plugs but no pump stations. Storm water from the Merritt and Miller Canals would be diverted to the Faka Union Canal, which would be widened to handle the increased storm flows. Faka Union Canal would also receive adjustable Obermeyer weirs. Analysis of Alternative 9 demonstrated that connector channels between the main canals, widening the receiving canals, and operation of adjustable Obermeyer weirs were able to provide ecosystem restoration in SGGE and avoid increasing flooding in NGGE (Table 6.3). However, the alternative would provide no benefits to oyster beds in Faka Union Bay and the widening of the Faka Union Canal forced the construction cost estimate very high. This alternative was not acceptable because of the continued point source discharge through Faka Union Canal during storm events. The high cost construction also made Alternative 9 not cost effective relative to Alternative 3D. For these reasons, Alternative 9 was not retained for any additional analysis.

Alternative 10 includes Obermeyer weirs in all four canals, including Prairie Canal. Preliminary analyses have shown that Obermeyer weirs in a canal maintain drainage for NGGE as well as the pump station, spreader channel, canal plug method. The costs for these two methods for a specific canal are relatively close. However, Obermeyer weirs are substantially less effective than pump, spreader, plug method in providing sheet flow and ecosystem restoration. Since the Prairie Canal does not provide drainage to NGGE, there is no need to construct features (Obermeyers or pump stations) within the Prairie Canal designed to maintain drainage and to provide restoration. Alternative 14 is similar to Alternative 10 except that it has canal plugs alone, without pumps, in the Prairie Canal. Alternative 10 would cost more than Alternative 14 and provide fewer ecosystem benefits. Obermeyer weirs in the largest canal, Faka Union, are not effective in reducing point discharges to Faka Union Bay, probably because the canal below the weirs is still intact and still intercepts

water from the landscape and conveys it southward. Thus, this alternative would provide no benefits to the oyster beds in the Faka Union Bay. This alternative also provides less than 50 percent restoration of the fish and nekton in the bay. For these reasons, together with the expected non-cost effectiveness, Alternative 10 was not retained for any further analysis.

Alternative 11 includes large pump stations and canal plugs in the Miller and Merritt Canals, much like Alternative 3D, and Obermeyer weirs in the Faka Union Canal. This alternative would provide restoration throughout much of the inland areas of SGGE and maintain flood protection in NGGE. Obermeyer weirs in the largest canal, Faka Union, are not effective in reducing point discharges to Faka Union Bay, probably because the canal below the weirs is still intact and still intercepts water from the landscape and conveys it southward. Thus, this alternative would provide no benefits to the oyster beds in the Faka Union Bay. This alternative also provides less than 50 percent restoration of the fish and nekton in the bay, and thus was not retained for any further analysis.

Alternative 12 includes large pump stations and canals plugs in the Faka Union and Merritt Canals, much like Alternative 3D, and Obermeyer weirs in the Miller Canal. This alternative would provide restoration throughout much of SGGE and maintain flood protection in NGGE. The total flows in Miller Canal are much less than the total flows in Faka Union Canal and thus the lower effectiveness of Obermeyer weirs relative to canal plugs does not fully prevent restoration in the estuaries, as occurs for Obermeyer weirs in Faka Union Canal. This alternative would provide at least 50 percent restoration of the oyster beds and fish of Faka Union Bay. This alternative was retained for additional detailed evaluation.

Alternative 13 includes a large pump station and canal plugs in Merritt Canal and Obermeyer weirs in Miller and Faka Union Canals. This alternative would provide restoration throughout much of SGGE and maintain flood protection in NGGE. Since this alternative would have Obermeyer weirs in the Faka Union Canal, much as Alternative 11, which was also modeled, the team expects that Alternative 13 would similarly not eliminate the point discharge to Faka Union Bay, would not provide benefits to the oyster beds of Faka Union Bay, and would provide only limited, much less than 50 percent, restoration benefits to fish. Alternative 13 was removed from further analysis.

Alternative 14 has Obermeyer weirs in three canals and plugs in Prairie Canal. Obermeyer weirs are effective at maintaining flood protection in NGGE, are similar cost to the pump, spreader, plug method, and are less effective in restoration than the pump, spreader, plug method. This alternative would provide much less restoration than Alternative 13, but at similar cost.

Alternative 14 was not modeled. Since this alternative would have Obermeyer weirs in the Faka Union Canal, much as Alternatives 11 and 13, which were modeled, the team expects that Alternative 14 would not eliminate the point discharge to Faka Union Bay, would not provide benefits to the oyster beds of Faka Union Bay, and would provide only limited, much less than 50 percent, restoration benefits to fish. Alternative 14 was removed from further analysis.

Alternative 15 includes plugs and pumps in Faka Union and Merritt Canals, plugs in Prairie Canal, and would leave the Miller Canal completely unmodified. There would be essentially no restoration along the entire Miller Canal. This canal would cause groundwater level drawdown up to 3 miles to the east, based on data for the existing impacts of the Prairie Canal to Fakahatchee Strand. Thus, an unmodified Miller Canal would reduce the restoration benefits from the canal plugs within the Faka Union Canal. The open canal also provides continuous point source drainage from NGGE and western SGGE directly into Faka Union Bay. There would be no benefits to oysters and only limited benefits to fish in Faka Union Bay. Roads near Miller Canal would also remain, further reducing hydrologic restoration, providing additional habitat for exotic species, substantial vehicle access, and continued disturbance to wildlife. This alternative was removed from further analysis.

Alternative 16 would leave two canals completely unmodified. There would be no restoration along the Miller or Faka Union Canals. The Faka Union canal would cause groundwater level drawdown up to 3 miles to the east, based on data for the Prairie Canal existing impacts. Thus, an unmodified Faka Union Canal would reduce the restoration benefits from the plugs placed within the Merritt Canal. The two open canals also provide continuous point source drainage from NGGE and western and central SGGE directly into Faka Union Bay. There would be no benefits to oysters and only limited benefits to fish in Faka Union Bay. Roads near the Miller and Faka Union Canals would also remain, further reducing hydrologic restoration, providing additional habitat for exotic species, substantial vehicle access, and continued disturbance to wildlife. This alternative was not retained for further analysis.

Alternative 17 has similar but greater restoration shortcomings than Alternatives 16 and 15 – point source discharge, no benefits to oyster beds, less than 50 percent restoration to hydrology and vegetation in SGGE and fish in the estuaries. This alternative was not retained for further analysis. This alternative was initially analyzed because its features, plugs in Prairie Canal, are a subset of nearly all of the alternatives that were considered.

Alternative 18 consists of acquisition of real estate, and additional management actions in the forests. This alternative would provide no hydrologic restoration to SGGE or the downstream estuaries. Benefits were assumed to be able to be

gained by improvements in fire and exotic species management on the land. The unchanged hydrology would prevent substantial improvement of the fire regime. Conditions would continue to be excessively dry for most of the year. Prescribed fire would be hard to control and large wildfires would continue to occur. Alternative 18 was not retained for further analysis.

Alternative 19 included pump stations, spreaders, and plugs for Miller and Merritt Canals. Under this alternative, the Faka Union Canal would be widened and deepened in NGGE and the northern half of SGGE so that its increased flow capacity would counteract the reduction of flow caused by canal plugs in the southern end of SGGE, and thus not increase flooding in NGGE. The pump stations initially proposed were 750 cfs for both Miller and Merritt canals. These were too small to avoid induced flooding in NGGE during storms. The predicted increased flooding in NGGE was of sufficient depth, duration, or frequency that a taking would have occurred and mitigation or compensation to land owners would have been required. To avoid flooding, the pump stations would have to be at least 1000 cfs for Miller and 800 cfs for Merritt, the pump stations sizes proposed under several alternatives, including 3D, 11, 12, 13, and 15. The cost of excavation to widen and deepen many miles of the Faka Union Canal is expected to be higher than the pump station proposed for the Faka Union Canal under Alternative 3D. Thus, the construction cost for Alternative 19 would be higher than Alternative 3D and the ecosystem benefits would be less (**Table 6-3**) and Alternative 19 would not be cost efficient. Alternative 19 was not retained for further analysis.

In addition to these alternatives, reservoir systems and aquifer storage and recover (ASR) systems were briefly considered as alternatives for restoration in SGGE. They were not assigned an alternative number and developed to the level of detail as some of the other alternatives because they were not well suited for the problems and goals of SGGE. Reservoirs alternatives would require similar sized pump stations and would also require similar canal plugs and road removal plans as the pump alternatives that were analyzed. They would not represent a cost savings over existing alternatives. The acreage of reservoirs would also be acres not restored. ASRs are suited for storing water during one season and producing / releasing water in another season. SGGE does not need to change the time of year when conditions should be wet. Rather, restoration needs to smooth the peak flows from storm events and to move the water from canals to sheet flow over the land (location). ASRs are also potentially very expensive and are still undergoing investigation through other CERP studies to determine their suitability for large-scale use in southern Florida.

In summary, Alternatives 3D, 6, and 12 are retained for detailed analysis. These three alternatives will be further analyzed in Sections 6.7 and 6.8 of this report. The other alternatives were removed from further consideration based

on high construction cost, cost effectiveness, and/or lack of benefits to inland and estuarine resources.

6.6 TOOLS FOR ECOSYSTEM EVALUATION

6.6.1 Hydrologic and Hydraulic Modeling

The MIKE SHE modeling system is an integrated and distributed, physically based mathematical model using finite difference computational solution. The model can be applied to quantify the surface and sub-surface flow conditions over a period of time. The application of the MIKE SHE model to this project was to simulate canal/aquifer interactions, to assess the impacts of various water management strategies on flood dynamics, wetland hydroperiods, and water supply within the watershed. The MIKE SHE modeling system is comprised of a number of flow modules, which may be combined to describe flow within the entire land-based part of the hydrological cycle. This MIKE SHE hydraulic model was used to design and evaluate an array of alternatives and was used to determine both the amount of ecosystem benefits and the probability of an alternative increasing flooding in NGGE. Appendix A contains a detailed description of the MIKE SHE model.

The results of October 2003 version of the SGGE MIKE SHE model were used to help predict the ecosystem benefits of ten of the alternative plans. The analysis was done at a screening level or medium level of detail. The PDT did not analyze all of the environmental features and estimate all of the monetary costs. The analysis was sufficient to identify those plans that were most promising for the benefits they would provide to the inland areas of SGGE, the adjacent publicly owned lands and to the downstream estuaries. The analysis was also sufficient to allow the PDT to remove those alternative plans that would induce substantial adverse impacts. The screening process is described in Section 6.5.3.

This second phase of MIKE SHE modeling (December 2003) was performed on only the three alternatives (3D, 6, and 12) that remained after the screening process was completed. The U.S. Army Corps of Engineers and the South Florida Water Management District modeling staff performed a few changes to the model so that its output would allow the PDT to more precisely estimate ecosystem benefits in SGGE and adjacent lands, and predict water levels in Northern Golden Gate Estates and thus confidently assess whether there would be impacts. The PDT combined the second phase model output with other data to analyze changes in additional environmental features than was done for the Screening analysis. These results are described in Section 6.7.

6.6.2 Key Relationships Between Model Hydrology And SGGE Ecosystems

Model Hydrology And Plant Communities

There is a relationship between wetland hydrology and the types of Big Cypress plant communities that can exist on a site (Duever et al. 1975; Duever 1984). While this relationship applies to both wet season water depth and hydroperiod (***Table 2-1***), in this project we have utilized information on average wet season (July 1 - October 1) water depths produced by the SGGE MIKESHE model to compare acres of each major plant community among the various alternatives.

It is important to be aware that the greatest value of the MIKE SHE model used in this study is its ability to quantitatively estimate future conditions when certain features of a system are altered in specific ways. Real ecosystems are far too complex to represent accurately in a model. However, the ability of a model to synthesize our current understanding of the major features and processes operating within an ecosystem allows us to manipulate the model so that we can then evaluate the implications of those specific manipulations much more precisely than would otherwise be possible. The MIKE SHE model has permitted us to compare wet season water levels, and by extension, the major plant communities associated with Pre-Development, Future Without Project, and the various restoration alternatives.

Model Flows and Salinity Relationships for Estuaries

Alterations in the timing and quantity of freshwater flowing into an estuary can have an impact on natural biodiversity by effecting food availability, predation pressure, and reproductive success and can directly cause chronic and acute stress (Serafy et al., 1997; Sklar and Browder, 1998). Freshwater inflow can influence primary productivity, zooplankton biomass and nekton abundance by influencing nutrient concentrations (Grange et al., 2000). Organic matter flowing into an estuary via freshwater inflow has been shown to contribute significantly to the food available for detritivores such as shrimp. Several studies have documented that brackish water estuarine environments serve as refuges from predation for vulnerable fish and shellfish species (Rozas and Hackney 1984; Shirley et al., 1990).

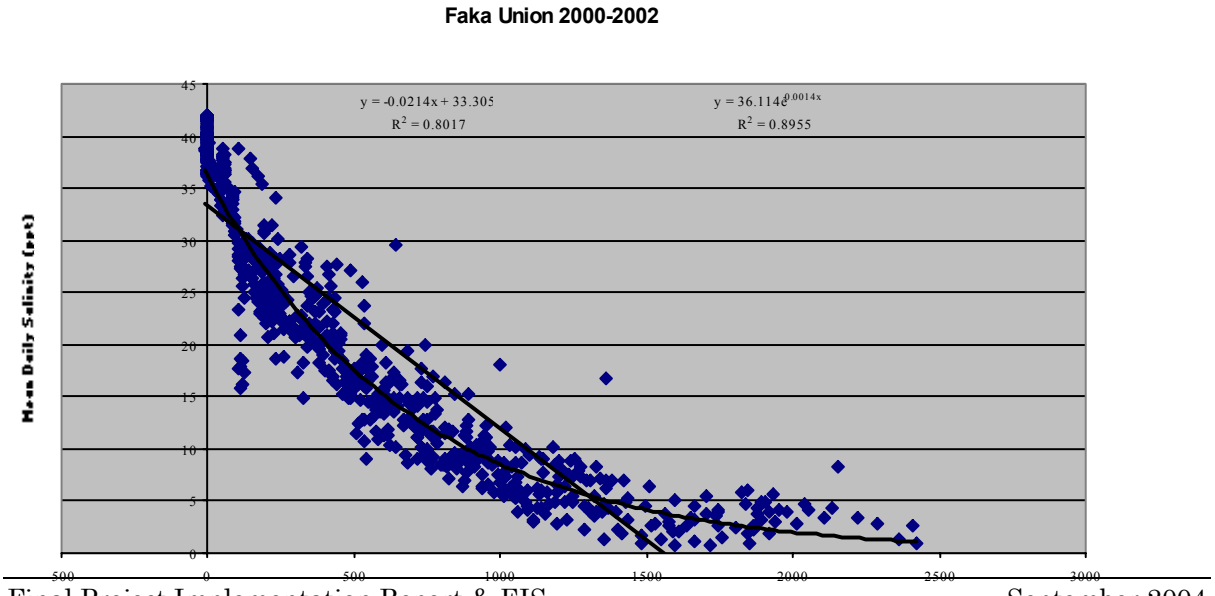
Salinity is critical to the reproduction, development, and growth of the American oyster. Oysters require a narrow range of salinities for successful spawning (between 15-25 parts per thousand (ppt)) during the months of May through July. Food availability is greatest between 15 and 35 ppt, so growth is maximized under these conditions. Finally predation and disease can cause high mortality within oyster populations, particularly when high salinities predominate. Infrequent freshets effectively reduce predation pressures and

significantly reduce the number of infectious parasites. Consequently, periods of lower salinity (< 15 ppt) are also needed.

Because the hydrologic models yield freshwater flows delivered to the estuaries, it is necessary to relate flow (in cfs) to estuarine salinity. Freshwater flow into Faka Union Bay has been monitored for many years from a stage gauge at Port of the Islands, just upstream of the fixed weir on the Faka Union trunk canal. Since 2000, Rookery Bay National Estuarine Research Reserve has been monitoring salinity at the mouth of the trunk canal. The relationship between flow and salinity for Faka Union is shown in Figure 6-3. The best-fit exponential function relating salinity to flow was used to evaluate the effectiveness of the flows generated by the various restoration alternatives (see Appendix D).

Many of the nektonic species, composed principally of fish and crustaceans, utilizing the estuaries are dependent upon oyster reefs for food. Consequently, the same conditions favorable for oyster health and reef development favor the nekton. Timing of reproduction of fish and crustacean species dependent upon reefs may differ from those months critical to the biology of oysters themselves. This generates specific salinity targets for different times of the year for these organisms. In addition, many fish and crustacean species critical to estuarine structure and function have specific salinity tolerances for other physiological functions. These were also used to target particular salinities.

FIGURE 6 - 3 THE RELATIONSHIP BETWEEN MEAN DAILY FLOW (IN CUBIC FEET PER SECOND) MEASURED ABOVE THE FIXED WEIR AT PORT OF THE ISLANDS ON THE FAKA UNION TRUNK CANAL AND MEAN DAILY SALINITY (PPT) MONITORED FROM A DATASONDE AT THE MOUTH OF THE FAKA UNION TRUNK CANAL FOR THE YEARS 2000-2002



6.6.3 Inland Habitat Changes

Inland habitat changes were characterized for several locations for pre-development conditions, existing conditions, future without project conditions, and each of the final three alternatives. The hydrologic performance measures of wet season, dry season, maximum and minimum water levels were estimated for the highly disturbed SGGE and the less disturbed adjacent, publicly owned Fakahatchee Strand State Preserve, Florida Panther National Wildlife Refuge, Belle Meade CARL, and Collier Seminole State Park. Estimated acres of vegetation communities were developed for SGGE and for the combined SGGE and adjacent public lands. Habitat units, which incorporate both quality and quantity of habitat, were developed for SGGE and the adjacent pubic lands. Habitat quality indices were developed for each scenario and restoration alternative. The quality indices were combined with the acres of restoration to produce habitat units for each scenario and restoration alternative. These habitat units were later converted into quantitative ecosystem benefits and for use in cost effectiveness and incremental cost analysis.

Hydrologic Performance Measures

The PDT assessed four hydrologic performance measures based on MIKE SHE model output. The four measures are average wet season water level, average dry season water level, annual maximum water level, and annual minimum water level.

They were estimated at 32 indicator regions (well sites), 23 in SGGE and 9 in adjacent Belle Meade and Fakahatchee Strand (**Figure 6-4**). They were estimated for predevelopment, existing, future without, and alternatives 3D, 6, and 12. Analysis is on percent of predicted predevelopment level (target).
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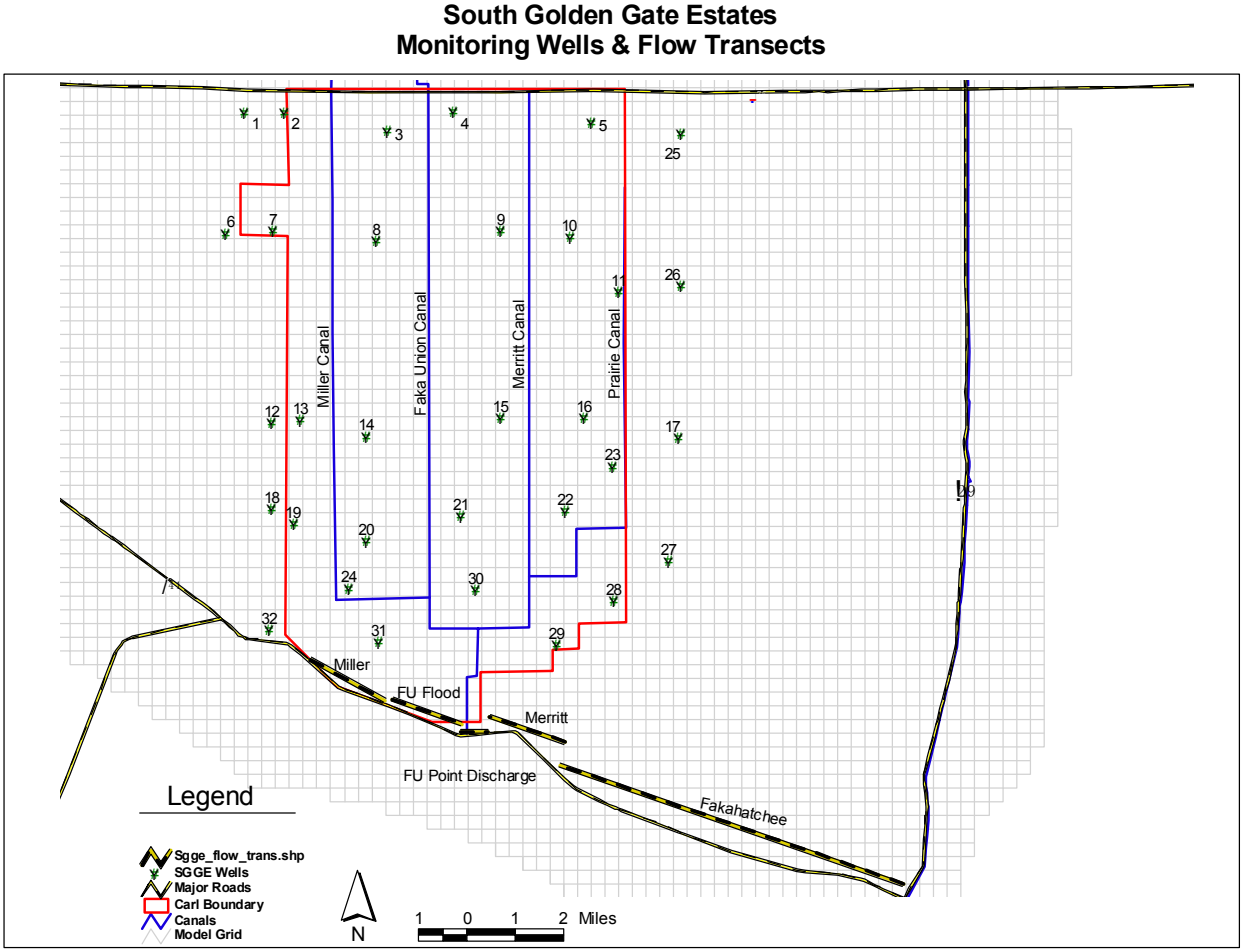
Acres of Vegetation Communities

The PDT utilized the relationship between on average wet season (July 1 - October 1) water depths and major plant communities together with the water depths predicted by the MIKE SHE model to estimate and compare acres of each major plant community among the various alternatives.

FIGURE 6 - 4 LOCATIONS OF INDICATOR REGIONS FOR HYDROLOGIC PERFORMANCE MEASURES. THE INDICATOR REGIONS ARE CO-LOCATED WITH THE 32 WELLS SHOWN



South Florida Assessment Method

The South Florida Assessment Method (SFAM) was developed to estimate hydrologic and biotic quality values for the Natural System, Existing, and Future Without Project conditions and for each of the restoration alternatives. The index parameters were initially based on a draft report on the application of the Hydrogeomorphic (HGM) methodology to peninsular Florida wetland flats (Trott et al. 1997). However, most of the information on environmental conditions was associated with project design characteristics, land management plans, and hydrologic model output for each of the restoration alternatives. Also, the SGGE is a large wetland-upland matrix, rather then a relatively small

wetland. These features of the project required development of a different approach that was feasible with the information available. The PDT used some of the terminology from the HGM methodology, but redefined the parameters based on information available. The PDT also produced only two indices to reduce redundancy in the use of the same parameter in more than one place. The team involved in the SGGE inland benefits assessment presented in this document included representatives from the U.S. Army Corps of Engineers, South Florida Water Management District, Florida Fish and Wildlife Conservation Commission, and U.S. Fish and Wildlife Service.

Each of the ten variables has a minimum value of 0.00 and a maximum value of 1.00. The maximum value represents restoration to pre-development conditions as predicted by the MIKE SHE model and by best professional judgment of experienced biologists familiar with the region. This is the desired condition and result for the project. For lesser degrees of restoration toward pre-development conditions, variables would be assigned lower values. The information needed for each variable and the method of calculation for each variable are presented in **Table 6-4** and discussed here.

Definition of Variables

The objective of creating the variables is to generate numbers between 0.00 and 1.00 for each variable for each scenario. Wetlands for which the variable has a value of 1.00 would be healthy in terms of that variable, while sites with a value of 0.00 would be very unhealthy. The formulas for calculating each variable and index are designed to create a value within this range and that also reflects the relatively positive or negative condition of the variable associated with each scenario.

Region = (1 – (proportion of the subwatershed used in the flood analysis that was affected by water levels more than 0.5 ft lower than those estimated for Natural conditions)). The subwatershed is the portion of the Big Cypress Basin that was used in the MIKE SHE flood analyses because it was the area that was potentially affected by restoration activities in SGGE and it included virtually all of the inflows to SGGE. We selected a lowered water level of 0.5 ft as a result of calculating the subwatershed acreages that would have been included at different lowered water levels, and selecting the one with between 25 and 75 percent of the area being affected under existing conditions. If we increased or decreased this value, either little or virtually all of the area, respectively, was affected, which would have made this variable insensitive to differences in SGGE conditions associated with the bases or restoration alternatives as predicted by the MIKE SHE model.

TABLE 6 - 4 SFAM VARIABLES AND INDICES

Region	= (1 – (proportion of the sub-watershed used in the flood analysis that was affected by water levels more than 0.5 ft lower than those estimated for Natural conditions))
Inundation	= acres of 1-2 ft average wet season water depth / acres of 1-2 ft average wet season water depth estimated for Natural conditions
Land Use	= (1 - (proportion of acres of impervious area, i.e. paved roads and canal berms))
Discharge	= (1 - (area drained as a proportion of total remaining length of canals in the SGGE basin / total length of canals under Future WO Project conditions))
Profile	= topographic alteration of area relative to range from Existing (0.00) to Natural (1.00) in terms of total miles of roads and canals
Hydrology Index	= (Region + Inundation + Land Use + Discharge + Profile) / 5
Vegetation	= (1 - (sum of absolute differences from Natural conditions in acreages of major habitat types / 2))
Nuisance	= For the Bases: (1 - (acreage dominated by palms (from NRCS maps for 1940 (Natural) and 1995 (Existing), and then assumed continued expansion at same rate from when canals were created in 1970 to 2050 (Future WO) / (acres in SGGE)). For the Alternatives: assumed palm control as a function of canal removal increasing the area not dominated by palms from what would otherwise exist under Future WO Project conditions: (above variable value for Future WO) + ((above variable value for Future WO) * (1 - (remaining length of canals in SGGE / total length of canals under Future WO Project conditions))
Exotic	= For the Bases: (1 - (acreage dominated by Brazilian pepper, which was zero in 1940, aerially estimated for Existing conditions in 2003, and then assumed continued expansion at same rate from when canals were created in 1970 to 2050 (Future WO) / (acres in SGGE)). The Alternatives assumed Brazilian pepper control as a function of herbicide application to any areas still dominated by Brazilian pepper after restoration.
Fire	= estimate of the proportion of the SGGE in which Florida Division of Forestry would be able to maintain an appropriate fire regime under unrestored vs. restored conditions.
Boundary	= proportion of SGGE boundary not developed
Biotic Index	= (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5

Inundation = acres of 1-2 ft average wet season water depth / acres of 1-2 ft average wet season water depth estimated for Natural conditions.
We have developed an agreed upon association between hydrology and the major SGGE plant community types. The average wet season water depth of 1-2 ft is the normal water depth for the cypress community, which was the predominant pre-development plant community in SGGE. Deeper communities, which are open water communities, were originally very minor components of the SGGE landscape. Thus, since the Natural pre-development community is the restoration target, we felt that if we could reestablish the original cypress acreage, the shallower communities would also be restored on the essentially unaltered topography.

Landuse = (1 – (proportion of acres of impervious area, i.e. paved roads and canal berms)).
Impervious areas were sites where water would be more likely to run off than infiltrate into the substrate. The most likely sites were the paved and gravel roads and the spoil along the canals, which resulted in increased runoff into adjacent areas due to either a dense impermeable surface or a relatively steep gradient, respectively."

Discharge = (1 – (area drained as a proportion of total remaining length of canals in the SGGE basin / total length of canals under Future Without Project conditions)).
The natural flow of water through SGGE was largely altered by the construction of the canal system that flows through it. Thus, the degree of restoration of the natural flow of water is tightly connected to the degree of elimination of the canal system, measured in the length of canals present in the area. The Discharge values ranged from 0.00 for the Existing conditions to 1.00 for the Natural pre-development condition.

Profile = topographic alteration of area relative to range from Existing (0.00) to Natural (1.00) in terms of total miles of roads and canals.
The natural flow of water through SGGE was largely altered by the construction of the canal system that flows through it, and secondarily altered by the road system that eliminated any remaining sheetflow during normal wet season high water levels. Thus, the degree of restoration of the natural flow of water is tightly connected to the degree of elimination of the canal and road systems, measured in the length of roads and canals present in the area. The Profile values ranged from 0.00 for the Existing conditions to 1.00 for the Natural pre-development condition.

Vegetation is a measure of how similar the acreages of major plant communities are to the pre-development conditions. Vegetation = (1 – (sum of absolute differences from Natural conditions in acreages of major habitat types / 2)). There will always be vegetation in SGGE, but the type of vegetation is largely an expression of the environmental conditions in SGGE, particularly its hydrology. This variable quantifies differences in acreages from the Natural pre-development condition of the major types of vegetation and is a measure of how close a scenario is to the pre-development restoration target. By using our agreed upon association between hydrology and the major plant community types and hydrology output from the MIKE SHE model, we were able to estimate these acreages for each scenario.

Nuisance is a measure of the proportion of the project area that is not dominated by nuisance species, particularly sabal palm. Nuisance = For the Bases: (1 – (acreage dominated by palms (from NRCS maps for 1940 (Natural) and1995 (Existing), and then assumed continued expansion at same rate from when canals were created in 1970 to 2060 (Future WO) / (acres in SGGE)). The Alternatives assumed palm control as a function of canal removal increasing the area not dominated by palms from what would otherwise exist under Future WO Project conditions: (Nuisance value for Future WO) + ((Nuisance value for Future WO) * (1 – (remaining length of canals in SGGE / total length of canals under Future WO Project conditions)).

The cabbage or sabal palm is a natural component of South Florida communities. It commonly occurs in a variety of these communities, and normally is a dominant or codominant canopy species on relatively small upland islands with calcareous soils. A factor in its ability to dominate these sites is its high flammability, while itself being very tolerant of fire. The drained SGGE, with its shallow depth to limestone, has become an ideal environment for the cabbage palm. In addition, the fuels that it is providing has allowed flames to get into the pine and cypress canopies and has virtually eliminated these canopy dominants throughout much of SGGE. Restoration would involve restoring the original hydrology over most of SGGE, which would create an unsuitable environment for dominance by cabbage palm of any significant portion of SGGE. It is likely that restoration will not kill all of the palms that have invaded over the past 35 years, and mechanical and/or chemical control will be required to eliminate these remaining individuals. However, once removed, it is unlikely that the palm will be able to reinvade these sites with their restored hydrologic regime.

Exotic is a measure of the proportion of the project area that is not dominated by exotic species, particularly Brazilian pepper. Exotic = For the Bases: (1 – (acreage dominated by Brazilian pepper, which was zero in 1940, aerially estimated for Existing conditions in 2003, and then assumed continued

expansion at same rate from when canals were created in 1970 to 2060 (Future WO) / (acres in SGGE)). The Alternatives assumed Brazilian pepper control as a function of herbicide application to any areas still dominated by Brazilian pepper after restoration.

There are a number of exotic plant species in SGGE, but none of them dominate as much of the site as does Brazilian pepper. It's seeds are spread by wildlife, so individual plants can appear anywhere in upland sites, where once established, they gradually spread and can dominate large areas. Their tall dense shrubby growth form allows them to carry fire into and thus eliminate a pine or remnant cypress canopy, and then to dominate the site by shading out the ground cover and any seedling trees or other shrubs that might germinate in their shade.

The drained SGGE has become an ideal environment for Brazilian pepper. Restoration would involve restoring the original hydrology over most of SGGE, which would create an unsuitable environment for dominance by Brazilian pepper of any significant portion of SGGE. It is likely that restoration will not kill all of the peppers that have invaded over the past 35 years, and mechanical and/or chemical control will be required to eliminate these remaining individuals. However, once removed, it is unlikely that it will be able to reinvade these sites with their restored hydrologic regime.

Fire = estimate of the proportion of the SGGE in which Florida Division of Forestry would be able to maintain an appropriate fire regime under unrestored vs. restored conditions.
The drained condition of SGGE and the widespread occurrence of the highly flammable cabbage palm have created an environment for very intense and frequent fires. This makes fire management and control very difficult in the area. Restoration will allow for a much more manageable fire environment because of the wetter conditions and reduction of the problem fuels.

Boundary = proportion of SGGE boundary not developed.
Conditions along the boundary of SGGE affect the site, particularly in terms of wildlife usage, but also as a function of fire regime and the potential for exotic plant and animal invasions. The current boundaries of SGGE are largely undeveloped, as they are primarily in public conservation ownership, and the one area in private ownership, NGGE, is not yet developed. This condition facilitates the movement of wildlife across these boundaries, which provides more flexibility and a likely greater success in their search for food, mates, and suitable habitat in this seasonally changeable environment. It means that there are fewer constraints on the use of prescribed burns, since the goal of all of these areas is to maintain a natural fire regime on the basis of natural, rather than artificial, plant community boundaries. Since all of these areas are striving to control exotic plants, there will be fewer nearby seed sources that could

facilitate exotic invasions. Also, since there are no human residences in these areas, there will be a lesser presence of feral animals or pets that could impact native animal populations on the public lands.

Hydrology Index = (Region + Inundation + Landuse + Discharge + Profile) / 5.
Since all aspects of the hydrologic regime are critical to restoration of SGGE and no variable overrides the others in determining the hydrologic regime, we simply added the variables and divided by five. The Hydrology Indices for Existing and Future Without Project conditions are essentially identical because there is no change in the canal and road system between these two periods. Restoration as evaluated by the Hydrologic Index would be complete by the end of the first growing season following completion of construction.

Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5.
Restoration of the SGGE plant and animal communities is a function of all five of these variables, which are all intimately interrelated in producing a Natural SGGE ecosystem. Thus, as was done for the Hydrology Index, we added the variables together and divided by five. There is a continued decline in the Biotic Indices between the Existing and Future Without Project time periods because of the continued spread of nuisance and exotic species and residential development in NGGE. Restoration as evaluated by the Biotic Index would extend over the whole 50-year period at an approximately steady pace following completion of construction. There would be a slow initial reestablishment of the native vegetation, which would accelerate over time, while the reduction of exotics and nuisance species and improvement in the fire regime would be more rapid during the early years following construction. Boundary conditions would change more or less steadily over the whole 50-year period.

The variables were defined and variables' values were assigned with consideration of an entire region or basin. For example, the Land Use variable for SGGE is defined using the percentage of the entire acreage of SGGE. And similarly, the Land Use variable for the Florida Panther NWR is defined using the percentage of the entire acreage of the Florida Panther NWR. During development of values for variables, the PDT did not limit its consideration to areas and locations that were hydrologically modified. Because of this method of developing variable and index values for each property, the Hydrology and Biotic Indices apply to the entire areas and not only to the hydrologically modified areas.

The Hydrology Index and the Biotic Index in SFAM are each calculated by taking the average of five variables. This method is used by HGM, the source of SFAM, to calculate index values. The PDT considers that averaging is more appropriate than using the minimum of the five variables to represent the index value. There is no single variable among those the PDT is using (**Table 6-4**)

which acts as a "gate" for what the team is trying to restore in SGGE. This might be true if the team were trying to restore a single plant community or single species. Improving all of the pieces (hydrology, fire, exotic or nuisance species, human disturbance) is what the team is striving for and what is needed to bring SGGE closer to what it was pre-development. One (potentially) low variable does not fully pull down the entire restoration and completely negate the other, higher variables. The average of all of the variables for the Index tells the story much better and represents the predicted future conditions better than using a single lowest value.

Habitat units for a location incorporate into one number the concepts of the quantity of habitat and the quality of that habitat. The SFAM Hydrologic Index and Biotic Index represent quality factors for the inland areas. The two indices and their component variables were developed while considering a specific defined land area. The habitat units for an alternative plan were calculated by multiplying the index and the acres of land over which it was developed.

6.6.4 Estuarine Habitat Changes

Blackwater, Pumpkin, and Faka Union Bays were selected for analysis because they represent the western-most, mid-region, and eastern-most estuaries respectively affected by restoration, and therefore should be indicative of the overall performance of the Ten Thousand Islands. Fakahatchee Bay experiences relatively few adverse impacts from human activities and serves as the reference bay for the estuary analysis.

Two methodologies were employed to assess the relative effectiveness of the various alternatives on estuarine restoration. The first technique utilizes an *empirically* based relationship between measured salinity and flow entering estuarine bays, and the relatively well studied relationships between salinity and estuarine biology. Unfortunately, only one estuary within the Ten Thousand Islands affected by SGGE restoration (Faka Union Bay), has been monitored thoroughly enough to permit the use of this technique. The second technique is more model-dependent and utilizes a *similarity* metric approach in which the relative effectiveness of an alternative is based upon how close the flow generated by a modeled alternative approaches the flow predicted by the pre-development model. The relative benefits provided by the alternatives for Blackwater and Pumpkin Bays must be analyzed in this way. This second approach was also applied to Faka Union. The two methods produce similar results for Faka Union Bay, thus indicating that the model-dependent similarity approach is reliable and suitable for all three bays (see Appendix D).

Empirical Approach for Estuaries

Nekton Performance Measures

Due to the dynamic nature of estuarine environments, setting a restoration goal for freshwater inflow for Faka Union Bay must account for natural changes in watershed rainfall amounts and include both physicochemical and biological endpoints.

The empirical performance measures were developed for the nekton (fish and other mobile animals) of Faka Union Bay based largely from data from the staff of the Rookery Bay National Estuarine Research Reserve on long-term salinity and fish/crab/shrimp collections in the three estuaries downstream of the SGGE project and in Henderson Creek, which is located further to the north towards Naples. These monitoring results indicate that the proposed performance measures will provide useful indicators of the status of altered freshwater inflows to the estuary that can be used to evaluate habitat restoration.

The various alternatives were scored using a 0.00 to 1.00 scale, where 0.00 represents no restoration over current conditions and 1.00 represents completely restored conditions. Fakahatchee Bay was used as a reference site to define the target for restoration.

1. Relative abundance of stenohaline and euryhaline crabs on oyster reefs.

Target: The ratio of the > 5 mm size class of stenohaline (*Petrolisthes armatus*) and euryhaline (*Eurypanopeus depressus*) crabs (total *P. armatus* +1)/total *E. depressus* +1) on reefs in Faka Union Bay should not be statistically different ($p = 0.05$) from the ratios of these species calculated from populations sampled on oyster reefs in Fakahatchee Bay. These numbers change depending on the season and year (wet or dry), reflecting natural shifts in these populations and habitat suitability in response to natural freshwater inflows.

2. Density of the blue crab (*Callinectes sapidus*) in various life stages.

Target: The density or relative density of various life stages of blue crabs in Faka Union Bay should be within 10% of density in homologous habitat in Fakahatchee.

3. Abundance and composition of dominant fish species and pink shrimp.

Target: Fish abundances in Faka Union should not be lower than those in the reference bay of highest abundance, Pumpkin or Fakahatchee Bays. Abundance in Faka Union Bay should not be more depressed than in Fakahatchee Bay at the onset of the rainy season. Composition should be similar (75% by Bray Curtis) to composition in Fakahatchee and Pumpkin

bays. Evenness (among dominants) should be similar (within 10%) to that in Fakahatchee and Pumpkin bays

Based on the salinity to flow calibration for Faka Union (Figure 6-3) and the above mentioned ecological performance measures, the following hydrologic targets are derived:

a) The number of days (or percent of year) of average canal discharge > 500 cfs should be minimized to reduce the frequency and duration of freshets.
b) The number of days (or percent of year) of average canal discharge < 50 cfs should be minimized to extend flow into the dry season.
c) The number of days (or percent of year) of average canal discharge 300-500 cfs should be maximized to improve reproductive conditions for estuarine fish, shrimp, and crabs.

While this suite of performance measures is meant to be applied to daily outflow data, this evaluation will use them for alternative evaluation by determining first, which alternative has the minimum number of months with flows above 500 cfs and below 50 cfs, and second by examining the magnitude of the flows above or below the 500/50 cfs limits as a means of judging restoration potential. Thus, we can assume that an alternative that exhibits few or no flows outside of the 500/50 cfs limits or with many small excursions outside of this limit will create a more natural flow regime and effect a greater restoration.

Oyster Reef Performance Measures

Four performance measures were developed for oyster reef health, distribution, and productivity as a result of the work of Mike Savarese and Aswani Volety in southwest Florida estuaries. Their research allowed the development of comparisons among several coastal bays of physically similar locations (homologues) that had been more and less impacted by periodic strong pulses of freshwater from SGGE. Below are shown the quality values developed for assessing the various scenarios for each of these performance measures.

1. Reef development at homologue 3

0.00 = area of reef coverage will continue to diminish
0.25 = no benefit; area of reef coverage will be maintained
0.50 = some benefit; area of reef coverage will increase
0.75 = great benefit; area of reef coverage will increase and approach pre-alteration state
1.00 = maximum benefit; area of reef coverage meets pre-alteration state

2. Living density among homologues

0.00 = pattern in living density at Faka-Union will continue to diminish with lower densities at homologues 1-4 in the future
0.25 = pattern seen at Faka-Union will remain unchanged
0.50 = some benefit; see oysters returning to homologue 1 and slight increases in living density at homologues 2-4, and slight a slight decrease at homologue 5
0.75 = great benefit; thriving reefs return to homologues 1 & 2; large increases in living density at homologues 1-4; large drop in density at homologue 5; and pattern closely approximates what is currently seen at Blackwater
1.00 = maximum benefit; pattern in living density parallels what is seen at Blackwater

3. Oyster recruitment among homologues

0.00 = pattern in recruitment at Faka-Union will continue to diminish with there being no successful recruitment at homologues 1-3 in the future
0.25 = pattern seen at Faka-Union will remain unchanged
0.50 = some benefit; oyster recruitment returns to homologue 2 and increases at homologues 3-5
0.75 = great benefit; oyster recruitment returns to homologue 1 and continues to increase towards levels seen at Blackwater at homologues 2-5
1.00 = maximum benefit; pattern in recruitment parallels what is seen at Blackwater

4. Condition index throughout Faka-Union

0.00 = condition indices measured during the non-breeding season should continue to decrease relative to values recorded at Blackwater
0.25 = pattern seen at Faka-Union will remain unchanged
0.50 = some benefit; condition indices rise slightly throughout Faka-Union
0,75 = great benefit; condition indices rise considerably towards those seen at Blackwater
1.00 = maximum benefit; condition indices comparable to those measured at Blackwater

Similarity Metric Approach for Estuaries

One can assume that the natural conditions of flow to the Ten Thousand Islands were ideal for the health of the estuarine system. In addition, an ideal restoration design would restore the natural, pre-development conditions to the

estuaries. The relative effectiveness of the restoration alternatives for the estuaries can be quantified by comparing the predicted flow from a given alternative to the flow generated under pre-development conditions. This yields a similarity metric for each alternative for each bay that serves as a measure of relative effectiveness. Similarity metrics, such as Jaccard, Sorenson or Bray-Curtis, are widely used in terrestrial and aquatic ecology for comparisons between a reference site and a restoration site.

The test metric, called "percent similarity", is structured after the Bray-Curtis similarity coefficient (Bray, 1957) and is defined below. Fakahatchee Bay is the estuary least affected by SGGE and therefore serves as a natural reference against which the other estuaries can be compared.

$$\% \text{ Similarity} = \text{Abs}\left[(d_{exist} - d_{alt}) / (d_{exist} + d_{alt}) \right] * 100, \quad (1)$$

where d_{exist} is the 'difference ratio' comparing the existing conditions of an estuary (x, either Faka Union, Pumpkin, or Blackwater) to the natural (=pre-development) conditions of the same estuary, normalized against conditions at Fakahatchee. As an equation,

$$d_{exist} = \text{Abs}\left[(x_{exist} / \text{Faka}_{exist}) - (x_{natl} / \text{Faka}_{natl}) \right] . \quad (2)$$

Similarly, the difference ratio of the alternative in question (alt) is defined as,

$$d_{alt} = \text{Abs}\left[(x_{alt} / \text{Faka}_{alt}) - (x_{natl} / \text{Faka}_{natl}) \right] . \quad (3)$$

Percent similarities were used in three ways. First, graphical output for each alternative was visually compared. Second, in order to more objectively compare effectiveness, the best performing alternatives each month were scored (3 pts for best performing, 2 pts for second best, and 1 pt for third best) and the scores were summed for the year. The relative total scores for the year were used to rank the effectiveness of the alternatives. Third, since the similarities were developed to represent the quality of restoration for each bay and alternative, similarities were multiplied by acres of potential oyster habitat produce oyster habitat units and acres of the entire bay to produce nekton (fish and other mobile animals) habitat units.

6.6.5 Changes to Other Resources

The indices for hydrology, biota, oyster, and nekton incorporate major changes to the ecosystem expected in the future without project conditions and under the restoration alternatives. However, the indices do not describe changes to all of the potentially important resources in the SGGE study area. Changes to features and resources such as acreages of specific plant community types, threatened and endangered species, cultural resources, economic activity,

recreation, and others are analyzed by different methods and do not rely on the indices and the estimates of habitat units. The other resources are discussed and evaluated in text and tables later in this report and in its appendices.

6.7 ENVIRONMENTAL RESOURCE EVALUATION

6.7.1 Introduction

This section of the draft PIR provides the results of detailed analysis of pre-development condition, existing conditions, future without project conditions, and the final three restoration alternatives, 3D, 6, and 12. It provides performance measures and habitat unit benefits.

6.7.2 Inland Performance Measures

Hydrologic Performance Measures

The PDT used the results of the MIKE SHE model to evaluate four performance measures: average water levels for the dry season (April 1-June 1), average water levels for the wet season (July1-October 1), annual maximum water levels, and annual minimum water levels. These performance measures were evaluated at the 32 locations (Indicator Regions (IRs)) shown in Figure 6-4. For each of the four performance measures and IRs, the PDT calculated a ratio by dividing the model's predicted water levels for existing conditions, future without project conditions and the three alternatives by the predicted water levels for pre-development conditions. The closer the predicted water levels for the alternatives are to the pre-development conditions, the closer the ratio is to 1.00 (100 percent) and the better the degree of restoration. The results, trends and patterns are summarized below. The full results for each indicator region and additional discussion can be seen in Appendix D.

One measure of the degree of restoration is shown in **Table 6-5** which presents the average percent of pre-development conditions water levels predicted for existing conditions, future without conditions, and Alternatives 3D, 6, and 12. The entries are the average of 32 indicator regions within and near SGGE. The future without project condition is drier than the pre-development condition, averaging only 60 to 81 percent for the four performance measures. The average dry season water level and the minimum water level are farther from the pre-development conditions predictions than are the average wet season and maximum water levels. Under Alternatives 3D and 6, the four performance measures would average from 94 to 97 percent of pre-development conditions. This is a very high degree of restoration. Alternative 12 does nearly as well as the other alternatives for the average wet season and maximum water levels, but does not perform as well for the average dry season and minimum water levels.

TABLE 6 - 5 THE AVERAGE PERCENT OF PRE-DEVELOPMENT CONDITIONS FOR FOUR HYDROLOGIC PERFORMANCE MEASURES. 32 INDICATOR REGIONS ARE INCLUDED IN THE AVERAGES.

Performance Measure		Exist	Future Without	Alt 3D	Alt 6	Alt 12
Average dry season water level		61%	60%	95%	94%	80%
Average Wet Season water level		74%	75%	96%	95%	93%
Average Maximum water level		81%	81%	97%	96%	96%
Average Minimum water level		59%	56%	96%	94%	88%

A second measure of the degree of restoration is shown in **Table 6-6**. It shows how many of the 32 indicator regions have predicted water levels that are within (plus or minus) 10 percent and within 20 percent of the predicted water levels for pre-development conditions. The higher the number of indicator regions with predictions that are close to the pre-development conditions prediction, the better the restoration. **Table 6-6** shows that existing and future without project conditions are not very close to the pre-development conditions. The three alternatives generally more than double the number of indicator regions that are within 10 percent of the pre-development conditions target. The three alternatives perform similarly for these four performance measures.

TABLE 6 - 6 THE NUMBER OF THE 32 INDICATOR REGIONS (IRS) WITHIN 10 PERCENT AND WITHIN 20 PERCENT OF PRE-DEVELOPMENT CONDITION FOR FOUR HYDROLOGIC PERFORMANCE MEASURES

Performance Measure		Exist	Future Without	3D	6	12
Average dry season water level	# IRs within 10% # IRs within 20%	3 7	2 5	14 20	10 21	14 23
Average Wet Season water level	# IRs within 10% # IRs within 20%	6 12	7 15	22 31	17 29	21 29
Average Maximum water level	# IRs within 10% # IRs within 20%	9 15	9 17	22 31	19 32	20 31
Average Minimum water level	# IRs within 10% # IRs within 20%	3 5	1 4	13 27	14 21	9 23

Water levels for the Indicator Regions in Belle Meade (IRs 6, 12, 18, 32) and Fakahatchee (IRs 25, 26, 17, 27) (**Figure 6-4)** were typically less affected by the existing drainage system than the IRs within SGGE. They were closer to pre-development conditions in the without project conditions and did not change as much under the alternatives as the IRs within SGGE.

There were few differences among the alternatives within individual Indicator Regions. The largest differences were in IRs 12 –13, 18 -19, (and also 24 for the minimum water level) where the unfilled Miller Canal in Alternative 12 resulted in lower dry season, wet season, maximum, and minimum water levels than in the other two alternatives where Miller Canal was filled. The only other relatively large difference was the lower water levels for Alternative 6 in IR 9, which was upstream of the restoration associated with this alternative but within the restoration areas for Alternatives 3D and 12.

Acreages of Major Plant Communities

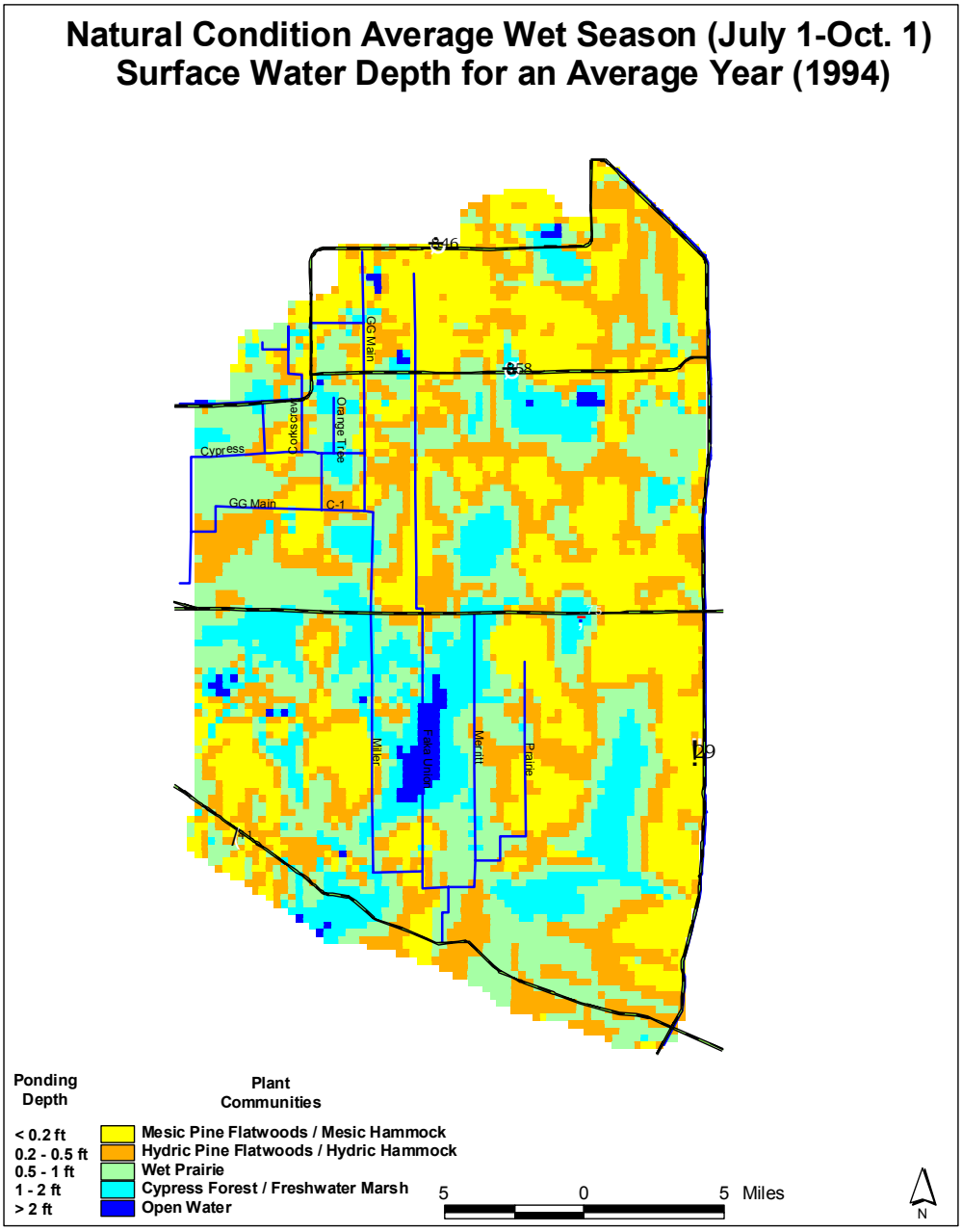
One set of output from the MIKE SHE model was average wet season water levels from July 1 through October 1, which is often closely related to hydroperiod (***Table 2-1***). These two hydrologic parameters are important determinants of the long-term distribution of the major types of plant communities in the Big Cypress (Duever 1984). Based on this correspondence between water depths and major plant community types, the team estimated the acreage of each community from the number of cells (each cell equals 51.65 acres) within each range of water depths present under each water management condition (***Table 6-7***).

Pre-Development. Results of the MIKE SHE model run for Pre-Development conditions indicated that water depths appropriate for cypress and marsh communities made up about 27 percent of the revised SGGE model area, wet prairie made up 33 percent, and flatwoods made up 35 percent (***Table 6-7***) (***Figure 6-5***). Large areas south of I-75 were primarily shallow-to-deep water environments and would be occupied by cypress forest with smaller areas of wet prairie grading into pine flatwoods. There were deep areas north and south of U.S. 41, which extended to the north along the western side of SGGE. While some of the more inland portions of this southern deeper area were cypress communities, it was predominantly herbaceous plant communities including wet prairies and saltwater marshes. The relatively drier upland communities existed as small islands in the vicinity of I-75. The intermediate hydrology wet prairies were located as transitions between the cypress and pine flatwoods communities and also over a large area between the deeper northern cypress and southern coastal marshes in the southeastern portion of SGGE.

TABLE 6 - 7 WATER DEPTHS AND MAJOR PLANT COMMUNITY TYPES

Plant Community	Water Depth	Pre-Devel	Existing	Without project	Alt 3D	Alt 6	Alt 12
Acres of Major Plant Communities							
Mesic Flatwoods	<0.2	9,194	55,058	54,078	18,388	26,393	22,210
Hydric Flatwoods	0.2 - 0.5	11,260	2,273	3,254	10,433	7,386	11,156
Wet Prairie	0.5 - 1.0	19,420	878	1,033	14,720	11,363	14,152
Cypress / Marsh	1.0 - 2.0	16,166	930	826	13,739	11,518	10,433
Open Water	>2.0	3,254	155	103	2,014	2,634	1,343
		59,294	59,294	59,294	59,294	59,294	59,294
Percent of Pre-Development to Other Scenarios (Scenario/Pre-Devel)							
Mesic Flatwoods	<0.2	100	599	588	200	287	242
Hydric Flatwoods	0.2 - 0.5	100	20	29	93	66	99
Wet Prairie	0.5 - 1.0	100	5	5	76	59	73
Cypress / Marsh	1.0 - 2.0	100	6	5	85	71	65
Open Water	>2.0	100	5	3	62	81	41
Percent of Without Project to Restoration Scenarios (scenario/without project)							
Mesic Flatwoods	<0.2			100	34	49	41
Hydric Flatwoods	0.2 - 0.5			100	321	227	360
Wet Prairie	0.5 - 1.0			100	1,425	1,100	1,443
Cypress / Marsh	1.0 - 2.0			100	1,663	1,394	1,683
Open Water	>2.0			100	1,995	2,557	1,304
Percent of Each Plant Community within a Scenario							
Mesic Flatwoods	<0.2	16	93	92	31	45	37
Hydric Flatwoods	0.2 - 0.5	19	4	5	18	12	19
Wet Prairie	0.5 - 1.0	33	1	2	25	19	24
Cypress / Marsh	1.0 - 2.0	27	2	1	23	19	18
Open Water	>2.0	5	0	0	3	4	2

FIGURE 6 - 5 PRE-DEVELOPMENT AVERAGE WET SEASON WATER DEPTH



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Future-Without-Project. With the canals in place for many years, upland conditions dominated virtually the entire SGGE (***Table 6-7, Figure 6-6***). It is important to remember that existing SGGE plant communities are still in transition from their Pre-Development condition to an ecosystem that will be created in response to the new combination of hydrologic, fire, and edaphic conditions that currently exist, as modified by the mix of invasive species that are coming to dominate parts of the area. Some mix of pine flatwoods or palm hammocks will occur where fires are frequent, as will a variety of types of hardwood hammocks where fires are infrequent. Wet prairies and marshes were confined to relatively small areas, primarily located below U.S. 41.

Looking at differences between Pre-Development and Future Without Project above ground water depths, the only areas that have not changed in water depth are areas that were and still are upland communities (***Table 6-7***). The upland communities were already dry. The model indicates that, except near the coast and in the northeast corner, there will be no areas larger than 25 acres (half the size of a 52 acre model cell) of wetlands in SGGE under Future-Without-Project conditions.

Alternative 3D. This restoration alternative increased water depths substantially from the Future Without Project condition in the areas downstream of the pumps, while retaining the drained condition upstream of the pumps (***Table 6-7***, ***Figure 6-7***). The pattern of plant communities was expansion of the wetlands throughout the SGGE. Alternative 3D produced more than an order of magnitude increase in cypress-marsh (19X) and wet prairie (14X) communities, major increases in hydric communities (3X), and a 66 percent decrease in upland communities (***Table 6-7***).

There were only small differences in water depth between the Pre-Development and Alternative 3D (***Table 6-7***), except for generally drier conditions upstream of the pumps. Most of this difference in upland communities over Pre-Development conditions was intentional, resulting from locating the pumps and spreader canals some distance south of I-75 to maintain upland habitat for wildlife in this area.

Alternative 6. This restoration alternative increased water depths substantially from the Future Without Project condition in the areas downstream of the plugs, while retaining the drained condition upstream (***Table 6-7***, ***Figure 6-8***). When compared to both the Existing and Future Without-Project conditions, Alternative 6 had about half of the acreage of upland mesic communities, approximately 2 times as much acreage of the hydric communities, and 11-25 times as much acreage of wet prairie, cypress, and open water communities (***Table 6-7***). Compared to the Pre-Development condition, the acreage of upland mesic communities were almost 3 times greater, while the three wetland communities were about 59-71%.

FIGURE 6 - 6 FUTURE WITHOUT PROJECT CONDITION AVERAGE WET SEASON WATER DEPTH

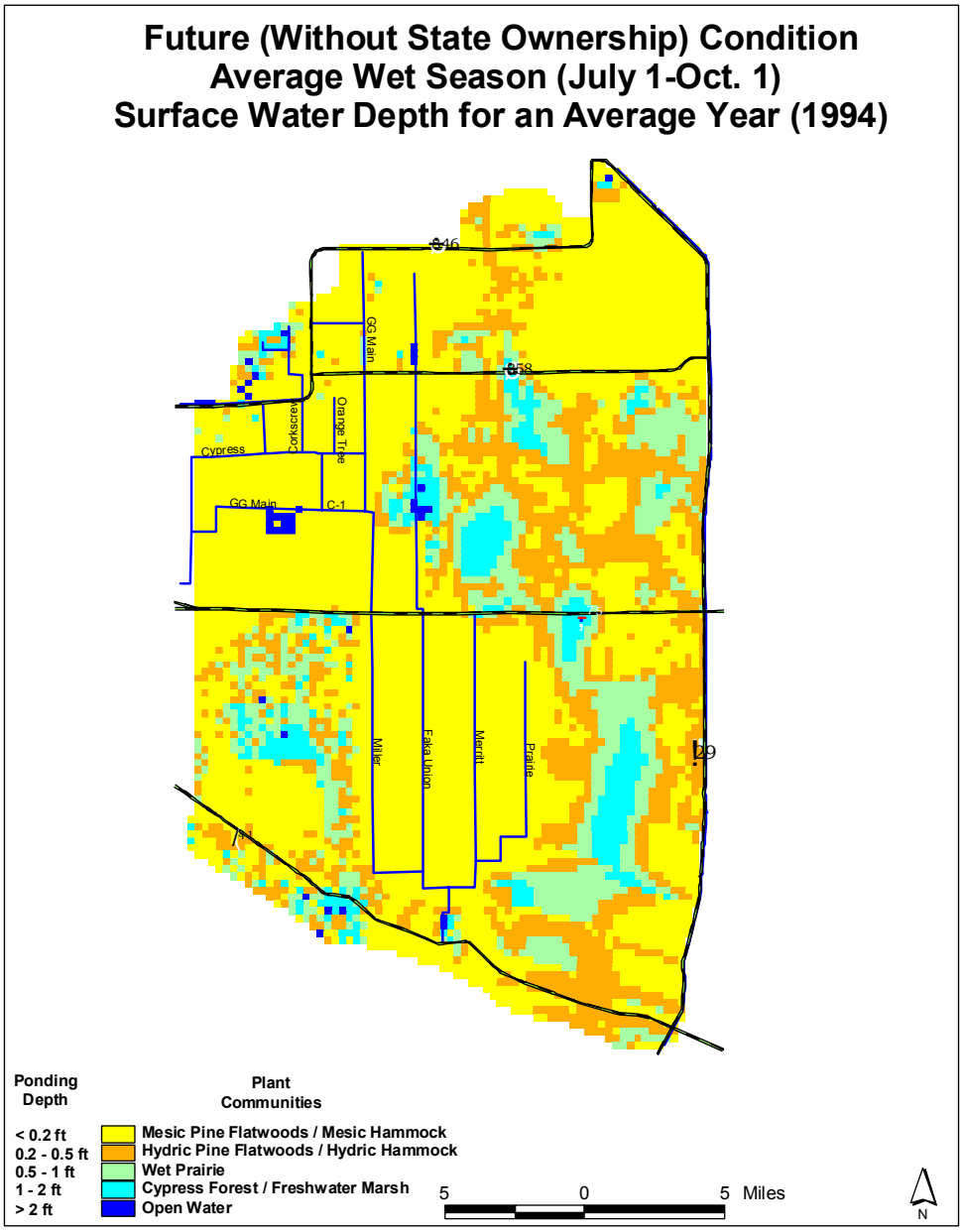

FIGURE 6 - 7 ALTERNATIVE 3-D AVERAGE WET SEASON WATER DEPTH

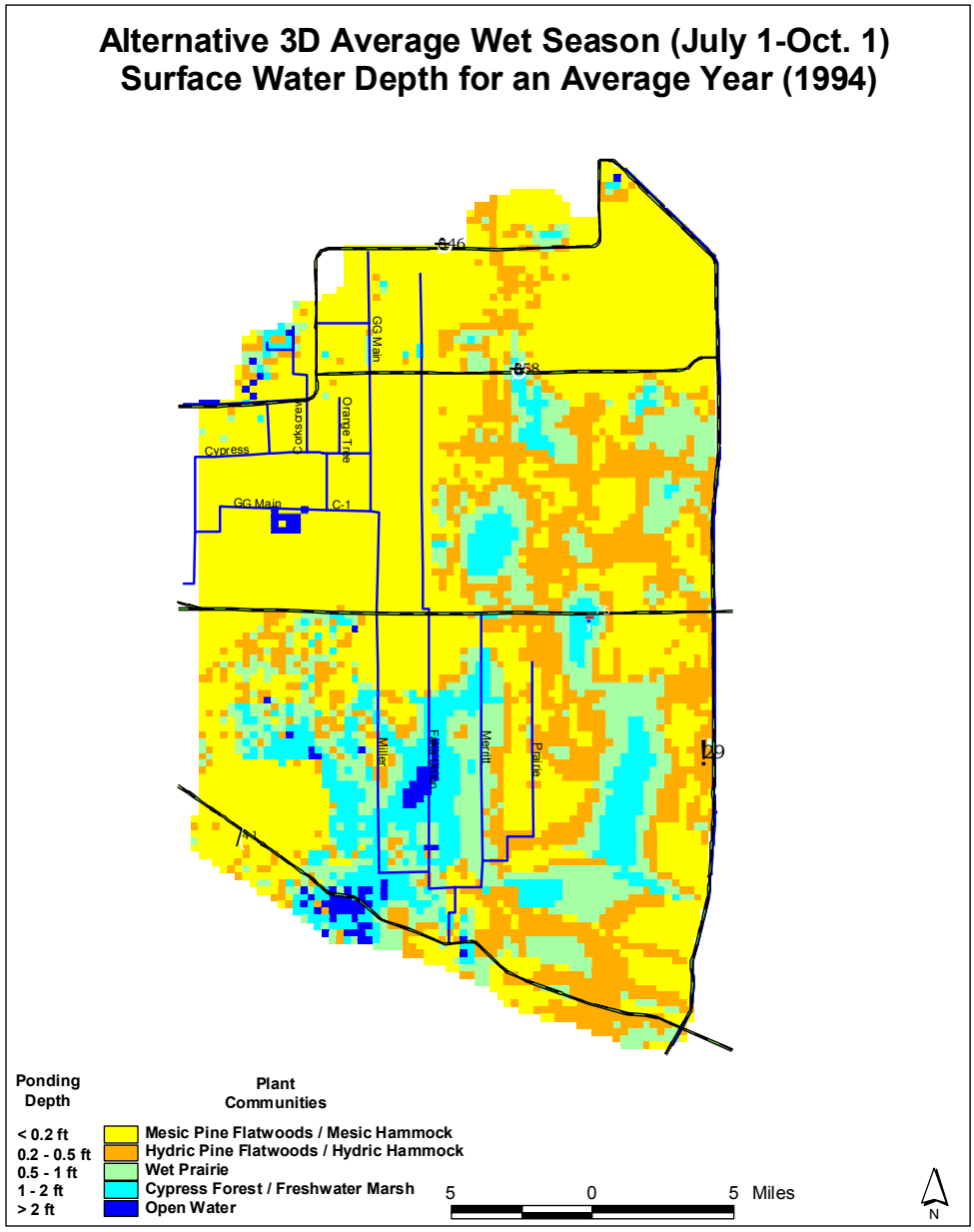

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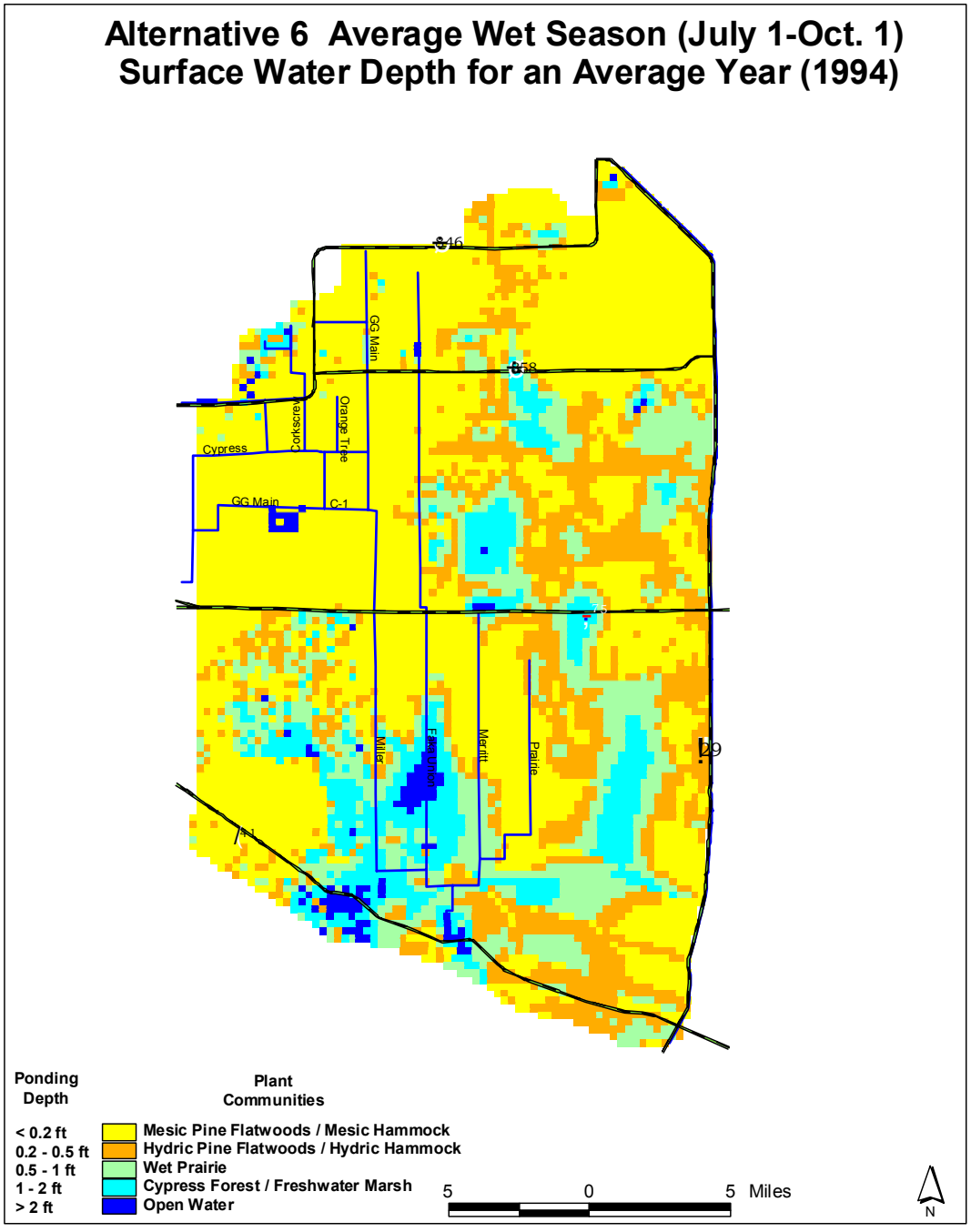
FIGURE 6 - 8 ALTERNATIVE 6 AVERAGE WET SEASON WATER DEPTH



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This alternative had the highest proportion of upland mesic communities (45% of SGGE) of the final three restoration alternatives (***Table 6-7***). Alternative 6 produced a smaller acreage of all wetland communities compared to Alternative 3D, except open water.

Alternative 12. There were major quantitative differences in acreages of the above ground water depth classes between Alternative 12 and the Pre-development, Existing, and Future-Without-Project conditions (***Table 6-7***, ***Figure 6-9***). When compared to both the Future-Without-Project condition, Alternative 12 had about 40% of the acreage of upland mesic communities, approximately 3.6 times as much acreage of hydric, and 16 times as much acreage of wet prairie and cypress communities.

When compared to the Pre-development condition, Alternative 12 produced about 2 times the acreages of upland mesic communities, similar acreages for the hydric community, and about 65-73 percent of the wet prairie, cypress and marsh wetland communities.

Alternative 12 produced intermediate acreages between the two other alternatives. Alternative 3D provided less mesic communities than Alternative 12, which provided less mesic communities than Alternative 6. Likewise, Alternative 3 provided more wetland communities than Alternative 12, which provided more wetland communities than Alternative 6.

SFAM Quality Indices

The PDT developed values for the South Florida Assessment Method (SFAM) Hydrology and Biota indices and their component variables. The results for SGGE, Fakahatchee Strand State Preserve, South Belle Meade, Collier Seminole State Park, and the Florida Panther National Wildlife Refuge are presented in ***Table 6-8***. The variables and indices are defined in Section 6.6, Tools for Ecosystem Evaluation. For SGGE, the Hydrology and Biota indices both suggest that Alternative 3D would provide more restoration than Alternatives 6 and 12, which would perform similarly. For the other locations in the project area, the differences among the indices for future without conditions and the three alternatives are much less than the differences seen for SGGE.

FIGURE 6 - 9 ALTERNATIVE 12 AVERAGE WET SEASON SURFACE WATER DEPTH

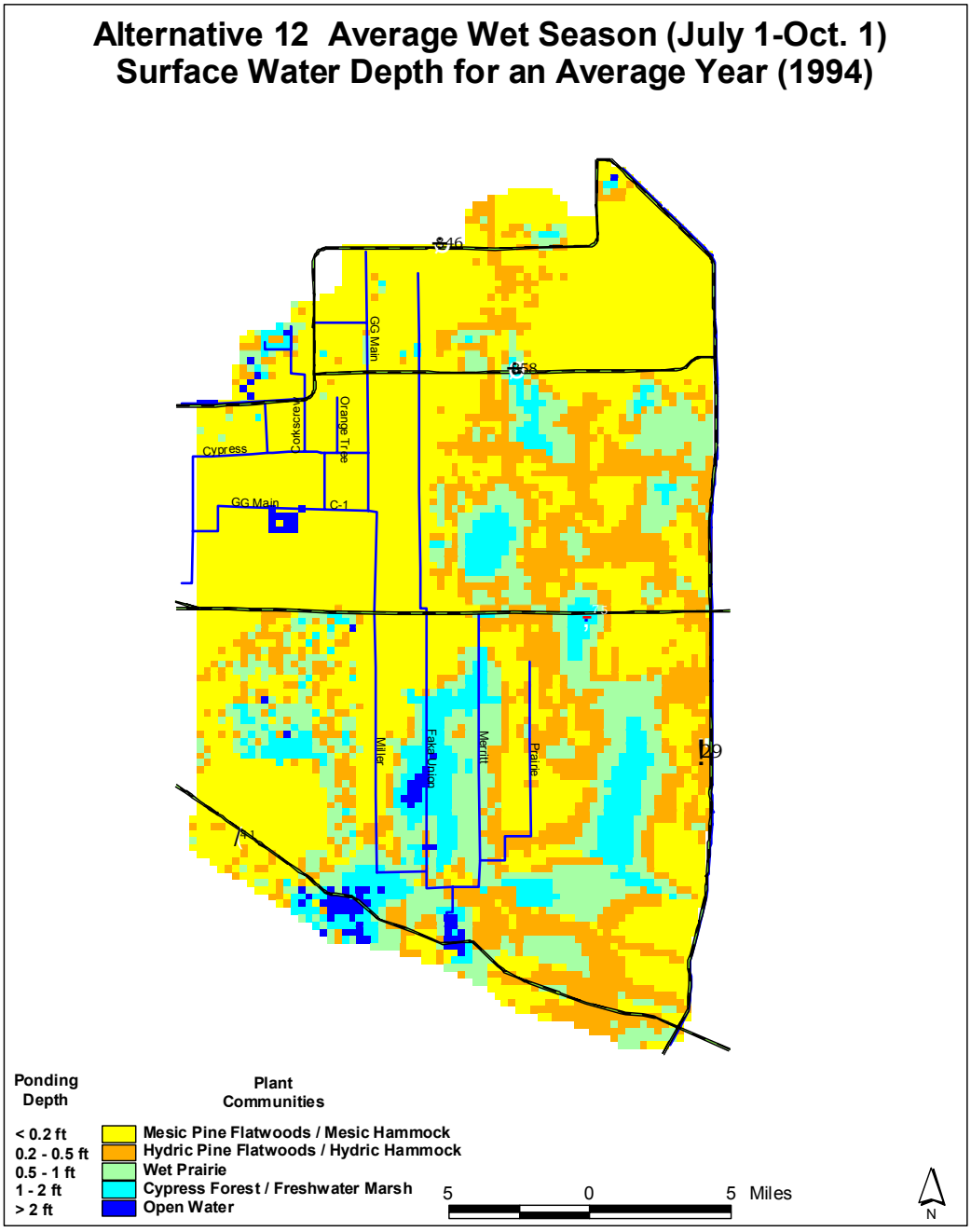

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FIGURE 6 - 10 DELETED FOR FINAL

TABLE 6 - 8 SOUTHWEST FLORIDA ASSESSMENT METHODOLOGY FOR THE SGGE PROJECT AREA

Variables	SGGE Bases and Alternatives					
Hydrology	**Pre-development**	**Exist**	**Future Without**	**3D**	**6**	**12**
Region	1.00	0.73	0.73	0.79	0.79	0.79
Inundation	1.00	0.04	0.04	0.85	0.71	0.65
Land Use	1.00	0.98	0.98	0.98	0.99	0.99
Drainage	1.00	0.00	0.00	0.79	0.57	0.57
Profile	1.00	0.00	0.00	0.78	0.75	0.75
Hydrology Index	**1.00**	**0.35**	**0.35**	**0.84**	**0.76**	**0.75**
Hydrology Index = (Region + Inundation + Land Use + Drainage + Profile) / 5						
Biota						
Vegetation	1.00	0.23	0.25	0.86	0.73	0.79
Nuisance	1.00	0.88	0.61	0.92	0.83	0.83
Exotic	1.00	0.90	0.85	0.99	0.99	0.99
Fire	1.00	0.40	0.40	0.80	0.80	0.80
Boundary	1.00	0.98	0.84	0.84	0.84	0.84
Biotic Index	**1.00**	**0.68**	**0.59**	**0.88**	**0.84**	**0.85**
Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5						

SFAM for Fakahatchee Strand State Preserve

Variables	Fakahatchee Strand Bases and Alternatives					
Hydrology	**Pre-development**	**Exist**	**Future Without**	**3D**	**6**	**12**
Region	1.00	0.73	0.73	0.79	0.79	0.79
Inundation	1.00	0.62	0.63	0.75	0.77	0.73
Land Use	1.00	1.00	1.00	1.00	1.00	1.00
Drainage	1.00	1.00	1.00	1.00	1.00	1.00
Profile	1.00	0.98	0.98	0.98	0.98	0.98
Hydrology Index	**1.00**	**0.87**	**0.87**	**0.90**	**0.91**	**0.90**
Hydrology Index = (Region + Inundation + Land Use + Drainage + Profile) / 5						
Biota						
Vegetation	1.00	0.87	0.87	0.89	0.90	0.89
Nuisance	1.00	0.95	0.90	1.00	1.00	1.00
Exotic	1.00	0.95	0.90	0.99	0.99	0.99
Fire	1.00	0.90	0.90	0.95	0.95	0.95
Boundary	1.00	0.93	0.93	0.93	0.93	0.93
Biotic Index	**1.00**	**0.92**	**0.90**	**0.95**	**0.95**	**0.95**
Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5						

SFAM for South Belle Meade

Variables	South Belle Meade Bases and Alternatives					
Hydrology	**Pre-development**	**Exist**	**Future Without**	**3D**	**6**	**12**
Region	1.00	0.73	0.73	0.79	0.79	0.79
Inundation	1.00	0.43	0.46	0.72	0.65	0.46
Land Use	1.00	1.00	1.00	1.00	1.00	1.00
Drainage	1.00	1.00	1.00	1.00	1.00	1.00
Profile	1.00	0.99	0.98	0.98	0.98	0.98
Hydrology Index	**1.00**	**0.83**	**0.83**	**0.90**	**0.88**	**0.85**
Hydrology Index = (Region + Inundation + Land Use + Drainage + Profile) / 5						
Biota						
Vegetation	1.00	0.81	0.82	0.79	0.78	0.82
Nuisance	1.00	0.85	0.80	0.90	0.85	0.80
Exotic	1.00	0.75	0.90	0.99	0.97	0.95
Fire	1.00	0.70	0.70	0.80	0.75	0.70
Boundary	1.00	0.37	0.37	0.37	0.37	0.37
Biotic Index	**1.00**	**0.70**	**0.72**	**0.77**	**0.74**	**0.73**
Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5						

SFAM for Collier Seminole State Park

Variables	Collier-Seminole State Park Bases and Alternatives					
Hydrology	**Pre-development**	**Exist**	**Future Without**	**3D**	**6**	**12**
Region	1.00	0.73	0.73	0.79	0.79	0.79
Inundation	1.00	0.56	0.41	0.63	0.63	0.54
Land Use	1.00	0.99	0.99	0.99	0.99	0.99
Drainage	1.00	1.00	1.00	1.00	1.00	1.00
Profile	1.00	0.99	0.99	0.99	0.99	0.99
Hydrology Index	**1.00**	**0.85**	**0.82**	**0.88**	**0.88**	**0.86**
Hydrology Index = (Region + Inundation + Land Use + Drainage + Profile) / 5						
Biota						
Vegetation	1.00	0.63	0.60	0.71	0.71	0.70
Nuisance	1.00	0.85	0.80	0.99	0.99	0.90
Exotic	1.00	0.95	0.95	0.97	0.97	0.95
Fire	1.00	0.90	0.90	0.95	0.95	0.95
Boundary	1.00	0.99	0.95	0.95	0.95	0.95
Biotic Index	**1.00**	**0.86**	**0.84**	**0.91**	**0.91**	**0.89**
Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5						

SFAM for Florida Panther National Wildlife Refuge

Variables	Florida Panther NWR Bases and Alternatives					
Hydrology	**Pre-development**	**Exist**	**Future Without**	**3D**	**6**	**12**
Region	1.00	0.73	0.73	0.79	0.79	0.79
Inundation	1.00	0.61	0.61	0.61	0.61	0.61
Land Use	1.00	1.00	1.00	1.00	1.00	1.00
Drainage	1.00	1.00	1.00	1.00	1.00	1.00
Profile	1.00	1.00	1.00	1.00	1.00	1.00
Hydrology Index	**1.00**	**0.87**	**0.87**	**0.88**	**0.88**	**0.88**
Hydrology Index = (Region + Inundation + Land Use + Drainage + Profile) / 5						
Biota						
Vegetation	1.00	0.76	0.76	0.76	0.76	0.76
Nuisance	1.00	0.90	0.90	0.90	0.90	0.90
Exotic	1.00	0.99	0.99	0.99	0.99	0.99
Fire	1.00	0.80	0.80	0.80	0.80	0.80
Boundary	1.00	0.42	0.35	0.35	0.35	0.35
Biotic Index	**1.00**	**0.77**	**0.76**	**0.76**	**0.76**	**0.76**
Biotic Index = (Vegetation + Nuisance + Exotic + Fire + Boundary) / 5						

6.7.3 Inland Habitat Units

Habitat Units (HU) are generally calculated by multiplying a habitat quality index by the acreage of land to which it applies. This simple product would represent conditions at the end point of restoration. It would not take into account any differences among alternatives of the rate of change from existing conditions to restored conditions.

All of the SGGE Project Area environmental outputs were adjusted on an average annual basis to account for the fact that several years may be required for full attainment of HU functional capacity. For example, 100% of the hydrological functional capacity would be reached during year 1 of the period of analysis. However, scientists estimated that the full biotic functional capacity would be reached more slowly, as woody vegetation and the wildlife inhabiting these cover types gradually returned following the re-hydration of the Project Area. See **Figure 6-11** for an example of the change through time of hydrology and biota habitat units. See Appendix E for similar graphs that are specific for each of the alternatives and index. ***Table 6-9*** presents the average annual habitat units for Hydrology and Biota. The average annual habitat units for each condition are calculated using the gradual growth relationship for each condition and a 50-year period of analysis. The habitat units of the same type (hydrology or biota) for the five locations can be added together. They represent the same kind of change although in different geographic locations.

FIGURE 6 - 11 SAMPLE HYDROLOGY AND BIOTA HABITAT TIME-SERIES GRAPHS WITH AND WITHOUT PROJECT CONDITIONS

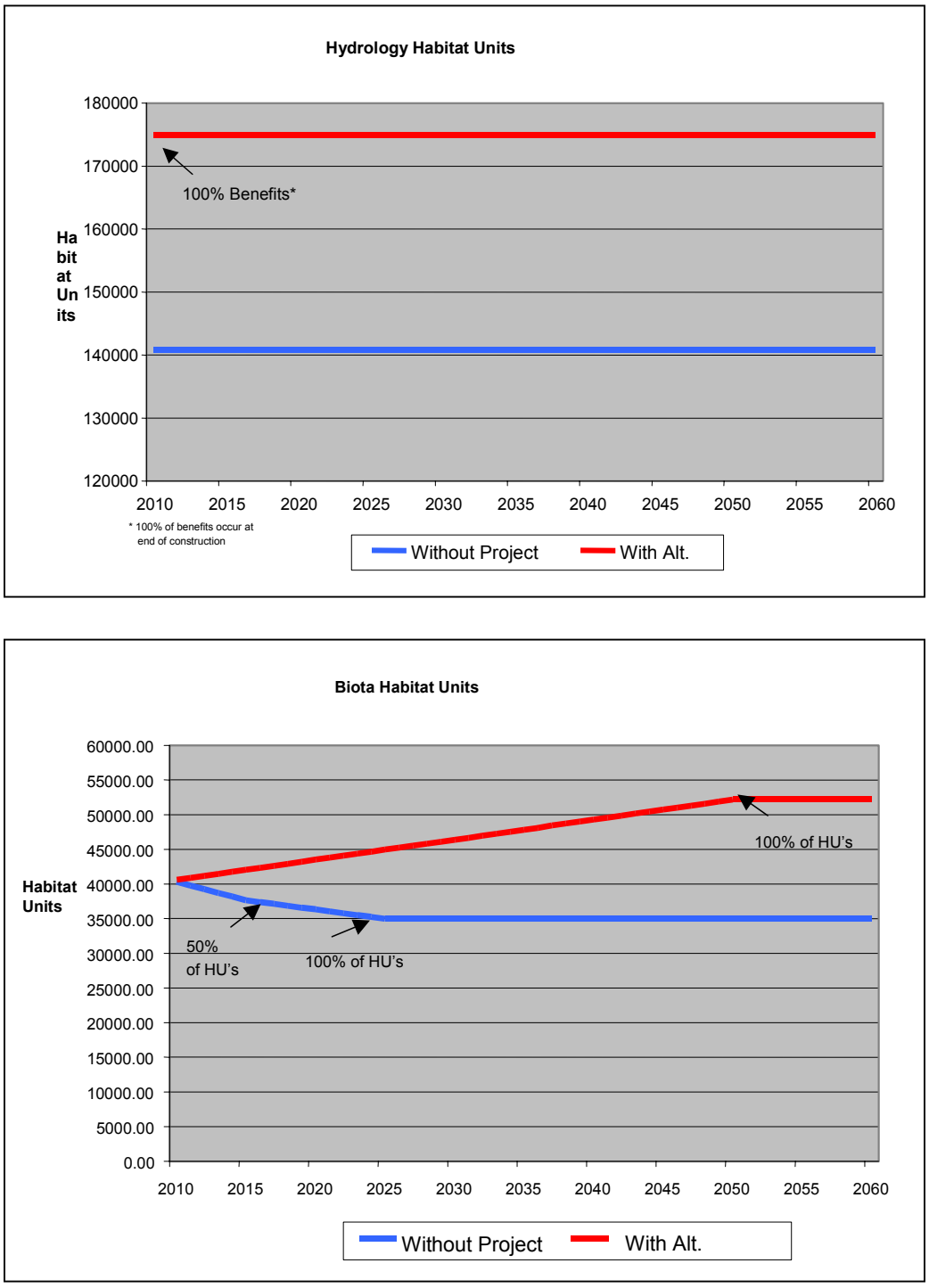


TABLE 6 - 9 AVERAGE ANNUAL HABITAT UNITS FOR HYDROLOGY AND BIOTA

Location	Acres	Future Without	3D	6	12
HYDROLOGY HUs					
SGGE	59,294	20,753	49,807	45,063	44,471
Fakahatchee	80,161	69,740	72,145	72,947	72,145
Belle Meade	30,061	24,951	27,055	26,454	25,551
Collier- Seminole	4,339	3,645	3,948	3,948	3,862
Panther	24,947	21,704	21,953	21,953	21,953
Total	**198,802**	**140,793**	**174,908**	**170,365**	**167,982**
BIOTA HUs					
SGGE	59,294	35,692	47,531	46,090	46,450
Fakahatchee	80,161	72,357	75,210	75,210	75,210
Belle Meade	30,061	21,564	22,322	21,774	21,591
Collier- Seminole	4,339	3,656	3,863	3,863	3,811
Panther	24,947	18,993	19,058	19,058	19,058
Total	**198,802**	**152,262**	**167,984**	**165,995**	**166,120**

Table 6-10 presents average annual benefits for hydrology and biota, where benefits are defined as the gain of habitat units due to an alternative, and are calculated as the average annual difference between the habitat units for a restoration alternative and the habitat units for future without project. For SGGE alone, and for all five locations combined, Alternative 3D provides the greatest average annual benefits to hydrology and biota. Alternative 6 provides the second most hydrology benefits, and Alternative 12 provides the second most biota benefits of these three final alternatives. Average annual benefits are used in the cost effectiveness and incremental cost analysis later in this report.

TABLE 6 - 10 AVERAGE ANNUAL BENEFITS FOR HYDROLOGY AND BIOTA

Location	Acres	Future Without	3D	6	12
HYDROLOGY HUs					
SGGE	59,294	n.a.	29,054	24,310	23,718
Fakahatchee	80,161	n.a.	2,405	3,207	2,405
Belle Meade	30,061	n.a.	2,104	1,503	600
Collier- Seminole	4,339	n.a.	303	303	217
Panther	24,947	n.a.	249	249	249
Total	198,802	n.a.	**34,115**	**29,572**	**27,189**
BIOTA HUs					
SGGE	59,294	n.a.	11,839	10,398	10,758
Fakahatchee	80,161	n.a.	2,853	2,853	2,853
Belle Meade	30,061	n.a.	758	210	27
Collier- Seminole	4,339	n.a.	207	207	155
Panther	24,947	n.a.	65	65	65
Total	198,802	n.a.	**15,722**	**13,733**	**13,858**

6.7.4 Estuarine Performance Measures

Performance measures for open water (nekton) in Faka Union Bay.

One performance measure for nekton is the number of months with flows above 500 cfs and below 50 cfs. A second performance measure for nekton is the magnitude of the flows above or below the 500/50 cfs limits. We assume that an alternative that exhibits few or no flows outside of the 500/50 cfs limits or has small excursions outside of this limit will create a more natural flow regime and effect a greater restoration than an alternative with greater extremes of flows. This method is further described in Section 6.6.2 and in the Benefit Analysis for Estuaries Report in Appendix D.

Alternative 6 performs best for this suite of performance measures (**Table 6-11**), with only two months outside the flow limit threshold (January and May both with 36 and 45 cfs respectively). Alternative 3D was the next best with four months outside the limits: January 20 cfs, February 26 cfs, April 27 cfs and May 14 cfs. Alternative 12 was the third best with four months outside the limit, two months above (September 523 cfs and October 665 cfs) and two months below (May 37 cfs and July 213 cfs).

TABLE 6 - 11 RELATIVE EFFECTIVENESS OF THE ALTERNATIVES FOR THE NEKTON PERFORMANCE MEASURES

Shown are (1) number of months where critical flow levels are violated for each modeled alternative, and (2) the total flow (in cfs) summed over the months when critical levels were violated.

Performance Measure			**3D**	**6**	**12**
# months flows were above/below 500/50 limits			4	2	4
Sum of flows above or below limits (cfs)			91	19	497

Performance Measures for Oyster Reefs in Faka Union Bay

Oyster reefs make excellent sentinels for estuarine health within the estuaries of Southwest Florida, particularly those systems located within the Ten Thousand Islands. Oyster reef development is critical to estuarine ecology and to the geomorphologic structure of the region. The development of mangrove islands that differentiate the inner and outer bays and passages is founded upon oyster reefs. Additionally, because the eastern oyster, *Crassostrea virginica*, is the principal suspension feeder within these estuarine waters, oyster reefs are

critical to pelagic – benthic coupling. Reefs remove the carbon fixed by these waters' principal primary producers, the phytoplankton, and transfer that carbon to the benthos. This filter feeding ability also serves to improve water quality and clarity for benthic primary production. Lastly, oyster reefs are one of the major types of "essential fish habitat" and provide substrate for many other fin- and shellfish species. Because the Ten Thousand Islands lack prolific sea grass beds, oyster reefs are arguably the most important ecosystem component of this estuarine system. Consequently, oysters and their reefs are ideal measures of estuarine health and can be used to monitor management and restoration practices.

Restoration of sheet flow should improve oyster health, physiology, and their distribution within the estuary. The decrease in freshwater point-source discharge into the estuary that would accompany improvements in sheet flow should shift the foci of oyster growth, recruitment, productivity, and reef distribution back to the middle regions in Faka-Union estuary. Thus, any restoration strategy that augments sheet flow and decreases freshwater point-source discharge should improve oyster physiological condition and reef development.

The closer a strategy restores the natural pre-alteration sheet flow conditions, the better the predicted improvement in reef health. Of the three alternatives, 3D and 6 do equally well at approximating natural freshwater inflows for the estuaries, and therefore should yield comparable improvements in reef health (**Table 6-12)**. Alternative 12 is considerably less effective at improving oyster health and distribution. The oyster reef performance measure is described in Section 6.6, Tools, and additional detail and maps are available in Appendix D. Each of the four measures is briefly discussed in the paragraphs following ***Table 6-12***.

TABLE 6 - 12 QUALITY VALUES REPRESENTING A RETURN TO PRE-DEVELOPMENT CONDITIONS FOR OYSTER VARIABLES

Measure of Oyster Health	Pre-Development	Existing	Without Project	Alt 3D	Alt 6	Alt 12
Reef Development	1.00	0.00	0.00	1.00	1.00	0.50
Living Density	1.00	0.00	0.00	0.75	1.00	0.75
Recruitment	1.00	0.00	0.00	1.00	0.75	0.50
Condition Index	1.00	0.00	0.00	1.00	1.00	0.25
Average Oyster Index	1.00	0.00	0.00	0.94	0.94	0.50

1. Reef Development.— The locus of reef development in Faka-Union should shift to homologue 3, the homologue exhibiting the most pervasive reef distribution in Blackwater. Restoration to near-natural conditions Alternative 3D and 6), which best approximates natural conditions relative to all other alternatives, should result in maximum reef development at homologue 3 (***Table 6-12***). Alternatives 12, although it restores natural sheet flow under most situations, should result in slightly lower reef development at homologue 3 because of the occasional intense pulsing during storm events.

2. Living Density.— Living density (number of living oysters per unit area on a reef) is highest at the middle homologues (2-4) in Blackwater and markedly lower at all homologues in Faka-Union except homologue 5. Complete restoration of natural sheet flow to Faka-Union should lead to a spatial distribution of living densities among the homologues comparable to that found in Blackwater. Consequently, Alternatives 3D and 6 should result in maximal benefit and lead to increases in living density at homologues 1-4 and a decrease at homologue 5 (***Table 6-12***. Alternative 12 should closely approximate this pattern, but, as for reef coverage, the storm pulsing associated with a fully open Miller Canal will prevent maximum improvement.

3. Oyster Recruitment.— Oyster recruitment is virtually non-existent currently at homologues 1 and 2 at Faka-Union. Additionally, juvenile mortality at these homologues, when spat are experimentally introduced to these regions, approximates 100%. Consequently, even with successful recruitment, the chance an oyster has for reaching sexual maturity is very low. Recruitment at all homologues in Faka-Union never reaches the healthy levels occurring at Blackwater . A near-complete restoration of sheet flow, such as in Alternatives 3D and 6, is predicted to generate the pattern of recruitment currently seen at Blackwater, with Alternative 12 doing more poorly at approximating natural conditions (***Table 6-12***).

4. Condition Index.— Condition index (tissue mass divided by shell mass) is a measure of the physiological status of an individual oyster. During times when energy resources are being allocated to fight disease, dealing with environmentally induced stress (caused by poor water quality), or to produce gametes, less energy is invested in tissue growth, thereby reducing the index. When condition index is monitored during the non-spawning season (between November and May for our subtropical region), the measure is a direct indicator of an oyster's physiological health. Oysters from Faka-Union typically exhibit condition indices that are statistically lower than those found in Blackwater, particularly in the non-breeding season. Full restoration of sheet flow should maximize condition index for Faka-Union's oysters overall with indices approaching those found in Blackwater. Consequently, Alternatives 3D and 6

should result in maximum restoration, with Alternative 12 showing somewhat less (***Table 6-12***).

Similarity Metric for All Bays

The similarity metric compares the bays to be restored to a reference bay and represents a degree or quality of the restoration by the alternative. Similarity metrics can be analyzed in three ways (see Sec 6.6 Evaluation Tools) – the graphic analysis of similarities by month and alternative, the scoring method of monthly similarities (difference ratio), and the annual average difference ratio.

Graphic and Scoring Analysis

The graphs of the similarity metric by month and alternative are complex and difficult to interpret. The scoring tables are large. The graphs and the full scoring tables are contained in the Estuary Report of Appendix D. Conclusions and summaries from the graphs and the scoring tables are presented in Table 6-13 and discussed below.

TABLE 6 - 13 RANK SCORES BY INDIVIDUAL BAY AND BY SEASON
In this table, higher numbers represent higher similarities and restoration closer to the target.

		Alt. 3D	Alt. 6	Alt. 12
Faka Union Bay		26	23	23
Pumpkin Bay		22	29	21
Blackwater Bay		27	25	20
Overall		**75**	**77**	**64**
Dry Season		**31**	**43**	**34**
Wet Season		**44**	**34**	**30**

For Faka Union Bay, Alternative 3D performs better than the other alternatives for most of the wet season, approximating natural conditions by over 80% (June - September. Alternative 6 finishes second during these months. Late in the dry season, February through May, alternative 3D performs as well as alternatives 6 and 12; all three alternatives exhibit > 70% similarity. Alternative 12 out-performs 3D and 6 in October, November, and January at similarities > 60%. Alternative 3D performs best in the monthly ranking, scoring 26 points, followed by 6 and 12 with 23 points each (**Table 6-13**). The integration of all these results demonstrates that the order of effectiveness for Faka Union Bay is: 3D > 6 > 12.

For Blackwater Bay, visual assessment shows that Alternative 3D and 6 perform equally well for most of the year (January - April; June - December). Both approximate natural conditions better than Alternative 12 in all months except May and October through December. Percent similarities for the critical wet season months exceed 60% (June - August) for 3D and 6. Monthly ranking yields similar results (**Table 6-13**). Alternative 3D scores 27 points, Alternative 6 scores 25 points, and alternative 12 scores 20. Overall, Alternatives 3D and 6 perform equally well for Blackwater Bay, trailed by Alternative 12.

For Pumpkin Bay, Alternative 3D out-performs 6 in June and July; 6 out-performs 3D in January - April and in October - December. Alternative 12 ranks in second place for portions of the wet season. Monthly scoring places alternative 6 in first with 29 points, followed by 3D with 22 and 12 with 21 (**Table 6-13**). Overall, after integrating results from both methods, alternative 3D and 6 are roughly equal in their performance, followed by 12.

For all three bays combined, alternatives 3D or 6 lead, depending upon whether the dry or wet season is considered (**Table 6-13**). During the wet season, 3D beats 6 with a score of 44 to 34 (with 12 scoring 30 points); during the dry season, 6 beats 12 with a score of 43 to 34 (with 3D scoring 31). For both seasons combined, alternatives 6 and 3D are almost indistinguishable, with 77 and 75 points respectively, followed by 12 with 64 points.

Average Similarity Index

Average similarity indices for nekton and oysters were calculated for three bays using the monthly similarity indices for each month for each alternative and bay. The annual average similarities are shown in **Table 6-14**. This similarity index is a quality index of the restoration. The similarity indices of Table 6-14 show a pattern similar to the pattern of the rank scores of Table 6-13. For Faka Union Bay, Alternative 3D provides the most restoration, and for Pumpkin Bay, Alternative 6 provides the most restoration. However, for Blackwater Bay, the pattern does not hold as well. For this bay, the graphical and rank analysis suggests that Alternative 3D provides the most restoration, followed closely by Alternative 6. For the Similarity indices, Alternative 6 provides the most restoration, but all three alternatives are very close.

TABLE 6 - 14 AVERAGE SIMILARITY INDICES

Average similarity indices (average annual difference ratio, see text for formula) for three alternatives and the future without project condition, based on the model predictions for flows to the coast.

Bay		Future Without	Alt 3D	Alt 6	Alt 12
Faka Union		0.036	0.747	0.692	0.726
Pumpkin		0.012	0.270	0.351	0.195
Blackwater		0.045	0.522	0.542	0.537

6.7.5 Estuarine Habitat Units

The nekton and oyster Habitat Units (HU) in ***Table 6-15*** are calculated by multiplying the similarity quality indices for each alternative scenario from **Table 6-14** by the appropriate acreages (listed in **Table 6-15**). These habitat unit values represent the end point of restoration, once the ecosystem has had time to respond to changes proposed under each alternative. The habitat units of the same type (nekton or oyster) for the three bays can be added together. They represent the same kind of change although in different geographic locations.

TABLE 6 - 15 HABITAT UNITS FOR NEKTON AND OYSTER REEFS FOR FUTURE WITHOUT PROJECT CONDITIONS AND ALTERNATIVES 3D, 6, AND 12

Nekton (shrimp, blue crab, fish)	Bay	Open Water Habitat (Acres)	Future Without	Alt. 3D	Alt. 6	Alt. 12
	Faka Union	470	17.14	350.91	325.01	341.13
	Pumpkin	540	6.60	145.87	189.77	105.08
	Blackwater	250	11.22	130.53	135.55	134.24
	Totals		*34.96*	*627.31*	*650.33*	*580.45*
Oyster Reef Habitat	**Bay**	**Potential Oyster Habitat (Ac)**	**Future Without**	**Alt. 3D**	**Alt. 6**	**Alt. 12**
	Faka Union	8.178	0.30	6.11	5.66	5.94
	Pumpkin	9.396	0.11	2.54	3.30	1.83
	Blackwater	4.35	0.20	2.27	2.36	2.34
	Totals		*0.61*	*10.92*	*11.32*	*10.10*

The total nekton and total oyster outputs were adjusted on an average annual basis to account for the fact that several years may be required for full attainment of HU functional capacity. See **Figure 6-12** for an example of the gradual increase through time of nekton and oyster habitat units. See Appendix E for similar graphs that are specific for each of the alternatives and indices. **Table 6-16** presents the average annual habitat units for all three bays combined. The average annual habitat units for each condition are calculated using the gradual growth relationship for each condition and a 50-year period of analysis. **Table 6-16** also presents average annual benefits, where benefits are defined as the gain of habitat units due to an alternative, and are calculated as the average annual difference between the habitat units for an alternative and the habitat units for future without project. Alternative 6 provides the greatest benefits to nekton and oyster. Alternative 3D provides the second most benefits, and Alternative 12 provides the fewest of these three final alternatives. Average annual benefits are used in the cost effectiveness and incremental cost analysis.

FIGURE 6 - 12 SAMPLE NEKTON AND OYSTER HABITAT TIME-SERIES GRAPHS WITH AND WITHOUT PROJECT CONDITIONS

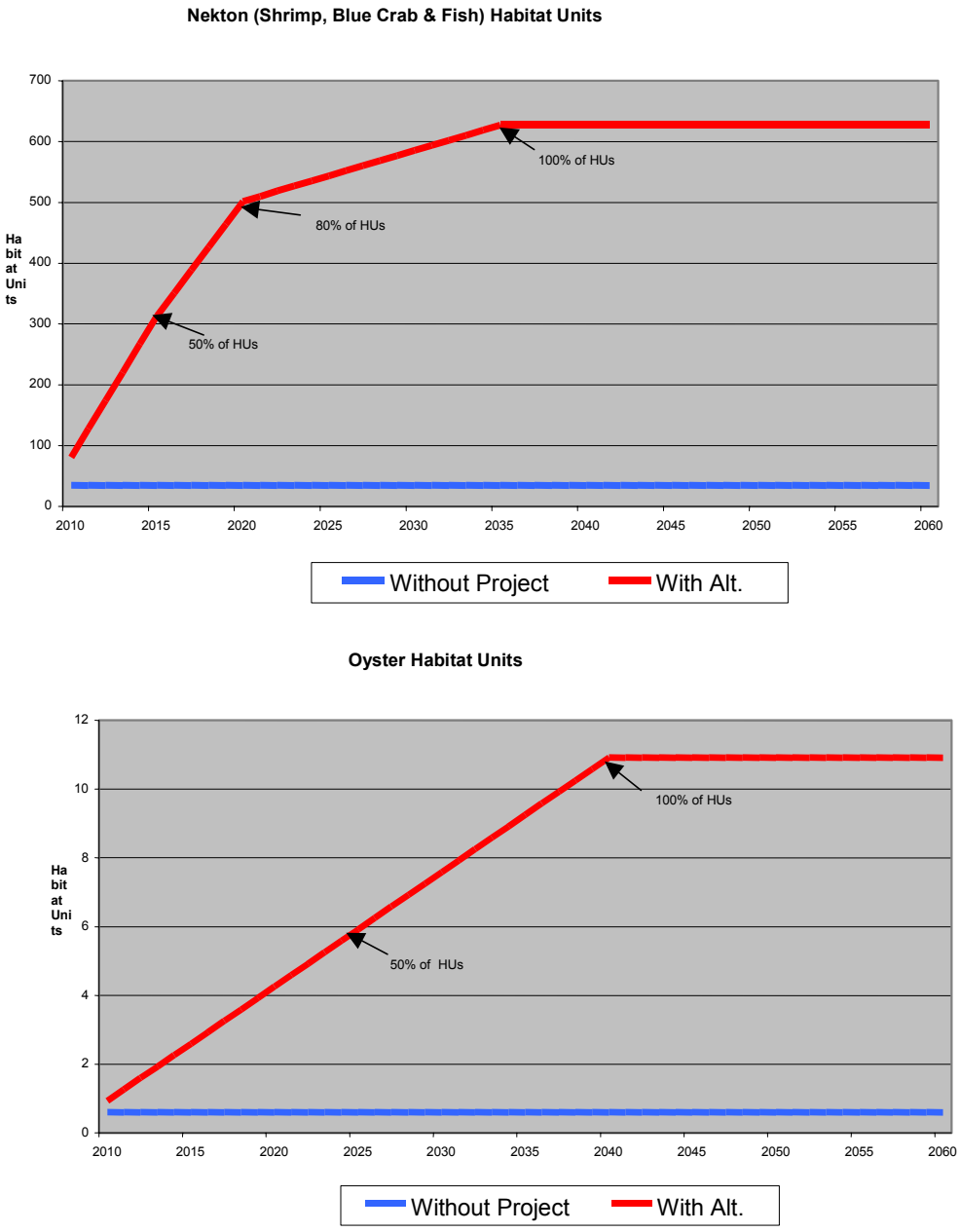


TABLE 6 - 16 ESTUARY AVERAGE ANNUAL HABITAT UNITS AND AVERAGE ANNUAL BENEFITS

Project Area outputs:	Future Without	3D	6	12
Nekton average annual HU	34.65	539.90	559.54	499.91
Oyster average annual HU	0.60	7.88	8.16	7.31
Nekton average annual benefits	n.a.	505.25	524.89	465.26
Oyster average annual benefits	n.a.	7.28	7.56	6.71

6.7.6 Generalized Alternative Comparison Table

The table below has been produced to put side by side a generalized evaluation of the environmental quality components for each of the three final array alternatives. The table is not meant to be definitive but only to allow the reader a method of quick comparison of the effect of each alternative on all the affected resources discussed in this report. In conjunction with a review of SFAM indices, the best professional judgment of Project Delivery Team (PDT) biologists from US Fish and Wildlife Service (FWS), Florida Fish and Wildlife Conservation Commission (FWC), US Army Corps of Engineers (Corps), South Florida Water Management District (SFWMD), Florida Division of Forestry (DoF), Florida Gulf Coast University (FGCU), and Florida Department of Environmental Protection (DEP) was used to determine the degree of beneficial or adverse affects of each alternative. Numerical results for beneficial and adverse effects, determined through the use of the South Florida Assessment Method (SFAM) hydrologic and biotic indices, are discussed in Section 6.7.5 above.

The following is a key to the symbols found in the table. Shading within the table highlight where the alternatives differ from each other in their impacts to the environment.

++++	+	0	-	- - - -
Very Beneficial	Beneficial	Not Beneficial or Adverse	Adverse	Very Adverse

* Plus or minus benefit for this row based on SFAM Hydrology Indices.
** Plus or minus benefit for this row based on SFAM Biota Indices.
*** Plus or minus benefit for this row based on both SFAM Indices.

TABLE 6 - 17 EVALUATION MATRIX FOR STUDY AREA LANDS AFFECTED BY THE SGGE PROJECT

Southern Golden Gate Estates Project Area				
	Future Without	**Alt. 3D**	**Alt. 6**	**Alt. 12**
ENVIRONMENTAL QUALILTY				
Plant communities restored***	- - - -	++++	++	+++
Control of invasive and exotic species***	- -	++++	++++	++++
Fire (wild fire prevention)**	- -	+++	+++	+++
Fish and Wildlife Resources***	- - - -	++++	+++	+++
Wading birds*	- - - -	++++	+++	+++
Small mammals*	- - -	++++	++++	++++
Federally listed species				
Endangered Florida panther***	- - - -	++++	++++	++++
Endangered red cockaded woodpecker***	- - - -	++++	++++	++++
Threatened bald eagle*	- - -	+++	+++	+++
Endangered wood stork*	- - -	++++	++++	+++
Endangered snail kite*	- - -	++	++	+
Endangered American crocodile*	- -	++	++	+
Endangered West Indian manatee*	- -	++	++	+
Threatened eastern indigo snake***	- - -	++++	++++	++++
Endangered smalltooth sawfish*	- -	+	+	+
Endangered plants***	- - -	+++	+++	+++
Essential fish habitat*	- -	++	++	+
Soils*	- - -	++	++	++
Air Quality***	-	+	+	+
Climate (local microclimate)*	- -	++++	+++	++
Hydrologic restoration*	- -	++++	+++	++
Water supply*	-	++	+	+
Water quality*	- -	++	++	++
Water management*	-	++	+	++
Estuarine resources*				
Oyster reefs*	- -	++++	++++	++
Nekton (Fisheries)*	- -	++++	++++	++
Crabs*	- -	++++	++++	++
Socio-Economic impacts				
Land use	0	0	0	0
Population	0	0	0	0
Recreational impacts	0	0	0	0
Water demand	0	0	0	0
HTRW remediation*	- - -	+++	+++	+++
Aesthetic resources***	- - -	+++	+++	+++
Cultural resources***	- - - -	+++	+++	+++
Noise*	- -	+++	+++	+++

Fakahatchee Strand State Preserve				
	Future Without	**Alt. 3D**	**Alt. 6**	**Alt. 12**
ENVIRONMENTAL QUALILTY				
Plant communities restored***	-	+	+	+
Control of invasive and exotic species***	- -	+	+	+
Fire (wild fire prevention)**	-	+	+	+
Fish and Wildlife Resources***	-	+	+	+
Wading birds*	-	+	+	+
Small mammals*	-	++	++	++
Federally listed species				
Endangered Florida panther***	- - - -	++++	++++	++++
Endangered red cockaded woodpecker**	-	+	+	+
Threatened bald eagle*	-	+	+	+
Endangered wood stork*	-	+	+	+
Endangered snail kite	0	0	0	0
Endangered American crocodile	0	0	0	0
Endangered West Indian manatee	0	0	0	0
Threatened eastern indigo snake	-	+	+	+
Endangered smalltooth sawfish	0	0	0	0
Endangered plants***	- -	++	++	++
Essential fish habitat	-	+	+	+
Soils*	-	+	+	+
Air Quality	0	0	0	0
Climate (local microclimate)*	-	+	+	+
Hydrologic restoration*	-	+	+	+
Water supply*	-	+	+	+
Water quality	0	0	0	0
Water management	-	+	+	+
Estuarine resources				
Oyster reefs	0	0	0	0
Nekton (Fisheries)	0	0	0	0
Crabs	0	0	0	0
Socio-Economic impacts				
Land use	0	0	0	0
Population	0	0	0	0
Recreational impacts	0	0	0	0
Water demand	0	0	0	0
HTRW remediation	0	0	0	0
Aesthetic resources***	-	+	+	+
Cultural resources	-	+	+	+
Noise	-	+	+	+

Florida Panther National Wildlife Refuge				
	Future Without	**Alt. 3D**	**Alt. 6**	**Alt. 12**
ENVIRONMENTAL QUALILTY				
Plant communities restored**	-	+	0	+
Control of invasive and exotic species	0	0	0	0
Fire (wild fire prevention)	0	0	0	0
Fish and Wildlife Resources***	-	+	0	+
Wading birds*	-	+	0	+
Small mammals	0	0	0	0
Federally listed species				
Endangered Florida panther**	- -	++	++	++
Endangered red cockaded woodpecker**	-	+	+	+
Threatened bald eagle*	-	+	0	+
Endangered wood stork*	-	+	0	+
Endangered snail kite	0	0	0	0
Endangered American crocodile	0	0	0	0
Endangered West Indian manatee	0	0	0	0
Threatened eastern indigo snake	-	+	0	+
Endangered smalltooth sawfish	0	0	0	0
Endangered plants	-	+	0	+
Essential fish habitat	0	0	0	0
Soils*	0	+	+	+
Air Quality	0	0	0	0
Climate (local microclimate)*	0	+	+	+
Hydrology restoration*	0	+	0	+
Water supply	0	0	0	0
Water quality	0	0	0	0
Water management	0	0	0	0
Estuarine resources				
Oyster reefs	0	0	0	0
Nekton (Fisheries)	0	0	0	0
Crabs	0	0	0	0
Socio-Economic impacts	0	0	0	0
Land use - population	0	0	0	0
Population	0	0	0	0
Recreational impacts	0	0	0	0
Water demand	0	0	0	0
HTRW remediation	0	0	0	0
Aesthetic resources*	-	+	+	+
Cultural resources	0	0	0	0
Noise	0	0	0	0

South Belle Meade CARL Lands				
	Future Without	**Alt. 3D**	**Alt. 6**	**Alt. 12**
ENVIRONMENTAL QUALILTY				
Plant communities restored***	- -	+++	++	+
Control of invasive and exotic species***	-	++++	+++	+++
Fire (wild fire prevention)**	-	+++	++	++
Fish and Wildlife Resources***	- -	+++	++	++
Wading birds*	- - -	+++	++	++
Small mammals***	-	++	+	+
Federally listed species				
Endangered Florida panther***	- -	+++	+++	+++
Endangered red cockaded woodpecker***	- -	+++	++	++
Threatened bald eagle*	-	++	++	+
Endangered wood stork*	-	+++	++	++
Endangered snail kite	0	0	0	0
Endangered American crocodile	0	0	0	0
Endangered West Indian manatee	0	0	0	0
Threatened eastern indigo snake***	- -	++	++	++
Endangered smalltooth sawfish	0	0	0	0
Endangered plants***	- -	+++	++	+
Essential fish habitat	-	+++	++	+
Soils*	-	+	+	+
Air Quality	0	0	0	0
Climate (local microclimate)*	-	+++	++	+
Hydrology restoration*	-	+++	++	+
Water supply	0	0	0	0
Water quality	0	0	0	0
Water management	0	0	0	0
Estuarine resources				
Oyster reefs	0	0	0	0
Nekton (Fisheries)	0	0	0	0
Crabs	0	0	0	0
Socio-Economic impacts	0	0	0	0
Land use - population	0	0	0	0
Population	0	0	0	0
Recreational impacts	0	0	0	0
Water demand	0	0	0	0
HTRW remediation	-	+	+	+
Aesthetic resources	-	+	+	+
Cultural resources	-	+	+	+
Noise	0	0	0	0

Collier Seminole State Park				
	Future Without	**Alt. 3D**	**Alt. 6**	**Alt. 12**
ENVIRONMENTAL QUALILTY				
Plant communities restored***	-	++	++	+
Control of invasive and exotic species***	0	+	+	0
Fire (wild fire prevention)**	0	+++	+++	+++
Fish and Wildlife Resources***	-	++	++	+
Wading birds*	-	+++	++	++
Small mammals*	-	+	+	+
Federally listed species***				
Endangered Florida panther***	-	+	+	+
Endangered red cockaded woodpecker	-	+	+	+
Threatened bald eagle*	-	+++	+++	++
Endangered wood stork*	-	+++	+++	++
Endangered snail kite*	-	+++	+++	++
Endangered American crocodile	0	0	0	0
Endangered West Indian manatee	0	0	0	0
Threatened eastern indigo snake	-	+	+	+
Endangered smalltooth sawfish	0	0	0	0
Endangered plants	-	++	++	+
Essential fish habitat	-	+++	+++	++
Soils*	-	+	+	+
Air Quality	0	0	0	0
Climate (local microclimate)*	-	+++	+++	++
Hydrology restoration*	-	+++	+++	++
Water supply	0	0	0	0
Water quality	0	0	0	0
Water management	0	0	0	0
Estuarine resources				
Oyster reefs	0	0	0	0
Nekton (Fisheries)	0	0	0	0
Crabs	0	0	0	0
Socio-Economic impacts	0	0	0	0
Land use - population	0	0	0	0
Population	0	0	0	0
Recreational impacts	0	0	0	0
Water demand	0	0	0	0
HTRW remediation	0	0	0	0
Aesthetic resources	-	+	+	+
Cultural resources	0	0	0	0
Noise	0	0	0	0

6.7.7 Comparison of Screening Analysis and Final Analysis

The discussion of the MIKE SHE hydraulic and hydrologic model in Section 6.6.1 described that the MIKE SHE model was upgraded between the third iteration of screening and the final evaluation of alternatives. The newer model included improved input data, was better calibrated, and was better able to produce results suitable for flood impact analysis. One may ask whether the two versions of the model would produce similar results for ecosystem benefits. The PDT performed many of the same habitat unit calculations on the output of the screening model for Alternatives 3D, 6, and 12 as was done for the final analysis of Alternatives 3D, 6, and 12. The results are compared in **Table 6-18**. The Biota and Hydrology average annual habitat units for Alternatives 3D, 6, and 12 are very close to each other. For nekton and oyster, the absolute numbers differ between screening and final, but in both cases Alternatives 3D and 6 are close to each other, with Alternative 12 lower.

Since the results are consistent for the four outputs for the three alternatives that were modeled during screening and final, the team expects that if other alternatives were also modeled, then they would also produce similar results with the two models. This suggests that if the final model had been available and used during the screening analysis, similar habitat unit results would have been calculated and the same screening decisions would have been made.

6.8 EVALUATION OF ALTERNATIVE PLANS

6.8.1 Introduction

The major purpose of the SGGE study is ecosystem restoration. As such, Sections 6.6 and 6.7, which address ecosystem changes under various alternatives, contain much detailed information. Section 6.8.2 summarizes these two large parts of the report. The subsequent subsections of Section 6.8 summarize some of the other impact areas. These topics are addressed in more detail in the appendices.

6.8.2 Summary of Environmental Evaluation

The hydrologic performance measures of the predicted ground water well data (Section 6.7.2.1) did not show dramatic differences among Alternatives 3D, 6, and 12. They did show that 3D would perform closest of the three alternatives to the pre-development condition.

TABLE 6 - 18 COMPARISON OF HABITAT UNITS AND ECOSYSTEM BENEFITS FROM THE FINAL ANALYSIS MODEL OUTPUT AND THE SCREENING ANALYSIS MODEL OUTPUT

	Average Annual Habitat Units Without Project	Average Annual Habitat Units **Alternative 3D**	**Alternative 3D** Average Annual Lift/Benefit	Average Annual Habitat Units **Alternative 6**	**Alternative 6** Average Annual Lift/Benefit	Average Annual Habitat Units **Alternative 12**	**Alternative 12** Average Annual Lift/Benefit
Biota - Final	35,692	47,531	11,839	46,090	10,397	46,450	10,758
Biota - Screening	30,076	45,055	14,979	44,694	14,618	45,055	14,979
Hydrology - Final	20,753	49,807	29,054	45,063	24,310	44,471	23,718
Hydro - Screening	21,347	49,217	27,870	43,880	22,533	44,473	23,126
Nekton - Final	35	540	505	560	525	500	465
Nekton - Screening	37	919	882	919	882	894	857
Oyster - Final	0.6	7.88	7.28	8.16	7.56	7.31	6.71
Oyster - Screening	0	15	15	15	15	8	8

The second subject of analysis is hydrology and major plant communities. This analysis relies on the established relationship between major plant communities and the average depth of inundation during the growing season (Section 6.6.2, ***Table 2-1***). The acres of different vegetation communities under pre-development, existing, future without, Alt 3D, Alt 6, and Alternative 12 were shown (Section 6.7.2 and ***Table 6-7***). Alternative 3D would provide the greatest number of acres of wetland vegetation communities, followed by Alternatives 12 and 6. Alternative 3D also would produce a pattern of the five major vegetation communities that more closely matched the pre-development pattern than did the other alternatives.

The third assessment was the presentation of inland ecosystem benefits (Section 6.7.3 and **Table 6-10**). Benefits are the difference of the average annual habitat units under the restoration alternative and the Future Without Project condition. The PDT used the South Florida Assessment Methodology to estimate habitat units. Alternative 3D provided the most hydrology benefits and the most biota benefits. Alternative 6 provided the second most hydrology benefits and third most biota benefits. Alternative 12 provided the third most hydrology benefits and the second most biota benefits. These habitat units are used for cost effectiveness analysis and incremental cost analysis later in this report.

The fourth subject is the assessment of how well each alternative achieves the performance measure targets for open water nekton in the estuaries (Section 6.7.4 and **Table 6-11**). Alternative 6 performs best, with the number of months with flows below lower limit critical flows or above upper limit critical flows. Alternative 3D is second and Alternative 12 is third.

The fifth analysis is on performance measures for oyster reefs (Section 6.7.4). The Oyster Index values for Faka Union Bay (**Table 6-12**) showed that Alternatives 6 and 3D were tied, and Alternative 12 was poorest of the three alternatives. A rank score of the similarity indices showed that Alternatives 3D and 6 performed similarly overall. Alternative 3D was closest to the reference condition for wet season and Alternative 6 was best during the dry season. Analysis of the average similarity indices for the three bays showed that Alternative 3D was best for Faka Union Bay, Alternative 6 was best for Pumpkin and Blackwater Bays. (Section 6.7.4)

The sixth subject is the quantification of the gain, or benefit, of estuary features that would occur under each alternative (Section 6.7.5, Table 6-16). The analysis of habitat units was based on the similarity index. Alternative 6 would produce the greatest number of habitat units for estuary open water nekton and for oyster reef habitat. Alternative 3D is second and Alternative 12 is third for both

of these benefit categories. These habitat units are used for cost effectiveness analysis and incremental cost analysis later in this report.

6.8.3 Water Supply Benefits

Municipal And Industrial Water Supply

A planning constraint throughout the development of the SGGE system components has been that Municipal & Industrial water supply will not be decreased with the plan implemented as compared to without the plan in place. No reduction in the amount of water available to municipal and industrial properties would be caused by implementation of the plan. Groundwater levels in SGGE may rise as a result of the alternatives, in turn yielding more water for the ecosystem. Section 12 provides more information on water supply.

Agricultural Water Supply

The agricultural land present in the SGGE surrounding is located primarily in the Belle Meade Agricultural Area and consists of row crops. Groundwater is the main source of water used for agricultural irrigation in the SGGE study area. In addition, the farms of the Belle Meade Agricultural Area currently use a system of ditches and pumps to reduce groundwater levels during certain times of the year. The four drainage canals in the SGGE study area are not used as a source for water irrigation. An extensive effort has been undertaken to ensure that the there would be no adverse effect of the restoration project on agricultural water supply. This was one of the constraints of the project, and surface and groundwater modeling have both demonstrated that there will be no reduction or increase in water to the agricultural lands in any of the alternatives that were evaluated.

Groundwater levels will rise in the Belle Meade lands located between the agricultural areas and SGGE. The higher groundwater levels may reduce the likelihood of saltwater intrusion into the agricultural area. This increase in groundwater levels would in effect be a measurable, albeit minimal benefit. This economic benefit was not quantified for this study.

6.8.4 Fiscal Impacts

There are tax implications of the various impacts. These include the additional revenue that would accrue to the state due to new corporate profits from local construction companies, the profits of the local companies engaged in monitoring, and the increase in agricultural profits due to the gains from modified water deliveries. The spending of the increased earnings of newly employed workers would result in increased local and state sales taxes.

The biggest loss of county tax revenue may be from the transfer of land from residential uses, which are currently on the tax rolls. The land that is being lost is mostly undeveloped land, and the value of the land is relatively low, leading to only a minor offset in county tax revenue. Some of this loss would be offset by the increase in eco-tourism, birding, fishing, and other industries based on the restoration of the watershed natural areas and estuary.

6.8.5 Recreation Resources

Alternatives 3D, 6 and 12 would ultimately increase recreational resource opportunities such as fishing and bird watching. Alternative 6 has additional water quality components that would create a healthier sustainable estuary resulting in increased fisheries production. In addition, all these alternatives rehydrate thousands of acres of impacted land, ultimately restoring these areas and allowing increased recreational opportunity. This healthy ecosystem would offer increased fishing, canoeing, boating, birding, etc. The natural areas would offer hiking, birding, and aesthetic opportunities. Illegal activities on the SGGE study area lands will ultimately decrease due to the lack of access and hydrated land.

6.8.6 Real Estate Evaluation

6.8.6.1 Underlying Concerns

The team's focus in determining real estate interests required for the Project was the knowledge that implementation of CERP must be consistent with both Federal and applicable state law in general, including NEPA and the Takings Clause of the 5th Amendment. Additionally state law requires that CERP project components meet all legal responsibilities under F.S. 373.1501 for water supply, water quality, flood protection, threatened and endangered species and other water or natural resources. Further, on December 11, 2000 the Water Resources Development Act of 2000 (WRDA 2000) was signed into law by the President of the United States (Public Law No. 106-541, of the 106th Congress). WRDA 2000 section 601(h)(5) prohibits the implementation of the Plan from eliminating or transferring existing legal sources of water without replacing them by a new source of water of comparable quantity and quality as that available on date of enactment. It also prohibits implementation of the Plan from reducing levels of service for flood protection that were in existence on date of enactment and in accordance with applicable law. The Programmatic Regulations for the Everglades (33 CFR §§ 385.5 and 385.35-37) require a programmatic guidance memorandum on existing legal sources of water, and a determination of the pre-CERP baseline conditions and direction about what constitutes "levels of service for flood protection … in accordance with applicable law" existing on date of enactment of WRDA 2000. These formal processes will involve extensive coordination with federal, State and local agencies, the South

Florida Water Management District, Tribes, stakeholders in CERP, and the public. Both of these processes also require concurrence by the Secretary of Interior and the Governor of the State of Florida. The guidance memorandum, the pre-CERP baseline, and direction about what constitutes "levels of service for flood protection" are still being developed. Among the fundamental questions being considered are whether private drainage canals are "levels of service of flood protection … in accordance with applicable law," what the baseline conditions are throughout the extent of CERP, and which hydrology indicators should be used to compare with project conditions to the pre-CERP baseline. In the absence of this information, the team considered potential impacts during the screening process *as if* Savings Clause issues were involved. Any other risks and uncertainties that may be impacted by the Savings Clause will be addressed during later stages of the Project, as necessary.

6.8.6.2 Review of Background Data

To better understand the hydrology of the Project area, a quick review of its history was performed. Prior to anthropogenic impacts, the area was characterized by seasonal flooding several months of the year, with a broad slow-moving sheet flow that sustained wetland vegetation and rejuvenated freshwater aquifers. Significant alterations of the hydrologic regime and vegetative communities occurred within SGGE CARL Area when cypress-logging operations began in the 1940s and 1950s. Land drainage activities began in southwest Florida with the diversion and channelization of the Caloosahatchee River, which later culminated in the 1960s development of Golden Gates Estates ("GGE"). Construction of I-75 divided the study area into Northern Golden Gate Estates ("NGGE") and SGGE. This historic drainage area has been reduced due to construction of roads, canals, urban expansion, and agricultural development.

The purpose of performing site specific hydrologic modeling was to determine whether flooding conditions on the lands would be changed as a result of the SGGE Project alternatives. Each land area impacted was subjected to a fact-intensive analysis based on current beneficial uses. The specific analyses performed are described below.

In performing the legal analysis to determine potential impacts to lands including and adjacent to the SGGE CARL area on alternatives 3D, 6 and 12, a uniform procedure was followed. The information utilized included groundwater impacts, stage impacts, and outstanding private interests in the potentially impacted areas. The groundwater impacts were based on the average wet season With Project conditions. The stage and duration impacts were based on model runs of the Without Project existing (2000 Land Use) condition compared against the average wet season, 10 year, 25 year, and 100 year storm events.

The PIR team did not assume that private drainage canals fall within the Savings Clause. However, in the event that drainage canals are eventually determined to fall within levels of service of flood protection of the Savings Clause, the PIR team proceeded to compare the impacts of the three main alternatives, 3D, 6 and 12, with the Dec. 2000 conditions. This analysis was based on model runs on the December 11, 2000 condition (Current Condition), which contained an existing fixed crested weir structure in the Faka Union Canal (Existing FU-4). Groundwater impacts were not considered to be within the Savings Clause since, pursuant to §13-9 of the Digest of Water Resources Policies and Authorities, there was no generic program for groundwater-induced flood damages. Additionally, there was no specific federal, state, or local project in this area providing protection from groundwater-induced damages at the date of enactment. However, groundwater-induced damages were analyzed in the Legal analysis.

The other analyses (Predicted With-Project and Predicted Without-Project) were based on model runs with a soon-to-be-built replacement to the Existing FU-4 structure, which will be a gated spillway, with a lower crest elevation. According to our study partner SFWMD, they have funds programmed for FY05 to replace the Existing FU-4 structure.

When the model runs were completed the raw data was transferred to SFWMD for post-processing. That data in turn was uploaded to a shared site for the Corps' review. In addition to simply reviewing that post-processed data, EN-H selected several representative cross sections along the canals within the SGGE CARL Area and NGGE areas and creeks in the adjacent park areas. Those cross sections were surveyed in the year 2002 and were compared against the raw data from the MIKE SHE model to produce stage and duration data for the legal analysis.

At the same time, data was compiled on private ownerships surrounding the SGGE CARL area. Several field visits were performed by Corps staff to confirm private ownerships, uses, access, and whether potential impacts would be significant and adverse under a Savings Clause or Florida Statutes Section 373.1501 type of analysis or effectively an ouster based on Takings case law. Significant attention was given to private parcels in the Belle Meade area that will be hydrologically impacted. The more frequently impacted parcels appear to be unimproved and perpetual flowage easements will be obtained for those areas. Other impacted areas in the Belle Meade area will only require an occasional flowage easement as predicted impacts will only occur during a 100-year event. While it currently does not appear that access to the Belle Meade area will be sufficiently compromised to require curative action, further analysis will be performed as necessary during the Planning, Engineering and Design ("PED") Phase of the project.

6.8.6.3 Groundwater Impacts

In reviewing the groundwater impacts, the focus of the analysis was the difference between the existing Without Project average wet year and the With-Project average wet year. Storm event differences were also reviewed, but those impacts did not exceed what was already evident from the existing With-Project runs. Figures have been provided showing the hydrologically impacted areas. See Figures A-36 and A-47 through A-190 in Appendix A. Groundwater levels for the existing With-Project condition alone show substantial increase in the SGGE CARL area, in most areas south of the pump stations a greater than 2 foot increase. However, throughout the areas north of the pump stations there are also significant groundwater impacts of between 1 and 2 foot. Increases of up to 1 foot cover substantial portions of Belle Meade and Ten Thousand Islands, with some areas in Belle Meade seeing up to a 2 foot increase. The groundwater increases in Belle Meade occur largely on unimproved parcels with existing hydrological impacts. A perpetual flowage easement would have to be acquired for those areas as needed. The impacts in Ten Thousand Islands occur on lands already hydrologically impacted. While there are some groundwater impacts on alternatives 3D and 12 just north of I-75 on the Miller and Faka Union canals of between ½ and 1 foot, these groundwater increases are not in areas that would results in damage to private property. Therefore, no real estate interest is needed in NGGE for Alternatives 3D and 12. Similarly, alternative 6 has groundwater impacts, but given the extensive stage and durational impacts seen over a 14,224 acres in NGGE, groundwater impacts take a secondary position.

6.8.6.4 Surface Water Impacts

In reviewing surface water impacts, close attention was paid to differences between the 2000 land use (Current) condition, the new FU-4 condition, and the projected With-Project conditions for the Average Wet Season, 10, 25, and 100-year storm events. Particular care was taken to ensure that the analysis accurately captured how much wetter the Project would make an already quite wet situation. For instance, many of the access routes to private ownerships are impacted even today, and certainly during the rainy season. Therefore, the analysis, in relation to statutory and other authority, focused on whether the degree to which the Project made a particular condition worse. When looking at the year 2000 runs, that difference in water depth and duration had to be both significant and adverse to the current use of the property to be considered a potential impact under the Savings Clause in the event that the Savings Clause eventually was determined to be applicable to drainage provided by private canals. Similarly, when looking at the difference in the new FU- 4 conditions across the four events modeled in order to comply with state requirements (F.S. 373.1501(c)(3)(D)), impacts were measured against whether the differences seen would more adversely impact private owners outside of the Project area. The

Legal Analysis, while also looking at the more immediate impacts, went much further in analyzing the long-range effects of the Project on private ownerships. As noted below, some private property owners would be hard-pressed to prove an ouster type of situation when currently a big storm would make access impossible, back up septic, and/or cause water intrusion into first floor elevations.

In the SGGE CARL area itself there will be sufficient stage and durational hydrological impacts in the With Project condition on all three alternatives to require a perpetual flowage easement over most of the area. These impacts occur both above and below the pump stations, though the ones below the pump stations occur more frequently and remain for a longer duration. Figures have been provided showing the hydrologically impacted areas. See figures A-119 to A-190 in Appendix A. Currently, this has been provided as a percentage of the total Project area. As already mentioned above, the entire SGGE CARL area will be impacted by increases in both surface water and/or groundwater.

The types of ownerships found the Fakahatchee Strand State Preserve ("Fakahatchee") areas that are hydrologically impacted are elevated recreational structures Current access is extremely limited and the only real change predicted is in the depth of the water beneath the structures. A field visit in March 2004 during the dry season found only one of five recreational structures identified in the impacted areas between the alternative 3D, 6, and 12 analyses dry enough to physically hike to for inspection. The one that was accessible by foot required a half hour traipse each way over a barely-discernable path to an unpermitted, unsecured, raised structure with few amenities. Therefore, compensation associated with those impacts are nominal, as indicated in the Real Estate Appendix.

Similarly, the few remaining private ownerships in Ten Thousand Islands National Wildlife Refuge ("Ten Thousand Islands"), with the exception of Port of the Islands, which will be protected by a levee, are already susceptible to elevated water levels during rainy seasons and storm events. The remaining private parcels in that area will not be impacted to an extent necessary to require a cure under a Savings Clause or Florida analysis, or a take under existing state and federal case law. The same can be said for the few remaining private ownerships in the Collier Seminole State Park ("Collier").

The Belle Meade State Conservation and Recreation Lands Projects area ("Belle Meade") presents a more complicated picture. There are a number of private ownerships in Belle Meade. Some have been identified under a "willing seller" type of program for acquisition. However, a significant number have also been given assurances that they will be neither acquired nor impacted. Unfortunately, some of those parcels that were given those assurances will be

impacted by increased groundwater, stage and/or durational flows during storm events. The majority of these parcels are currently unimproved and farming operations have already ceased. Perpetual flowage easements will be acquired in this area. Further north in the Belle Meade area there are several homes and/or businesses whose underlying parcels will experience increased hydrological activity. However, all structures that are in compliance with current building codes for septic and first floor elevations will not be impacted. Further, of the structures that were visible without physically accessing the properties, they too should not be impacted. However, those low spots on the properties that are currently susceptible to surface water and groundwater impacts will continue to experience such impacts to a greater degree in both depth and duration. For those properties an occasional flowage easement will be acquired. Finally, while access routes will be impacted in Belle Meade, it will not be to an extent significantly more than currently experienced. However, access issues will again be evaluated during the PED Phase of the Project.

One team objective was to protect the lands located within the 6L Farms levee. Extensive modeling was performed to adequately assess interior drainage and seepage requirements for construction of the levee. For a discussion and figures please see Appendix A, Figures A-45, A-182 and A-191. Given the design of the levee, those protected lands will not be adversely impacted by the Project.

Another one of the team's objectives was to avoid impacts north of I-75 in the NGGE area. The team has been successful in that effort for alternatives 3D and 12. Many iterations of the model were run to evaluate water control structure operations and operations of the pumps. For Alternative 3D to meet the stated objective, it was necessary to increase the total cfs capacity of both the Miller and Faka Union Canal Pump Stations to 1250 cfs and 2630 cfs, respectively. Further, with 8 bays in the Faka Union and 6 in the Miller, flow regulation was increased thus improving the overall efficiency of the system and avoiding drainage of jurisdictional wetlands to the north. Therefore, with alternative 3D, no lands in the NGGE area will be impacted by the Project.

The NGGE impacts seen on Alternative 6 are simply a function of plugging the canals and having no pumps or other means to send the additional water where it needs to go. Field analysis in May of 2004 showed substantial residential tracts in the impacted areas and new construction ongoing. Tax assessments in the NGGE area have gone up approximately 20% in the last year alone. In the residential locations closest to the I-75, the impacts could include damage to first floor elevations. The further the north from I-75, the impacts will be to septic systems and access. Clearly, the potential cost increase that would be required to either purchase or cure the impacted lands in NGGE would be substantial. Equally critical is the need to protect jurisdictional wetlands in and around the impacted areas. The current Incremental Cost Analysis includes sufficient

information on private ownerships to complete the planning process.

As the study team developed information on how certain project features seem to generate impacts in corresponding geographical areas, the study team looked back over the other alternatives that fell out in earlier screenings. Thus far, the assumptions made in those cases have proven accurate and we have found no need to pull back in previously discarded alternatives. We will continue to confirm the basis of those decisions as we develop additional data.

6.8.6.5 Real Estate Constraints

In addition to analyzing hydrological impacts to the SGGE CARL area, the study team determined that restrictions and prohibitions on the use of the SGGE CARL area lands were required. The team also determined that management measures were also required to insure the lands were environmentally restored. The following constraints were applied to alternatives 3D, 6 and 12 in the SGGE CARL area. The constraints, prohibitions and restrictions on private use include, but were not limited to, the following:

a) A prohibition of livestock was required. The negative effects of allowing cattle, horses, or other livestock on the natural areas will result in continued grazing on desirable upland and wetland plants and the production of manure which can degrade surface and ground water quality on site and off site. Restrictions would allow landowners to use low-density livestock on a temporary basis to control exotic species. Only temporary fencing would be allowed. Assistance from a grazing professional would be required to determine for each parcel the timing and number of livestock. The small size of each parcel would require very short-term use probably measured in terms of days in order to not devastate the native vegetation. Providing road or trail access to each of the grazed parcels would in itself be very detrimental to the ecosystem. Wetlands created by the Project would have to be fenced off to exclude livestock. Permanent fencing like roads reduces ecosystem values. No public agency could take on the management of this number of separate grazing plans. Cattle could still impact upland habitats if they had access and potential expected habitat units may be not realized over existing conditions.

b) A prohibition of all agricultural activity was required. High intensity farming activities, such as row or field crops, sod, citrus, ornamental plants, etc are inconsistent with wetland or upland restoration and would be prohibited. These types of land cover provide poor wildlife habitat. The unrestricted use of pesticides and fertilizers can negatively affect Habitat Units both on site and off site and would therefore be prohibited. Some low intensity type lumbering or other forestry related activities might be appropriate to promote vegetative restoration. Planting and eventual thinning of native pine seedlings and

saplings could enhance the restoration of historic pine flatwoods. Activities such as removal and even commercial sale for landscaping of invasive species such as the cabbage palm might be incorporated into a restoration plan without significantly altering upland habitat units gained. However managing programs for logging or farming with easements on privately held estates would be daunting for any land management agency.

c) A prohibition of new construction activity was required. The Habitat Units were calculated assuming that the infrastructure of the subdivision would be removed leaving behind only those structures necessary for the requirements of the managing agency and to provide for acceptable public recreational use. Providing access to any of the parcels would require the maintenance of some portion of the 279 miles of roads. The elimination of the road system, easy vehicle access, and human presence on both the wetlands and uplands provide the most important ecosystem benefits with which the Habitat Units were calculated. The maintenance of existing structures and the construction of new structures (homes, buildings, roads, parking lots, and utilities) on any of the parcels would cause a significant reduction of the calculated Habitat Units. By allowing homes or other buildings to remain or to be constructed within SGGE CARL Area, access to the sites would have to be maintained. Removal of portions of existing roads was imperative to restoration.

d) A prohibition on the extraction of minerals or water, or the application of municipal sludge on site was required. These are generally inconsistent with restoration activities planned for the natural areas. The extraction of minerals or water, are generally inconsistent with the restoration activities planned for the SGGE. Habitat Units were calculated assuming that no further mineral, surface, or ground water extraction would occur. If build out on easement parcels occurred, the need for fill material and well water would contribute to as much as a 100% loss of Habitat Units in affected wetlands and a 50% loss in potential Habitat Units in affected uplands. The managing agency might be able to allow restricted groundwater withdrawals for surrounding communities without affecting the calculated Habitat Units.

e) Some restriction of public and private access was be required. Some activities like hiking and fishing would be allowed with the assumption that they would only have minimal impacts on calculated habitat units. Intensive unfettered public access would likely have detrimental effects on the ecosystem. Habitat units were calculated on the assumption that portion of public roadway would be removed and much of the remaining roadways would be restricted. The remaining secondary roads would be restricted seasonally to motorized vehicles. Off road vehicle use would be prohibited. Easements on the private land would need to account for this restricted public access.

There was a requirement for land management activities for restoration. These types of activities are necessary for full restoration of the SGGE CARL Area as envisioned. If the activities were not conducted then there would be a loss of potential habitat units that would have been gained. These activities include contaminant remediation, fire management, and exotic species control.

6.8.6.6 Real Estate Interests and Costs

The real estate costs for alternatives 3D, 6 and 12 were based on the above analysis for each alternative and on a determination of lands required for construction of project features both inside the SGGE CARL area and outside the SGGE CARL area, lands impacted hydrologically by construction and/or operation of Project both inside the SGGE CARL area and outside the SGGE CARL area, and lands within the SGGE CARL area required to achieve the environmental/ecological benefits. Based on the hydrological impacts combined with other prohibitions, restrictions and management measures being taken in the area to promote restoration, it was determined that fee title was the required estate for all three alternatives within the SGGE CARL area.

For Alternative 3D, it was determined that fee would be required over all the lands within the SGGE CARL area (55,247 acres), and 334 acres required for construction of levees outside the SGGE CARL area. A perpetual flowage easement would be required over approximately 9,021 acres in Belle Meade CARL Area due to hydrologic impacts. Total estimated real estate costs, which included cost of lands, costs of improvements, relocation payment costs, and administrative costs associated with the acquisition of the lands was $250,408,000.

For Alternative 6, it was determined that fee would be required over all the lands within the SGGE CARL area (55,247 acres), and 334 acres required for construction of levees outside the SGGE CARL area. A perpetual flowage easement would be required over approximately 4,547 acres in Belle Meade CARL Area due to hydrologic impacts. Additionally, modeling showed hydrologic impacts to approximately 14,224 acres in Northern Golden Gate Estates, north of I-75, requiring acquisition of a perpetual flowage easement and possible cure or acquisition of a substantial number of improved properties. Total estimated real estate costs, which included cost of lands, costs of improvements, relocation payment costs, and administrative costs associated with the acquisition of the lands was $686,832,000.

For Alternative 12, it was determined that fee would be required over all the lands within the SGGE CARL area (55,247 acres), and 334 acres required for construction of levees outside the SGGE CARL area. A perpetual flowage easement would be required over approximately 2,137 acres in Belle Meade CARL Area due to hydrologic impacts. Total estimated real estate costs, which

included cost of lands, costs of improvements, relocation payment costs, and administrative costs associated with the acquisition of the lands was $240,537,000.

While Alternative 12 impacted less acres in Belle Meade CARL Area than Alternative 3D, the acres impacted by Alternative 12 were in the drier areas and were higher in value.

6.8.7 Costs of Alternatives

Data for initial construction/implementation, land acquisition, monitoring, and periodically recurring costs for OMRR&R (operation, maintenance, repair, replacement, and rehabilitation), have been developed through engineering design and cost estimation, and real estate appraisal efforts. Details of the data development for initial construction/implementation are explained and discussed in Appendix C, details of the data development for monitoring costs are explained and discussed in Appendix H, and details for data development for periodically recurring costs for OMRR&R (operation, maintenance, repair, replacement, and rehabilitation) are explained and discussed in Appendix C of this report. The main issues requiring economic evaluation attention include equivalent time basis calculations, price levels, and timing of project spending.

Costs represent the difference between conditions without any plan (the "base condition", or "without-project condition") and with a plan or alternative. For purposes of this report and analysis, NED costs (National Economic Development Costs, as defined by Federal and Corps of Engineers policy), are expressed in 2003 price levels, and are based generally on costs estimated to be incurred over a 50 year period of analysis. Costs of a plan represent the value of goods and services required to implement and operate/maintain the plan.

The timing of a plan's costs is important. Construction and other initial implementation for component costs cannot simply be added to periodically recurring costs for project operation, maintenance, and monitoring. Also, construction costs incurred in a given year of the project can't simply be added to construction costs incurred in other years if meaningful and direct comparisons of the costs of the different components are to be made. A common practice of equating sums of money across time with their equivalent at an earlier single point in time is the process known as discounting. Through this mathematical process, which involves the use of an interest rate (or discount rate) officially prescribed by Federal policy for use in water resource planning analysis (currently set at 5.625% per year), the cost time stream for the alternative plans were mathematically translated into a equivalent time basis value.

Engineering Regulation (ER) 1105-2-100 requires that interest during construction (IDC) be computed which represents the opportunity cost of capital

incurred during the construction period. Interest was computed for construction and PED costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date. All alternatives have the same real estate IDC amounts, due to the same land being needed for construction and the same certification dates, including the real estate IDC, would amount to a linear increase in costs for all alternatives which would have no influence on the incremental analysis. For the Recommended Plan Section (Section 8), interest during construction was computed for real estate from the date the lands are expected to be certified for the project. For the SGGE lands, there are two certification dates. The first on the lands that are need for construction, the second will be for the remaining lands, which will be certified when construction is completed and benefits begin.

The cost of a project is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial costs such as real estate and PED plus interest during construction. The following ***Table 6-19*** summarizes the total investment cost and total annual equivalent costs of each alternative plan.

TABLE 6 - 19 SUMMARY OF COSTS OF ALTERNATIVE PLANS

	Alternative 3D	Alternative 6	Alternative 12
Construction Cost	$95,164,200	$44,216,700	$93,942,800
Pre-construction Engineering & Design	$8,071,300	$3,486,300	$7,962,500
Construction Management	$8,968,800	$3,873,800	$8,846,300
Construction subtotal	$112,204,200	$51,576,800	$110,751,600
Lands	$250,408,000	$686,832,000	$240,537,000
Initial Cost	$362,612,200	$738,408,800	$351,288,600
Interest During Construction	$20,824,951	$11,866,023	$20,610,430
Total Project Investment	$383,437,251	$750,274,823	$371,899,030
Interest and Amortization	$23,063,143	$41,311,856	$22,369,137
Operation and Maintenance	$2,129,000	$175,000	$1,498,000
Monitoring	$700,000	$700,000	$700,000
Total Annual Equivalent Costs	$25,892,143	$42,186,856	$24,567,137

- IDC for real estate was not included in the plan selection screening. All alternatives have the same real estate IDC amounts, due to the same land being needed for construction and the same certification dates, having no influence on the incremental analysis. IDC for real estate was included for the Recommended Plan in the Recommended Plan section (SECTION 8).
- Alternative 3D costs were updated as part of the detailed design of the recommended plan, and were not included in the plan selection process, but are included in the Recommended Plan section (SECTION 8) of the main report.

Note: Columns may not add due to rounding.

6.8.8 ECONOMIC EVALUATION

The Regional Input-Output Structure

The regional impacts analyzed in this report have been estimated using information from the U.S. Department of Commerce's Regional Input-Output Modeling System (RIMS II). RIMS final demand multipliers provide a way to estimate the consequences of economic activity stimulated by project implementation. Final demand multipliers can be thought of as a way to calculate the economic impact dollars spent by one industry on all industries in a given economy. For example, one dollar spent in one industry will generate financial activity for another industry within a community; that is, to purchase food, clothing, housing or other goods, or to pay taxes.

The types of economic impacts that a new project can have on output (sales), earnings, and employment in a region are known as "direct," "indirect," and "induced." The first round of expenditures for the project causes direct impacts. The indirect impacts count the inputs that are purchased as a result of the first round expenditures. Indirect effects will vary in significance depending on the complexity of production in the study area and the degree to which local producers supply required materials. Induced impacts are the cumulative economic effects that result from the spending of the workers' earnings. These three impacts combine to form the final demand impacts of a project in the study area.

In assessing the impacts presented in this report, the limits of the RIMS methodology should be recognized. The data used to develop the RIMS II multipliers were based on 1992 regional economic data. These data may not capture the variances in today's economy, but should provide a reasonable impact estimate. Proper use of the RIMS II 1992 multipliers requires that total cost estimates first be price-adjusted to 1992 price level using a CORPS published construction index (Civil Works Construction Cost Index System (CWCCIS) 31 Mar 2001). The effects of the costs at the 1992 level were then calculated, using the 1992 RIMS II multipliers. These impacts were then price-adjusted to 2003 figures by utilizing the appropriate CPI index published by the Bureau of Labor Statistics.

Keeping these limitations in mind, it is important to recognize that RIMS multipliers are based on a formal and widely accepted national analysis of economic activity. The RIMS analysis continues to provide a consistent method to quantify the economic impact of construction projects at the regional level.

Overall Impacts: Output (Sales), Jobs, And Earnings

The impact of all the categories of expenditure on gross output (sales), jobs, and earnings were computed for each alternative. The impacts represent the effects resulting from construction spending during project implementation and will occur during the construction period, expected to last 4 years beginning in 2006.

At first glance the figures from the following ***Table 6-20*** look like enormous impacts resulting from the construction spending required to implement the various project components. When placed in the context of Collier County, however, these effects generally represent a very small percentage of the total economic activity taking place in this region.

TABLE 6 - 20 OVERALL REGIONAL ECONOMIC IMPACTS OF THE SOUTHERN GOLDEN GATE ESTATES ALTERNATIVES

Alternative	Project Component	Impacts			Project Costs ($)
		Output ($1,000's)	Earnings ($1,000's)	Employment (FTE)	
ALT 3D	Construction	194,110	78,016	2,662	112,204,200
	O & M (Annual)	3512	1593	53	2,129,000
ALT 6	Construction	89,226	35,861	1,224	51,576,700
	O & M (Annual)	388	131	4	175,000
ALT 12	Construction	191,597	77,006	2,628	110,751,600
	O & M (Annual)	2471	1121	38	1,498,000

It is important to remember that the construction is not a one-year injection into the regional economy, but will be broken up over a number of years. The effects of the annual spending on the regional economy will prove even less significant than viewing the expenditures in total. Since the impacts are likely to occur in varying magnitude over time, the summary effects given in ***Table 6-20*** represent the upper limit if all these impacts were to occur simultaneously. In reality, the impacts of the construction last only as long as those activities are carried out. The impacts represent the effects resulting from construction expenditures during project implementation that is expected to last four years beginning in 2006. The impacts of the monitoring and operation-maintenance costs begin at a relatively low level at the time the project is initiated, rise to a maximum, and then continue at a constant level once the project is completed.

These effects are noteworthy, but the relative impact on the regional economy is quite small, mirroring the estimate regional impact of the overall CERP project estimated in the Comprehensive Review Study.

When comparing the impacts of construction, as shown in ***Table 6-21***, to the actual total figures for the counties and state, it is important to recognize that the latest earnings data available were from 2000 census data. These figures have increased since 2000, but are considered sufficient for this analysis. It should be noted that these calculated comparison percentages will appear larger than the actual representative percentages based on up to date earnings and output data, meaning the impact will not be as great. The comparison percentages of the total regional economy to construction impacts involved in the various projects are represented in the following table. The total output (sales) for the counties and the Southwest Region is not available at this time. The total output for the state of Florida will be used for this generalization. The impacts are compared to the figures of the respective region.

TABLE 6 - 21 CONSTRUCTION IMPACTS VS. ACTUAL DEMOGRAPHIC FIGURES

Alternative		Employment	Earnings ($1,000s)	Output ($1,000s)
ALT 3D	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	2,662 375,307 0.71%	$78,016 $26,444,402 0.30%	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$194,110 $442,895,000 .04%
ALT 6	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	1,224 375,307 0.33%	$35,861 $26,444,402 0.14%	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$89,226 $442,895,000 .02%
ALT 12	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	2,628 375,307 0.70%	$77,006 $26,444,402 0.29%	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$191,597 $442,895,000 .04%

6.8.9 Cost Effectiveness And Incremental Cost Analyses

Cost effectiveness and incremental cost analyses (CE/ICA) reveal information about good financial investments given the dollar costs and non-dollar outputs ("benefits") of alternative investment choices. The analyses are conducted in a series of steps that progressively identify alternatives that meet specified criteria and screen-out those that do not. Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration.

Cost effectiveness analysis begins with a comparison of the costs and outputs of alternative plans to identify the least cost plan for every possible level of output considered. The resulting least cost alternative plans are then compared to identify those that would produce greater levels of output at the same cost, or at a lesser cost, as other alternative plans. Alternative plans identified through this comparison are the cost effective alternative plans. Next, the cost effective alternative plans are compared to identify the most economically efficient alternative plans, that is, the "Best Buy" alternative plans that would produce the "biggest bang for the buck." Finally, the additional costs for the additional amounts of output ("incremental cost") produced by the Best Buy alternative plans are calculated. The results of all the calculations and comparisons of costs and outputs provide a basis for addressing the decision question "Is it worth it?," i.e., are the additional outputs worth the costs incurred to achieve them?

In practice, Corps ecosystem restoration studies typically measure the ecosystem benefits of alternative plans in terms of physical dimensions (number of acres of wetlands, for example), or population counts (number of wading birds, for example), or various habitat-based scores ("habitat units" based on the U.S. Fish & Wildlife Service's *Habitat Evaluation Procedures*, or "HEP", for example). Although for the Southern Golden Gate Estates project many performance measures were evaluated to ascertain how well each of the alternative plans performed on various criteria indicative of ecosystem restoration in the estuary and inland, habitat units were selected by the PDT as the metric that best integrated information regarding the quality and quantity of improved habitat for various representative species and/ or communities within the estuarine and inland ecosystems.

Sometimes it is difficult to summarize the results of CE/ICA when the analyses are performed separately on habitat units for distinct species or communities. This phenomenon often occurs simply because different management measures or alternative plans "do" different things, provide different types of output, and provide benefits to different biological communities. This is the case for the SGGE features and alternatives, in which certain features or alternatives provide greater benefits to the uplands habitats in the watershed, while other alternatives provide greater benefits for the estuary habitats. Therefore, in

addition to the four separate types of habitat units quantified (oysters, hydrology, nekton and biota) CE/ICA was also performed on two additional metrics. An estuary habitat unit was calculated as the combined habitat units for the two species of communities inhabiting the estuary (oysters and nekton). The two communities occupy two separate zones of spatial extent within the estuarine aquatic ecosystem (or at least were delineated as separate areas for the purposes of habitat unit estimation), so it is appropriate to add them together (since there is no spatial overlap) to get a better indication of total estuary output. Likewise, an inland habitat unit was calculated as the combined habitat units for the two indicators of inland (biota and hydrology).

In many cases it may be desirable to estimate benefits to both the estuary and inland added together, but in the case of SGGE, it was determined that simply examining the combined estuary and combined inland habitat units separately provided substantial data for determining the alternative that is the most economically efficient. This will be demonstrated in the various following charts and graphs. In summary, CE/ICA was performed using the following 6 metrics to represent various ecosystem outputs of the SGGE alternatives:

- Oyster habitat units
- Nekton habitat units
- Biotic habitat units
- Hydrology habitat units
- Combined Weighted Average uplands habitat units
- Combined estuary habitat units

Cost effectiveness and incremental cost analyses were conducted for each of the SGGE alternative plans. The analyses compared the alternative plans' average annual costs against the appropriate average annual habitat unit estimates. The average annual outputs were calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2060). The without-plan habitat units, with alternatives habitat units and lift calculations are provided in ***Table 6-22***.

The total cost of CERP is not included in this cost effectiveness and incremental cost analyses. The cost of the balance of the CERP features, those not included in the SGGE alternatives, is the same for all the SGGE alternatives. As such, including it in this analysis does not bring any additional insight or differentiation between alternatives. For this analysis, the difference between the alternatives can be shown through a display of the outputs and costs of each SGGE alternative without the cost of the "other CERP" features.

TABLE 6 - 22 COSTS AND OUTPUTS USED IN COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES (VALUES FOR ALTERNATIVES ARE DIFFERENCES BETWEEN "WITHOUT" PLAN AND "WITH" PLAN ON AN AVERAGE ANNUAL BASIS)

	Average Annual Habitat Units Without Project	Average Annual Habitat Units Alternative 3D	Alternative 3D Average Annual Lift/Benefit (Difference between with and without)	Average Annual Habitat Units Alternative 6	Alternative 6 Average Annual Lift/Benefit (Difference between with and without)	Average Annual Habitat Units Alternative 12	Alternative 12 Average Annual Lift/Benefit (Difference between with and without)
Average Annual Cost			**$25,892,143**		**$42,186,856**		**$24,567,137**
SGGE	35,692	47,531	11,839	46,090	10,397	46,450	10,758
Fakahatchee	72,357	75,210	2,853	75,210	2,853	75,210	2,853
Panther	18,993	19,058	65	19,058	65	19,058	65
Belle Meade	21,564	22322	757	21,774	209	21,591	27
Collier Seminole	3,656	3,863	207	3,863	207	3,811	154
Total Biota	**152,262**	**167,984**	**15,721**	**165,995**	**13,731**	**166,120**	**13,857**
SGGE	20,753	49,807	29,054	45,063	24,310	44,471	23,718
Fakahatchee	69,740	72,145	2,405	72,947	3,207	72,145	2,405
Panther	21,704	21,953	249	21,953	249	21,953	249
Belle Meade	24,951	27,055	2,104	26,454	1,503	25,551	600
Collier Seminole	3,645	3,948	303	3,948	303	3,862	217
Total Hydrology	**140,793**	**174,908**	**34,115**	**170,365**	**29,572**	**167,982**	**27,189**
Total Nekton	**34.65**	**539.9**	**505.25**	**559.54**	**524.89**	**499.91**	**465.26**
Total Oyster	**0.6**	**7.88**	**7.28**	**8.16**	**7.56**	**7.31**	**6.71**

Note: Values assume system benefits (ecosystem outputs that would accrue to the SGGE study area if rest of CERP is constructed).

All of the environmental outputs were calculated on an average annual basis to account for the fact that several years may be required for full attainment of the functional capacities to be realized. This was performed for the expected future with and without project habitat units, which were used to calculate the average annual benefits for each ecosystem output.

Cost Effectiveness Analysis

The following sections present the results of cost effectiveness analysis for the SGGE alternative plans for respective output indicators, grouped by estuary outputs and watershed outputs. All the alternative plans are arrayed by increasing output to clearly show plans that provide the same output for less cost or more output for the same or less cost (i.e., the cost effective plans).

Cost Effectiveness Analysis – Estuary Outputs

Cost Effectiveness Analysis – Oyster Habitat Units

Table 6-23 and ***Figure 13*** show that Alternatives 3D, 6 and 12 are all cost effective in the production of oyster habitat. Alternative 6 provides a greater habitat lift than Alternative 3D, but Alternative 3D ($3,556,000/HU) has a much lower average cost per output than Alternative 6 ($5,580,000/HU).

TABLE 6 - 23 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – OYSTER HABITAT UNITS

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1000)	Cost Effective?
Plans	Oyster Habitat Units (HU)			
Without Plan	$0	0	N/A	
Alternative 12	24,567	6.71	3,661	YES
Alternative 3D	25,892	7.28	3,556	YES

Cost Effectiveness Analysis – Nekton Habitat Units

Table 6-24 and ***Figure 14*** show that Alternative 3D, 6 and 12 are cost effective in the production of neckton habitat. Alternative 3D provides a substantial amount of nekton habitat at a per unit cost of ($51,240/HU). Alternative 6 ($80,300/HU) provides only 4% more benefits at a greater than 50% increase in

cost per habitat unit. Alternative 6's higher costs stem from higher land cost due to additional land purchases required north of SGGE.

FIGURE 6 - 13 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON OYSTER HABITAT

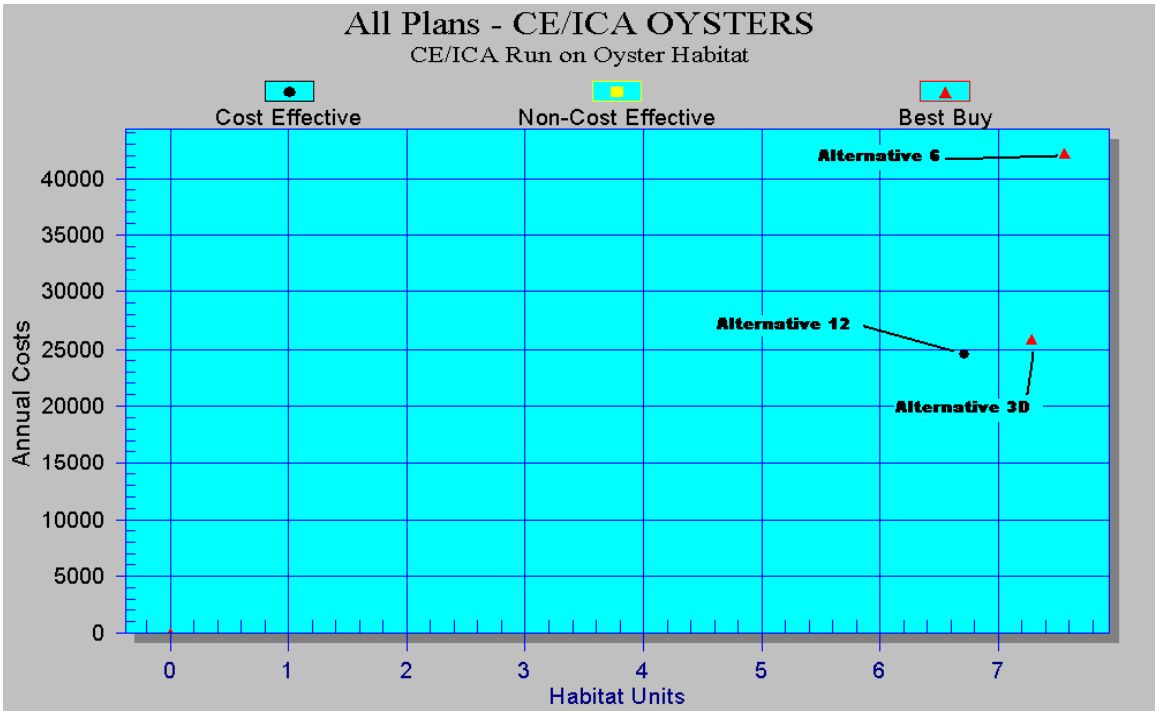
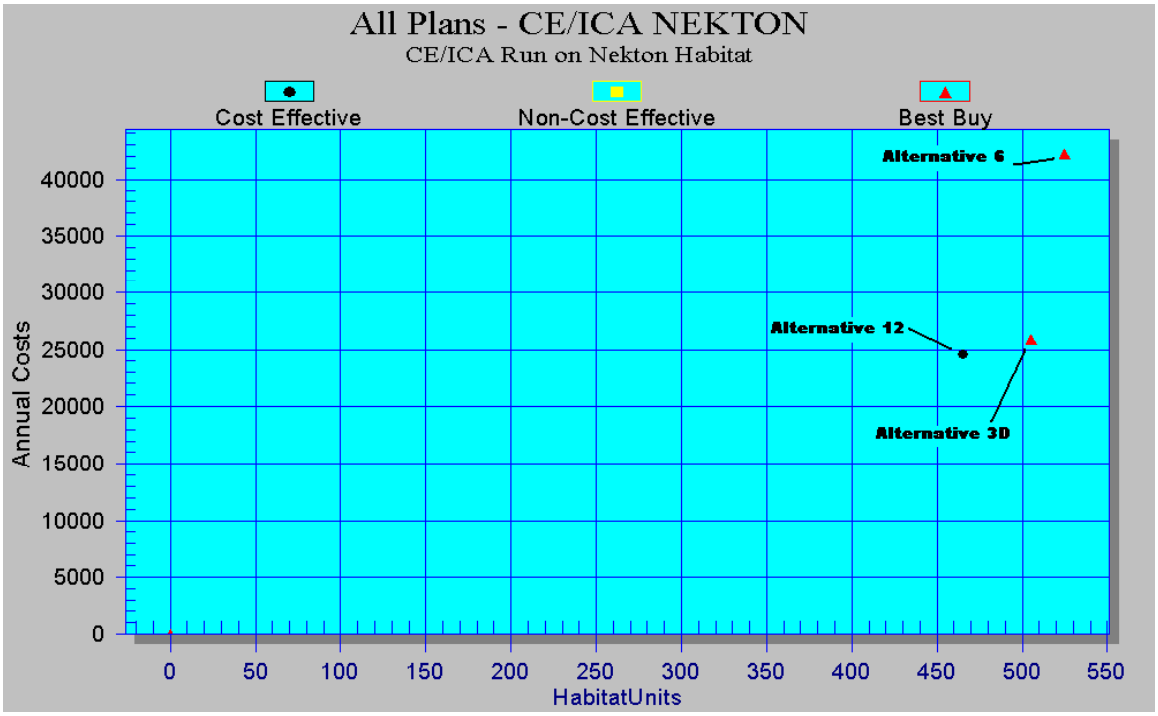


TABLE 6 - 24 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – NEKTON HABITAT UNITS

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Nekton Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	465.26	52.8	YES
Alternative 3D	25,892	505.25	51.24	YES
Alternative 6	42,187	524.89	80.38	YES

FIGURE 6 - 14 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON NEKTON HABITAT



Cost Effectiveness Analysis – Combined Estuary Habitat Units

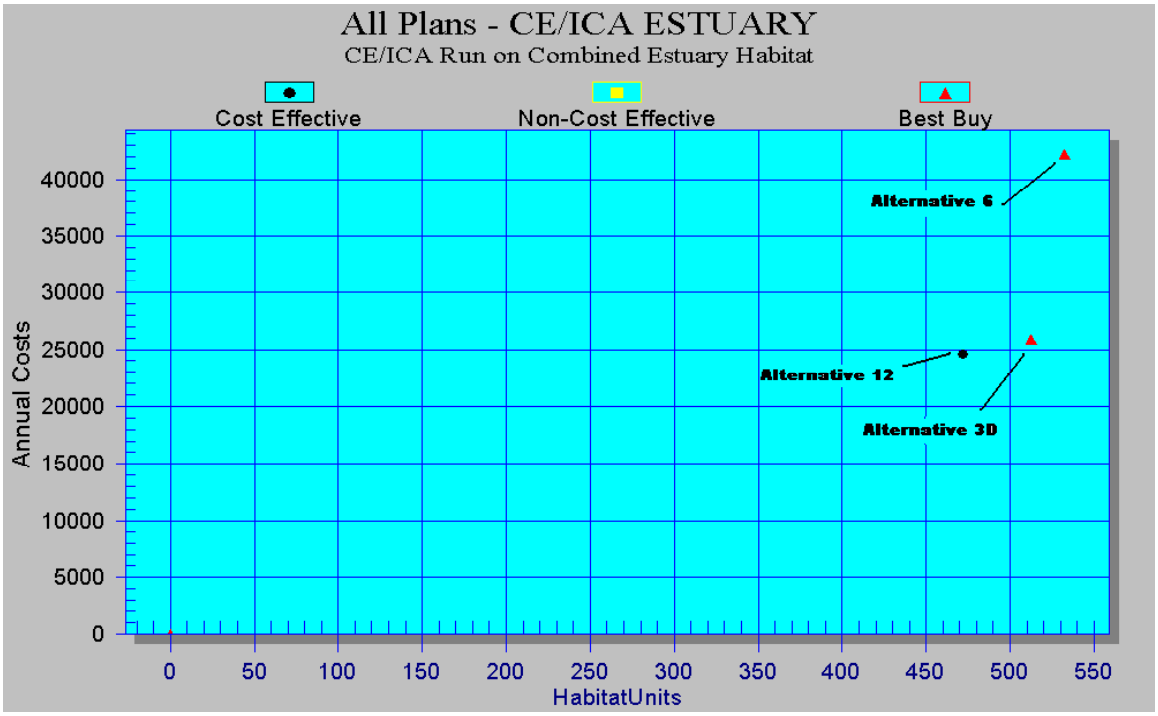
A combined estuary habitat unit was calculated as the combined habitat units for the two species or communities inhabiting the estuary (oysters and nekton). These indicators are combinable due to their relationships and distinct separable spatial extent in the estuary.

Table 6-25 and ***Figure 15*** show that Alternative 3D, 6 and 12 are cost effective in the production of estuary habitat. Alternative 3D provides a 512.54 habitat units at a per unit cost of ($52,060/HU). Alternative 6 ($79,240/HU) provides only 4% more benefits at more than a 50% increase in cost per habitat unit. Alternative 6's higher costs stem from higher land cost.

TABLE 6 - 25 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – TOTAL ESTUARY HABITAT UNITS

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	Total Estuary Habitat Units (HU)			
Without Plan	$0	0	N/A	
Alternative 12	25,567	471.97	52.06	YES
Alternative 3D	25,892	512.54	50.52	YES
Alternative 6	42,187	532.45	79.24	YES

FIGURE 6 - 15 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON TOTAL ESTUARY HABITAT



Cost Effectiveness Analysis – Inland Outputs

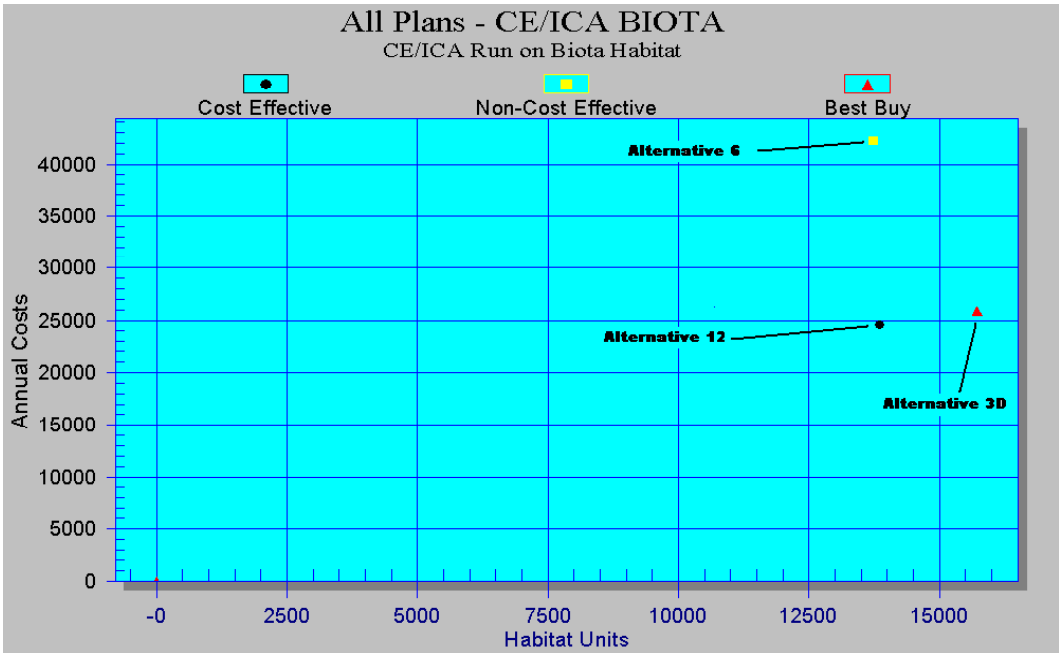
Cost Effectiveness Analysis – Biota

Table 6-26 and ***Figure 16*** show that Alternatives 3D and 12 are the only cost effective plans in producing Biota output. Alternative 6 ($1,427/HU) provides almost 2,000 fewer HU's at an average cost that is almost twice as high as Alternative 3D ($1,650/HU). Alternative 6 provides the least amount of lift at the greatest cost. Alternative 12 produces less output than Alternative 3D and at a lower cost.

TABLE 6 - 26 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – BIOTA HABITAT

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1000)	Cost Effective?
Plans	Biota Habitat Units (HU)			
Without Plans	$0	0	N/A	
Alternative 6	42,187	13,731	3.073	
Alternative 12	24,567	13,857	1.773	YES
Alternative 3D	25,892	15,721	1.65	YES

FIGURE 6 - 16 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON BIOTA HABITAT



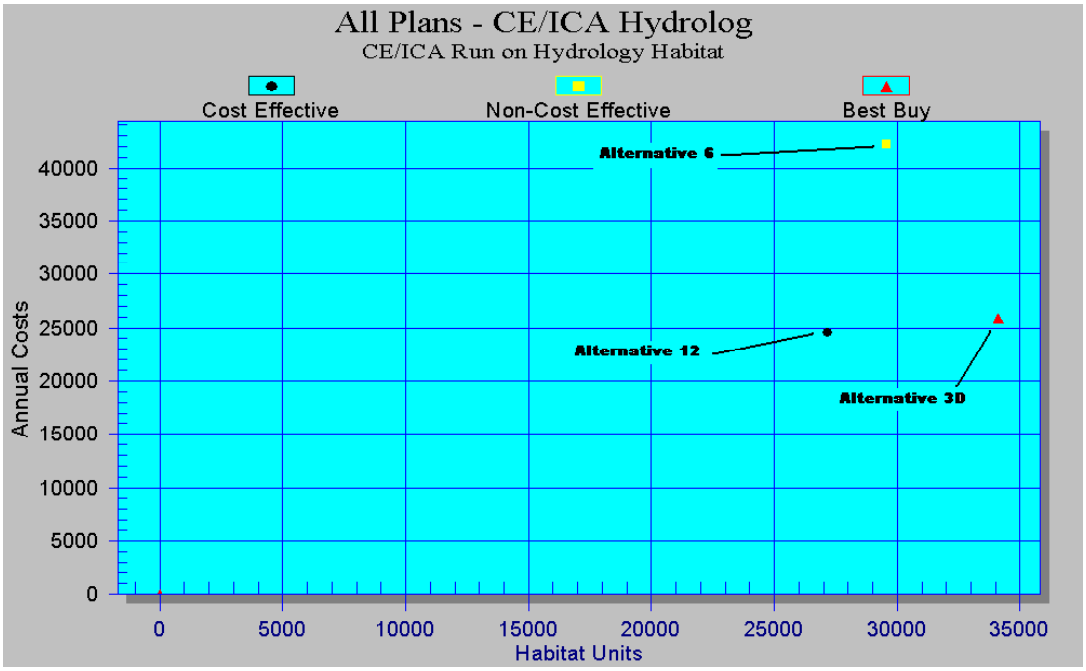
Cost Effectiveness Analysis – Hydrology

Table 6-27 and ***Figure 17*** show that Alternatives 3D and 12 are the only cost effective plans in producing Hydrology output. Alternative 6 ($1,794/HU) provides almost 5,000 less HU's at an average cost that is almost twice as high as Alternative 3D ($968/HU). Alternative 12 produces less output than Alternative 3D and at a lower cost, meeting the definition of cost effective.

TABLE 6 - 27 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – HYDROLOGY HABITAT

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Hydrology Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	27,189	0.904	YES
Alternative 6	42,187	29,572	1.427	
Alternative 3D	25,892	34,114	0.76	YES

FIGURE 6 - 17 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON HYDROLOGY HABITAT



Cost Effectiveness Analysis – Combined Inland Habitat Units

An inland habitat unit was calculated as the combined habitat units for the two communities inhabiting the watershed (biota and hydrology). The hydrology and biota habitat were calculating using the same acreage, therefore requiring a weighted average to determine the total inland habitat units. The team of scientists calculating the habitat units for SGGE determined that both hydrology and biota were of equal importance, meriting both plans be assigned an equal weight of one. In order to obtain the total inland habitat units, the habitat units created from hydrology were added to the habitat units created from biota and averaged.

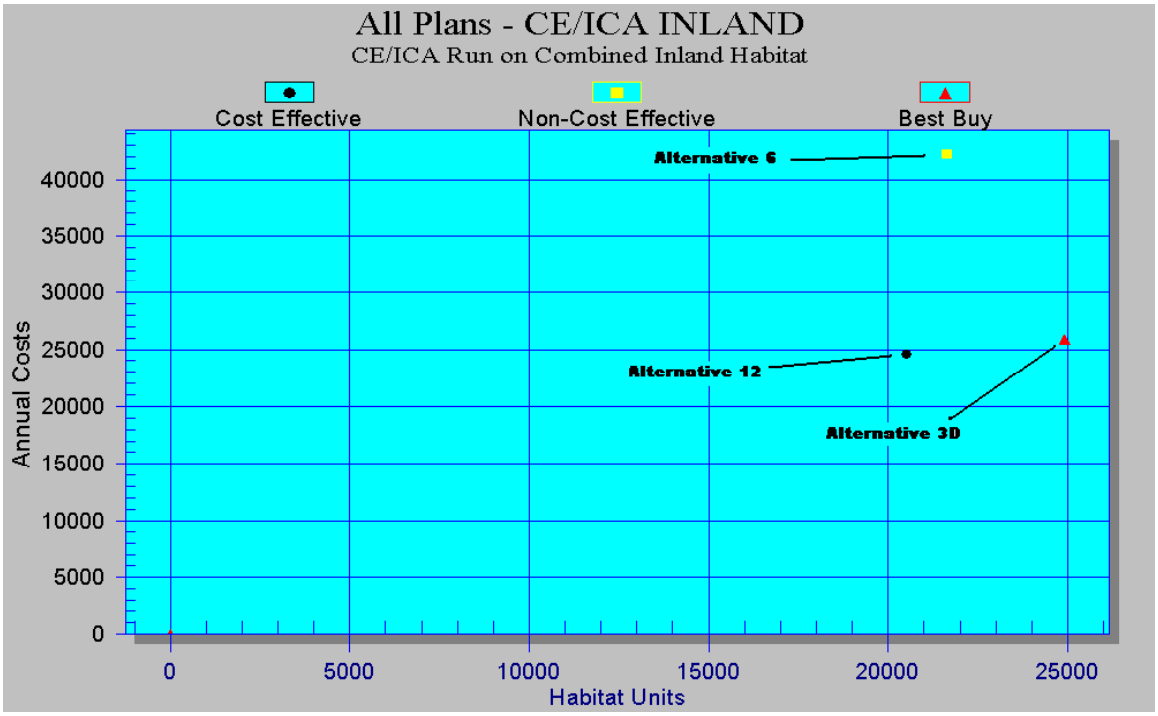
Weighted Inland Total Average = ((Hydrology HU's) + (Biota HU's)) / 2

Table 6-28 and ***Figure 18*** show that Alternatives 3D and 12 are the only cost effective plans in producing combined inland output. Alternative 6 ($1,949/HU) provides more than 3,000 less HU's at an average cost per unit of output that is almost two times greater than Alternative 3D ($1,039/HU). Both Alternatives 12 and 6 produce less output than Alternative 3D. Alternative 12 produces less output and costs less than Alternative 3D, making it a cost effective plan.

TABLE 6 - 28 RESULTS OF COST EFFECTIVENESS ANALYSIS: ALL PLANS & COST EFFECTIVE PLANS ARRAYED BY INCREASING OUTPUT FOR EACH OUTPUT CATEGORY – INLAND HABITAT COMBINED

	Average Annual Cost ($1,000)	**Output**	**Average Cost Per Output ($1,000)**	**Cost Effective**
Plans	Combined Inland Habitat Units (HU)			
Without Plan	$0	0	N/A	
Alternative 12	24,567	20,523	1.1979	YES
Alternative 6	42,187	21,651	1.949	
Alternative 3D	25,892	24,917	1.039	YES

FIGURE 6 - 18 SGGE ALTERNATIVE PLANS - CE/ICA RUN ON COMBINED INLAND HABITAT



Incremental Cost Analysis

Tables 6-29 through 6-34 and ***Figures 6-19 through 6-24*** present the results of incremental cost analysis for the SGGE alternative plans for respective output indicators. All the cost effective plans are arrayed by increasing output to clearly show changes in cost (i.e., increments of cost) and changes in output (i.e., increments of output) of each cost effective alternative plan compared to the Without Plan condition. The plan with the lowest incremental costs per unit of output of all plans is the first Best Buy plan. After the first Best Buy plan is identified, all larger cost effective plans are compared to the first Best Buy plan in terms of increases in (increments of) cost and increases in (increments of) output. The alternative plan with the lowest incremental cost per unit of output (for all cost effective plans larger than the first Best Buy plan) is the second Best Buy plan. There are no more than two Best Buy plans for any output indicator for the SGGE alternatives.

Incremental Cost Analysis – Estuary Outputs

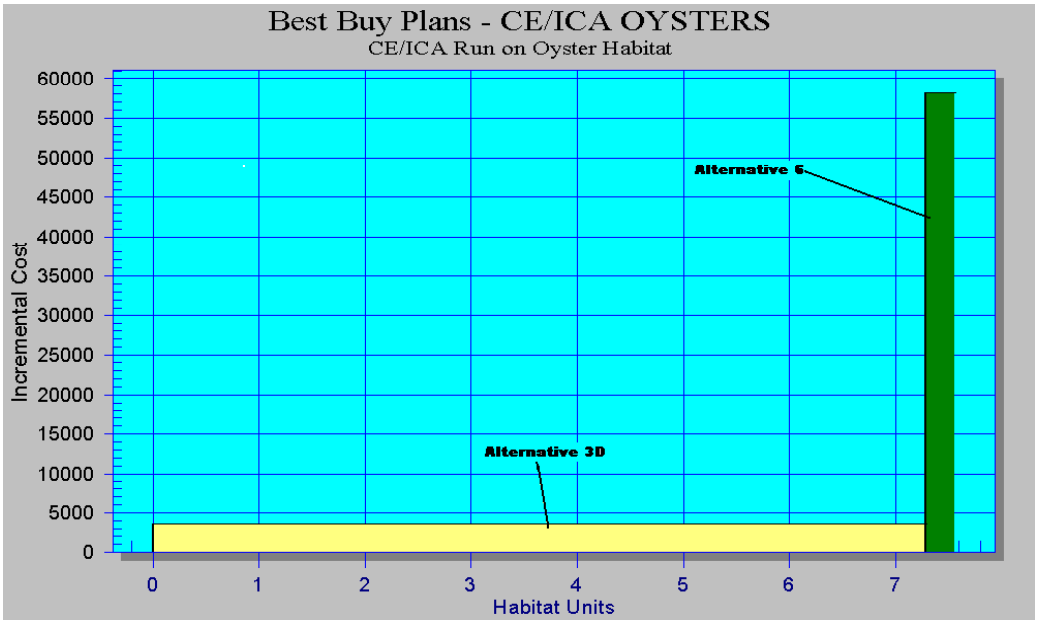
Incremental Cost Analysis – Oyster Habitat Units

Table 6-29 and ***Figure 19*** show that there are two Best Buy plans for oyster habitat, Alternative 3D and Alternative 6. Looking at the box graph an obvious spike occurs between Alternatives 3D and 6. This spike reflects that Alternative 6 only produces .28 more habitat units at an average annual cost that is over $15,000,000 more than Alternative 3D. Alternative 3D produces 96% of the oyster benefits that Alternative 6 does, yet Alternative 6 cost greater than 60% more than Alternative 3D.

TABLE 6 - 29 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT FOR OYSTER HABITAT

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	7.28	3,556	25,892	7.28	3,556	1st Best Buy
Alternative 6	42,187	7.56	5,580	16,295	.28	58,202	2nd Best Buy

FIGURE 6 - 19 BEST BUY PLANS FOR OYSTER HABITAT



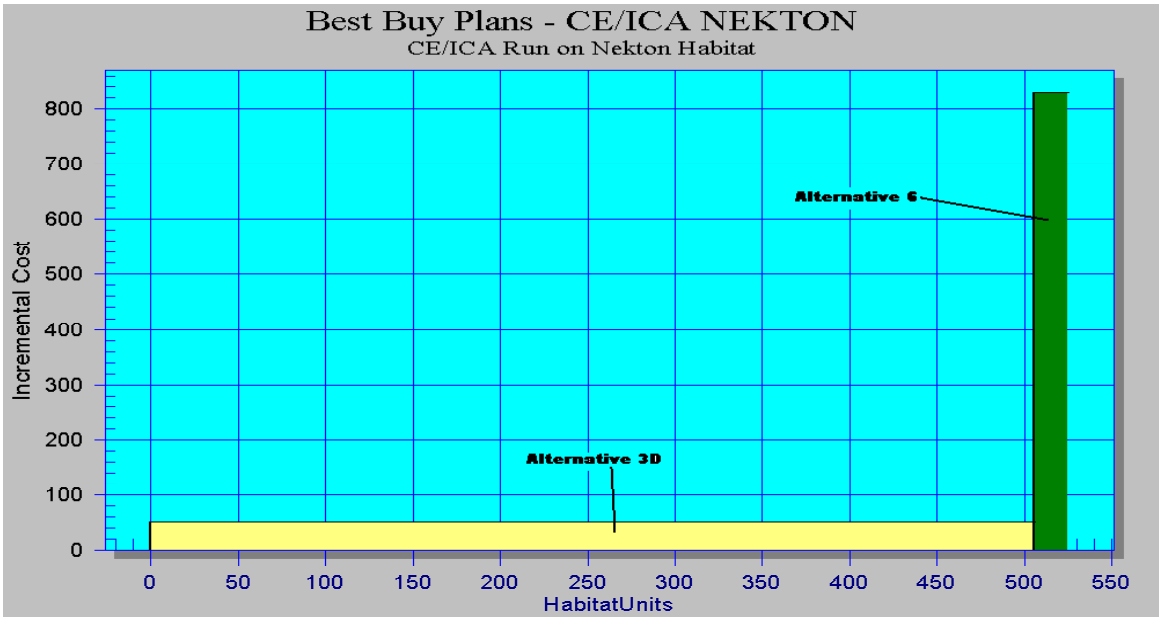
Incremental Cost Analysis – Nekton Habitat Units

Table 6-30 and ***Figure 20*** show that there are two best buy plans for nekton habitat, Alternatives 3D and 6. Alternative 3D has the lowest incremental costs per unit of nekton output of any of the alternatives ($51,250 per HU). This stands to reason, as this alternative does not include the real estate costs for the area north of Southern Golden Gate Estates. The next best alternative in terms of nekton habitat is Alternative 6. It provides an increment of 19.64 additional HU's over Alt 3D (at a high incremental cost of $829,770 per unit of nekton habitat), and has a higher average costs ($80,380 per HU). Alternative 6 has an incremental cost per unit of output that is over 16 times greater than Alternative 3D's.

TABLE 6 - 30 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT FOR NEKTON HABITAT

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Incremental Avg. Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
NEKTON HABITAT UNITS (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	505.25	51.25	25.892	505.25	51.25	1st Best Buy
Alternative 6	42,187	524.89	80.38	16,295	19.64	829.77	2nd Best Buy

FIGURE 6 - 20 BEST BUY PLANS FOR NEKTON HABITAT



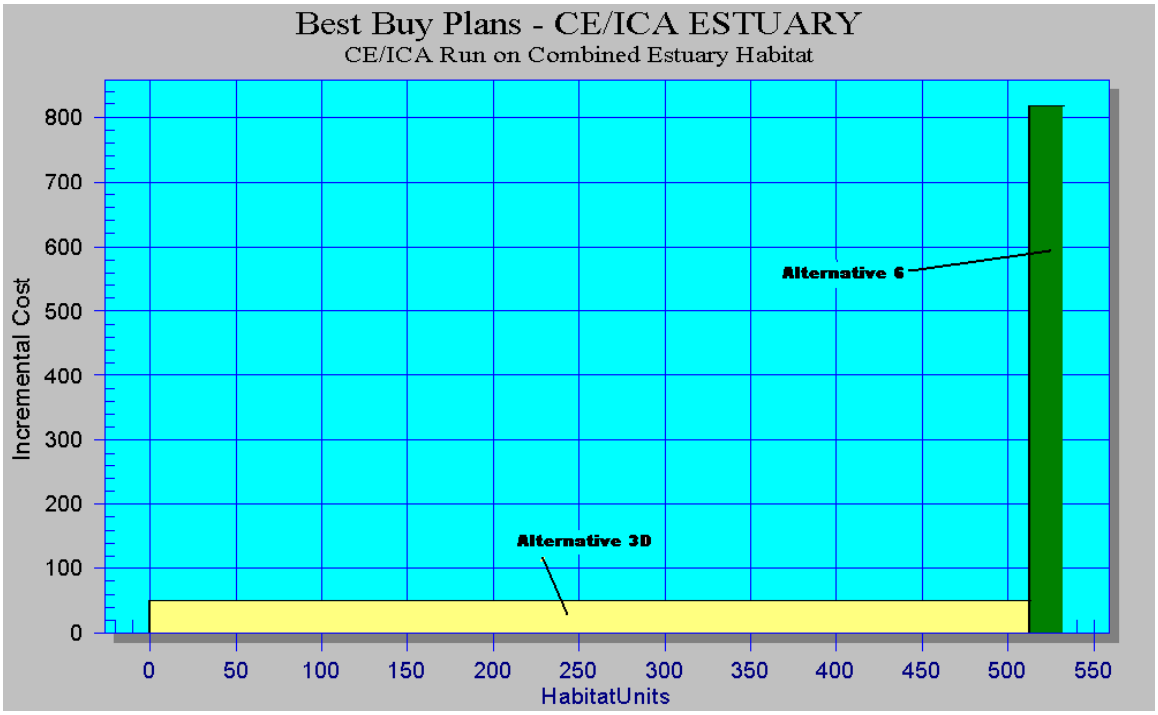
Incremental Cost Analysis – Combined Estuary Habitat Units

Table 6-31 and ***Figure 21*** show that there are two best buy plans for combined estuarine habitat, Alternatives 3D and 6. As with both the nekton and oyster best buy box graphs, the same spike can be seen when going from Alternative 3D to Alternative 6. Alternative 3D has the lowest incremental costs per unit of combined estuarine output of any of the alternatives ($50,520/HU). This stands to reason, as this alternative does not include the real estate costs for the area north of Southern Golden Gate Estates, and can be ascertained that since Alternative 3D had the lowest incremental costs per unit of estuarine outputs separately it would also when combined. The next best alternative in terms of combined estuarine habitat is Alternative 6. It provides an increment of 19.91 additional HU's over Alt 3D (at a high incremental cost of $818,110/habitat unit), and has a higher average costs ($79,240 per HU). Alternative 6 does provide the most total estuarine habitat units (532.45), but it is important to note that it is producing fewer than 4% more estuarine benefits at a cost that is more than 60% greater than Alternative 3D.

TABLE 6 - 31 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT FOR TOTAL ESTUARY HABITAT

	Average Annual Cost ($1000)	**Output**	**st. Per. Output ($1000)**	**Incremental Average Annual Cost ($1000)**	**Incremental Output**	**Incremental Cost Per Output ($1000)**	**Best Buy**
Combined Estuary Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	512.54	50.52	25,892	512.54	50.52	1st Best Buy
Alternative 6	42,187	532.45	79.24	16,295	19.91	818.11	2nd Best Buy

FIGURE 6 - 21 BEST BUY PLANS FOR COMBINED ESTUARY HABITAT



Incremental Cost Analysis – Inland Outputs

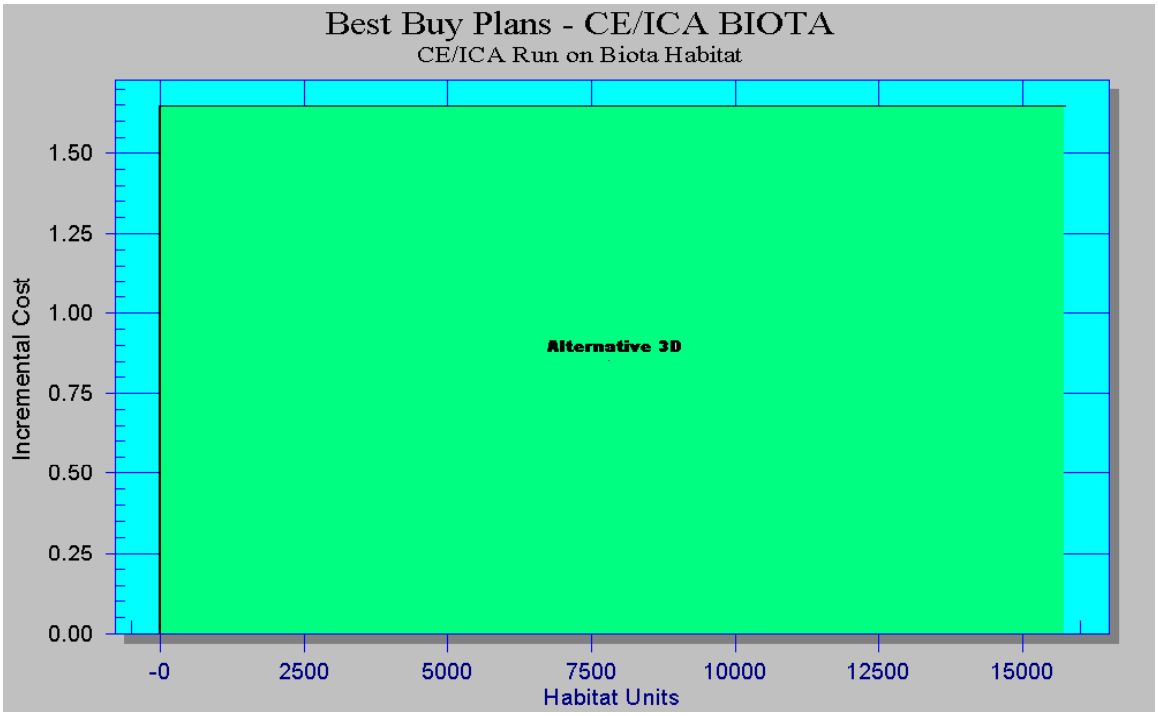
Incremental Cost Analysis – Biota Habitat Units

Table 6-32 and ***Figure 22*** show that there is one Best Buy plan for biota habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

TABLE 6 - 32 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Biota Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	$25,892	15,721	1.65	25,892	15,721	1.65	Only Best Buy

FIGURE 6 - 22 BEST BUY PLANS FOR BIOTA HABITAT



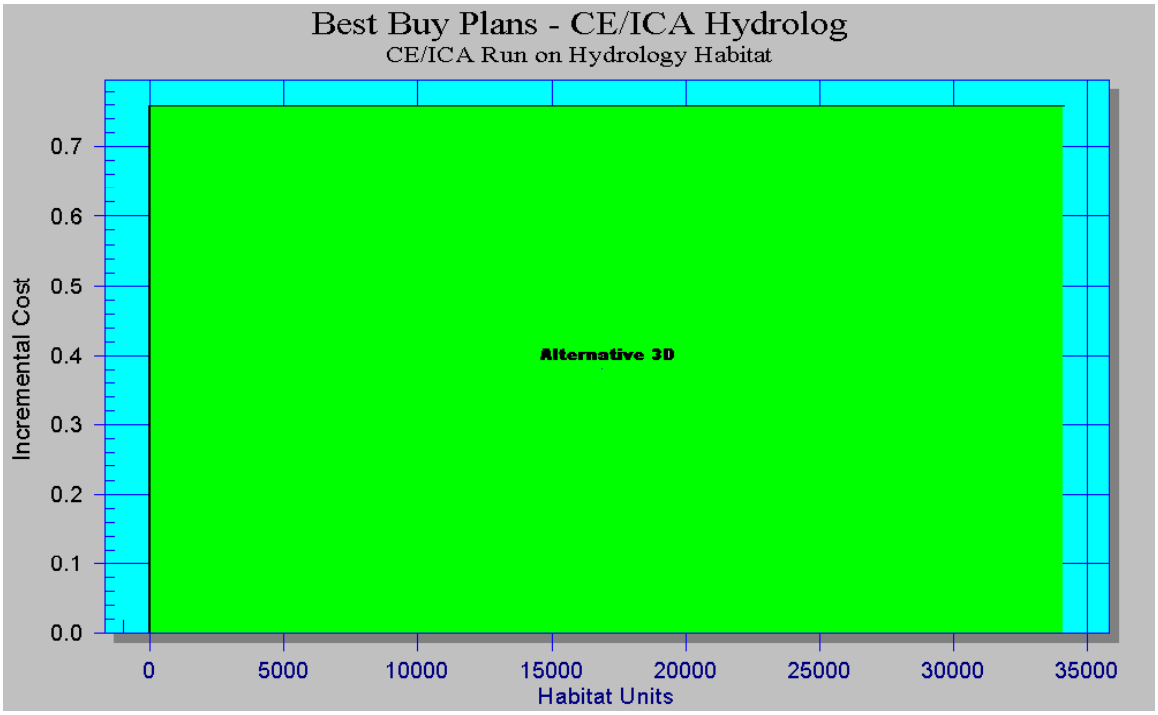
INCREMENTAL COST ANALYSIS – HYDROLOGY HABITAT UNITS

Table 6-33 and ***Figure 23*** show that there is one Best Buy plan for hydrology habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

TABLE 6 - 33 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT FOR HYDROLOGY HABITAT

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Coast ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Hydrology Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	$25,892	34,114	0.759	25,892	34,114	0.759	Only Best Buy

FIGURE 6 - 23 BEST BUY PLANS FOR HYDROLOGY HABITAT



Incremental Cost Analysis – Combined Inland Habitat Units

Table 6-34 and ***Figure 24*** show that there is one Best Buy plan for combined inland habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

TABLE 6 - 34 RESULTS OF INCREMENTAL COST ANALYSIS: COST EFFECTIVE & BEST BUY PLANS ARRAYED BY INCREASING OUTPUT FOR COMBINED INLAND HABITAT

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Combined Inland Habitat Unit (HU)							
Without Plan	0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	24,197	1.039	25,892	24,917	1.039	Only Best Buy

FIGURE 6 - 24 BEST BUY PLANS FOR COMBINED INLAND RESTORATION

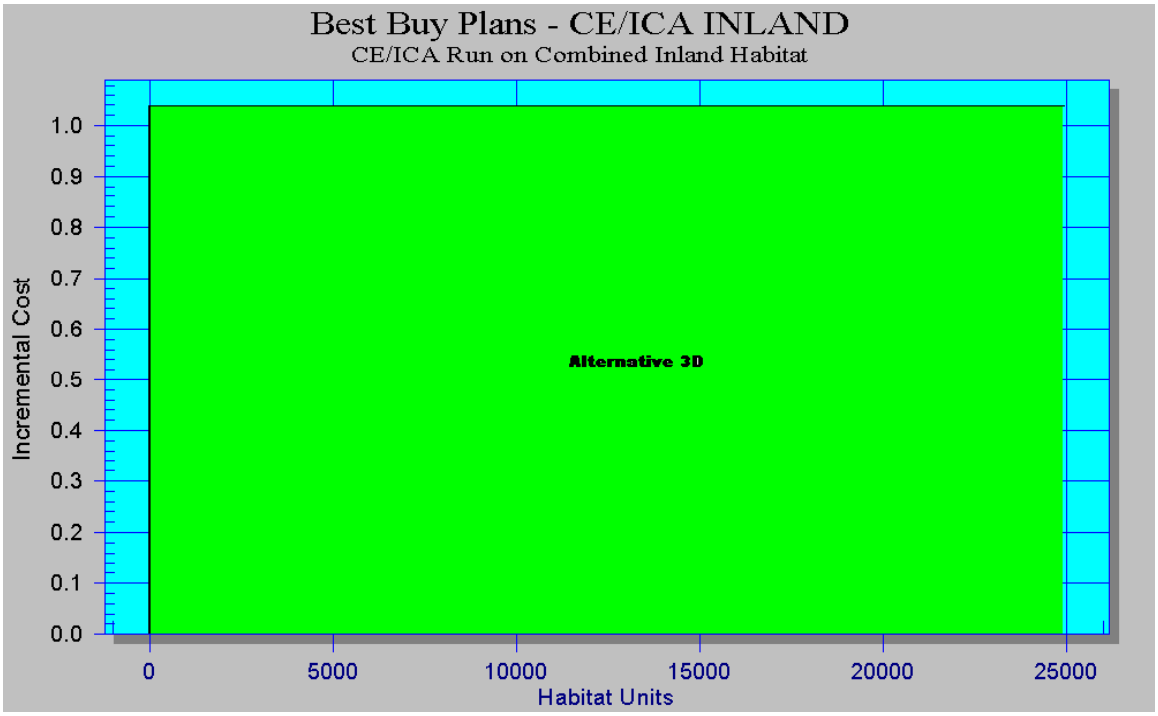


Table 6-35 below summarizes the results of cost effectiveness and incremental cost analyses for all the ecosystem outputs and metrics used in the analyses. As can be noted from the table below, Alternative 3D is the only alternative that is both cost effective and a best buy for all habitat categories. Alternative 6 costs almost 300 million dollars more than Alternative 3D, while only providing 4% more estuarine benefits. Conversely, alternative 6 has a 70% increase in total cost over Alternative 3D, and actually provides 15% less inland benefits.

These figures assisted in answering the question of "Is it Worth It?" Looking at inland habitat units, is it worth paying more for Alternative 6 to obtain less benefits? This answer to this question is a resounding no. Examining estuarine habitat units, is it worth paying 70% more for less than a 4% increase in benefits. Once again, the answer is no, the small increase in benefits do not warrant the enormous extra expense. This substantial increase in price, relatively large decrease in inland habitat units and minor increase in estuarine habitat units leads to the logical conclusion of screening Alternative 6 from further consideration.

TABLE 6 - 35 RESULTS OF COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES

Variable	Alt 3D	Alt 6	Alt 12
Oyster Habitat	Cost Effective Best Buy	Cost Effective Best Buy	Cost Effective
Nekton Habitat	Cost Effective Best Buy	Cost Effective Best Buy	Cost Effective
Total Estuary Habitat	Best Buy	Cost Effective Best Buy	Cost Effective
Biota Habitat	Cost Effective Best Buy		Cost Effective
Hydrology Habitat	Cost Effective		Cost Effective
Total Inland Habitat	Cost Effective Best Buy		Cost Effective

6.8.10 Evaluation of Objectives

Table 6-36 illustrates how each of the alternatives addresses each of the Planning Objectives from Section 5 of this report.

6.8.11 Evaluation of Planning Criteria

Corps of Engineers policy (ER 1105-2-100) requires the use of four screening criteria in the screening and evaluation of alternative plans. The criteria are acceptability, completeness, effectiveness, and efficiency. These four criteria are defined in the following paragraphs. **Table 6-37** presents the results of assessing each alternative by the planning criteria.

Acceptability is the workability and viability of the alternative plan with respect to acceptance by Sate and local entities and the public and compatibility with existing laws, regulations, and public policies. One aspect of acceptability is whether the alternative is feasible or doable with regard to technical, environmental, economic, social, or similar reasons.

Completeness is the extent to which an alternative plan includes and accounts for all necessary investments or other actions to ensure the realization of the planned effects.

TABLE 6 - 36 HOW EACH OF THE ALTERNATIVES ADDRESSES EACH OF THE PLANNING OBJECTIVES

	Planning Objectives	Alternative 3D	Alternative 6	Alternative 12
1	Reestablish natural freshwater flows to estuary	Second greatest reduction of discharge from Faka Union canal. 512 total estuarine habitat units	Greatest reduction of discharge from Faka Union canal. 532 total estuarine habitat units	Some reduction of discharge from Faka Union canal. 472 total estuarine habitat units
2	Restore historic hydropatterns, including sheet flow and flow ways	33,616 average annual hydrology habitat units	29,572 average annual hydrology habitat units	26,228 average annual hydrology habitat units
3	Reestablish natural plant distribution and composition	15,461 average annual biotic habitat units	13,471 average annual biotic habitat units	13,413 average annual biotic habitat units
4	Increase surface aquifer recharge	Greatest area with increase of ground water elevation. Increases throughout SGGE.	Increased ground water level in southern SGGE but limited increase in northern SGGE.	Increased ground water level in eastern SGGE but limited increase in western SGGE.
5	Restore habitat for listed species	Roadless areas for panther. Retain minimum upland areas for panther & indigo snake. Wet areas for wood stork, snail kite.	Similar to 3D for roadless areas and minimum upland areas. Fewer wet areas for wood stork and snail kite.	Similar to 3D for roadless areas and minimum upland areas. Fewer wet areas for wood stork and snail kite.
6	Increase fish and wildlife resources	15,461 average annual biotic habitat units	13,471 average annual biotic habitat units	13,413 average annual biotic habitat units
7	Restore ecological connectivity and provide contiguous habitat protection to adjacent public lands	All three plans increase connectivity.	See 3D	See 3D.
8	Provide resource based recreational opportunities compatible with the protection of the natural systems	All plans similar. Division of Forestry will develop revised Management Plan based on features that may be authorized.	See 3D	See 3D
9	Restore natural fire regime	Best to allow Division of Forestry to manage prescribed fire	Leaves northern half of SGGE with little additional water, thus more difficult to manage for fire.	Leaves western half of SGGE with little additional water, thus more difficult to manage for fire.

TABLE 6 - 37 RELATIONSHIP OF ALTERNATIVES TO PLANNING CRITERIA

Criteria	No Action	Alternative 3D	Alternative 6	Alternative 12
Acceptability	N/A	Acceptable	Acceptable. However, social and economic effects of major land acquisition in NGGE greatly reduce acceptability.	Acceptable
Completeness	Not complete	Complete	Complete	Complete
Effectiveness	Not effective. Does not address objectives or provide ecosystem benefits.	Most effective of the three alternatives. Provides most benefits in the inland and second most benefits in the estuary	Less effective than Alt 3D. Provides second most benefits in inland and most benefits in estuary.	Less effective than Alt 3D for both inland and estuary.
Efficiency		Cost effective and a best buy plan for inland and estuary. Lowest average costs, lowest incremental costs per unit of output, and least increases in cost for the greatest increases in output	Cost effective and best buy for estuary. Not cost effective for inland.	Cost effective but not best buy for inland and estuary benefits.

Effectiveness is the extent to which an alternative plan contributes to the attainment of the planning objectives (alleviates problems and achieves opportunities). The most effective alternatives make significant contributions to all of the planning objectives. Less effective alternatives make smaller contributions to one or more of the alternatives. Effectiveness is a matter of degree rather than all or nothing.

Efficiency is the extent to which an alternative plan is the most cost-effective means of alleviating problems and realizing opportunities, consistent with protecting the Nation's environment. It is a measure of allocation of resources. Cost-effectiveness is one common measure of efficiency. Both monetary and non-monetary costs are considered. Opportunity costs are also considered.

6.8.12 Evaluation of Hazardous and Toxic Waste

Hazardous, toxic, and radioactive waste (HTRW) was considered during this study. In 2002, the SFWMD retained URS Corporation to conduct a Phase I and Phase II assessment on the 55,000 acre SGGE property. After coordination of the results with FL DEP and USFWS, the SFWMD contracted for additional

sampling of the 750-acre area labeled Former Agriculture Area West (FAW) (Section 3.14 and Figure 3-3). This additional study identified only 36 acres within the FAW for corrective actions. Three types of remediation actions for chlordane are planned, depending on the site-specific concentrations. The estimated corrective action cost for the 36 acres in FAW is $1,690,000. Appendix D contains a summary of the Phase I and Phase II study and a separate summary of the subsequent sampling of FAW and proposed remedial actions and costs.

Several of the initial alternatives avoided the FAW – Alternatives 1, 15, 16, 17, and 18. These alternatives were not retained for the final analysis because of their inability to achieve the objectives of the project (see Section 6.5). Alternatives 3D, 6, and 12 require the same real estate interest in the HTRW affected lands within FAW because they would provide similar amount of rehydration of these areas. The sponsor was aware of the magnitude of these costs during the final evaluation of alternatives. The sponsor was also aware that remediation would not be cost shared with the Federal government and that it would be required to be complete prior to starting construction of the ecosystem restoration project.

6.8.13 Risk and Uncertainty Analysis

A risk and uncertainty evaluation has been conducted to characterize and address issues of risk and uncertainty inherent in the planning, design and implementation of the Southern Golden Gate Estates recommended plan. An overview of feasibility, forecasting, and implementation issues is presented; future data needs are identified; and the role of the adaptive assessment strategy in addressing risk and uncertainty is discussed in the following sections.

Monitoring and adaptive assessment strategies will continue to evaluate and address issues pertaining to construction sequencing, connectivity, and potential for early restoration benefits. Such evaluations will continue to reduce uncertainties and increase the likelihood for overall success.

Planning

Two primary areas of focus for this risk and uncertainty evaluation are simulation model confidence, and project performance. This analysis addresses the reliability and accuracy of the assumptions and tools used to forecast with- and without-project conditions are evaluated.

Modeling and Predictive Analyses

Hydrologic Simulation Tools

The MIKE SHE modeling system is an integrated and distributed, physically based mathematical model with finite difference computational solution. The model can be applied for continuous simulation of the surface and sub-surface flow conditions over a specified period of time. The MIKE SHE model was used to quantify canal/aquifer interactions, to assess the impact of various water management strategies on flood dynamics, wetland hydroperiods, and water supply within the watershed. This hydrologic-hydraulic assessment of the spatial and temporal distribution of depth and area of inundation was performed with certain limitations on data and methods of representing the surface and groundwater flow characteristics. The topographic data used in this study is adapted from many sources (see below section). Considering the very flat topographic condition, and the change in inundation depth in the matter of inches, procurement of more detailed topographic data input is recommended to verify the final plan during the detailed design stage of the project.

Uncertainty of Project Benefits

The project benefits analysis predicts future with-project acreages of various types of vegetation based on changes in water depth and hydroperiod. The changes in vegetation communities are sensitive to the changes in water depths.

The MIKE SHE integrated ground water surface model was used to predict the expected future water depths (i.e. restoration modeling). That model was selected through technical peer review between the South Florida Water Management District and the United States Army Corps of Engineers Jacksonville District as the most applicable, state of the art model for integrated surface water/groundwater modeling for hydrologic restoration within Florida. The latest topography was gathered as input to the geometry portion of MIKE SHE model and the calibration and verification of this model was done for both the surface water and groundwater modeling scenarios with historical stage gages. The overall calibration for the area produced at mean error of 1.0 ft.

An uncertainty analysis of the project benefits was performed on the Big Cypress Basin (BCB) model for the SGGE project area. That analysis was based topographic data used in SGGE and the mean model calibration error. The inland ecosystem benefits for the SGGE PIR were evaluated using the Southwest Florida Assessment Methodology (SFAM), which has two primary restoration indices, hydrologic and biotic. Water depth is one of the factors that affect both indices. Therefore, the uncertainty analysis of the topographic data in SGGE was performed on those indices.

The inundation variable for the hydrologic index and the vegetation variable for the biotic index were based on the overland flooding for the average wet season. The overland component of the MIKESHE model is represented by a grid of cells, each cell is 1500 feet by 1500 feet in size and assumes an average elevation ground elevation. The SGGE proper area was selected for the uncertainty analysis because that area would have the greatest variation in elevation between the existing grade, drainage swales and excess spoil mounds from the canals and swales. It was also selected because the majority of hydrologic and biotic indices were developed from that region. The SGGE proper area is roughly defined as the area bounded on the north and south by I-75 and US-41, respectively and east to west between Fakahatchee Strand State Preserve and roughly Miller Blvd., respectively.

The sensitivity analysis of topography within SGGE proper was performed by raising and lowering it by 1 foot, which was consistent with the calibrated model error. Then the SFAM Hydrologic and Biotic indices were computed for those extremes and compared to the baseline indices for Alternative 3D (recommended plan). The different index values were then compared to the latest MIKESHE model results using a standard error analysis and results are shown below.

TABLE 6 - 38 SENSITIVITY OF HYDROLOGY AND BIOTIC INDICES FOR SGGE

Run	Hydrologic Index	Change of Hydrologic Index	Biotic Index	Change of Biotic Index
Alt 3D	.84		.88	
Alt 3D –1 foot	.72	14.3%	.83	5.7%
Alt 3D +1 foot	.69	17.9%	.77	12.5%

The maximum errors for the hydrologic and biotic indices were 17.9% and 12.5%, respectively. These maximum differences are not very substantial when considering that in the analysis the entire land surface was moved up or down. The 1-foot adjustment represents a very large change. It is unlikely that all locations in SGGE are incorrect by 1 foot in the same direction. The two estuarine indices, oyster and nekton, are independent of inland water depths and are not expected to vary with inland topography. The results of model calibration, the spatial analysis method of increasing and decreasing topography by 1 foot shows a level of confidence that the predicted hydrology, SFAM indices, and thus habitat units, will be achieved even though there is uncertainty in the topography and model calibration.

Socioeconomic Considerations

Socioeconomic impacts are anticipated to be positive. Primary impact categories identified include recreational and commercial fishing, and tourism. A quantitative determination of impacts to commercial and recreational fishing is precluded for several reasons. Such a determination requires greater understanding of the impacts of regulatory releases and runoff; short- and long-term ecological effects of the releases; impacts attributable to variations in the levels of releases and salinity levels. Nonetheless, restoration of the estuary is anticipated to restore habitat necessary for ecological diversity. The dynamic nature of tourism makes it difficult to accurately forecast impacts. Despite the uncertainties in quantifying the socioeconomic impacts, the project is anticipated to have positive and significant local and regional impacts.

Performance

The ultimate performance of the plan is contingent of many factors, several of which are described below. While it is not possible to analyze every theoretical permutation of these factors, it is expected that the project will, in concert with these, produce significant restoration benefits.

In the years from 1980 through 2002, the Division of Forestry has tracked the number and acres of wildfires within SGGE. For this time period, the number of fires per year averaged 17.4, with a total average acreage burned per year of 2,654 acres. It is anticipated that this trend would continue without the SGGE hydrologic restoration project, resulting in the elimination of all cypress communities in less than 10 years. Existing forage habitat for migratory birds, the Big Cypress fox squirrel, and the red-cockaded woodpecker would be severely reduced. Potential nesting habitat for the Southeastern American kestrel and red-cockaded woodpecker would be negatively impacted.

There could be a time period lag between implementation of the components for a more natural salinity envelope and the ecological response of the indicator organisms, oysters. Experience from the Chesapeake Bay restoration has shown that this lag can range from 5 to 15 years. Artificial habitats could mediate some of this time lag and more rapidly facilitate a productive estuary.

Design and Implementation

The feasibility assessment includes evaluations of design and construction issues, such as project scheduling, technology, construction cost estimate contingencies, land availability and hazardous or toxic waste.

Project Schedules

Additional design work will be required to go from planning-based design assumptions to plans and specifications-based design assumptions. There is also the possibility that an additional risk-based analysis or additional survey and mapping data will be required. There may be additional time required to complete detailed design. However, it is anticipated that these new tasks will not increase the overall project delivery dates. Most of the additional work can be accomplished in parallel with other work that was already scheduled. The net impact to the overall project schedules is expected to be negligible.

Technology

A summary of project features and associated risks and uncertainties is provided in ***Table 6-39***. The U.S. Army Corps of Engineers has extensive experience and reputable credibility in the construction of such features in water resources planning.

TABLE 6 - 39 SUMMARY OF PROJECT FEATURES AND ASSOCIATED RISK AND UNCERTAINTY

Feature	Risk	Uncertainty
Pump Stations	Minimum	Low - established and applied technology
Culverts	Minimum	Low - established and applied technology
Earthwork Filling/Plugging canals Road Removal	Minimum	Low - established and applied technology

Construction Cost Estimate Contingencies

A construction contingency factor of 25% of construction cost was used. No statistical analysis of cost risk was performed. A summary of cost features and associated risk is presented in ***Table 6-40***. Structure quantities were calculated from standard designs. Some variations are expected in site-specific designs, but changes that would affect quantity are not anticipated for the levee and canal alignments and cross sections. Some design variances are expected as more specific site data is acquired. Standard quantity variations and production rate variances may be expected for dredging and pumping. Standard design variances are expected and standard contingency values are used. The risk of cost overruns is considered low.

TABLE 6 - 40 SUMMARY OF CONSTRUCTION COST FEATURES AND ASSOCIATED RISK

Feature	Factor	Risk
Structure Quantities	Standard designs	Normal variance expected
Levee and Canal Design	Quantity calculations	Normal variance expected

Land Availability and Acquisition Issues

The Florida Department of Environmental Protection, in partnership with the United States Department of Interior, has been acquiring lands since 1984 for "Save Our Everglades Florida Forever Project, Southern Golden Gate Estates, Collier County, Florida." The land being acquired within SGGE is about 55,247 acres consisting of about 19,986 Parcels. As of March 2004, FDEP has acquired 52,779 acres in fee, which represents approximately 95 percent of what is required. A preliminary investigation indicates that the State owns a buffer zone for I-75. In addition, the State owns the Fakahatchee Strand State Preserve, the Collier Seminole State Park and Belle Meade State Conservation and Recreation Land (Carl) Project (Figure 1-4). SFWMD and FDEP will certify the lands necessary for the project. Uncertainties surrounding land acquisition include keeping on the current schedule to complete acquisition of estates in order to meet construction schedules; the potential utility relocations that may be required; the necessity of removing roads that may be under the ownership and management of Collier County; the potential presence of minerals and mineral rights on lands to be acquired; the potential for hazardous, radioactive, or toxic materials on the lands to be acquired (see section below entitled Hazardous or Toxic Waste). Additional uncertainties with land include the potential for project impacts outside the study area. If these impacts are found to be substantial, acquisition of flow easements or other land interests may be required. See the Real Estate Appendix for an estimate of acreage and associated cost.

Hazardous or Toxic Waste

The SFWMD contracted with URS Corporation for Hazardous, Toxic, and Radioactive Waste (HTRW) Phase I, II, & III assessments on the SGGE project site and immediate surrounding areas. High levels of selenium, chlordane and dieldrin were found on several locations in the project area, primarily due to former agricultural activities on the land. Subsequent sampling has narrowed the required actions to chlordane on only 36 acres of the entire area. These materials could pose a risk to small mammals, birds, and invertebrates. Corrective actions will be completed before these areas are rehydrated.

The project area is unique in the fact that although it is located in a particularly remote area, it has accessible roadways throughout. This type of opportunity has resulted in illegal dumping of hazardous materials within the project area. This dumping was considered during the thorough HTRW surveys and the recommendations for corrective actions. However, it is possible that some of these sites may have been missed during the surveys, and any that were missed may pose a threat to surface and groundwater once the project is under way and water levels within the project area begin to rise.

Topography

The topography for the study area was comprised of two different data sets of the US Geological Survey (USGS) with the vertical data set at North American Vertical Datum (NAVD) 1988 and the horizontal data set at North American Datum (NAD) 1983. The first data set was a set of 0.5 foot contour maps that were extrapolated from the 5 foot USGS Quadrangles (Quads). The second data set was 2 foot contour gathered by aerial LIDAR from the year 2000. The general topography is characterized by low relief and poorly defined drainage patterns.

Cross-sectional surveys of the canals within the Big Cypress Basin were gathered from multiple sources, such as private engineering firms, local governmental agencies, etc. The latest 2003 cross sectional survey information was gathered for the Northern Golden Gate and Southern Golden Gate Estates. The vertical datum was 1988 NAVD.

The topography and the cross sectional surveys were compiled into one data set for the study. This survey information was used to make a relative comparison of modeling between existing conditions and the proposed alternatives.

Additional site specific topography will be gathered for the engineering designs and analyses required in the Detail Project Design and the Plans and Specification phases of this project. This required to minimize the uncertainty of design site conditions.

6.8.12 Conclusions

Alternative 3D is the recommended plan for all of the following reasons.

Alternative 3D meets the planning constraints for maintaining drainage in NGGE, maintaining water for existing users, no effect on Tribal compacts, and no adverse impacts to listed species.

Alternative 3D would make the most progress towards the performance measure targets for hydrology, biotic communities, and oyster reefs, and second most progress for open water communities (nekton).

Alternative 3D would provide the greatest habitat unit benefits, defined as the average annual difference between With Project and Without Project conditions, for hydrology and biological communities. Alternative 3D would provide the second greatest number of habitat units for nekton and oyster habitat. Alternative 3D would provide the greatest net increase in acres of cypress forest, marsh, wet prairie, and hydric flatwoods vegetation communities.

Alternative 3D is a cost effective and best buy plan. It has the lowest annualized cost per output for all four of the ecosystem benefit measures - hydrology, biotic communities, nekton, and oysters.

Alternative 3D is a good value and the benefits are worth the cost. Ecosystem benefits for SGGE proper were calculated based on 59,294 acres of watershed (upland and wetland mosaic) and 1,282 acres of estuarine habitat. The total investment cost is $383,437,000 and the annualized cost is $25,892,413. With these cost values, the annualized cost per watershed habitat unit is $1,039, the annualized cost per estuarine habitat unit is $50,518. Since cost per habitat unit is sensitive to the method of calculation of the habitat units, one can look at the cost per acre restored. Annualized cost per acre of watershed is $437, the annualized cost per acre of three bays is $20,197 and the annualized cost per acre for all areas restored is $427. The total investment cost per acre restored in SGGE and three estuary bays is $6,330. These estimates represent simple ratios of cost/acre. The costs have not been partitioned between inland and estuary acres. For comparison, the Kissimmee River Restoration 1991 Feasibility Report and EIS contained the estimated total cost of $422,667,000 and the estimated total annualized cost of $43,926,000. Approximately 29,000 acres of wetlands would be restored and a total of 67,843 acres would be needed for restoration and flood protection purposes. The annual cost per acre of wetland restored is $1,505 and the annual cost per acre of land needed for the project is $648. Both of these values for Kissimmee are larger than the corresponding values for SGGE ($437 and $427).

The above calculations represent the acreages in SGGE proper, where a large proportion of the inland ecosystem benefits would occur, and the acreages of Pumpkin, Blackwater, and Faka Union Bays, where the PDT quantified benefits. Inland benefits would also be gained in Fakahatchee Strand State Preserve, Florida Panther National Wildlife Refuge, South Belle Meade, and Collier-Seminole State Park. Estuary benefits would also be gained throughout a large part of the Ten Thousand Islands Region. It is difficult to precisely define the acreages of these areas that would be strongly affected, as the benefits of the construction within SGGE become more diffuse as the distance from SGGE increases, and the analyses used by the PDT do not produce a definitive boundary and acreage that can be directly compared to the Kissimmee River numbers. However, if the additional acreages were included, then the costs per acre would be lower than presented above.

SECTION 7

RECOVER EVALUATION

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SECTION 7
RECOVER EVALUATION

RECOVER REGIONAL EVALUATION REPORT (Draft)
Southern Golden Gate Estates Hydrologic Restoration Project

Prepared by the RECOVER Regional Evaluation and Water Quality Teams
March 3, 2004

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EXECUTIVE SUMMARY

One of the primary missions of RECOVER is to work with the PDTs to evaluate (through predictive modeling) and maximize the contribution made by each project to the system-wide performance of CERP. With this mission RECOVER prepared a Regional Evaluation of the final three proposed project alternatives for the Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project. The purpose of this regional evaluation is to: 1) inform the PDT of the compatibility of proposed project alternatives with regional CERP restoration goals and performance expectations, 2) identify improvements for project performance that would improve its regional performance, and 3) provide decision-makers required information regarding regional performance expectations of the SGGE project.

This evaluation compares the three project alternatives to performance expectations of the Comprehensive Plan (Alternative D13R) by contrasting the alternatives to the Future Without Project conditions and against restoration targets. It should be noted that this regional evaluation is unusual for RECOVER because the evaluation was conducted out of sequence, i.e., the evaluation was conducted after selection of a preferred plan; therefore, the regional evaluation was not taken into consideration when selecting the preferred plan. This altered sequence was due to an expedited schedule for project completion. Also, the regional evaluation conducted for this report was performed without benefit of regional modeling results since the SGGE project is hydrologically isolated and cannot be simulated by the regional landscape models. Consequently, this evaluation is based on the best professional judgment of an interagency team of RECOVER evaluators using a local project hydrologic model (MIKE SHE).

Consistency with Objectives of the Comprehensive Plan – The planning objectives developed for the SGGE project are consistent with the objectives of the Comprehensive Plan. The planning objectives developed for the SGGE project were developed using both the broad CERP goals and objectives and the more defined regional and site-specific restoration objectives of hydrologic restoration.

Consistency with Performance Measures of the Comprehensive Plan – There is general compatibility between the project-level performance measures developed for the SGGE Project and the system-wide performance measures of the Comprehensive Plan.

Project Performance – Comparison to the Comprehensive Plan and Future Without Conditions – Based on information provided by the PDT, RECOVER has concluded that the three SGGE Project alternatives (Alternatives 3D, 6 and 12) will meet or exceed the three performance expectations outlined in the Comprehensive Plan. The performance expectations that will be met include hydrologic restoration, groundwater recharge, and water quality improvements to coastal estuaries. Alternative 3D outperforms Alternatives 6 and 12 in achieving performance expectations. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return most of the SGGE to its pre-development character, including the plant communities and wildlife that it previously supported. However, it should be recognized that the full benefits of the restoration process would take many decades to be realized.

If none of the SGGE alternatives are implemented, conditions will continue to decline. By 2050, upland conditions would dominate virtually the entire project site and no wetlands larger than 25 acres would exist, with the exception of coastal marshes. The continuity of natural habitats between government preserved land resources would be lost. Without restoration of sheetflow and the elimination of point source discharges to Faka Union Bay, continued water quality degradation caused by salinity fluctuations would result in further loss of species diversity. Forage fish populations would continue to decline and recreational fishing would also suffer. Oyster reefs would be eliminated.

System-Wide Performance Expectations – From a regional perspective RECOVER has concluded that the three SGGE project alternatives would support the restoration of the three essential characteristics of the south Florida ecosystem prior to development.

Pre-development Ecosystem Characteristic	SGGE Project Regional Benefit
A hydrologic regime that featured dynamic water storage capabilities and sheetflow to coastal estuaries	Increases the storage of surface water in wetlands and allows the volume and timing of freshwater flows to the estuaries to occur in a more natural manner
A large spatial scale	Continuity of natural habitat would be expanded by combining the SGGE restored lands with surrounding natural areas; all managed by the same natural resource agency
Heterogeneity of natural habitats	Improves the ecological health and habitat characteristics of three estuaries by reducing salinity fluctuations from a single point source discharge

Conclusions - RECOVER has concluded that the three SGGE Project alternatives (Alternatives 3D, 6 and 12) will meet or exceed the three performance expectations outlined in the Comprehensive Plan. Alternative 3D can be expected to restore a more natural pattern of wetland hydroperiod and freshwater flow to estuaries than the present hydrologic regime. Alternatives 6, 12, and 3D all provide significant improvement over the Future Without Project Condition and would contribute to restoration of the estuaries and expansion of the continuity of natural habitat by combining the restored lands of the SGGE project site with surrounding natural areas.

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SECTION 8

RECOMMENDED PLAN

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SECTION 8
RECOMMENDED PLAN

8.1 INTRODUCTION

Alternative 3D is the recommended plan (the Preferred Alternative, under terminology used in the National Environmental Policy Act, NEPA). The main features of Alternative 3D are shown in Figure 8 - 1. The next sections present the construction features, operational features, real estate requirements, monitoring requirements, and the cost estimate for the recommended plan.

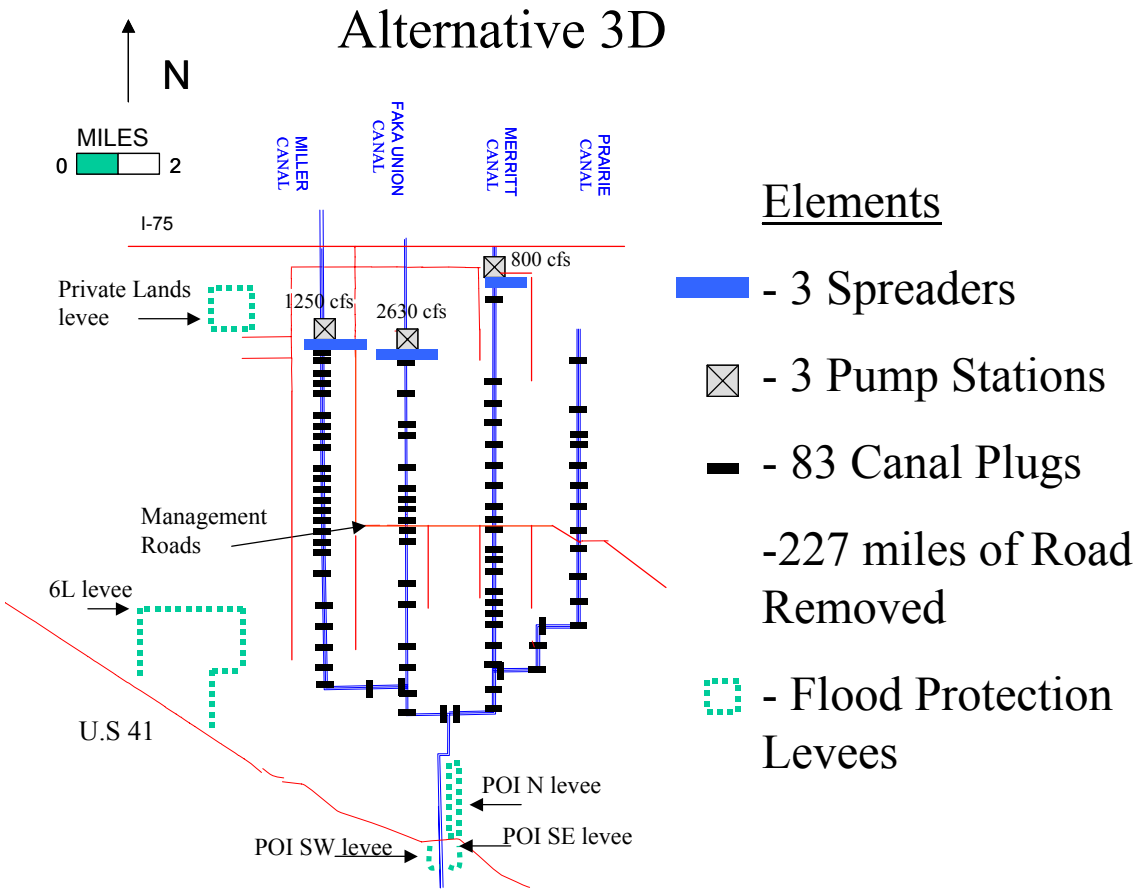


FIGURE 8 - 1 ALTERNATIVE 3D

In response to agency and public comments, the team continued to analyze Alternative 3D during the period after release of the draft PIR. The team looked more closely at many aspects of Alternative 3D, including but not limited to drainage for NGGE during storms, the total water to be made available for the environment, and real estate costs. As a result of this continued evaluation, Alternative 3D has been modified slightly from the alternative presented in the draft PIR. The features and cost estimates for Alternative 3D presented in this updated Section 8 of the PIR are not identical to the values for Alternative 3D in Section 6 of the PIR. The principle changes are that the pump station sizes and associated construction cost estimates have increased; the real estate cost estimate for SGGE land has decreased; and the total first cost has decreased by about $13 million. Ecosystem benefits did not change. The construction cost changes would have been applied to all alternatives with pump stations. The real estate cost changes for SGGE land would have been the same for all three of the final alternatives. This highest refined level of analysis was not performed for the other alternatives because these changes would not have altered which alternative became the recommended plan.

8.2 CONSTRUCTION FEATURES

8.2.1 Canals

Eighty-three canal plugs would be placed in the four canals. The approximate locations of the plugs are shown in Figure 8 - 1. The source material for the canal plugs and swale blocks would be from the spoil from the original canal and swale excavations, and the demolition and degrading of the roads (see below). There will be sufficient material available to do the proposed work.

Three spreader channels will be constructed and will run in an east-west direction, across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The spreader canals will be located immediately downstream of the proposed pump stations. The pumps have been designed to have discharge pipe free fall into the spreader channels, which will act as a plunge pool for energy dissipation and to aerate the water. The discharge waters will then be conveyed overland to the downstream project area. The spreader canals' lengths were optimized for restoration pumping rates. For the Miller, Faka Union and Merritt pump stations the spreader canal lengths will be approximately 4500 feet, 7000 feet and 1400 feet, respectively. They will serve to distribute the flows along the overland areas to emulate the historic sheet flow of the area.

8.2.2 Pump Stations

Pump stations would be constructed on the Miller, Faka Union and Merritt Canals (Figure 8-1). The Miller Pump Station would be constructed on the Miller Canal near 64th Avenue SE. The Miller Pump Station would have 4-125 cfs pumps and 2-375 cfs pumps, for a total of 1,250 cfs and 6 bays. The Faka Union Pump station would be constructed on the Faka Union Canal near 66th Avenue SE. The Faka Union Pump Station would have 2-125 cfs pumps, 2-250 cfs pump and 4-470 cfs pumps, for a total of 2,630 cfs and 8 bays. The Merritt Pump station would be constructed on the Merritt Canal near 54th Avenue SE. The Merritt Pump Station would have 2-80 cfs pumps and 3-213 cfs pumps, for a total of 800 cfs and 5 bays. The pumps would be utilized to maintain flow through the project area during flood events and as a means for restoration. A small 100 cfs pump station with 2-50 cfs pumps will be required for interior drainage of the Private Lands levee system. Refer to Appendices A and C for engineering details.

8.2.3 Levees

Levees will be built to protect private property from any adverse flooding do to the project plan. The typical levee section will be 15 feet wide, 6 to 9 feet high, and have 1:3 side slopes. The source material for the levee would be from the spoil from the original canal and swale excavations and road demolition work. All five of the levees are shown on Figure 8-1 with more details in the Engineering Appendices (A through C).

A ring levee would be built in the southern end of the SGGE to protect the Port of the Islands (POI) Waterfront RV Resort and other structures from being flooded by the higher water and sheet flow from the north and northeast. The levee would be on the eastern side of the Faka Union Canal, south of the "T" (the intersection where the four SGGE canals become one canal), and north of U.S. 41 (Figure 8-1). The levee would be approximately 3.0 miles in length.

A second levee would protect the Port of the Islands development southeast of the intersection of the Faka Union Canal and U.S. 41 (Figure 8-1). The levee would be approximately 0.81 miles long.

A third levee would be constructed to protect the Port of the Islands development southwest of the intersection of the Faka Union Canal and U.S. 41 (Figure 8-1). The levee would be approximately 0.36 miles long.

The agricultural area in southern Belle Meade is surrounded by a levee or berm to assist the farms' operators with managing water levels in the farm. A new, improved perimeter levee (6L levee in Figure 8-1) would be constructed to ensure that the higher water levels expected from the recommended plan will not flood the agricultural area. The levee would be approximately 12.2 miles long.

A ring levee would be constructed around the set of private residential properties located in northeastern Belle Meade, adjacent to the northwest corner of SGGE (Figure 8-1). The levee would be approximately 4.2 miles long.

8.2.4 Roads

Approximately 227 of the 279 miles of roads existing in SGGE would be demolished so that they would be low enough to allow sheet flow of water. Approximately 219 miles of the roads are constructed of crushed limestone and 60 miles are paved with asphalt. The road material would be removed with standard earth-moving equipment. Asphalt would be removed off-site and disposed of according to state regulations. Trees and other vegetation growing along and in the roads would be left in place as much as practicable. The demolished roads would generally become impassable by vehicles. Some of the material would be used for construction of the canal plugs and flood protection levees. Any remaining material would be placed in the canals to supplement the canal plugs.

Approximately 52 miles of existing road would remain in SGGE. Stewart Boulevard would remain between Janes Scenic Parkway and Everglades Boulevard. Everglades Boulevard would remain between Stewart Boulevard and I-75. Berson Boulevard west of the Merritt Canal would remain. These roads would be modified with a mix of low water crossings to allow water to flow over them and with culverts to allow water to flow under them. Portions of the north-south Miller, DeSoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but would remain available for use during the dry season.

Up to 4 miles of new, unpaved roads would be constructed from Berson Boulevard southward to the sites of the three proposed pump stations.

8.2.5 Culverts

New culverts would be constructed under U.S. 41. The culverts would supplement the bridges and culverts that exist today. The culverts are identified as 42A, 46A, 51A, 51B, 51C, 55A, 62A, 66A, and 66B in the Letter Report and Environmental Assessment for the Tamiami Trail Culverts Critical Project.

Culverts would be constructed under Everglades Boulevard immediately south of I-75 to convey water between the Miller and Faka Union Canals. Culverts and low water crossings would be constructed in Stewart Boulevard and other roads that would remain within SGGE. The number, size, and specific location of these culverts will be determined during the detailed design phase.

Culverts would be required for some of the levee systems to provide interior drainage. They would convey runoff off- site to reduce the amount of interior flooding that could occur during storms.

8.3 OPERATIONAL TESTING AND FEATURES

8.3.1 Operational Testing

Subsequent to the completion of the construction phase of the project operational testing of the pump stations and other project components will be required. Assuming that there is an adequate supply of water each pump station will require approximately 2 to 4 weeks of operational testing. Other project components such as the spreader canals and canal plugs will be currently tested with the operational testing of the pump stations. If the pump stations are tested in series, it will take approximately 4 months to complete the operational testing.

8.3.2 Operational Features

Several versions of the operating manual will be prepared prior to project completion. In the Pre-construction and Detailed Design phase, the draft operating manual developed for the PIR (see Appendix A) may be modified, as necessary, for operations during construction. A draft operating manual for the operational testing and monitoring phase will then be prepared. Experience gained from the operational testing and monitoring phase will be incorporated into the final operating manual, which will be coordinated with

SFWMD and the South Atlantic Division (SAD), and will supercede all other iterations of the operating manual. At this point, the SFWMD, as the local non-Federal sponsor, will accept ownership and responsibility for long-term operations of the project.

The non-runoff phase of operation is characteristic of the dry period (mid October – April) across the SGGE Project landscape and is maintained by gravity flow. Many of the roads that obstruct the historic flow ways will be degraded to natural ground level. As water flow in the canals encounters the canal plugs, it will form a series of pools. The operation of the pump stations during this period will be necessary if gravity flow is not adequate to maintain the optimum canal stages.

The flood control phase of operation is characteristic of periods of high discharges during the wet season (May – mid October), particularly during runoff events, and during severe tropical storms in order to remove excess runoff or regain canal storage. Continuous pump station operations during the wet season are anticipated.

The Florida Division of Forestry will manage the SGGE land as a unit of the Picayune Strand State Forest. The Division of Forestry will perform prescribed fires throughout SGGE. The Division will use a variety of methods to reduce the distribution and abundance of invasive native and exotic plants. The Division will operate under its existing 5-year management plan. After the SGGE plan is authorized, the Division's management plan will be updated to reflect the construction features and the expected changes to the landscape.

8.4 REAL ESTATE REQUIREMENTS

The lands required for the recommended plan are based on an analysis of the lands needed for construction, operation, maintenance, repair, replacement and rehabilitation of the Project. The real estate component of the recommended plan is tentative in nature for planning purposes only. Both the final real property acquisition lines and the real estate cost estimates provided herein and in Appendix F are subject to change. More detail of the real estate requirements for the recommended plan is discussed in Appendix F.

8.4.1 Land Acquisition

The total estimated land requirement is approximately 64,690 acres. There are 55,247 acres in the Southern Golden Gate Estates CARL Area, which will be required in fee title. A perpetual flowage easement will be required over approximately 9,021 acres in the Belle Meade State Conservation and Recreation Land (CARL) Area, which will be hydrologically impacted in the average wet season with an increase in the depth of waters from the Project on average from 0.5 to over 1.0 feet. Fee title will be required over approximately 20 acres for installation of the Tamiami Trail Culverts. Fee title will be the required estate over 397 acres required for construction of the five levees. A temporary road easement will be required over 5.20 acres for the period of construction. More detail is discussed in Appendix F.

8.4.2 Relocation Assistance

In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended, (Public Law 91-646), relocation assistance is required to be provided to affected residents and business. There were originally 47 owners or tenants who qualified as displacees for the Uniform Relocation Assistance Benefits. The 47 displacees consisted of 41 single residence owners and 6 apartment tenants. There remains 1 displacee to be relocated. It is anticipated that due to limited availability of comparable replacement housing and rapidly rising real estate values in the area last resort housing may be required. In Belle Meade, there are approximately 25 owners who may require relocation assistance benefit payments.

8.5 ADAPTIVE ASSESSMENT AND MONITORING

The intent of the SGGE Ecological and Water Quality Monitoring Plan is to determine if the anticipated hydrologic, vegetative, wildlife, and estuarine benefits of the project are being achieved and to support the adaptive management process over the 50-year life of the project. The plan proposes to monitor ecosystem responses to the changes in hydroperiod depth and duration and changes in flows to the estuaries resulting from implementation of recommended alternative 3D. The monitoring plan is in Appendix H, Ecological and Water Quality Monitoring Plan.

8.6 COST ESTIMATE

The estimate for the SGGE recommended plan includes:

1. Initial costs (land acquisition and construction costs)
2. Investment costs
3. Operation and maintenance costs

These costs are presented in more detail in the following sub-sections. Equivalent annual costs were also calculated for the features of the recommended plan.

8.6.1 Initial Costs

The total estimated initial cost of the recommended plan is $349,422,000 at October 2004 price levels. This estimate is the "baseline" estimate, and in accordance with Federal water resource-planning regulations does not include future price escalation. The estimated initial cost for the recommended plan is shown in Table 8-1**.**

TABLE 8 - 1 ESTIMATED INITIAL COSTS

FEATURE	**COST ***	**TOTALS**
Utilities & Relocation	$2,094,000	
Road Demolition	$34,065,000	
Canals & Plugs	$5,382,000	
Levees	$7,401,000	
Pump Stations	$67,476,000	
Culverts	$8,528,000	
Subtotal		**$124,946,000**
Detailed Design	$11,369,000	
Construction Management	$12,633,000	
Subtotal		$24,002,000
		$148,948,000
Monitoring during const	$7,431,000	
Construction Total		**$156,379,000**
Lands	$193,043,000	
Total		**$349,422,000**

(***** October 2004 price levels)

Table 8 - 2 provides a comparison of the features of the SGGE plan described in the Comprehensive Plan and those provided in the SGGE recommended plan in this PIR.

TABLE 8 - 2 SUMMARY OF CHANGES CERP AND SGGE PIR

	SGGE in the Comprehensive Everglades Restoration Plan final report	**SGGE PIR**
Construction Cost	$ 15,500,000 (Oct 1999 Price Level)	$ 124,946,000 (Oct 2004 Price Level)
Real Estate Cost	$0 in main report; $134,400,000 in Appendix A, Plan Formulation	$193,043,000
Components	Non-specific/Conceptual Source report (1996 conceptual plan): Miller Pump Station 200 cfs Faka Union Pump Station 500 cfs Merritt Pump Station 160 cfs Prairie Canal Plugs 130 miles of roads removed. (No levees) (No culverts and levee ramps)	Miller Pump Station 1,250 cfs Faka Union Pump Station 2,630 cfs Merritt Pump Station 800 cfs Prairie Canal Plugs (same) 227 miles of roads removed. 5 ring levees for flood protection Culverts and levee ramps
Feature Siting	Non Specific/Conceptual	Criteria Used: Current Land Use, Topography, Hydrologic, and Ecological Connectivity
Amount of Land	The land between I-75, U.S. 41, Fakahatchee Strand, and Belle Meade area	59,294 acres between I-75, U.S. 41, Fakahatchee Strand, and Belle Meade area

8.6.2 Investment Costs

Department of the Army Engineering Regulation (ER) 1105-2-100 requires that interest during construction (IDC) be computed which represents the opportunity cost of capital incurred during the construction period. Interest was computed for construction and pre-construction engineering and design (PED) costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date. Interest during construction is shown within Table 8-3.

TABLE 8 - 3 TOTAL COSTS

Cost Component	**Alternative 3D***
Construction Features	$156,379,000
Lands	$193,043,000
Initial Cost	**$349,422,000**
Interest during construction	
Construction	$26,325,000
Lands	$4,169,000
Monitoring	$1,007,000
Total Interest During Construction	$31,501,000
Total Project Investment	**$380,923,000**
Average Annual Costs	
Interest and Amortization	$22,912,000
Operation and Maintenance	$2,129,000
Monitoring	$887,000
Total Annual Equivalent Cost	**$25,928,000**

*Alternative 3D costs were updated as part of the detailed cost analysis for the recommended plan. The annual cost is less than $30,000 greater than used in the incremental analysis.

The cost of a project is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial cost such as real estate and PED cost plus interest during construction. In this analysis, most of the constructed components had different construction completion dates. The IDC for the construction element of the recommended plan is $26,325,193 (Table 8-3).

Interest during construction was computed for real estate using the date the lands are to be certified for the project. For the SGGE lands, there are two certification dates. The first is the lands that are needed for construction, which consists of a much smaller percentage of land then the whole of the SGGE study area. This set of land will be certified in 2006. The second date is for the remaining lands, which will not be certified until construction is completed and benefits start accruing in 2010. The lands associated with the second certification date will not accrue interest during construction since benefits start at the same time these lands are certified. The total IDC on real estate is estimated to be $22,912,000 (Table 8-3).

Interest during construction was computed for monitoring during construction. This began five years prior to benefits starting to accrue. The IDC for the monitoring during construction is $1,007,000 (Table 8-3).

8.6.3 Operation, Maintenance, Repair, Replacement, and Rehabilitation Costs

Annual operation and maintenance costs were estimated for the construction features of the recommended plan. The operation and maintenance costs were determined by extrapolation from operational costs histories supplied by the South Florida Water Management District (SFWMD), by using industry standard cost data and by using data from past and projected future cost trends. The average annual operation, maintenance, repair, replacement and rehabilitation (OMRR&R) costs are estimated to be $2,129,000 (Table 8-3).

8.6.4 Monitoring and Adaptive Assessment Costs

The current estimate for the average annual monitoring and adaptive assessment activities described in Section 8.4 and Appendix H is $887,000 (Table 8-3). Much of the monitoring is "front-loaded", with the most intensive monitoring scheduled for the early years of the project, when the most rapid ecosystem change is expected to occur.

8.6.5 Annual Costs

Investment costs were converted to annual costs using an interest rate of 5 5/8 percent and a period of analysis of 50 years to compute interest and amortization. Annual operation and maintenance costs and monitoring and adaptive assessment costs were then added to the interest and amortization costs to determine the average annual cost, which is $25,928,000 for the recommended plan (Table 8-3).

8.6.6 Cost Estimate Uncertainties

The current estimated cost of the recommended plan is based on the best available information. Appropriate contingency factors were used in developing the cost estimates to reflect the uncertainties inherent at this stage of project development. As more site-specific analysis is completed, the contingency factors will be revised to reflect the greater levels of certainty. Value engineering will be used to optimize the design of facilities in the detailed planning and design phases of implementation for individual projects. During the detailed design phases, opportunities will be sought that

reduce the number of control structures as well as using more passive control structures wherever feasible, which could result in reduced construction and OMRR&R costs of projects.

8.7 COST SHARING

Responsibilities for implementing the recommended plan will be shared by the Corps, on behalf of the Federal government, and the non-Federal sponsor, the SFWMD. The Corps and the SFWMD will cost share equally in the design of projects resulting from this plan. The SFWMD will acquire and furnish necessary lands, easements, rights of way, relocation, and disposal areas (collectively referred to as LERRD); and operate and maintain the completed project. Construction contracts to build the projects will be managed by either the Corps or SFWMD to maintain a 50-50 cost. Rules, which determine how project responsibilities are shared, are established in Federal law and related administration implementing policies. Section 601 of WRDA 2000 provides in-kind cost sharing for the non-federal sponsor for design, construction and operational and maintenance and for treatment of credit between projects to maintain a 50/50 cost share.

8.7.1 Cost Sharing of Construction and Land Costs

Section 601 of the Water Resources Development Act of 2000 and Corps policy requires that:

- LERRD will be provided by the non-Federal sponsor.

- The total first cost of the project, including the value of LERRD and pre-construction engineering and design costs, will be shared equally between the Federal government and the non-Federal sponsor. The non-Federal sponsor will provide cash or manage a portion of construction as necessary to meet its 50 percent share of the total first cost of the project to be balanced according to Section 601 of WRDA 2000 to maintain a 50/50 cost share every five years.

Table 8 - 4 contains an apportionment of project costs between the Federal government and the non-Federal sponsor based on the recommended plan.

TABLE 8 - 4 COST APPORTIONMENT OF SGGE RECOMMENDED PLAN (INITIAL COSTS ROUNDED)

Item	Total	Federal	Non-Federal
Construction	$156,379,000	$136,711,000	$19,753,000
LERRD	$193,043,000	* $38,085,000	$154,958,000
Total	$349,422,000	$174,711,000	$174,711,000

* $38,085,000 of Farm Bill funds from the Department of Interior were used by the non-Federal sponsor to acquire lands

8.7.2 Cost Sharing of Adaptive Assessment and Monitoring

As previously described in Section 8.5, the Adaptive Assessment Program has been developed. The program is needed to provide essential information that supports the development and the implementation of the recommended plan. Data collected as part of the monitoring program is critical to the refinement of the features of the recommended plan by providing the basis for adjustments to design and operation criteria as needed. The monitoring program is a necessary component for ensuring that ecosystem benefits are achieved in the Southern Golden Gate Estates area and the Ten Thousand Islands area, as well as Fakahatchee Strand State Preserve, the Florida Panther National Wildlife Refuge, the Belle Meade CARL area, and Collier Seminole State Park. Section 601(b)(2) of the Water Resources Development Act of 2000 specifies that adaptive assessment and monitoring will be cost shared equally by the Federal Government and the non-Federal sponsor (SFWMD). These adaptive management costs have been allocated to Construction and O&M for budgeting purposes.

8.7.3 Cost Sharing of Operations and Maintenance

Section 601(e)(4) of the Water Resources Development Act of 2000 specifies that the operations and maintenance of authorized projects of the Comprehensive Everglades Restoration Plan would be cost shared equally by the Federal Government and the non-Federal sponsor. Consistent with the provisions of section 601(e)(4) of the Water Resource Development Act of 2000, it is appropriate for the OMMRR&R associated with this plan to be shared equally between the Federal government and the non-Federal local sponsor.

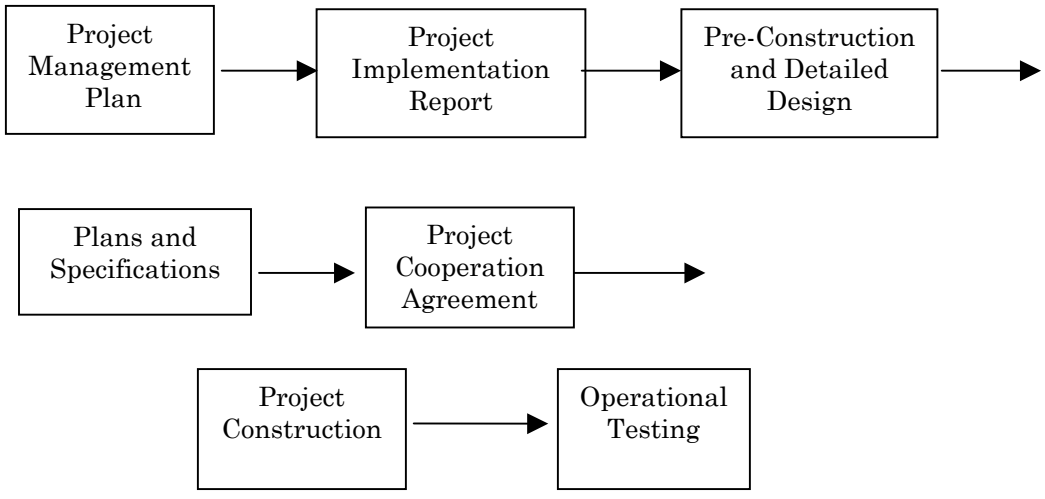
8.7.4 Cost Sharing of Early Construction

Corps of Engineers policy is that credit is not normally given to the non-Federal sponsor for construction work that is performed by the sponsor prior to signature of the Project Cooperation Agreement (PCA). If the sponsor proceeds with construction actions prior to the PCA, the sponsor is a risk of not receiving credit for the work. Section 13 (Recommendations) of this PIR recommends that Congress authorize credit to the non-Federal sponsor for constructing plugs within the Prairie Canal and constructing culverts under U.S. 41, based on verification that the work completed is necessary for the Project and that the costs are reasonable. If Congress approves this recommendation, and the work performed is necessary and of reasonable cost, then the cost of the Prairie Canal plugs and the U.S. 41 culverts will be shared equally between the Federal government and the non-Federal sponsor.

8.8 PROJECT IMPLEMENTATION

The implementation of the recommended plan will be consistent with procedures described in the Master Program Management Plan adopted by the Corps and the South Florida Water Management District for the implementation of the Comprehensive Everglades Restoration Plan (CERP) and any amendments thereto. The tasks necessary to implement the SGGE recommended plan is described in this report. Upon completing the Final PIR, work will be initiated on Detailed Design. The Project Implementation Report addresses the reservation of water for the natural system and any issues that might be required by Section 601(h) of the Water Resources Development Act of 2000. The SGGE project implementation process is outlined in **Figure 8-2**.

FIGURE 8 - 2 SGGE IMPLEMENTATION



8.8.1 Project Management Plan

Implementation of the recommended plan will be guided through the development and use of documents known as the project management plan (PMP) and the Project Implementation Report (PIR). The PMP was approved 24 May 2001. Preparation of a PIR was begun immediately after the completion of the PMP. The SGGE PMP contains the work plan and schedule for tasks identified as necessary to implement the recommendations of the SGGE Project, including those tasks accomplished through pre-construction engineering and design (PED). The PMP/PIR will be updated prior to commencement of project construction.

8.8.2 Project Implementation Report

The SGGEPIR contains all of the project-specific requirements for PIRs outlined in Section 601(h)(4)(A)(iii) of the Water Resources Development Act of 2000 (WRDA 2000) including sub-clause (V) which states that the PIR shall "…identify the amount of water to be reserved or allocated for the natural system…" Furthermore, Section 601(h)(5) of WRDA 2000 (the "Savings Clause") requires that existing legal sources of water may not be transferred or eliminated until a new source of comparable quantity and quality is available. Additionally, the Savings Clause provides that implementation of CERP shall not reduce levels of service for flood protection that are in accordance with applicable law and in existence on the date of enactment of WRDA 2000. Section 601(h)(4)(c)(I) of WRDA 2000 also requires an operating manual that is consistent with the reservations described in the PIR. Since this Project Implementation Report will be finished before completion of the formal guidance memoranda and the pre-CERP baseline, this PIR compares the effect of the three leading alternatives on flooding to the flooding conditions that existed at the time of enactment and considers whether there would be any affect on these flooding conditions by any of these alternatives.

Similarly, Florida Statute 373.470 requires, in part, that "Prior to executing a project cooperation agreement with the Corps for the construction of a project component, the District (South Florida Water Management District), in cooperation with the Corps, shall complete a project implementation report to address the project component's economic and environmental benefits, engineering feasibility, and other factors provided in s. 373.1501 sufficient to allow the district to obtain approval under s 373.026. Each project

implementation report shall also identify the increase in water supplies resulting from the project component. The additional water supply shall be allocated or reserved by the District under Chapter 373." This PIR contains information to meet the requirements of the Programmatic Regulations, 33 Code of Federal Regulations § 385.15, which provides that PIRs shall include such information and analyses as are necessary to facilitate review and approval of projects by the South Florida Water Management District and the State pursuant to requirements of Florida law.

8.8.3 Pre-Construction and Detailed Design Phase

One of the first considerations of an implementation plan must be the completeness of the recommendations to be implemented. While a substantial interagency effort has gone into the development of this report, not every aspect of the planning process is finished.

Engineering analyses and design were completed using best available survey information. Improved survey information has been gathered but not incorporated into the engineering analyses and design to date. To determine if any additional design efficiencies can be incorporated into the recommended plan, engineering analyses and designs will be performed with this new survey information. The additional engineering analyses requirements are site specific hydraulic modeling, detailed geotechnical investigation, structural and mechanical optimization of the proposed pump station, but these are only some of the detailed design requirements for this phase. The outcome of this additional analysis is not expected to be adverse to the implementation of the recommended plan or result in increased cost. This detail engineering is only required to minimize the unfinished engineering design aspects required for a Plans and Specification Document for construction.

Soils and geologic information available from the original canal construction and a few other sources was employed in the current designs. Soils in the region are known to be relatively consistent and it is thought that soils are not likely to present problems for the type of construction contemplated. However, prudent and safe design demands that a thorough geotechnical investigation be completed prior to the development of construction plans and specifications.

The Phase II and Phase III assessment for hazardous, toxic, and radioactive waste and evaluation of the risk associated with the flooding / inundation of the Southern Golden Gate Estates area was completed in September 2003. The SFWMD has been coordinating the findings with the Florida

Department of Environmental Protection (FDEP) and the U.S. Fish and Wildlife Service to develop appropriate actions for residual agrochemicals that were discovered. A total of 36 acres of land within SGGE contain chlordane that requires action. The SFWMD is aware of the requirement that lands provided for the project must be free from contamination. SFWMD plans to perform a combination of soil inversion, soil inversion plus capping, and soil excavation, depending on the site-specific concentration of chlordane. The estimated cost for all remediation is $1,690,000. The SFWMD would perform this remediation during this Pre-Construction and Detailed Design phase. The costs of remediation would be entirely non-Federal and not cost shared between the sponsor and the Federal Government. Additional details are in Appendix D.

Real estate acquisition activities will continue concurrent with detailed design. The Florida Department of Environmental Protection is overseeing the acquisition. The acquisition is currently 97% complete. It is anticipated that the acquisition will be completed prior to completion of PED. The non-federal sponsor is engaged in real estate acquisition and the non-federal sponsor understands that until a Project Cooperation Agreement is executed its real estate acquisition is at its sole risk and expense.

8.8.4 Project Cooperation Agreement

The South Florida Water Management District and the Federal Government will enter into binding agreements for local cooperation prior to the implementation of the project. The Federal Government and SFWMD are currently developing a Master Agreement for Local Cooperation on the Comprehensive Everglades Restoration Plan (CERP) that will apply to the projects in the recommended plan. It is envisioned that the Master Agreement will include provisions common to all projects for which the South Florida Water Management District is the non-Federal sponsor. In addition, the Federal Government and the South Florida Water Management District will enter into a binding Project Cooperation Agreement specific to each project. The Project Cooperation Agreement will include provisions that are unique to the specific projects and will only be executed after all the applicable requirements of Federal and State laws have been met.

8.8.5 Construction

A majority of the activities that take place during the construction phase of a project are detailed in an updated PMP/PIR for construction as designs are completed. This phase encompasses the actual construction of a project's

components. Prior to the beginning of this phase, the PMP/PIR is updated to reflect the latest project schedule and cost estimates. Also, the on-site environmental monitoring plan is finalized and put into effect. As the construction phase is concluded, the operation, maintenance, repair, replacement and rehabilitation manuals are completed.

8.8.6 Early Construction

Two components of the recommended plan will be exceptions to the implementation sequence described above. The non-Federal sponsor has started construction of the Prairie Canal plugs and plans to start construction of the U.S. 41 culverts prior to Congressional authorization of the project and prior to signature of the Project Cooperation Agreement. These features are being constructed early because they provide immediate benefits to the ecosystem and they are necessary steps for the later construction features. Ecosystem benefits would be greatly reduced and the recommended plan would not function without these components. The non-Federal sponsor is proceeding under a risk that it may not receive credit for the work. Section 13 (Recommendations) of this PIR recommends that Congress authorize credit to the non-Federal sponsor for constructing plugs within the Prairie Canal and constructing culverts under U.S. 41, based on verification that the work completed is necessary for the Project and that the costs are reasonable. If Congress approves this recommendation, then this early construction work will be treated the same as the other construction features, and their costs will be shared equally between the Federal government and the non-Federal sponsor.

8.8.7 Public Involvement

Public involvement will continue to be a part of the SGGE Project throughout its implementation. Exact dates and times of public meetings cannot be predicted at this time. It is probable that public involvement events will take place as plans for each basin are solidified. As the details of design and construction are developed, the public will be afforded an opportunity to participate and comment.

8.8.8 Implementation Schedule

Throughout project implementation the schedule for individual tasks developed for the PMP and PIR will likely require adjustments to ensure the overall project stays on schedule and within budget. While the project will be

managed, insofar as possible, to comply with the schedule developed for the PMP and PIR and within the currently estimated cost, it is inevitable that changes may be necessary. The estimated schedule for major phases of the SGGE project is presented in Table 8-5.

TABLE 8 - 5 ESTIMATED DURATION TO COMPLETE UPCOMING SGGE PROJECT PHASES

Phase	Estimated Duration
Detailed Design and Plans & Specifications	2 years
Project Cooperation Agreement	Complete by the end of P&S phase
Construction	3 years

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SECTION 9

ENVIRONMENTAL EFFECTS

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SECTION 9
ENVIRONMENTAL EFFECTS

9.1 SECTION DEFINITION

This section includes a brief summary of the expected beneficial and adverse physical, ecological, and socio-economic effects if the agency's recommended alternative 3D ("with project") were implemented on resources within the Picayune Strand (Southern Golden Gate Estates - SGGE) project area. It does not attempt to provide comprehensive coverage of all effects on all resources. The following assessments are based on a comparison between the recommended alternative and the "without project" (no action) alternative. **An evaluation and comparison of all the alternatives can be found in Section 6 of this report**.

9.2 GENERAL ENVIRONMENTAL EFFECTS

The primary purpose of this project is to restore the ecosystem within the SGGE Project Area and adjacent affected public lands to conditions as close to the pre-drainage condition as possible. This goal would be accomplished by partially reversing the effects of drainage and compartmentalization, where surface water sheet flow has been intercepted by 279 miles of roads and captured in 48 miles of canal. Alternative 3D would build three pump stations, place plugs in a total of 42 miles of the four canals and grade down or remove 227 miles of roads. The resulting flow patterns would be more natural. It is expected that plant communities will show succession to cover patterns more like historic vegetation cover. These restored communities would provide improved habitat for native fish and wildlife. Additionally, removal of roads and permanent residents will decrease the effects of past human disturbance for sensitive species. Present day freshwater surge discharges through the Faka Union Canal system would be replaced by more natural slow shallow sheetflow across a broad front. Drainage toward all of the estuaries south of the project area would follow a pattern resembling historic drainage patterns, rather than occurring, as now, largely as a single heavy discharge into the Faka Union estuary.

The 55,247-acre SGGE Project Area is extremely important regionally. The SGGE lands have been a "hole" in the center of a complex of surrounding state and federal nature preserves and wildlife areas. Completion of the project and management of the lands as a State Forest, as proposed, will turn all of these reserves into a contiguous block of land (Figure 1-1). This area would be large enough to provide viable habitat for wide ranging species such as the endangered Florida panther and the state listed black bear. Completion of the SGGE ecosystem restoration, and proper management of the resulting Picayune

Strand State Forest, is central to the connectivity of these existing preserved areas. Besides providing an extensive cohesive landscape for wildlife, the restoration area would provide an infiltration area to benefit groundwater aquifers. Pine flatwood and hardwood hammock plant communities are fast disappearing from the South Florida landscape. Because the relatively dry upland nature of these communities, they are the first acreages to be developed into subdivisions. As part of alternative 3D, an area in the northwest corner of the project would intentionally be reserved for restoration of these upland communities. Planned hydrologic changes in Alternative 3D would reestablish a more natural ground water table that would assist the Florida Division of Forestry (DOF) to manage this area for high quality upland habitat.

9.2.1 Infrastructure

Alternative 3D would lower to ambient grade and abandon approximately 227 miles of the 279 total miles of roadway in the SGGE Project Area. Of the remaining 52 miles of roads, 41 would remain at existing grade or be lowered to ambient grade and maintained for use during the dry season by Division of Forestry personnel. The remaining 11 miles of road would be elevated for all-season access to the pump stations and access to the private lands residential area in Belle Meade. Three pump stations located on the Merritt (800 cfs), Faka Union (2,630 cfs), and Miller (1,250 cfs) would be constructed to replace the capacity of the plugged SGGE canals draining the private lands in Northern Golden Gate Estates (NGGE). Spreader canals would be constructed for each pump station to facilitate moving the water onto the land to restore a more natural pre-drainage sheet flow. Most of the culverts, bridges, and weirs would be removed or abandoned. Private land in holdings in the adjacent South Belle Meade part of the Picayune Strand State Forest would be protected by five separate levees. A connector culvert under Everglades Boulevard would be constructed to tie together drainage canals along Interstate 75.

The removal of existing and the construction of the new infrastructure for alternative 3D would require an estimated excavation of 4.7 million cubic yards of material, 2.3 million cubic yards of fill, and the clearing of 5,104 acres.

Alternative 3D would not affect state highways. Pump stations have been designed to operate to maintain drainage in NGGE under average conditions and storm events. I-75 is located along the southern edge of NGGE, and thus would also be protected from changes in groundwater and surface water. State Road 29 is located approximately 7 miles east of SGGE, well beyond any hydrology changes resulting from Alternative 3D. Nine additional culverts would be constructed under U.S. 41. These culverts, in combination with existing culverts and bridges, would prevent any hydrological impacts to U.S. 41 that might occur as a result of the project. However, if any potential impacts to

U.S. 41 from the project were discovered during the detailed design phase of this project, the impacts would be mitigated. The Corps and SFWMD will be working closely with the Florida Department of Transportation (FDOT) during detailed design to ensure that the correct profile information on U.S. 41 is used in the design modeling to ensure that public safety is not compromised. Any necessary road improvements caused by lack of maintenance will be segregated from project costs and negotiated separately with FDOT. At this time, our engineering does not indicate any additional impacts to U.S. 41 related to this project.

9.3 PLANT COMMUNITIES

The long-term goal of Alternative 3D is to return the hydrology of the SGGE Project Area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage and development. This alternative would also produce a beneficial ground water effect on the upland plant communities that are upstream of the pumps. The combination of a restored hydrology, a more natural fire regime, and an appropriate exotic vegetation control program can be expected to reestablish the pre-drainage character of SGGE plant communities. This would mean that plant communities that have developed under the existing hydrologic and fire regimes, but were not present prior to drainage, would be greatly reduced or eliminated during the decades following restoration, and would be replaced by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in SGGE prior to construction of the canal system, but have become established in new areas as a result of drainage, would likely return to their original distribution.

The time frame for restoration of the original communities would vary, but tree-dominated cover types do not change rapidly. The time to full community restoration would depend on the type of community to be reestablished and the degree to which they have been disturbed, particularly by severe fires. Loss of older forest trees would require at least many decades to replace, during which time the sites would be dominated by earlier successional communities, most likely willow in the cypress swamps and a mixture of wax myrtle and herbaceous species in the pine flatwoods. During this successional period it would be important to monitor for and eradicate exotic/invasive plant species while their populations are small. The proposed monitoring plan includes periodic surveys of vegetation, providing an opportunity for adaptive assessment and management actions to control the process.

The significantly reduced duration of flooding in SGGE under the current drainage regime has likely had dramatic impacts on tropical vegetation due to the loss of freeze protection from the moderating influence of standing water

when winter cold fronts pass through the area. Restoring the natural hydrology by implementing Alternative 3D would reestablish conditions where many of these tropical communities could reestablish.

9.4 FIRE

Under Alternative 3D prescribed burns would be less intense due to the restored water table, resulting in lower tree mortality. With purchase of all residential tracts, prescribed burns may be conducted when conditions are ideal over large areas. The seasonal window for performing prescribed burns would be greatly extended. Longer hydroperiods will permit coverage of more area each year. There would be increased opportunity for doing more lightning season burns, which would mimic the historic fire regime. Removal of most roads would reduce human caused wildfires. In addition to blocking sheet flow, roads also act to check the natural spread of low intensity prescribed fire. Road removal would allow a more efficient and beneficial prescribed fire regime. One of the functions of the at grade roads that would be maintained in the project area would be management of prescribed fire.

9.5 FISH AND WILDLIFE RESOURCES

The presence and health of wildlife populations are a function of the habitats available to support them. Given the dramatic changes in road access, hydrology, plant communities, and fire regimes in SGGE over the past thirty years, the current wildlife populations have undoubtedly changed from those present historically. Alternative 3D would enhance fish and wildlife resources by restoring or reestablishing: natural hydroperiods, pre-drainage sheet flow, freshwater flowways to downstream estuaries, native plant distribution and composition, surface aquifer recharge, and the area's natural fire regime. The ecological condition of SGGE affects wildlife in the immediate Project Area as well as significant regional fish and wildlife resources within the region, due to its central position in a complex of nature reserves, forests and parks. Restoring habitat values in the project area is extremely important to ecosystem connectivity (Figure 1-1). These other reserves include the adjacent Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, Collier Seminole State Park, South Belle Meade portion of the Picayune Strand State Forest, and the Ten Thousand Islands Region, including the Ten Thousand Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Reserve, and Everglades National Park.

Implementing alternative 3D would return the landscape to a more natural hydrology, which has obvious implications for wetland dependent wildlife species. Populations of amphibians, otters, wading birds, forage fish and aquatic

invertebrates would likely increase. Although some of these elements, especially wading birds, would only utilize the area during the rainy season, restoring this habitat can be expected to benefit species that have suffered an overall loss of foraging habitat during the recent historic period, such as the endangered wood stork. It would also benefit terrestrial wildlife through the reestablishment of high quality mesic and hydric pine flatwood / hammock habitats that would have most roads removed, limited human access, and management areas for upland species. In the September 2004 Coordination Act Report (CAR) the FWS states "The Service supports Alternative 3D because it would provide greater wetland restoration benefits to the SGGE project site, Faka Union estuary, and adjacent coastal bays, according to hydrologic modeling results provided by the Corps/SFWMD and our evaluations (than other alternatives evaluated). However, this support is qualified and dependent upon the development of future operational plans for the pump stations".

In the September 22, 2004 Final Coordination Act Report (FCAR) the FWS made the following major recommendations:

1. Conduct baseline, construction, and post-restoration surveys for federally and state listed species including the West Indian manatee and its critical habitat, Florida panther, Florida black bear, wood stork, red-cockaded woodpecker, and state-listed wading birds;

   Response: Surveys of state and federally listed species are proposed in the Ecological Monitoring and Adaptive Assessment Plan. The Corps and WMD staffs have been coordinating the plan included in this PIR with Service, State and non-government conservation groups. The monitoring plan is a result of this ongoing collaboration.

2. Conduct construction and post-restoration surveys for fish and wildlife using methodologies established in existing baseline wildlife surveys;

   Response: The monitoring plan includes a provision to continue baseline surveys so that change would be detected. Project construction specifications will specify needed surveys and protections to be established to protect fish and wildlife during construction activities.

3. Continue site management activities and develop the Ten-Year Picayune Strand Resource Management Plan consistent with site restoration and management objectives described in the Picayune Strand Restoration Project, Florida Forever Program, Florida Division of Forestry management goals, and the Farm Bill and Interim Management Agreements with the Department of the Interior;

Response: The Ten-Year Picayune Strand Resource Management Plan is under development by the Florida Department of Forestry with cooperation from other agencies. It is central to the success of many project goals related to land use management, but its development is outside the scope of this PIR.

4. Implement the Ecological and Water Quality Monitoring Plan (Plan) (Appendix H of the Project Implementation Report/Environmental Impact Statement), integrating the results of fish and wildlife monitoring with design and operational plans to increase the long-term resource restoration benefits of the project. Modify the Plan to include Inland and Listed Species elements currently under development by the Service, South Florida Water Management District, Florida Division of Forestry, Florida Fish and Wildlife Conservation Commission and the Conservancy of Southwest Florida.

   Response: The Ecological Monitoring and Adaptive Assessment Plan has been further developed with input from Service biologists and staff of the agencies cited above. This plan would be refined, if the project is approved, during the Preconstruction Engineering and Design (PED) phase. Please refer to Appendix H of this report.

5. Following multi-agency review and approval, implement a detailed Project Operating Manual that will benefit restoration of freshwater wetlands and downstream estuaries by restoring the quantity, quality and timing of freshwater flows to the natural system, as well as protect and improve freshwater wetlands upstream of the project. In addition to ecosystem benefits, the project's operational rules must ensure that existing levels of flood protection for surrounding developed communities are not reduced;

   Response: A draft Operations Manual for alternative 3D is included in Appendix A of this PIR. The final operations plan will continue to be developed, if this project is authorized, during Pre-Construction Design. We expect to continue to include Service staff in coordination and finalization of this plan.

6. Establish new water quality/quantity monitoring sites on the project and on adjacent public lands, such as the Ten Thousand Islands National Wildlife Refuge that would likely be affected by the project;

   Response: A Water Quality Monitoring Plan for the project is included in Appendix H of this PIR. Establishment of additional monitoring stations (not included in the Monitoring Plan) is not within the financial scope of the project. Many groundwater monitoring stations and flow transects have already been set up by the SFWMD to obtain baseline data prior to

project construction. The Corps notes that the National Estuarine Research Reserve currently operates several automated water quality data loggers at the mouths of some of the affected estuarine creeks.

7. Monitor conditions in estuarine environments during project operation to validate hydrologic model predictions and provide a basis for improving the performance of the plan within the range of operational flexibility provided by the project design structures;.

   Response: The Ecological Monitoring and Adaptive Assessment Plan (Appendix H) includes some estuarine monitoring. The intensity of monitoring in terrestrial vs estuarine habitats is roughly proportional to the ecosystem benefits expected to be derived in each area as a result of the project.

8. Ensure that existing baseline water quality data continue to be collected by government and local entities, such as Collier County, U.s. Geological Survey, Florida Department of Environmental Protection, the South Florida Water Management District and the Southwest Florida Water Quality Consortium;

   Response: A Water Quality Monitoring Plan is included in this report. The intent of CERP projects is not to substitute for or subsidize ongoing monitoring programs of other agencies. These programs are expected to continue under their existing funding sources.

9. Develop an estuarine mixing model for the downstream estuaries of Faka Union, Fakahatchee, Pumpkin, and Blackwater Bays.

   Response: The intent is to include evaluation tools for the post-restoration conditions in the Ecological Monitoring and Adaptive Assessment Plan subject to available funding. Developing an estuarine mixing model is however beyond the scope of this project. Modeling tidal hydrodynamics in this extensive region might be an objective for the more comprehensive Southwest Florida Feasibility Study, but the Corps notes that detailed bathymetry of the region would be required in order for such a model to be developed. Data do not exist at present to calibrate an estuarine mixing model for the region.

10. Draft an Exotic/Invasive Species Management Plan for the project and implement measures to control exotic plants during project construction and operation phases throughout the project area.

    Response: The Florida Division of Forestry has stated that it will include measures for invasive and exotic plant control in the Ten-Year Picayune

Strand Resource Management Plan. Corps construction specifications will contain exotic plant control language for the contractors, such as washing construction vehicles prior to entering/leaving the work site. The project O&M plan will contain exotic species control within the footprint of construction activities during the second and fourth year after construction. However, the plan recommended in Alt 3D does not include a major budget item for overall exotic invasive plant control. The Corps and SFWMD acknowledge that invasive exotics are a problem throughout the south Florida ecosystem. Other CERP programs are dedicated to address the invasive exotics problem directly through research in new control agents and techniques.

11. Identify and reach consensus on issues related to design storm calculations by development of a "white paper" by an interagency team;

    Response: The Corps and SFWMD are not proposing such a study, which is outside the scope of this project. The Corps follows Engineer Regulations that determine how the level of protection is defined; and SFWMD and ACE engineers are in agreement regarding the design storm calculations.

12. Develop a specific Comprehensive Everglades Restoration Plan Guidance Memorandum on Flood Damage Assessment Procedures.

    Response: The CERP Design Coordination Team (DCT) may consider this recommendation, but it is outside the scope of this project. Note that the Corps already has Engineer Regulations that direct that flood damage be assessed in certain ways. These regulations are promulgated at a national level. Likewise, the State of Florida has statutory regulations that address reductions in level of service for flood protection on new projects.

13. Evaluate hydrologic information for the thirteen-year period of record simulated by the model to provide a full analysis of the project effects on the natural system. Develop assessment performance measures for dry season conditions, flood control and water supply.

    Response: Dry and wet season Hydrologic performance measures were included in Section 6.7.2. The engineering Operations Manual is based on maintaining existing drainage conditions for NGGE. Water supply is covered under Project Assurances located in Section 12 of this PIR.

14. Remediate any contaminated portions of the project impact area where wildlife could be adversely affected by high levels of selenium, chlordane, and dieldrin as a result of project operation.

Response: SFWMD is working with the US Fish and Wildlife Service to decide on the most cost effective and preferred options for cleanup of site contaminants. Note that the local sponsor is aware of its responsibility to remediate HTRW problems prior to conveying the lands to the Federal Government. SFWMD has made significant progress in selecting remediation methods in consultation with other State agencies and FWS. The Federal Government will not accept lands for the project until they are certified free of contamination. This is a general procedure applied to all Federal construction projects, and is not unique to CERP.

15. Modify detailed project design to reduce engineered structures such as pumps and berms to allow for more passive water management in the project area; and

    Response: A number of alternatives with a more passive design were evaluated during development of the recommended plan. To date these designs did not allow rehydration of lands south of I-75 while maintaining "level of service for flood control" in NGGE. Construction designs that allow for a more passive management of the flows to the natural system may be re-evaluated, if the project is approved, during the Preconstruction Engineering and Design phase (PED) when additional data are available.

16. Ensure that all recreation proposals by the site manager, Florida Division of forestry, are consistent with the restoration objectives of this project which are primarily to restore natural resources to their natural condition and to prioritize protection of fish and wildlife resources, listed species and downstream estuaries. All activities proposed by the Florida Division of Forestry must be reviewed and approved by the Department of the Interior consistent with Farm Bill 3 and Interim Protocol Agreements, National Environmental Policy Act, Endangered Species Act, and various other State and Federal regulations.

    Response: The Corps and WMD intend to continue in close collaboration with FWS and other Federal agencies to assure that the management plan is developed to foster the purposes and objectives of the proposed Federal project. We note that it is DOI responsibility to assure consistency with the Farm Bill.

Interagency coordination among biologist and hydrologist staff of FWS, Corps and SFWMD staffers has continued. Project staff met with FWS staff at the FWS South Florida Ecosystem Office on August 5 and 11, 2004 to discuss, respectively, fish and wildlife and habitat issues, and hydrologic modeling issues. PIR team members of USACE and SFWMD repeated their commitment to continue working in close coordination with resource agencies to develop the best possible management and monitoring plans for this project, within the scope of the budget.

It is expected that, if the project is approved, better data to support endangered species information and monitoring will be available after the required surveys are completed in the PED phase.

9.6 THREATENED AND ENDANGERED SPECIES

An October 27, 1999 FWS Planning Aid Letter (PAL) for the SGGE project was received by the Corps. It outlined fish and wildlife concerns including federally listed threatened and endangered (T&E) species that are known to or may occur in the vicinity of or may be affected by the SGGE project. These species are the threatened eastern indigo snake (*Drymarchon corais couperi*), endangered wood stork (*Mycteria Americana*), endangered red-cockaded woodpecker (*Picoides borealis*), endangered Florida panther [*Felis* (=*Puma*) *concolor coryi*], endangered snail kite, *(Rostrhamus sociabilis plumbeus)*, endangered American crocodile (*Crocodylus acutus)*, and endangered West Indian manatee (*Trichechus manatus)* (U. S. FWS 1999). In a PAL dated January 17, 2003, FWS reaffirmed this list of species and added the threatened bald eagle *(Haliaeetus leucocephalus)*. In a second PAL dated August 11, 2003. The February 2004 draft Coordination Act Report (dCAR) also reaffirmed the above list of T &E species. On May 1, 2003 the smalltooth sawfish (*Pristis pectinata*) was added under this section heading when the National Marine Fisheries Service (NMFS) listed it as an endangered species.

In southwest Florida all of the above threatened and endangered species are vulnerable to the same significant threats to their survival. They require relatively large home ranges. Residential and commercial construction, agriculture, and timbering expansion have caused wide spread habitat loss, degradation, and fragmentation. Extensive tracts of wild land are the most important refuge for large numbers of these species. SGGE is located in Collier County, which has one of the fastest growing human populations in the United States. SGGE is also bordered on three sides by large expanses of federal and state owned public lands dedicated to the preservation of natural ecosystems (Figure 1-1). The restoration of SGGE is the key to providing the connectivity of the extensive home ranges needed by these and many other species. Additional information about the effects of the recommended alternative on these species can be found in the FWS Coordination Report located in Appendix D.

In response to the October 27, 1999 PAL the Corps submitted to FWS a draft Biological Assessment (BA) of federally listed T&E species that may be affected by the SGGE project. The determinations in this BA, which can be found on the SGGE WEB site, were not responded to by FWS due to a Corps and SFWMD decision to develop new alternatives. As a member of the PDT the FWS has actively assisted the Corps in development of alternatives and the selection of the recommended alternative. This extensive informal consultation process is

intended to minimize the adverse effects of the project on federally listed species and maximize positive effects. In the FCAR The FWS stated that it believed that further coordination and baseline studies must be committed to by the action agencies before the ongoing informal consultation can be concluded. In accordance with Corps planning regulations, an updated Biological Assessment was coordinated with the Service on October 20, 2004 (it is included in Appendix D of this PIR). This BA coordinated "no effects" determinations for Everglades snail kite and American crocodile critical habitat. It concluded "may affect, unlikely to adversely affect" regarding the red-cockaded woodpecker, the bald eagle, the Everglade snail kite, the eastern indigo snake, and West Indian manatee habitat. It concluded that there is still insufficient information to determine effects on the West Indian manatee, wood stork or Florida panther. The Service indicated concurrence with the BA on October 20, 2004. Coordination will continue on the 3 species listed above during the detailed design and engineering phase of the project, if it is approved. In any case no construction of recommended alternative 3D will take place prior to full concurrence of FWS. It is the intention of the USACE to comply fully with requirements of the ESA.

The following is a discussion of individual listed species known to occur in the region.

9.6.1 American Crocodile

The crocodile is an estuarine species; its largest population occurs in extreme southeast Florida, in the "Model lands" and south Everglades panhandle, extending to north Key Largo. A few observations of crocodiles have been made in the Ten Thousand Islands Region, and it is thought that under favorable estuarine conditions the American Crocodile may be expanding its range into the southwest Florida coast. The hydrologic restoration of SGGE would restore freshwater flows to offsite creeks and inland marshes downstream of the project. Discharges now reaching mostly the Faka Union Canal system would be distributed across a broad front of intertidal crocodile habitat in other parts of estuaries and bays within the Ten Thousand Islands Region. Among other beneficial effects, the increased freshwater in these estuaries should stimulate more prolific mangrove growth and litter production. The Corps of Engineers believes that the recommended plan would have a favorable influence on American crocodile habitat.

9.6.2 Bald Eagle

Eagle distribution is influenced by the availability of suitable nest and perch sites near large, open water bodies, typically with high amounts of water-to-land

edge. While the edge habitat already exists, suitable perch trees may be restricting current eagle habitat use. Restoration of the project lands, along with stimulation of growth of cypress and pine flatwoods communities, should improve perch and nest habitat by stimulating tree growth. This is a long-term effect that may take 20 years or more to occur. One of the current factors limiting full development of mesic and wet pine flatwoods communities has been the frequency of hot fires that shoot to the crowns of trees, killing them. Additionally, improvement of the overall productivity of the estuaries, expected as a consequence of the re-distribution of water, is expected to result in an increase of prey species. There are records of eagle nests during recent years in lands adjacent to the project. Surveys for nests will occur during P.E.D. and prior to construction in all areas, and appropriate eagle protection measures will be incorporated, as customary, in project specifications.

The reestablishment of long hydroperiod wetlands dominated by tall trees, the removal of roads, and the restricted human presence would provide the eagle with suitable nest sites near the estuaries and bays of the Ten Thousand Islands Region. The restoration of wetlands within the SGGE Project Area would make available some foraging areas for the eagle.

9.6.3 Eastern Indigo Snake

The Project Area is a critically important segment in the consolidation of a landscape that would connect surrounding public lands into a large block of relatively wild habitat for the snake. The removal of hundreds of miles of road, and a restricted human presence would produce a more natural landscape. It is expected that recommended alternative 3D would increase the indigo snake's ability to feed, breed, and shelter, as a result of hydrological restoration of both wetlands and uplands on the Project Area site. To restore indigo habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to natural conditions. Eastern indigo snakes could be encountered during construction; therefore implementation of the standard construction practices to avoid adverse effect on the species would be included in the construction specifications for this plan.

9.6.4 Florida Panther

The recommended plan is expected to benefit populations of Florida panther that utilize habitats in the region. Figures 9 and 10 in the FCAR (Appendix D) show the project area in context of the surrounding region. Panthers habitually are found in the SGGE area and surrounding protected lands. Each dot on the map indicates a position (a "hit") of an animal bearing a telemetry collar. These maps clearly show the importance of the area as panther habitat; but they show that

adjacent, less disturbed areas such as Fakahatchee Strand State Preserve are even better habitat. Road removal, land purchase, and administration as part of a State Forest all are actions that should increase the panther habitat value of the land. Although panthers generally den in uplands, they utilize marsh and swamp habitat extensively, especially seasonally wet-and-dry wetlands like pine flatwoods and short-hydroperiod marshes. In order to appreciate project benefits to the panther, consider that under the no-action plan ("future without project") about 40 percent of SGGE lands were expected to be developed as residential tracts. Under existing conditions, there are hundreds of miles of roads, accessible to high-clearance vehicles and ORV's, throughout the project area. Under the 40 percent development scenario it would be expected that many of the existing roads would be paved and widened, traveled by ordinary passenger cars at high speed, and daily traffic would be substantial. Conversion of the project area to a managed State forest, rehydration of project wetlands, restoration of more natural plant cover, and removal of most human disturbance over such a large area will undoubtedly favor the panther's ability to feed, breed, and shelter. Restoration will also improve habitat conditions for the panthers' prey base, and a more restricted human presence would produce a large block of moderately wild habitat for the panther. A major feature of the suggested restoration plan is the removal of the majority of the 279-mile road grid. This is important to the panther because it would reduce vehicle-related mortality, decrease human disturbance to panthers and panther prey, reduce exotic plant invasion that tends to be more severe near disturbed roadsides, and result in thousands of acres of restored habitat. The SGGE Project Area is a critically important segment in the consolidation of a natural landscape that would connect surrounding public lands (Figure 1-1) into a region of sufficient size to assist in the recovery of the panther.

9.6.5 Red-Cockaded Woodpecker

The recommended plan, with its incomplete hydrologic restoration of SGGE in the project's northwest corner would retain some upland habitat (pine flatwoods) for terrestrial wildlife such as red-cockaded woodpeckers (RCW). RCW groups utilize mature pine flatwood communities and nest in older pines. The SGGE Project Area is not currently documented as RCW habitat although active clusters are located within the adjacent South Belle Meade portion of Picayune Strand State Forest and in Big Cypress Preserve approximately 37 miles east of the site. Habitat evaluations predicted by the MIKE SHE hydrological model indicate that a significant acreage of flatwoods will be replaced by cypress and other wetland communities as a result of the restoration. However these flatwoods that the model shows as being lost are low quality artifacts of overdrainage that still have remnant populations of wetland plant communities interspersed or dominated by invasive or exotic plant species. The effect of alternative 3D is to improve the quality of the remaining pine flatwoods and

potentially restore a forest that can support additional RCW clusters. It is also the intent of the restoration to protect existing or reestablish lost pine strands that under natural condition were located on slightly elevated ridges that ran parallel to the southwesterly wetland flow patterns on the site. The geographic location of flatwoods communities on the post-restoration site will also be important in enhancing regional RCW populations. Forest restoration would contribute to adjacent public lands management of this endangered species, and possibly contribute to regional recovery of the RCW population in southwest Florida by providing a forested "bridge" of habitat for the woodpeckers to disperse over a wider landscape.

9.6.6 Estuarine Fishes and Sea Turtles

The hydrologic restoration of SGGE under alternative 3D would redistribute freshwater flows from the Faka Union Canal system to other parts of Study Area estuaries and bays within the Ten Thousand Islands Region. Reestablishing a more natural hydrology would restore the slow year-round influx of fresh water needed to maintain the salinity in the natural range that is optimal for estuarine organisms. The only truly estuarine endangered species found in the region is the smalltooth sawfish, recently listed. Improvements in estuarine salinity gradients will in turn benefit (stimulate) estuarine secondary productivity, which will benefit the sawfish by favoring development of forage fish and invertebrate communities. No effects are expected on marine turtles, which are not normally present in the inner estuaries. The Faka Union Canal weir #1 that is just north of US Highway 41 will remain in place as a barrier to salt water intrusion. It will act as a barrier to any upstream movement of these species thus protecting them during construction. Implementation of the recommended plan should have a favorable impact on estuarine habitats used by these T&E fishes and turtles.

9.6.7 Everglades Snail Kite

The hydrologic restoration of SGGE is not expected to greatly benefit the snail kite, a bird of open marshes that depends on sight-feeding to locate its favored foot source, the apple snail. There is virtually no apple snail habitat in the project area under current conditions. Under the "no-action" scenario, increased and intensified residential development would reduce snail and snail kite habitat even further. The proposed project would restore primary and secondary wetland habitats for the snail kite. Offsite creeks and inland marshes located downstream from the project that may be used by the snail kite might benefit from the reestablishment of a slow continuous release of freshwater. The habitats used by the Everglade snail kite would not be adversely affected and might be positively influenced by implementation of the recommended plan.

9.6.8 West Indian Manatee

The most important habitat utilized by the local sub-population of manatees is the area downstream of the Faka Union canal weir. USGS biologists have been monitoring this sub-population, and report that large numbers of manatees aggregate in the Port of the Islands marina basin in winter. These animals have been observed swimming upstream to the weir to drink fresh surface water. During the rest of the time, in cold weather they aggregate on the bottom in the deepest parts of the (dredged) marina basin. The recommended project will not affect this basin, and is not expected to adversely affect manatee aggregation in winter, but it will affect flows over the weir.

Manatee mortality related to cold-stress has been observed in this location. This tidal boat basin shows a typical saline stratification during calm dry weather, with denser (warmer) salt water covering the basin deep spots, while less dense freshwater forms the surface layers. The animals evidently rest in the warmer bottom waters, rising to the surface to breathe or drink. During warmer months, manatees visit the marina, but venture to the outer Ten Thousand Islands area to feed on marine vegetation.

Clusters of mortality at the site are associated with cold fronts, with air temperature dropping below 20° C. The hypothesis is that the animals utilize the (relatively) warm bottom water to avoid hypothermia, remaining in the marina rather than going to deeper ocean waters because they need to drink fresh water. The weir appears to be a constant source of freshwater overflow in the dry season under existing conditions.. Some weather events linked to cold front passage may play a role in manatee mortality, inducing turnover or mixing of the deep water.

It is unknown what role the dynamics of freshwater inflow at the weir play in the balance of marina water temperature or basin stratification. It is known that conditions during the coldest, driest winter months are most critical. Therefore, the project-monitoring plan includes monitoring flows at the weir and providing support to monitor this manatee sub-population to attempt to determine project effects and avoid adverse effects. The project will be managed to assure that a minimum influx of freshwater remains available at the FU-1 weir to satisfy this sub-population's freshwater needs during the winter dry season. It is the intention of the USACE and SFWMD to cooperate with FWS and USGS manatee researchers and manage flows at the weir interactively (probably by installation of a well-supplied alternate fresh water source) to assure that lack of freshwater does not add to natural cold stress.

The recommended plan is projected to substantially reduce the average freshwater November-May dry season flows from the Faka Union Canal system into Faka Union Bay. Under this alternative the reduction of canal system flows

would restore watershed connections to the adjacent estuaries in bays to the west and to a lesser degree the Fakahatchee Bay estuaries to the east (Figure 3-2). Restoration of the watershed may contribute to additional manatee use of these natural freshwater sources as opposed to the existing freshwater point source discharges from the canal system into Faka Union Bay. This redistribution of flow to more natural discharge points is likely to influence manatee use of the Faka Union Canal and therefore their distribution throughout the region. USGS biologists hypothesize that during cold periods (water temperature < 20ºC), manatees will continue to aggregate in the Port of the Islands Marina basin south of the SGGE project, in part because of thermal buffering provided by the deeper (saline) bottom water. During warmer periods (water temperature >20ºC), manatees will tend to disperse from the canal, particularly if adjacent rivers are receiving greater freshwater input than the canal and are closer to feeding areas.

Because use of the Faka Union Canal brings manatees into close proximity with boats, it is possible that boat-related deaths and injuries in this region will be reduced if manatees become less reliant on the canal as their major source of fresh water. A change in manatee use of Faka Union Canal during periods of cold stress could also change exposure to boat traffic.

The impacts of the SGGE project on the extensive seagrass beds located in the outer edges of this estuarine system cannot be quantified due to lack of models for tidal circulation, but the project's influence is likely limited to the inner estuaries. However, in Faka Union Bay, directly downstream of Faka Union canal, studies indicate that algae dominate during winter (dry season) months, and seagrasses increase during the summer (wet season) months (USFWS 2002). Dramatic seasonal increases in seagrasses occur in Fakahatchee Bay west of the project, where inflows into the estuary follow a more natural hydrologic regime (Carter *et al.* 1973). Restoration of more natural flows to the estuary is expected to improve marine resources, including seagrass distribution and abundance.

As part of their research contribution to the CERP, the U.S. Geological Survey initiated a study on the impacts of hydrological restoration on manatees in the Ten Thousand Islands region in June 2000. The major objectives of the study are to determine distribution, movements, and habitat use of manatees associated with coastal waters and rivers, and to develop a population-level model to predict manatee response to changes in hydrology achieved by the SGGE project as well as the overall CERP. These data provide the basis for the first detailed analysis of manatee use patterns in the Ten Thousand Islands/Everglades National Park area.

9.6.9 Wood Stork

Alternative 3D would restore extensive primary and secondary wetland habitats for wood storks. These wetlands would provide expanded foraging opportunities for wood stork colonies located 23km away at the Corkscrew Sanctuary. Wetlands within 30 km of rookery sites have been described as core forage areas for wood storks; however, they may forage as far as 75 km from rookery sites. The preservation and restoration of hydrology and connectivity of wetlands on an ecosystem scale is essential to the survival and reproduction of wood storks in South Florida. The hydrologic restoration of SGGE would establish a contiguous block of protected wetlands near this sanctuary.

Tentatively recommended alternative 3D would reestablish critical natural hydroperiods in post-restoration wetlands. The more natural sheetflow would support surface water connections between wetlands to allow forage fish dispersal, establish dry-season or drought-resistant refugia, increase the extent and quality of wetlands; decrease competition between forage fish species; reduce predation on forage fish species, and reduce unwanted exotic fish species that compete with forage fish. Under this alternative the plugging and filling of canals would eliminate year round habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could result in access for predatory fish to isolated wetlands and increased predation of small fishes on the site, reducing the small fish forage base for wading birds and wood storks.

Water management and operation plans for alternative 3D infrastructure are critical in determining the effects of the project on wood storks. During wet years, water management practices could prevent the formulation of shallow pools that concentrate wood stork forage fishes. During dry years, water management practices could overdrain the freshwater sloughs and reduce wetland productivity of forage fishes for wood storks. Variable water management practices could increase or decrease frequencies of wood stork nest failure in area rookeries. A water control plan that considers wood stork habitat will be completed during the DDR phase of this project.

9.6.10 Endangered Plants

Tentatively recommended alternative 3D might decrease native tropical plant species mortality and tissue damage experienced during brief freeze periods. Hydrologic restoration of the project area will raise groundwater levels and allow surface water to remain in many wetlands well into the coldest part of winter. As water freezes it gives off heat that in combination with restored plant canopies would create localized microclimates where these plants could survive. Under this alternative federally listed orchids, which can be found in the

adjacent Fakahatchee Strand State Preserve, would someday have a chance to reestablish in SGGE.

9.6.11 Essential Fish Habitat

The Magnuson–Stevens Fishery Conservation and Management Act is intended to protect essential habitat for economically important species of marine fish. The species and habitats requiring evaluation are determined by regional Fisheries Councils; in the case of this project the Gulf Fisheries Council determined species and habitats of importance. The law requires coordination with the National Marine Fisheries Service (NMFS) anytime a federal project may adversely impact Essential Fish Habitat (EFH). The intent of the Southern Golden Gate Estates project is to restore to the extent possible the pre-development overland hydrology that feeds fresh water into the Ten Thousand Islands Region. This alternative would reduce point-source fresh water surges into Faka-Union Bay and restore more natural pre-development flows to Palm Bay, Black Water Bay, Buttonwood Bay, Pumpkin Bay, and Fakahatchee Bay, thereby vastly improving the extent and health of essential fish habitat predicted for the "without project" condition. The NMFS web site lists the Ten Thousand Islands Region as Essential Fish Habitat for adult and juvenile for brown shrimp (*Penaeus aztecus)*, gray snapper (*Lutjanus griseus)*, gulf stone crab *(Menippe adina)*, pink shrimp *(Penaeus duorarum)*, red drum (*Sciaenops ocellatus)*, Spanish mackerel *(Scomberomorus maculates)*, spiny lobster *(Panulirus argus)*, stone crab *(Menippe mercenaria)*, and white shrimp *(Penaeus setiferus)*.

All the construction features of the alternative 3D are well upstream of any juvenile or adult habitat for the listed species. Standard best management practices to reduce erosion and downstream turbidity will be included in the construction specifications. Construction should have no impact on EFH in the receiving bays. It is therefore the conclusion of the Corps of Engineers that restoring a more natural hydrology to the Study Area will have a positive affect on Essential Fish Habitat in the Ten Thousand Islands Region. David Dale of NMFS was contacted by email in August 2001 and agreed with the Corps evaluation that implementation of alternative 3D would have only beneficial effects on EFH and did not require formal consultation with NMFS.

9.7 GEOLOGY AND SOILS

The geology within SGGE would not be expected to be significantly altered within the 50-year life of the project except in the case of an unpredictable cataclysmic event

Tentatively recommended alternative 3D would reestablish a more natural hydrology over the SGGE landscape. The restoration of water depth and duration and reestablishment of a higher ground water table would help arrest the destruction of organic soils by oxidation and fire. Organic matter will start to deposit in areas with the proper parent material, living organisms, climate, and topography; however the rate of organic soil formation over time is not clear.

9.8 AIR QUALITY

Tentatively recommended alternative 3D would not adversely affect air quality within the project area. Some temporary increase in air pollution within the project vicinity can be expected from equipment used during construction. The elimination of most project roads would benefit air quality by reducing dust and emissions from vehicular traffic. SGGE is considered by the Environmental Protection Agency (EPA) to be an air quality attainment area. Project construction would not affect that status.

9.9 CLIMATE

A draft CERP Guidance Memorandum (17 October 2003) titled "*Sea Level Rise Considerations for Design of CERP Projects*" states that the Project Delivery Team (PDT) should consider sea level rise as a future condition. This guidance was not available during the building of the MIKESHE model used to evaluate the SGGE tentatively recommended alternative hence the model does not contain a sea level rise component. Tables in the above memo were used to calculate a 50% probability of an 8" rise in sea level for the Naples area in 2050. Elevations in the study area vary between sea level and 28 feet so it is probable that an 8" rise may have some effects. The PDT has decided to address effects of sea level rise on tentatively recommended alternative 3D during the Detailed Design Report (DDR) phase of this project.

9.10 HYDROLOGY

For information identifying the appropriate quantity, timing and distribution of water to be dedicated and managed for the natural system, the amount to be reserved by the state, and the water available for other uses see Section 12 Project Assurances.

9.10.1 Increases in Water Supply

Discussion of the effects of the preferred alternative on water supply is found in Section 12, "Project Assurances". In essence, the requirements of the Water Resources Development Act of 2000 is that each CERP project must identify the amount of water reserved for environmental restoration and that reserved for other purposes.

The water made available for the natural system that is necessary for the protection of fish and wildlife will be incorporated into a water reservations rule and protected under State law prior to execution of the PCA. Since this PIR is a design document that will be followed by a detailed design phase, construction, and final operating manuals, it is possible that the actual performance of the recommended plan may change. This change may affect the amount of water initially identified to be reserved by rule for the natural system. Therefore, the reservation rule has been conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved. Hydrologic monitoring is included in the operations plan to verify the quantities of water delivered to the natural system and made available for other uses. A detailed description of the monitoring plan is included in the Appendix H Ecological and Water Quality Monitoring Plan. This adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project.

9.10.2 Water Quality

The implementation of Alternative 3D would improve the water quality of coastal estuaries by increasing freshwater distribution to estuaries east and west of Faka-Union Bay and reducing very large wet season discharges into Faka-Union bay. Additionally, sheet flow of water originating upstream of the project will improve the quality of this water as it passes through restored wetlands communities The diversity and productivity of estuarine plants and benthic communities (mangroves, seagrass beds, macroalgal beds and oyster reefs) should improve.

As documented in Sections 3.10 Water Quality and 3.14 HTRW under the existing conditions of this report, there are within the project area soils contaminated with organochlorines, polycyclic aromatic hydrocarbons and/or other toxins. SFWMD is actively developing and implementing remediation for these substances in cooperation with DEP and FWS, and lands will be fully remediated when transferred to the Federal Government for implementation, if the project is authorized.

Considering the rapidly urbanizing NGGE area, the water quality from the NGGE canals would continue to worsen particularly in terms of nutrients (total phosphorous and total nitrogen) and coliform bacteria due to the expected increase of septic tanks in the area. Increased nutrient concentrations coupled with storm water point source inputs could potentially lead to the formation of enriched gradients within the study area and encourage the growth of nuisance plant species, e.g. cattails and primrose willow. If phosphorus levels become sufficiently high as NGGE develops, it may become necessary to implement storm water treatment management of canal inflows to protect the character of SGGE native communities. USGS and FDEP have performed, and continue to conduct, significant groundwater and water quality studies within the SGGE project boundaries and downstream estuaries. A water quality-monitoring plan has been developed as part of this project and is included in Appendix H.

9.10.3 Water Management

Several versions of the operating manual will be prepared prior to project completion. In the Pre-construction and Detailed Design phase, the draft operating manual developed for the PIR may be modified, as necessary, for operations during construction. A draft-operating manual for the operational testing and monitoring phase will then be prepared. Experience gained from the operational testing and monitoring phase will be incorporated into the final operating manual, which will be coordinated with SFWMD and the South Atlantic Division (SAD), and will supercede all other iterations of the operating manual. At this point, the SFWMD, as the local non-Federal sponsor, will accept ownership and responsibility for long-term operations of the project. The versions of the operating manual would include the operating criteria and additional provisions that may be required to collect, analyze, and disseminate basic data. Detailed operating instructions to ensure project safety, and operation of the project to assure restoration is achieved would also be included in the versions of the operating manual. The Corps and the SFWMD would jointly develop the operating manuals and ensure that the objectives of the restoration project are met using operational criteria and rules. The Draft Operating Manual will be consistent with the reservation or allocation of water described in the PIR and the PCA.

9.11 ESTUARINE RESOURCES

The benefits of alternative 3D transcend the freshwater wetland boundaries of the Project Area. Estuarine resources in the Ten Thousand Islands Region would be positively affected by the hydrologic restoration. The sheetflow disrupted by the existing SGGE canal system has altered salinities within much

of the 83 square mile area that makes up the Ten Thousand Islands Region (Figure 3-2). Adding the rehydrated marine area to the upland acreage restored within the SGGE Study Area increases total project benefits.

The severely altered freshwater input to three major estuarine systems (from west to east: Blackwater River, Pumpkin Bay, and Faka-Union Bay), and the smaller intervening estuaries, would be restored by the recommended plan. Plugging of the project canal system would reverse the freshwater inundation experienced by Faka-Union Bay during the rainy season. This inundation significantly reduces salinity along with other co-varying physical quality parameters. Sheetflow to the estuaries west of Faka-Union has been substantially reduced and this has artificially increased salinity during the rainy season. The impacts to water quality in Fakahatchee, the estuary east of Faka-Union, are not as clear because this system has not been monitored as extensively. It is suspected however, that this system has also experienced freshwater flow reduction to a lesser extent. Alternative 3D would restore the pre-alteration seasonal timing and discharge of sheet flow to the central Ten Thousand Islands Region, and would eliminate the point-source discharge of freshwater from SGGE into Faka Union Bay.

Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternatively, the elimination of variability because of the reduction of freshwater input, is harmful to the health of the system. All estuarine habitats, including sub-aquatic vegetation beds, oyster reefs, soft-bottom embayments, sand or mud shoals, fringing mangrove forests, and the open water nekton, all depend upon fresh- and marine water mixing. Brackish water conditions provide nutrient and dissolved oxygen enrichment, which promotes productivity. These conditions also provide a refuge from predation and an ideal setting for reproduction and juvenile growth and development. Ultimately, the health of the entire estuarine system is predicted to improve. However since a hydrologic restoration project of this magnitude has not been previously attempted in South Florida, the ecologic response of the estuarine aquatic system is unclear. Therefore the estuarine experts on the SGGE Project Delivery Team recommend monitoring efforts to establish pre-project baselines and post-restoration effectiveness on such parameters as salinity response, oyster health and reef distribution, the effects upon state and federally listed marine species, changes in salt marsh plant diversity and fishes, and the potential for sea grass development. Specific recommendations can be found in the Ecological Monitoring and Adaptive Management Plan found in Appendix H of this report.

9.12 SOCIO-ECONOMICS

9.12.1 Land Use/Population

Lands acquired with state and Federal dollars for the purpose of this restoration project would undergo extensive ecological and hydrological restoration. The land in the SGGE study area would not be used for development purposes with the SGGE recommended plan implementation, and would provide environmental benefits and much more closely resemble predevelopment condition. The surrounding residential areas will experience a large population increase, therefore an increase in infrastructure.

As part of project implementation, a monitoring plan would be conducted to assist in verifying desired benefits were achieved and help lay the groundwork for future operational plans in the area.

9.12.2 Population

The recommended plan will to some degree limit the growth potential of Collier County. Lands otherwise expected to grow in proportion to the rest of the County in the project area will not be available for growth. Lands in NGGE are expected to gradually convert from the present mix of residential/commercial/vacant to fully developed.

Development of adjacent lands will increase demands on regional water supply, recreational use of State and Federally owned lands, and increase pressure on native wildlife and their habitats. The complex of Federal and State Forests, refuges and preserves will play an ever increasing and critical role in the survival of native vegetation types and native species, as undeveloped but unprotected habitats disappear under golf courses, residential tracts and commercial-industrial sites.

In comparison to the "future without project" scenario, which contemplated 40 percent development in the project lands, about _23,000_fewer acres will be available to support development in Collier County through 2060.

Current statistics demonstrate that Collier County, including the study area of SGGE, is characterized by a much greater population growth rate than the rest of the State and the Nation as a whole. Collier County had a 2000 census population of 251,377 persons. The population of this county had an enormous increase of 65.3 percent from 1990 to 2000, and the estimate percentage change between 2000 and 2001 was 5.7 percent. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectfully during the

same period. The state of Florida added over three million persons from 1990 to2000, ranking third in the nation in numerical change.

Population in Collier County is expected to more than triple from 2000 to 2060. Due to this anticipated population growth, the county is expected to have one of the largest populations in the Lower West Coast. The dense urban area of southwestern Florida has contributed to development pressure and population increases in Collier County.

Table 9-1 summarizes existing and projected population in the study area. The 2000 figures are from the U.S. Census. The future estimates are based on Collier County's April 1, 2001 publication of population projection to the year 2030. BEBR medium estimates (there are also "high" and "low" estimates) growth trends evident between 2020-2030 were utilized to extend Collier County's population projection out to 2050. Build out is expected to occur in the county prior to 2050, therefore projections between 2050-2060 are nominal. These population projections were calculated for the South West Florida Feasibility Study. Table 9-2 displays the population rates of growth for each decade from 2000 to 2050. Table 9-3 indicates the population growth rate of the study area is expected to exceed that of the State from 2000-2050.

TABLE 9 - 1 STUDY AREA POPULATION ESTIMATES, 2000-2050

Population (1,000's)							
	Year						
	2000	**2010**	**2020**	**2030**	**2040**	**2050**	**2060**
Collier	251.3	383.7	529	689.3	740.9	792.6	800
Share of Florida Total	1.60%	2.00%	2.20%	2.40%	2.60%	2.90%	N/A
Florida Total	15,982.40	18,866.70	21,792.60	24,528.60	27,118.70	29,714.50	N/A

TABLE 9 - 2 STUDY AREA POPULATION RATES OF GROWTH 2000-2050

Average (% Per year) Population Growth						
	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050	**2050-2060**
Collier	5.3%	3.8%	3.0%	>1%	>1%	>1%
Florida Total	1.8%	1.55%	1.26%	1.06%	0.96%	N/A

TABLE 9 - 3 STUDY AREA POPULATION GROWTH

	% Change 2000-2060
Collier	215%
Florida	85.9%

9.12.3 Water Demand

Under all alternatives the water demands will increase due to an increase in population. Water demand calculations are being conducted for 2000-2050 by Gulf Engineers in conjunction with the Southwest Florida Feasibility Study. The results of these projections are in draft form, but the final figures are not expected to significantly change. Preliminary water demand projections estimate Collier County's most likely population scenario, conservation–adjusted water use in 2050 at 295.3 MGD. Due to the exceptionally small rate of growth projected between 2050 and 2060, it not expected that 2060's water demands will be any higher than in 2050, after taking into account conservation measures. Collier County is expected to be using 60 percent of the total water demanded in the Lower West Coast.

With the implementation of the recommend plan, the groundwater levels will increase leading to increased supplies of water and decreased salinity levels in private wells in the NGGE. With more persons drawing water and less water available, the increased level of groundwater may provide incidental water supply benefits. The amount of additional water supplied is unknown, so an attempt to quantify the NED benefits has not been conducted.

The SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, requiring rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

9.13 AESTHETIC RESOURCES

Under Alternative 3D, 100 percent of the SGGE landscape would be in public ownership and managed as a natural area The existing infrastructure of roads and canals would be mostly eliminated. Limited motor vehicle access would reduce illegal dumping, poaching, and the irresponsible use of firearms.

9.14 HAZARDOUS, TOXIC, AND RADIOACTIVE WASTE

The SFWMD contracted with URS Corporation for Hazardous, Toxic, and Radioactive Waste (HTRW) Phase I, II, & III assessments on the SGGE project site and immediate surrounding area. The contract was completed on September 30, 2003 by delivery of the report entitled *Phase I/II Environmental Site & Ecological Risk Assessment*. Additionally the District contracted with Environmental Consulting & Technology, Inc (ECT), to delineate impacts in a portion of the SGGE project and prepare a supplemental assessment a report entitled *Additional Scope Sampling Program*. Executive summaries for the URS and ECT reports, including instructions for accessing an electronic copy of each document, can be found in Appendix D. The URS report delineates the project area into 4 zones. The following is a brief overview of the potential HTRW remediation solutions within each zone. Each of these specific zones can be located on Figure 3-3. High levels of selenium, chlordane and dieldrin were found on several locations in the project area, which could pose a risk to small mammals, birds, and invertebrates.

(1) Interior Area
The URS report identified no significant HTRW impacts that would inhibit the proposed restoration activities within this zone. It recommended that the homesteads in the Interior Area be surveyed for potential asbestos containing materials, the potable wells abandoned, and the septic systems decommissioned.

(2) Former Agricultural Area – Southeast (FASE)
Soil sampling in this zone identified selenium above the USFWS interim guideline concentration. The results of the URS ERA indicate that levels of selenium in soils found within these two areas may pose a minimal risk potential for small ground foraging mammals however it is unlikely that the contamination will affect any ESA trustee species. Based on the results of the selenium desorption tests, the statistical review, and groundwater analytical results, it was recommended in the Phase III ERA that no additional assessments or corrective activities be conducted in the FASE. This zone within SGGE should be acceptable for the District's proposed future use of the property. It is important to note that the USFWS has not completed their review of this section of the property. At sites where selenium has been found in high concentrations in the FASE (Grids 25 and 29), it was tentatively recommend that remediation or capping actions be conducted.

(3) Former Agricultural Area _ Northeast (FANE)
Composite soil sampling within the FANE identified areas of organochlorine pesticides above the Sediment Quality Assessment Guideline (SQAG). Follow-up testing indicated that these residual pesticides were not consistently applied across the FANE, and are limited to localized areas at low concentrations. Two of the 24 composite soil samples contained selenium at levels above USFWS

guidelines. Based on the results of the ERA, soils impacted with selenium in the FANE may pose a minimal risk potential for certain small ground foraging mammals, however; it is unlikely that these selenium concentrations will affect the USFWS trustee species. According to the URS Phase III report the FANE is acceptable for the District proposed future use pending FWS final review and concurrence.

(4) Former Agricultural Area – West (FAW)

Soil sampling within the FAW indicated that organochlorine pesticides chlordane and dieldrin were detected above the SQAG and selenium above the USFWS interim guideline concentration. Therefore the URS report recommends that the District Project manager and project design team (PDT) consider implementing a final design to minimize the ecological risk associated with inundating the contaminated areas. Design modifications consistent with minimizing this ecological risk may include shifting the southwestern project boundary to exclude the impacted area, site grading, and changing the depth/time interval of flooding by manipulating pump operations. In the event that these design modifications are not reasonable alternatives, corrective action may be required.

ECT conducted a supplementary assessment to confirm the extent of impacted soil that will require corrective action. Since no selenium was detected above the 1.0 mg/kg USFWS guidance concentration, ECT proposed no further action with respect to selenium impacts. Nevertheless, as discussed with the USFWS, ECT will re-sample grids 29 and 30 (25 acres each) with the USFWS to confirm results in these two grids. It is anticipated that the selenium re-sampling will return results less than the guidance concentration. In the event the guidance concentration is exceeded, corrective action may be required.

Based on the results of the supplementary assessment, 36 acres of chlordane impacted soil will require additional assessment or corrective actions. A remedial approach was developed that could effectively balance the reduction of risk to an acceptable level and reasonable restoration costs. The remediation strategy is predicated on USFWS' conceptual agreement that (1) "hotspots" identified in a 2000 FDEP report (and included in ECT's estimation of area of impacts) will be delineated and (2) three remediation approaches will be applied, based on the severity of chlordane impacts. The three remediation approaches are:

- Soil inversion by plowing of 8 acres (low-level chlordane impacts, e.g., between 100 ug/kg and 200 ug/kg);
- Soil inversion by burial and capping of 21 acres (by trackhoe/pan scraper) with native, subsurface soils (medium level impacts, e.g., between 200 ug/kg and 1,000 ug/kg); and
- Excavation and disposal of 7 acres for high impacts (e.g., greater than 1,000 ug/kg).

Corrective action costs were estimated based on assumptions of areal extent of impacts, unit costs from the 2004 Means Construction Cost Estimating manual, and unit costs obtained from contractors. The estimated corrective action cost for the 36 acres in FAW is $1,690,000.

Under Alternative 3D the asphalt from the 60 miles of paved road within SGGE would be removed and disposed of consistent with DEP and EPA guidance.

9.15 CULTURAL RESOURCES

Coordination with the State Historic Preservation Officer (SHPO) of the recommended alternative 3D is complete. The Army Corps of Engineers (Corps) has concluded that Phase I and Phase II cultural resources surveys are necessary to determine the potential impacts of alternative 3D on historic resources.

These surveys are being coordinated with the SHPO and the Advisory Council on Historical Places (ACHP), in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended through 2000 (PL-89-665) and the Archaeological and Historic Preservation Act of 1974, as amend (PL 93-291). Site file reviews, consultation with the SHPO, other concerned parties, surveys, and determinations of significance will continue until the Section 106 process is completed. If research identifies additional historic properties that are determined to be eligible or potentially eligible for the National Register of Historic Places, further measures will be taken to avoid, minimize or mitigate adverse impacts to such sites. Required Cultural Resource Management (CRM) Surveys will be conducted during the DDR phase of this project.

Coordination with SHPO on that portion of alternative 3D known as the Prairie Canal "Early Start" project construction is complete. A Phase I Survey of the Prairie Canal area was conducted as part of the "Early Start Prairie Canal Project". The survey area was a 60-meter band on each side of Prairie Canal, from the north terminus to the south bend, an estimated 7 miles. The Phase I survey did not locate any previously unrecorded archaeological or historical sites in the project area; therefore, the refilling of Prairie Canal will have no impact on any known archaeological or historical sites that are eligible, or potential eligible, to the National Register.

A second portion of the survey, a Phase II Survey of areas considered to be high probability, located between 88th Ave. SE & 92nd Ave SE and 104th & 106th Ave St., were not surveyed due to inclement weather. These high probability areas will be investigated in future.

9.16 RECREATION RESOURCES

The SGGE ecosystems can support a significant amount of outdoor recreation in the Lower West Coast of Florida. A significant portion of the expenditures comes from tourists. It is not possible at this time to anticipate precisely how expenditures and consumer surplus associated with SGGE-related recreation would change with the recommended plan. However, based on the recent adverse effects related to environmental damaging of the ecosystem, it can be concluded that improving the environmental quality of the SGGE ecosystem, there will be substantially increased recreation-based businesses. Future recreational activities will be environmentally friendly activities and not contribute to future detriment of the ecosystem. Given the potential levels of expenditures and consumer surplus in the future, a small percentage increase in the quantity or quality of SGGE-related recreation could represent an increase in recreation value.

The State of Florida has planned recreation activities to be implemented with or without the SGGE project implementation. The uses presently considered compatible with resource protection and passive recreation include: horseback riding, hiking, camping, fishing, off road bicycling, hang gliding, some types of hunting, wildlife viewing and nature study. All the uses are consistent with the five-year management plan and use best management practices (BMPs) to protect the natural resources.

Benefits that could arise from recreation include the following:

- Properties that are adjacent to recreation areas often increase in value.
- Can provide stimulus for growth in the immediate area.
- Create a demand for jobs, sales, and service to tourists.

9.17 NOISE

The elimination of 227 miles of road under alternative 3D would have a beneficial effect on noise pollution. Reducing easy access by motor vehicle should decrease noise from the incidences of reckless firearm use. The restriction on use of ORV would also lower noise levels.

9.18 ENVIRONMENTAL EFFECTS ON ADJACENT LANDS

Within the SGGE Study Area (Figure 1-4) the following administrative units will be affected by Alternative 3D: Fakahatchee Strand State Preserve (FSSP), Panther National Wildlife Refuge (FPNWR), South Belle Meade (SBM), Collier

Seminole State Park (CSSP), and the estuaries and bays of the Ten Thousand Islands Region. Ecosystem restoration in SGGE would restore the connectivity (Figure 1-1) between all of these units. Other benefits to CSSP and FPNWR from 3D would be primarily hydrologic with the consequent improvement in the health of their native plant communities.

Under alternative 3D, the 42 miles of the canal system in SGGE would be removed. The hydrology would be restored to near pre-drainage conditions. Plugging and filling of the Faka Union Canal system would restore sheet flow across the landscape, reestablish the natural flowways, and bring back ground water levels to near pre-drainage conditions on much of the surrounding public lands. Plugging the Prairie Canal would improve ground water levels within the affected portion of Fakahatchee Strand State Preserve. Filling the Merritt Canal would mitigate overdrainage problems in the FL Panther National Wildlife Refuge. Flowways in South Belle Meade and Collier Seminole State Park would be reestablished by plugging the Miller and Faka Union Canals. Damaging freshwater surges from the Faka Union Canal system into Faka Union Bay would be eliminated. The other bays within the Ten Thousand Islands Region would benefit from a return of the slow discharge of fresh water flows from creeks and springs that are needed for healthy estuarine ecosystems.

9.18.1 Cumulative Effects

A cumulative impact, according to the Council on Environmental Quality's National Environmental Policy Act-implementing guidelines, is "the impact on the environment that results from the incremental impact of the action when added to other past, present, and future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time (40 CFR 1508.7)." Individually, the alternative 3D would benefit estuarine resources, wildlife, water quality, water supply, and other ecosystem values in the SGGE Study Area. Together with other similar ecosystem restoration activities (which are existing or being considered in the area) even greater benefit could be expected. The Southwest Florida Feasibility Study (SWFFS) is an ongoing inquiry that may be able to enhance the ecosystem benefits that the SGGE restoration project would produce.

The Tamiami Trail Critical Project involves road resurfacing and the construction of new culverts under U.S. Highway 41 to facilitate the more natural redirected flows from the SGGE hydrologic restoration. Although this project has overall beneficial effects, it may potentially increase overall vehicle use, which, in turn, may pose long-term consequences to endangered Florida panthers in the form of increased automobile-animal interactions.

Fish and wildlife as well as T&E species are vulnerable throughout the SGGE Planning Area. Urbanization, rural subdivision, timbering, agriculture, and other land-clearing activities continue to destroy, degrade, and fragment their habitat. Lack of fire or infrequent fire that maintains habitat quality, invasion by exotic vegetation, and short-circuiting of the natural hydrology would persist as problems for all pant and animal species.

Eutrophication of water bodies and wetlands occurs in SW Florida through inappropriate disposal of domestic sewage and runoff of nutrient-laden water from urban and agricultural lands. The build out of Northern Golden Gate Estates and other acreage in the Planning Area may cause longterm degradation of water quality entering the SGGE Project Area.

While hydrologic conditions most favorable to one species may not be most favorable for another, all animals have evolved to survive the hydrologic variability characteristic of the natural system. The reduced heterogeneity and extent of the present SGGE habitat make certain species more vulnerable to natural and man-caused threats. Management actions may be required on a temporary basis to protect a particular species from a high risk of extinction, but long-term management goals should not be driven by protection of a single species, but rather geared toward the sustainability of the entire ecosystem.

9.19 ENVIRONMENTAL COMMITMENTS

The Corps and its sponsor the SFWMD agree to follow-up on and maintain the commitments in the Ecological and Water Quality Monitoring Plan located in Appendix H. The U.S. Army Corps of Engineers and contractors commit to avoiding, minimizing, or mitigating for adverse effects by taking the following actions:

1. Employ best management practices with regard to erosion and turbidity control. Prior to construction, the construction team should examine all areas of proposed erosion/turbidity control in the field, and make adjustments to the plan specified in the plan control device as warranted by actual field conditions at the time of construction.

2. Construction at each location should be timed to avoid relevant nesting and/or breeding seasons for animals, which may be impacted by the project. Each location should be surveyed prior to construction to determine if any protected species are using the area.

3. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. Contract

specifications will also include protective measures for listed species as appropriate, in coordination with FWC and FWS. A spill prevention plan will be prepared.

4. Demolition debris would be transported to a landfill or otherwise disposed of in accordance with Federal, State, and local requirements. Concrete or paving materials would be disposed of in accordance with Federal, State, and local requirements.

5. The Corps and the SFWMD agree to maintain an open and cooperative informal consultation process with the FWS throughout the design, construction, and operation of this restoration project.

9.20 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Alternative 3D would require commitment of a combination of local, state, and federal funding, labor project materials, and energy to build, operate and maintain this ecosystem restoration project. The estimated cost of this alternative is $349,422,000. Four canals would be permanently plugged, 227 miles of roads would be removed, 19,992 parcels would be purchased from private landowners, and 55,247 acres would be restored to a more natural pre-drainage condition.

9.21 RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

The overall long-term goal of this restoration project is to create a healthy, sustainable ecosystem on the SGGE landscape and to restore more natural freshwater flows to the bays and estuaries of the Ten Thousand Islands Region. Alternative 3D will reduce the negative environmental impacts relative to the infrastructure of the SGGE subdivision including loss of wetland habitat, contaminants into the groundwater, freshwater surge discharges, wildlife disturbance due to human activities, and irreversible conversion of wetlands into residences. With implementation, approximately 55,247 acres of natural areas will come into public ownership. Over the long-term, these areas will form a more natural mosaic of habitats, decrease runoff, increase water quality, and provide habitat for numerous species of plants and animals.

9.22 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Alternative 3D would result in net benefits to the SGGE watershed and the bays and estuaries in the Ten Thousand Islands Region. Direct impacts to the fish and wildlife habitat would be small and offset by the environmental benefits of this project. Construction would require filling or plugging of the canals, which would displace fauna currently living in them. The Corps is conducting Section 7 consultation with the USFWS and National Marine Fisheries Service and both agencies have concluded that this alternative would have overall benefits to the ecosystem required by the threatened and endangered species existing in the Study Area. For more information see the USFWS FCAR in Appendix D.

Construction activities proposed under the preferred alternative that may result in the removal of native vegetation, include: the removal and grading of selected roads, ditches, and berms; and the construction of canal plugs, spreader channels, pump stations, and earthen levees around private property.

Exotic plant species such as Melaleuca, cogon grass, and especially Brazilian pepper are common in the Study Area. Soil disturbance associated with construction activities creates the potential for introduction and propagation of exotic and nuisance plant species. This propagation has already been observed in the Prairie Canal backfill project (Duever, pers. comm. Jan. 28, 2004). Invasion of restored areas by exotic plants would limit restoration benefits by more than 2,735 acres (approximate footprint of disturbance associated with canal and road removal). Introduction of exotics, or creation of conditions that favor exotic establishment, will be addressed in contract specifications for future work, if the project is approved.

Noise, fumes, and human presence associated with mobilization of equipment and temporary construction activities may disturb roosting or foraging wading and water birds as well as breeding birds. Construction activities will result in the loss of some native fishes, particularly sunfish and tarpon. Amphibians and reptiles may experience temporary increases in mortality associated with construction access on roadways during the wet season or the onset of dredge and fill activities after the wet season

Canals function as fire breaks which would be partially eliminated by canal backfill activities.

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SECTION 10

PUBLIC INVOLVEMENT

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SECTION 10
PUBLIC INVOLVEMENT

10.1 INTRODUCTION

Public involvement is a critical component of the Picayune Strand Restoration Project [formerly called the Southern Golden Gate Estates (SGGE) Ecosystem Restoration Project, Collier County, Florida] due to the public, political, and media interest in the restoration of the ecosystem. The failed subdivision was the topic of study, court cases, and discussion by both the county and the state before inclusion under the Comprehensive Everglades Restoration Plan (CERP). The environmental impacts of the subdivision were first addressed in an engineering study for Collier County in 1974, and the public has historically had multiple opportunities to be involved with the development of the project, including the Golden Gate Estates Feasibility Study, the Central and Southern Project Comprehensive Review Study (the "Restudy"), and the SFWMD conceptual restoration plan prior to inclusion in CERP. Under CERP, public input continues to be a very important and integral part of the development of this integrated PIR/EIS and will continue to be important throughout implementation of the preferred plan components.

Public involvement is a process by which interested and affected individuals, organizations, agencies, tribes, and governmental entities participate in a decision-making process. Public involvement has been, and will continue to be, a critical component of the Picayune Strand Restoration Project, scoping, plan formulation, report writing, and implementation process. The agencies involved were responsible for developing plans and strategies that effectively addressed the expressed issues and concerns of the public, including targeted stakeholder groups. Five goals for public involvement were identified and implemented throughout the process:

- Inform the public about the Picayune Strand Project and generate input on key issues and concerns. This input involves diverse groups outside of the Project Delivery Team (PDT) who assisted early on in the process of problem definition, issue and opportunity identification, as well as providing input on potential solutions.
- Develop relationships critical to the success of the study and implementation of the recommendations of the study.
- Facilitate open and honest discussions that enhance efforts to foster public understanding of the tradeoffs and complexities of developing multi-purpose water resources.

- Support an exchange of ideas and information among interested individuals and stakeholder groups critical to resolving the challenges involved in an environmental restoration effort of this magnitude.
- Develop and utilize innovative techniques to inform and engage traditionally under-represented communities and socially and economically disadvantaged individuals, including those with limited English language proficiency.

As the lead agencies, the U.S. Army Corps of Engineers (Corps) and South Florida Water Management District (SFWMD) are to:

- Keep people informed so that they can make educated choices;
- Provide visible ways to participate in the process;
- Provide equal access to information and decision-makers regardless of viewpoint; and
- Reach communities that have been under-represented in decision-making processes in the past and provide under-served communities with the information concerning aspects of the project, which may interest or affect them.

10.2 PUBLIC WORKSHOPS

The draft of the Project Management Plan (PMP) was published in May 2001. In order to involve the public in the process, a public workshop was held to inform the public of changes in the plan before implementation. The workshop was held on July 11, 2002 at the Collier County Government Center in the County Commissioner's Chambers.

The public workshop generated a large amount of input from the public. Local citizens groups have formed, local news have done numerous stories on the project, and citizens groups have invited project partners to speak at public meetings.

The draft integrated Project Implementation Report/Environmental Impact Statement (dPIR/EIS) was published in May 2004. After May 12, 2004, 14 additional requests for copies of the document were received, and the printed copies and/or CDs were mailed out. Printed copies were mailed on May 6, 2004 and made available at local libraries, SFWMD offices, the local community center, and the local county extension office. The comment period dates and availability of the document on the Internet were highlighted on the May 14, 2004 "What's New" section of the evergladesplan.org homepage. The opening of the comment period for the draft document was May 14, 2004. The public had the opportunity to review the document for 34 days prior to the public workshop.

A public workshop was held at seven o'clock on the evening of June 17, 2004 at the Best Western Naples Plaza Hotel. The purpose of the meeting was to provide an update and overview of the project, present the tentatively recommended plan, and provide an opportunity for the public to comment on the project and the draft PIR/EIS document. The public had the opportunity to speak and provide comments during the public meeting, provide written comments, and take comment sheets (with directions for submittal) to use for additional comments at a later date. The closing date for comments and information on how to submit comments by mail or via the Internet was provided verbally during the presentation, shown on a slide during the presentation, and provided on an additional information sheet. The question/answer and comment period lasted approximately three hours.

10.3 SCOPING

The Picayune Strand Restoration Project has had a long history of public and interagency involvement dating back to the 1978 Congressional authorization for the Corps to prepare a Golden Gate Estates (GGE) Feasibility Study. The Corps published the GGE Feasibility Study in 1986. In February of 1996, the Big Cypress Basin/South Florida Water Management District submitted the "Hydrologic Restoration of Southern Golden Gate Estates – Conceptual Plan" to the Governor of Florida. In January 1997, the Interagency Technical Advisory Committee (ITAC) convened with representatives from the Corps, U.S. Fish and Wildlife Service (FWS), U.S. Geological Survey (USGS), Florida Department of Environmental Protection (FDEP), Florida Game and Fresh Water Fish Commission, and others to provide input and assistance for the Cooperative Watershed Planning Assistance Study led by the Natural Resources Conservation Service (NRCS) and SFWMD. NRCS published this study in September 2001. In September 2000, utilizing the expertise of the ITAC, the Corps and SFWMD jointly initiated the development of a Project Management Plan (PMP) for the SGGE project (now known as the Picayune Strand Restoration Project). The PMP was presented to the Big Cypress Basin Board of Directors at a public meeting in February of 2001. During the past 24 years, local and state agencies have held numerous meetings to gather input on issues and opportunities involving the restoration of Picayune Strand.

A Notice of Intent (NOI) to prepare a draft integrated Project Implementation Report and Environmental Impact Statement (dPIR/EIS) for the Southern Golden Gate Estates Hydrologic Restoration Project (now known as the Picayune Strand Restoration Project) was published in the Federal Register on May 24, 2002. The NOI outlined the project purposes, objectives, features, and scope; described the study area; and laid out the scoping process utilized to involve

Federal, State, and local agencies, affected Native American Tribes, and interested private organizations and parties.

A Scoping Letter dated June 26, 2002 was sent out by the Corps to approximately 3,000 interested parties. The letter solicited views, comments, and information about resources, study objectives, alternatives, and important features within the study area. During the 30-day comment period, 122 phone calls, 42 e-mails, and 9 letters were received. This correspondence covered various issues. The theme of these inquiries was invariably the same. Most respondents were having a problem locating their property on the project map that had been included in the scoping letter. A summary representative of the questions asked is as follows:

1. Is my property within the project area?
   Answer: Respondents were assisted in locating their property. All property was determined to be outside of the project boundaries.
2. Why did I get this letter from the Corps of Engineers?
   Answer: When the Corps of Engineers designs a project, it is customary to notify surrounding landowners. Even though your land is outside project boundaries, the Corps asks if you have any concerns that need to be addressed.
3. Is the "Government", during the implementation of the Picayune Strand (formerly known as SGGE) project, going to purchase, steal, or force me to sell my land in Northern Golden Gate Estates (NGGE)?
   Answer: The State of Florida has already purchased 92% of the lands needed for the Picayune Strand Project. There was a lot of confusion between the Picayune Strand (formerly known as the Southern Golden Gate Estates Restoration Project) and two local NGGE land protection programs called Regional Offsite Mitigation Areas (ROMA) and Transfer of Development Rights (TDR). Respondents were given local phone numbers for the agencies in charge of these programs.
4. Will my property be flooded by the hydrologic restoration?
   Answer: The intent of the Picayune Strand Restoration Project is to design a project that does not impact the level of flood service for any of the surrounding private property.

10.4 FOCUS GROUPS

As part of the process, the PDT conducted focus group meetings throughout Collier County. The meetings were held between May 2001 and September 2002. The purpose of these workshops was to provide information to the public about the project and gather input from the stakeholders.

10.5 STAKEHOLDER INVOLVEMENT AND OUTREACH

The Strategic Communications and Public Outreach Plan is comprised of four components: 1) stakeholder involvement, 2) media program, 3) public information/awareness program, and 4) public meetings.

10.5.1 Stakeholder Involvement

The Picayune Strand Restoration Project PDT conducted regular working meetings that were open to public observation. Public comment was permitted at the conclusion of PDT meetings. Throughout the duration of the project, numerous opportunities have been provided for the public to obtain information outside of formal workshops. Published information is available via either the www.sfwmd.gov or www.evergladesplan.org websites. Printed copies of documents are available at the Big Cypress Basin (BCB) office or from any of the PDT members. Public meetings, briefings, and technical workshops with civic associations, neighborhood associations, colleges, faith-based organizations, environmental groups, and local governments have provided, and will continue to provide, avenues for the study team to encourage public participation in this project. The BCB Board receives quarterly updates. The Basin Board meetings are open to the public and are usually televised on the government access cable channel. Elected officials, homeowner associations, and any interested party may receive the free BCB Express Newsletter with periodic updates on the SGGE Hydrologic Restoration Project (now known as the Picayune Strand Restoration Project).

The following list provides examples of the many meetings held in the stakeholder outreach effort:

- Meeting with Belle Meade Landowners - May 21, 2001
- Golden Gate Civic Association Meeting Panel Presentation - July 18, 2001
- Presentation to the Board of County Commissioners – December 5, 2001
- Meeting with Billie Cypress/Tribal Council - February 5, 2002
- Updates to the BCB Board – November 2, 2001; May 31, 2002; August 30, 2002; and December 5, 2002
- Meeting with the Florida Attorney General and staff – April 17, 2002
- Meeting with real estate developer Don Lester and the Property Rights Action Committee – August 7, 2002

The following stakeholder meetings were held to gather detailed comments on the draft PIR document prior to the public workshop in Naples on June 17, 2004:

- Collier County - April 29, 2004
- Port of the Islands - May 6, 2004
- Port of the Islands RV Resort and Gun Club - May 17, 2004
- Collier Enterprises/Barron Collier - June 7, 2004
- Environmentalists - June 7, 2004
- Public Land Managers - June 8, 2004
- 6L's Farm - June 8, 2004
- Property Rights Action Committee - June 8, 2004
- 6L's Farm, Deseret Farm, Sunny Grove Civic Association - June 17, 2004

The Miccosukee Tribe of Indians have been involved with the development of the project. The Miccosukee Tribe owns land within the project footprint that is the subject of a condemnation action and has been a much more active participant in the development of the project. The Corps of Engineers understands its responsibilities to the Seminole Tribe of Indians and the Miccosukee Tribe of Indians regarding the Tribes' sovereign nation status and abides by the guidelines set forth in the U. S. Army Corps of Engineers Tribal Policy Principles when dealing with the Tribes. Representatives for the Miccosukee Tribe have been involved in numerous stakeholder meetings with the SFWMD. Several representatives of the Tribe were invited to and attended Project Delivery Team (PDT) meetings. In addition, representatives for the Miccosukee Tribe attended the June 17, 2004 public workshop. Counsel for the Miccosukee Tribe gave verbal comments at the workshop and written followup at a later date. Concerns of the Miccosukee Tribe include compliance with the Indian Trust Doctrine, the National Environmental Policy Act (NEPA), the Water Resources Development Act (WRDA), the Administrative Procedure Act, the Endangered Species Act, and Programmatic Regulations, as well as concerns regarding the 5th Amendment, due process, environmental justice, and the Tribe's cultural resources, and water quality and quantity.

Several members of the Corps staff have had discussions with representatives of the Miccosukee Tribe regarding their comments, and a detailed response to comments was sent to the Tribe.

On June 29, 2004, the Corps sent a request to Tribal Chairman Billy Cypress requesting government-to-government consultation on the draft PIR so that the Tribe and the U.S. Army Corps of Engineers could collaboratively work to develop resolutions to the Tribe's concerns with the project at this pre-decisional stage. A similar request was sent to the Chairman Mitchell Cypress of the Seminole Tribe of Indians of Florida.

10.5.2 Stakeholder Group Meetings

Meetings in Collier County included staff from the Florida Wildlife Federation, Audubon, and The Conservancy of Southwest Florida. Members of the general public were also included in meetings, especially those interested in property rights or recreational opportunities in the Picayune Strand State Forest.

As required, the SFWMD has coordinated a series of ongoing stakeholder meetings with local utility companies (refer to Section 10.7 "Other Required Coordination" and Section 12.6.4 "Coordination Of Project With Existing Utilities And Public Infrastructure").

10.5.3 Small Group Meetings

Throughout the alternative plan development process, informal meetings were held to maintain dialogue, clarify issues, and identify concerns. Meetings were held with groups such as the Property Rights Action Committee, Environmental Groups, Homeowner Associations, and the Rotary Club.

In addition, the SFWMD has had an ongoing dialogue with representatives for the Miccosukee Tribe of Indians regarding a variety of water management district and Tribal issues and concerns. One of the items discussed at the meetings is the Prairie Canal Project, which is part of the proposed Picayune Strand Restoration Project. A letter dated Sept. 3, 2003 was received from the Miccosukee Tribe detailing their concerns regarding coordination associated with the restoration of the Prairie canal (Phase 1) in the Picayune Strand. Tribal representatives and SFWMD members met on September 18, 2003 to discuss early start of Phase 1. Modeling results were presented that showed no impacts to Tribal lands. On October 24, 2003, there was a follow-up meeting at the Miccosukee Tribe office to discuss the Prairie Canal Project.

10.5.4 Local Government Briefings

Formal presentations have been made periodically and will continue throughout the life of the project. Presentations were made during regularly scheduled county commission meetings in Collier County. Local government officials were briefed several times through personal meetings, the BCB Express Newsletter, and via televised BCB Board Meetings.

10.5.5 Project Team Briefings

Briefings of PDT members were made on a quarterly basis throughout the process to provide updates on plan development activities and to discuss stakeholder concerns and possible remedies.

10.5.6 Water Management District Governing Boards

As the non-Federal sponsor of the Picayune Strand Restoration Project and the state governmental body charged with water resource management in South Florida, the SFWMD Governing Board provided policy guidance during the course of the study. Periodic presentations were made to the BCB Board throughout all phases of the project. These meetings were open to the public and public comment was welcomed. The SFWMD's Board Members were also kept informed of the project.

10.5.7 Public Information and Outreach

Because of the intense public interest in the Picayune Strand Restoration Project, there have been a wide variety of outreach efforts. The District and the Corps utilize printed and electronic media to provide written reports. Staff from the Big Cypress Basin (BCB) and Lower West Coast Regional Service Center offices are available to make presentations to interested parties.

10.5.7.1 Written Publications

Newsletters and other informational pieces were developed to provide information and updates to the public. Written publications included public notices identifying the purpose and location of the workshops/public meetings, fact sheets describing study progress, and multiple reports. In addition, the draft and final PMP and PIR documents were made available to the public for comment in a variety of formats, including print copies, CDs, and copies available over the Internet.

Prior to the beginning of the comment period on May 14, 2004 and the June 17, 2004 public meeting, printed copies of the draft integrated PIR/EIS for the Picayune Strand Restoration Project (formerly called the "Southern Golden Gate Estates Ecosystem Restoration Project, Collier County, Florida") document were made available for public review at the following locations:

- SFWMD Administrative Offices, 3301 Gun Club Road, West Palm Beach, FL
- SFWMD Lower West Coast Service Center, 2301 McGregor Boulevard, Fort Myers, FL
- SFWMD/Big Cypress Basin, 6089 Janes Lane, Naples, FL
- NGGE Max Hasse Community Park, 3390 Golden Gate Blvd. West, Naples, FL
- Collier County Extension Office, 14700 Immokalee Road, Naples, FL
- Collier County Library Headquarters, 2385 Orange Blossom Drive, Naples, FL
- Collier County Library Golden Gate Estates Branch, 266 Golden Gate Blvd., Naples, FL
- Collier County Public Library, 650 Central Avenue, Naples, FL 34102

10.5.7.2 Electronic Publications

A web page has been developed and is maintained for information access by the general public on the Comprehensive Everglades Restoration Plan (www.evergladesplan.org). Portions of that website specifically address the Picayune Strand Restoration Project (formerly known as the SGGE Hydrologic Restoration Project). Electronic versions of interim study products have been, and will continue to be, posted there to facilitate greater public access to informative documents. Information, including a calendar with scheduled meetings, has been and will continue to be posted at this website. New items of interest were posted on the homepage of the www.evergladesplan.org website, including the availability of the draft PIR document online; the dates of the comment period; a contact, mailing address, and e-mail address for comments; and updated fact sheets in both English and Spanish.

Information and reports are also available at the BCB homepage as part of the SFWMD web site. The web address is www.sfwmd.gov. Dates for public workshops were listed on the website's calendar.

10.5.7.3 Media

The overall public involvement strategy included a media plan for the restoration project. Various news interviews have been conducted throughout the study to explain the purpose and strategy for addressing the study's objectives. In addition, the media has had the opportunity to attend PDT meetings to observe the actions and discussions of the PDT. Opportunities have also been made available for the media to be briefed on concerns and important issues. Press releases in English and Spanish have been sent out to announce

public meetings and comment periods, and public meetings have also been advertised in newspapers of general and local circulation. Corps staff have worked in partnership with local newspapers to provide information to the public regarding public workshops and comment periods.

10.5.7.4 Minority Outreach

The Southern Golden Gate Estates area did not have a significant number of developed home sites, so much of the outreach for the project involved providing information to landowners whose primary residences were in other areas and to people who lived in the adjacent Northern Golden Gate Estates area.

Spanish speakers represent the largest minority group in the local area. To reach this group, informational post cards, fact sheets, and the executive summary of the draft PIR have been translated and made available in Spanish in public workshops and on the Internet. In addition, advertisements (not small notices) have been placed in Spanish language newspapers, and translation services have been available at public workshops. Spanish speaking staff members have been also available to receive and answer questions.

10.5.7.5 Educational Institution Partnerships

On April 11, 2002, the SFWMD entered into two-year cooperative agreements with five community colleges and Florida Gulf Coast University (FGCU). The agreements put into action a creative public partnership that expands community outreach, environmental education, and job training in local communities throughout the SFWMD's 16-county region. Through this partnership, the SFWMD will collaborate with the selected institutions to increase environmental awareness, while at the same time supporting the creation of environmental science degree programs designed specifically to prepare Florida's workforce for opportunities related to the SFWMD's major projects, such as Everglades restoration. FGCU is working with Edison Community College on environmental issues that are of interest to Florida's western coast, including water conservation and Everglades restoration.

The innovative partnership initiative began in January 2001 as a pilot effort at Florida Memorial College in Miami, the only Historical Black College in South Florida. The partnership agreements also include aggressive community-driven outreach strategies to inform the region's diverse communities and businesses.

10.6 PUBLIC MEETINGS

Public meetings or workshops are one of many methods that have been utilized to engage and involve the public and obtain public comment during the development of the Picayune Strand Restoration Project.

The National Environmental Policy Act (NEPA) of 1969 regulations and Council of Environmental Quality (CEQ) Regulations (40 CFR 1506.6 of the Code of Federal Regulations) do not require a specific number of public meetings. However, Section 1503.1(a)(4) of the Army Regulation ER 200-2-2 states that the proponent agency for a Federal Action, such as the Corps, should solicit comments on the draft EIS from the public, especially "those persons or organizations who may be interested or affected."

Public workshops were held to solicit comments on both the draft Project Management Plan (PMP) and the draft integrated Project Implementation Plan and Environmental Impact Study (dPIR/EIS), and were noticed in compliance with 40 CFR 1506.6.

A public workshop was held July 11, 2002 to provide an overview of the restoration plan including alternative plans, and provided an opportunity for public comment on the SGGE Hydrologic Restoration Project (now known as the Picayune Strand Restoration Project) draft Project Management Plan. The workshop was held at the Collier County Board of County Commissioners' Chambers. Approximately 80 people signed in at the workshop with 26 people providing public comments. Some attendees chose not to sign in since the chamber seats were all filled and the room held 135 audience chairs. A comment sheet was distributed during the workshops in case people chose to provide input at a later date. Public comments recorded at the meeting provided a good sense of the public's concerns and issues as well as the magnitude of each concern. This information was used to help with future outreach efforts. A video was also made of the proceedings. A full account of this and other meetings can be made available upon request to the Corps. Below is a list of the most widely held concerns expressed by the public at the workshop:

- Property rights
- Eminent Domain process
- Flooding north of the project
- Other effects to property north of the project
- Questions about the National Environmental Policy Act (NEPA) process
- Whether the final plan will include pump stations
- Support for completion of the project

A public workshop was held June 17, 2004 to provide an update on the project, present the three preferred alternatives and the tentatively recommended plan, and gather comments on the draft integrated Project Implementation Report and Environmental Impact Statement (dPIR/EIS) document.

Information on the Picayune Strand Restoration Project (formerly called the "Southern Golden Gate Estates Ecosystem Restoration Project, Collier County, Florida") Public Workshop on June 17, 2004 was provided to the public in a variety of ways:

- The event was listed on the main Everglades restoration website calendar at www.evergladesplan.org and the South Florida Water Management District's online calendar at www.sfwmd.gov.
- Stakeholders were notified of the upcoming workshop at a series of eleven stakeholder meetings held prior to the public workshop. Stakeholders were contacted in advance by phone and notified of the public meeting.
- A joint news release was issued on May 28, 2004, and a Spanish version of the news release went out on June 7, 2004 to the local Spanish-speaking newspapers, *A Toda Marcha, Gaceta Tropical, Gente Bonita,* and *Nuevos Ecos*.
- An advertisement (not a small notice) was placed in the following local newspapers: *The Fort Myers News Press* (June 8, 2004), *The Naples Daily News* (June 8, 2004), *The Gazette* (June 8, 2004), and Spanish-speaking *Nuevos Ecos* (June 16, 2004).
- An e-notice was sent out to a list of over 1,100 people that had previously requested to be contacted regarding CERP projects (including those who attended past Picayune Strand Restoration Project meetings and indicated their interest on comment cards). The e-notice was sent out on June 2, 2004, two weeks before the meeting. It was sent out again as a reminder on June 9, 2004, one week before the meeting.
- An invitation was sent out to 35 local elected officials the week before the meeting.
- The following newspapers also published notices announcing the workshop and its purpose: *Everglades Echo* (June 8, 2004), *The Gazette* (June 8, 2004), and *The Naples Sun Times* (June 16, 2004).

To address the special needs of individuals with disabilities, a notice stating that assistance for people with special needs could be provided by calling either one of two contact names (phone numbers supplied) was included in the following:

- Press releases in Spanish and English
- Newspaper advertisements (3 English and 1 Spanish)
- E-notice (sent out twice to over 1,100 people)
- CERP events calendar at www.evergladesplan.org on the Internet

One call requesting information regarding the meeting facilities came in from an individual with disabilities, and the person's questions were answered during multiple phone calls by outreach staff. One person with visual disability attended the meeting but did not request special assistance or materials in advance.

A request was made for a copy of the draft PIR document in Braille by a person who was not an individual with blind or low vision disability (the requestor was observed using a standard printed dPIR for reference at the meeting where the request was first made). No specific individual with a need to accommodate blind or low vision disability was identified by the requestor, nor did the requestor provide contact information for such a person when that information was requested by Corps staff.

To determine how to address the issue of a general request for a copy of the two-volume document in Braille, Corps staff consulted with several agencies involved in providing access for people with disabilities. All discussions yielded the same conclusion: different users have preferences or necessities to access information in different ways. Therefore, it is essential to be able to directly discuss the needs of the individual with the visual disability, in order to be able to provide the information according to their preferences and specific individual needs. Braille is a good mechanism for providing accessible text to those who know Braille, though not all people who are blind know Braille - especially people who lose their sight when they are older. Staff from Computer/Electronic Accommodations Program (CAP) has noted that the majority of people with visual disabilities prefer to access information using screen readers that translate text on a page into speech or refreshable Braille. In addition, they suggested that even Braille readers would probably prefer to use a screen reader to access information in such a large document, simply because it is more convenient to use. Voice output provides the most widely used method for providing access to information for individuals with visual disabilities. In addition, providing materials in electronic format is the most cost-effective and convenient way of making materials available to people with disabilities. Staff from the Computer/Electronic Accommodations Program (CAP) confirmed that the dPIR document provided on the Internet was accessible and in the correct format to be used by those individuals with visual disabilities using screen readers.

Since no request came from a specific individual with a visual disability (and no contact information was provided to the Corps so they could best accommodate specific individual needs and preferences), and the Corps has already provided a reasonable accommodation, a Braille version of the dPIR was not created.

The entire public workshop lasted approximately three and a half hours, with a three-hour comment period. A presentation was given that included the three decision criteria used for selection of the tentatively recommended plan:

1. No point source discharge to the estuary
2. Restore greater than 50% of the area to its pre-drainage condition
3. No adverse impacts to the existing levels of drainage for NGGE

There were approximately 175 attendees, including representatives from community groups, local government, local businesses, homeowners, and the Tribes. There were approximately 45 speakers from the audience. There were six representatives from the media, including three major television news affiliates, two local newspapers, and one of general circulation. Some attendees chose not to sign in. Comment cards were made available to the public. The proceedings were recorded on audiotape and by a stenographer. A workshop transcript can be made available upon request to the Corps (two individuals requested and received electronic copies of the transcript). A comment sheet was distributed during the workshop for people who preferred to provide written comments at a later date. Spanish translation and interpretation services were made available but were not utilized. Fact sheets were available in both English and Spanish. In addition, information sheets were provided to the public, with information on how to make additional written comments (including the contact information, a mailing address, an e-mail address, and the dates of the comment period). Information was available on how to access the draft PIR/EIS on the Internet. The information sheets also provided referrals and contact information for other issues of local interest that are not connected to the dPIR, such as Federal Emergency Management Area (FEMA) flood insurance rate maps, the Regional Off-site Mitigation Area (ROMA), land acquisition, endangered species, and the Division of Forestry Management Plan.

Public concerns and comments at the 2004 public workshop were similar in scope to the 2002 issues listed above, with the following additional issues:

- Berms/effects on Port of the Isles community, 6 L's Farm, Deseret Farms and Belle Meade
- Emergency evacuation routes/access for emergency services
- Public access; public use; recreational use, including horseback riding and ORV use
- Request for extension of the comment period
- Meetings - current meeting conditions inadequate, request for additional meetings
- Citizens rights
- Pump function during hurricanes
- Land management plan/dumping issues, including waste cleanup

- Dewatering/wellfields/flooding of Northern Golden Gate Estates
- Noticing of public meetings
- Land acquisition/Hardy Property
- Miccosukee Tribal concerns
- Project costs
- Scientific basis for the project
- Assistance for individuals with disabilities

Follow-up articles were published in *The Golden Gate Gazette* (June 29, 2004 and July 14, 2004), *The Naples Daily News* (June 18, 2004), on Naplesnews.com (June 18 and 24, 2004), and *The Naples Sun Times* (June 30, 2004).

10.6.1 Summary Public and Stakeholder Concerns

Two-way communication with the general public and organized stakeholders has been an integral part of the Picayune Strand Restoration Project. Throughout the public meetings and other outreach efforts to gather public input, several consistent areas of concern were encountered. As areas of controversy or concerns arose, efforts were made to ensure these issues where addressed. The following are some areas of controversy or concern encountered during the project development and the efforts to resolve those issues.

10.6.1.1 Misunderstanding of the Picayune Strand Project Area

There are other environmental projects under consideration in areas adjacent to the Picayune Strand Restoration Project area, so there is confusion over the area included in the Picayune Strand Restoration Project. An extensive information campaign with maps has been undertaken to show exactly where the Picayune Strand Restoration Project begins and ends. The campaign has stated that other projects under consideration, including but not limited to a mitigation area and a project in Belle Meade, are NOT part of the Picayune Strand Restoration Project.

10.6.1.2 Responsible Agency

There was some confusion over what agency was in charge of the Picayune Strand Restoration Project. Since so many agencies, organizations, and groups are involved in the decision-making process, there has been confusion over what agencies and who in these agencies should answer questions regarding the Picayune Strand Restoration Project. In order to end some confusion, there are only two contact names on all current literature, such as the fact sheets

available in English and Spanish. The project managers and their e-mail addresses are also listed on the section of the www.evergladesplan.org website specifically associated with this project. The Corps project manager and the SFWMD project manager can either answer a question or send the person with the question to the expert who knows the answer. This has reduced the frustration of all involved and reduced the amount of red tape the stakeholders were dealing with in order to receive answers

10.6.1.3 Drainage Impacts to the Northern Golden Gate Estates Area

The plan has considered a number of alternatives, looking for the one that does the most for restoration of the Picayune Strand area, while having no significant or adverse impact on current drainage in the NGGE area. The public has been assured repeatedly that no such impacts are legally allowed in the NGGE area, and the alternative that is chosen will preserve current drainage levels in the area.

Another issue relating to flood impacts to NGGE was encountered when Federal Emergency Management Agency (FEMA) released updated flood maps for this area. FEMA's update to the flood maps for NGGE would require the NGGE residence to have increased flood insurance. Due to concerns generated by this action, Commissioner Jim Coletta held a public meeting on June 11, 2003 at Gulf Coast High School on Immokalee Road in Naples, Florida. The Corps and SFWMD staff attended this workshop in order to clear up misinformation relating these categorization changes and the Picayune Strand Restoration Project. During this workshop, it was stated by the SFWMD that FEMA's change in the flood classification of NGGE was in no way related to any work or study being conducted in the Picayune Strand Restoration Project (formerly known as SGGE) project area, but rather an independent FEMA map update schedule and revisions based on the SFWMD's latest rainfall atlas data. Furthermore, the analysis for the Picayune Strand Restoration Project PIR was completely independent of any flood map production by FEMA.

10.6.1.4 Private Property Rights

Property rights are a major issue among landowners in the area. Lawsuits were filed over the adequacy of compensation being paid by the FDEP to willing sellers in the Picayune Strand Restoration Project area. The state court ruled that an independent real estate appraisal would be done and both the state and owners would abide by the appraisal value. The first sales were finalized within weeks of the court ruling. An incorrect rumor persists that landowners that went through the eminent domain process were not compensated adequately or

were compensated at extremely reduced rates. Letters have been sent to landowners and literature has been made available on the laws governing the eminent domain process. Public meetings were held where actual bills of sale between FDEP and former landowners were provided. The bills of sale showed that adequate compensation was paid. In the case where the former landowners had residential property, they were moved to new and sometimes better accommodations at FDEP expense. Maps were used to show that no properties north of Interstate 75 would be impacted.

10.6.1.5 Land Usage after the Picayune Strand Restoration Project

The State of Florida Division of Forestry, as manager of the property, will publish a management plan (including a recreational use plan) after the PIR for the Picayune Strand Restoration Project is complete. They are collecting data and requests for recreational land usage after the restoration. Currently, there are areas available for recreation. However, recreational opportunities in the future may change as a result of the restoration. For example, dry areas that are currently available may remain wet year round after the restoration. The need to provide areas for recreational off road vehicle (ORV) use has been recognized, and three agencies, the Florida Department of Environmental Protection (FDEP), Florida Fish and Wildlife Conservation Commission (FWCC), and Florida Division of Forestry (FDOF), will establish a committee to identify land in the area and throughout southern Florida to address ORV use.

10.7 OTHER REQUIRED COORDINATION

Florida Statute 373.1501(5)(e) requires that the SFWMD "ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility and public infrastructure are minimized." Since 2002, SFWMD staff has maintained an ongoing dialog with all utility companies in the area. Details regarding ongoing stakeholder meetings with local utilities are discussed in depth in Section 12 of this report under "Project Assurances", specifically Section 12.6.4, "Coordination Of Project With Existing Utilities And Public Infrastructure."

The South Florida Ecosystem Restoration Task Force was provided with information about the final three alternative plans that were developed and evaluated before the completion of the draft PIR at the December 3, 2003 meeting in Delray Beach, Florida, as required by the Programmatic Regulations for the Comprehensive Everglades Restoration Plan, 33 CFR Part 385.26(a)(2).

Regulations for implementing NEPA state that, when requested by the lead agency, any other Federal agency with jurisdiction shall be a cooperating agency. In addition, any other Federal agency having special expertise with respect to any environmental issue that should be addressed in the study may be a cooperating agency upon request of the lead agency (40 CFR, Parts 1500-1508, § 1501.6) (Restudy 1999). The Corps and SFWMD requested participation of cooperating agencies on the PDT, organized meetings, and assigned relevant tasks to the various cooperating agencies depending on agency authority and/or particular expertise. Coordination throughout the plan formulation process culminated in a smaller sub-team of the PDT working together to write and edit the Picayune Strand Restoration Project draft integrated Project Implementation Report and Environmental Impact Statement.

In addition to the scoping required by the NEPA, coordination required by other Federal laws and regulations has been conducted with the following agencies.

10.7.1 U.S. Fish and Wildlife Service

As part of the plan formulation process, a Planning Aid Letter (PAL) was received from the U.S. Fish and Wildlife Service (FWS) on October 2, 2001. A Coordination Act Report (CAR) has been prepared and is included in Appendix D. Conclusions and recommendations in the CAR are discussed in Section 9.5. A second Planning Aid Letter was received from USFWS, dated August 11, 2003. The FWS and Florida Fish and Wildlife Conservation Commission (FWC) have taken part in PDT meetings and have been integral to the technical sub-team processes of evaluating components, determining benefits and producing performance measures for the alternatives. Section 9.6 of this report describes the informal Section 7 Endangered Species Act consultation that has been ongoing with the FWS since the inception of this project.

10.7.2 Cooperating State and Federal Agencies

The Picayune Strand Restoration Project (formerly known as Southern Golden Gate Estates) Project Delivery Team (PDT) has been an interdisciplinary, multi-agency group of local, state, and Federal agency representatives. Coordination was achieved through staff member participation on the PDT and sub-teams as necessary. The Corps, SFWMD, Natural Resources Conservation Service, U. S. Fish and Wildlife Service,, Florida Department of Environmental Protection, Florida Division of Forestry, National Park Service, National Marine Fisheries Service, Florida Fish and Wildlife Conservation Commission, and Collier County all contributed one or more staff members as active participants of the PDT.

The issues and concerns of these agencies and governments were continuously a part of PDT activities.

PDT meetings were working meetings that were open to public observation, but not participation. Public comments and questions were taken at the end of each meeting. A list of the Picayune Strand Restoration Project (formerly known as SGGE) PDT members can be found in Section 14 of this report.

Since Congressional approval of CERP, the planning and analysis for individual restoration projects have been proceeding via individual project delivery teams. As restoration has advanced, the concept of consolidating individual project teams into a reduced number of regional teams has been implemented. In an effort to manage projects more efficiently by consolidating meetings and providing a regional perspective, two Regional Project Delivery Teams (RPDTs), South and Central, were initiated in May 2004. As the lead agencies, the Corps and SFWMD have multiple members from a variety of disciplines serving on both RPDTs. Other federal, state, and local agencies and Tribes involved in the restoration effort are represented by a single member on each RPDT team. The public is invited to observe the proceedings as part of the audience and is provided an opportunity for comment. The RPDT meetings will provide stakeholders and the public opportunities to review the progress of multiple projects at a single meeting, while maintaining a regional perspective. Both project-level and regional issues can be addressed and resolutions applied to multiple projects. This reduces duplication of effort, ensures greater consistency among projects, and makes the project development process more efficient. The first South Regional Project Delivery Team meeting (SRPDT) was held on July 13, 2004 in Ft. Lauderdale, FL. The second meeting was held in Naples, FL on August 24, 2004. Future meetings will be scheduled monthly or on an as-needed basis as required for the development of the projects.

10.7.3 Draft Integrated Project Implementation Report and Environmental Impact Statement Recipients

The Notice of Availability (NOA) for the Picayune Strand Restoration Project (formerly known as SGGE) draft integrated Project Implementation Report and Environmental Impact Statement (dPIR/EIS), was published in the Federal Register on May 14, 2004. Copies of the document were sent to numerous local, state, and Federal agencies and private interest groups for review and comment in accordance with the Council on Environmental Quality's NEPA regulations and related Corps guidance.

The following agencies, groups, and individuals were sent copies of the Picayune Strand Restoration Project (formerly known as SGGE). Draft Integrated Project Implementation Report and Environmental Impact Statement:

Native American Tribes
Miccosukee Tribe of Florida
Seminole Tribe of Florida

Federal Agencies
Bureau of Indian Affairs
Natural Resources Conservation Service
National Marine Fisheries Services
National Oceanic and Atmospheric Administration
U.S. Department of Agriculture
U.S. Department of the Interior
U.S. Environmental Protection Agency
U.S. Department of Justice
Federal Highway Administration
U.S. Fish and Wildlife Service
Big Cypress National Preserve

State Agencies
Governor, State of Florida
Florida State Clearinghouse
Florida Department of Community Affairs
Florida Department of Environmental Protection
Florida Fish and Wildlife Conservation Commission
Florida Department of Health
Florida Department of State
Florida Department of Transportation
Florida Division of Forestry
South Florida Water Management District

Regional Governments
South Florida Regional Planning Council

County Governments
Collier County

Municipal Governments
City of Marco Island
Mayor, City of Everglades

Universities
Florida Gulf Coast University

Libraries
Collier County Public Library

Groups
Golden Gate Landowners, Inc.
Lehtinen, Vargas & Rener Professional Association
Max Hasse Community Park

Individuals

A list of individuals who received the Picayune Strand Restoration Project (formerly known as SGGE) draft Project Implementation Report and Environmental Impact Statement is on file in the Corps Jacksonville District at the address shown on the cover page of this document. Every effort was made to ensure that stakeholders and other individuals with an interest in the project were notified of the availability of the document, the dates of the comment period, and information regarding the public meeting.

Prior to December 26, 2003, 2,812 blue high-visibility postcards were mailed out to people that had been identified as adjacent property owners (outside of the project area, mostly in Northern Golden Gate Estates) and others who had expressed interested in the project. The postcard notified the public that the Corps was moving ahead with plans for the Southern Golden Gate Estates project (as it was known at the time) and was preparing a draft integrated Project Implementation Report/Environmental Impact Statement (dPIR/EIS) document that would be available for comment in the beginning of 2004. The mailing notified the public that the document would be available at six locations locally (locations and addresses were provided) and the main SFWMD office in West Palm Beach, as well as on the Internet. Individuals were also able to request (ahead of time) the following when they became available:

- Printed copy of the executive summary in English or Spanish
- Printed copy of the entire dPIR/EIS (English only)
- Electronic copy of the entire dPIR/EIS on a CD

The postcard notified the public that after the dPIR/EIS was published, a public meeting would be held to present an overview of the project and provide a forum for public comment. It also stated that information regarding the public meeting would be forthcoming.

Pursuant to the requests returned, the draft PIR/EIS document was sent out to the public during the week of May 10-May 14, 2004 in the following formats: 51 CDs, 71 executive summaries in English, 23 executive summaries in Spanish, and 50 print copies. Copies went out in various formats (CD and print) to various addresses at: 3 city agencies, 4 county agencies, 32 environmental groups, 60 federal agencies, 3 libraries, 3 press agencies, 7 private/civic groups, 9 regional agencies, 20 state agencies, 11 state clearinghouses, 2 universities, and 7 addresses for the Indian Tribes. Additionally, a complete copy was available on the Internet throughout that time period in a format compatible with voice synthesizing software for the use of interested parties who are visually impaired.

Prior to the publication of the Notice of Availability (NOA) for the final PIR/EIS document for the Picayune Strand Restoration Project, the public will be notified in advance (via e-mail, e-notice, or newspaper coverage) that the final PIR/EIS will be available at various local public locations and on the Internet. All members of the public that attended the June 17, 2004 public workshop (and provided contact information) or provided comments on the draft document will be offered the opportunity to have the document sent to them on a CD or in print, using the method of contact available. In addition, a general e-notice (sent to a list of over 1,100 people who have previously indicated an interest in Everglades restoration projects) and press releases in both Spanish and English will announce the availability of the final PIR/EIS on the Internet and in public locations, as well as the beginning and ending dates of the 30 day comment period for the final PIR/EIS and information on how to submit comments on the final PIR/EIS (including a contact, e-mail address, and mailing address).

10.8 COMMENTS AND RESPONSES

In accordance with NEPA requirements, all interested parties had opportunities to comment on the contents of the Picayune Strand Restoration Project (formerly called the "Southern Golden Gate Estates Ecosystem Restoration Project, Collier County, Florida") draft integrated Project Implementation Report and Environmental Impact Statement. The original public comment period was 45 days, beginning May 14, 2004 and ending June 28, 2004. A public workshop was held 5 weeks after the document was made available to the public. The document was available in print, on CD, and on the Internet. It was also made available at several local public libraries, the SFWMD offices, the local community center, and the county extension office. The purpose of the workshop, held during the middle of the comment period, was to provide an update on the project, allow the public to review and comment on the draft document and, answer questions from all interested parties. A request for extension of the comment period was made at the June 17, 2004 public workshop. A 15 calendar-day extension of the comment period was granted,

with July 13, 2004 as the new closing date. In addition to notifying those who made a formal, written request for an extension of the comment period, all people who attended the public workshop that provided correct e-mail addresses were notified of the comment period extension via e-mail. Corps staff also notified the local newspaper, *The Gazette*, of the extension, where an article was published on the front page of the June 29 edition, with a special section containing information on the comment period extension and how to submit comments. During the 45-day comment period and 15 calendar-day extension, 34 e-mails, one phone call, 3 comment sheets, and 18 letters were received. The range of issues covered in the comments included:

- Support for the project
- Support for alternative 3D
- Hurricane/emergency evacuation routes
- Additional data collection and modeling needed
- High price of cost estimates/project
- Fears of over-drainage and excess flooding
- Requests for the comment period to be extended
- Inability to read report or insufficient time to read it
- Concerns of what will happen if project doesn't work
- Inadequate June 17, 2004 public meeting in Naples, FL
- No notice of public meeting
- Opposition to project
- Further review and modification of document needed
- Concerns of taking away ATV riding area
- Concerns of taking away people's private land (especially Jesse Hardy's)
- Concerns about U.S. 41
- Not received copy (CD or paper) of document
- Report was not published in Braille
- Requests for additional time for comment beyond the 15 calendar-day extension that was granted

Comments received during the review of the draft have been addressed and documented in the final Project Implementation Report and Environmental Impact Statement. The letters and comments are also included in their entirety in Appendix G.

10.9 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires the Federal government to achieve environmental justice by identifying and addressing high, adverse, and disproportionate effects of its activities on minority and low-income

populations. It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental laws, regulations, and policies. It also requires Federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns and the communication of associated risks to the public.

The Picayune Strand Restoration Project will provide benefits to quality of life by improving the natural environment. The Picayune Strand Restoration Project will restore wetlands and improve water discharge in locations remote from urban populations, such that negative impacts are eliminated for all communities. The Picayune Strand Restoration Project is a congressionally approved project funded 50/50 between Federal and State governments to make improvements to hydrology that benefit both man and the environment.

The Picayune Strand Restoration Project does not present any environmental impacts that are high, adverse, and disproportionate to low income, minority, or Tribal populations. Through the public participation process of the outreach and NEPA scoping, no high or adverse impacts became known. There was sufficient public input to feel confident that scoping was successful and that the breadth of the potential impacts were communicated and understood by the public. Since no high or adverse impacts were discovered during scoping, there is no requirement for a disproportionate impact analysis. In conclusion, the NEPA process has found no evidence of high, adverse, or disproportionate impacts.

Project sites are located based upon hydrologic characteristics, land availability, and interconnection to existing canals and structures to optimize operations. Furthermore, in the consideration of the project site, urban areas are avoided to eliminate the negative impacts typically associated with site location of large projects. Through "willing seller" agreements a variety of land rights have been or will be acquired that allow the use of land for the resulting improvements to the human quality of life and the intended environmental benefits of the Picayune Strand Restoration Project.

These environmental benefits provide quality of life improvements to all people and primarily to people in the communities within the Picayune Strand Study Area. Existing canals will be operationally and physically changed to allow water to sheet flow as it did under natural, historic conditions. This will also help to eliminate peak detrimental storm water runoff and add other water-related benefits. By the nature of the project design, the operating procedures will have no significant or adverse impact on current drainage. The project will improve the quality of human life by providing increased wildlife activity and by improving the health of natural coastal communities. This will be a special bonus for those who appreciate seeing increases in fish and bird populations. It

will translate into aesthetic and economic benefits for sport fishing and other recreational communities.

Most lands acquired for the Picayune Strand Restoration Project will not require a significant number of people to be relocated. The vast majority of the land was unimproved and did not require the physical relocation of permanent residents. The results of the scoping process, directed at property owners as well as residents, was such that many owners did not even know whether their property was in the Picayune Strand Restoration Project Area. Census data only applies to residents and thus has limited value in fully portraying the demographics of those affected.

10.10 ALTERNATIVES AND MITIGATION

To date, the Picayune Strand Restoration Project does not appear to present any environmental impacts that are high, adverse, or disproportionate to low income, minority, or tribal populations. However, in the event that it becomes apparent that an issue does exist with any group, the lead agencies will work proactively to incorporate their concerns into the continued analysis to reduce impacts. If it is not possible to reduce impacts, the lead agencies will work with the community to develop acceptable options.

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SECTION 11

COMPLIANCE WITH FEDERAL ENVIRONMENTAL STATUTES

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SECTION 11
COMPLIANCE WITH FEDERAL ENVIRONMENTAL STATUTES

All alternative plans were considered in relation to compliance with Federal environmental review, consultation, and regulatory statues. Florida statutes relevant to environmental review and state funding requirements are covered in Section 12 of this report.

11.1 NATIONAL ENVIRONMENTAL POLICY ACT OF 1969, AS AMENDED

Notice of Intent to prepare a Draft Integrated Project Implementation Report and Environmental Impact Statement (dPIR) for the Southern Golden Gate Estates (SGGE) project was published in the Federal Register on May 24, 2002. Scoping was initiated with a letter sent to federal, state, and locale agencies, Indian tribal governments, and surrounding landowners on June 26, 2002. The Draft Project Implementation Report and integrated Draft Environmental Impact Statement (DEIS) were coordinated with agencies and interested public beginning on May 14, 2004, when the Notice of Availability was published in the Federal Register. The initial public comment period was 45 days, but at the request of several stakeholders present at the Public Workshop, an additional 15 days were granted for review and comment. The comment period on the Draft PIR/EIS ended on July 13. Agency, tribal, and public involvement as required by NEPA is covered in Section 10 of this report. Through this stage in planning, the SGGE project is in compliance with the requirements of the National Environmental Policy Act (NEPA) of 1969 as amended.

11.2 ENDANGERED SPECIES ACT OF 1973, AS AMENDED

The U.S. Fish and Wildlife Service (FWS) has been an integral part of the SGGE Project Delivery Team (PDT) as it proposed, designed, and selected alternatives for this project. Informal Endangered Species Act (ESA) consultation with FWS has been underway on all alternatives since the inception of the project. Service biologists provided specific concerns relative to the Florida Panther, the West Indian Manatee and other listed species in the September 22, 2004 Final Coordination Act Report included in Appendix D. Additionally, Service biologists have provided in-depth analysis of habitat requirements and stressors to the population of West Indian Manatee that utilize the Ten Thousand Islands area and the Port of the Islands Marina; specific information on Florida Panther movements within its range throughout the region and in the project area. The Corps has determined that the recommended alternative, Alt 3D, may affect, but is unlikely to adversely affect, the red-cockaded woodpecker, bald eagle,

Everglade snail kite, eastern indigo snake, American crocodile and West Indian manatee critical habitat. The proposed project would have "no effect" on everglade snail kite critical habitat and American crocodile critical habitat. Corps and Service biologists have agreed that there is insufficient information at this project phase to make a determination regarding effects on wood stork, West Indian manatee and Florida Panther. By letter dated October 20, 2004, the Service concurred with these determinations. A copy of the Biological Assessment for listed species found on proposed project lands is included in Appendix D. Coordination has concluded for the planning (feasibility-stage) of the project in 2004, but will continue, if the project is approved and funds are provided to continue through detailed design and construction, throughout the project life. No construction will begin until determinations of effects are coordinated with the Service for the three species of ongoing concern and concurrence is reached. It is the expectation of Corps and Service biologists that with detailed analysis, availability of pre-construction surveys, and final coordination of listed species conservation measures, concurrence may be reached early in the detailed design phase.

Initial informal consultation on marine species with the National Marine Fisheries Service (NMFS) began on May 25, 2001. Informal consultation was updated in an email exchange and a February 10, 2004 phone conversation. NOAA fisheries indicated its concurrence with a Corps information determination of no effect on listed marine species.

Section 9.6 of this report has additional information on both marine and upland listed species. With receipt of Service concurrence with current effect determinations, the Project is in compliance with the ESA for feasibility phase activities. Full compliance will be achieved when determinations on the manatee, Florida panther and wood stork are re-coordinated with the Service in a new BA, and Service concurrence is received.

11.3 FISH AND WILDLIFE COORDINATION ACT OF 1958, AS AMENDED

Consultation was initiated with FWS on February 26, 1999 in a Scope of Work (SOW) requesting a Planning Aid Letter (PAL) for the SGGE project. Several planning aid letters (PALs) have been received by the Corps (ref. Appendix D) Further coordination with the U.S. Fish and Wildlife Service resulted in the submission to the Corps of a draft Coordination Act Report (dCAR) dated February 2, 2004 and a Final report (FCAR) on September 22, 2004. The FCAR included 16 recommendations to assure that the objectives of the project would be achieved. The FWS stated that the proposed project, as described, should provide significant hydrologic improvements and enhancement of wetland

habitats through restoration of more natural sheet flow. Long-term benefits of this restored hydrology include a decrease in the rate of expansion of exotic plant species, and possible increases in forage, cover and reproductive areas for fish and wildlife. FWS provided additional detailed recommendations and editorial assistance for the Final PIR/EIS, and Service biologists have worked cooperatively with the Corps and Water Management District to develop a monitoring plan and operational recommendations to further assure fish and wildlife benefits are realized. Answers to FWS recommendations contained in the FCAR can be found in Section 9.5 of this report. Service comments on the Draft Report and Corps Responses are also shown in Appendix D. Many Service recommendations have been incorporated directly in this document's text, as indicated in the comment-response matrix. This report incorporates a final Fish and Wildlife Coordination Act Report and is in compliance with the Act.

11.4 NATIONAL HISTORIC PRESERVATION ACT OF 1966

The National Historic Preservation Act of 1966 as amended (PL89-665), The Archaeological and Historic Preservation Act as amended (PL 93-291), and Executive Order 11593 and consultation with the State Historic Preservation Officer (SHPO) will be completed during the PED phase once project specific designs are developed. Letters dated 13 March 2002 were received from the SHPO, which confirmed the necessity of a cultural resources survey within the project area. The survey is currently underway, and it will continue until the entire potentially affected area has been covered. Results of the survey and recommendations will be addressed in future consultation. Project specific surveys for cultural resources and site evaluations will be conducted during pre-construction Engineering and Design Phase of the project. Project construction will not commence until coordination with the SHPO is complete and full compliance will be achieved upon concurrence with Corps recommendations by the SHPO.

11.5 CLEAN WATER ACT OF 1972, AS AMENDED

A Section 401 water quality certification from the Florida Department of Environmental Protection will be obtained by the SFWMD. All State water quality standards will be met. A Section 404(b)(1) evaluation is included in Appendix D of this report. The project is in compliance with this act.

11.6 SAFE DRINKING WATER ACT OF 1974, AS AMENDED

Implementation of the recommended alternative will improve infiltration into the upper groundwater aquifer however there is no Project Area involvement with waters actually or potentially designated for drinking use that would be affected by project related activities. The project is in compliance with this act

11.7 COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT (CERCLA) OF 1980, AS AMENDED

The State of Florida, as owner of some Study Area lands that have HTRW problems is aware of their responsibility to remediate the contamination prior to the beginning of project construction. Sections 3.14, 8.8.3, and 9.14 contain information on state agency efforts to determine the best option for contamination cleanup and the current status of ongoing studies and remediation. The project is in compliance with this act.

11.8 CLEAN AIR ACT OF 1972, AS AMENDED

Air quality within the SGGE Project Area is in compliance with the Environmental Protection Agency (EPA) and Florida Department of Environmental Protection (FDEP) standards. There are no non-attainment basins in the area or its immediate surroundings. Implementation of the recommended alternative will improve air quality. See Sections 3.8 and 9.8 of this report for more information. The project is also in compliance with Chapter 3.09 of the Law regarding public coordination of proposed Federal Projects. The project is in compliance with this act.

11.9 COASTAL ZONE MANAGEMENT ACT OF 1972, AS AMENDED

A Florida coastal zone management program federal consistency evaluation is included in Appendix D of this draft PIR. State review of the evaluation was performed during the 60 day agency coordination of the draft PIR/EIS. The State of Florida Clearinghouse determined that the project is in compliance with the Florida Coastal Program at this time. (Clearinghouse comments are reproduced in the “Coordination” appendix G.

11.10 FARMLAND PROTECTION POLICY ACT OF 1981

The Natural Resource Conservation Service (NRCS) was contacted prior to preparation of the Draft PIR/EIS. No prime or unique farmland would be impacted by implementation of this project. The project is in compliance with this act

11.11 WILD AND SCENIC RIVER ACT OF 1968, AS AMENDED

No designated Wild and Scenic river reaches would be affected by project related activities. The project is in compliance with this act

11.12 MARINE MAMMAL PROTECTION ACT OF 1972, AS AMENDED

The Corps has determined that the only marine mammal that may be affected by the SGGE project is the West Indian manatee. The environmental effects of this project on manatees have been addressed in Section 9.6.8. In general, the project should improve the overall hydration of the shallow aquifer in the project area, providing a longer duration of seepage into all the upper estuaries, while reducing "shock flows" of high volume into the Faka Union canal. Protection measures to assure survival of the manatee subpopulation that resides in the Ten Thousand Islands region and winters in the cold weather refugium in the Port of the Islands marina have been recommended by Service biologists and have been incorporated into the project. If anything, the project is expected to provide adequate groundwater-derived flow to assure manatees would not be adversely affected by cold weather episodes. However, an additional source of groundwater will be provided in the vicinity of the FU downstream weir, when and if necessary, to supplement or augment low flows during dry season cold spells. Formal consultation with the Service is ongoing. Refer also to the Biological Assessment in Appendix D. The project is in compliance with this act.

11.13 ESTUARY PROTECTION ACT OF 1968

In the draft PIR the Corps has considered the effects of the recommended alternative on the estuaries and bays of the Ten Thousand Islands Region. Most project effects are expected to be beneficial. The U.S. Environmental Protection Agency, which administers this law, has accepted the DPIR/DEIS as adequate. See Sections 3.11 and 9.11 of this report for more information. The project is in compliance with this act.

11.14 E.O. 11990, PROTECTION OF WETLANDS

The purpose of the SGGE project is to restore wetland habitats. The project is in compliance with the intent of this executive order.

11.15 E.O. 11988, FLOODPLAIN MANAGEMENT

The objective of the SGGE project is to reestablish the natural floodplain hydrology. Flood hazards to Northern Golden Gate Estates (NGGE) were considered during the planning process. Existing flood levels in NGGE will not be significantly or adversely impacted. The project is in compliance with the intent of this executive order.

11.16 E.O. 12898, ENVIRONMENTAL JUSTICE

No adverse impacts to human health or the environment are anticipated as result of the SGGE project. Impacts to "subsistence consumption of fish and wildlife resources" are not anticipated as a result of the proposed project. See Section 10.9 of this report for more information. The project is in compliance with the intent of this executive order.

11.17 E.O. 13089, CORAL REEF PROTECTION

Those species, habitats, and other natural resources associated with coral reefs are not found in close enough proximity to the project area to be likely to derive either benefit or adverse effects from implementation of the recommended project. The project is in compliance with the intent of this executive order.
.

11.18 E.O. 13112, INVASIVE SPECIES

The existing and future problem of invasive species growing within the SGGE Study Area has been considered during the planning process. All feasible and prudent measures to reduce present infestations and to minimize risk of introducing new invasive species will be followed. The Florida Division of Forestry (DOF) as the Project Area managing agency has an ongoing program of invasive and exotic species control. The Comprehensive Everglades Restoration Program (CERP) also includes further studies of means and methods to reduce the influence of exotic invasive plant species, including melaleuca and Brazilian

pepper, both of which are found on project lands. Additionally, some future DOF management actions, including fire management, are expected to reduce the dominance of the native cabbage palm. The Corps notes that FWS comments on the Draft PIR/EIS indicate some disagreement with this conclusion, and recommend a specific exotic species management plan for the project. However, such a plan will be part of the DOF management plan for Picayune Strand State Forest. The project is in compliance with the intent of this executive order.

11.19 FEDERAL WATER PROJECT RECREATION ACT

The Florida Department of Forestry will manage the SGGE project as part of the Picayune Strand State Forest. Outdoor recreation and fish and wildlife enhancement will be a large part of the Forest management plan. The project is in compliance with this act.

11.20 SUBMERGED LANDS ACT OF 1953

The project does not occur on submerged lands of the State of Florida. The project is in compliance with this act

11.21 COASTAL BARRIER RESOURCES ACT AND COASTAL BARRIER IMPROVEMENT ACT OF 1990

There are no designated coastal barrier resources within the project area. The project is in compliance with this act

11.22 RIVERS AND HARBORS ACT OF 1899

The proposed work would not obstruct navigable waters of the United States currently regulated by the Rivers and Harbors Act of 1899. Any modifications of navigable capacity caused by changes in water level in the canal system and its connections with tidal waters are authorized by the Congressional approval of the PIR and EIS. The project is in compliance with this Act.

11.23 ANADROMOUS FISH CONSERVATION ACT

The SGGE project would not be affect anadromous fish species. The project has been coordinated with the National Marine Fisheries Service and is in compliance with this act.

11.24 MIGRATORY BIRD TREATY ACT AND MIGRATORY BIRD CONSERVATION ACT

The restoration actions proposed within recommended alternative 3D should enhance natural habitat for migratory birds. The hydrologic restoration contained in this alternative should also increase available forage species such as amphibians, fish and aquatic invertebrates for wading birds. The project is in compliance with these acts.

11.25 MARINE PROTECTION, RESEARCH AND SANCTUARIES ACT

The SGGE project does not involve any ocean dumping nor does it establish any marine sanctuaries. The project is in compliance with this act

11.26 MAGNUSON-STEVENS FISHERY MANAGEMENT AND CONSERVATION ACT (PL 94-265)

This law addresses conservation of marine fish species of commercial importance, and requires consultation with the administering agency (National Marine Fisheries Service) on potential effects of proposed Federal projects on essential marine habitat for such species. Both the species and the habitat are defined by each Regional Fisheries Council. Informal consultation with National Marine Fisheries Service (NMFS) determined that project construction features are far enough upstream so that they are not likely to have a net negative effect on Essential Fish Habitat (EFH) in the SGGE Study Area. On the contrary, the net effect of the proposed project is expected to be the re-hydration of several estuaries to the west of the Faka Union estuary, with a consequent improvement in fish nursery habitat in each. As required under this act, the recommended alternative will continue to be coordinated with NMFS. The project is in compliance with this Act.

11.27 RESOURCE CONSERVATION AND RECOVERY ACT OF 1976

The discovery of widespread soil contamination by chlordane, DDE, DDD, Dieldrin and Endosulfan lead the sponsor to commission a Phase I and II Environmental Site and Ecological Risk Assessment. See Sections 3.14 and 9.14 for more information. Prior to commencement of construction all identified contamination will be remediated and the project will be in compliance with this act.

11.28 WATER RESOURCE DEVELOPMENT ACT OF 1986, SECTION 904

Section 904 of the Water Resources Development Act of 1986 requires that the plan formulation and evaluation process consider both quantifiable and unquantifiable benefits and costs of the quality of the total environment and preservation of cultural and historical values. The project is in full compliance with this act.

11.29 WATER RESOURCE DEVELOPMENT ACT OF 1990, SECTION 307

Section 307 of the Water Resources Development Act of 1990 establishes, as part of the water resources development program, an interim goal of no overall net loss of the Nation's remaining wetlands, and a long-term goal of increasing the quality and quantity of the Nation's wetlands. The recommended alternative would restore wetlands in the immediate SGGE Study Area, in the Fakahatchee Strand State Forest, in Picayune Strand State Forest, and in the estuaries that collectively make up a major portion of the Rookery Bay- Cape Romano National Estuarine Research Reserve (?) and the Ten Thousand Islands National Wildlife Refuge. This project is in full compliance with this act.

11.30 WATER RESOURCE DEVELOPMENT ACT OF 2000, SECTION 601

Section 601 of the Water Resources Development Act of 2000 establishes that water generated from the Comprehensive Everglades Restoration Plan will be made available for the restoration of the natural system. Water made available by this project will not be permitted for consumptive use or otherwise made unavailable by the State, until such time as sufficient reservations of water for the restoration of the natural system are made under made under State law in accordance with the project implementation report and consistent with the Comprehensive Everglades Restoration Plan.

Section 601 of this act also establishes that until a new source of water supply of comparable quantity and quality as that available on the enactment of the Act is available to replace the water to be lost as a result of the implementation of the plan, the Secretary or non-Federal sponsor shall not eliminate or transfer existing legal sources of water including those for:

(i) an agricultural or urban water supply;
(ii) allocation or entitlement to the Seminole Tribe of Florida under Section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);

(iii) the Miccosukee Tribe of Indians of Florida;
(iv) water supply for Everglades National Park; or
(v) water supply for fish and wildlife.

In addition to the above Section 601 of this Act also established that implementation of the plan shall not reduce level of service for flood protection that is:

(i) in existence on the date of enactment of this Act; and
(ii) in accordance with applicable law.

A detailed discussion can be found in Section 12 of this report. The project is in full compliance with this act.

SECTION 12

PROJECT ASSURANCES

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SECTION 12
PROJECT ASSURANCES

12.1 SUMMARY OF PROJECT ASSURANCES

12.1.1 Background

As a result of laws passed by both the Federal government and the State of Florida, Comprehensive Everglades Restoration Plan (CERP) project implementation reports are required to contain documentation to ensure that the interests of the stakeholders, including the Federal government and the State of Florida, are adequately addressed by the project being recommended for approval and implementation. The following sections summarize those legislative requirements and the evaluations to be performed to address those requirements.

12.1.2 Water Resources Development Act (WRDA 2000)

Congress enacted the Water Resources Development Act of 2000, Title VI, Comprehensive Everglades Restoration (WRDA 2000) to approving the CERP "as a framework for modifications and operational changes to the Central and Southern Florida (C&SF) Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection." Section 601(h) of WRDA 2000, entitled "Assurance of Project Benefits" establishes programmatic and project specific assurances to be addressed as part of CERP implementation.

Section 601 (h)(1) of WRDA 2000 provides:

> *"IN GENERAL - The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized."*

Section 601(h)(4)(A) of WRDA 2000 contains the following requirements for project implementation reports:

> *"(A) PROJECT IMPLEMENTATION REPORTS. –*
> *(i) IN GENERAL. – The Secretary (of the Army) and the non-Federal sponsor shall develop project implementation reports in accordance with Section 10.3.1 of the Plan.*
> *(ii) COORDINATION. – In developing a project implementation report, the Secretary and the non-Federal sponsor shall coordinate with appropriate Federal, S ate, tribal, and local governments.*
> *(iii) REQUIREMENTS. – A project implementation report shall –*
> > *(I) be consistent with the Plan and the programmatic regulations promulgated under paragraph (3);*
> > *(II) describe how each of the requirements stated in paragraph (3)(B)[sic] is satisfied*
> > *(III) comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);*
> > *(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system;*
> > *(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement under State law, subclauses (IV) and (VI);*
> > *(VI) comply with applicable water quality standards and applicable water quality permitting requirements under subsection (b)(2)(A)(ii);*
> > *(VII) be based on the best available science; and*
> > *(VIII) include an analysis concerning the cost-effectiveness and engineering feasibility of the project.*

Subsequent sections of this report contain descriptions of the basic principles associated with identifying water that is to be made available for the natural system and for other water related needs of the region, the procedures followed for identifying water for the natural system and other water related needs, and quantitative information addressing timing and distribution of water identified to be reserved for the natural system associated with project implementation.

The project's effect on level of service for flood protection as required by WRDA 2000 is addressed primarily in Appendix A of this report.

12.1.2.1 Savings Clause

Section 601(h)(5) of WRDA 2000, entitled "Savings Clause" creates additional requirements for projects:

(A) NO ELIMINATION OR TRANSFER. – Until a new source of water supply of comparable quantity and quality as that available on the date of enactment of this Act is available to replace the water to be lost as a result of implementation of the Plan, the Secretary and the non-Federal sponsor shall not eliminate or transfer existing legal sources of water, including those for –

(i) an agricultural or urban water supply;
(ii) allocation or entitlement to the Seminole Indian Tribe of Florida under section 7 of the Seminole Indian Land Claims Settlement Act of 1987 (25 U.S.C. 1772e);
(iii) the Miccosukee Tribe of Indians of Florida;
(iv) water supply for Everglades National Park; or
(v) water supply for fish and wildlife.

(B) MAINTENANCE OF FLOOD PROTECTION. – Implementation of the Plan shall not reduce levels of service for flood protection that are –

(i) in existence on the date of enactment of this Act; and
(ii) in accordance with applicable law.

(C) NO EFFECT ON TRIBAL COMPACT. – Nothing in this section amends, alters, prevents, or otherwise abrogates rights of the Seminole Indian Tribe of Florida under the compact among the Seminole Tribe of Florida, the State, and the South Florida Water Management District, defining the scope and use of water rights of the Seminole Tribe of Florida, as codified in section 7 of
the Seminole Indian Land Claims Act of 1987 (25 U.S.C. 1772e).

Section 12.5 of this report addresses project effects on existing legal sources of water for categories of users listed above.

12.1.3 Programmatic Regulations (33 CFR PART 385)

Subpart E of the Programmatic Regulations for the Comprehensive Everglades Restoration Plan, entitled "Ensuring Protection of the Natural System and Water Availability Consistent with the Goals and Purposes of the Plan" contains requirements addressing the pre-CERP baseline water availability, elimination or transfer of existing legal sources of water, flood protection, interim goals, evaluation of progress toward other water related needs, the development of several programmatic guidance memoranda, and periodic reporting to Congress.

The Programmatic Regulations provide that a pre-CERP baseline be developed to aid the Corps of Engineers and the District to implement the Savings Clause in determining if existing legal sources of water will be eliminated or transferred. The pre-CERP baseline is one of the tools to be utilized in this

determination. The Programmatic Regulations also provide that each Project Implementation Report consider the operational conditions developed in the pre-CERP baseline to demonstrate that the levels of service of flood protection in existence on the date of enactment of WRDA 2000 and in accordance with applicable law will not be reduced by implementation of the project.

The pre-CERP baseline water availability for agricultural and municipal supplies, allocations or entitlement to the Seminole Indian Tribe, the Miccosukee Indian Tribe, water supply for Everglades National Park, and water supply for fish and wildlife is to be identified by the Corps of Engineers and the South Florida Water Management District in consultation with several other Federal, State, Tribal, and local agencies. The pre-CERP baseline water availability is to be identified to evaluate whether elimination or transfer of existing legal sources for the above listed categories will occur as a result of CERP project implementation. Each project implementation report is required to take into account the estimated total quantity of water necessary for the restoration of those areas of the natural system that are the focus of the project. The pre-CERP baseline has not yet been established, but is under development at the time if this PIR. Once developed, the programmatic regulations require concurrence by the Governor and the Secretary of Interior on the pre-CERP baseline.

Since the pre-CERP baseline is not established at this time, the Savings Clause analysis for the Southern Golden Gates Estates PIR is based on model simulations representative of 2000 conditions (i.e., 2000 land use and 2000 water supply pumped demands).

12.1.3.1 Operating Manual

Section 385.28(a)(6)(vi) of the CERP Programmatic Regulations (33 CFR Part 385) requires that the project operating manual be consistent with the reservation or allocation of water for the natural system as described in the project implementation report, and reflect the operational criteria used in the identification of the appropriate quantity, timing an distribution of water dedicated and managed for the natural system. The Draft Operating Manual was also developed based on the operations included in the hydrologic model. In the development of the Draft Operating Manual, the project delivery team worked with hydrologic modelers and water managers to develop operating criteria that reflected the intent of the operations represented in the hydrologic model, which includes operations associated with the allocation of water for the natural system. The drought contingency plan within the operations manual for the project will guide operations during shortages.

12.1.4 State of Florida Statutory Requirements

Section 373.026, F.S., describes the powers and duties of the Florida Department of Environmental Protection (FDEP) under Chapter 373, Florida Statutes. Sub-section (8)(b) of this statute addresses the FDEP's role in reviewing and approving CERP projects:

> *373.026(8)(b) – "To ensure to the greatest extent possible that project components will go forward as planned, the department shall collaborate with the (South Florida Water Management) district in the restudy. Before any project component is submitted to Congress for authorization or receives an additional appropriation of state funds, the department must approve, or approve with amendments, each project component within 60 days following formal submittal of the project component to the department. Department approval shall be based upon a determination of the district's compliance with s. 373.1501(5). Once a project component is approved, all requests for an additional appropriation of state funds needed to implement the project component shall be submitted to the department and such requests shall be included in the department's annual request to the Governor."*

The project implementation report is to contain adequate documentation addressing the criteria contained in Section 373.1501 sufficient for FDEP approval. Section 373.470, Florida Statutes, requires that prior to executing a Project Cooperation Agreement with the Corps, a PIR that contains sufficient information to receive FDEP approval under Section 373.026(8)(b), Florida Statutes, must first be completed. The SFWMD must demonstrate, using information in the PIR, that criteria set forth in Section 373.1501(5), Florida Statutes, is complied with in order to receive approval of the project component by the FDEP.

12.1.4.1 Criteria for Approval (Section 373.1501[5], F.S.)

Section 373.1501(5), F.S., contains five criteria (a-e) to be addressed in CERP project documentation:

> *373.1501 (5): in its role as local sponsor for the project, the district shall comply with its responsibilities under this chapter and implement project components through appropriate provisions of this chapter. In the development of project components, the district shall:*
>
> *(a) Analyze and evaluate all needs to be met in a comprehensive manner and consider all applicable water resource issues, including water supply,*

water quality, flood protection, threatened and endangered species, and other natural system and habitat needs;
(b) Determine with reasonable certainty that all project components are feasible based upon standard engineering practices and technologies and are the most efficient and cost-effective of feasible alternatives or combinations of alternatives, consistent with restudy purposes, implementation of project components, and operation of the project.
(c) Determine with reasonable certainty that all project components are consistent with applicable law and regulations, and can be permitted and operated a proposed. For purposes of such determination:
1. The district shall convene a pre-application conference with all state and federal agencies with applicable regulatory jurisdiction;
2. State agencies with applicable regulatory jurisdiction shall participate in the pre-application conference and provide information necessary for the district's determination; and
3. The district shall request that federal agencies with applicable regulatory jurisdiction participate in the pre-application conference and provide information necessary for the district's determination;
(d) Consistent with this chapter, the purposes of the restudy provided in the Water Resources Development Act of 1996, and other applicable federal law, provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service of flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment.
(e) Ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility or public infrastructure are minimized.

Section 12.6 of this report addresses the above-listed criteria associated with implementation of the recommended plan.

12.1.4.2 Water Reservations (Section 373.223[4], F.S.)

Part II of Chapter 373, F. S. contains the laws of the State of Florida governing permitting of consumptive uses of water in Florida. Section 373.223(4), F.S., provides that:

"(4) The Governing Board or the department, by regulation, may reserve from use by permit applicants, water in such locations and quantities, and for such seasons of the year, as in its judgment may be required for the protection of fish and wildlife or the public health and safety. Such

reservations shall be subject to periodic review and revision in the light of changed conditions. However, all presently existing legal uses of water shall be protected so long as such use is not contrary to the public interest."

This statute provides the legal framework for water that may be reserved from use for the protection of fish and wildlife or for the protection of public health and safety. The statute also requires existing legal uses of water be protected so long as such existing use is not contrary to the public interest. Additionally, the statute also directs that reservations shall be reviewed periodically to assess changed conditions and revised as necessary. Reservation of water is by administrative rule.

12.2 PRINCIPLES AND METHODS FOR IDENTIFYING WATER FOR THE NATURAL SYSTEM

12.2.1 Regional-Scale and Project Level Effects

One of the underlying principles of the CERP is to capture and store excess flows and discharges to tide to restore some of the historic regional water storage function that has been lost through the implementation of drainage and flood control infrastructure and development in the region. Since the projects that comprise CERP are designed to work together to achieve the system-wide goals and purposes of CERP, in most cases, the quantification of benefits should be done on a system-wide basis in addition to a project-by-project basis. However, since the Southern Golden Gate Estates (SGGE) project is hydrologically separate from the regional system and other proposed CERP projects, the coastal estuaries affected by the project will be considered as regional scale effects of the project. In terms of the project's effects on the natural system within the SGGE and downstream coastal estuaries, operation of the project components will create:

(1) Beneficial regional scale effects through the improved deliveries of water reflecting a change in distribution and timing to the coastal estuaries for the protection of fish and wildlife; and

(2) Beneficial project-level effects associated with enhanced storage and flow of surface water and groundwater to natural areas resulting in more natural hydropatterns for the protection of fish and wildlife in the SGGE area (i.e., includes natural areas outside the project footprint that hydrologically benefit by the recommended plan).

The recommended plan features were designed to determine beneficial water deliveries to the natural system at both the regional and project levels in order to achieve ecosystem restoration objectives. The MIKE SHE hydrologic

simulation model (see Section 6.6 for model documentation) was used to identify the quantity, timing, and distribution of the existing beneficial water and the beneficial water made available by the recommended plan. The project's effects based on the restoration performance measures were determined by comparing model simulations representative of 2003 conditions (i.e., 2000 land use, 2003 permitted water supply demands) with the recommended plan features and 2003 condition without the recommended plan features.

12.2.1.1 Redirected Flows to the Estuary

The recommended plan can produce regional scale effects by improving the timing and distribution of freshwater inflows in the downstream coastal estuaries, including the Ten Thousand Islands National Wildlife Refuge and reducing freshwater peak flows from the Faka Union Canal. The project does not significantly affect the total volume (i.e., quantity) of water discharged to the coastal estuaries; however, the redirected water made available by the project (i.e., including sheetflow, structural flow and groundwater flow) discharged within the identified estuarine targets improves the timing and distribution of water and is considered to be beneficial (i.e., water of adequate quality is discharged to the estuary when the estuarine system needs flow) and is therefore identified for the natural system.

12.2.1.2 Natural Areas

The recommended plan produces project-level effects by attempting to reestablish the pre-development hydrology within the Southern Golden Gate Estates project area to ensure restoration of the natural system, improvements in the continuity of sheet flow and retention of additional water made available by the project on the natural areas.

The recommended plan was formulated to retain water on project lands to restore a more natural hydrologic condition to an area where surface water sheet flow has been intercepted by 290 miles of roads and captured in 4 major canals. The recommended plan involves filling or plugging drainage features, such as canals, and removal 270 miles of roads. Over drainage of the SGGE landscape and surrounding public land would be halted. Improvements in the continuity of sheet flow would lead to more natural hydropatterns, in which restored historic plant communities may again provide habitat for native fish and wildlife. The recommended plan also includes 17,720 acres in the northwest corner of the project intentionally left out of the hydrologic restoration to provide habitat for upland species. Completion of the SGGE environmental restoration is central to the connection of existing preserved areas north and east of the project. The

quantity of water (surface water and groundwater) delivered to or retained within the project that results in wetland hydropatterns that fall within restoration targets is considered beneficial water that is identified for the natural system.

12.2.2 Quantity, Timing, Distribution, and Water Quality

Viewed from a programmatic perspective, identification of water for the natural system associated with the CERP involves an analysis of four different aspects of ecological responses to hydrologic changes: 1) responses to the change in the quantity of water received by the natural system; 2) responses to the timing of those deliveries; 3) responses to the distribution of water delivered to the natural system; and, 4) responses to the quality of the water received by the natural system. In a project specific sense, however, the relative importance of each of these aspects (quantity, timing, distribution, and quality) will vary from project to project depending upon the specific objectives established for the project.

For example, some CERP projects may focus formulation efforts on simply changing the timing (seasonality) or distribution (inflow and outflow points, internal movement) of water delivered to the natural system. Other projects may focus primarily on increasing or decreasing the amount of water delivered to the natural system, while still other projects may focus on improving the quality of the water delivered to the natural system to maintain desirable ecological community structure. All of these aspects (depending upon their applicability to specific projects) are addressed during plan formulation through performance measures and evaluation criteria used to evaluate alternative plans.

Section 601(h)(4)(A)(iii) of WRDA 2000 requires that project implementation reports:

> *"(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system; and*
>
> *(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement under State law, subclauses (IV) and (VI)"*

To address these requirements, a probabilistic approach has been selected utilizing volume probability curves to depict the distribution of volumes of water that provide natural system benefits as a result of project features through the entire range of climatic conditions contained within the period of record. These volumes of water may include beneficial water that currently exists without project features and the beneficial water made available from project features through the entire range of historic climatic conditions. The largest period of hydrologic record available for the SGGE project is 1988 through 2000.

Water quality is also taken into account during plan formulation and evaluation as either a project constraint (i.e., projects cannot cause or contribute to violations of water quality standards). Based on the project description from the April 1999 Comprehensive Review Study report, the SGGE project does not include water quality improvement features (i.e., water quality improvement was not needed to achieve regional ecosystem restoration objectives), nor is water quality improvement an evaluation criterion to be addressed during project design.

12.2.3 Volume Probability Curves

For purposes of identifying the portion of water for the natural system made available by the project over and above the existing beneficial water, volume probability curves are produced depicting the range of the quantities of water for the natural areas and coastal estuaries under all climatic conditions through the period of record used to perform project evaluations. The period of record used for hydrologic simulation modeling for this project is 1988 through 2000. This period includes sufficient climatological variability (including natural fluctuations of water) to be representative of long term hydrologic conditions in the region.

The probability curve indicates the probability (percentage of time equaled or exceeded, x-axis) that a certain quantity of water (expressed as flow, volume, stage, depth, y-axis) is made available for fish and wildlife protection as a function of historical rainfall distribution. It is produced by sorting quantities associated with different water years for different time windows or seasons.

The building of probability distribution curves requires the consideration of three separate time periods:

- Model time step (i.e., for SGGE: daily for overland and channel flows; 7 days for groundwater flow);
- Time interval for computing the total water made available, the beneficial water to be managed for the natural system, and for other water related needs; and
- Time windows (or seasons) for which the above time series will be summarized in the form of probability curves.

The longest historic period of hydrologic record available for the three time series noted above, (total water, beneficial water for the natural system and water for other water related needs) is partitioned into water year, dry season, and wet season. The following table depicts the range of these time windows:

TABLE 12- 1 RANGE OF TIME WINDOWS OR SEASON

Time Window or Season	Start	End
Water year*	November 1	October 31, following year
Dry season*	November1	May 31, following year
Wet season	June 1	October 31

(*) Denotes overlap of two consecutive years

The average water year probability distribution curve represents the cumulative volumes of water delivered from the project features to the natural system averaged for each 12-month period for each water year contained within identified for evaluation for the entire period of simulation.

The wet season in South Florida is defined as the period of time from June 1 through October 31 a five-month period of time coinciding with higher rainfall, sometimes associated with tropical storms and hurricanes. Typically, natural areas in South Florida that are included in CERP projects are not in need of additional water during the wet season. In fact, many of the natural areas in South Florida receive excessive runoff or flood control discharges that are harmful to the natural system (i.e., such as coastal estuaries). For those projects one of the planning objectives would be to reduce harmful discharges to natural areas. While it is expected that plans recommended for approval would reduce the volume and frequency of discharges harmful to the natural system, it is not possible in all cases that CERP project features will be designed to prevent all harmful discharges.

The dry season in South Florida is defined as the period of time from November 1 through May 31, a seven-month period of time coinciding with cooler temperatures and lower rainfall. Typically, natural areas in South Florida that are included in CERP projects are in need of additional water during all or portions of the dry season due to the design and operation of the existing water management system and water management practices. For those projects where the natural system lacks adequate water during the dry season, one of the planning objectives would typically be to increase the volume of water available to the natural system during the dry season. However, depending upon the sources of water affecting a project and the hydrologic effect of project features, dry season hydrologic targets may not be fully met for all CERP projects. Nevertheless, it is expected that under most circumstances, the additional dry season deliveries of water from CERP projects to the natural system (unless such deliveries would lead to increases in water levels when levels should be decreasing) would be beneficial. The drought contingency plan within the operations manual for the project will guide operations during shortages.
To identify incremental project effects (i.e., water made available by the project), probability curves for the with project condition are compared to without project probability curves using the model simulations based on 2003 conditions (i.e.,

2000 land use, 2003 permitted demands). The difference resulting from this comparison will reflect the water made available by the project.

12.2.4 Identification of Water to be Reserved

The identification of existing water and water produced by the project for the natural system is based on the portion of water available for the natural system that is beneficial (i.e., necessary to achieve ecosystem restoration objectives reflected in the performance measures and other evaluation criteria evaluated during plan formulation and evaluation work). To identify incremental SGGE project effects, volume probability curves for the 2003 with-project condition are compared to volume probability curves for the 2003 without project condition after a preferred alternative has been selected for recommendation. Beneficial water as a result of project features is determined by comparing volume probability curves for with project condition for a given time window (i.e., a specific month, year, or

period) against volume probability curves for a target (ecologically beneficial) for the same condition. The volume probability curves depicting the beneficial water made available by the project for the protection of fish and wildlife retained on the natural areas of the SGGE and discharged to the downstream coastal estuary under the full range of hydrologic conditions comprise the quantity, timing, and distribution of water identified to be reserved.

12.3 PRINCIPLES AND METHODS FOR IDENTIFYING WATER FOR OTHER WATER RELATED NEEDS OF THE REGION

Both WRDA 2000 and Section 373.470, Florida Statutes require that CERP is to "restore, preserve, and protect the South Florida ecosystem "*while providing for other water-related needs of the region, including water supply and flood protection*." It is anticipated under certain conditions, water made available by the project may exceed the quantity that is beneficial to the natural system. This quantity of water which is not identified for the protection of fish and wildlife will not be reserved by the State of Florida and may be considered for other water related needs of the region at this time. However, should a determination that be made that all or a portion of this water is necessary for restoration of the natural system at a future date, the State shall take appropriate actions to protect this water (e.g, through a revised reservation for this Project or through a reservation for another CERP project). Water for other water related needs is identified as water that contributes to meeting targets for quantity, timing, and distribution of water used for water supply or resource protection, and is evaluated using the hydrologic performance measures established to meet the goals and objectives of the project. The quantity, timing and distribution of

water for other water-related needs which progress toward or meet these water supply or resource protection performance measures is identified on a system-wide and/or sub-regional basis.

The quantity, timing and distribution of this water is expressed in much the same way as the water identified for the natural system using a sufficient period of record of hydrologic data that is representative of the full range of known conditions. The same model selection (Mike SHE for SGGE) including the same period of hydrologic record for the model simulations, and modeling procedures that are used for the identification and quantification of water to be managed for the natural system must be used for the identification and quantification of water for other water related needs. For the SGGE project, the identification of this water for other water related needs is based on the same volume probability curves used for the identification of water for the natural system.

12.4 QUANTIFICATION OF WATER MADE AVAILABLE FOR THE NATURAL SYSTEM AND FOR OTHER WATER RELATED NEEDS OF THE REGION

12.4.1 Background

Table 12-2 lists the restoration areas and the targets and the sources of the beneficial water associated with the SGGE project. For each of the restoration areas identified, volume probability curves depicting quantities or flows of water available during annual, dry, and wet conditions, and for the 1988 through 2000 period of hydrologic record were produced for the 2003 condition (i.e., 2000 land use with 2003 permitted demands) without the recommended plan components, the 2003 condition with the recommended plan components, and the restoration target (i.e., necessary to achieve ecosystem restoration objectives).

TABLE 12- 2 RESTORATION AREAS TARGETS AND SOURCES OF BENEFICIAL WATER ASSOCIATED WITH THE RECOMMENDED PLAN

Restoration Areas	Target	Source of Beneficial Water
Faka Union Bay and downstream coastal estuaries	Natural system flows	Composite sheetflow from the project area (i.e., portion of the Faka Union Canal Basin); groundwater; structural flow
Natural Area Restoration	Natural system volume retained for the project footprint[1]	Rainfall; groundwater; inflow from north of the project

[1] The application of Mike SHE (version 2003) used to develop the pre-development natural system model for the Big Cypress Basin Regional Model was based on the historic land cover complex indices as represented in the pre-development vegetation map of southwest Florida (Duever, et al, 2003) and existing topography devoid of anthropogenic features (i.e., roads, canals, etc.).

12.4.2 Project-Level Effects

The recommended plan produces project-level effects involving retention of additional water on the natural areas to achieve the restoration goals and objectives of the project. These incremental project level effects which are beneficial to the natural system will be subject to the water reservations requirement of WRDA 2000.

12.4.2.1 Project Footprint

The recommended plan results in the retention of water on (and subsequent redistribution of water from) the project footprint. Much of the water retained on project lands will restore historic wetland values and is beneficial for the restoration of the natural system (i.e., not an excess amount over and above that necessary to restore ecological function). This water made available by the project is necessary to restore the ecological functions of those areas as part of the overall restoration of the SGGE ecosystem.

To analyze project effects on water retained within the project boundary and adjacent areas that benefit hydrologically by the project, restoration targets for the volumes of water retained on the natural areas under all conditions were calculated. As required for restoration, more beneficial water is retained on the natural areas under 2003 with-project conditions than the volume indicated for the 2003 without-project conditions.

Figure 12-1 shows the SGGE project affected area and the MIKE SHE model boundary and grid cells used for the project assurances analysis.

12.4.2.2 Surface Water Project Benefits

Figure 12-2 shows the volume probability curve[2] for the volume of water retained on and adjacent to the project footprint over the entire 1988 through 2000 period of hydrologic record for 2003 conditions and restoration target. As indicated in this figure, the hydrologic conditions with the recommended plan (blue, dashed-line curve) more closely approaches the restoration target levels. The beneficial water made available by the project, over and above the existing beneficial water, is identified to be reserved, per WRDA 2000. The beneficial existing water is depicted by the red, solid-line curve.

[2] The surface water volume probability curve was developed by ranked plotting position analysis for the daily simulated values for the simulation period of 1988 through 2000.

FIGURE 12 - 1 SGGE PROJECTED AFFECTED AREA AND THE MIKE SHE MODEL BOUNDARY/GRID CELLS

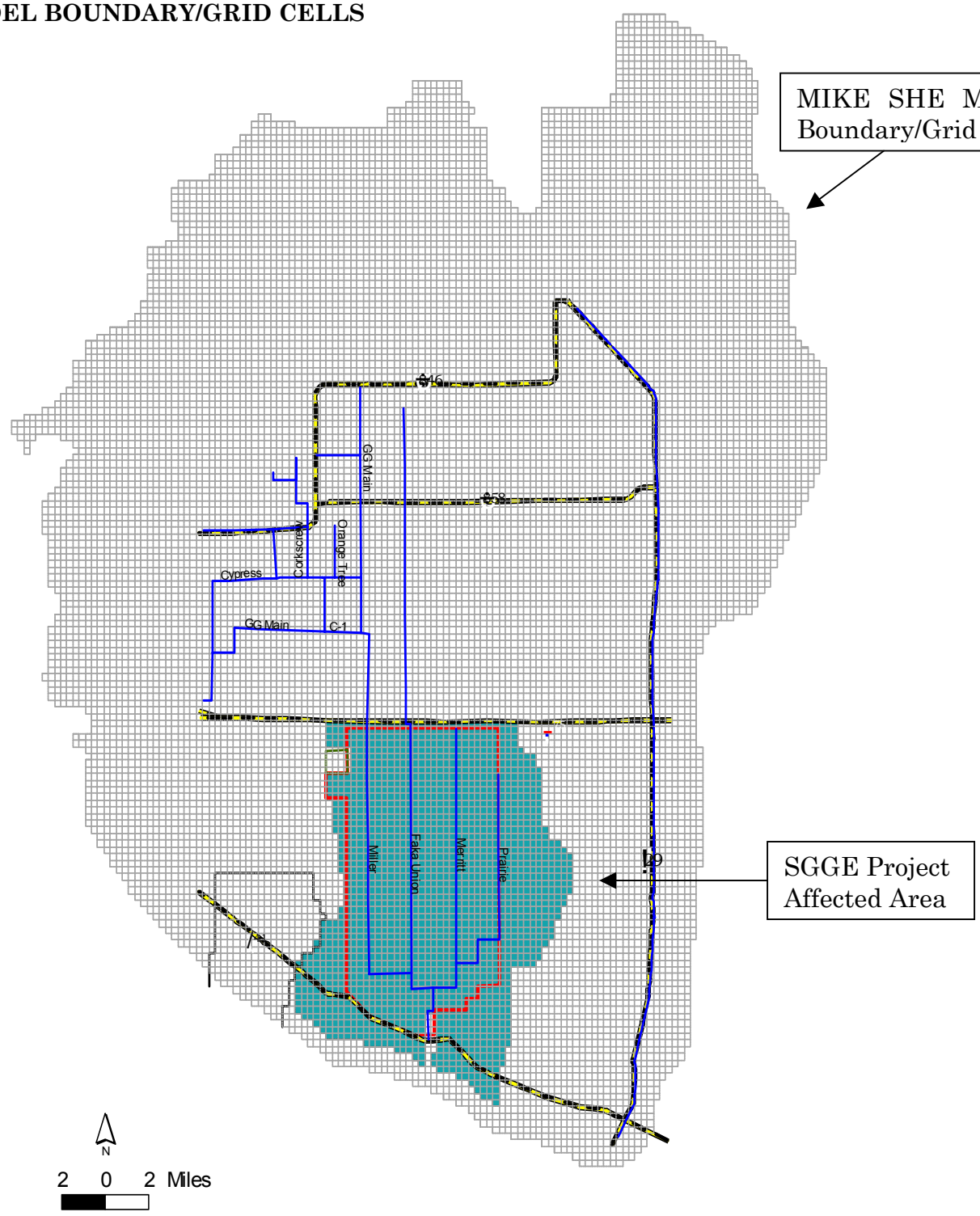
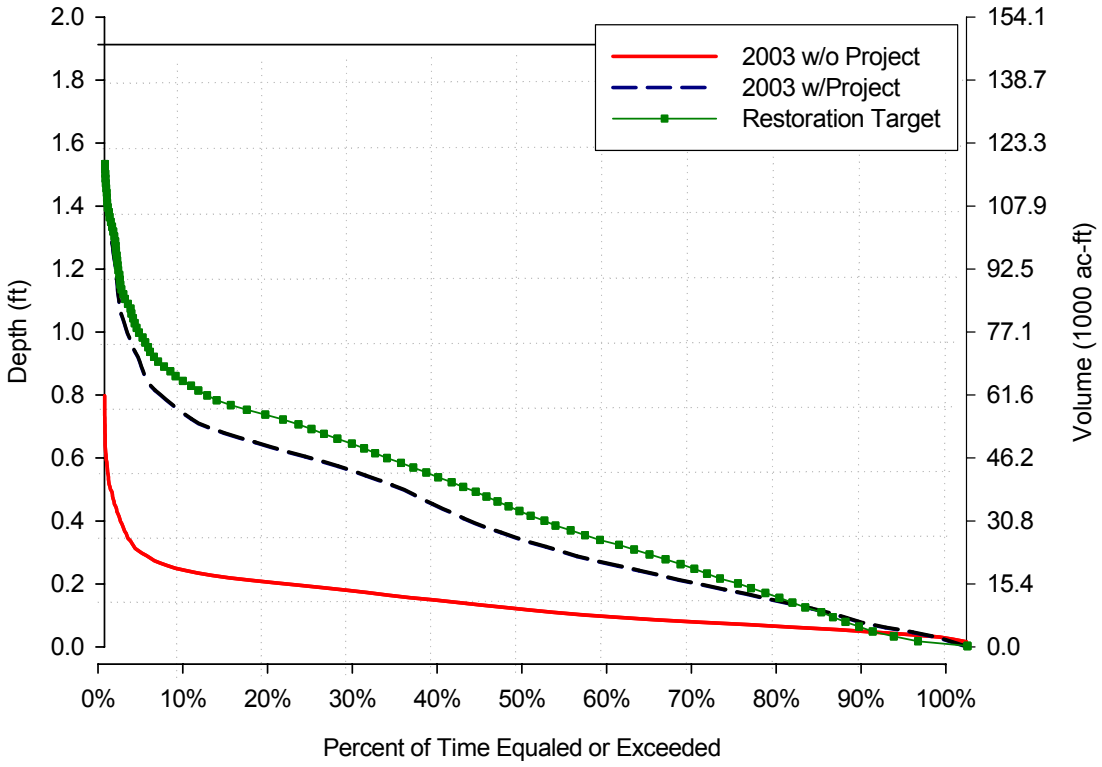


FIGURE 12 - 2 SGGE NATURAL AREAS - 2003 CONDITIONS VOLUME PROBABILITY - 1988 THROUGH 2000



Figures 12-3 and 12-4 show volume probability curves for the wet season (June to October) and dry season (November to May) conditions for the 1988 through 2000 period of hydrologic record. Figures 12-5 through 12-7 show the volume probability curves for conditions expected in an average year (1994), a representative wet year (1995), and a representative dry year (2000). As indicated in these figures, the hydrologic conditions with the recommended plan more closely approach the restoration target levels. The beneficial water made available by the project over and above the existing beneficial water is identified to be reserved, per WRDA 2000.

FIGURE 12 - 3 SGGE NATURAL AREAS - 2003 CONDITION VOLUME PROBABILITY CURVE - WET SEASON

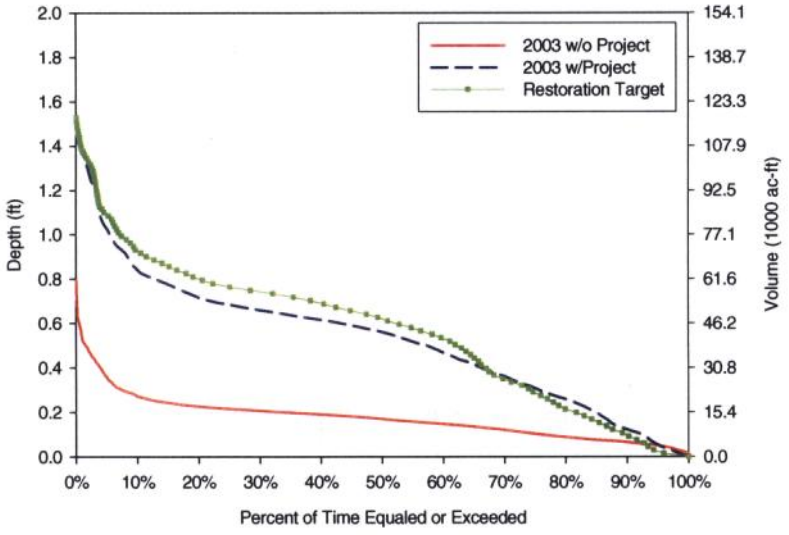


FIGURE 12 - 4 SGGE NATURAL AREAS - 2003 CONDITIONS VOLUME PROBABILITY CURVE - DRY SEASON

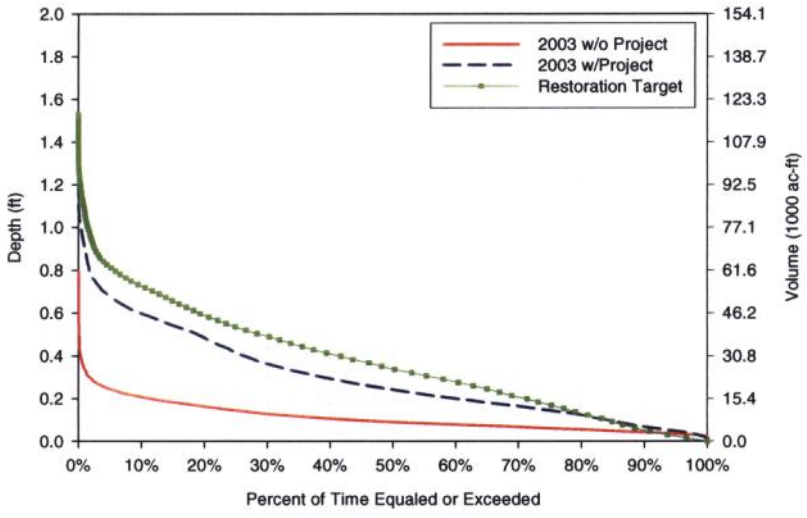


FIGURE 12 - 5 SGGE NATURAL AREAS - 2003 CONDITION VOLUME PROBABILITY CURVE - AVERAGE YEAR (1994)

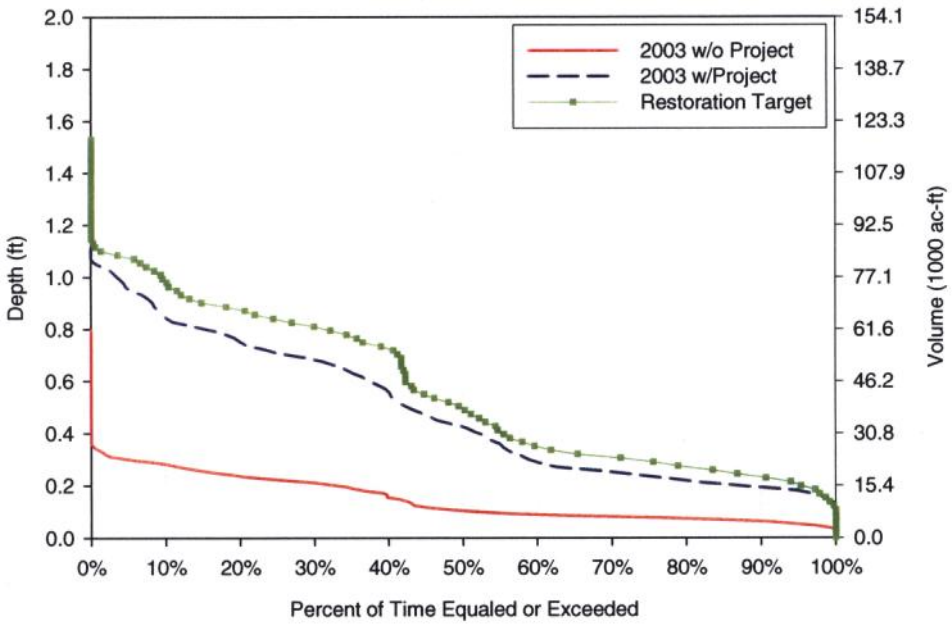


FIGURE 12 - 6 SGGE NATURAL AREAS - 2003 CONDITION VOLUME PROBABILITY CURVE - WET YEAR (1995)

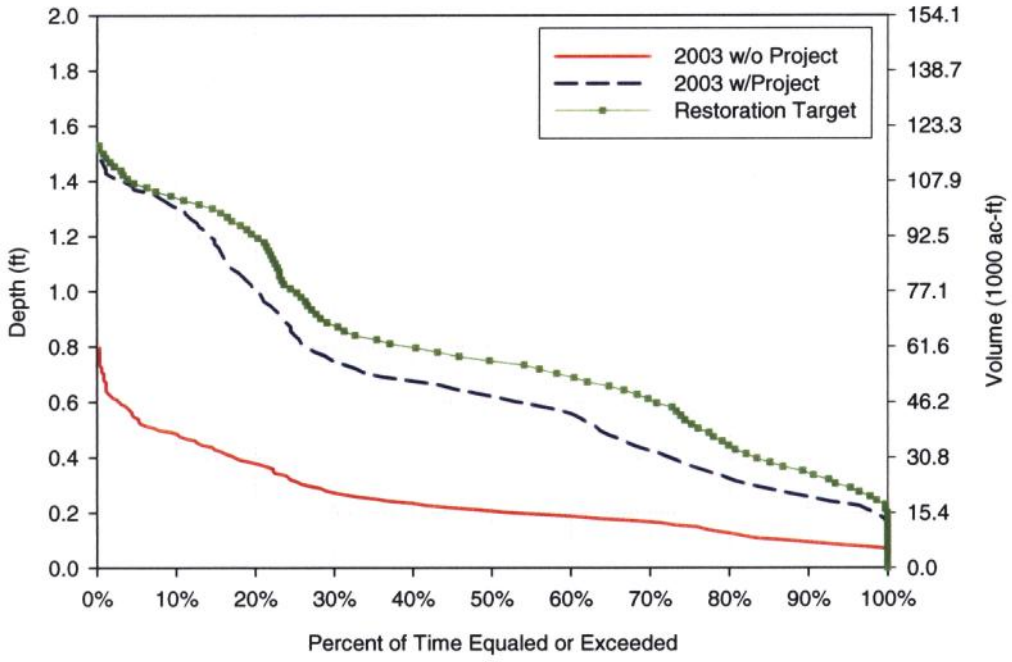
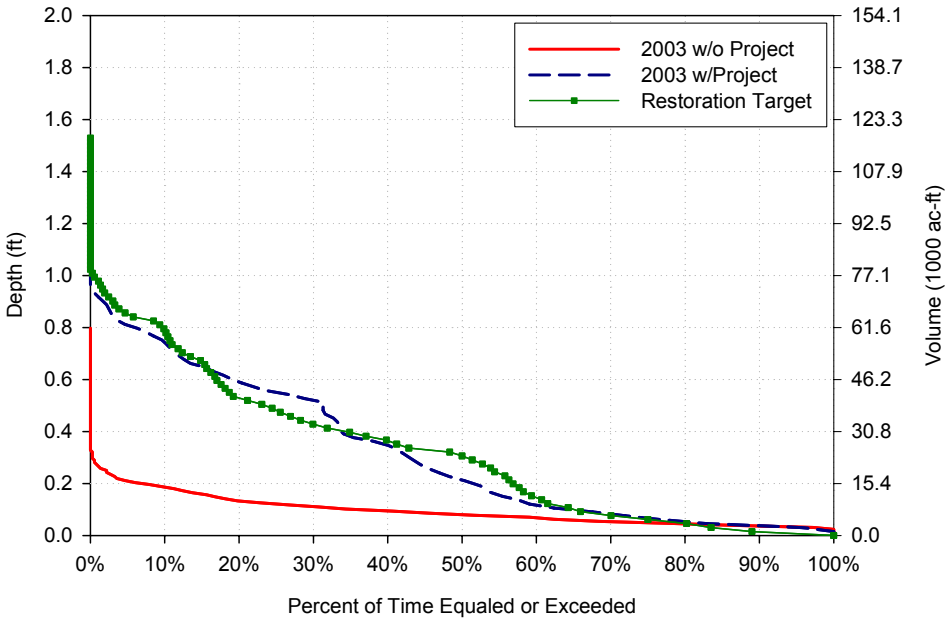


FIGURE 12 - 7 SGGE NATURAL AREAS - 2003 CONDITION VOLUME PROBABILITY CURVE - DRY YEAR (2000)

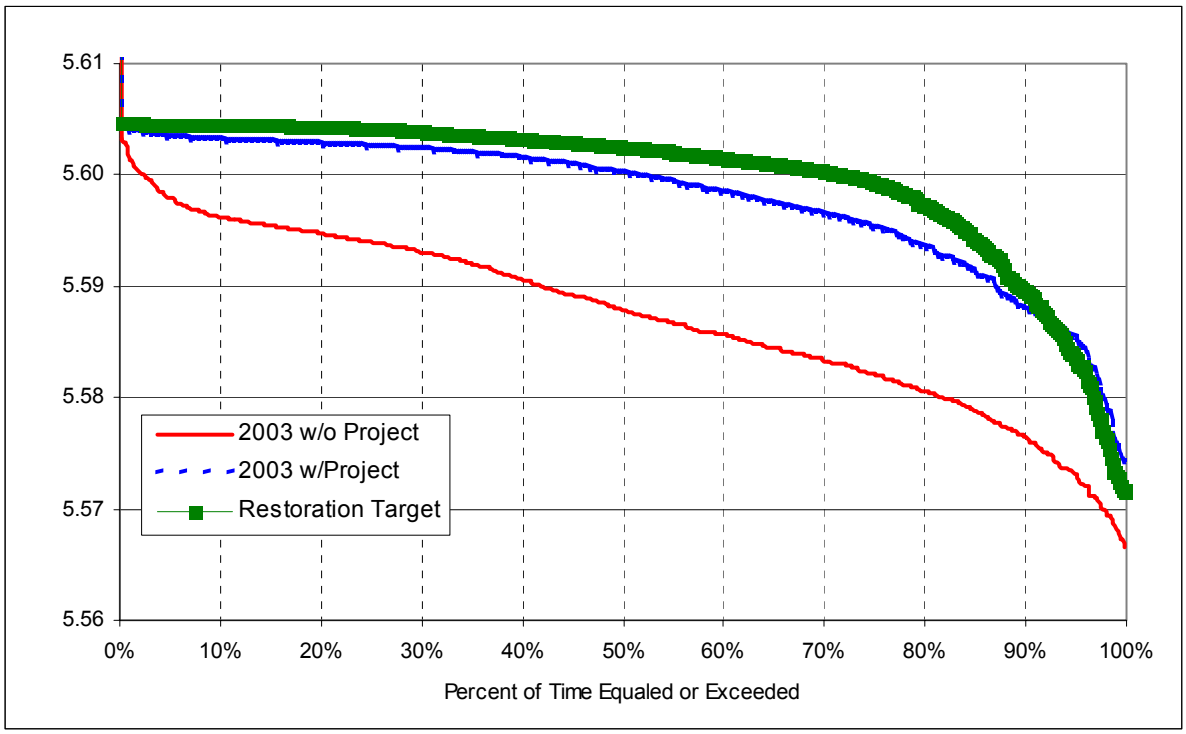


Figures 12-3 and 12-7 indicate the project will provide a small quantity of water in excess of the restoration target levels. This quantity of water in excess of the restoration target levels is identified as water potentially available for other water related needs of the region at this time.

12.4.2.3 Groundwater Project Benefits

Figure 12-8 shows the volume probability curve for the volume of groundwater storage for the period of hydrologic record 1988 through 2000. As indicated in this figure, the groundwater storage conditions with the recommended plan more closely approaches the restoration target level than the without project simulation. The beneficial water made available by the project over and above the existing beneficial water is identified to be reserved, per WRDA 2000.

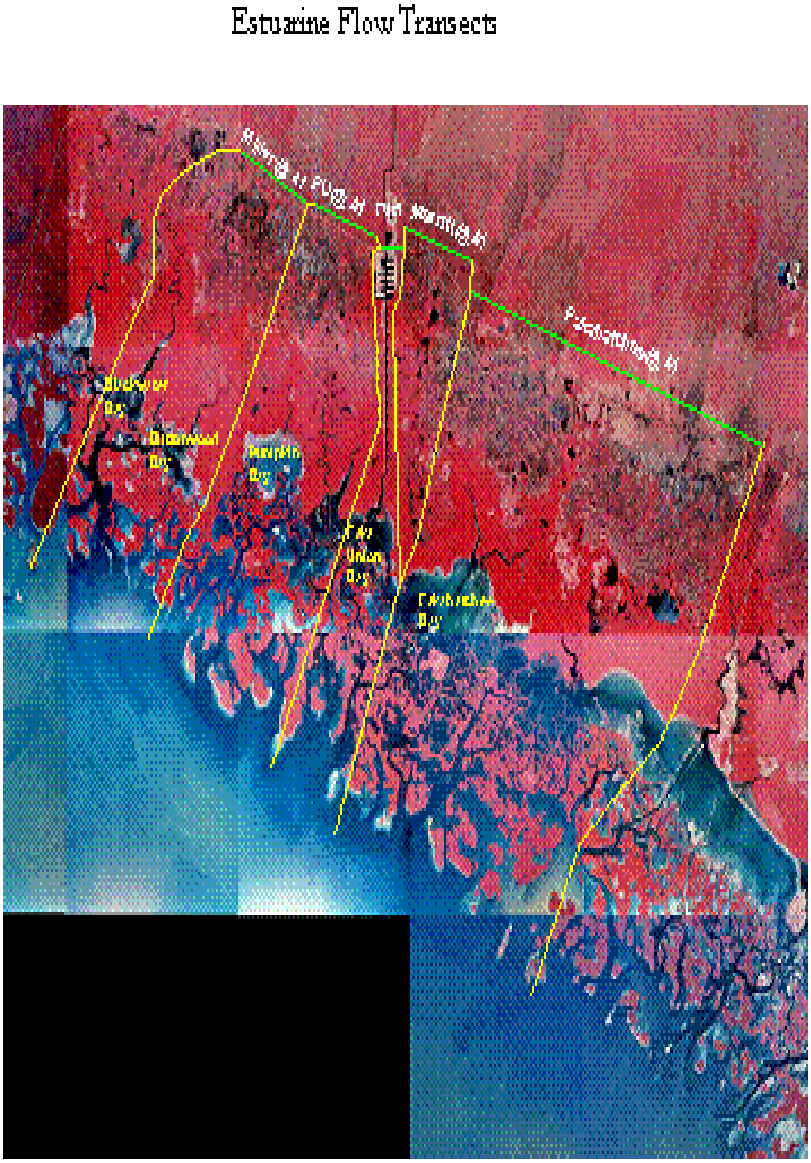
FIGURE 12 - 8 GROUNDWATER STORAGE - 2003 CONDITION VOLUME PROBABILITY CURVE - 1988 THROUGH 2000



12.4.3 Regional Scale Effects

The primary regional effect on the quantities of water for the natural system associated with implementation of the SGGE recommended plan is improved timing, distribution and quantity of water discharged to the coastal estuaries which comprise a portion of the Ten Thousand Islands NWR. The components of the recommended plan will reduce non-beneficial flows to the coastal estuaries. In addition, discharges from the project will be redistributed into diffuse surface flow entering the coastal estuaries at many points, instead of a single point source discharge through the Faka Union Canal. The identification and quantification of water for the downstream estuaries are based on flows modeled along four transects, namely Miller, Faka Union, Merritt and Fakahatchee, with flow outputs at US41. In addition, the residual channellized flow of the Faka Union Canal at weir#1 was also quantified for flow input to the Faka Union Bay. These transects are shown on Figure 12-9.

FIGURE 12 - 9 ESTUARINE FLOW TARGETS



12.4.3.1 Redirected Flows to the Estuary

The primary regional scale benefit of this project is to improve the timing and distribution of freshwater flows and reduce damaging point source flows (i.e., through the Faka Union Canal) to the downstream estuary. The recommended plan involves redistribution and timing of freshwater flows necessary to maintain a desirable salinity range within the estuarine system. To identify the

regional scale effects, the recommended plan effects, based on the restoration performance measures, were determined by comparing the 2003 (i.e., 2000 land use and 2003 permitted demands) without project condition to the 2003 with project condition. The flows to the downstream estuary are evaluated by aggregating the flows from four transects, including the residual channellized flow of the Faka Union Canal at weir#1 (Figure 12-9) along the southern boundary of the project footprint, and includes sheet flow, channel and groundwater flows.

In terms of an analysis of beneficial flows to the estuary, significant reductions in point source discharge from the Faka Union Canal into the estuary are demonstrated for average, wet and dry year conditions with the recommended plan. In order to show the reduction in point source discharges from the Faka Union Canal, the 2003 without project and 2003 with project condition were simulated using on the Faka Union Canal as the single discharge source to the downstream estuaries (Figures 12-10 through 12-12). These figures show the Faka Union Canal discharges to the estuary more closely match the restoration target with the recommended plan than with the 2003 without project condition. This reduction in damaging point source discharges from the Faka Union Canal will provide a more beneficial salinity regime for the downstream estuarine system.

Figures 12-13 through 12-18 demonstrate the improvement in timing and distribution of freshwater flows into the estuarine system aggregated across the southern boundary of the project footprint with the recommended plan. In Figure 12-13, the probability curve[3] for flows throughout the entire period of record (1988 through 2000) indicates that 100% of the time, the restoration flow target is met, with slight exceedances (water quantities exceeding target amounts) occurring less than 35% of the time. Figure 12-14, which represents wet season conditions, indicates the restoration flow target is slightly exceeded approximately 60% of the time with the recommended plan; however, these quantities are less than the without recommended plan simulation. Dry season conditions depicted on Figure 12-15 indicate the flows for both the with project and without project simulations closely match the restoration target. The hydrographs shown on Figures 12-16 through 12-18 indicate project effects on estuary deliveries in an average water year (1994), a representative wet year (1995), and a representative dry year (2000).

The additional flows produced by the project that meet the restoration target will be quantified for the natural system, per WRDA 2000. The estuarine flows that exceed the restoration target are considered to be potentially available for other water related needs of the region at this time.

[3] The probability curve for estuarine deliveries was developed by ranked plotting position analysis for the daily simulated values for the simulation period of 1988 through 2000.

FIGURE 12 - 10 ESTUARY DELIVERIES ACROSS FAKA UNION CANAL - 2003 CONDITION HYDROGRAPH - AVERAGE YEAR (1994)

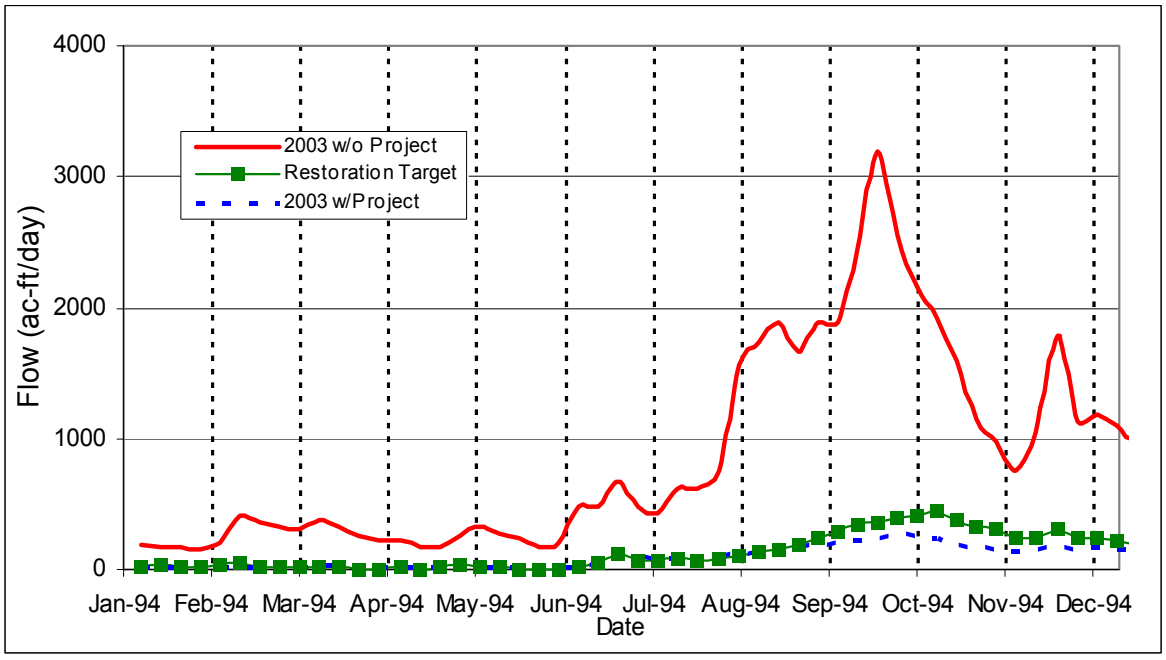


FIGURE 12 - 11 ESTUARY DELIVERIES ACROSS FAKA UNION CANAL - 2003 CONDITION HYDROGRAPH - WET YEAR (1995)

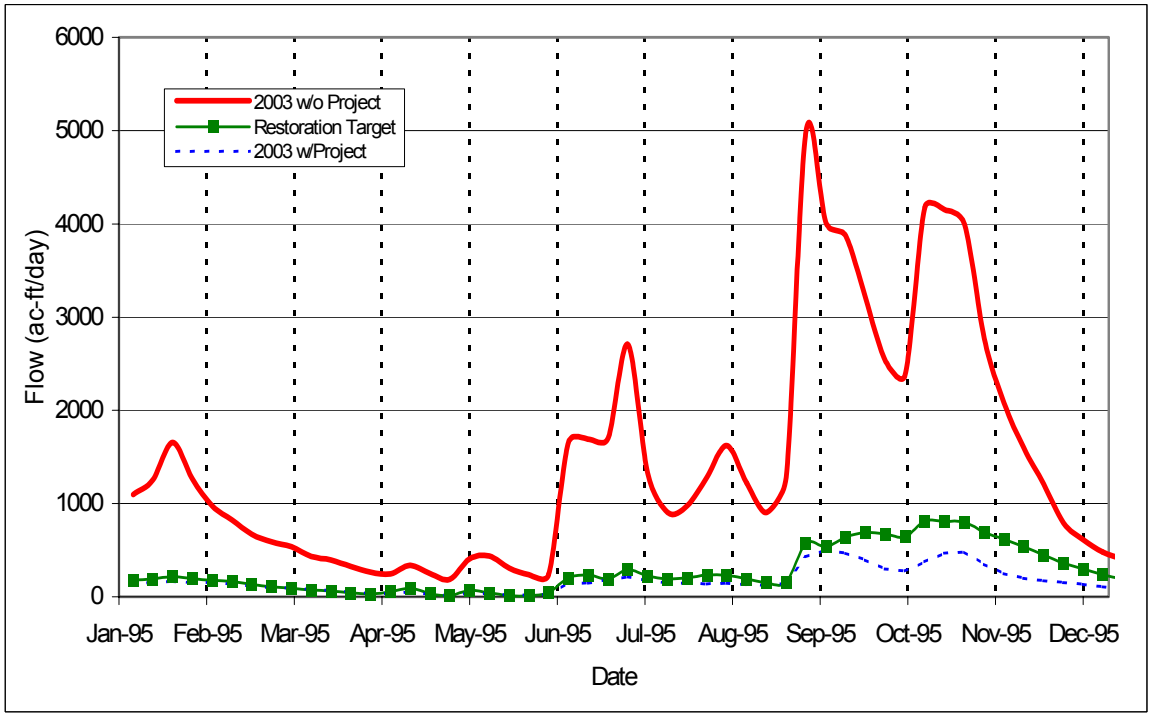


FIGURE 12 - 12 ESTUARY FLOWS ACROSS FAKA UNION CANAL 2003 CONDITION HYDROGRAPH - DRY YEAR (2000)

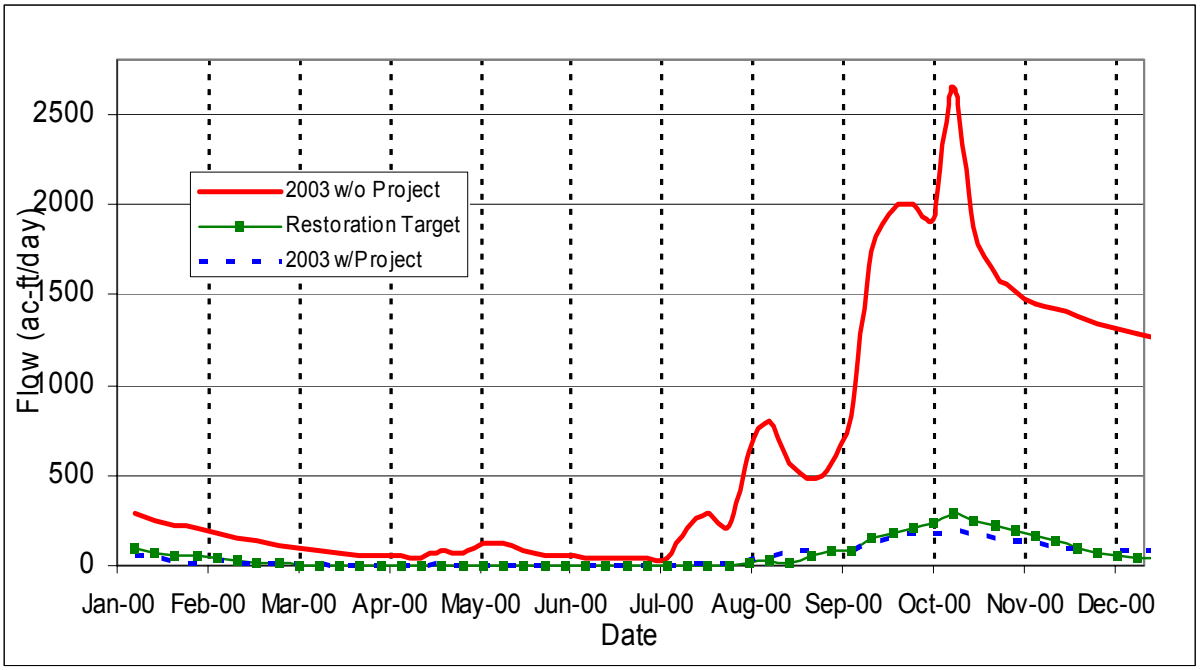


FIGURE 12 - 13 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDITION VOLUME PROBABILITY CURVE - 1988 THROUGH 2000

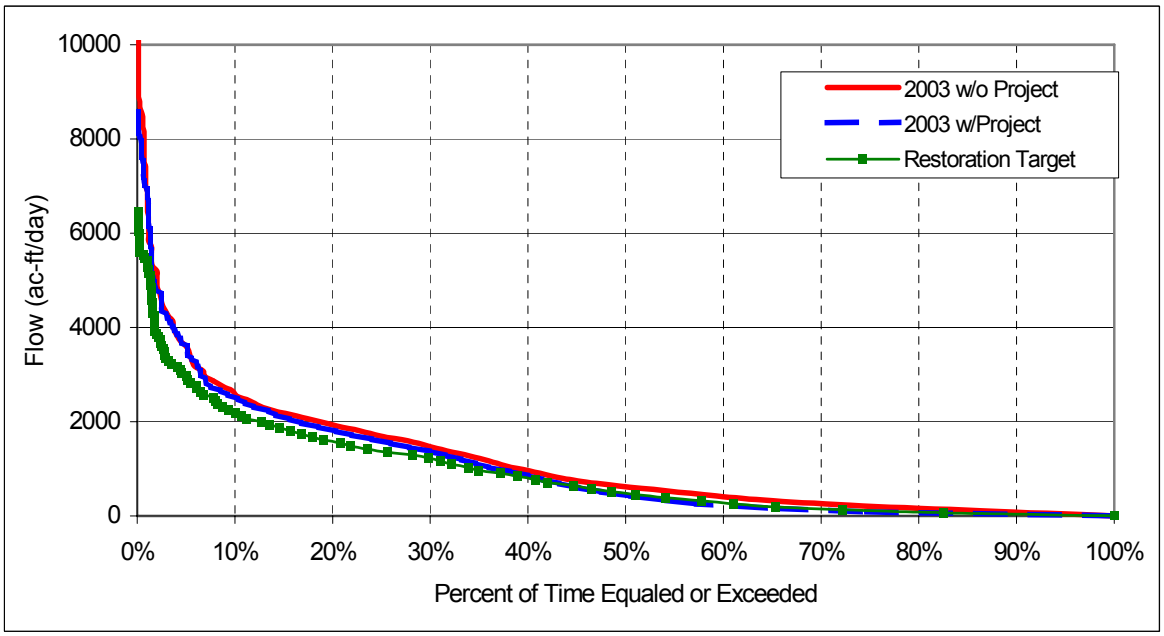


FIGURE 12 - 14 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDTION VOLUME PROBABILITY CURVE - WET SEASON

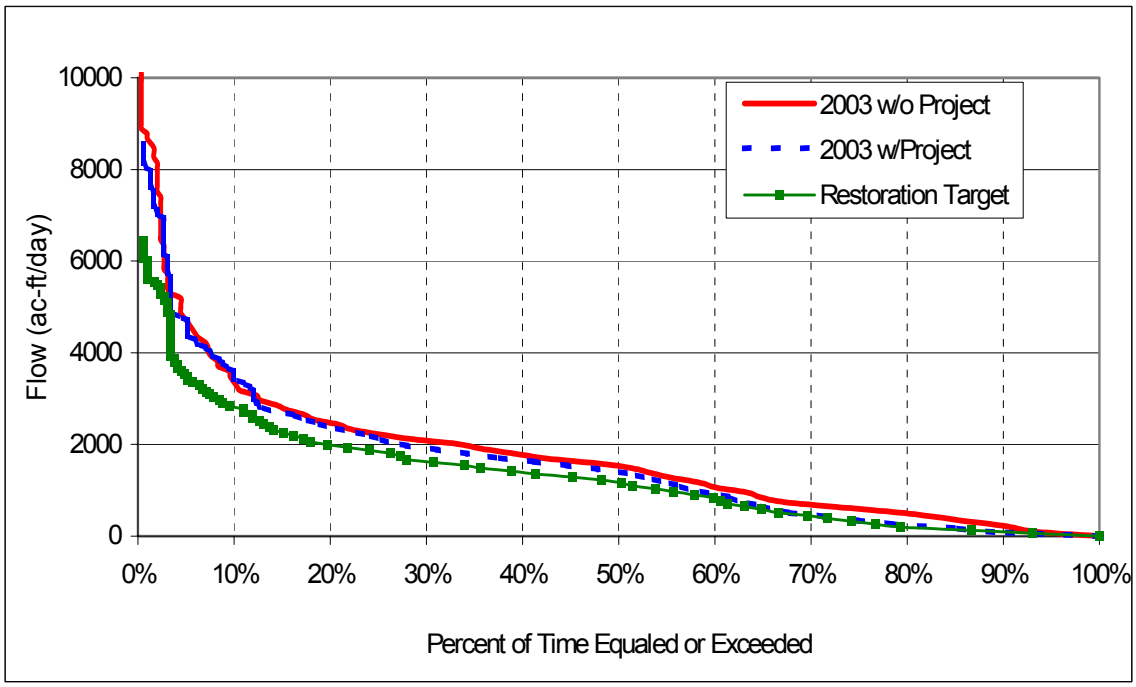


FIGURE 12 - 15 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDITION VOLUME PROBABILITY CURVE - DRY SEASON

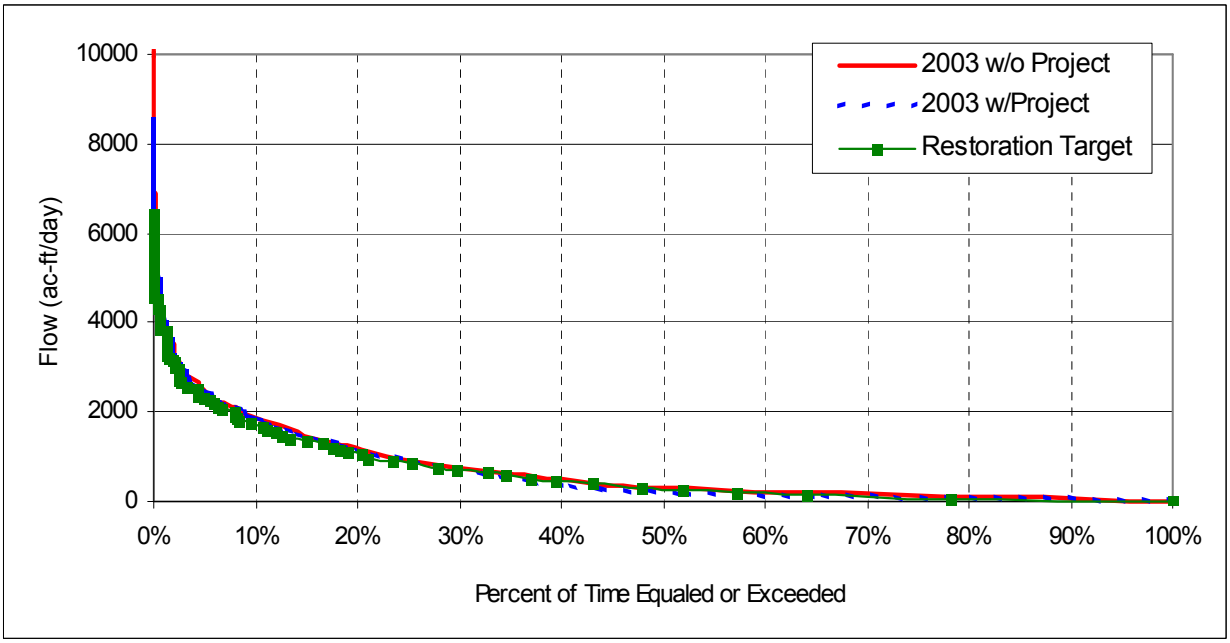


FIGURE 12 - 16 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDITION HYDROGRAPH - AVERAGE YEAR (1994)

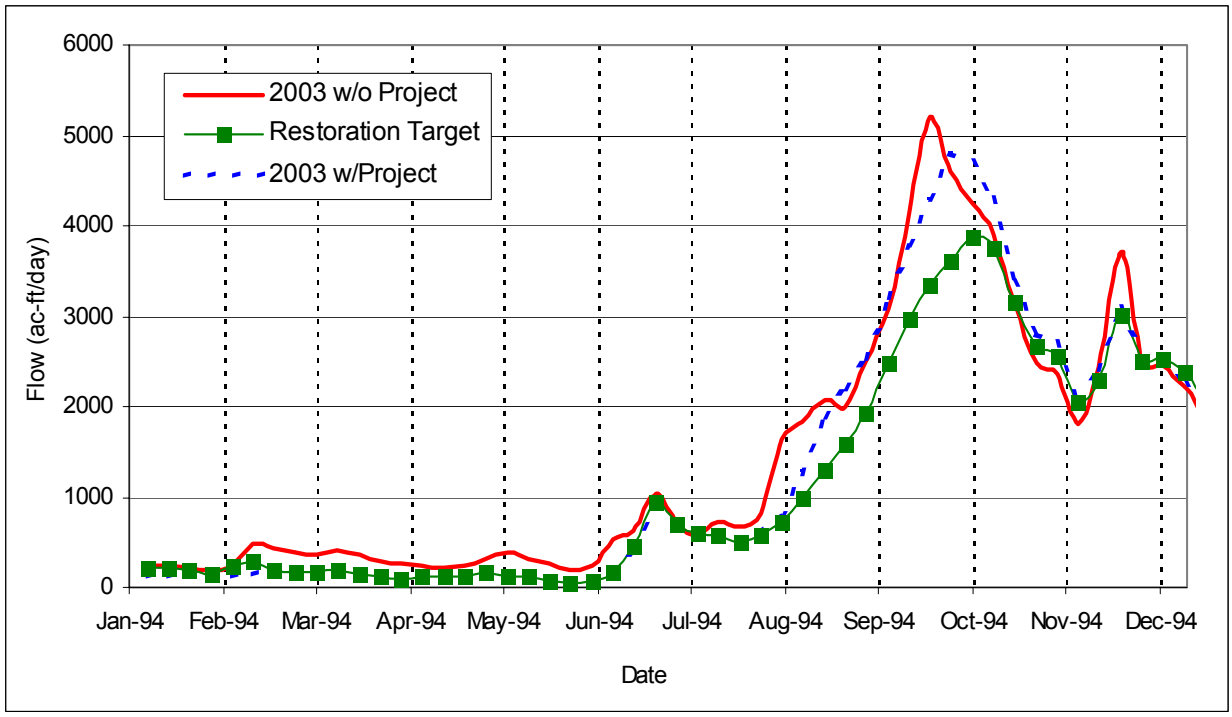


FIGURE 12 - 17 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDITION HYDROGRAPH - WET YEAR (1995)

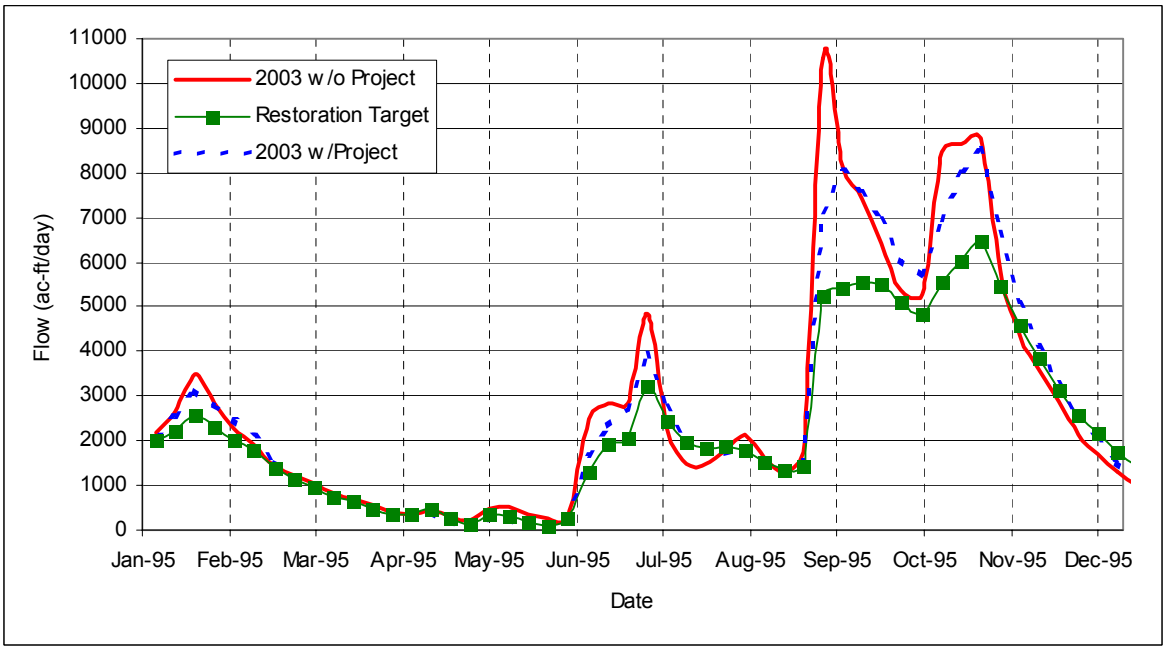
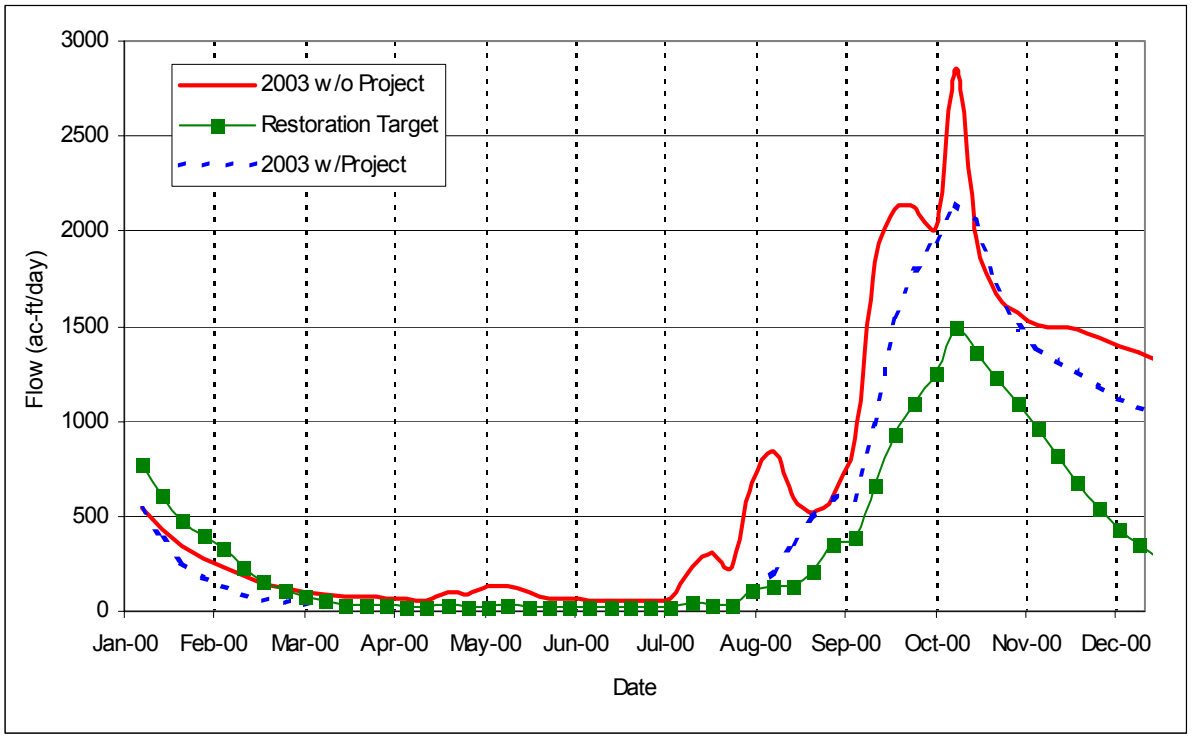


FIGURE 12 - 18 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2003 CONDITION HYDROGRAPH - DRY YEAR (2000)



12.5.1 Background

Section 601(h)(5)(A) of WRDA 2000 requires that existing legal sources of water supplying agricultural and urban users, the Miccosukee and Seminole Tribes, Everglades National Park, and water for fish and wildlife available on the date of enactment of WRDA 2000 may not be eliminated or transferred as a result of implementation of CERP projects until a new source of comparable quantity and quality is available. This requirement necessitates that existing legal sources of supply to each of the six users identified in WRDA as of December 2000 be identified in the study area and a determination made about whether the project will affect those sources.

For many of the components of the CERP, the original purpose and intent as reflected in the initial formulation documented in the 1999 Comprehensive Review Study was to create new volumes of water and change the timing and distribution of water (primarily through storage of excess water discharged to tide) to make more water available for the natural system. Depending upon the location of specific components, the hydrologic changes inherent in the design of those components, and the sequence for implementation of CERP projects legal sources of water may be partially or entirely eliminated or transferred to new

sources as a result of project implementation. It is these effects that must be addressed under the Savings Clause prior to project implementation.

12.5.2 Identification of Existing Legal Sources of Water

Within and adjacent to the project area, the existing legal sources of water supplies for fish and wildlife, urban, and agricultural users in the study area are local rainfall and basin storage, and the surficial aquifer (Table 12-3). It should be noted that there are no Seminole or Miccosukee reservation or leased lands within the study area. Legal sources of water for tribal uses will not be affected by project implementation; therefore, there are no existing legal sources requiring identification in this PIR for tribal use. The project is also not expected to adversely affect existing legal sources of water to Everglades National Park; however, the project does result in a beneficial redistribution of surface water discharged to the Ten Thousand Islands NWR.

TABLE 12- 3 EXISTING LEGAL SOURCES FOR WATER SUPPLY SGGE PROJECT STUDY AREA

User Category	Legal Sources	
Fish and Wildlife	Local basin storage and runoff	surficial aquifer
Agricultural	Local basin storage and runoff	surficial aquifer
Urban	Local basin storage and runoff	surficial aquifer
Ten Thousand Islands NWR; Everglades National Park	Local basin storage and runoff	surficial aquifer
Seminole and Miccosukee	No direct supply of water to tribal users from local basin storage and runoff in the study area for this project	

12.5.3 Description of Method Used to Evaluate Project Effects on Existing Legal Sources

The Programmatic Regulations provide that a pre-CERP baseline be developed to aid the Corps of Engineers and the District to implement the Savings Clause in determining if existing legal sources of water will be eliminated or transferred. Existing legal sources of water are identified for affected water user basins within the study area of a CERP project. Through the plan formulation and evaluation process, the quantity of water available from existing legal sources associated with pre-CERP baseline conditions is established for each existing water user basin for all hydrologic conditions.

Using a hydrologic simulation model, a time-series of water deliveries resulting from project implementation is established for each existing water user basin. This delivery is climate driven and is described as a time-series of monthly flows

over the full range of hydrologic conditions. The hydrologic model simulates critical processes in a basin and shows the deliveries of water to all defined water user basins. The periods of record and climatic conditions in the model are the same for the pre-CERP baseline and the with-project conditions. The hydrologic model simulates the pre-CERP baseline conditions and the effects of project components and operating criteria as developed for the recommended plan.

The pre-CERP baseline has not been formally established at the time this PIR was developed; therefore, the Savings Clause analysis is based on model simulations representing 2000 conditions (i.e., 2000 land use, 2000 actual water supply demands).

For this project, the existing legal sources are shown in Table 12-3. The effects of the project, in terms of elimination or transfer of sources of water under WRDA 2000, are analyzed by comparing the modeled delivery of water from legal sources to each user basin as a result of project implementation to deliveries from legal sources as modeled for conditions as of December 2000 in the basin. To determine effects on existing legal sources, evaluation criteria based on 2000 urban and agricultural demands were developed and evaluated for the 2000 condition without the recommended plan and the 2000 condition with the recommended plan.

12.5.4 Elimination or Transfer of Existing Legal Sources

The recommended plan's effects on sources of water for urban and agricultural users were evaluated for the Faka Union Canal Basin and immediately adjacent areas. To establish whether elimination or transfer of a source of water would occur as a result of project implementation, pumped demands for water supply by urban and agricultural users in the study area were determined by comparing the model results of the 2000 condition without the recommended plan components to the 2000 condition with the recommended plan components.

The primary environmental problems addressed by the SGGE project alternatives and the recommended plan are too much fresh water being discharged by the Faka Union Canal to the estuarine system and excess drainage of the wetland areas within the project boundary. To restore the hydroperiod for the pre-development (1940) habitat types and restore more natural flows of fresh water to the coastal estuaries, the recommended plan restores the natural storage capability in the wetland areas within the project boundary and diffused surface flow entering the estuary from many points within the study area. Stored and/or sheet flow fresh water is then available at more appropriate times, meeting the restoration goals of the project. The

existing legal sources of supplies from local basin storage and runoff and the surficial aquifer to meet the demands of users, including fish and wildlife on the project lands and in the coastal estuaries, are not expected to be adversely affected by project implementation.

For this project, the analysis of elimination or transfer of existing legal sources focused on sources of water for agricultural and urban water users in and adjacent to the study area, since generally fish and wildlife in the area are currently adversely affected by too little water being retained within the project boundary, and too much point discharge fresh water into coastal estuaries.

The SGGE project area comprises the southern portion of the Faka Union Canal basin. Within this basin, the principal land use is residential estates, with some large agricultural parcels located in the northern portion of the basin. In addition, the study is bordered on the west by substantial agricultural operations. These adjacent water users rely primarily on rainfall and canals, through either direct withdrawal or from aquifer recharge. Retention of water on project lands is not expected to eliminate or transfer the existing sources for those agricultural users, and should make additional water available (compared to 2000 conditions) by providing additional water for aquifer recharge. Agricultural and urban water users within the project footprint are limited or non-existent in number. Since the project features are designed to restore historic wetland conditions (i.e., water volumes and flows) within and adjacent to the project footprint, these features are not expected to diminish the quantity of water available for withdrawal from the underlying aquifers.

The project corridor does not include any public water supply wellfields. The closest wellfield to the project is located 1.2 miles from the intersection of the Faka Union Canal and US 41. This wellfield, with a capacity of 0.5 million gallons per day, supplies water to the Port of the Isles development south of US 41. The City of Naples Eastern Golden Gate Wellfield is located along the Faka Union Canal between weirs Faka Union 4 and Faka Union 5 (approximately 3.5 miles north of the northern project boundary). This wellfield has a maximum daily allocation of 21.0 million gallons per day and supplies most of the potable water for Naples and the unincorporated service area. The majority of residents in Northern Golden Gates Estates utilize private wells to supply their water. One of the incidental project benefits of the recommended plan will be to improve the aquifer recharge in and adjacent to the study area; therefore, water supply conditions will not be adversely impacted.

12.5.5 Identification of Project Effects on Existing Legal Sources of Water

The recommended plan provides more water available to fish and wildlife on project lands (through increased storage on project lands and enhanced canal/aquifer recharge) than is estimated to be available in 2000 based on existing pumped demands over the full range of hydrologic conditions (Figure 12-19). During the dry season, the project retains up to 20,000 additional acre feet of water compared to 2000 condition without the project (Figure 12-21).

In terms of its effect on water discharged to the coastal estuaries directly from canals or indirectly through aquifer recharge within and adjacent to the study area, the recommended plan results in a slight reduction, under some conditions, in producing the same amount of water from existing legal sources discharged to the coastal estuaries. However, under all conditions, the recommended plan produces either the target amount of water or more than the target amount that is beneficial for fish and wildlife in the coastal estuaries. Therefore, no elimination or transfer of an existing legal source of water occurs as a result of the recommended plan. Furthermore, the reduction in flows from existing legal sources is acceptable since under all conditions, the coastal estuaries are receiving the target beneficial amount of water.

FIGURE 12 - 19 SGGE NATURAL AREAS - 2000 CONDITION VOLUME PROBABILITY CURVE - 1988 THROUGH 2000

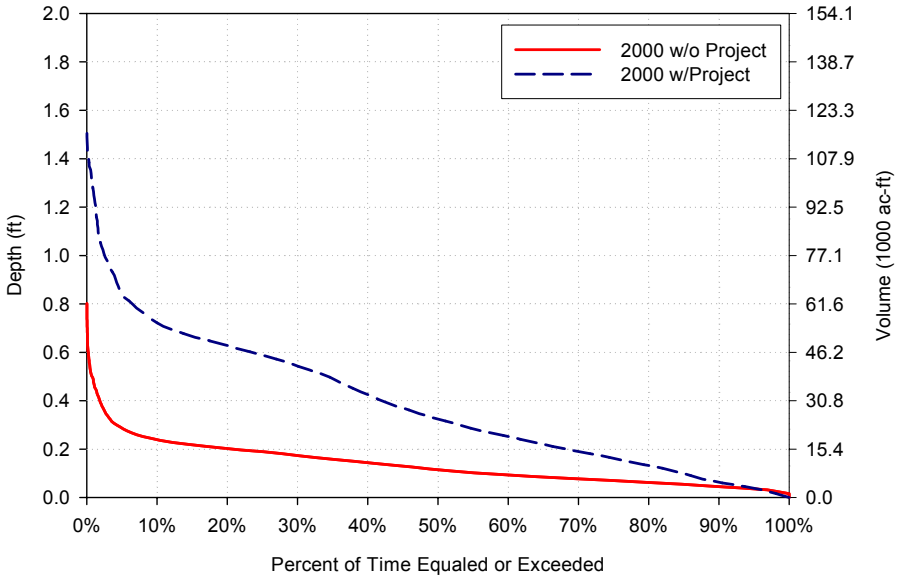


FIGURE 12 - 20 SGGE NATURAL AREAS - 2000 CONDITION VOLUME PROBABILITY CURVE - WET SEASON

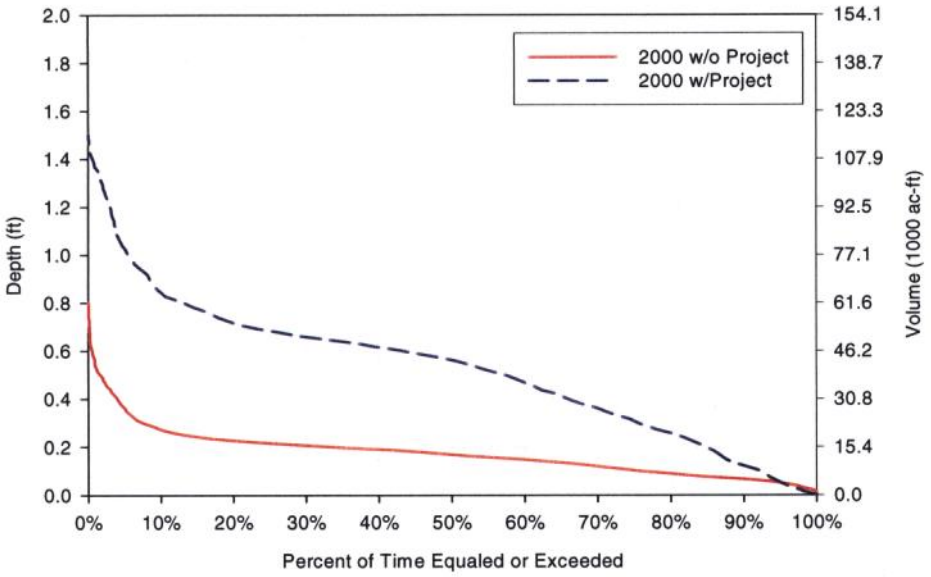


FIGURE 12 - 21 SGGE NATURAL AREAS - 2000 CONDITION VOLUME PROBABILITY CURVE - DRY SEASON

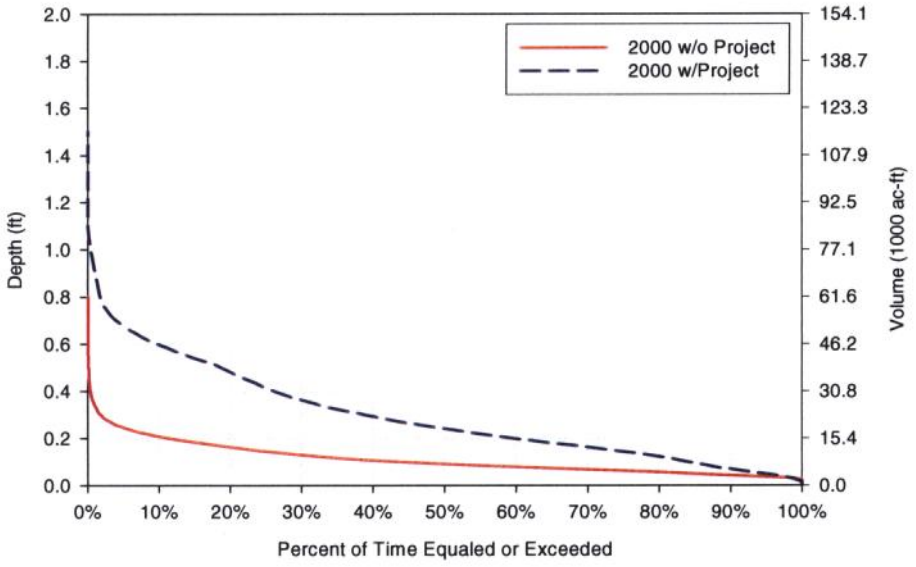


FIGURE 12 - 22 GROUNDWATER STORAGE - 2000 CONDITION VOLUME PROBABILITY CURVE - 1988 - 2000

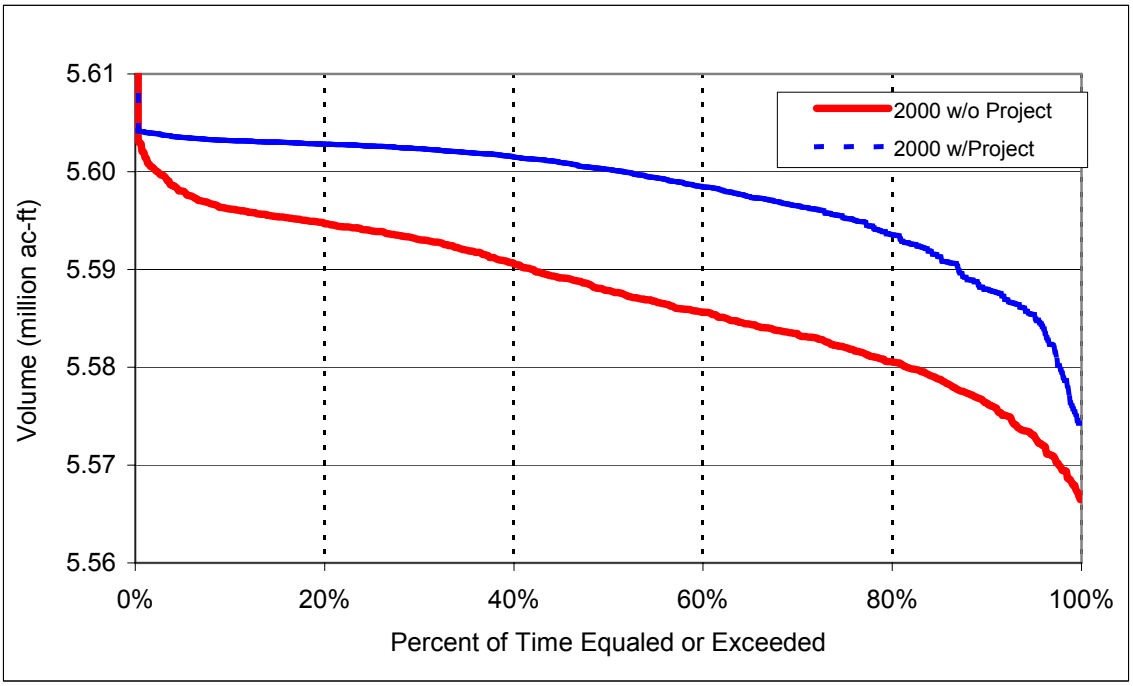


FIGURE 12 - 23 GROUDWATER STORAGE - 2000 CONDITION VOLUME PROBABILITY CURVE - WET SEASON

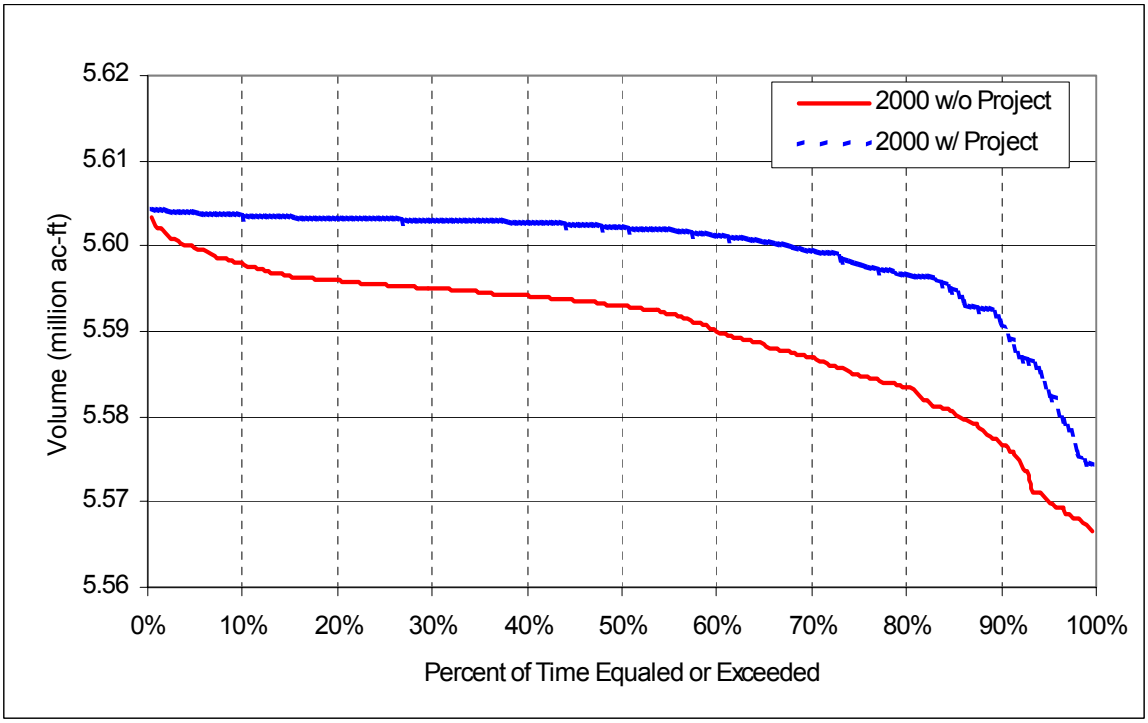


FIGURE 12 - 24 GROUNDWATER STORAGE - 2000 CONDITION VOLUME PROBABILITY CURVE - DRY SEASON

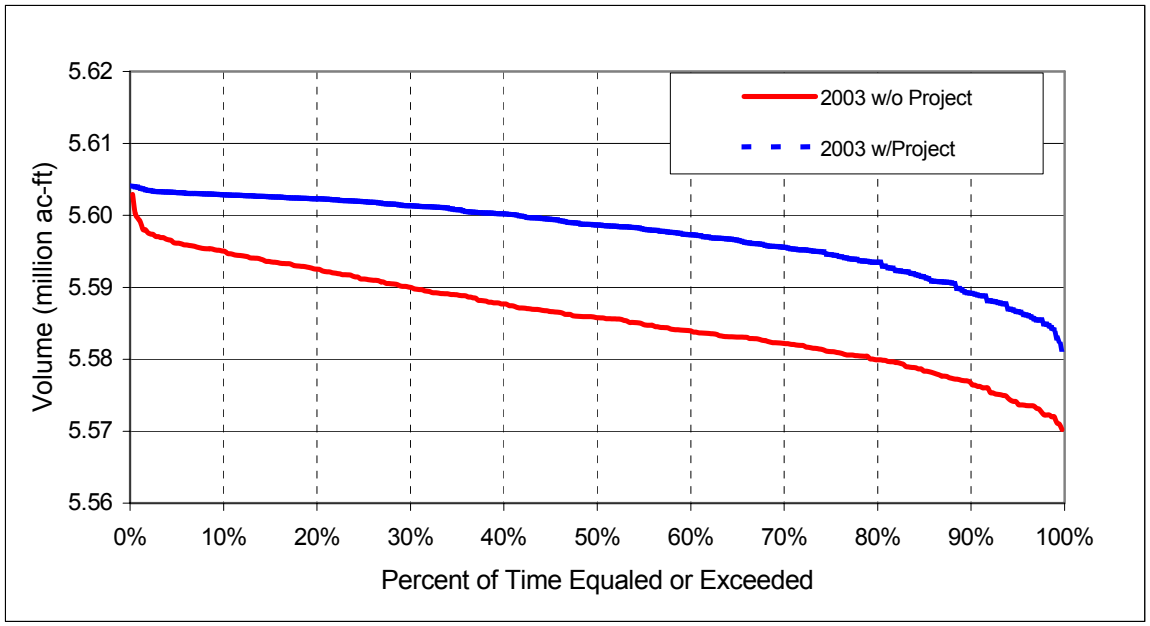


FIGURE 12 - 25 ESTUARY DELIVERIES ACOSS SOUTHERN TRANSECT - 2000 CONDITION VOLUME PROBABILITY CURVE - 1988 TO 2000

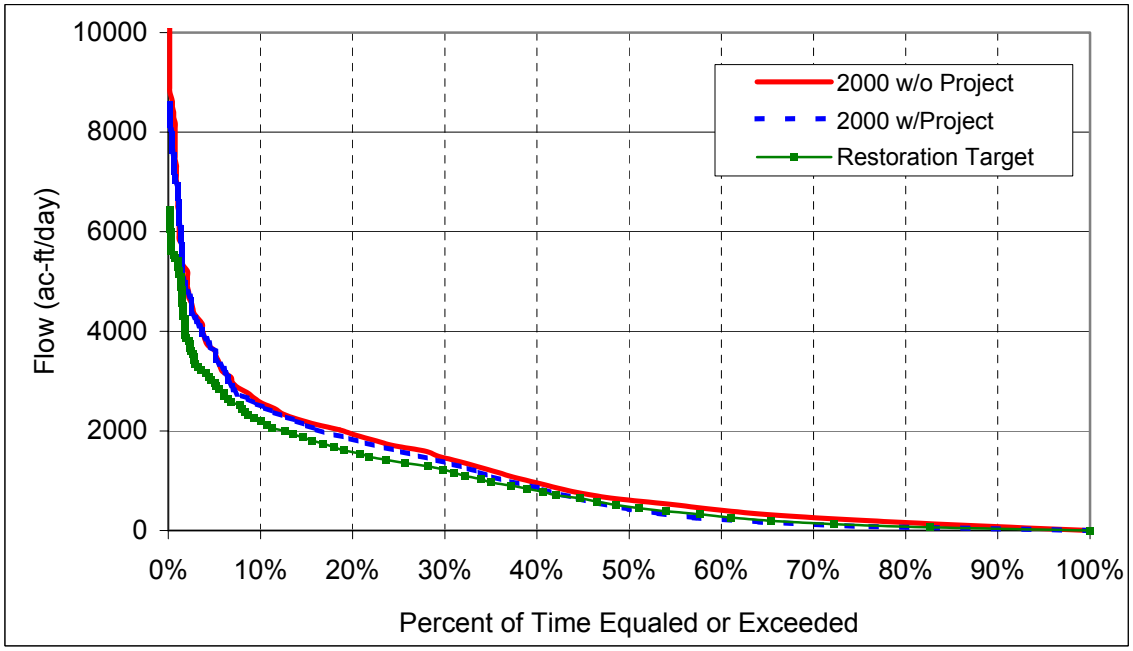


FIGURE 12 - 26 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2000 CONDITION HYDROGRAPHY - AVERAGE YEAR (1994)

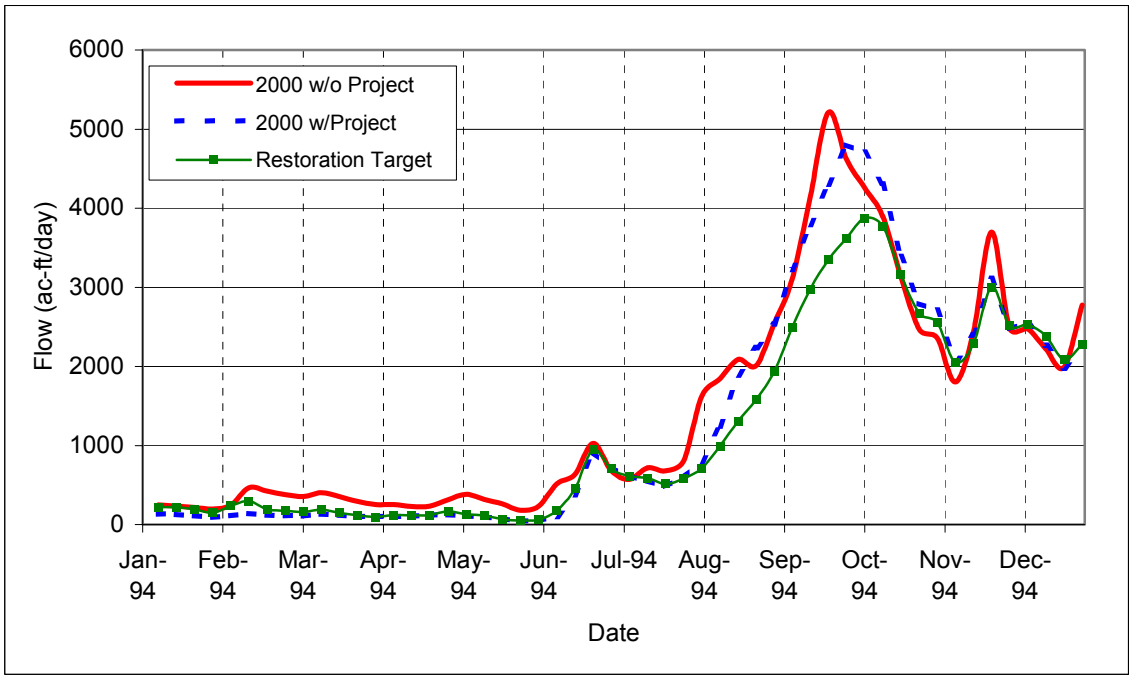


FIGURE 12 - 27 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2000 CONDITION HYDROGRAPHY - WET YEAR (1995)

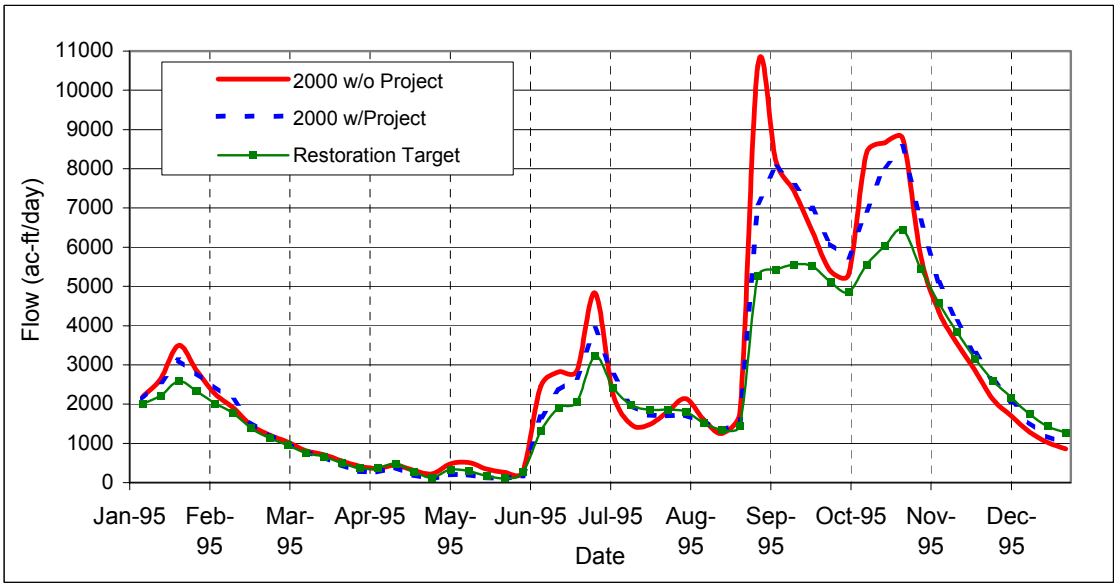
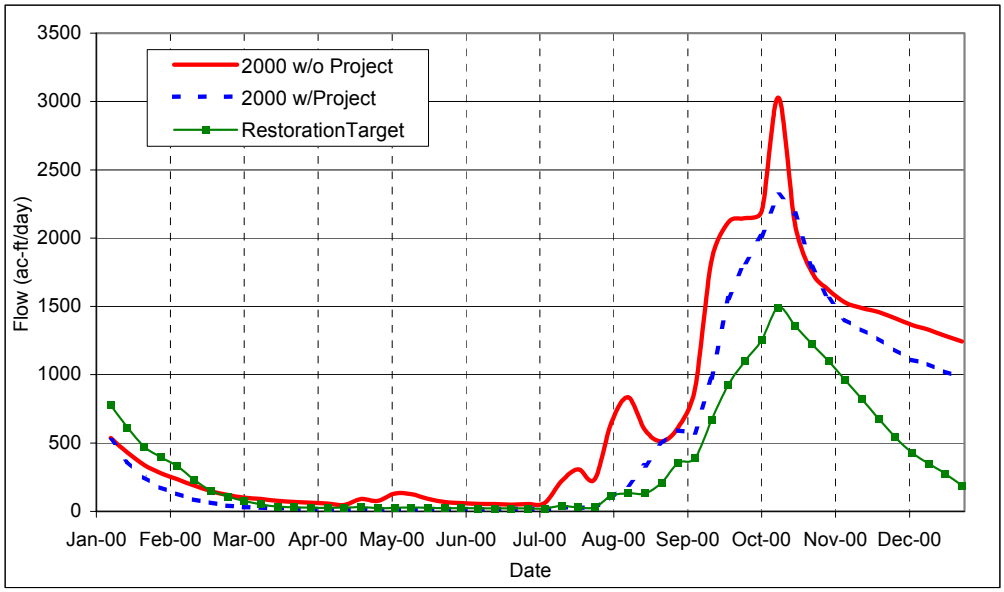


FIGURE 12 - 28 ESTUARY DELIVERIES ACROSS SOUTHERN TRANSECT - 2000 CONDITION HYDROGRAPHY - DRY YEAR (2000)



12.5.5.1 Mike SHE Model Boundary Fluxes

In order to demonstrate that the recommended plan will not have adverse affects on existing legal sources outside of the model domain, an analysis of model boundary fluxes was performed. A combination of constant and variable head boundary conditions were applied for simulating the integrated surface and groundwater flow in the Big Cypress Basin (BCB) Mike SHE model. These boundaries are illustrated in Figure 12-29. A constant head boundary was applied along the southwestern coastline. A tidal boundary condition would in principle provide more accurate results in assessing the impacts on tidal wetlands. However, sufficient information on groundwater levels along the coastline was not available to generate transient head boundary conditions. Time-varying head boundary conditions were applied along the northern boundary from available groundwater level data from wells. The time series of variable heads for cells in between locations with measured data were generated using the triangular linear integration. A no-flow boundary condition was specified for the eastern boundary. These boundary conditions were applied to all with and without project condition scenarios. Comparisons of an average year (1994) groundwater flow in the water table aquifer along the X and Y directions for the existing and with project conditions at two representative cells (N-1 and W-1) in the northern and western boundaries of the model domain are illustrated in Figures 12-30 through 12-33. These figures indicate very little impact of the project on the groundwater flow outside the model domain along the northern and western boundaries.

FIGURE 12 - 29 BCB MIKE SHE MODEL BOUNDARY CONDITIONS AND SELECTED CELL LOCATIONS FOR GROUND WATER FLOW ALONG BOUNDARIES

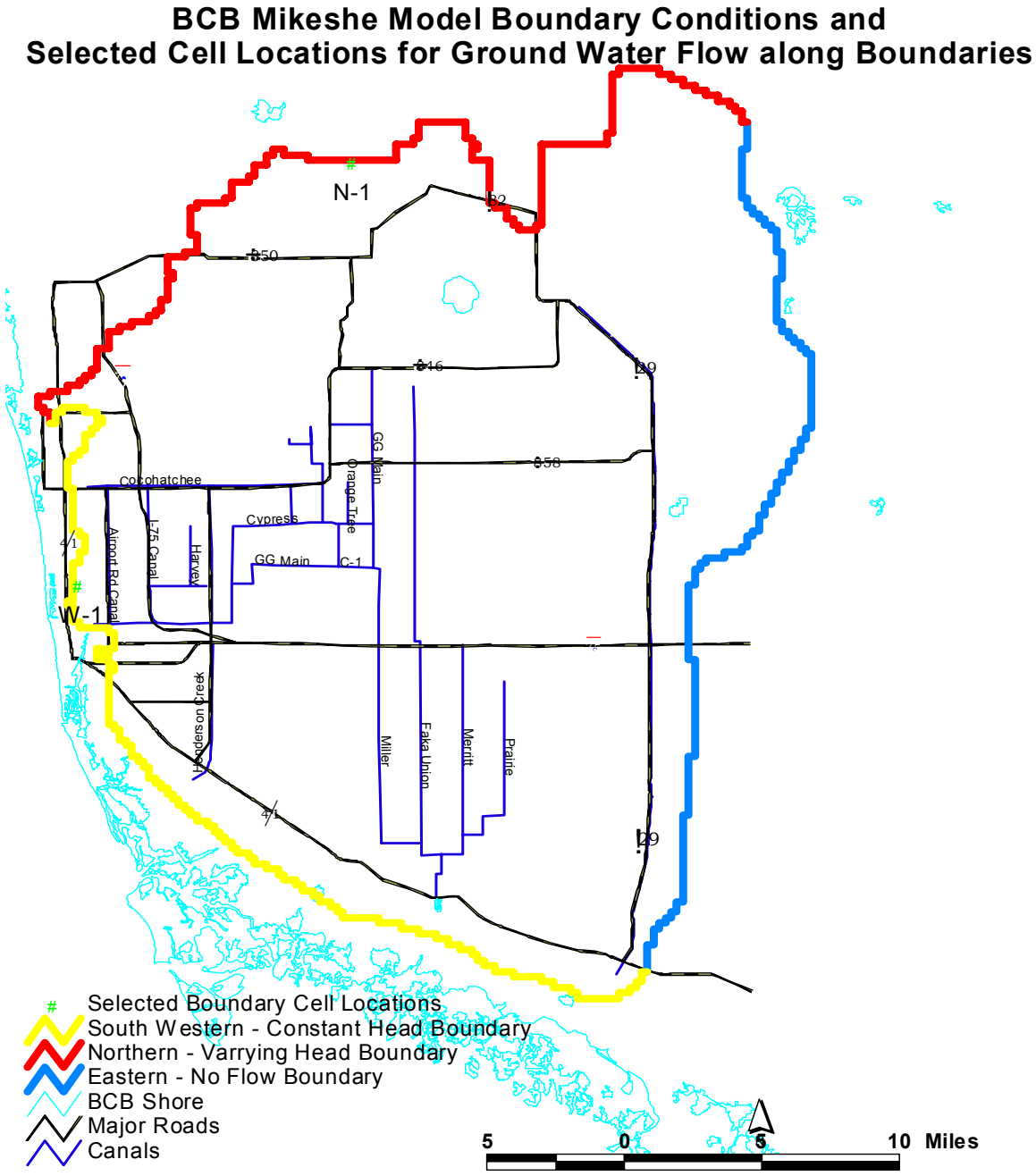


FIGURE 12 - 30 COMPARISON OF X - DIRECTION ROW IN WATER TABLE AQUIFER AT NORTHERN BOUNDARY CELL N-1 FOR AN AVERAGE YEAR

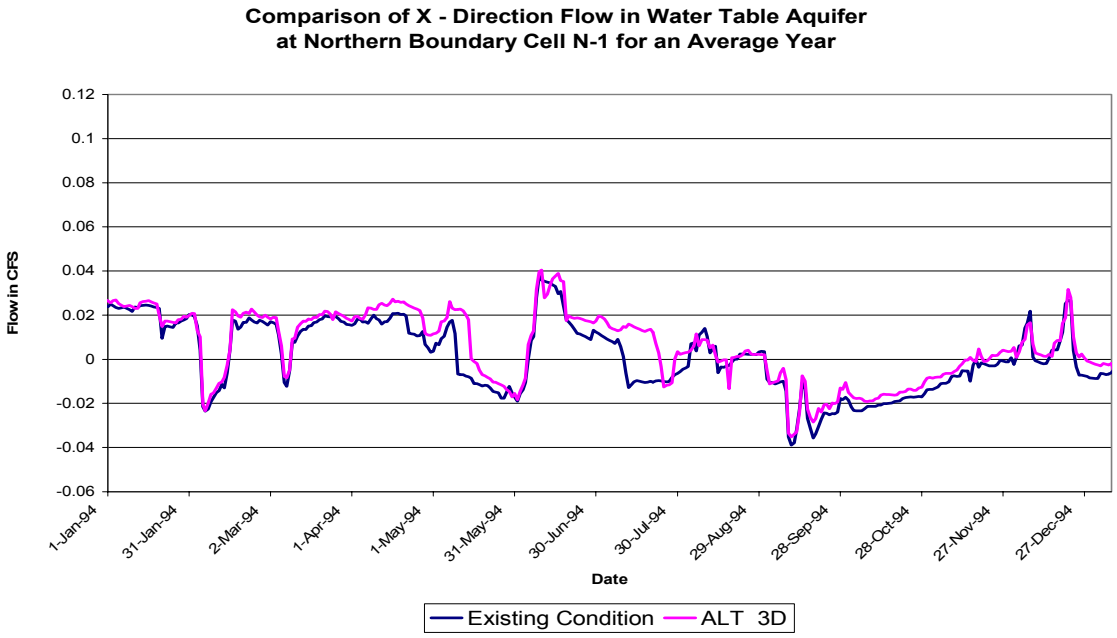


FIGURE 12 - 31 COMPARISON OF Y - DIRECTION ROW IN WATER TABLE AQUIFER AT NORTHERN BOUNDARY CELL N-1 FOR AN AVERAGE YEAR

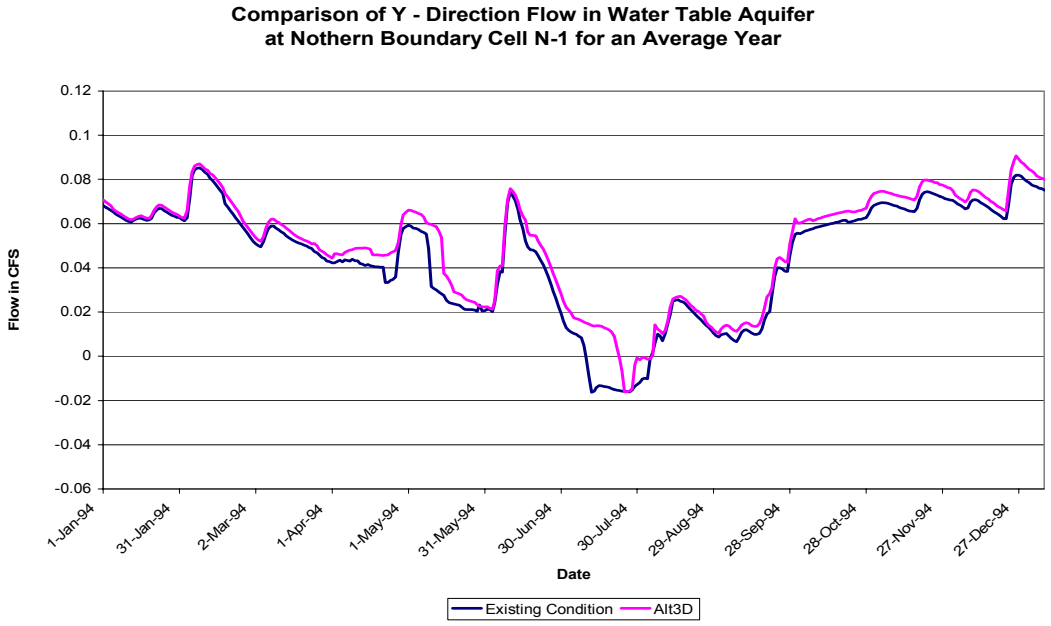


FIGURE 12 - 32 COMPARISON OF X - DIRECTION ROW IN WATER TABLE AQUIFER AT WESTERN BOUNDARY CELL W-1 FOR AN AVERAGE YEAR

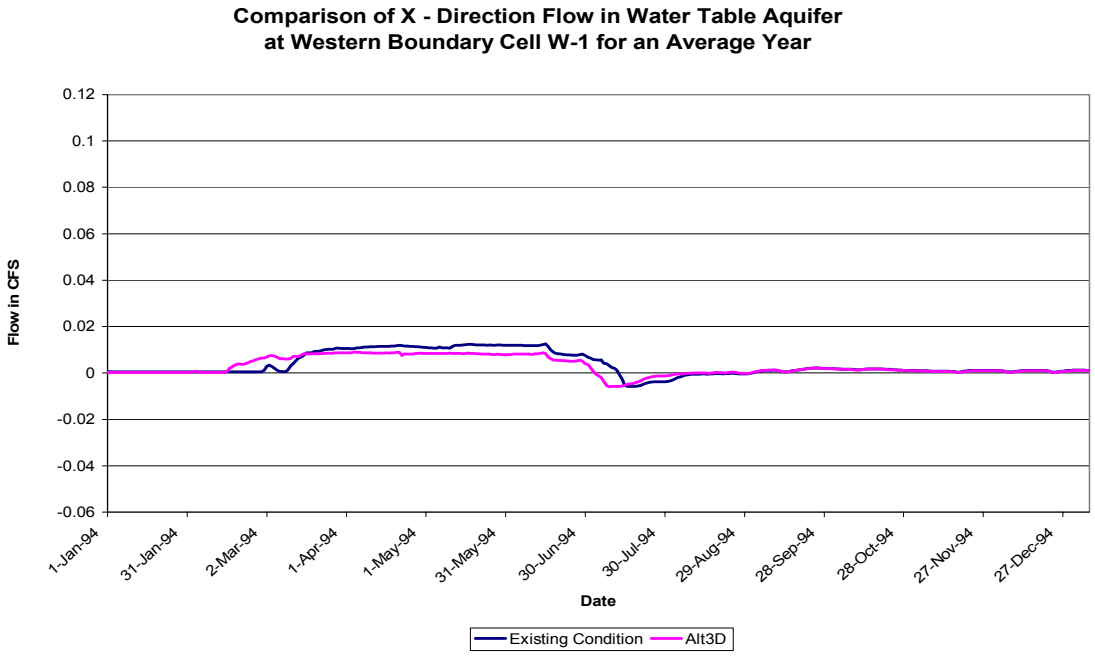
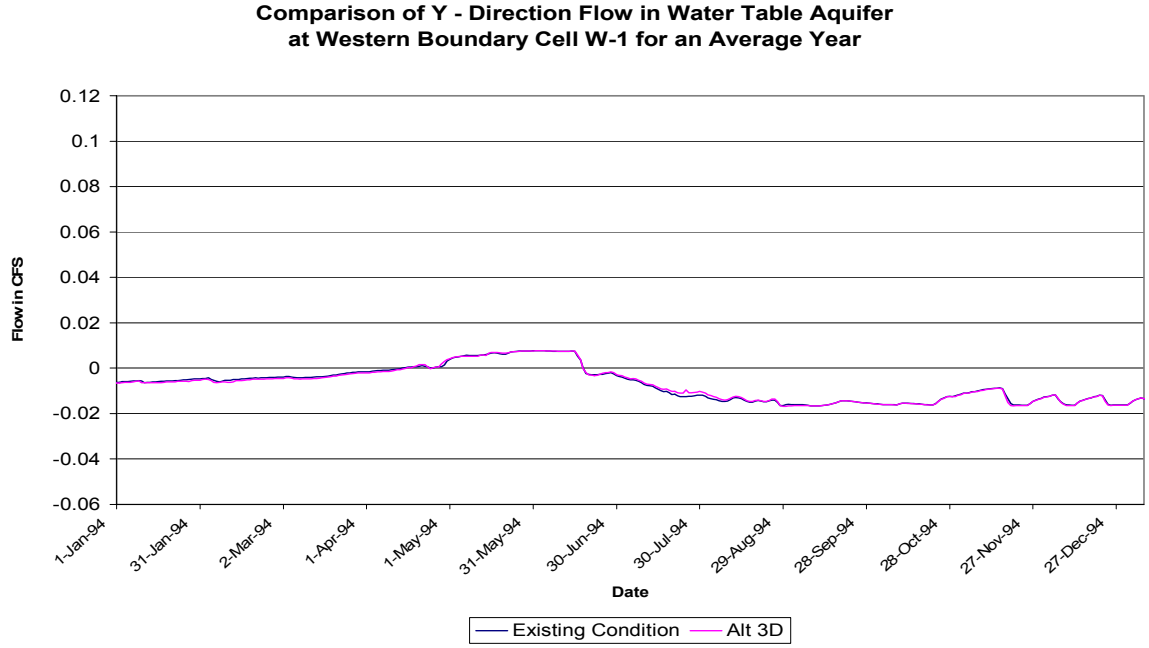


FIGURE 12 - 33 COMPARISON OF Y - DIRECTION ROW IN WATER TABLE AQUIFER AT WESTERN BOUNDARY CELL W-1 FOR AN AVERAGE YEAR



12.6 COMPLIANCE WITH STATE LAW

12.6.1 Introduction

12.6.1.1 Florida Statutes Chapters 373.026, 373.1501, 373.470

In 1999, 2000, and 2001, the Florida Legislature enacted a series of laws defining the South Florida Water Management District (SFWMD) and the Florida Department of Environmental Protection (DEP) roles in the implementation of CERP, including Sections 373.026(8), 373.1501, and 373.470, F.S. With regard to assuring project benefits, similar to WRDA 2000, Section 373.470(b) requires that the comprehensive plan be used as a guide and framework to ensure that the project will be implemented to achieve the purposes of the "Federal Water Resources Development Act of 1996…" S. 373.470(3)(b)2., F.S.

Prior to any project or project component being submitted to Congress for authorization or receipt of an appropriation of state funds for construction, the DEP must approve each project component, pursuant to Section 373.026(8), F.S., upon a finding that the SFWMD has complied with the requirements set forth in Section 373.1501(5), F.S.

Prior to executing a project cooperation agreement, the South Florida Water Management District must address the requirements in Section 373.1501, F.S., and obtain approval under Section 373.026, F.S. from the Florida Department of Environmental Protection. In addition, Section 373.470(3), F.S. requires that each PIR identify the increase in water supplies resulting from a project component, and that such additional water supplies be allocated or reserved by the SFWMD under Chapter 373.

12.6.1.2 Comprehensive Need Analysis and Evaluation

s 373.1501(5)(a) Florida Statutes requires the SFWMD to “Analyze and evaluate all needs to be met in a comprehensive manner and consider all applicable water resource issues, including water supply, water quality, flood protection, threatened and endangered species, and other natural system habitat needs.”

The following sub-sections describe the procedures and methodologies used in assessing the water resource issues along with a short description of how these issues have been met or resolved for the recommended plan.

12.6.1.3 Water Supply

Water supply impacts for the project were evaluated using the Mike SHE model. This model simulates hydraulic processes such as rainfall, evapotranspiration, overland flow and canal flow as well as the operational and structural aspects of the project. The period of record for the simulation included historical rainfall data from 1988 to 2000.

Agricultural and urban water users within the project footprint are limited or non-existent in number. One of the incidental project benefits of the recommended plan will be to improve the aquifer recharge in and adjacent to the study area (Figures 12-22 through 12-24); therefore, supplies of water to meet the demands of existing legal users are not expected to be adversely impacted by project implementation.

12.6.1.4 Water Quality

The SGGE Project Delivery Team has ensured that water quality issues and environmental concerns were thoroughly addressed during the analysis of alternatives. The primary team goals were to:

- Assess the existing water quality conditions of the geographical area
- Evaluate the impact of each alternative on water quality to ensure that federal and state water quality standards are not violated
- Propose measures based on sound engineering concepts to bring any impacts into compliance with water quality standards
- Recommend monitoring strategies during project implementation to ensure the accuracy of assumptions made during the alternatives selection process.

The water quality analysis in this report utilized water samples collected from the canal and estuarine basins in which the project is located. Water quality considerations regarding waters retained on site for hydrologic restoration can be summarized into the following issues:

- Assess water quality characteristics
- Preserve compliance with applicable water quality criteria
- Ensure that water releases from the project will not degrade the quality of the receiving water body.

The water quality benefits identified for the SGGE project include:

- An estimated 75% decrease in the freshwater point discharges currently entering the downstream estuary (Faka-Union Bay);
- A more natural regime for the timing, distribution and quantity of these freshwater discharges to Faka-Union Bay;
- Reduction of nutrient and contaminant loads from upstream land uses as storm water run-off is filtered across the reestablished wetland communities; and
- Reestablishment of more natural freshwater sheetflow to neighboring estuaries.

USGS and FDEP have performed, and continue to conduct, significant groundwater and water quality studies within the SGGE project boundaries and downstream estuaries. A water quality monitoring plan has been developed as part of this project and is included in Appendix D.

12.6.1.5 Flood Protection

Modeling results demonstrate that as a result of the project there will be no additional flooding over and above existing levels for lands not in public ownership or proposed to be in public ownership.

In order to make this determination a series of simulations were prepared for the hydrologic conditions as they existed in December 2000 for the Average Year, a 10 year design storm, a 25 year design storm and a 100 year design storm. Design storms are hypothetical, standardized storm events that are useful in comparing the effects of a set of standardized weather conditions on different scenarios. Those same simulations were then modified to include the project. The results of the "with project" simulations and the "without project" simulations were compared to determine if the with project simulations showed an increase in water stage or duration. The comparison showed that while flooding occurred in the existing condition under some storm events, this flooding was not made any worse by the addition of the project, that is the stage and duration of any flooding was the same under both the with and without project scenarios.

More detailed information, including maps illustrating the comparison between existing and with project conditions, can be found in Appendix A of this report.

12.6.1.6 Threatened and Endangered Species

The U.S. Fish and Wildlife Service (FWS) has been an integral part of the SGGE Project Delivery Team (PDT) as it proposed, designed, and selected alternatives

for this project. As such, informal Endangered Species Act (ESA) consultation with FWS has been underway on all alternatives since the inception of the project. Service biologists provided specific concerns relative to the Florida Panther, the West Indian Manatee and other listed species in the Coordination Act Report included in Appendix D.

The Corps has determined that the recommended alternative, Alt 3D, may affect, but is unlikely to adversely affect, listed species, and the monitoring plan and operations of the project will specifically address measures to avoid such adverse effects. Various suggested FWS design changes to mitigate ESA concerns have been incorporated in components of alternatives as they were developed. The Biological Assessment for listed species found on proposed project lands is included in Appendix D. FWS and Corps will coordinate a Biological Assessment (BA) for endangered species beginning at this Final PIR/EIS. Coordination is expected to conclude for the planning (feasibility-stage) of the project in 2004, but continue, if the project is approved and funds are provided to continue through detailed design and construction, throughout the project life. No construction will begin until completion of consultation under Section 7 of the ESA.

Section 9.6 of this report has additional ESA information on both marine and upland species. Project coordination is ongoing and at this stage the project is in partial compliance with the ESA. Full compliance will be achieved when the BA is coordinated and Service concurrence is received.

12.6.1.7 Natural System and Habitat Needs

The long-term goal of the recommended plan is to return the hydrology of the area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage. This alternative would also have a beneficial groundwater effect on the upland habitats that are upstream of the pumps. The combination of a restored hydrology, a more natural fire regime, and an appropriate exotic vegetation control program can be expected to reestablish the pre-drainage character of SGGE plant communities. This would mean that plant communities that have developed under the existing hydrologic and fire regimes, but were not present prior to drainage, would be eliminated during the decades following restoration, and would be replaced by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in SGGE prior to construction of the canal system, but have become established in new areas as a result of drainage, would likely return to their original distribution. More detailed information regarding changes in habitat can be found in Section 9.3.

12.6.1.8 Determination of Feasibility

Florida Statute s 373.1501(5)(b) requires the SFWMD to "Determine with reasonable certainty that all project components are feasible based upon standard engineering practices and technologies and are the most efficient and cost-effective of feasible alternatives or combination of alternatives, consistent with restudy purposes, implementation of project components, and operation of the project." The information provided in the following sub-sections forms the basis for the determination by SFWMD.

12.6.1.9 Engineering Standards

The project design will include water control structures such as pumps, weirs and culverts, ditches and berms. These elements can be found in standard engineering designs for surface water management systems for agricultural, commercial and residential projects and flood control projects located throughout south Florida. These are also standard elements utilized in many water resource and flood control projects constructed by the U.S. Army Corps of Engineers. Sound engineering judgment, experience gained from past projects and studies, and other published criteria were utilized in the alternatives design analysis.

The general engineering design criteria that was used can be found in Appendices A and B of this report. Although detailed design work remains to be completed, at this stage it has been determined that the project is feasible based upon standard engineering practices.

12.6.1.10 Cost Effectiveness and Efficiency of Feasible Alternatives

The recommended plan (Alternative 3d), as well as the other feasible alternatives, meet the planning constraints of for level of service for flood protection, maintaining water for existing users, no effect on Tribal compacts, and no adverse impacts to listed species.

Alternative 3d would make by far the most progress towards the performance measure targets for hydrology, vegetation communities, wildlife, open water estuary biota, and oysters. Alternative 3d would provide the greatest habitat unit benefits for hydrology, vegetation communities, wildlife, open water estuary biota, and oyster habitat. It would also provide the greatest net increase in acres of cypress forest, marsh, wet prairie, and hydric flatwoods vegetation communities.

Alternative 3d is a cost effective and best buy plan. It has the lowest annualized cost per output for all five of the ecosystem benefit measures - hydrology, vegetation communities, wildlife, open water estuary biota, and oysters. Alternative 3d is a good value and the benefits are worth the cost.

A detailed analysis on cost effectiveness and efficiency can be found in Section 6.8.6 of this report.

12.6.2 Determination of Project Consistency with Applicable Laws and Regulations

Florida Statute s 373.1501(5)(c) requires the SFWMD to "Determine with reasonable certainty that all project components are consistent with applicable law and regulations and can be permitted and operated as proposed." Such determination requires the SFWMD to convene preapplication conferences with those state and federal agencies having regulatory jurisdiction. State and federal agencies with applicable regulatory jurisdiction shall also provide information necessary for the District's determination.

The preapplication conference for the SGGE PIR was held on January 15, 2004 at the SFWMD Big Cypress Basin office in Naples, Florida. The submitted meeting minutes provide a summary of that meeting including comments from the various regulatory agencies in attendance

Based upon these interagency discussions at the Federal, state and local levels, the SFWMD has determined with reasonable certainty that the components evaluated are consistent with applicable law and regulations and can be permitted and operated as proposed.

The FDEP indicated that it did not anticipate any problems with the 1501 process, but that determination will be made once the SFWMD submits the draft PIR to the FDEP for review.

In the invitation letter to the preapplication conference, each of the agencies was asked by the SFWMD to specify the applicable laws and regulations, and the likelihood that the project components would comply with those laws and regulations. The agencies were also asked to address the following: 1) the applicable permitting requirements administered by that agency; 2) the likelihood of obtaining those permits; 3) other laws administered by the agency which might affect the project; and 4) the likelihood that the projects would comply with those other laws.

In the request, the SFWMD acknowledged that the agency responses would be non-binding and non-final agency action, since the project components are still undergoing design and review. Nevertheless, the agency responses contribute to the SFWMD's reasonable certainty that the project components can be permitted and operated as designed, and will conform to applicable laws and regulations.

Pre-Application Conference
Florida Statute 373.1501 Requirements

January 15, 2004 10:00 am to 12:30 pm

TO: Attendees

FROM: Jacobs / MWH Joint Venture (JMJV)

ATTENDEES: See Attendance Sheet(s)

HANDOUTS:
- Agenda
- Average Monthly Available charts
- Table: Water made available in the average year.
- Federal and state listed species
- Executive Summary: SGGE Phase I and II Environmental Site Assessment and Ecological Risk Assessment

A Pre-application Conference was held for the Southern Golden Glades Estates (SGGE) - Hydrologic Restoration Project, in accordance with Florida Statutes 373.1501 Requirements, on January 15, 2004, at the Big Cypress Basin offices of the South Florida Water Management District (SFWMD).

INTRODUCTION

Laura Reilly (SFWMD) welcomed the attendees to the Pre-application Conference for the SGGE - Hydrologic Restoration Project, in accordance with Florida Statutes 373.1501 requirements. The attendees introduced themselves and agencies they represented.

Temperince Morgan from the Florida Department of Environmental Protection (FDEP) informed the attendees that the 373.1501 process requires a pre-application conference in order to discuss the issues/concerns related to the project. She requested that the attendees provide comments and identify their issues as they will be included as a part of the process.

OVERVIEW

Laura Reilly (SFWMD) and Temperince Morgan (FDEP) gave a brief summary of the Chapter 373.1501, which requires that a preapplication meeting, with all State and Federal agencies having regulatory jurisdiction of the project area, be held to determine if the project component is consistent with applicable laws and regulations; and whether it can be permitted and operated as proposed.

Ms. Reilly stated that the PIR will include a chapter addressing compliance with the 1501 process. Any shortcomings for each project component that could potentially become an obstacle to the permitting process will be documented as part of the 1501 process and will be included in the PIR.

SGGE - Hydrologic Restoration Project

Juan Diaz (SFWMD) gave a presentation of the recommended plan for the SGGE project.

The project area is bounded by a residential area and the Florida Panther National Wildlife Refuge on the north, the Fakahatchee Strand State Preserve on the east, the Belle Meade area on the west and the Ten Thousand Islands National Wildlife Refuge on the south. The goal of this project is to restore the hydrology within the project area, area, by filing in the canals and restoring sheetflow. All canal and ditch banks would be leveled to grade and the material used to fill the canals and ditches. The restoration of this project will result in a more continuous natural area.

Alternative 3D has been selected as the preferred alternative. Alternative 3d proposes the following changes:

- Demolition of 227 miles of roads.
- Three spreader channels that run in an east-west direction.
- 3 pump stations designed to prevent any change in the existing level of service for flood protection in Northern Golden Glades Estates.
- Installation of a total of 83 canal plugs.
- Elimination of the canal maintenance south of the spreader systems.
- Construction of culverts under U.S. 41.
- Construction of an earthen berm to prevent flooding in the Port of the Islands Waterfront RV Resort.

Factors in Restoration Design

During the construction phase of this project, the canals will be filled from the fill acquired only from the canal banks. No additional fill will be brought in.

No additional flooding will result from the implementation of this project. Pump stations will turn on when the water levels rise above a certain level in the canal north of the stations.

Additional culverts under Stewart Blvd will be added to ensure that the sheet flow is maintained and that Stewart Blvd remains above water.

The implementation of this project may result in slightly higher water levels in the Florida Panther National Wildlife Refuge.

The U.S. Fish and Wildlife Service will provide construction guidelines to protect Threatened and Endangered Species. These guidelines must be followed by the contractor during construction.

AGENCY DISCUSSION

Janet Starnes (SFWMD) stated the following

- Since there will be no additional fill brought in for this project, the canal may have gaps in some places.
- The Tamiami Trail project has to be built prior to the SGGE.
- The 'T' hinders the sheet flow and thus eventually has to be considered in this project.
- The berms that are proposed by this project are specifically for flood protection.
- The berms around the agricultural areas will be reinforced.
- The implementation of this project will not result in any impacts to the surrounding roadways.
- Appropriate security measures will be taken by the SFWMD according to the Homeland Security requirements.

Easements, right of way
There are 2 privately owned properties, adjacent to but not in the project footprint, around which berms will be established in the event that the land cannot be acquired. Efforts to acquire these properties are currently ongoing.

Archaeological Sites
It is not expected that cultural resources will impact project implementation.

Threatened and Endangered Species
Jim Beever (FWC) handed out a sheet of the Federal and State listed species that exist within the project area. Jim Beever stated that footprint impacts from the berms, spreaders and pumps will have an effect on certain species. The potential of flooding due to the creation of spreader zones and the change in habitat will also impact a number of species. Thus, this project will have some

permitting requirements. All impacts to any listed species should be addressed properly in order to avoid third party litigation.

Kim Dryden (FWS) stated that many design issues in this project have not yet been finalized; therefore many listed species issues have not yet been resolved. However, since this project is a habitat restoration project, the listed species found may not be of a serious concern. There are some construction concerns that need to be properly addressed. These concerns include the construction impacts to panthers and eastern indigo snakes, and specific guidelines to be adhered to in terms of vehicles on site, access to the site and operation of machinery during construction. The District will co-ordinate with the FWS to outline the specific guidelines/special provisions and the educational plan to be executed and adhered to during construction. Due to the flooding, there will be a definite loss of the Flatwoods within the area, which will in turn impact certain species such as the red cockaded woodpeckers, panthers and bears. Changes in the habitat and water flow into the estuary is of major concern as it will affect the listed species as well as general fish and wildlife resources. The project commitments, with regards to the listed species, are currently being negotiated with the USACE, which will determine the effects of this project on the listed species. The commitments for the Prairie Canal early start project are also being assessed for any improvements. Changes in water conditions: water quality, water flow and its potential impacts to manatees, and all other impacts of this project must be properly addressed in the PIR.

A meeting between the SFWMD, the USACE, and the State Clearinghouse officials is scheduled for February 4th, 2004. The meeting will serve to brief the clearinghouse officials on the project.

Contamination

3 known sites within the project areas were determined to have contamination slightly above the state limits. These sites were identified in the phase 2 study that was conducted on this project. Resampling of these 3 sites confirmed the contamination to be slightly above state limits. Remediation will be done on these sites prior to construction. Currently meetings are being set up to determine a remediation plan for these sites. This plan will be included in the PIR. Temperince Morgan (FDEP) stated that a commitment from the SFWMD regarding adequate remediation needs to be included in the PIR.

Other issues/concerns

There are no problems anticipated with the existing legal water users due to this project. Flood protection will be defined more clearly in the PIR. The PIR will address the placement of the berms, water modeling and any other issues or concerns. This project proposes assessment of the berms during the detail design in order to minimize impacts. Temperince Morgan (FDEP) stated that

issues such as identification of the wells, well protection, and impacts to the drinking water quality should be addressed as per the 1501 process. Issues such as improvements to the roads, culverts, changes in water quality etc should also be addressed in the PIR.

Janet Starnes (SFWMD) informed the attendees that water quality modeling is not being done on this project as this project being a restoration project assumes improvement to water quality.

Collier County representatives expressed their concern of maintaining existing levels of flood protection within the areas adjacent to the project. A separate pre application meeting will be scheduled with Collier County in order to discuss issues brought forward by the county representatives. These issues include septic tanks in the vicinity of the project, roads adjacent to the project, the consistency of the project with the county's comp plan and flood management issues. Janet Starnes (SFWMD) informed the attendees that the analysis for this project is being done according to the present land use, as stated by the law. Kim Dryden (FWS) informed the attendees that this project, being executed under federal restoration program, requires that the funds cannot be allocated towards flood management.

OPEN DISCUSSION

Implementation of this project will make more water available; however, water within the project will be first and foremost available for the natural system. No excess water for human use is proposed by this project. The water table in the adjacent wells will increase as a direct result of this project. The SFWMD will not consider permitting for more pumping from these wells.

PUBLIC COMMENT

No public comment.

ACTION ITEMS

- Preparation of meeting minutes to be distributed to the agencies who attended to provide them the opportunity to review and make comments with regards to the accuracy of the minutes.
- Distribute meeting minutes to agencies that were not able to attend and provided them the opportunity to make any comments with regards to the purpose of this meeting.
- Agencies to sign the meeting minutes if in agreement and/or provide additional comments to these meeting minutes.

ADJOURN

The meeting ended 12:30 p.m.

ATTENDEES LIST

Name	Agency	E-mail
Ron Popowski	FWS	Ron.Popowski@fws.gov
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Jim Beever	FWC	James.Beever@fwc.state.fl.us
Shabbir Ahmed	SFWMD	sahmed@sfwmd.gov
Ananta Nath	SFWMD	anath@sfwmd.gov
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Juan Diaz-Carreras	SFWMD	jhdiaz@sfwmd.gov
Karen Bickford	FDEP	Karen.Bickford@dep.state.fl.us
Stan Chrzanowski	Collier County	stanchrzanowski@colliergov.net
Raj Kamthe	JMJV	pkamthe@sfwmd.gov

The Florida Department of Environmental Protection (DEP) has primary responsibility for coordinating their planning and permitting activities associated with this project. The project is still in the early stages of development and design, so it is difficult to establish with great certainty what regulatory issues might arise as the project proceeds. DEP will continue to participate with SFWMD staff in coordination of preapplication meetings and the preparation of information to be submitted to DEP for review and approval. DEP has committed to working with the SFWMD and Corps to issue the required permit(s) in a timely manner.

Presently, it is anticipated that all permits required for the SGGE project will be issued by the State. These include a CERPRA permit, NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities, and Clean Water Act Title V Air permits. Based on the current best available information, the proposed project is an integral component of CERP and will be refined and designed, constructed and cost-shared jointly by the SFWMD and the USACE. As such, the project components will not need federal Clean Water Act 404 permits. However, should circumstances change to remove this partnership for any of the components and the SFWMD becomes the sole proponent, then 404 permits may be required.

Not causing or contributing to violations of water quality standards under the authority provided in WRDA 96 will be an underlying consideration of the Department during the permitting process. DEP will work with the SFWMD and Army Corps of Engineers to ensure that surface water discharges and ground water recharge from the project will meet water quality standards and water quality objectives. This position is consistent with both the intent and language of CERP and the CERPRA permitting legislation (373.1502 F.S.).

12.6.3 Reasonable Assurances

Florida Statute s 373.470(3)(c) states that "Prior to executing a project cooperation agreement with the Corps for the construction of a project component, the District, in cooperation with the Corps shall complete a project implementation report to address the project component's economic and environmental benefits, engineering feasibility, and other factors provided in s 373.1501 sufficient to allow the District to obtain approval under s 373.026. Each project implementation report shall also identify the increase in water supplies resulting from the project component. The additional water supply shall be allocated or reserved by the District under chapter 373."

Florida Statute s 373.1501(5)(d) states that the SFWMD shall "Consistent with this Chapter, the purpose for the restudy in the Water Resources Development Act of 1996, and other applicable federal law, provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project, and that water management practices will continue to adapt to meet the needs of the restored natural environment."

Analyses performed to make these determinations include both groundwater and surface water hydrologic modeling for the period of record between 1988 through 2000.

12.6.3.1 Water Supply Assurance.

This section provides sufficient information "reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, ….." Section 373.1501(5)(a), F.S. Pursuant to Section 373.219, F.S., existing legal users are those that have a consumptive use permit or are exempt from permitting requirements, such as domestic users.

These assurances require a quantification of the amount of water permitted to all existing legal users and used by exempt users within and immediately adjacent to the SGGE project footprint during the PIR process. This quantification is determined by comparing model simulations of the 2003 condition (2000 land use, 2003 permitted demands) without the project components to 2003 condition with the project components to examine the potential impact of the recommended plan on the quantity and quality of water for the existing legal users.

Figures 12-34 through 12-43 indicate the surface water and groundwater quantities for existing legal users will not be diminished as a result of the project. Based on this information, the SFWMD is providing reasonable assurances that water supply for existing legal users shall not be diminished through project implementation.

FIGURE 12 - 34 SURFACE WATER STORAGE VOLUME PROBABILITY CURVE

(1988 through 2000)

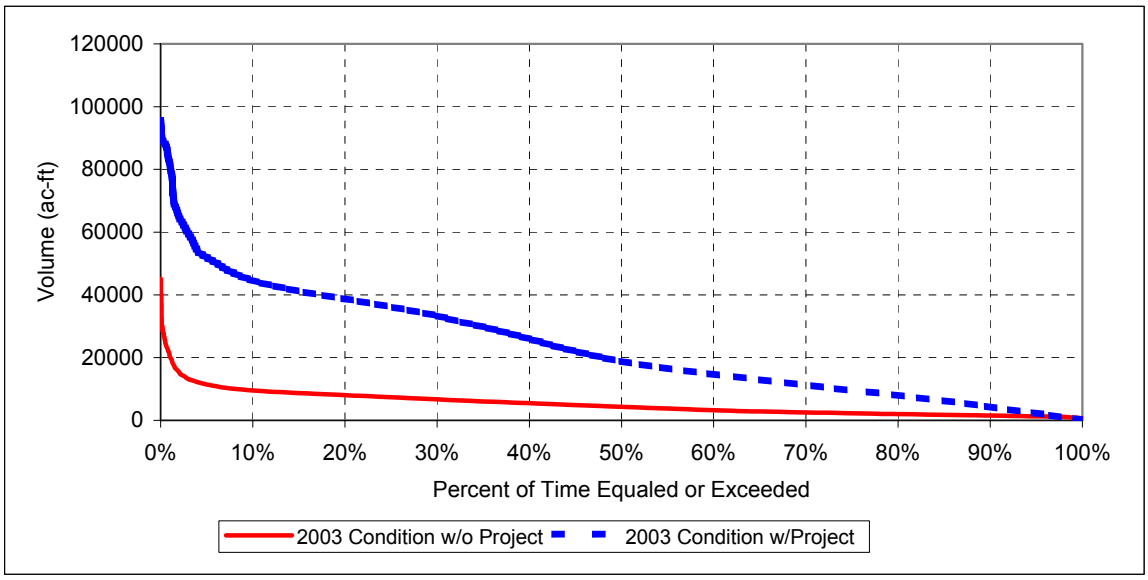


FIGURE 12 - 35 SURFACE WATER STORAGE FOR AVERAGE YEAR (1994)

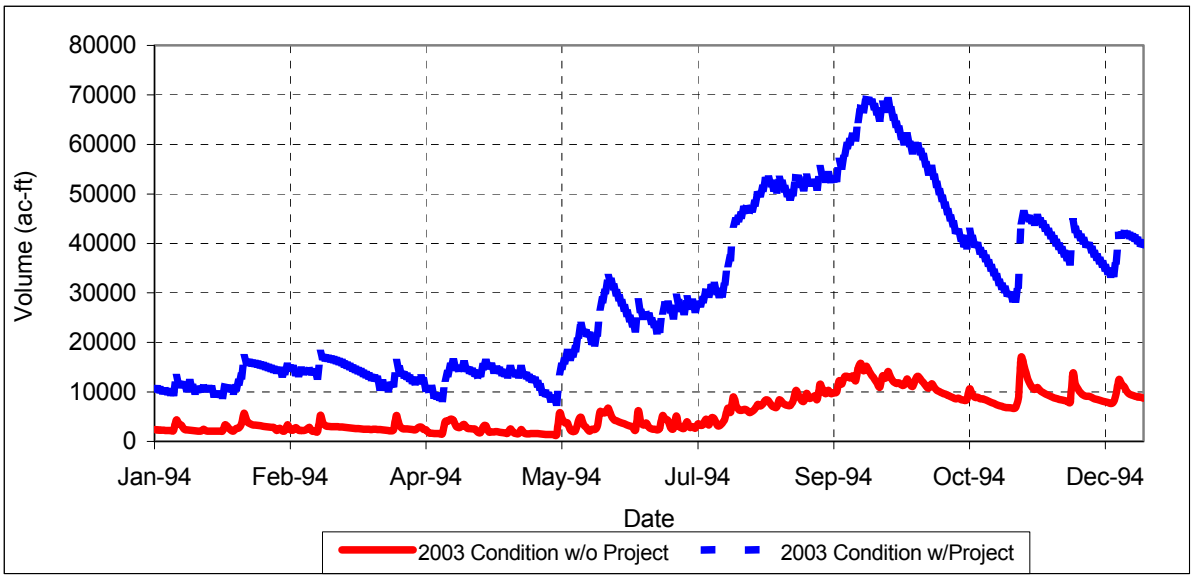


FIGURE 12 - 36 SURFACE WATER STORAGE FOR WET YEAR (1995)

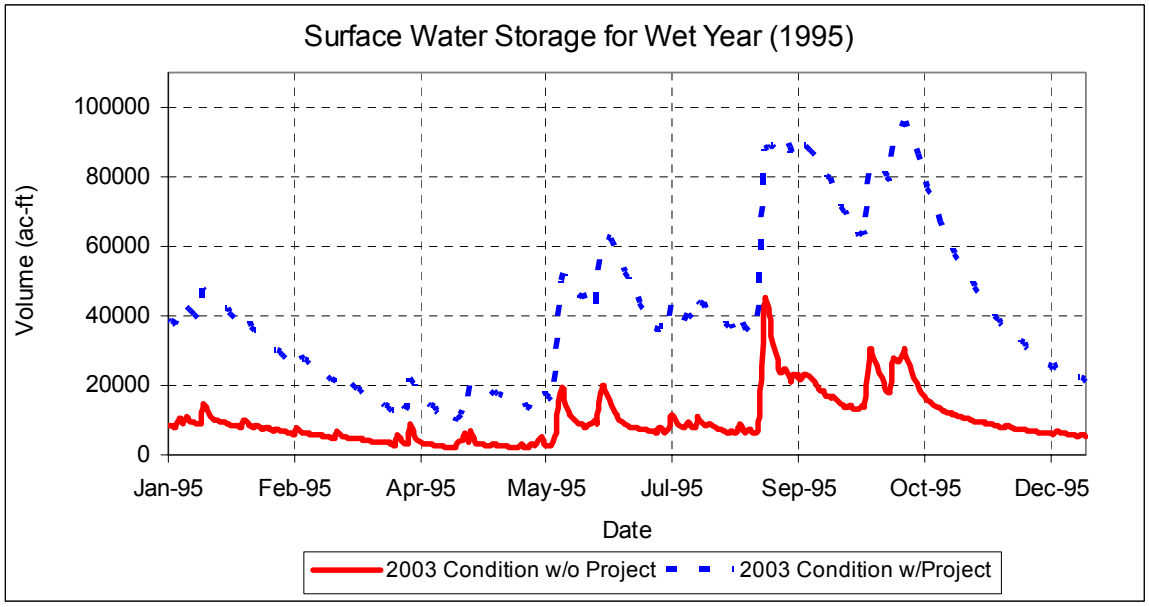


FIGURE 12 - 37 SURFACE WATER STORAGE FOR DRY YEAR (1990)

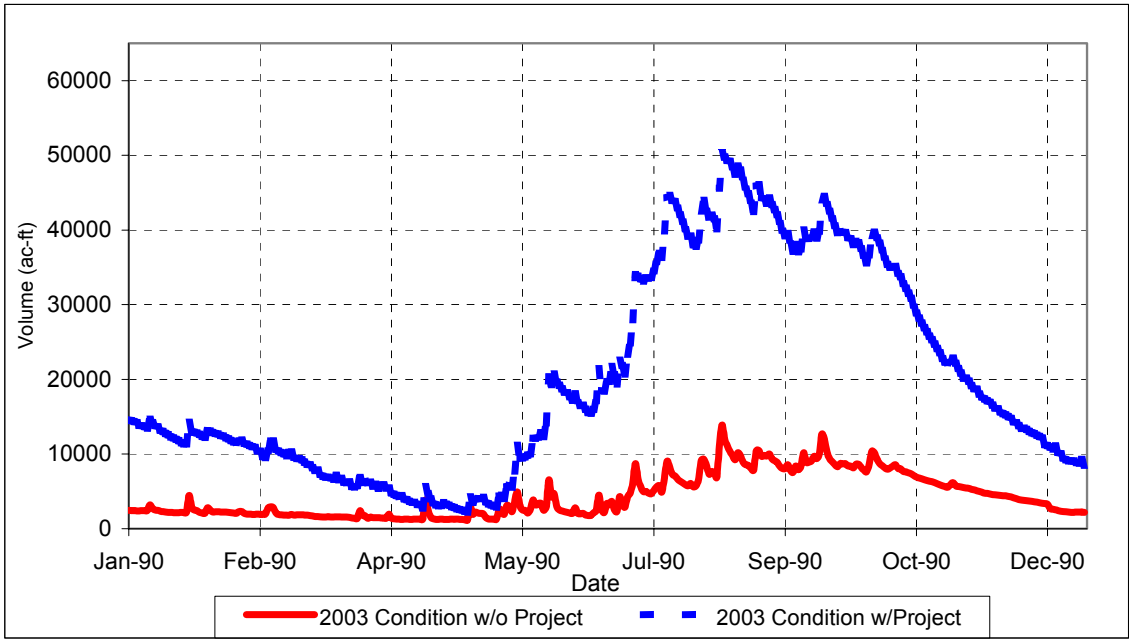


FIGURE 12 - 38 GROUNDWATER STORAGE - 2003 CONDITION VOLUME PROBABILITY CURVE - 1988 THROUGH 2000

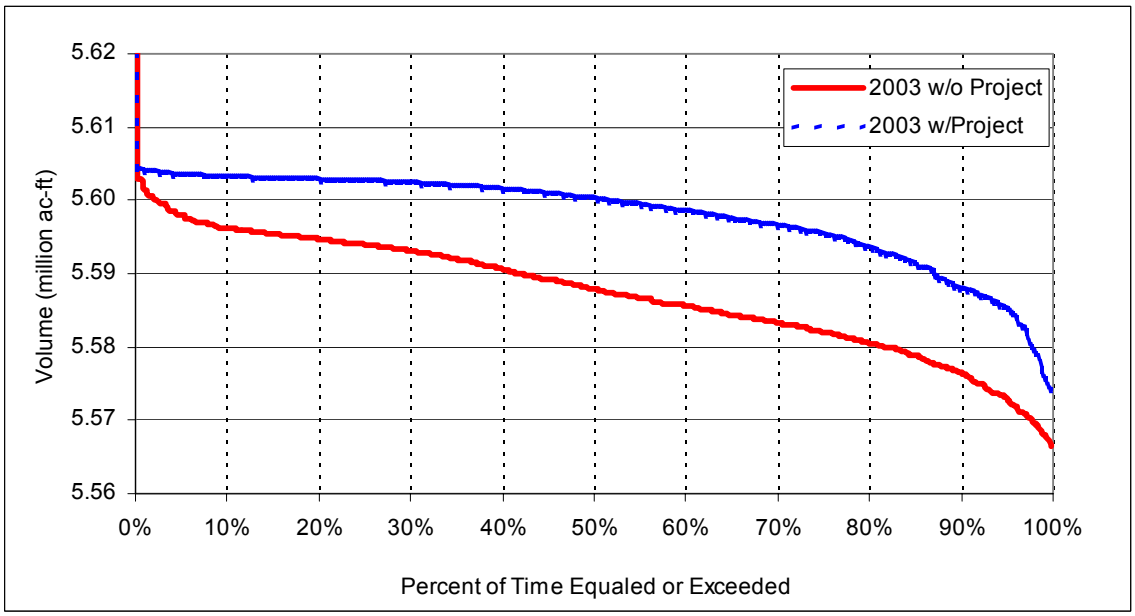


FIGURE 12 - 39 GROUNDWATER STORAGE - 2003 CONDITION VOLUME PROBABILITY CURVE - WET SEASON

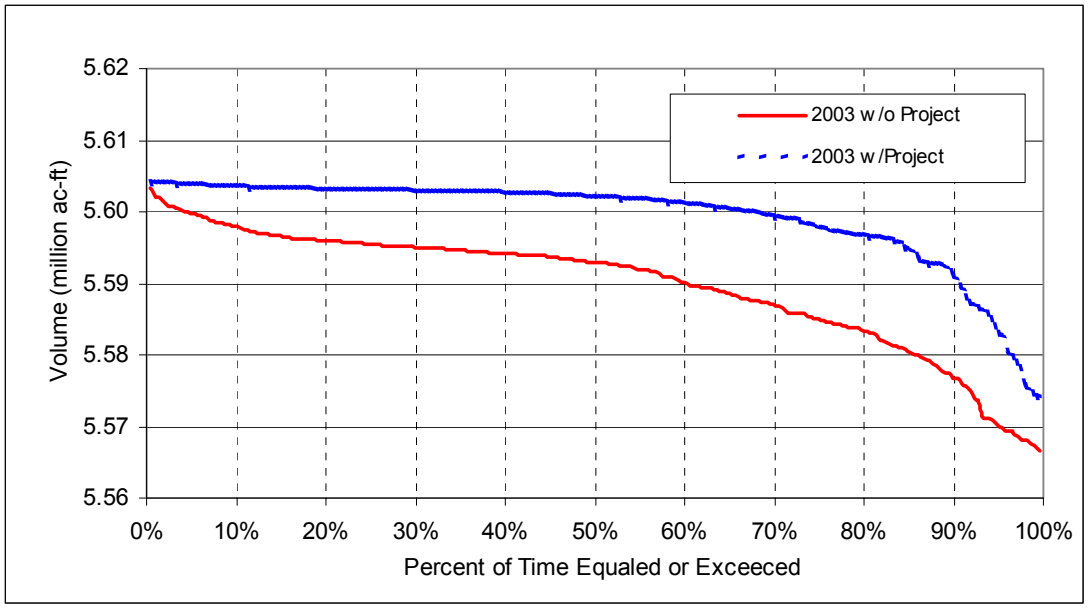


FIGURE 12 - 40 GROUNDWATER STORAGE - 2003 CONDITION VOLUME PROBABILITY CURVE - DRY SEASON

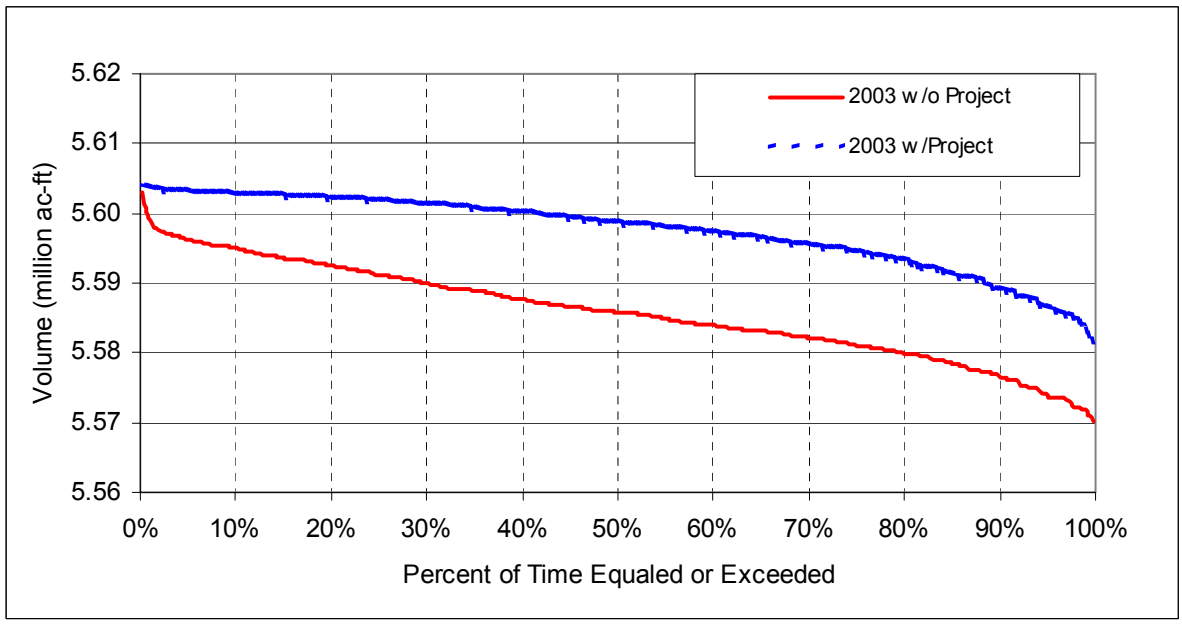


FIGURE 12 - 41 GROUNDWATER STORAGE - 2003 CONDITION HYDROGRAPH - AVERAGE YEAR (1994)

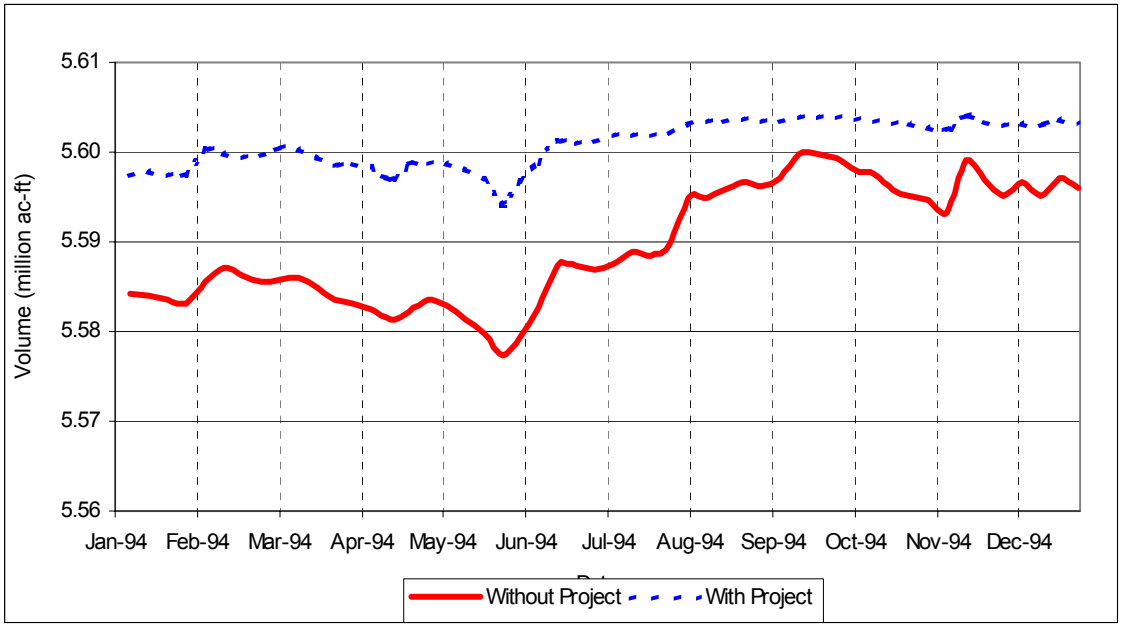


FIGURE 12 - 42 GROUNDWATER STORAGE - 2003 CONDITION HYDROGRAPH - WET YEAR (1995)

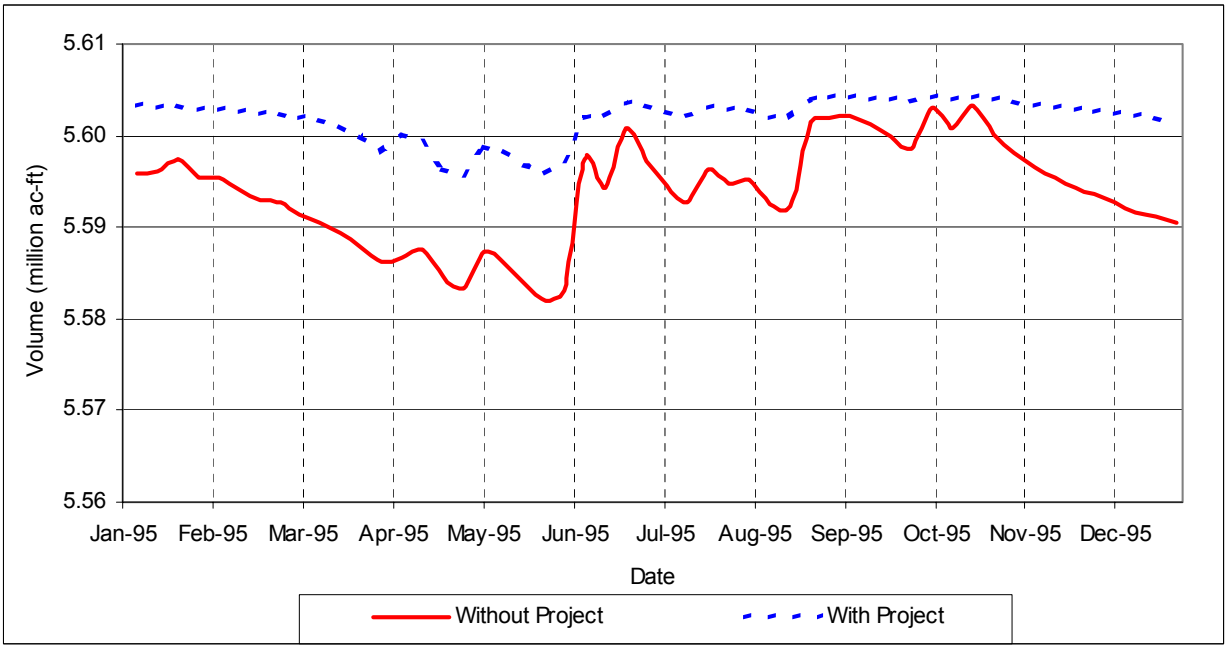
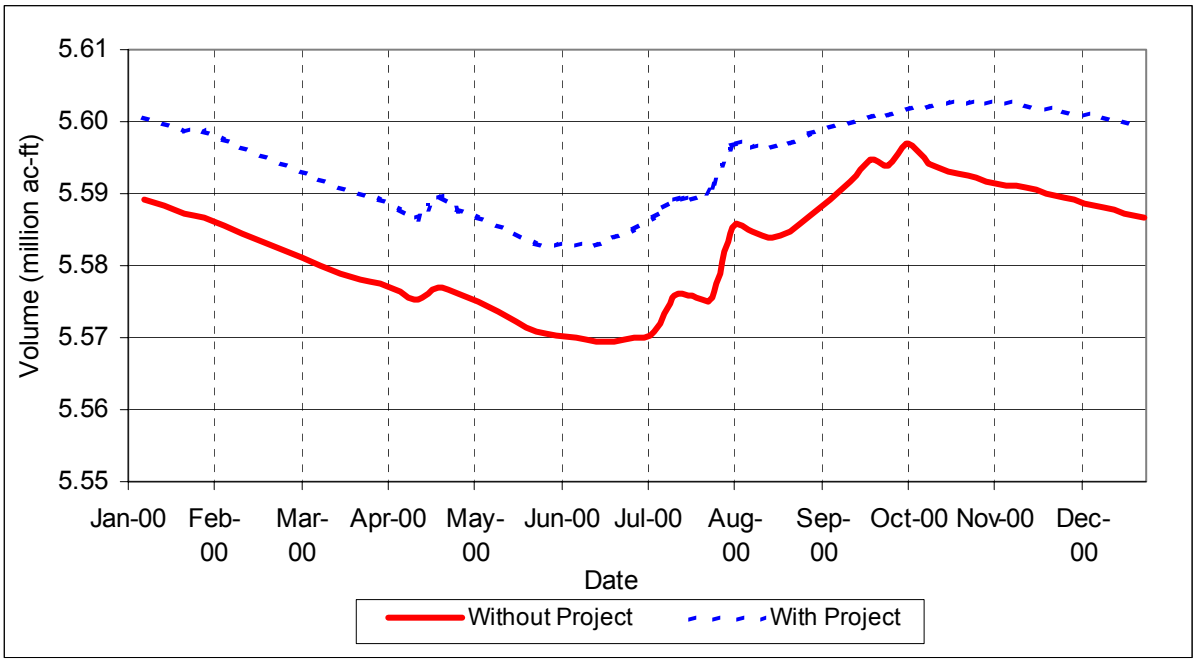


FIGURE 12 - 43 GROUNDWATER STORAGE - 2003 CONDITION HYDROGRAPH - DRY YEAR (2000)



12.6.3.2 Flood Protection Assurance

Flood protection assurance as required under this chapter was evaluated using the MIKE SHE model. Model runs made without the project were compared against results obtained after project implementation. More detailed analysis and model results can be found in Appendix A. The construction of several new levees designed to protect existing development from elevated water levels is also proposed. The five levees to be constructed will serve to prevent higher water and sheet flow leaving the project area from adversely affecting surrounding residential development, agricultural interests and existing structures. Appendix C of this report contains levee descriptions, construction details, and locations. Based upon this information, the SFWMD is providing reasonable assurances that existing levels of service for flood protection will not be diminished outside the geographic area of the project.

12.6.3.3 Adaptive Water Management Practices

Based upon procedures outlined for the planning process, adaptive water management practices were utilized during the modeling runs and the development of the preferred alternative. Along with standard engineering

practices and procedures for the detailed design and the establishment of the RECOVER process, adaptive water management practices will continue throughout the project implementation. These practices and procedures will ensure that the Recommended Plan will contain the most efficient and cost effective design to meet the needs of the restored natural environment.

12.6.4 Coordination of Project with Existing Utilities and Public Infrastructure

Florida Statute s 373.1501(5)(e) requires that the SFWMD "Ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility and public infrastructure are minimized."

The only utilities that provide service in the Southern Golden Gates Estates (SGGE) area are Florida Power & Light Company (power) and Sprint (telephone). Due to the development patterns in the SGGE area, service is limited primarily to the northwest portion of SGGE. Most of the FPL and Sprint facilities are located within the rights of way (ROW) of the local road network in SGGE. There are no major utility corridors or easements that transverse the SGGE area although some of the local distribution lines provide service to the Belle Meade area west of SGGE. Time Warner, the cable provider in the Golden Gate Estates area to the north, does not provide any service south of I-75/Alligator Alley.

Preliminary contacts were made with the utilities and Collier County regarding the SGGE project during 2002. A follow up meeting was held on January 22, 2003 with FPL, Sprint, Collier County, FDEP (who was responsible for acquiring the SGGE lands on behalf of the State of Florida), Florida Division of Forestry (the local entity who is responsible for the interim management of these lands pursuant to an agreement with FDEP), FDOT, COE, and SFWMD staff. The purpose of the meeting was to:

(1) review the network of existing utility facilities and roads in the area;

(2) identify those utility facilities that could be removed and the process and timeframes for implementing their removal consistent with the project schedule;

(3) identify those facilities that needed to remain that might be impacted by the proposed project;

(4) discuss options for minimizing and/or avoiding impacts to the facilities that needed to remain and, if necessary, relocation options; and

(5) identify any other potential utility and infrastructure issues that needed to be addressed during the planning, design, and/or construction process.

At this time, based on the discussions at the January 22, 2003 meeting and follow up discussions and email correspondence, it appears that most of the existing power lines will need to remain in order to provide power to: (1) the existing landowners in the Belle Meade area immediately east of SGGE (until such time as their land may be acquired by the State of Florida under the Belle Meade willing seller program); (2) the buildings in SGGE that are utilized by the Division of Forestry staff for their land management activities; (3) the two landowners within SGGE who have not yet vacated their property; and (4) the proposed pump station(s) and/or other structure(s) that are part of the full SGGE project. However, the existing distribution line along Everglades Boulevard that currently brings power into the SGGE area from north of I-75 will need to be upgraded to 3-phase power in order to meet the power demands of the proposed pump station(s) and/or structure(s) as will the distribution lines leading to the proposed pump station(s) and/or other structure(s). FPL has provided preliminary cost projections for this work that has been incorporated into the alternatives analysis process.

The extent to which existing power and telephone lines can be removed in the future will depend on the final approved design and management plan for the entire SGGE project and the extent to which landowners remain in the Belle Meade area to the east of SGGE at that time. Staff will continue to keep FPL and Sprint appraised of the on-going SGGE planning and design processes and schedule any follow up meetings that may be needed.

In September 2003, Collier County, the SFWMD, and the Trustees for the Internal Improvement Trust Fund (TIITF), the entity that holds title to State owned lands, approved an interagency agreement which governs the vacation of the road rights of way within the SGGE area. The agreement includes provisions for providing easements, as needed, for those utility facilities that are currently located within the road rights-of-way that will remain on either an interim or permanent basis once the project is completed.

During the State Clearinghouse review process, the FDOT District One office raised some concerns regarding potential impacts to the state highway system due to the proposed project. These concerns dealt primarily with potential impacts to the integrity of the U.S. 41 road base as a result on increased groundwater levels in the vicinity of the road. SFWMD, Corps of Engineers, and FDOT District 1 staff have discussed the FDOT concerns most recently via conference call on August 12, 2004 and at a meeting in Bartow on Friday, August 27, 2004. It was determined during these discussions that the FDOT concerns could be adequately addressed in the modeling work that will be done during the detailed design phase of the project.

An additional question has been raised regarding the need for additional culverts under Tamiami Trail as a result of this project in addition to those already planned as a part of the Western Tamiami Trail Culverts project that has just begun construction. At this time, it is not anticipated that additional culverts will be needed, but this will be addressed as part of the detailed design modeling efforts noted above.

It is the District's understanding that follow up letters summarizing these discussions and the agreements reached will be forthcoming from the Corps of Engineer and from the FDOT shortly thereafter.

Water and wastewater services in the project area are provided by individual private wells and septic tanks. However, the facilities for water treatment and waste water treatment along with an wetland reclamation area serving the Port of the Islands community is located in the area south of the SGGE project, north of US 41 and immediately east of the Faka Union Canal. The project design calls for these areas to be surrounded by earthen berms with adequate seepage control measures to prevent adverse flooding impacts and maintain access. The Port of the Islands water supply wellfield is, however, located east of the proposed berm. Access to the wellfield is maintained by a road at higher grade.

SFWMD staff met with Richard D. Getty, Chair, Port of the Islands Board of Supervisors, and others from the Port of the Islands on May 6, 2004 and May 17, 2004 to discuss the SGGE project and the features that have been proposed to protect the existing Port of the Islands facilities. Representatives from the Port of the Islands were also present at the Public Workshop on June 17, 2004. Based on the feedback received to date from the Port of the Islands representatives, the SFWMD is not aware of any concerns that have not been addressed by the current proposals.

12.6.5 Increased Water Supply Available from Project (Ch. 373.470)

12.6.5.1 State Requirements

Section 373.470, F.S., requires that the PIR identify the increase in water supplies resulting from the project components and that the additional water be allocated or reserved under Chapter 373, F.S.

The recommended plan results in the retention of water on (and subsequent sheet flow of water from) the project footprint. The primary purpose of the project is to establish historic wetland values within the project footprint which is beneficial for the restoration of the natural system. In addition, the project will provide improved timing, quantity and distribution of water to the

downstream coastal estuaries which meets the restoration targets of the estuarine system. The water necessary to meet the goals of the project that is beneficial for restoration will be identified and subsequently reserved under State of Florida law to ensure project benefits. Quantities of water which exceed the restoration target for the natural system is not considered beneficial for the protection of fish and wildlife; therefore this quantity will not be reserved by the State of Florida. This quantity of water which is not beneficial for the natural system is considered as potentially available for other water related needs of the region. However, should a determination be made that all or a portion of this water is necessary for restoration of the natural system at a future date, the State shall take appropriate actions to protect this water (e.g, through a revised reservation for this Project or through a reservation for another CERP project) (see Figures 12-3, 12-7, 12-8, 12-13 and 12-14).

SECTION 13

RECOMMENDATIONS

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SECTION 13
RECOMMENDATIONS

I am recommending a plan that will restore, enhance and protect an extensive wetland-upland mosaic of critical wildlife habitat in the southwestern portion of the Everglades ecosystem – Picayune Strand. This plan will reverse the environmental impacts that have occurred to wetland systems within the project area over the past fifty years and will provide significant benefits to adjacent and downstream lands and estuaries including the Fakahatchee Strand State Preserve, Collier-Seminole State Park, Ten Thousand Island National Wildlife Area and Everglades National Park. The Picayune Strand Restoration Project was developed from the Southern Golden Gate Estates Restoration (OPE) component of the Comprehensive Everglades Restoration Plan approved by Congress in the Water Resources Development Act of 2000, Public Law 106-541. The Draft Integrated Project Implementation Report and Environmental Impact Statement for this project was titled, "Southern Golden Gate Estates Ecosystem Restoration Project." The name has been changed to "Picayune Strand Restoration Project" to represent the significant wetland complex that existed prior to human disturbance and that the project will restore.

I find that once restored, the Picayune Strand project area, which encompasses 94 square miles of Collier County between I-75 (Alligator Alley) and US-41 (Tamiami Trail), will provide extensive wetland and upland habitat for fish and wildlife resources, including threatened and endangered species such as the Florida panther, Florida black bear, red cockaded woodpecker and wood stork, as well as other rare habitat such as tropical hammocks and plant species including orchids and bromeliads. Modifications are required to provide for the restoration and protection of this portion of the Everglades ecosystem. These modifications can be undertaken in a manner that allows us to continue to provide existing water supply and flood protection benefits necessary for the economic and social sustainability of the region.

The features of the Picayune Strand Restoration Project were essentially included in the Comprehensive Everglades Restoration Plan that was approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. These features require authorization pursuant to the provisions of Section 601(d) of the Water Resources Development Act of 2000.

Therefore, I recommend that the Picayune Strand Restoration Project, as described in the section of this report entitled "The Recommended Plan," be authorized for construction with such modifications thereof as in the discretion of the Chief of Engineers may be advisable. The total estimated project first cost is $349,422,000 with an estimated Federal first cost of $174,111,000 and an estimated non-Federal first cost of $174,111,000. The estimated total annual cost of operation, maintenance, repair, rehabilitation, replacement, and monitoring and adaptive assessment is $3,061,000 with an estimated Federal annual cost of $1,508,000 and an estimated non-Federal annual cost of $1,508,000.

The above recommendations are made with the provision that the non-Federal sponsor and the Secretary of the Army shall enter into a binding agreement defining the terms and conditions of cooperation for implementing the Project, and that the non-Federal sponsor agrees to perform the following items of local cooperation:

a. Provide 50 percent of total project costs consistent with the provisions of Section 601(e) of the Water Resources Development Act of 2000 including authority to perform design and construction of project features consistent with Federal law and regulation;

b. Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

c. Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project;

d. Give the Government a right to enter, at reasonable times and in a reasonable manner, upon land that the local sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of completing, operating, maintaining, repairing, rehabilitating, or replacing the project;

e. Assume responsibility for operating, maintaining, repairing, rehabilitating, and replacing (OMRR&R) the project or completed functional portions of the project, including mitigation features, in a manner compatible with the project's authorized purposes and in

accordance with applicable Federal and State laws and specific directions prescribed in the OMRR&R manuals and any subsequent amendments thereto. Cost sharing for OMRR&R will be in accordance with Section 601 of WRDA 2000:

"(e) COST SHARING.-
(4) OPERATION AND MAINTENANCE.- Notwithstanding section 528(e)(3) of the Water Resources Development Act of 1996 (110 Stat. 3770), the non-Federal sponsor shall be responsible for 50 percent of the cost of operation, maintenance, repair, replacements and rehabilitation activities authorized under this section…";

f. Unless otherwise provided for in the statutory authorization for this project, comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element;

g. Hold and save the Government free from all damages arising for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project and any project-related betterments, except for damages due to the fault or negligence of the Government or the Government's contractors;

h. Keep and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project to the extent and in such detail as will properly reflect total project costs;

i. Perform, or cause to be performed, any investigations for hazardous substances that are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 USC 9601-9675, that may exist in, on, or under lands, easements or rights-of-way necessary for the construction, operation, and maintenance of the project; except that the non-Federal sponsor shall not perform such investigations on lands, easements, or rights-of-way that the Government determines to be subject to the navigation servitude without prior specific written direction by the Government;

j. Assume complete financial responsibility for all necessary cleanup and response costs of any CERCLA regulated materials located in, on or under

lands, easements, or right-of-ways that the Government determines necessary for the construction, operation, or maintenance;

k. As between the Government and the Non-Federal Sponsor, the Non-Federal Sponsor shall be considered the operator of the Project for purposes of CERCLA liability. To the maximum extent practicable, the Non-Federal Sponsor shall operate, maintain, repair, replace, and rehabilitate the Project in a manner that will not cause liability to arise under CERCLA;

l. Prevent obstructions of or encroachments on the project lands (including prescribing and enforcing regulations to prevent such obstruction or encroachments) which might reduce ecosystem restoration benefits, hinder operation and maintenance, or interfere with the projects proper function, such as any new developments on project lands or the addition of facilities which would degrade the benefits of the project;

m. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public law 91-646, as amended by title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987 (Public Law 100-17), and the Uniform Regulations contained in 49 CFR part 24, in acquiring lands, easements, and rights-of-way, and performing relocations for construction, operation, and maintenance of the project, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

n. Comply with all applicable Federal and State laws and regulations, including Section 601 of the Civil Rights Act of 1964, Public Law 88-352, and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army.";

o. Comply with Section 106 of the National Historic Preservation Act in completion of all consultation with the Florida State Historic Preservation Officer and as necessary the Advisory Council on Historic Preservation prior to construction as part of the Pre-construction Engineering Design phase of the project;

p. Provide 50 percent of that portion of total cultural resource preservation mitigation and data recovery costs attributable to the project that are in excess of one percent of the total amount authorized to be appropriated for the project;

q. Not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is expressly authorized;

r. The Non-Federal Sponsor shall maintain an appropriate quantity, quality, timing, and distribution of water to ensure the restoration, preservation and protection of the natural system [meaning all land and water managed by the Federal Government or the State within the South Florida ecosystem, including, but not limited to, water conservation areas; sovereign submerged land; Everglades National Park; Big Cypress National Preserve; other Federal and State (including a political subdivision of the State) land that is designated and managed for conservation purposes; the contiguous near-shore coastal water of South Florida; and any tribal land that is designated and managed for conservation purposes, as approved by the tribe] for so long as the Project remains authorized. This quantity, quality, timing, and distribution of water shall meet applicable water quality standards and be consistent with the natural system restoration goals and objectives of the Comprehensive Everglades Restoration Plan, as the Plan is defined in the Programmatic Regulations. In fulfillment of this obligation, the Non-Federal Sponsor shall:

1) Ensure, through appropriate and legally enforceable means under Florida law, that the quantity, quality, timing, and distribution of water, which this Project Implementation Report identifies is available to the areas benefited by the Picayune Strand Restoration Project, including associated downstream estuaries, (the "Project Affected Areas") and is necessary to achieve the restoration goals and objectives for the Project Affected Areas, will be available to the Project Affected Areas at the time the Project becomes operational and will remain available to the Project Affected Areas for so long as the Project remains authorized.

2a) Prior to the execution of the Project Cooperation Agreement, reserve from the additional water that will be made available by implementation of the Project the water identified in this Project Implementation Report determined to be necessary to achieve the restoration goals and objectives for the Project Affected Areas and the natural system.

2b) After the Project Cooperation Agreement is signed and the Project becomes operational, make such adjustments to this reservation of water that are determined under the Programmatic Regulations to be necessary to achieve the restoration goals and objectives for the Project Affected Areas and the natural system.

3) Provide the Government with written certification that the requirements of subparagraphs 1 and 2 of this paragraph have been fulfilled.

4) For so long as the Project remains authorized, notify and consult with the Secretary of the Army should any change in the reservation of water or other legally enforceable means of protecting water be proposed, so the Government can assure itself that the changed reservation or legally enforceable means of protecting water conforms with the State's obligations under this paragraph and continues to ensure that the appropriate quantity, quality, timing and distribution of water is dedicated and managed to achieve the restoration goals and objectives for the Project Affected Areas and the natural system. Any change to a reservation of additional water made available by implementation of this Project shall require an amendment to the Project Cooperation Agreement.

I recommend that credit for the value of the lands, easements, and rights-of-way required for the Project shall be as follows:

a. For any lands or acreage within the former Southern Golden Gate Estates Subdivision comprised of 55,247 acres acquired by the Non-Federal Sponsor or the Florida Department of Environmental Protection prior to May 31, 2004, the creditable value shall be a sum not to exceed $75,394,333, subject to a Peer Review Report by a party designated by the Deputy Assistant Secretary of the Army (Civil Works) and approval of the Peer Review Report by the Deputy Assistant Secretary of the Army (Civil Works) and subject to a determination that the lands are required for the Project.

b. For lands, easements and rights-of-way within the former Southern Golden Gate Estates Subdivision comprised of 55,247 acres acquired by the Non-Federal Sponsor or the Florida Department of Environmental Protection after May 31, 2004, the creditable value shall be the actual acquisition cost of such real property interests at the time the interests are acquired, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable.

c. Subject to a Peer Review Report by a party designated by the Deputy Assistant Secretary of the Army (Civil Works) and approval of the Peer Review Report by the Deputy Assistant Secretary of the Army (Civil Works), the incidental/administrative costs incurred by the Florida Department of Environmental Protection for the acquisition of all lands,

easements, and rights-of-way within the former Southern Golden Gate Estates Subdivision shall not exceed the sum of $29,158,914.

d. If the lands, easements and rights-of-way which lie outside the boundaries of the former Southern Golden Gate Estates Subdivision were acquired prior to execution of the Project Cooperation Agreement, the creditable value shall be their purchase price, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable, together with their reasonable and necessary incidental costs of acquisition.

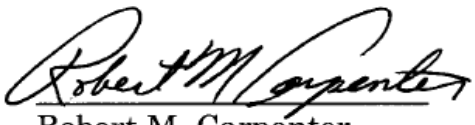
e. The value of lands, easements, or rights-of-way required for the Project which lie outside the boundaries of the former Southern Golden Gate Estates Subdivision acquired by the Non-Federal Sponsor after the effective date of the Project Cooperation Agreement executed for this Project shall be the actual acquisition cost of such real property interests at the time the interests are acquired, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable, together with their reasonable and necessary incidental costs of acquisition.

I also recommend that Congress provide authority for the Non-Federal Sponsor to receive credit for planning, engineering, design and construction performed by, or on behalf of, the Non-Federal Sponsor, towards the implementation of the Picayune Strand Restoration Project before project cooperation agreement execution if the Secretary of the Army determines that the work performed was for a reasonable cost, necessary and integral to the Project and was implemented to appropriate design and construction standards.

I also recommend that for the Prairie Canal plugging and installation of culverts under U.S. 41 construction components, the non-Federal sponsor be credited for all construction activities that they complete, including those completed in advance of executing a Project Cooperation Agreement with the Corps subject to: a) certification by the Secretary of the Army that those restoration activities are necessary, for a reasonable cost and integral to the CERP restoration project and b) that the restoration activities have been constructed in accordance with applicable federal and state law. It is in the best interest of the Federal Government for this component to be implemented expeditiously because of the early benefits to several federally listed threatened and endangered species within the Picayune Strand project area, as well as hydrologic benefits to federal lands and estuaries downstream of the project, including Ten Thousand Islands National Wildlife Refuge and Everglades National Park.

Credit for such work is subject to the Secretary of the Army determining that the work is necessary and integral to the authorized Picayune Strand Restoration Project and that the construction is consistent with applicable Corps construction standards and applicable federal law. The non-Federal Sponsor is aware that it will not receive a credit for these costs unless the Congress approves the granting of the credit in law by the authorization of the Picayune Strand Restoration Project and the Secretary of the Army later determines the work is necessary and integral to the authorized Picayune Strand Restoration Project.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.



Robert M. Carpenter
Colonel, Corps of Engineers
District Engineer

SECTION 14

LIST OF STUDY & ITR TEAM MEMBERS
&
REPORT PREPARERS

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SECTION 14

LIST OF STUDY AND ITR TEAM MEMBERS AND REPORT PREPARERS

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SECTION 15

ABBREVIATIONS AND ACRONYMS

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SECTION 15

ABBREVIATIONS AND ACRONYMS

Ac-ft	Acre-Feet
ACHP	Advisory Council on Historical Places
ACOE	Army Corps of Engineers
ASR	Aquifer Storage and Recovery
BA	Biological Assessment
BCB	Big Cypress Basin
BEBR	Bureau of Economic and Business Research
BMP	Best Management Practice
BP	Before Present
C&SF	Central and Southern Florida
CARL	Conservation and Recreation Lands
CE	Cost Effectiveness
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CERP	Comprehensive Everglades Restoration Plan
CFS	Cubic Feet Per Second
Corps	U.S. Army Corps of Engineers
CWCCIS	Civil Works Construction Cost Index System
DCAR	Draft Coordination Act Report
DDR	Detailed Design Report
DOF	Florida Division of Forestry
dPIR	Draft Project Implementation Report
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
ER	Engineering Regulation
ERA	Ecological Risk Assessment
FANE	Former Agricultural Area - Northeast
FASE	Former Agricultural Area - Southeast
FAW	Former Agricultural Area - West
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FGCU	Florida Gulf Coast University
FMSF	Florida Master Site File
FNAI	Florida Natural Area Inventory
FWC	Florida Fish and Wildlife Conservation Commission
FWS	U. S. Fish and Wildlife Service
GAC	Gulf American Corporation

GGE	Golden Gate Estates
HGM	Hydrogeomorphic Methodology
HTRW	Hazardous, Toxic, and Radioactive Waste
ICA	Incremental Cost Analyses
IDC	Interest During Construction
ITAC	Interagency Technical Advisory Committee
MDS	Multi-dimensional Scaling Analyses
NED	National Economic Development
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NGGE	Northern Golden Gate Estates
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
OMRR&R	Operation, Maintenance, Replacement, Repair, and Rehabilitation
PAL	Planning Aid Letter
PCA	Project Cooperation Agreement
PDT	Project Delivery Team
PED	Preconstruction, Engineering, and Design
PIR	Project Implementation Report
PMP	Project Management Plan
RCW	Red-cockaded Woodpeckers
RIMS II	U.S. Department of Commerce's Regional Input-Output Modeling System
ROMA	Regional Offsite Mitigation Areas
S&A	Supervision and Administration
SAV	Submerged aquatic vegetation
SFWMD	South Florida Water Management District
SGGE	Southern Golden Gate Estates
SHPO	State Historic Preservation Officer
SOW	Scope of Work
SQAG	Sediment Quality Assessment Guideline
T&E	Federal Threatened and Endangered
TDR	Transfer of Development Rights
USGS	United States Geological Survey
WRDA	Water Resources Development Act

SECTION 16

REFERENCES

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APPENDIX A

HYDROLOGY AND HYDRAULICS

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PICAYUNE STRAND ECOSYSTEM RESTORATION

(SOUTHERN GOLDEN GATE ESTATES RESTORATION)

COLLIER COUNTY, FLORIDA

APPENDIX A

HYDROLOGY AND HYDRAULICS APPENDIX

September 2004

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PICAYUNE STRAND ECOSYSTEM RESTORATION
(SOUTHERN GOLDEN GATE ESTATES RESTORATION)
COLLIER COUNTY, FLORIDA

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III. INTRODUCTION

This report presents the basic hydrologic-hydraulic (H&H) data and analyses used to define the feasibility of implementing the hydrologic restoration plan for the Picayune Strand or Southern Golden Gate Estates (SGGE) in Collier County, Florida. It includes the methods, analyses and the results of the H&H assessment of the SGGE landscape under the natural (pre-development) condition, under the existing condition with the anthropogenic influence of roads, canals and water control structures, and under the future condition with the implementation of the SGGE restoration plan as an integral element of the Comprehensive Everglades Restoration Plan (CERP).

IV. DRAINAGE BASIN INFORMATION

A. WATERSHED DESCRIPTION

The Southern Golden Gate Estates project area encompasses an approximately 94 square-mile area of sensitive environmental landscape between Interstate Highway 75 and U.S. Highway 41 (Figure A-1). Located southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands National Estuarine Reserve, west of the Fakahatchee Strand State Preserve, and east of the Belle Meade State Conservation and Recreation Land Projects area, the SGGE constitutes the heart of the State of Florida's Picayune Strand State Forest. The historic watershed, including SGGE and part of the Northern Golden Gate Estates (NGGE), included an area of approximately 234 square miles. The generalized overland flow pattern was to the southwest. However, the extent of the historic drainage area (Figure A-2) has been reduced due to construction of roads, canals and urban and agricultural development. The existing Faka Union Canal watershed is approximately 189 square miles containing approximately 70 miles of canals with 12 weir structures, and the majority of the watershed includes a grid-like system of roads spaced every quarter mile. Generalized historic overland flow patterns are illustrated in Figure A-2.

B. TOPOGRAPHY

The topography for this study is referenced to the horizontal datum, 1983 North American Datum (NAD) Florida State Plane East and the vertical datum is referenced to 1988 North American Vertical Datum (NAVD).

The SGGE watershed gently slopes from the northeast at 40 feet to 0 feet NAVD at the southwest corner of the watershed. There are several sloughs that are 0.5 to 2 feet lower in elevation. Most of the roads in the watershed with roadbeds that are 1 to 2 feet above the native topography. With

the associated ditches, these roads have sufficient relief to affect the surface runoff.

C. TRIBUTARIES

The Faka Union Canal system is made up of four major tributary canals (Miller, Faka Union, Merritt and Prairie) and extends north from the estuaries of the Ten Thousand Islands nearly to County Road 846, a distance of some 28 miles. The canals are trapezoidal in shape and have an average excavated depth of approximately 10 feet from top of bank to bottom of channel with surface widths ranging from 45 to over 200 feet. Canal discharge records measured at the gauging station located upstream from the outfall weir of the Faka Union Canal are available starting in 1969. The average discharges for the period of record are 115 cfs during the dry season (November through May) and 460 cfs during the wet season (June through October), with an extreme discharge of 3,200 cfs occurring right after the canals were built.

The purpose of the Golden Gate Estates canal system was to (1) provide rapid drainage of surface water, (2) lower the water table to reduce flooding, and (3) provide fill for development. They were made to intercept large volumes of surface flow and quickly divert them to the Gulf of Mexico. The construction of the weirs was intended to prevent overdrainage during the dry season. In spite of the operation of these low-head weirs, the effects of the canals on the area's hydrology have been significant and far reaching. The runoff that once slowly drained as overland sheet flow is now channelized in the canals and released as a point discharge at the south end of the Faka Union Canal. This channelization results in both increased runoff volumes and runoff rates. Less runoff is available for groundwater recharge.

Due to the shallowness of the Water Table Aquifer, the canals have affected the groundwater levels. Since many of the canals are 10 feet or more in depth, there is a direct hydraulic connection between the canal system and the upper portions of the shallow aquifer. Undoubtedly, construction of the GAC canal network has resulted in some drainage of the shallow aquifer, which has caused a general lowering of the groundwater table during the dry season. The water table was lowered 1.5 to 2 feet after the construction of the canals. A field investigation showed a drop in the water table of approximately 2 feet at a distance of 6,000 feet from the canal. After construction of the canals, annual runoff for the Faka Union watershed has increased to about 17 inches. Since the Water Table Aquifer is open to the land surface, it responds very quickly to changes in monthly rainfall, and direct infiltration from rainfall is the main source of recharge. Other sources of recharge are inflow from surface water bodies, such as canals, subsurface flow from adjacent areas, and upward seepage from semi-confined aquifers. Generally, recharge occurs after rainfall events when the canal levels immediately upstream from the weirs are higher than adjacent groundwater levels.

D. SOILS

The soils are poorly drained sandy and loamy soils with varying and intermittent layers of fractured and processed limestone. The limestone is within 50 inches of the surface throughout the watershed. Permeability of these soils is very high. Characteristic of the poorly drained soils of the Pompano-Charlotte association, Ochopee-Broward association, and Freshwater swamp association, these soils are subject to prolonged flooding.

E. LAND USE

The Faka Union Canal watershed is part of Golden Gate Estates Development, and is zoned for single-family residential land use (Figure A-3). Some previously farmed areas in the northern part of the watershed are now zoned residential and commercial. The residential zoning is low density with minimum lot size of 2.25 acres. The remaining area is used for agriculture, predominately truck farming, except in areas of persistent flooding. The most populated areas are north of Alligator Alley (I-75) especially near west of Everglades Boulevard. Telephone and electric services are not available in most areas south of Alligator Alley and the area remains generally undeveloped. A small urban area exists at the extreme southern end of the area called Port of the Islands.

South of Alligator Alley, the majority of the land cover is identified as wetlands. The vegetative community characteristics are described elsewhere in detail in the subsequent sections of this report. The loss of sufficient hydroperiods necessary to sustain wetland vegetation has caused a severe alteration of the historical plant species composition from that of wetland to upland or invasive exotics. As wetlands are drained, the organic soils that support wetland vegetation growth can be destroyed by fire, oxidation, shrinkage, and compaction. In addition, the processes responsible for the formation of these soils cannot take place during a shortened hydroperiod. The long inundation characteristic of cypress forests protects it from fire but once drained, the forests are burned more frequently. This can cause slower growth rates and hinder regeneration. Cypress forests cannot survive or develop in areas with frequent fires. Slash pines are more resistant to fire, and even require fire, to prevent natural succession to a hardwood hammock. Saw palmettos are extremely fire resistant. The more frequent and intense fires in SGGE have resulted in a large part of the previously dominant cypress forest to be invaded by pine and palmettos, and later by exotic species like Brazilian Peppers.

The shortened hydroperiod of wet prairies has resulted in an inhibited growth of periphytic algae, which sustain the small forage fish. Additionally, there is no standing water for these fish. Larger animals, particularly wading birds, cannot survive without this food source. The extensive roadway system in SGGE has resulted in a loss of canopy that has affected

understory vegetation, air flows, and temperature. Many species, including some endangered orchids and bromeliads, require exact temperature and/or humidity conditions.

F. HYDROGEOLOGY

The geology of the area consists of a Surficial Aquifer system, Lower Tamiami aquifer and the Sandstone aquifer. The Surficial Aquifer System includes the Water Table Aquifer and some portion of the Lower Tamiami Aquifer that extends down to approximately 80 feet. The Water Table Aquifer is well connected with the canal systems and responds rapidly to rainfall, the only source of recharge, and canal drainage. The Surficial Aquifer System is separated from the lower aquifers by an aquiclude. The Lower Tamiami Aquifer is the primary source of regional public water supply. However, the rapid urban development in Collier County has stressed this aquifer to its safe yield limits, and a lower Mid-Hawthorne formation is now being tapped into for supplemental public water supply by reverse osmosis treatment.

G. REGIONAL FLOWS

It has been estimated that, of the 50+ inches of rain received in western Collier County, historical natural runoff is on the order of 0 to 10 inches annually. Historically, the general water movement can be characterized by slow, overland sheet flow a few inches to a few feet deep and several miles wide. Much of the drainage was concentrated in slightly lower sloughs and strands. The area was regularly inundated by several feet of water during the wet season. During the wet season, overland runoff would be stored in depressional areas and the peak flows would be attenuated and a longer hydroperiod would be maintained well into the dry season. The storage within these wetlands is a part of the hydrology of the watershed. Subsurface flow, groundwater recharge and evapotranspiration are major components in the hydrologic cycle. As the wet season ends and throughout the dry season, water stored in depressions is slowly depleted as it recharges the shallow Water Table Aquifer and is used by vegetation in the evapotranspiration process. This reduces the amount of surface runoff. Since the construction of the canals, the roads and canals largely control the surface flow patterns and the subbasin boundaries.

V. HYDROLOGIC AND HYDRAULIC MODELING FOR RESTORATION

A. GENERAL

The hydrogeology of the SGGE area is unique because the limestone is within 4 feet of ground surface. The drainage canals are within this limestone layer and they have a direct hydraulic connection with the aquifer.

Overdrainage occurs because this limestone layer is part of the surficial aquifer. During the dry season, the rapid rate of runoff caused by the overdrainage depletes groundwater storage, which causes an environmental strain on the ecosystem within SGGE. The swamp and marsh ecosystem has been degraded due to the shortened hydroperiod. To evaluate the effectiveness of the restoration to this area, an integrated surface water groundwater model is required. The proposed project is to environmentally restore the SGGE area. Thus, an enhanced surface water and groundwater flow model was required to simulate the complex interaction of surface and groundwater flow patterns of the watershed. An integrated SGGE model was formulated by the application of the integrated mathematical modeling system MIKE SHE version MIKE ZERO 2003 from the Danish Hydraulic Institute (DHI). The objectives of this modeling effort are to evaluate the effectiveness of the restoration plans re-establishing a wetland hydroperiod for the area, re-establishing historic sheet flow patterns, and reducing the amount of freshwater discharge at the outlet of the SGGE to the downstream estuaries.

The restoration of the SGGE will require flood control analysis and design to ensure that no adverse flooding is incurred to the adjacent areas, which currently utilize the existing canal system for flood control. The hydrologic analysis will be performed for the 10 year, up to the 100-year storm event. The impacts to the adjacent areas, with respect to flood control, will be done with hydraulic analysis.

B. MIKE SHE MODEL

The MIKE SHE modeling system is an integrated and distributed, physically based mathematical model with finite difference computational solution. The model can be applied for continuous simulation of the surface and sub-surface flow conditions over a long period of time. The MIKE SHE model application on this project is to quantify canal/aquifer interactions, to assess the impact of various water management strategies on flood dynamics, wetland hydroperiods, and water supply within the watershed.

The MIKE SHE modeling system comprises a number of flow modules, which may be combined to describe flow within the entire land-based part of the hydrological cycle. The main components which have been applied in SGGE restoration modeling studies are the MIKE SHE overland flow and channel module (MIKE SHE OC), the MIKE SHE unsaturated flow module (MIKE SHE UZ), the MIKE SHE saturated flow module (MIKE SHE SZ), the MIKE SHE evapotranspiration module (MIKE SHE ET), MIKE SHE irrigation demand module (MIKE SHE IR), the one-dimensional hydraulic model (MIKE 11), and the MIKE SHE pre- and post-processing modules (MIKE SHE PP). The simulation methods of these components are described below, and presented in Table A-1.

1. MIKE SHE Overland Flow / Channel Flow Module

The overland flow and channel (OC) component of the MIKE SHE model determines the sheet flow runoff and concentrated flow. The model calculates surface runoff as two-dimension flow of water over the watershed. The surface runoff is controlled by the slope, surface roughness and ponding. The land slope is determined by the surface topography. The topography remains the same for all simulation scenarios with the exception of the description of the changed physical features. The surface roughness is a function of the vegetation. Surface detention storage results from small depressions and irregularities in the relief of the landscape. Water ponds in these depressions until a threshold is met and surface runoff begins.

2. MIKE SHE Unsaturated Zone Module

Water movement through the soil is calculated by the Unsaturated Zone (UZ) component of MIKE SHE. The UZ component computes flow and water content in the soil from the ground surface to the water table. Infiltration and percolation are calculated using soil physical properties of the soil. The properties include hydraulic conductivity and the soil moisture characteristic's curve. These data are specified in a database for each soil horizon of each soil type in the watershed.

3. MIKE SHE Evapotranspiration Module (ET)

Vegetation cover determines ET, which is the primary component of water loss in the watershed. It is the combination of evaporation from soil and water surfaces and the transpiration of water from plants. Two vegetation parameters, leaf area index and the rooting depth are used by MIKE SHE to calculate actual evapotranspiration. The leaf area index is a measure of the area of transpiring surface and the rooting depth determines the volume of soil from which moisture can be extracted. These two parameters are provided as monthly values, for each vegetation cover type used in MIKE SHE.

4. MIKE SHE Saturated Flow Module

Landscape drainage and interflow are important components of the watershed hydrology that contribute flow to the canals and the wetlands. Groundwater flow is calculated in the Saturated Zone (SZ) component of the MIKE SHE model. The groundwater flow and potential heads are computed using the standard finite-difference solution scheme. Water table aquifer information, such as bottom elevation, horizontal and vertical hydraulic conductivities, and storage coefficient, are the major input data in the model.

C. MODEL DOMAIN

The domain of the Big Cypress Basin (BCB) regional integrated model (Figure A-4) covers a 1200 square-mile area of the Faka Union Canal and Fakahatchee Strand Watershed. This model domain is set up on a 1500 feet by 1500 feet grid that has 6171 computational cells per layer. The model is set up in the State Plan NAD 1983 Florida East coordinates and NAVD 1988.

D. INPUT DATA AND MODEL SETUP

An extensive database of meteorological and land-based hydrologic-hydraulic data was utilized for the development of the BCB model. Some of the major input parameters are:

1. Meteorological Data

The driving forces for the integrated model are rainfall and evapotranspiration (ET). Continuous records of rainfall for the study area are available at 20 rainfall stations (Figure A-5) for a 13-year period of record (1988-2000). The objective was to run the model for typical weather data and runoff conditions for hydrologic restoration. The conditions modeled represent the hydrologic conditions for average, wet, and dry years in southwest Florida, which are 1994, 1995, and 2000, respectively. The measured rainfall from the 20 stations (Figure A-5) was spatially distributed with the triangulation method, Triangular Irregular Network – 10 (TIN –10). This method divides daily rainfall estimates into 2 mile by 2 mile grid cell into 10 by 10 sub-cells, thus the sub-cell size becomes 1056 feet by 1056 feet (Figure A-6). For a given day, a TIN is built whose vertices are rain gauge locations with non-missing values. For a given 2 mile by 2 mile grid cell, the above TIN is used to interpolate rainfall at the centroids of each of the 100 sub-cells covering that cell. The average of the 100 rainfall values is represented as the daily rainfall for a 2 mile by 2 mile cell. The operation is repeated to generate daily rainfall records for the entire model period.

Evapotranspiration accounts for the bulk of water loss from the modeling area. Water is lost to the atmosphere by evaporation from plant surfaces, evaporation from free water surfaces, by soil evaporation, and through transpiration from the plant root zone thereby reducing water available for runoff and groundwater flow. Two vegetation parameters, leaf area index and the rooting depth (Table A-2), are used by MIKE SHE to calculate actual evapotranspiration.

The BCB model requires a measure of daily potential evapotranspiration (ET). Measured potential ET rates are not available. Typically, the potential ET is calculated from weather data and adjusted for vegetation type, soil conditions, and time of growing season. It is also possible to use the measured data from evaporation pans in a humid, semi-tropical

environment to estimate wet marsh potential ET. The estimation of the wet marsh potential ET for the BCB model was performed by the SFWMD Simple Method, which computes the long-term historical (1965-2000) wet marsh potential ET from the evaporation stations in the model domain (Figure A-5). Due to the difference in the roughness characteristics between marsh and grass surfaces, the crop coefficients developed were modified for use with wet marsh potential ET. Additionally, five National Oceanic and Atmospheric Administration (NOAA) stations with daily temperature data for long-term (1965-2000) were thoroughly checked and patched to correct systematic errors, trends, and missing values with the purpose of producing the best possible temperature dataset for ET parameters and ET estimates. The spatial distribution of the wet marsh potential ET values for the model domain was performed by the TIN-10 method across the five evaporation stations. A summary of the statistics of the wet marsh potential evapotranspiration for those NOAA stations is shown on Table A-3.

2. Land Use

The MIKE SHE land use distribution map (Figure A-3) in the BCB model was developed from the SFWMD 2000 land use Geographic Information System (GIS) coverage. The standard utilized for compiling this data was the Florida Land Use, Cover and Forms Classification system developed by Florida Department of Transportation Procedure No. 550-010-001-a, dated September 1985, Second Edition. The 2000 land use coverage contains 300 different land use types, which have been simplified into 23 vegetation cover classes that are hydrologically different. These codes have been used to convert land use into the MIKE SHE grid coverage using Table A-4. Additionally, pre-development (Natural) condition shown on Figure A-7 was developed into a digital vegetation coverage from the 2001 South Florida Water Management District Soil Classification Database. Future 2060 land use information was adapted from the Collier County Comprehensive Plan. Two future land use conditions were considered for this study, one with State (Florida) ownership of SGGE (Figure A-8) and the other condition without State (Florida) ownership, where the lands within SGGE were not acquired (Figure A-9).

3. Topographic Data

The ground surface elevation was interpolated to a 1500 feet grid based on topography generated from the USGS quadrangle data. However, this data was enhanced Lidar survey data (2000) from Collier County and USACE cross sectional surveys gathered in the Golden Gate Estates canal system (2003). The interpolated topographic digital grid input map is presented in Figure A-10. Overland detention storage also represents small depressions and irregularities in the surface; e.g., small ponds, which are not captured by the topographic maps. Ponded water will accumulate in depressions and local ponds

until a certain topographic threshold is exceeded. This is expressed by the detention storage coefficient in the overland flow component.

4. Canal Network – Hydraulic Data

Channel flows in the BCB model are described by the 1-D hydrodynamic river/flood model MIKE 11, which is coupled dynamically to the integrated hydrologic MIKE SHE model. Input for the model consists of the canal network, as illustrated in Figure A-11, surveyed cross sections, appropriate boundary consistent with actual surface boundaries and bed resistance. Moreover, flow regulation structures such as culverts, bridges, and control gates that may significantly alter or modify river flows and stages are specified as input to the model. Finally the rivers exchange water with underlying aquifer. This may either be described entirely by the aquifer material properties or by a river lining leakage coefficient.

Cross sections in the MIKE 11 model were converted from existing BCB UNET model, which was developed by Dames & Moore (1995). As an improvement to the MIKE 11 model, an additional 150+ canal cross sections, weir, bridge and culvert structure details were gathered along the Miller, Faka Union, Merritt, and Prairie canals. The operational control structures in the basin model (Figure A-11) were specified according to the South Florida Water Management District - Big Cypress Basin Water Control Manual. Table A-5 gives the operational schedules of water control structures on the canal systems in the BCB model. Boundary conditions are specified at free upstream and downstream ends of the river network. Upstream is a zero flow boundary. A tidal stage boundary condition has been applied to all downstream of the channels (Figure A-12).

a. Roughness Coefficients

The bed conveyance factor, or Manning's M, is inversely proportional to the bed resistance, Manning's n, which has been used traditionally for roughness values for river branches and floodplains. The Manning's M is the roughness parameter of the MIKE SHE/MIKE 11 model. Typical Manning's M values for natural stream channels and floodplains range between 5 $m^{1/3}/s$ ($n=0.2\ s/m^{1/3}$) and 35 $m^{1/3}/s$ ($n=0.029\ s/m^{1/3}$) depending on the density of the vegetation in the flow ways. However, some areas of the model, such as Corkscrew Swamp will have values that fall below those values because of their very dense vegetated floodplain. The tradition Manning's n values for the rivers and canals in the BCB model are shown in Table A-6. Those values were based on aerial photographs, site inspections and engineering judgment.

5. Soil Properties in the Unsaturated Zone

The unsaturated zone is defined as extends from the ground surface to the groundwater table. The depth varies throughout the year with

groundwater fluctuations. During the wet season, the unsaturated zone may disappear in depression areas where the water table rises above ground. Unsaturated flow in MIKE SHE is computed based on a calculated infiltration and simplified Richard's equation, and thus depends on a number of soil properties such as hydraulic conductivity, soil retention, residual soil moisture, and water content at field capacity (Table A-7). These data are specified in a database for each soil horizon of each soil type in the watershed.

There are over 50 different soil types in Collier County. However, not all of these soils are different hydrologically. An analysis of the runoff and drainage characteristics was conducted using the DRAINMOD model, which was developed by Dr. Wayne Skaggs at North Carolina State University to predict the effects of drainage and associated water management practices on the water table depths, the soil water regime and crop yields. It was determined that soils in Collier County could be classified into six different hydrologic response groups, where each of the six groups a characteristic soil profile was selected and the soil physical data from those horizons is used in the BCB model. The six soil type groups are shown on Table A-8.

The MIKE SHE soil distribution map shown on Figure A-13 was obtained from 2001 South Florida Water Management Soils Database for Collier County. Each of the soil hydrologic response groups was assigned to each soil type. The predominant soil group in each grid cell was assigned to the BCB model grid cell. The soil profile was discretized into small, 10-cm intervals for calculation of flows. There were thin layers in the upper horizon with gradually increasing layers with depth. The soil water flow was calculated for each grid cell.

6. Properties of Groundwater Flow in the Saturated Zone

Groundwater flow and potential head are computed in the BCB model using a 3-D finite-difference groundwater model. The hydrogeology of the area consists of the Water Table Aquifer (Figure A-14), Water Table Basal Confining layer (Bonita Springs Marl Confining Layer) (Figure A-15), the Lower Tamiami Aquifer (Figure A-16), C-1 Confining layer (Upper Peace River Confining Layer) (Figure A-17), and the Sandstone Aquifer (Figure A-18). In the BCB model, the hydrogeology strata divided into three layers:

- Layer 1: The Water Table Aquifer. The water table aquifer is well connected with the canal systems and responds rapidly to rainfall.
- Layer 2: The Lower Tamiami Aquifer.
- Layer 3 - The Sandstone Aquifer.

The hydro-geological parameters specified for each layer in the model include:

- Horizontal and vertical hydraulic conductivities, and
- Confined and unconfined storage coefficients.

Figures A-19 and A-24 illustrate the value and distribution of horizontal and vertical hydraulic conductivity in the three aquifer layers. The range of the hydro-geological parameters values used in the BCB model is listed in Table A-9.

The boundary conditions for the confining layer are an impermeable boundary. The boundary conditions for the three aquifer layers are specified as combinations of constant head and variable head no-flow boundaries. The initial water levels for the aquifer layers are given in Figures A-25 through A-27.

7. Drainage Parameters

Landscape drainage and interflow are important components of the watershed hydrology that contribute flow to the canals and the wetlands. Drainage flow is modeled using the simple linear reservoir approximation and depends on drainage constants, and drainage levels. The drainage area code map is presented in Figure A-28, which was delineated based on land use and subbasin maps. A map of drainage levels (Figure A-29) was prepared by subtracting a drain depth map prepared based on root depth from the topography. The drainage time constant are shown on Figure A-30.

8. Irrigation Data

The main types of irrigation occurring in the model area are residential and agricultural irrigation. The MIKE SHE irrigation module provides a method for assessing irrigation demands based on evapotransporation and crop water demands. Figure A-31 is the irrigation distribution map used in the model. The maximum allowable soil water deficit is used for assessing irrigation demand. The drip irrigation option has been used for the entire domain.

9. Summary of Model Parameters

Table A-9 summarizes the main parameters applied in the BCB model. The simulating process is dominated by a strong interaction between surface water and groundwater components. The model parameters in MIKE SHE/MIKE 11 will, therefore, affect the model results of the particular component in both realms of the surface and groundwater flow phenomena. The effect of changing one parameter, e.g.; in the saturated zone, may have an effect on surface water runoffs, evaporation, irrigation demands, and stage levels in flooded areas etc.

The soil property parameters listed in Table A-10 for the saturated zone including hydraulic conductivity and storage coefficients will mainly affect the general potential head level in the aquifers and the dynamics of water levels. In the upper shallow layers, however, changing these parameters will in turn have an effect on drainage flows to rivers, canal base flow and stages in flooded areas. Drawdowns due to well extraction for public water supply and agricultural irrigation will also be affected.

Drainage depths and time constants are typically also varied during the calibration procedure. Too low drainage depths will produce very flat water levels and may result in a general decrease in simulated water levels far below observed water levels. The drainage depth also affects the volume of groundwater in the rivers and thus has a considerable effect on downstream peak levels in the river system. Drain flow during dry periods, where irrigation typically comes into play, is an indication that drain levels may be too low.

Soil properties in the unsaturated zone including hydraulic conductivity and soil moisture parameters affecting the retention curve and unsaturated hydraulic conductivity have an influence on evapotranspiration rates, groundwater recharge and shallow groundwater levels. In agricultural areas with irrigation, the irrigation demands may be affected and this may in turn influence pumping rates and groundwater levels in the lower aquifers in the dry season.

The evapotranspiration parameters are empirical and are typically kept constant at default values. The main calibration parameter is the root mass distribution, which may change the evapotranspiration distribution over the year.

The roughness or flow resistance of the surface is described by the Manning's M number, which depends mainly on land use. The Manning's M values used in this model ranged from .3 to 28.57 meter$^{1/3}$/second. A number of large roads run through the area impeding overland flow. The major roads may thus be perceived as ridges or walls and can either be included in the model by changing the topography or by using the separated overland flow options in the OC component, the latter option was chosen for the BCB model. Figure A-32 gives overland flow boundary condition and separated overland flow area distribution.

The detention coefficient is a threshold above which surface runoff is assumed to occur and may thus change the contributions of surface water to the rivers and to the subsurface in turn affecting groundwater levels. Similarly the leakage coefficient of the surface and river lining controls the exchange of surface water and groundwater.

The crop water stress factor in the irrigation module ensures that ample water is supplied to agricultural areas and thus has an effect on groundwater levels locally. The threshold value for pumping on the other hand will limit the available water for evapotranspiration and plant growth in the dry season.

E. MODEL CALIBRATION AND VERIFICATION FOR RESTORATION

1. Simulation Control

The simulation of surface and subsurface flow for the integrated BCB MIKE SHE model was performed in different time steps. A maximum time step of 8 hours was used in the saturated zone component, while the overland component and the unsaturated zone solver used a maximum of time step of 4 hours. A time step of 3 minutes was used in the MIKE 11 component throughout the simulation due to the complexity of the model. Default computational control parameters were elsewhere applied in the model.

2. Initial Boundary Conditions

The initial surface water boundary conditions are specified at free upstream- and downstream ends of the river network. Upstream, a flow boundary condition of 3.5 cubic feet per second (cfs) (=0.1 m^3/sec) has been specified for the first five days of simulation decreasing to 0.0 for the rest of the simulation period in order to avoid numerical instability. This flow in the beginning is insignificant and will not effect the whole watershed catchment water balance or runoff.

A tidal boundary condition has been applied at the downstream limit of the rivers that discharge into the Gulf of Mexico. No measurements of tidal data in the area were available from 1988-2000; consequently, values were generated based on older recordings found in the International Hydrographic Organization (IHO) database. The generated values for Little Hickory are assumed to be applicable for the downstream ends of Imperial River, Cocohatchee Canal, Golden Gate Main Canal, Henderson Creek, Faka Union Canal, Fakahatchee Strand and Barron River (SR29).

3. Boundary Condition for Subsurface Flow

For the subsurface flow there is in general an east-west flow gradient towards the coastal zone in the aquifers and as a result a constant head-boundary was applied on the western boundary. A tidal boundary condition would in principle provide more accurate results in terms of modeling the hydro-period in the wetland areas along the coast but sufficient information was not available to generate the time varying head boundary conditions. The northern boundary was set up as a time-varying constant head boundary. Measured groundwater data from wells along the boundary were used, and the time-varying head time series for cells in between locations with measured data were generated using the triangular linear integration. A no-flow boundary condition was specified for the eastern boundary. The boundary conditions for the

confining layer are an impermeable boundary. The boundary conditions for the three aquifer layers are specified as combinations of constant head and variable head no-flow boundaries. The initial water levels for the aquifer layers are given in Figures A-25 through A-27.

4. Boundary Condition for the Overland Flow

In the MIKE SHE overland flow module the northern and eastern boundaries were modeled as no-flow boundaries. The default boundary condition in MIKE SHE is a constant head boundary or constant stage level. At the western and southern boundaries a constant water depth of 0.4 inches (10 mm) was applied where water can move freely into the Gulf of Mexico. The 1,500-foot model grid cell size is too coarse to capture fine-scale topographic features that can restrict overland flow. Therefore the proposed levee systems within the model were specified with no-flow boundary conditions.

The overland flow boundary was assigned initially and kept that way in the whole simulation period. Generally the depth of overland flow is considered small and the influence of the overland flow boundary is limited to the adjacent cells.

5. Calibration, Verification and Validation

The BCB Regional model has been calibrated with daily observations for a period from 1995-1999 and verified with hourly observations from the same period.

The input parameters for an integrated MIKE SHE model are listed on Table A-10. In order to simplify the calibration procedure and obtain a well-calibrated model within a reasonable time frame, some restrictions were imposed on the parameters. The number of primary calibration parameters was limited to available field observations, existing calibrated values used in other MIKE SHE models for watersheds located close to the SGGE area and based on representation of scenarios of the model. A number of key calibration parameters have been identified in the BCB model and are listed on Table A-11.

The calibration of the model illustrating the simulated and observed headwater stage and flow at Faka Union Weir No. 1 (FU-1) is presented in Figures A-33 and A-34, respectively. Figures A-35 and A-36 illustrate the groundwater observation wells locations. The results of the simulated and observed groundwater level for well C-690 (just south of I-75 between Miller and Faka Union Canals), and well C-496 (Fakahatchee Strand south of I-75) are shown on Figures A-37 and A-38, respectively.

F. SIMULATION SCENARIOS FOR RESTORATION

Four scenarios representing the natural, existing, no action (2060 land use condition without State ownership of SGGE) and the restored

conditions were developed to evaluate the impact of restoration on surface and groundwater flow interactivity. The hydrology of those scenarios was simulated for an average meteorological condition. The 1994 year was considered to have average hydrologic conditions and not considered a hydrologic wet or dry year. The results from the natural systems conditions simulation provide a baseline for determining how well the restoration performed. Comparison between the existing conditions and the restored system provides a measure of how well the proposed plan has improved the hydroperiods of the wetlands.

1. Natural Systems Model

The Natural System Model (NSM) attempts to simulate the hydrologic response of the pre-drainage SGGE using records of rainfall and other climatic inputs. The NSM does not simulate the hydrologic response of the natural system prior to influence by man, but rather its hydrologic response due to the most recent climatic inputs. Although one may wish to recreate pre-development (Natural) hydrologic conditions (Figure A-7) of SGGE, climatic and other data necessary to perform such a simulation do not exist. The use of recent historical records of rainfall and other inputs allow modelers and environmental scientists to make meaningful comparisons between the responses of the current system to that of the natural system under conditions of identical climatic inputs. In this sense, the NSM can be a useful tool for restoring hydrologic conditions of the natural SGGE.

The present landscape of south Florida has been greatly affected by land development, flood control, and water management activities, which have occurred since the early 1990s. The NSM, in its current form, attempts to simulate the hydrologic system as it would function today without the existence of man's influence.

A Southwest Florida Pre-development Vegetation Map was incorporated in the NSM to represent the natural condition shown on Figure A-7. Topography data and geologic formation parameters are the same as existing regional BCB model, except, all of the dominant anthropogenic features like roads, canals and water control structures were removed to represent the historic landscape. The land cover simulated by the NSM is static, i.e., the model does not attempt to simulate vegetation succession.

2. Existing Systems Model

This simulation was developed to show the hydrologic conditions of the existing canals, major roads and water control structures. The wetland and channel system in the Big Cypress Basin is complex due to a large number of natural sloughs and man-made canals with water control structures. The BCB MIKE 11 channel network system includes 14 floodplains, all primary canals, major water control structures (culverts, weirs, gated spillways, etc.), and major bridges on these channels. The channel and floodplain configuration

were set up in MIKE 11 with a level of detail that captures the physics of the surface water system, while keeping computational time to a minimum. Due to low relief terrain, floodplains were mainly defined where a specific flow direction could be established. The MIKE SHE overland flow component handles surface runoff in the remaining part of the system where no specific flow direction could be established. During the dry season when the groundwater table is low and the wetland system tends to dry up, the overland flow component will automatically handle flow in the MIKE 11 floodplain areas. Due to scale and computational requirements minor ditches and roads were not included in the model.

3. Future No Action Condition

A future no-action condition was simulated with year 2060 land use data obtained from the Collier County's Growth Management Plan. That plan has slated the SGGE area as a natural resources protection area. Although the population in the NGGE is going to increase, the future land use in the NGGE will still continue as Urban low-density (residential). The continued overdrainage by the canal system has the dominant impact on overall drainage and hydrologic conditions of the NGGE compared to the change in land use classification.

4. Restored Conditions

The planning process for restoring the SGGE project area has developed and evaluated numerous alternatives to formulate an optimized plan that will help achieve desired project objectives without adverse environmental, social, and economical impacts. The Alternatives 1, 2, 3A, 3B, and 3C of the 1996 Study completed by the South Florida Water Management District were not simulated by the integrated model since they were not considered effective. Also, simulation was not performed for Alternatives 4 (I-75 bridge enlargement), 5 (Alternative 3D with different pump sizes), 10 (all Obermeyer weirs), 14 (Obermeyer weirs on 3 canals, Prairie Canal plugged), 15 (Alternative 3D with Miller Canal left in place), 16 (Alternative 3D with Faka Union Canal and Miller Canal left in place) and Alternative 18 (land acquisition and management). It was determined by the project delivery team that these alternatives were not feasible for restoration.

The 2060 future (with State ownership) condition land use was used as the restoration condition for the simulations for Alternatives 3D, 6, 7 (a combination of Alternatives 3C and 6), 8 (Prairie Canal Plugged, Merritt Canal Pump Station, Faka Union Canal widen 100 ft. with Obermeyer Weirs, and Miller Canal with Obermeyer Weirs), 9 (Prairie, Merritt and Miller Canals Plugged, and Faka Union Canal widen 140 ft. with Obermeyer Weirs), 11 (a combination of Alternatives 9 and 3D), 12 (a variation of Alternative 11), 13 (a combination of Alternatives 11 and 12), 17 (Prairie Canal plugged), and 19 (a

variation of Alternative 9). Those Alternatives were screened based on minimum restoration benefits and cost effectiveness. It was determined by the Project Delivery Team (PDT) that only the three most cost effective plans that met the threshold of restoration benefits would be further analyzed for maintenance of flood protection policy and regulations. The PDT determined Alternatives 3D, 6, and 12 would be further simulated for maintenance of flood protection. The major features and model conditions for Alternatives 3D, 6, and 12 are described below.

Alternative 3D – Canal Blocks, Spreader Channel, Pump Stations, and Road Removal Plan

Figure A-39 is the plan of Alternative 3D. The model setup for this alternative has the time-varying discharge, water levels, and potential head boundary conditions at a sub-regional scale model. Common features in regional scale model are:

- Remove existing Miller-2, FU-3 and Lucky Lake Weir structures.
- Three pump stations added on the Miller, Faka Union, and Merritt Canals. The 1 percent chance flood event design flows for the pumps stations were 1250 cfs for Miller Canal, 2630 cfs for Faka Union Canal, and 800 cfs for Merritt Canal. The restoration for Faka Union Canal, design flows for the pumps stations were 200 cfs for Miller Canal, 500 cfs for Faka Union Canal, and 160 cfs for Merritt Canal. Only a portion of the flood control pump capacity will be required for restoration.
- Downstream of the pumps, the existing channel cross-sections were replaced by spreader canal cross-sections and floodplain cross-sections extracted from the topography. In the proposed plan, there are 83 canal plugs in the project area. In order to model future conditions when the floodplain is fully established, the blocked portion and its cross sections were modeled as the actual floodplain cross-sections extracted from topography. Floodplain cross-sections were delineated, based on the topography, and were basically added at the location of the existing branches, including Merritt, Miller, Faka Union, and Prairie Canals from downstream of the spreader channels to the junction where the channels become one single main channel, Faka Union Canal. The downstream part of Faka Union Canal was maintained downstream of this point and so was the fixed crest weir, FU-1. As for the spreader channels, the lengths

were set to 4488 feet in Miller Canal, 7040 feet in Faka Union Canal, and 1425 feet in Merritt Canal.

- Due to the one-dimensional MIKE 11 approach, another modification to the setup was made. The main flow direction in the system is from north to south, but flow between the floodplains may also occur. Consequently, floodplain codes were established at the between the canal overbanks to allow for east-west flow, thereby artificially creating one large wetland system.
- Each cell size for the model is 1500 feet by 1500 feet; the minor road widths are generally much smaller than the model cell. It is very difficult to simulate the road removal because of the resolution.

Alternative 6: Partial Canal Blocks on Four Canals, and Road Removal Plan

Figure A-40 is the plan of alternative 6. The model setup for this alternative has the time-varying discharge, water levels, and potential head boundary conditions at a sub-regional scale model. Common features in regional scale model are:

- Filled entire Prairie Canal, the Miller, Faka Union, and Merritt Canals were blocked south of I-75 near Stewart Boulevard, as shown on Figure A-40. There are 46 canal plugs in the project area. In order to model future conditions when the floodplain is fully established, the blocked portion and its cross sections were modeled as the actual floodplain cross-sections extracted from topography. Floodplain cross-sections were delineated, based on the topography, and was basically added at the location of the existing branches, including Merritt, Miller, Faka Union, and Prairie Canals. The canals/sloughs were extended all the way to the Faka Union Bay and have tidal boundary conditions. Floodplain codes were included between the canal cross sections in order to allow water flowing from one flood plain to another.
- Removed existing Miller-2, FU-3, and Lucky Lake Weir structures.

Alternative 12 – Canal Blocks, Pump Stations, Obermeyer Weirs, and Road Removal Plan

Figure A-41 is the plan of Alternative 12. The model setup for this alternative has the time-varying discharge, water levels, and potential head boundary conditions at a sub-regional scale model. Common features in regional scale model are:

- Remove existing Miller-1, Miller-2, FU-3 and Lucky Lake Weir structures.

  Three pump stations added on the Miller, Faka Union, and Merritt Canals. The 1 percent chance flood event design flows for the pumps stations were 2000 cfs for Faka Union Canal and 800 cfs for Merritt Canal. The restoration for Faka Union Canal, design flows for the pumps stations were 100 cfs for Miller Canal, 500 cfs for Faka Union Canal, and 160 cfs for Merritt Canal. Only a portion of the flood control pump capacity will be required for restoration.
- Added three Obermeyer Weirs structures on the Miller Canal. Each structure has been modeled as combined weir and gates. In order to achieve the maximum restoration, the control strategy of these structures was modeled as such: In both wet and dry seasons, the control structures were set to a level corresponding to top of bank elevation at its location. When the water level exceeds this level, the control structures will open. The structures will close when the water level drops below that level. During the storm event, all the Obermeyer gates will be kept completely open corresponding to no restriction of conveyance.
- Downstream of the pumps, the existing channel cross-sections were replaced by spreader canal cross-sections and floodplain cross-sections extracted from the topography. In the proposed plan, there are 64 canal plugs in the project area. In order to model future conditions when the floodplain is fully established, the blocked portion and its cross sections were modeled as the actual floodplain cross-sections extracted from topography. Floodplain cross-sections were delineated, based on the topography, and were basically added at the location of the existing branches, including Merritt, Miller, Faka Union, and Prairie Canals from downstream of the Obermeyer Weirs and spreader channels to the junction where the channels become one single main channel, Faka Union Canal. The downstream part of Faka Union Canal was maintained downstream of this point and

so was the fixed crest weir, FU-1. As for the spreader channels, the lengths were set to 7040 feet in Faka Union Canal and 1425 feet in Merritt Canal.

- Due to the one-dimensional MIKE 11 approach, another modification to the setup was made. The main flow direction in the system is from north to south, but flow between the floodplains may also occur. Consequently, floodplain codes were established at the between the canal overbanks to allow for east-west flow, thereby artificially creating one large wetland system.
- Each cell size for the model is 1500 feet by 1500 feet; the minor road widths are generally much smaller than the model cell. It is very difficult to simulate the road removal because of the resolution.
-

G. MODELING RESULTS FOR RESTORATION

The spatial and temporal distributions of the simulated hydrologic responses on surface and groundwater flow characteristics are illustrated in the following series of graphics and tables. These results represent the hydrologic conditions and differences for natural, existing, future without project, and Alternatives 3D, 6 and 12 the restored condition at the year 2060.

Figure A-36 illustrates 32 monitoring well locations and transects Miller, Faka Union, Merritt and Fakahatchee Strand floodplains.

Figures A-42 through A-46 illustrate the average annual overland flows through those five transects for the average hydrologic year (i.e. Average Year (1994)).

Figures A-47 through A-78 illustrate ground water level hydrographs for the Average Year for the 32 monitoring wells.

Figures A-79 through A-84 illustrate the water depths during an average wet season for the Average Year condition for the natural, existing, future without, Alternative 3D restoration, Alternative 6 restoration, and Alternative 12 restoration conditions.

VI. HYDROLOGIC AND HYDRAULIC MODELING FOR FLOODING

A. EXISTING CONDITIONS

The flood simulation for the Southern Golden Gates Estates (SGGE) project evaluated the proposed changes to the canal network within the SGGE project area and its impacts to the adjacent area outside of the project areas. One of the main project goals was to achieve environmental restoration without adversely impacting the existing level of flood protection in the neighboring areas of the SGGE project. The existing and restored conditions were analyzed

for the wet season condition and the 10 year, 25 year, and 100 year storm events. The hydrology of those conditions was simulated for a wet meteorological condition. The results from the existing conditions simulation provided a baseline for determining the level of flooding due to the proposed plan.

This hydrologic-hydraulic assessment of the spatial and temporal distribution of depth and area of inundation was performed within the purview of certain limitations of data and simulating methods of representing the surface and groundwater flow characteristics in an integrated fashion for the SGGE region. Some of these features are discussed below.

There was a time-varying boundary condition applied for the groundwater and channel flow. The default overland flow boundary condition in MIKE SHE is constant stage-level. The value at boundary cells are assigned initially and kept that way for the entire simulation period. It is generally considered that depth of the overland flow is very small and the influence of the overland flow boundary will be mainly limited to the adjacent cells.

The topographic data used in this study were created by interpolation from the compilation of USGS five-foot contour data, two-foot Lidar contour data, and cross-sectional survey data. Although the topographic database was enhanced by recent field survey data, an accurate representation of the topography at the modeled grid level may not have been attained due to the 1500-foot by 1500-foot grid cell discretization. A previous study concluded that micro-topography is the dominant factor causing spatial variation in overland flow depth, velocity, and direction, the measurement and representation of elevation and flow resistance in sufficient detail to be meaningful is essential in modeling the surface hydrodynamics of wetland-type flow. More detailed topographic data was gathered to help verify the final plan during the detailed design stage of the project.

1. Basin Description

The existing Faka Union Canal basin includes SGGE and part of NGGE and is approximately 189 square miles with an integrated canal network that flows through flat urban, agricultural, and swamp lands. The primary canal network is comprised of the Miller, Faka Union, Merritt and Prairie Canals. The predominant land use within the basin is identified as residential estates. An extensive roadway and canal system was installed throughout the basin during initial construction to serve these areas. The NGGE area, north of Interstate 75 (I-75), has undergone rapid residential development. The SGGE area, south of Interstate 75, has little development to date. Historically, the Faka Union canal basin was swampland that contained cypress trees, islands of pine forests, and wet and dry prairie. The storage within these wetlands is the predominant hydrology of the basin. The water flowed overland in a general southwest direction, which was characterized by slow, overland sheet flow a few inches to a few feet deep and several miles wide. In much of the undeveloped land the drainage was concentrated in slightly lower

sloughs and strands. As the wet season ended and throughout the dry season, water stored in depressions was slowly depleted as it recharged the shallow water table aquifer and was used by the vegetation in the evapotranspiration process.

a. Land Use

The baseline land use for this analysis was the 2000 SFWMD land use GIS coverage. There were two analyses that the 2000 land use coverage was applied to assess the level of flooding. The two analyses were the Real Estate Takings analysis and the Savings Clause analysis. The Real Estate Takings analysis condition was based on the existing canal system in the year 2004 and the proposed new FU-4 gated spillway structure, which was programmed by SFWMD to be built with FY-04 funds. The Savings Clause analysis condition was based on the date of enactment of that statute, 11 December 2000.

b. Rainfall

It has been estimated that approximately 50+ inches (in.) of rainfall was received annually in western Collier County. The historic natural runoff was approximately between 0 to 10 inches, annually.

The spatial and temporal distributions for the 5-day point precipitation for the 10 year, 25 year, and 100-year return periods are based on extensive frequency analysis of local rainfall data tested with several widely used probability distribution methods.

The South Florida Water Management District (SFWMD) operates some rain gages in the State of Florida and provides technical documentation based on those gages. The SFWMD developed the synthetic rainfall spatial distributions from their Technical Publication EMA # 390 Frequency Analysis of Daily Rainfall Maximum for Central and South Florida, dated 2001 and later modified for the BCB model in June 2003. The spatial distribution for the 5-day point precipitation for the 10 year, 25 year, and 100-year return periods for the BCB model are shown on Figures A-85 through A-87. The SFWMD developed the temporal distribution from 5-day rainfall distribution patterns for three major tropical storms in the recent years at five recording rainfall gage stations in the Collier County. Those rainfall distributions were compared with the SCS Type II (modified for Florida) distribution and another prepared recently for the EAA Storage Reservoir - CERP project. The Collier County tropical storms demonstrated a somewhat distinctly different temporal distribution pattern showing that approximately 85 percent of the five-day total rainfall occurring on the third day and also a much steeper slope than the other rainfall distributions. Therefore, a composite rainfall distribution curve (Figure A-88) was developed using local storm patterns, and was recommended for use in the BCB model.

c. Antecedent Moisture Conditions

The antecedent moisture condition was set 1 month, 1 August, into the 1995 wet season, which was considered a very wet season where approximately 80+ inches of cumulative rainfall was recorded in collier county area. The scenarios for the 10, 25 and 100-year storms were run for 2 months from 1 August to 1 October, which was considered a wet antecedent condition for the storms. The average wet season runs were run for 26 months from 1 June 1993 to 31 July 1995. The hydrology of that time period determined to be an average meteorological condition.

The results for the existing conditions simulation provided a baseline for determining the level of flooding for the Savings and Takings Analyses.

2. Discharge and Stages for Existing Conditions

The peak stage and discharge data for the 100-year frequency were estimated by the MIKE SHE / MIKE 11 at the outlet of SGGE, weir structure FU-1, are shown on Figures A-89 and A-90 for the Takings and Savings Analyses Condition, respectively. At the FU-1 weir the 100 year Taking Analysis condition showed the peak headwater stage and discharge to be 5.2 feet (1.58 meters) and 3426 cfs (97.08 cms), respectively. For the 100 year Savings Analysis condition the peak headwater stage and discharge at the FU-1 weir were 5.2 feet (1.58 meters) and 3433 cfs (97.28 cms), respectively.

The hydraulic modeling of existing flood stages and were compiled by using MIKE SHE/MIKE 11 model. The canals in the Faka Union basin and SGGE study area primarily consist of 4 canals, the Miller Canal, the Faka Union Canal, the Merritt Canal, and the Prairie Canal. These canals convey floodwaters in the north through the SGGE Project area out to the Faka Union Bay and the Ten Thousand Island Estuary of the Gulf of Mexico. The flooded areas for the Existing Conditions are shown on Figures A-159 through A-162 for the Takings Analysis condition for the Average Wet Season Maximum Stage, 10 year storm event, 25 year storm event, and the 100 year storm event, respectively**.** That condition (Taking Analysis condition) represent proposed new FU-4 weir that is to be built with appropriated funds. The flooded areas Existing Conditions are shown on Figures A-175 through A-178 for the Savings Analysis condition for the Average Wet Season Maximum Stage, 10 year storm event, 25 year storm event, and the 100 year storm event, respectively**.** That condition (Saving Analysis condition) represent 11 December 2000 baseline condition for the Comprehensive Everglades Restoration Plan (CERP) Programmatic Regulation for the Savings Clause Condition.

3. Calibration, Verification and Validation

The calibration was based on comparisons of measured versus predicted data at 57 groundwater-monitoring locations, 26 river/canal staff gages, and 5 flow gages. Figures A-91 and A-92 show the locations of wells and surface water stations, respectively. Tables A-12 and A-13 present the errors between the recorded and modeled data for the groundwater and surface water stations (stages and flows), respectively. The 2003 BCB model shows a mean error of approximately 1.0 feet. The model error statistics were based on 12-hour time intervals for the groundwater and surface water elevations. The calibration period for the BCB model was from 1995 through 1999.

a. Rainfall

The model was verified and validated by comparing the modeled data to the observed data for two storm events, tropical storm Jerry (August 23-25, 1995) and tropical storm Harvey (September 19-21, 1999). Figures A-93 and A-94 shows the rainfall stations used in the verification, which distributed the observed and synthetic hourly rainfalls with Thiessen Polygons and Tables A-14 and A-15 detail the stations used in the verification runs. Table A-16, illustrates the observed rainfall amounts at those precipitation gages for those two tropical storms. The frequency analysis performed determined those events to be approximately 25-year event for Tropical Storm Jerry (1995) and the 10-year event for Tropical Storm Harvey (1999).

Observed rainfall was used to validate the model. The observed hourly data was compared to the measured daily and hourly values. This comparison was done to confirm that the hourly data is consistent with the daily data that was used during model calibration. Figure A-95 shows the locations of the hourly gages used in the storm validation runs. The stations shown are Cocohatchee Canal Weir #1 headwater (COCO1), Faka Union Canal Weir #1 headwater (FU-1), Faka Union Canal Weir #4 headwater (FU-4), BYCP7 in Miller Canal, and Golden Gate Canal Weir #1 headwater (GG-1). Discharge data was also available for three of those stations, COCO1, FU-1 and GG-1.

b. Initial Conditions and Simulation Period

Initial conditions for both storm validation runs were based on wet season water levels and a warm-up period of 2 months. Use of a 2-month warm-up period was sufficient to minimize the potential effects of poor initial conditions. As a result the simulated stages and discharge were noted to be close to the observed values at most of the observation locations after a couple of weeks of simulation time. The level of accuracy of the initial conditions would have been much more important if hourly data were only available for the storm events and storm verification simulation times were restricted to the actual

period of the events. However, the simulation period was extended 2 to 3 months after the storms of interest to ensure that the flood events have sufficient time to travel through the system.

The simulation period for model validation during tropical storm Jerry is from June 1, 1995 to December 25, 1995. The simulation period for model validation during tropical storm Harvey is from July 1, 1999 to December 25, 1999.

c. Results

Tropical storm Jerry occurred from 23-25 August 1995, the rainfall ranged from 3.75 inches at the RSW airport station to 13.83 inches at the Collier County station (Table A-15). A maximum rainfall intensity of 1.30 in/hr was observed at the Golden Gate at I-75 hourly rainfall station during tropical storm Jerry. A maximum synthetic hourly rainfall rate of 2.33 in/hr was used in the model at the Everglades City daily rainfall station during tropical storm Jerry. Validation plots from the three gage stations are shown on Figures A-96 through A-102 with hourly and daily observation data during tropical storm Jerry. Table A-17 shows the statistical error of the 1995 validation event.

Tropical storm Harvey occurred from 19-21 September 1999, the rainfall ranged from 1.37 inches at the Collier WWTP hourly station to 11.45 inches at the Golden Gate at I-75 station (Table A-16). A maximum rainfall intensity of 1.01 in/hr was observed at the Golden Gate Fire Station rainfall station during tropical storm Harvey. A maximum synthetic hourly rainfall rate of 1.86 in/hr was used in the model at the Immokalee daily rainfall station during tropical storm Harvey. Validation plots from the five gage stations are shown on Figures A-103 through A-112 with hourly and daily observation data during tropical storm Harvey. Table A-18 shows the statistical error of the 1999 validation event.

4. Hydrology of Interior Flooding

These analyses address the management of interior surface runoff from areas that are protected by project levees. The US Army Corps of Engineers Hydrologic Engineering Center Interior Flood Hydrology (HEC-IFH) was utilized for the analyses and design of the interior drainage systems. HEC-IFH is a comprehensive computer program that performs most of the components of an interior flooding analysis. It is a framework on which the analyst can model rainfall-runoff, routing, interior area ponding, and gravity outlet performance as a dynamic simulation integrated with the changing flood conditions of the receiving stream.

Various gravity outlet configurations were analyzed for the 10 year, 25 year and 100 year frequency events and the 10 year exterior flood stage hydrographs for the with-project condition were used as a downstream tailwater boundary condition. Figures A-39 through A-41 show the areas

protected by levee systems for Alternatives 3D, 6 and 12, respectively. A culvert outlet structures will be required for drainage of 3 of the 5 interior area (6L Ranch Levee, Private Lands Levee, and the Port of the Islands (US 41 North) Levees). All culvert structures will be fitted with flap gate controls. The Private Lands Levee system will be supplemented with a small pump station and a detention basin will be required for the interior storm runoff.

5. Tidal Flooding

The SGGE project area can also be flooded by hurricane tides from the Gulf of Mexico. The 100-year base flood elevation north of Tamiami Trail is 7.0 feet National Geodetic Vertical Datum (NGVD) 1929, which is based on the Flood Insurance Study for Collier County by the Federal Emergency Management Agency (FEMA), dated 3 June 1986. Tidal flooding effects were not considered in the analysis. Tidal flood protection was not within the scope of the environmental restoration project.

B. HYDRAULIC DESIGN

1. Hydraulic Design Criteria

The hydraulic design criteria and procedures used herein are in accordance with standard engineering practice and applicable Corps of Engineers manuals, regulations and criteria relative to design and construction for civil works projects. Engineering criteria adopted to meet special local conditions are in accordance with that previously approved for similar projects.

2. Design Objective

The main design objective was to optimize ecosystem restoration through rehydrating historic wetlands without adversely impacting the adjacent private lands with respect to flood control. The 100-year return frequency event was the maximum stage analyzed for Alternatives 3D, 6, and 12 for this project. Takings and Savings Analyses were performed on those alternatives, with respect to the stage and duration comparison to the existing flood protection levels of the project areas and adjacent lands.

3. Project Features for Alternatives

a. Alternative 3D

This alternative is shown on Figure A-39. The primary features of flood control are pump stations and levees. The primary features of environmental restoration are the canal plugs, pump stations and spreader channels.

i. Pump Stations

Three pump stations have been designed to accommodate restoration and flood control to the area to the north of the project area and I-75. This flood control is based on the existing land use of the area, which is primarily residential. These pump stations will be built on the Miller, Faka Union and Merritt canals and will have the flood control capacities of 1250, 2630 and 800 cubic feet per second (cfs), respectively for flood control. The capacities of those pump station were designed to not adversely impact the existing levels of flood protection up to the 100-year 5-day synthetic storm. These pump stations have been optimized to meet the environmental restoration demands of the project area.

A fourth small 100 cfs pump station will be required for interior drainage to the private lands levee system, PL Levee, at the northwest corner of the project. A 6 acre-foot detention basin will be required for sump and drainage collection requirements.

ii. Spreader Channels

Spreader channels will be located immediately downstream of the pump stations. Figure A-113 shows a typical profile drawing of the pump station with the spreader channels. The pumps have been designed to have discharge pipe free fall into the spreader channels, which would act as a plunge pool for energy dissipation and to aerate the water. The discharge waters would then be conveyed overland to the downstream project area. The spreader canals lengths were optimized for restoration pumping rates. For the Miller, Faka Union and Merritt pump stations the spreader canal lengths will be approximately 4500 feet, 7000 feet and 1400 feet, respectively.

iii. Levees

There will be five project levee segments. The first levee system, 6L Levee, will be near the 6L Ranch in Belle Meade. This site was selected due to the existing levee system in place. However, site investigations to the area determined that the existing levee system would be difficult to rehabilitate. Therefore a new levee system will be constructed adjacent to the restored lands and a seepage collection system will be incorporated between the proposed levee and the existing levee. This levee will protect the lands to the west of that levee from the 100-year flooding due to the proposed project.

The second levee system, PL Levee, will protect the private lands on the boundary with Belle Meade at the northwest corner of the project. The levee system will encircle those private lands to protect the area

from the 100 year flooding do to the project. A seepage collection system will be part of the levee system.

The third levee system, 41 N Levee, will be built to protect the private lands on the southern end of the project area, which is just northeast of the FU-1 structure. This area will be encompassed by the proposed levee to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of the levee system.

The fourth and fifth levee systems, 41 W Levee and 41 E Levee, will be built to protect the private lands on the western and eastern banks of the Faka Union Canal just south of US 41 at the Port of the Islands at the southern end of the project area. Those areas will be protected on the backsides with levees to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of these levee systems.

vi. Culverts

Culvert structures are required to provide interior drainage to the protected lands. The 6L Ranch levee has a series of existing culverts through US 41 that allows for the existing drainage to be conveyed downstream and away from the site. However, 6 – 72 inch (in.) corrugated metal pipe (cmp) culverts and 2 – 48 in. culverts with flap gate controls will be require to convey flow on the north side of US 41 (Tamiami Trail) through the 6L Levee. The PL Levee will require 2 – 36 in. cmp culverts with flap gate controls. The 41 N Levee will require 3 – 72 in. culverts with flap gate control at the outfall at the Faka Union Canal and another uncontrolled 3 – 72 in. culvert structure at the entrance into the protected area from US 41. The two levee systems south, 41 W Levee and 41 E Levee, of US 41 adjacent to the Faka Union canal will have a hardened concrete outfall apron to protect against head cutting from the interior drainage ditch discharges.

An additional culvert structure will be required on the southern abutment to connect the east and west borrow canals at I-75. This structure will have 3 - 72 in. cmp with no control. This structure is part of the restoration effort to allow water to flow between the Faka Union Canal and the Miller Canal.

v. Removal of Existing Structures

The Miller-2, FU-3 and Lucky Lake weir structures will be removed. These existing structures are fixed concrete weirs. The Lucky Lake weir has steel plated sluice gates mounted to the crest, which will require additional demolition work.

vi. Removal of Existing Roads

The existing roads within the project area will be removed and degraded to enhance the restoration of sheet flow through the project area. Only the roads to the pump station structures, the private lands levee and the access roads required by the State of Florida Division of Forestry (DOF) for maintenance will remain within the project area.

vii. Canal and Swale Plugs

The existing swales adjacent to the roads and canal within the project area would be filled with plugs. The source material for those plugs would be obtained from the original side cast that exists adjacent to the canals and swales. Additional material for the plugs will be utilized from degrading the roads. It is anticipated that there will not be enough material to completely fill the canals and swales, therefore the plugging was considered the only alternative to enhance sheet flow and flowway restoration.

There approximately 83 canal plugs that are to be placed in the Miller, Merritt, Faka Union and Prairie Canals. The plugs were designed to block conveyance downstream of the pump stations and assist in providing a sheet flow flow regime to that area. The canal plugs also were implemented to assist in elevating the water table along the canals and limit the groundwater drawdown to the adjacent lands.

b. Alternative 6

This alternative is shown on Figure A-40. The primary features of this alternative is road removal and to allow the water to inundate the lower elevation land south of I-75 in the southern region of the SGGE property by plugging canals in that area. This alternative was designed as a passive water management system for flood control and restoration.

i. Pump Stations

A small 100 cfs pump station will be required for interior drainage to the private lands levee system, PL Levee, at the northwest corner of the project. A 6 acre-foot detention basin will be required for sump and drainage collection requirements.

ii. Removal of Existing Roads

The existing roads within the project area will be removed and degraded to enhance the restoration of sheet flow through the project area. Only the roads to the pump station structures, the private lands

levee and the access roads required by the State of Florida Division of Forestry (DOF) for maintenance will remain within the project area.

iii. Canal Plugs

The existing swales adjacent to the roads will be filled with the source material adjacent to those swales. The Miller, Faka Union and Merritt canals below Stewart Blvd. and the Prairie canal will be filled with canal plugs. The source material for those plugs would be obtained from the original side cast that exists adjacent to the canals. Additional material for the canal and swale plugs will be utilized from degrading the roads. It is anticipated that there will not be enough material to completely fill the canals and swales, therefore the plugging was considered the only alternative to enhance sheet flow and flowway restoration.

There approximately 46 canal plugs that are to be placed in the Miller, Merritt, Faka Union and Prairie Canals. The plugs were designed to block conveyance downstream of the pump stations and assist in providing a sheet flow flow regime to that area. The canal plugs also were implemented to assist in elevating the water table along the canals and limit the groundwater drawdown to the adjacent lands.

iv. Levees

There will be five project levee segments. The first levee system, 6L Levee, will be near the 6L Ranch in Belle Meade. This site was selected due to the existing levee system in place. However, site investigations to the area determined that the existing levee system would be difficult to rehabilitate. Therefore a new levee system will be constructed adjacent to the restored lands and a seepage collection system will be incorporated between the proposed levee and the existing levee. This levee will protect the lands to the west of that levee from the 100-year flooding due to the proposed project.

The second levee system, PL Levee, will protect the private lands on the boundary with Belle Meade at the northwest corner of the project. The levee system will encircle those private lands to protect the area from the 100 year flooding do to the project. A seepage collection system will be part of the levee system.

The third levee system, 41 N Levee, will be built to protect the private lands on the southern end of the project area, which is just northeast of the FU-1 structure. This area will be encompassed by the proposed levee to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of the levee system.

The fourth and fifth levee systems, 41 W Levee and 41 E Levee, will be built to protect the private lands on the western and eastern banks of the Faka Union Canal just south of US 41 at the Port of the

Islands at the southern end of the project area. Those areas will be protected on the backsides with levees to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of these levee systems.

v. Culverts

Culvert structures are required to provide interior drainage to the protected lands. The 6L Ranch levee has a series of existing culverts through US 41 that allows for the existing drainage to be conveyed downstream and away from the site. However, 6 – 72 inch (in.) corrugated metal pipe (cmp) culverts and 2 – 48 in. culverts with flap gate controls will be require to convey flow on the north side of US 41 (Tamiami Trail) through the 6L Levee. The PL Levee will require 2 – 36 in. cmp culverts with flap gate controls. The 41 N Levee will require 3 – 72 in. culverts with flap gate control at the outfall at the Faka Union Canal and another uncontrolled 3 – 72 in. culvert structure at the entrance into the protected area from US 41. The two levee systems south, 41 W Levee and 41 E Levee, of US 41 adjacent to the Faka Union canal will have a hardened concrete outfall apron to protect against head cutting from the interior drainage ditch discharges.

An additional culvert structure will be required on the southern abutment to connect the east and west borrow canals at I-75. This structure will have 3 - 72 in. cmp with no control. This structure is part of the restoration effort to allow water to flow between the Faka Union Canal and the Miller Canal.

vi. Removal of Existing Structures

The Miller-1, Miller-2, FU-3 and Lucky Lake weir structures will be removed. These existing structures are fixed concrete weirs. The Lucky Lake weir has steel plated sluice gates mounted to the crest, which will require additional demolition work.

c. Alternative 12

This alternative is shown on Figure A-41. The primary features of flood control are pump stations, Obermeyer weirs and levees. The primary features of environmental restoration are the canal plugs, pump stations, Obermeyer weirs and spreader channels.

i. Pump Stations

Two pump stations have been designed to accommodate restoration and flood control to the area to the north of the project area and I-75. This flood control is based on the existing land use of the area, which is primarily residential. These pump stations will be built on the Faka Union and Merritt canals and will have the flood control capacities of 2000 and

800 cubic feet per second (cfs), respectively for flood control. The capacities of those pump station were designed to not adversely impact the existing levels of flood protection up to the 100-year 5-day synthetic storm. These pump stations have been optimized to meet the environmental restoration demands of the project area.

A third small pump station will assist environmental flow southward at the northern most Obermeyer weir structures to convey flows southward into the restoration area when excess water is available. The capacity of this pump station is 100 cfs.

A fourth small 100 cfs pump station will be required for interior drainage to the private lands levee system, PL Levee, at the northwest corner of the project. A 6 acre-foot detention basin will be required for sump and drainage collection requirements.

ii. Spreader Channels

Spreader channels will be located immediately downstream of the pump stations. Figure A-113 shows a typical profile drawing of the pump station with the spreader channels. The pumps have been designed to have discharge pipe free fall into the spreader channels, which would act as a plunge pool for energy dissipation and to aerate the water. The discharge waters would then be conveyed overland to the downstream project area. The spreader canals lengths were optimized for restoration pumping rates. For the Faka Union and Merritt pump stations the spreader canal lengths will be approximately 7000 feet and 1400 feet, respectively.

iii. Levees

There will be five project levee segments. The first levee system, 6L Levee, will be near the 6L Ranch in Belle Meade. This site was selected due to the existing levee system in place. However, site investigations to the area determined that the existing levee system would be difficult to rehabilitate. Therefore a new levee system will be constructed adjacent to the restored lands and a seepage collection system will be incorporated between the proposed levee and the existing levee. This levee will protect the lands to the west of that levee from the 100-year flooding due to the proposed project.

The second levee system, PL Levee, will protect the private lands on the boundary with Belle Meade at the northwest corner of the project. The levee system will encircle those private lands to protect the area from the 100 year flooding do to the project. A seepage collection system will be part of the levee system.

The third levee system, 41 N Levee, will be built to protect the private lands on the southern end of the project area, which is just northeast of the FU-1 structure. This area will be encompassed by the proposed

levee to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of the levee system.

The fourth and fifth levee systems, 41 W Levee and 41 E Levee, will be built to protect the private lands on the western and eastern banks of the Faka Union Canal just south of US 41 at the Port of the Islands at the southern end of the project area. Those areas will be protected on the backsides with levees to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of these levee systems.

iv. Culverts

Culvert structures are required to provide interior drainage to the protected lands. The 6L Ranch levee has a series of existing culverts through US 41 that allows for the existing drainage to be conveyed downstream and away from the site. However, 6 – 72 inch (in.) corrugated metal pipe (cmp) culverts and 2 – 48 in. culverts with flap gate controls will be require to convey flow on the north side of US 41 (Tamiami Trail) through the 6L Levee. The PL Levee will require 2 – 36 in. cmp culverts with flap gate controls. The 41 N Levee will require 3 – 72 in. culverts with flap gate control at the outfall at the Faka Union Canal and another uncontrolled 3 – 72 in. culvert structure at the entrance into the protected area from US 41. The two levee systems south, 41 W Levee and 41 E Levee, of US 41 adjacent to the Faka Union canal will have a hardened concrete outfall apron to protect against head cutting from the interior drainage ditch discharges.

An additional culvert structure will be required on the southern abutment to connect the east and west borrow canals at I-75. This structure will have 3 - 72 in. cmp with no control. This structure is part of the restoration effort to allow water to flow between the Faka Union Canal and the Miller Canal.

v. Removal of Existing Structures

The Miller-2, FU-3 and Lucky Lake weir structures will be removed. These existing structures are fixed concrete weirs. The Lucky Lake weir has steel plated sluice gates mounted to the crest, which will require additional demolition work.

vi. Removal of Existing Roads

The existing roads within the project area will be removed and degraded to enhance the restoration of sheet flow through the project area. Only the roads to the pump station structures, the private lands levee and the access roads required by the State of Florida Division of Forestry (DOF) for maintenance will remain within the project area.

vii. Canal and Swale Plugs

The existing swales adjacent to the roads and canal within the project area would be filled with plugs. The source material for those plugs would be obtained from the original side cast that exists adjacent to the canals and swales. Additional material for the plugs will be utilized from degrading the roads. It is anticipated that there will not be enough material to completely fill the canals and swales, therefore the plugging was considered the only alternative to enhance sheet flow and flowway restoration

viii. Obermeyer Weirs

Three Obermeyer weir structures will be required on the Miller canal. The locations of these structures were based on the topography for the area. These structures were sited in areas that would most benefit the restoration goal of enhancing sheet flow through the project area. Between these structures water can be pooled and water can be diverted through the existing swales to hydrate the historic flowways. Under flood conditions these structures can be lowered to give full canal conveyance. The crest elevation of this type of structure has the ability to be adjusted from bank to channel invert elevations.

There approximately 64 canal plugs that are to be placed in the Merritt, Faka Union and Prairie Canals. The plugs were designed to block conveyance downstream of the pump stations and assist in providing a sheet flow flow regime to that area. The canal plugs also were implemented to assist in elevating the water table along the canals and limit the groundwater drawdown to the adjacent lands.

C. PERFORMANCE OF ALTERNATIVES

1. Alternative 3D

a. With Project Conditions

The existing flood conditions north of the project area would not be adversely impacted under Alternative 3D for the Takings and Savings Conditions as shown in the stage hydrographs at chainage points (cross sections) 8716, 21799 and 19788 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm (Figures A-119 through A-136 and (Savings) and A-139 – A-156 (Takings)). Figures A-137 through A-138 (Savings) and A-157 through A-158 (Takings) show the stage hydrographs at various locations within the project area under Alternative 3D for the 100-year storm. The flooded areas for the Takings Analysis condition for Alternative 3D are shown in Figures A-163 through A-166 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm, respectively. The flooded areas for the Savings Analysis condition for Alternative 3D are shown in Figures

A-179 through A-182 for the Average Wet Season Maximum, 10-year storm, 25 year storm and 100 year storm, respectively. The flood recession for a 100-year event of would last for more than 30 days. The pump stations would continually pump through the 30+ day period.

This alternative was selected as the recommended plan therefore, more in depth analysis on the interior drainage and the levee protection design was performed on this alternative.

b. Levee Protection Design

Design water surface elevations within the project area are up to and including the 1% chance flood to prevent from overtopping the levees. The levee profiles for all of the levee systems are shown on figures A-114 – A-118. Events that exceed the design capacity are rare but do occur. In the event of a flood greater than the 1% chance flood overtopping the project levees occur. A portion along the proposed levee has a lower crest elevation. Overtopping reaches of all of the levee systems will be designed in the Detailed Design Phase of this project. The overtopping area will be designated in an area to minimize loss of life and property, as well as, serve to provide warning that the design event has been exceeded.

c. Residual Flooding

Runoff from the protected side of the levees would collect in designated ponding areas and discharge to the flood plain through culverts and/or pumps. The culvert drainage structures would be fitted with flap gate controls that would prohibit flow from the flood plain into the protected areas.

The interior drainage was designed for the 25-year storm using HEC-IFH. The interior runoff was calculated using the Soil Conservation Service (SCS) method. For that analysis Curve Numbers (CN) ranged from 70 to 98. Seepage rates were based on the Darcy Equation, where the average horizontal hydraulic conductivity (k_h) was equal to 3.28×10^{-6}. The exterior hydrographs were extracted from the MIKE 11/MIKE SHE model. The residual flooded area are shown on plates A-191 through A-195 for all of the levee system, 6L Levee, PL Levee, 41 N Levee, 41 W Levee and the 41 E Levee.

d. People at Risk

Each levee system primarily protects residential communities. The 6L Levee system does protect some farmlands and residential areas. The 41 N Levee, 41 W Levee and 41 E Levee systems adjacent to the Faka Union Canal protect a water treatment facility, commercial and residential properties. The PL Levee system protects residential properties.

Each levee system will have egress for access and emergency evacuation. It is planned that each levee system will use the following evacuation routes. The levee systems adjacent to the Faka Union Canal should use US 41 to SR 29 for evacuation. The PL Levee should use 52nd Ave. to Everglades Blvd. for evacuation. The 6L levee system should use US 41 to CR 951 for evacuation.

2. Alternative 6

a. With Project Conditions

The existing flood conditions north of the project area would be adversely impacted under Alternative 6 for the Takings and Savings Conditions as shown in the stage hydrographs at chainage points (cross sections) 8716, 21799 and 19788 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm (Figures A-119 through A-136 and (Savings) and A-139 – A-156 (Takings)). Figures A-137 through A-138 (Savings) and A-157 through A-158 (Takings) show the stage hydrographs at various locations within the project area under Alternative 6 for the 100-year storm. The flooded areas for the Takings Analysis Condition Alternative 6 are shown in Figures A-167 through A-170 for the Average Wet Season Maximum, 10-year storm, 25-year storm and 100-year storm, respectively. The flooded areas for the Savings Analysis Condition Alternative 6 are shown in Figures A-183 through A-186 for the Average Wet Season Maximum, 10-year storm, 25-year storm and 100-year storm, respectively. The flood recession for a 100-year event of would last for more than 30 days.

This alternative was not analyzed for further in depth analysis on the interior drainage and the levee protection design was performed on this alternative.

b. Levee Protection Design

Levee protection was not fully developed or designed for this alternative because it was not selected as the recommended plan.

c. Residual Flooding

The residual flooding analysis was not fully analyzed or designed for this alternative because it was not selected as the recommended plan.

d. People at Risk

Each levee system primarily protects residential communities. The 6L Levee system does protect some farmlands and residential

areas. The 41 N Levee, 41 W Levee and 41 E Levee systems adjacent to the Faka Union Canal protect a water treatment facility, commercial and residential properties. The PL Levee system protects residential properties.

Each levee system will have egress for access and emergency evacuation. It is planned that each levee system will use the following evacuation routes. The levee systems adjacent to the Faka Union Canal should use US 41 to SR 29 for evacuation. The PL Levee should use 52nd Ave. to Everglades Blvd. for evacuation. The 6L levee system should use US 41 to CR 951 for evacuation.

3. Alternative 12

a. With Project Conditions

The existing flood condition north of the project area may be adversely impacted under Alternative 12 for the Takings and Savings Conditions as shown in the stage hydrographs at chainage points (cross sections) 8716, 21799 and 19788 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm (Figures A-119 through A-136 and (Savings) and A-139 – A-156 (Takings)). Figures A-137 through A-138 (Savings) and A-157 through A-158 (Takings) show the stage hydrographs at various locations within the project area under Alternative 12 for the 100-year storm. The flooded areas for the Takings Analysis condition Alternative 12 are shown in Figures A-171 through A-174 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm, respectively. The flooded areas for the Savings Analysis condition Alternative 12 are shown in Figures A-187 through A-190 for the Average Wet Season Maximum, 10 year storm, 25 year storm and 100 year storm, respectively. The flood recession for a 100-year event of would last for more than 30 days. The pump stations would continually pump through the 30+ day period.

This alternative was not analyzed for further in depth analysis on the interior drainage and the levee protection design was performed on this alternative.

b. Levee Protection Design

Levee protection was not fully developed or designed for this alternative because it was not selected as the recommended plan.

c. Residual Flooding

The residual flooding analysis was not fully analyzed or designed for this alternative because it was not selected as the recommended plan.

d. People at Risk

Each levee system primarily protects residential communities. The 6L Levee system does protect some farmlands and residential areas. The 41 N Levee, 41 W Levee and 41 E Levee systems adjacent to the Faka Union Canal protect a water treatment facility, commercial and residential properties. The PL Levee system protects residential properties.

Each levee system will have egress for access and emergency evacuation. It is planned that each levee system will use the following evacuation routes. The levee systems adjacent to the Faka Union Canal should use US 41 to SR 29 for evacuation. The PL Levee should use 52nd Ave. to Everglades Blvd. for evacuation. The 6L levee system should use US 41 to CR 951 for evacuation.

VII. DRAFT OPERATING MANUAL

This Draft Operating Manual is for the recommended plan, Alternative 3D. It describes the proposed operating criteria for structures located in the Southern Golden Gate Estates area and Picayune Strand Project vicinity. All elevations referenced in this Draft Operating Manual are from the 1988 North American Vertical Datum (NAVD 88) unless otherwise stated.

A. INTRODUCTION

This Draft Operating Manual focuses on how this project will function during the operational testing and monitoring phase. This Draft Operating Manual may be modified during the Pre-construction and Detailed Design Phase, as appropriate. This plan includes the flexibility to make incremental changes to the proposed operating criteria throughout the operational testing and monitoring phase to achieve the desired project benefits while maintaining the existing level of flood protection in the NGGE.

The Programmatic Regulations for the Comprehensive Everglades Restoration Plan require that the Operating Manual be consistent with the water reservations or allocations and savings clause provision described in the Project Implementation Report (PIR) and the Project Cooperation Agreement (PCA). This manual was developed based on the hydrologic model used in the Project Assurances Analysis found in Section 12 of the PIR. Structural operations in this manual are based on the hydrologic modeling results for selected plan Alternative 3D. In the development of this manual, the project operators and water managers worked with the hydrologic modelers to develop operating criteria that reflected the intent of the operations represented in the hydrologic model.

This project consists of constructing several project features, including a combination of spreader channels, canal plugs, flow impediment removal, pump stations, levees, culverts and weir structures in the Western

Basin and Big Cypress, Collier County, south of Interstate (I-75) and north of US 41 between the Belle Meade Area and the Fakahatchee Strand State Preserve.

B. GENERAL OBJECTIVES

The purpose of this project is to restore and enhance the wetlands in Golden Gate Estates through enhanced surface water and groundwater flow, re-establish a wetland hydroperiod for the area, re-establish historic sheet flow patterns, and reduce the amount of freshwater discharge at the outlet of the Southern Golden Gate Estate to the downstream estuaries while maintaining the existing level of flood protection in NGGE, and North and South Belle Meade.

Restoration of hydrology will restore vegetation communities, wildlife populations, protected species populations, and the downstream estuary condition to a more historic state. Implementation of the restoration plan will also benefit the water quality of downstream coastal estuaries by moderating the large salinity fluctuations caused by freshwater point discharge of the Faka Union Canal. The plan would also aid in protecting the city of Naples' Eastern Golden Gate well field by improving groundwater recharge.

C. PROJECT FEATURES

1. Existing Project Features

Within the project area there are four basin canals, 8 water control structures and a series of existing culverts. The four basin canals are the Miller, Faka Union, Merritt and Prairie Canals. The eight water control structures are weir structures consisting of 4 various types, 3 fixed crest weirs with operable gates, 2 fixed crest weirs with V-notches, 2 fixed crest weirs with stop logs and 1 fixed crest weir. The purpose of the weir structures is to prevent over drainage. These existing weir structures in SGGE are Miller 2, FU-3, Lucky Lake, Prairie 1, Merritt 1, FU-2, Miller 1 and FU-1.

The series of existing culverts are located in the 6L Ranch levee through US 41 and allows for the existing drainage to be conveyed downstream and away from the site.

2. Proposed Project Features

Recommended plan, Alternative 3D, project features include four pump stations, three spreader channels, 83 canal plugs (Figure A-39), fifteen 72 inch (in.), corrugated metal pipe (CMP) culverts, two 48 in. CMP culverts, two 36 in. CMP culverts and two hardened concrete outfall aprons.

The three spreader channels will be located immediately downstream of each pump station located on the Miller, Faka Union and Merritt Canals, respectively. The purpose of the spreader channels shown on Figures A-39 and A-113) is to act as plunge pools for energy dissipation and to aerate the water discharging from the pump stations. They

will also redirect the water from flowing southward within the canals to east and west direction perpendicular to the canals. As the water rises within the spreader channel, the water would overtop the southern, downstream bank of the channel and then flow over the land as sheet flow.

Three of the four pump stations will be located in the Miller, Faka Union and Merritt Canals south of existing structures Miller 2, FU-3 and Lucky Lake, respectively. The capacities of the pump stations, 1250 cubic feet per second (cfs) at the Miller Canal, 2630 cfs at the Faka Union Canal and 800 cfs at the Merritt Canal, were designed to be large enough so that the spreader channels and other construction features would not reduce the drainage of NGGE that is provided by the canals. The fourth pump station will be located at the southeast corner of the Private Lands area in the Private Lands Levee (PL Levee). This Private Lands area pump station will be used to discharge seepage from the PL Levee borrow canal and for flood control purposes.

Existing structures Miller 2, FU-3 and Lucky Lake will be removed. Existing structures Miller 1, FU-2, Merritt 1 and Prairie 1 will remain as non-functional structures. FU-1, an existing weir located south of the SGGE Project will remain as a salt-water barrier and serve as the outflow structure for the SGGE Project.

Six 72 in. corrugated metal pipe culverts and two 48 in. culverts with flap gate controls will convey flow on the north side of US 41 (Tamiami Trail) through the 6L Levee. Two 36 in. cmp culverts with flap gate controls will allow flow through the PL Levee. Three 72 in. culverts with flap gate control will be installed at the outfall at the Faka Union Canal. Three uncontrolled 72 in. culvert structures will be installed at the 41 N Levee and another at the entrance into the protected area from US 41. Three 72 in. cmp uncontrolled culvert structure will be installed on the southern abutment to connect the east and west borrow canals at I-75. This structure is part of the restoration effort and will allow water to flow between the Faka Union Canal and the Miller Canal.

The two levee systems south, 41 W Levee and 41 E Levee, of US 41 adjacent to the Faka Union canal will have a hardened concrete outfall apron to protect against head cutting from the interior drainage ditch discharges.

D. MAJOR CONSTRAINTS

1. Flood Protection

Structural flood protection in the NGGE includes the SGGE canals, which are the Miller, Faka Union, and Merritt canals. The existing infrastructure of drainage systems was never intended to totally eliminate flooding in developed area. While flood protection is not the primary intent of this project, the evaluation of project features and operations does

include the analysis of those improvements and their effects on the existing level of flood protection. The project will not adversely impact the existing level of protection, and although it was not a specific goal of the study to increase the level of protection, some ancillary benefits may be achieved. This constraint strongly influenced the features in the restoration alternatives.

2. Storm Events

Hurricane and tropical storm events can occur in the Project area, resulting in tidal flooding and storm surge from the Gulf of Mexico. The 100-year base flood elevation north of Tamiami Trail is 7.0 feet Nation Geodetic Vertical Datum (NGVD) 1929, which is based on the Flood Insurance Study for Collier County by the Federal Emergency Management Agency (FEMA), dated 3 June 1986. During hurricane and tropical storm events storm surges and tidal flooding may reduce the discharge capacity of the SGGE Project due to increased stages downstream of structure FU-1.

3. Availability of Flow from NGGE

The SGGE Project is dependent on flow from NGGE to achieve project objectives. NGGE flows will extend the hydroperiods in the SGGE Project area. In addition, flow fro NGGE on a seasonal basis will affect groundwater recharge in the SGGE Project area. Operations for existing structures may need to be revised to allow for SGGE Project objectives. These revised operations have not been identified at this point and are not included in this manual.

E. OVERALL PLAN FOR WATER MANAGEMENT

The SGGE project conveys water from NGGE to SGGE through Miller, Faka Union, Merritt Canals, and Prairie Canal. The water is then pumped into spreader channels (Figure A-113) that will act as plunge pools for energy dissipation and to aerate the water discharging from the pump stations. These spreader channels will also redirect the water from flowing southward within the canals to east and west directions perpendicular to the canals. As the water rises within the spreader channel, the water would overtop the southern, downstream bank of the channel and then flow over the land southward as sheet flow. As water flows south it will encounter the 83 canal plugs strategically placed throughout the Miller Faka Union, Merritt and Prairie Canals and will spread as sheet flow toward structure FU-1 at the southern extent of the Project. The pump stations on the Miller, Faka Union and Merritt Canals will be used to maintain optimum canal stages upstream of the pump station (Table A-19) maintaining the existing levels of flood protection in NGGE residential areas. The term “optimum” refers to the water levels associated with water management operations resulting from extensive modeling that includes the Big

Cypress Basin Manual of Water Control Structures dated July 2000 (Table A-5). This operations plan was written for the recommended plan shown on Figure A-39.

The Miller Canal is located on the western extent of the project area approximately 2 miles west of the Faka Union Canal and is used to convey NGGE basin and SGGE basin runoff to the south. The Miller Canal runs south from the NGGE area north of I-75 into SGGE and approximately 11 miles south of I-75. The Miller Canal then runs east approximately 2 miles and terminates at the Faka Union Canal. The Miller Canal will contain approximately twenty-six canal plugs used to retard and spread waters, creating an overland flow regime. Existing structures Miller 2 will be removed and Miller 1 will be non functional. An optimum stage of 7.2 will be maintained upstream of the Miller Canal pump station in the Miller Canal during the dry season and an optimum stage of 4.9 will be maintained upstream of the Miller Canal pump station during the wet season. The Miller Canal pump station is located on Miller Canal approximately 2.9 miles south of I-75 and will be used to regulate the stages in the Miller Canal.

The Faka Union Canal runs south from the NGGE area north of I-75 into SGGE and approximately 11 miles south of I-75. The Faka Union Canal then runs east approximately 1 mile and south again, terminating at structure FU-1. The Faka Union Canal will contain approximately eighteen canal plugs used to retard and spread waters, creating an overland flow regime. Existing structure FU-3 will be removed and existing structure FU-2 will be non functional. Existing structure FU-1 will remain functional as a saltwater barrier at the southern extent of the project. An optimum stage of 7.2 will be maintained upstream of the Faka Union Canal pump station in the Faka Union Canal during the dry season and an optimum stage of 4.9 will be maintained upstream of the Faka Union Canal pump station during the wet season. The Faka Union Canal pump station is located on Faka Union Canal approximately 2.9 miles south of I-75 and will be used to regulate the stages in the Faka Union Canal.

The Merritt Canal runs south from I-75 approximately 11 miles then runs west approximately 1 mile and terminates at Faka Union Canal. The Merritt Canal will contain approximately twenty-three canal plugs used to retard and spread waters, creating an overland flow regime. Existing structure Lucky Lake will be removed and existing structure Merritt 1 will remain as non functional. An optimum stage of 8.0 will be maintained upstream of the Merritt Canal pump station in the Merritt Canal during the dry season and an optimum stage of 5.2 will be maintained upstream of the Merritt Canal pump station during the wet season. The Merritt Canal pump station is located on Merritt Canal approximately 1.5 miles south of I-75 and will be used to regulate the stages in the Merritt Canal.

The Prairie Canal begins approximately 1.7 miles south of I-75 and runs south approximately 7 miles then runs west approximately 1.1 miles then

south approximately 1.1 miles then west approximately 1 mile and terminates at Merritt Canal. The Prairie Canal will contain approximately sixteen canal plugs used to retard and spread waters, creating an overland flow regime. Existing structure Prairie 1 will remain as non-functional. Stages in the Prairie Canal will remain unregulated.

F. STANDING INSTRUCTIONS TO PROJECT OPERATORS

Once the operational testing and monitoring phase of components of the SGGE Project has been completed, the SFWMD Big Cypress Basin will be responsible for day-to-day water management operations. The SGGE Project is a system of conveyance canals designed to benefit the project area, while maintaining existing flood control. The canal pump stations are operated to maintain optimum stages in canals. The optimum stage essentially represents the regulation of the project for the planned purposes. The optimum levels were derived from extensive modeling based on the Big Cypress Basin Manual of Water Control Structures dated July 2000 (Table A-5). The optimum stages in this manual were analyzed for their effect on flood control, low water regulation, seepage, and fish and wildlife. The minimum levels are set to maintain flood control and enhance conditions within the project area.

During normal conditions the project structures shall be operated in accordance with the approved Operating Manual (Draft and Project) and in accordance with the structure design criteria. Optimum elevations in the plan shall be followed. Deviation from the normal operations will be permitted only under emergency conditions or prior approval.

G. FLOOD DAMAGE REDUCTION

1. Normal Operations

The Miller Canal pump station is a five bay pump station with four 125 cfs pumps and two 375 cfs pumps. The total pumping capacity of the Miller Canal pump station is 1250 cfs. The pump station was modeled with a phased pumping rate based on the surface water elevation at a water stage recorder gage (upstream gage) located at I-75, approximately 3.0 miles upstream of the pump. Pumping rates at the Miller Canal pump station shall be increased incrementally as needed to maintain optimum stages in the canal. During the wet season, pumping at the Miller Canal pump station shall commence when stages at the upstream gage exceed 4.9 feet and terminate when stages at the upstream gage recede to 4.9 feet. During the dry season, pumping at the Miller Canal pump station shall commence when stages at the upstream gage recede to 7.2 feet. A summary of operations for the Miller Canal pump station is shown on Table A-20.

The Faka Union pump station is an eight bay pump station comprised of four 470 cfs pumps, two 250 cfs pumps and two 125

cfs pumps. The total pumping capacity of the Faka Union pump station is 2630 cfs. The pump station was modeled with a phased pumping rate based on the surface water elevation at the upstream gage located at I-75, approximately 2.9 miles upstream of the pump. Pumping rates at Faka Union Canal pump station shall be increased incrementally as needed to maintain optimum stages in the canal. During the wet season, pumping at the Faka Union Canal pump station shall commence when stages at the upstream gage exceed 4.9 feet and terminate when stages at the upstream gage recede to 4.9 feet. During the dry season, pumping at the Faka Union Canal pump station shall commence when stages at the upstream gage exceed 7.2 feet and terminate when stages at the upstream gage recede to 7.2 feet. A summary of operations for the Faka Union Canal pump station is shown on Table A-20.

The Merritt Canal pump station is a two bay pump station comprised of two 80 cfs pumps and three 213 cfs pumps. The total pumping capacity of the Merritt Canal pump station is 800 cfs. The pump station was modeled with a phased pumping rate based on the surface water elevation at an upstream gage located at I-75, approximately 1.5 miles upstream of the pump. Pumping rates at Merritt Canal pump station shall be increased incrementally as needed to maintain optimum stages in the canal. During the wet season, pumping at the Merritt Canal pump station shall commence when stages at the upstream gage exceed to 5.2 feet and terminate when stages at the upstream gage recede to 5.2 feet. During the dry season, pumping at the Merritt Canal pump station shall commence when stages at the upstream gage exceed 8.0 feet and terminate when stages at the upstream gage recede to 8.0 feet. A summary of operations for the Merritt Canal pump station is shown on Table A-20.

The PL Levee system interior drainage pump station is located on the southeast corner of the Private Lands Area. The pump station is comprised of two 50 cfs pumps, one for seepage and one for flood control. The PL Levee system interior drainage pump station was modeled to operate based on the surface water elevations in the levee borrow canal. Pumping at the PL Levee system interior drainage pump station shall commence, for purposes of seepage control, at a rate of 50 cfs when stages in the levee borrow canal exceed 7.8 feet. When stages in the levee borrow canal exceed 8.5 feet the pumping rate shall be increased to a rate of 100 cfs, for purposes of flood control. When stages in the levee borrow canal recede below 8.5 feet the pumping rate shall be decreased to 50 cfs. When stages in the levee borrow canal recede below 7.8 feet pumping shall cease. A summary of pump operations for the PL Levee interior drainage pump is shown on Table A-21.

No pumping shall occur at those pump stations beyond what is shown except by approved deviation as noted in the Deviation From Normal Regulation section of this Manual.

Existing structure FU-4 is a fixed crest weir with operable steel gates. The structure is located approximately 600 feet south

of the easterly terminus of 16th Avenue SE, east of Everglades Boulevard in Golden Gate Estates. This structure prevents over drainage from the northern Faka Union Canal basin and provides groundwater recharge to the City of Naples eastern Golden Gate Estates well field. This structure will be modified and relocated approximately 2000 feet south near the terminus of 20th Ave SE and the Faka Union Canal. This structure will be an automated gated, spillway with six vertical roller gates. Each gate will be 10 feet tall and 13.3 feet wide. Each gate will operate independently as needed to maintain the target water stages upstream of the proposed structure (FU-4 New). During the dry season, surface water upstream of FU-4 New will be maintained at an optimum stage of 11.4 to 12.2 feet. During the wet season, surface water upstream of FU-4 New will be maintained at an optimum stage of 11.3 feet. During the dry season gates on FU-4 New shall be opened when stages rise above 12.2 feet and close when stages recede to 11.4 feet or below. During the wet season gates on FU-4 New shall be opened when stages rise above 11.3 feet and closed when stages recede below or are equal to 11.3 feet. A summary of FU-4 New gate operation is shown in Table A-22.

2. Hurricane or Tropical Storm Operations

Water management operations within the SGGE Project area for hurricanes or tropical storms should follow the SFWMD BCB's Emergency Preparedness Manual – Suggested Hurricane Operating Procedures, April 2004. Pre-storm canal drawdowns for the SGGE project may be conducted in conjunction with hurricane and tropical storm operations as described in the Pre-storm Canal Drawdown section of this Manual.

H. PRE-STORM CANAL DRAWDOWN

The hurricane season is from 1 June through 30 November. When there are tropical depressions, tropical storms, and or hurricanes in the Atlantic/Caribbean Basin or Gulf Cost of Florida, the National Hurricane Center (NHC) issues tropical cyclone public advisories, forecast advisories, forecast discussions, and strike probability forecasts. The maximum strike forecast probabilities are 10-15% at 72 hours, 20-25% at 48 hours, 25-35% at 36 hours, 40-45% at 24 hours, and 74-85% at 12 hours.

Pre-storm canal drawdowns may be initiated based upon these NHC products and conditions within the SGGE and NGGE basins. Pre-storm canal drawdown operations should cease once the stage at the upstream control gage of corresponding pump station(s) has reached 0.5 below the optimum stage.

Additional operational guidance for pre-storm drawdown procedures will be provided in the Draft Operating Manual for Operations During Construction and in the Project Operating Manual. The pre-storm drawdown procedures and operational criteria in this Draft Operating Manual are subject to change.

I. CONSISTENCY WITH WATER RESERVATION OR ALLOCATION AND SAVINGS CLAUSE PROVISIONS

This Draft Operating Manual will be consistent with the water reservations or allocations of water and the savings clause provision described in the PIR and the PCA.

This Draft Operating Manual was developed based on the hydrologic model used in the Project Assurances analysis found in Section 12 of the PIR. The project operators and water managers coordinated with the hydrologic modelers to develop operating criteria that reflected the intent of the operations represented in the hydrologic model.

J. WATER QUALITY

The SGGE Project does not have specific water management operations for the purpose of improving water quality. However, an important goal of the project is to improve water quality in the receiving waters of the Ten Thousand Islands Estuary downstream of the SGGE Project, by reducing shock loads of freshwater discharges. This project will reduce freshwater point discharges, and enhance the salinity balance in the Faka Union Bay and nearby estuaries.

K. RECREATION

SGGE Project water management operations do not include operations specifically for the benefit of recreational activities within the Project area.

L. FISH AND WILDLIFE

Other than maintaining optimum canal levels, the SGGE Project does not have specific water management operations to enhance fish and wildlife species. Typical operation of the SGGE Project will provide an enhancement of hydroperiods in the SGGE Project area. The enhanced hydroperiod in their habitat will benefit indigenous animal and plant species as well as assist in the prevention of exotic plant species. Structure operating guidelines currently followed in the project area for manatee protection will be implemented at all relevant structures of the SGGE Project.

M. DROUGHT CONTINGENCY PLAN

The SFWMD Big Cypress Basin drought procedures will be referred to for operations during drought events. The Drought Contingency Plan for the SGGE Project is the Lower West Coast Water Supply Plan, SFWMD, dated April 2000.

N. DEVIATION FROM NORMAL REGULATION

The Jacksonville Corps of Engineers District Engineer may be requested to deviate from the normal regulation procedures for water control structures and canals of the SGGE Project. This request is normally received from the South Florida Water Management District Big Cypress Basin and will be coordinated with appropriate Federal, State, and local agencies. Approval for a deviation is to be obtained from the South Atlantic Division (SAD) of the Corps of Engineers except as noted below. Deviation requests usually fall into the following categories.

1. Emergencies

Some emergencies that can be expected are drowning and other accidents, failure of operation facilities, fire control, and flushing or containment of pollution. Necessary action under emergency conditions is taken immediately unless such action would create equal or worse conditions. The Jacksonville District of the Corps of Engineers shall be informed as soon as practicable. A written confirmation showing the deviation and conditions will be furnished to SAD after the incident.

2. Unplanned Minor Deviations

There are unplanned instances that create a temporary need for minor deviation from normal regulation of the canals, although they are not considered emergencies. Changes in water control structure releases are sometimes necessary for maintenance and inspection. Requests for release rate changes are generally for a few hours or a few days. Each request is analyzed on its own merits. Consideration is given to upstream watershed conditions, potential flood threat and possible alternative measures. In the interest of maintaining good public relations, the requests are complied with, providing there are no adverse effects on the overall regulation of the project for the authorized purposes. Approval for these minor deviations will normally be obtained from SAD by telephone. A written confirmation showing the deviation will be furnished to SAD.

3. Planned Deviations

Each condition will be analyzed on its own merits. Sufficient data on flood potential, groundwater effects, watershed conditions, possible alternative measures, benefits to be expected, and probable effects on other authorized and useful purposes will be presented by letter, telephone, or electronic mail to SAD along with recommendations for review and approval.

O. SEEPAGE CONTROL

A levee borrow canal will be constructed around the interior of the Private Lands levee to control seepage from this feature. The Private Lands

levee system interior drainage pump station is located on the southeast corner of the Private Lands Area. The pump station is comprised of two 50 cfs pumps, one for seepage and one for flood control. The Private Lands levee system interior drainage pump station was modeled to operate based on the surface water elevations in the levee borrow canal.

Pumping at the Private Lands levee system interior drainage pump station shall commence, for purposes of seepage control, at a rate of 50 cfs when stages in the levee borrow canal exceed 7.8 feet. Pumping shall continue at a minimum rate of 50 cfs until stages in the levee borrow canal recede below 7.8 feet.

P. WATER CONTROL DATA ACQUISITION SYSTEM PLAN

For the SGGE Project, all operable water control structures will be equipped with remote automation components and operated by use of a remote telemetry system. The automation components of all the structures will eventually be operated and maintained by the SFWMD Big Cypress Basin and must conform to SFWMD standards. Equipment used in data acquisition essential to the water control management function will be included in the Water Control Data Acquisition System Plan. This includes all hardware and software to be used for acquisition, transmission, processing, display, and dissemination of hydrologic, meteorological, water quality, and project data for the purpose of supporting the water control mission. For the SGGE Project this includes, but is not limited to, uninterruptible power supplies, field data collection platforms, and data communication devices and circuits.

The Water Control Data Acquisition System Plan will also identify site location of all hardware included within the plan. Hardware siting will be determined through coordination with appropriate agencies including the U.S. Geological Survey and the Big Cypress Basin. The Water Control Data Acquisition System Plan will be completed during the Plans and Specifications phase and will be a subset of the Water Control Data System that is specific to the SGGE Project.

Southern Golden Gate Estates Hydrologic Restoration Study Area

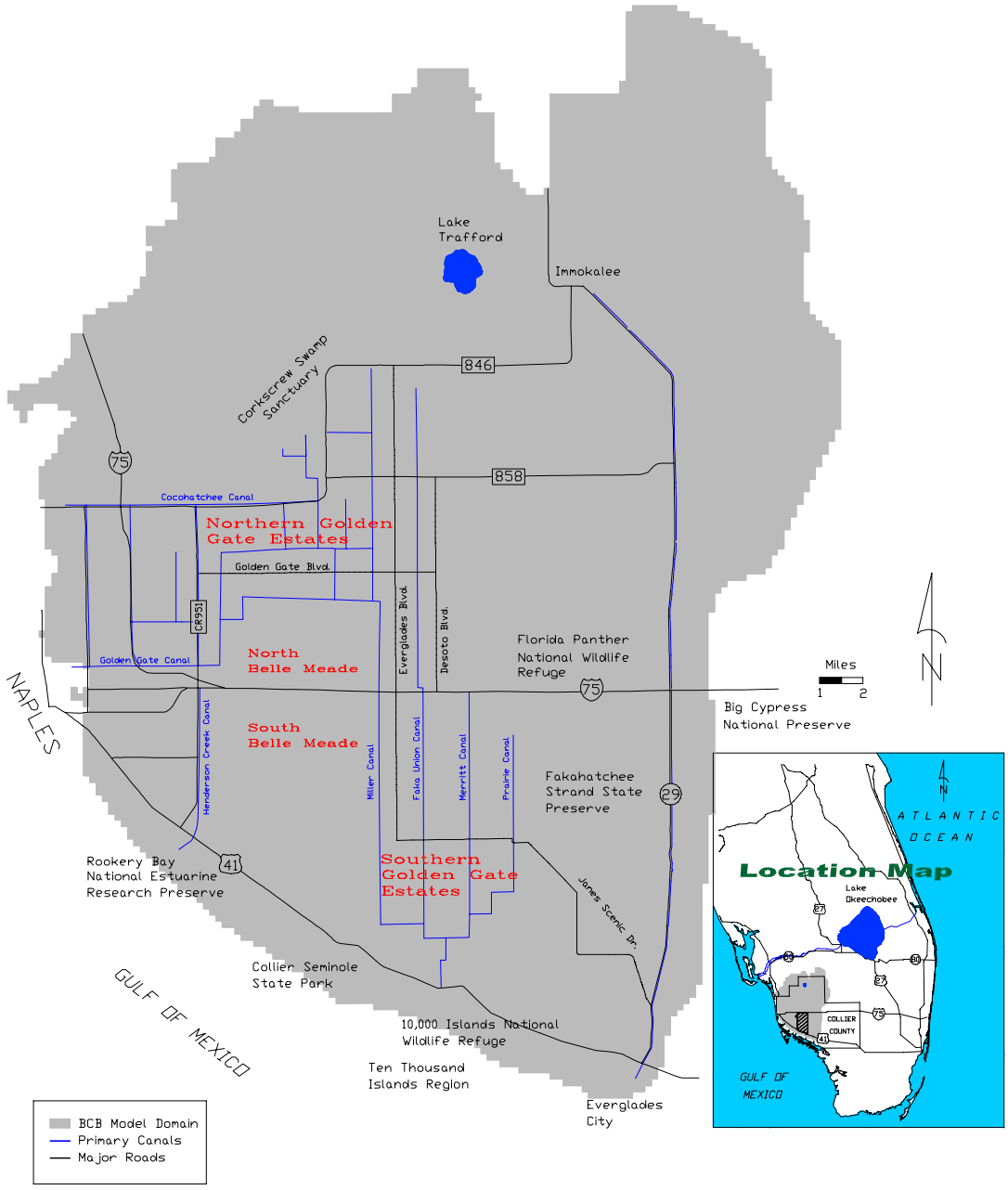

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Figure A-1

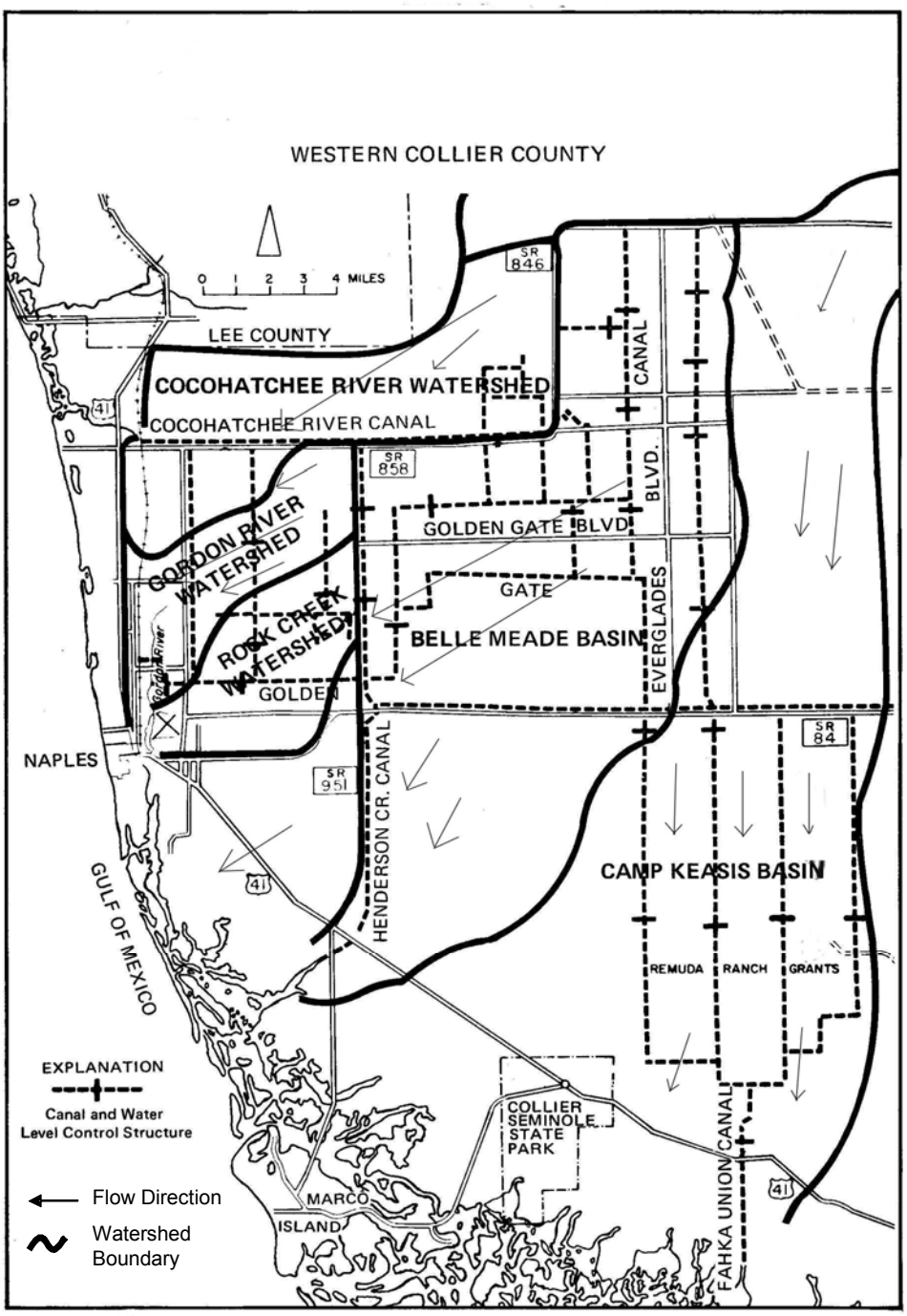

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Figure A-2

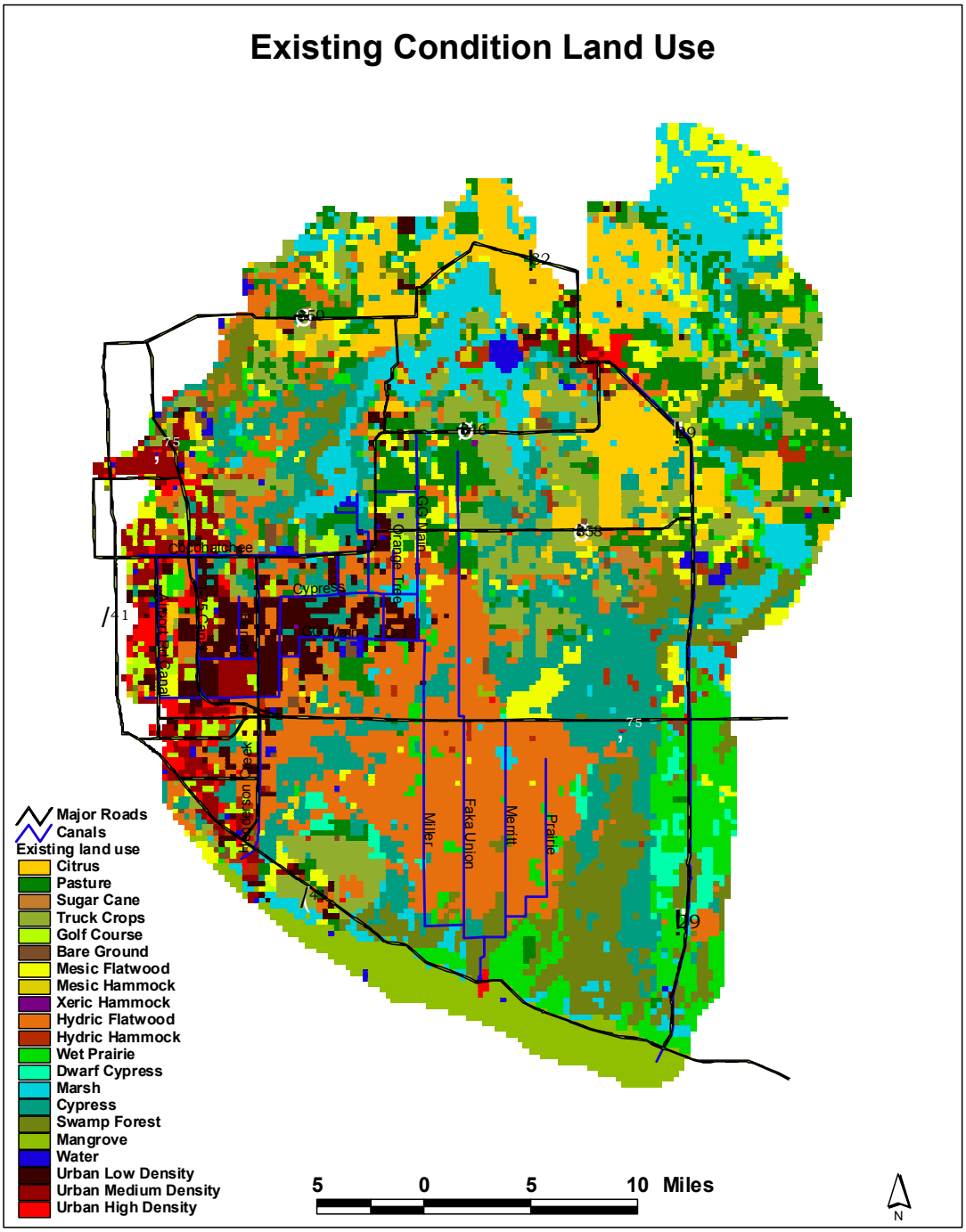

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Figure A-3

BCB Regional Model Boundary and

Area of Interest

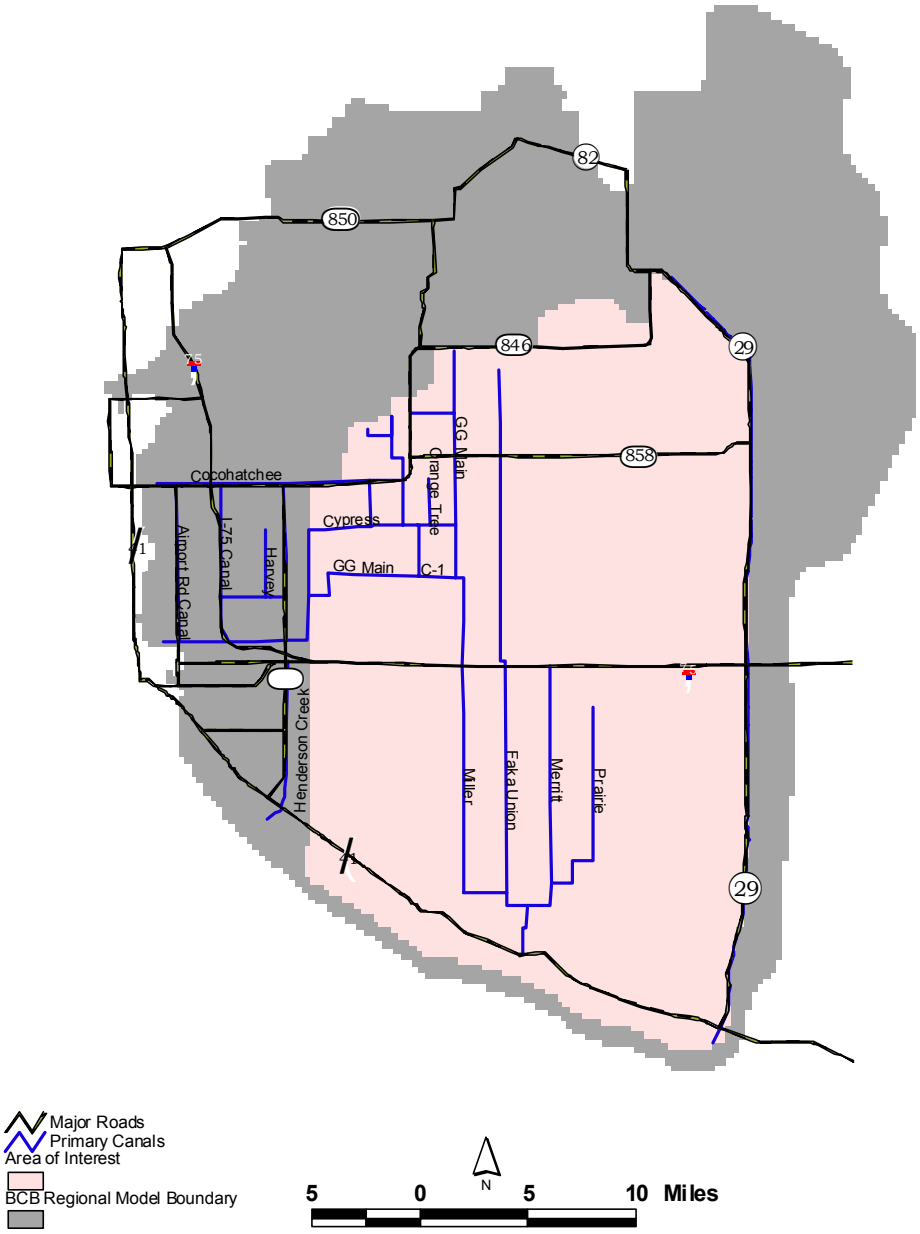

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Figure A-4

Rainfall and Evaporation Stations

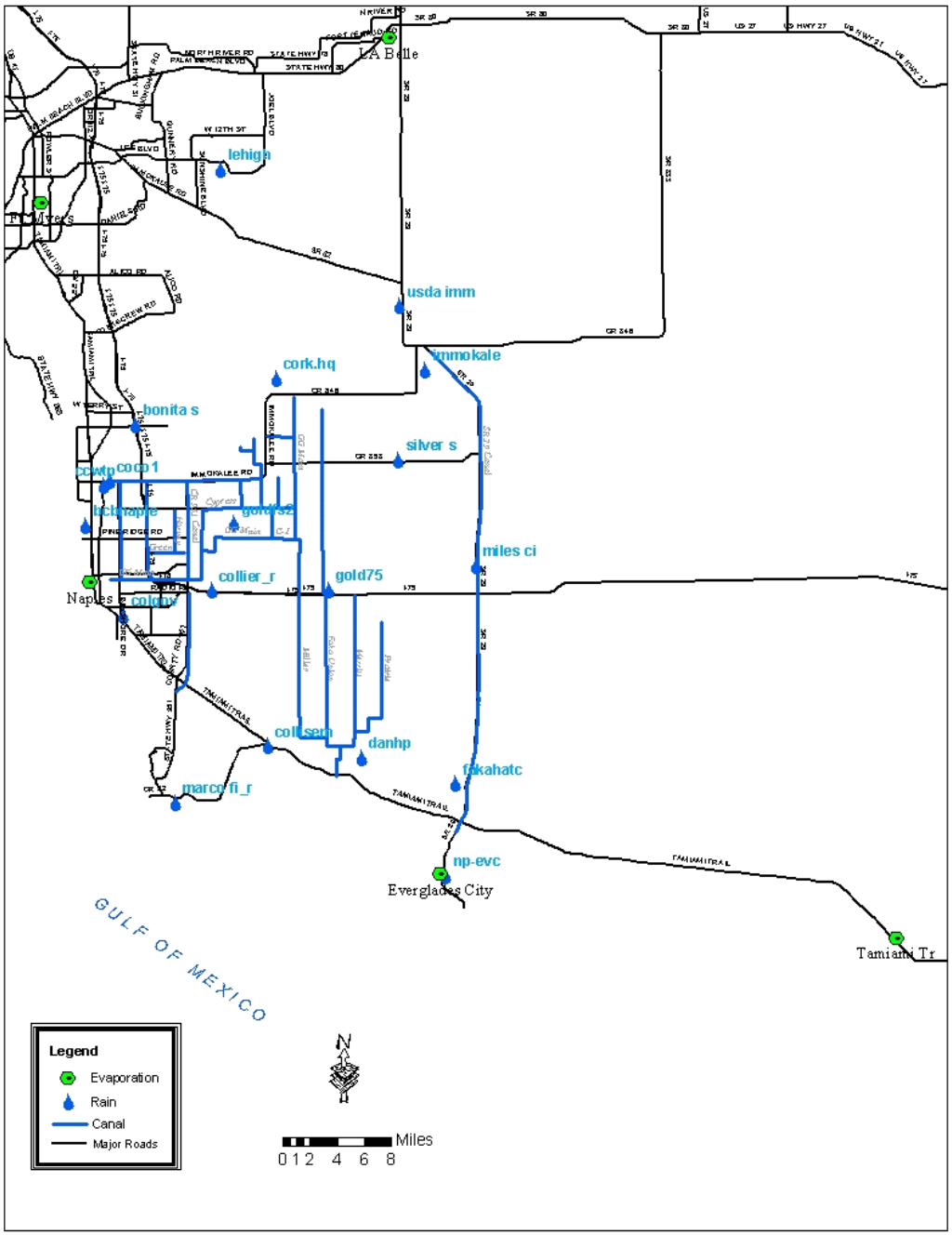

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Figure A-5

Spatial Distribution of Rainfall using TIN-10

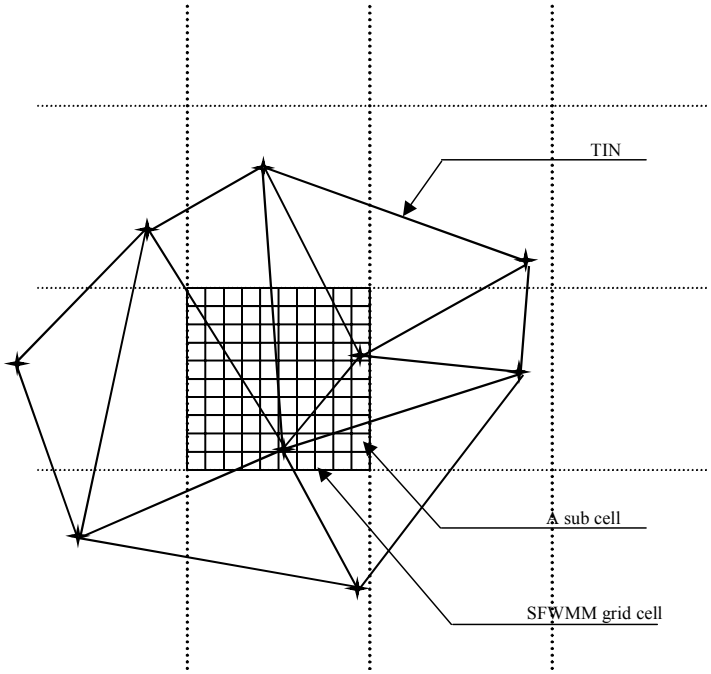

Figure A-6

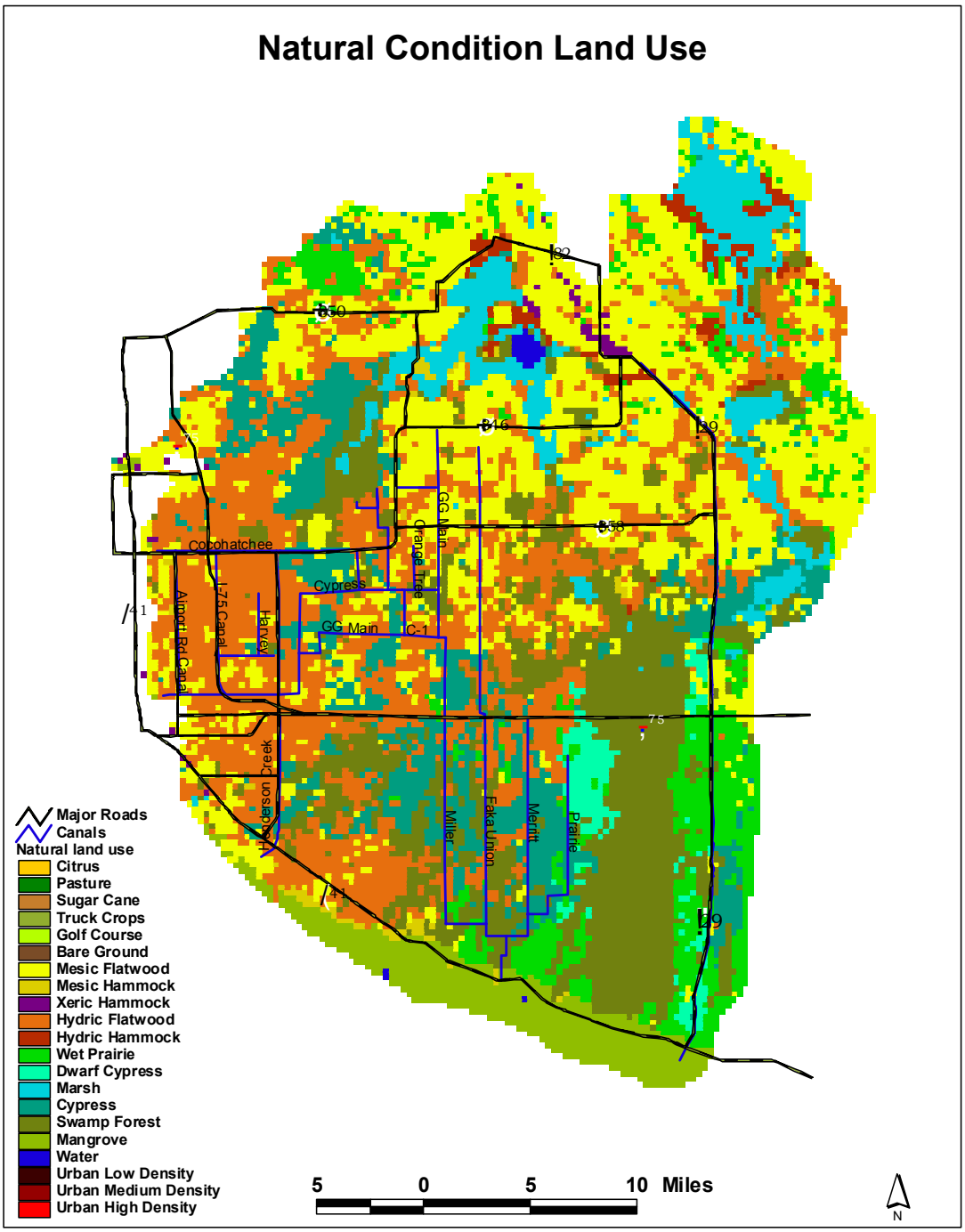

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Figure A-7

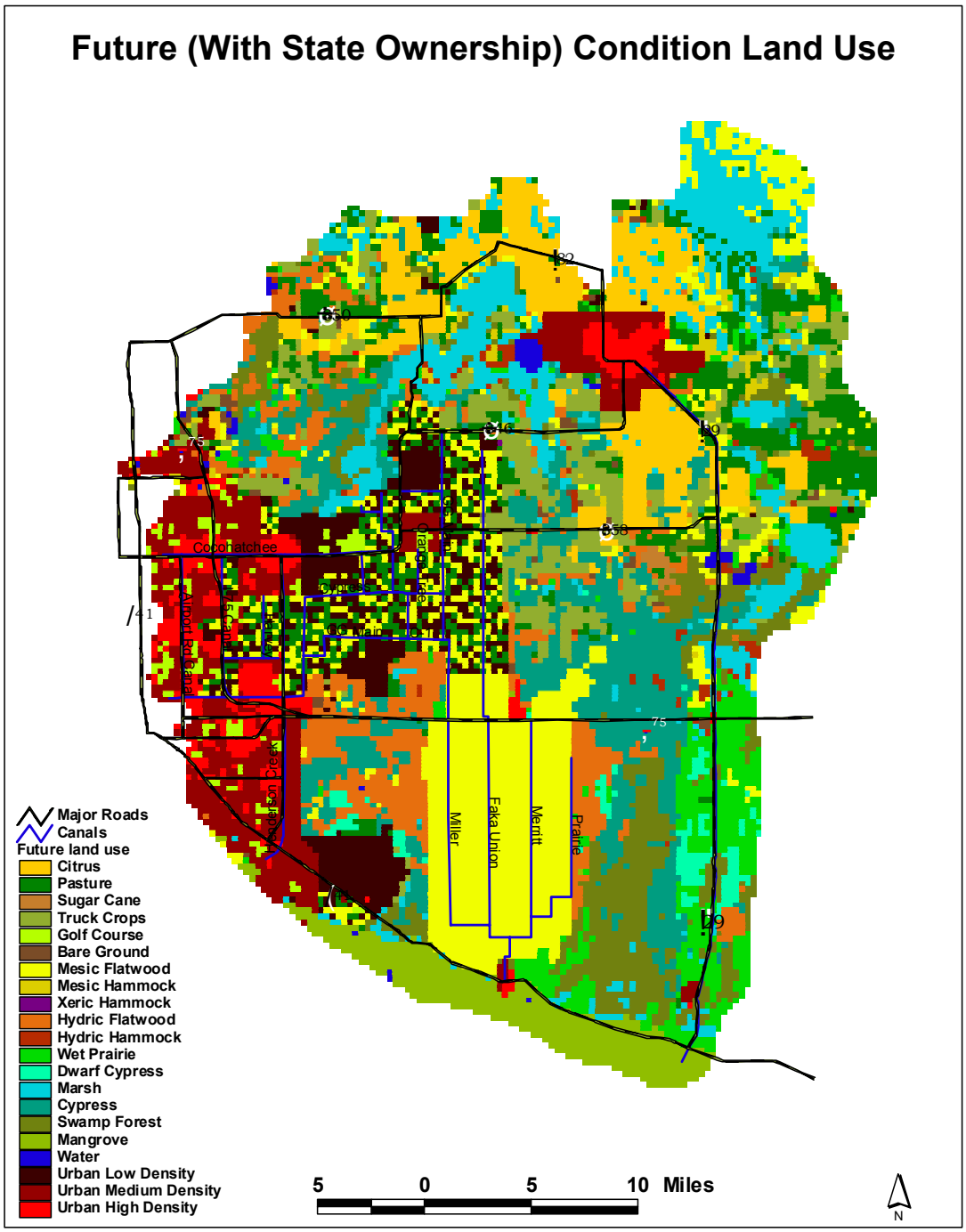

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Figure A-8

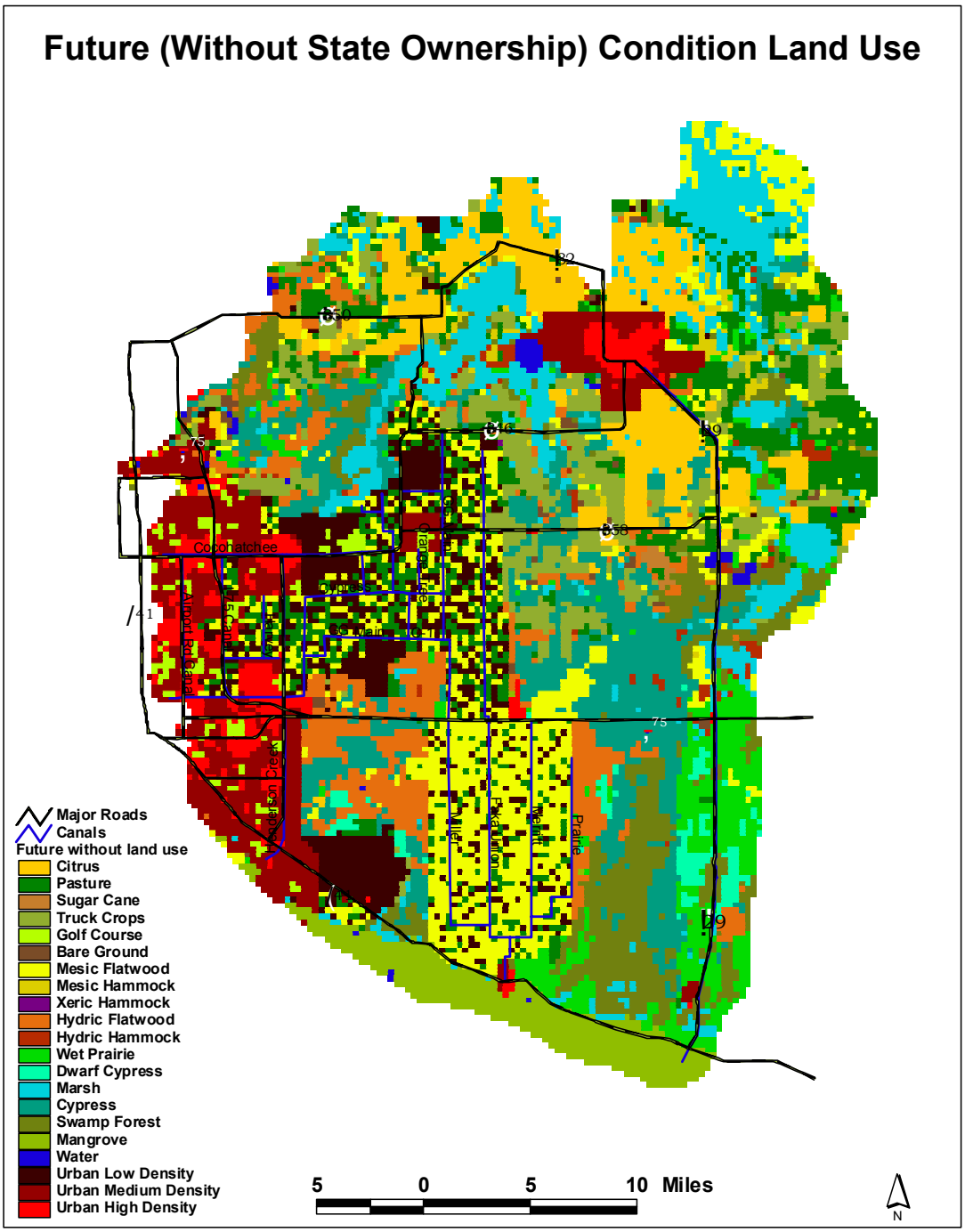

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Figure A-9

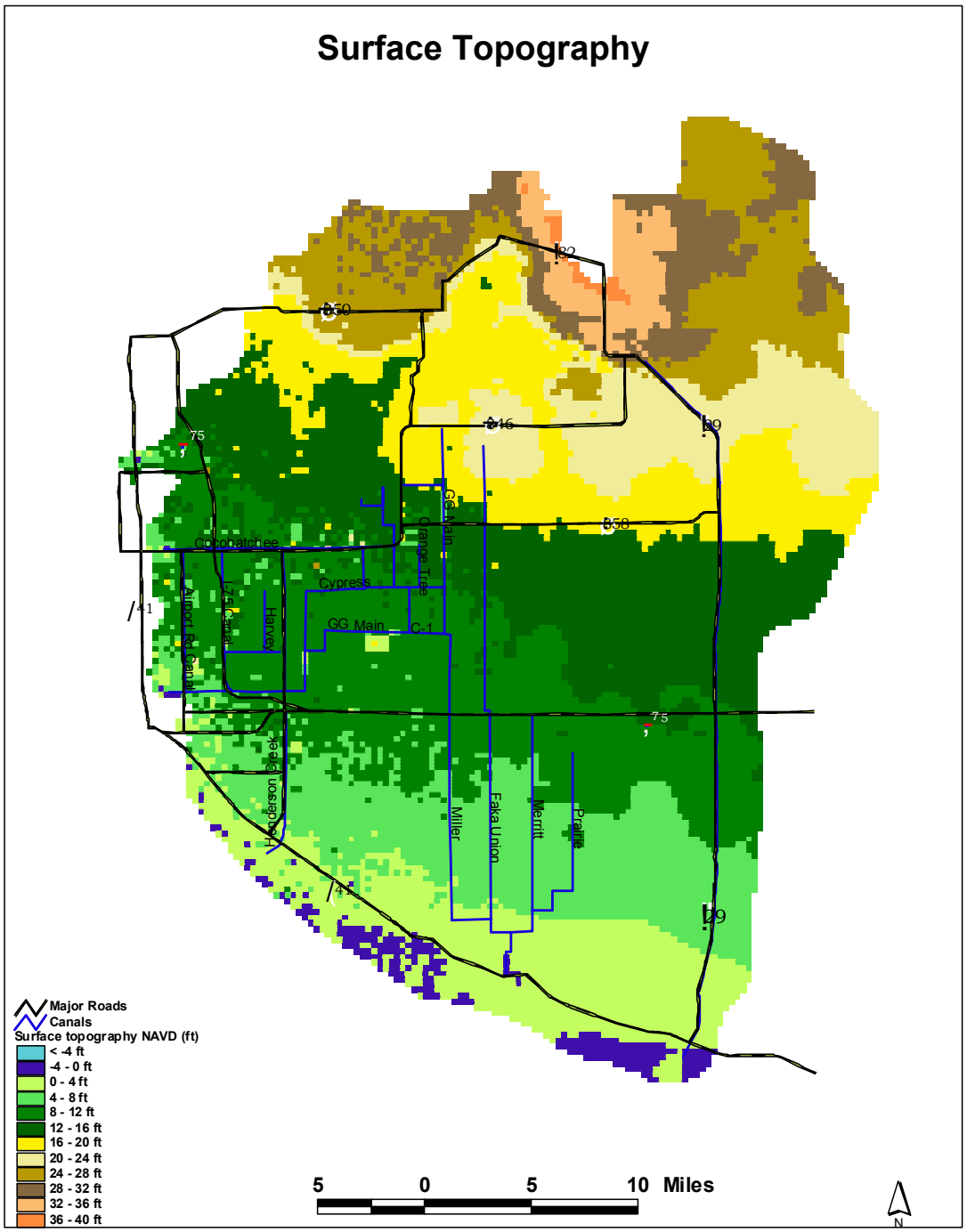

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Figure A-10

Primary Canal System and

Water Control Structures

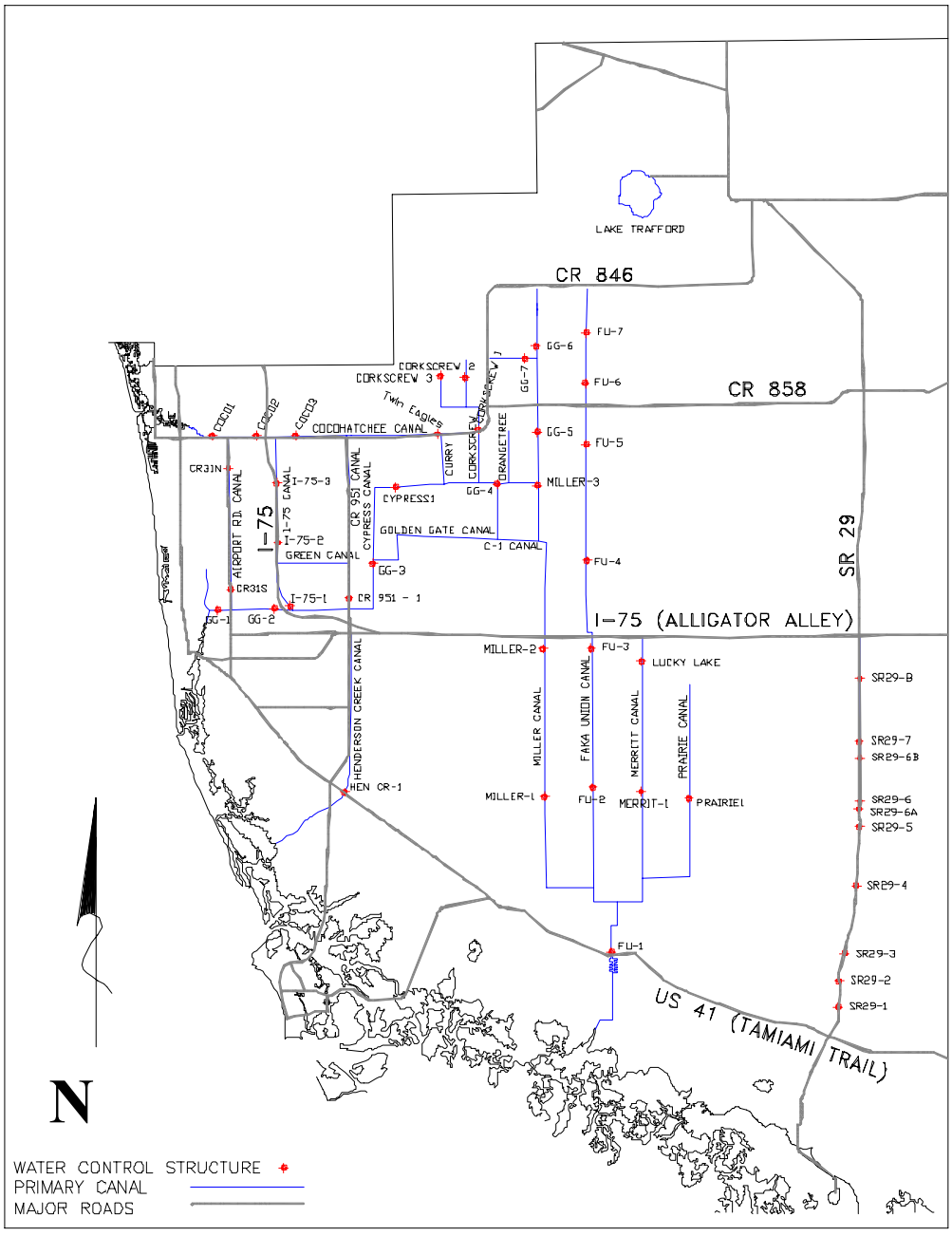

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Figure A-11

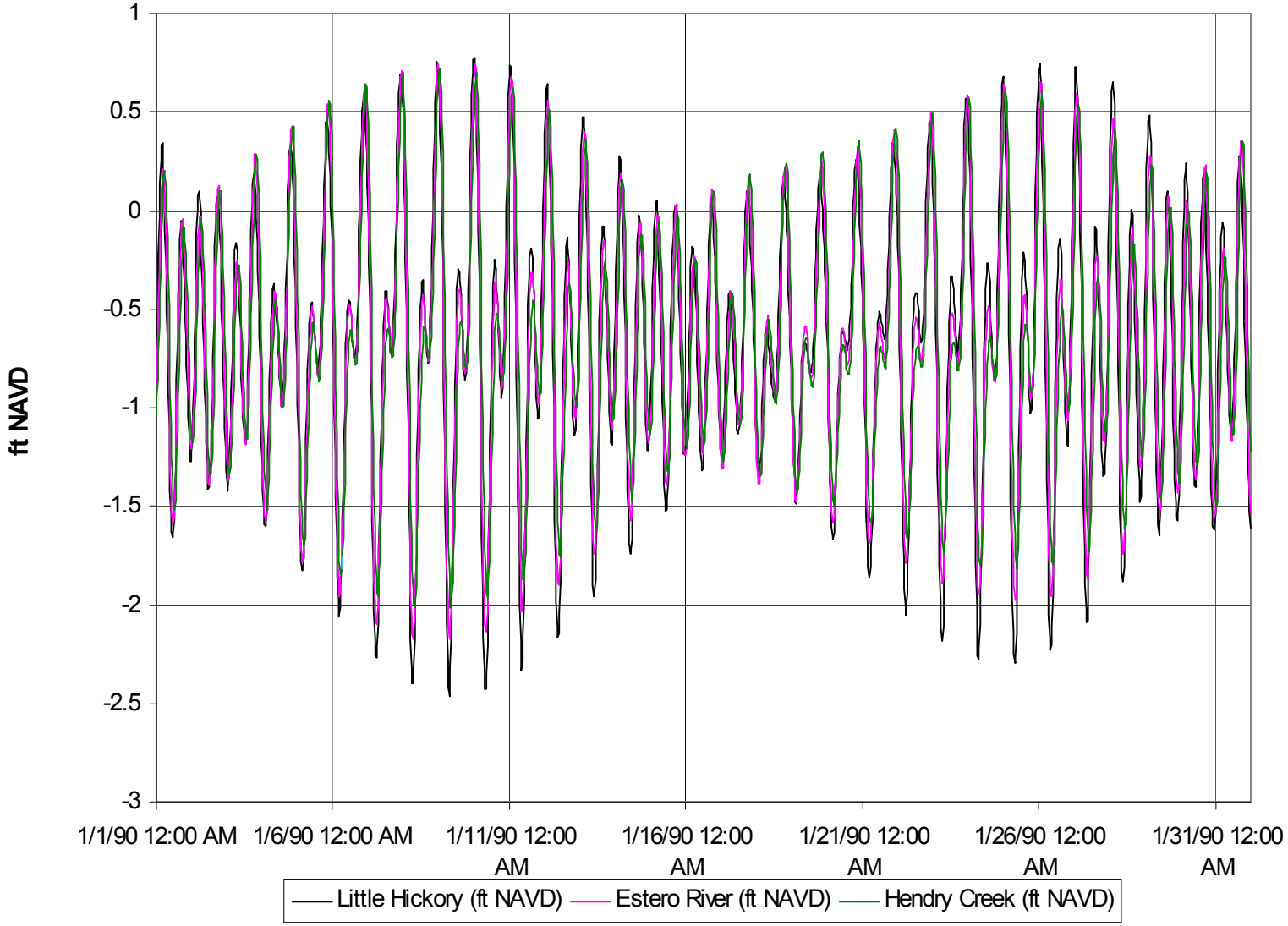
ft NAVD
1
0.5
0
-0.5
-1
-1.5
-2
-2.5
-3
1/1/90 12:00 AM
1/6/90 12:00 AM
1/11/90 12:00 AM
1/16/90 12:00 AM
1/21/90 12:00 AM
1/26/90 12:00 AM
1/31/90 12:00 AM
Little Hickory (ft NAVD)
Estero River (ft NAVD)
Hendry Creek (ft NAVD)

Figure A-12

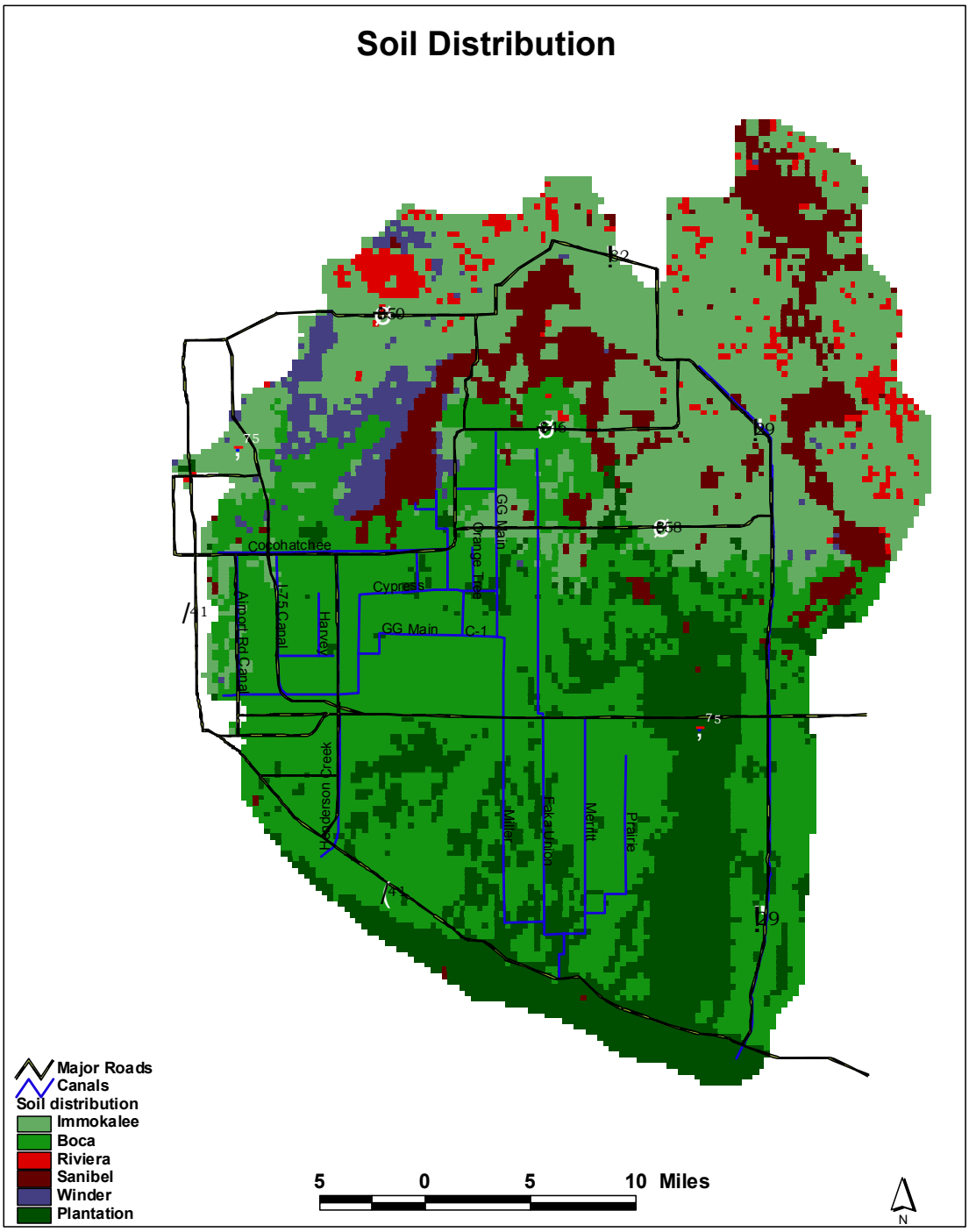

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Figure A-13

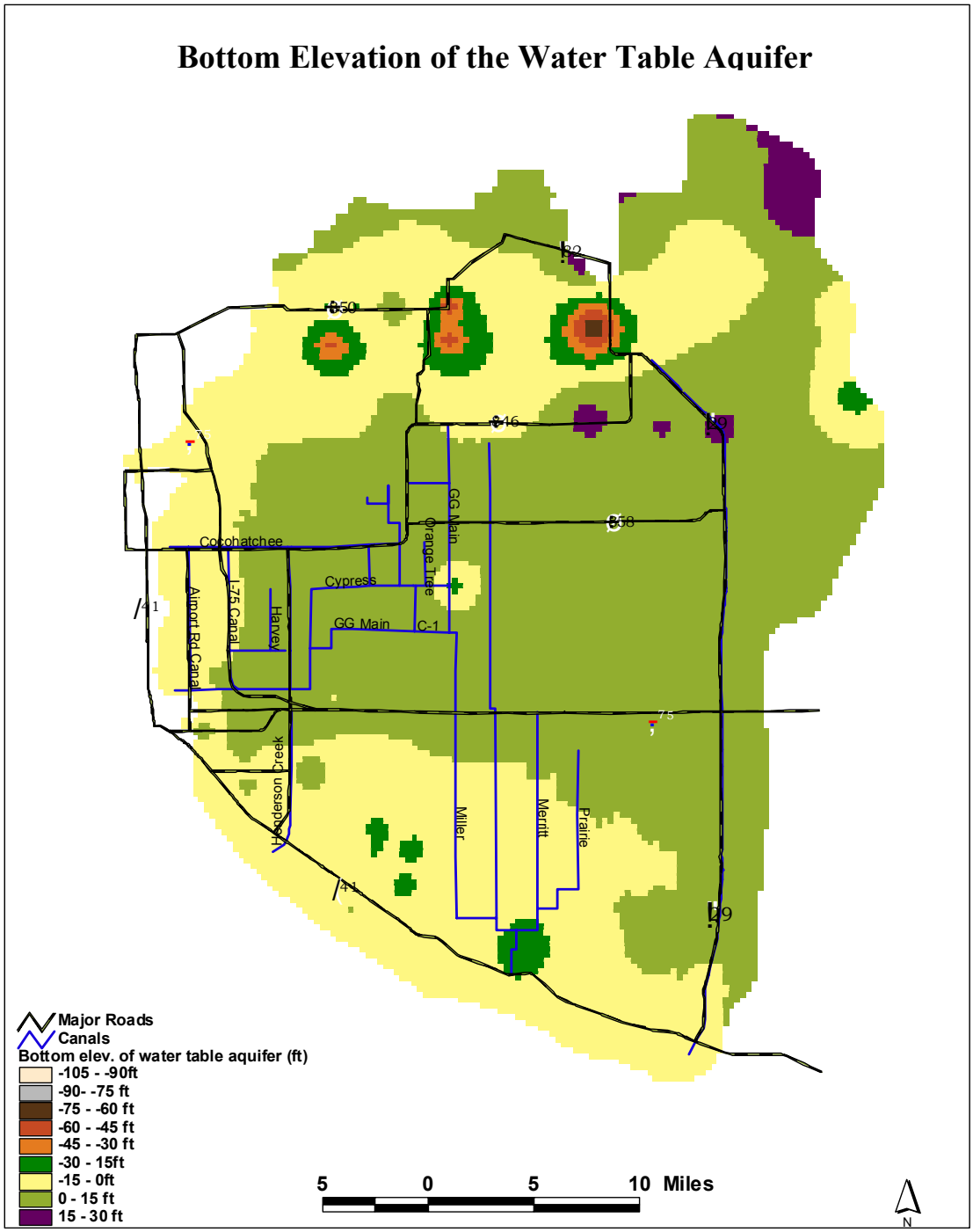

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Figure A-14

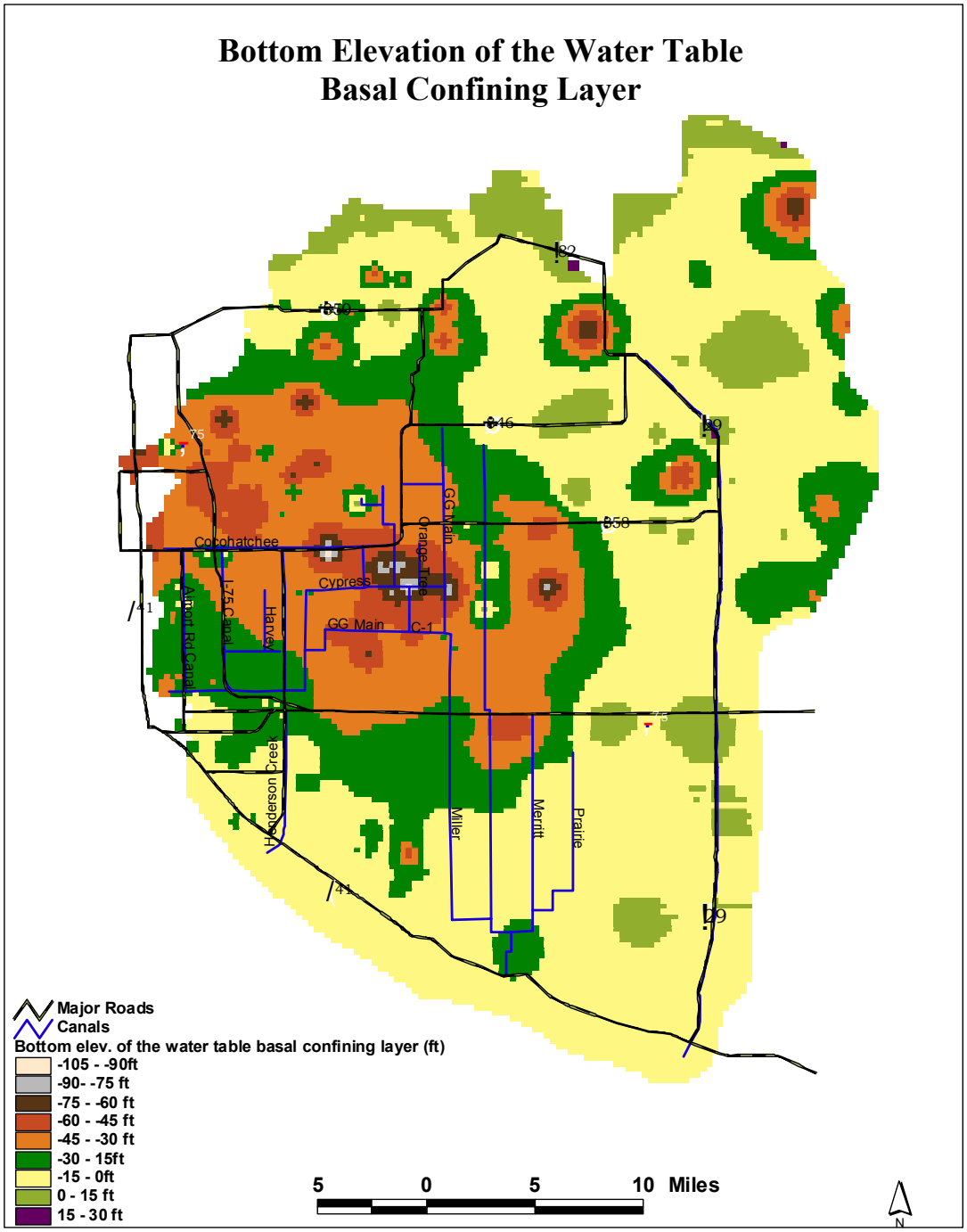

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Figure A-15

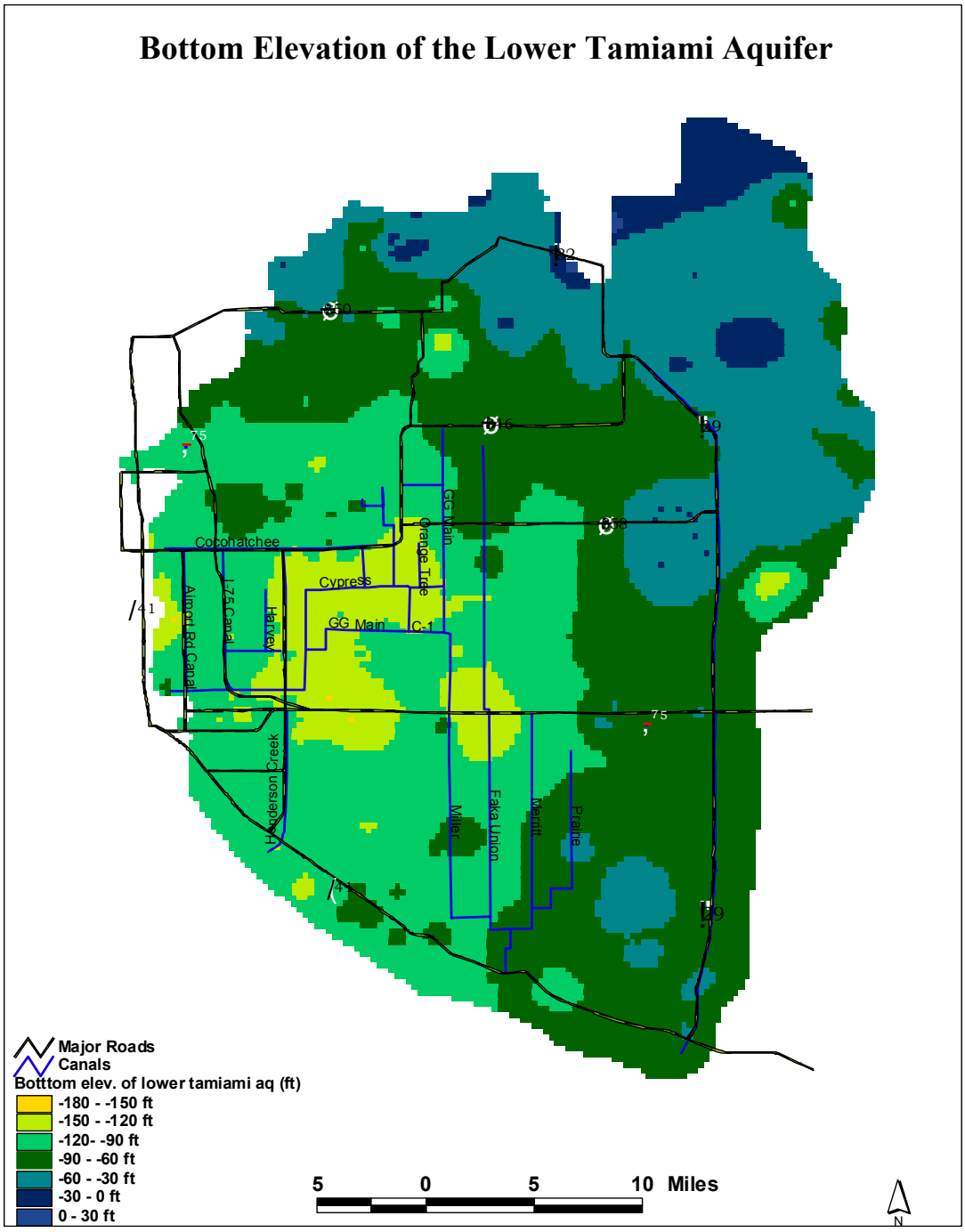

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Figure A-16

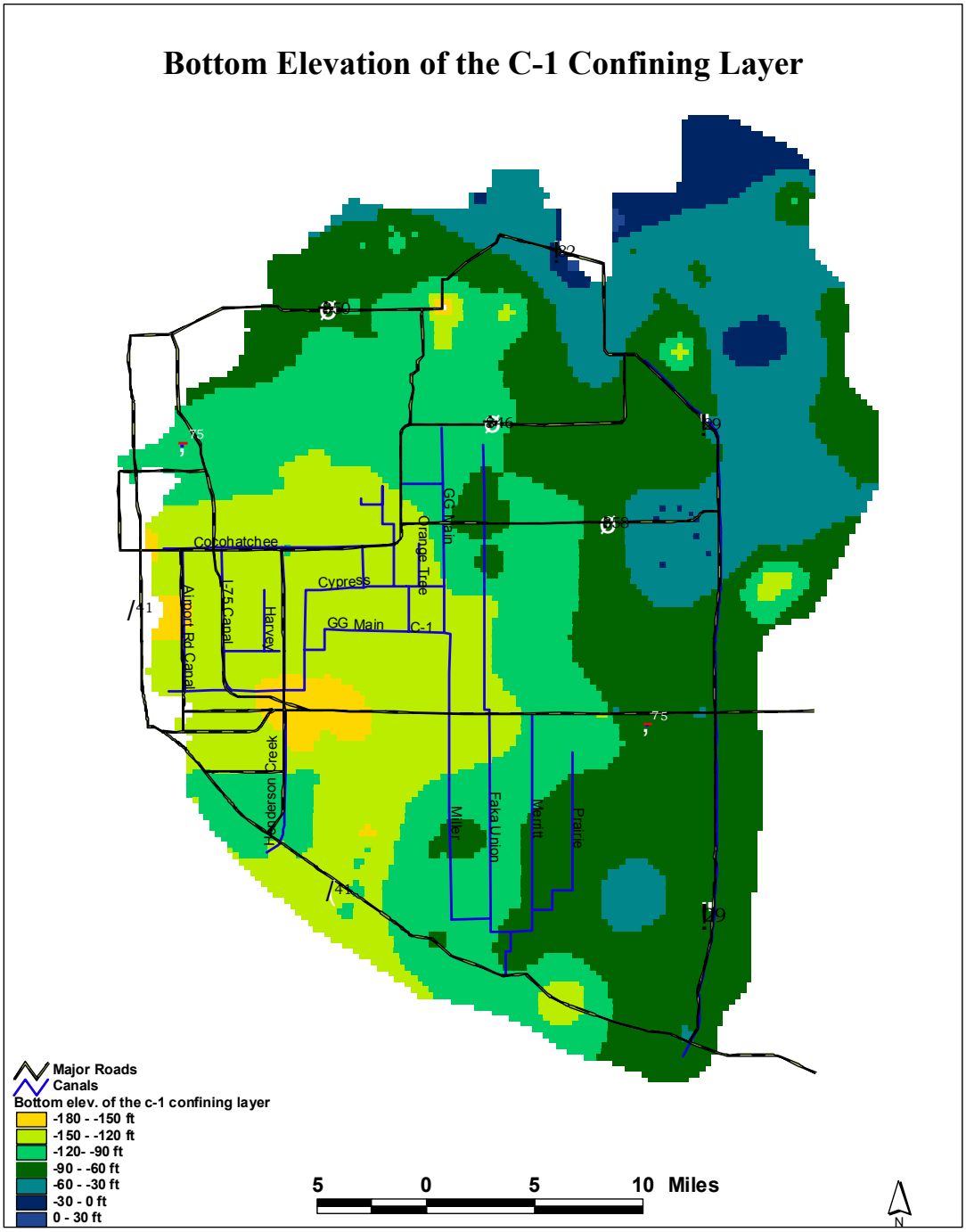

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Figure A-17

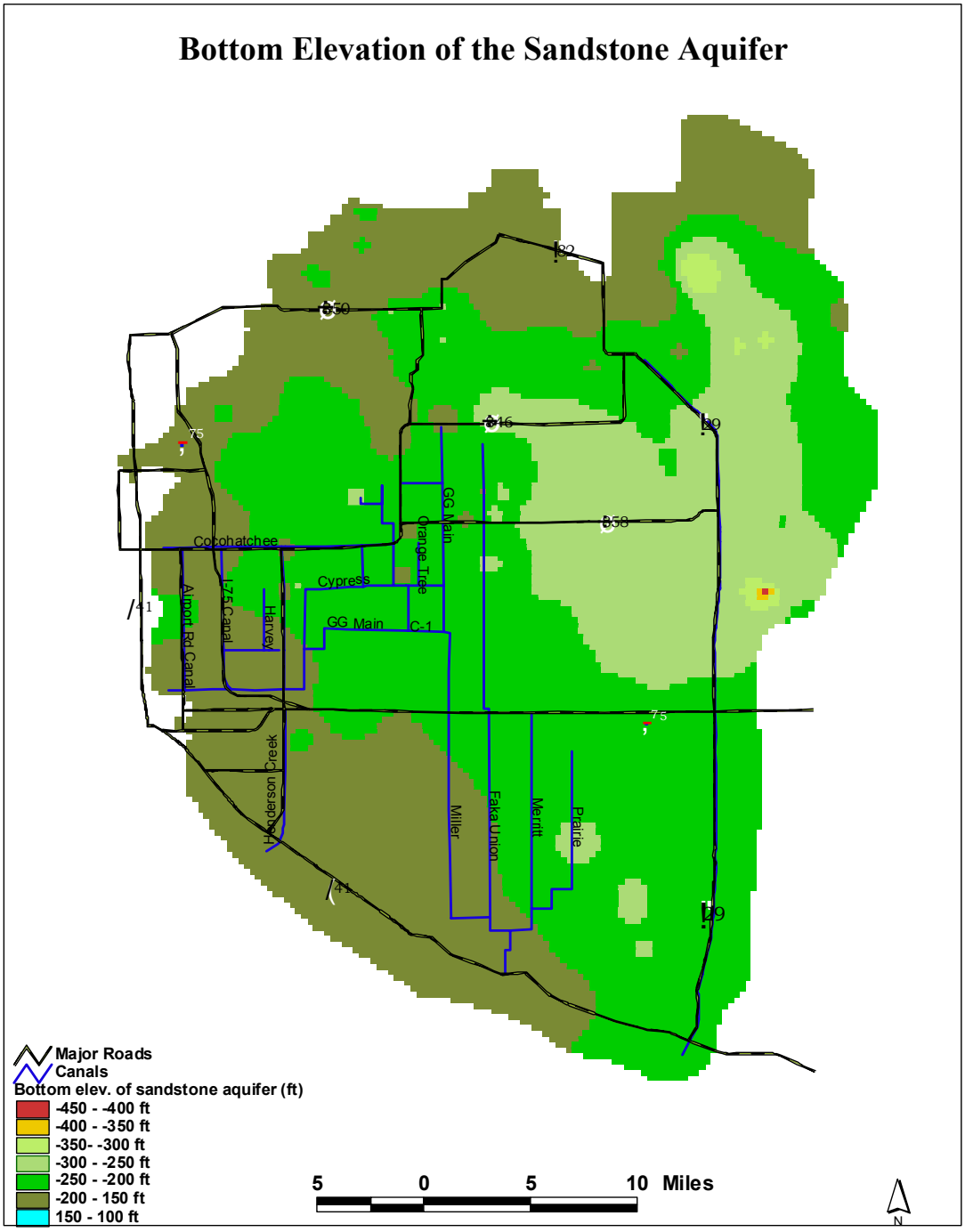

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Figure A-18

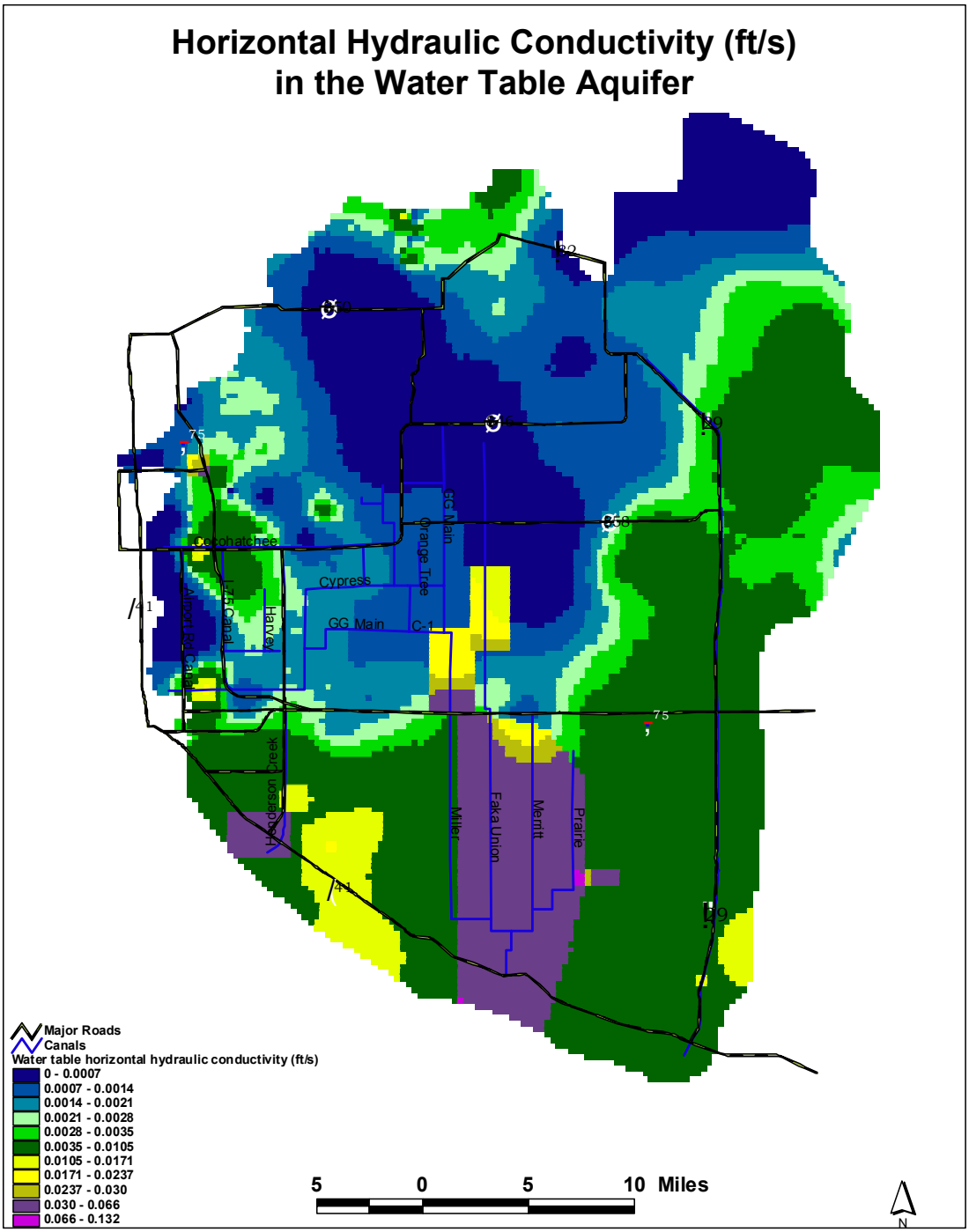

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Figure A-19

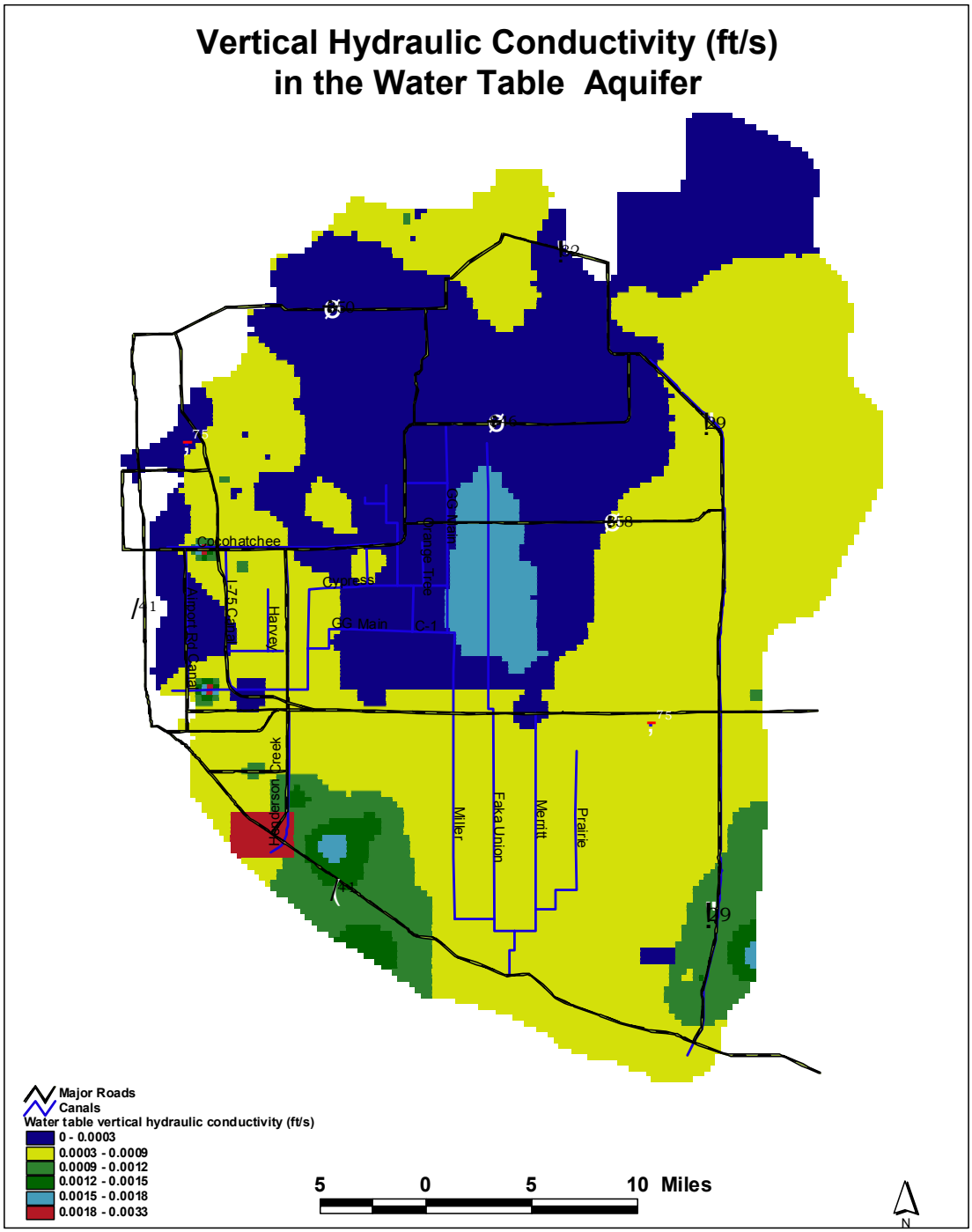

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Figure A-20

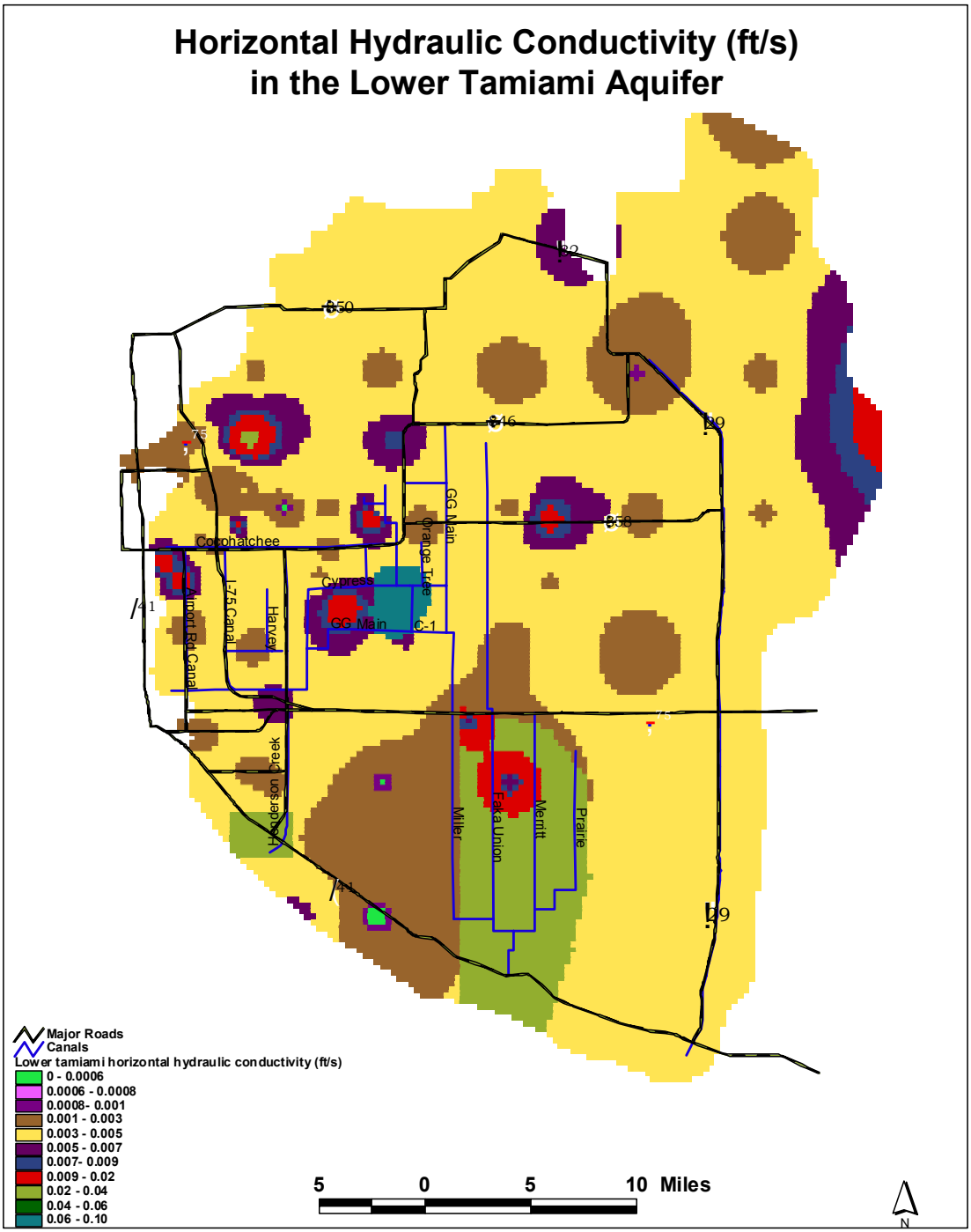

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Figure A-21

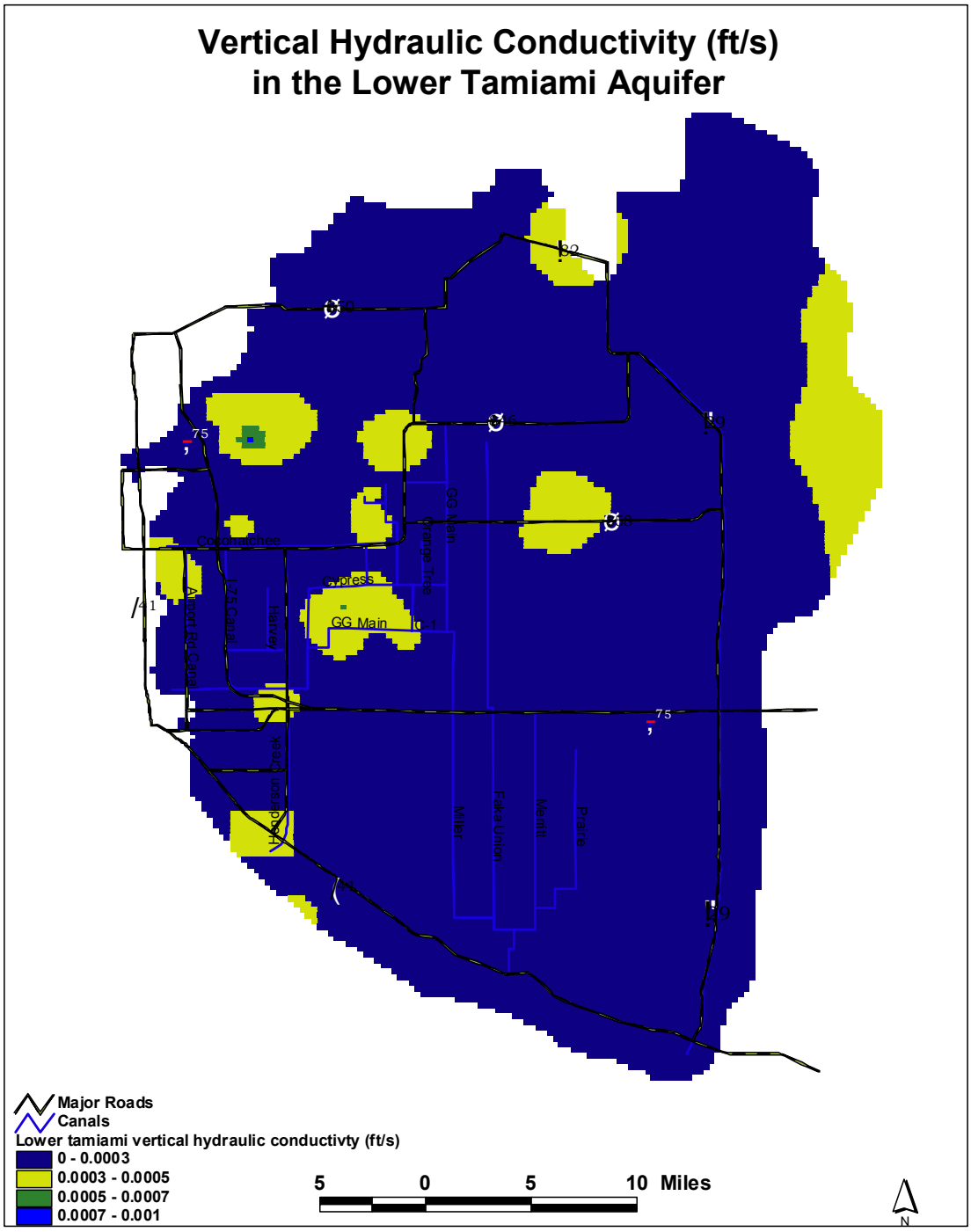

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Figure A-22

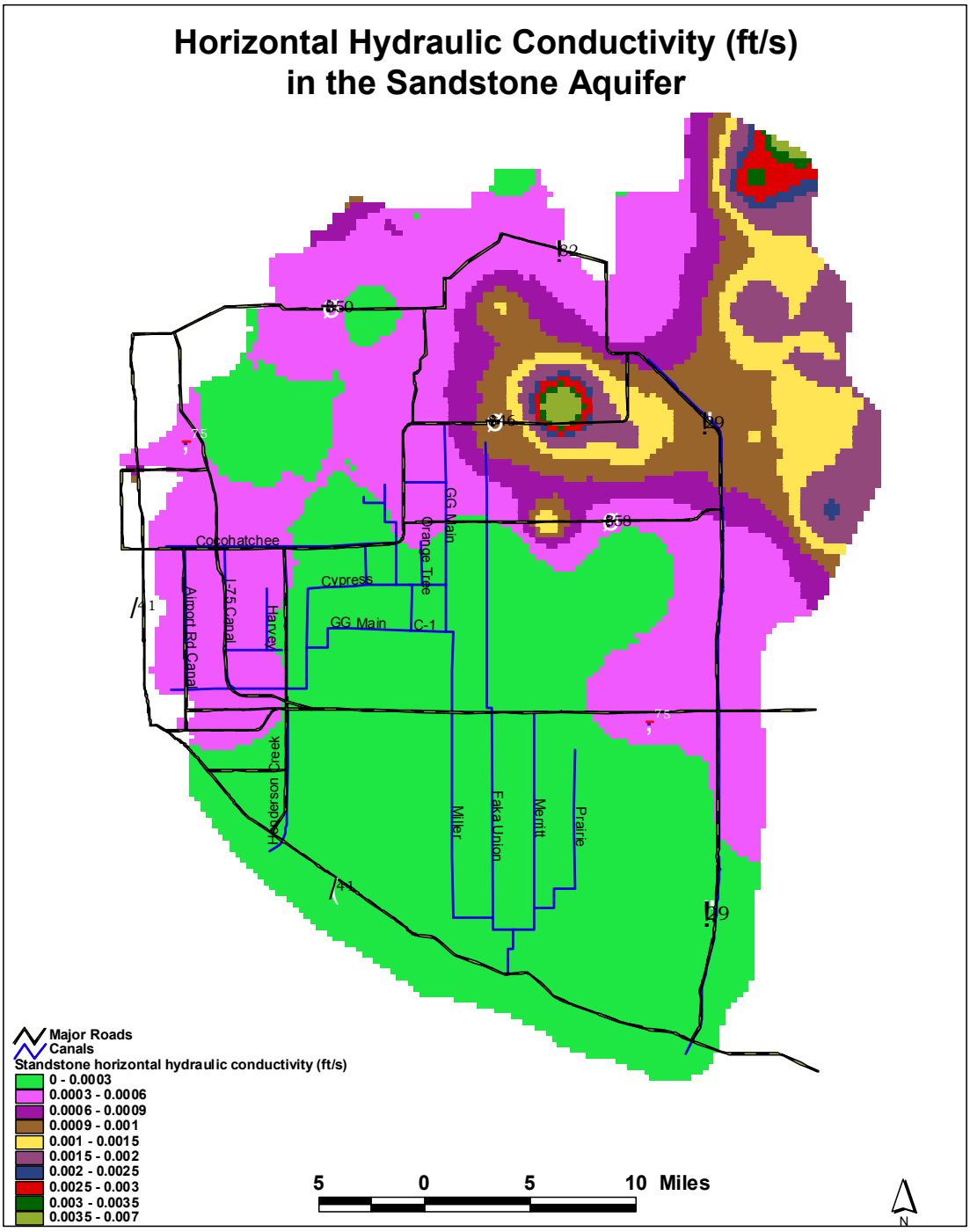

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Figure A-23

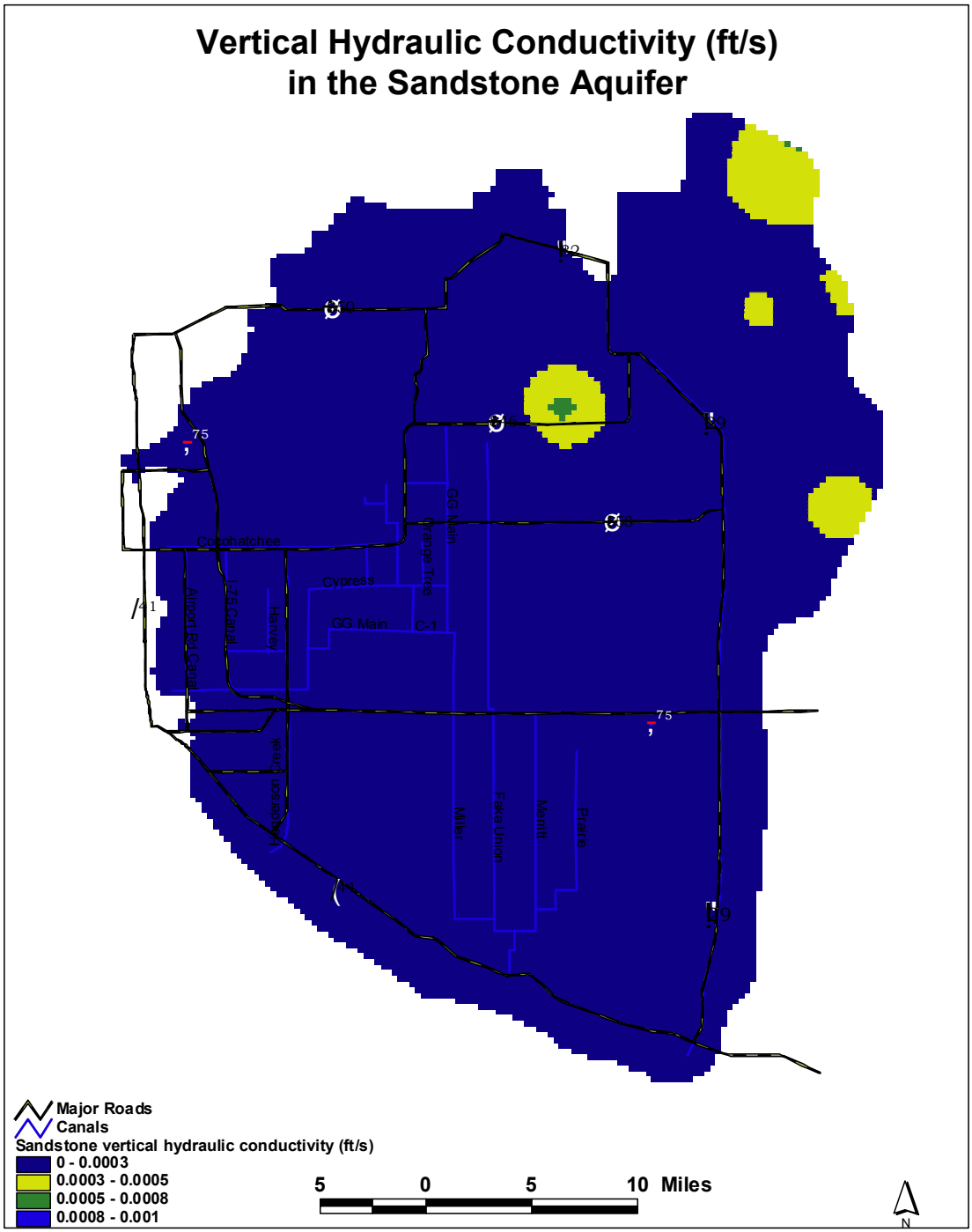

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Figure A-24

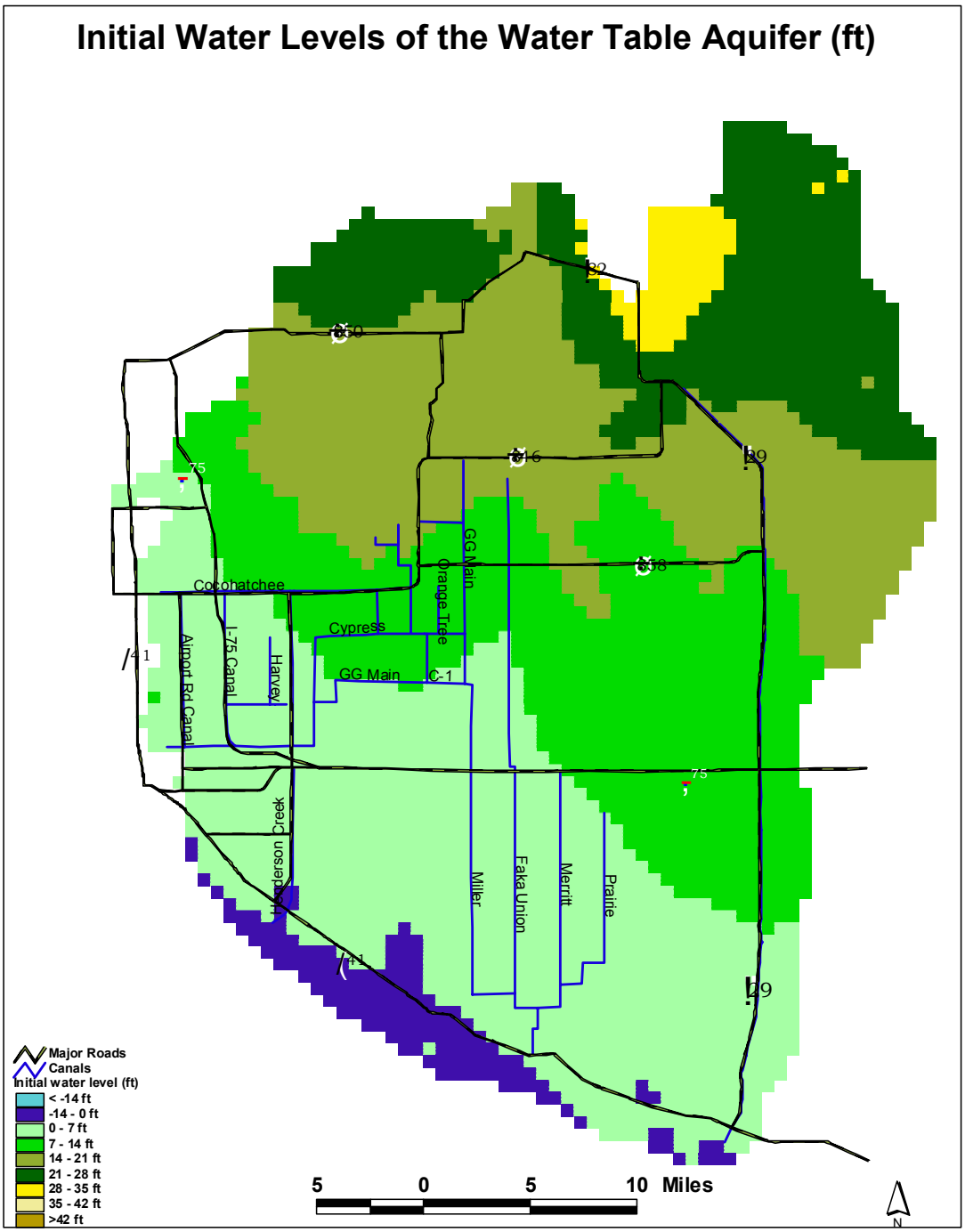
Initial Water Levels of the Water Table Aquifer (ft)
Cocohatchee
Cypress
GG Main
Orange Tree
I-75 Canal
Airport Rd Canal
Harvey
C-1
Miller
Faka Union
Merritt
Prairie
Major Roads
Canals
Initial water level (ft)
< -14 ft
-14 - 0 ft
0 - 7 ft
7 - 14 ft
14 - 21 ft
21 - 28 ft
28 - 35 ft
35 - 42 ft
>42 ft
5 0 5 10 Miles
N

Figure A-25

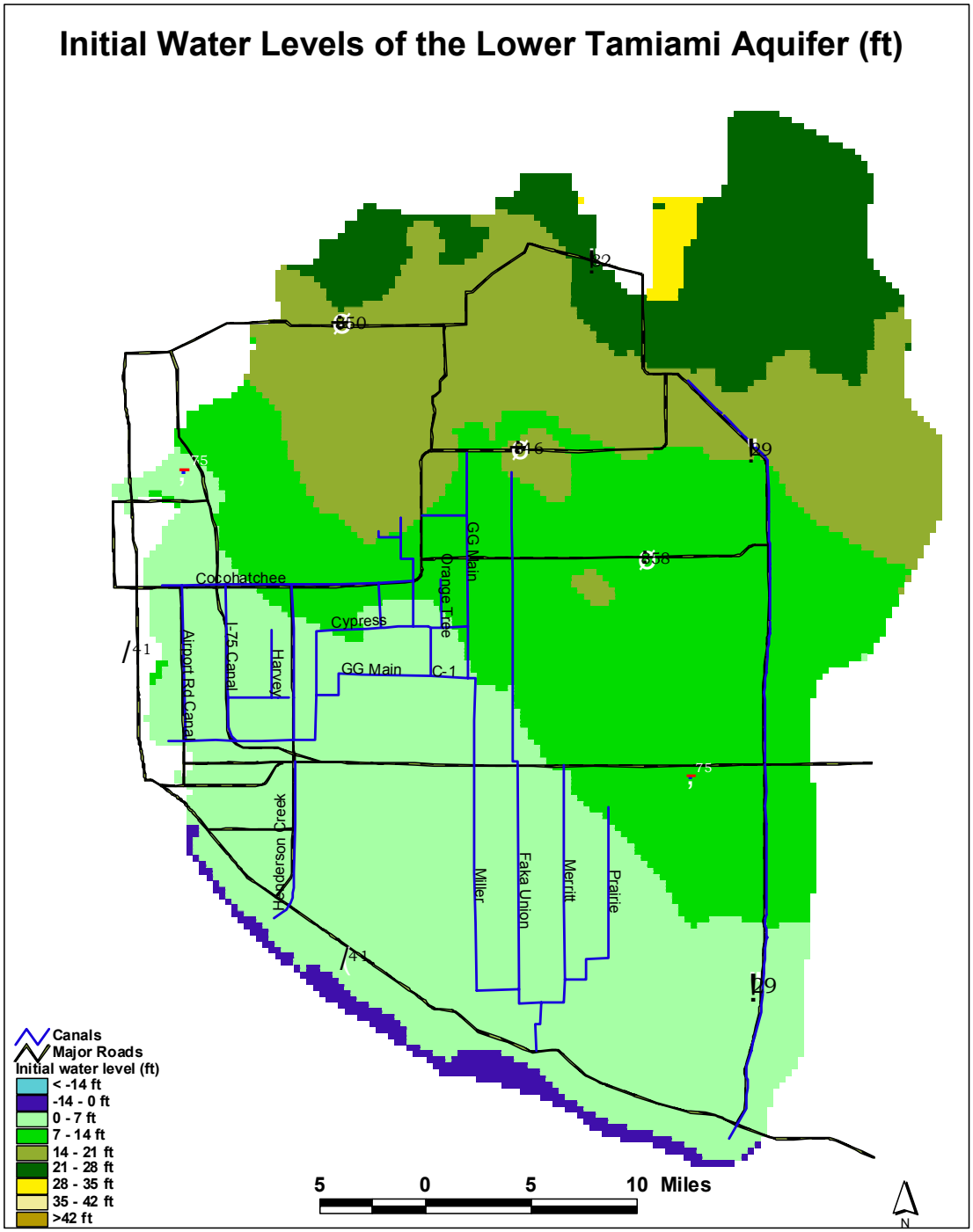
Initial Water Levels of the Lower Tamiami Aquifer (ft)
Cocohatchee
Cypress
GG Main
C-1
Orange Tree
GG Main
I-75 Canal
Airport Rd Canal
Harvey
Henderson Creek
Miller
Faka Union
Merritt
Prairie
Canals
Major Roads
Initial water level (ft)
< -14 ft
-14 - 0 ft
0 - 7 ft
7 - 14 ft
14 - 21 ft
21 - 28 ft
28 - 35 ft
35 - 42 ft
>42 ft
5 0 5 10 Miles
N

Figure A-26

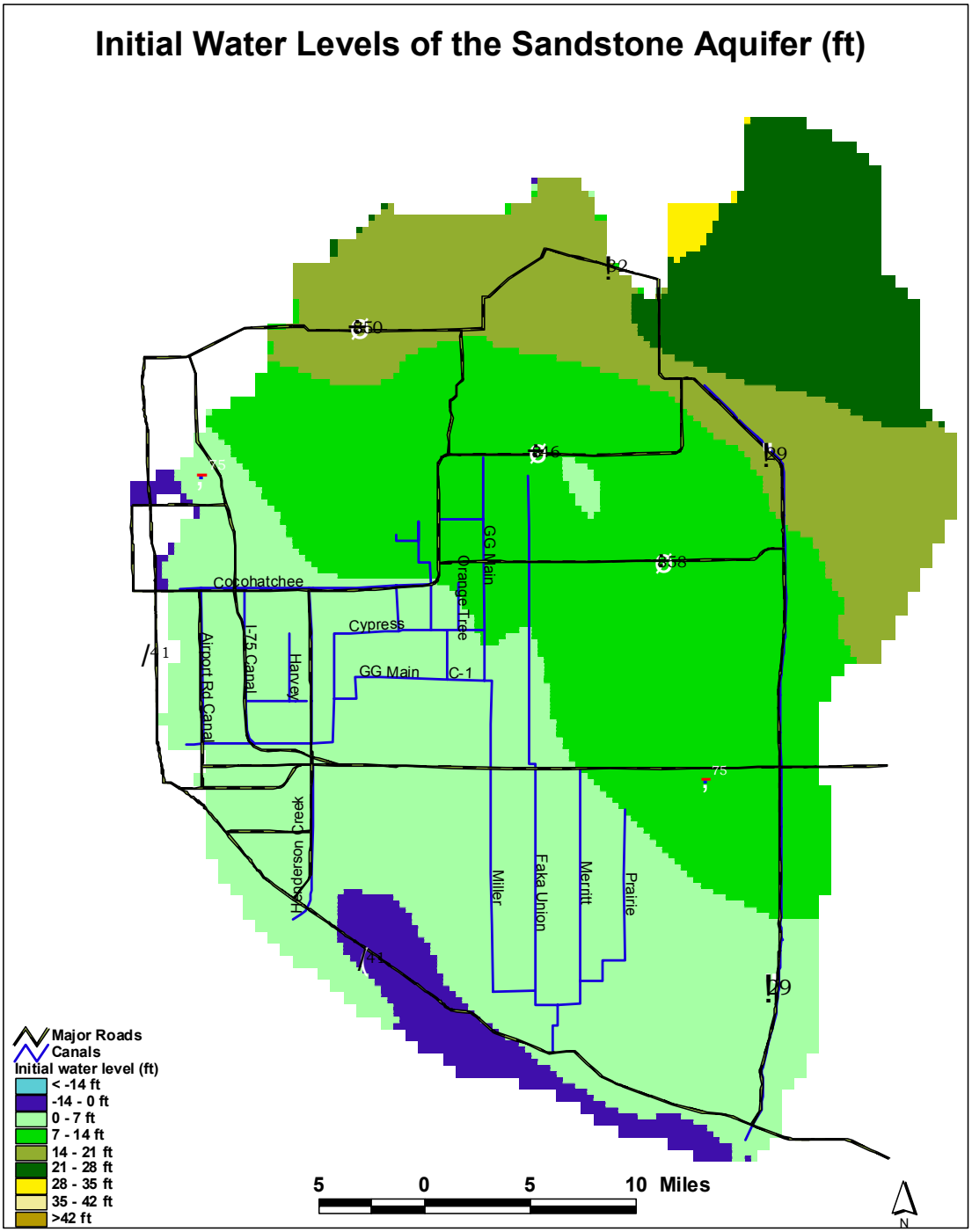

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Figure A-27

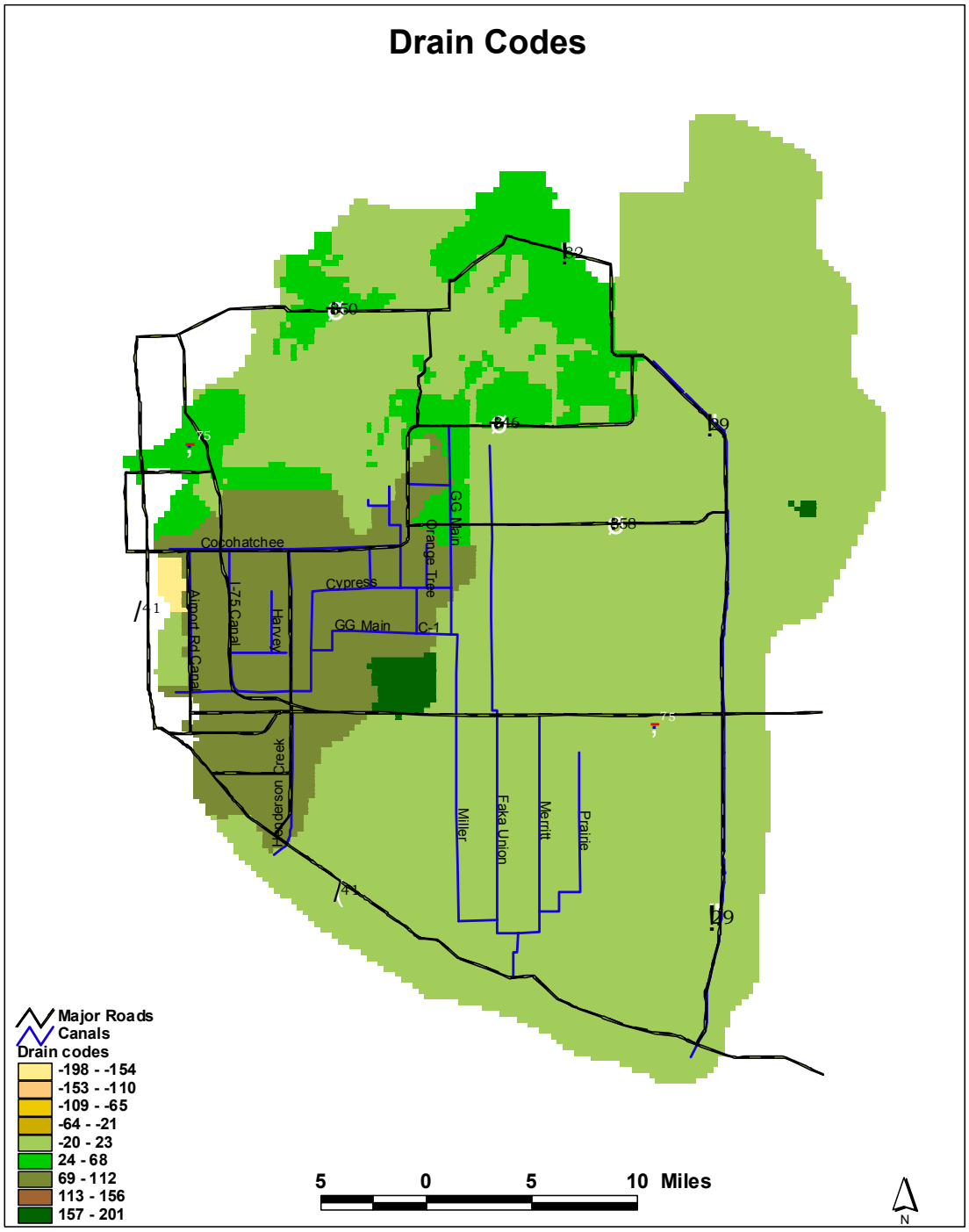
Drain Codes
Cocohatchee
Cypress
GG Main
Orange Tree
Airport Rd Canal
I-75 Canal
Harvey
C-1
Henderson Creek
Miller
Faka Union
Merritt
Prairie
Major Roads
Canals
Drain codes
-198 - -154
-153 - -110
-109 - -65
-64 - -21
-20 - 23
24 - 68
69 - 112
113 - 156
157 - 201
5 0 5 10 Miles
N

Figure A-28

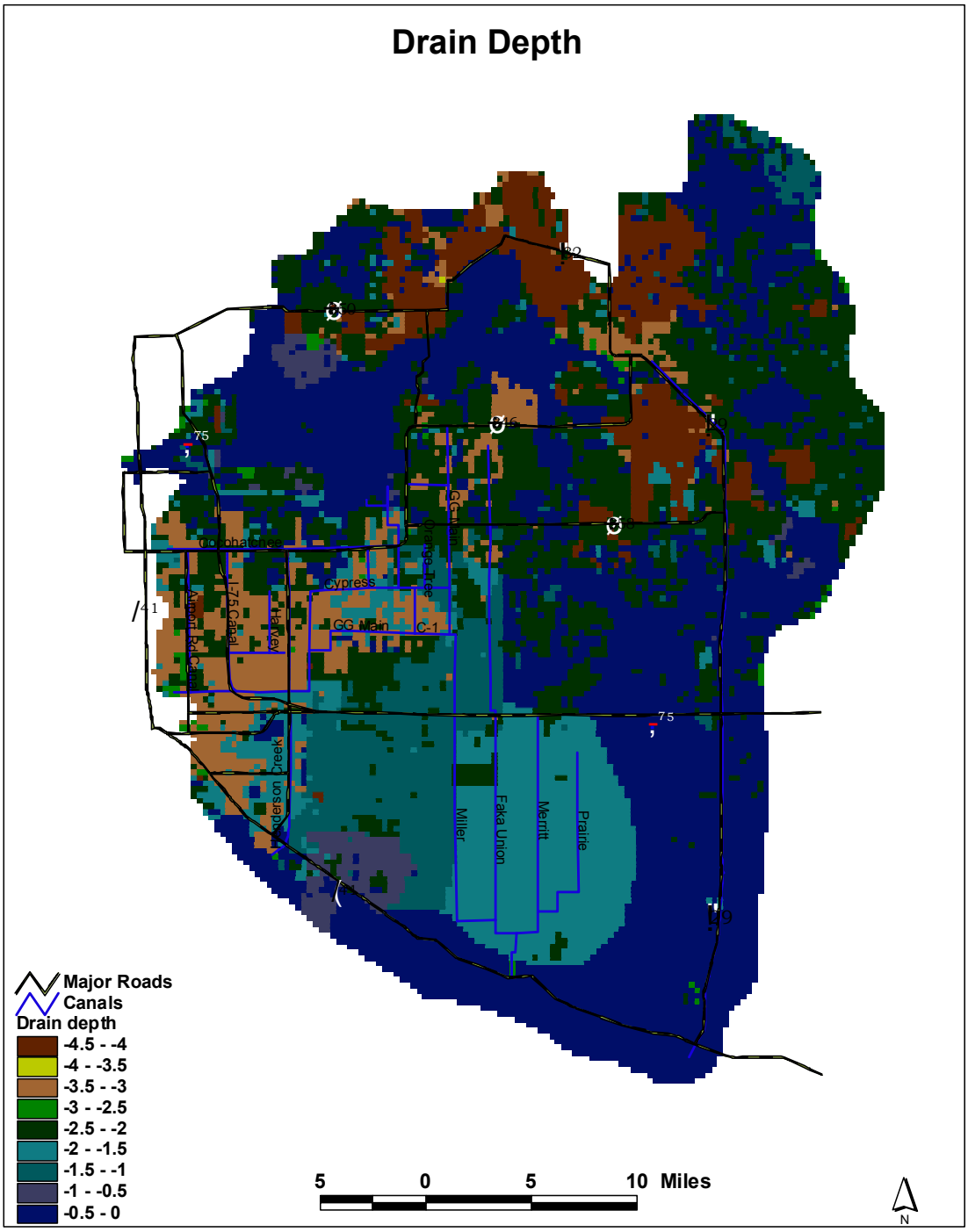

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Figure A-29

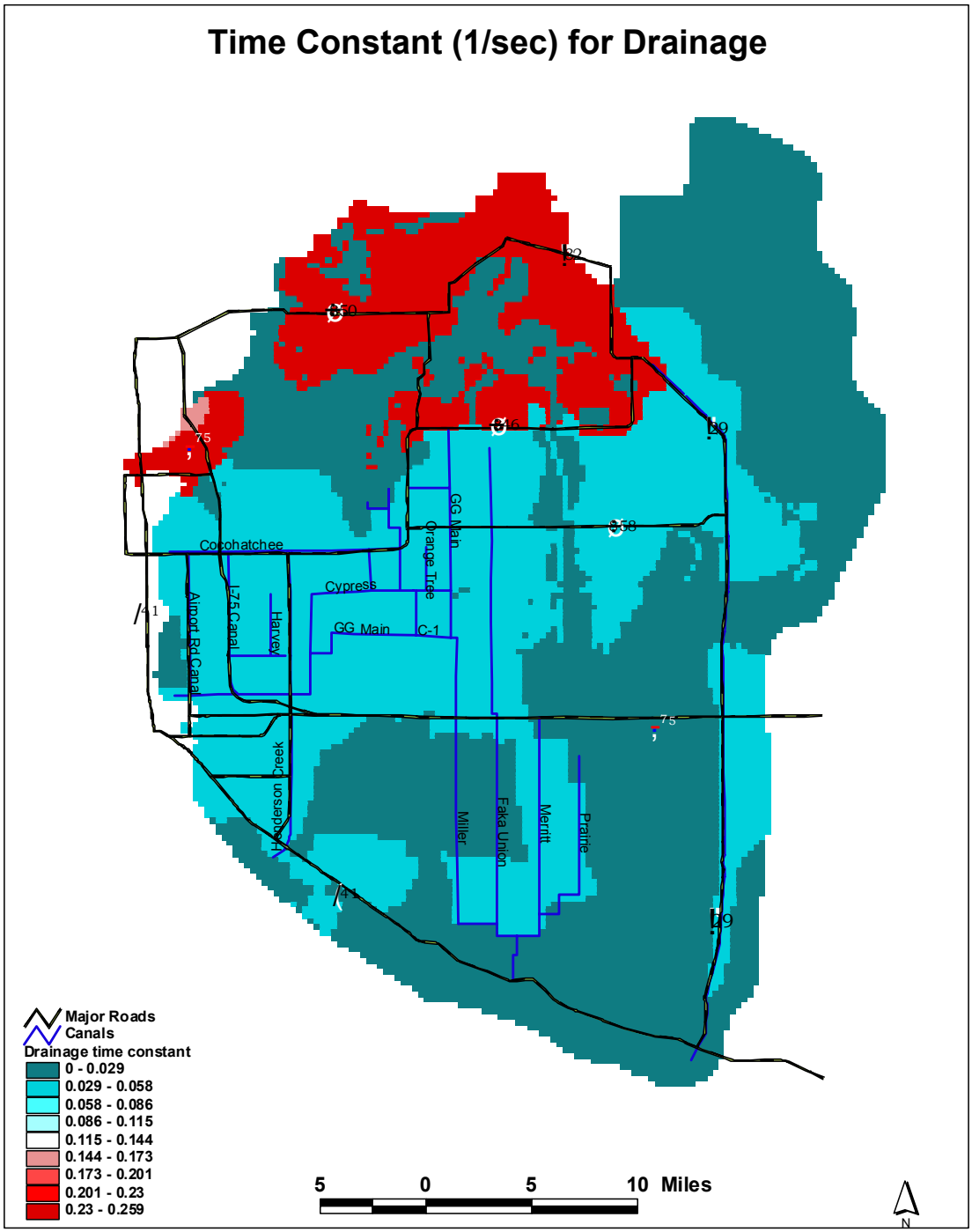

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Figure A-30

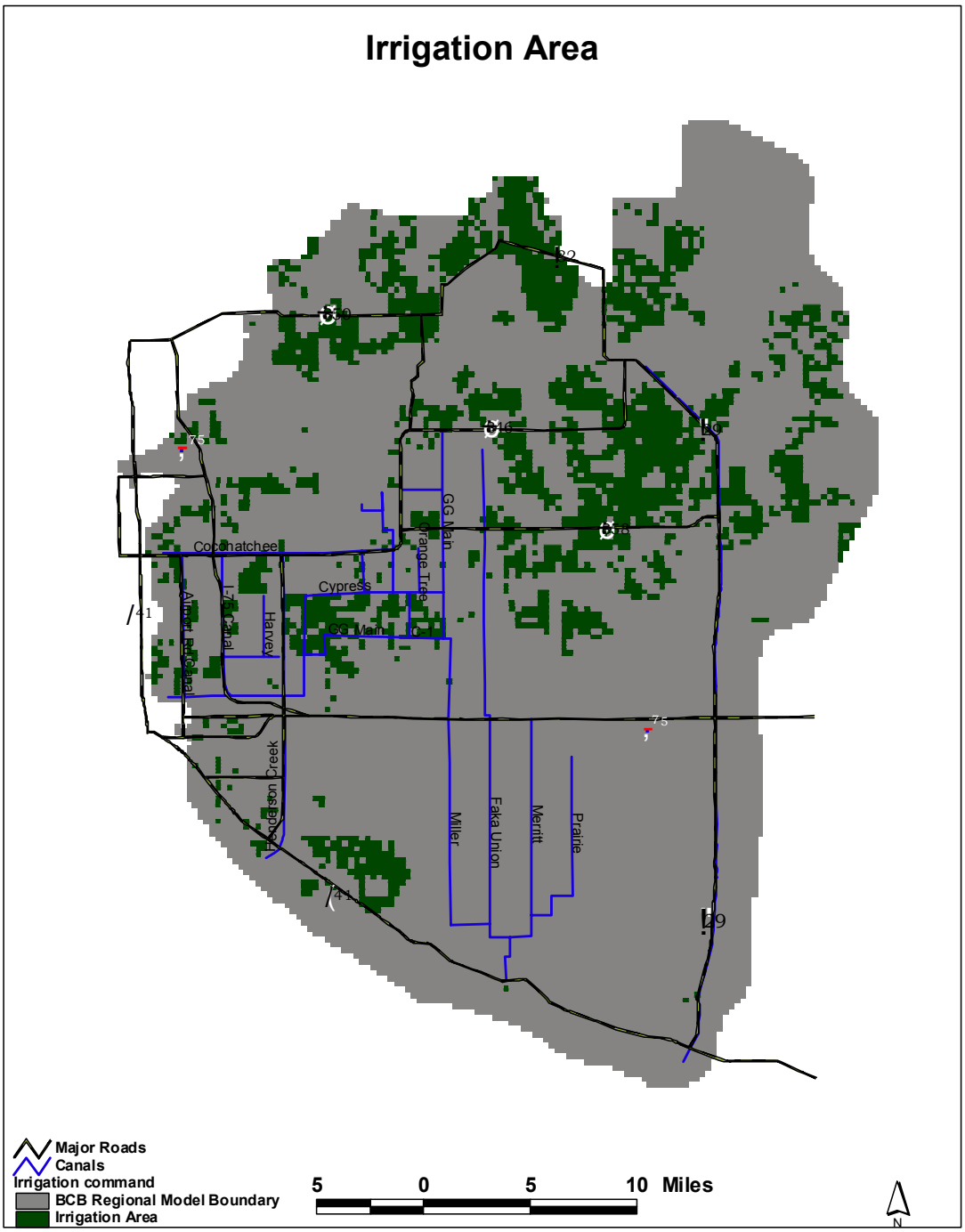

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Figure A-31

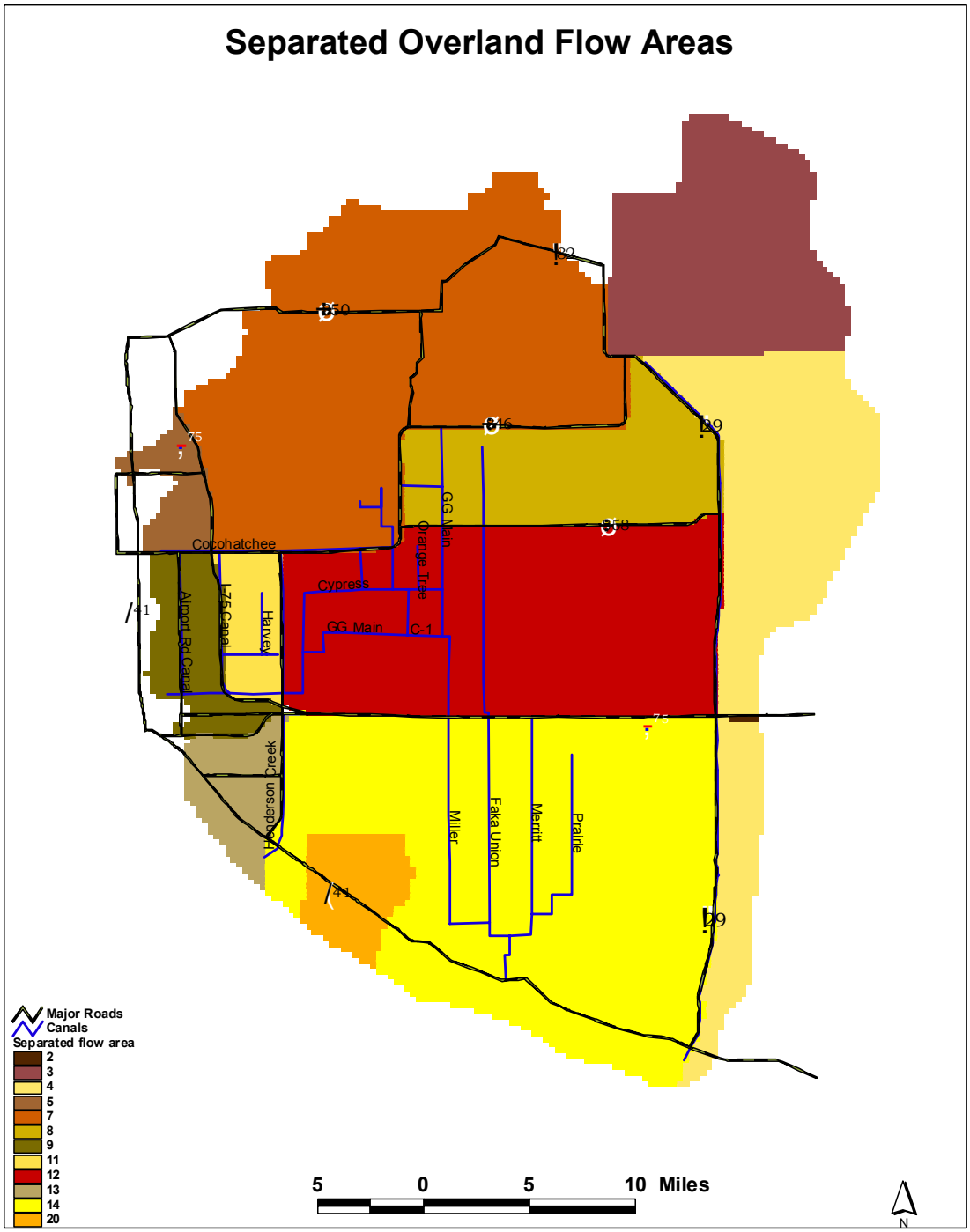

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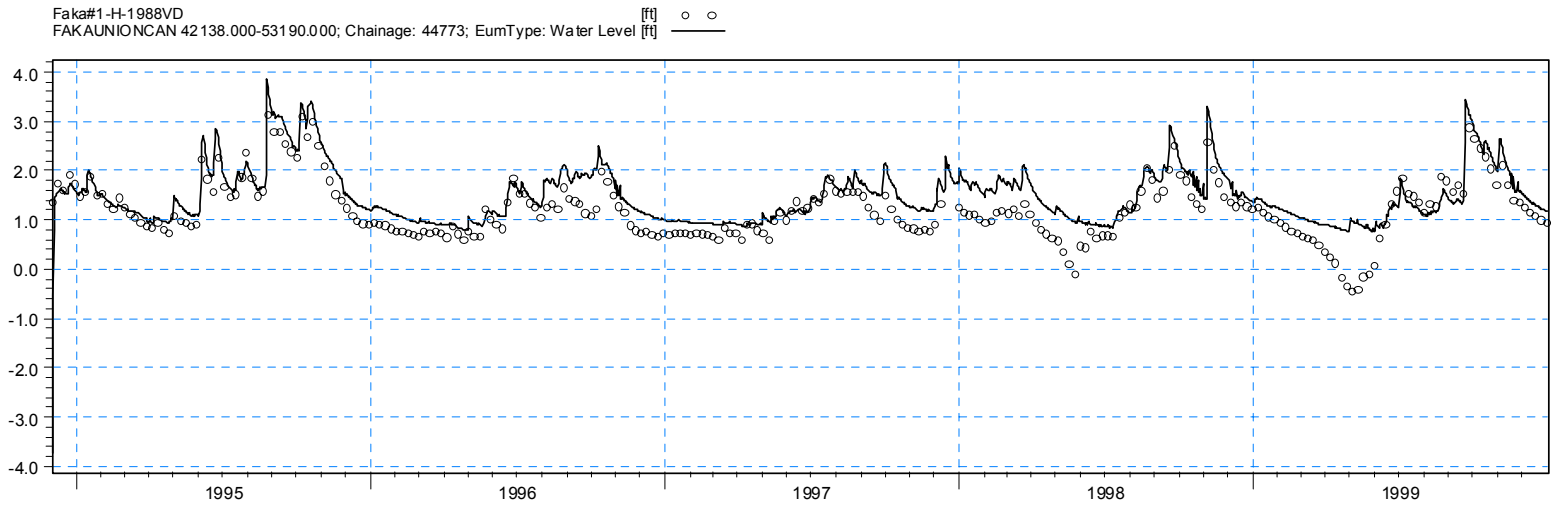
Figure A-32

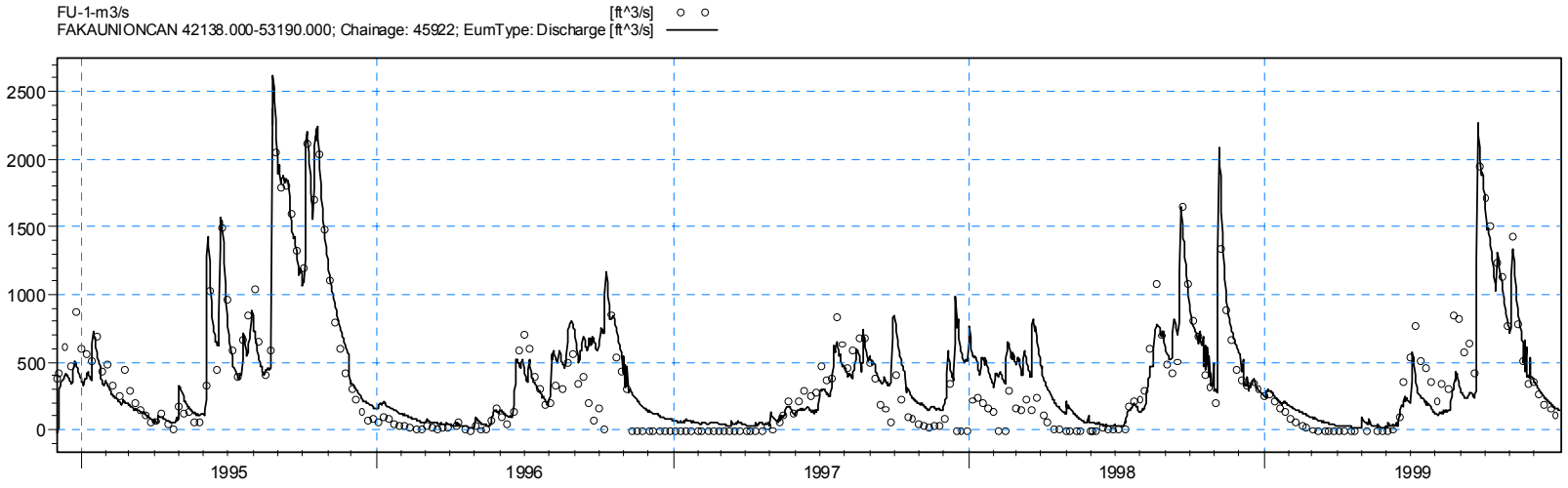
Headwater Stage at FU-1 Weir during Calibration Period



ME=-0.260438
MAE=0.312554
RMSE=0.406389
STDres=0.311968
R(Correlation)=0.860849
R2(Nash_Sutcliffe)=0.553116

Figure A-33

Discharge at FU-1 Weir during Calibration Period



ME=-35.0216
MAE=136.07
RMSE=191.502
STDres=188.273
R(Correlation)=0.908787
R2(Nash_Sutcliffe)=0.817164

Figure A-34

Calibration Wells Near SGGE

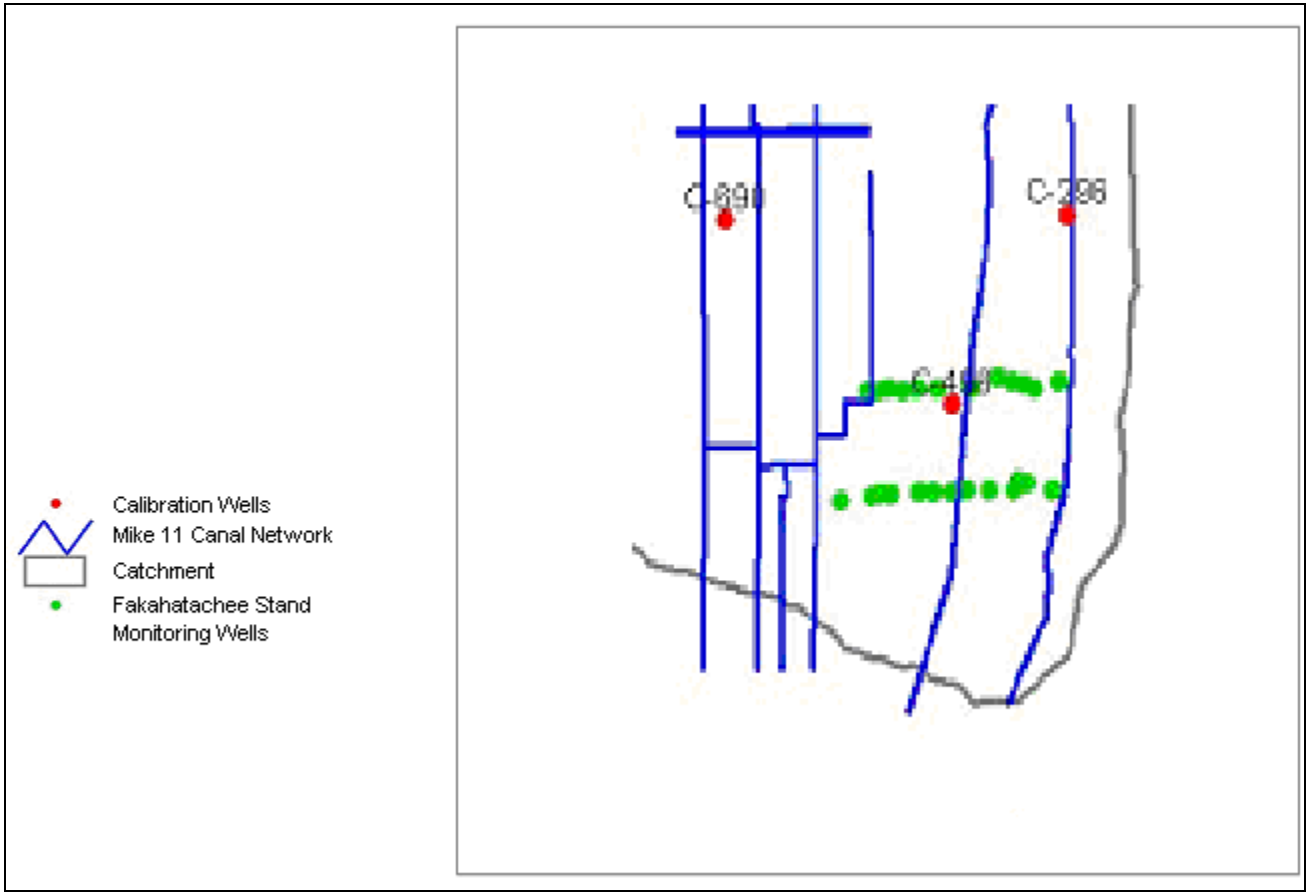


Figure A-35

South Golden Gate Estates

Monitoring Wells & Flow Transects

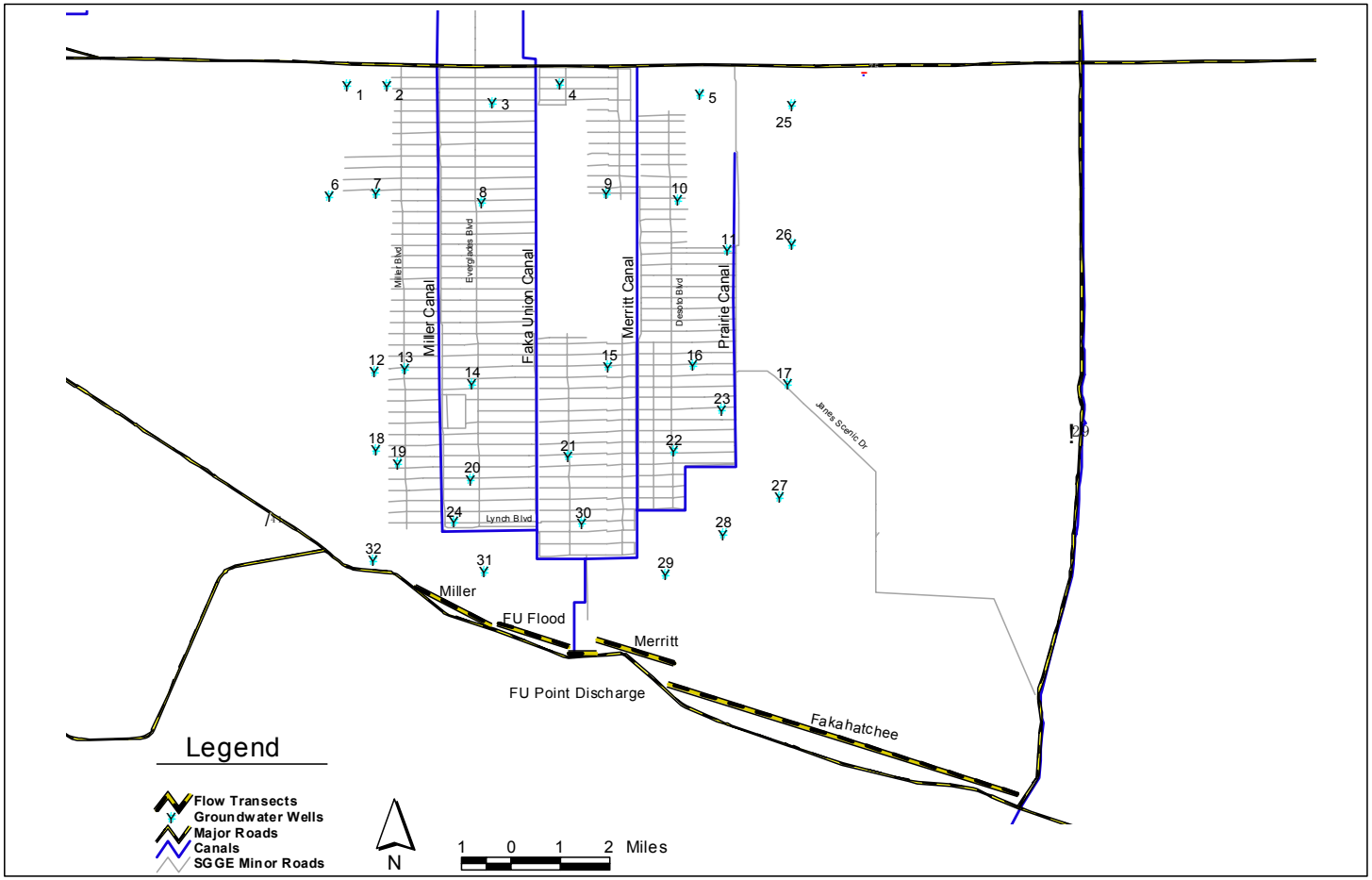


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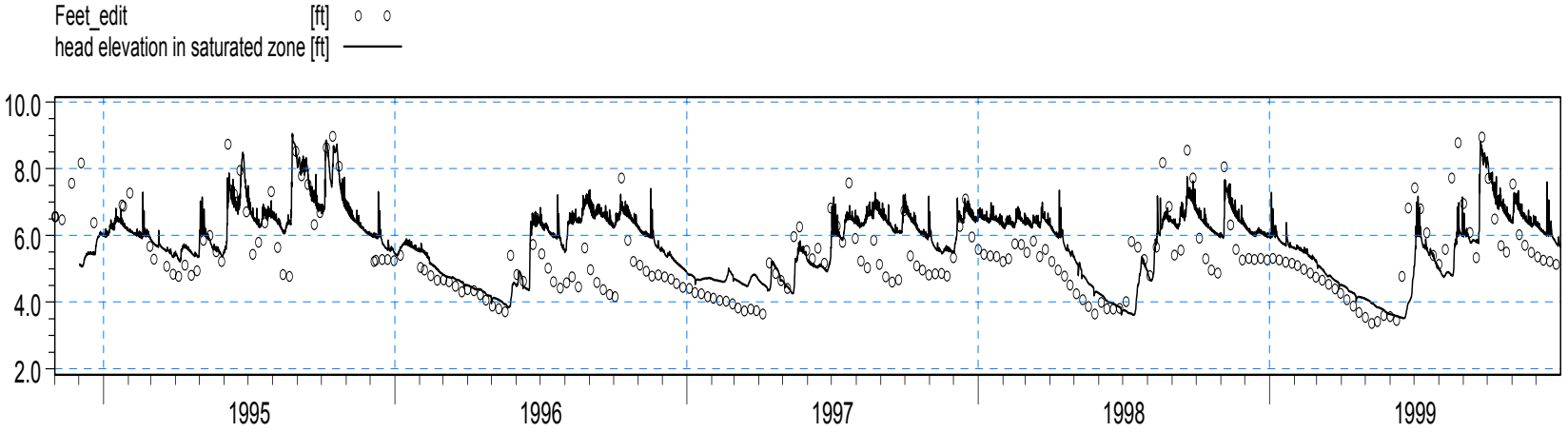
Figure A-36

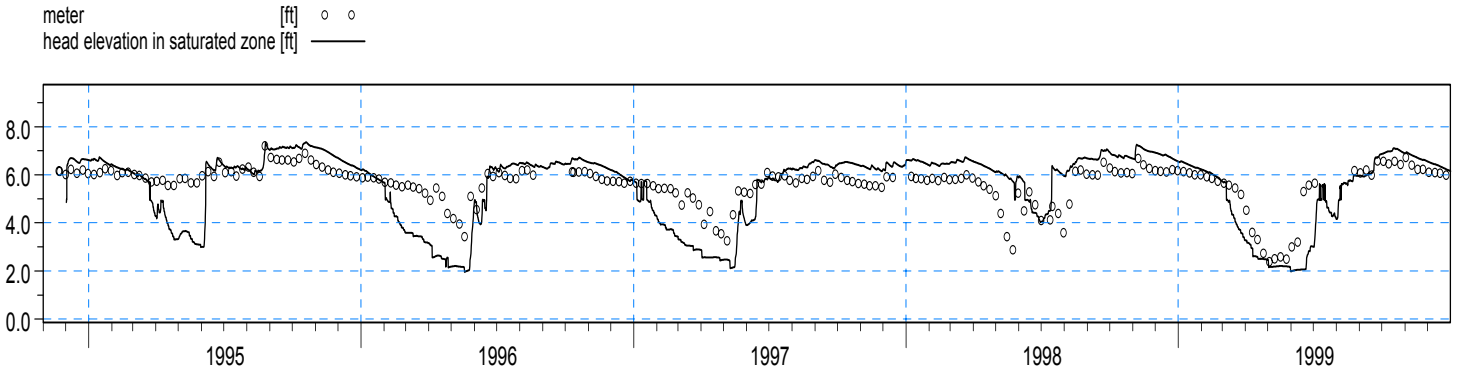
Observed Groundwater Level for Well C-690
(South of I-75 between Miller and Faka Union Canals)



ME=-0.428054
MAE=0.76222
RMSE=0.961212
STDres=0.860638
R(Correlation)=0.6986
R2(Nash_Sutcliffe)=0.305965

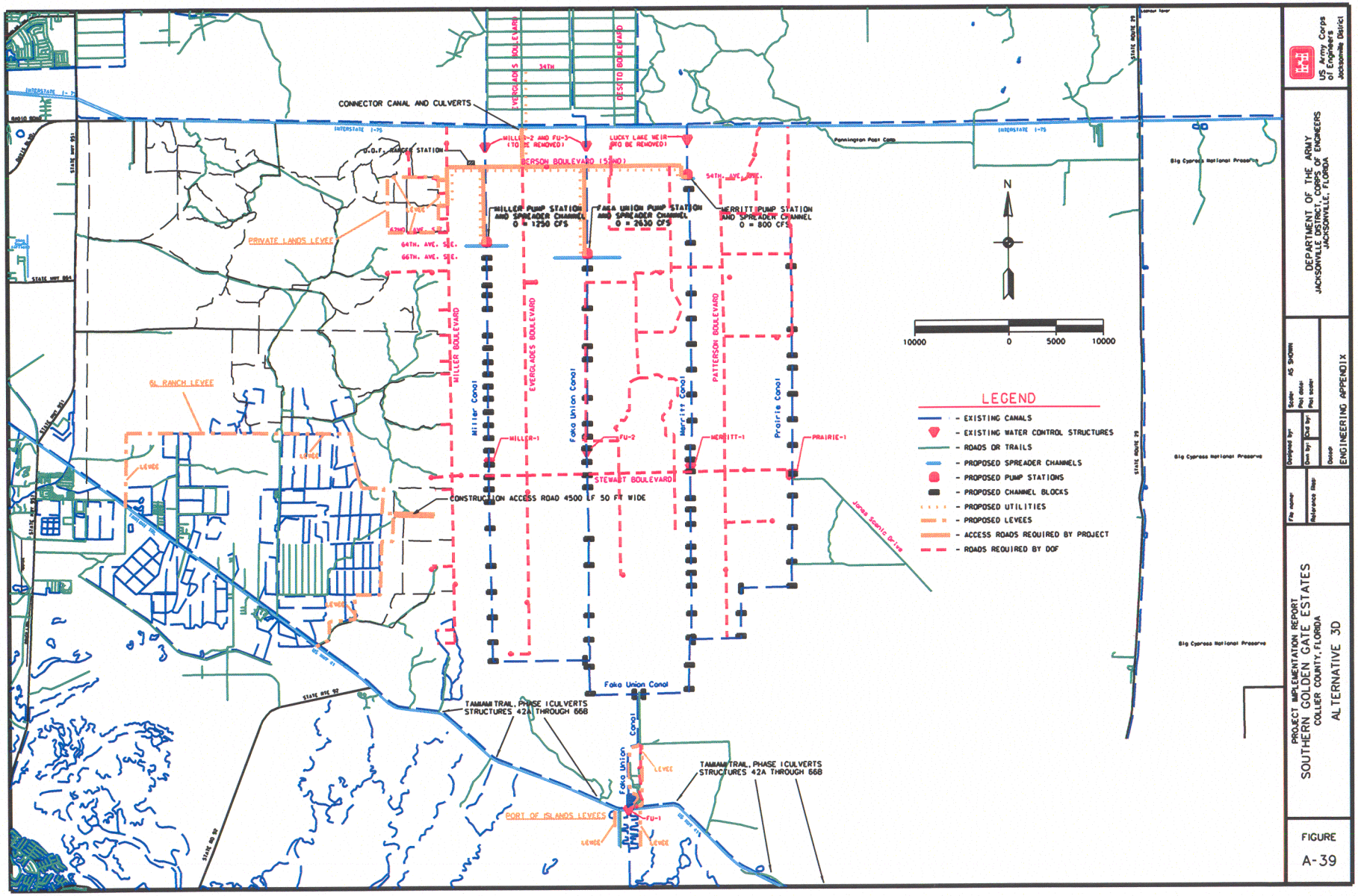
Figure A-37

Observed Groundwater Level for Well C-496
(Fakahatchee Strand south of I-75)



ME=0.0847068
MAE=0.790851
RMSE=1.05606
STDres=1.05266
R(Correlation)=0.741699
R2(Nash_Sutcliffe)=-0.440119

Figure A-38



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File name:
Reference files:
Designed by:
Dwn by:
Ckd by:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated:
ENGINEERING APPENDIX

PROJECT IMPLEMENTATION REPORT
SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
ALTERNATIVE 3D

FIGURE
A-39

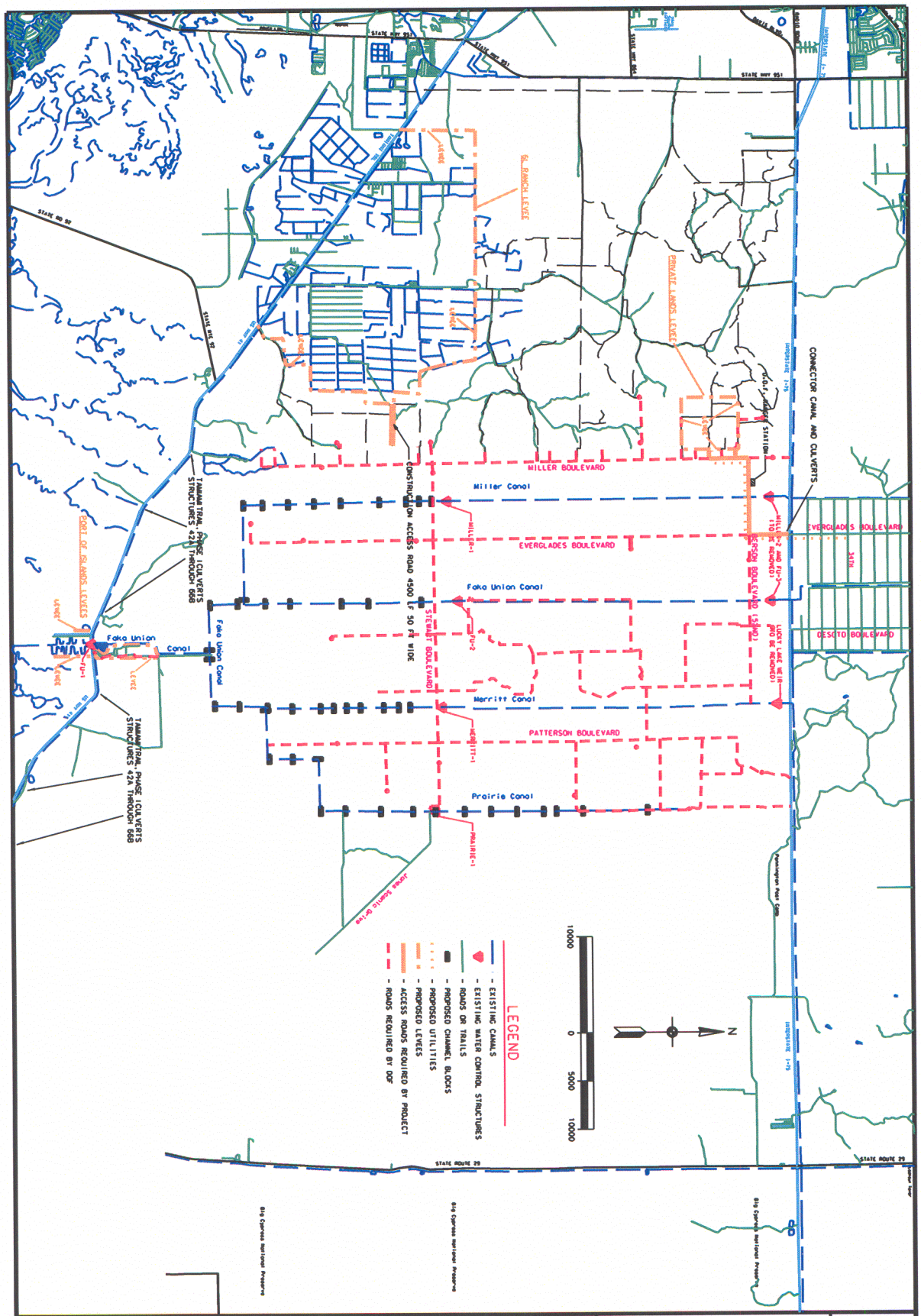

FIGURE A-40

PROJECT IMPLEMENTATION REPORT
SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
ALTERNATIVE 6

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Reference files:
Designed by:
Drawn by:
Chd by:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated:
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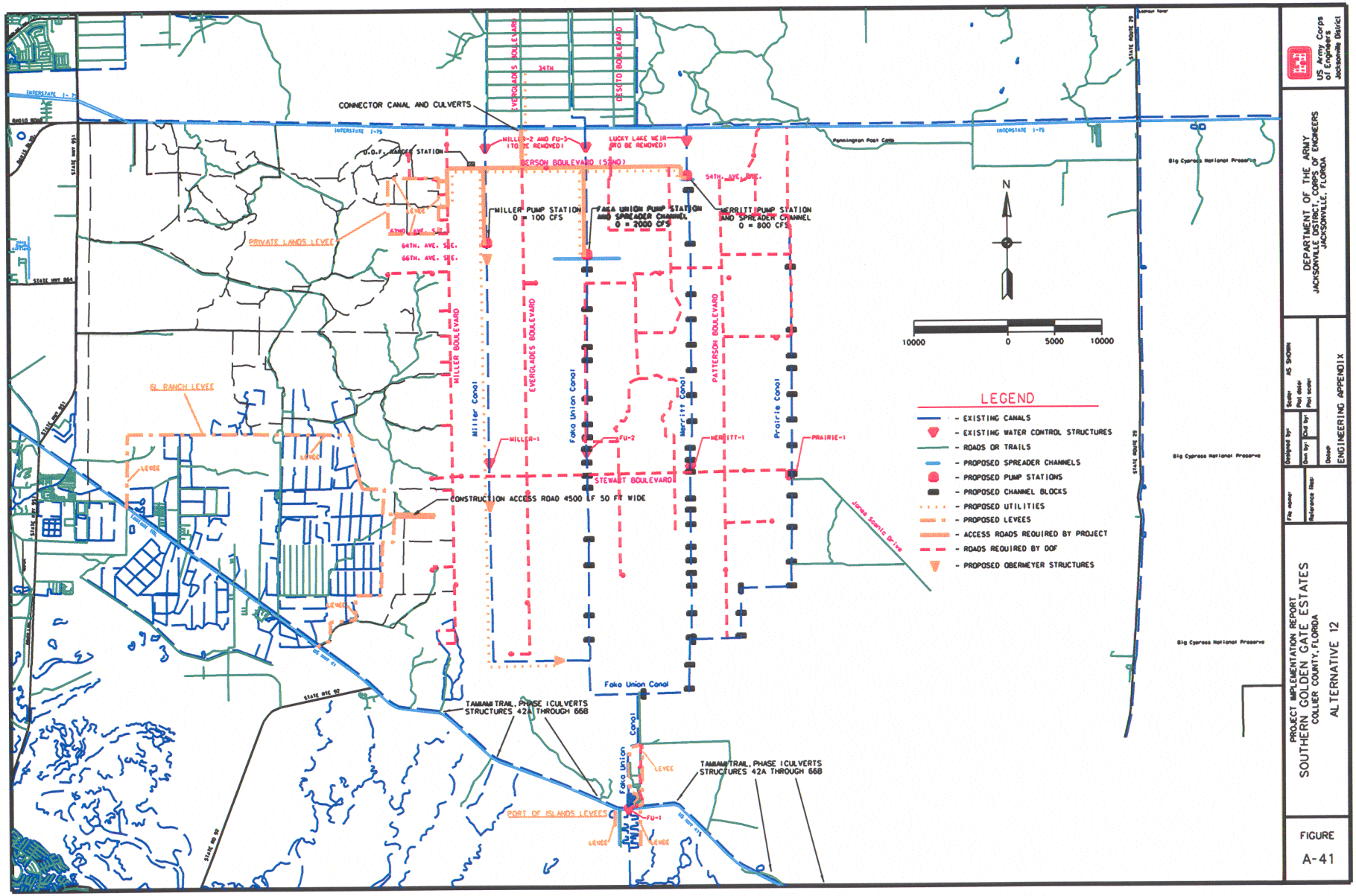
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District



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JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

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Plot scale:
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Dwn by:
Ckd by:
Date:
ENGINEERING APPENDIX
File name:
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PROJECT IMPLEMENTATION REPORT
SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
ALTERNATIVE 12

FIGURE
A-41

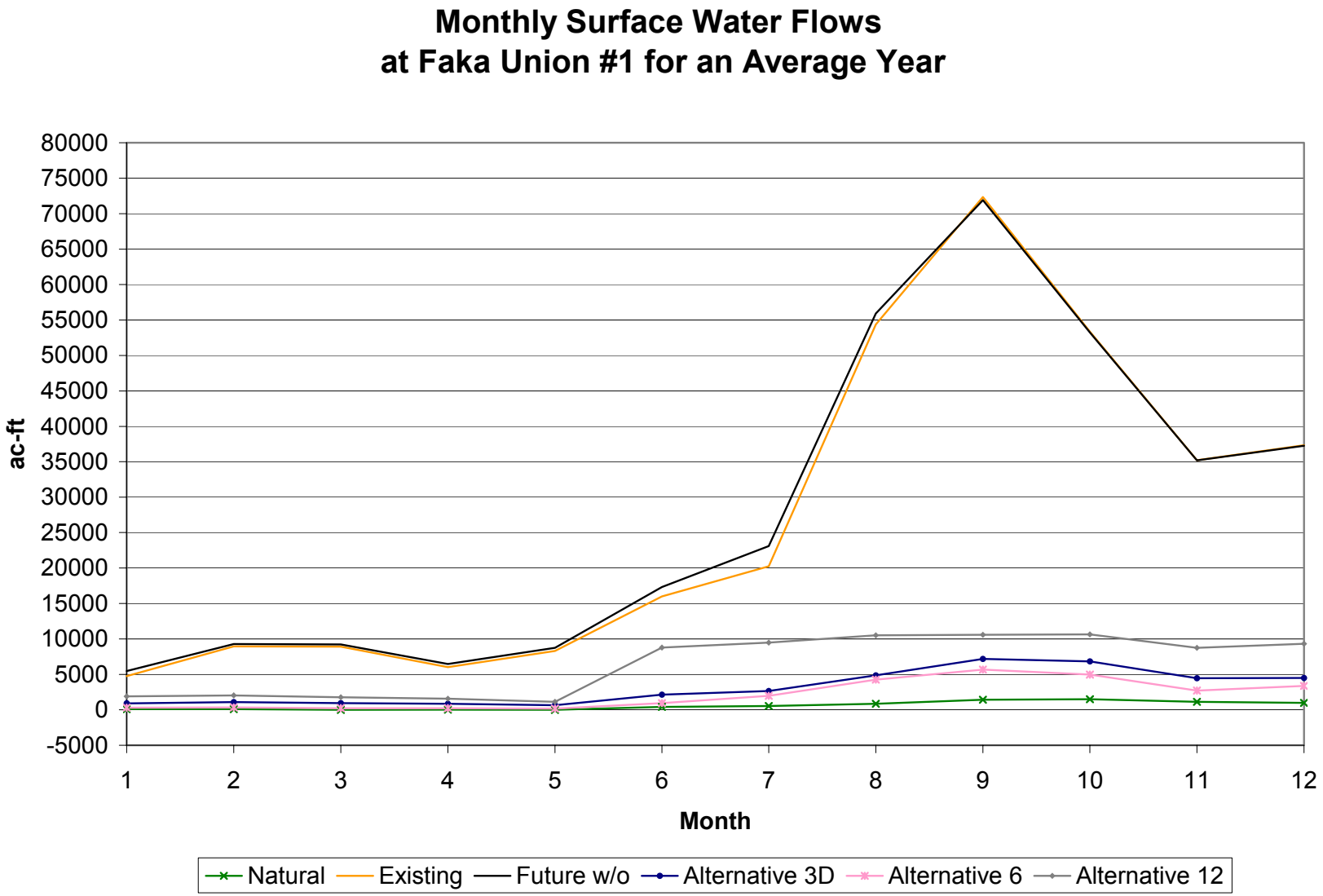

Monthly Surface Water Flows
at Faka Union #1 for an Average Year
ac-ft
80000
75000
70000
65000
60000
55000
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
-5000
1
2
3
4
5
6
7
8
9
10
11
12
Month
Natural
Existing
Future w/o
Alternative 3D
Alternative 6
Alternative 12

Figure A-42

Monthly Surface Water Flows
Through Fakahatchee Flow Way at US-41 for an Average Year

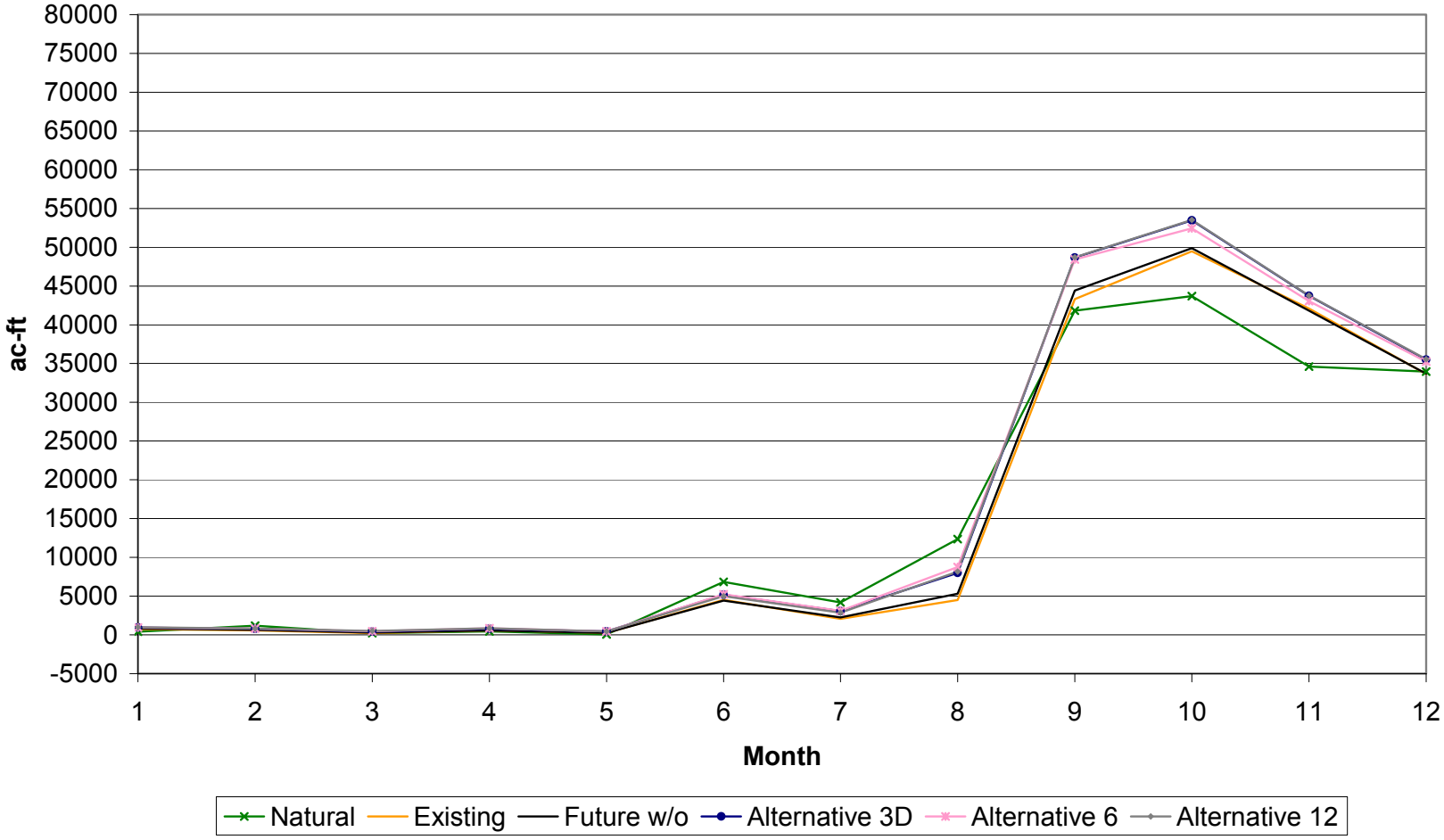


Figure A-43

Monthly Surface Water Flows
Through Miller Flow Way at US-41 for an Average Year

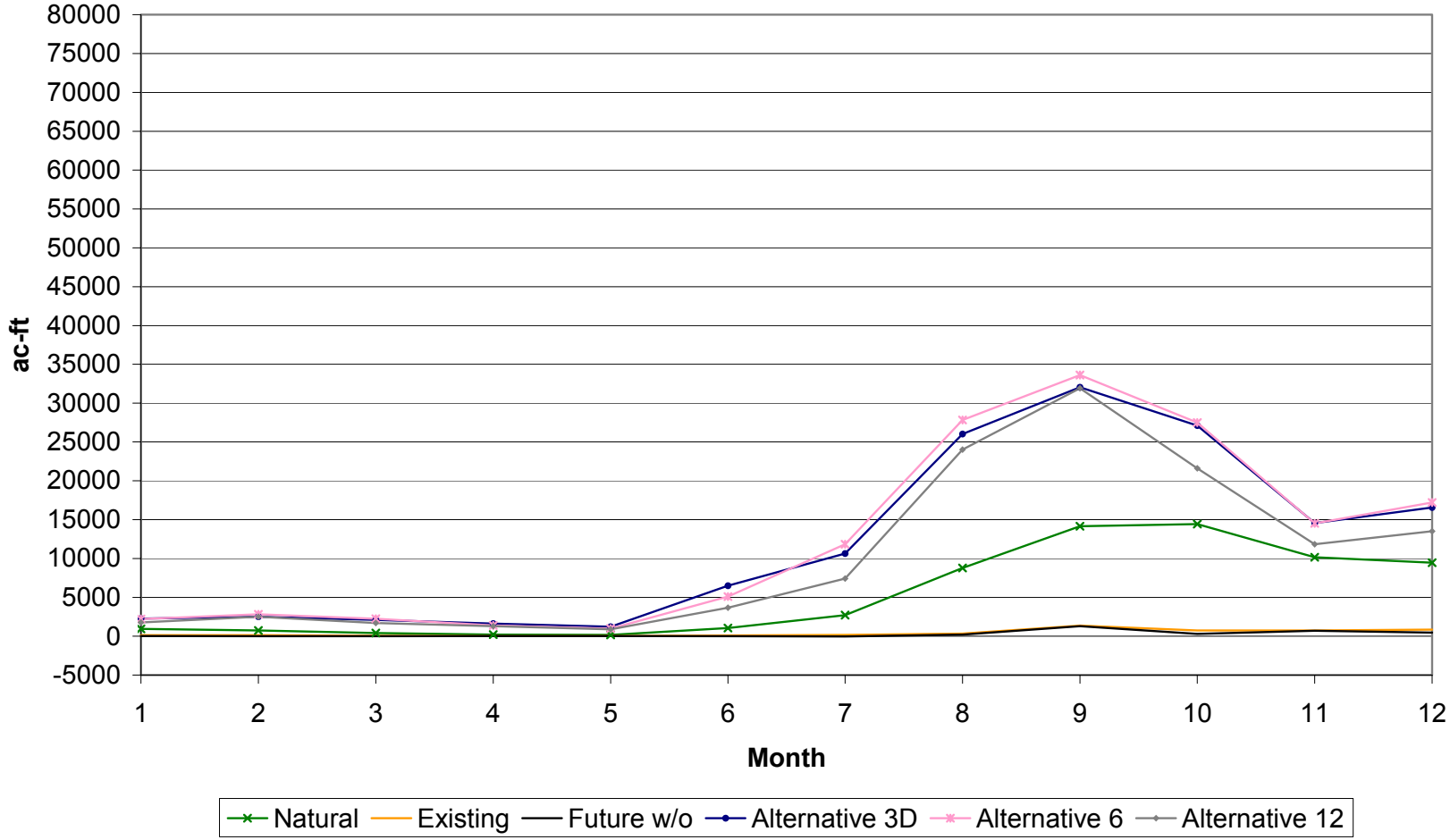


Figure A-44

Monthly Surface Water Flows
Through Merritt Flow Way at US-41 for an Average Year

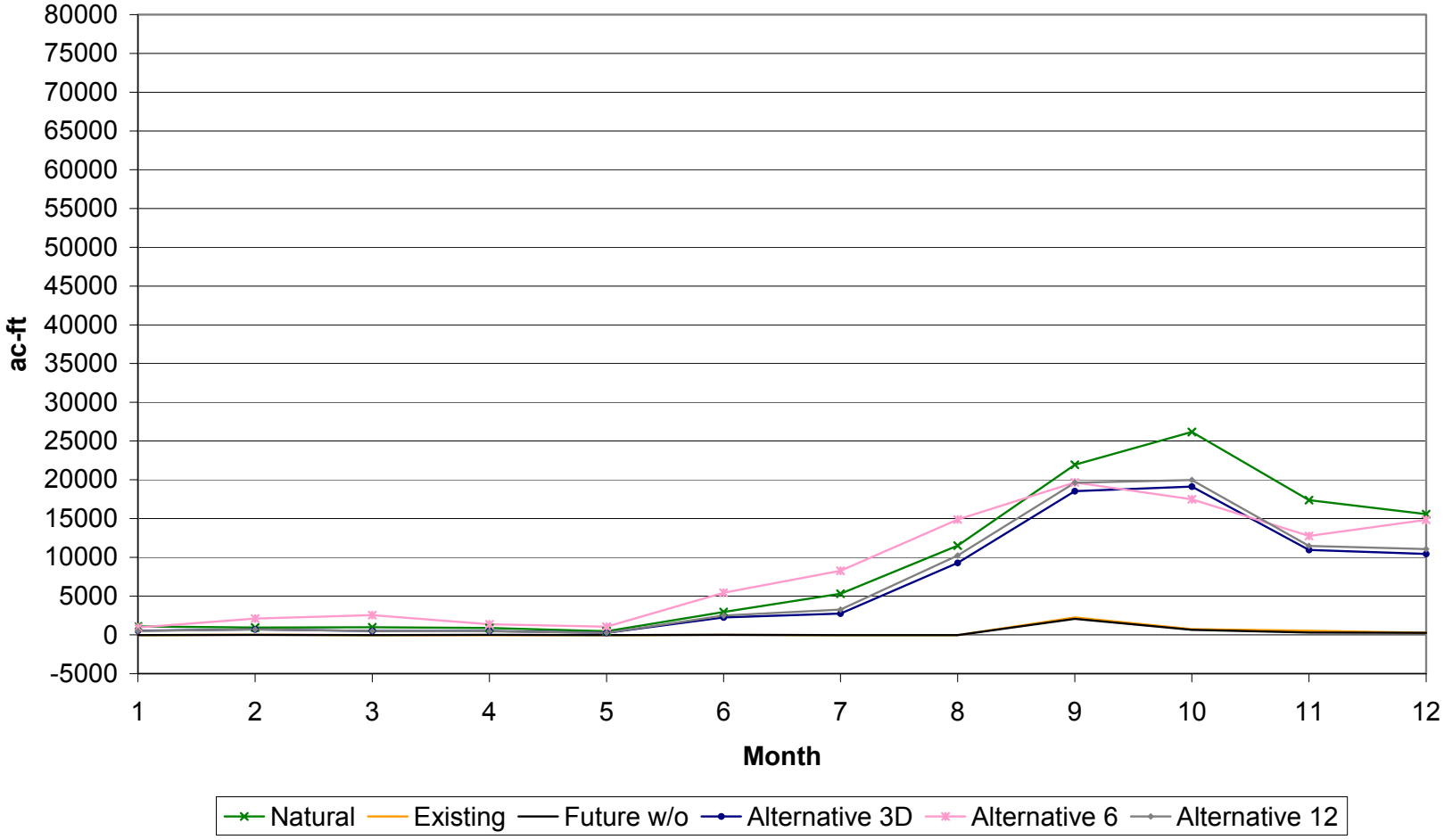


Figure A-45

Monthly Surface Water Flows
Through Faka Union Flow Way at US-41 for an Average Year

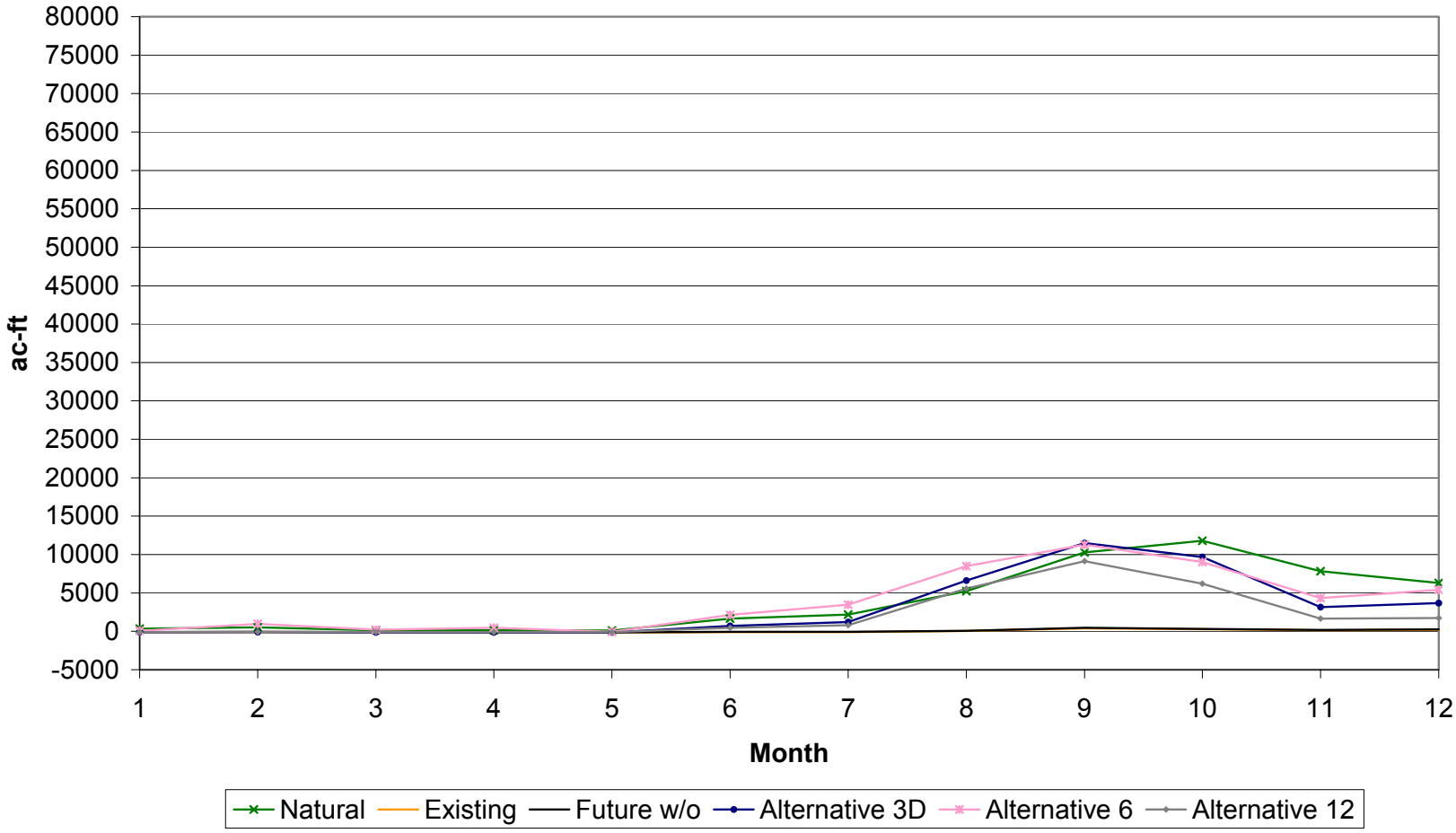


Figure A-46

Simulated Groundwater Stage Hydrograph at Well 1 for an Average Year (1994)

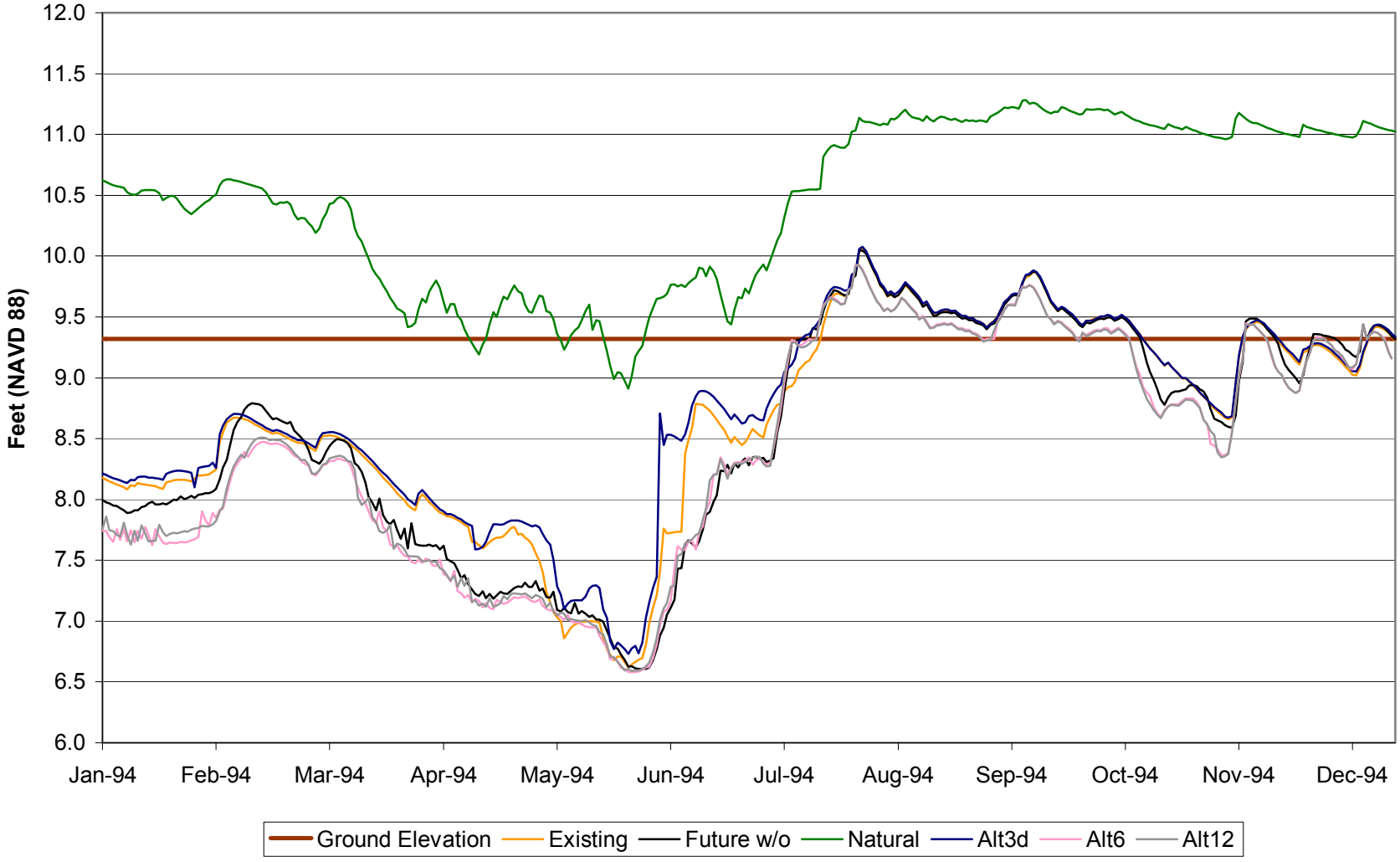
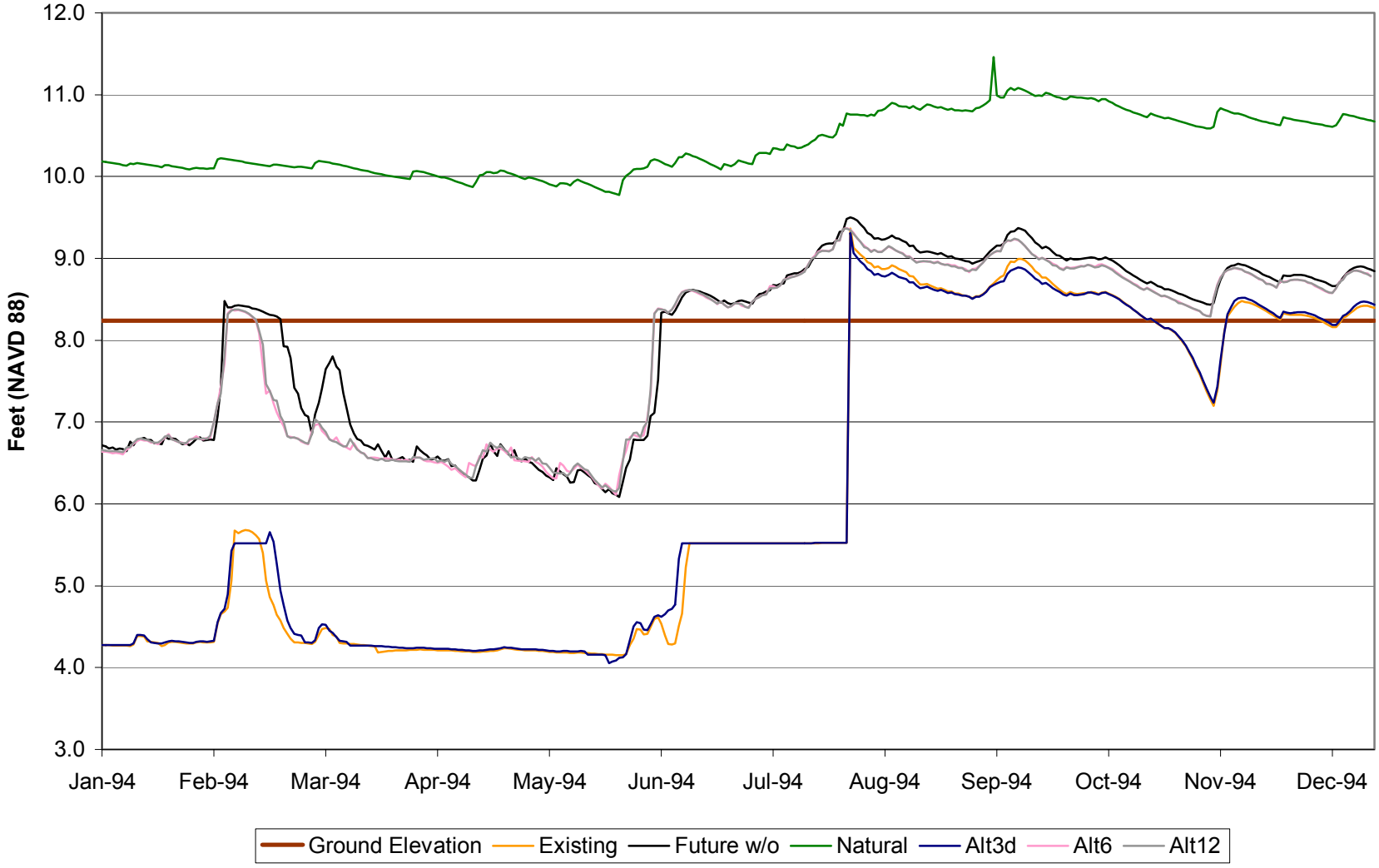


Figure A-47

Simulated Groundwater Stage Hydrograph at Well 2 for an Average Year (1994)



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Comprehensive Everglades Restoration Plan
Southern Golden Gate Estates Project Implementation Report

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Figure A-48

Simulated Groundwater Stage Hydrograph at Well 3 for an Average Year (1994)

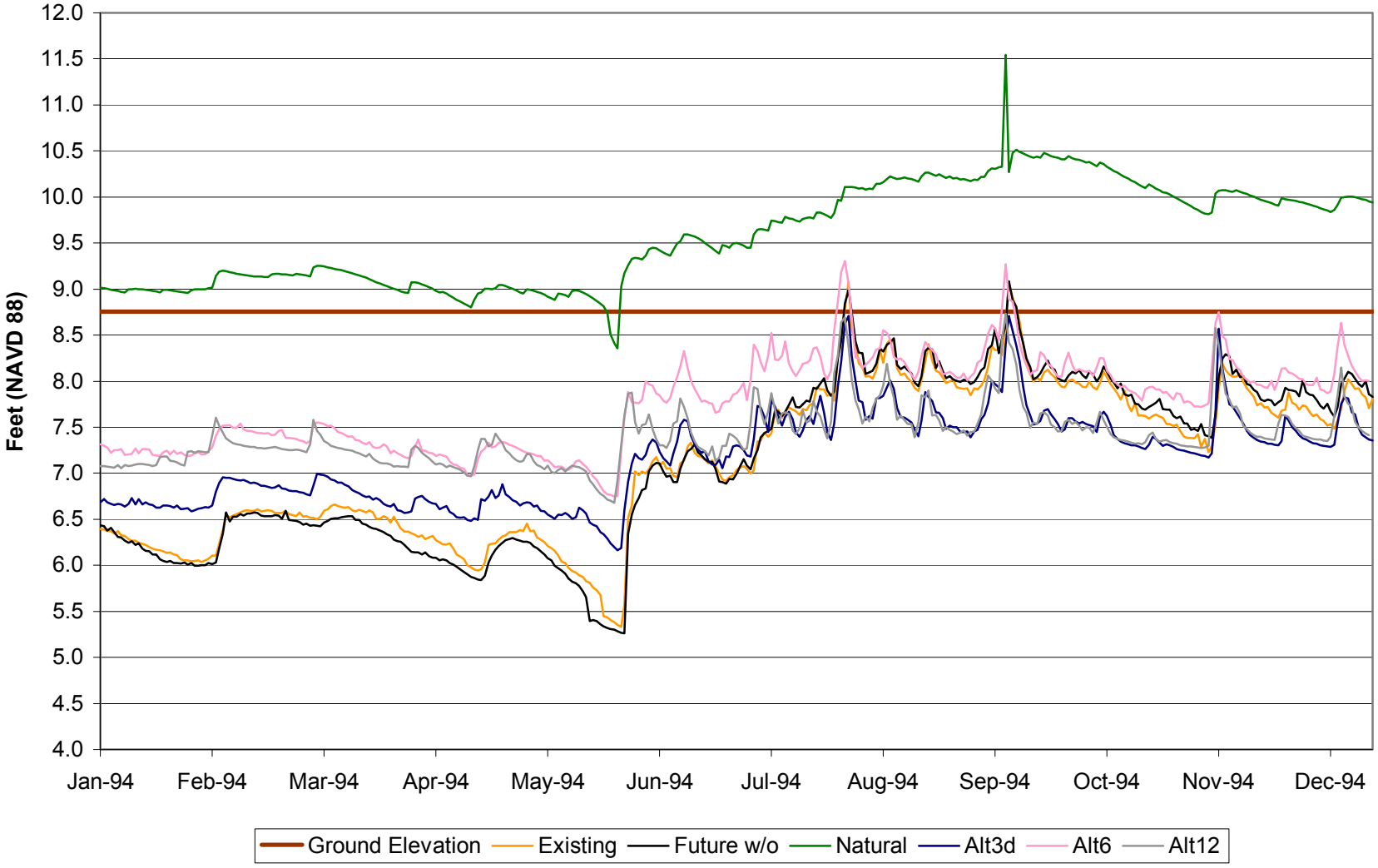

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Figure A-49

Simulated Groundwater Stage Hydrograph at Well 4 for an Average Year (1994)

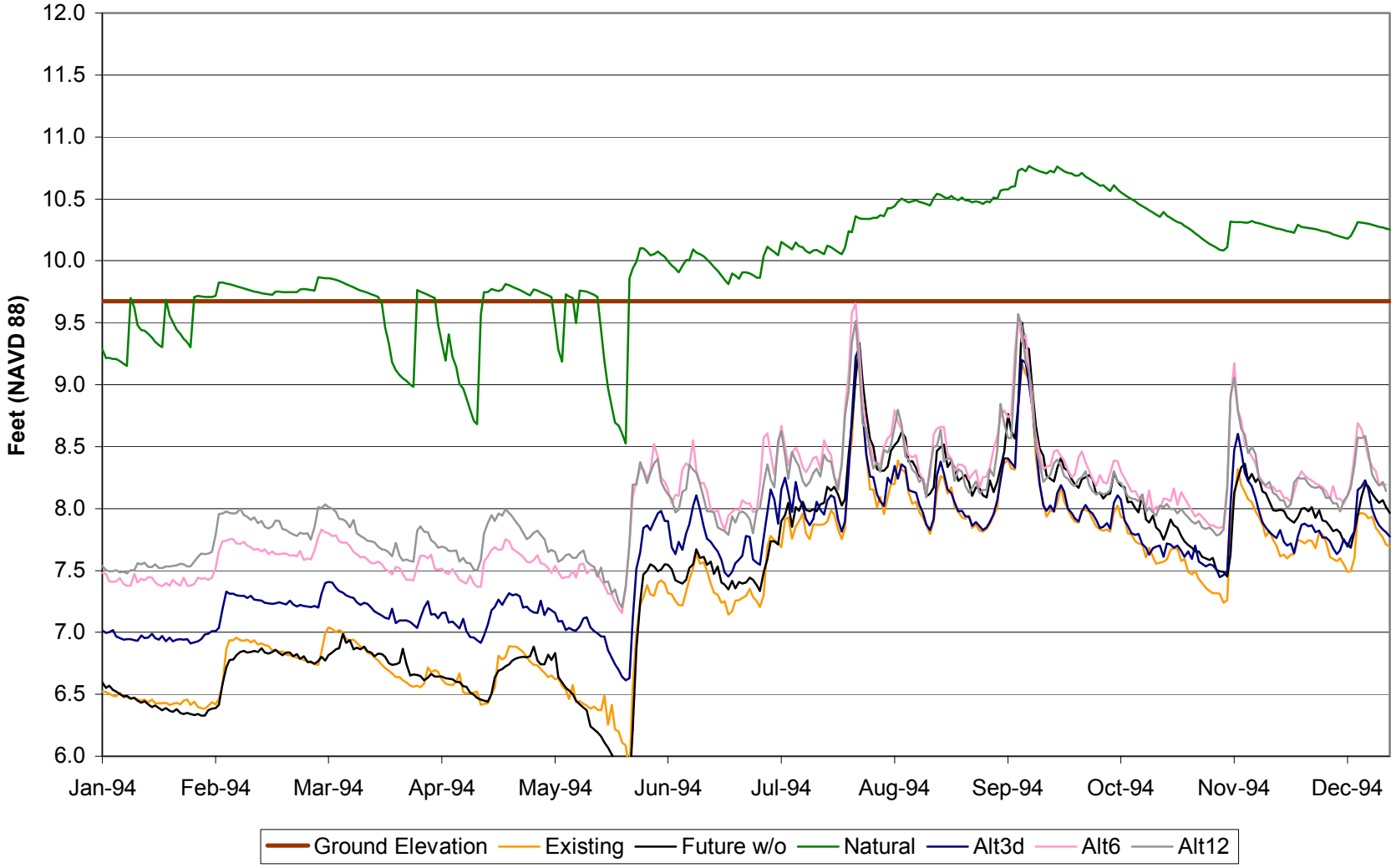

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Figure A-50

Simulated Groundwater Stage Hydrograph at Well 5 for an Average Year (1994)

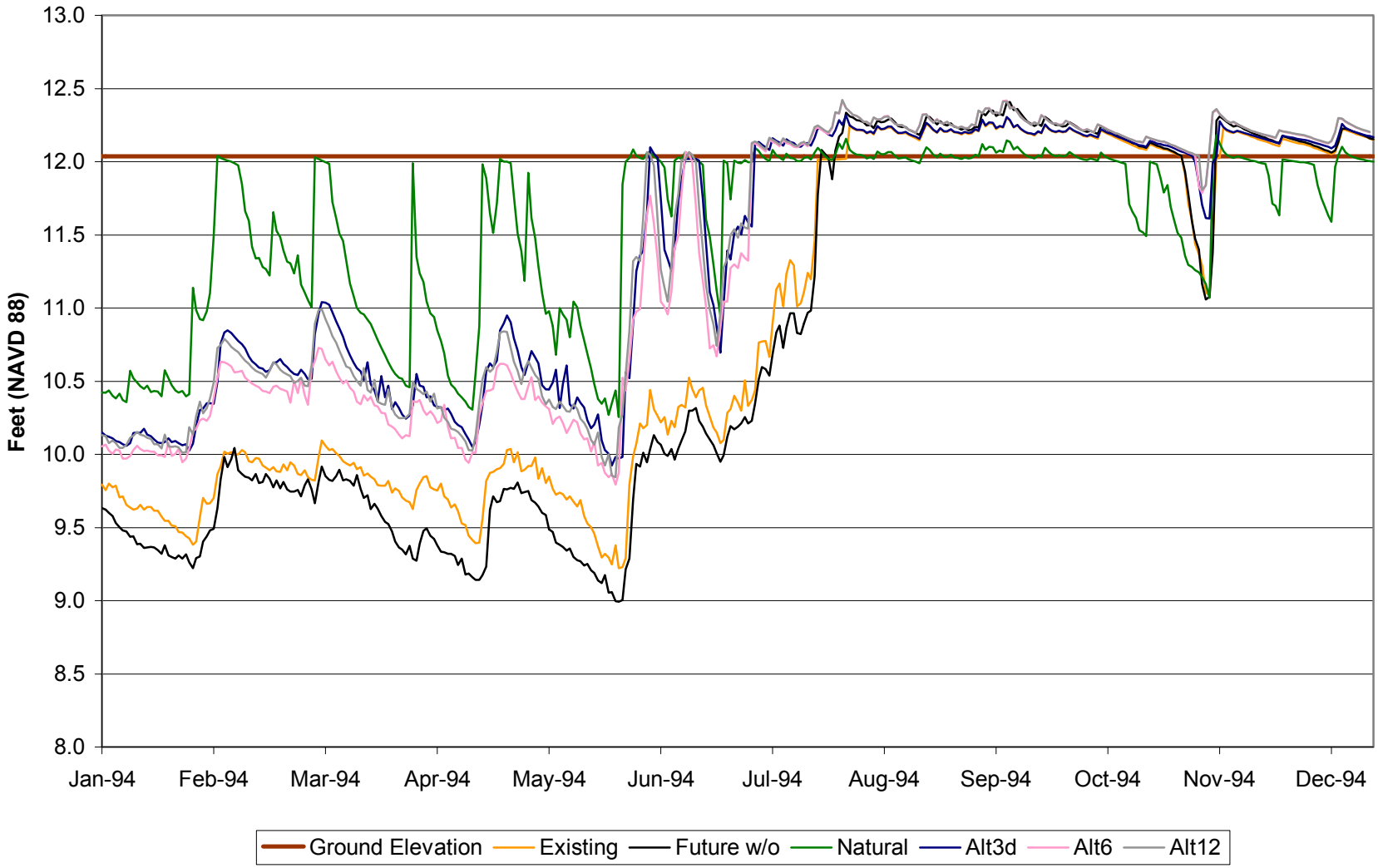

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Figure A-51

Simulated Groundwater Stage Hydrograph at Well 6 for an Average Year (1994)



Figure A-52

Simulated Groundwater Stage Hydrograph at Well 7 for an Average Year (1994)

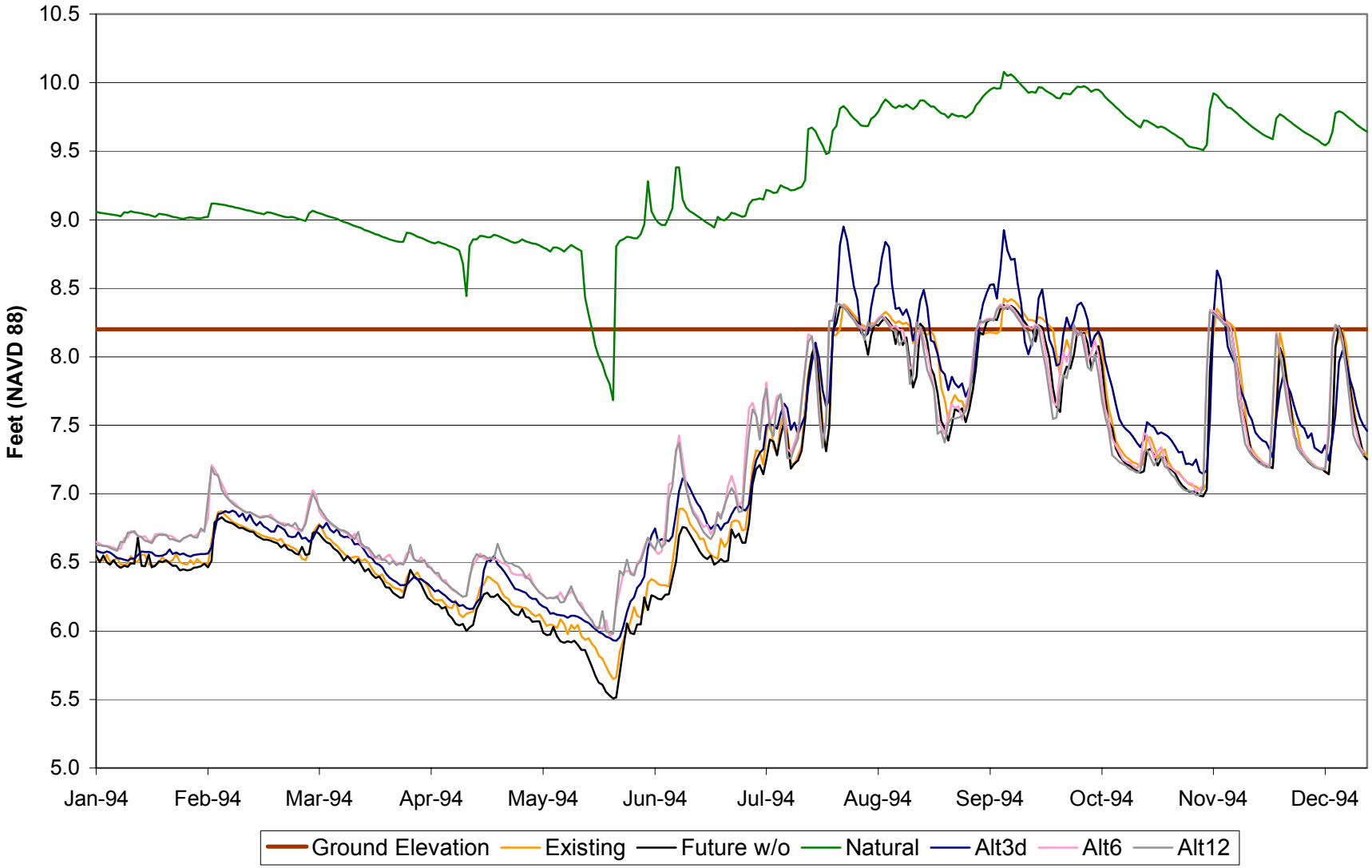

Figure A-53

Simulated Groundwater Stage Hydrograph at Well 8 for an Average Year (1994)

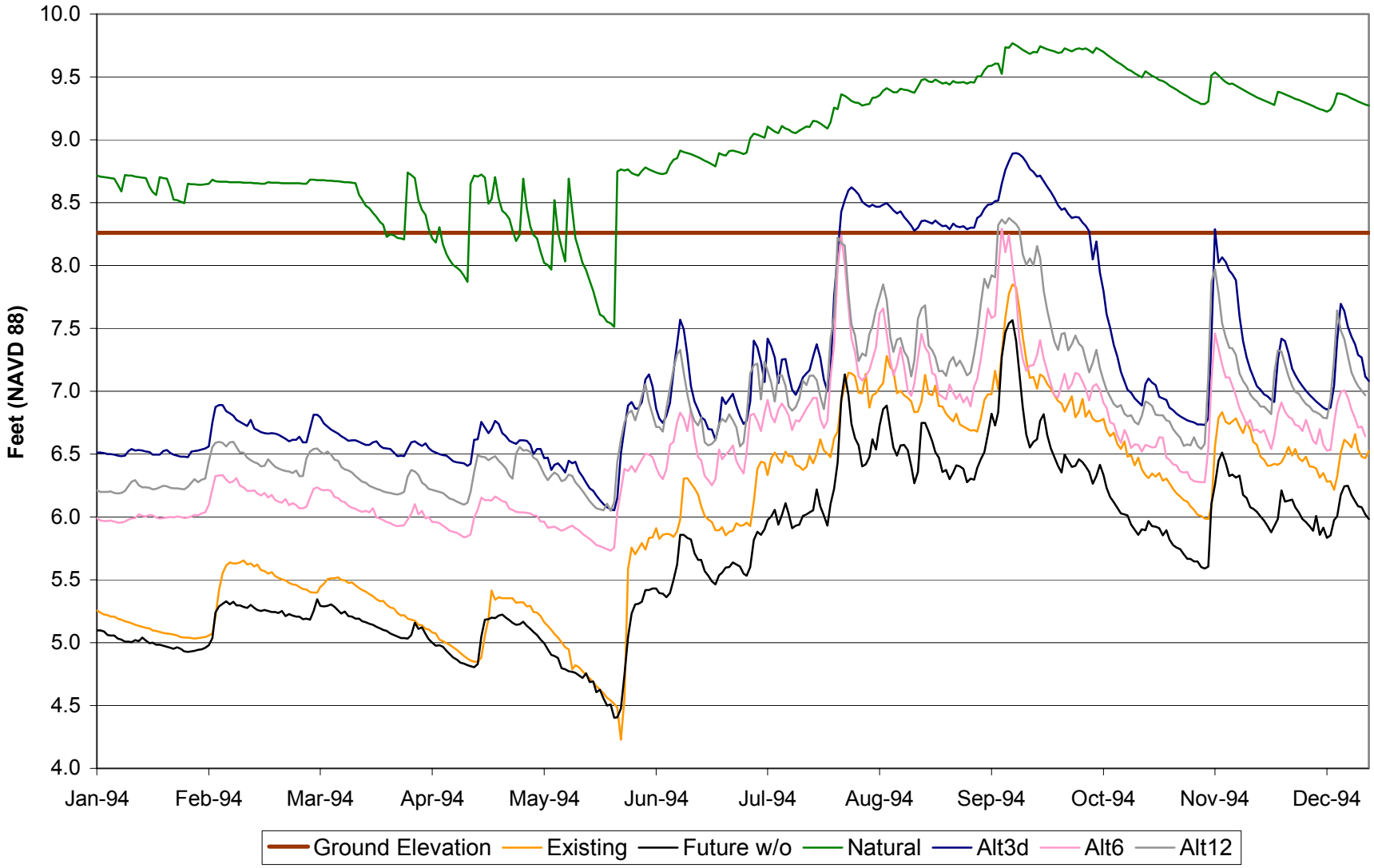

Figure A-54

Simulated Groundwater Stage Hydrograph at Well 9 for an Average Year (1994)

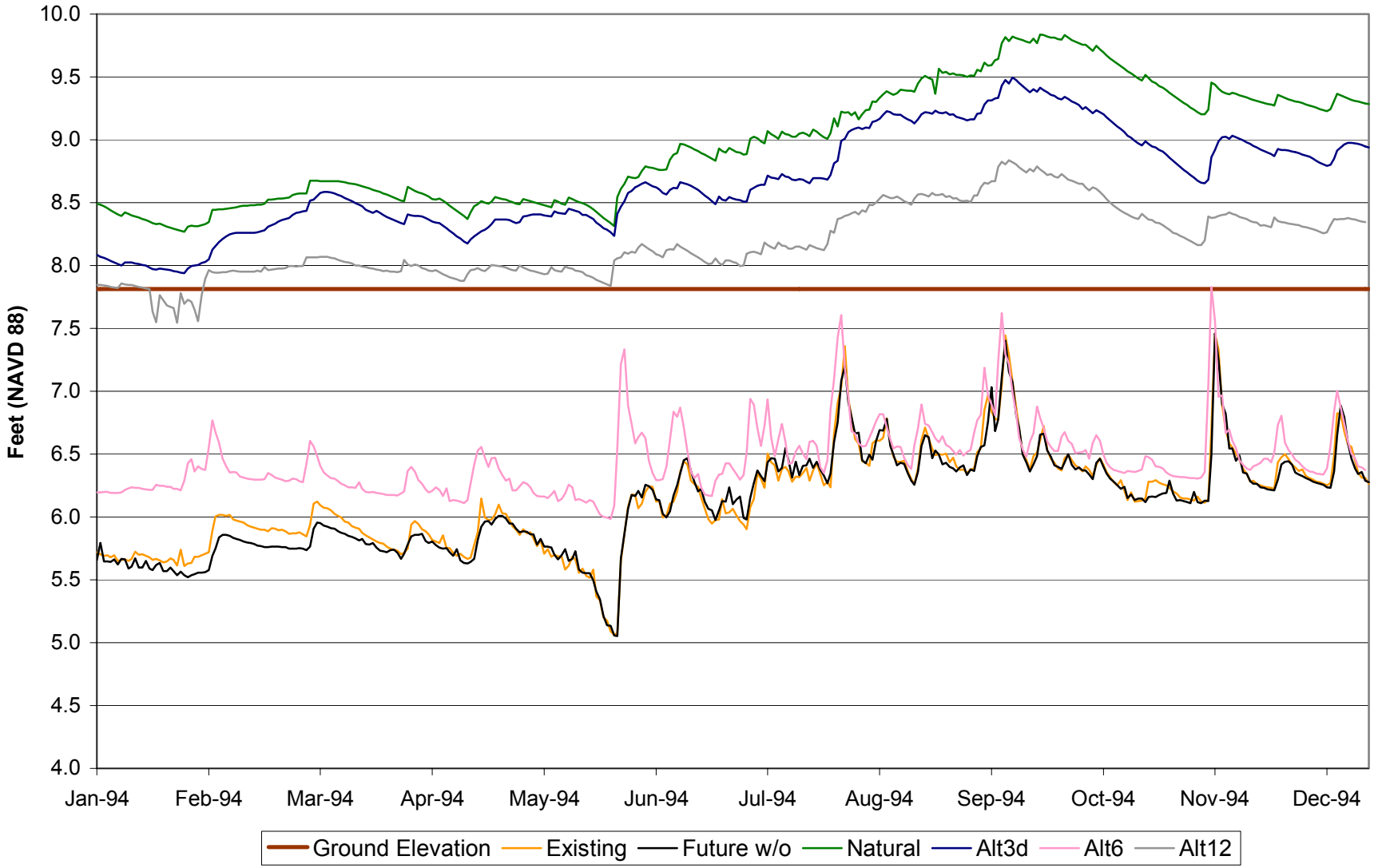

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Figure A-55

Simulated Groundwater Stage Hydrograph at Well 10 for an Average Year (1994)

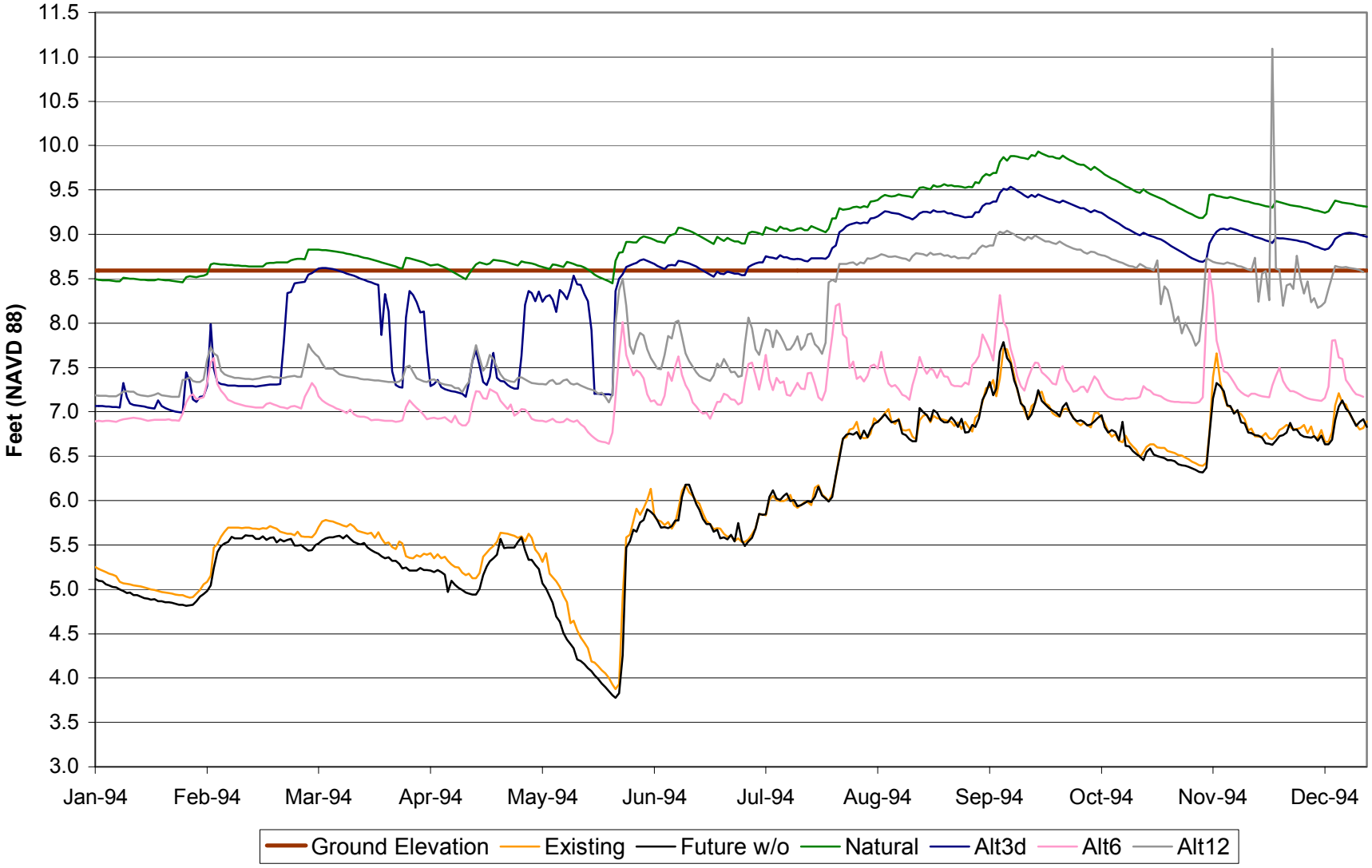

Figure A-56

Simulated Groundwater Stage Hydrograph at Well 11 for an Average Year (1994)

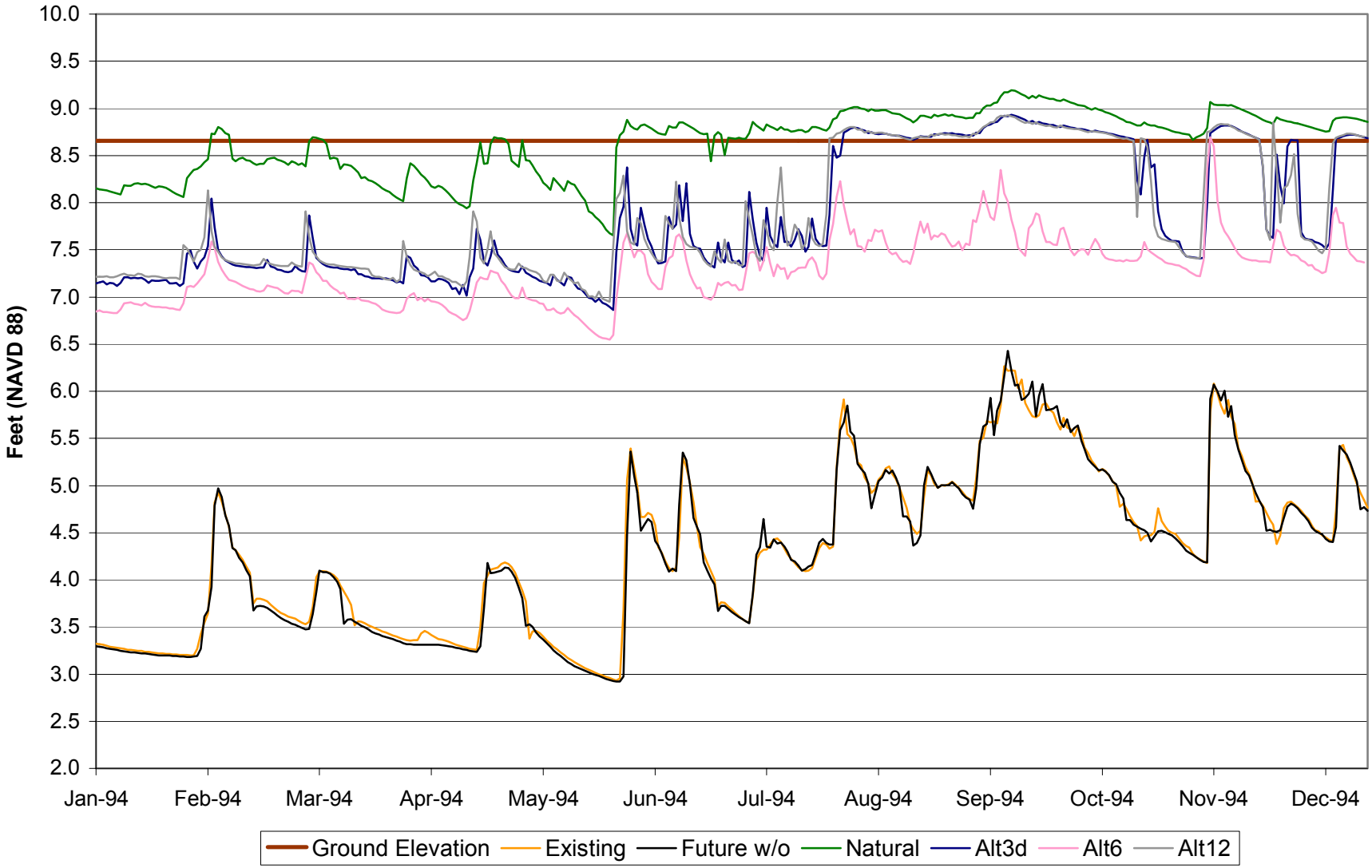

Figure A-57

Simulated Groundwater Stage Hydrograph at Well 12 for an Average Year (1994)

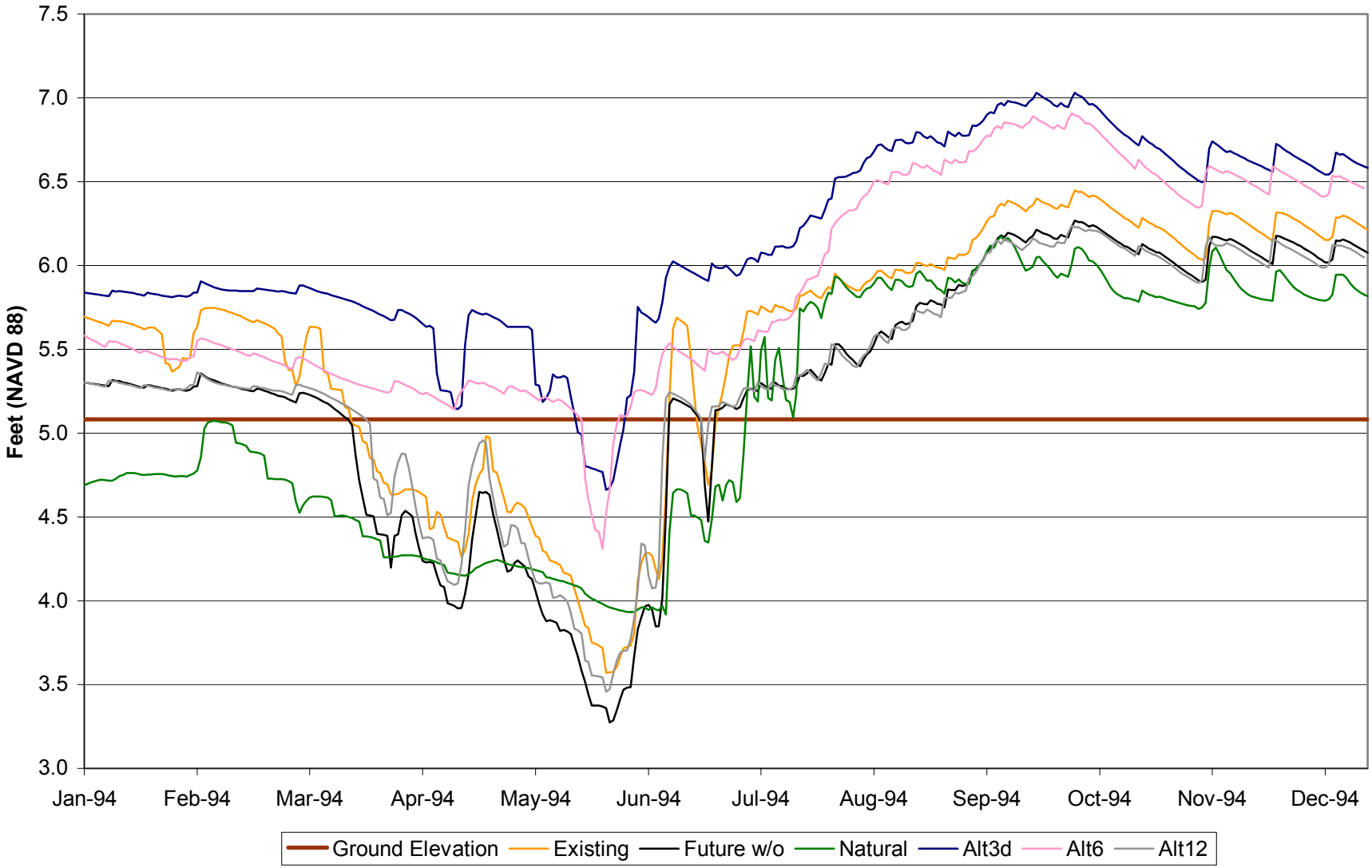

Figure A-58

Simulated Groundwater Stage Hydrograph at Well 13 for an Average Year (1994)

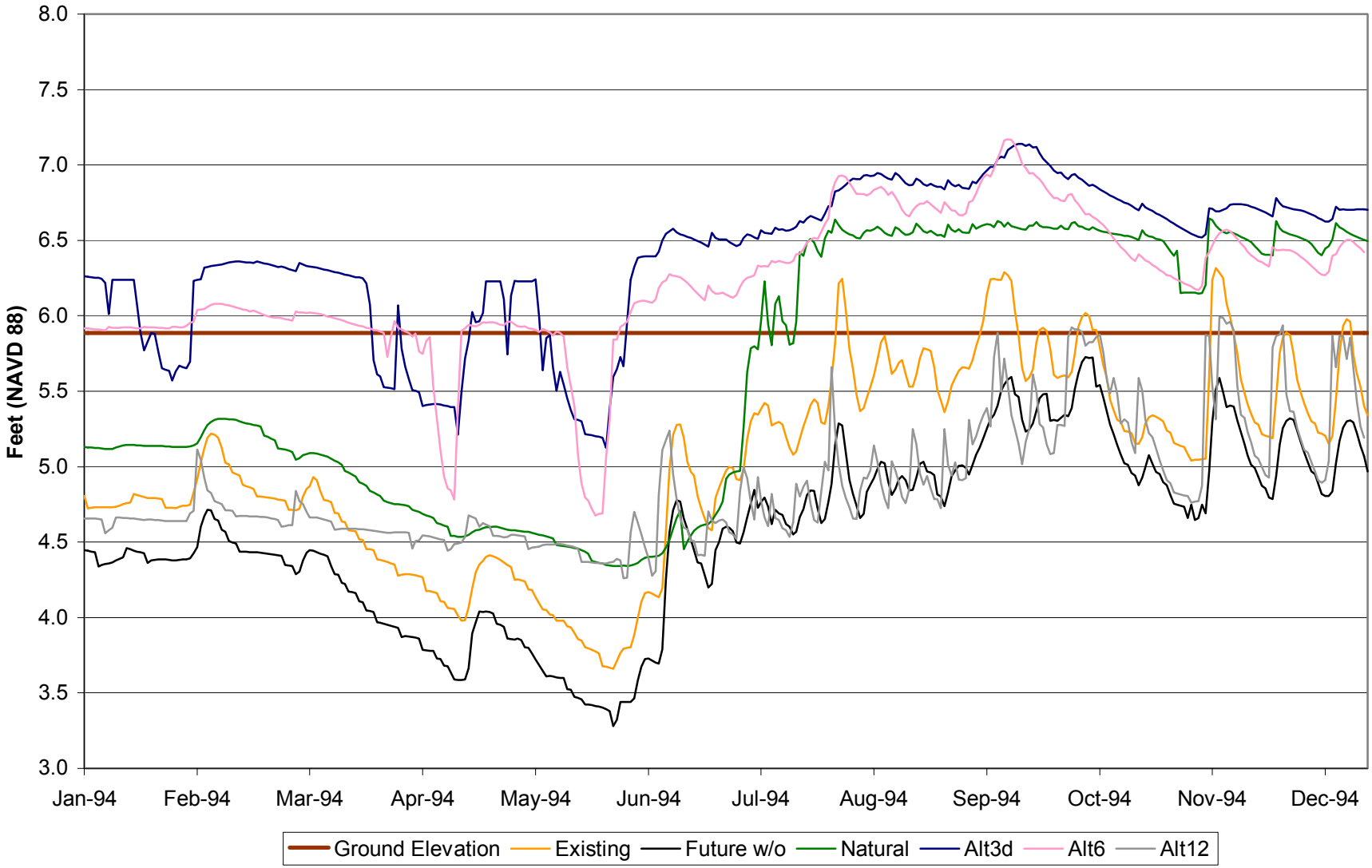

Figure A-59

Simulated Groundwater Stage Hydrograph at Well 14 for an Average Year (1994)

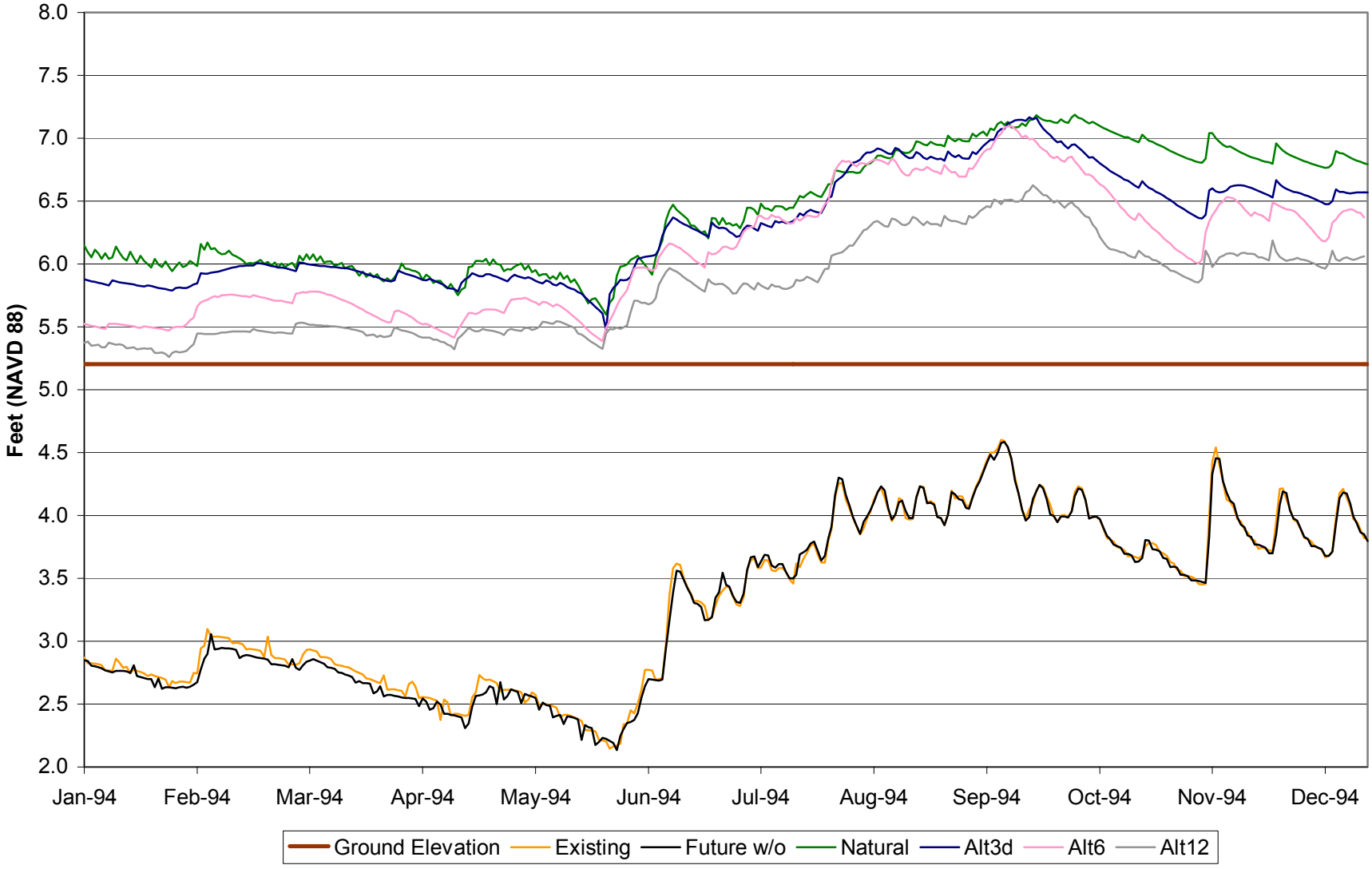

Figure A-60

Simulated Groundwater Stage Hydrograph at Well 15 for an Average Year (1994)

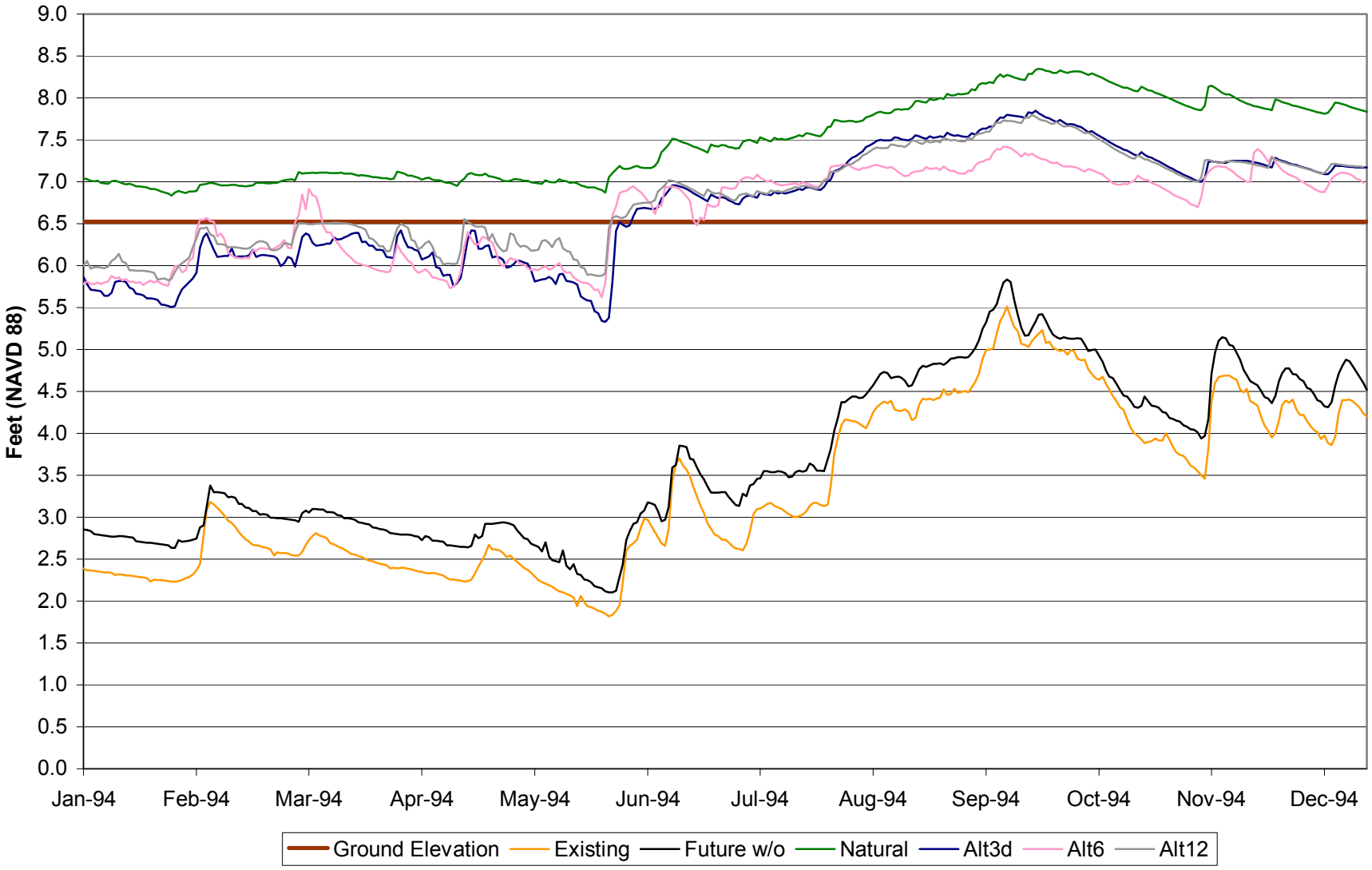

Figure A-61

Simulated Groundwater Stage Hydrograph at Well 16 for an Average Year (1994)

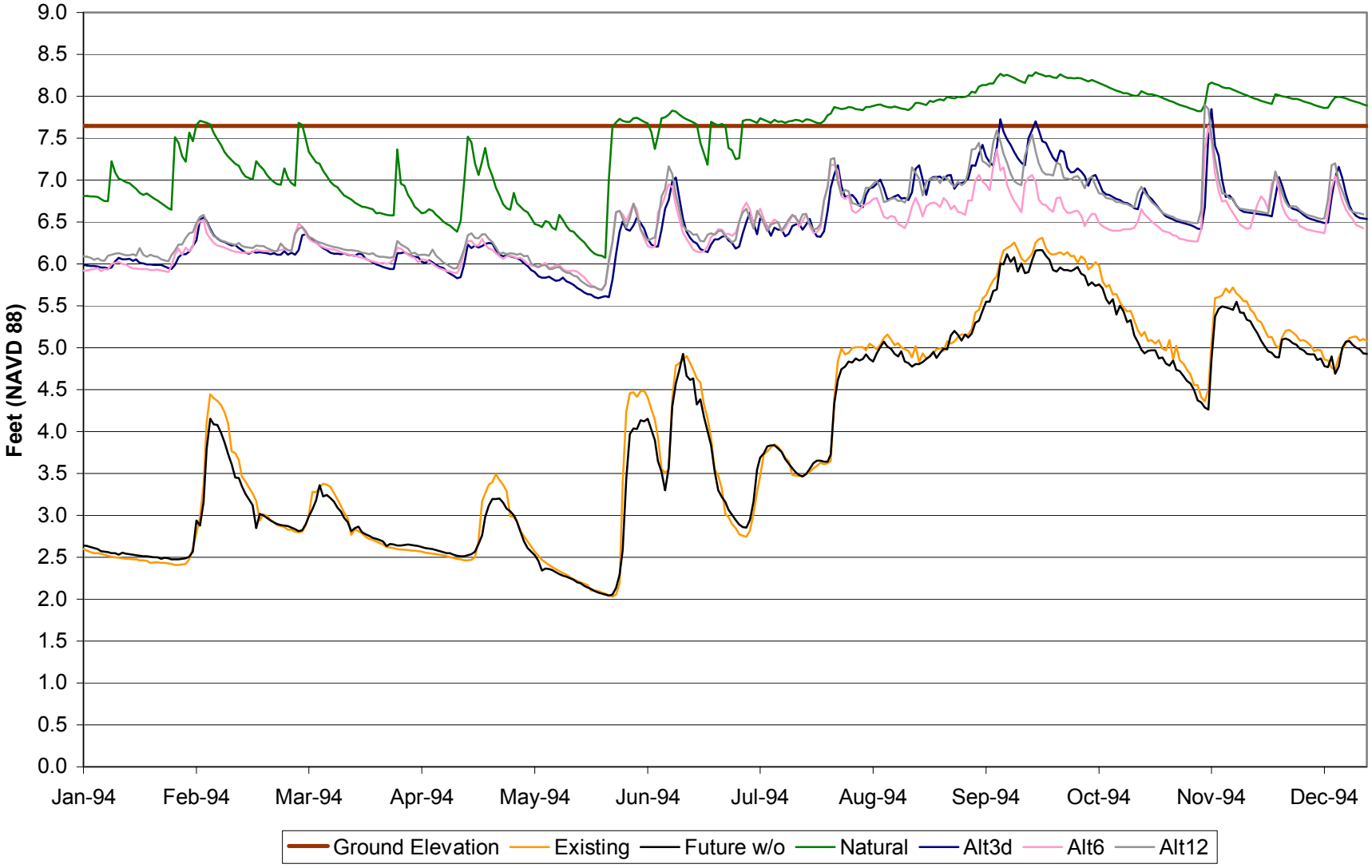

Figure A-62

Simulated Groundwater Stage Hydrograph at Well 17 for an Average Year (1994)

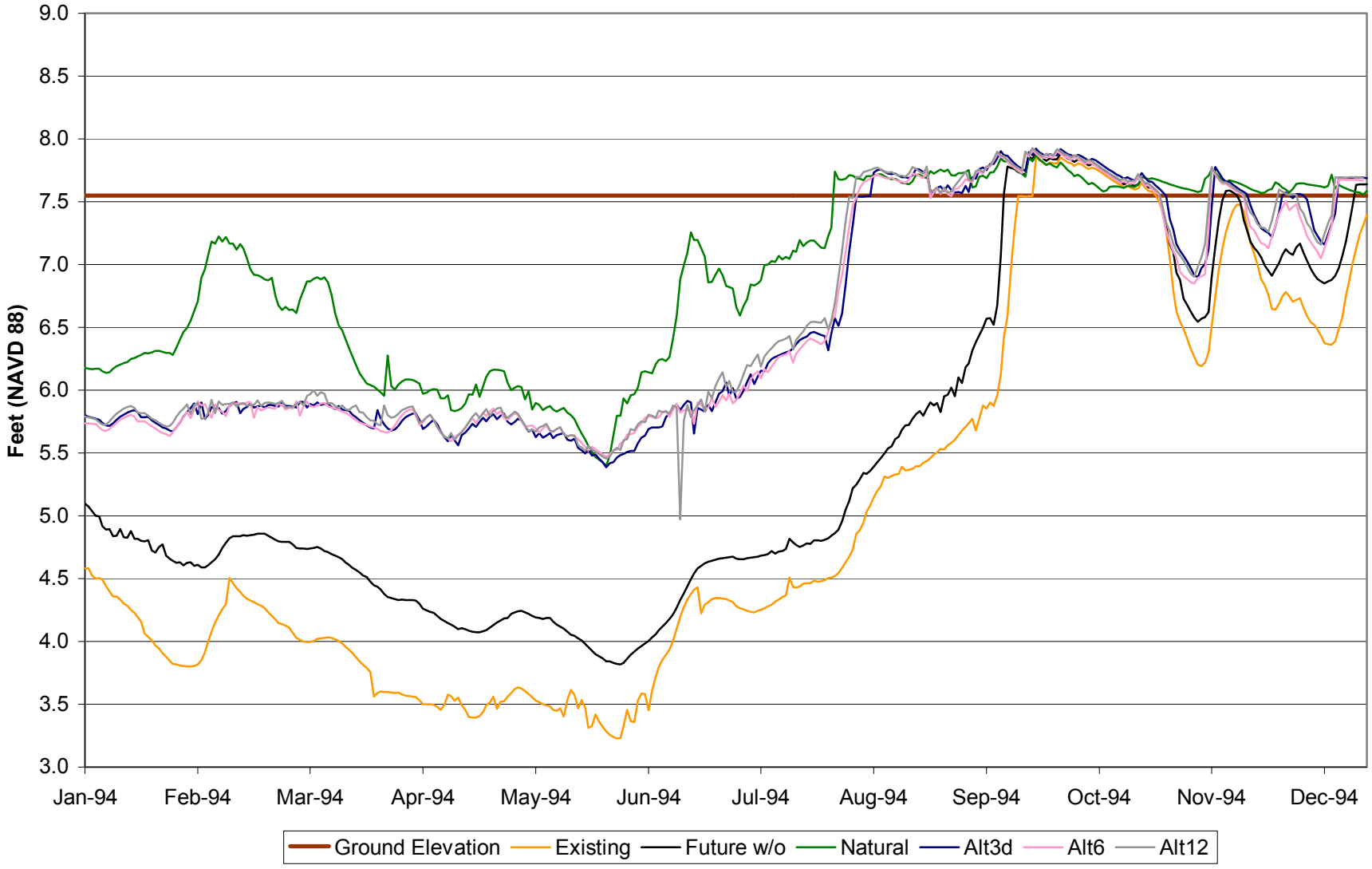

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Figure A-63

Simulated Groundwater Stage Hydrograph at Well 18 for an Average Year (1994)

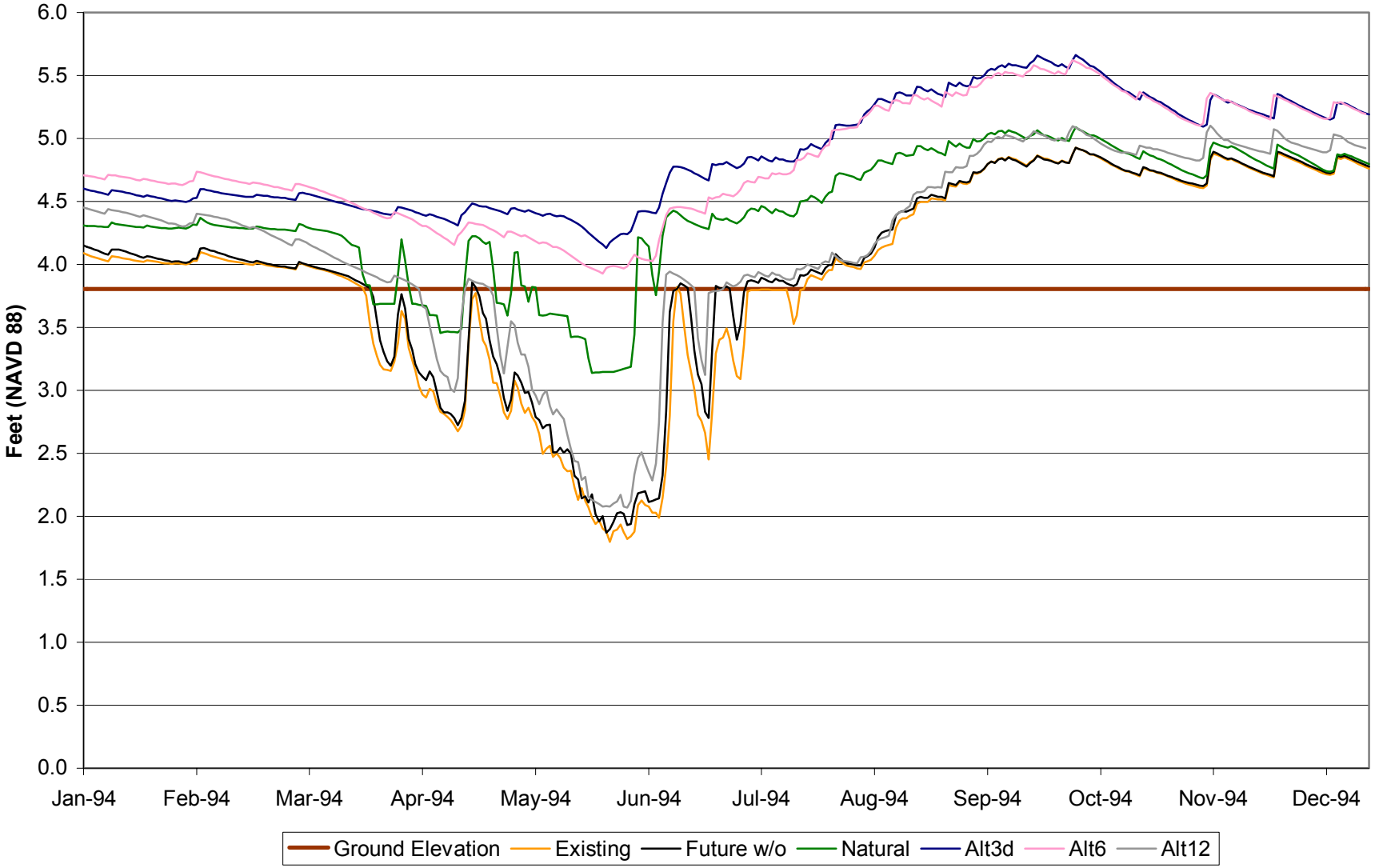

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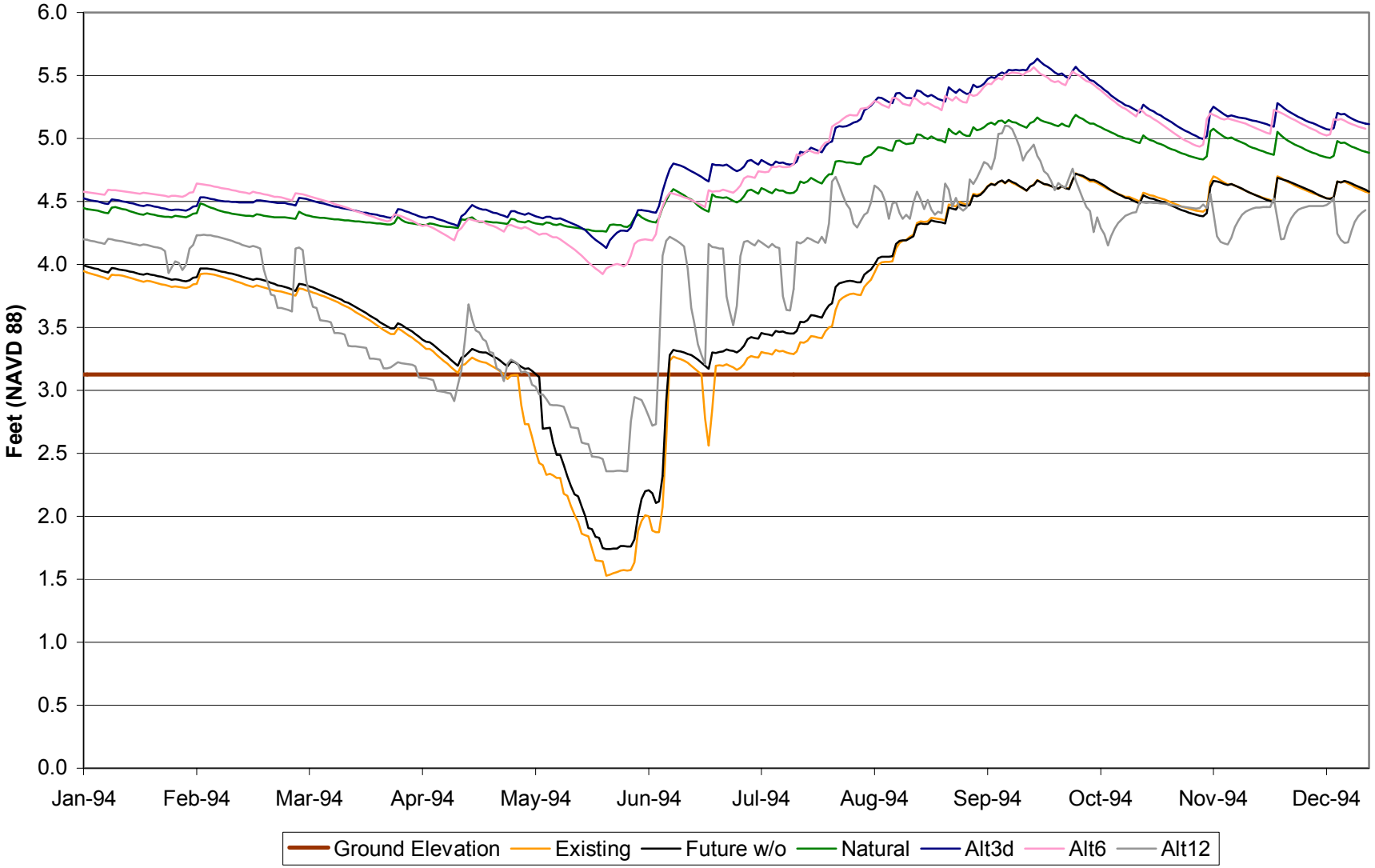
Figure A-64

Simulated Groundwater Stage Hydrograph at Well 19 for an Average Year (1994)



US Army Corps of Engineers	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Comprehensive Everglades Restoration Plan **Southern Golden Gate Estates** **Project Implementation Report**	SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Figure A-65

Simulated Groundwater Stage Hydrograph at Well 20 for an Average Year (1994)

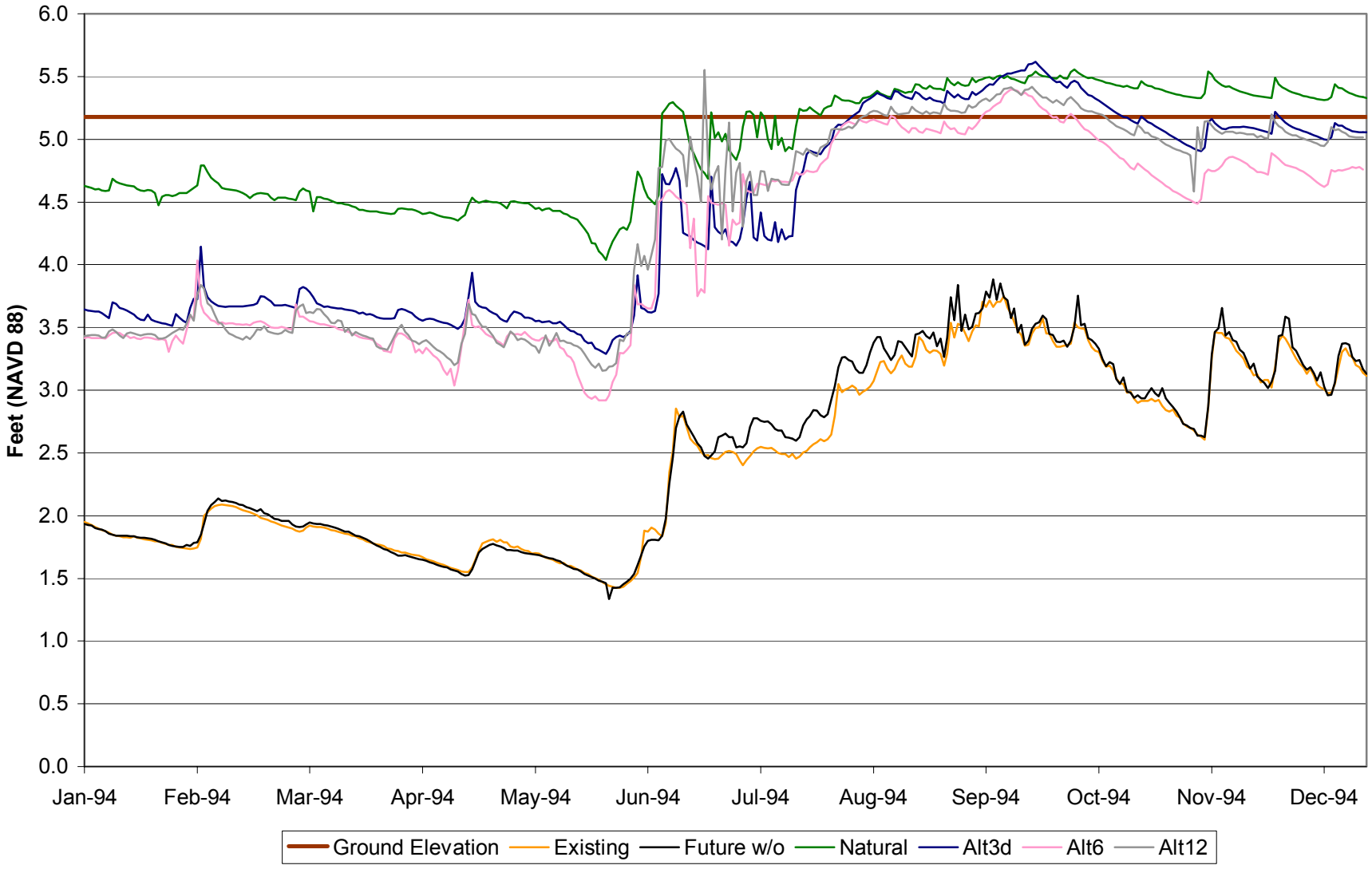


Figure A-66

Simulated Groundwater Stage Hydrograph at Well 21 for an Average Year (1994)

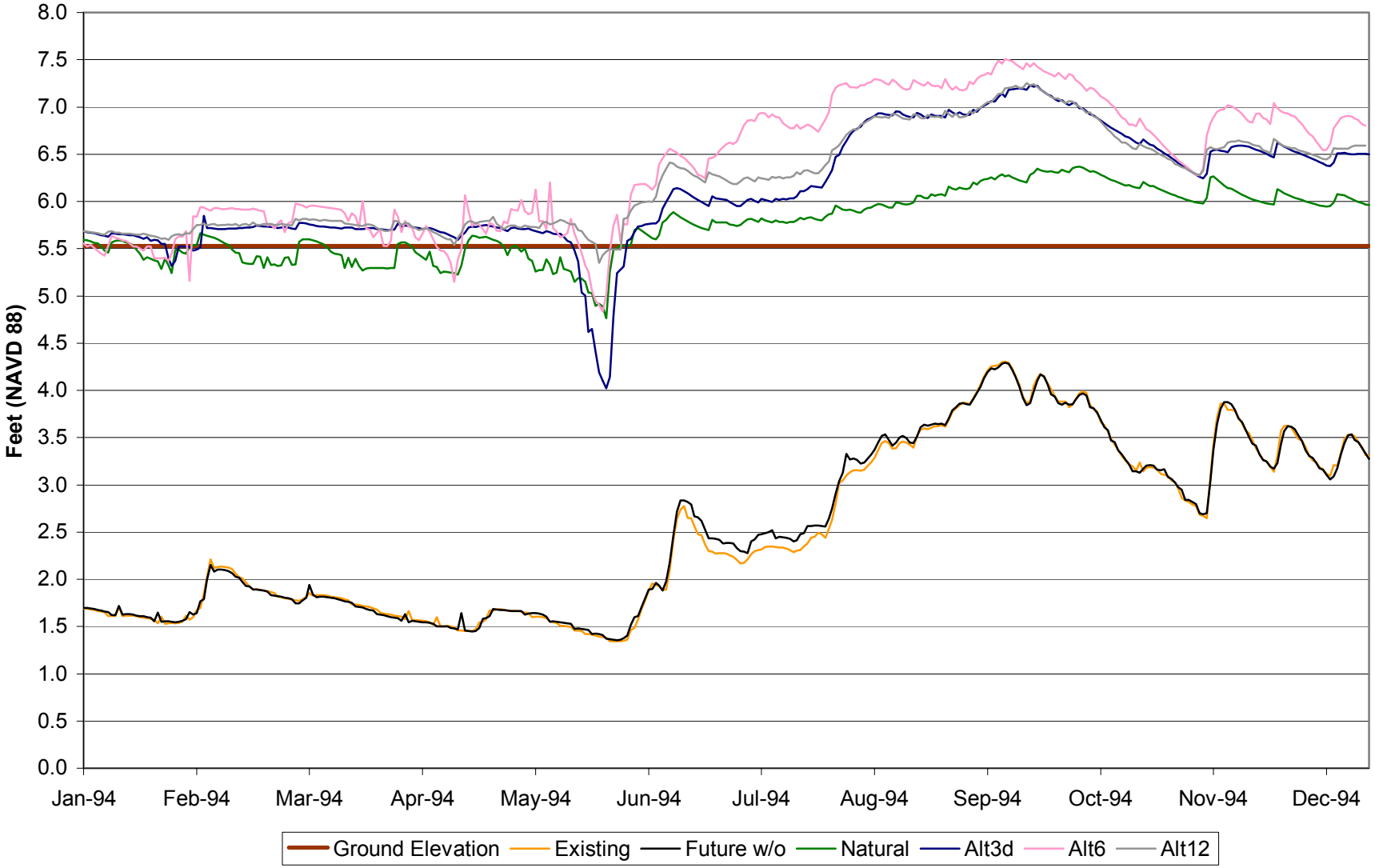


Figure A-67

Simulated Groundwater Stage Hydrograph at Well 22 for an Average Year (1994)

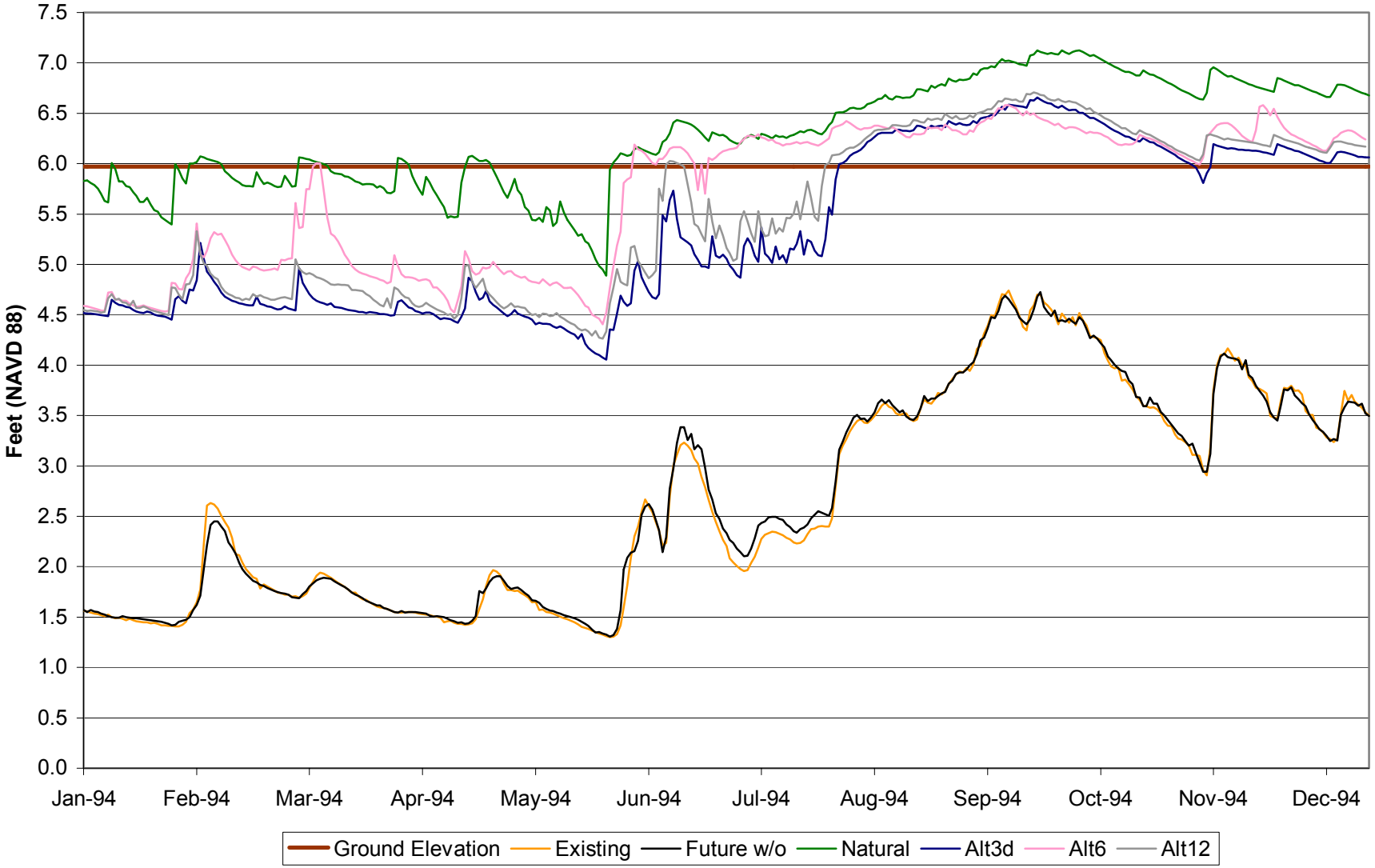


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Figure A-68

Simulated Groundwater Stage Hydrograph at Well 23 for an Average Year (1994)

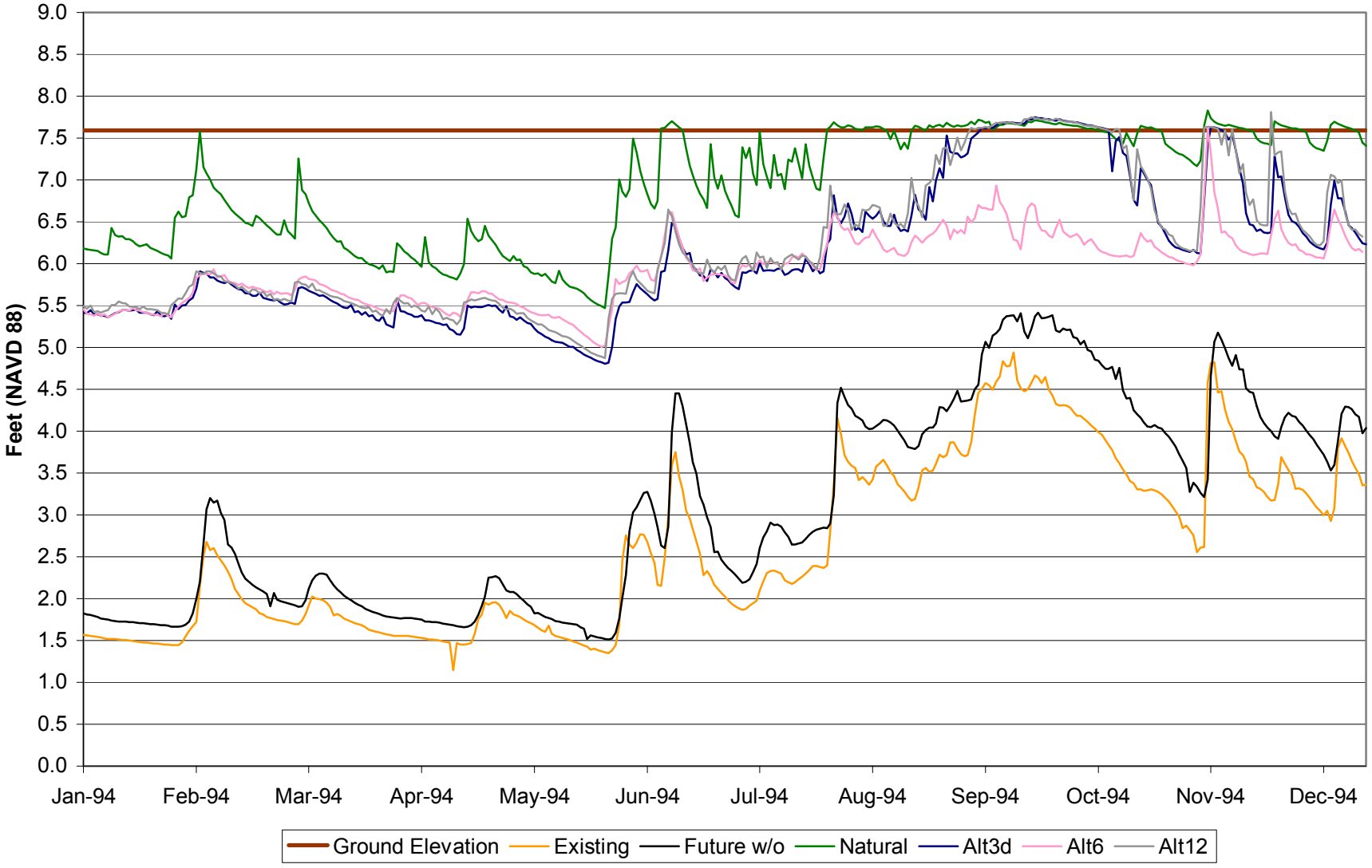

Figure A-69

Simulated Groundwater Stage Hydrograph at Well 24 for an Average Year (1994)

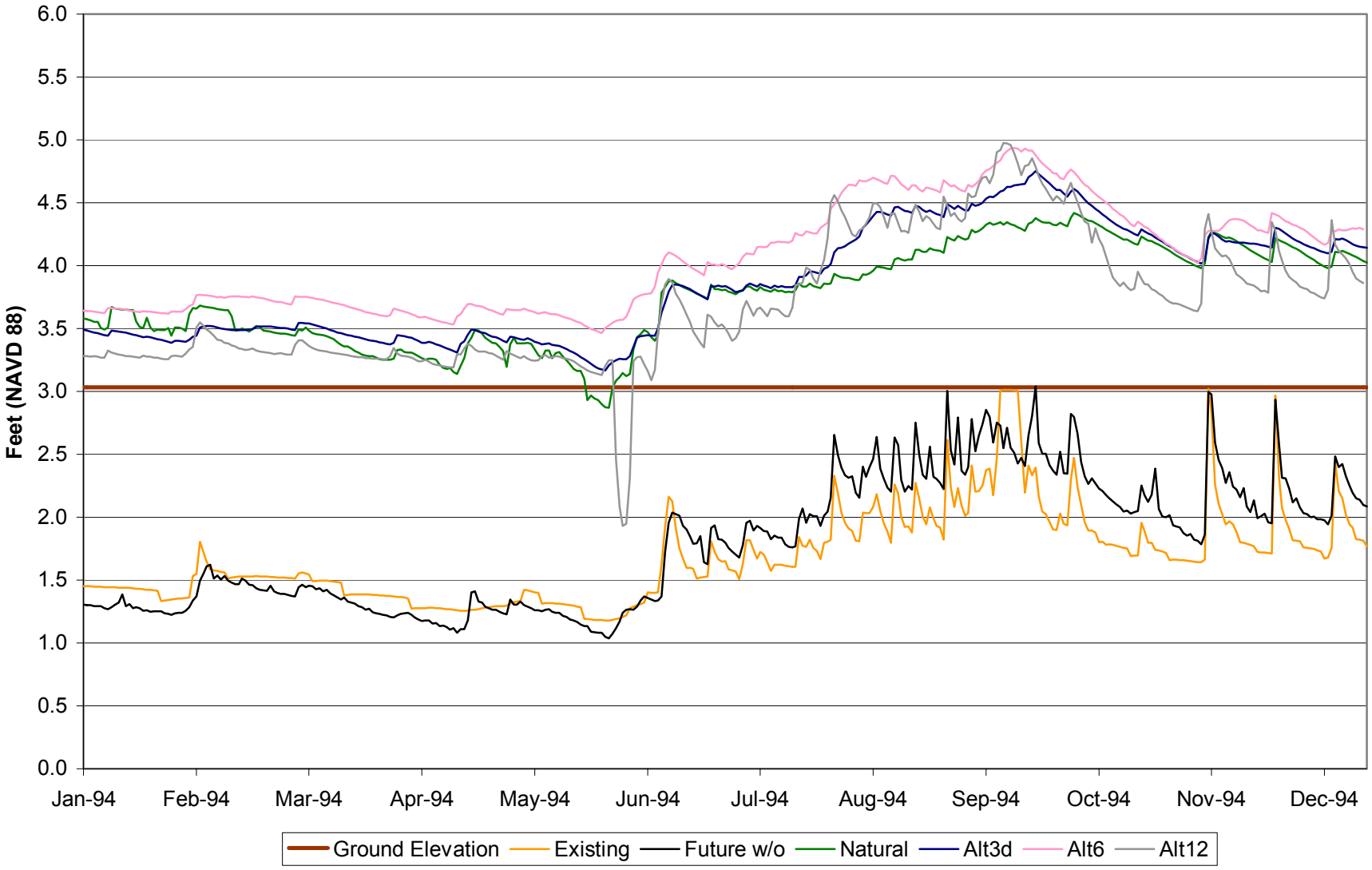

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Figure A-70

Simulated Groundwater Stage Hydrograph at Well 25 for an Average Year (1994)

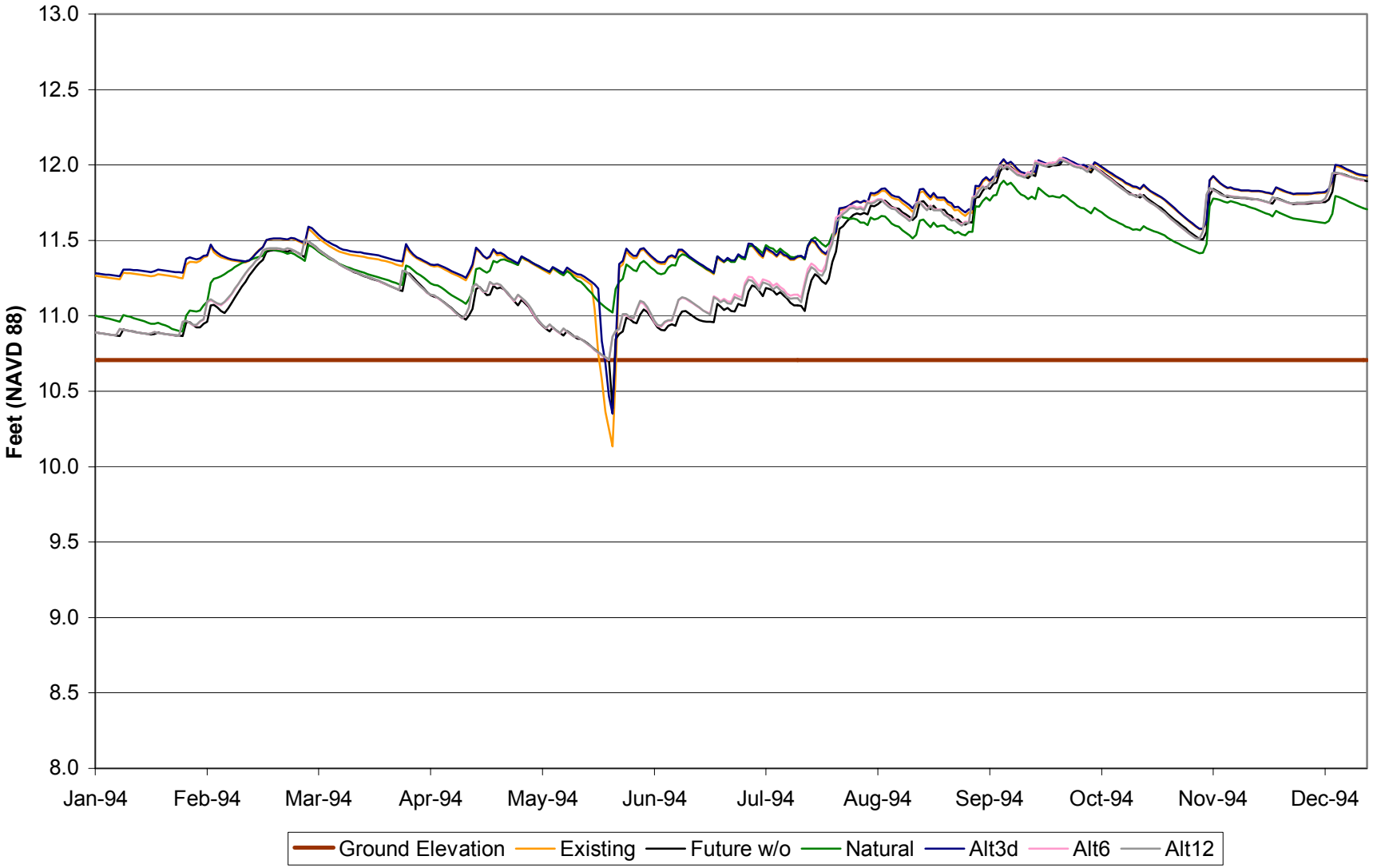

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Figure A-71

Simulated Groundwater Stage Hydrograph at Well 26 for an Average Year (1994)

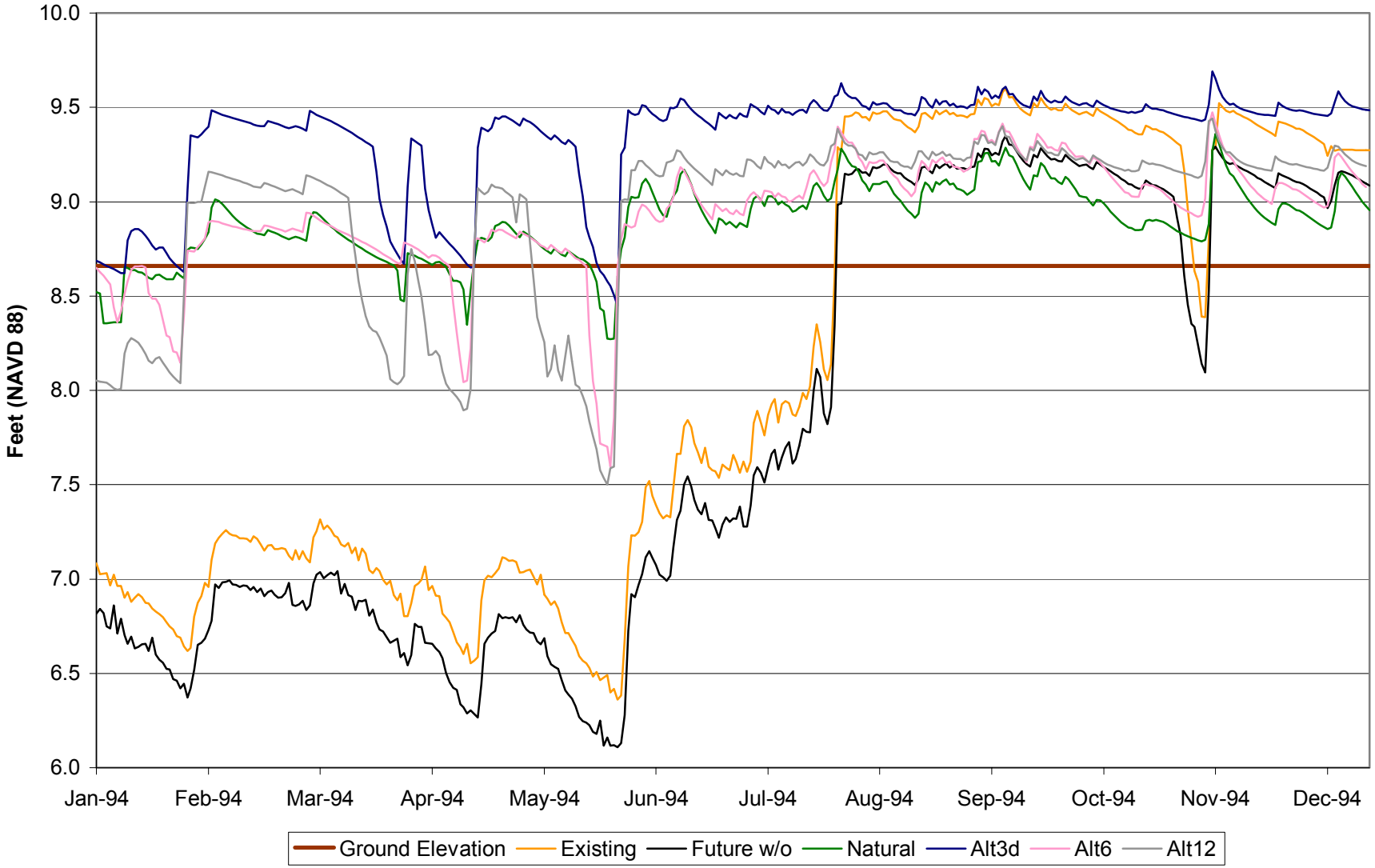

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Figure A-72

Simulated Groundwater Stage Hydrograph at Well 27 for an Average Year (1994)

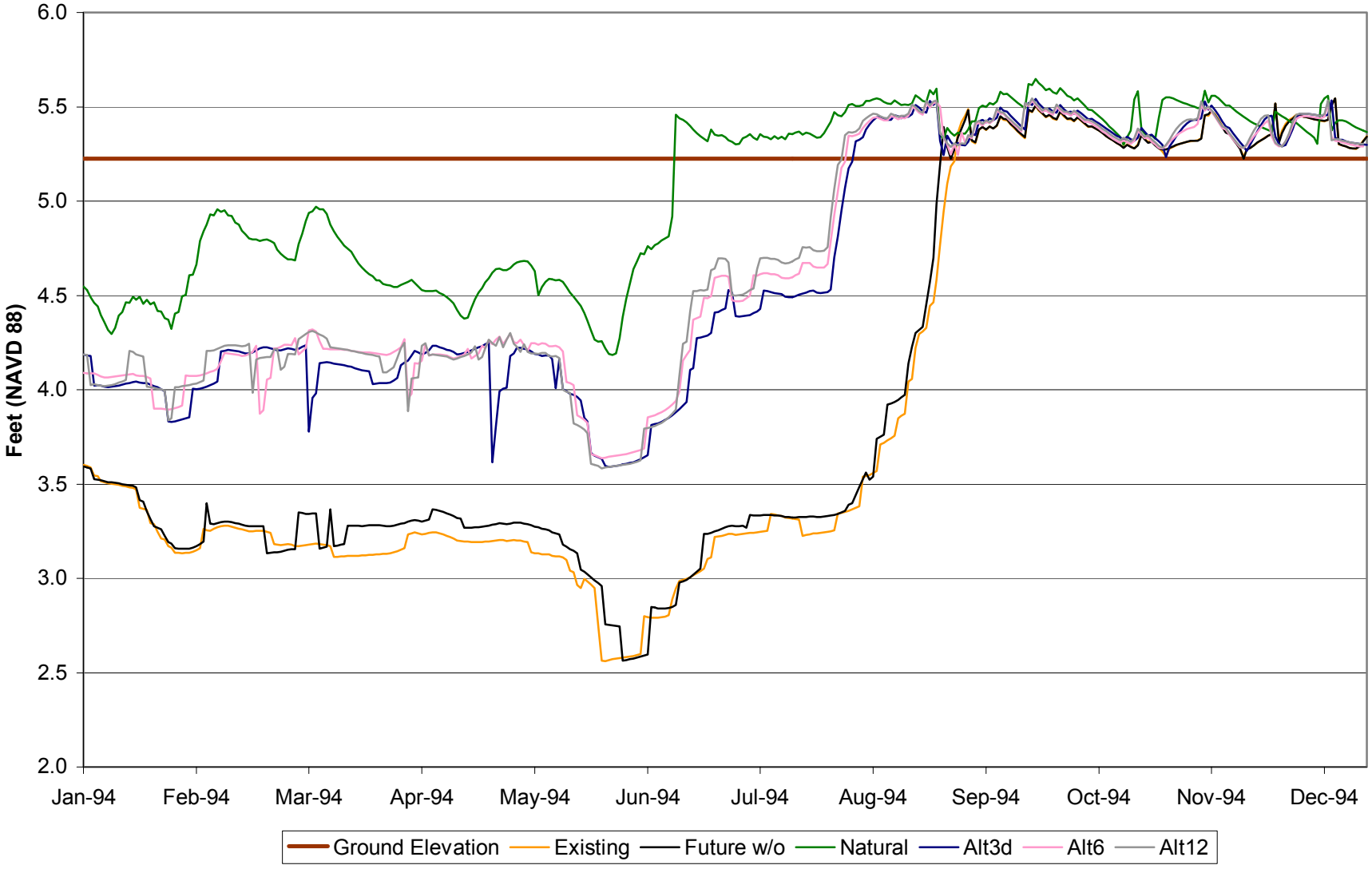

Figure A-73

Simulated Groundwater Stage Hydrograph at Well 28 for an Average Year (1994)

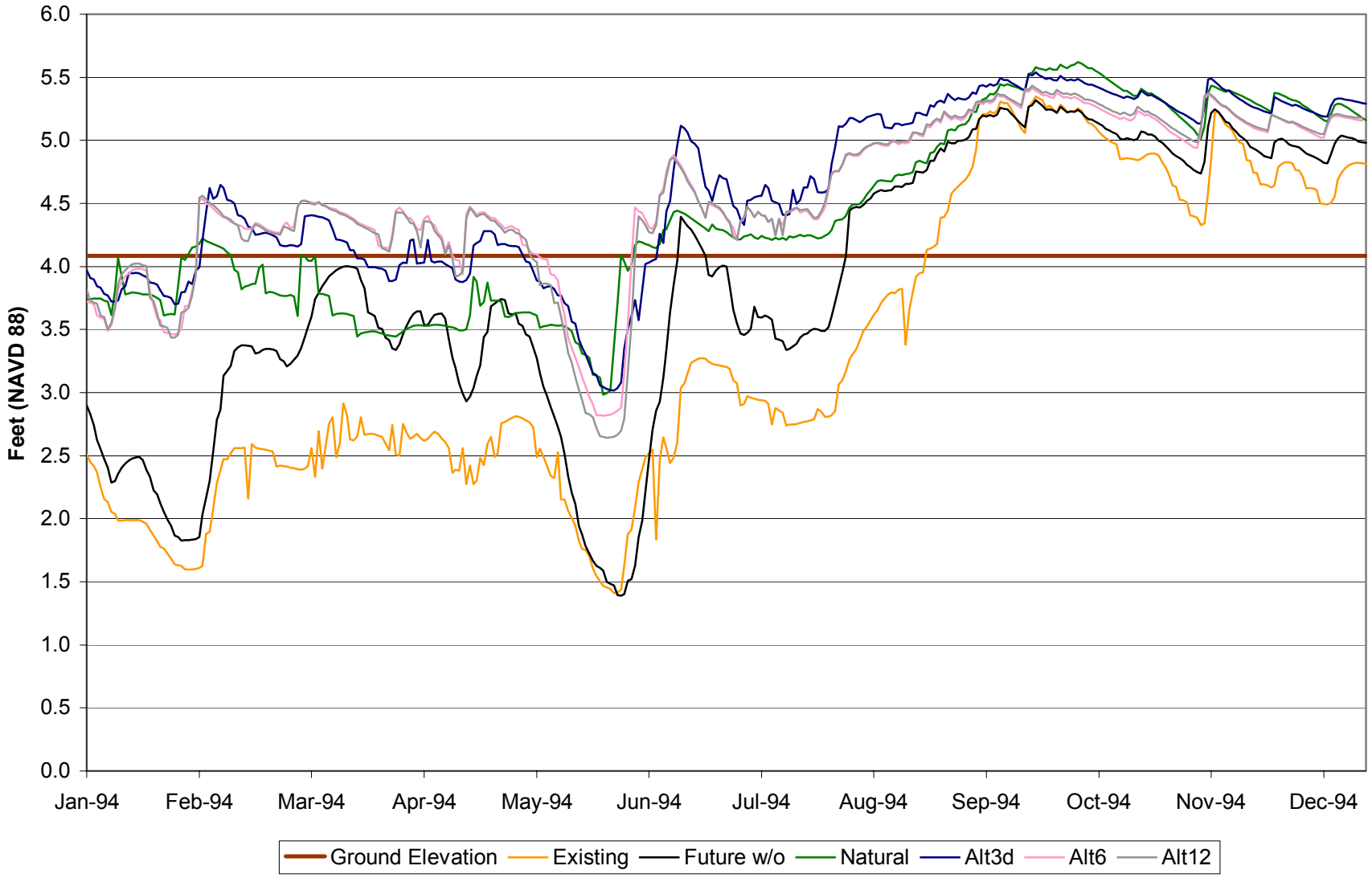

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Figure A-74

Simulated Groundwater Stage Hydrograph at Well 29 for an Average Year (1994)

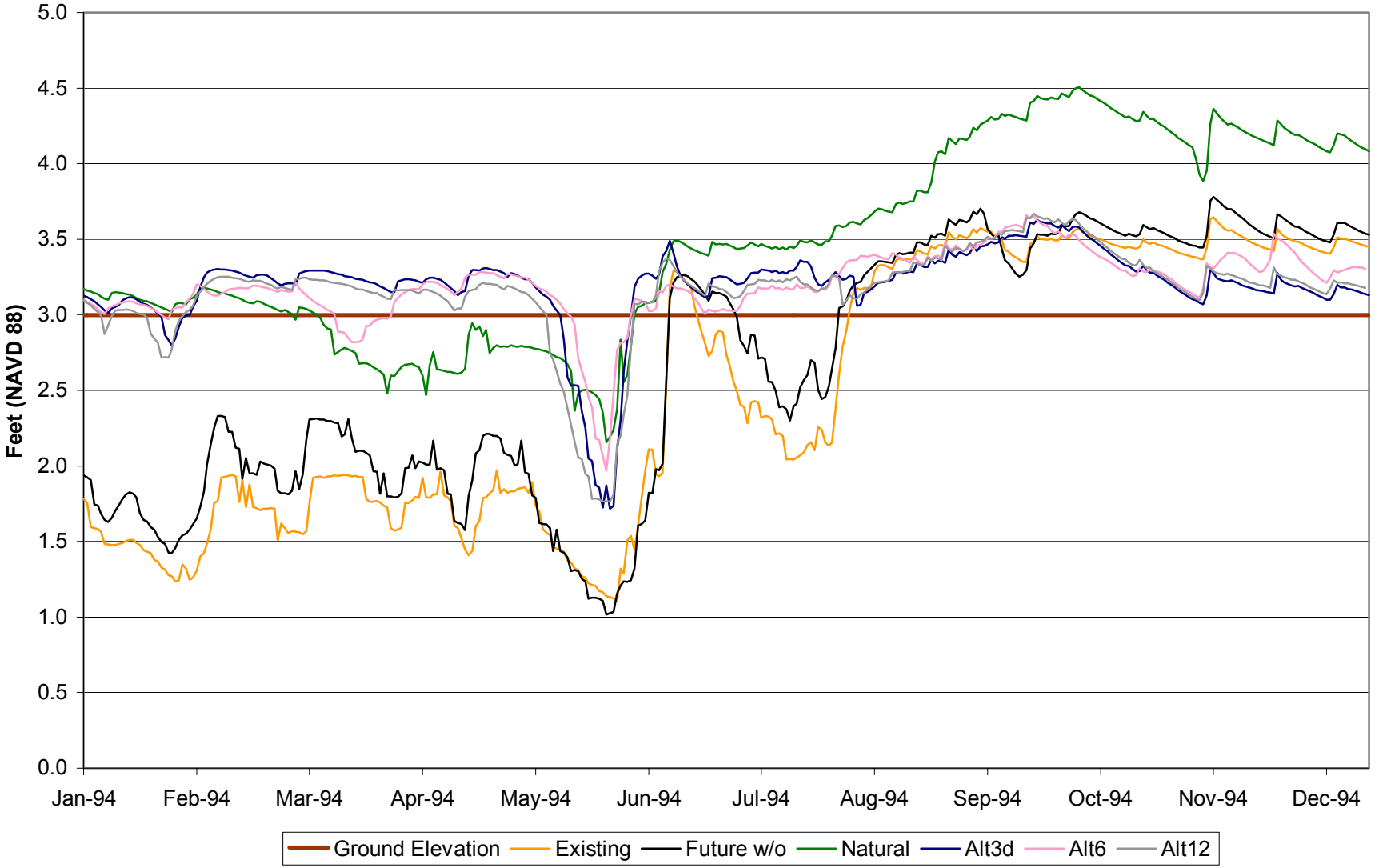

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Figure A-75

Simulated Groundwater Stage Hydrograph at Well 30 for an Average Year (1994)

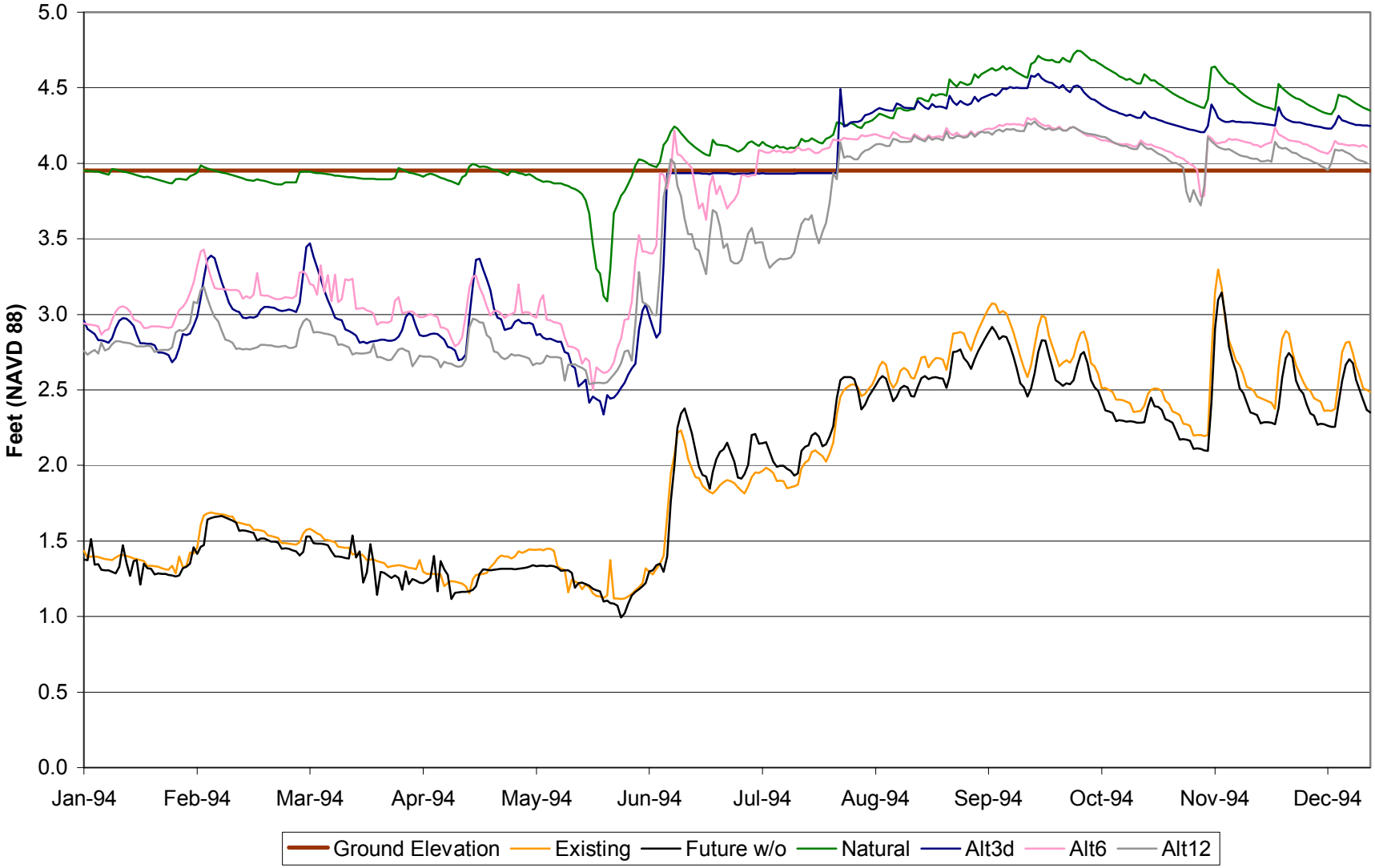

Figure A-76

Simulated Groundwater Stage Hydrograph at Well 31 for an Average Year (1994)

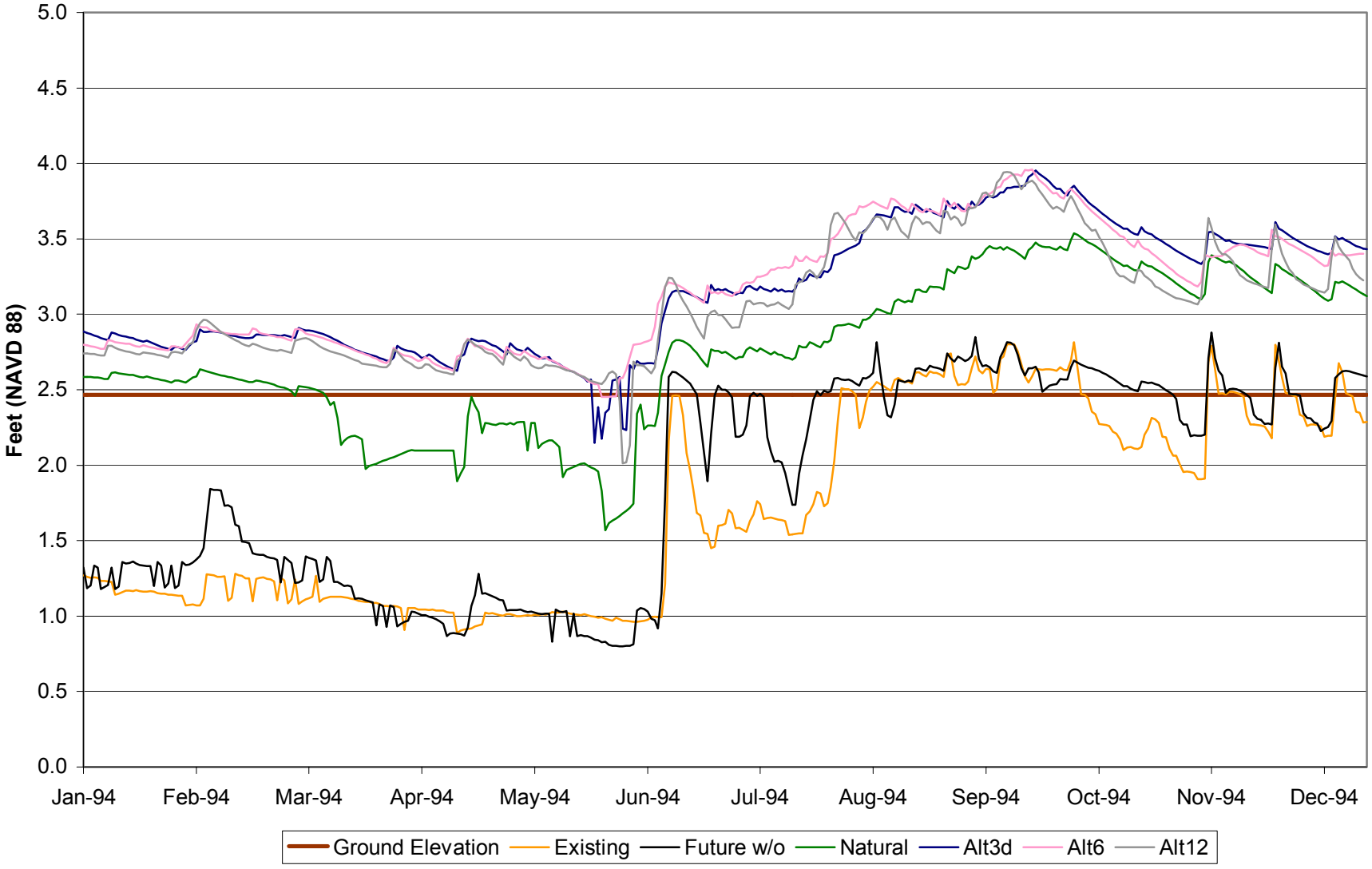

Figure A-77

Simulated Groundwater Stage Hydrograph at Well 32 for an Average Year (1994)

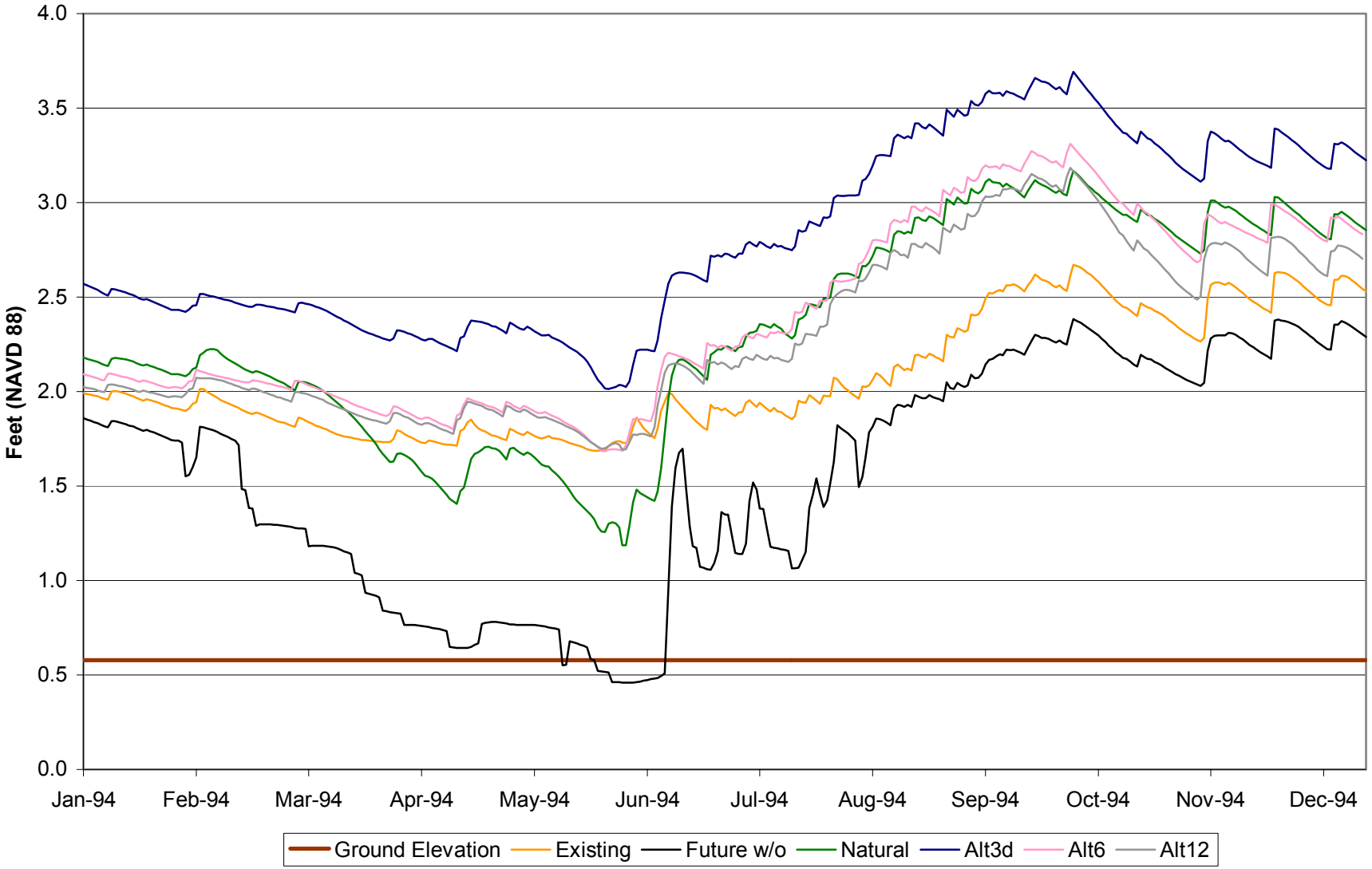

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Figure A-78

Natural Condition Average Wet Season (July 1-Oct. 1) Surface Water Depth for an Average Year (1994)

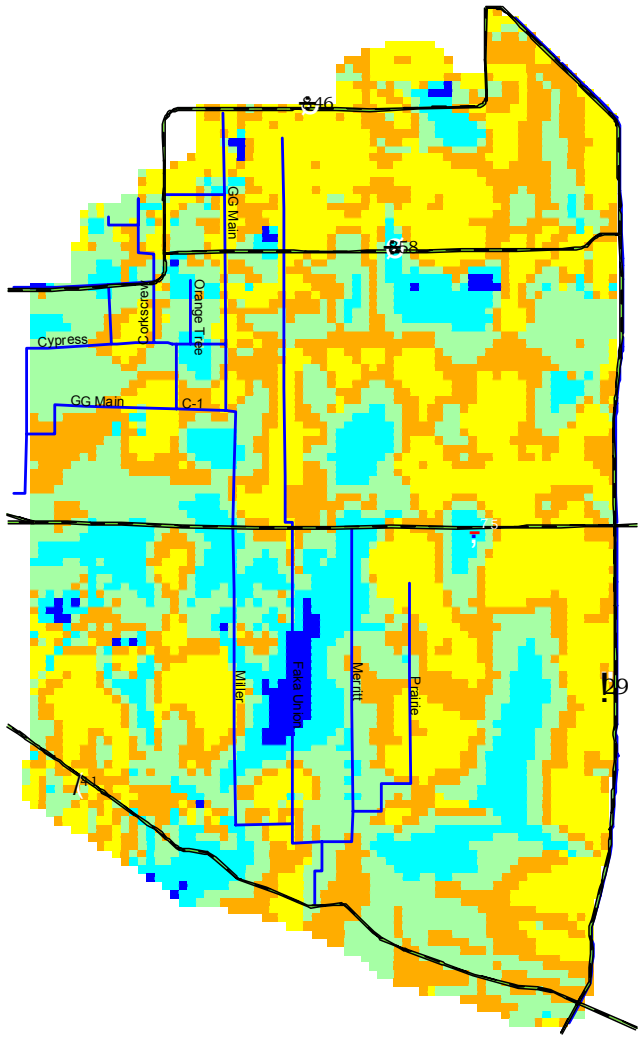

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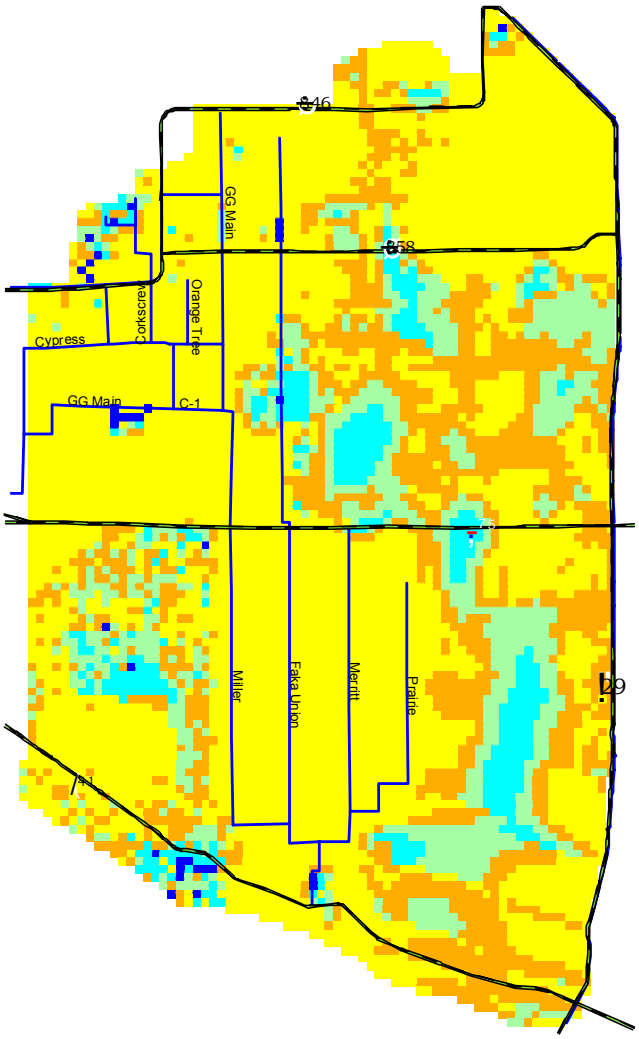
Figure A-79

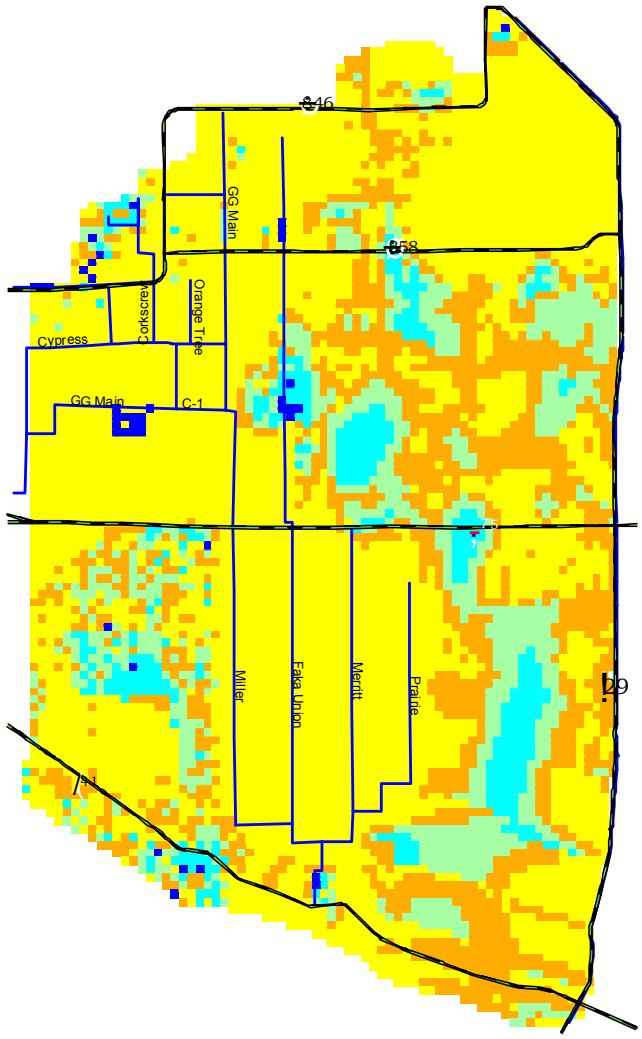
Existing Condition Average Wet Season (July 1-Oct. 1) Surface Water Depth for an Average Year (1994)



US Army Corps of Engineers	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Comprehensive Everglades Restoration Plan Southern Golden Gate Estates Project Implementation Report	SOUTH FLORIDA WATER MANAGEMENT DISTRICT	

Figure A-80

Future (Without State Ownership) Condition
Average Wet Season (July 1-Oct. 1)
Surface Water Depth for an Average Year (1994)



Ponding Depth	Plant Communities
< 0.2 ft	Mesic Pine Flatwoods / Mesic Hammock
0.2 - 0.5 ft	Hydric Pine Flatwoods / Hydric Hammock
0.5 - 1 ft	Wet Prairie
1 - 2 ft	Cypress Forest / Freshwater Marsh
> 2 ft	Open Water

5 0 5 Miles

N

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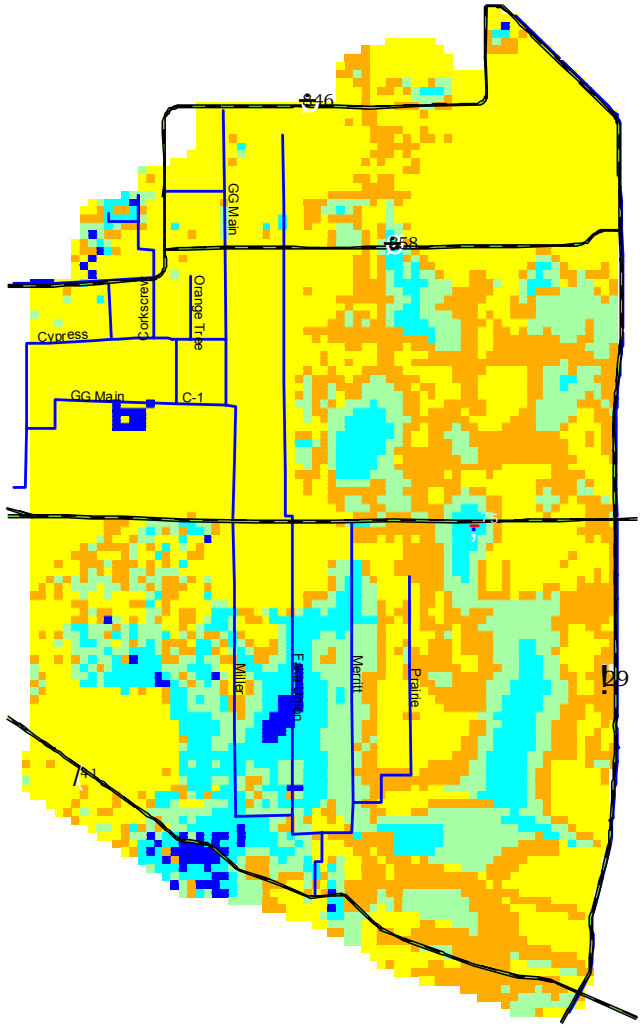
Figure A-81

Alternative 3D Average Wet Season (July 1-Oct. 1) Surface Water Depth for an Average Year (1994)



Ponding Depth

< 0.2 ft
0.2 - 0.5 ft
0.5 - 1 ft
1 - 2 ft
> 2 ft

Plant Communities

- Mesic Pine Flatwoods / Mesic Hammock
- Hydric Pine Flatwoods / Hydric Hammock
- Wet Prairie
- Cypress Forest / Freshwater Marsh
- Open Water

5 0 5 Miles

N

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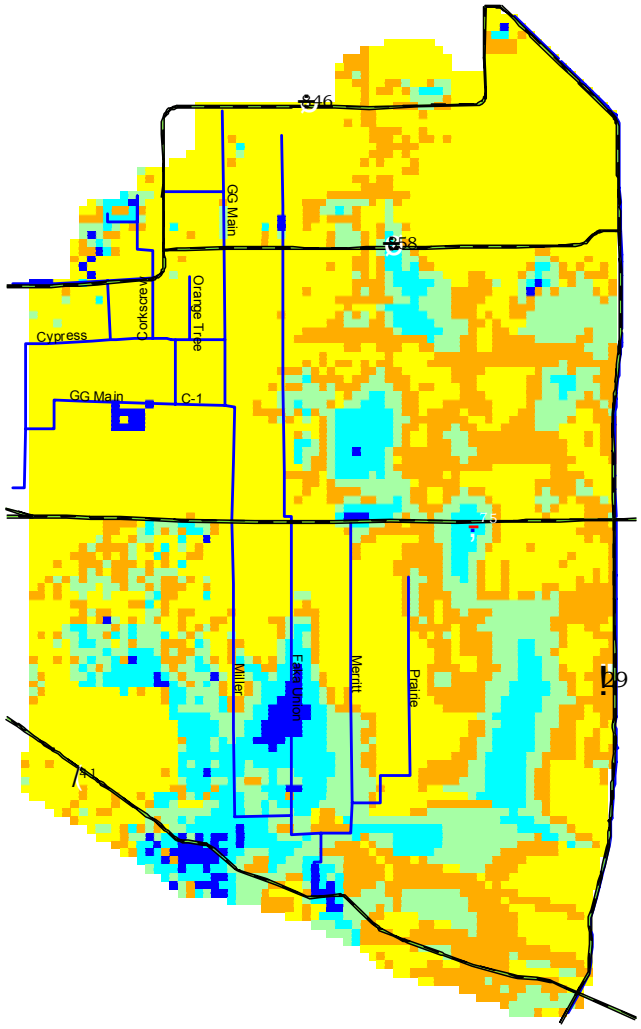
Figure A-82

Alternative 6 Average Wet Season (July 1-Oct. 1) Surface Water Depth for an Average Year (1994)



Ponding Depth

< 0.2 ft
0.2 - 0.5 ft
0.5 - 1 ft
1 - 2 ft
> 2 ft

Plant Communities

Mesic Pine Flatwoods / Mesic Hammock
Hydric Pine Flatwoods / Hydric Hammock
Wet Prairie
Cypress Forest / Freshwater Marsh
Open Water

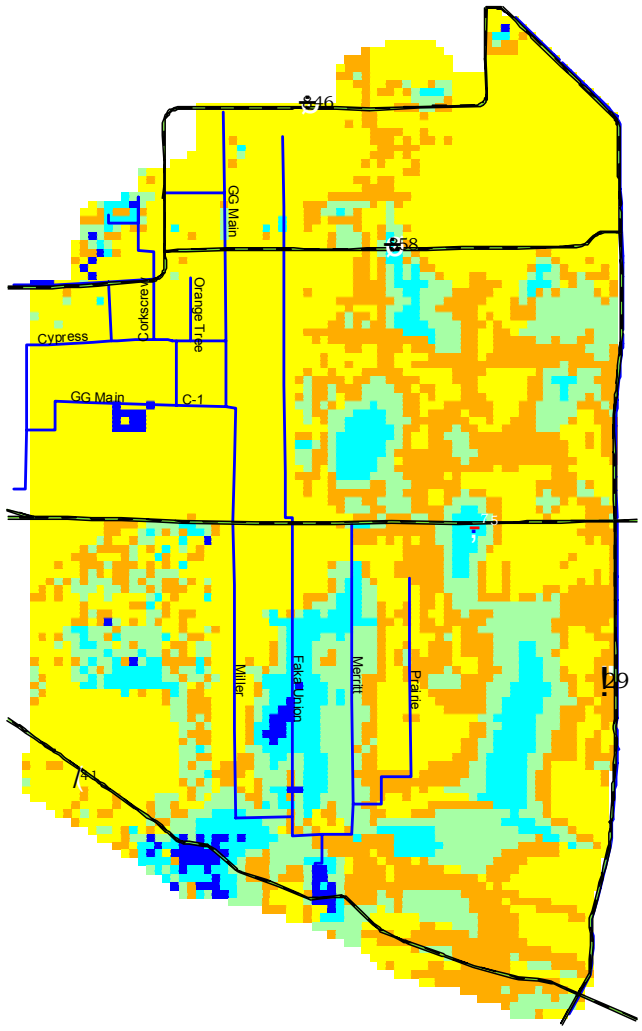
5 0 5 Miles

N

US Army Corps of Engineers	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Comprehensive Everglades Restoration Plan **Southern Golden Gate Estates Project Implementation Report**	SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Figure A-83

Alternative 12 Average Wet Season (July 1-Oct. 1) Surface Water Depth for an Average Year (1994)



US Army Corps of Engineers	DEPARTMENT OF THE ARMY JACKSONVILLE DISTRICT, CORPS OF ENGINEERS JACKSONVILLE, FLORIDA	Comprehensive Everglades Restoration Plan Southern Golden Gate Estates Project Implementation Report	SOUTH FLORIDA WATER MANAGEMENT DISTRICT	

Figure A-84

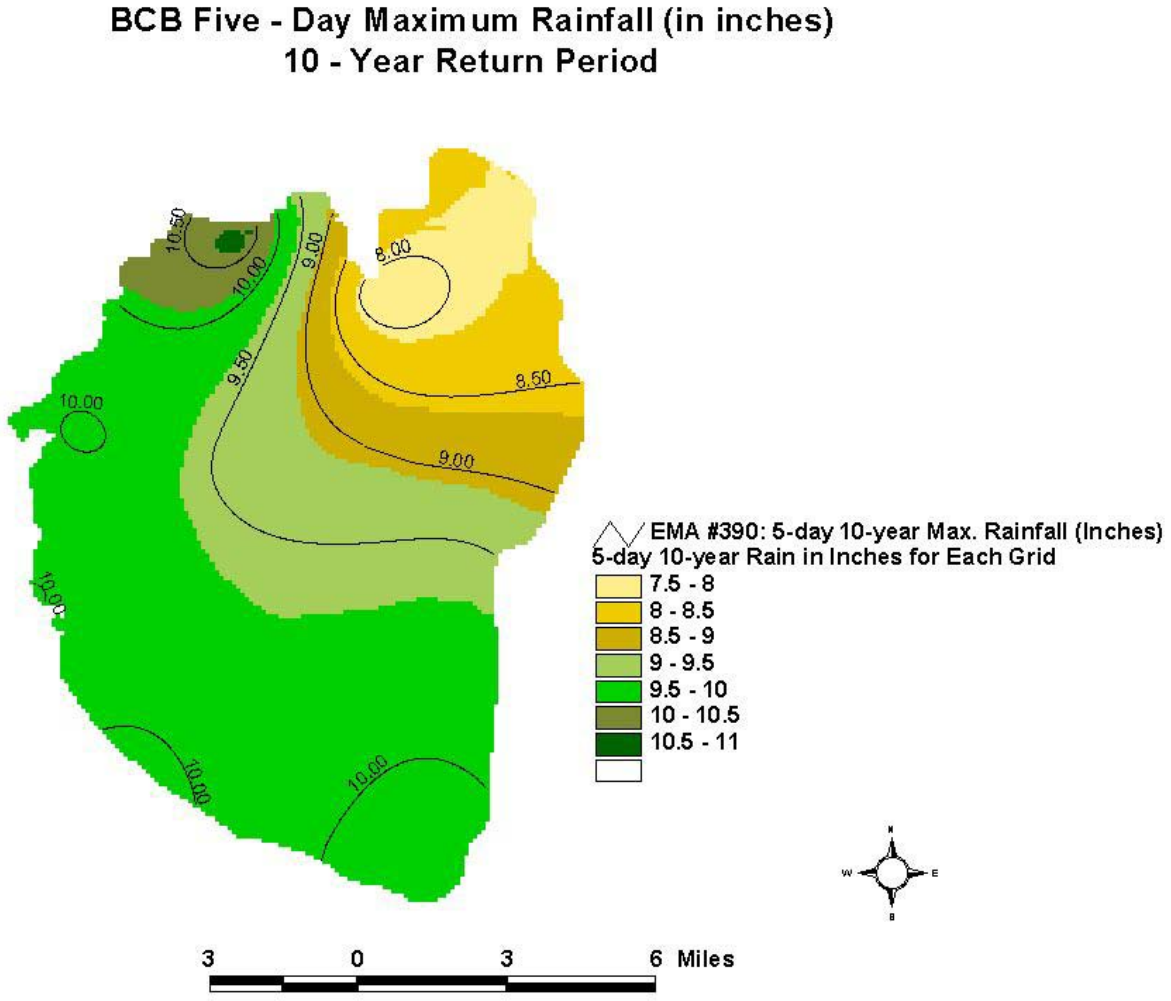

BCB Five - Day Maximum Rainfall (in inches)
10 - Year Return Period
10.50
10.00
9.50
9.00
8.50
8.00
10.00
10.00
10.00
10.00
EMA #390: 5-day 10-year Max. Rainfall (Inches)
5-day 10-year Rain in Inches for Each Grid
7.5 - 8
8 - 8.5
8.5 - 9
9 - 9.5
9.5 - 10
10 - 10.5
10.5 - 11
N
W
E
S
3
0
3
6 Miles

Figure A-85

BCB Five - Day Maximum Rainfall (in inches)
25 - Year Return Period

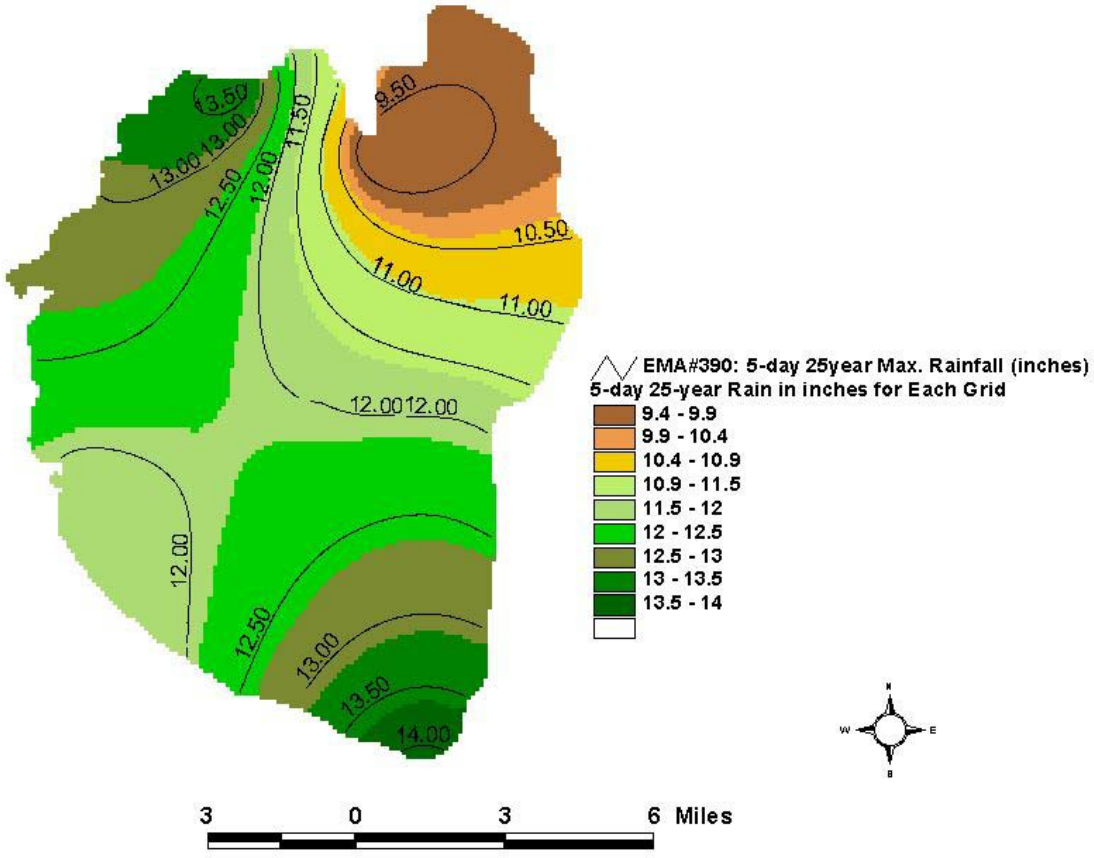


Figure A-86

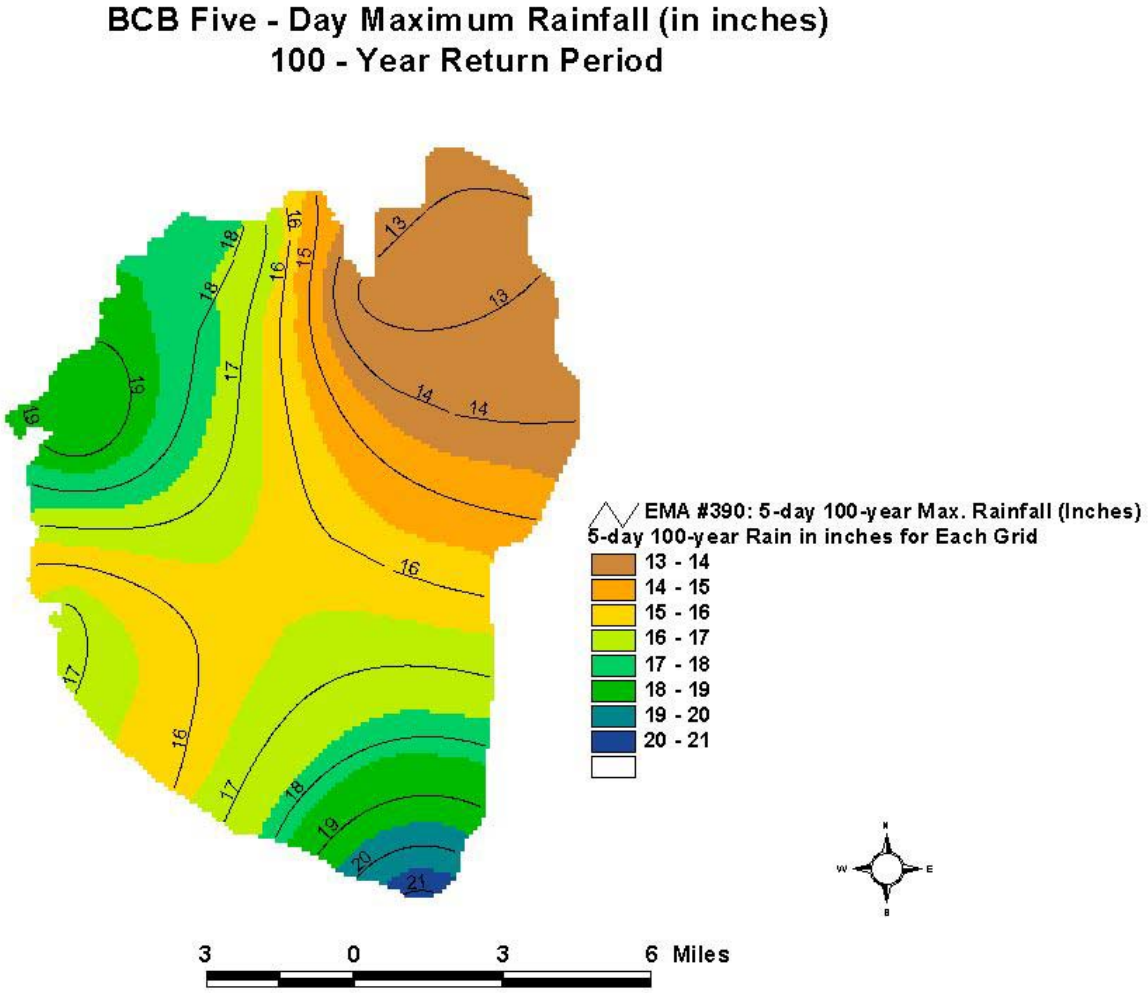

BCB Five - Day Maximum Rainfall (in inches)
100 - Year Return Period
EMA #390: 5-day 100-year Max. Rainfall (Inches)
5-day 100-year Rain in inches for Each Grid
13 - 14
14 - 15
15 - 16
16 - 17
17 - 18
18 - 19
19 - 20
20 - 21
3 0 3 6 Miles

Figure A-87

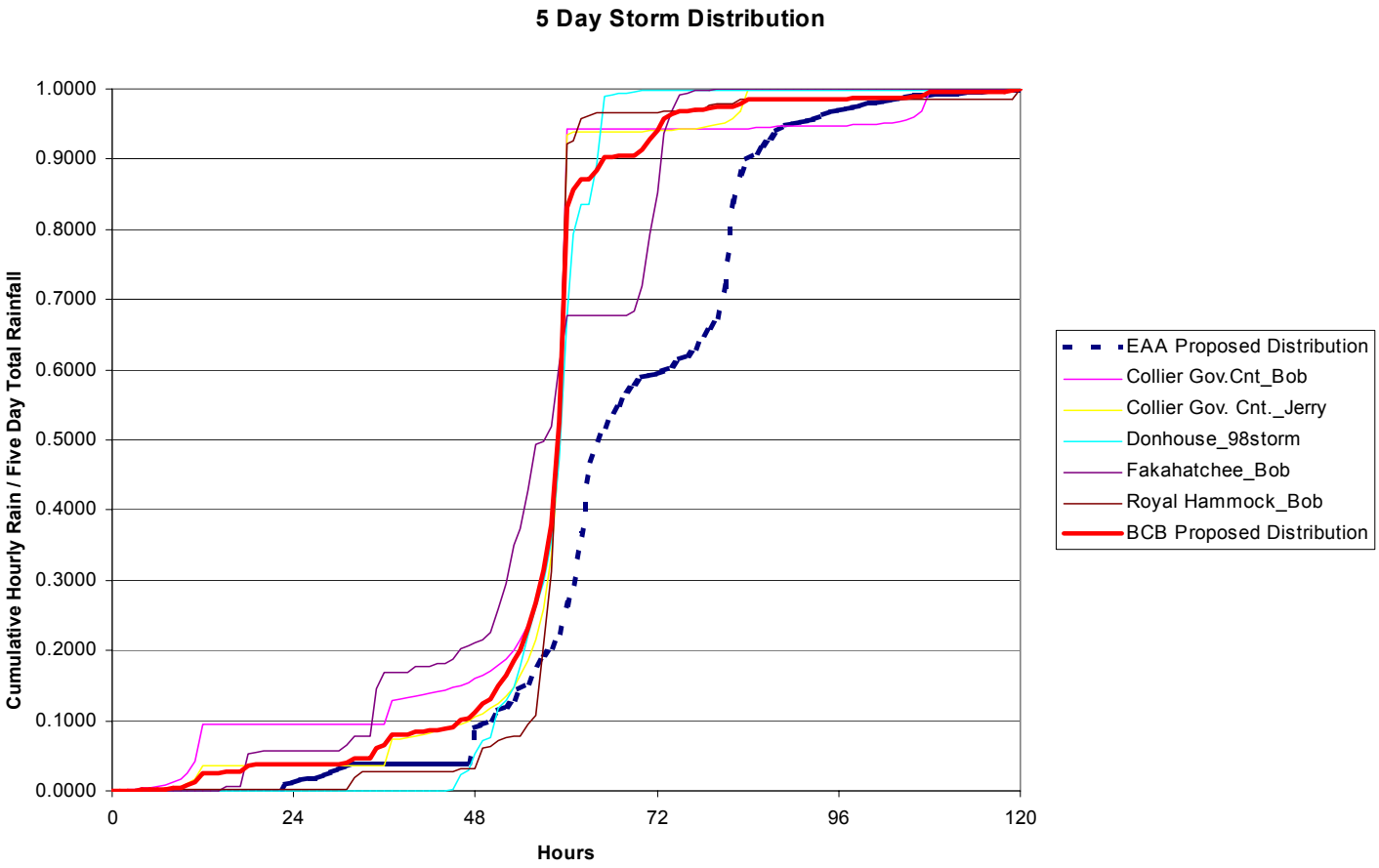

5 Day Storm Distribution
Cumulative Hourly Rain / Five Day Total Rainfall
1.0000
0.9000
0.8000
0.7000
0.6000
0.5000
0.4000
0.3000
0.2000
0.1000
0.0000
0
24
48
72
96
120
Hours
EAA Proposed Distribution
Collier Gov.Cnt_Bob
Collier Gov. Cnt._Jerry
Donhouse_98storm
Fakahatchee_Bob
Royal Hammock_Bob
BCB Proposed Distribution

Figure A-88

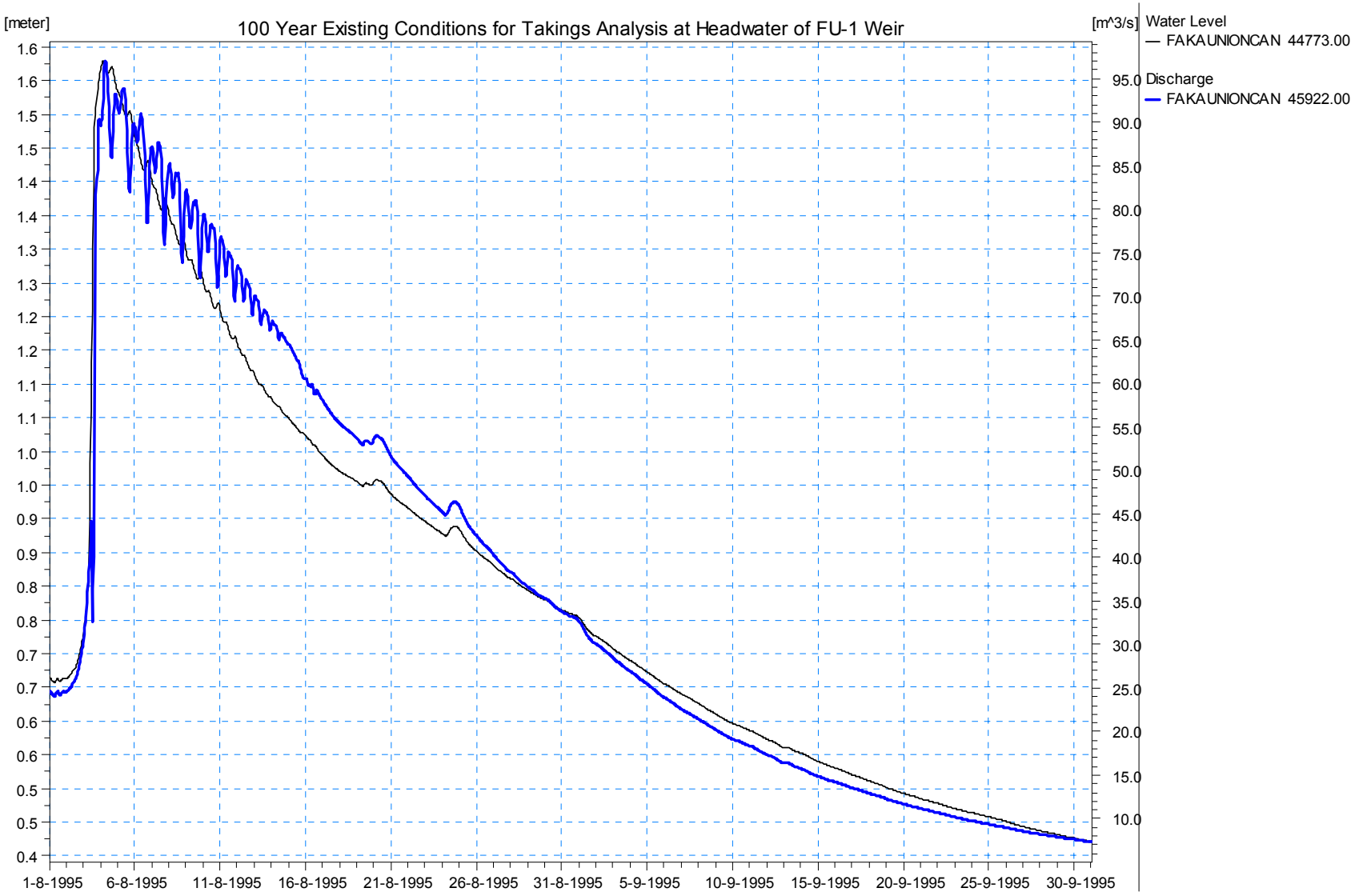

100 Year Existing Conditions for Takings Analysis at Headwater of FU-1 Weir
[meter]
[m^3/s]
Water Level
FAKAUNIONCAN 44773.00
Discharge
FAKAUNIONCAN 45922.00
1.6
1.6
1.5
1.5
1.4
1.4
1.3
1.3
1.2
1.2
1.1
1.1
1.0
1.0
0.9
0.9
0.8
0.8
0.7
0.7
0.6
0.6
0.5
0.5
0.4
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
1-8-1995
6-8-1995
11-8-1995
16-8-1995
21-8-1995
26-8-1995
31-8-1995
5-9-1995
10-9-1995
15-9-1995
20-9-1995
25-9-1995
30-9-1995

Figure A-89

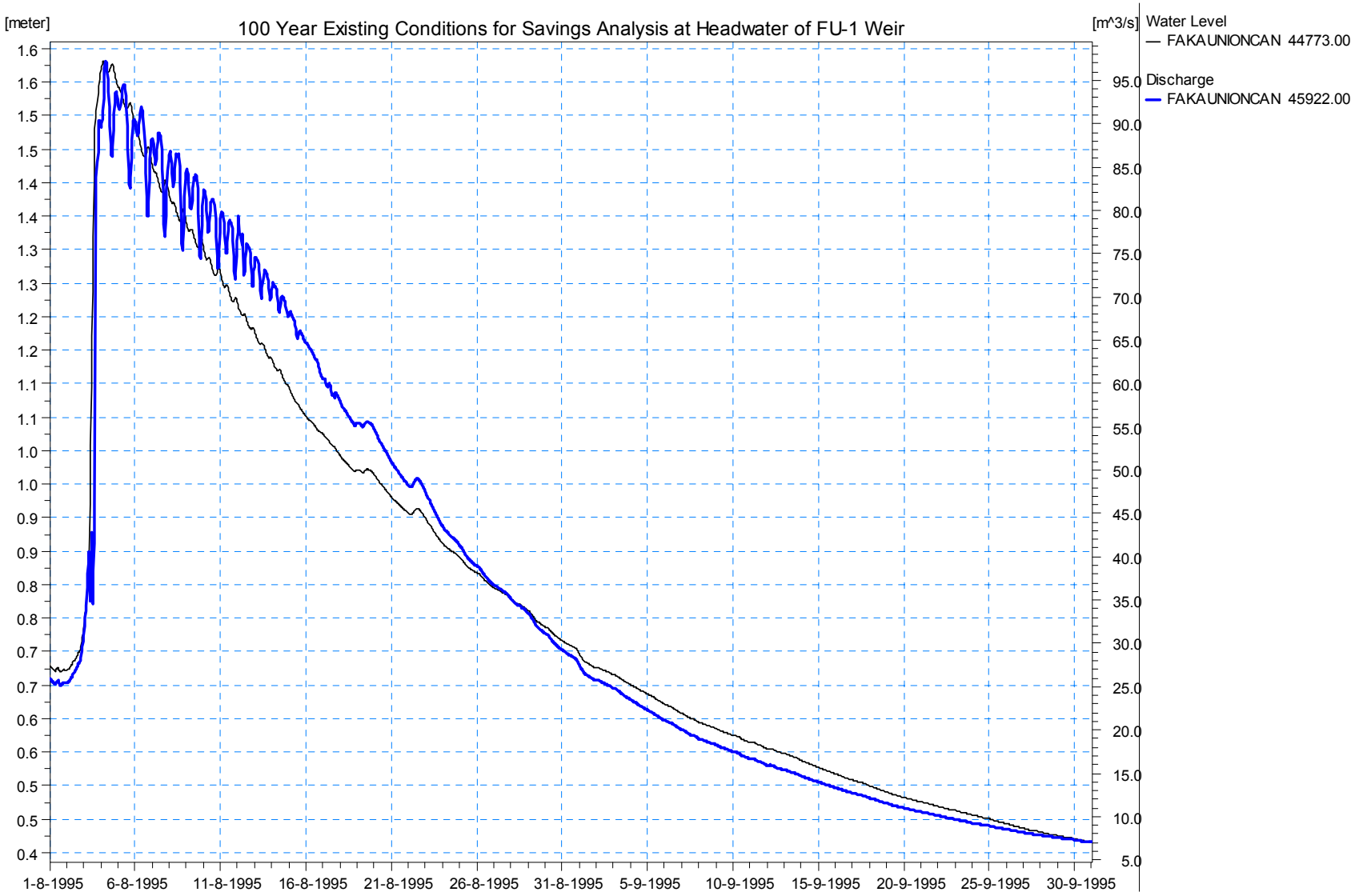

100 Year Existing Conditions for Savings Analysis at Headwater of FU-1 Weir
[meter]
[m^3/s]
Water Level
FAKAUNIONCAN 44773.00
Discharge
FAKAUNIONCAN 45922.00
1.6
1.6
1.5
1.5
1.4
1.4
1.3
1.3
1.2
1.2
1.1
1.1
1.0
1.0
0.9
0.9
0.8
0.8
0.7
0.7
0.6
0.6
0.5
0.5
0.4
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
1-8-1995
6-8-1995
11-8-1995
16-8-1995
21-8-1995
26-8-1995
31-8-1995
5-9-1995
10-9-1995
15-9-1995
20-9-1995
25-9-1995
30-9-1995

Figure A-90

Calibration Wells for the BCB Model Area



Calibration Wells
Mike 11 Canal Network
Catchment
Fakahatchee Strand
Monitoring Wells

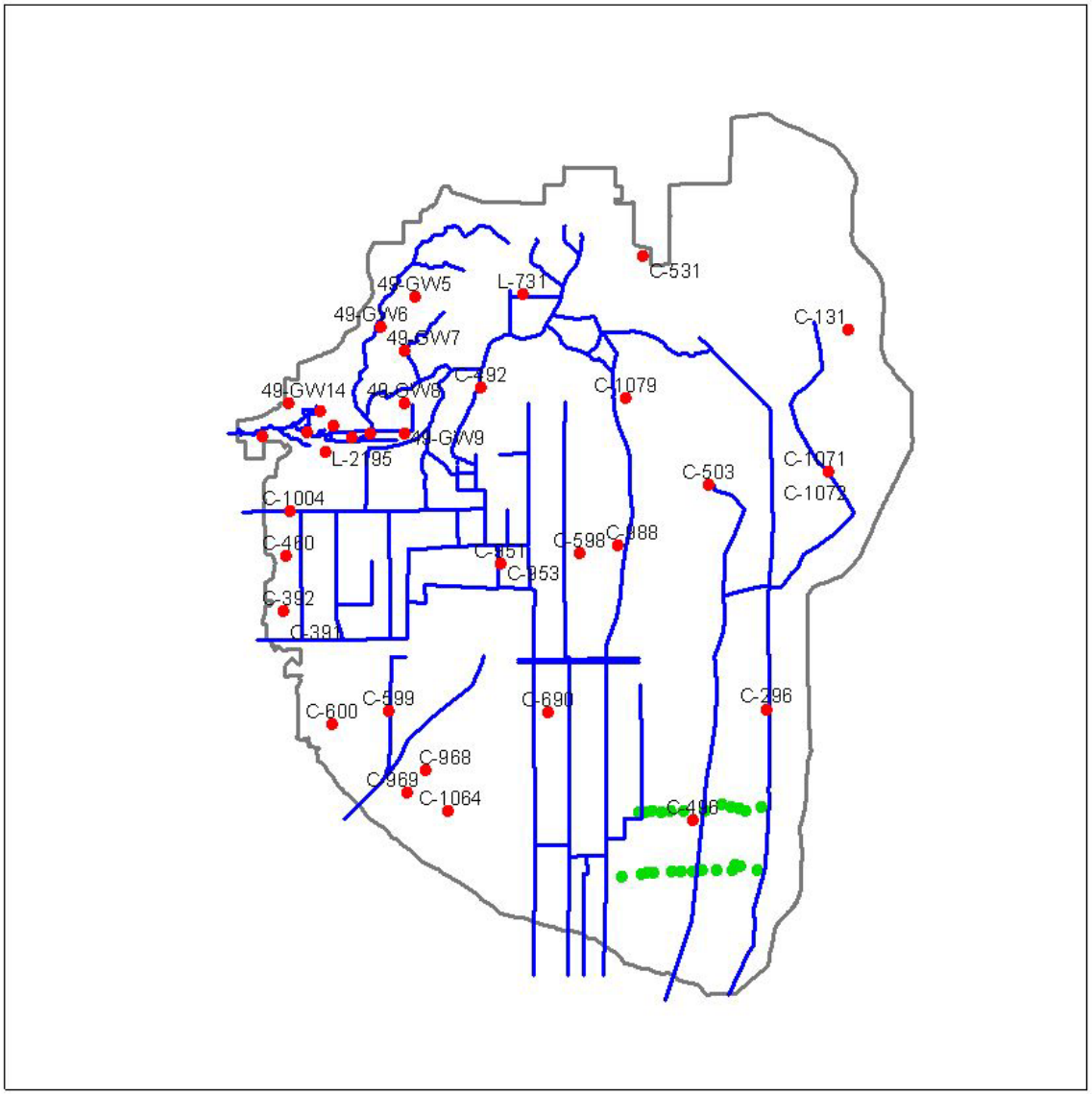


Figure A-91

Calibration Canal and River Staff Gages for the BCB Model Area

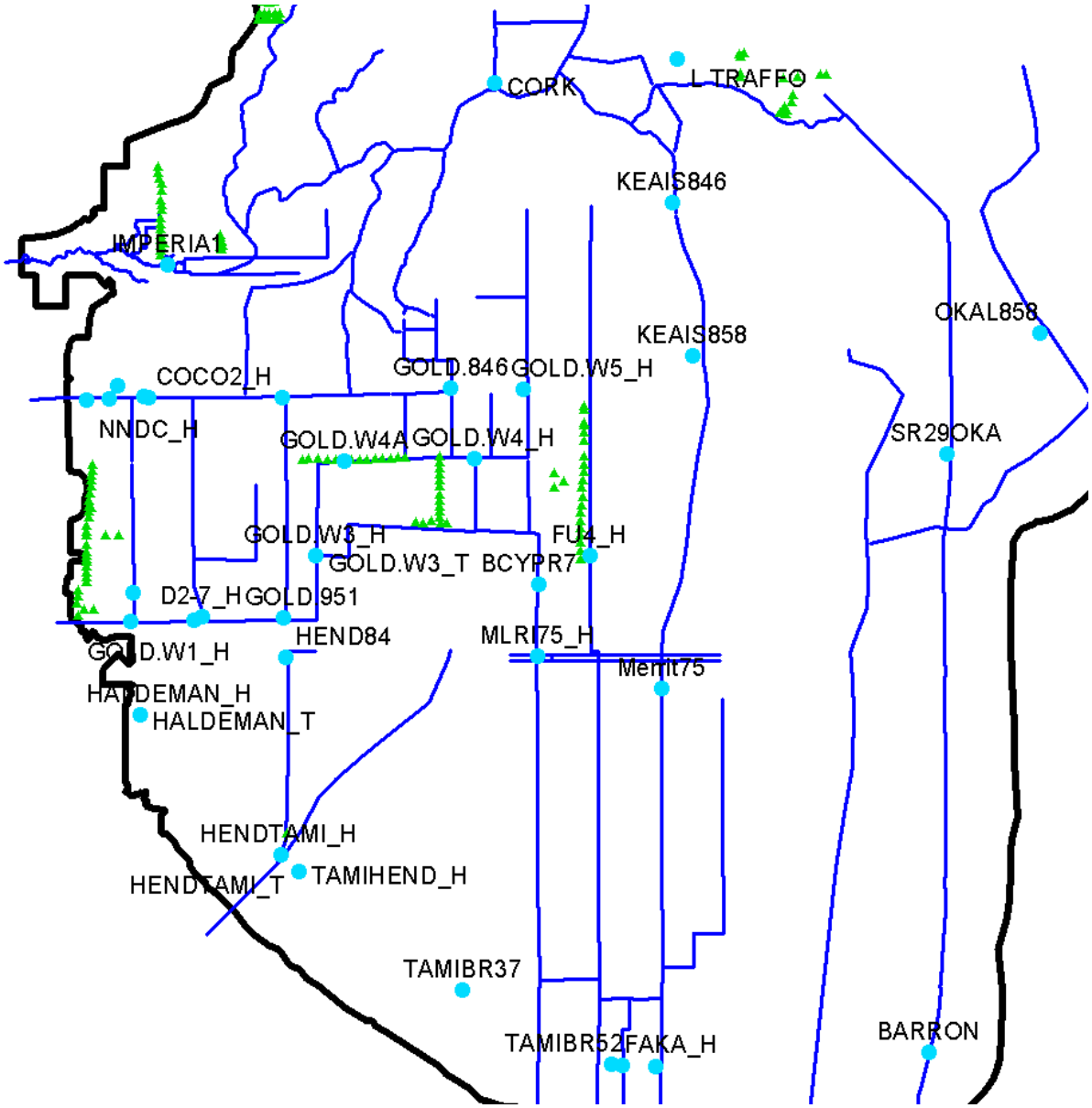


Figure A-92

Thiessen Polygon Distribution Used for the 1995 Storm Verification of the BCB Model

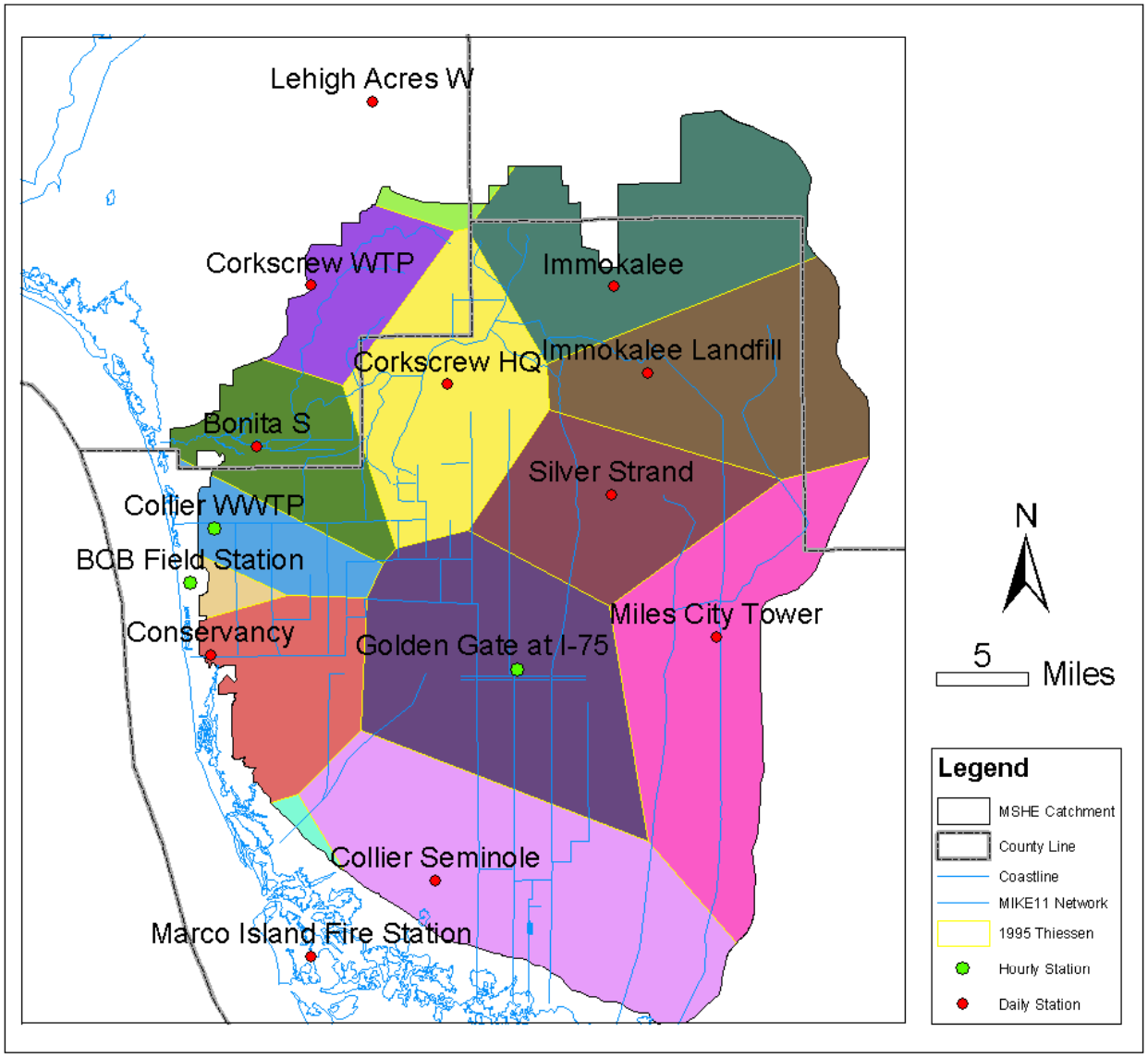


Figure A-93

Thiessen Polygon Distribution Used for the 1999 Storm Verification of the BCB Model

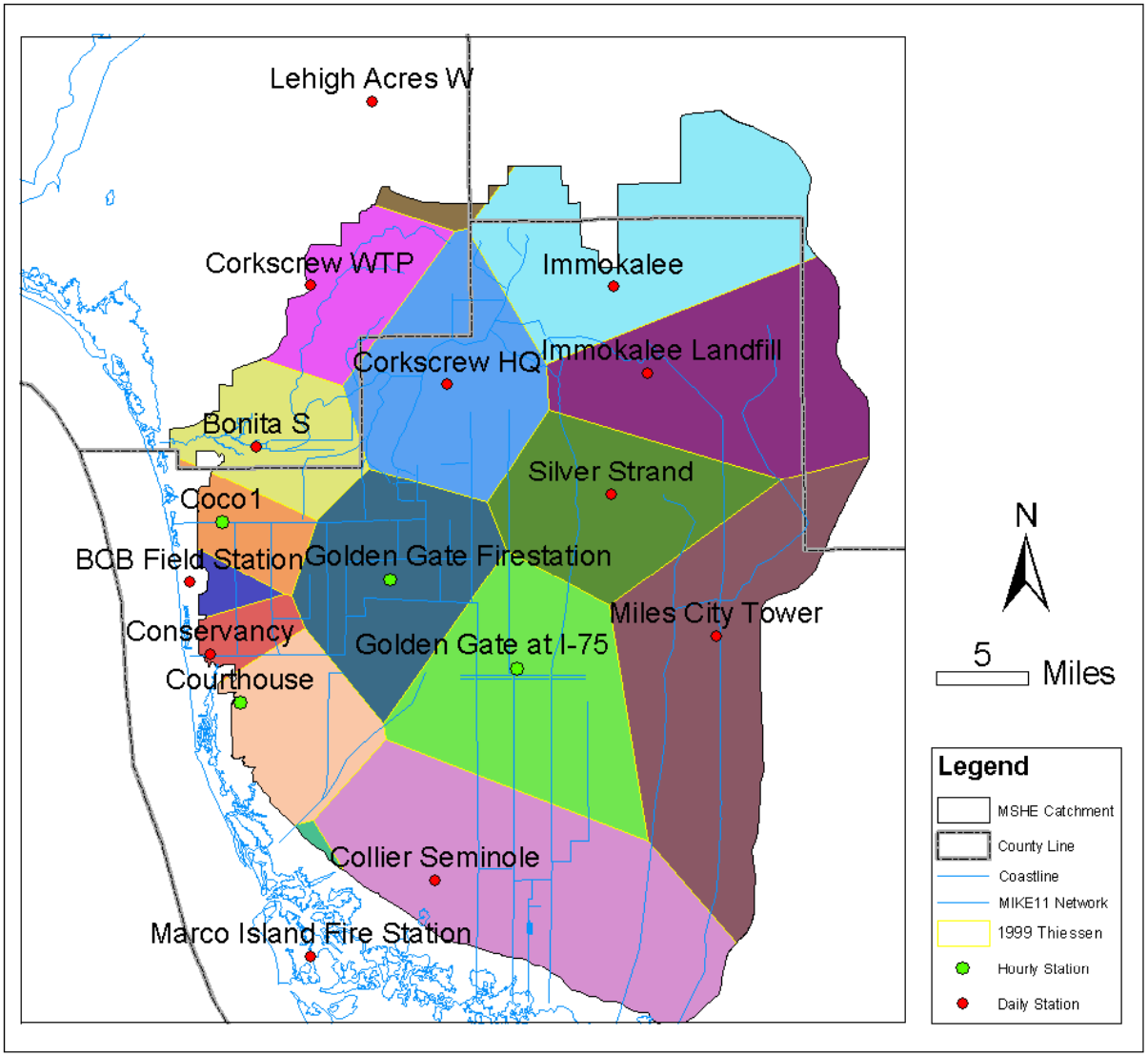


Figure A-94

Location of the Hourly Rainfall Gages used in the Storm Validation of the BCB Model

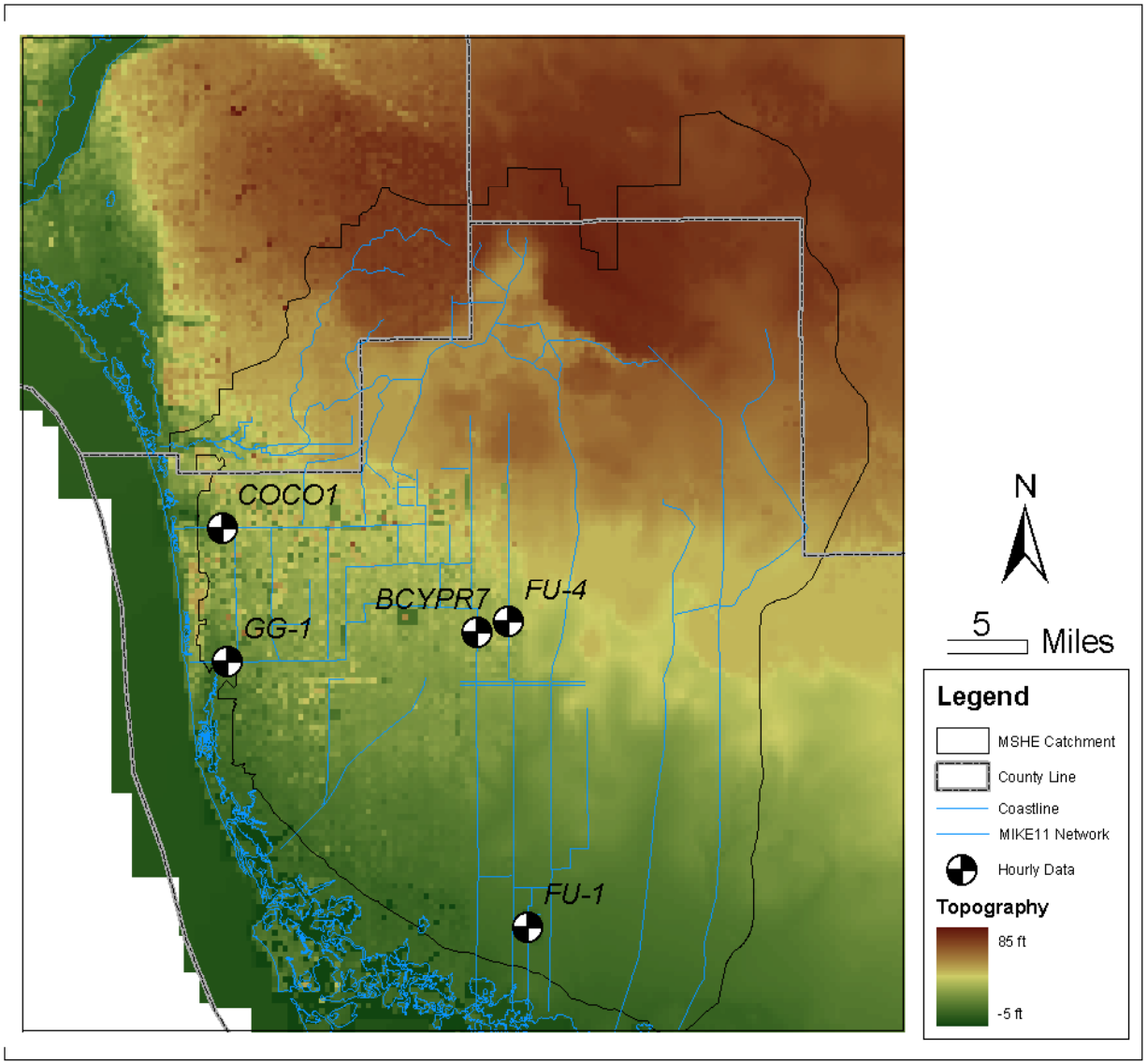
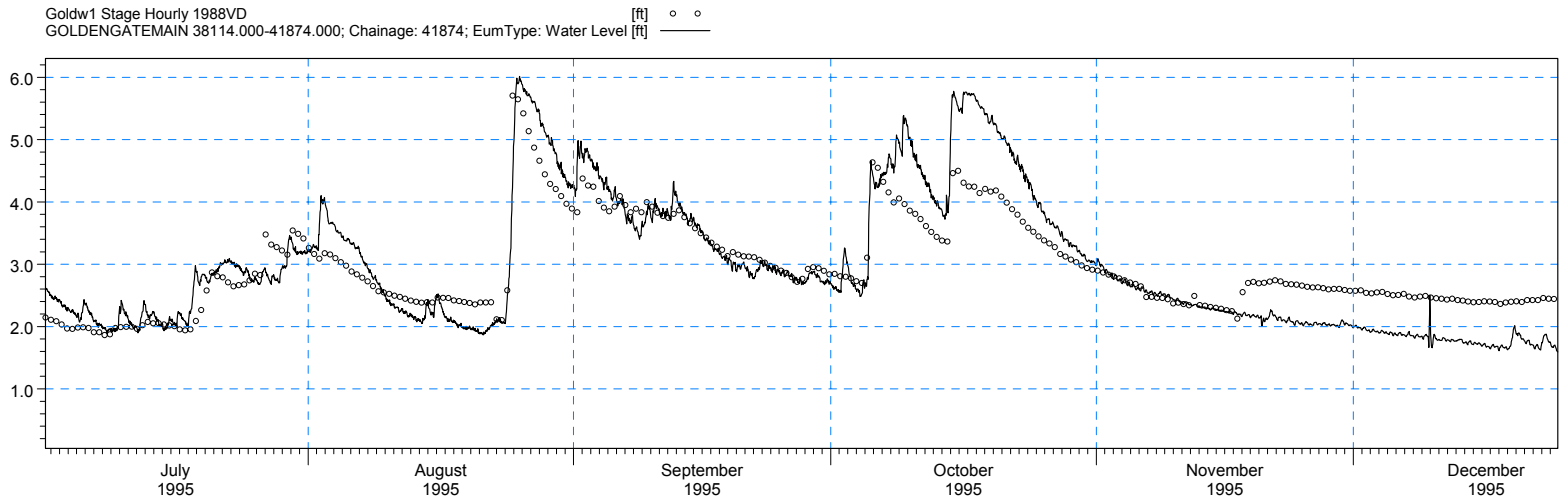


Figure A-95

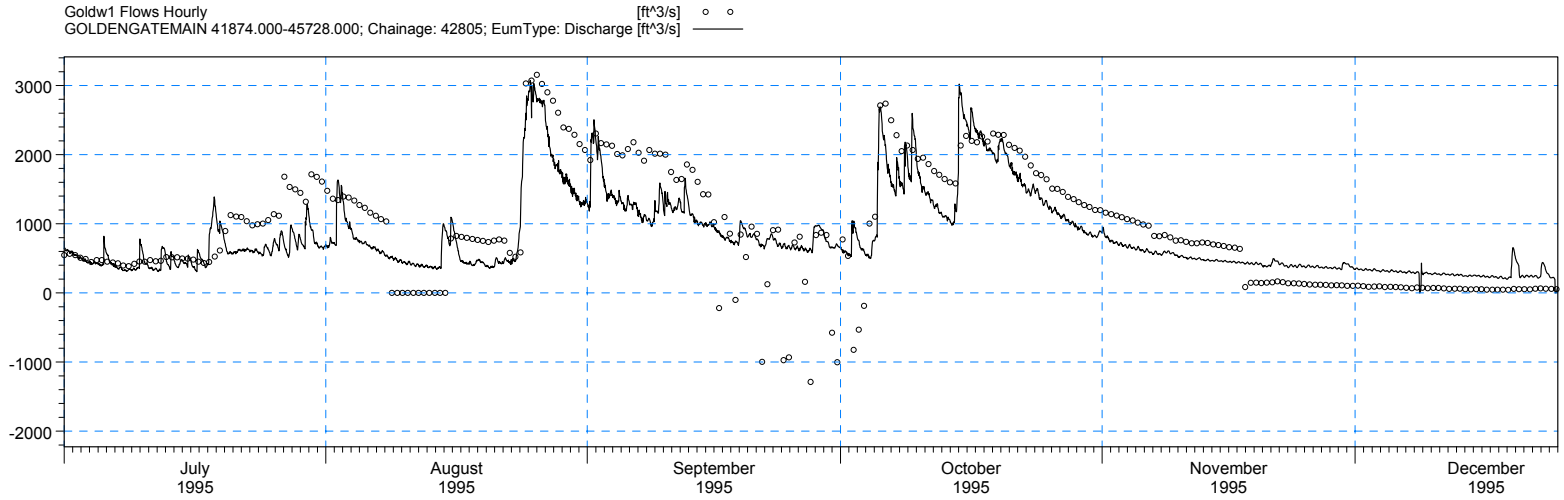
Simulated and observed stage in Golden Gate Main at GG #1 for 1995
Tropical Storm Jerry Validation of the BCB Model



ME=7.0905e-005
MAE=0.380409
RMSE=0.498856
STDres=0.498856
R(Correlation)=0.908256
R2(Nash_Sutcliffe)=0.556827

Figure A-96

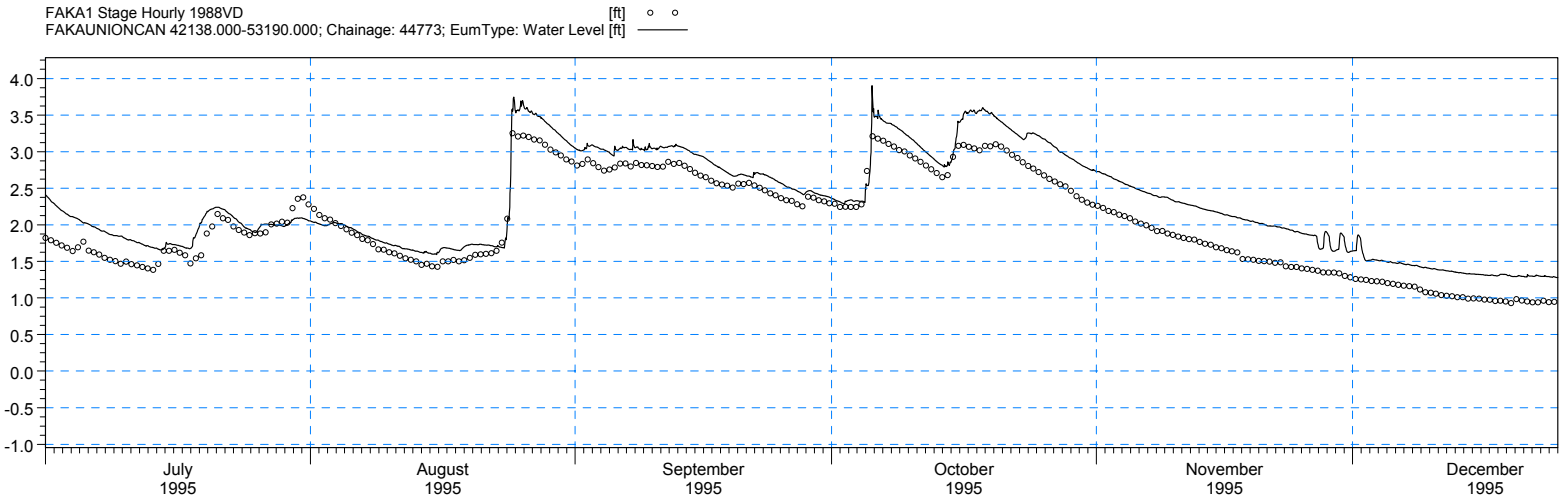
Simulated and observed discharge in Golden Gate Main at GG #1 for 1995 Tropical Storm Jerry Validation of the BCB Model



ME=94.1635
MAE=378.905
RMSE=501.263
STDres=492.339
R(Correlation)=0.830303
R2(Nash_Sutcliffe)=0.65461

Figure A-97

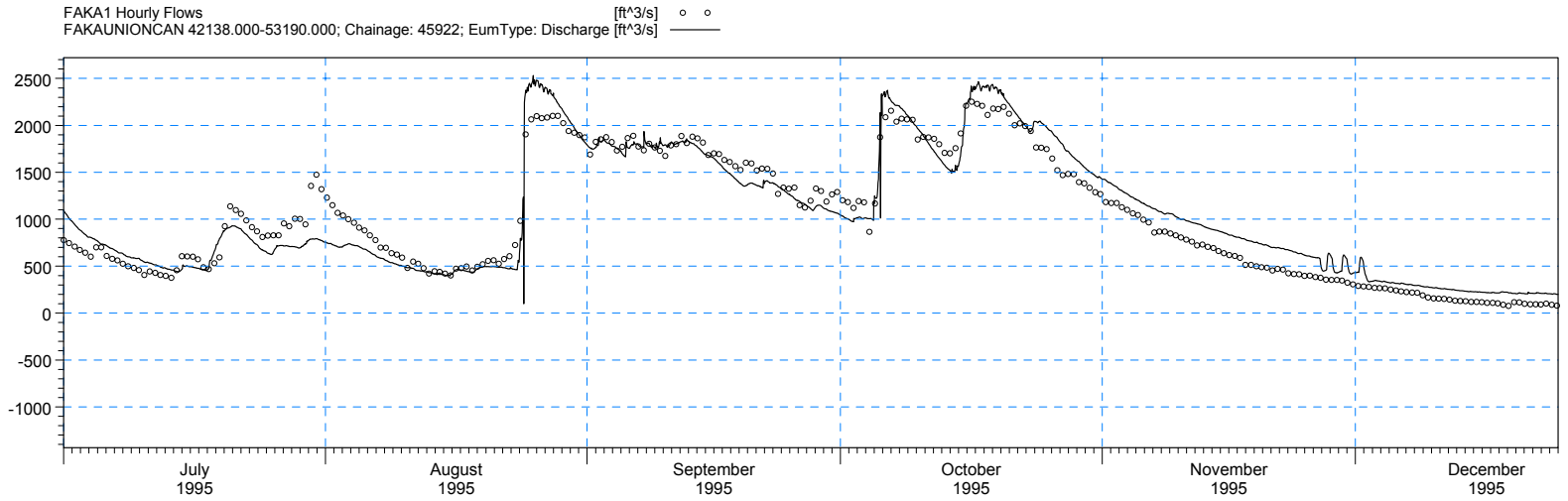
Simulated and observed stage in Faka Union Canal at FU #1 for 1995
Tropical Storm Jerry Validation of the BCB Model



ME=-0.269704
MAE=0.283859
RMSE=0.319559
STDres=0.1714
R(Correlation)=0.965934
R2(Nash_Sutcliffe)=0.763621

Figure A-98

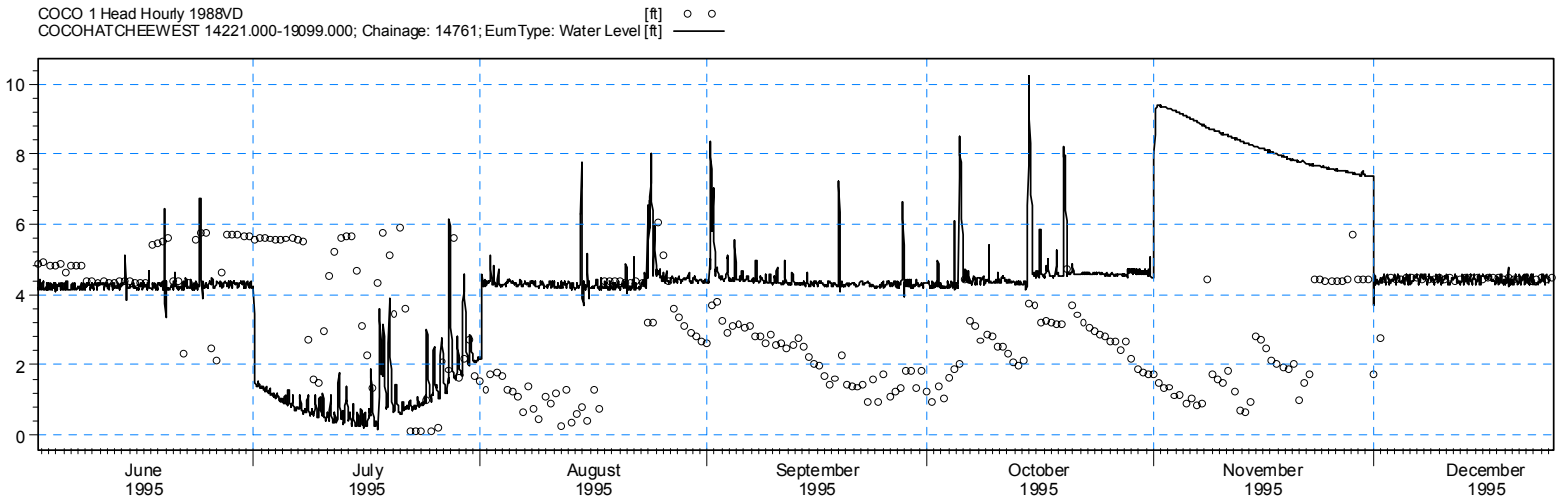
Simulated and observed Discharge in Faka Union Canal at FU #1 for 1995 Tropical Storm Jerry Validation of the BCB Model



ME=-34.9917
MAE=148.18
RMSE=181.295
STDres=177.886
R(Correlation)=0.961672
R2(Nash_Sutcliffe)=0.920109

Figure A-99

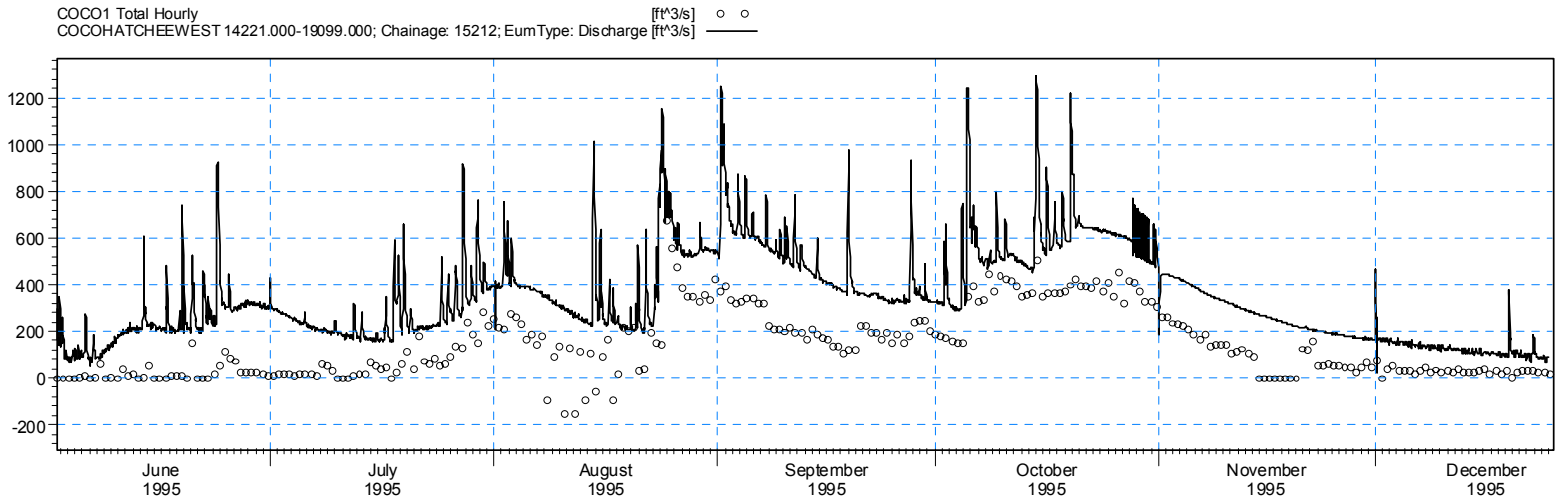
Simulated and observed stage in Cocohatchee West at COCO #1 for 1995
Tropical Storm Jerry Validation of the BCB Model



ME=-1.35848
MAE=2.32108
RMSE=3.10339
STDres=2.79027
R(Correlation)=-0.195775
R2(Nash_Sutcliffe)=-2.76111

Figure A-100

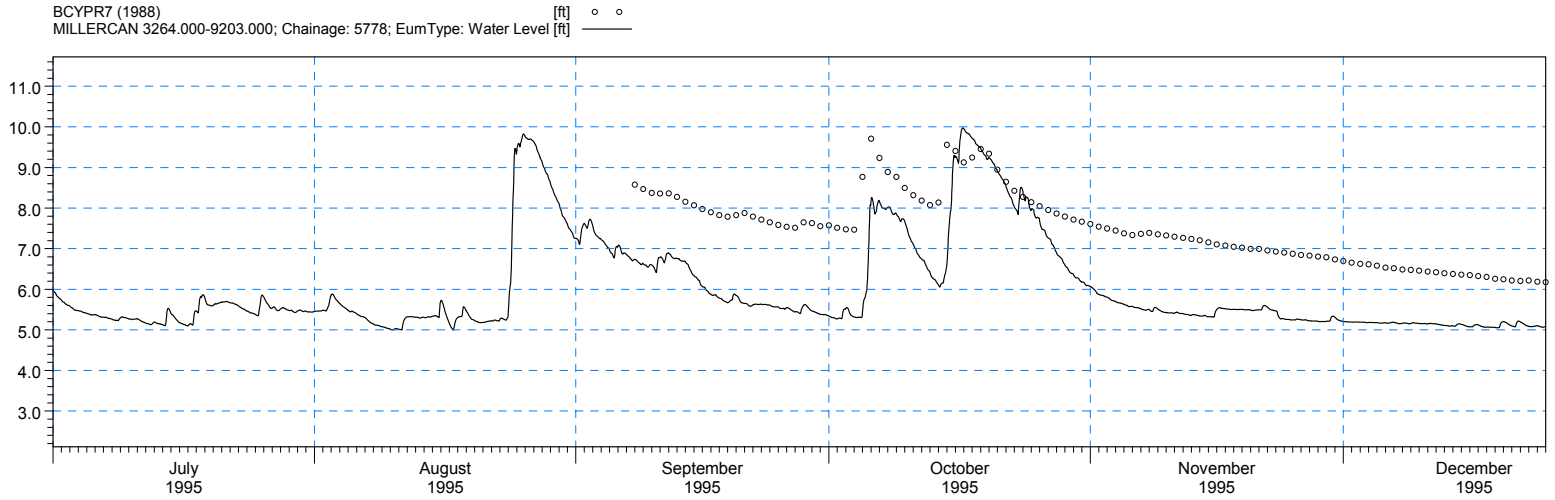
Simulated and observed discharge in Cocohatchee West at COCO #1 for 1995 Tropical Storm Jerry Validation of the BCB Model



ME=-199.001
MAE=199.433
RMSE=229.772
STDres=114.865
R(Correlation)=0.806594
R2(Nash_Sutcliffe)=-1.50893

Figure A-101

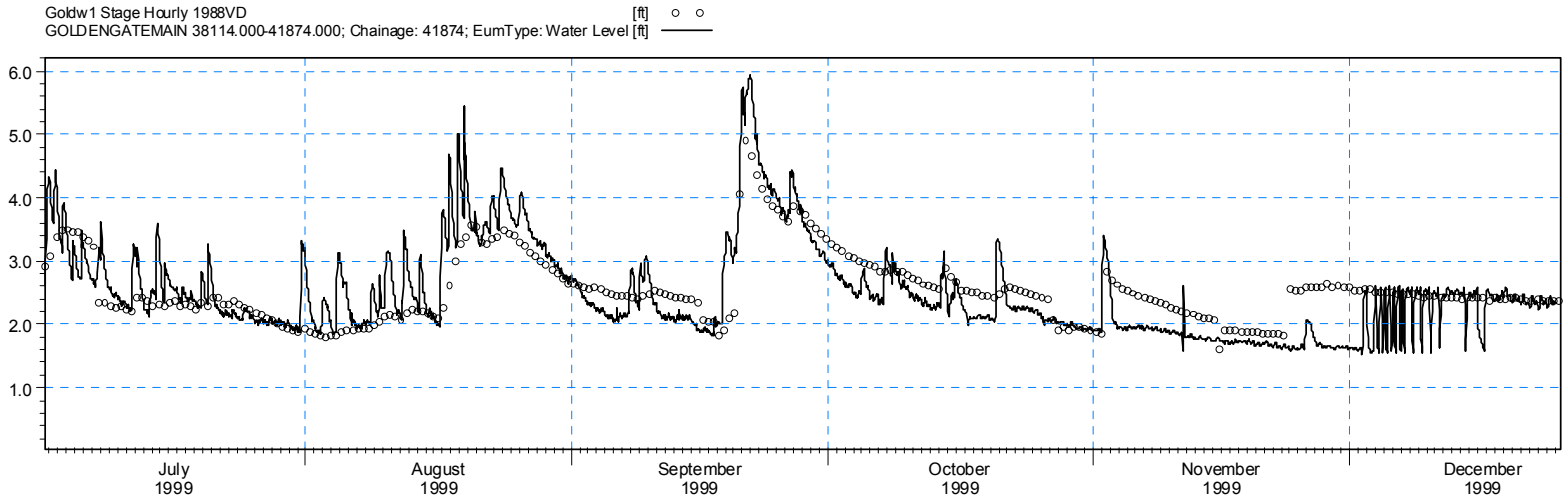
Simulated and observed daily stage in Miller Canal at BCYPR7 for 1995
Tropical Storm Jerry Validation of the BCB Model



ME=1.65464
MAE=1.67715
RMSE=1.81423
STDres=0.744052
R(Correlation)=0.750203
R2(Nash_Sutcliffe)=-3.63257

Figure A-102

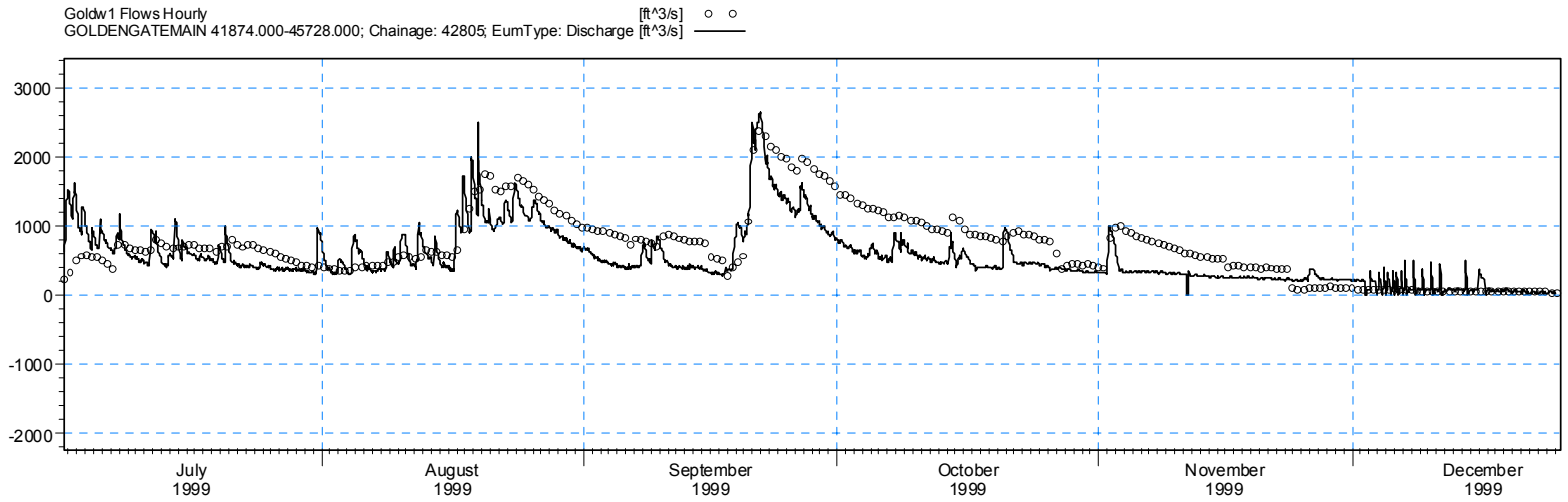
Simulated and observed stage in Golden Gate Main at GG #1 for 1999
Tropical Storm Harvey Validation of the BCB Model



ME=0.0512413
MAE=0.341249
RMSE=0.459852
STDres=0.456989
R(Correlation)=0.779949
R2(Nash_Sutcliffe)=0.266511

Figure A-103

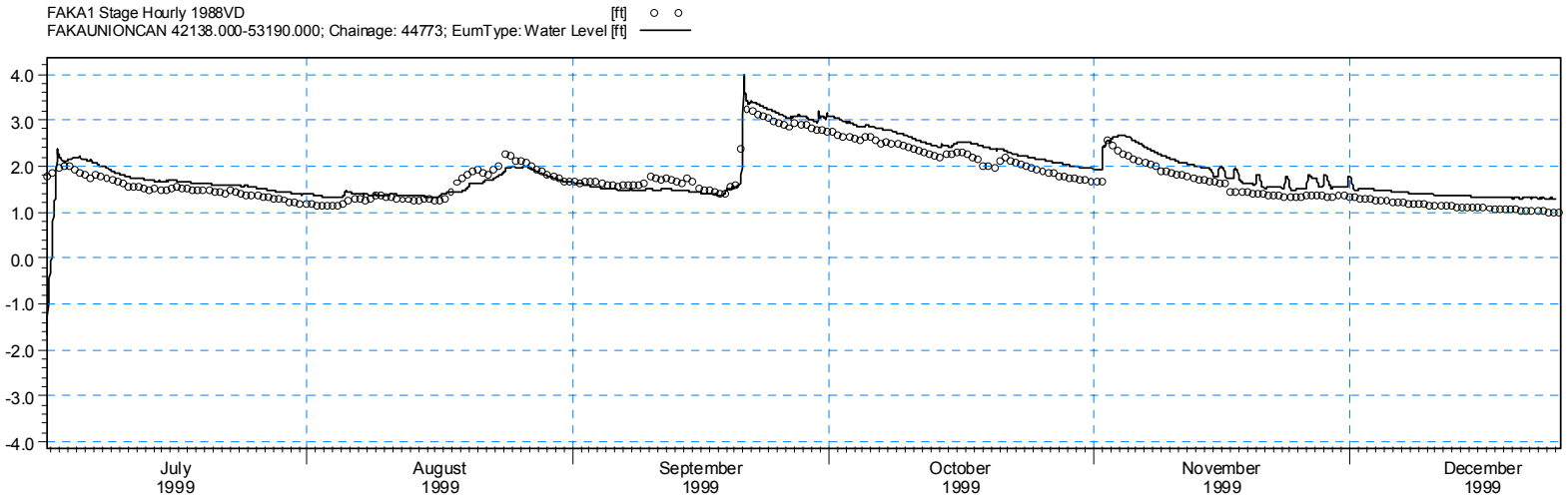
Simulated and observed discharge in Golden Gate Main at GG #1 for 1999 Tropical Storm Harvey Validation of the BCB Model



ME=180.827
MAE=274.83
RMSE=344.545
STDres=293.279
R(Correlation)=0.812296
R2(Nash_Sutcliffe)=0.530228

Figure A-104

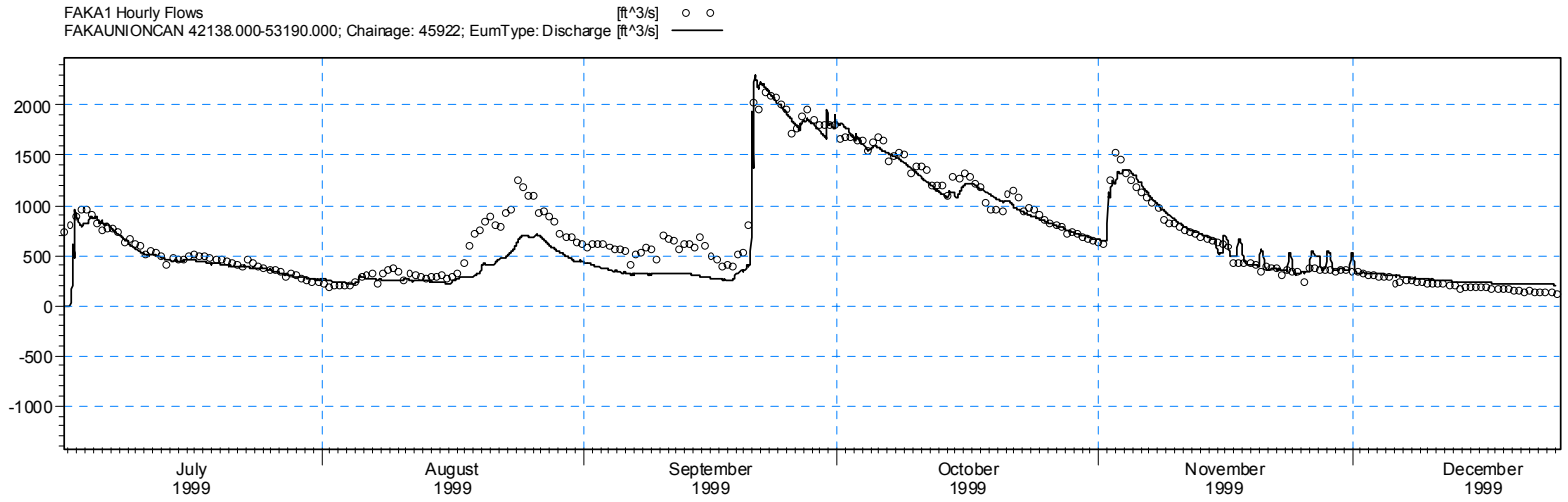
Simulated and observed stage in Faka Union Canal at FU #1 for 1999
Tropical Storm Harvey Validation of the BCB Model



ME=-0.126172
MAE=0.209633
RMSE=0.27221
STDres=0.241202
R(Correlation)=0.904208
R2(Nash_Sutcliffe)=0.713111

Figure A-105

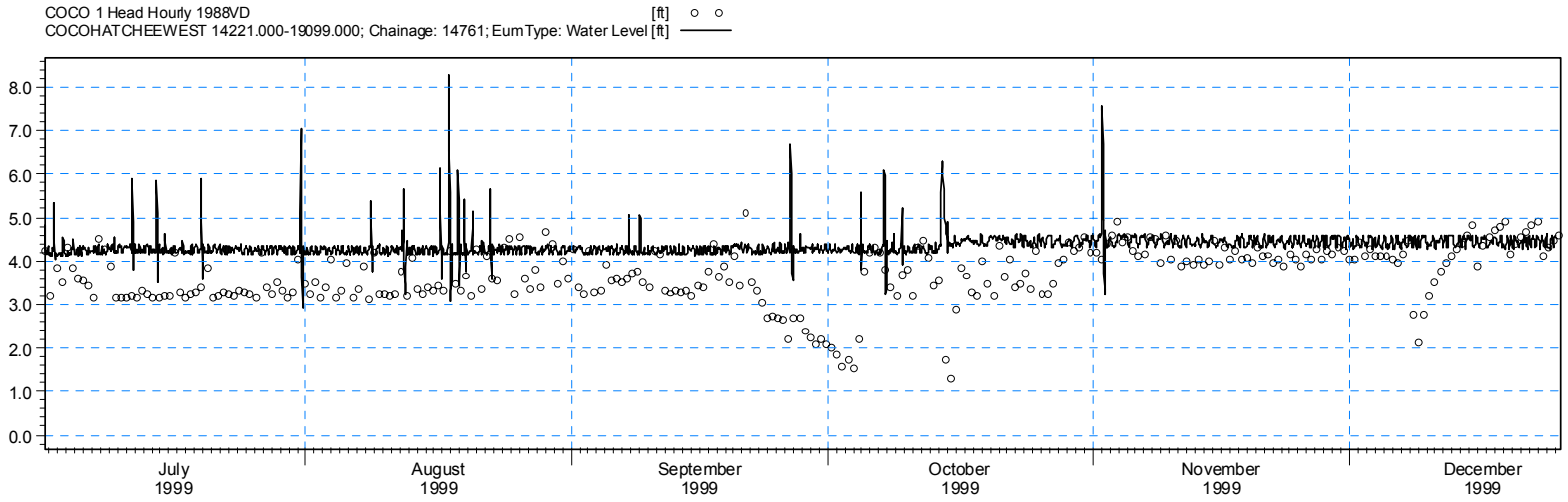
Simulated and observed Discharge in Faka Union Canal at FU #1 for 1999 Tropical Storm Harvey Validation of the BCB Model



ME=63.7818
MAE=105.407
RMSE=167.196
STDres=154.552
R(Correlation)=0.949813
R2(Nash_Sutcliffe)=0.881671

Figure A-106

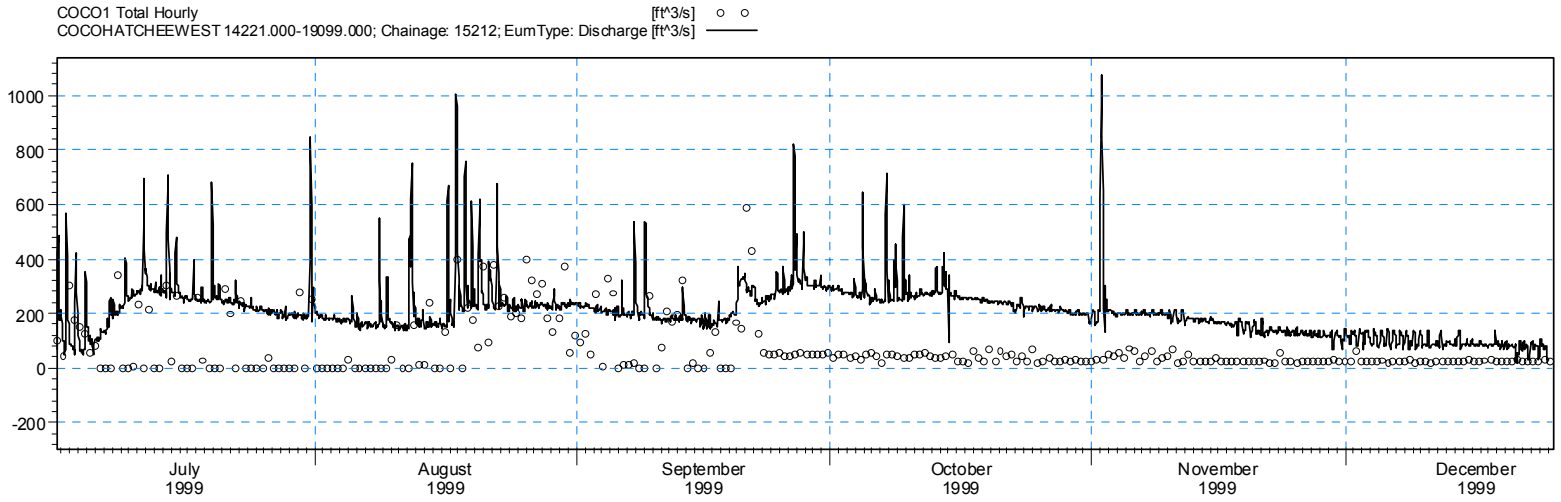
Simulated and observed stage in Cocohatchee West at COCO #1 for 1999
Tropical Storm Harvey Validation of the BCB Model



ME=-0.629628
MAE=0.688338
RMSE=0.91324
STDres=0.661495
R(Correlation)=0.156899
R2(Nash_Sutcliffe)=-0.965377

Figure A-107

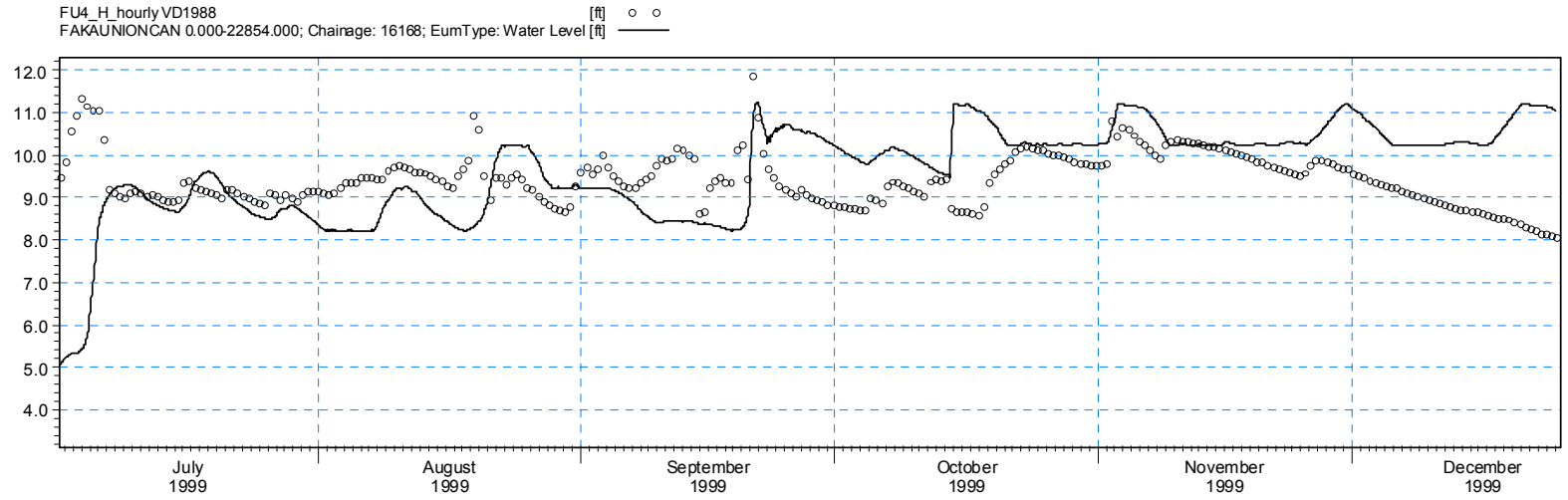
Simulated and observed Discharge in Cocohatchee West at COCO #1 for 1999 Tropical Storm Harvey Validation of the BCB Model



ME=-138.956
MAE=158.499
RMSE=185.377
STDres=122.703
R(Correlation)=0.190542
R2(Nash_Sutcliffe)=-2.64962

Figure A-108

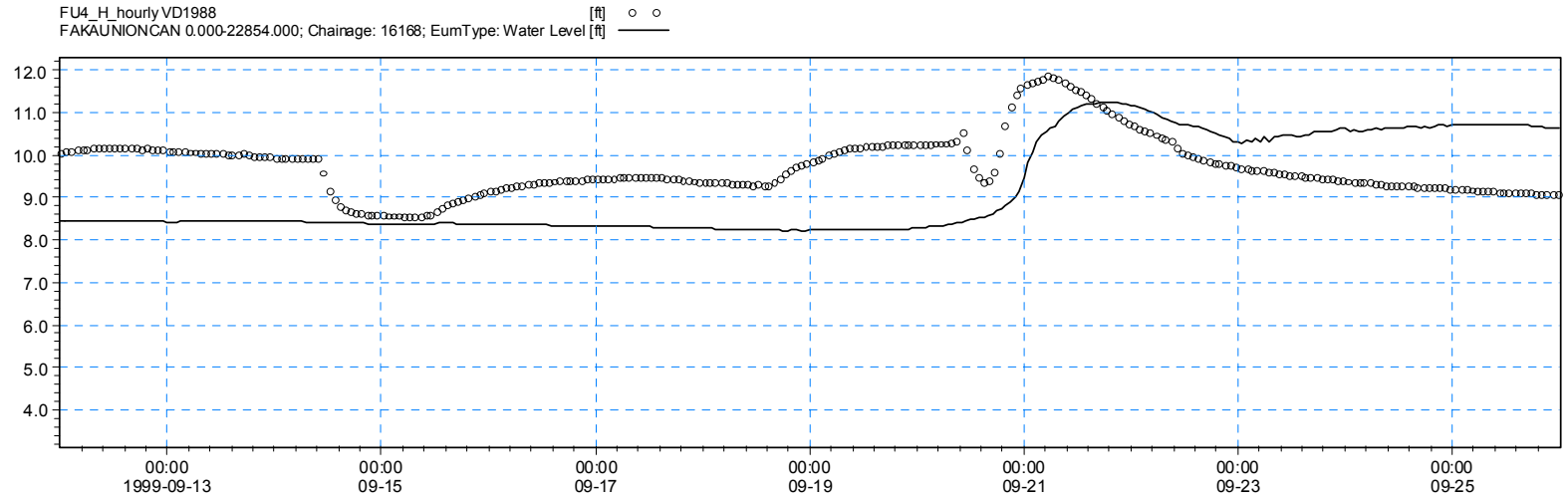
Simulated and observed stage in Faka Union Canal at FU #4 for 1999
Tropical Storm Harvey Validation of the BCB Model



ME=-0.18869
MAE=0.985257
RMSE=1.35802
STDres=1.34485
R(Correlation)=-0.174134
R2(Nash_Sutcliffe)=-3.95313

Figure A-109

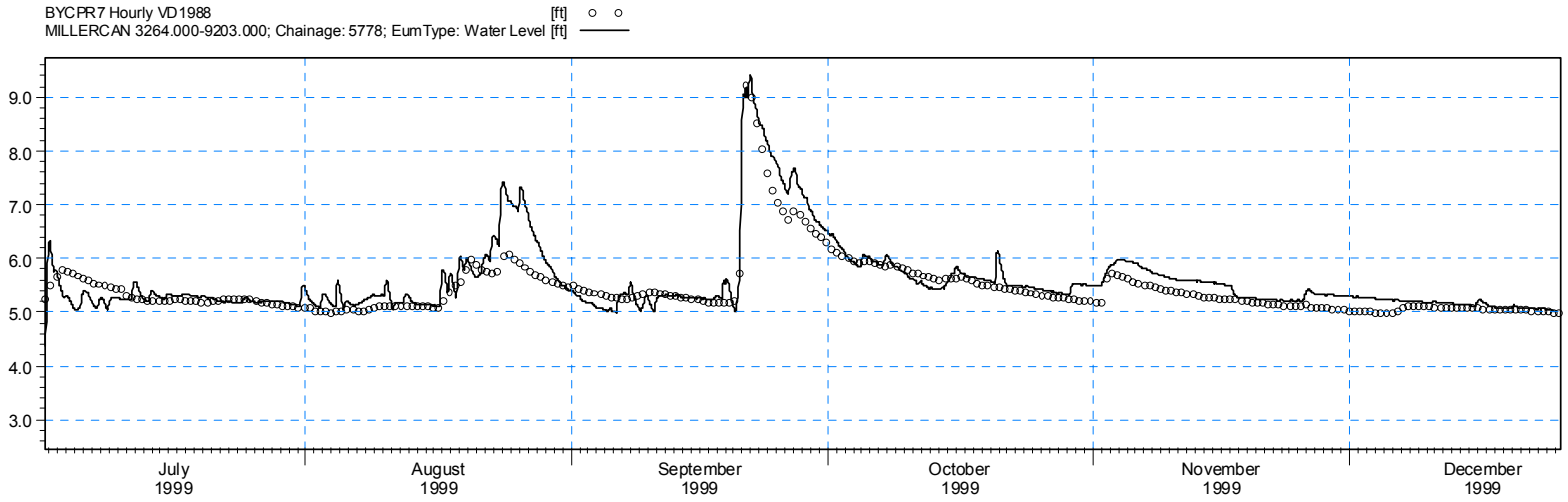
Simulated and observed Hourly Stage in Faka Union Canal at FU #4 for 1999 Tropical Storm Harvey Validation of the BCB Model



ME=0.538128
MAE=1.18625
RMSE=1.29761
STDres=1.18077
R(Correlation)=0.228067
R2(Nash_Sutcliffe)=-2.43238

Figure A-110

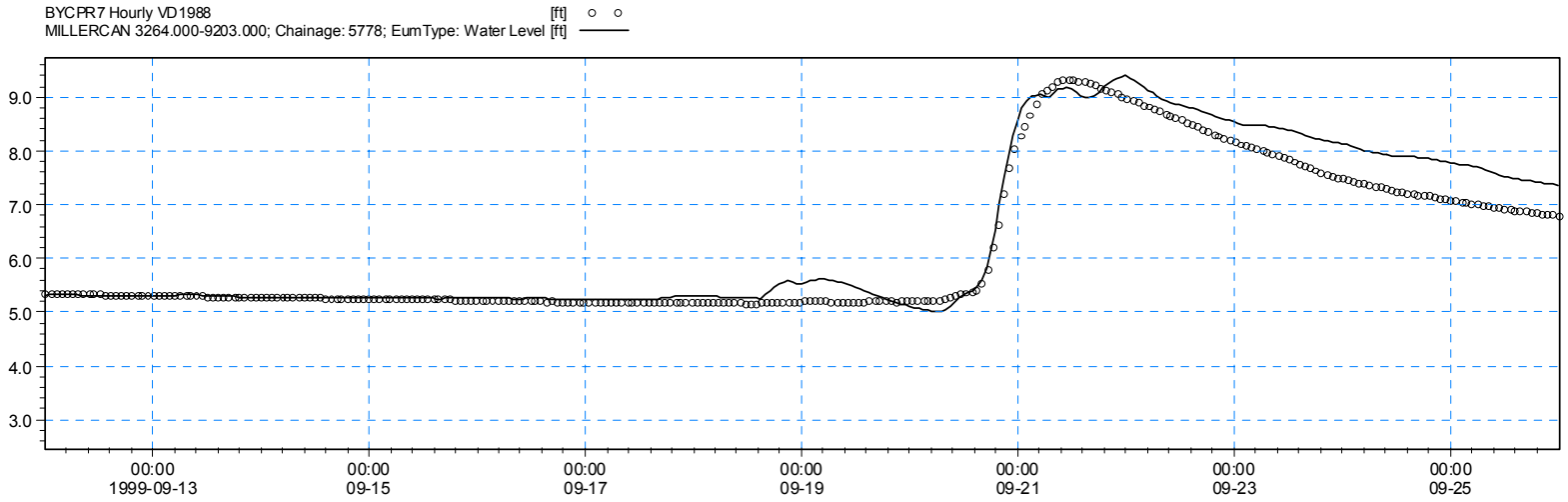
Simulated and observed stage in Miller Canal at BCYPR7 for 1999
Tropical Storm Harvey Validation of the BCB Model



ME=-0.11926
MAE=0.193388
RMSE=0.282745
STDres=0.256363
R(Correlation)=0.929883
R2(Nash_Sutcliffe)=0.753507

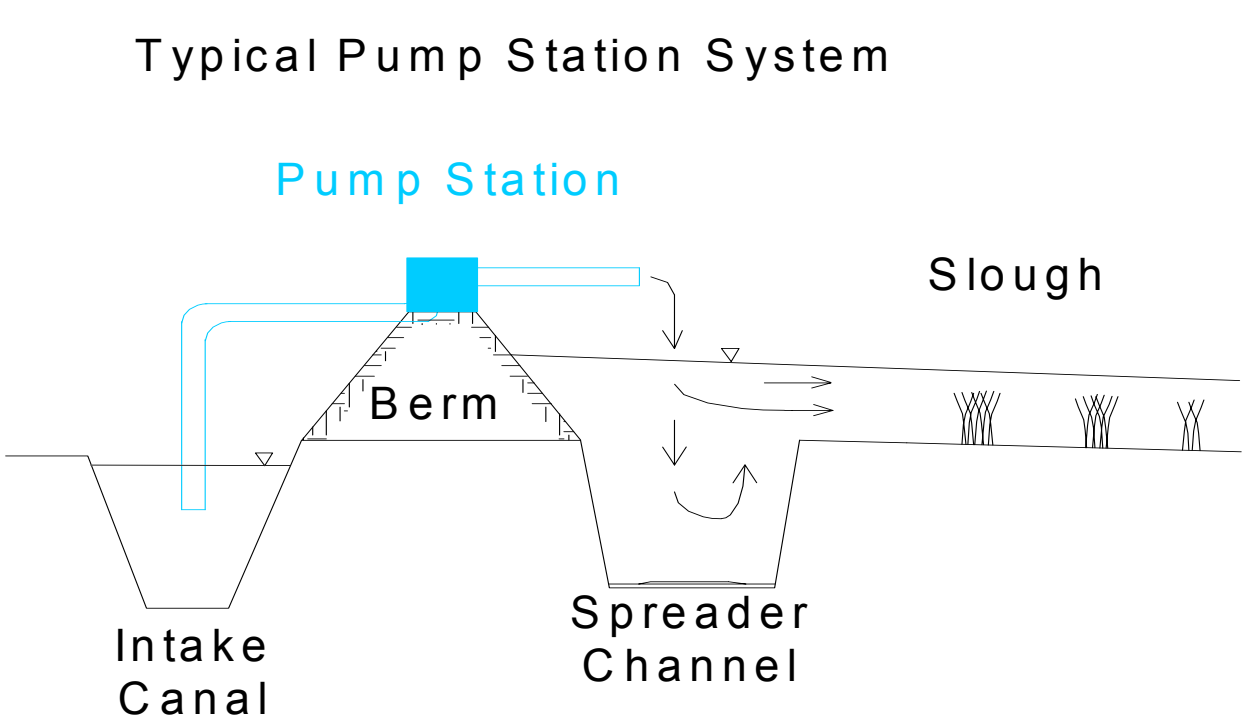
Figure A-111

Simulated and observed stage in Miller Canal at BCYPR7 During for 1999 Tropical Storm Harvey in the BCB Model



ME=-0.185118
MAE=0.217979
RMSE=0.317971
STDres=0.258528
R(Correlation)=0.988401
R2(Nash_Sutcliffe)=0.947369

Figure A-112



SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Figure A-113

6L Levee Profile

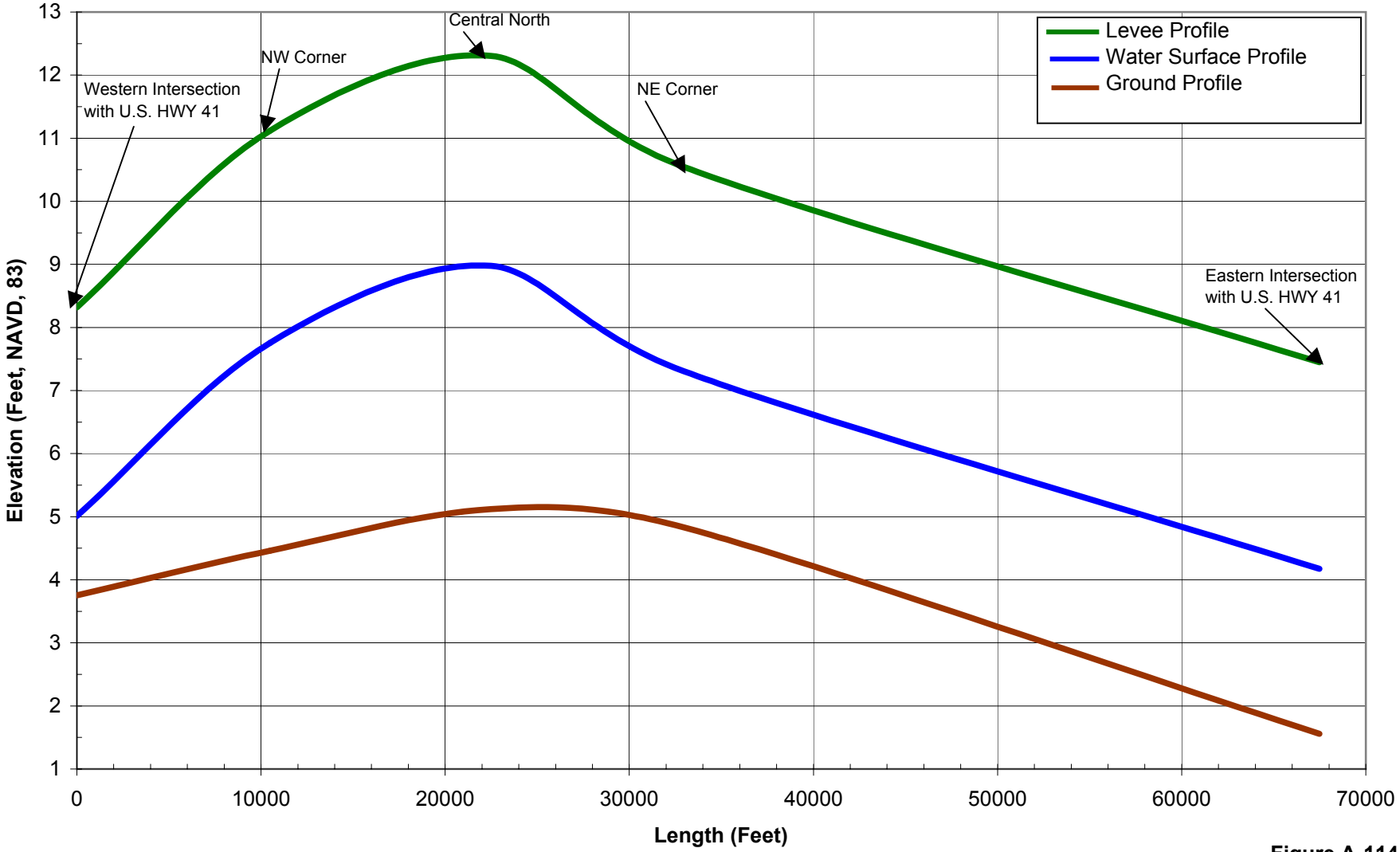


Figure A-114

PL Levee Profile

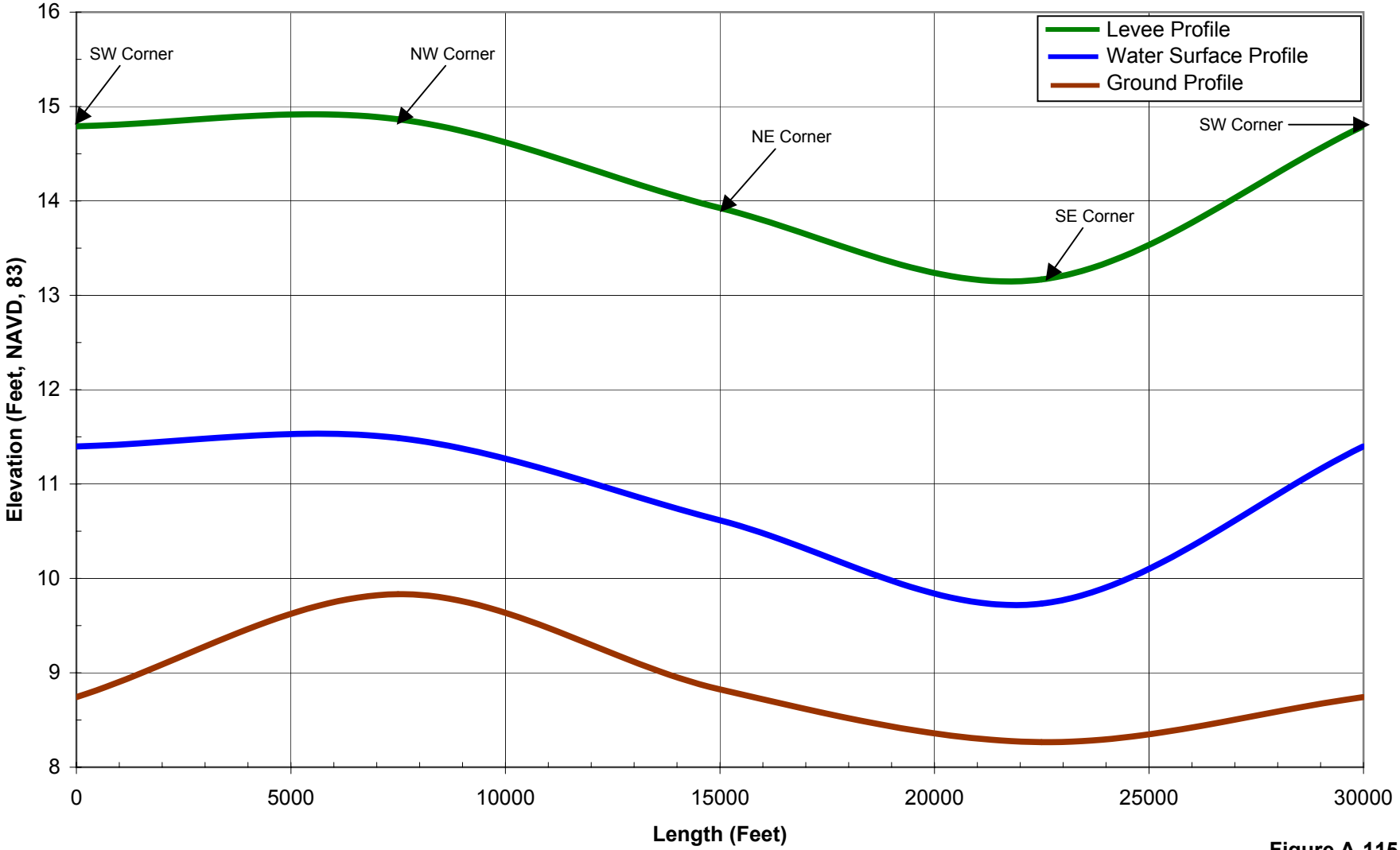


Figure A-115

41N Levee Profile

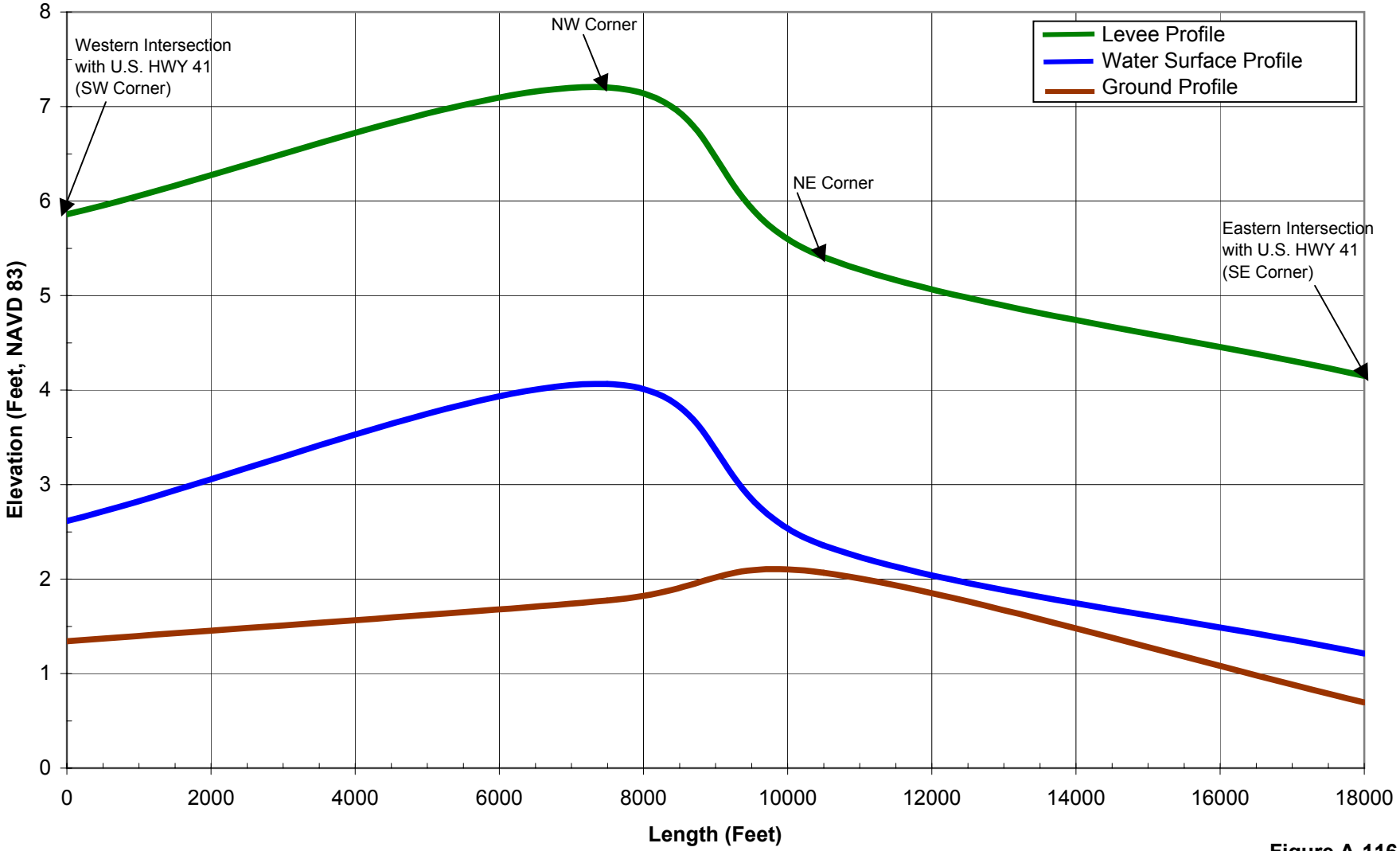


Figure A-116

41E Levee Profile

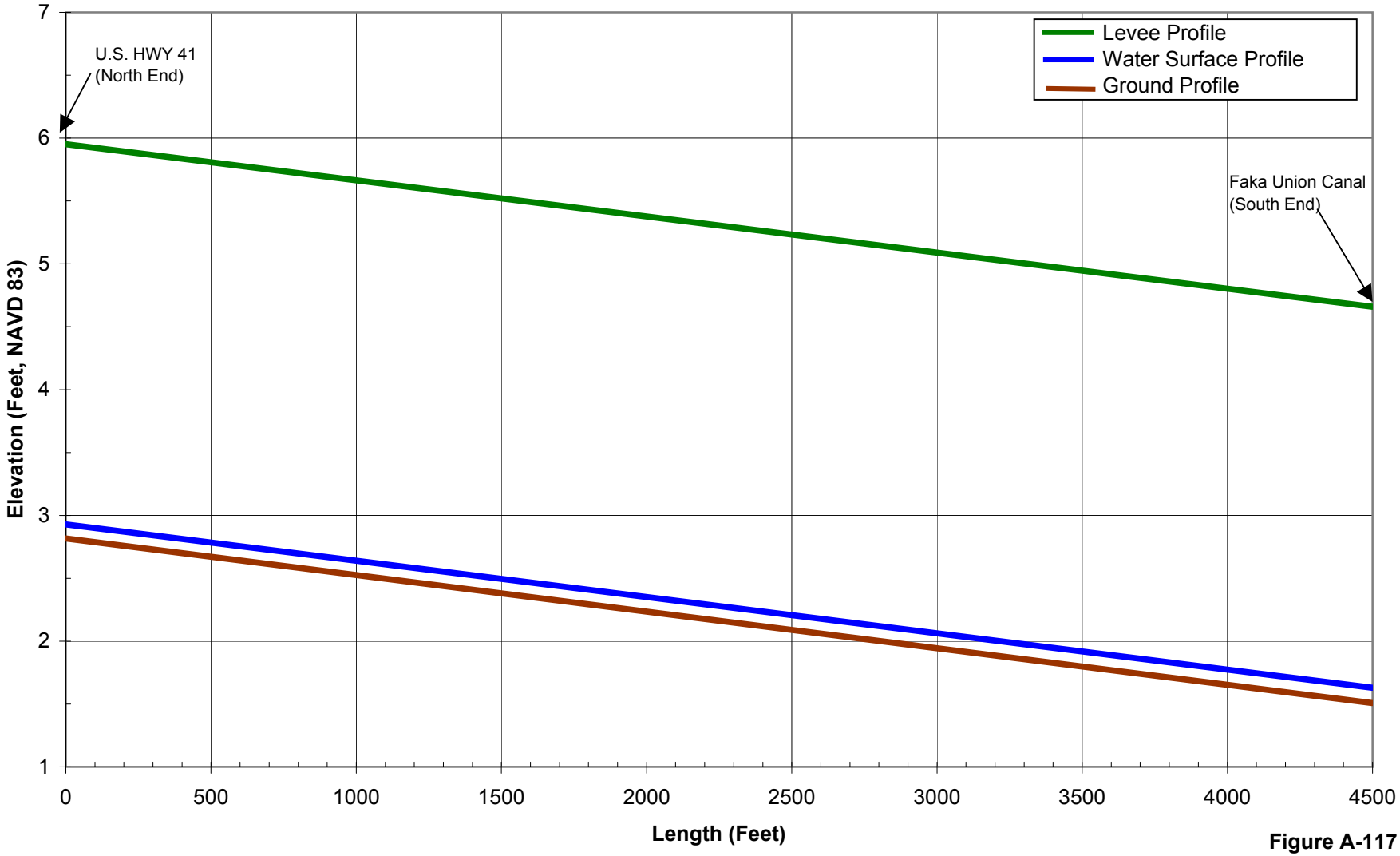


Figure A-117

41W Levee Profile

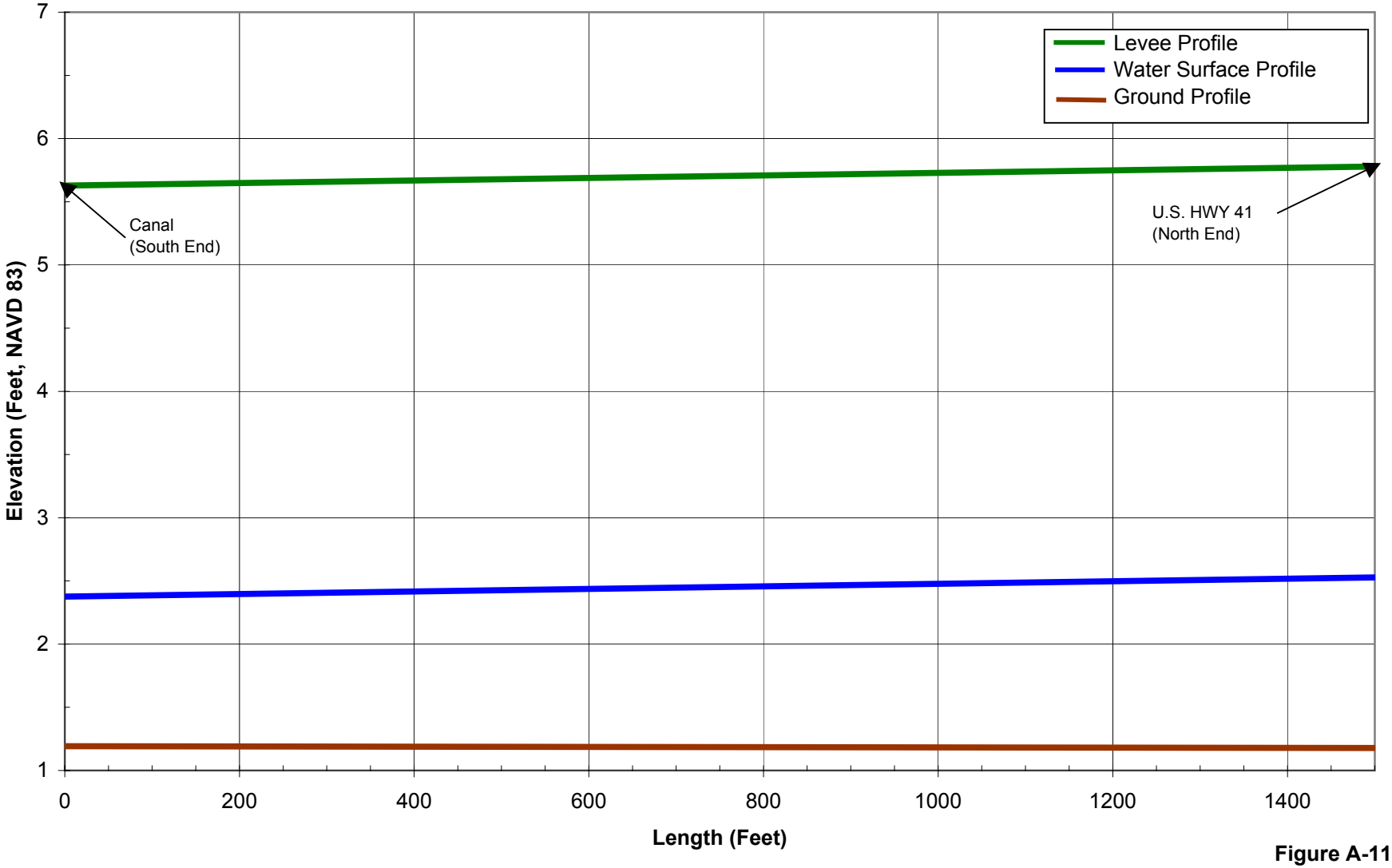


Figure A-118

Figure A-119
Savings Condition
N I-75 Miller Canal Chainage 8716
Average Wet Period

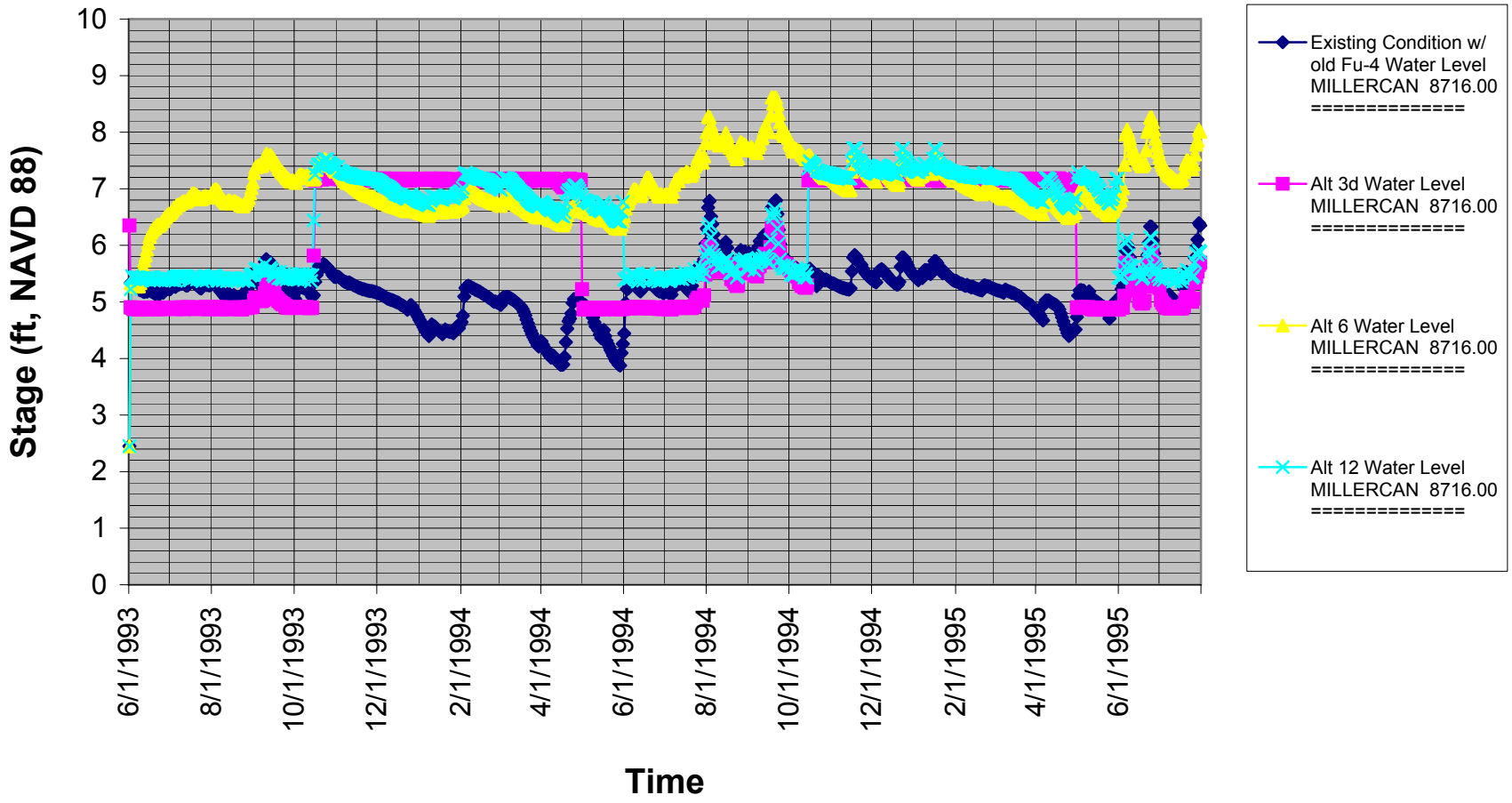


Figure A-120
Savings Condition
N of I-75 at Faka Union Canal Chainage 21799
Average Wet Period

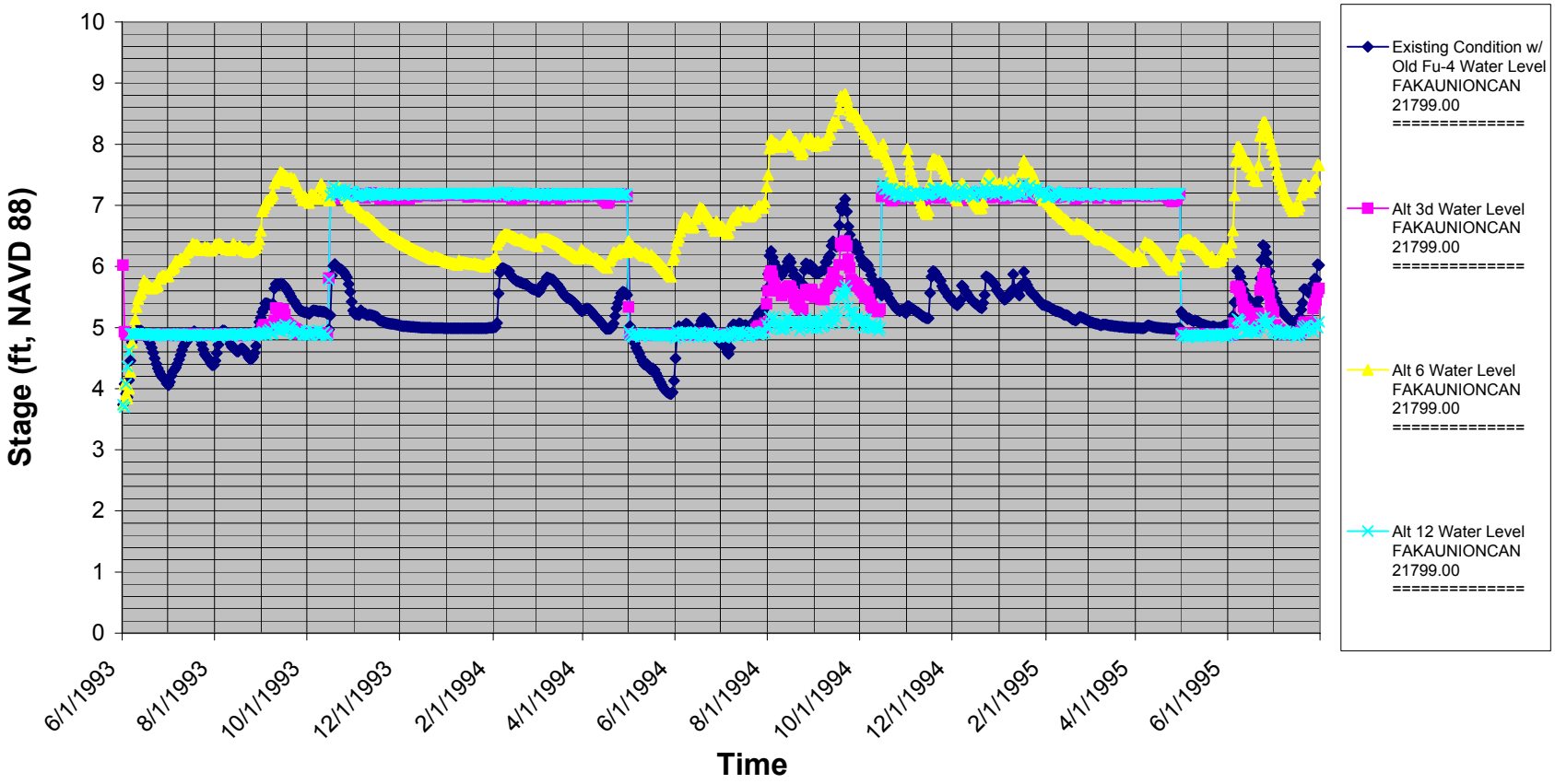


Figure A-121
Savings Condition
N I-75 Faka Union Canal Chainage 18177
Average Wet Period

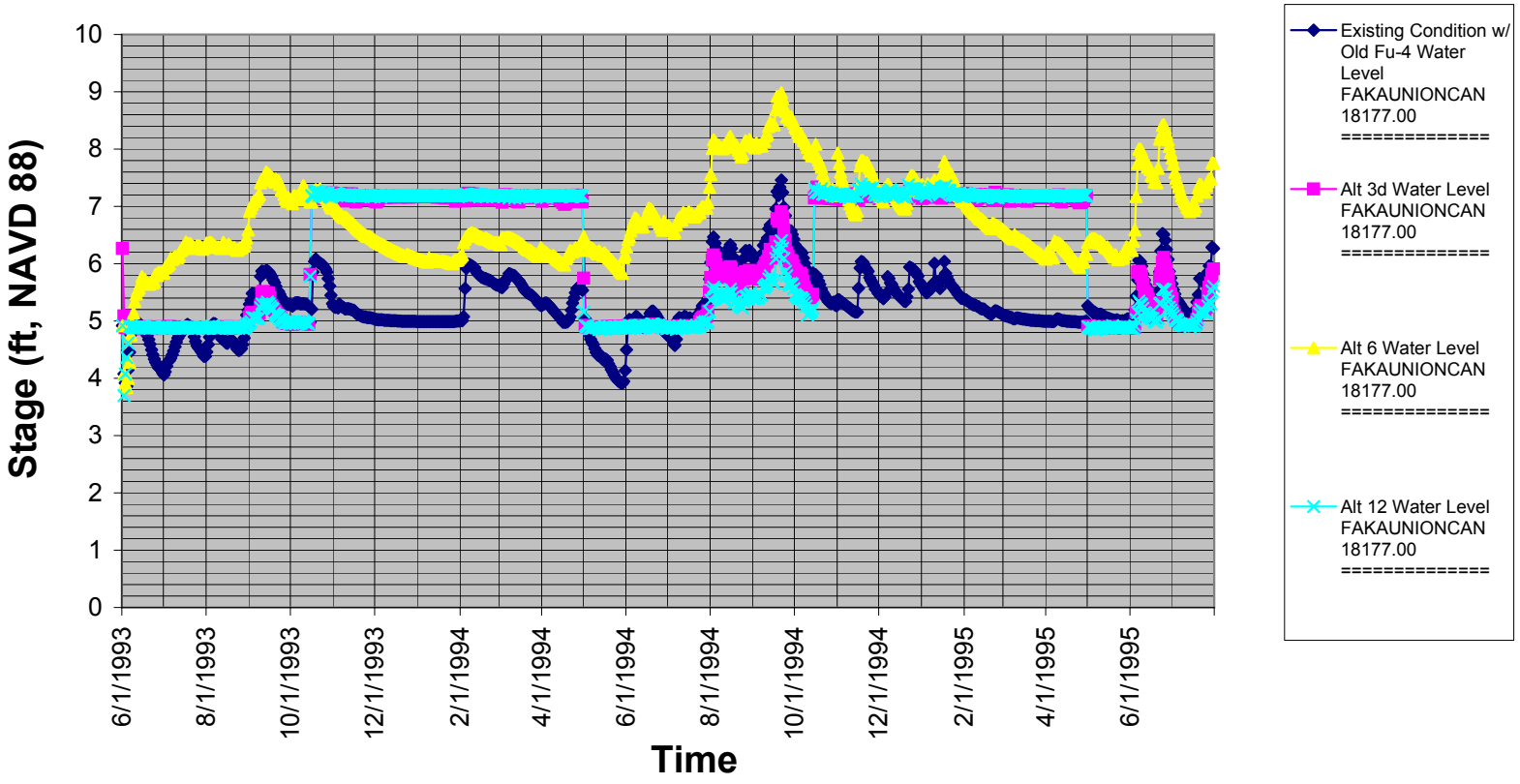


Figure A-122
Savings Condition
In SGGE Miller Canal Chainage 21560
Average Wet Period

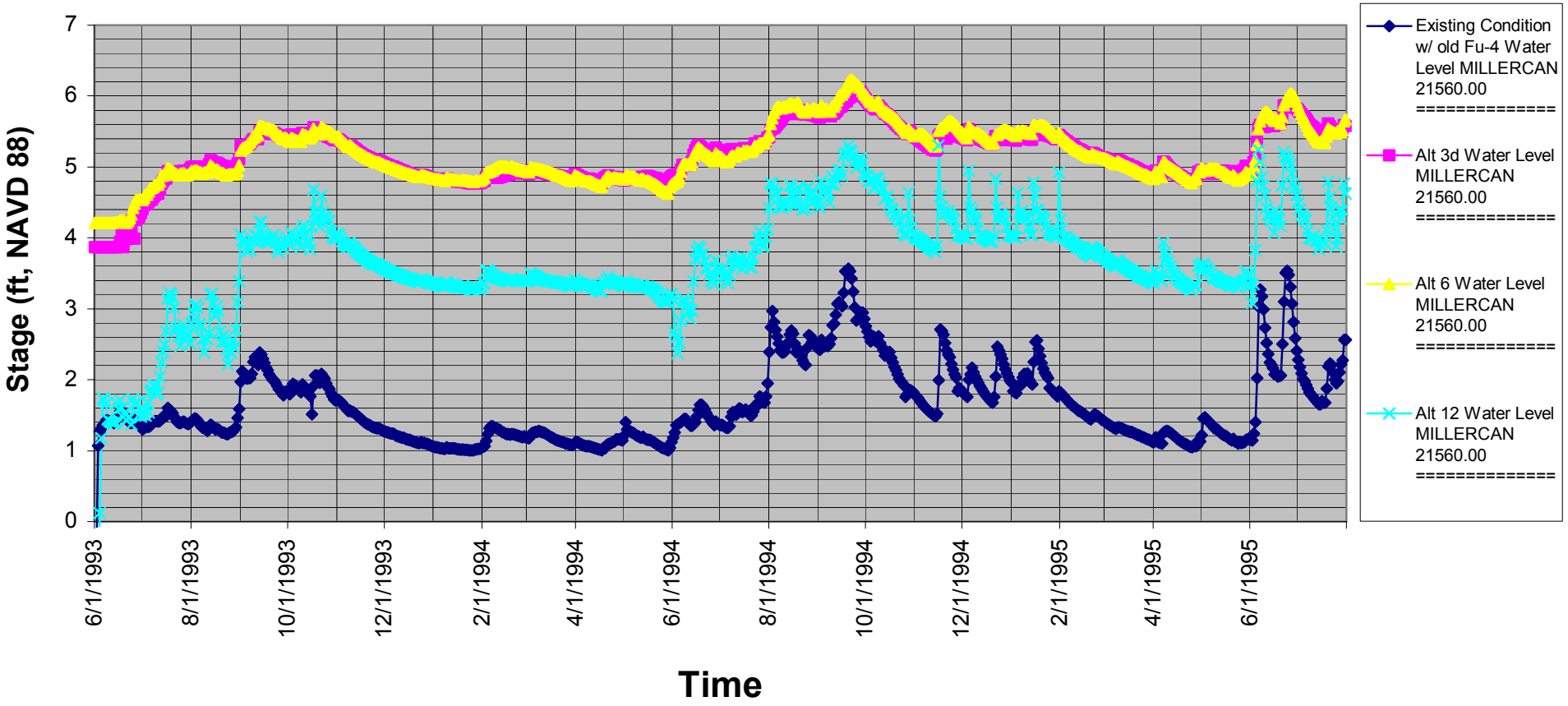


Figure A-123
Savings Condition
In SGGE at Faka Union Canal Chainage 29143
Average Wet Period

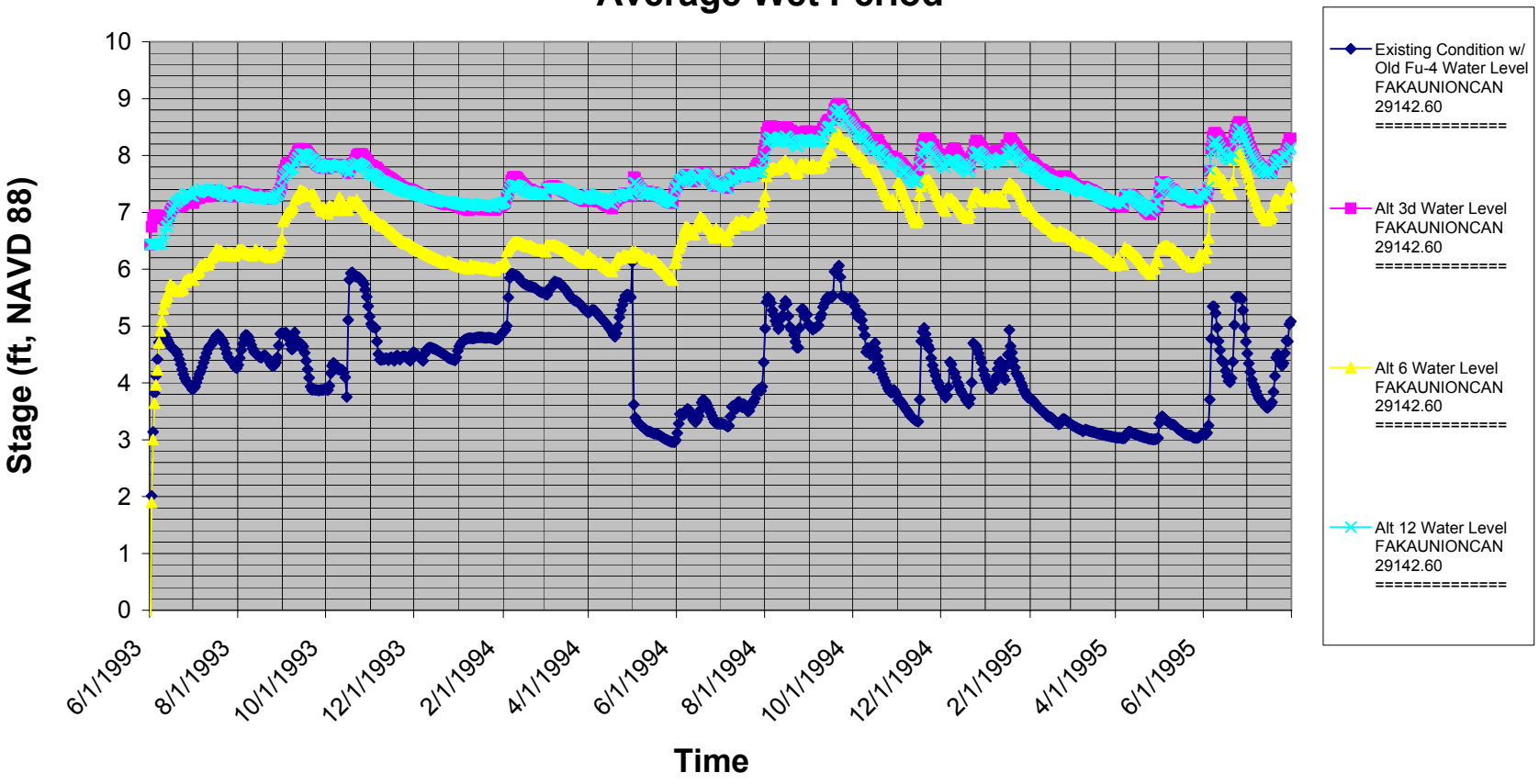


Figure A-124
Savings Condition
N I-75 Miller Canal Chainage 8716
10 Year Storm

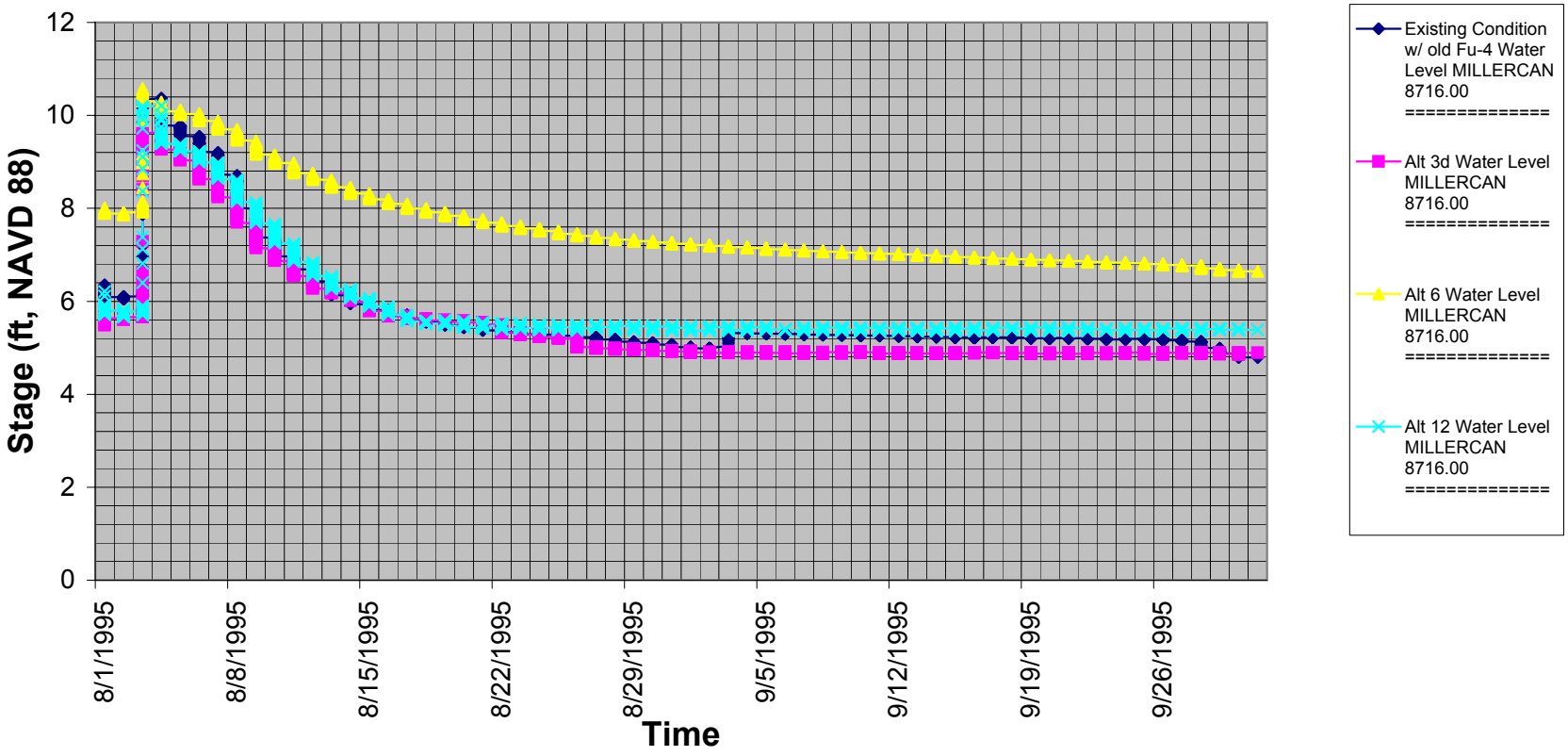


Figure A-125
Savings Condition
N of I-75 at Faka Union Canal Chainage 21799
10 Year Storm

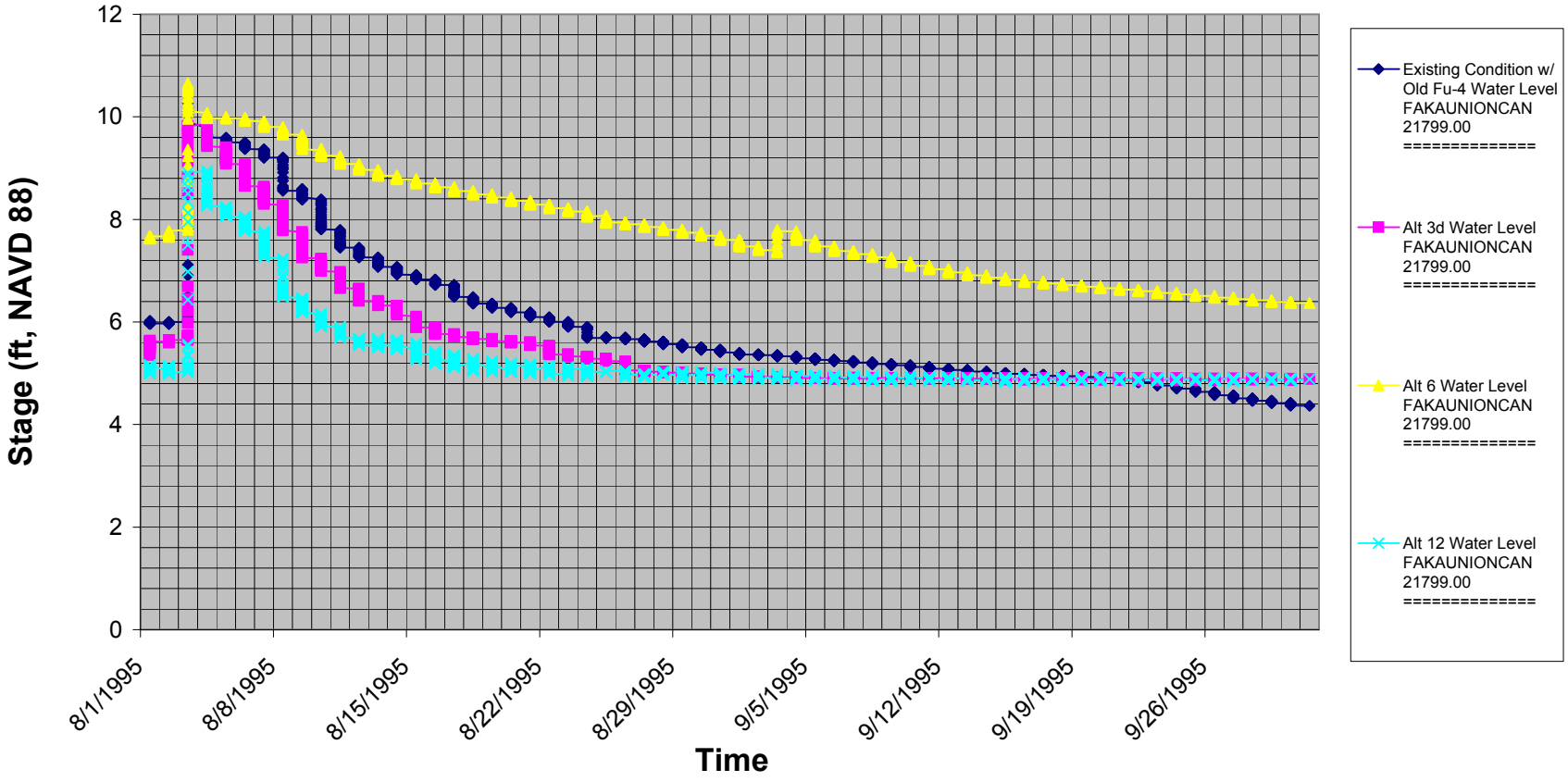


Figure A-126
Savings Condition
N I-75 Faka Union Canal Chainage 18177
10 Year Storm

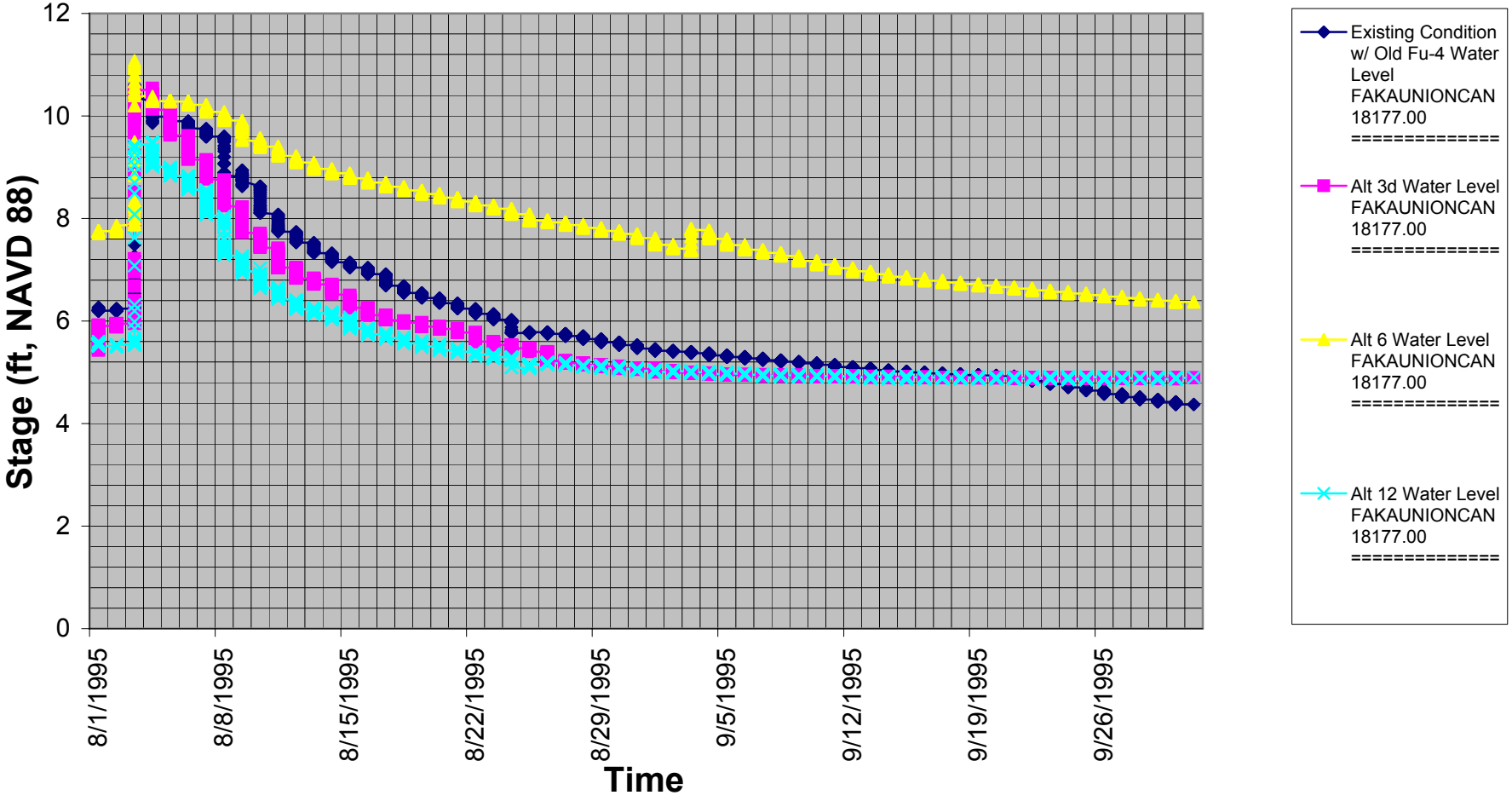


Figure A-127
Savings Condition
In SGGE Miller Canal Chainage 21560
10 Year Storm

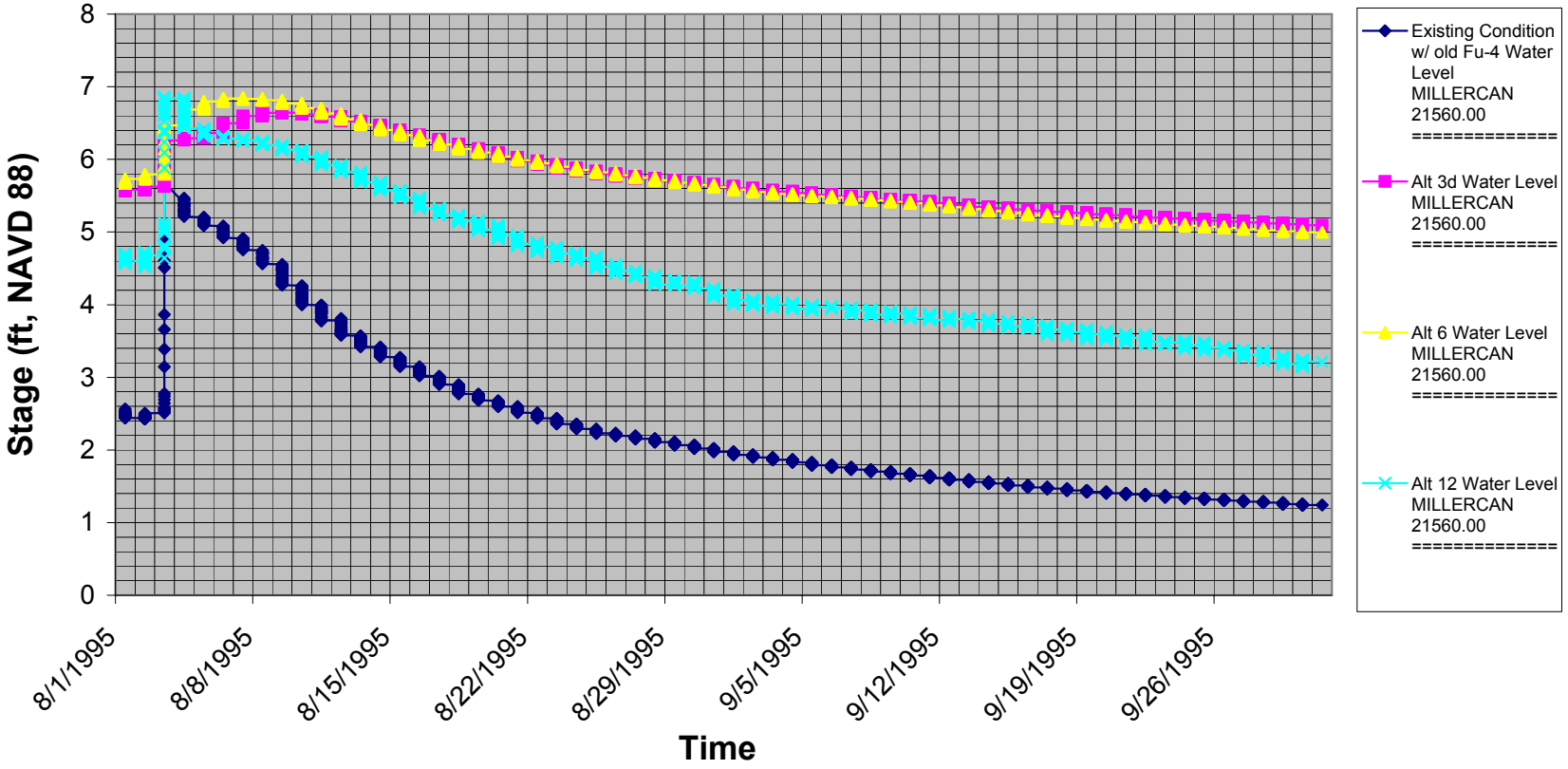


Figure A-128
Savings Condition
In SGGE at Faka Union Canal Chainage 29143
10 Year Storm

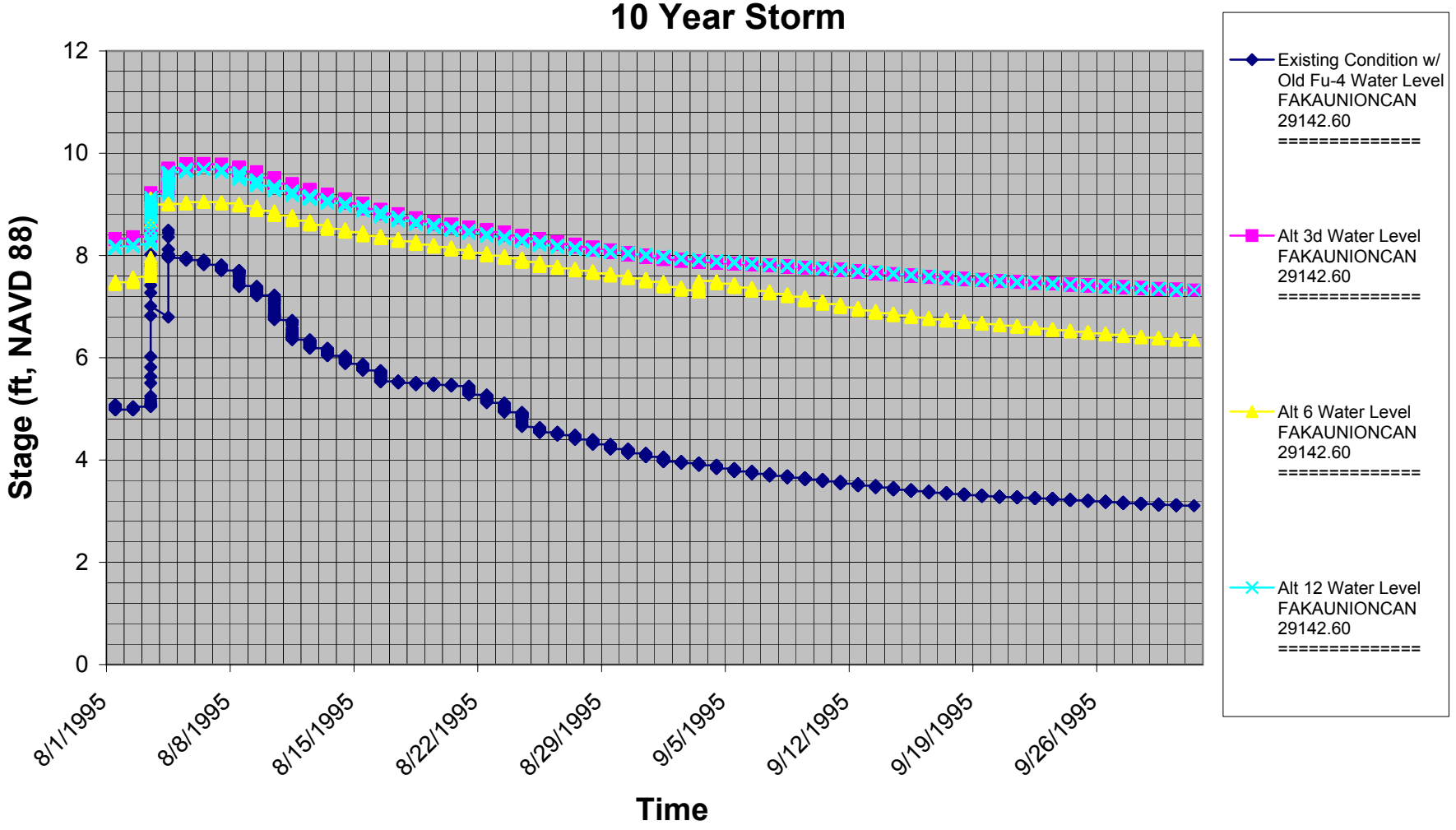


Figure A-129
Savings Condition
N I-75 Miller Canal Chainage 8716
25 Year Storm

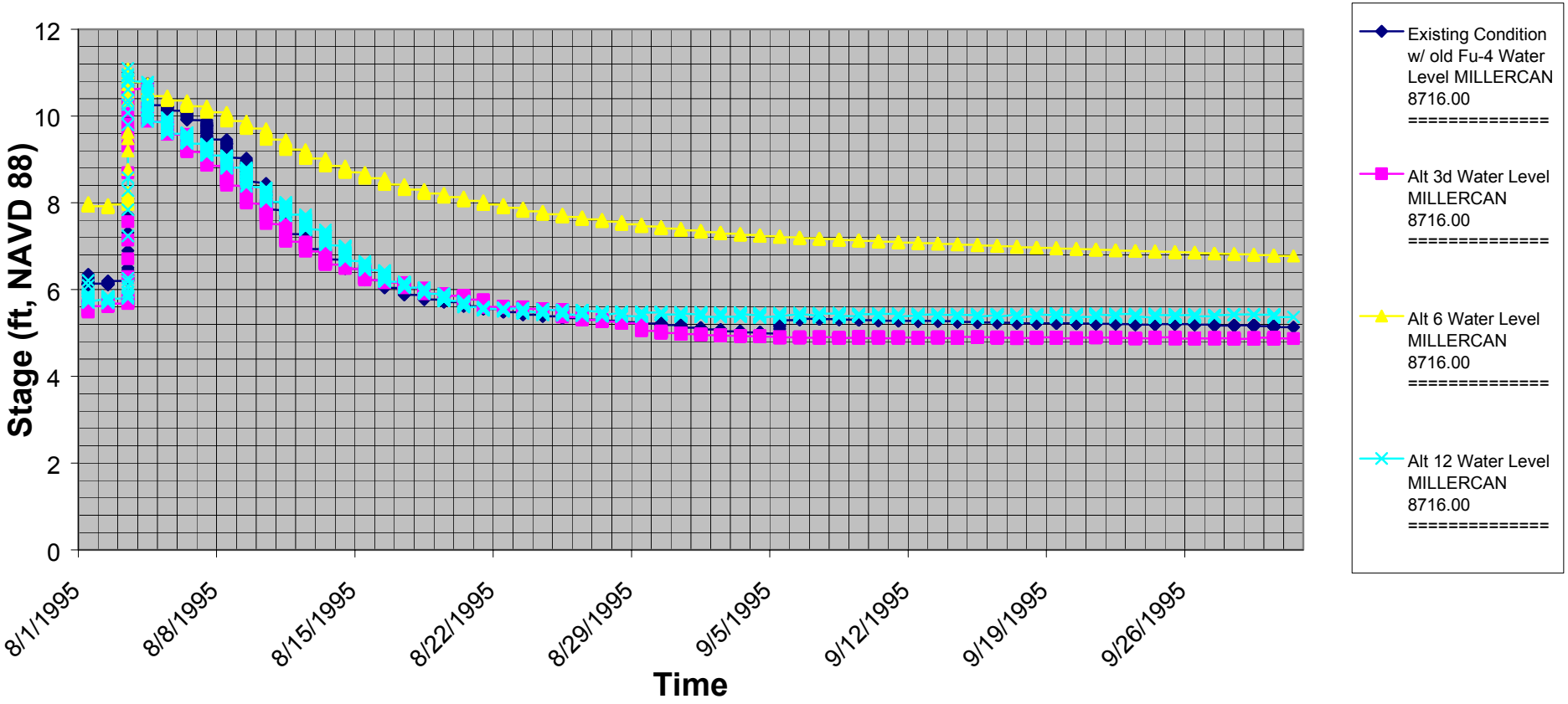


Figure A-130
Savings Condition
N of I-75 at Faka Union Canal Chainage 21799
25 Year Storm

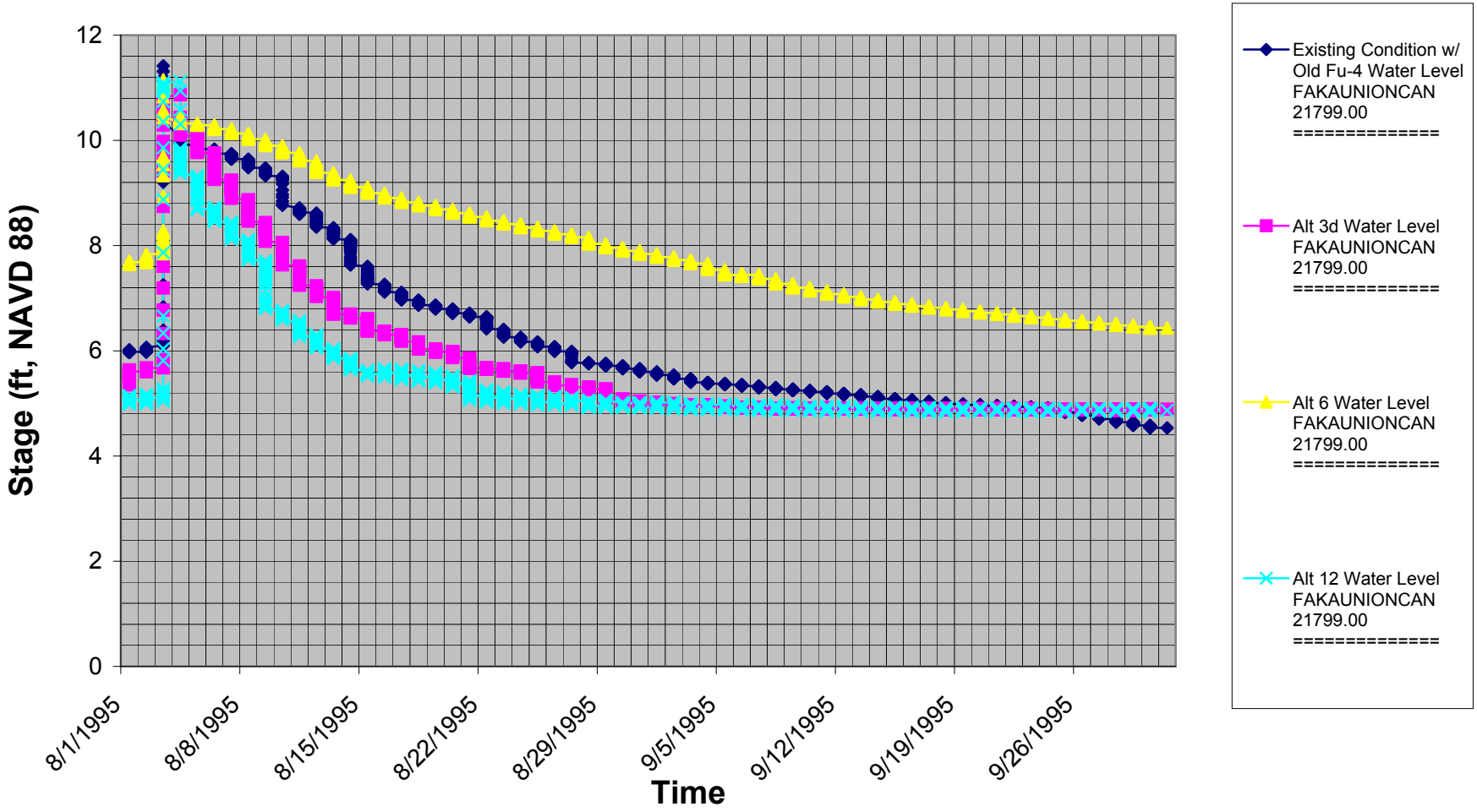


Figure A-131
Savings Condition
N I-75 Faka Union Canal Chainage 18177
25 Year Storm

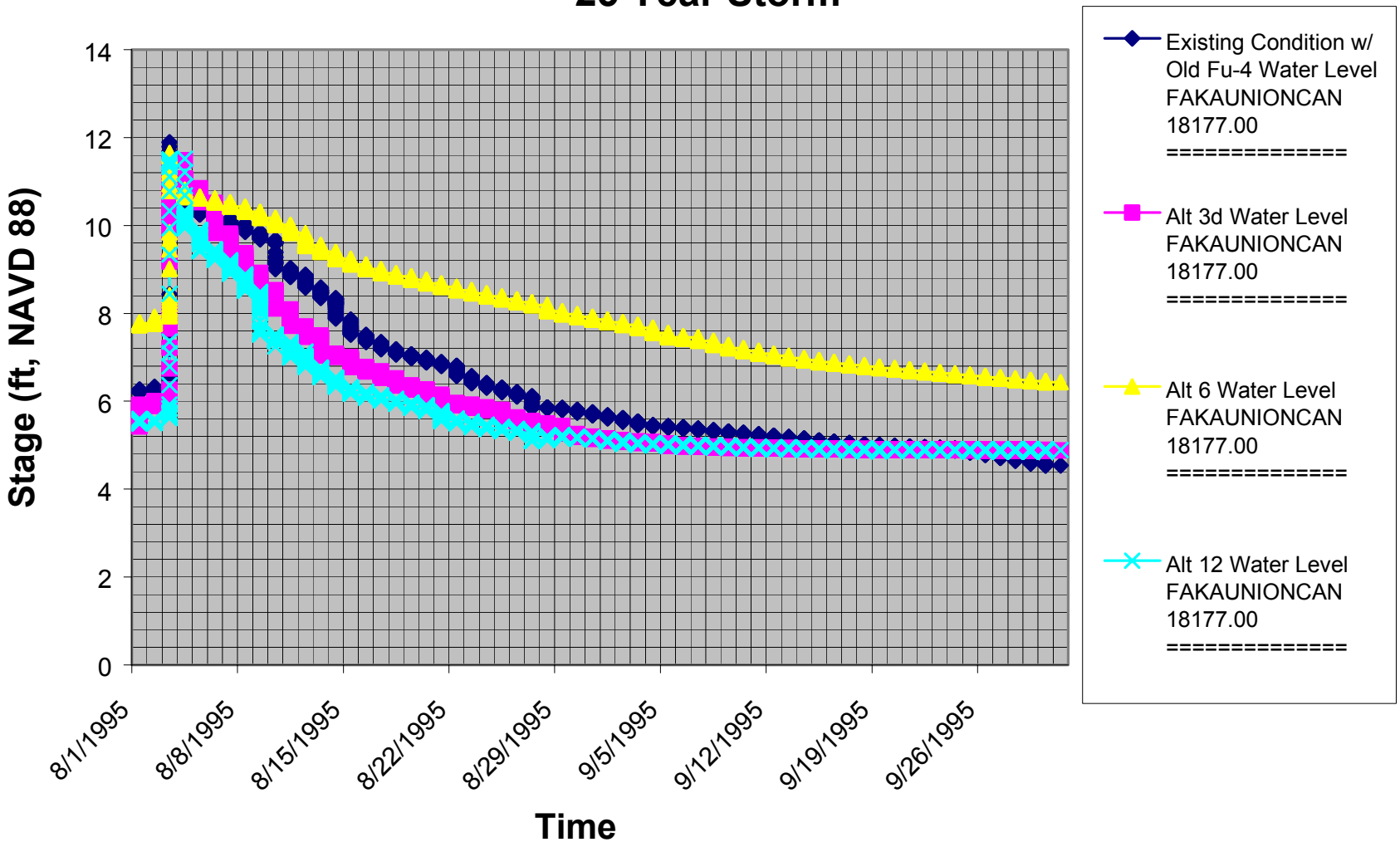


Figure A-132
Savings Condition
In SGGE Miller Canal Chainage 21560
25 Year Storm

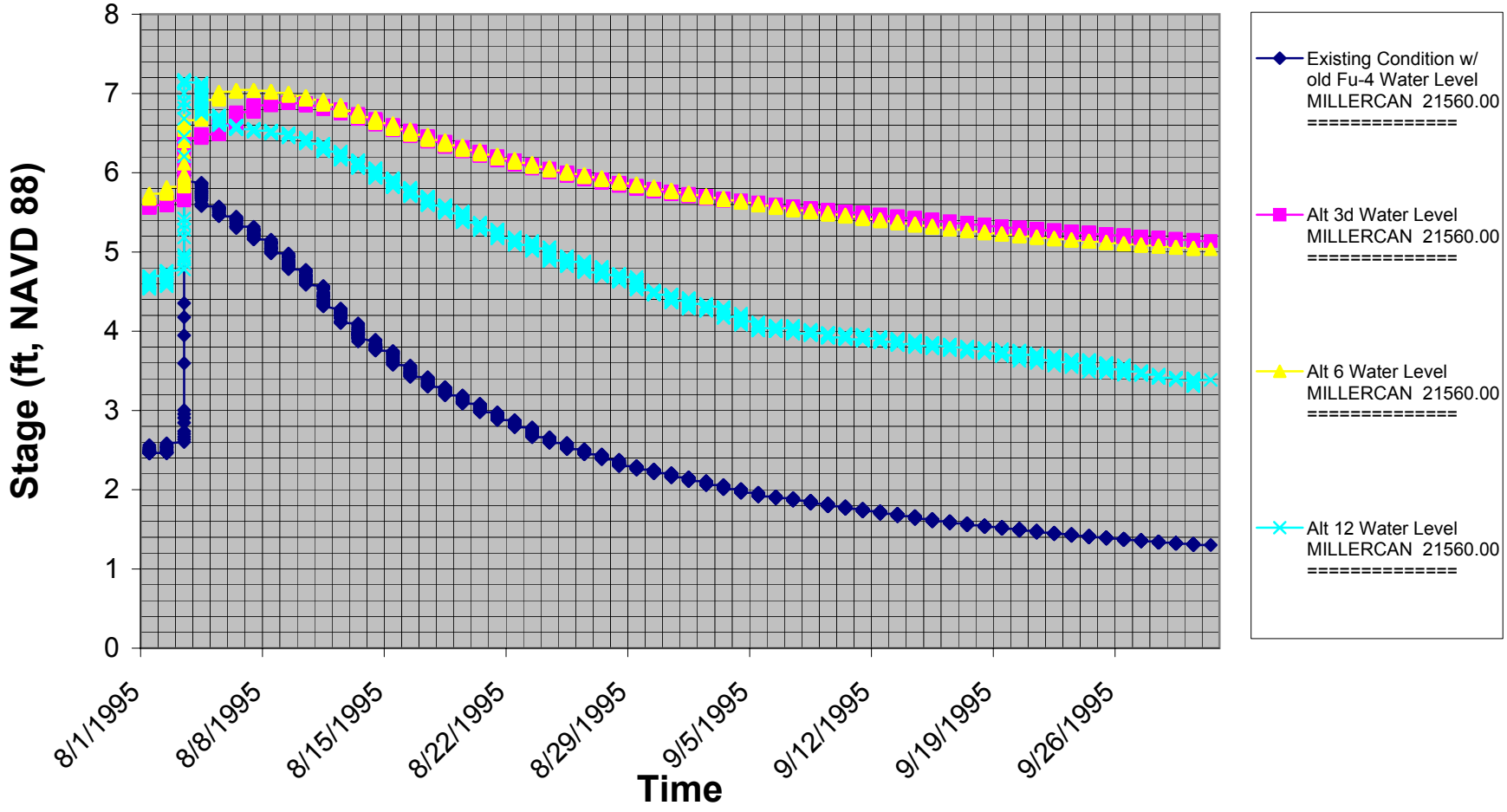


Figure A-133
Savings Condition
In SGGE at Faka Union Canal Chainage 29143
25 Year Storm

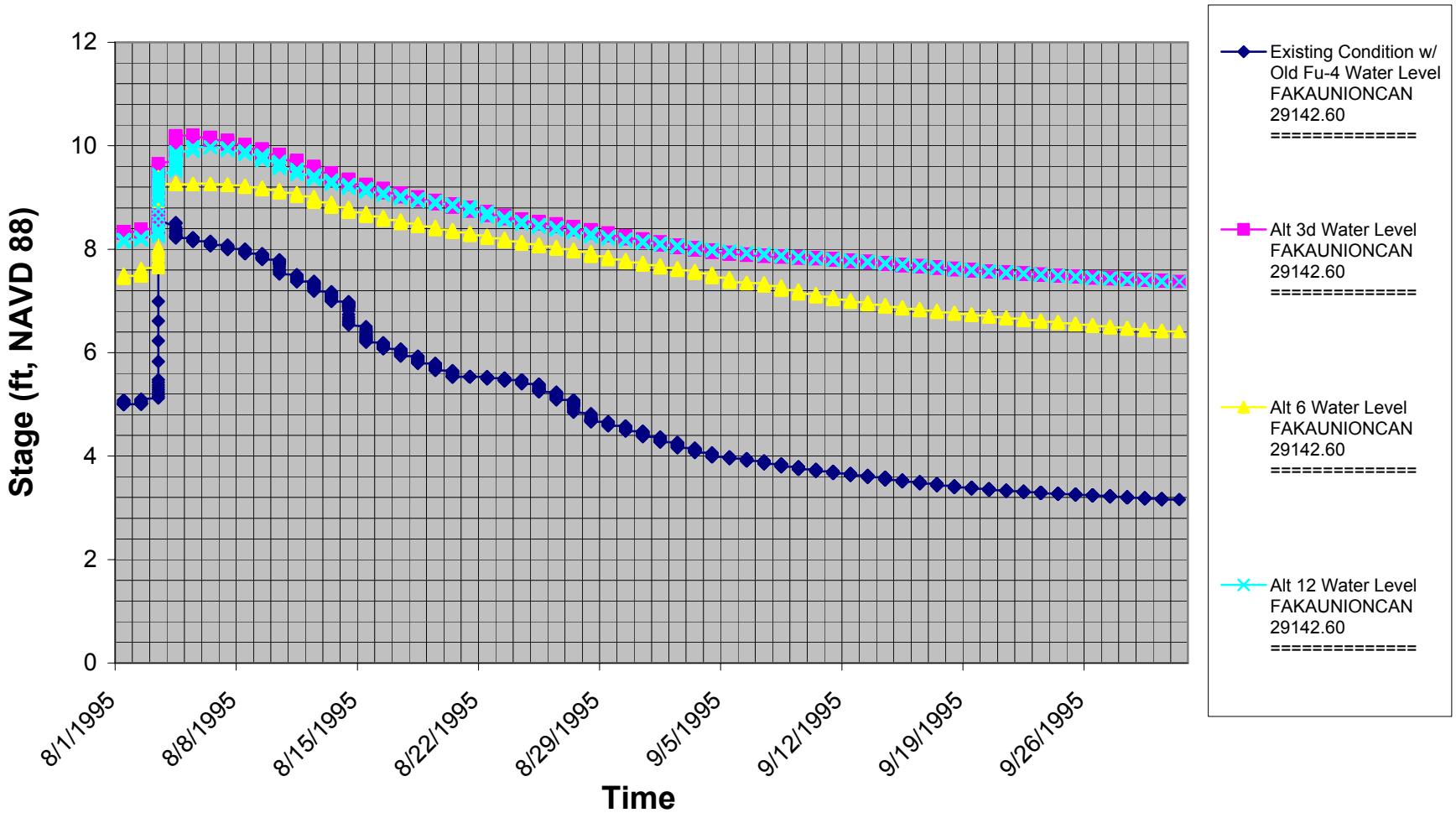


Figure A-134
Savings Condition
N I-75 Miller Canal Chainage 8716
100 Year Storm

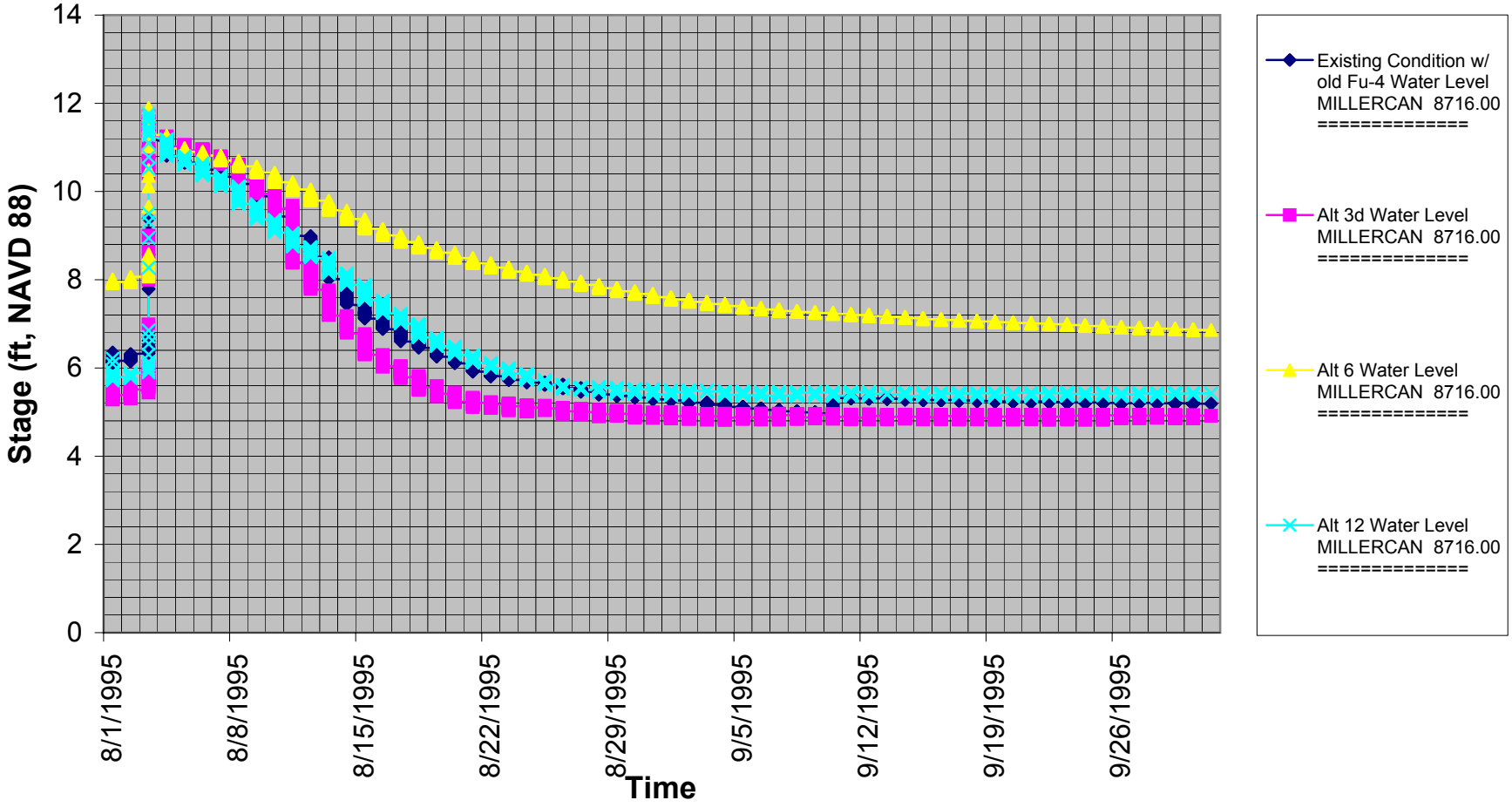


Figure A-135
Savings Condition
N of I-75 at Faka Union Canal Chainage 21799
100 Year Storm

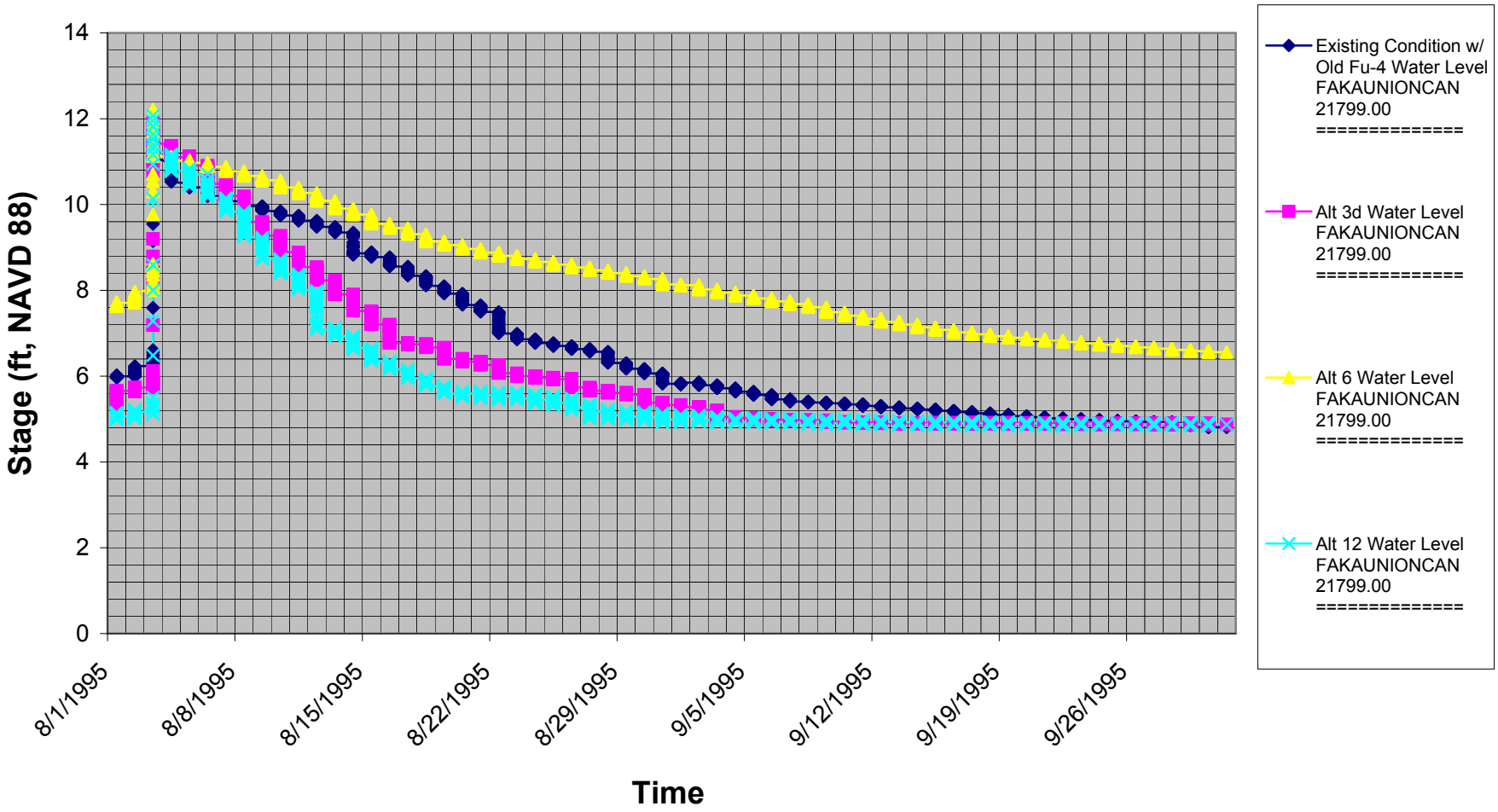


Figure A-136
Savings Condition
N I-75 Faka Union Canal Chainage 18177
100 Year Storm

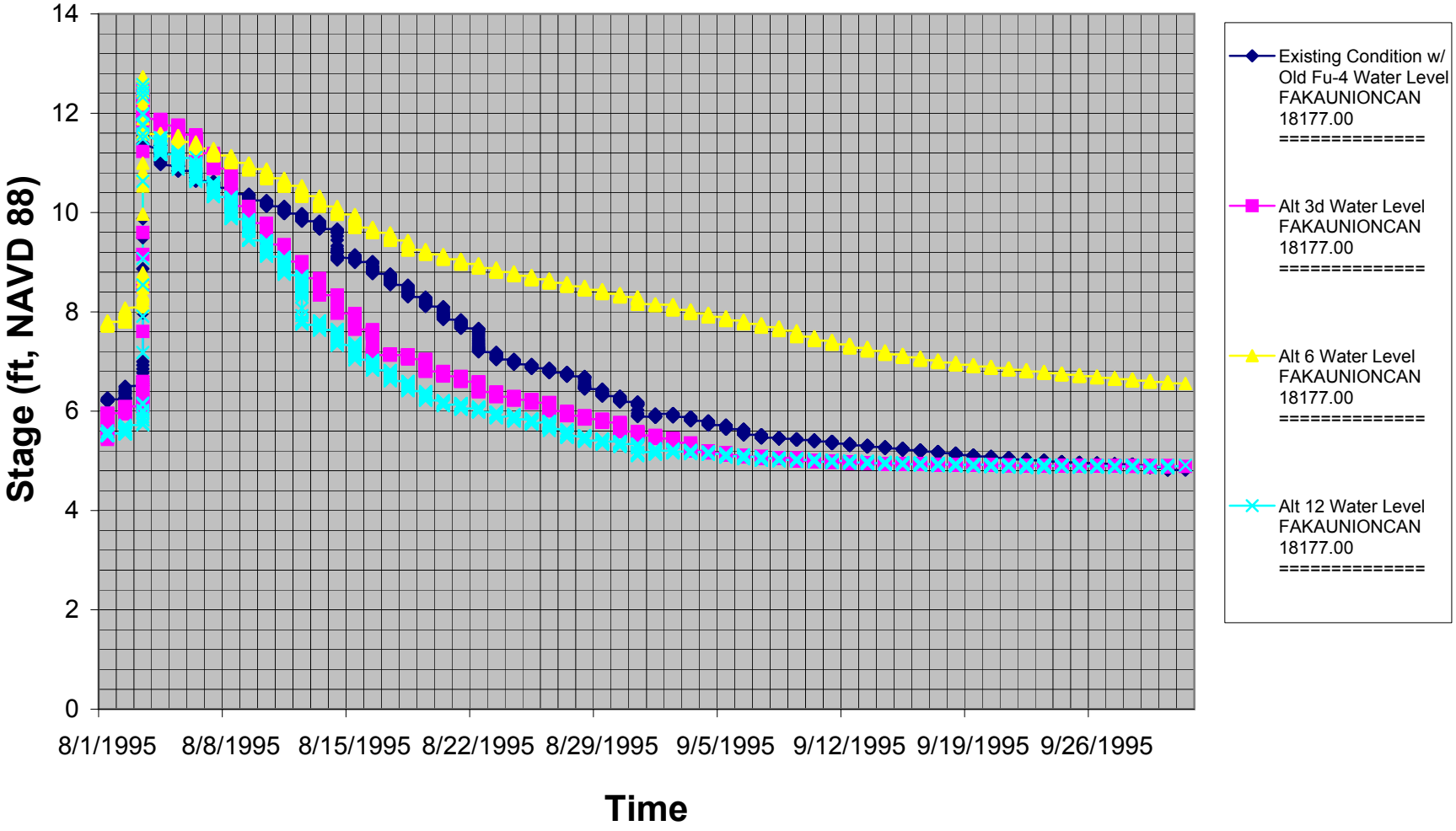


Figure A-137
Savings Condition
In SGGE Miller Canal Chainage 21560
100 Year Storm

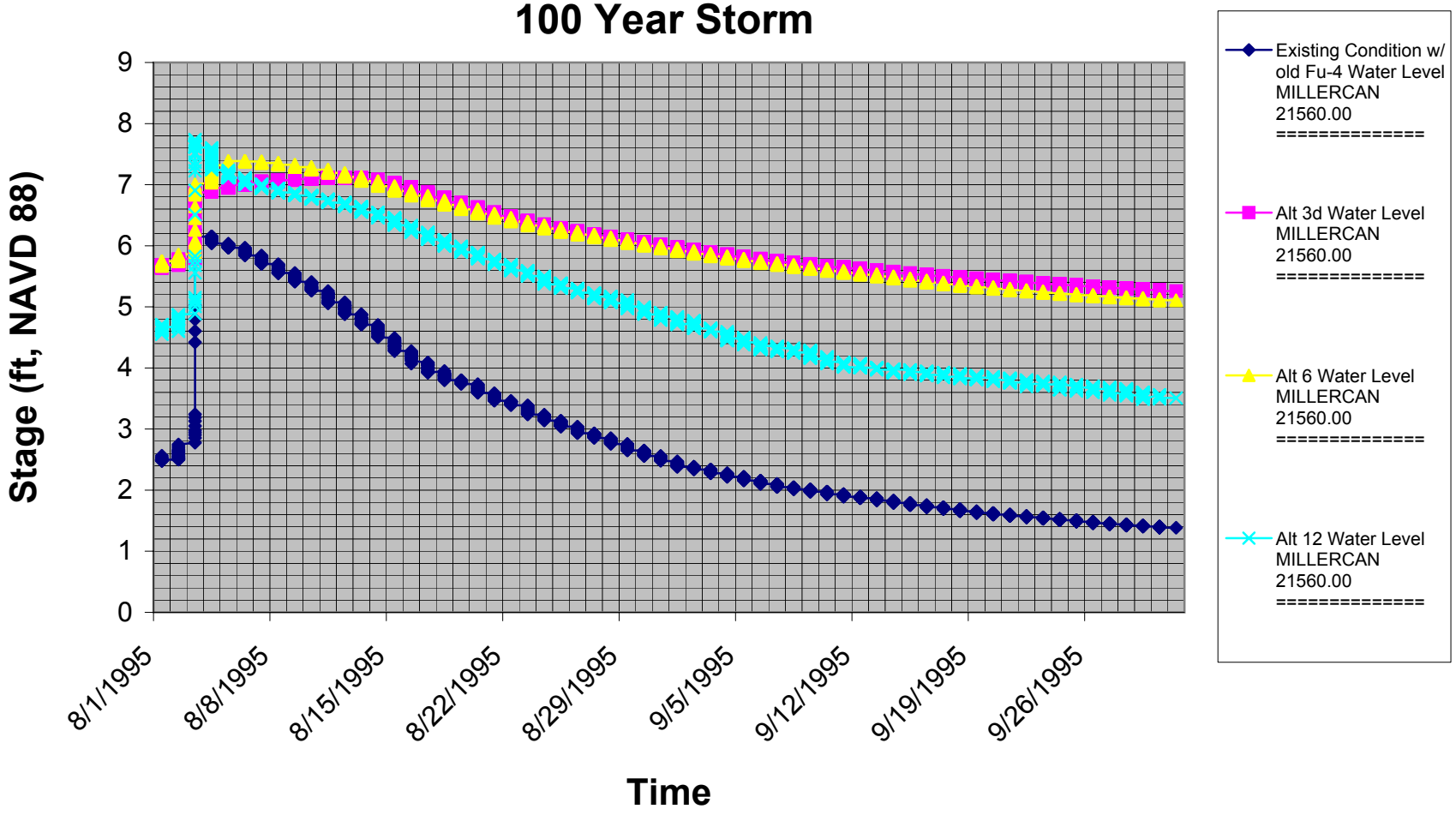


Figure A-138
Savings Condition
In SGGE Faka Union Canal Chainage 29143
100 Year Storm

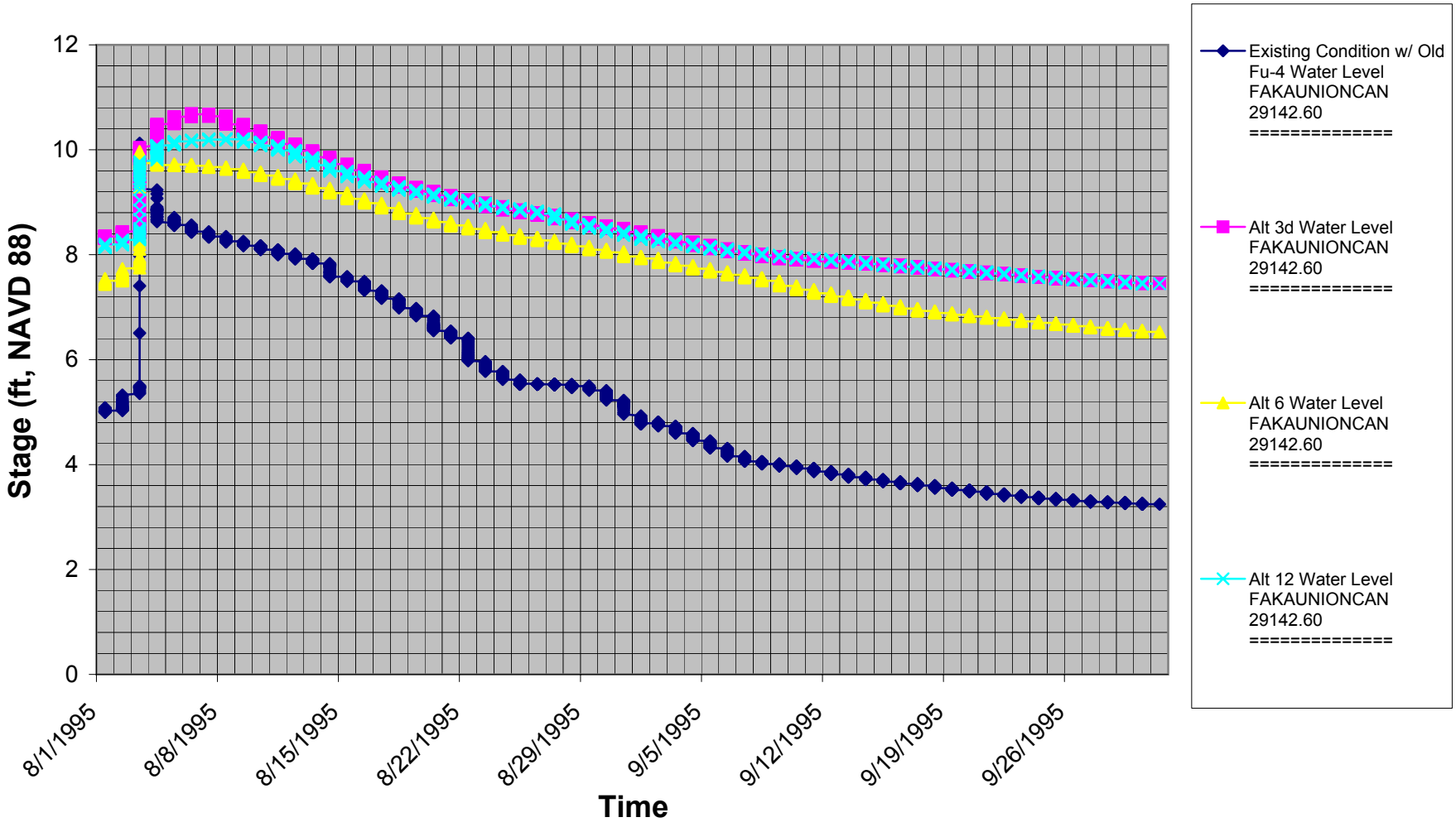


Figure A-139
Takings Condition
N I-75 Miller Canal Chainage 8716
Average Wet Period

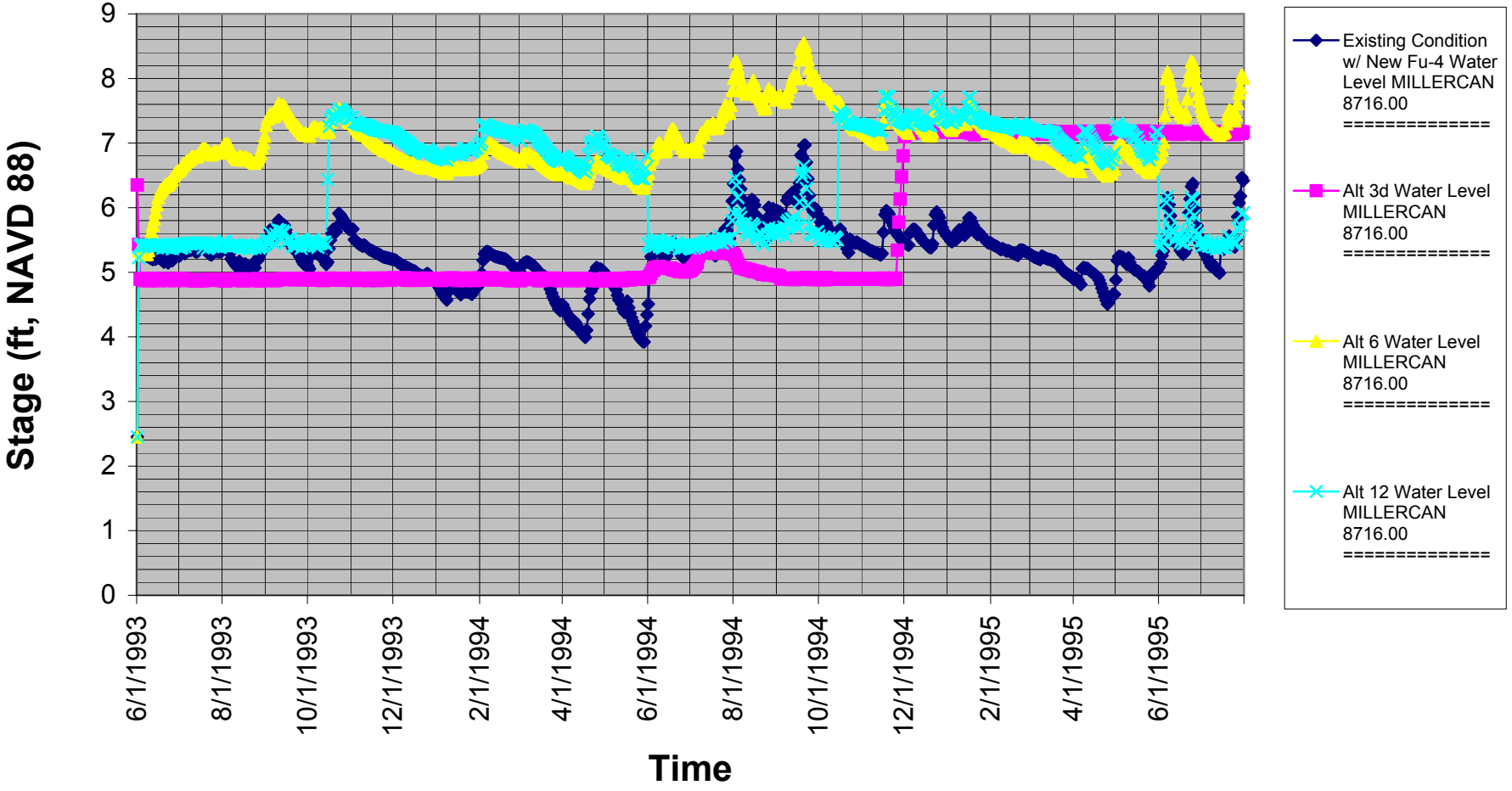


Figure A-140
Takings Condition
N of I-75 at Faka Union Canal Chainage 21799
Average Wet Season

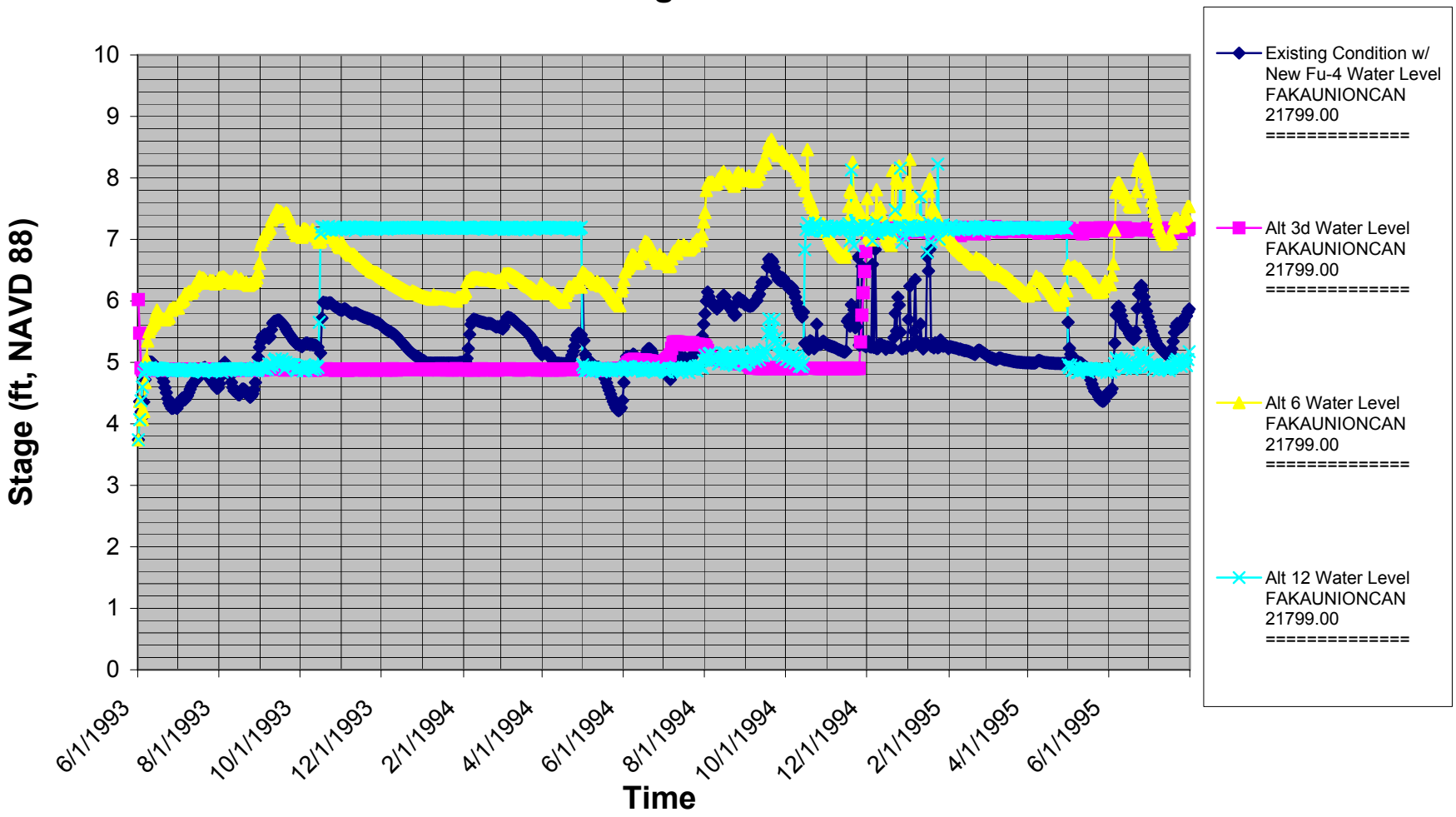


Figure A-141
Takings Condition
N I-75 Faka Union Canal Chainage 18177
Average Wet Season

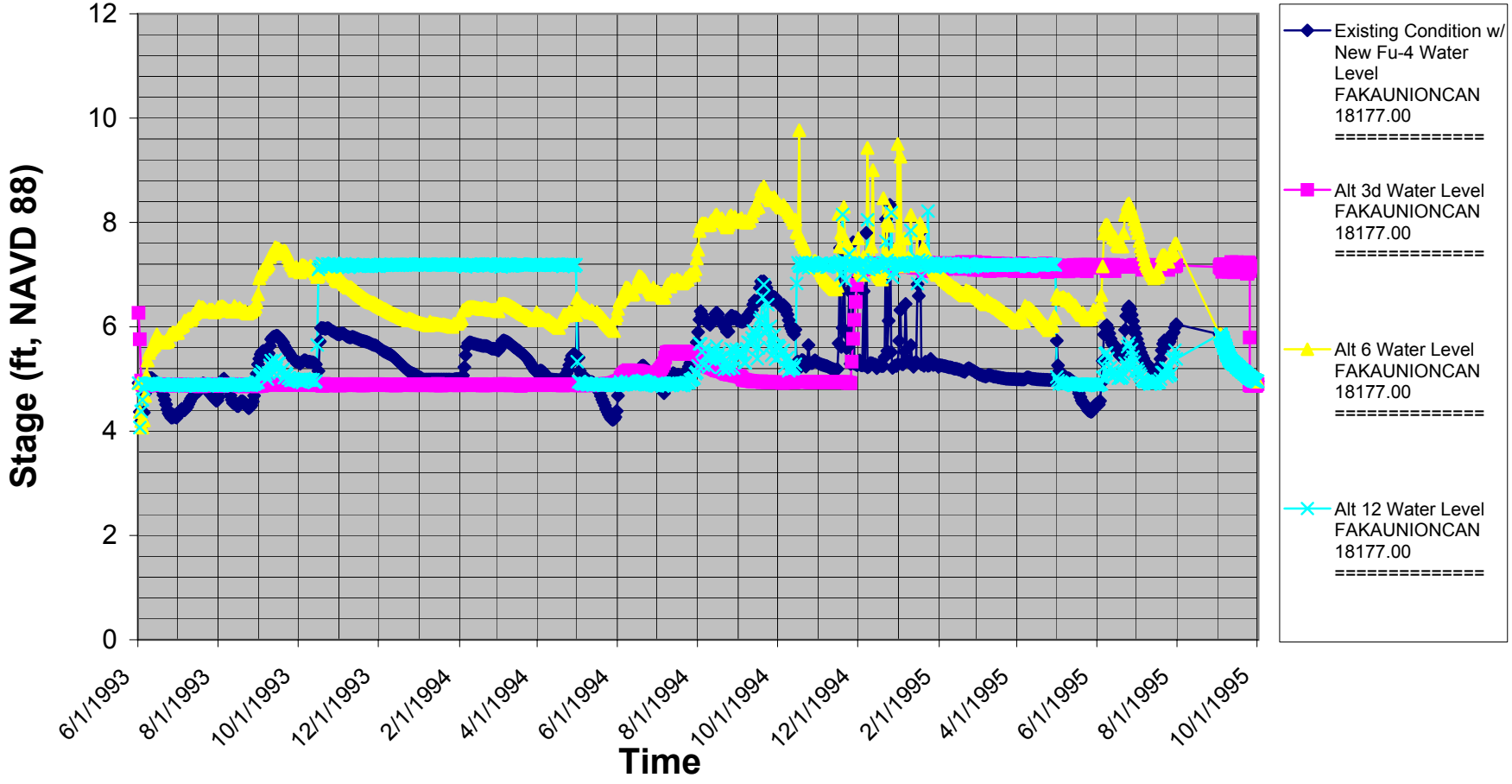


Figure A-142
Takings Condition
In SGGE Miller Canal Chainage 21560
Average Wet Period

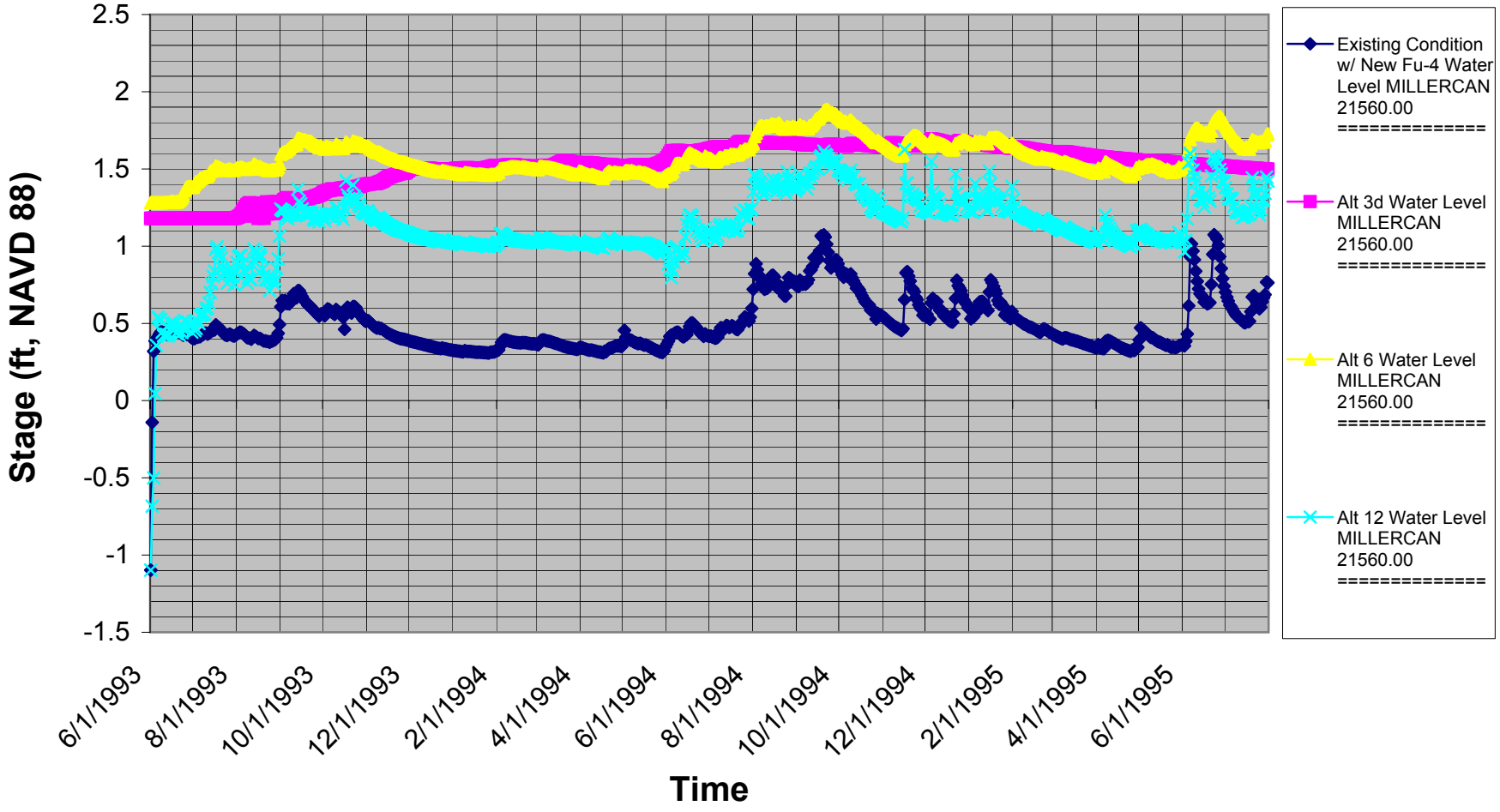


Figure A-143
Takings Condition
In SGGE at Faka Union Canal Chainage 29143
Average Wet Season

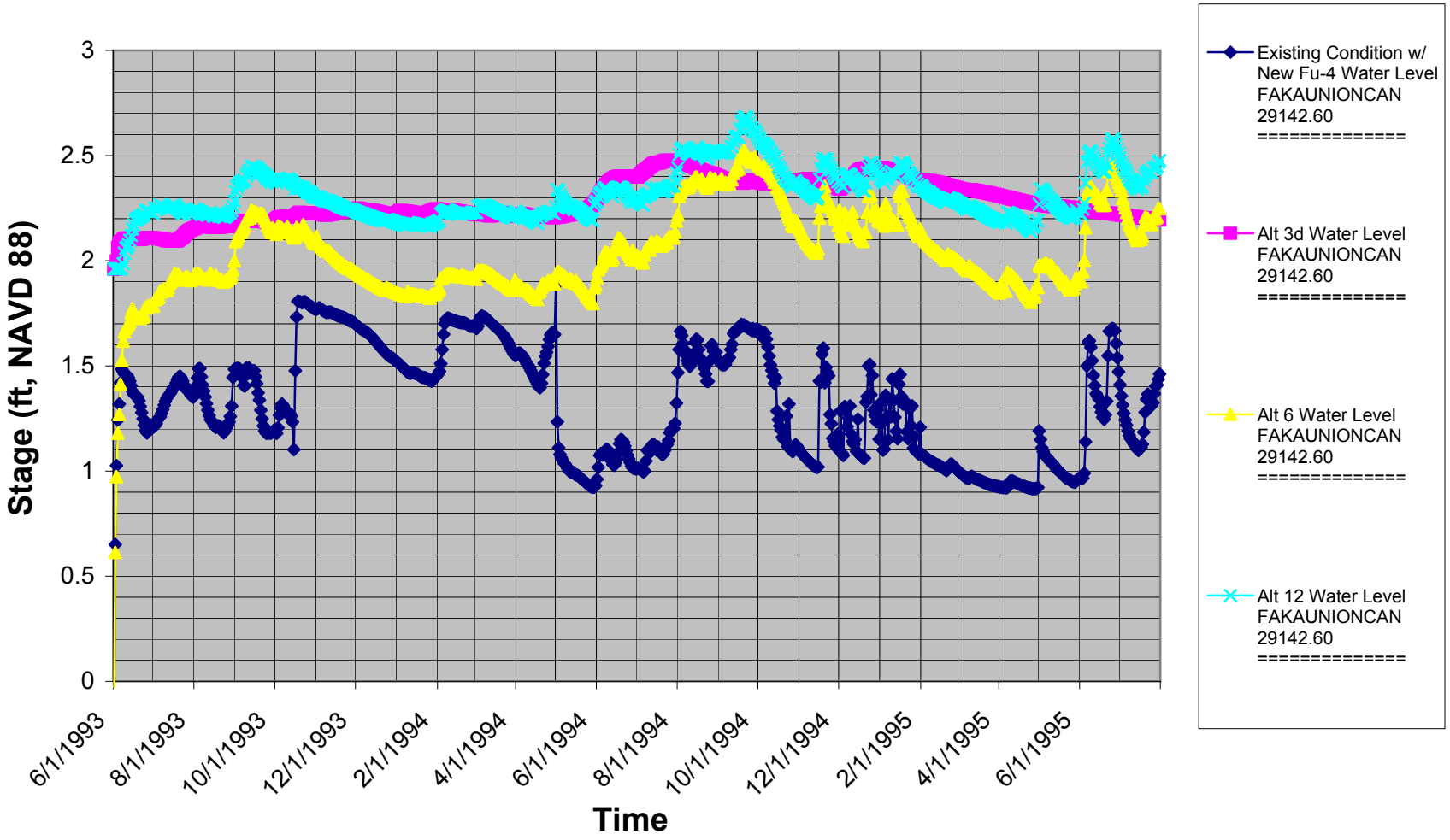


Figure A-144
Takings Condition
N I-75 Miller Canal Chainage 8716
10 Year Storm

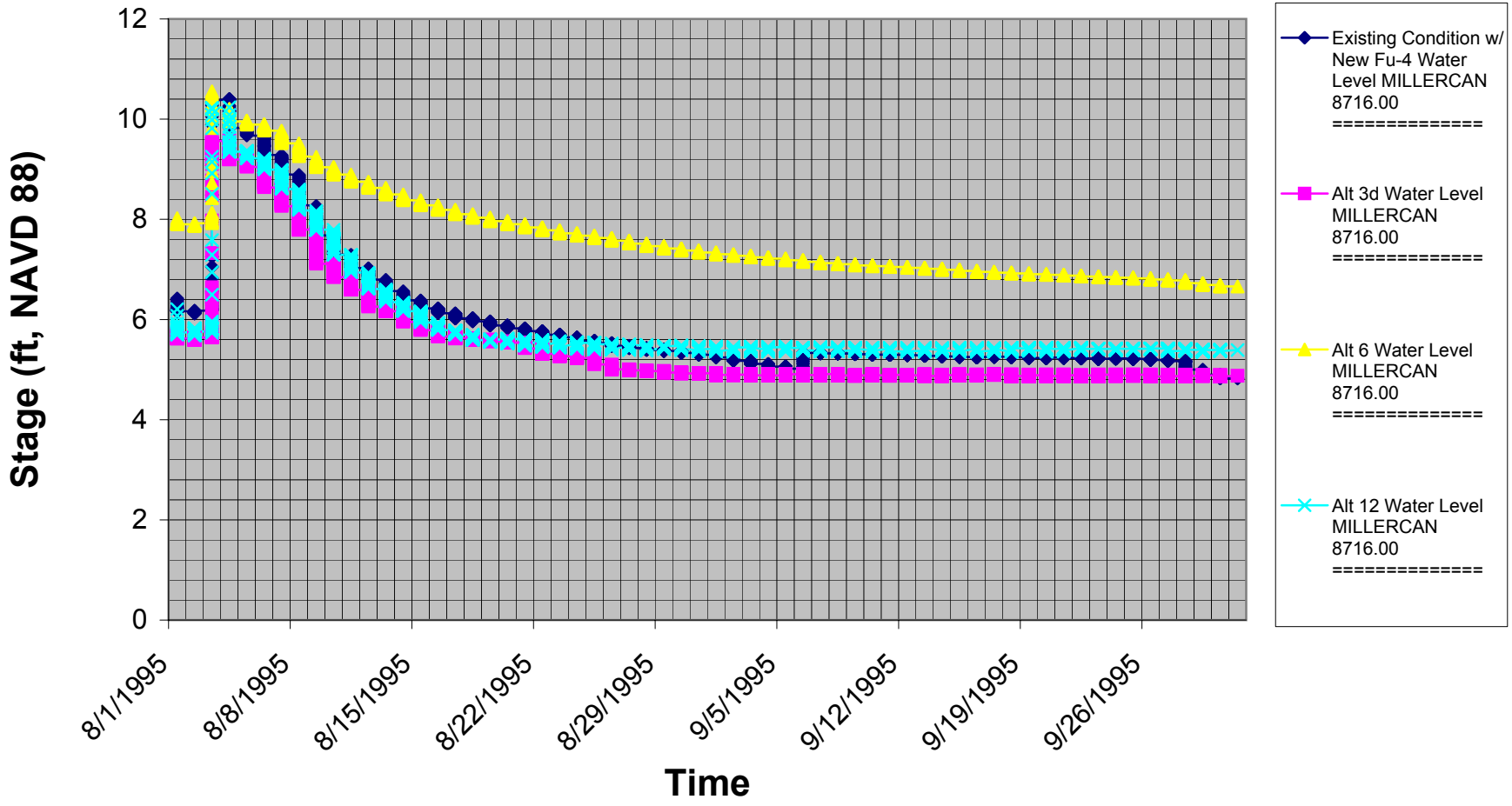


Figure A-145
Takings Condition
N of I-75 at Faka Union Canal Chainage 21799
10 Year Storm

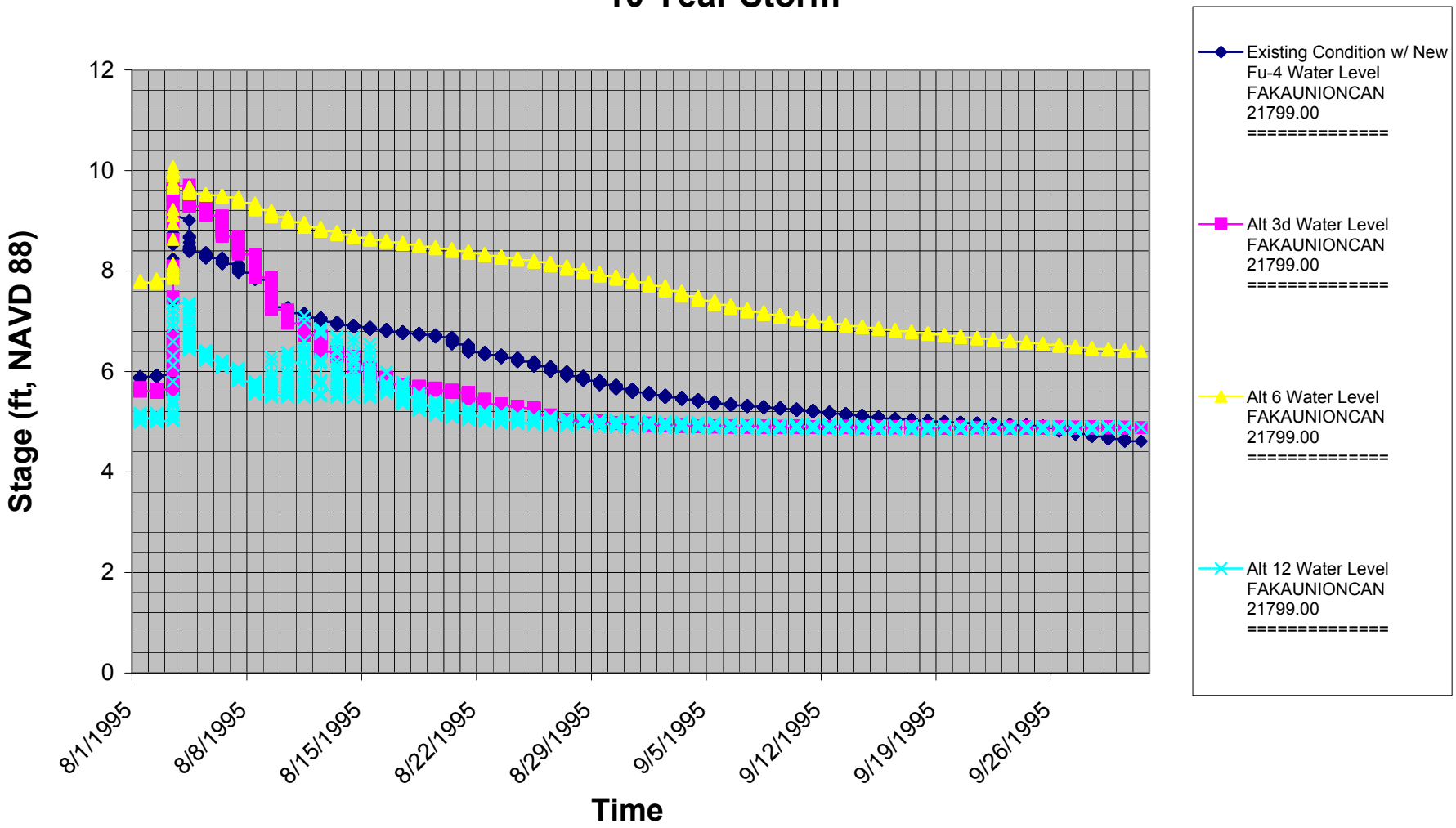


Figure A-146
Takings Condition
N I-75 Faka Union Canal Chainage 18177
10 Year Storm

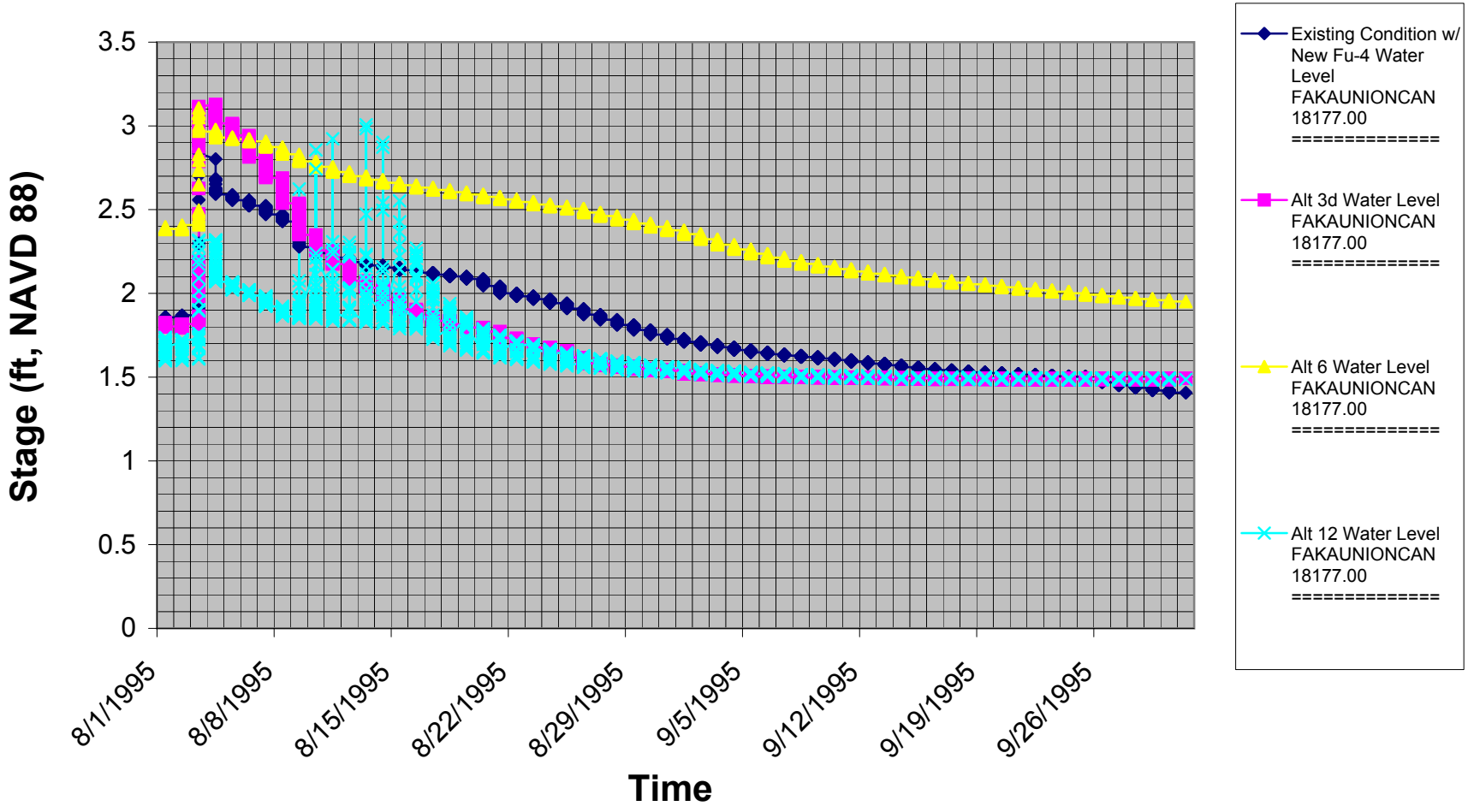


Figure A-147
Takings Condition
In SGGE Miller Canal Chainage 21560
10 Year Storm

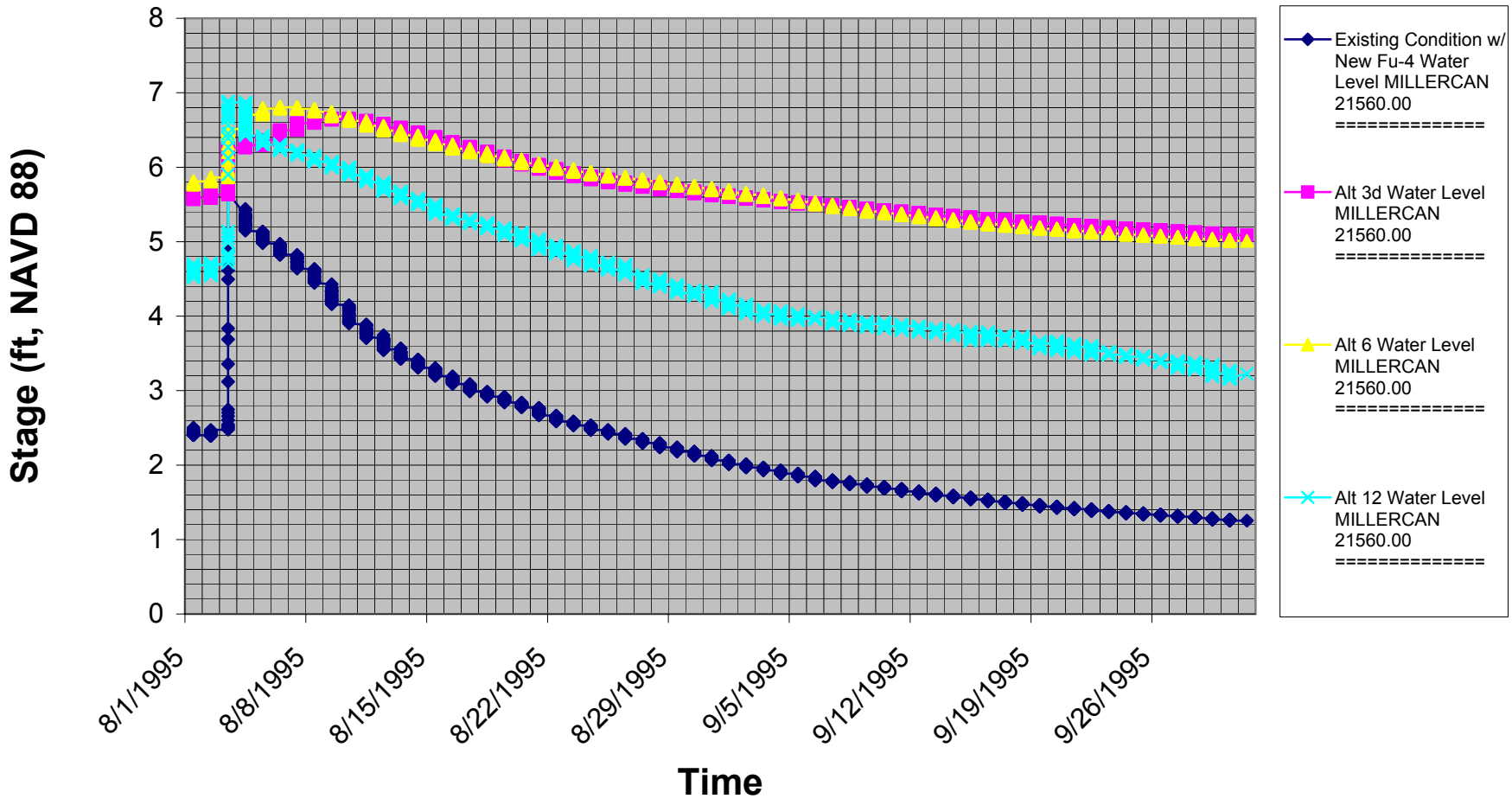


Figure A-148
Takings Condition
In SGGE at Faka Union Canal Chainage 29143
10 Year Storm

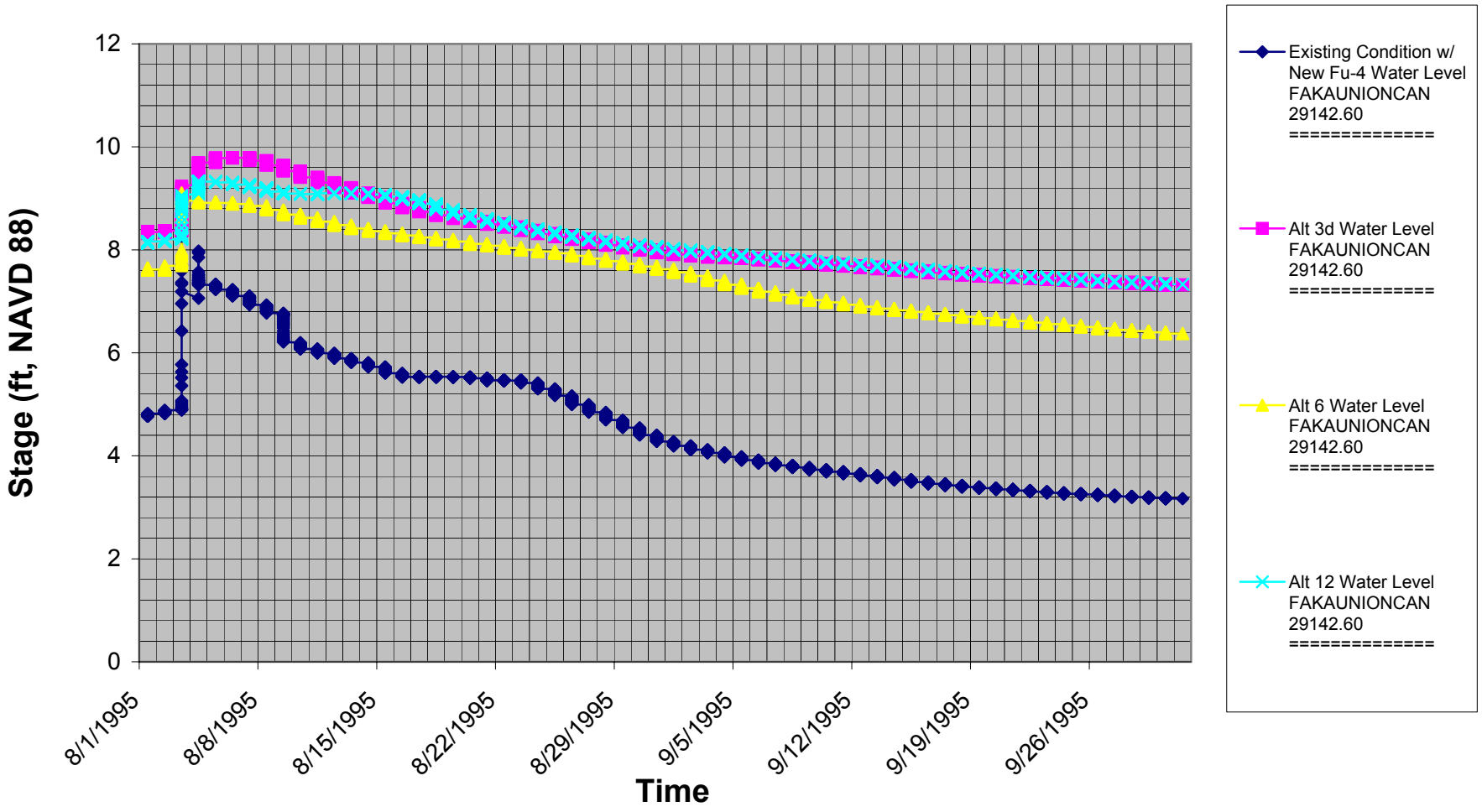


Figure A-149
Takings Condition
N I-75 Miller Canal Chainage 8716
25 Year Storm

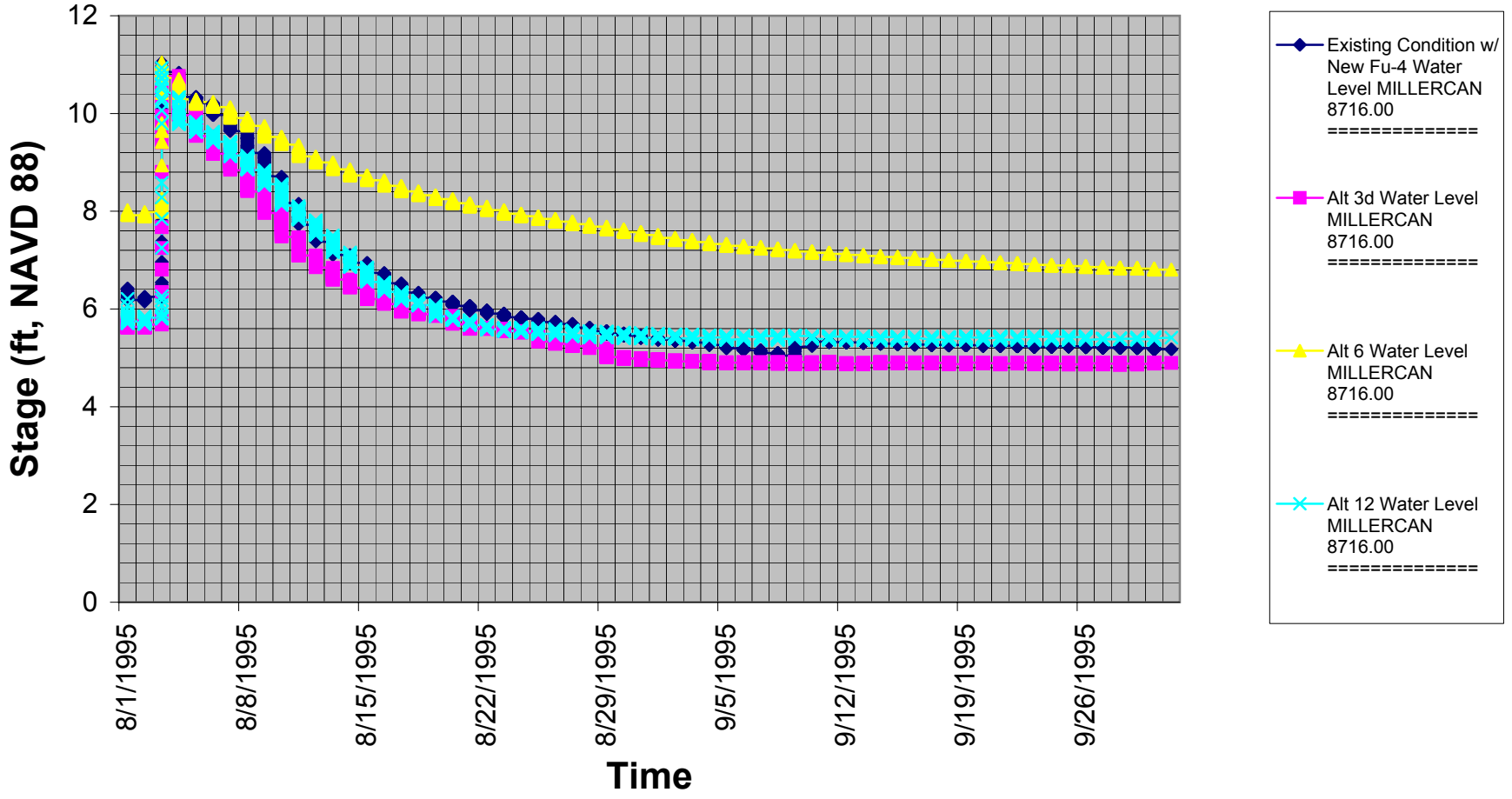


Figure A-150
Takings Condition
N of I-75 at Faka Union Canal Chainage 21799
25 Year Storm

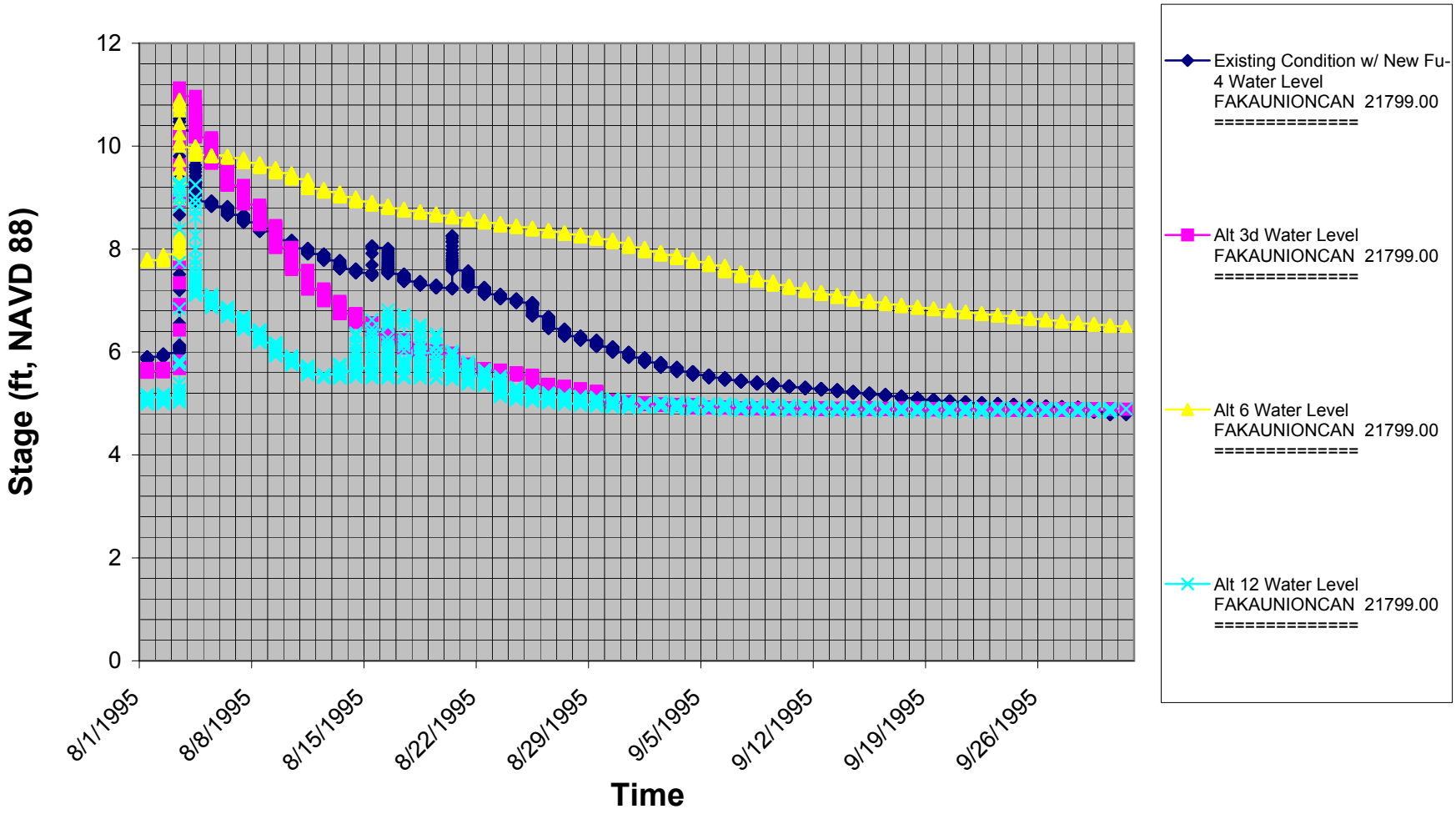


Figure A-151
Takings Condition
N I-75 Faka Union Canal Chainage 18177
25 Year Storm

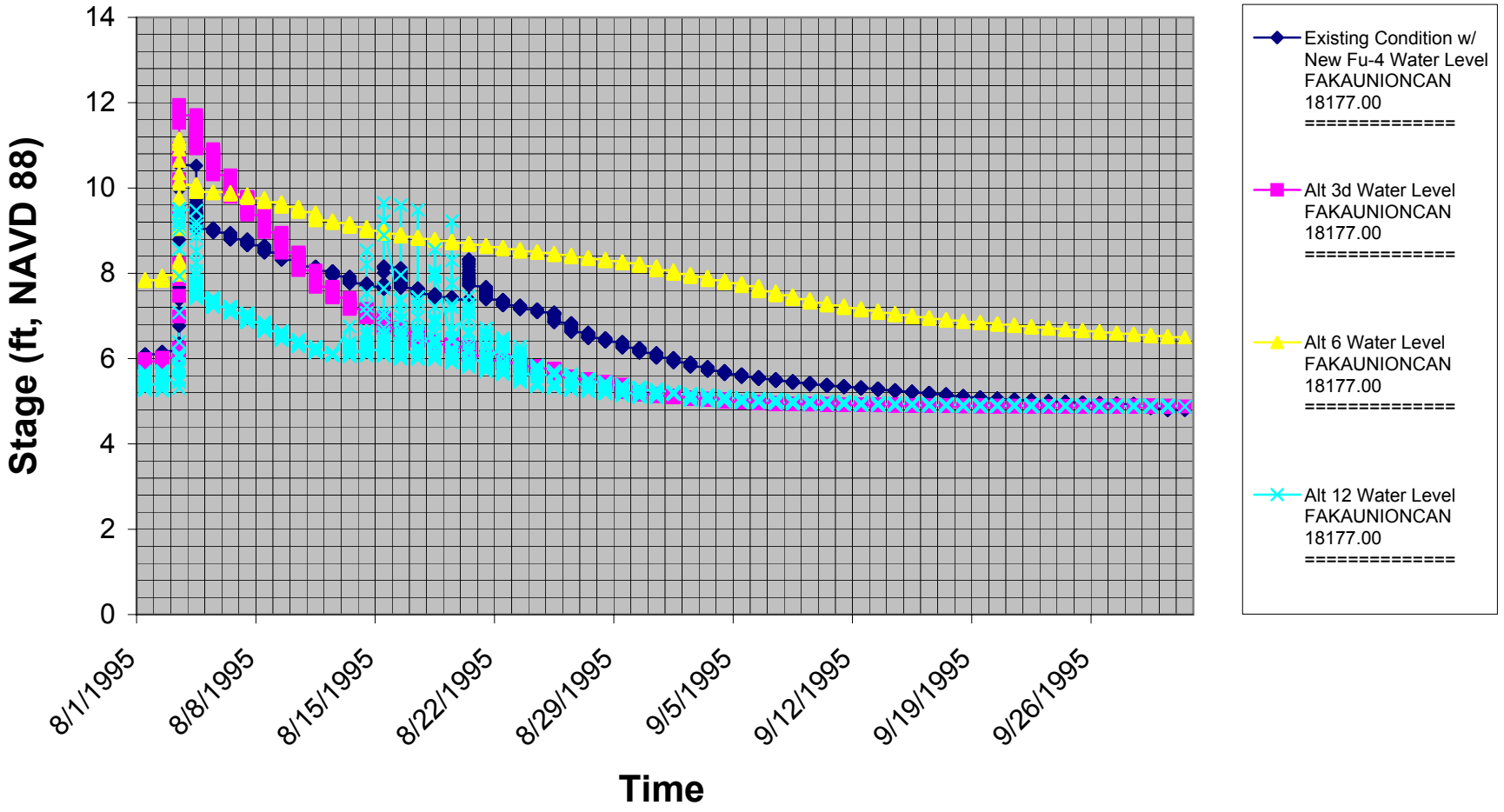


Figure A-152
Takings Condition
In SGGE Miller Canal Chainage 21560
25 Year Storm

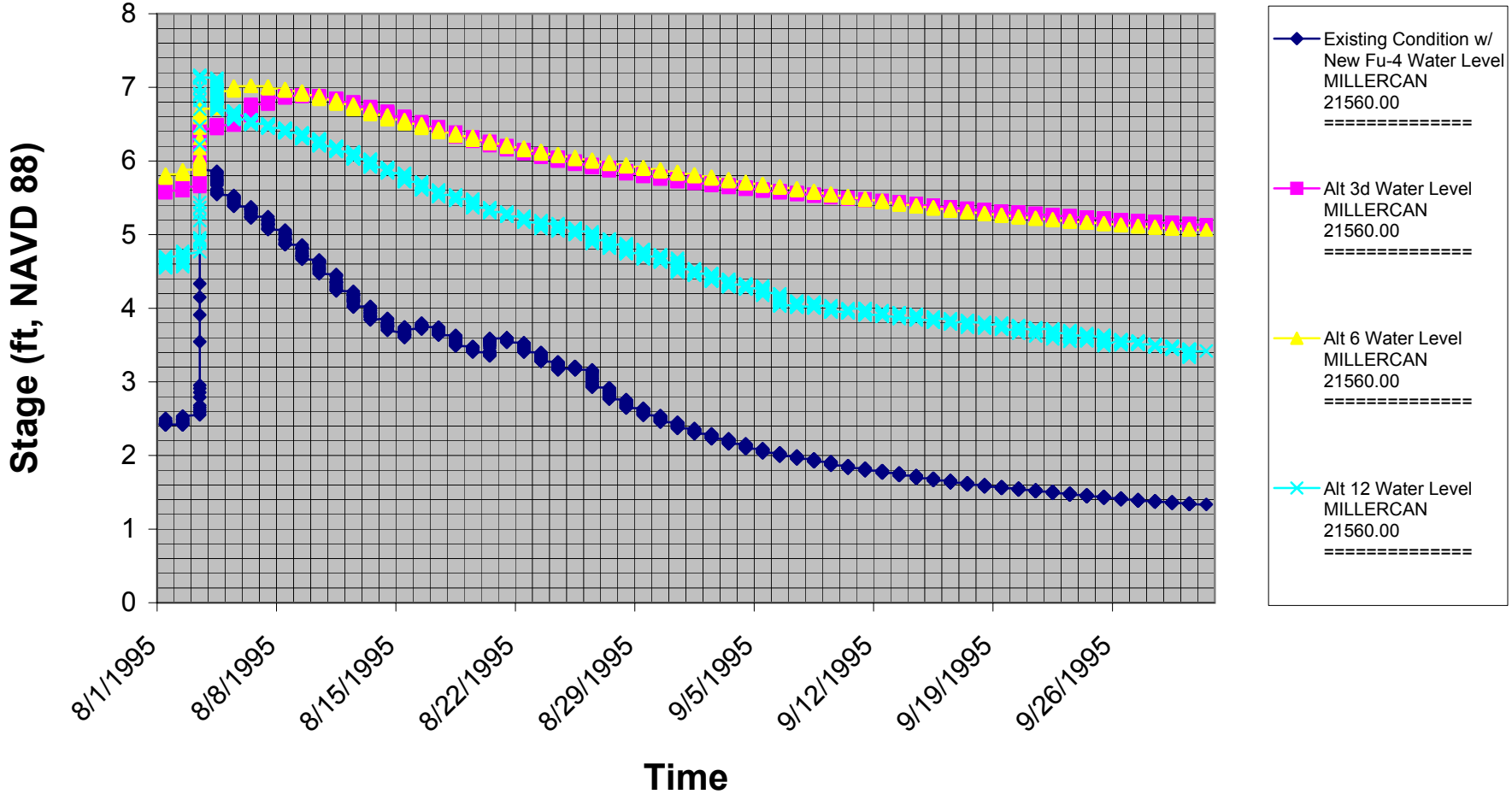


Figure A-153
Takings Condition
In SGGE at Faka Union Canal Chainage 29143
25 Year Storm

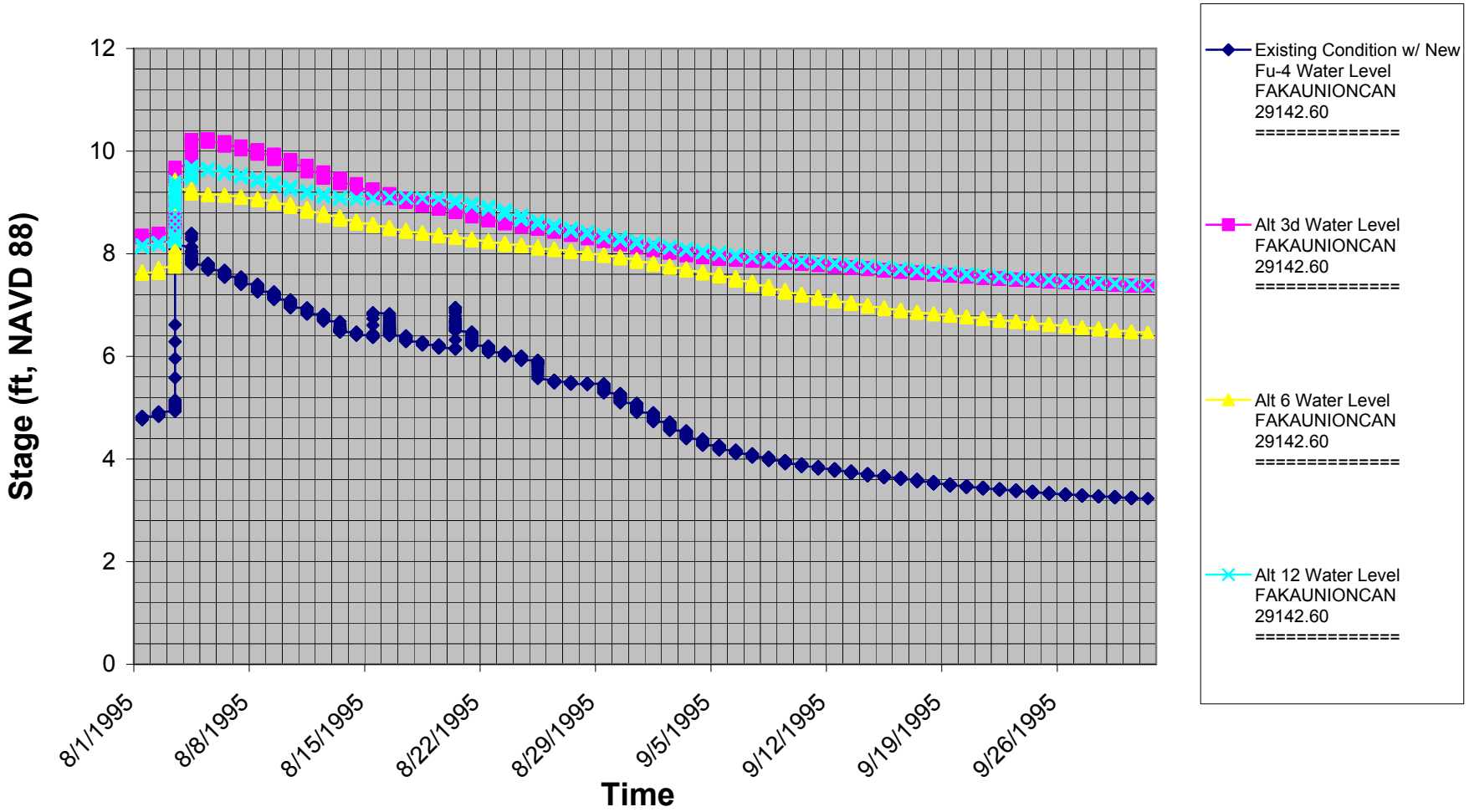


Figure A-154
Takings Condition
N I-75 Miller Canal Chainage 8716
100 Year Storm

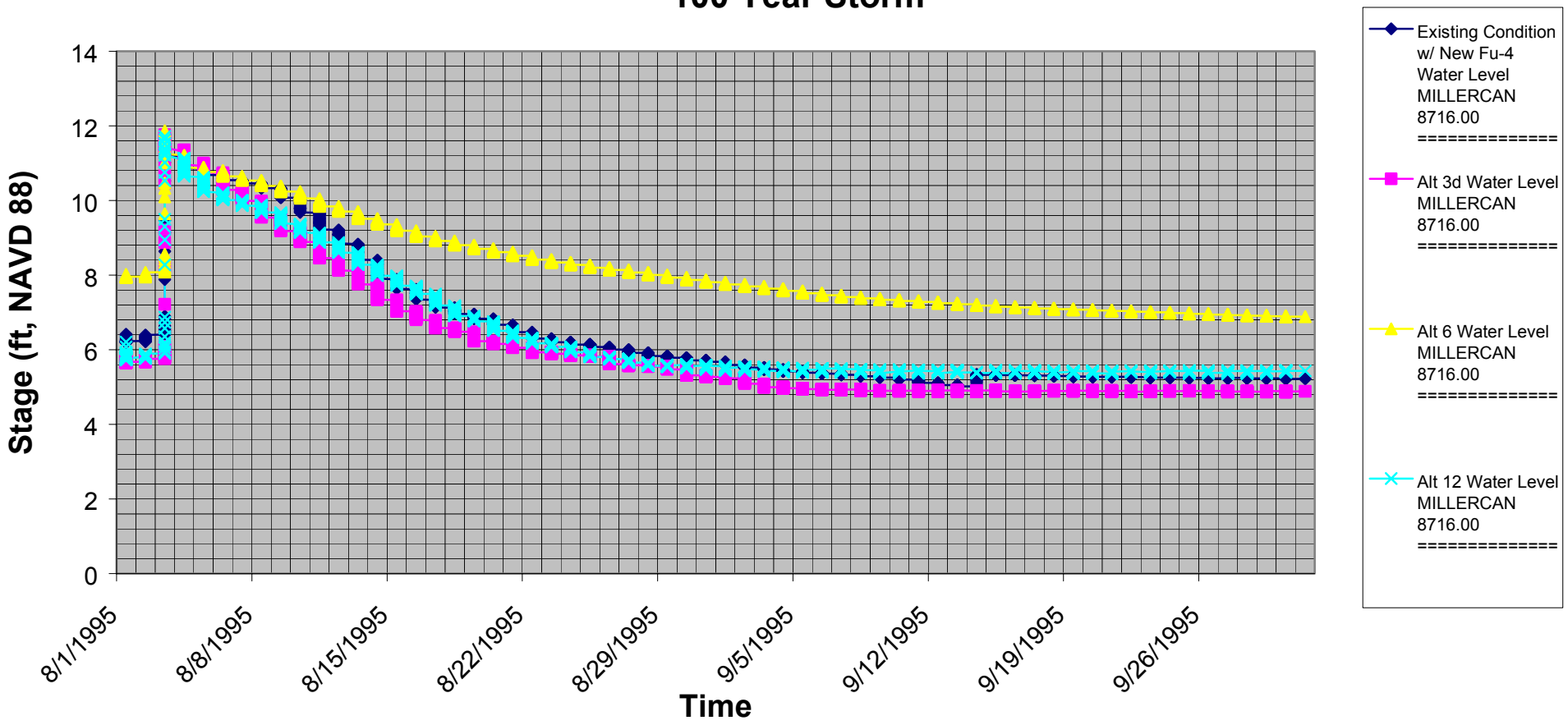


Figure A-155
Takings Condition
N of I-75 at Faka Union Canal Chainage 21799
100 Year Storm

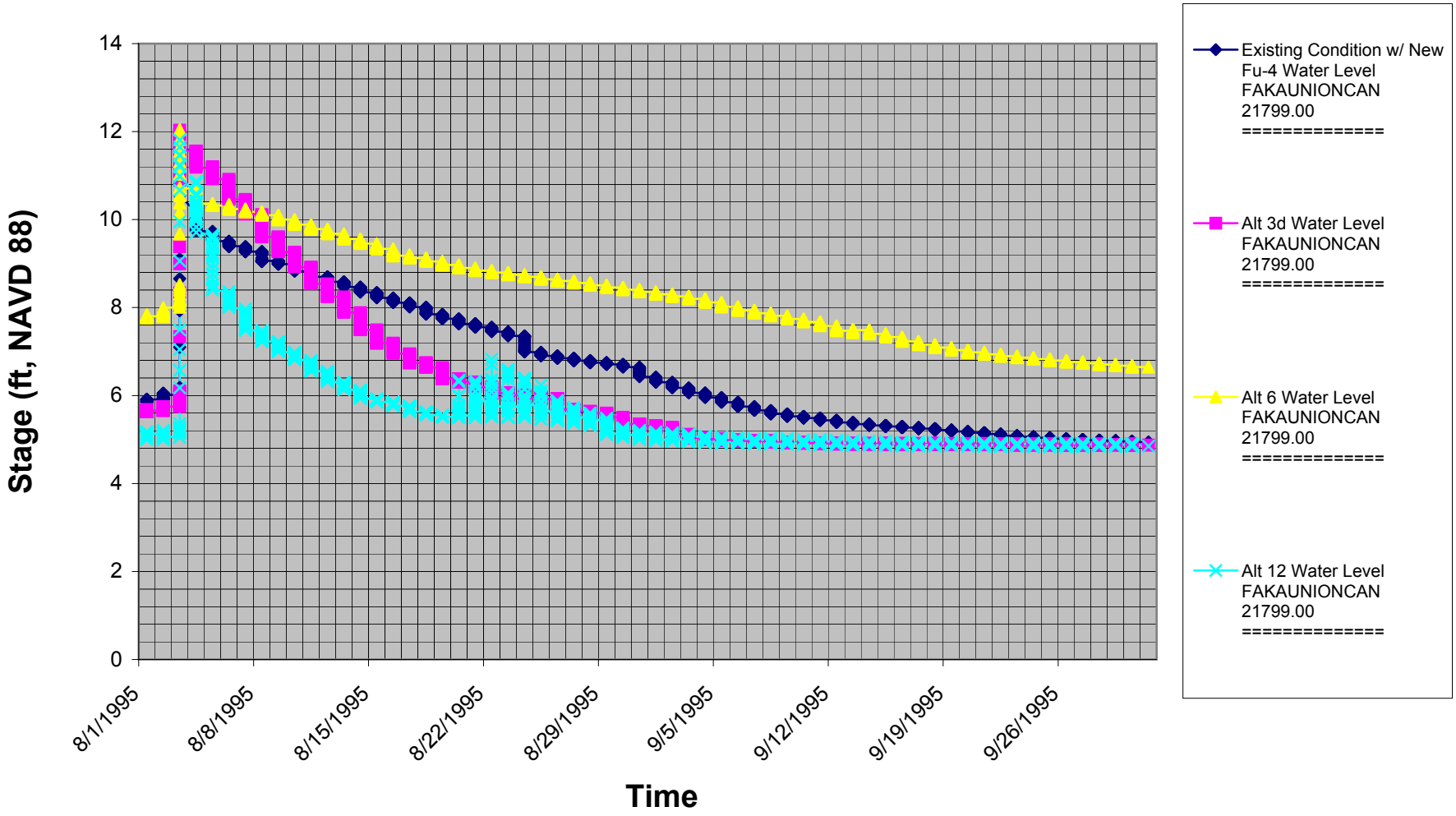


Figure A-156
Takings Condition
N I-75 Faka Union Canal Chainage 18177
100 Year Storm

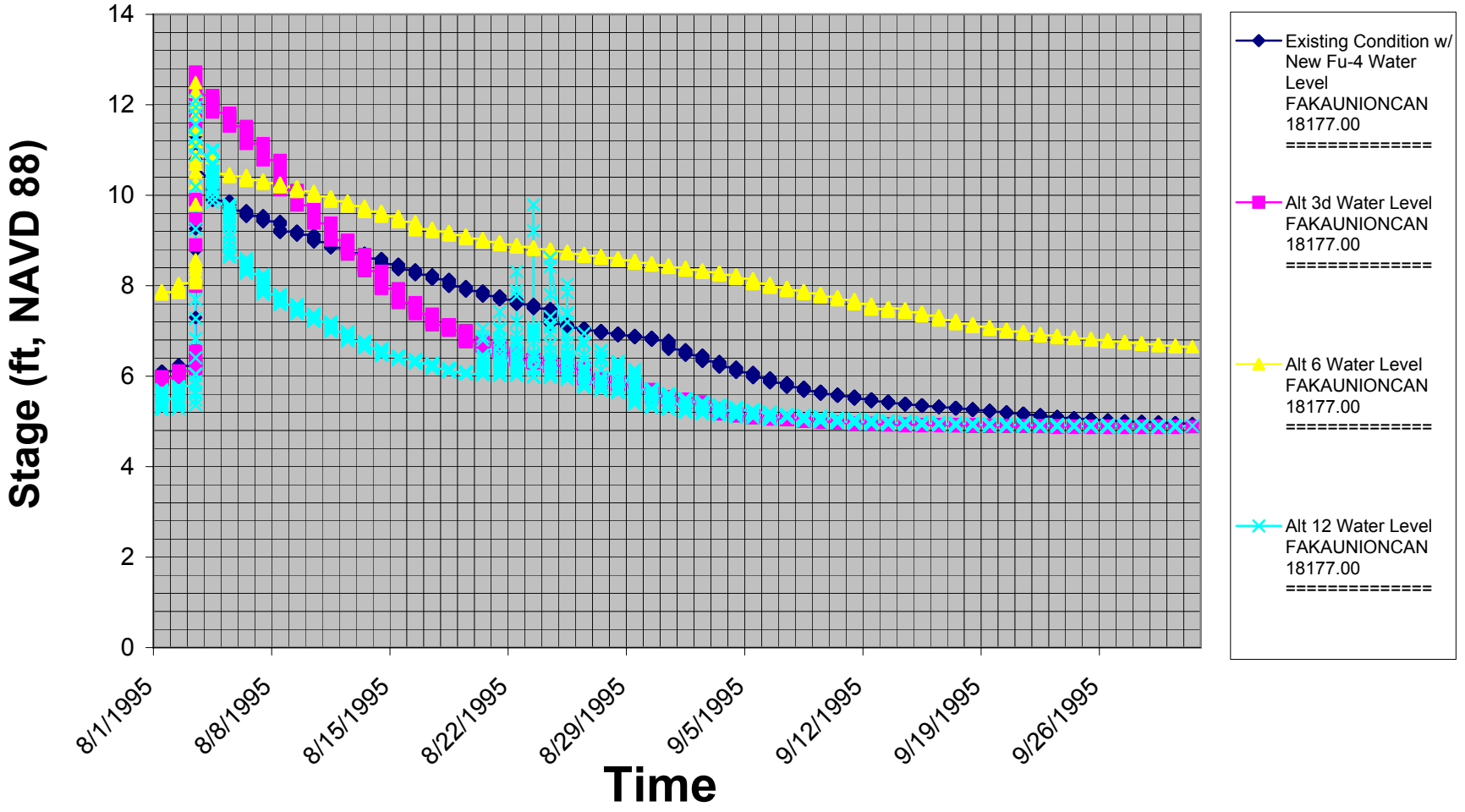


Figure A-157
Takings Condition
In SGGE Miller Canal Chainage 21560
100 Year Storm

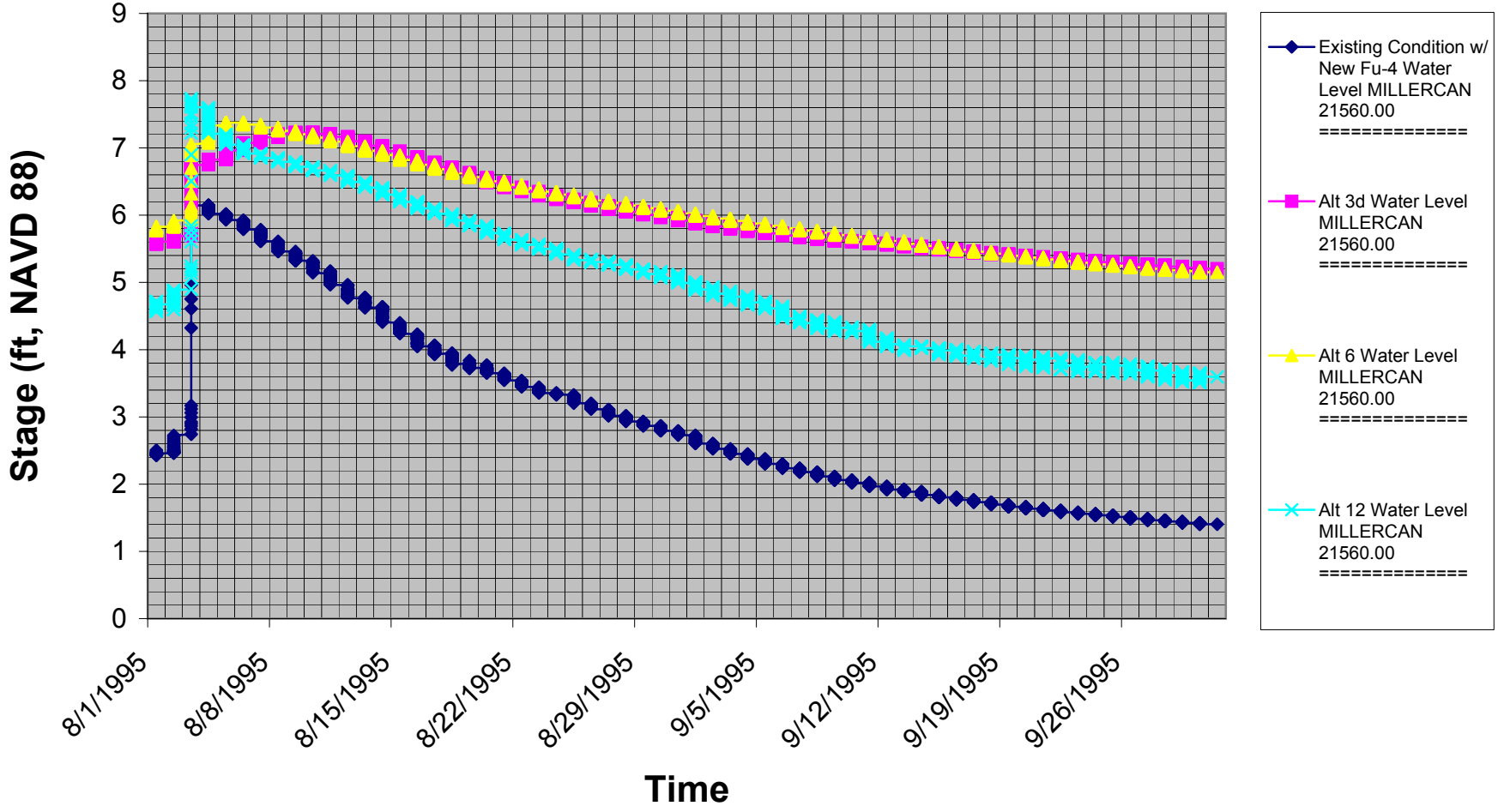
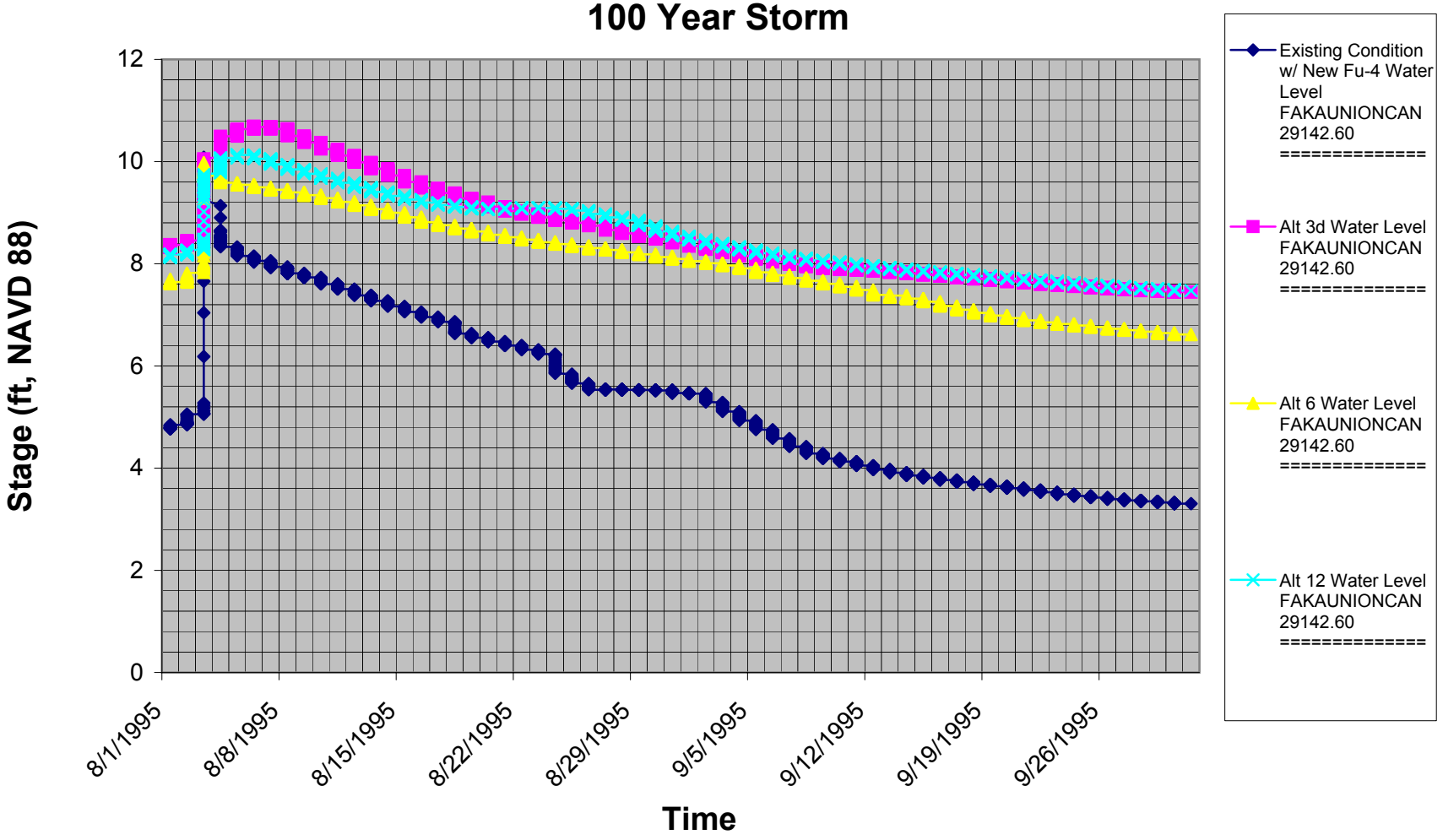
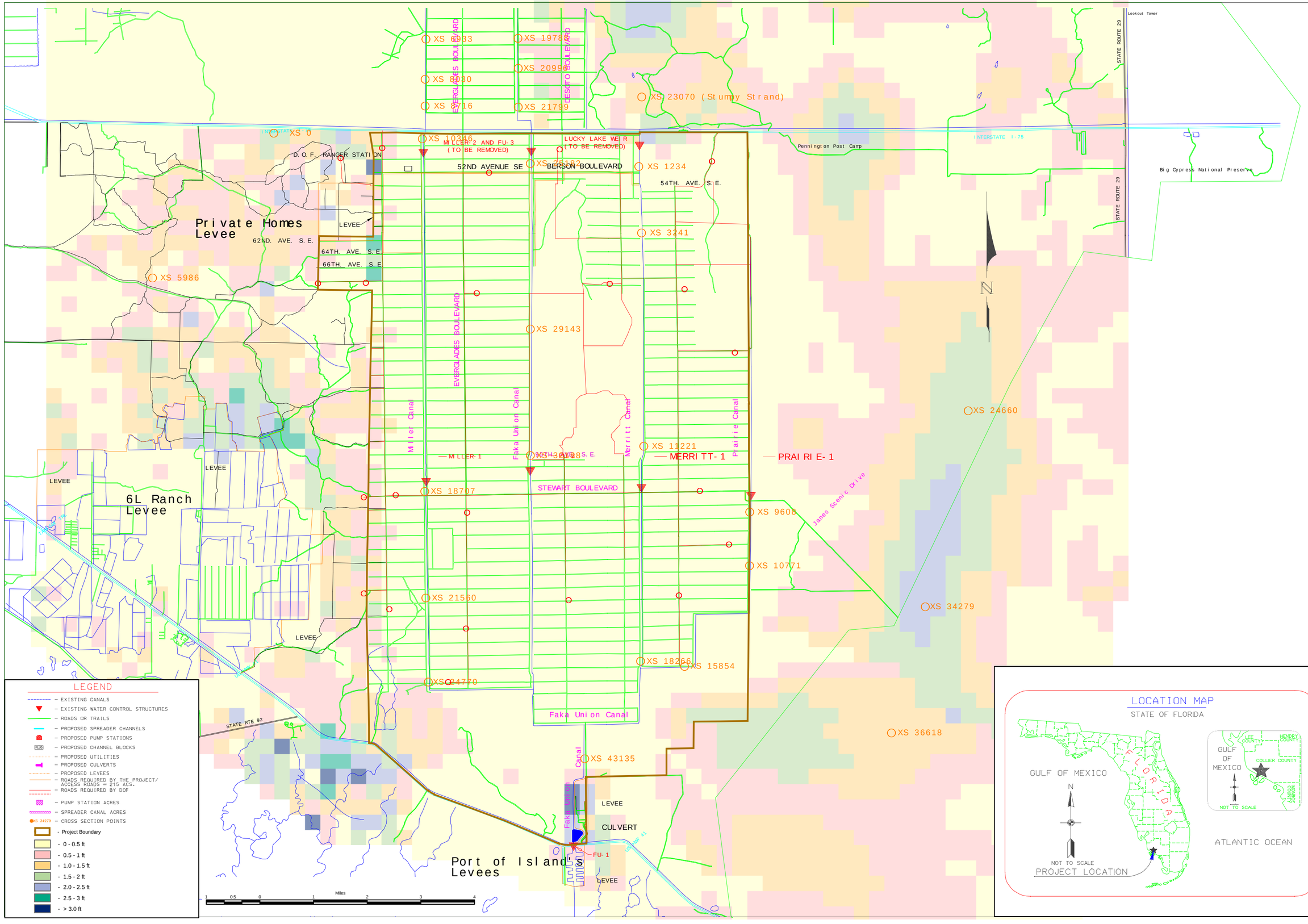


Figure A-158
Takings Condition
In SGGE Faka Union Canal Chainage 29143
100 Year Storm





LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

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Jacksonville District

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JACKSONVILLE, FLORIDA

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Plot scale: Scale: AS SHOWN

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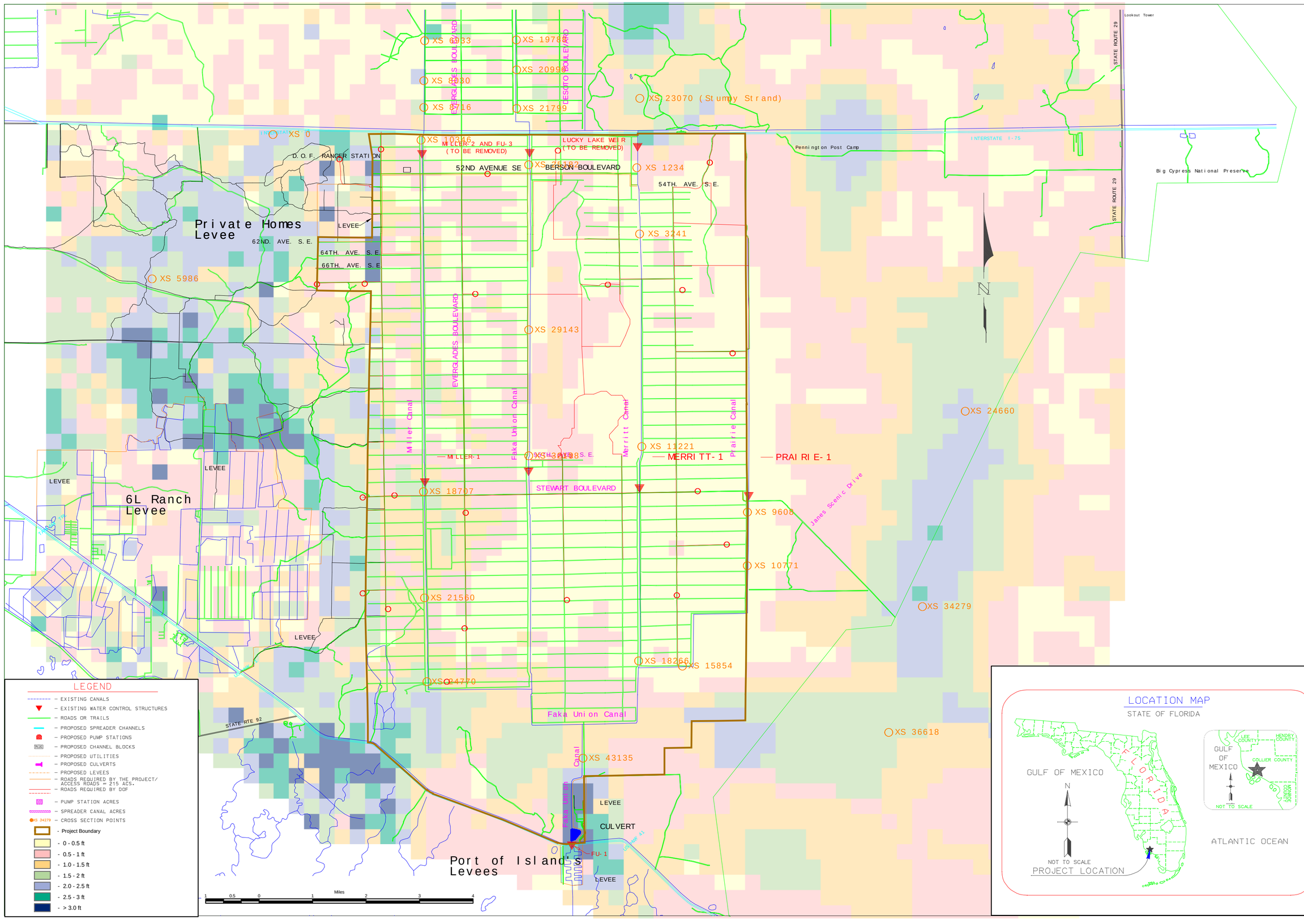
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Takings Analysis Conditions
Existing conditions
Average Wet Season Maximum
Flooded Areas

Figure
A-159



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

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SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Takings Analysis Conditions
Existing conditions
10 Year Storm Event
Flooded Areas

Figure
A-160

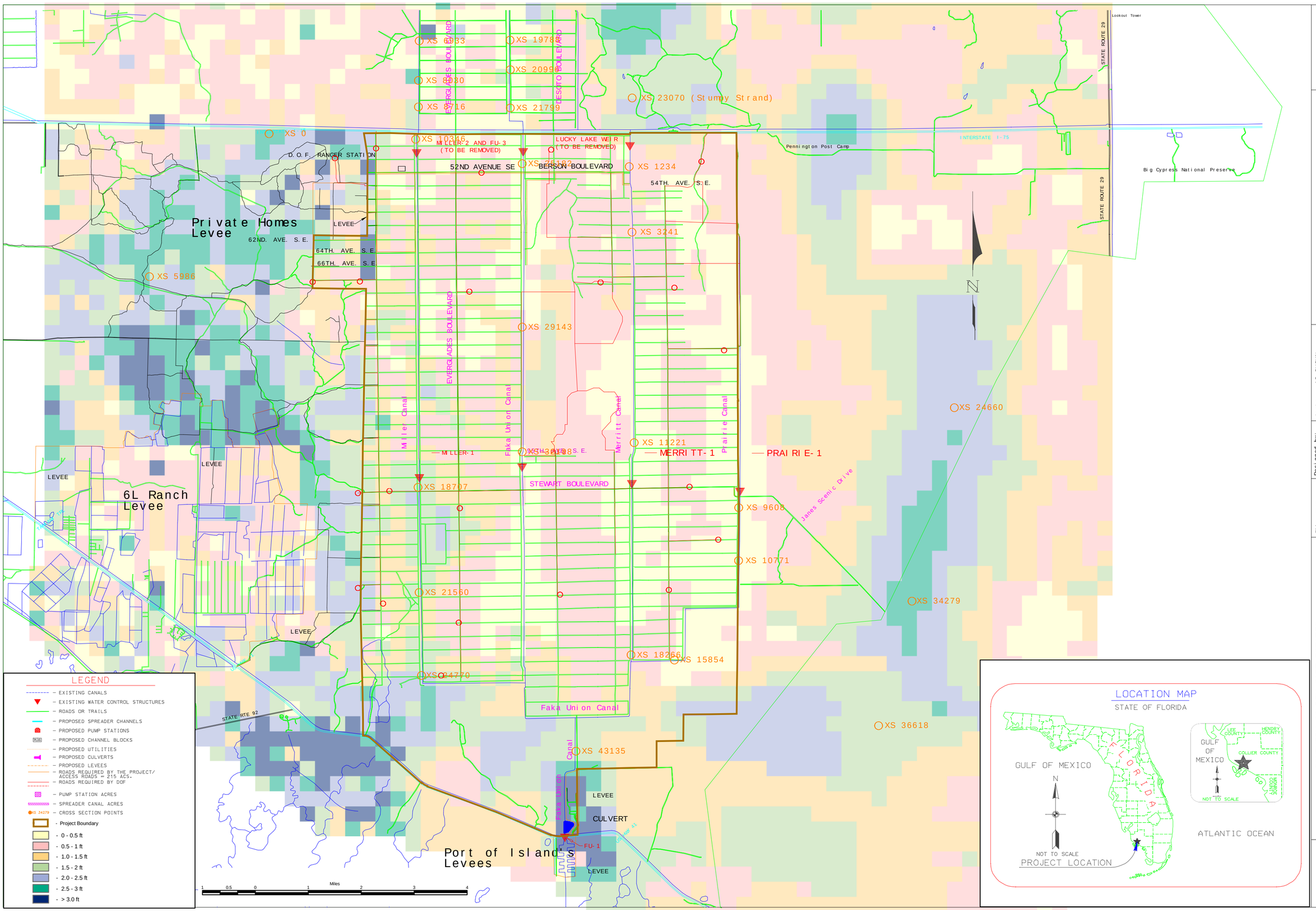

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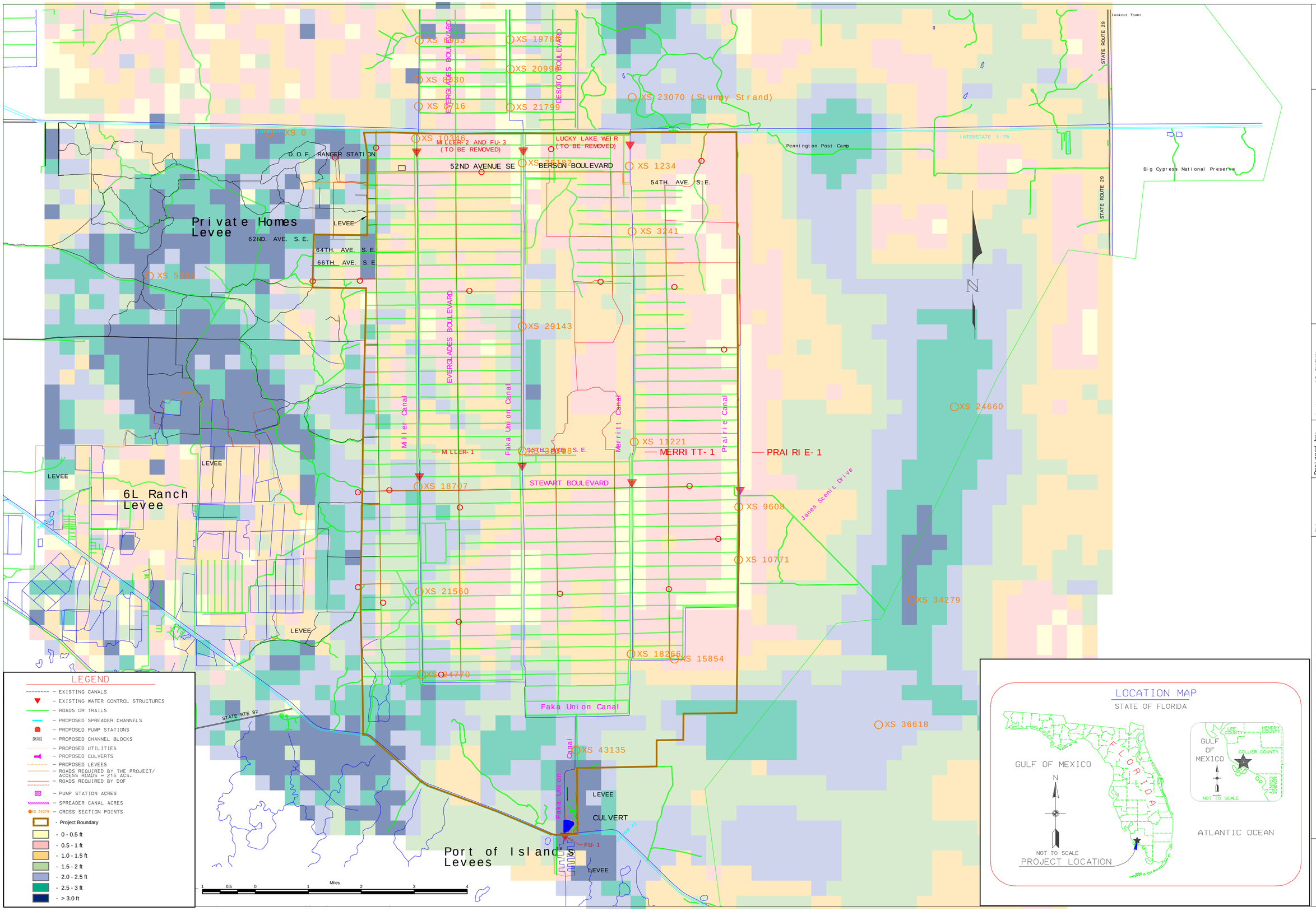
Figure A

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Takings Analysis Conditions
Existing conditions
25 Year Storm Event
Flooded Areas

Figure
A-161



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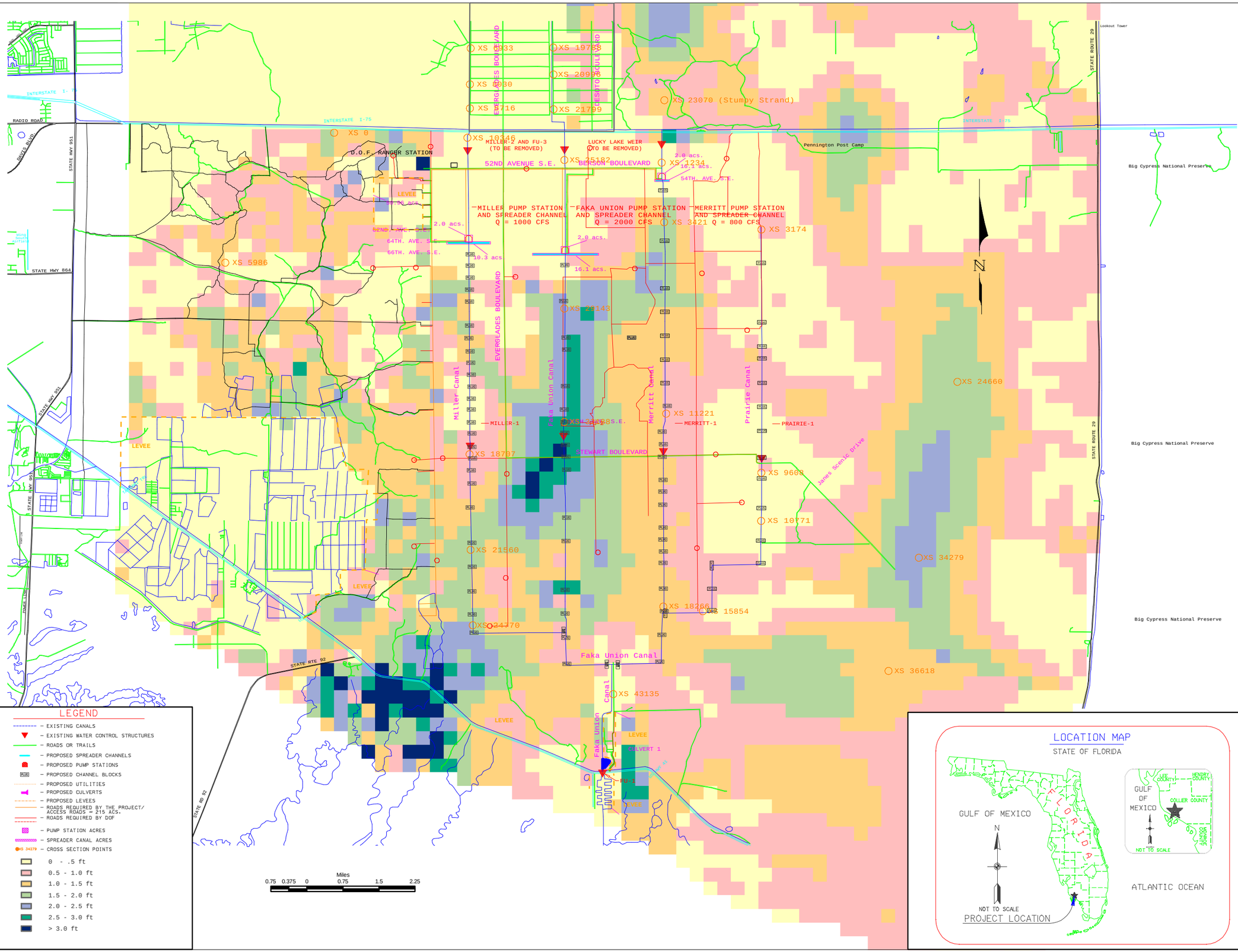
File name:
Reference files:

Figure

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Takings Analysis Conditions
Existing conditions
100 Year Storm Event
Flooded Areas

Figure
A-162



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Jacksonville District

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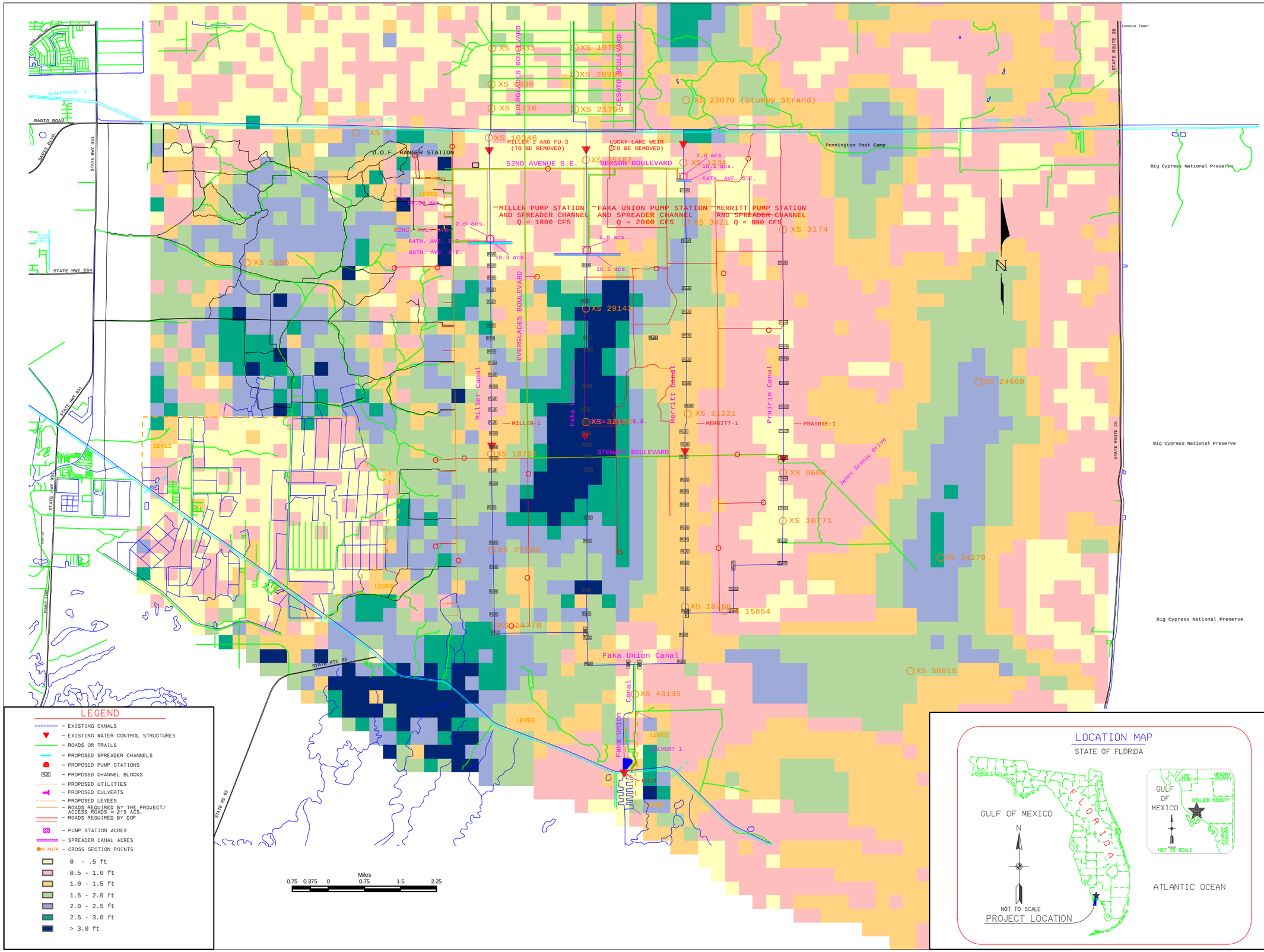
Scale: AS SHOWN
Plot date:
Plot scale:
Dated: D.O.FILE NO. - /

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 3D
Maximum Wet Season
Flooded Areas

Figure
A-163



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Plot scale:
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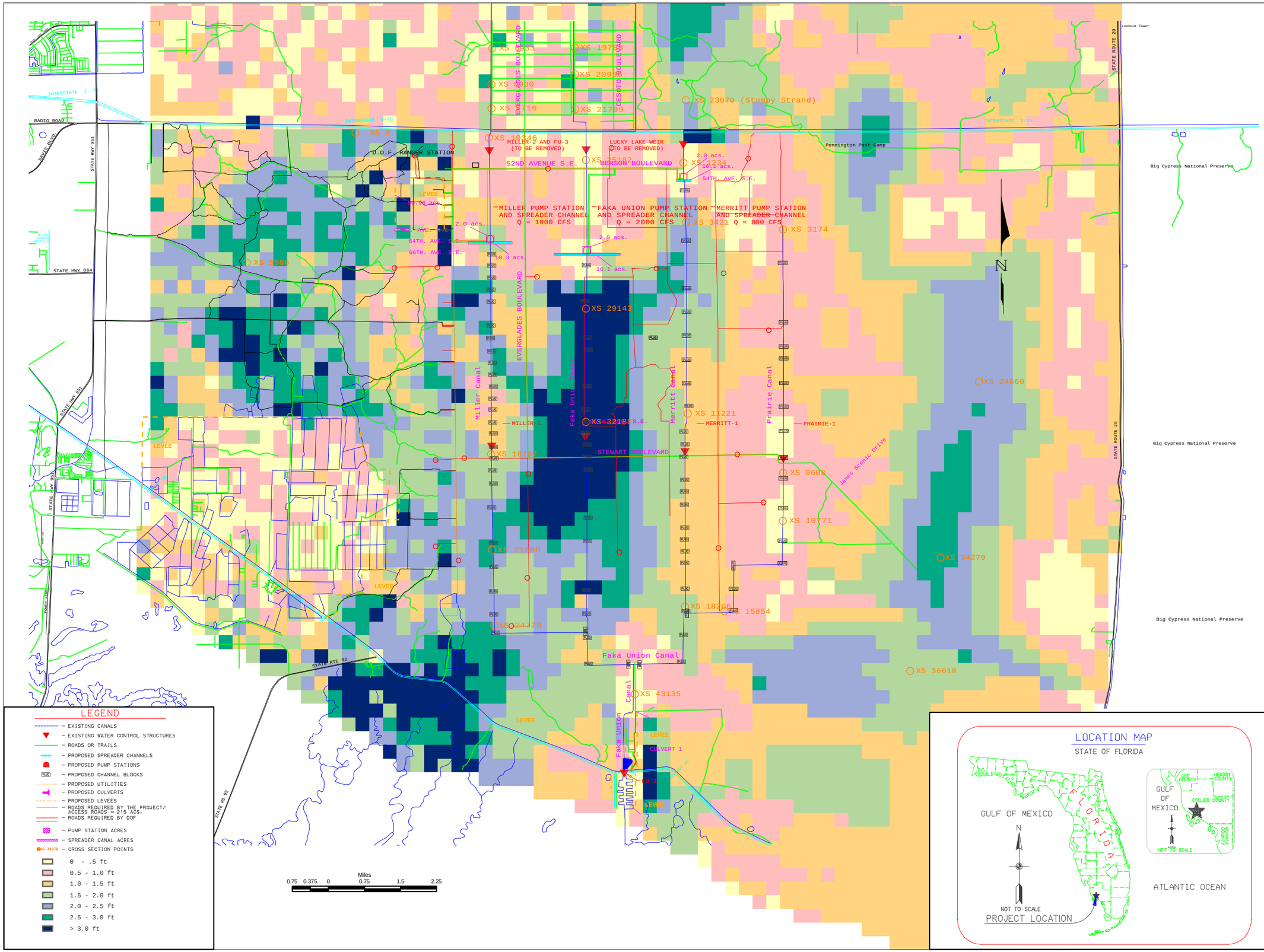
Reference files:
Dated: D.O.FILE NO. - /

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 3D
10 Year Storm Event
Flooded Areas

Figure
A-164



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- CROSS SECTION POINTS (XS 34279)

	0 - .5 ft
	0.5 - 1.0 ft
	1.0 - 1.5 ft
	1.5 - 2.0 ft
	2.0 - 2.5 ft
	2.5 - 3.0 ft
	> 3.0 ft

LOCATION MAP

STATE OF FLORIDA

US Army Corps of Engineers
Jacksonville District

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Plot date:
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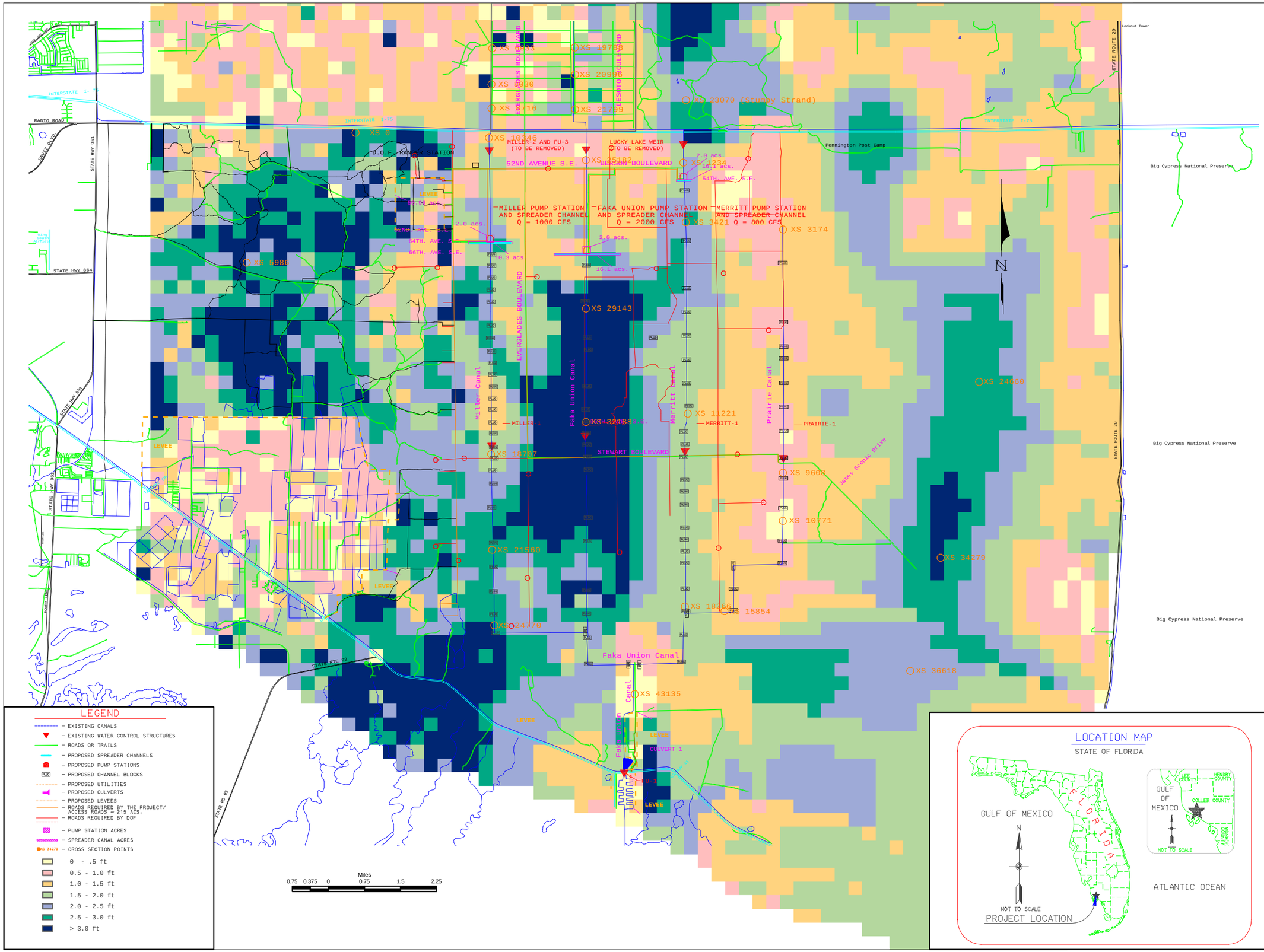
File name:
Reference files:

Dated:
D.O.FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 3D
25 Year Storm Event
Flooded Areas

Figure
A-165



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Jacksonville District

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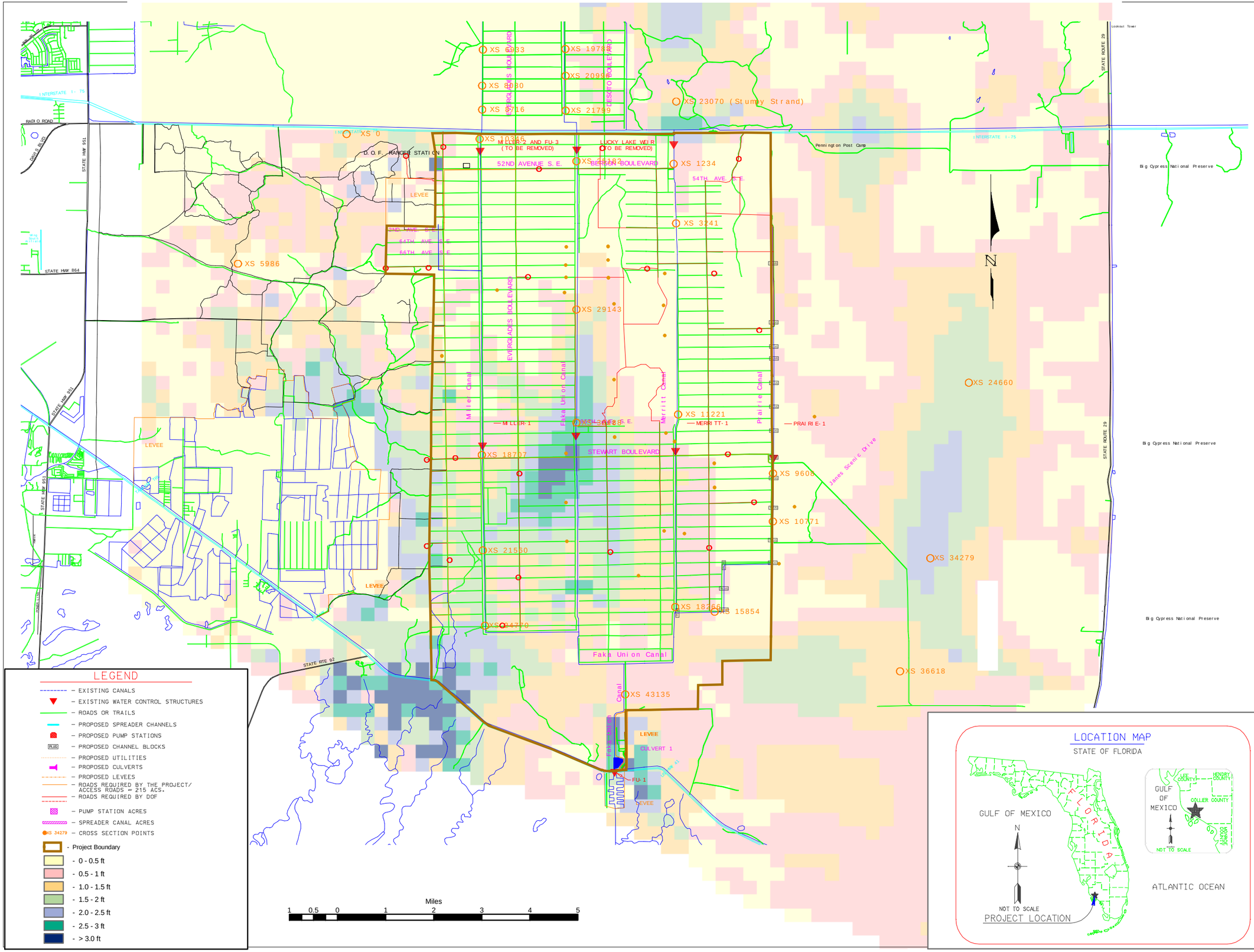
Plot date:
Plot scale:
File name:
Reference files:
Dated: D.O.FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 3D
100 Year Storm Event
Flooded Areas

Figure
A-166



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Jacksonville District

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File name: | Reference files:

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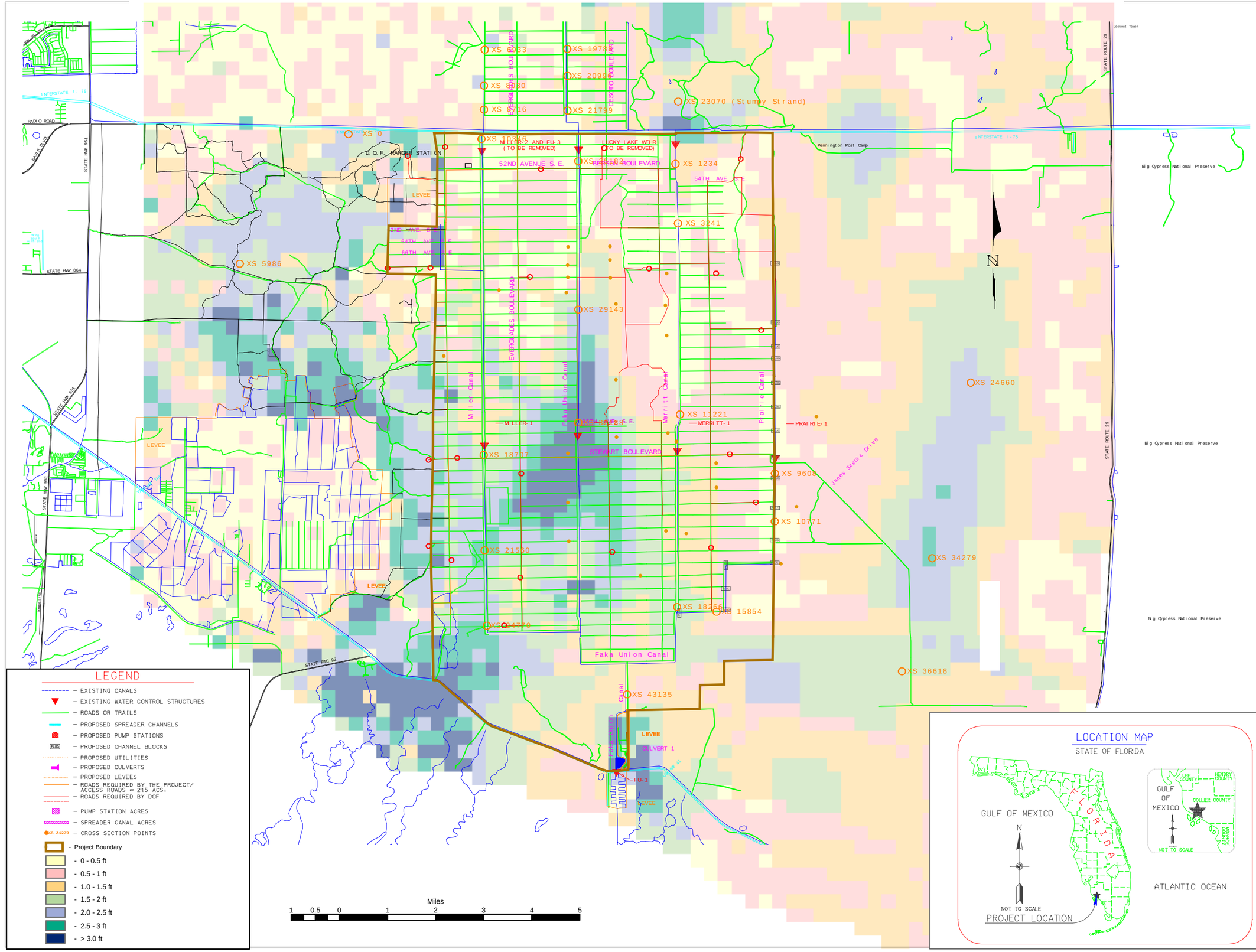
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 6
Average Wet Season Maximum
Flooded Areas

Figure
A-167



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
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- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

LOCATION MAP

STATE OF FLORIDA

US Army Corps of Engineers
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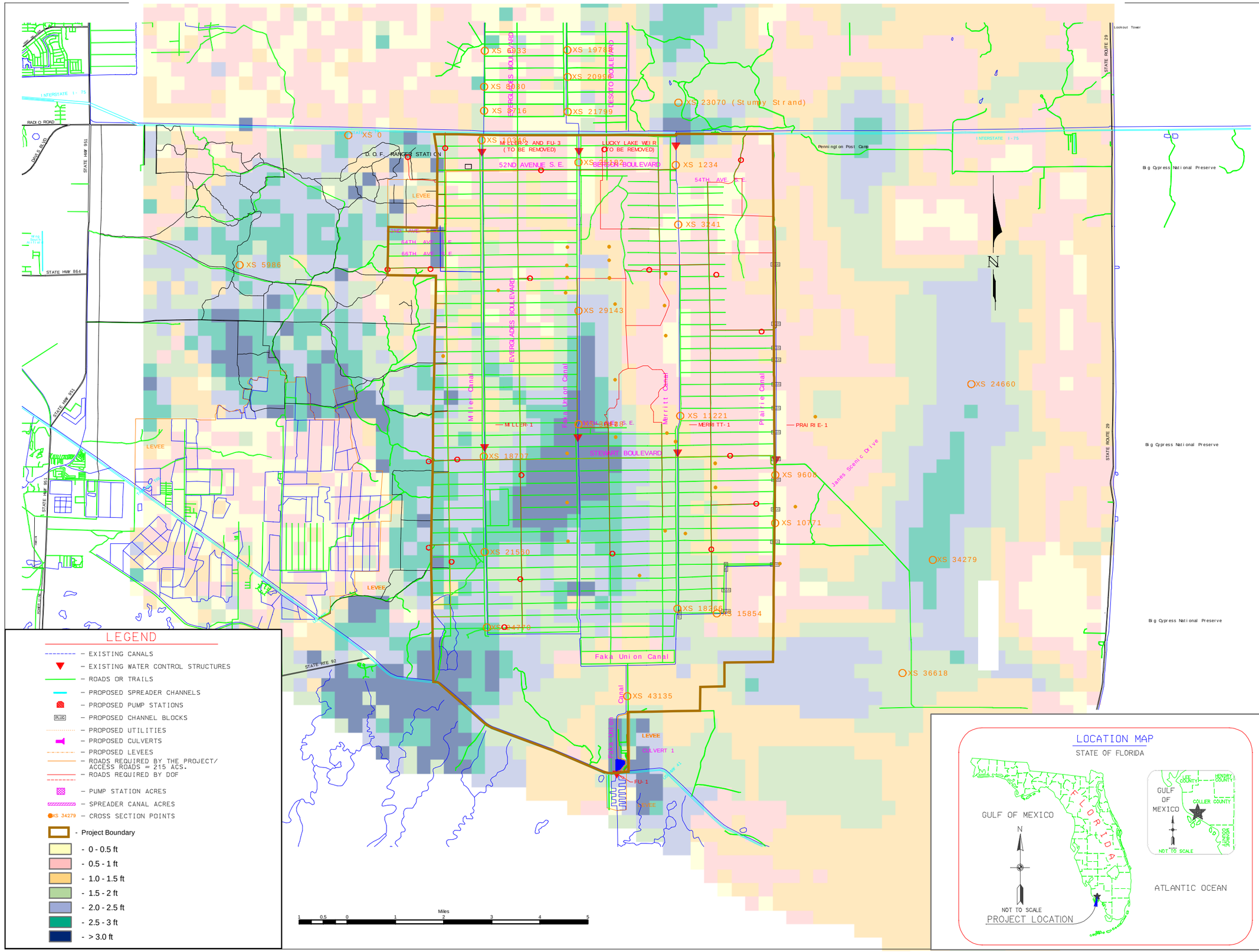
Plot scale:
File name:
Reference files:
D.O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 6
10 Year Maximum Storm Event
Flooded Areas

Figure
A-168



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JACKSONVILLE, FLORIDA

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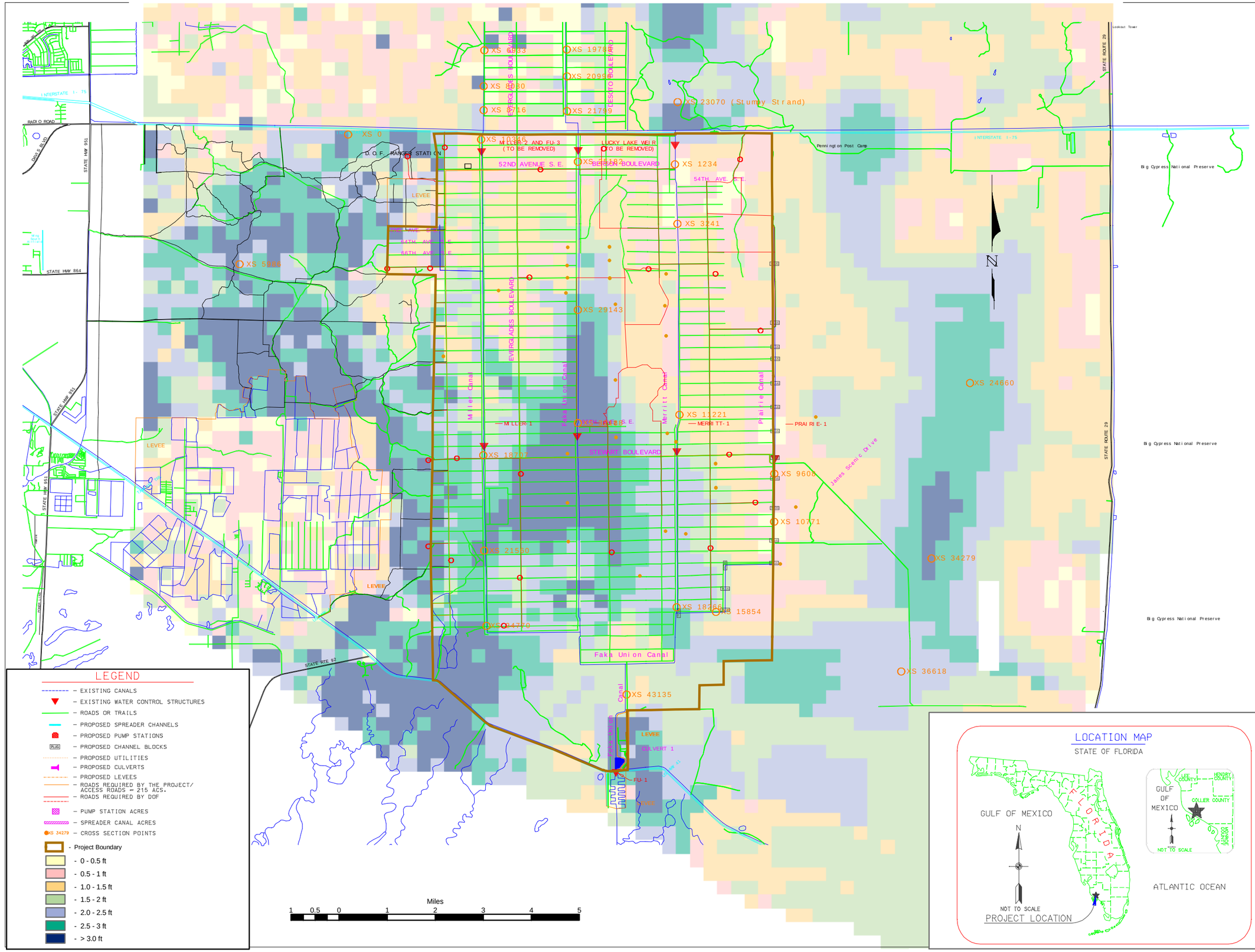
File name: | Reference files:

Dated: D.O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 6
25 Year Maximum Storm Event
Flooded Areas

Figure
A-169



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Jacksonville District

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No.	Symbol	Zone	Description	Approved

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JACKSONVILLE, FLORIDA

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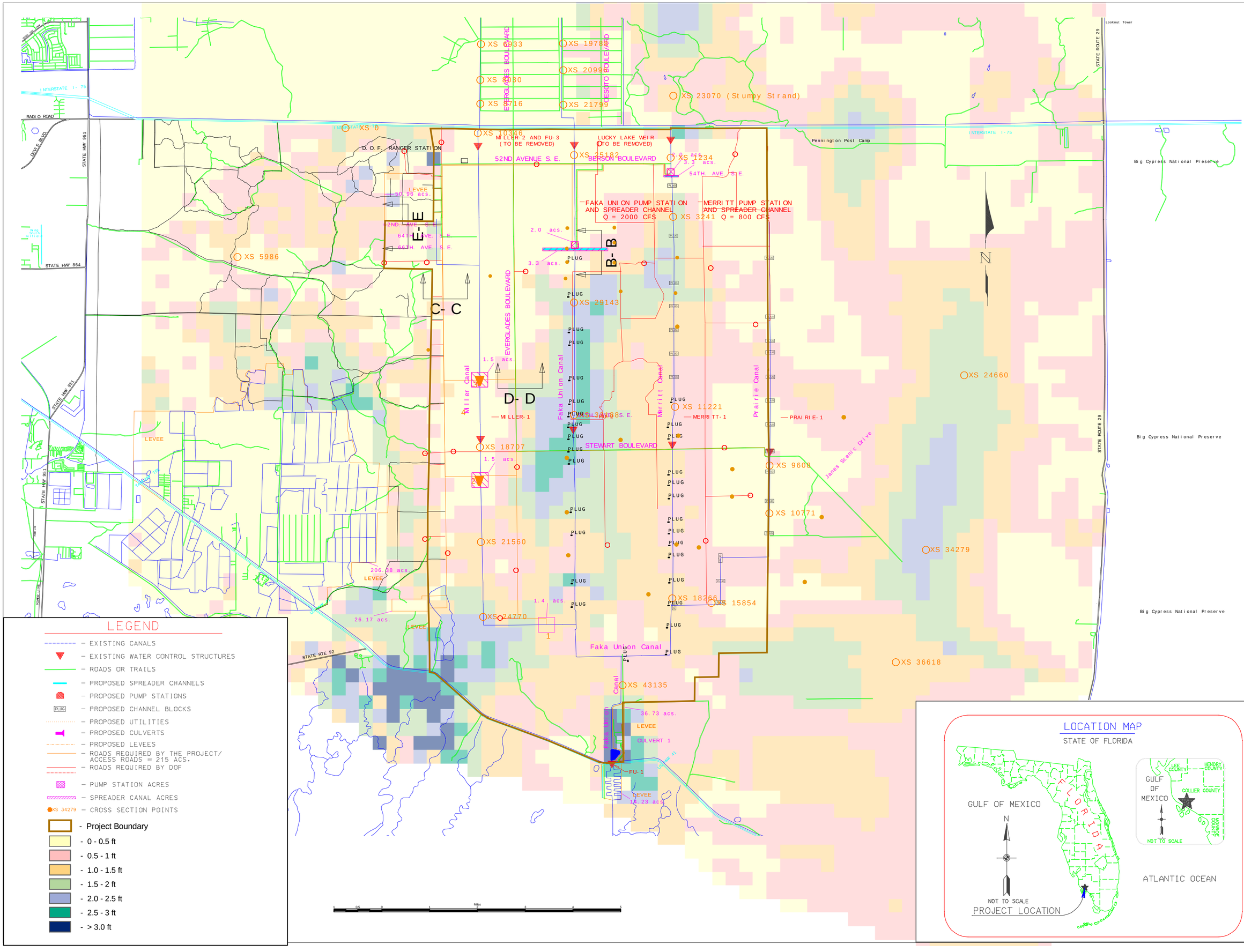
File name: | Reference files:

Dated: D.O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 6
100 Year Maximum Storm Event
Flooded Areas

Figure
A-170



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

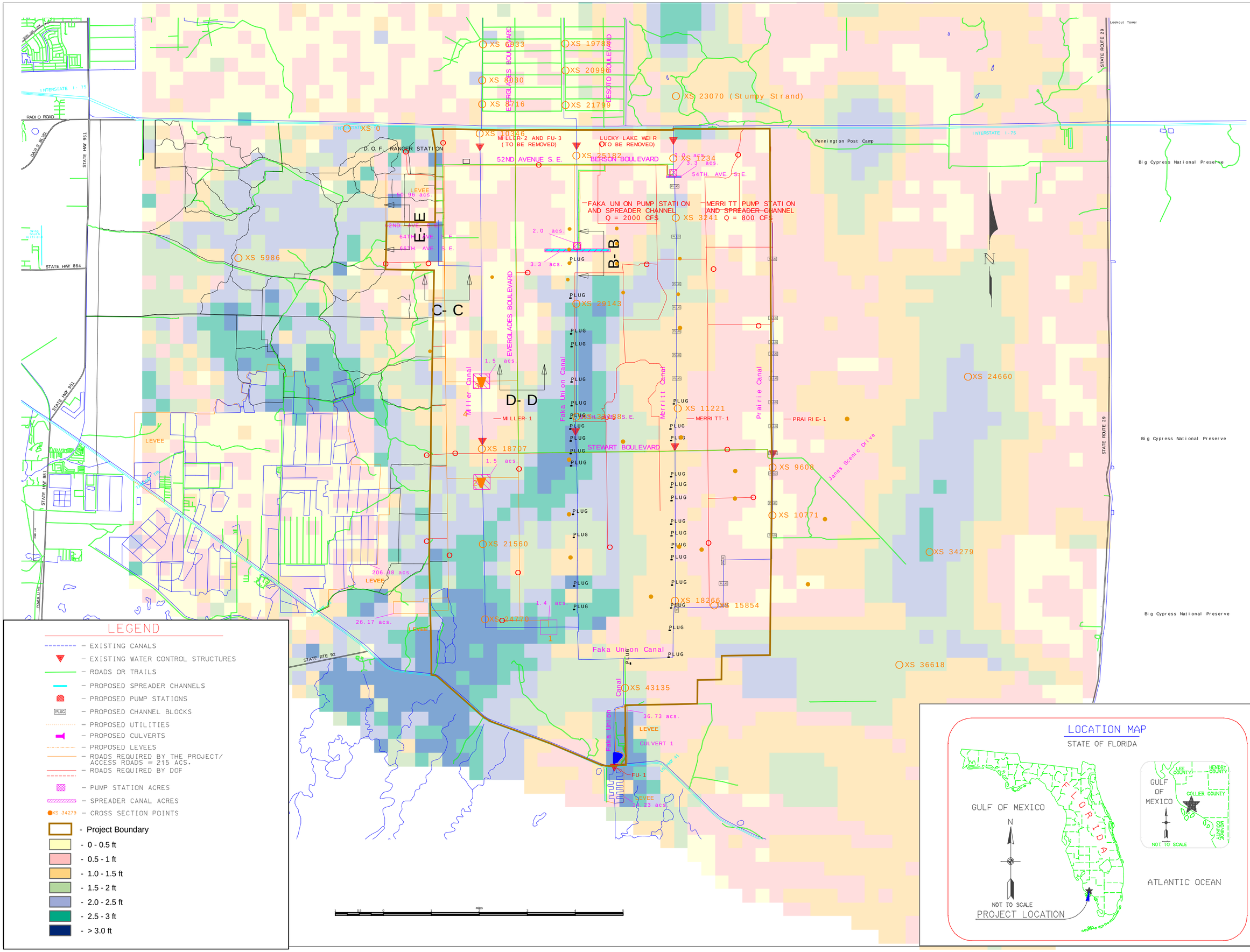
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

File name:
Reference files:
Designed by:
Dwn by:
Ckd by:
Inv. No. DACW17-
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated:
D. O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 12
Average Wet Season Maximum
Flooded Areas

Figure
A-171



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- XS 34279 CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

LOCATION MAP

STATE OF FLORIDA

US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Inv. No. DACW17- -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:

Designed by:
Drawn by:
Ckd by:
Dated:
D. O. FILE NO.

File name:
Reference files:

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 12
10 Year Maximum Storm Event
Flooded Areas

Figure

A-172

US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

No.	Symbol	Zone	Description	Approved

Inv. No. DACM17- -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:

Designed by:
Drawn by:
Ckd by:

File name:
Reference files:

Dated:
D. O. FILE NO. -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 12
25 Year Maximum Storm Event
Flooded Areas

Figure

A-173

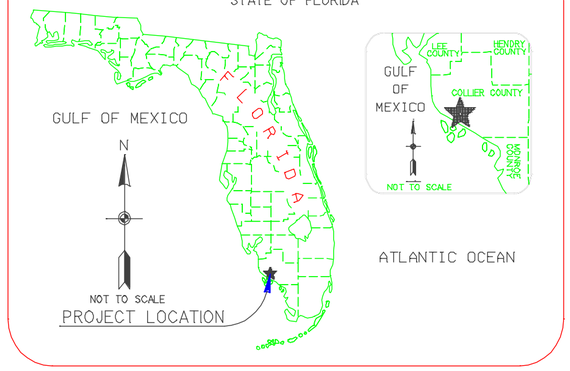
LEGEND

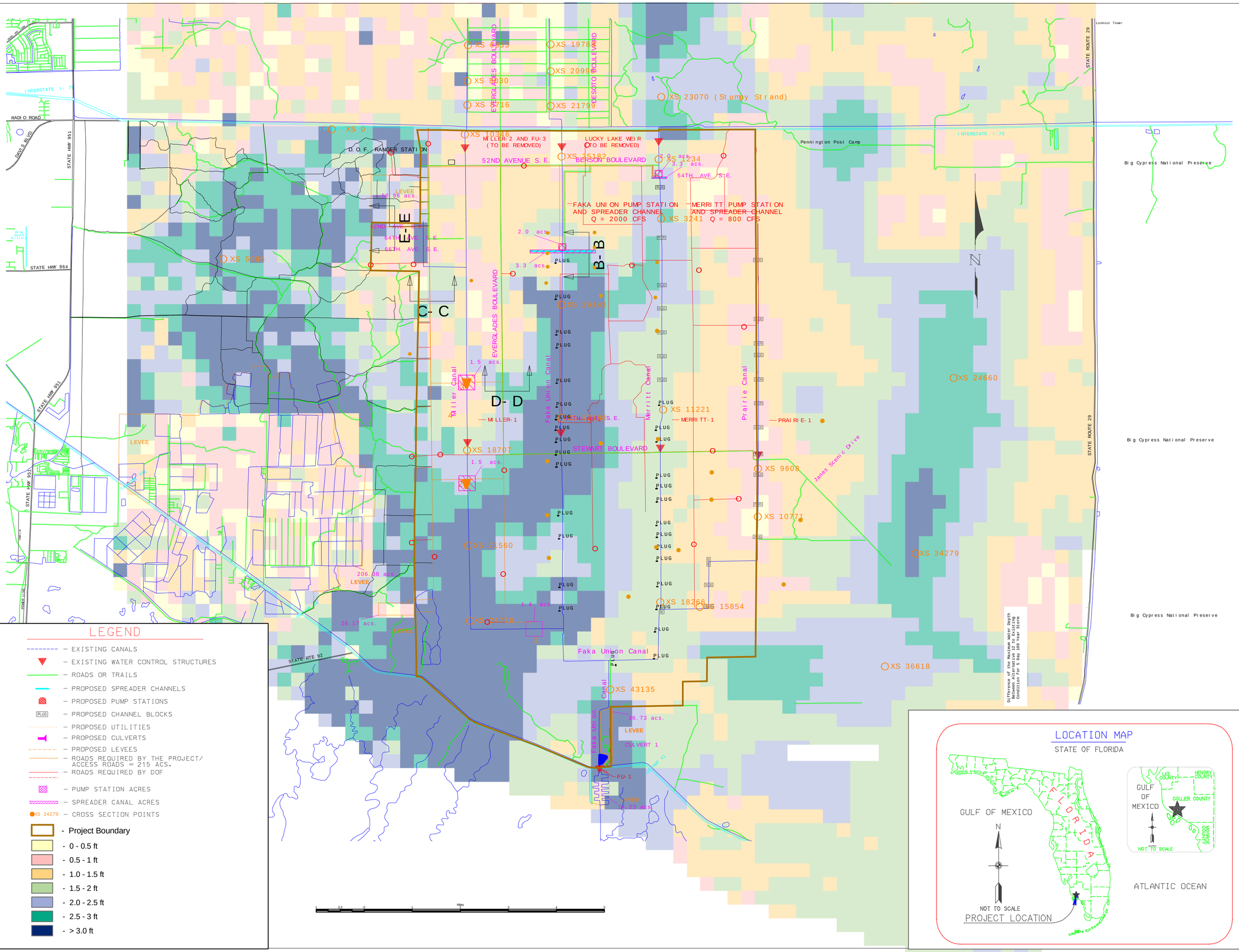
- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- XS 34279 CROSS SECTION POINTS

- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

LOCATION MAP

STATE OF FLORIDA





US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

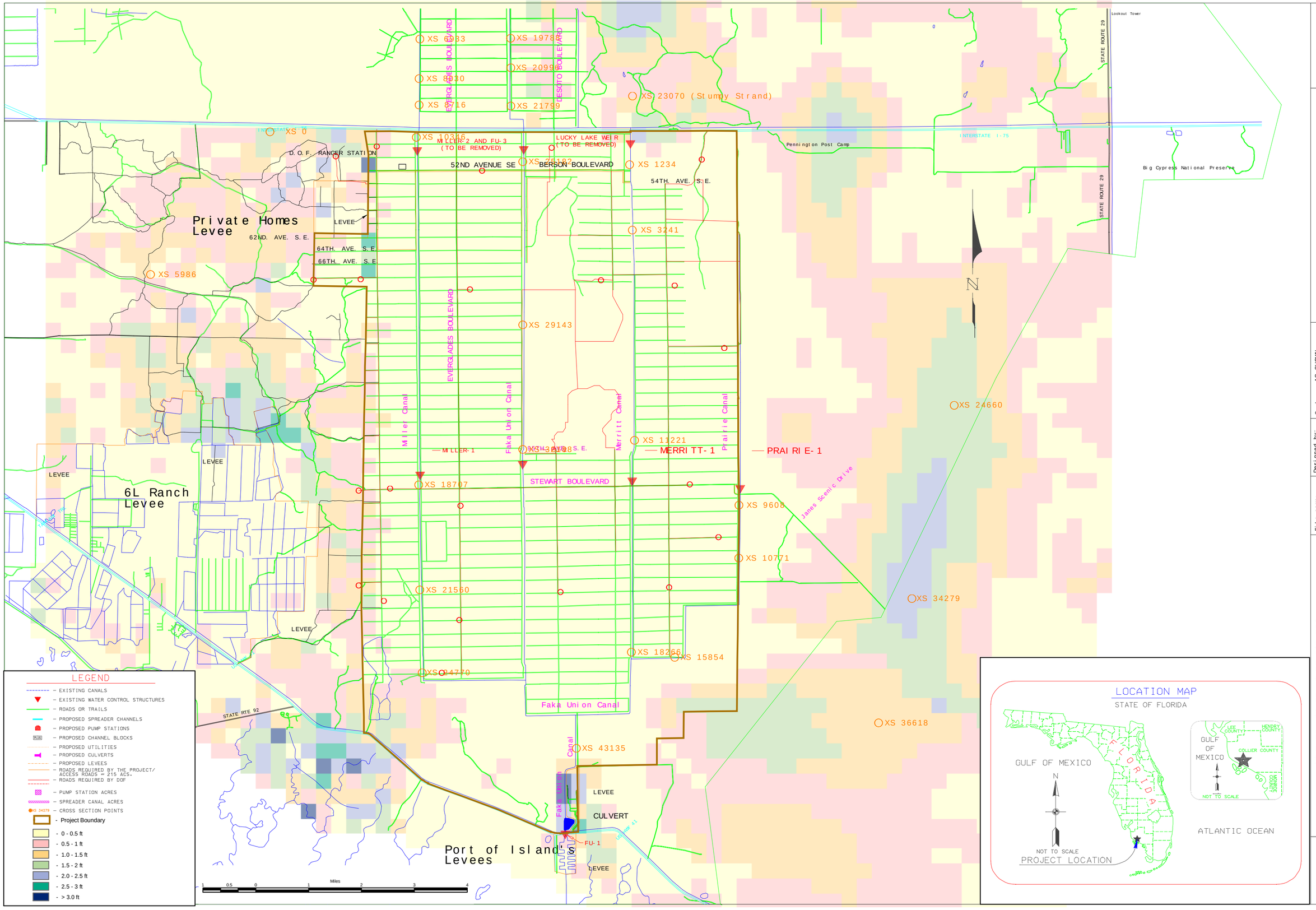
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Inv. No. DACW17- - -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
Designed by:
Dwn by:
Ckd by:
File name:
Reference files:
Dated:
D. O. FILE NO. - ,

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Takings Analysis Conditions
Alternative 12
100 Year Maximum Storm Event
Flooded Areas

Figure
A-174



US Army Corps of Engineers
Jacksonville District

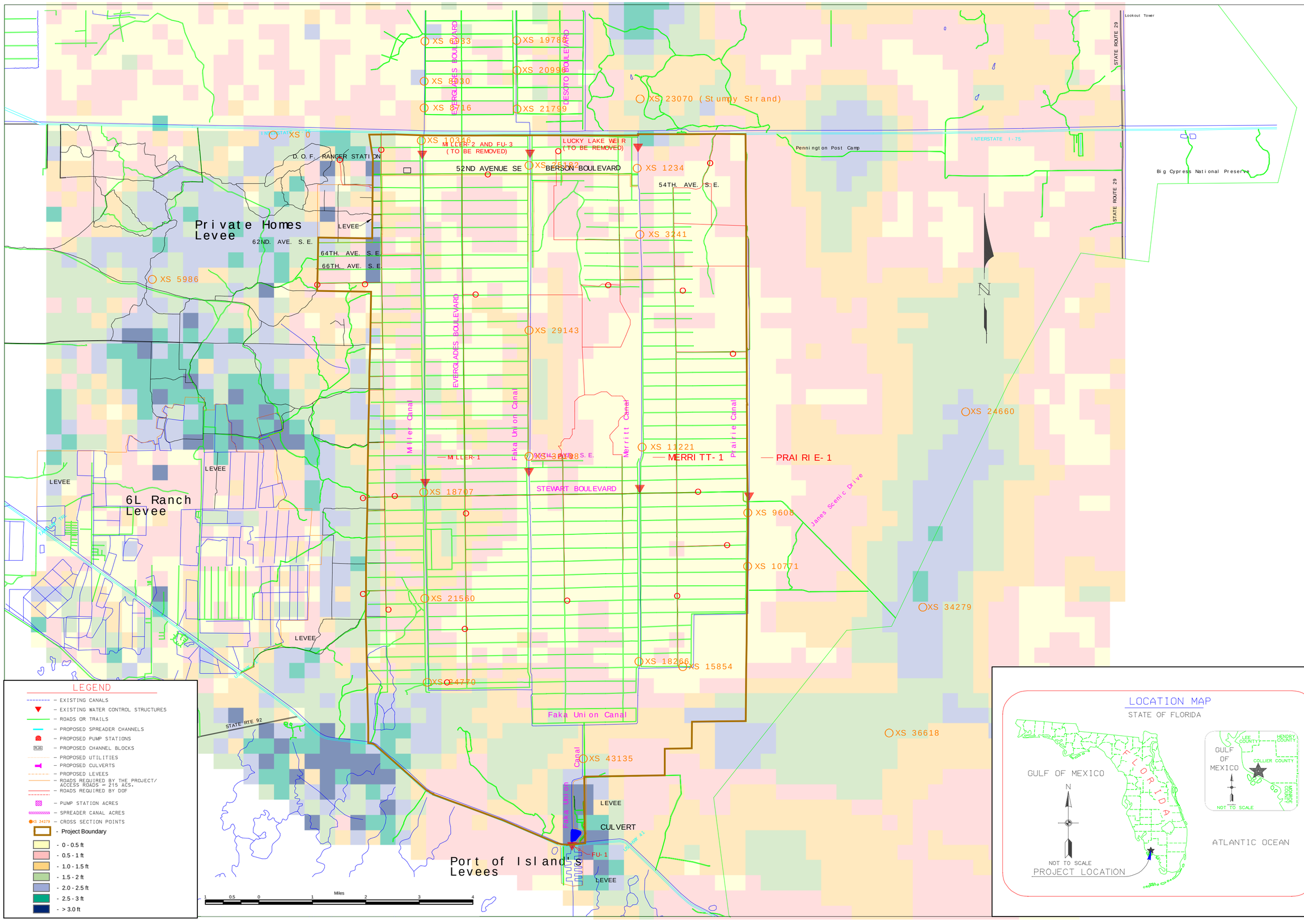
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Scale: AS SHOWN
Plot date:
Plot scale:
Designed by: ---
Dwn by:
Ckd by:
File name:
Reference files:

Figure A-4

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Existing conditions
Average Wet Season Maximum
Flooded Areas

Figure
A-175



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- XS 34279 - CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

LOCATION MAP

STATE OF FLORIDA

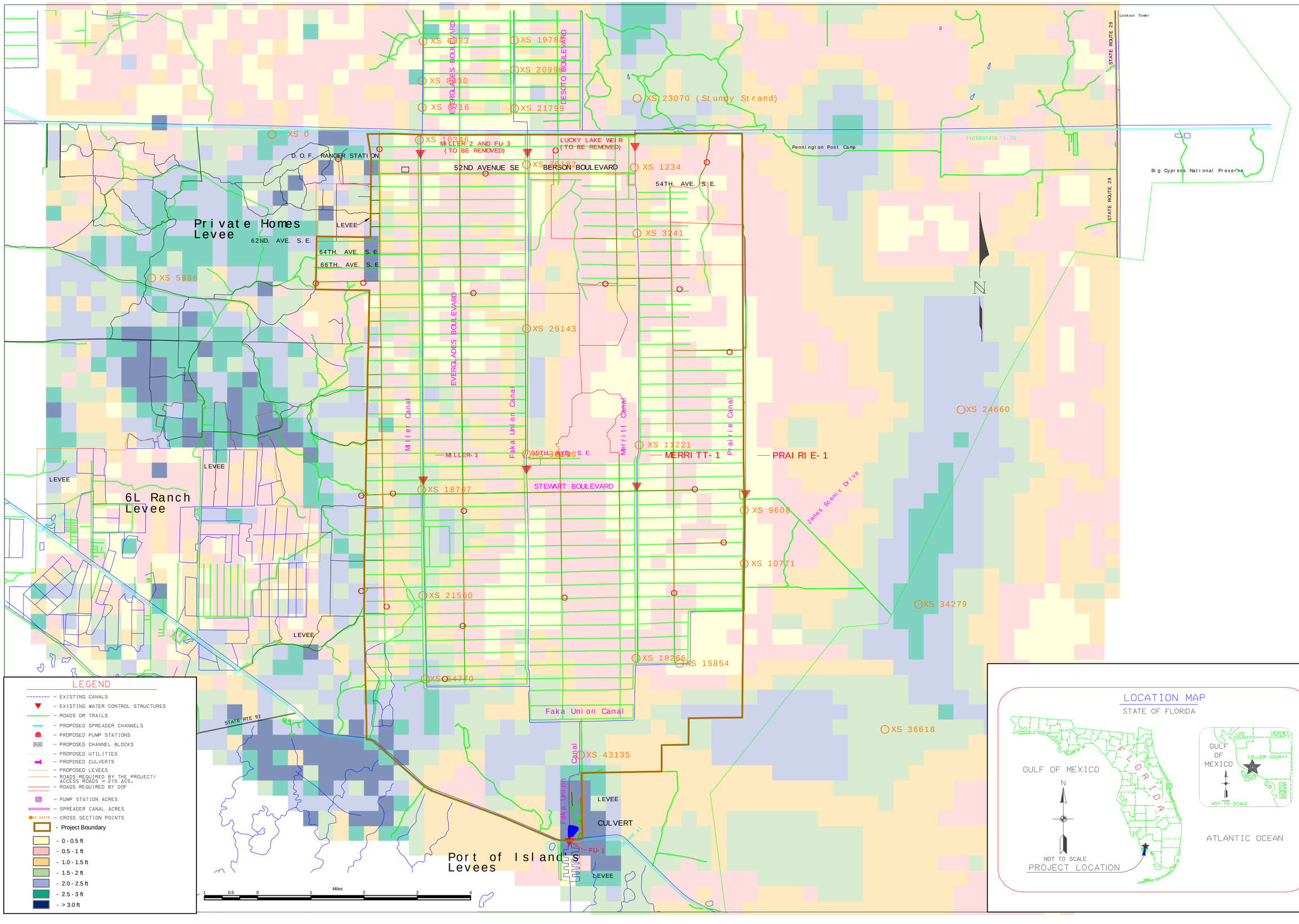
US Army Corps of Engineers
Jacksonville Distri

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: ---
Drawn by:
Ckd by:
Plot date:
Plot scale: Scale: AS SHOWN
File name:
Reference files:

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Existing conditions
10 Year Storm Event
Flooded Areas

Figure
A-176



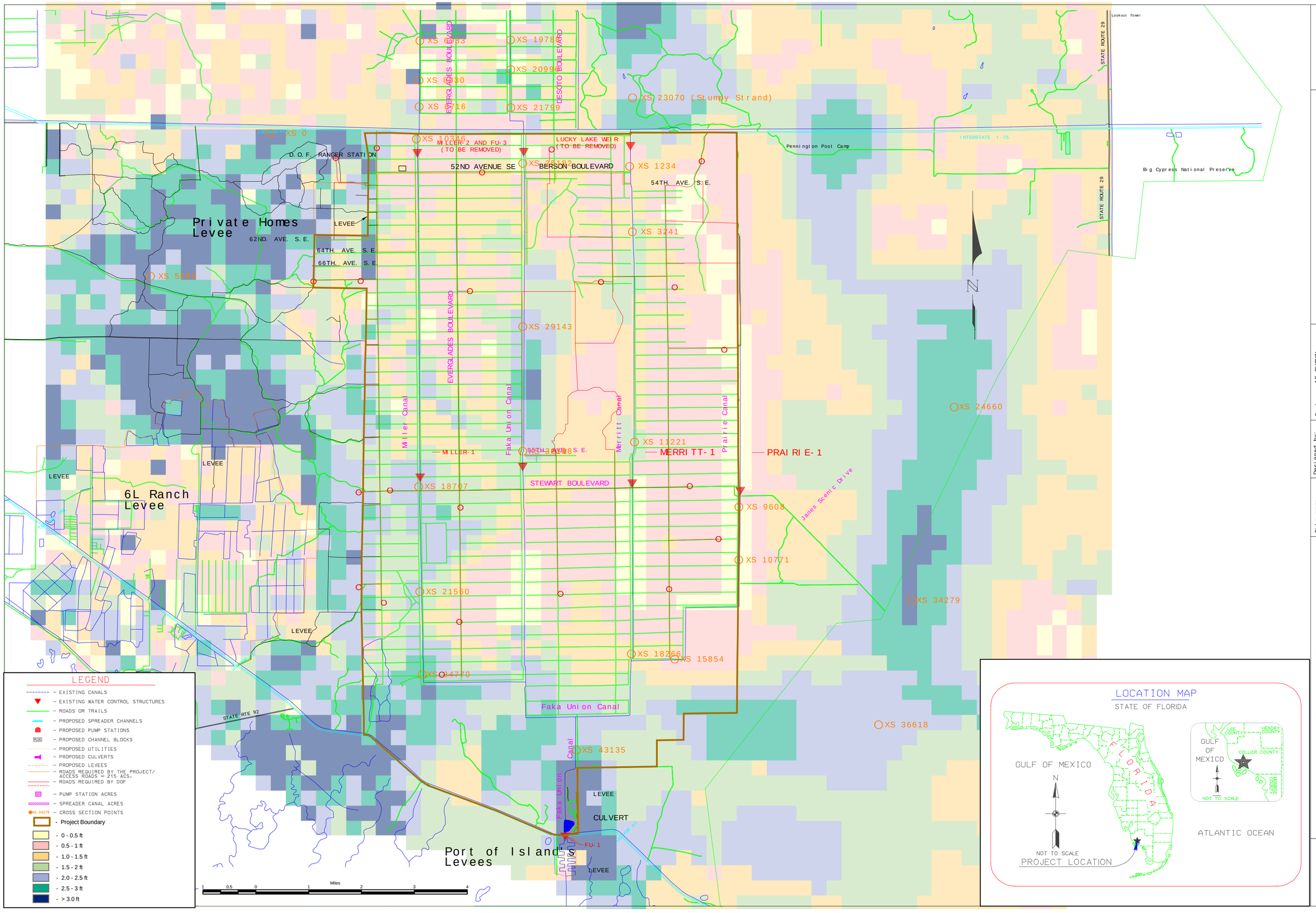
US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Scale: AS SHOWN
Plot date:
Plot scale:
Designed by: ---
Dwn by:
Ckd by:
File name:
Reference files:

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Existing Conditions
25 Year Storm Event
Flooded Areas

Figure
A-177



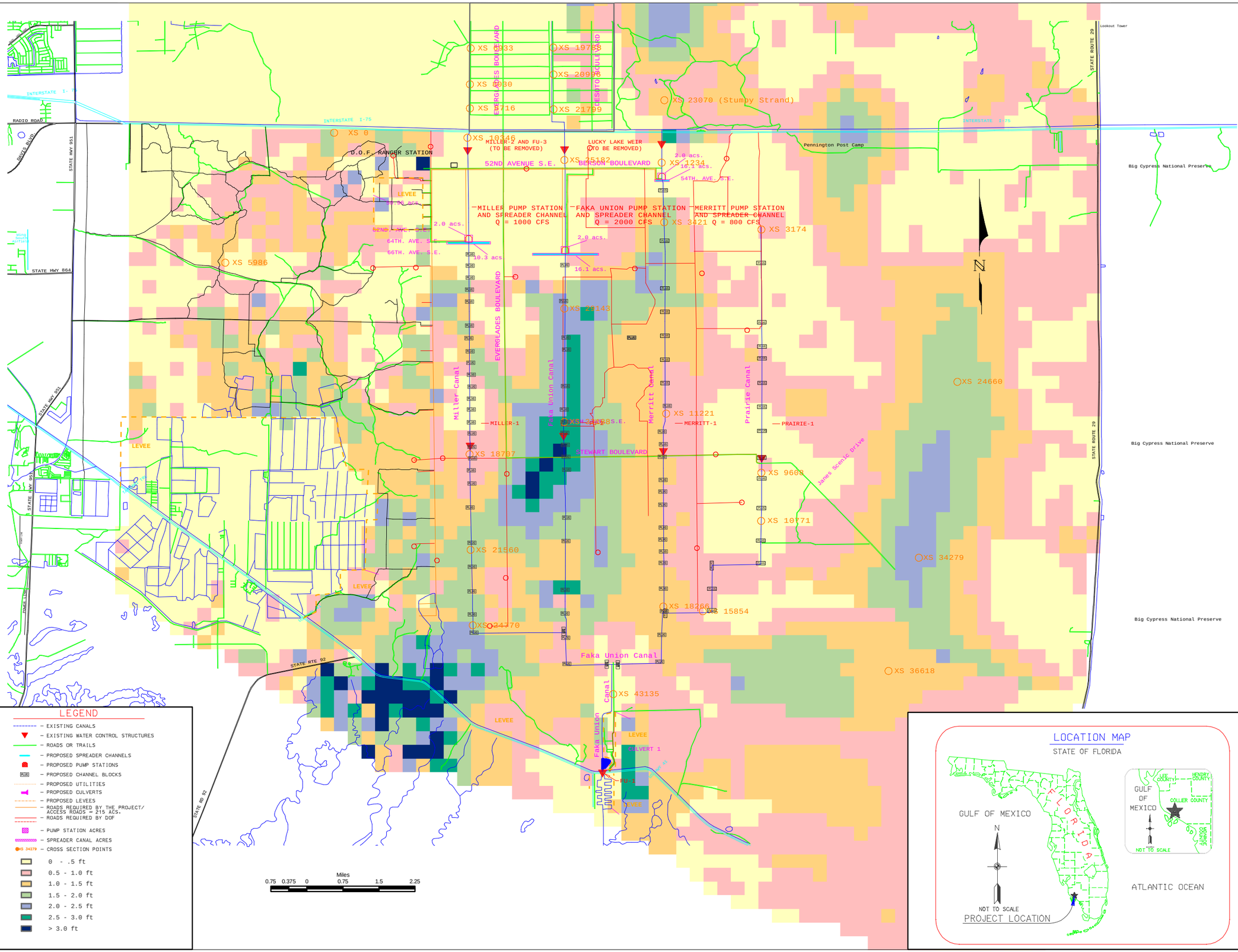
US Army Corps of Engineers
Jacksonville District

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Scale: AS SHOWN
Plot date:
Plot scale:
Designed by:
Dwn by:
Ckd by:
File name:
Reference files:

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Existing Conditions
100 Year Storm Event
Flooded Areas

Figure
A-178



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS - 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- CROSS SECTION POINTS

	0 - .5 ft
	0.5 - 1.0 ft
	1.0 - 1.5 ft
	1.5 - 2.0 ft
	2.0 - 2.5 ft
	2.5 - 3.0 ft
	> 3.0 ft

LOCATION MAP

STATE OF FLORIDA

US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
CORPS OF ENGINEERS
JACKSONVILLE DISTRICT, FLORIDA
JACKSONVILLE, FLORIDA

Designed by:
Drawn by:
Ckd by:

Inv. No: A17- - -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:

File name:
Reference files:

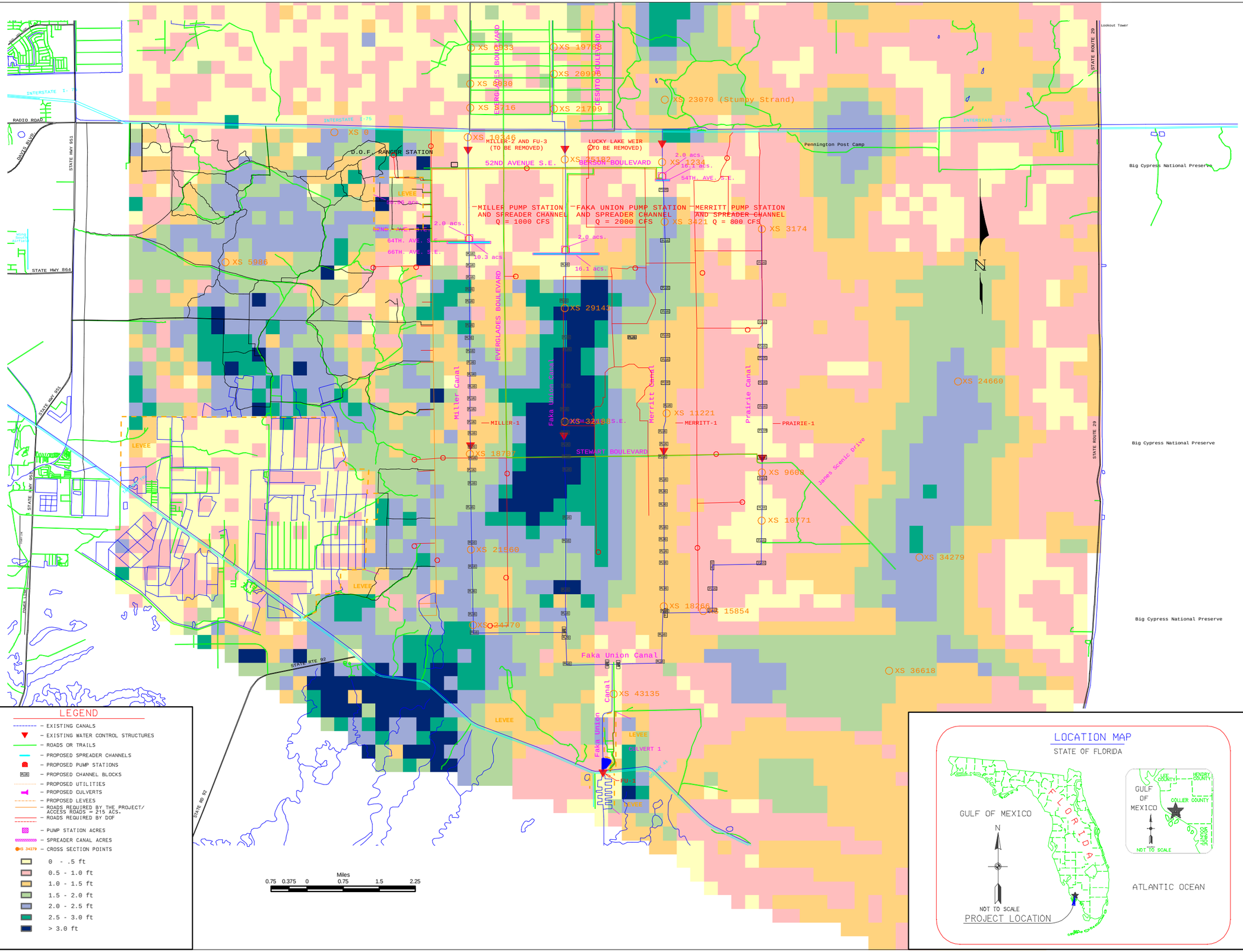
Dated:
D.O.FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 3D
Maximum Wet Season
Flooded Areas

Figure

A-179



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

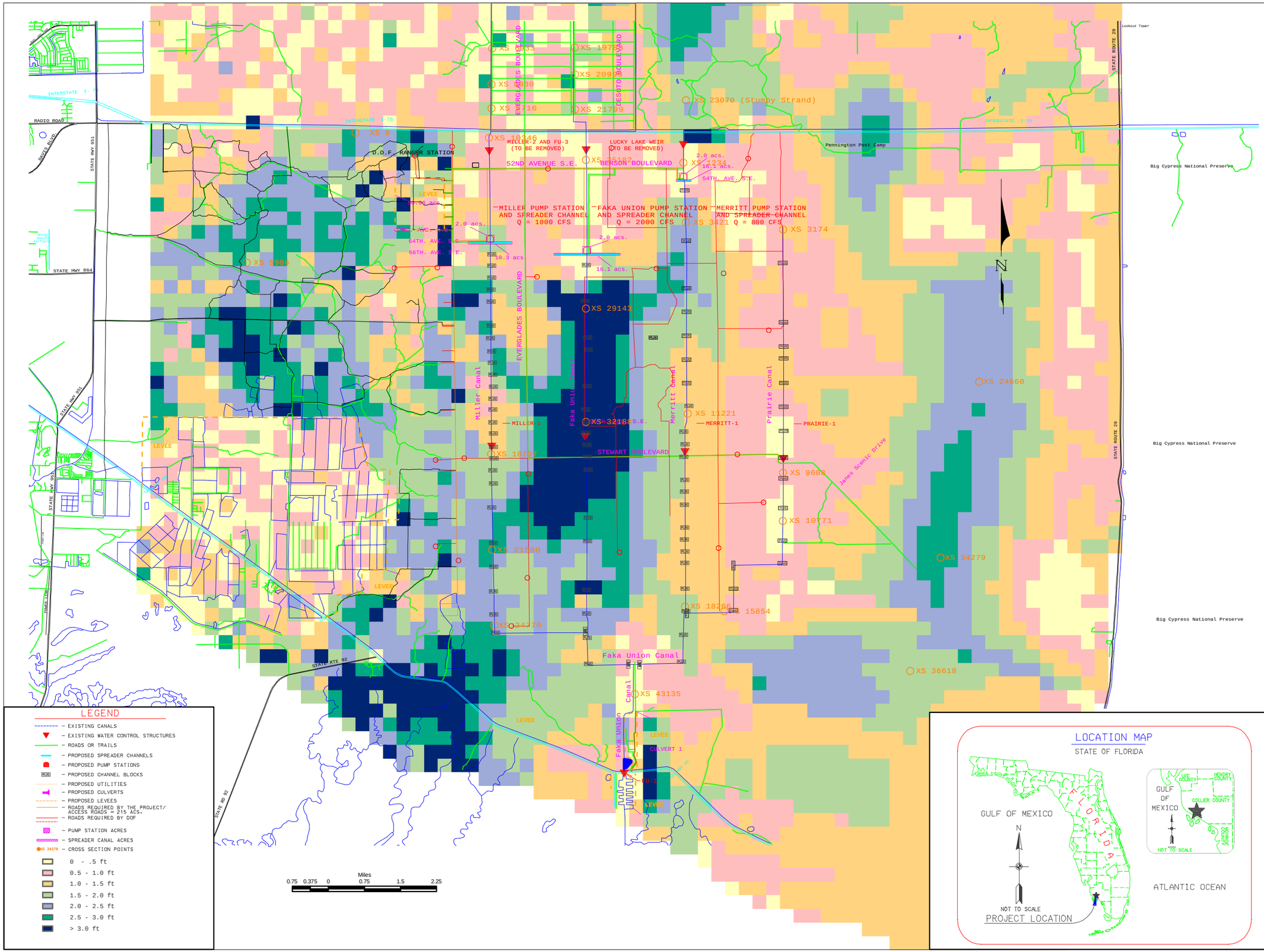
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Inv. No. ACW17- - -
Dwn by: | Ckd by: | Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
File name:
Reference files:
Dated: D.O.FILE NO. - /

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 3D
10 Year Storm Event
Flooded Areas

Figure
A-180



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

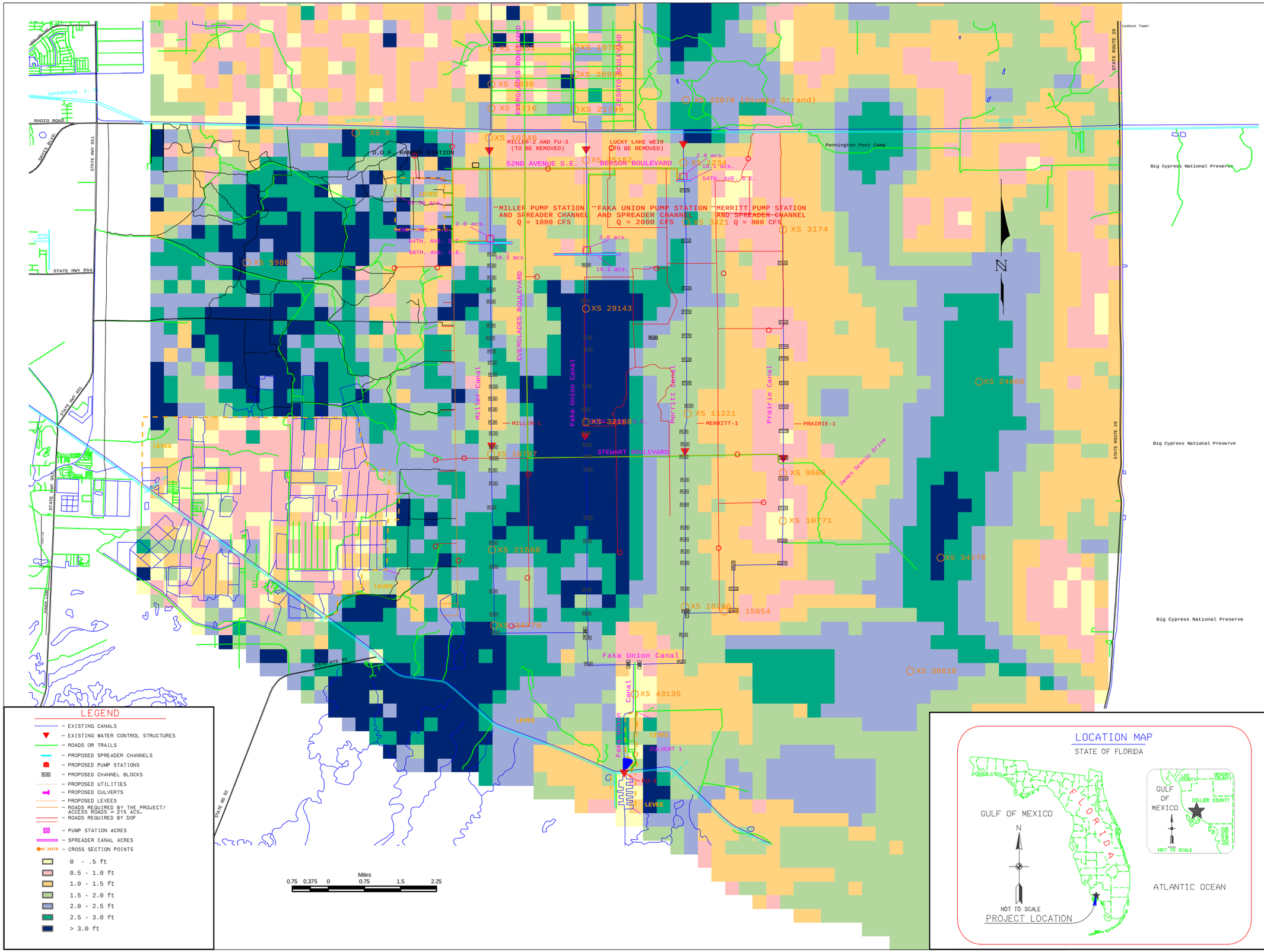
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Inv. No. | Dated:
Dwn by: | Ckd by: | Scale: AS SHOWN
Plot date:
Plot scale:
File name:
Reference files:
Dated: D.O.FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 3D
25 Year Storm Event
Flooded Areas

Figure
A-181



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

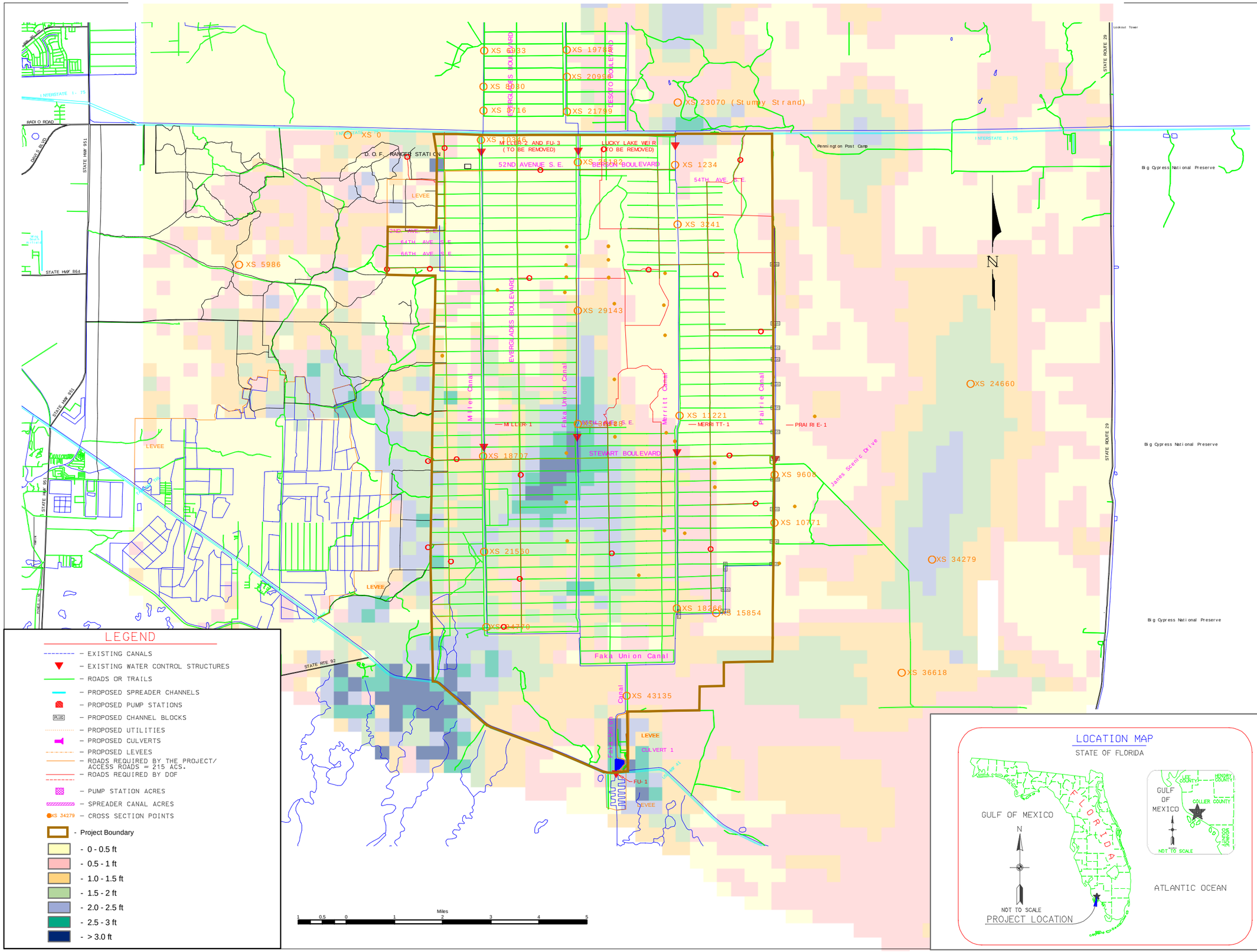
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Inv. No: NGDACW17- - -
Dwn by: | Ckd by: | Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
File name:
Reference files:
Dated: D.O.FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 3D
100 Year Storm Event
Flooded Areas

Figure
A-182



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Dwn by: | Ckd by: | Inv. No. DACW17- | Dated: | Scale: AS SHOWN | Plot date: | Plot scale:

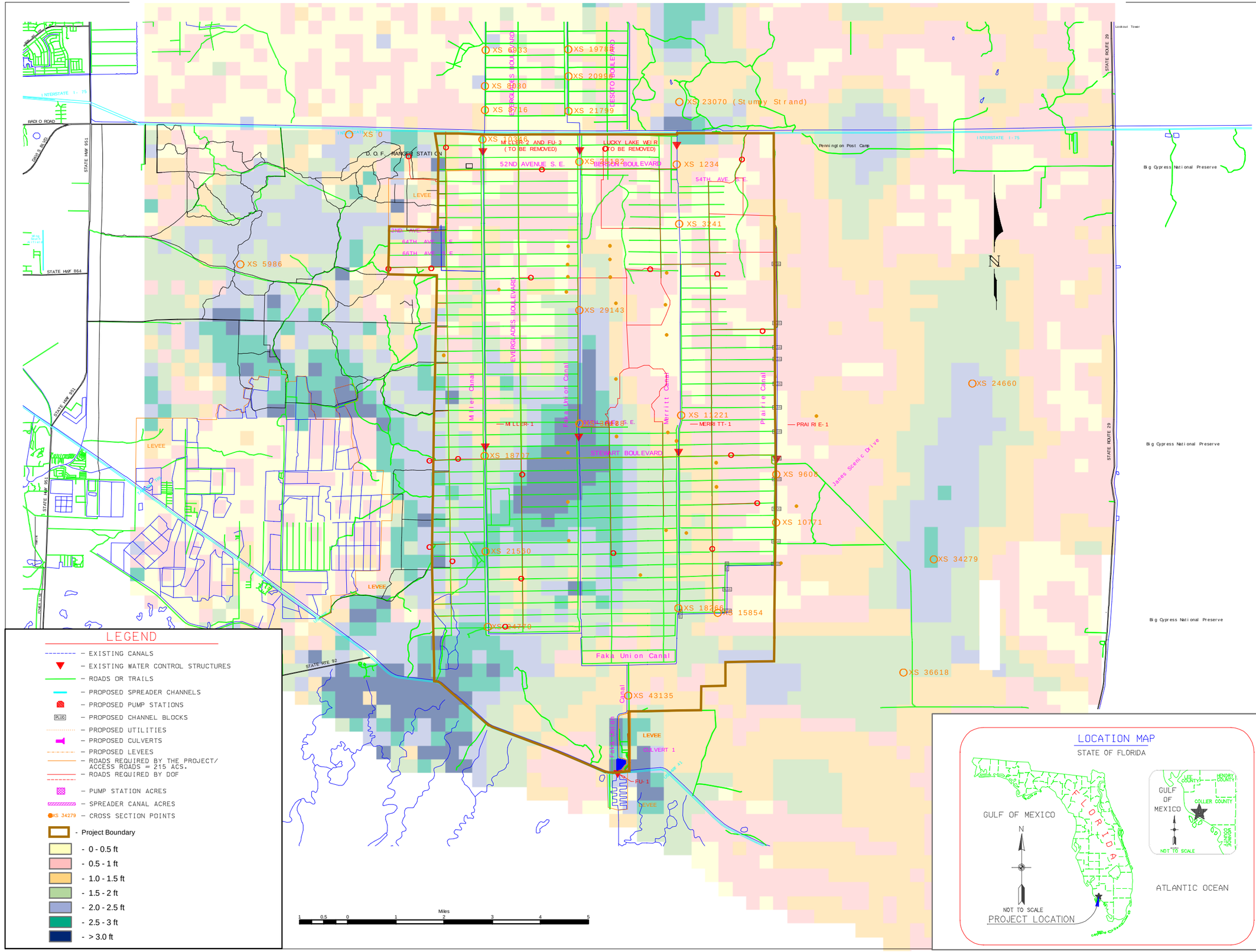
File name: | Reference files:

Dated: D. O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 6
Average Wet Season Maximum
Flooded Areas

Figure
A-183



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

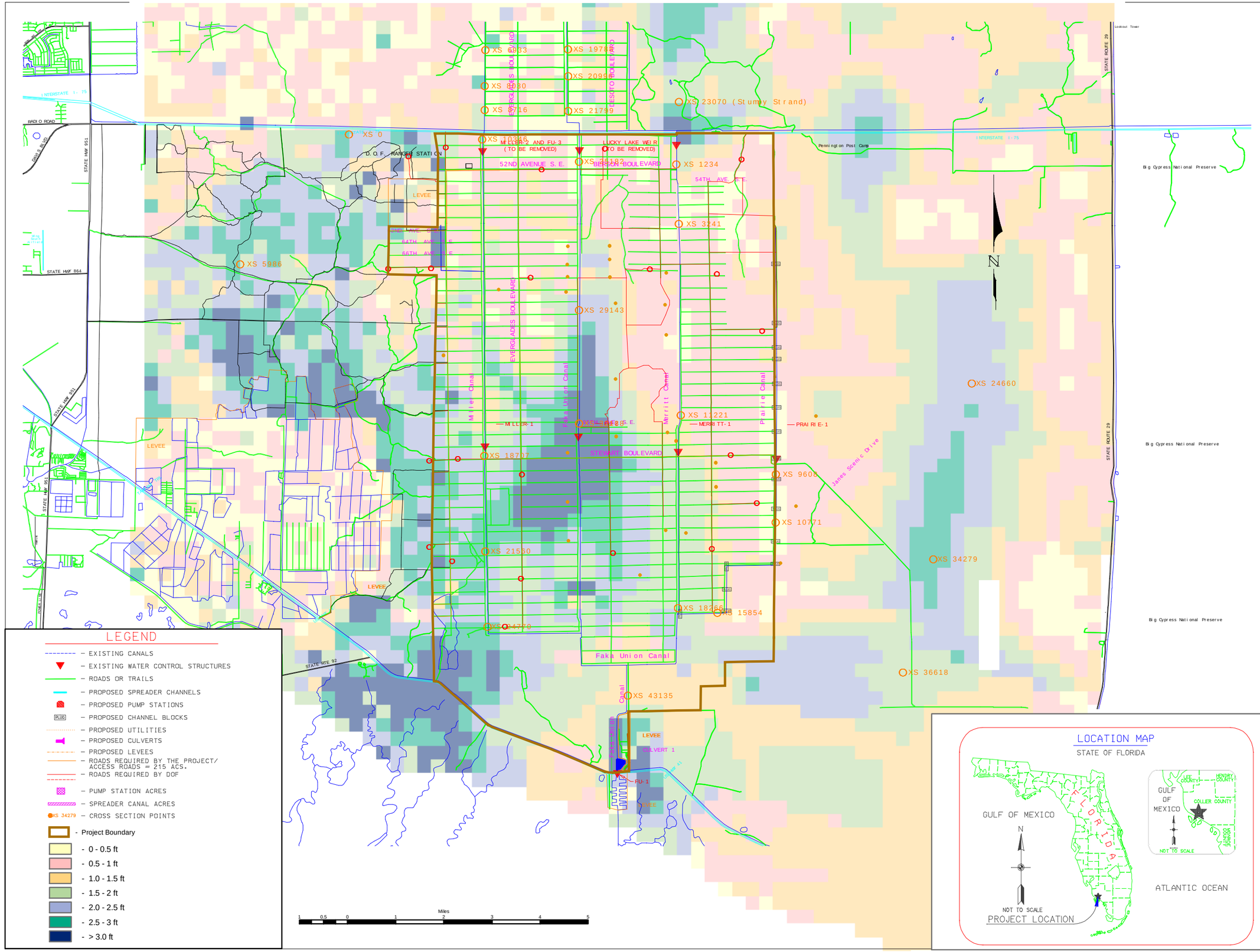
No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Inv. No. DACW17- - -
Dwn by: | Ckd by: | Dated: | Scale: AS SHOWN
Plot date: | Plot scale:
File name: | Reference files:
Dated: D. O. FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Alternative 6
10 Year Storm Event
Flooded Areas

Figure
A-184



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- XS 34279 – CROSS SECTION POINTS
- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Inv. No.DAOM27: - -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:

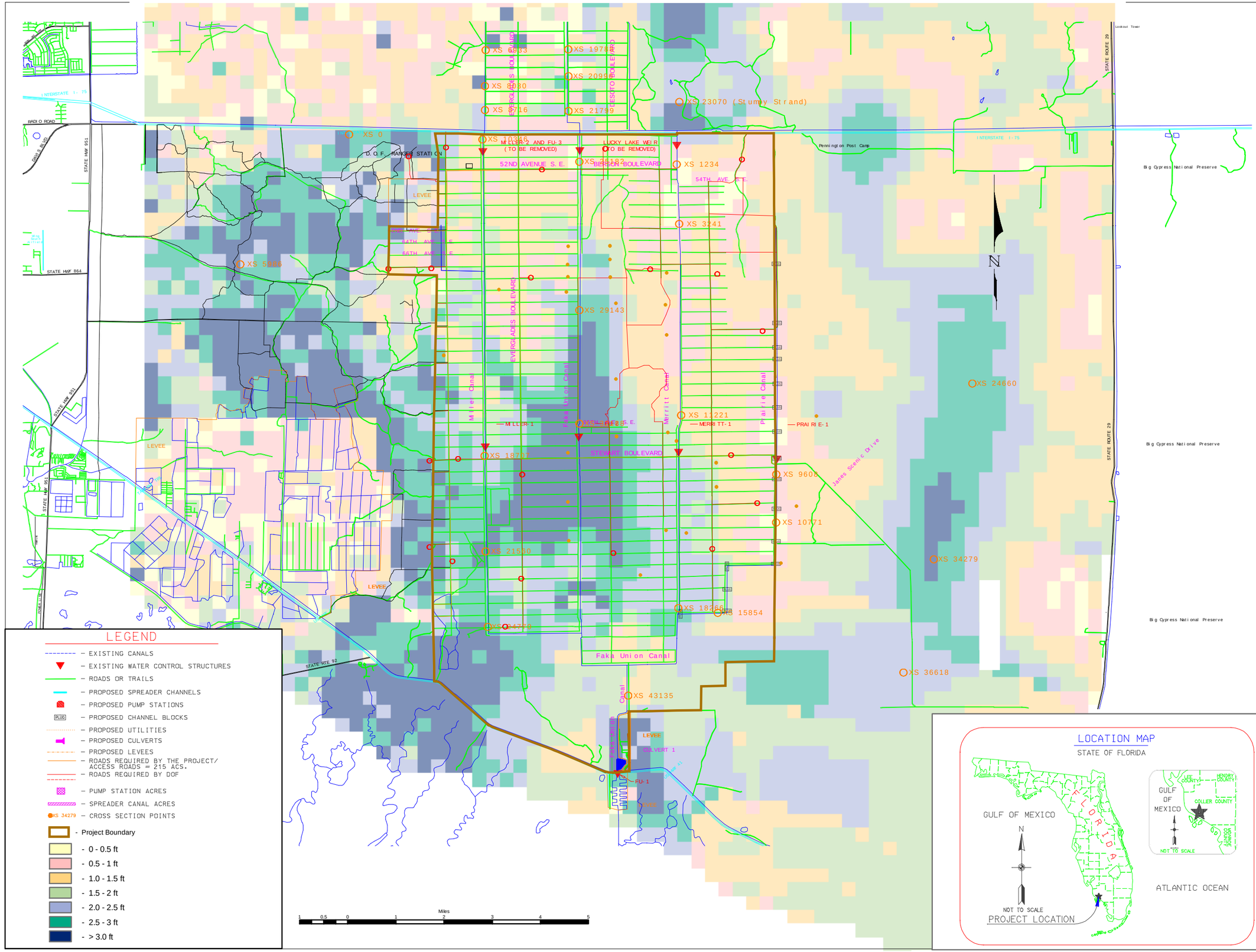
Designed by:
Drawn by:
Ckd by

File name:
Reference files:

Dated:
D. O. FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Alternative 6
25 Year Storm Event
Flooded Areas

Figure
A-185



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by: | Dwn by: | Ckd by: | Inv. No. DACW17- | Dated: | Scale: AS SHOWN | Plot date: | Plot scale:

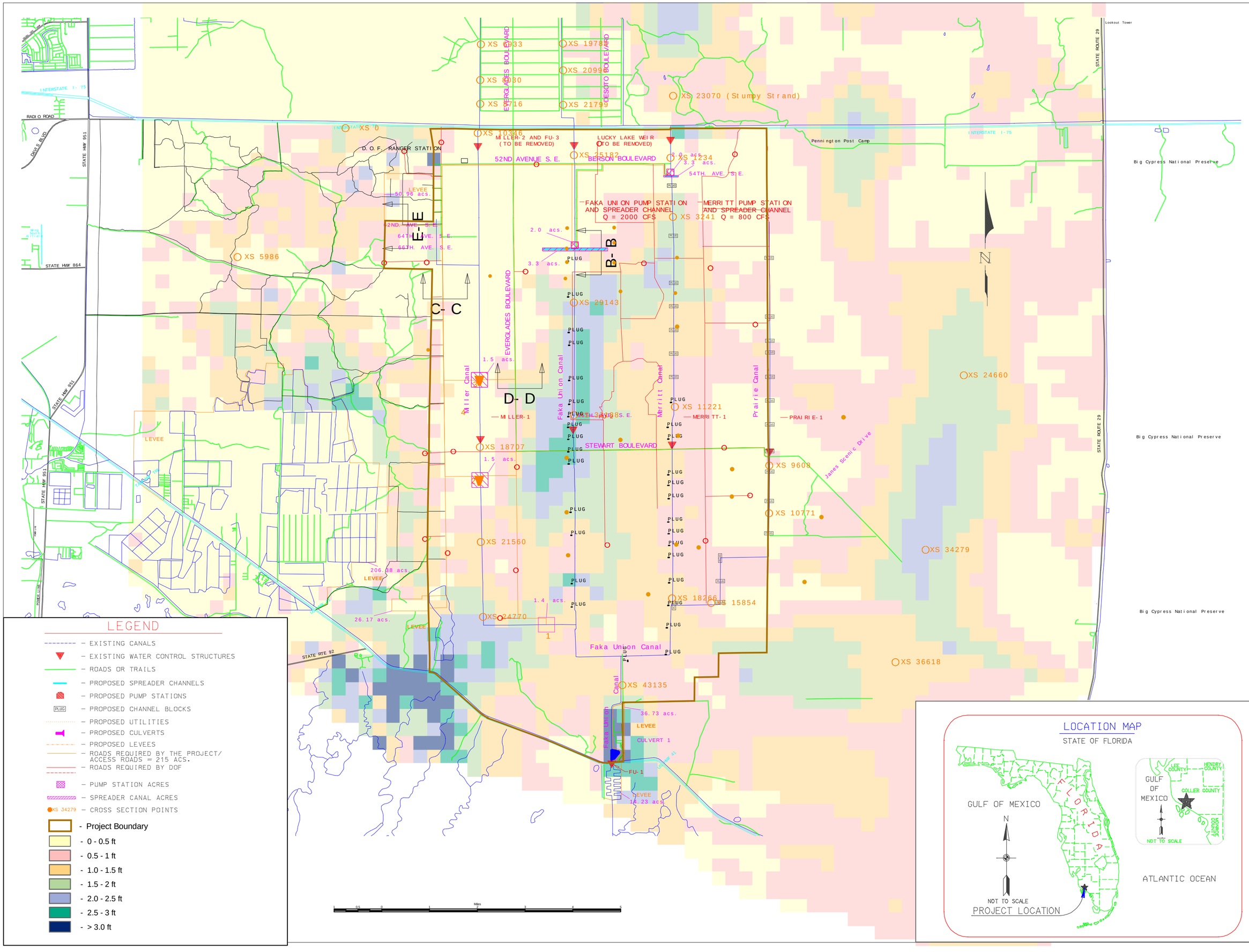
File name: | Reference files:

Dated: D.O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 6
100 Year Storm Event
Flooded Areas

Figure
A-186



LEGEND

- EXISTING CANALS
- EXISTING WATER CONTROL STRUCTURES
- ROADS OR TRAILS
- PROPOSED SPREADER CHANNELS
- PROPOSED PUMP STATIONS
- PROPOSED CHANNEL BLOCKS
- PROPOSED UTILITIES
- PROPOSED CULVERTS
- PROPOSED LEVEES
- ROADS REQUIRED BY THE PROJECT/ ACCESS ROADS = 215 ACS.
- ROADS REQUIRED BY DOF
- PUMP STATION ACRES
- SPREADER CANAL ACRES
- XS 34279 — CROSS SECTION POINTS

- Project Boundary
- 0 - 0.5 ft
- 0.5 - 1 ft
- 1.0 - 1.5 ft
- 1.5 - 2 ft
- 2.0 - 2.5 ft
- 2.5 - 3 ft
- > 3.0 ft

US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Inv. No. DACW17- - -
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:

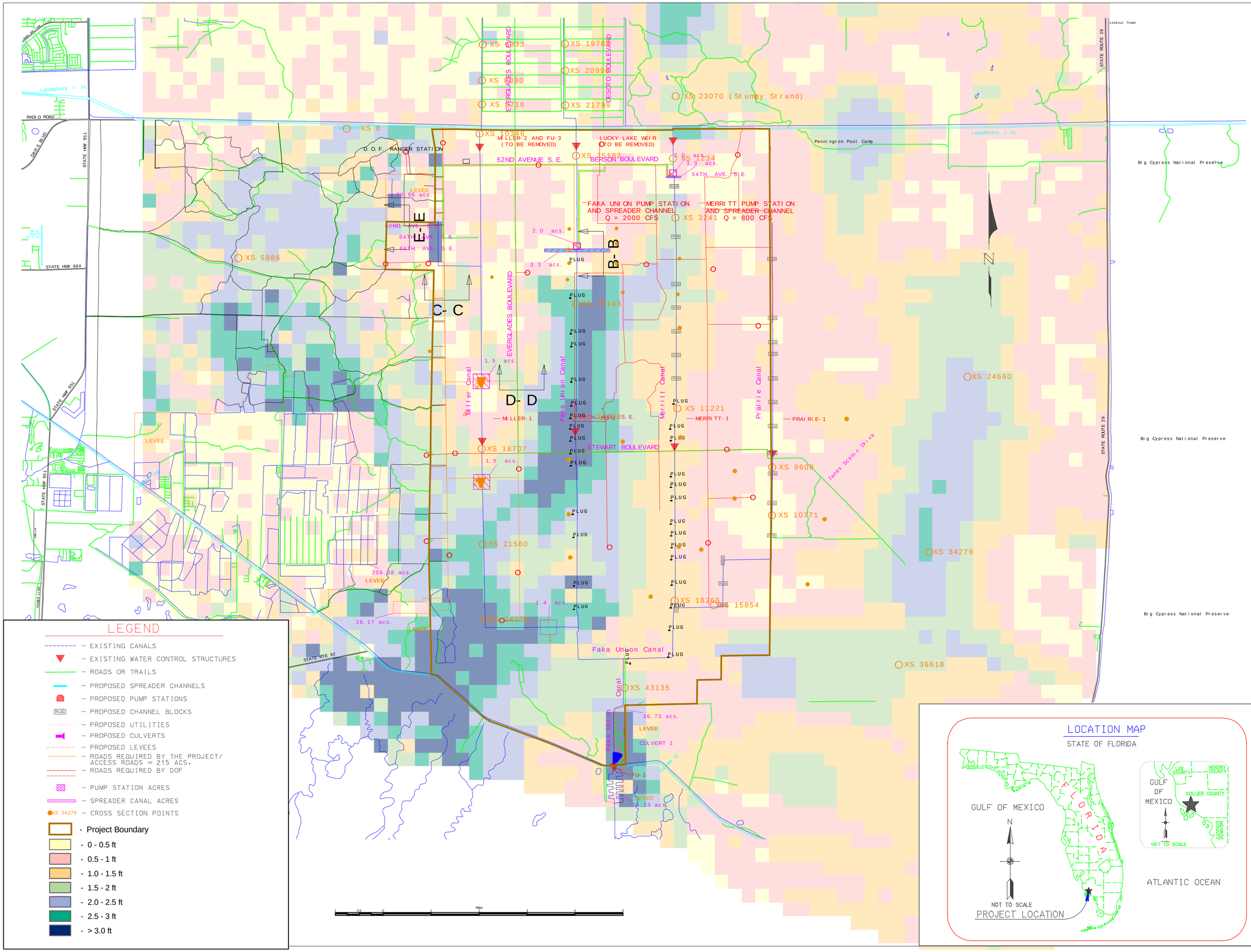
Designed by:
Drawn by:
Ckd by:

File name:
Reference files:

Dated:
D. O. FILE NO. - -

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
Savings Analysis Conditions
Alternative 12
Average Wet Season Maximum
Flooded Areas

Figure
A-187



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

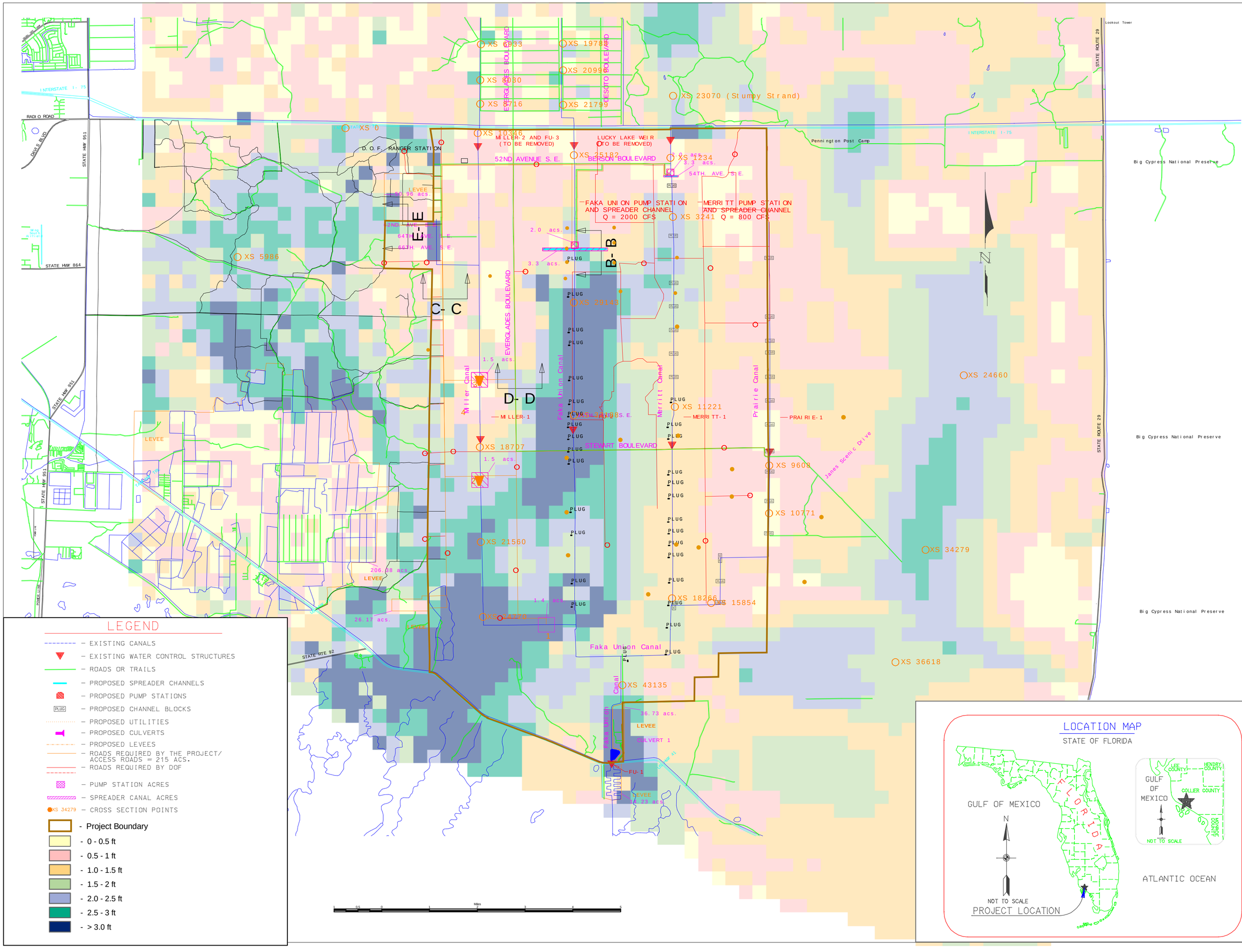
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Dwn by:
Ckd by:
Inv. No. DACW17-
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
File name:
Reference files:
Dated:
D. O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 12
10 Year Storm Event
Flooded Areas

Figure
A-188



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

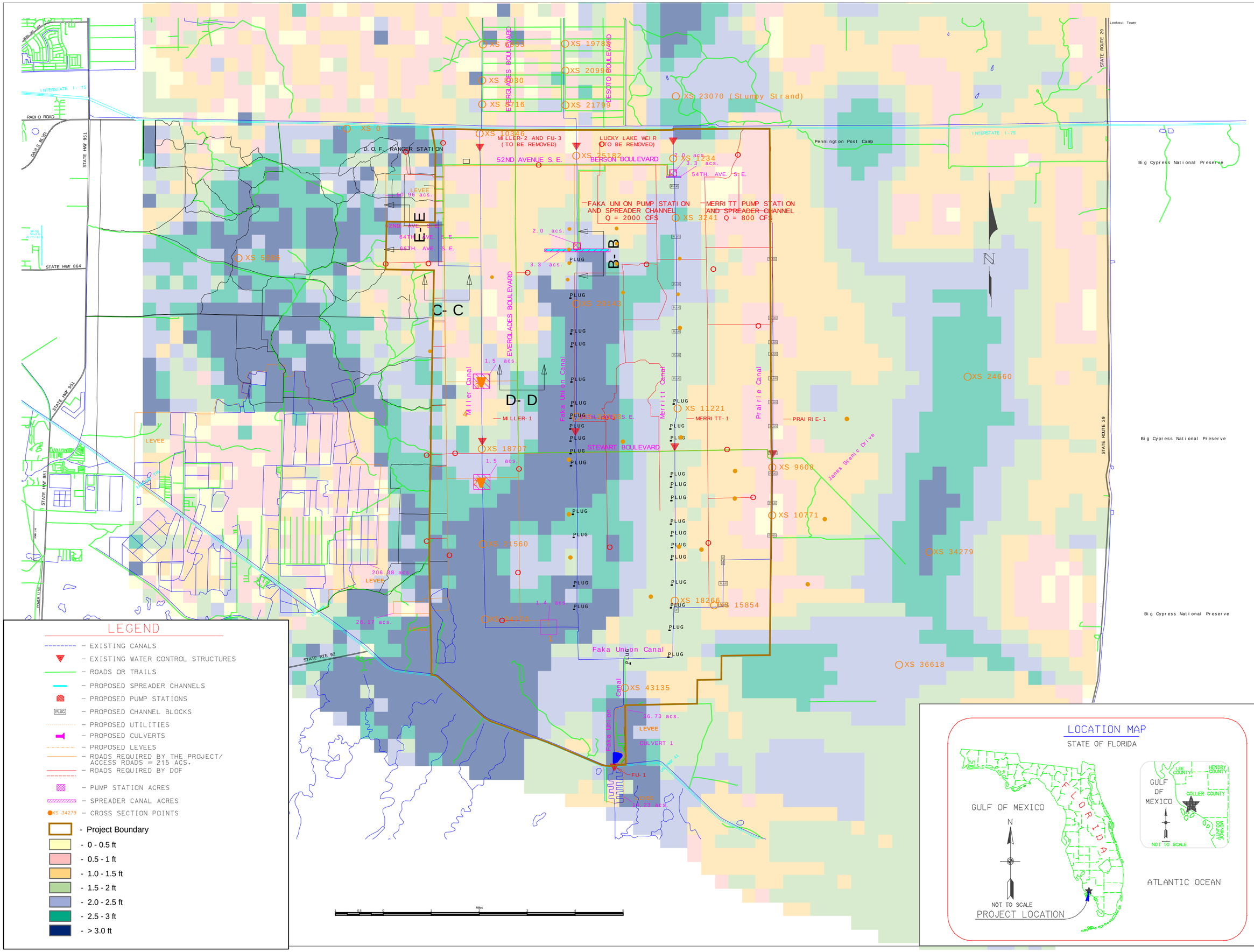
DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

File name:
Reference files:
Designed by:
Dwn by:
Ckd by:
Inv. No. DACW17-
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated:
D. O. FILE NO.

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 12
25 Year Storm Event
Flooded Areas

Figure
A-189



US Army Corps of Engineers
Jacksonville District

SAFETY ON THIS JOB DEPENDS ON YOU

No.	Symbol	Zone	Description	Approved

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

Designed by:
Dwn by:
Ckd by:
Inv. No. DACW17-
Dated:
Scale: AS SHOWN
Plot date:
Plot scale:
Dated: D. O. FILE NO.
File name:
Reference files:

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT

Savings Analysis Conditions
Alternative 12
100 Year Storm Event
Flooded Areas

Figure
A-190

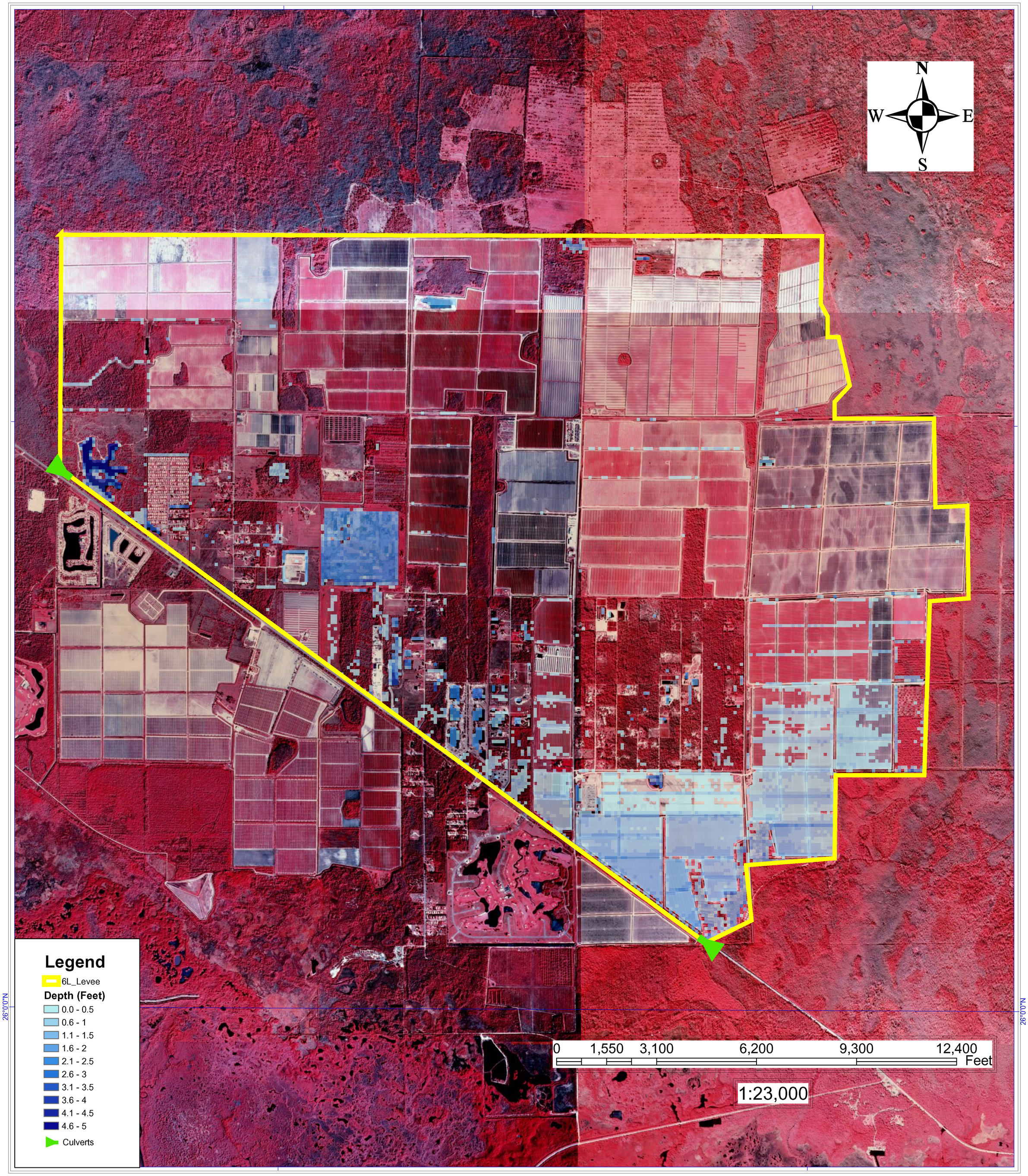


Figure A-191. 6L Levee {6L Levee} Residual Flooded Areas for 25-year Design Storm

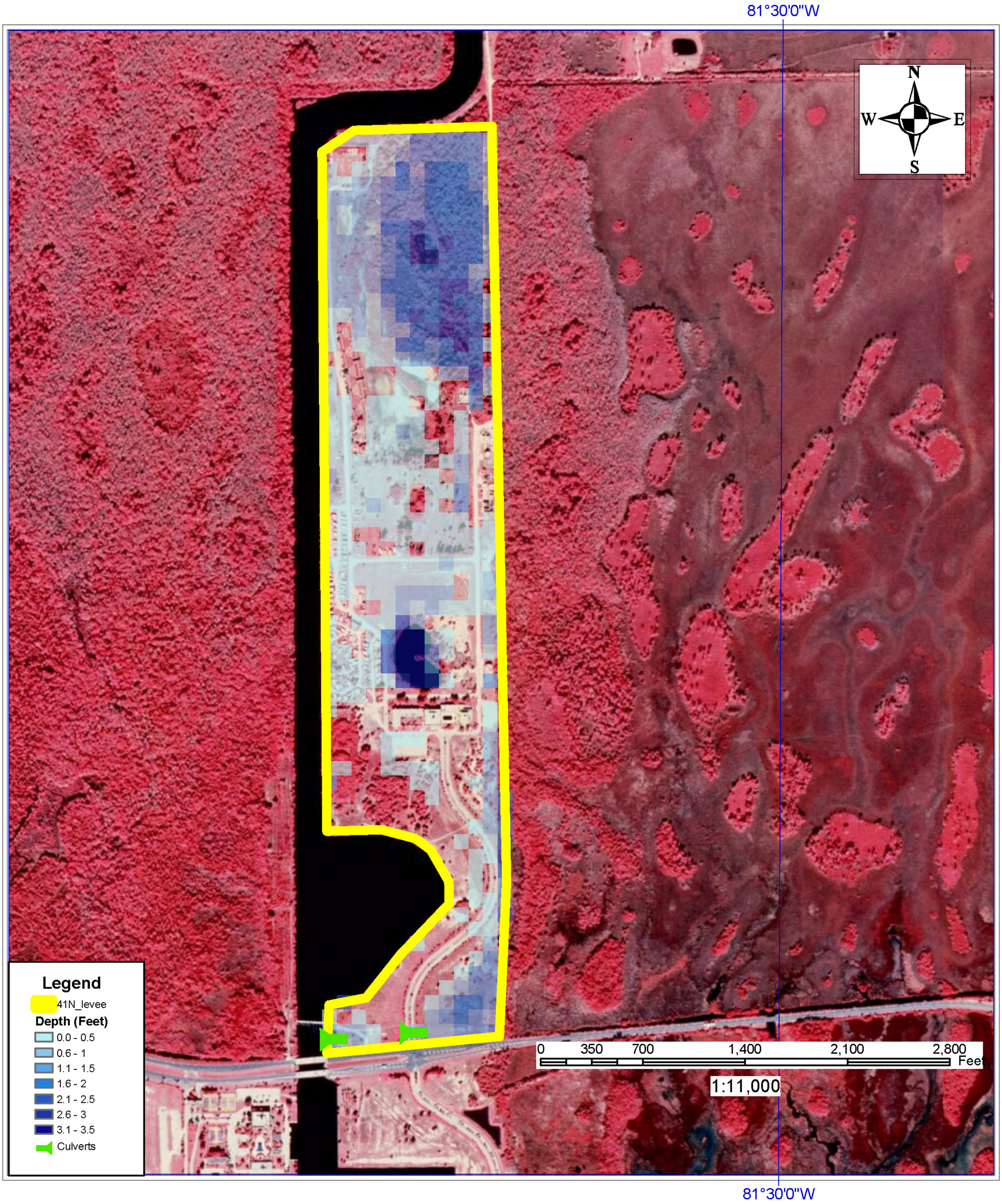


Figure A-192. 41 North Levee {41 N Levee} Residual Flooded Areas for 25-year Design Storm

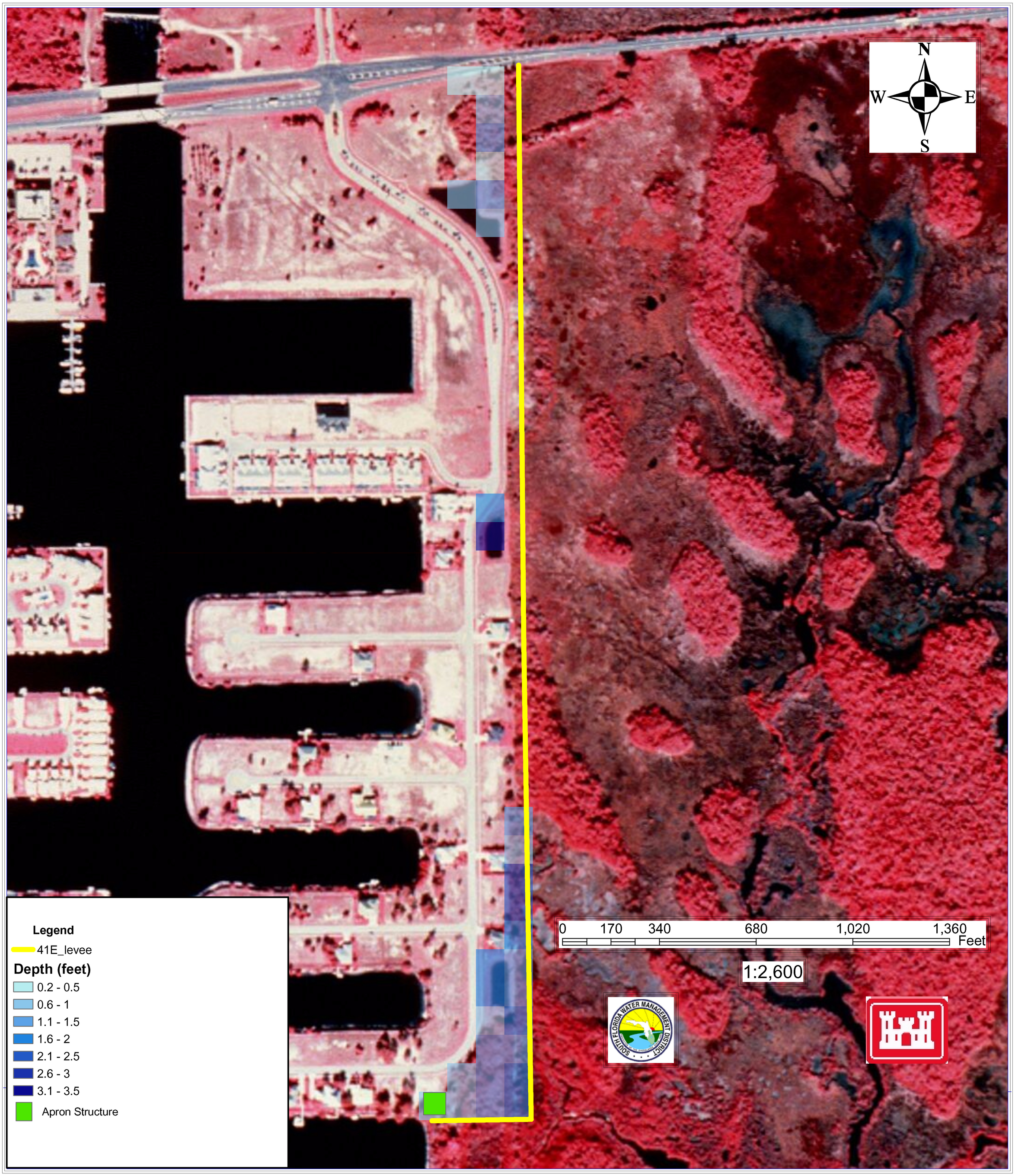
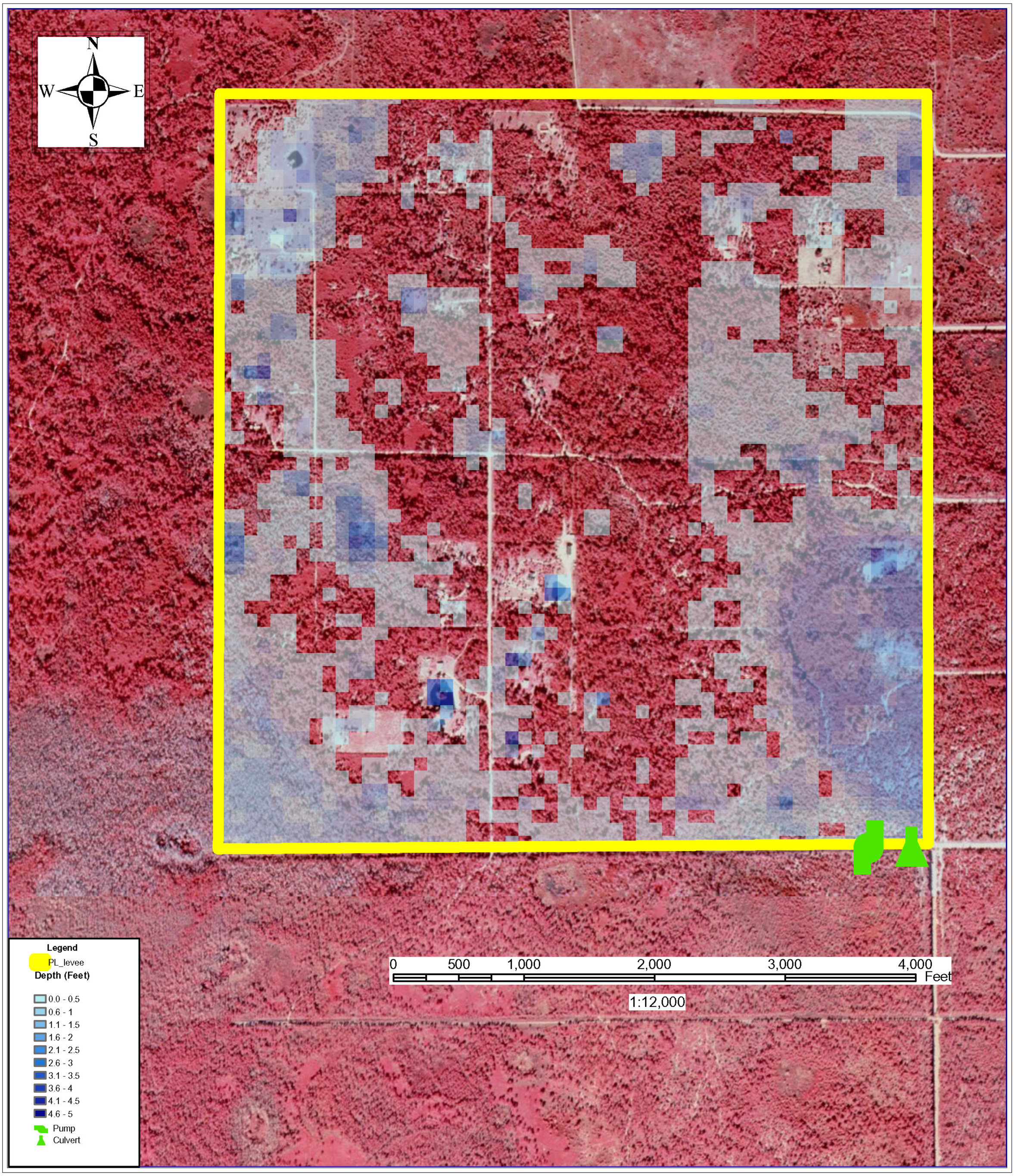


Figure A-193. 41 East Levee Residual Flooded Areas for 25-year Design Storm



Figure A-194. 41 West Levee Residual Flooded Areas for 25-year Design Storm



Figue A195. Private Lands Levee {PL Levee} Residual Flooded Areas for 25-year Design Storm

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Table A-1 – Model Components Applied for the BCB Model

Model Component	Simulates	Fully Dynamic Coupling with:	Dimension	Governing Equation
MIKE SHE OC	Overland sheet flow and water depth, depression storage	MIKE SHE SZ, UZ and MIKE 11	2-D	Saint-Venants equation (kinematic wave approximation)
MIKE 11	Fully dynamic river and canal hydraulics (flow and water level)	MIKE SHE SZ, OL	1-D	Saint-Venants equation (dynamic wave approximation)
MIKE SHE UZ	Flow and water content of the unsaturated zone, infiltration and groundwater recharge	MIKE SHE SZ, OL	1-D	Richard's equation / gravitational flow (no effects of capillary potential)
MIKE SHE ET	Soil and free water surface evaporation, plant transpiration	MIKE SHE UZ, OL	-	Kristensen & Jensen / Penman-Monteith
MIKE SHE SZ	Saturated zone (groundwater) flows and water levels	MIKE SHE UZ, OL, and MIKE 11	3-D	Boussinesqs' equation
MIKE SHE IR	Irrigation demands (soil water deficit) and allocation (surface water/ groundwater)	MIKE SHE SZ, MIKE 11	-	-
MIKE SHE PP	Pre- and post-processing	-	-	-

Table A-2. Vegetation Parameters.

Model Land Use Type	Growth Period	Leaf Area Index (-)	Root Depth (mm)	Crop Coef. Kc (-)	AROOT
Citrus	All year	4.5	1250	0.77-0.9047	0.25
Pasture	All year	3-4	750	0.7	0.5
Sugar Cane	All year	1-6	500-1500	0.665-1	0.25
Urban Low Density	All year	1-2	200	0.552-0.777	0.5
Urban Medium Density	All year	0.5-1	200	0.552-0.777	0.5
Urban High Density	All year	0.1-0.2	200	0.552-0.777	0.5
Truck Crops	All year	3-4.5	152-750	0.561-1	0.5
Golf Course	All year	2-3	750	0.552-0.777	0.75
Bare Ground	NA	0	0	1	0.25
Mesic Flatwood	All year	1.5-3	1219	0.246-0.82	1
Mesic Hammock	All year	2.5-4	610	0.246-0.82	1
Xeric Flatwood	All year	1-2	1219	0.221-0.738	0.5
Xeric Hammock	All year	2-3	610	0.221-0.738	0.5
Hydric Flatwood	All year	1.5-3	1219	0.237-0.79	1.5
Hydric Hammock	All year	2.5-4	610	0.237-0.711	1.5
Wet Prairie	All year	1.5-3	152	0.225-0.75	2
Dwarf Cypress	All year	1-2	152	0.22-0.734	1
Marsh	All year	2-4	152	0.254-0.845	2
Cypress	All year	2-4	1524	0.237-0.79	1
Swamp Forest	All year	3-5	1524	0.237-0.79	1
Mangrove	All year	3-4	1524	0.271-0.904	1
Water	NA	0	0	1	0.25

Table A-3 Annual time series and summary statistics of wet marsh potential evapotranspiration in inches estimated at 5 NOAA stations.

Year	La Belle	Ft Myers	Naples	Everglades City	Tamiami Trail
1965	56.57	57.96	59.53	62.05	60.80
1966	54.92	56.94	57.94	60.51	56.16
1967	58.40	56.46	59.36	60.73	63.63
1968	57.37	57.70	58.36	60.22	59.78
1969	56.72	53.86	58.11	60.46	56.65
1970	58.85	55.86	60.22	58.52	53.54
1971	61.77	57.34	61.43	60.25	61.22
1972	59.76	59.32	60.88	58.41	58.83
1973	57.06	59.23	61.91	60.27	59.57
1974	58.07	59.90	62.95	60.58	60.10
1975	58.97	59.61	62.70	58.42	59.04
1976	57.73	59.14	62.31	60.21	56.12
1977	58.69	57.89	61.44	59.61	57.40
1978	58.38	57.57	59.82	59.58	55.98
1979	56.35	57.93	60.48	57.97	58.29
1980	57.67	58.56	60.36	58.80	59.75
1981	59.41	60.05	63.16	60.43	62.67
1982	55.33	56.76	60.70	57.69	60.47
1983	54.48	54.26	59.79	57.51	57.95
1984	55.53	56.73	58.12	60.35	56.93
1985	56.87	58.30	57.75	60.30	61.93
1986	56.85	59.85	58.34	61.27	57.20
1987	55.08	58.74	56.96	60.21	56.57
1988	56.33	60.61	58.36	63.59	57.99
1989	57.56	61.41	58.70	56.99	64.46
1990	56.37	60.83	58.71	56.90	63.73
1991	55.61	58.12	56.90	59.62	59.45
1992	54.66	58.23	57.35	57.69	59.79
1993	54.35	57.82	57.95	60.45	54.22
1994	56.24	57.11	55.85	59.39	56.36
1995	54.83	55.46	55.62	58.75	54.22
1996	54.60	57.27	58.11	62.45	58.31
1997	55.18	59.45	56.89	59.47	57.63
1998	53.60	56.51	56.33	56.20	56.44
1999	56.08	57.63	56.67	57.31	56.16
2000	55.22	58.85	57.49	58.12	56.67
Ann Ave	56.71	58.04	59.10	59.48	58.50
Stdev	1.81	1.71	2.07	1.63	2.70
Max	61.77	61.41	63.16	63.59	64.46
Min	53.60	53.86	55.62	56.20	53.54
Kr	0.158	0.179	0.176	0.190	0.179

Table A-4. Land Use Types in the Model and Corresponding FLUCCS Codes.

Model Land Use Type	MIKE SHE Code	FLUCCS Code (Level)
Citrus	1	220
Pasture	2	210 (3), 242
Sugar Cane	3	2156
Urban Low Density	41	110 (2), 180 (2), 192, 193, 240 (3), 241, 243, 245, 246, 250 (2)
Urban Medium Density	42	1009, 120 (2), 144, 833, 834
Urban High Density	43	130 (2), 140 (2), 150 (3), 151, 155, 170 (2), 810 (2), 820 (2), 830 (2), 152, 153, 154, 159
Truck Crops	5	214, 215
Golf Course	6	182
Bare Ground	7	160 (3), 161, 162, 163, 182, 230 (2), 261, 740 (3), 742, 744, 835
Mesic Flatwood	8	190 (3), 191, 194, 260 (3), 310 (2), 321, 330 (2), 410 (3), 411, 414, 429, 435, 440 (3), 441, 443, 710 (2), 720 (2), 741
Mesic Hammock	9	420 (3), 422, 423, 426, 427, 434, 437, 438, 439
Xeric Flatwood	10	412, 413
Xeric Hammock	11	322, 421, 432
Hydric Flatwood	12	4119, 419, 624
Hydric Hammock	13	329, 424, 425, 428, 433, 610 (3), 611, 743
Wet Prairie	14	643, 6439
Dwarf Cypress	15	6219
Marsh	16	6171, 6172, 640 (3), 641, 6411, 6412, 644
Cypress	17	620 (3), 621, 6218, 745
Swamp Forest	18	613, 614, 615, 616, 617, 630 (2)
Mangrove	19	612, 642
Water	20	166, 500 (1)

Table A-5 Basic Operating Schedule - Big Cypress Basin Water Control Structures							
Serial #	Structure	Type	Weir Crest Elevation	Operating Elevations Feet NAVD 88			
				Wet Season		Dry Season	
			Feet NAVD 88	Open at	Close at	Open at	Close at
1	Golden Gate Canal Weir #1	Movable Crest Weir	0.70/2.05	2.55	1.20	2.55	1.45
2	Golden Gate Canal Weir #2	Fixed Crest with 2 Gates	3.70	4.20	3.70	4.70	3.95
3	Golden Gate Canal Weir #3	Fixed Crest with 2 Gates	6.20	6.70	6.20	7.20	6.45
4	Golden Gate Canal Weir #4	Fixed Crest with 2 Gates	8.20	8.70	8.20	9.20	8.45
5	Golden Gate Canal Weir #5	Fixed Crest with 2 Gates	9.20	9.70	9.20	10.20	9.45
6	Golden Gate Canal Weir #6	Fixed Crest with V-Notch	10.80	11.30	10.80	11.80	11.05
7	Golden Gate Canal Weir #7	Fixed Crest with V-Notch	11.80	12.30	11.80	12.80	12.05
8	I-75 Canal Weir #1	Fixed Crest with 1 Gate	4.90	5.40	4.90	5.90	5.15
9	I-75 Canal Weir #2	Fixed Crest with 2 Gates	6.70	7.20	6.70	7.70	6.95
10	I-75 Canal Weir #3	Fixed Crest with 2 Gates	8.70	9.20	8.70	9.70	8.95
11	Cypress Canal Weir 4A1	Fixed Crest with 2 Gates	8.20	8.70	8.20	9.20	8.45
12	Airport Road Canal North	Amil Gate	7.20	6.20		7.20	
13	Airport Road Canal South	Amil Gate	7.20	6.20		7.20	
14	Faka Union Canal Weir #1	Fixed Crest	0.70				
15	Faka Union Canal Weir #2	Fixed Crest with Steel Gates	2.57	4.90	3.90	4.90	4.40
16	Faka Union Canal Weir #3	Fixed Crest with V-Notch	4.89	5.39	4.89	5.89	5.14
17	Faka Union Canal Weir #4	Fixed Crest with Steel Gates	7.91	10.21	9.21	11.21	10.21
18	Faka Union Canal Weir #5	Fixed Crest Sheet Pile Weir	10.70	12.20	10.70	12.70	11.70
19	Faka Union Canal Weir #6	Fixed Crest with V-Notch	13.20	13.70	13.20	14.20	13.45
20	Faka Union Canal Weir #7	Fixed Crest with V-Notch	15.40	15.90	15.40	16.40	15.65
21	Miller Canal Weir #1	Fixed Crest with Steel Gates	2.85	3.70	2.70	3.70	3.20
22	Miller Canal Weir #2	Fixed Crest with V-Notch	4.89	5.39	4.89	5.89	5.15
23	Miller Canal Weir #3	Fixed Crest with V-Notch	9.20	9.20	8.20	9.20	8.70
24	Lucky Lake Weir	Fixed Crest with 2 Steel Gates	3.20	5.70	5.20	8.50	8.00
25	Merritt Canal Weir #1	Adjustable Concrete Blocks	7.72	4.20	2.70	5.20	4.20

Table A-5 continued - Basic Operating Schedule – Big Cypress Basin Water Control Structures							
Serial #	**Structure**	**Type**	**Weir Crest**	**Operating Elevations Feet NAVD 88**			
			Elevation	**Wet Season**		**Dry Season**	
			Feet NAVD 88	**Open at**	**Close at**	**Open at**	**Close at**
26	Prairie Canal Weir #1	Adjustable Steel Plates	7.75	4.20	2.70	5.20	4.20
27	Henderson Creek Weir #1	Gated Spillway	3.70	3.70	3.20	4.70	4.20
		Flap Gate	-0.80	4.45	4.20	4.45	4.20
		East Side Channel	2.22	3.70	2.70	4.70	4.20
		West Side Channel	2.15	3.20	2.15	3.70	3.20
28	Cocohatchee Canal Weir #1	Gated Spillway	5.20	4.70	3.20	4.90	3.90
29	Cocohatchee Canal Weir #2	Gated Spillway	8.70	7.20	6.20	8.20	7.20
30	Cocohatchee Canal Weir #3	Gated Spillway	10.70	10.20	8.70	10.50	9.50
31	S.R. 29 Canal Weir #1	Fixed Crest with Removable Steel Sheet	1.91*	1.41	-0.09	1.91	0.91
32	S.R. 29 Canal Weir #2	Fixed Crest with Removable Steel Sheet	2.26*	1.76	0.26	2.26	1.26
33	S.R. 29 Canal Weir #3	Fixed Crest with Removable Steel Sheet	4.14*	3.64	2.14	4.14	3.14
34	S.R. 29 Canal Weir #4	Fixed Crest with Removable Steel Sheet	6.61*	6.11	4.61	6.61	5.61
35	S.R. 29 Canal Weir #5	Fixed Crest with Removable Steel Sheet	9.92*	9.42	7.92	9.92	8.92
36	S.R. 29 Canal Weir #6	Fixed Crest with Removable Steel Sheet	10.10*	9.60	8.10	10.10	9.10
37	S.R. 29 Canal Weir #6A	Gated Weir	9.70	9.20	8.20	9.70	9.20
38	S.R. 29 Canal Weir #6B	Gated Weir	9.70	9.20	8.20	9.70	9.20
39	S.R. 29 Canal Weir #7	Fixed Crest with Removable Steel Sheet	9.84*	9.34	7.84	9.84	8.84
40	S.R. 29 Canal Weir #8	Fixed Crest with Removable Steel Sheet	10.63*	10.13	8.63	10.63	9.63

*Elevation of top of concrete headwall, not weir crest

Table A-6 – Canal and River Manning's n Values

River	Chainage (ft)	Manning's n	River	Chainage (ft)	Manning's n
AirportRdN	1,568	0.035	CorkScrewCan	2,943	0.035
AirportRdN	11,566	0.035	CorkScrewCan	32,856	0.035
AirportRdS	0	0.035	CorkscrewN	0	0.050
AirportRdS	28,259	0.035	CorkscrewN	27,488	0.050
BirdRookry	0	0.667	CorkscrewS	0	0.667
BirdRookry	33,548	0.667	CorkscrewS	36,757	0.667
BonBeach	0	0.040	CorkscrwNE	0	0.050
BonBeach	22,937	0.040	CorkscrwNE	19,817	0.050
C1-connector	0	0.035	CorkscrwSE	0	0.500
C1-connector	8,534	0.035	CorkscrwSE	35,579	0.500
CocohatcheeEast	0	0.035	CorkTribCan	0	0.035
CocohatcheeEast	10,138	0.035	CorkTribCan	7,218	0.035
CocohatcheeWest	0	0.035	CR951	0	0.035
CocohatcheeWest	57,418	0.035	CR951	38,742	0.035
CocohatcheeWest	60,699	0.100	CurryCan	0	0.035
CocohatcheeWest	62,664	0.200	CurryCan	10,539	0.035
Connection7	0	0.035	CypressCan	0	0.035
Connection7	394	0.035	CypressCan	41,390	0.035
Connection8	0	0.035	EastCan	0	0.500
Connection8	394	0.035	EastCan	19,007	0.200
Cork2	0	0.035	Fakahatchee Strand	0	0.500
Cork2	10,014	0.035	Fakahatchee Strand	162,971	0.500
CorkIrrCan1	0	0.050	FakaUnionCan	0	0.035
CorkIrrCan1	12,865	0.050	FakaUnionCan	174,516	0.035
CorkIrrCan2	0	0.050	GoldenGateBr	0	0.035
CorkIrrCan2	14,774	0.050	GoldenGateBr	7,792	0.035
CorkIrrCan3	0	0.050	GoldenGate Main	0	0.035
CorkIrrCan3	10,440	0.050	GoldenGate Main	95,149	0.035
Corkscrew	17,032	0.500	GoldenGate Main	96,255	0.029
Corkscrew	98,151	0.500	GoldenGate Main	111,977	0.029
Corkscrew	103,545	0.200	GoldenGate Main	113,195	0.029
Corkscrew	121,509	0.200	GoldenGate Main	150,034	0.029
GrMeadows	0	0.125	ImmokaleeS	0	0.500
GrMeadows	103,355	0.200	ImmokaleeS	41,019	0.500

Table A-6 Continued– Canal and River Manning's n Values

River	Chainage (ft)	Manning's n	River	Chainage (ft)	Manning's n
GrMeadows	103,699	0.200	Imperial	0	0.100
GrMeadowsS	0	0.333	Imperial	41,173	0.100
GrMeadowsS	17,356	0.333	ImpTrib75	0	0.067
HarveyCan	0	0.035	ImpTrib75	3,041	0.067
HarveyCan	27,816	0.035	KehlCan	0	0.040
HendersonCr	5,282	0.040	KehlCan	31,101	0.040
HendersonCr	19,686	0.040	MerrittCan	0	0.035
HendersonCr	40,934	0.050	MerrittCan	71,345	0.035
HendersonStrand	0	0.333	MillerCan	0	0.035
HendersonStrand	42,653	0.200	MillerCan	91,304	0.035
HendersonStrand	46,918	0.100	OakCreek	0	0.067
HendersonStrand	65,213	0.100	OakCreek	11,871	0.067
I-75Can	0	0.035	OkaloaCon	0	0.333
I-75Can	40,071	0.035	OkaloaCon	13,032	0.333
I75N-1	0	0.035	Orange	0	0.035
I75N-1	4,265	0.035	Orange	10,558	0.035
I75N-2	0	0.035	OrangeCreek	0	0.067
I75N-2	9,843	0.035	OrangeCreek	0	0.035
I75N-3	0	0.035	OrangeCreek	8,455	0.067
I75N-3	10,171	0.035	OrangeCreek	8,455	0.035
I75N-4	0	0.035	PrairieCan	0	0.035
I75N-4	9,843	0.035	PrairieCan	55,964	0.035
I75S-1	0	0.035	SR29	0	0.064
I75S-1	4,265	0.035	SR29	207,149	0.064
I75S-2	0	0.035	StumpyStrand	1,831	0.500
I75S-2	9,843	0.035	StumpyStrand	78,728	0.500
I75S-3	0	0.035	WestCan	0	0.500
I75S-3	10,171	0.035	WestCan	36,872	0.200
I75S-4	0	0.035			
I75S-4	9,843	0.035			

Table A-7. Soil Profile Definition and Soil Parameters

Profile No. and MSHE Code	Soil Type and Depth	Saturated Hydraulic Conductivity K_s [m/s]	Saturated Water Content Θ_s	Water Content at Field Capacity Θ_{fc}	Water Content at Wilting Point Θ_w	Residual Water Content Θ_r
1	Immokalee A1 (0.0-0.1 m)	2.0e-4	0.42	0.15	0.013	0.01
	Immokalee AE (0.1-0.23 m)	1.1e-4	0.42	0.15	0.02	0.031
	Immokalee E1 (0.23-0.41 m)	8.6e-5	0.39	0.14	0.02	0.015
	Immokalee E2 (0.41-0.91 m)	1.0e-4	0.38	0.14	0.01	0.01
	Immokalee Bh1(0.91-1.27 m)	1.2e-6	0.38	0.33	0.057	0.031
	Immokalee Bh2 (1.27-1.4 m)	6.1e-6	0.38	0.28	0.05	0.043
	Immokalee Bw/Bh (1.4-30 m)	7.5e-5	0.38	0.20	0.03	0.02
2	Boca A (0.0-0.08 m)	1.1e-4	0.487	0.11	0.04	0.029
	Boca E1 (0.08-0.23 m)	9.7e-5	0.46	0.11	0.034	0.023
	Boca E2 (0.23-0.36 m)	8.0e-5	0.408	0.09	0.024	0.015
	Boca Bw (0.36-0.64 m)	5.4e-5	0.396	0.10	0.009	0.006
	Boca Btg (0.64-30 m)	8.3e-7	0.347	0.33	0.122	0.071
3	Riviera Ap (0-0.15 m)	1.2e-6	0.38	0.23	0.049	0.031
	Riviera A (0.15-0.28 m)	4.2e-5	0.52	0.22	0.047	0.02
	Riviera E1 (0.28-0.41 m)	5.0e-5	0.46	0.12	0.022	0.01
	Riviera E2 (0.41-0.64 m)	5.5e-5	0.4	0.06	0.003	0.001
	Riviera Bw (0.64-0.74 m)	3.5e-5	0.38	0.06	0.004	0.001
	Riviera Btg (0.74-30 m)	2.5e-7	0.38	0.32	0.102	0.08
4	Sanibel Oa1 (0-0.12 m)	2e-5	0.752	0.72	0.207	0.2
	Sanibel Oa2 (0.12-0.15 m)	7.8e-5	0.73	0.69	0.205	0.1
	Sanibel A1 (0.15-0.23 m)	9.4e-5	0.51	0.39	0.025	0.01
	Sanibel A2 (0.23-0.3 m)	1.7e-4	0.41	0.17	0.013	0.01
	Sanibel C1 (0.3-0.66 m)	1.4e-4	0.37	0.09	0.013	0.01
	Sanibel C2 (0.66-30 m)	1.1e-4	0.38	0.08	0.011	0.01
5	Winder A1 (0.0-0.08 m)	3.6e-5	0.374	0.26	0.024	0.014
	Winder E (0.08-0.33 m)	5.7e-5	0.37	0.15	0.008	0.004
	Winder B/E (0.33-0.41 m)	1.6e-6	0.328	0.23	0.048	0.027
	Winder Btg (0.41-0.58 m)	7.4e-6	0.43	0.40	0.153	0.101
	Winder BCg (0.58-0.74 m)	7.4e-6	0.34	0.26	0.05	0.028
	Winder C1 (0.74-0.89 m)	4.1e-6	0.332	0.27	0.038	0.021
	Winder C2 (0.89-1.04 m)	5.0e-6	0.347	0.23	0.042	0.024
	Winder C3 (0.89-30 m)	1.9e-6	0.355	0.31	0.107	0.062
6	Plantation Oap (0-0.23 m)	1.6e-4	0.86	0.56	0.164	0.1
	Plantation A/E (0.23-0.48 m)	8.4e-5	0.491	0.19	0.029	0.022
	Plantation Bw (0.48-30 m)	1.2e-4	0.392	0.10	0.003	0.002

Table A-8. Correlation between landscape type and associated soil type.

Vegetation Code*	Vegetation Type**	MSHE Code	Soil Name
15	Xeric Flatwood	1	Immokalee
16	Xeric Hammock		
8	Mesic Flatwood and Mesic Hammock North portion		
4	Hydric Flatwood and Hydric Hammock North portion		
99	XX		
3	Disturbed		
9	Mesic Flatwood and Mesic Hammock South portion	2	Boca
5	Hydric Flatwood and Hydric Hammock South portion		
14	Wet Prairie South portion		
10	Dwarf Cypress and Scrub Cypress		
2	Cypress South portion		
14	Wet Prairie North portion	3	Riviera
11	Swamp Forest North portion	4	Sanibel
7	Marsh		
13	Open Water		
6	Mangrove		
2	Cypress North portion	5	Winder
11	Swamp Forest South portion	6	Plantation
12	Tidal Marsh		
1	Beach		

* The vegetation code refers to the pre-development vegetation map prepared by the SFWMD, 2003. ** North and South portions refer to a line dividing southwest Florida delineated by the SFWMD.

Table A-9. Hydro-Geological Parameters in the BCB Model

Model layer	Horizontal K (m/s)	Vertical K (m/s)	Specific Yield (-)	Storage Coeff. (1/m)
1	$5 \cdot 10^{-8}$ – $3.9 \cdot 10^{-2}$	$2.3 \cdot 10^{-10}$- $1 \cdot 10^{-3}$	0.099 - 0.2	$9.9 \cdot 10^{-6}$ - $1 \cdot 10^{-5}$
2	$9.7 \cdot 10^{-11}$ – 0.01	$9.7 \cdot 10^{-11}$- $7 \cdot 10^{-5}$	0.1 - 0.2	$9.9 \cdot 10^{-6}$ - $1 \cdot 10^{-5}$
3	$1.4 \cdot 10^{-6}$- $2.8 \cdot 10^{-3}$	$6.2 \cdot 10^{-9}$- $1.8 \cdot 10^{-5}$	0.2	$9.9 \cdot 10^{-6}$ - $1 \cdot 10^{-5}$

Table A-10 List of Model Input and Parameters for MIKE SHE

Model Component	Model Input	Model Parameters
MIKE SHE SZ Saturated zone flow	Geological model (lithological information Boundary conditions Drainage depth (drain maps) Wells and withdrawal rate	$K_{h,}$ Horizontal hydraulic conductivity $K_{v,}$ Vertical hydraulic conductivity S, confined storage coefficient S , unconfined storage coefficient Drainage time constant
MIKE SHE UZ Unsaturated zone flow	Map of characteristic soil types Hydraulic Conductivity Curves Retention curves	Ks, saturated hydraulic conductivity □s Saturated water content □$_{res}$ Residual water content □$_{eff}$ Effective saturation water content pFc, Capillary pressure at field capacity pFw, Capillary pressure at wilting point n, Exponent of hydraulic conductivity curve
MIKE SHE ET Evapotranspiration	Time series of vegetation Leaf Area Index Time series of vegetation root depth	C_1, C_2, C_3 : Empirical parameters C_{int} : Interception parameter A_{root} :Root mass parameter Kc : Crop coefficient
MIKE SHE OC Overland and river/canal flow (MIKE11)	Topographical map Boundary conditions Digitized river/canal network River/canal cross sections	M, Overland Manning no. D , Detention storage L, leakage coefficient M, River/canal Manning no.
MIKE SHE IRR Irrigation module	Irrigated areas Irr. sources (pumps/canals/reservoirs) Distribution method (sheet, sprinkler, drip) Source capacity	Eact/Epot, crop water stress factor (target ratio between actual and potential evapotranspiration rates) Well threshold

Table A-11 Primary Parameters Adjusted During Calibration

Model component	Calibration parameters	Parameter range
MIKE SHE SZ – Saturated zone flow	K_v: Vertical hydraulic conductivity (m/s) K_H/K_v Drainage time constant (s^{-1}) Drain level (m) Boundary head conditions: Northern Boundary (-) Eastern Boundary Tidal Boundary	$9.7 \cdot 10^{-11}$- $1 \cdot 10^{-3}$ 1 - 1000 $2.9 \cdot 10^{-6}$- 0.00 -1.62 – 13.30 Time Varying No Flow Fixed Head
MIKE SHE OC – Overland and river/canal flow (MIKE11)	M, Overland Manning no. $m^{1/3}/s$ D , Detention storage (mm) L, leakage coefficient (s^{-1}) Canal M (Reverse of Manning's n) ($m^{1/3}/s$) Floodplains M ($m^{1/3}/s$)	0 - 2 50 - 100 $9.9 \cdot 10^{-7}$ – $9.9 \cdot 10^{-5}$ 2 - 35 2 - 35

Table A-12 Groundwater Model Errors at Various Stations During Calibration

		BCB 2003
Well	**Plot no.**	**Abs mean error [ft]**
c-1079	1	3.004
c-1004	2	1.673
c-1064	3	0.866
c-1071	4	1.573
c-1072	5	2.069
c-131	6	1.753
c-296	7	0.617
c-391	8	0.503
c-392	9	0.472
c-460	10	1.059
c-462	11	NA
c-492	12	0.350
c-496	13	0.085
c-503	14	0.156
c-531	15	0.408
c-598	16	0.217
c-599	17	NA
c-600	18	1.853
c-690	19	0.428
c-951	20	1.606
c-953	21	0.466
c-968	22	0.762
c-969	23	0.165
c-988	24	0.043
FP2	25	6.568
FP3	26	0.244
FP4	27	0.078
Hpot_49_GW1	28	0.029
Hpot_49_GW10	29	0.771
Hpot_49_GW11	30	2.038
Hpot_49_GW12	31	1.251
Hpot_49_GW13	32	3.536
Hpot_49_GW14	33	0.090
Hpot_49_GW15	34	1.891
Hpot_49_GW3	35	NA
Hpot_49_GW5	36	1.030
Hpot_49_GW6	37	0.644
Hpot_49_GW7	38	0.513
Hpot_49_GW8	39	0.193
Hpot_49_GW9	40	0.847
Hpot_49L_GW1	41	0.563
L_2194	42	2.446
L-2195	43	0.485

Table A-12 Continued Groundwater Model Errors at Various Stations During Calibration

Well	Plot no.	Abs mean error [ft]
L-731	44	4.739
Fakahatchee_well_data_NW_2	45	0.757
Fakahatchee_well_data_NW_4	46	0.120
Fakahatchee_well_data_NW_8	47	0.942
Fakahatchee_well_data_NW_10	48	0.910
Fakahatchee_well_data_NE_2	49	0.811
Fakahatchee_well_data_NE_4	50	0.135
Fakahatchee_well_data_NE_6	51	0.005
Fakahatchee_well_data_NE_8	52	0.011
Fakahatchee_well_data_SW_2	53	0.548
Fakahatchee_well_data_SW_4	54	0.231
Fakahatchee_well_data_SW_6	55	0.168
Fakahatchee_well_data_SW_10	56	1.071
Fakahatchee_well_data_SE_2	57	1.407
Fakahatchee_well_data_SE_4	58	1.168
Fakahatchee_well_data_SE_8	59	0.445
Fakahatchee_well_data_SE_10	60	0.626
Count:		57
Average of mean error		1.008

Table A-13 Surface Water Model Errors for the Canal/River Staff Gages and Flows at Various Stations During Calibration

Station (ft)	ME	MAE	RMSE	STDres	R	Nash_Sut
L Trafford	0.044	0.194	0.260	.0256	0.934	0.845
Imperial	0.087	0.684	0.996	0.993	0.917	0.839
Keas846	0.359	0.461	0.539	0.402	0.861	0.426
Cork	-0.571	0.574	0.826	0.596	0.964	0.143
Faka Union 4H	-0.916	1.343	1.638	1.358	0.698	0.111
Faka Union 1H	-0.260	0.313	0.406	0.312	0.861	0.553
Merritt I-75	ND	ND	ND	ND	ND	ND
BCYPR7*	0.515	0.719	1.016	0.876	0.708	0.329
Barron River	-0.370	0.754	1.323	1.270	0.386	0.062
GG Main #5_H	0.0467	0.131	0.220	0.215	0.512	0.686
GG Main W4_H	-0.356	0.440	0.649	0.543	0.764	0.402
GG Main #3_H	-0.295	0.532	0.724	0.661	0.813	0.560
GG Main #3_T	0.061	0.295	0.403	0.399	0.877	0.748
GG Main CR951	0.309	0.391	0.510	0.406	0.839	0.474
GG Main #2_H	0.147	0.292	0.398	0.370	0.797	0.501
0.208163	0.208	0.361	0.482	0.435	0.722	-0.004
GG CR 846	0.00582	0.476	0.615	0.615	0.761	0.577
I-75 Canal D2-8-H	-0.522	0.554	0.856	0.678	0.399	-0.356
Coco CR 951	0.561	0.707	0.842	0.628	0.845	0.480
Coco #2 H	0.561	0.707	0.842	0.628	0.845	0.480
Coco #2_T	-0.328	0.817	2.689	2.669	0.606	-4.52
Coco #1_H	-0.179	0.359	1.569	1.558	0.0546	-18.13
Coco #1	-0.220	0.600	1.690	1.675	-0.037	-3.75
Coco #1_T	-0.012	0.562	1.135	1.135	0.383	-2.25
Henderson US 41	0.053	1.225	1.503	1.502	0.528	0.273
FLOW STATIONS	ME, cfs					
Imperial River	-54.5	81.0	142.4	131.6	0.90	0.70
Faka Union #1	-35.0	136.1	191.5	188.3	0.91	0.82
GG Main #1	40.4	136.6	207.9	203.9	0.90	0.80
Coco #2	-28.5	60.6	84.4	79.4	0.80	0.56
Coco #1	-76.9	79.6	110.8	79.7	0.84	-1.20

Table A-14 Hourly rainfall stations used to develop the synthetic hourly rainfall data from the daily station data in 1995.

1995	
Hourly Station	**Daily Station**
BCB Field Station	Conservancy - 10 Marco Island Firestation -11 BCB Field Station -12
Collier WWTP	Bonita Springs - 01 CorkWTP - 03 Lehigh Acres WTP - 07
Golden Gate at I-75	Corkscrew HQ - 02 Immokalee - 06 Collier Seminole - 13 Immokalee Landfill - 16 Miles City Tower - 17 Silver Strand - 18 Everglades City - 20

Table A-15 Hourly rainfall stations used to develop the synthetic hourly rainfall data from the daily station data in 1999.

1999	
Hourly Station	**Daily Station**
Coco1	Bonita Springs - 01 Corkscrew WTP - 03 Lehigh Acres WTP - 07 BCB Field Station - 12
Golden Gate Firestation	Corkscrew - 02 Immokalee - 06 Immokalee Landfill - 16
Courthouse	Conservancy - 10 Marco Island Firestation -11
Golden Gate at I-75	Collier Seminole - 13 Immokalee Landfill - 16 Miles City Tower - 17 Silver Strand - 18 Everglades City - 20

Table A-16 Observed rainfall amounts for tropical storms Jerry and Harvey

Station	Tropical Storm Jerry (1995)	Tropical Storm Harvey (1999)
BCB Fieldstation	9.41	7.05
BCB Fieldstation (hourly)	9.12	NA
Bonita Springs	7.55	7.05
Bonita Springs (hourly)	NA	7.5
Coco 1	NA	NA
Collier County	13.83	8.83
Collier Seminole	8.13	7.34
Collier WWTP (hourly)	9.13	1.37
Conservancy	9.41	8.4
Corkscrew	8.88	5.31
Corkscrew WTP	7.46	4.69
Courthouse (hourly)	NA	NA
Everglades City	13.59	8.72
Ft. Myers	8.68	8.83
Ft.Myers	6.31	8.83
Golden Gate at I-75 (hourly)	10.04	11.45
Golden Gate Firestation	9.4	NA
Golden Gate Fire Station (hourly)	NA	7.4
Immokalee	6.66	7.45
Immokalee Landfill	6.6	8.5
LakesPK	8.68	5.74
Lehigh Acres WTP	5.77	NA
Lfas	6	8.5
Marco Island Firestation	10.34	7.8
Miles City Tower	9.4	8.2
RSWAirport	3.75	8.83
Silver Strand	9.87	8.1
Minimum for Stations with Rainfall	3.75	1.37
Maximum for Stations with Rainfall	13.83	11.45

Table A-17 Statistical validation measurements for the 1995 Tropical Storm Jerry

	Data Type	ME	RMSE	Correlation
Lk_Trafford	Stage	0.28	0.40	0.87
Imperial1	Stage	-0.06	1.30	0.90
Keais846	Stage	0.32	0.50	0.92
FAKA1-H Hourly	Stage	-0.27	0.32	0.97
FU4-H	Stage	NA	NA	NA
BCYPR7	Stage	1.65	1.81	0.75
Barron River	Stage	-0.29	0.44	0.90
GG#5-H	Stage	-0.07	0.51	0.48
GOLD_W4_H	Stage	-0.30	0.57	0.76
GG#3-H	Stage	0.15	0.42	0.88
GG#3-T	Stage	0.03	0.52	0.93
GG-CR951	Stage	0.04	0.47	0.92
GG#2-H	Stage	0.06	0.45	0.91
GG#1-H (Goldw1) Hourly	Stage	0.00	0.50	0.91
GG-CR846	Stage	-0.54	0.73	0.84
D2-8-H	Stage	-0.53	1.01	0.23
Coco.CR951	Stage	0.32	0.77	0.86
COCO#1 Hourly	Stage	-1.36	3.10	-0.20
Coco#1-T	Stage	-0.20	0.64	0.84
Imperial	Flow	-115	300	0.85
FU#1 (FAKA1) Hourly	Flow	-35	181	0.96
GG#1 (Goldw1) Hourly	Flow	94	501	0.83
COCO1 Hourly	Flow	-199	230	0.81

Table A-18 Statistical validation measurements for the 1999 Tropical Storm Harvey

	Data Type	ME	RMSE	Correlation
Lk_Trafford	Stage	0.31	0.42	0.75
Imperial1	Stage	0.61	1.35	0.85
Keais846	Stage	0.42	0.53	0.86
FAKA1-H Hourly	Stage	-0.13	0.27	0.90
FU4-H Hourly	Stage	-0.19	1.36	-0.17
BCYPR7 Hourly	Stage	-0.12	0.28	0.93
Barron River	Stage	0.40	0.79	0.65
GG#5-H	Stage	0.03	0.27	0.43
GOLD_W4_H	Stage	-0.10	0.38	0.63
GG#3-H	Stage	0.14	0.44	0.73
GG#3-T	Stage	-0.08	0.58	0.84
GG-CR951	Stage	0.39	0.65	0.83
GG#2-H	Stage	0.13	0.48	0.82
GG#1-H (Goldw1) Hourly	Stage	0.05	0.46	0.78
GG-CR846	Stage	0.06	0.62	0.32
D2-8-H	Stage	-0.20	0.48	0.37
Coco.CR951	Stage	0.82	0.91	0.35
COCO#1 Hourly	Stage	-0.63	0.91	0.16
Coco#1-T	Stage	0.05	0.63	0.39
Imperial	Flow	-46	193	0.73
FU#1 (FAKA1) Hourly	Flow	64	167	0.95
GG#1 (Goldw1) Hourly	Flow	181	345	0.81
COCO1 Hourly	Flow	-139	185	0.19

Table A-19 - Optimum Canal Stages Upstream of the Miller, Faka Union and Merritt Canal Pump Stations

Optimum Canal Stages		
Project Feature Name	Dry Season Optimum Stage (ft, NAVD 88)	Wet Season Optimum Stages (ft, NAVD 88)
Miller Canal	7.2	4.9
Faka Union Canal	7.2	4.9
Merritt Canal	8.0	5.2

Table A-20 – Miller, Faka Union and Merritt Canal Pump Stations Operations

Summary of Pump Station Operations				
Pump Station	Pump Turn On Stage (ft, NAVD 88) at Upstream Gage		Upstream Distance to Upstream Gage (miles)	Pumping Capacity, Minimum & Maximum (cfs)
	Wet Season	Dry Season		
Miller Canal Pump Station	≥ 4.9	≥ 7.2	3.0	100 – 1250
Faka Union Canal Pump Station	≥ 4.9	≥ 7.2	2.9	125 – 2630
Merritt Canal Pump Station	≥ 5.2	≥ 8.0	1.5	80 - 800

Table A-21 – Private Lands Levee (PL Levee) Pump Stations Operations

PL Levee Pump Station Operations				
Pump Station Name	Pump Turn on Stage (ft, NAVD 88) in levee borrow canal		Pumping Capacity, Minimum Maximum (cfs)	
	Flood Control	Seepage Control	Flood Control	Seepage Control
PL Levee Interior Drainage Pump Station	≥ 8.5	≥ 7.8	50 – 100	50

Table A-22 – Summary of New FU-4 Operations

Summary of New FU-4 Structural Operations				
Structure Name	Stage (ft, NAVD 88) at Upstream gage when Gates Open		Stage (ft, NAVD 88) at Upstream gage when Gates Close	
	Wet Season	Dry Season	Wet Season	Dry Season
FU-4 New	> 11.3	>12.2	11.3	11.4

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APPENDIX B

GEOTECHNICAL

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PICAYUNE STRAND ECOSYSTEM RESTORATION

(SOUTHERN GOLDEN GATE ESTATES RESTORATION)

COLLIER COUNTY, FLORIDA

APPENDIX B

GEOTECHNICAL

September 2004

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The objective of this appendix is to investigate and analyze the geology, hydrogeology, geotechnical engineering, and environmental engineering aspects of the project. This information will be used in the formulation of project alternatives, screening and selection of alternatives, and design and construction of the selected project features.

1.1 Review of Existing Information

A detailed literature search of existing information from past reports and investigations was performed, including geotechnical reports, bore hole logs, geophysical logs, academic studies, hydrogeologic reports, aerial photography, surveys, utility mapping, and infrastructure locations. A brief discussion of relevant information follows. However, it is recommended that the original sources be referenced for detailed information.

The South Florida Water Management District (SFWMD) published the *Hydrologic Restoration of Southern Golden Gate Estates Conceptual Plan* in February 1996. In this report, a description of local geology as relating to hydrologic features was presented. SFWMD studies show three major layers: a top layer 0-15 feet thick of sand, clay, marl and weathered rock; a middle layer 20-50 feet thick of moderate to low permeability soft, sandy limestone and marl; and a lower layer of moderately permeable limestone. The soils are also described as moderately well to poorly drained and subject to prolonged flooding. The freshwater aquifers in the project area are the Water Table, Lower Tamiami and Sandstone Aquifers. In many places the Water Table aquifer, which is part of the surficial aquifer, is within 10 feet of the land surface. It is assumed the close proximity allows a direct connection between the existing canal system and the upper portions of the surficial aquifer.

The Natural Resources Conservation Service (NRCS) conducted a field survey of Southern Golden Gate Estates in 1991. This work has not been published at this time in a report format. The purpose of the survey was to describe the soils encountered using hydric indicators, which are used to differentiate wetland soils. The survey was accomplished with a 3-¼ inch auger to top of rock or to the limit of the equipment, with visual classification of the soils. Overburden materials are described mostly as fine sands with some loam, muck, marl, clay and silt. Rock was encountered at about 80 percent of the sites investigated. Termination was generally within 5 to 6 feet of the surface. Where rock was encountered, the average depth of top of rock was 34 inches. The rock is described as fractured limestone.

The Final Feasibility Report for Golden Gate Estates, May 1986, by the U.S. Army Corps of Engineers contains some general geologic descriptions of Collier County. The surface layer, up to 40 feet thick, consists of quartz sands, shell and clay. This feasibility report referred to preliminary findings of the SFWMD Technical Publication No. 85 of May 1985, which states that the Surficial Aquifer System in the region consists of the Water Table Aquifer and the Tamiami Aquifer. It indicated that

transmissivities of the upper Aquifer, which it called the Water Table Aquifer, range from 100,000 to 1,000,000 gallons per day per foot (gpd/ft). This technical publication further states that below the Water Table Aquifer, separated by beds of lower permeability material, is the Tamiami Formation, which ranges in thickness of from 75 to 100 feet and has transmissivities ranging from 100,000 to 500,000 gpd/ft. Beneath the Surficial Aquifer System is the Hawthorn Group, consisting of clay, quartz sand, carbonate (dolomite and limestone), and phosphate. Within the Hawthorn Group is the Sandstone Aquifer and the mid-Hawthorn Aquifer with transmissivities of below 100,000 gpd/ft and below 50,000 gpd/ft, respectively.

1.2 Preliminary Field Investigations

Preliminary field investigations were performed to augment the existing available data. The scope of these investigations included exploring potential project feature sites as identified by the design team and the SFWMD Conceptual Plan. The goals of the preliminary field investigations were to: (1) determine aquifer characteristics and groundwater movement necessary for groundwater modeling and seepage studies, (2) characterize potential areas from which material will be excavated for construction of earthwork, and (3) characterize the geology at the project site to assess the feasibility of alternatives.

The field investigations included core borings using a split spoon sampler and a NW size core barrel, recharge testing, and laboratory testing of samples. The core boring locations are shown on Figure 1. The core borings and laboratory testing information are shown at the end of this Appendix. The information from the recharge tests are shown in Table 1. The recharge tests were performed by inserting a 5-foot well screen to the test depth. The hole was backfilled with gravel to the top of the screen. The groundwater was allowed to stabilize for 30 minutes prior to the initial reading by tape. Water was added by pump and a constant head maintained to the top of the PVC riser. The flow rate from the hole into the surrounding materials was then recorded. The recharge tests were conducted in overburden material, defined as the material above solid rock that is easily penetrated with the split spoon sampler. As will be discussed later, the rock in many locations on the project site is of poor quality and is easily broken by the sampler. Where blow counts indicate resistance to sampling, rock coring was attempted and samples of the cored material collected. Also, a bulk sample of material from the gravel road was collected in order to characterize this material, which is proposed for use as fill for the canal plugs.

1.3 Discussion of Findings

The core borings logs reveal a gravel fill material at the surface to the first sample depth of 1.5 feet. This is described as crushed limestone of angular gravel sized pieces. (When used for road bases, this material is typically referred to as crushed limerock.) These borings were located on the site's access roads, which were constructed using this crushed limerock. This material is assumed to be excavation

spoil from the canals, processed to make a road base for better drivability through the wet terrain. The bulk sample of road base material was also tested for permeability, compaction and settling rate.

The materials below the road base and above the limestone are characterized as mostly poorly sorted, fine to coarse, medium dense, angular, shelly, calcareous sands with clay, quartz sand and some silt. Below the sand layer is limestone. The split spoon sampler was driven through the limestone in many areas with some effort and a sample retrieved of broken gravel. The blows per foot corresponding to these areas is generally in excess of 30. This is more than likely a very poor quality limestone that has been sampled, rather than the gravel that was retrieved, and is described as such on the boring logs. A NW core barrel was used to attempt recovery of the limestone with minimal results. Recovery was on average about 40%. The rock quality designation (RQD) was 0%, indicating that the limestone broke into small pieces as the corer progressed. The limestone is described as "vuggy", porosity in excess of 30%, with voids up to 1 inch in diameter. The average depth to top of rock is 6 feet.

Recharge tests were performed at two locations, CP01-SGGRR-CB0002 at the north end of the site and CP01-SGGRR-CB0012 at the southern end. The recharge tests were performed with the purpose of obtaining permeability values for the overburden material and the limestone. Only core boring 12 shows the presence of limestone in the test depth. The results of the recharge tests shown in Table 1, indicate a less permeable material than the literature suggests. It should be noted that in one case the limit of the pump was reached, so the material is more permeable than the value calculated. Laboratory permeability tests were attempted on the overburden material. However, insufficient quantities of material were collected from the split spoon sampler to perform the tests. A laboratory permeability test was performed on the bulk sample material collected from the crushed limestone road. The permeability reported is
2.5×10^{-6} cm/s or 0.0071 feet/day.

The data collected by the Corps of Engineers agrees in large part to the more general characterizations presented above from other sources. The NRCS study was the only study limited to the project area. However, the investigations were performed using different equipment and for different purposes. For example, where the NRCS data was terminated as encountering rock, the Corps sampler was progressed and continued sometimes to less dense material. Also it is not known what sampling tool was used for that study that prevented advancement.

1.4 Design Evaluation

The alternatives being considered for this project include the following components: constructing new pump stations, excavating shallow spreader channels, degrading roadways, creating canal plugs with roadway material, creating shallow water

crossings over the permanent road, and constructing emergency flood levees around residential and agricultural areas to the west and south of the SGGE site.

The Construction of the pump stations will require foundation excavation and dewatering. Excavation through the sands and into the limestone for limited depth may be attainable using conventional excavation equipment without blasting at locations where the limestone is of very poor quality as was indicated by its being readily crushed by the SPT sampler in the shallower depths of most of the core borings.

However, better quality limestone that required diamond tipped core drilling, and may require blasting for excavation, was encountered at shallow depths in core borings at the northern portion of the site and deeper in some of the other core borings as well. Specifically, core borings CP01-SGGRR-CB-0002 and 0003 encountered the hard limestone at depths of 1.5 feet (elevation 8.7 ft) and 3.0 feet (elevation 4.2 feet), respectively. Hard limestone that required diamond tipped core drilling was also encountered at depths of 8.5 feet in both core borings CP01-SGGRR-CB-0006 and 0009 (elevations of –0.7 and –2.1 feet, respectively). In core borings CP01-SGGRR-CB-0004, 0005 and 0012 hard limestone that needed to be sampled by diamond tipped core drilling was encountered at depths of 19.0, 16.5 and 13.5 feet (elevations –10.2, -4.7 feet and –7.6 feet), respectively. Also, limestone with SPT test blow counts at or near refusal was encountered between the depths of 12.5 and 16.5 (elevations –0.7 and –4.7) in core boring CP01-SGGRR-CB-0005. The intact rock should provide adequate support for the pump stations. Further exploration of the foundation materials in the final locations of the structures is recommended. In addition, bearing capacity and settlement analyses should be performed prior to the final foundation design.

The permeability of the limestone will likely be sufficiently high to present problems during dewatering of the site, based upon the SFWMD Technical Publication No. 85, discussed in the review of existing information, above. This high porosity rock together with the high water table (averaging 6 feet below the ground surface) in the SGGE area will potentially necessitate the construction of a cut off wall around the excavation and the placement of a tremie slab on the excavation's floor. The cut off wall would be installed prior to the excavation being made. The excavation would then be made and the tremie slab installed in the wet after which the excavation could be pumped dry. Borings in the final locations will aid in the design of the dewatering system prior to preparation of contract drawings.

The proposed cross section of the spreader channels is 25 feet in bottom width and 3 to 5 feet deep. This places the excavation of material within the sandy overburden material. The material is characterized as medium dense sand. Excavation to this depth and through this material should be readily performed with conventional earthmoving equipment. It is anticipated that the excavated material will be placed adjacent to the channels to form diversion levees to increase the flow of water away from the canals. The sandy material will require some compaction to form levees

but should drain and provide good constructability. Slope stability analysis will be performed during design after more site-specific core boring data along the channel alignments is obtained. However, it is anticipated that the slopes of both the spreader channels and the adjacent diversion levees will need to be 1V:3H in order to be stable for the three cases that will need to be evaluated. These three cases will be End-of-Construction, Maximum Storage Pool and Steady Seepage. The Rapid Draw Down case will not be evaluated as it is anticipated that flooding will be regional and, therefore, will subside slowly.

Blasting should not be necessary for construction of the shallow spreader channels. Although the top of the limestone surface may vary such that rock may be encountered above the anticipated 6-foot depth, the limestone close to the surface has a large amount of voids, which allow the limestone to be easily excavated with conventional equipment such as dozer rippers. Some ripping or backhoe excavation of rock may be needed in addition to the sand excavation. If isolated areas of rock are located within the excavation prism that resist excavation with conventional equipment, but which will not limit the hydraulic capacity, it is recommended to modify the depth of excavation rather than blast for such channels.

Materials obtained during excavation and degrading of the roadways will be used to form canal plugs in order to decrease the flow of water exiting the property through the canals. The road base material is crushed limerock fill. Conventional equipment can readily excavate the material. It is assumed that the fill will be placed in the canals by end dumping through the water column with minimal directed placement of material. Since preliminary evaluations indicate an adequate quantity of material available, it is not necessary to use the minimum stable cross section and slopes for the plugs in the canal. Therefore, a construction method may be used that requires less control but a greater quantity of material. End dumping would be one such method. Based on past experience, it is appropriate to assume that the 1V:4H slopes in the recommended plan will be attained. The use of the larger particles of the crushed limerock fill on the slope surfaces would also be an advantage during periods of high flow, as the large particle sizes will resist movement. The downstream slope of the plugs is presented in the recommended plan at a 1V:10H for added stability. The necessity of this flat slope will be verified at a later time after obtaining the water depth over the plugs and velocity during high flows from the modeling results. As an alternative to such a flat slope, the plug may be made to fill a greater length of the canal with the naturally resulting slope from the uncontrolled placement (such as end dumping). This extra length of plug would allow for a naturally stable downstream slope to form flatter, as water flows over the plug and transports material, than the original slope that resulted from end dumping.

The effectiveness of the canal plugs in raising the water table elevation or slowing the discharge of floodwaters from the property requires some additional modeling verification. The laboratory permeability test on the crushed limerock resulted in a permeability of 2.5×10^{-6} cm/s or 0.0071 feet/day. The low permeability rate is typical of crushed limerock. The aquifer data reported in the Feasibility Study show

transmissivities of 100,000 to 1,000,000 gpd/ft (13,368 cf/day/ft to 133,680 cf/day/ft) for the upper most portion of the Surficial Aquifer System, referred to as the Water Table Aquifer. The Feasibility Study also gave a range of thickness for the Water Table Aquifer from 20 to 60 feet. Dividing these high and low transmissivities by the corresponding high and low aquifer thickness yields a permeability range from about 670 to 2,225 ft/day. If it is assumed that the higher end of this transmissivity range occurred at a thinner portion of the aquifer the permeability would be as much as 6,680 ft/day. Comparing either the permeability values calculated from the transmissivities reported from the Feasibility Study or those calculated from the recharge test results, it could be concluded that the crushed limerock proposed for the plugs is much less permeable than the surrounding In-Situ limestone. The addition of the canal plugs will slow the progress of the water down the canal. However, since the In-Situ limestone surrounding the plug is highly porous, water will likely flow through the limestone around the canal plug. The dimensions of the canal plug will be adjusted to obtain the desired ponding of water and limit seepage to acceptable levels. It is recommended that groundwater seepage modeling be conducted on the proposed canal plug modified system to assess the amount of loss through the limestone and around the plug.

The shallow water crossings are part of the paved thoroughfare to remain on the property. They serve to allow water to flow along ancient paths unobstructed by the road. The long-term stability of the crossing is an issue if water is to routinely flow over it. The foundation will need to be constructed in such a manner that erosion will not occur during high flows. The In-Situ silty fine sand material that occurs as an overburden layer above the limestone is not suitable for this purpose. The fine sand below the flow way will need to be excavated to a depth of 2 feet beneath the top of road base elevation and backfilled with crushed limerock in preparation for surfacing with concrete. The crushed limerock from the roadways intended for degradation may be suitable backfill for this purpose.

Five ring levees are to be constructed around residential and agricultural areas, four of which are adjacent to US Highway 41. The longest of the five levees, which is located to the west of the southern portion of the SGGE site, will tie into US Highway 41. This levee will make up approximately three quarters to four fifths of the perimeter “high ground” of the area it will protect while US Highway 41 will make up the remainder of the “high ground” perimeter.

Three of the other four ring levees also tie into US Highway 41 and are located on either side of US Highway 41 at the southern end of the Faka Union Canal. The remaining ring levee is located adjacent to the northwest corner of the SGGE site. This remaining levee will make up the entire perimeter of the area it will protect.

Four of the ring levees will have heights of 6 feet above grade and will impound a maximum of 3 feet of water on the outside, or upstream, slope. The one levee adjacent to the north side of US Highway 41 at the Faka Union Canal will have a

height of 9 feet above grade and will be designed to provide flood protection for a maximum of 6 feet of water on its upstream slope.

The typical cross section of the 9-foot levee, along with the minimum factor of safety slip surface from the slope stability analysis for three loading cases, is shown in Figures 2, 3 and 4. The maximum crest height of this levee section is 9 feet above grade, the crest width is 15 feet and the slope of both the upstream and downstream side is 1V:3H. Expected flood flows will create a 6-foot maximum impoundment on the upstream slope of the 9-foot high levees during periods of especially heavy rain.

The proposed material to build these levees is the spoil from- the degradation of the existing roads. After the canal plugs are constructed, the quantity of material remaining from these roads appears, from the available data, to be close to the quantity required for construction of the levees. A more detailed evaluation of the quantity of material available from the roads and the quantities required to construct the canal plugs and the levees will be made prior to Plans & Specs. In the event that additional materials are needed, these will be obtained first from either on-site spoil mounds or excavation of the spreader canals or the seepage ditches adjacent to the flood control levees. It is possible that a small percentage of the project's fill requirements will need to be obtained from an off-site source. The excavation of the spreader canals would probably yield sand and silty sand rather than crushed limerock.

The slope stability analysis was performed using the SLOPEW program, which utilized Spenser's method to perform the calculations. The 9-foot high levee with 1V:3H slopes was analyzed with the assumption that the levee would be constructed from crushed limerock on a foundation of silty sand. The shear strength used for the crushed limerock was $c = 0$ and $\phi = 45^{o}$, which is a typical value for the shear strength of crushed limerock used in south Florida. The cases that were analyzed were End-of-Construction, Maximum Storage Pool and Steady Seepage. Since any flooding in the SGGE area would be wide spread and would, therefore, subside gradually the Rapid Draw Down case was not analyzed. Also, since south Florida is not a seismic zone, the Earthquake condition likewise was not analyzed.

Guidance for the required factors of safety was obtained from the most recent version, 31 Oct 2003, of EM 1110-2-1902 titled "Slope Stability". This EM requires the following factors of safety:

Analysis Condition	Required Minimum Factor of Safety
End-of-Construction	1.3
Long-term	
Maximum Storage Pool	1.5
Steady Seepage	1.5

Note that EM 1110-2-1902 lists both the Maximum Storage Pool and the Steady Seepage cases under Long-term condition with the required factor of safety for both being 1.5.

In all three of the cases analyzed, the slip surfaces that had the lowest factors of safety were shallow. The factors of safety gradually increased as the program analyzed deeper and deeper slip surfaces. For both the End-of-Construction and the Maximum Storage Pool conditions, the minimum factors of safety were well above the minimum required.

Figure 2 shows the results of the analysis from the End-of-Construction condition where the slip surface with the lowest factor of safety was so shallow that it is not visible at the scale shown. This is a typical result for analyses in granular materials (i.e. no cohesion) and no phreatic surface. In this case, the minimum factor of safety from the program's Spenser method algorithm was identical with the infinite slope analysis with both being equal to 3.0 and was well above the minimum required factor of safety of 1.3 for this condition.

Figure 3 shows the results of the analysis from the Maximum Storage Pool condition. The minimum factor of safety for this condition was 2.46. This was again well above the minimum required, which was 1.5 for this condition.

Figure 4 shows the results from the Steady Seepage condition analysis. The minimum factor of safety for this condition was 1.41, which was below the minimum required factor of safety of 1.5. However, the shear strength used for the crushed limerock in the embankment fill in this analysis was based on local assumed values and is considered to be conservative. During the next phase of the project, shear strength tests will be performed in the lab, which will enable the use of a more accurate, and likely higher, shear strength. Also, it is possible that hydraulic studies to be performed during the next phase of the project will show that a flood condition will not exist for a long enough period for the phreatic surface of the Steady Seepage condition to fully develop. If this proves to be the case, the factor of safety that would exist in the field during the partially developed seepage condition would be higher than the 1.41 indicated by the Steady Seepage condition analysis above. In the unlikely event that the laboratory strength is not sufficiently high to obtain the required minimum factor of safety and that future hydraulic studies show that there will be sufficient time for the Steady Seepage condition to fully develop, a downstream toe drain can be incorporated into the design to lower the phreatic surface and satisfy the 1.5 minimum required by EM 1110-2-1902. If there is sufficient crushed limerock borrow material from the road degradations the need for a toe drain is not likely. However, if a portion of the levee has to be constructed from sand a toe drain may be necessary to draw down the phreatic surface on the downstream side of the levee in order to maintain the minimum required Factor of Safety, during the Steady State Seepage condition, which is discussed below. A toe drain can have a significant cost. Therefore, it will only be used if further analyses, which will be performed during Plans & Specs, indicate that it is necessary.

Since the 9-foot high levees had a maximum pool of two thirds of its height (6 feet), it would have the lower factors of safety for the various loading conditions as compared to the projects 6-foot high levees, which only had a maximum pool of one half of the levees height (3 feet). Therefore, a slope of 1V:3H was also selected for the 6-foot high levee as well as for the 9-foot high section with no further analysis being necessary at this stage of the design.

When more site-specific data has been acquired, representative analyses will be performed for each levee section and site condition. Steeper slopes may be used if these analyses indicate that the minimum required factors of safety would be obtained just as the preliminary analyses performed for this report have indicated. The ability to maintain (i.e. mow) may control the steepness. According to EM 1110-2-1913, chapter 6, the steepest slope that is convenient for maintenance is 1V:2.5H. This will be coordinated with the local sponsor's requirements as well.

1.5 Future Studies

Once the recommended plan is approved, detailed field investigations will be required at the final locations of levees, excavations and structural improvements. The goals of the detailed field investigations are to: (1) determine the suitability of the underlying geology to support proposed levees and structures, (2) provide additional data to determine excavation requirements and the suitability of excavated materials for levee fill and (3) characterize the underlying geologic properties for permeability, seepage and dewatering operations. Field investigations may include core borings, test pits, sample collection, surface and down-hole geophysical testing, aquifer testing, pump tests, infiltrometer tests, In-Situ rock and soil testing, and laboratory testing of samples.

The future field investigations shall be tailored to the recommended plan. The following is a suggested investigation plan with contract cost estimates. Contract preparation costs are not included. It is recommended for each pump station, to conduct five borings to 50 feet in depth and perform a pump test using one of the borings while monitoring the others. The excavation of the spreader channels will require one boring to 20 feet in depth every 1000 feet along the channel length. Each spillway that will serve as a water crossing over a roadway will require two borings to 15 feet. The levee construction will require one 20-foot deep boring for every 1,000 feet of levee in addition to sampling of the spoil material for compaction and stability studies. It is recommended to perform test pit excavation every 1000 feet along the spoil mound.

Computer modeling will be used to determine settlement, slope stability, groundwater flow and seepage, bearing capacity, and structural foundation design considerations. Results from the computer modeling will be used for design of the earthwork and structures. Essential elements to the project that will be completed in the DDR phase include: The final location of the structures, the type and size of

structures, reliability and risk, foundation treatments, drainage or seepage control features, erosion and scour protection, instrumentation, and the location of borrow/disposal areas. (It is recommended that alternative borrow areas be identified for use in the event that the roads to be degraded do not contain sufficient fill for the construction of both the canal plugs and the levees.) This information will be provided for inclusion in the cost estimates for construction. Also included will be efforts necessary for the development of the project, such as coordination and site visits. Construction concerns will be identified and the designs completed prior to final plans and specification preparations.

1.6 References

Hydrologic Restoration of Southern Golden Gate Estates Conceptual Plan, South Florida Water Management District, February 1996.

The Final Feasibility Report for Golden Gate Estates, U.S. Army Corps of Engineers, May 1986.

Table 1, Recharge Test Data

Core Boring	Test Depth (ft)	Recrge Test GrnndWater Depth (ft)	Casing Stick-up (ft)	Constant Head H_c (ft) fromGWT	D (ft)	L (ft)	q (gpm)	q (cfd)	k_h (ft/day)	k_h (ft/year)
CB-2	6.3-11.3	4.7	2.4	7.1	0.33	5	20	3,850	59	21,498
CB-12	8.5-13.5	1.6	2.5	4.1	0.33	5	1	193	5	1,856
* 20 gallons per minute was the maximum capacity of the pump used for the recharge test.										

$$k_h = q \ln \left[\frac{mL/D + \{1 + (mL/D)^2\}^{1/2}}{2\pi LHc} \right]$$

where: kh = horiz. permeability
kv = vert. permeability
m = transformation ratio
$m = (kh / kv)^{1/2}$
(assumed to be 1)
D = diameter of test hole
L = length of test hole
Hc = constant piez. head
q = flow rate of water into test hole

Assumptions: No, disturbance, segregation, swelling or consolidation of soil. No sedimentation or leakage. No air or gas in soil, well point or pipe. Hydraulic losses in pipes, well point or filter negligible.

Equation from Fig. 19.4, Lambe and Whitman, case G (from Hvorslev, 1951)

CORE BORING LOGS

NOTES:

1. Boring locations are shown on Plate 1.

2. Elevations are in feet and tenths and refer to Mean Sea Level (NAVD 1988).

3. Horizontal locations refer to State Plane East 1983. The locations were recorded using a Trimble 7400 GPS unit in RTK mode. Accuracy is within 1 centimeter.

4. BLS/0.5 ft. refers to the number of hammer blows required to advance a split-spoon (1 3/8" I.D. x 2.0" O.D.) one-half foot. The spoon is 2.0 feet long and driven continuously one and one-half feet where possible.

5. (SP), (SM), (CH), etc., refers to the Corps of Engineers Unified Soils Classification System. Materials are classified on the basis of visual examination and laboratory analyses. Laboratory classification takes precedence over visual field classification.

Hole No.CP01-SGGRR-CB-0001

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=495,158 Y=657,850
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-000
6. NAME OF DRILLER: D. HEWETT
8. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 39.5 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88 Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 26 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: 4.5
16. DATE HOLE STARTED: 09/17/01 COMPLETED: 09/18/01
17. ELEVATION TOP OF HOLE: 11.04 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 63 %
19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
11.0	0.0					11.0	
			SAND, clayey, mostly fine to medium grained carbonate, little, silt, little clay, trace limestone gravel, strong HCL reaction, moist, moderately plastic, possible fill, brown, (SC)	53	1	SPT	4, 4, 6
			From El. 9.0 light gray dense	67	2	SPT	26, 29, 16
			El. 8.0 to 9.0 thin 3/4" Limestone beds	73	3	SPT	9, 5, 9
7.0	4.0					6.5	
6.5	4.5		SILT, organic-L, low plactiicity, firm, little fine grained sub-rounded quartz, few clay, moist, black (OL)	53	4	SPT	9, 9, 6
4.8	6.2		SILT, inorganic-L, low plasticity, firm, little fine grained rounded quartz, trace clay, trace limestone gravel, moist, brown, (ML)	70	5	SPT	4, 6, 8
2.0	9.0		LIMESTONE, moderately hard, moderately weathered, fine to medium grained, vuggy, fossiliferous, inter bedded with sand lenses, trace clay, sample breaks down into sand and gravel, gray	100	6	SPT	5, 9, 5
.5	10.5		SAND, poorly graded, mostly fine to coarse grained sub-angular carbonate, trace quartz, strong HCL reaction, wet, gray, (SP)	14	7	SPT	3, 3, 3
-1.0	12.0		SAND, silty mostly fine to coarse grained sub-angular carbonate, trace quartz, strong HCL reaction, wet, with thin hard limestone lenses, gray (SM)	27	8	SPT	2, 3, 4
-2.5	13.5		SAND, clayey, mostly fine to coarse grained carbonate, some clay, little silt, wet, gray, (SC)	27	9	SPT	3, 2, 2
			SAND, silty, mostly fine to coarse grained angular shells and limestone, wet with thin limestone lenses, gray (SM)	40	10	SPT	3, 2, 3
				60	11	SPT	3, 5, 4
				27	12	SPT	6, 6, 6
				100	13	SPT	6, 4, 9
				80	14	SPT	8, 8, 12
				100	15	SPT	17, 13, 14
						-11.5 (continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

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PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0001

Hole No.CP01-SGGRR-CB-0001

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 11.04 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-11.5	22.5					-11.5	
			SAND, silty, mostly fine to coarse grained angular shells and limestone, wet with thin limestone lenses, gray (SM)	100	16	SPT	15 18 25
						-13.0	
-13.5	24.5			80	17	-13.5 SPT	50@ 0.4
			LIMESTONE, hard, unweathered, aphanitic, vuggy, fossiliferous, SM filing voids, gray	24	Box-1	NW DIAMOND SET BIT D.T. = 3.5 MIN RQD = 0%	
-16.0	27.0					-16.0	
			SAND, silty, mostly fine to coarse grained sub-rounded to angular carbonate, strong HCL reaction, wet, with thin <1" limestone lenses, gray (SM)	80	18	SPT	27 21 18
						-17.5	
				67	19	SPT	19 27 25
						-19.0	
				75	20	SPT	22 15 15
						-20.5	
				80	21	SPT	12 15 20
						-22.0	
				73	22	SPT	9 5 9
						-23.5	
				67	23	SPT	7 11 13
						-25.0	
				100	24	SPT	16 30 20
						-26.5	
				47	25	SPT	10 4 2
						-28.0	
-28.5	39.5			100	26	-28.5 SPT	50

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
2	9.5-8.0	SM
4	6.5-5.0	ML-CL
12	-5.5 to -2.0	SM

*Lab visual classification based on gradation curve. No Atterberg limits.

140# hammer w/30" drop used with 2.0" split spoon (1 3/8" I.D. X 2" O.D.).

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PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0001

Hole No.CP01-SGGRR-CB-0002

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=484,431 Y=649,736	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88 Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0002	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 27 undisturbed: 0
5. NAME OF DRILLER: D. HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 10.2
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 10/02/01 COMPLETED: 10/02/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 10.2 Ft.
9. TOTAL DEPTH OF HOLE: 41.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 60 %
	19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'	
10.2	0.0					10.2		0
			SAND, silty, mostly fine to coarse grained carbonate, some silt, few coarse limestone gravel, dry, light brown (SM)	33	1	SPT	10 17	
8.7	1.5					8.7		
			LIMESTONE, hard to soft, aphanitic, massive, few vugs <2" diameter, tan	56	Box-1	NW DIAMOND SET BIT RQD = 24%	20	2.5
5.9	4.3					5.2		
4.7	5.5		CLAY, fat, high plasticity, soft, some fine to medium grained carbonate, little silt, wet, brown (CH)	33	3	SPT	10 15 7	5
			SAND, silty, mostly fine to medium grained sub-rounded quartz, little silt, trace shell fragments, wet, with thin limestone beds <1" brown (SM)			3.7		
				20	4	SPT	4 6 9	7.5
						2.2		
				47	5	SPT	17 17 15	
						.7		
				47	6	SPT	10 17 32	10
-.8	11.0					-.8		
			LIMESTONE, soft to hard, aphanitic, wet, spoons into sand, fragments, gray		7	SPT	50+	
-2.3	12.5			31	Box-1	NW DIAMOND SET BIT RQD = 0%		12.5
			SAND, silty, mostly fine to coarse grained carbonate, little silt, little shell fragments, strong reaction to HCl, wet, with thin limestone lenses <1" thick (SM)			-2.3		
				53	9	SPT	14 10 10	
						-3.8		
				67	10	SPT	10 14 11	15
						-5.3		
				67	11	SPT	17 12 14	
						-6.8		
				80	12	SPT	9 9 11	17.5
						-8.3		
				53	13	SPT	10 10 10	
						-9.8		20
				67	14	SPT	10 12 14	
						-11.3		
				73	15	SPT	11 12	22.5
						(continued)		

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PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0002

Hole No.CP01-SGGRR-CB-0002

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 10.2 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-12.3	22.5						
				73	15	-12.8 SPT	18
				80	16	SPT	14, 10, 12
						-14.3	
				60	17	SPT	10, 9, 8
						-15.8	
				53	18	SPT	4, 3, 2
						-17.3	
			from El. -18.0 little fine rounded quartz	47	19	SPT	8, 2, 3
						-18.8	
				67	20	SPT	2, 3, 4
						-20.3	
				73	21	SPT	10, 12, 12
-21.8	32.0					-21.8	
			SAND, poorly graded, mostly fine to coarse grained shells, some fine quartz, trace silt, strong HCl reaction, moist, tan, (SP)	0	22	SPT	14, 16, 28
						-23.3	
			from El. -23.5 gray	87	23	SPT	23, 3, 3
-24.8	35.0					-24.8	
			SILT, inorganic-L, some fine, carbonate sand, little quartz, strong reaction to HCl, wet, tan, (ML)	40	24	SPT	2, 2, 4
-26.3	36.5					-26.3	
			SAND, silty, mostly fine to medium grained carbonate, little silt, few clay, strong reaction to HCl, wet, occassional limestone <1" thick, gray to tan (SM)	0	25	SPT	4, 3, 2
						-27.8	
				80	26	SPT	3, 5, 8
-29.3	39.5					-29.3	
			SAND, clayey, mostly fine to medium grained carbonate, little clay, little silt, limestone <1" thick, moderate plasticity, gray to tan (SC)	0	27	SPT	15, 15, 48
-30.8	41.0					-30.8	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
3	5.7-4.2	GM

Recharge Tests
El. +5.7 to +0.7 BGS
El. -14.8 to -19.8 BGS

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0002

Hole No.CP01-SGGRR-CB-0003

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=474,148 Y=650,967
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0003
5. NAME OF DRILLER: D. HEWETT
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 41.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88 Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 30 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: 4.2
16. DATE HOLE STARTED: 09/18/01 COMPLETED: 09/20/01
17. ELEVATION TOP OF HOLE: 8.7 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 52 %
19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5
8.7	0.0					8.7	
			SAND, silty, mostly fine to coarse grained sub-rounded, carbonate, some coarse sub-rounded to angular limestone gravel, little quartz, little silt, clay fill, brown (SM)	67	1	SPT	5 4 4
7.2							
				40	2	SPT	2 2 2
5.7	3.0		From El. 7.2, mostly fine sub-rounded quartz, little fine to coarse carbonate sand, little silt, orange to tan			5.7	
				40	3	SPT	3 6 30
4.2	4.5		SAND, clayey mostly fine to coarse grained carbonate, little clay, little silt, low plasticity, soft, moist, gray (SC)			4.2	
3.5	5.2		LIMESTONE, soft to hard, nonweathered, fine to coarse grained with minor aphanitic matrix, sandy, fossiliferous, light gray	55	Box-1	NW DIAMOND SET BIT RQD = 28%	
						2.2	
				100	5 6	NW DIAMOND SET BIT	
						1.2	
			LIMESTONE, hard, non-weathered, aphanitic massive, little vugs, 20% moldic porosity, fossiliferous, dark gray to brown	40	7	.7 SPT	N/A
			From El. 0.5 tan	64	Box-1	NW DIAMOND SET BIT RQD = 41%	
			El.- 1.6 moldic porosity pore size increasing with depth				
-3.8	12.5					-3.8	
			SAND, silty, mostly fine to medium sub-angular grained carbonate, some silt, strong reation with HCL, wet, interbedded with thin lenses of soft limestone, gray (SM)	67	12	SPT	10 6 15
-5.3						-5.3	
				27	13	SPT	8 3 2
-6.8						-6.8	
				27	14	SPT	3 3 5
-8.3						-8.3	
			From El. -13.6 hard limestone lens	33	15	SPT	6 6 7
-9.8						-9.8	
				53	16	SPT	7 8 12
-11.3						-11.3	
				67	17	SPT	6 6 8
-12.8						-12.8	
				67	18	SPT	6 11
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0003

DRILLING LOG (Cont. Sheet) | ELEVATION TOP OF HOLE 8.7 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-13.8	22.5						
				67	18	-14.3 SPT	8
				20	19	SPT	7 5
						-15.8	4
				73	20	SPT	1 3
						-17.3	5
				67	21	SPT	5 6
						-18.8	11
				20	22	SPT	4 4
						-20.3	4
			From El. -20.3 traces 3/4" diameter shells, tan	67	23	SPT	3 3
						-21.8	3
			At El. -22.8 hard limestone bed	60	24	SPT	3 3
						-23.3	3
				33	25	SPT	3 2
						-24.8	2
				27	26	SPT	1 WOH
-26.3	35.0					-26.3	1
			SAND, clayey, mostly fine to coarse grained carbonate, little silt, little clay and few shells, strong reaction to HCL, slightly plastic, wet, gray to tan (SC)	67	27	SPT	2 7
-28.3	37.0					-27.8	9
			SAND, silty, mostly fine to coarse grained carbonate, little silt, little shell up to 1/2", wet with thin hard limestone lenses, gray, (SM)	67	28	SPT	11 12
						-29.3	15
				73	29	SPT	12 14
						-30.8	19
				67	30	SPT	10 18
-32.3	41.0					-32.3	18

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
3	5.7-4.2	GM

*Lab visual classification based on gradation curve. No Atterberg limits.

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CP01-SGGRR-CB-0004

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=505,894 Y=635,478	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0004	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 14 undisturbed: 0
5. NAME OF DRILLER: LC GREGORY	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 2.8
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 08/31/01 COMPLETED: 09/05/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 8.8 Ft.
9. TOTAL DEPTH OF HOLE: 25.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 40% Soil 30% Rock %
	19. SIGNATURE OF GEOLOGIST: J. MINTON

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'	
8.8	0.0					8.8		0
			CLAY, lean, medium plasticity, little fine to medium sand, trace shells, weak HCL reaction, moist, moderate cementation, brown (CL)	80	1	SPT	5 22 15	
						7.3		
				50	2	SPT	7 26 38	2.5
5.8	3.0					5.8		
			SAND, clayey, mostly fine to coarse grained angular carbonate, some clay, strong HCL reaction, moist, strongly cemented, tan (SC)	60	3 D-3	SPT	9 18 14	
						4.3		
				20	4	SPT	6 8 17	5
2.8	6.0					2.8		
			LIMESTONE, soft, highly weathered, aphanatic, wet, pitted, poorly indurated, inner bedded with hard limestone lenses, breaks down into sand and gravel, gray	20	5	SPT	5 3 5	
						1.3		7.5
				20	6	SPT	6 18 21	
						-.2		
				30	7	SPT	10 11 26	10
						-1.7		
				30	8	SPT	16 21 17	
						-3.2		
				60	9 D-9	SPT	12 19 19	12.5
						-4.7		
				30	10	SPT	14 14 12	
						-6.2		15
				40	11	SPT	16 9 11	
						-7.7		
				40	12	SPT	10 10 11	
						-9.2		17.5
				50	13 D-13	SPT	10 9	
-10.2	19.0					-10.2		
			LIMESTONE, hard, slightly weathered, aphanitic, vuggy, fossiliferous, moderately indurated, gray				50@ 0.2	
				27	Box-1	NW DIAMOND SET BIT RQD = 0% D.T. = 3 MIN		20
			At El. -13.2 to -13.7 soft, highly weathered			-13.2		
				30	14	-13.7 SPT	50@ 0.2	22.5
						(continued)		

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0004

Hole No.CP01-SGGRR-CB-0004

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 8.8 Ft.

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'
-13.7	22.5					-13.7	
			LIMESTONE, hard, slightly weathered, aphanitic, vuggy, fossiliferous, moderately indurated, gray	32	Box-1	NW DIAMOND SET BIT RQD = 0% D.T. = 2.5 MIN	
-16.2	25.0					-16.2	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
1	8.8 - 7.3	SM
2	7.3 - 5.8	CL
3	5.8 - 4.3	SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates

HOLE NUMBER: CP01-SGGRR-CB-0004

Hole No.CP01-SGGRR-CB-0005

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=474,219 Y=635,138	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0005	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 16 undisturbed: 0
5. NAME OF DRILLER: D. HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 5.8
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 08/20/01 COMPLETED: 08/21/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 11.8 Ft.
9. TOTAL DEPTH OF HOLE: 26.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 57 %
	19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'	
11.8	0.0					11.8		0
			GRAVEL, clayey, mostly angular medium grained limestone, little silt, little clay, strong HCl reaction, moist, light gray (GC)	53	1	SPT	4 9 6	
10.3	1.5					10.3		
			SAND, silty, mostly fine grained sub-angular quartz, some, silt, trace coarse carbonate gravel, moist, brown (SM)	40	2	SPT	8 8 12	-2.5
8.8	3.0					8.8		
			SAND, silty, mostly fine sub-rounded carbonate, few clay, trace carbonate gravel, strong HCl reaction, with thin limestone lenses, light gray, (SM)	67	3	SPT	6 12 20	
						7.3		
				67	4	SPT	6 20 7	-5
5.8	6.0					5.8		
			LIMESTONE, soft, slightly weathered, aphanitic, occasional vugs, zones of soft limestone, poorly indurated, sample breaks down to sand and gravel, gray	80	5	SPT	10 20 18	
						4.3		-7.5
			from El. -5.8 to -4.3 little clay, wet	53	6	SPT	11 10 6	
						2.8		
				60	7	SPT	5 5 9	-10
			from El. -1.8 fossiliferous			1.3		
.3	11.5							
			LIMESTONE, hard, slightly weathered, aphanitic, occasional vugs, sample breaks down into sand and gravel, gray	67	8	SPT	10 15 22	
						-.2		
				67	9	SPT	26 50 29	-12.5
						-1.7		
				67	10	SPT	28 50 30	
						-3.2		-15
				87	11	SPT	40 87 100	
						-4.7		
			from El. -6.2 moderately hard.	0	NR	DIAMOND SET BIT		-17.5
						-6.7		
				60	12	SPT	12 17 22	
-8.2	20.0					-8.2		-20
			SAND, poorly graded, mostly fine to coarse grained sub-rounded carbonate, trace silt, strong HCl reaction, wet, occasional thin lenses of limestone, gray, (SP)	67	13	SPT	11 14 18	
-9.2	21.0					-9.7		
			LIMESTONE, moderately hard, slightly weathered, aphanitic,	53	14	SPT	10 15	-22.5
						(continued)		

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0005

Hole No.CP01-SGGRR-CB-0005

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 11.8 Ft.

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel		BLOWS/ 0.5'
-10.7	22.5							
			fossiliferous, occasional vugs, moderatly indurated breaks down into sand and gravel, gray	53	14	-11.2	SPT	22
								12
				53	15		SPT	15
						-12.7		13
								9
				47	16		SPT	14
-14.2	26.0					-14.2		14

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
3	8.8 - 7.3	SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CP01-SGGRR-CB-0006

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=495,150 Y=628,748
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0006
5. NAME OF DRILLER: D. HEWETT
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 26.0 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 15 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: 0.3
16. DATE HOLE STARTED: 08/28/01 COMPLETED: 08/29/01
17. ELEVATION TOP OF HOLE: 7.8 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 74 %
19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
7.8	0.0					7.8	
			SAND, silty, mostly fine to medium grained sub-rounded quartz, trace coarse carbonate gravel, no HCl reaction, moist, organic, brown (SM)	33	1	SPT	6 3 4
6.3	1.5					6.3	
			SAND, clayey, mostly fine to medium sub-rounded quartz, trace cabonate gravel, no HCl reaction, soft, moist, gray/brown (SC)	40	2	SPT	3 5 6
						4.8	
				47	3	SPT	3 2 2
						3.3	
			from El. -2.8 light gray	100	4	SPT	4 12 14
						1.8	
1.3	6.5						
			LIMESTONE, soft to moderately hard, unweathered, aphanitic, breaks down into sand and gravel, gray/brown	100	5	SPT	10 27 60
.3	7.5					.3	
			CLAY, fat, high plasticity, soft, some fine carbonate sand, little silt, wet, with thin limestone lenses, gray (CH)	100	6	SPT	15 50@0.5
-.7	8.5					-.7	
			LIMESTONE, hard, slightly weathered, aphanitic, thin bedded, vuggy, fossiliferous, gray	100	Box 1	NW DIAMOND SET BIT RQD = 60%	
						-2.7	
			from El. -2.7 to -4.7 vuggy	10		NW DIAMOND SET BIT RQD = 0%	
-4.7	12.5					-4.7	
			SAND, silty, mostly fine to coarse grained sub-rounded carbonate, some shells, strong HCl reaction, wet, with thin lenses of unweathered limestone, gray, (SM)	14	8	SPT	7 4 3
						-6.2	
				73	9	SPT	8 10 9
						-7.7	
				100	10	SPT	8 8 12
						-9.2	
				100	11	SPT	15 14 14
						-10.7	
				67	12	SPT	15 15 10
						-12.2	
				93	13	SPT	7 11 14
						-13.7	
				87	14	SPT	14 11
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0006

DRILLING LOG (Cont. Sheet) | ELEVATION TOP OF HOLE 7.8 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-14.7	22.5						
				87	14	-15.2 SPT	8
							12
				93	15	SPT	11
						-16.7	14
							14
				100	16	SPT	12
-18.2	26.0					-18.2	9

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
7	-3.3 to -1.8	SM
10	-7.7 to -9.2	SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CP01-SGGRR-CB-0007

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=484,589 Y=628,631	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0007	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 17 undisturbed: 0
6. NAME OF DRILLER: D. HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 2.3
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 08/28/01 COMPLETED: 08/28/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 8.8 Ft.
9. TOTAL DEPTH OF HOLE: 25.5 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 70 %
	19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
8.8	0.0					8.8	
			GRAVEL, silty, mostly coarse grained angular limestone, little carbonate sand, strong HCl reaction, dry, fill, light gray/ brown (GM)	60	1	SPT	4, 16, 17
7.3	1.5					7.3	
			SAND, silty, mostly fine to coarse grained sub-angular carbonate, few clay, strong HCl reaction, moist, with thin limestone lenses, brown, (SM)	60	2	SPT	7, 4, 17
5.8						5.8	
				47	3	SPT	10, 8, 12
4.3	4.5					4.3	
			SAND, clayey, low platicity, mostly fine to coarse grained sub-rounded carbonate, strong HCl reaction, moist, soft, with thin limestone lenses, light gray (SC)	47	4	SPT	3, 4, 2
2.8	6.0					2.8	
			LIMESTONE, soft, unweathered, aphanitic, inner bedded with sand, poorly indurated, sample breaks down to sand and gravel, light gray	100	5	SPT	3, 4, 9
1.3						1.3	
				60	6	SPT	3, 2, 3
-.2	9.0					-.2	
			SAND, silty, mostly fine to coarse grained sub-angular carbonate, strong HCl reaction, wet, occasional thin lenses of limestone, gray, (SM)	20	7	SPT	4, 6, 3
-1.7						-1.7	
				47	8	SPT	3, 7, 7
-3.2						-3.2	
			From El. -4.2 to -4.7 limestone lens	67	9	SPT	8, 8, 11
-4.7						-4.7	
				67	10	SPT	7, 8, 9
-6.2						-6.2	
				87	11	SPT	12, 8, 6
-7.7						-7.7	
				80	12	SPT	9, 8, 7
-9.2	18.0					-9.2	
			LIMESTONE, soft to moderately hard , unweathered, aphanitic, fossiliferous, moderately indurated, inner bedded with sand, breaks down into sand and gravel, gray,	100	13	SPT	8, 12, 11
-10.7						-10.7	
				87	14	SPT	9, 8, 27
-12.2						-12.2	
				100	15	SPT	27, 8, 11
-13.7						-13.7	
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0007

Hole No.CP01-SGGRR-CB-0007

DRILLING LOG (Cont. Sheet) | ELEVATION TOP OF HOLE 8.8 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-13.7	22.5					-13.7	
				67	16	SPT	3 4 8
						-15.2	
			From El. -15.4 nonfossiliferous	100	17	SPT	7 17 22
-16.7	25.5					-16.7	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
2	7.3 - 4.8	SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

ENG FORM 1836 MAR 71 PREVIOUS EDITIONS ARE OBSOLETE.

PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0007

Hole No.CP01-SGGRR-CB-0008

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=505,867 Y=614,329
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0008
5. NAME OF DRILLER: LC GREGORY
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 22.5 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 15 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: -2.9
16. DATE HOLE STARTED: 09/06/01 COMPLETED: 09/07/01
17. ELEVATION TOP OF HOLE: 6.1 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 37 %
19. SIGNATURE OF GEOLOGIST: J. MINTON

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5
6.1	0.0					6.1	
			GRAVEL, silty, mostly crushed coarse grained angular limestone, dry, fill, light gray/brown (GM)	30	1	SPT	11, 8, 15
4.6	1.5					4.6	
			CLAY, lean, medium plasticity, some fine to medium grained quartz, no HCl reaction, moist, brown (CL)	40	2	SPT	5, 5, 2
						3.1	
				10	3	SPT	6, 4, 3
1.6	4.5					1.6	
			SAND, clayey, medium plasticity, mostly fine to medium grained quartz, trace organics, no HCl reaction, moist, brown (SC)	50	4	SPT	2, 3, 6
.1	6.0					.1	
			CLAY, lean, medium plasticity, some fine to medium grained sand, weak HCl reaction, with thin limestone lenses, moist, gray (CL)	70	5 D-5	SPT	2, 3, 7
						-1.4	
				50	6	SPT	8, 11, 15
-2.9	9.0					-2.9	
			LIMESTONE, soft, highly weathered, aphanitic, poorly indurated, wet, inner bedded with hard limestone lenses, breaks down into sand and gravel, gray	40	7	SPT	5, 10, 10
						-4.4	
				30	8	SPT	3, 10, 14
						-5.9	
				40	9 D-9	SPT	3, 12, 22
						-7.4	
				30	10	SPT	8, 17, 17
						-8.9	
				20	11	SPT	6, 14, 8
						-10.4	
				20	12	SPT	8, 7, 12
						-11.9	
				50	13 D-13	SPT	6, 11, 14
						-13.4	
				40	14	SPT	5, 9, 14
						-14.9	
				40	15	SPT	9, 9, 8
-16.4	22.5					-16.4	
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0008

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 6.1 Ft.

SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'
						-16.4	
			Notes: 1. Soils are field visually classified in accordance with the Unified Soils Clasification System. 2. Boring backfilled with 4 batches of neat cement grout. SAMPLE NO. / SAMPLE ELEVATION / LAB CLASSIFICATION 5 / -0.1 to -1.6 / CL 6 / -1.6 to -3.1 / GM *Lab visual classification based on gradation curve. No Atterberg limits.			140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).	

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

ENG FORM 1836 PREVIOUS EDITIONS ARE OBSOLETE. MAR 71

PROJECT: Southern Golden Gate Estates

HOLE NUMBER: CP01-SGGRR-CB-0008

Hole No.CP01-SGGRR-CB-0009

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=495,291 Y=614,180	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0009	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 16 undisturbed: 0
5. NAME OF DRILLER: LC GREGORY/HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 1.9
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 09/07/01 COMPLETED: 09/12/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 6.4 Ft.
9. TOTAL DEPTH OF HOLE: 26.0 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 77% SOIL 40% ROCK %
	19. SIGNATURE OF GEOLOGIST: JL MINTON

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'
6.4	0.0					6.4	
			SAND, silty, mostly fine to medium grained, carbonate little fine limestone gravel, little organics, weak HCl reaction, moist, brown (SM)	80	1 D-1	SPT	4 5 7
						4.9	
				30	2	SPT	10 17 19
						3.4	
				60	3	SPT	4 2 6
1.9	4.5					1.9	
			LIMESTONE, soft, highly weathered, aphanitic, moderately crystalline, poorly indurated, wet, inner bedded hard limestone lenses, breaks down into sand and gravel, tan,	80	4 D-4	SPT	17 24 14
						.4	
				50	5	SPT	5 12 12
						-1.1	
				10	6	SPT	12 50
-2.1	8.5					-2.1	
			LIMESTONE, hard, moderately weathered, medium grained, vuggy, fossiliferous, gray	40	Box-1	NW DIAMOND SET BIT RQD = 0%	
-4.6	11.0					-4.6	
			LIMESTONE, soft, decomposed, fine grained, with thin lenses of hard limestone, breaks down into sand and gravel, white	80	7	SPT	12 7 11
						-6.1	
				70	8	SPT	14 12 11
						-7.6	
				80	9	SPT	9 10 9
						-9.1	
				100	10	SPT	17 14 18
						-10.6	
				100	11	SPT	18 14 17
						-12.1	
				100	12 D-12	SPT	14 14 19
						-13.6	
				100	13	SPT	7 12 17
						-15.1	
				100	14	SPT	8 20
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0009

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 6.4 Ft.

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-16.1	22.5						
				100	14	-16.6 SPT	30
				100	15 D-15	SPT	13 18 35
						-18.1	
				100	16	SPT	12 22 23
-19.6	26.0					-19.6	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
1	6.4 - 7.9	SP-SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Hole No.CP01-SGGRR-CB-0010

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=484,673 Y=615,381
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0010
5. NAME OF DRILLER: D. HEWETT
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 25.5 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 17 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: 2.4
16. DATE HOLE STARTED: 08/23/01 COMPLETED: 08/23/01
17. ELEVATION TOP OF HOLE: 6.9 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 75 %
19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
6.9	0.0					6.9	
			SAND, silty, mostly fine to medium grained sub-angular carbonate, few clay, trace quartz, strong HCl reaction, dry, with thin soft limestone lenses, brown (SM)	20	1	SPT	3 8 4
						5.4	
				67	2	SPT	7 10 8
						3.9	
				67	3	SPT	8 10 4
						2.4	
				33	4	SPT	5 6 7
						.9	
.4	6.5						
			LIMESTONE, moderately hard, unweathered, aphanatic, fossiliferous, moderately indurated, breaks down into angular sand and gravel, gray	67	5	SPT	7 6 30
						-.6	
				100	6	SPT	50 28 30
						-2.1	
				100	7	SPT	16 12 12
						-3.6	
				100	8	SPT	15 28 40
-5.1	12.0					-5.1	
			SAND, silty, mostly fine to coarse grained sub-angular carbonate, strong HCl reaction, wet, occasional thin lenses of limestone, light gray (SM)	100	9	SPT	17 14 5
						-6.6	
				87	10	SPT	14 10 12
						-8.1	
-7.6	14.5						
			LIMESTONE, soft, unweathered, aphanitic, moderately indurated, breaks down into sand and gravel, gray,	73	11	SPT	8 8 5
						-9.6	
				67	12	SPT	8 15 12
						-11.1	
				100	13	SPT	14 15 17
						-12.6	
				73	14	SPT	NA NA NA
						-14.1	
				100	15	SPT	18 15 16
						-15.6	
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0010

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 6.9 Ft.

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
-15.6	22.5					-15.6	
				87	16	SPT	17 17 16
						-17.1	
			From El.-17.1 fossiliferous At El. -18.1 hard	40	17	SPT	25 18 50
-18.6	25.5					-18.6	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
2	-5.4 to -3.9	SP-SM

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CP01-SGGRR-CB-0011

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=474,412 Y=615,288	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0011	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 15 undisturbed: 0
5. NAME OF DRILLER: D. HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: 2.5
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 08/21/01 COMPLETED: 08/22/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 5.5 Ft.
9. TOTAL DEPTH OF HOLE: 25.5 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 63 %
	19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
5.5	0.0					5.5	0
			SAND, poorly graded, mostly carbonate fine to coarse grained, few angular carbonate gravel, few silt, strong HCl reaction, moist, tan (SP)	40	1	SPT	4 7 7
4.0	1.5					4.0	
			SAND, silty, mostly fine to medium grained quartz, some sub-angular fine to coarse carbonate sand, weak HCl reaction, moist, light brown (SM)	53	2	SPT	6 14 17
						2.5	2.5
				40	3	SPT	7 9 8
.5	5.0					1.0	
			LIMESTONE, soft, slightly wearthered, aphanitic, poorly indurated, breaks down into sand and gravel, thin lenses of quartz sand, brown	73	4	SPT	4 28 15
						-.5	5
				33	5	SPT	3 6 1
-2.0	7.5					-2.0	7.5
			SAND, silty, mostly fine to medium graind sub-angular quartz, few clay, weak HCl reaction, wet, gray (SM)	67	6	SPT	6 7 6
-3.5	9.0					-3.5	
			LIMESTONE, soft, slightly weathered, aphanitic, zones of hard limestone, occasional lenses of quarz sand, poorly indurated, sample breaks down to sand and gravel, gray	67	7	SPT	9 9 7
						-5.0	10
				67	8	SPT	8 32 12
-6.5	12.0					-6.5	
			SAND, silty, mostly fine to coarse grained sub-rounded carbonate, little quartz, strong HCl reaction, wet, occasional thin lenses of limestone, gray, (SM)	60	9	SPT	7 2 3
						-8.0	12.5
				100	10	SPT	3 5 2
			From El.-9.5 to -11.0 more limestone lenses.			-9.5	15
				67	11	SPT	3 6 3
-11.0	16.5					-11.0	
			LIMESTONE, hard, slightly weathered, aphanitic, fossiliferous, vuggy up to 1" diameter, moderatly indurated, breaks down into sand and gravel when spooned, gray.	67	12	SPT	3 12 10
						-12.5	17.5
				40	13	SPT	8 25 30
						-14.0	
				100	14	SPT	18 21 46
						-15.5	20
				100	15	SPT	21 46 25
						-17.0	22.5
						(continued)	

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PROJECT: Southern Golden Gate Estates | HOLE NUMBER: CP01-SGGRR-CB-0011

Hole No.CP01-SGGRR-CB-0011

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE: 5.5 Ft.

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'
-17.0	22.5						
				50	Box 1	NW DIAMOND SET BIT RQD = 0%	
-20.0	25.5						
			Notes: 1. Soils are field visually classified in accordance with the Unified Soils Clasification System. 2. Boring backfilled with neat cement grout. SAMPLE NO. 2 — SAMPLE ELEVATION 4.0'-2.5 — LAB CLASSIFICATION SP-SM *Lab visual classification based on gradation curve. No Atterberg limits.			140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).	

22.5 25 27.5 30 32.5 35 37.5 40 42.5 45 47.5 50

Hole No.CP01-SGGRR-CB-0012

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates	10. SIZE AND TYPE OF BIT: See Remarks
2. LOCATION (Coordinates or Station): X=489,760 Y=603,532	11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
3. DRILLING AGENCY: Corps of Engineers	12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0012	13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 15 undisturbed: 0
5. NAME OF DRILLER: D. HEWETT	14. TOTAL NUMBER OF CORE BOXES: 1 of 1
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED	15. ELEVATION GROUND WATER: -1.6
7. THICKNESS OF BURDEN: 0 Ft.	16. DATE HOLE STARTED: 09/12/01 COMPLETED: 09/17/01
8. DEPTH DRILLED INTO ROCK: 0 Ft.	17. ELEVATION TOP OF HOLE: 5.9 Ft.
9. TOTAL DEPTH OF HOLE: 25.5 Ft.	18. TOTAL CORE RECOVERY FOR BORING: 75 %
	19. SIGNATURE OF GEOLOGIST: J. MINTON/S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
5.9	0.0					5.9	
			SAND, silty, mostly fine to medium grained, little organics, weak HCl reaction, moist, weakly cemented, with thin limestone lenses, brown, (SM)	60	1	SPT 4.4	4, 9, 9
				70	2	SPT 2.9	4, 5, 9
				60	3	SPT 1.4	4, 8, 11
				80	4	SPT -.1	66, 100, 100
-1.6	7.5			75	5	SPT -1.6	85, 88, 115
			SAND, poorly-graded, with silt, mostly fine to medium quartz, trace organics, no HCl reaction, wet, brown (SP-SM)	70	6	SPT -3.1	7, 55, 100
				70	7	SPT -4.6	22, 22, 22
-5.6	11.5			50	8	SPT -6.1	33, 33, 168
			LIMESTONE, moderately hard, unweathered, aphanitic, vuggy, fossiliferous, moderately indurated, light gray	100	9	SPT -7.6	116, 116, 225
-10.6	16.5			83	Box-2	NW DIAMOND SET BIT RQD = 0% -10.6	
			SAND, silty, mostly fine to coarse grained sub-rounded quartz, some fine grained subrounded carbonate, wet, with thin lenses of limestone, light gray (SM)	100	10	SPT -12.1	112, 222, 115
-12.6	18.5		LIMESTONE, hard, unweathered, aphanitic, fossiliferous, little fine quartz grains, breaks down into sand and gravel, gray	87	11	SPT -13.6	115, 274, 500
-13.6	18.5		SAND, silty, mostly fine to coarse grained angular to sub rounded carbonate, trace quartz, wet, with thin sandy limestone beds, (SM)	100	12	SPT -15.1	225, 188, 256
				100	13	SPT -16.6	100, 144, 225
			At El.-15.1 fossiliferous limestone bed			(continued)	

Hole No.CP01-SGGRR-CB-0012

DRILLING LOG (Cont. Sheet)

ELEVATION TOP OF HOLE 5.9 Ft.

SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates

INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.6'
-16.6	22.5					-16.6	
				100	14	SPT	7 12 12
						-18.1	
				100	15	SPT	8 10 10
-19.6	25.5					-19.6	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
4	1.4 to 0.1	SP

Recharge Test
El. -2.6 to -7.6 BGS

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50

Hole No.CP01-SGGRR-CB-0013

DRILLING LOG | DIVISION: South Atlantic | INSTALLATION: Jacksonville District | SHEET 1 OF 2

1. PROJECT: Southern Golden Gate Estates
2. LOCATION (Coordinates or Station): X=488,533 Y=591,540
3. DRILLING AGENCY: Corps of Engineers
4. HOLE NO. (As shown on drawing title and file number): CP01-SGGRR-CB-0013
5. NAME OF DRILLER: D. HEWETT
6. DIRECTION OF HOLE: ☒ VERTICAL ☐ INCLINED
7. THICKNESS OF BURDEN: 0 Ft.
8. DEPTH DRILLED INTO ROCK: 0 Ft.
9. TOTAL DEPTH OF HOLE: 25.5 Ft.
10. SIZE AND TYPE OF BIT: See Remarks
11. DATUM FOR ELEVATION SHOWN (TBM or MSL): NAVD-88; Horizontal Datum - NAD83, FLE
12. MANUFACTURER'S DESIGNATION OF DRILL: CME 45
13. TOTAL NO. OF OVERBURDEN SAMPLES TAKEN: disturbed: 17 undisturbed: 0
14. TOTAL NUMBER OF CORE BOXES: 1 of 1
15. ELEVATION GROUND WATER: 1.7
16. DATE HOLE STARTED: 10/03/01 COMPLETED: 10/03/01
17. ELEVATION TOP OF HOLE: 4.4 Ft.
18. TOTAL CORE RECOVERY FOR BORING: 78 %
19. SIGNATURE OF GEOLOGIST: S. MYERS

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/0.5'
4.4	0.0					4.4	
			SAND, poorly graded, mostly fine to medium grained sub-rounded quartz, some medium to coarse grained carbonate, moist, interbedded with thin soft poorly cemented limestone, tan (SP)	60	1	SPT 2.9	5, 4, 17
			From El.- 1.7 wet	67	2	SPT 1.4	17, 19, 19
			From El. -1.1 dark brown	53	3	SPT -.1	9, 13, 10
			From El. -1.6 coarse grained shells, no limestone	47	4	SPT -1.6	4, 7, 14
				73	5	SPT -3.1	8, 7, 8
				60	6	SPT -4.6	6, 6, 11
				20	7	SPT -6.1	4, 7, 9
-7.1	11.5			100	8	SPT -7.6	3, 4, 10
-7.6	12.0		CLAY fat, moderately plastic, soft, little fine sand, little silt, gray (CH)	100	9	SPT -9.1	5, 17, 29
-9.1	13.5		SAND, poorly graded, mostly fine to medium grained subrounded quartz, wet, tan (SP)	80	10	SPT -10.6	6, 7, 44
			CLAY, fat, moderately plastic, soft, little fine grained sand, little silt, moist, with thin hard limestone lenses, <2" thick, gray (CH)	100	11	SPT -12.1	16, 38, 34
-12.1	16.5		From El. -11.1 some sand				
			SAND, silty, mostly fine to medium sub-angular to sub-rounded, carbonate, little silt, wet, with thin limestone lenses, gray (SM)	100	12	SPT -13.6	17, 15, 16
				93	13	SPT -15.1	14, 11, 11
				67	14	SPT -16.6	9, 9, 9
				100	15	SPT -18.1	9, 14, 12
						(continued)	

0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 | 17.5 | 20 | 22.5

Hole No.CP01-SGGRR-CB-0013

DRILLING LOG (Cont. Sheet) | ELEVATION TOP OF HOLE 4.4 Ft. | SHEET 2 OF 2

PROJECT: Southern Golden Gate Estates | INSTALLATION: Jacksonville District

ELEV.	DEPTH	LEGEND	CLASSIFICATION OF MATERIALS (Description)	CORE REC %	SAMPLE NUMBER	REMARKS Bit & Barrel	BLOWS/ 0.5'
-18.1	22.5					-18.1	
				100	16	SPT	7 10 10
						-19.6	
				100	17	SPT	7 7 6
-21.1	25.5					-21.1	

140# hammer w/30" drop used with 2.0' split spoon (1 3/8" I.D. X 2" O.D.).

Notes:

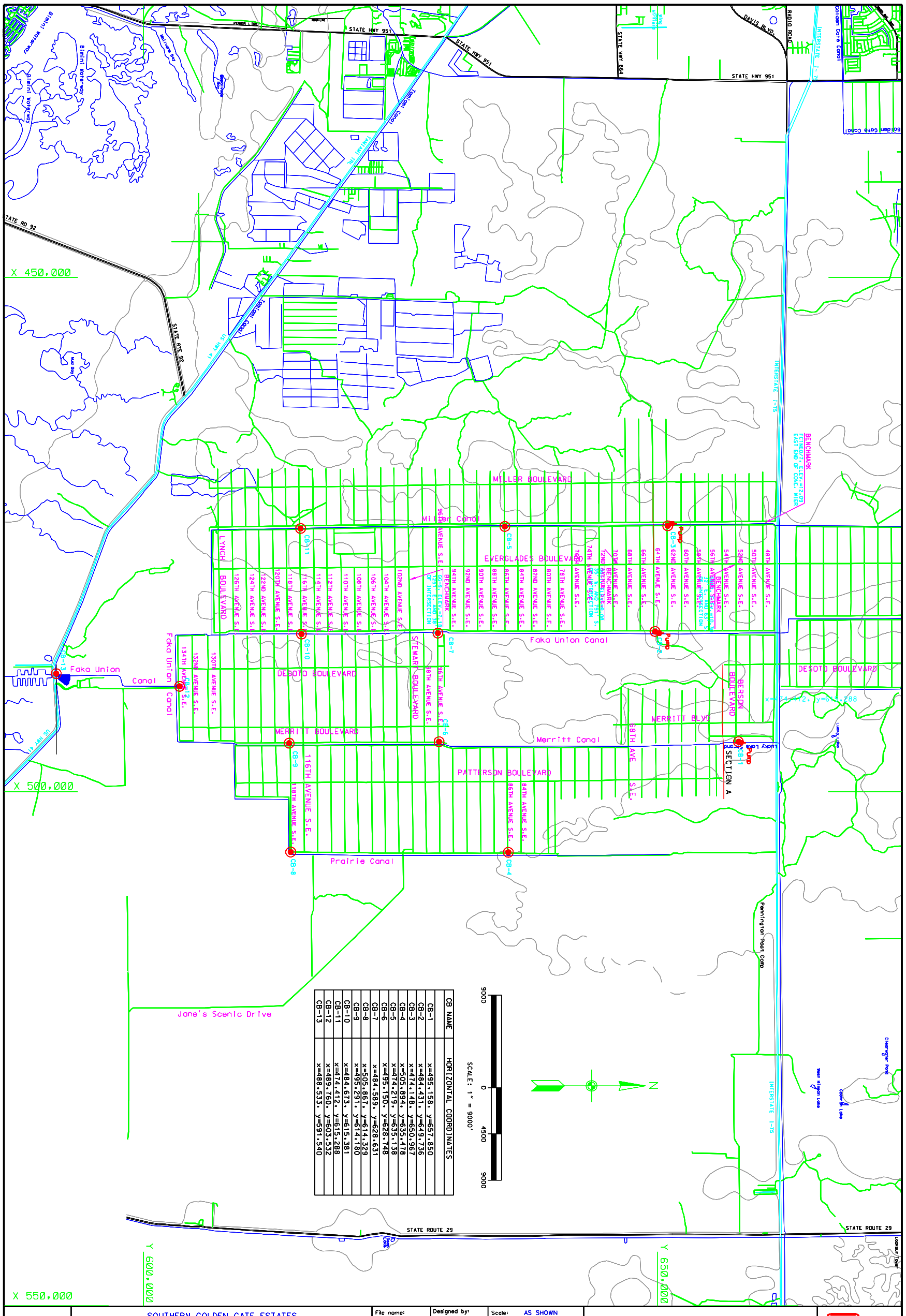
1. Soils are field visually classified in accordance with the Unified Soils Clasification System.

2. Boring backfilled with neat cement grout.

SAMPLE NO.	SAMPLE ELEVATION	LAB CLASSIFICATION
5	-1.6 to -3.1	SP
10	-9.1 to -10.6	SC

*Lab visual classification based on gradation curve. No Atterberg limits.

22.5
25
27.5
30
32.5
35
37.5
40
42.5
45
47.5
50



CB NAME	HORIZONTAL COORDINATES
CB-1	x=495,158, y=657,850
CB-2	x=484,431, y=649,736
CB-3	x=474,148, y=650,967
CB-4	x=505,894, y=635,478
CB-5	x=474,219, y=635,138
CB-6	x=495,150, y=628,748
CB-7	x=484,589, y=628,631
CB-8	x=505,867, y=614,329
CB-9	x=495,291, y=614,180
CB-10	x=484,673, y=615,381
CB-11	x=474,412, y=615,288
CB-12	x=489,760, y=603,532
CB-13	x=498,533, y=591,540

FIGURE 1

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
CORE BORING LOCATION MAP
GEOTECHNICAL APPENDIX
SEPTEMBER 2004

File name: CB-LAYOUT.dgn
Reference files:

Designed by: C.V.K.
Dwn by: C.V.K.
Ckd by:
Dated: D.O.FILE NO.

Scale: AS SHOWN
Plot date: XX-XX-XXXX
Plot scale: 1" = 9000'

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District

END OF CONSTRUCTION

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	LIMEROCK FILL	120	Cohesion: 0.0 Friction angle: 45	N/A
2	SILTY SAND	122	Cohesion: 0.0 Friction angle: 30	N/A
3	BEDROCK	--	--	--

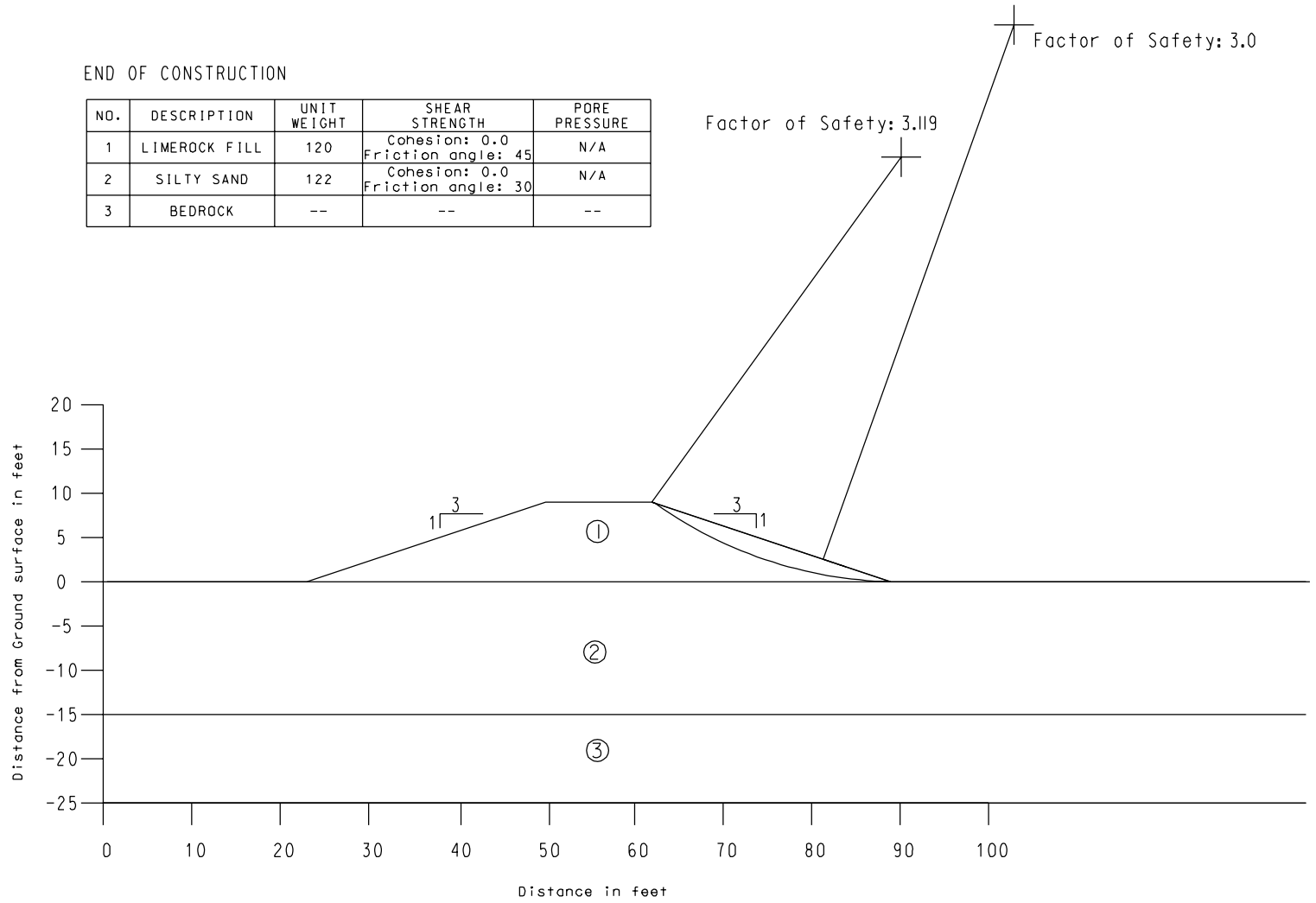


FIGURE 2

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLIMENTATION REPORT
SEPTEMBER 2004
FLOOD CONTROL LEVEE SLOPE STABILITY ANALYSIS
END OF CONSTRUCTION CASE

File name: Fig 2 - EOC.DGN
Reference files:

Designed by: HKH
Dwn by: JRD
Ckd by: HKH
Dated: 20 JAN 2004
D.O.FILE NO.

Scale: AS SHOWN
Plot date: 20 JAN 2004

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District

FULL POOL

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	LIMEROCK FILL ABOVE GWT	120	Cohesion: 0.0 Friction angle: 45	N/A
2	LIMEROCK FILL BELOW GWT	140	Cohesion: 0.0 Friction angle: 45	PIEZO LINE
3	SILTY SAND	122	Cohesion: 0.0 Friction angle: 30	PIEZO LINE
4	BEDROCK	--	--	--

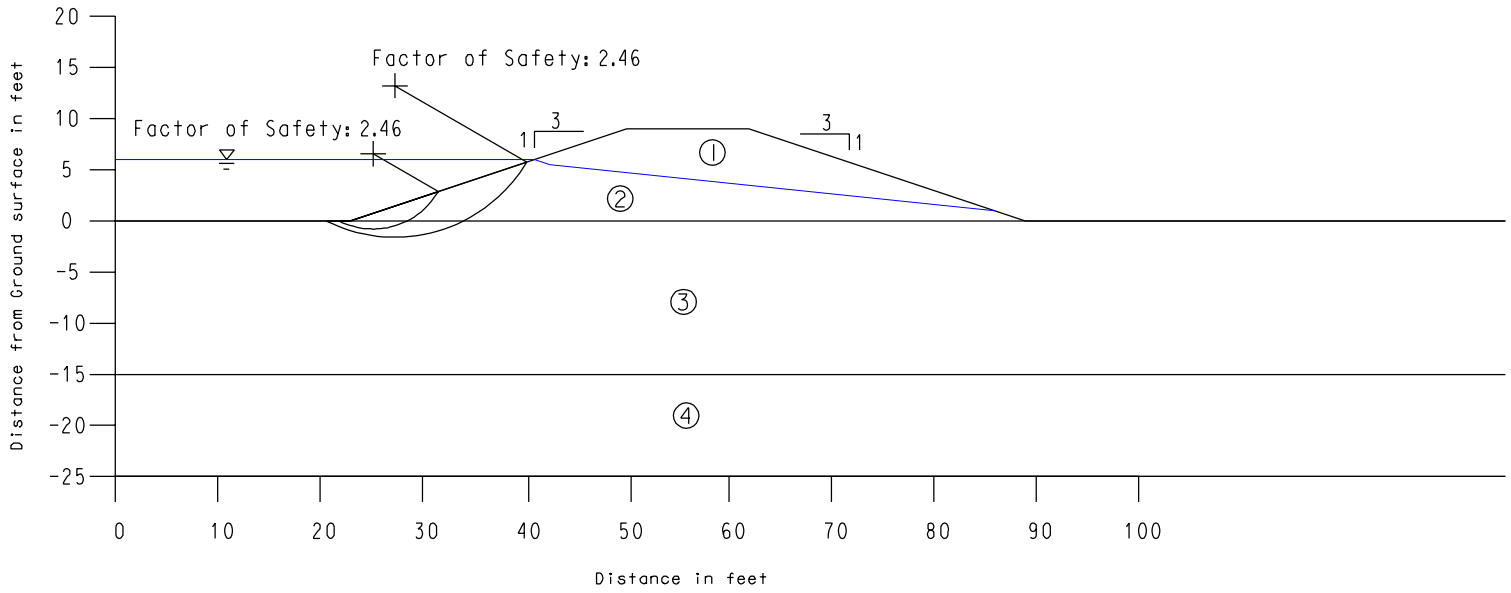


FIGURE 3

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLIMENTATION REPORT
SEPTEMBER 2004
FLOOD CONTROL LEVEE SLOPE STABILITY ANALYSIS
FULL POOL CASE

File name: Fig3-Full Pool.dgn
Reference files:
Designed by: HKH
Dwn by: JRD
Ckd by: HKH
Scale: AS SHOWN
Plot date: 20 JAN 2004
Dated: 20 JAN 2004
D.O.FILE NO.

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District

STEADY STATE SEEPAGE

NO.	DESCRIPTION	UNIT WEIGHT	SHEAR STRENGTH	PORE PRESSURE
1	LIMEROCK FILL ABOVE GWT	120	Cohesion: 0.0 Friction angle: 45	N/A
2	LIMEROCK FILL BELOW GWT	140	Cohesion: 0.0 Friction angle: 45	PIEZO LINE
3	SILTY SAND	122	Cohesion: 0.0 Friction angle: 30	PIEZO LINE
4	BEDROCK	--	--	--

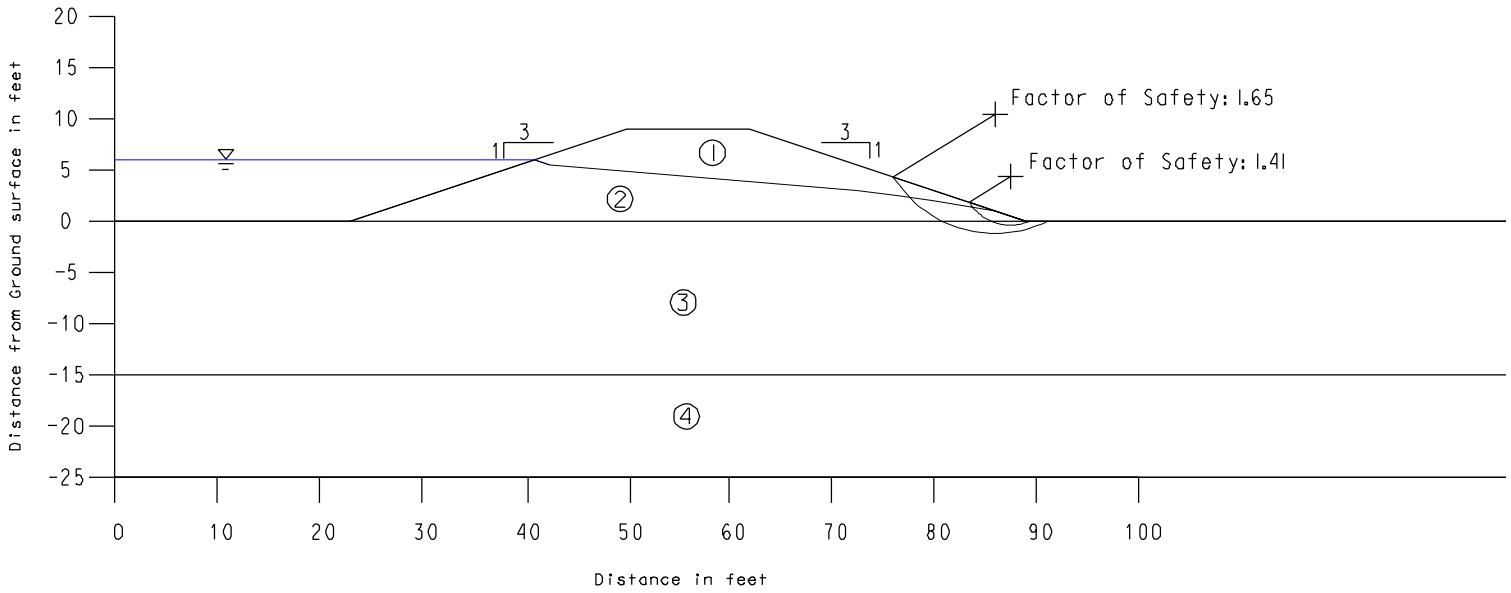


FIGURE 4

SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLIMENTATION REPORT
SEPTEMBER 2004
FLOOD CONTROL LEVEE SLOPE STABILITY ANALYSIS
STEADY SEEPAGE CASE

File name: Fig4-Steady Seepage.dgn
Reference files:

Designed by: HKH
Dwn by: JRD
Ckd by: HKH
Dated: 20 JAN 2004
D.O.FILE NO.

Scale: AS SHOWN
Plot date: 20 JAN 2004

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

US Army Corps of Engineers
Jacksonville District

APPENDIX C

DESIGN AND COST ESTIMATES

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SOUTHERN GOLDEN GATE ESTATES

COLLIER COUNTY, FLORIDA

PROJECT IMPLEMENTATION REPORT (PIR)

APPENDIX C (ALT-3D)

DESIGN AND COST ESTIMATES

September 2004

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SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
PROJECT IMPLEMENTATION REPORT (PIR)

APPENDIX C (ALT-3D)
DESIGN AND COST ESTIMATES
September 2004

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SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
PROJECT IMPLEMENTATION REPORT (PIR)

APPENDIX C (ALT-3D)
DESIGN AND COST ESTIMATES

A. INTRODUCTION

1. General. This appendix presents the discussion of preliminary design considerations and construction methods utilized to address the project requirements and to support development of the project cost estimate.

2. Proposed Plan. The proposed plan (Alternative 3D) would build three new pump stations with spreader canals and block existing drainage channels to provide restoration flows to the southern golden gate area. This plan alternative also includes building new levees for an area of Private Lands located on the northwest side of the project, for the Six L's Agricultural area located on the southwest side of the project, and for the Port of the Islands area located at the south end of the project. Drainage culverts would also be placed in the flood control levees as required for implementation of the proposed plan. Refer to the Hydrology and Hydraulics Appendix of this report for a detailed discussion of the projects features and related hydraulic requirements. Demolition of three existing weirs is also a plan component.

B. STRUCTURAL DESIGN CRITERIA

3. Structural Design Criteria. The structural design requirements for this project would be addressed during preparation of construction plans and specifications after obtaining sufficient site-specific surveys, geotechnical site borings, and pertinent hydraulic information. Preliminary hydraulic data included only flows (cfs) and pump sizes for pump stations. As a result, very few of the requirements for structural content of a PIR level document have been met at this time. Loads, load combinations, safety factors, and uplift pressures have not yet been determined. Substructure requirements have not been determined. The most conservative method of dewatering has been assumed. Construction techniques and sequence have been assumed without knowledge of topography and possible site restrictions. No stability analyses have been performed. No initial stress analyses have been performed.

C. DESIGN AND CONSTRUCTION

4. Demolition. Three weirs would be demolished and removed: Miller 2, FU-3, and Lucky Lake Weir.

5. New Structures. Three major pumping stations and one small pumping station would be constructed:

Miller Pumping Station – 1250 cfs.
Faka Union Pumping Station – 2630 cfs.
Merritt Pumping Station – 800 cfs.
Private Lands Levee Pumping Station – 100 cfs.

6. Site Access / Haul Road. Existing county and state roads would provide access to structures during construction. Permanent stabilized roads would be constructed to provide all weather access to the pump stations and residences as shown on Plate C-1. Access roads would include culverts to accommodate the passing of floodwaters. A typical section of the access road is provided on Plate C-7.

A temporary haul road would be required to provide construction access to the Six L's Agricultural Area and the Port of the Island via US 41 (Tamiami Trail). The road would be approximately 4,500 linear feet, a minimum of 2 feet above existing grade, and have two 12 ft. travel lanes with 6 ft. sloping shoulders. The road would be constructed in a 50 ft. cleared right-of-way. The southeastern portion of the 6L's levee would be used as a haul route to access Tamiami Trail and the Port of the Island levees. The anticipated alignment is shown on Plate C-1, and a typical section of the temporary haul road is provided on Plate C-8.

7. Borrow Areas. Suitable fill material for construction of the pump stations and grading of the structure sites should be available from excavation within the project area. However, should additional select structural fill be required, it is readily available from many commercial sources in south Florida.

8. Dewatering. Groundwater levels in south Florida are generally at or near the ground surface. Therefore, structures with inverts at or below existing ground require dewatering to construct in the dry. A steel sheet pile cofferdam with underwater concrete seal is assumed to be required for the project structures. Open excavation with a well point system is also a possible method of dewatering and will be considered in the final design stage of the project.

9. Cofferdams. Cofferdams are assumed to be similar to previous designs performed by the Jacksonville District for structures located in south Florida. Components include steel sheet pile, wale, strut, underwater concrete seal, and rock anchors.

10. By-pass Canals. Existing canals in the design regions will remain in service throughout the construction period. For structures that will be demolished or constructed in an existing canal, a temporary by-pass canal will be constructed to channel flow around the demolition/ construction site.

11. Pumping Stations. Four pumping stations are proposed for the project as stated above. The Merritt Pumping Station is considered to be a medium sized pump station, and Miller and Faka Union Pumping Stations are considered to be large pump stations. The Private Lands Pumping Station is considered small but would be similar in design to the medium pumping station. Typical plan and section drawings for medium and large pumping station are shown on Plates 3D-1 through 3D-4.

The primary structural components of a pumping station are substructure, operating floor and superstructure. The substructure includes the sumps and water passages that conduct water to the pump intakes. The operating floor supports pumps, diesel engines, and generators. The superstructure is the enclosure for equipment and personnel areas in the plant. Miscellaneous structural items include crane, service bridge, retaining wall, and trash rack.

12. Mechanical / Electrical Design. A detailed discussion of the mechanical and electrical design criteria and the design and construction of the pump stations including design plates is provided as an attachment to this appendix.

13. Culverts and Pumps Drainage culverts with flap gates would be required at various locations in all of the levees. The number and size of culverts have been estimated and included in the project cost estimate. A more detailed analysis and design of these culverts would be accomplished after project authorization and receipt of more detailed survey topographic data.

As stated above, pumps would be required in the levee for the Private Lands area to provide adequate drainage as follows:

Private Lands - 50cfs capacity pump with a 50cfs emergency backup pump

14. Roadway Degrading. Existing roadways would be degraded to approximately the original existing grade to help reestablish sheet flow over the project area. The degraded material would be used to construct the levees discussed below, to plug existing canals, and to fill the adjacent roadside swales to the extent possible. Typical sections of the roadway degrading are shown on Plate C-6.

15. Spreader / Seepage Canals. A spreader canal and berm would be constructed downstream of each pump station to help restore uniform flows over the project area. Excavated material would be used to construct the adjacent berm and to elevated the pump station sites to the level of the respective access roads. Excess

material would be used in other areas of the project that require fill. Spreader canal locations are shown on Plate C-1, and a typical section is provided on Plate C-3.

Seepage canals or ditches would be constructed adjacent to the levees to provide interior drainage. For the Six L's Agricultural area and the Port of the Islands, the seepage would be released through culverts. For the Private Lands, the seepage would be pumped back to the flood side of levee. Typical seepage canal sections are included on the typical levee section plates identified below.

16. Levees. Levees would be constructed to protect residential areas on both the west side and south side of the project. West side areas would include the Private Lands, and the Six L's Agricultural Area. South side areas would include the Port of the Islands both north and south of U.S. Highway 41. Sufficient material required for construction would be available from the degrading of the roadways, excavation of the spreader canal, and from construction of the seepage canals as discussed above. Excess material would be used either to increase the size or number of proposed canal plugs. A geotechnical discussion of the suitability of materials is provided in Appendix B. The levees would be constructed to satisfy the hydraulic requirements presented in Appendix A. Typical levee sections for the Six L's area and for the other areas are provided on Plate C-4 and Plate C-5, respectively

17. Levee Road Ramps. Road ramps would be required over the levees wherever access is to be maintained. Each ramp would also require four drainage culverts (2-36" CMP on the interior and 2-36" CMP on the exterior sides of the levee). It is currently estimated that three road ramps would be required (two for the Private Lands area and one for the Port of Island's north levee). The estimated cost for the road ramps is included in the project cost estimate for "Roads". Road ramps would be designed during preparation of construction plans and specifications.

18. Canal Plugs. As briefly discussed in the above paragraphs, the existing drainage canals (Miller, Faka Union, Merritt, and Prairie) would be plugged at numerous locations to help reestablish overland drainage patterns.

The locations of the canal plugs are provided on Plate C-1, and a typical section is shown on Plate C-2.

D. RELOCATIONS

19. General. The project sponsor would be required to assume the costs for all relocations and alterations. The alternative plan presented in this report would require relocation of utilities to provide electrical and water service to the proposed pump stations. It is assumed that a 3 phase, 480 volt electrical service already exists at the intersection of Everglades Boulevard and 52nd Avenue.

The estimated costs for this relocation is included in the project cost estimate.

E. OPERATIONS AND MAINTENANCE

20. General. The project sponsor would be responsible for operation and maintenance of the improvements and features proposed in this report upon completion of the construction project. The Contractor would be responsible for all maintenance during the construction contract.

21. Inspection. Joint field inspections with personnel from the U.S. Army Corps of Engineers and the local sponsor would be conducted on a regular basis to evaluate the performance and condition of the various project features. Additional field inspections would be conducted following a significant storm event.

22. Estimated Annual Costs. The estimated annual operation and maintenance cost for the project would be $2,129,000. This is based on projected estimate of costs for operation and general maintenance of the pump stations including periodic replacement of operating equipment. This cost also includes maintenance of the levees and access roads. Levee maintenance would consist of periodic mowing and erosion repair.

23. O&M Manual. Operation and maintenance of the project facilities would be performed in accordance with instructions prepared and incorporated in the "Operation and Maintenance Manual" which would be furnished to the project sponsor. The O&M Manual would be prepared in accordance with ER 1110-2-401.

F. QUANTITIES AND COST ESTIMATES

24. Summary of Costs. The estimates of first cost for construction of the proposed plan (Alternative 3D) were prepared using M-CACES software and are presented in Table C-1. Also, the cost of the non-construction features of the project is included. The cost estimate includes a narrative, a summary cost, and a detailed cost showing quantity, unit cost, and the amount for contingencies for each cost item.

The cost estimates are prepared for an effective date of October 2004.

TABLE C-1

ALTERNATIVE 3D
PROJECT COST ESTIMATE

Designed By:
Estimated By: CESAJ-EN-C

Prepared By:
KRC

Preparation Date: 08/13/04
Effective Date of Pricing: 10/01/04

Sales Tax: 7.00%

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by Building Systems Design, Inc.
Release 5.31

This is a concept level cost estimate for the construction of alternate 3D of the Southern Golden Gates Estates hydrologic restoration located in Collier County, Florida.

This project includes a combination of spreader channels, canal plugs, road removal and pump stations in the Western Basin and Big Cypress, Collier County, south of I-75 and north of U.S. 41 between the Belle Meade Area and the Fakahatchee Strand State Preserve.
The purpose of this project is to restore and enhance the wetlands in Golden Gate Estates and in adjacent public lands by reducing over-drainage. Implementation of the restoration plan would also improve the water quality of coastal estuaries by moderating the large salinity fluctuations caused by freshwater point discharge of the Faka Union Canal. The plan would also aid in protecting the City of Naples eastern Golden Gate well field by improving groundwater recharge.

The cost estimate is based on a scope of work provided in a 30 December 2002 CESAJ-EN-HH Memorandum "Design and Cost Estimates and Draft Engineering Appendices, Southern Golden Estates (SGGE) Alternative 3D, 8 and 9, Florida" with later revisions and additions.

The basis of the estimates is published cost data, MCACES models, MCACES unit price book, and developed cost.
A contractor cost of approximately 30% including profit is part of the estimate. A MCACES model developed by EN-C was employed in producing the pump plant cost. This model is based on historical contracted cost and includes contractor cost in the reported labor, equipment and materials cost, therefore does not include any additional contractor markup.
Escalation is applied to the pump plant cost. The MCACES model is based on cost for a 4th Qtr 2000 contract. The model cost have been escalated utilizing the CWCCIS (EM 1110-2-1304) indexes for pump plants from 4 qtr FY00 to 1 qtr FY05 The general recent(03/04) escalation of steel and oil cost has been reflected by an overall material cost adjustment.

The PED cost is 9 % of contract cost as directed.
The S&A cost is10 % of contract cost as directed.
No specific cost risk analysis was performed. However a contingency of 25% of contract cost is used for construction cost contingency because of the level of design and investigations. Real estate cost and contingency were provided by Real Estate Division. The Real estate contingency cost may not be allocated to the sub features of the 01 account in the manner intended by the real estate cost reporters because of MCACES program limitations.

The project features include:

Site clearing, utilities removal, and 3 weir structures removed.

Pump plants and associated spreader canals for the Miller (1250 cfs), Faka Union(2630 cfs), and Merritt (800 cfs) canals and a 100 CFS pump plant for the Private Lands protection levee. The major canals will be plugged with material produced from the road removals. The lead plug in each canal will be hardened.

Road removal including asphalt removal. The asphalt will be removed, hauled to an off site disposal area. Eleven and two tenths miles of access road will be constructed and have culverts each 500 feet.
Protection levees will be constructed. Each protection levee will include culverts and seepage ditches. The Private lands levee will include a 100 cfs flood protection pump plant.
Each levee will include road ramps with culverts on either side of the levee.
Construction of the 6Ls levees will require the construction of a temporary access road and its removal. The material required for protection levee construction is provided by the seepage ditches and by hauled material produced by the road degrading.

Connector channel with culverts

SUMMARY REPORTS SUMMARY PAGE

PROJECT OWNER SUMMARY - Contract.....1
PROJECT OWNER SUMMARY - Feature.....2
PROJECT OWNER SUMMARY - Sub Feat.....3

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

** PROJECT OWNER SUMMARY - Contract (Rounded to 1000's) **

	CONTRACT COST	CONTINGN	TOTAL COST
01 Southern Golden Gates Alt 3D	300,230,000	41,759,000	341,989,000
TOTAL SGGE alt 3D	300,230,000	41,759,000	341,989,000

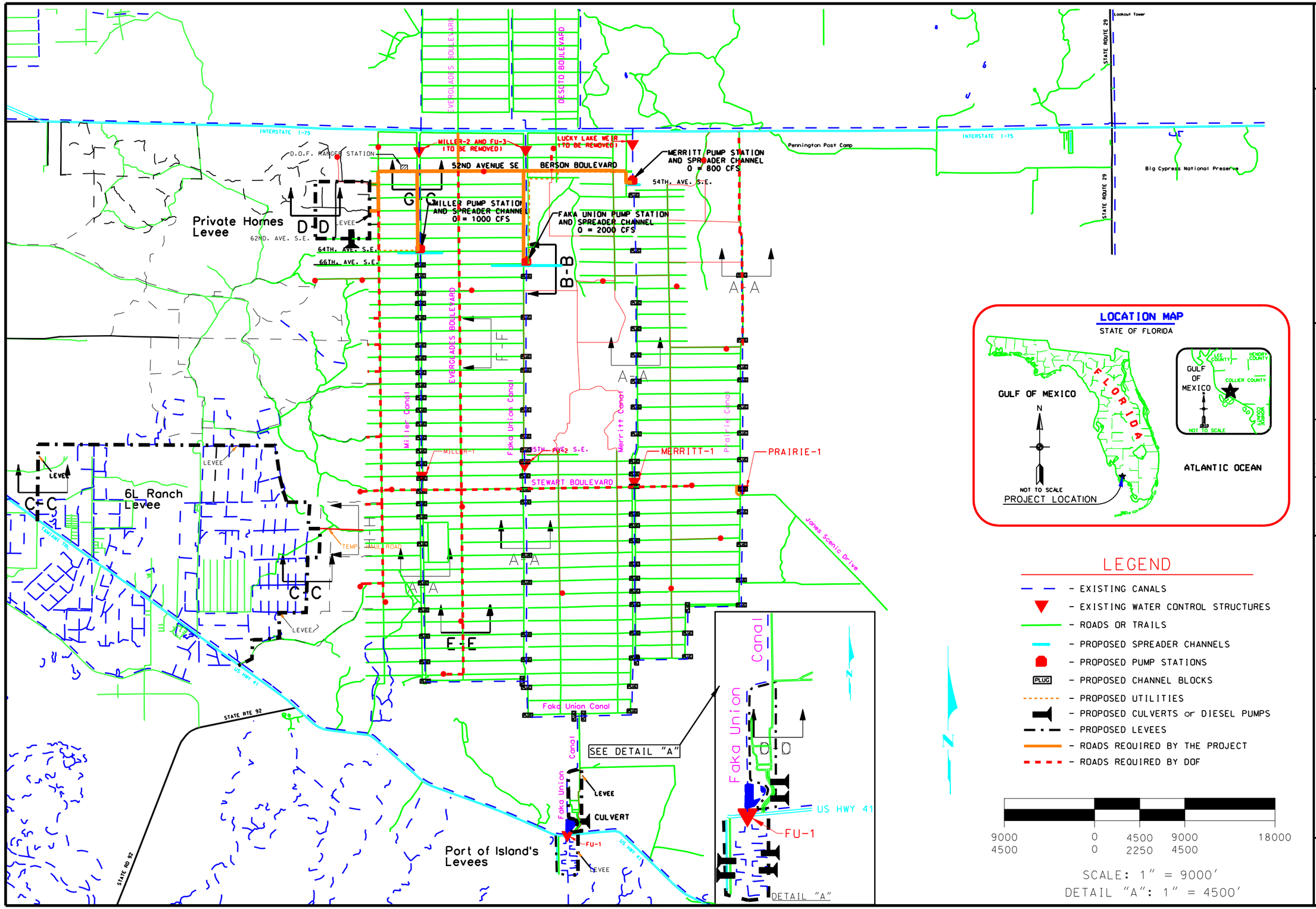
	CONTRACT COST	CONTINGN	TOTAL COST
01 Southern Golden Gates Alt 3D			
01-0001 Construction Cost			
01-0001/02 Relocations	1,675,000	419,000	2,094,000
01-0001/08 Roads Railroads and Bridges	27,252,000	6,813,000	34,065,000
01-0001/09 Channels and Canals	4,306,000	1,076,000	5,382,000
01-0001/11 Levees and Floodwalls	5,921,000	1,480,000	7,401,000
01-0001/13 Pump PLant	53,981,000	13,495,000	67,476,000
01-0001/15 Floodway Control-Diversion Struc	7,919,000	609,000	8,528,000
TOTAL Construction Cost	101,054,000	23,892,000	124,946,000
01-0002 Non Construction Cost			
01-0002/01 Lands and Damages	179,975,000	13,066,000	193,041,000
01-0002/30 Preconstruct Engineerng & Design	9,095,000	2,274,000	11,369,000
01-0002/31 Construction Management	10,106,000	2,527,000	12,633,000
TOTAL Non Construction Cost	199,176,000	17,866,000	217,043,000
TOTAL Southern Golden Gates Alt 3D	300,230,000	41,759,000	341,989,000
TOTAL SGGE alt 3D	300,230,000	41,759,000	341,989,000

** PROJECT OWNER SUMMARY - Sub Feat (Rounded to 1000's) **

	CONTRACT COST	CONTINGN	TOTAL COST
01 Southern Golden Gates Alt 3D			
01-0001 Construction Cost			
01-0001/02 Relocations			
01-0001/02.10 Utilities	1,542,000	385,000	1,927,000
01-0001/02.20 Weir Structure removal	134,000	33,000	167,000
TOTAL Relocations	1,675,000	419,000	2,094,000
01-0001/08 Roads Railroads and Bridges			
01-0001/08.10 Mob, Demob and Preparatory Work	1,306,000	326,000	1,632,000
01-0001/08.20 Road Demolition	14,299,000	3,575,000	17,874,000
01-0001/08.30 Clearing Req for Road Demo	7,651,000	1,913,000	9,564,000
01-0001/08.50 Access Road	3,017,000	754,000	3,772,000
01-0001/08.60 Asphalt Off Site Disposal	979,000	245,000	1,223,000
TOTAL Roads Railroads and Bridges	27,252,000	6,813,000	34,065,000
01-0001/09 Channels and Canals			
01-0001/09.01 Canal Plugs	1,029,000	257,000	1,287,000
01-0001/09.02 Merritt Spreader	117,000	29,000	146,000
01-0001/09.03 Faka Union Spreader	815,000	204,000	1,019,000
01-0001/09.04 Miller Spreader	551,000	138,000	689,000
01-0001/09.06 Connector Channel	147,000	37,000	183,000
01-0001/09.07 Protection Levees' Seepage Ditch	1,647,000	412,000	2,058,000
TOTAL Channels and Canals	4,306,000	1,076,000	5,382,000
01-0001/11 Levees and Floodwalls			
01-0001/11.01 Protection Levee-6Ls	2,489,000	622,000	3,111,000
01-0001/11.02 Levee Port of Islands North	760,000	190,000	951,000
01-0001/11.03 Levee Private Lands	603,000	151,000	753,000
01-0001/11.05 Levee South of 41 East	118,000	30,000	148,000
01-0001/11.06 Levee South of 41 West	53,000	13,000	66,000
01-0001/11.07 Mobilization and Demobilization	199,000	50,000	249,000
01-0001/11.08 Levee Fill Material Hauling	1,699,000	425,000	2,124,000
TOTAL Levees and Floodwalls	5,921,000	1,480,000	7,401,000
01-0001/13 Pump PLant			

		CONTRACT COST	CONTINGN	TOTAL COST
01-0001/13.01	Faka Union Pump Plant 2630 CFS	26,727,000	6,682,000	33,409,000
01-0001/13.02	Miller Pump Plant 1250 CFS	14,139,000	3,535,000	17,673,000
01-0001/13.03	Merritt Pump PLant 800 CFS	11,447,000	2,862,000	14,309,000
01-0001/13.04	Pump Plant Private Lands 100CFS	1,668,000	417,000	2,085,000
	TOTAL Pump PLant	53,981,000	13,495,000	67,476,000
01-0001/15	Floodway Control-Diversion Struc			
01-0001/15.10	Mob and Demob	124,000	31,000	155,000
01-0001/15.20	Protection Levee Culverts	1,257,000	314,000	1,571,000
01-0001/15.30	Levee Ramp Culverts	69,000	17,000	87,000
01-0001/15.40	Access Road Culverts	516,000	129,000	644,000
01-0001/15.45	Connector Culverts	90,000	22,000	112,000
01-0001/15.50	Earthwork cut and fill	379,000	95,000	474,000
01-0001/15.60	Contract -Tamiami Trail Culverts	5,484,000	0	5,484,000
	TOTAL Floodway Control-Diversion Struc	7,919,000	609,000	8,528,000
	TOTAL Construction Cost	101,054,000	23,892,000	124,946,000
01-0002	Non Construction Cost			
01-0002/01	Lands and Damages			
01-0002/01.1C	Condemnations	1,512,000	110,000	1,622,000
01-0002/01.1E	Appraisals	1,368,000	99,000	1,467,000
01-0002/01.1F	PL 91-646 Assistance	140,000	10,000	150,000
01-0002/01.1G	Temp Lic Permit ROE	35,000	3,000	38,000
01-0002/01.1M	Related Admin	10,000	1,000	11,000
01-0002/01.1R	Real Estate Payments	138,184,000	10,032,000	148,216,000
01-0002/01.AA	Project Planning	60,000	4,000	64,000
01-0002/01.B4	Review of LS	632,000	46,000	678,000
01-0002/01.B_	Acquisitions	33,632,000	2,442,000	36,074,000
01-0002/01.R2	PL 91-646 Assis Payments	4,402,000	320,000	4,722,000
	TOTAL Lands and Damages	179,975,000	13,066,000	193,041,000
01-0002/30	Preconstruct Engineerng & Design			
01-0002/30.01	Planning, Engnrng & Design (E&D)	9,095,000	2,274,000	11,369,000
	TOTAL Preconstruct Engineerng & Design	9,095,000	2,274,000	11,369,000
01-0002/31	Construction Management			

		CONTRACT COST	CONTINGN	TOTAL COST
01-0002/31.01	Construction Management (S&I)	10,106,000	2,527,000	12,633,000
TOTAL	Construction Management	10,106,000	2,527,000	12,633,000
TOTAL	Non Construction Cost	199,176,000	17,866,000	217,043,000
TOTAL	Southern Golden Gates Alt 3D	300,230,000	41,759,000	341,989,000
TOTAL	SGGE alt 3D	300,230,000	41,759,000	341,989,000



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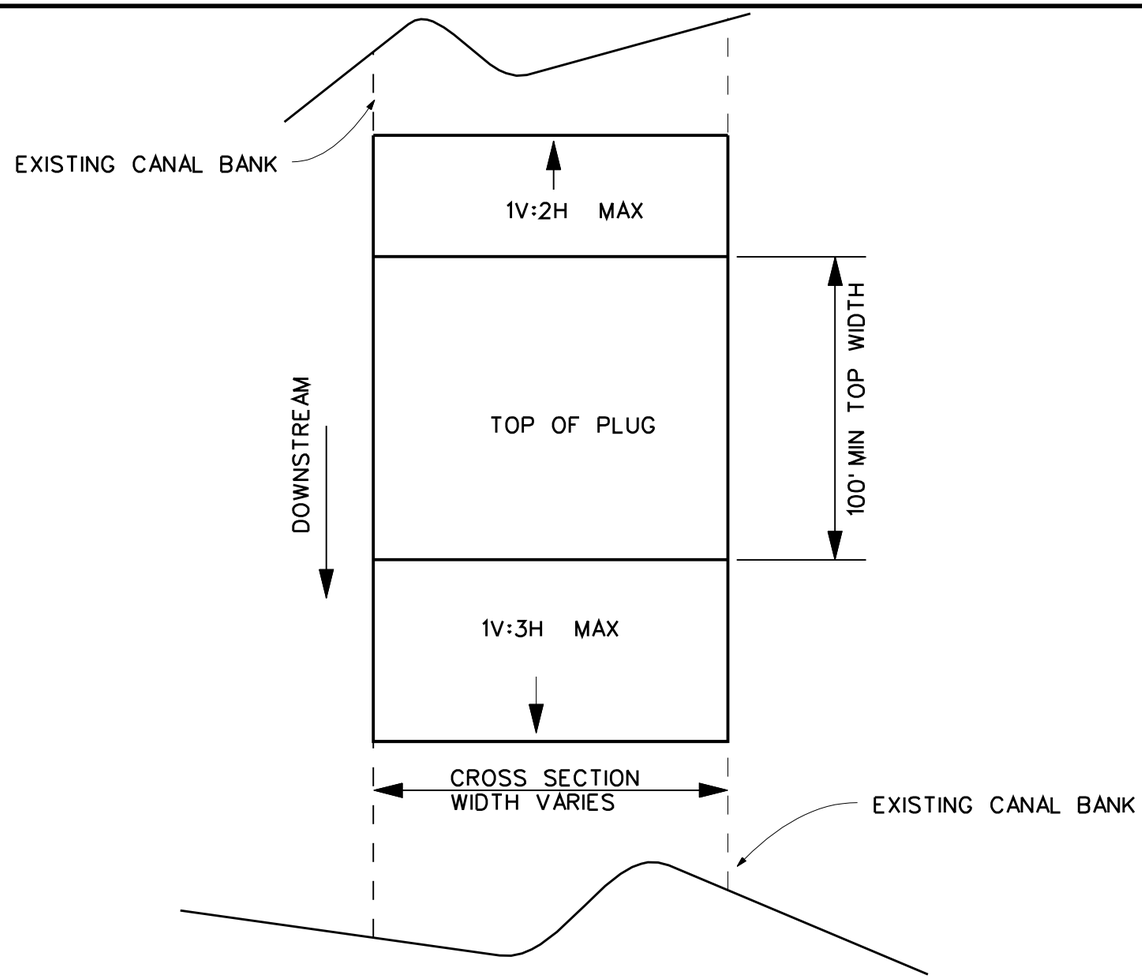
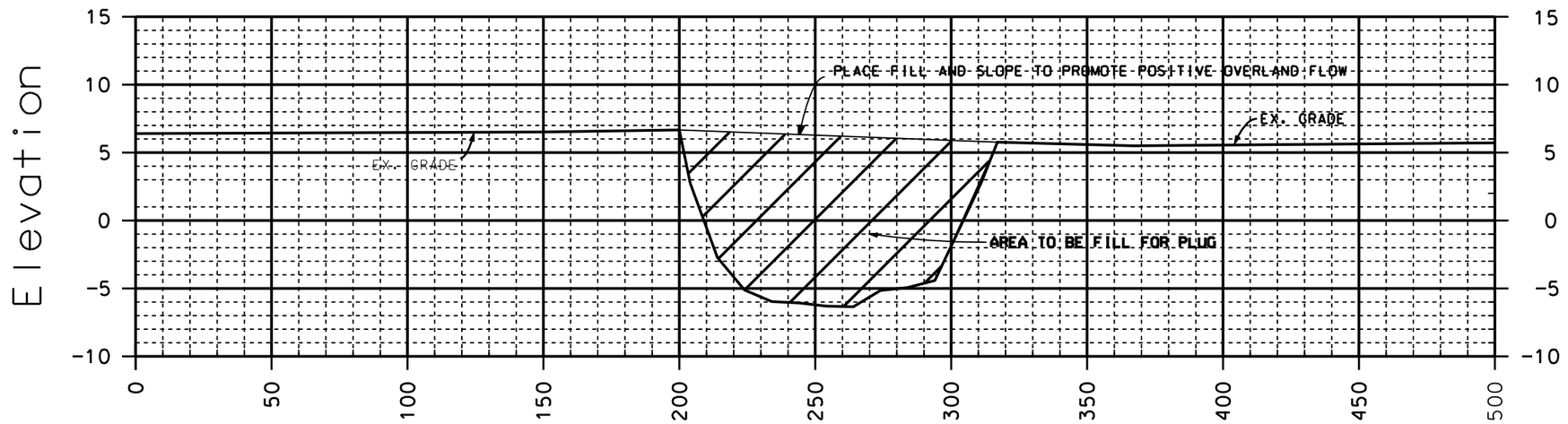
PROJECT IMPLEMENTATION REPORT

PLAN AND LOCATION MAP

PLATE
C-1





SECTION A-A -- TYPICAL SECTION FOR MILLER, FAKA UNION, MERRITT AND PRAIRIE CANALS

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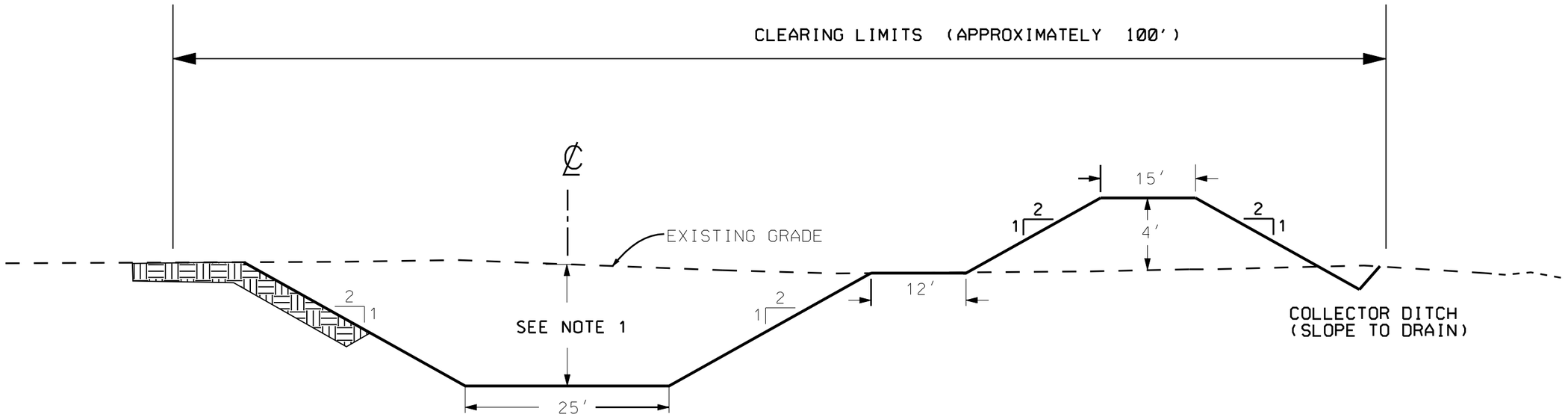
CANAL PLUG FILL
TYPICAL SECTION

PLATE
C-2



SECTION B-B -- TYPICAL SECTION
SPREADER CANAL
(Not to Scale)

NOTES:

1. PROPOSED CANAL BOTTOM ELEVATION: +2.0 FEET (NAVD 88)

2. DEPTH OF CANAL VARIES WITH ELEVATION OF EXISITNG GROUND.

3. TOTAL CANAL LENGTH WOULD BE APPROXIMATELY 13,000 FEET.
   MILLER PUMP STATION - SPREADER CANAL = 4500 FEET
   FAKA UNION PUMP STATION - SPREADER CANAL = 7025 FEET
   MERRITT PUMP STATION - SPREADER CANAL = 1450 FEET

4. CROSS SECTIONAL AREA OF CANAL SECTIONS MAY BE REDUCED IF ON SITE MATERIALS PERMIT STEEPER SIDE SLOPES.

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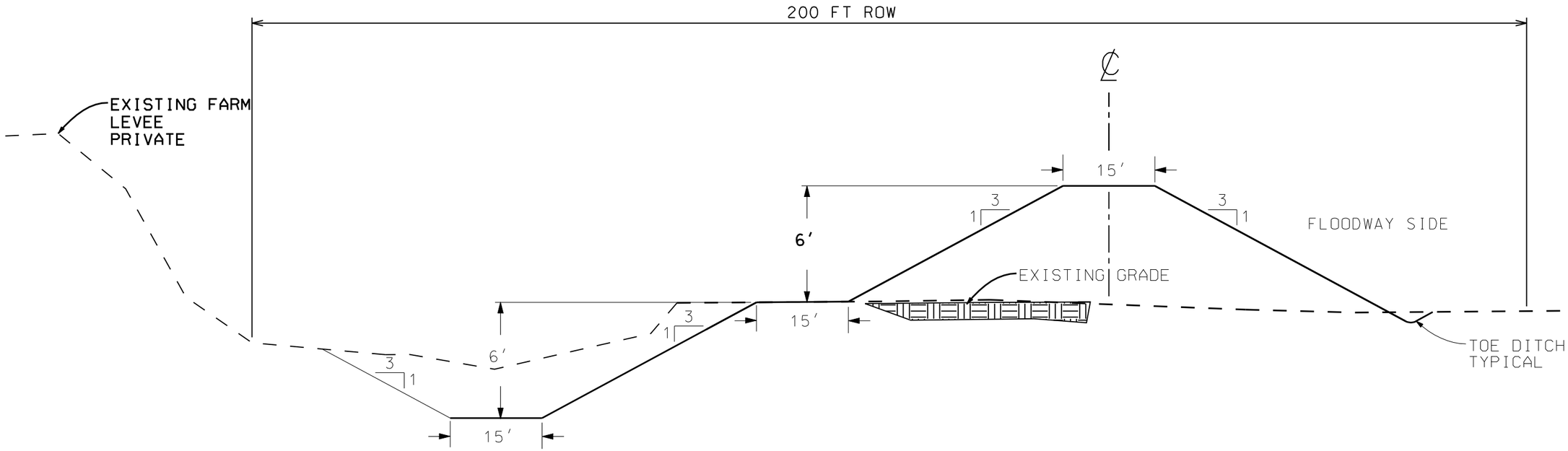
PROJECT IMPLEMENTATION REPORT

SPREADER CANAL
TYPICAL SECTION

PLATE
C-3



SECTION C-C TYPICAL SECTION FLOOD CONTROL LEVEE -- 6L′s RANCH

NOTES:

1. LEVEE TO BE CONSTRUCTED FROM MATERIALS TAKEN FROM SEEPAGE DITCH CONSTRUCTION, ROADWAY DEGRADATION AND CANAL IMPROVEMENTS.

2. CROSS SECTIONAL AREA OF LEVEE SECTIONS WOULD BE APPROXIMATELY:
   6′ SECTION 198 SQ FT

3. LEVEE LENGTHS WOULD BE APPROXIMATELY:
   SIX L′s RANCH 64,200 LF

4. CROSS SECTIONAL AREA OF LEVEE SECTIONS MAY BE REDUCED IF ON SITE MATERIALS PERMIT STEEPER SIDE SLOPES.

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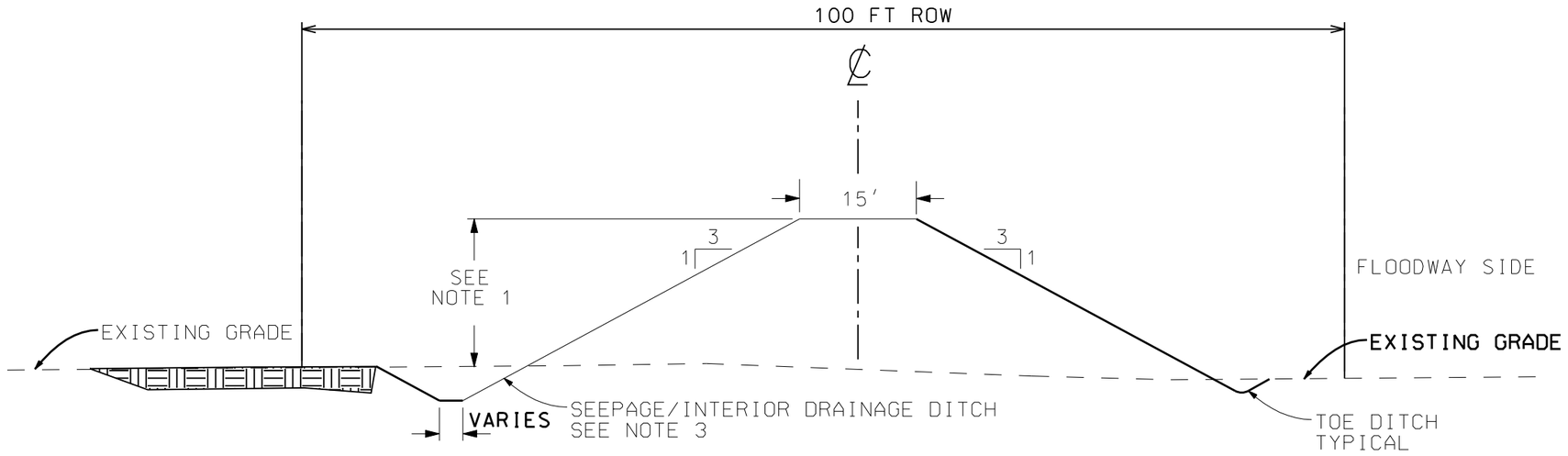
FLOOD CONTROL LEVEE
TYPICAL SECTION

PLATE
C-4



SECTION D-D TYPICAL SECTION FLOOD CONTROL LEVEE -- OTHER PROPERTIES

NOTES:

1. LEVEE HEIGHT ABOVE NATURAL GROUND:
   PRIVATE LANDS 6'
   PORT OF THE ISLANDS NORTH 9'
   PORT OF THE ISLANDS SOUTH 6'

2. LEVEE TO BE CONSTRUCTED FROM MATERIALS TAKEN FROM SEEPAE DITCH CONSTRUCTION, ROADWAY DEGRADATION AND CANAL IMPROVEMENTS.

3. SEEPAGE DITCH TO BE CONSTRUCTED IN ALL LOCATIONS. CROSS SECTION VARIES WITH LOCATION.

PRIVATE LANDS	3' DEEP	15' BOTTOM WIDTH
PORT OF THE ISLANDS NORTH	3' DEEP	3' BOTTOM WIDTH
PORT OF THE ISLANDS SOUTH	3' DEEP	3' BOTTOM WIDTH

3. CROSS SECTIONAL AREA OF LEVEE SECTIONS WOULD BE APPROXIMATELY:
   6' SECTION 198 SQ FT
   9' SECTION 378 SQ FT

4. LEVEE LENGTHS WOULD BE APPROXIMATELY:
   PRIVATE LANDS 22,200 LF
   PORT OF THE ISLANDS NORTH 16,000 LF
   PORT OF THE ISLANDS SOUTH 6,200 LF

5. CROSS SECTIONAL AREA OF LEVEE SECTIONS MAY BE REDUCED IF ON SITE MATERIALS PERMIT STEEPER SIDE SLOPES.

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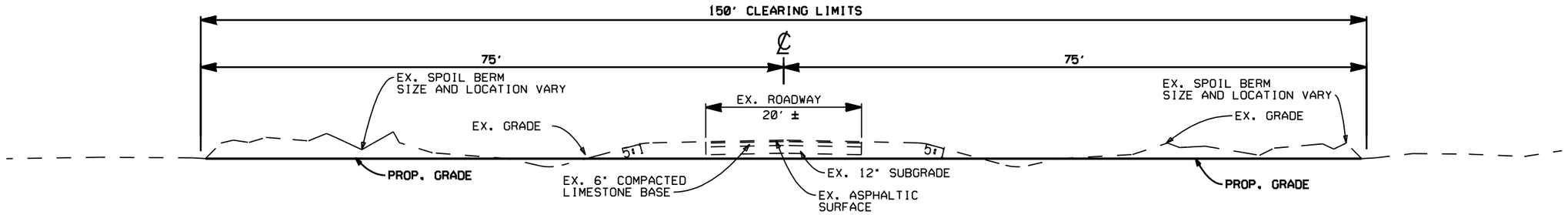
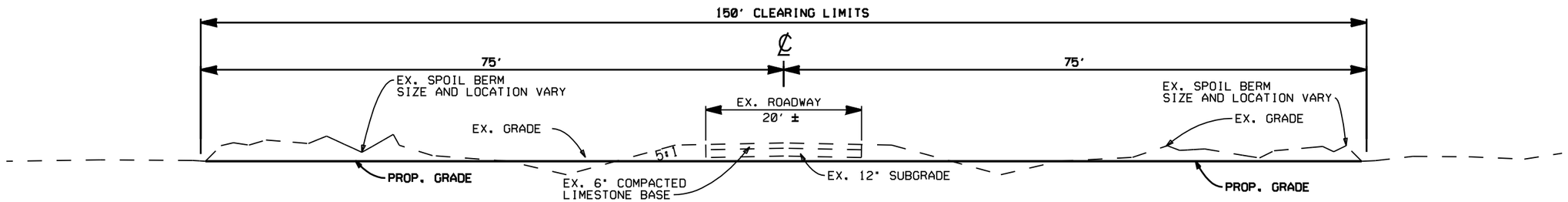
FLOOD CONTROL LEVEE
TYPICAL SECTION

PLATE
C-5



SECTION E-E -- TYPICAL SECTION PAVED ROADWAY DEGRADATION



SECTION F-F -- TYPICAL SECTION UNPAVED ROADWAY DEGRADATION

NOTES:

1. ROADWAYS ARE TO BE DEGRADED TO PROMOTE OVERLAND FLOW PATTERNS.
2. TYPICAL SECTION MAY BE MODIFIED TO PROMOTE OVERLAND FLOW.
3. EXCESS MATERIAL WOULD BE USED TO CONSTRUCT PROPOSED STRUCTURES AND FILL EXISTING CANALS.

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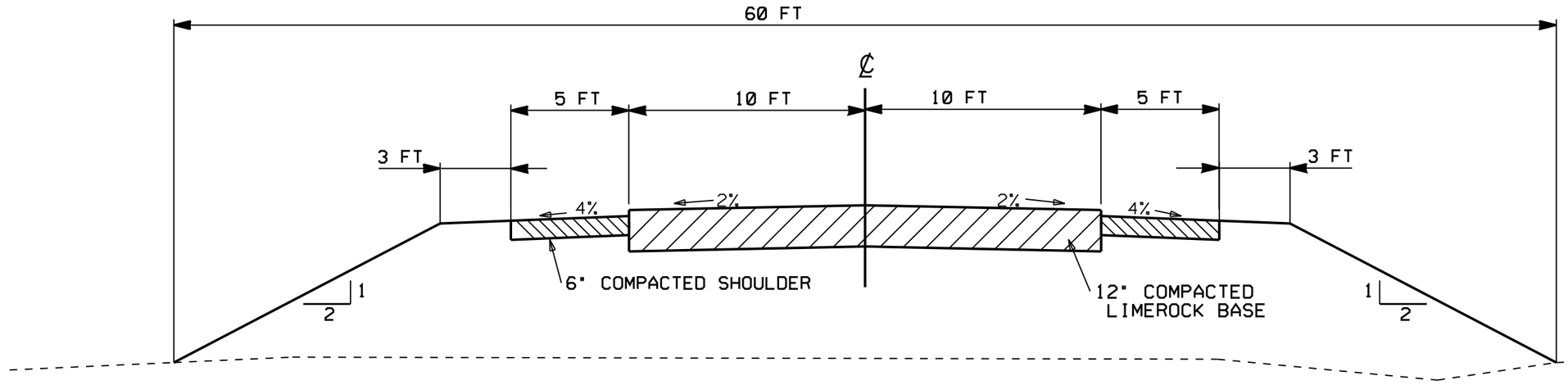
ROADWAY DEGRADATION
TYPICAL SECTION

PLATE
C-6



SECTION G-G -- TYPICAL SECTION ACCESS ROAD

NOTES:

1. TOTAL LENGTH OF ROADWAYS IS APPROXIMATELY 11.2 MILES
2. TYPICAL CROSS SECTION AREA: 278 SF
3. ROADWAY TO BE CONSTRUCTED FROM ON SITE SPOIL MATERIAL.
4. ROADWAY WOULD BE CONSTRUCTED A MINIMUM OF 6 FEET ABOVE EXISTING GRADE.
5. 36" CMP CULVERTS ON 500' CENTERS AND AT LOW POINTS IN ROAD ALIGNMENT AS REQUIRED.

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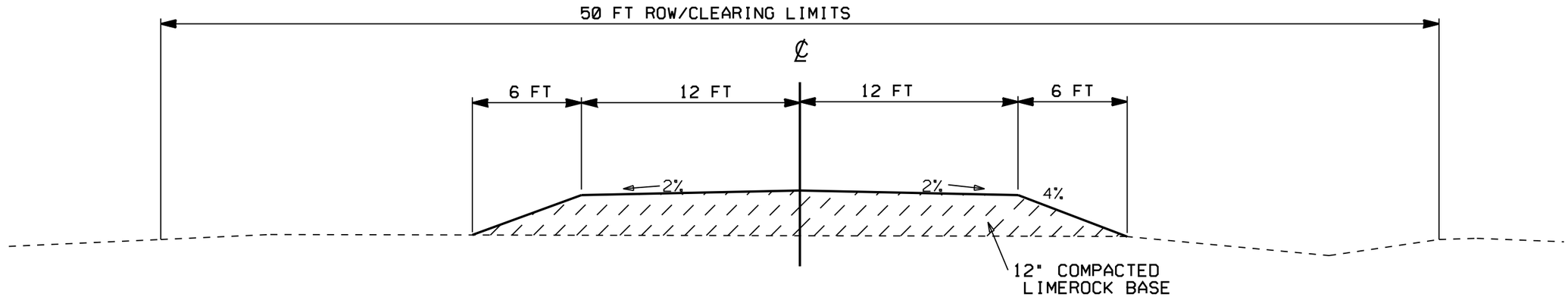
PROJECT IMPLEMENTATION REPORT

PERMANENT ACCESS ROAD
TYPICAL SECTION

PLATE
C-7



SECTION H-H -- TYPICAL SECTION TEMPORARY HAUL ROAD

NOTES:

1. TOTAL LENGTH OF ROADWAYS IS APPROXIMATELY 4,500 LF
2. TYPICAL CROSS SECTION AREA: 60 SF
3. ROADWAY TO BE CONSTRUCTED FROM ON SITE SPOIL MATERIAL.
4. ROADWAY WOULD BE CONSTRUCTED A MINIMUM OF 2 FEET ABOVE EXISTING GRADE.

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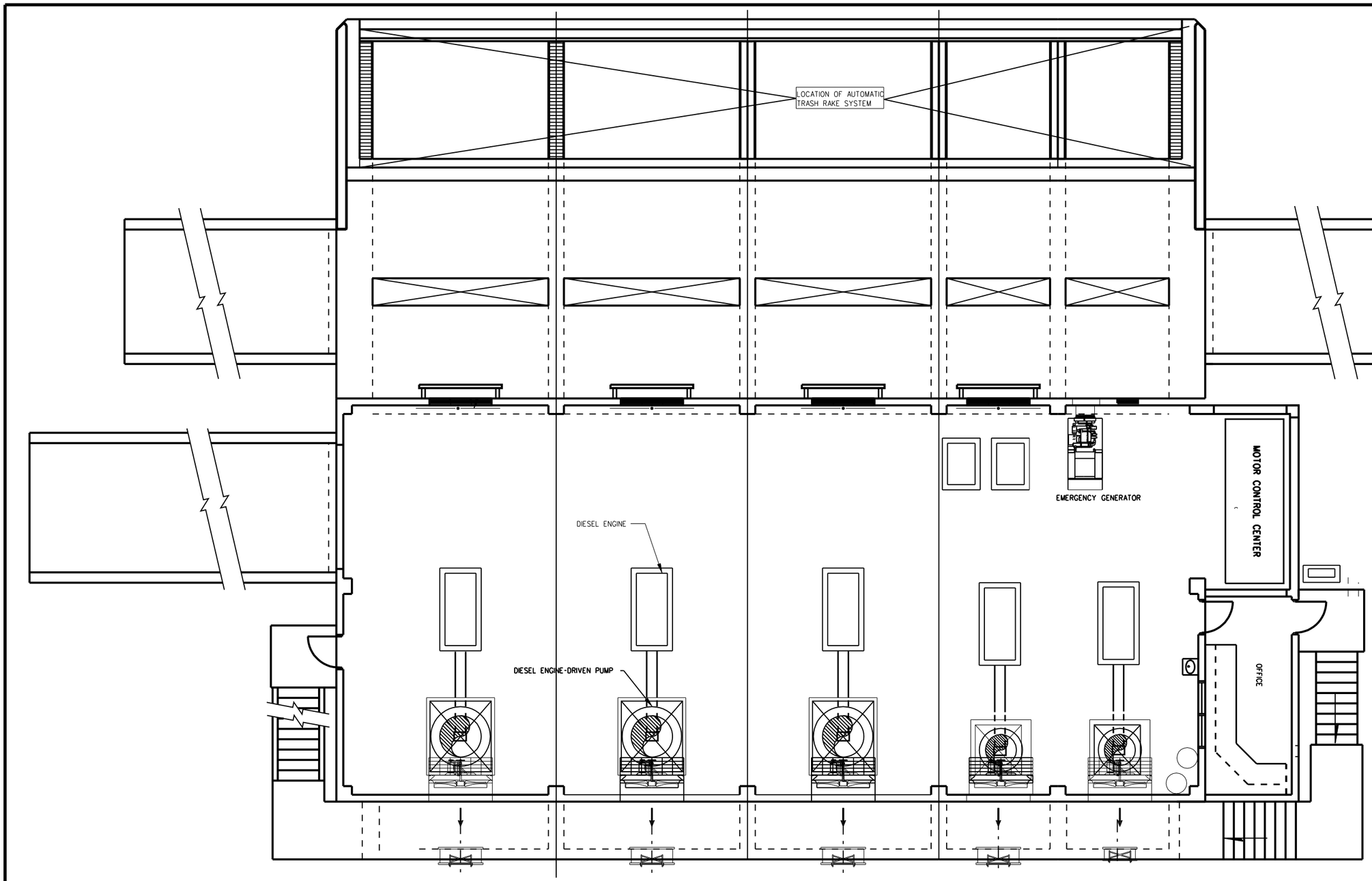
PROJECT IMPLEMENTATION REPORT

PERMANENT ACCESS ROAD
TYPICAL SECTION

PLATE
C-8



GRAPHIC SCALE
4' 0 4 8'

MEDIUM SIZED PUMPING STATION PLAN

US Army Corps of Engineers
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Reference files:

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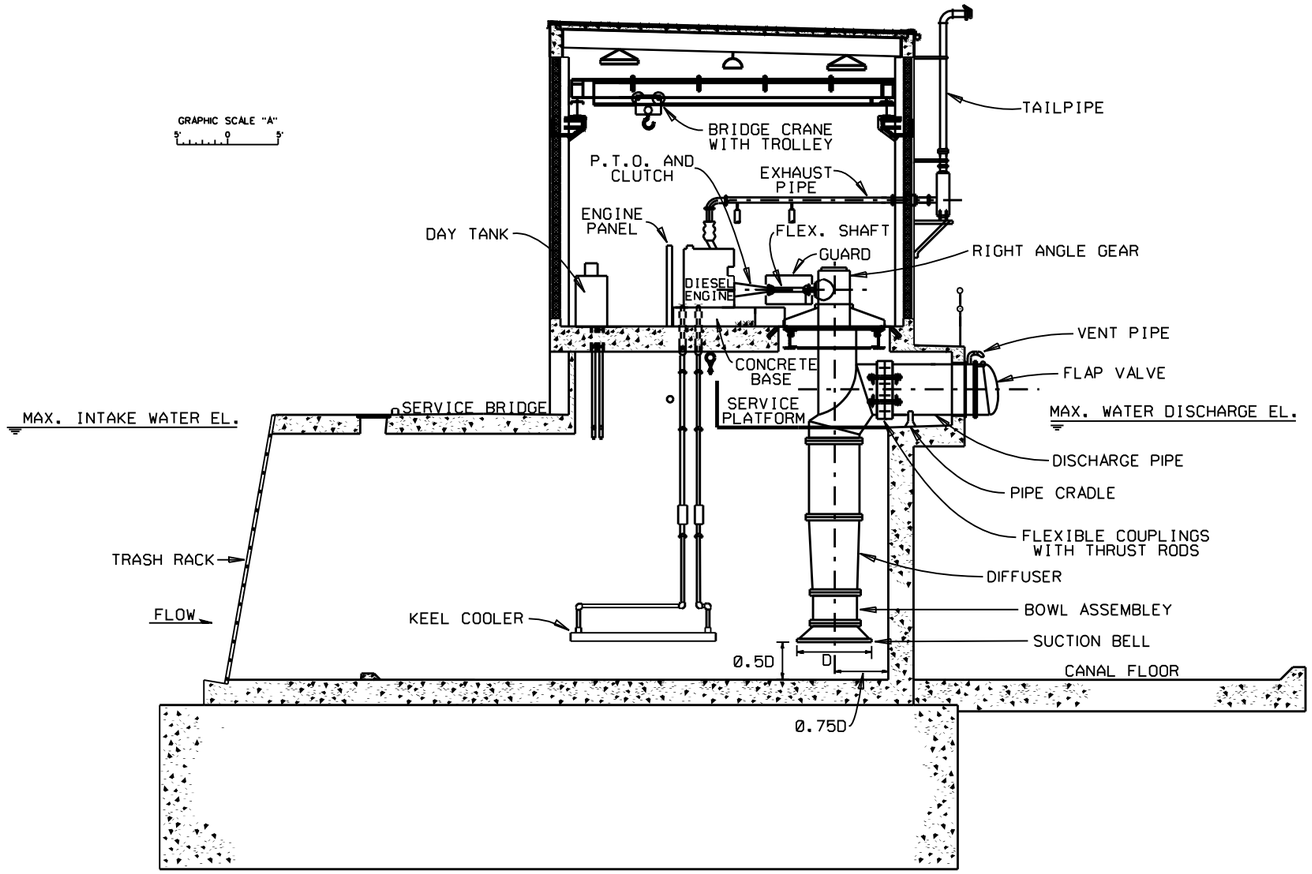
SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
STRUCTURAL
MEDIUM SIZED PUMPING STATION PLAN

PLATE
3D-1



DIESEL ENGINE-DRIVEN PUMP

SCALE "A"

MEDIUM SIZED PUMPING STATION SECTION

US Army Corps of Engineers Jacksonville District

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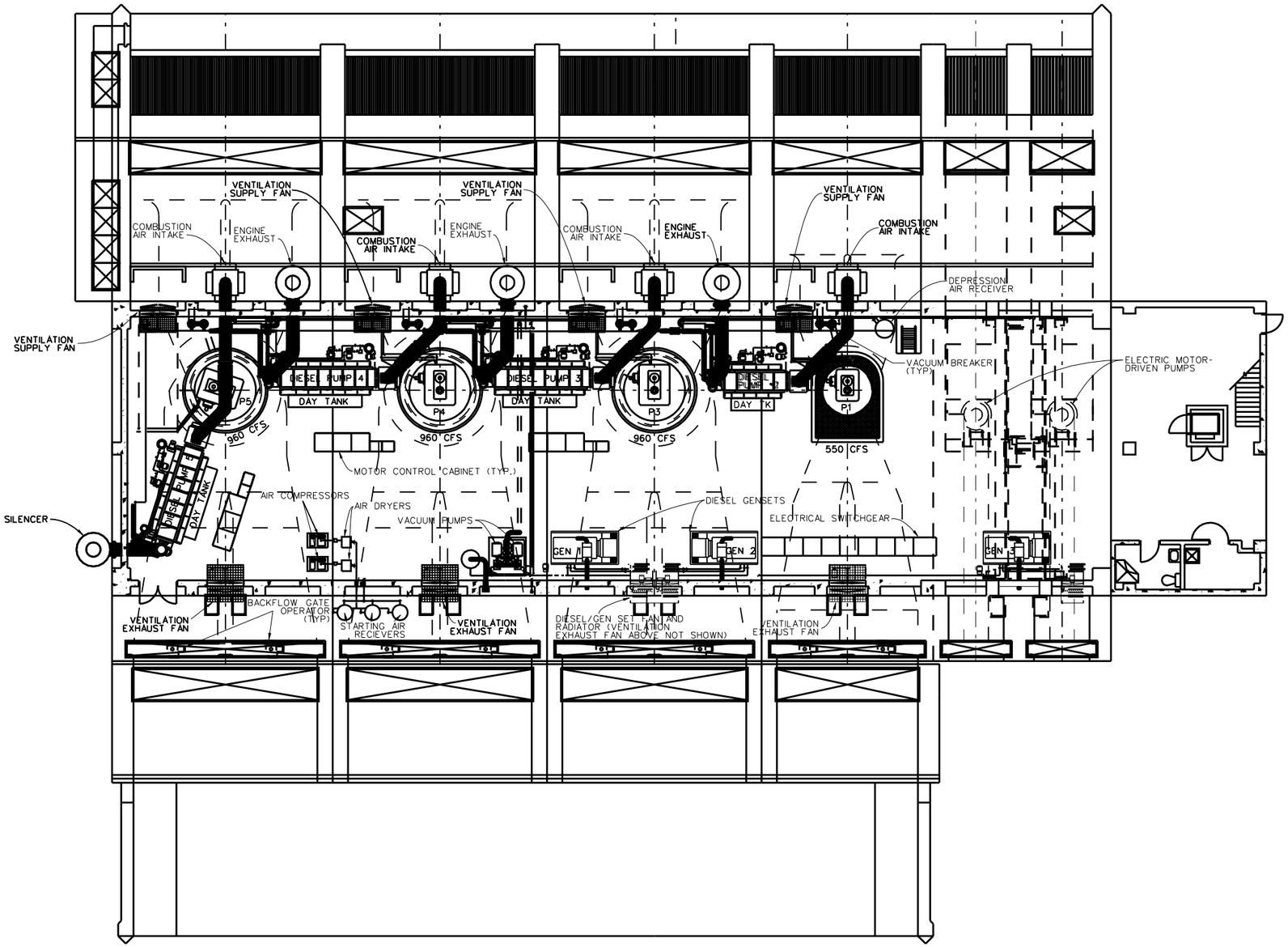
COLLIER COUNTY, FLORIDA
STRUCTURAL
MEDIUM SIZED PUMPING STATION SECTION

PLATE
3D-2



GRAPHIC SCALE
10' 0 10'

LARGE-SIZED PUMPING STATION PLAN

US Army Corps of Engineers
Jacksonville District

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SOUTHERN GOLDEN GATE ESTATES
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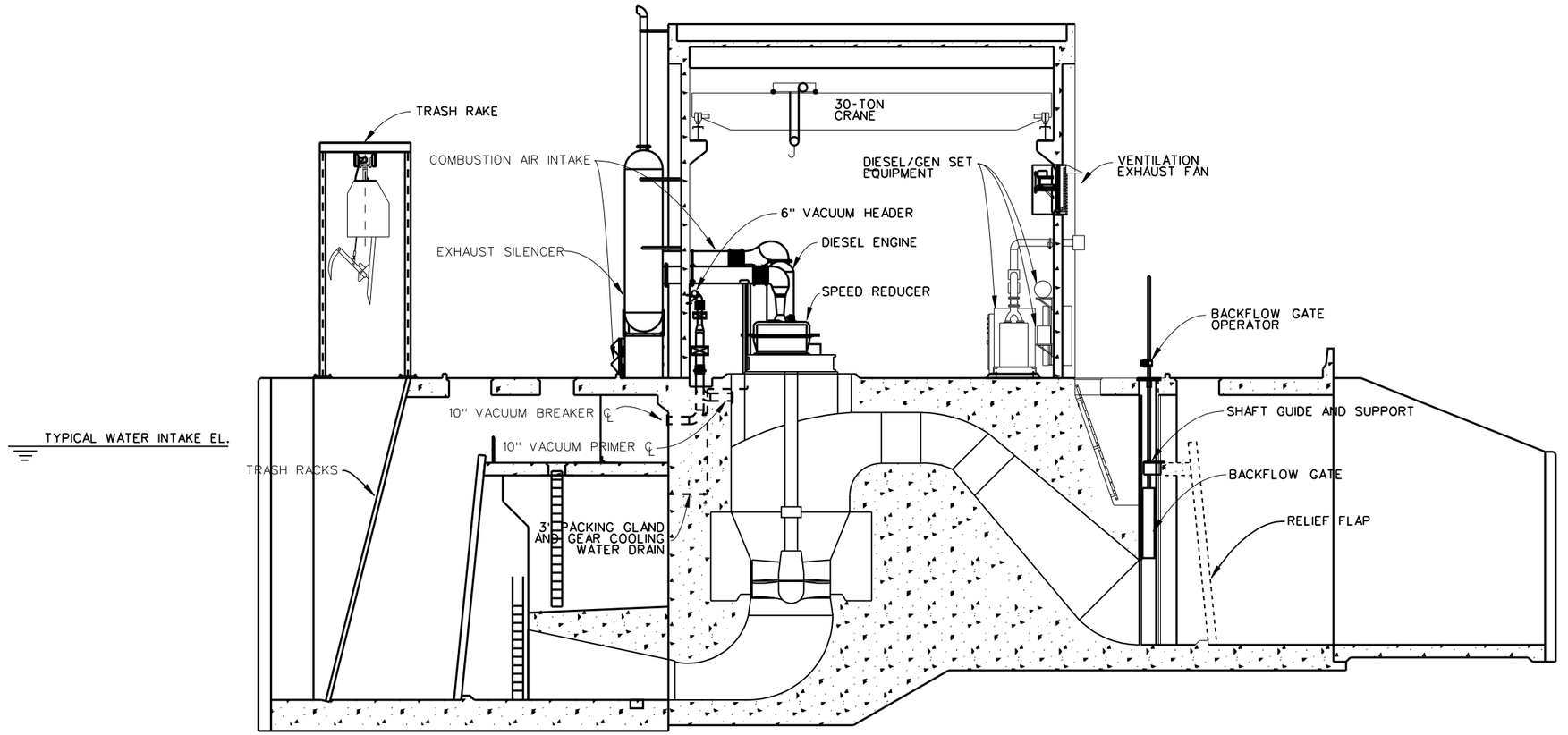
STRUCTURAL
LARGE-SIZED PUMPING STATION PLAN

PLATE
3D-3



GRAPHIC SCALE
10' 0 10'

LARGE-SIZED PUMPING STATION SECTION

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SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
STRUCTURAL
LARGE-SIZED PUMPING STATION SECTION

PLATE
3D-4

SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
MECHANICAL DESIGN

ATTACHMENT TO APPENDIX C (ALT-3D)
DESIGN AND COST ESTIMATES

A. PUMPING STATION DESIGN INTRODUCTION

1. General Mechanical.

The pumping stations of the Southern Golden Gates Estates (SGGE) Project shall be broken into three categories: small-sized, medium-sized and large-sized. For the purpose of this study, small-sized pumping stations shall have a total pumping capacity of less than 250 Cubic Feet per Second (CFS), medium-sized pumping stations shall have a total pumping capacity from 250 CFS to 1000 CFS, and large-sized pumping stations shall have a total pumping capacity of over 1000 CFS.

The pump stations shall be designed in accordance with Hydraulic Institute Standards, EM 1110-2-3102 (General Principles of Pumping Station Design and Layout), and EM 1110-2-3105 (Mechanical and Electrical Design of Pumping Stations). Small and medium-sized pumping stations will also follow the guidance of ETL 1110-2-313 (Hydraulic Design Guidance for Rectangular Sumps of Small Pumping Stations with Vertical Pumps and Ponded Approaches).

It is assumed that axial flow or mixed flow pumps will be used for all pumping stations. General information for the pumping stations is located on Table A, SGGE Pumping Stations. The capacity of smaller electric motor driven pumps, intended for seepage control, which may be part of the final design, is not included in the total flow capacity of the station. Plates M-1 through M-4 show section and plan views of typical medium-sized and large-sized pumping stations. Plate M-5 shows a complex fuel system for a typical large-sized pumping station.

Preliminary pumping station design details in this report conform with available hydraulic data and flood control requirements. These details provide background for understanding the configuration and equipment needed to develop typical pumping station cost estimates. Total pumping station capacity, as well as the number and sizes of pumps, may change in the final design. The pumping station design criteria furnished describes features found in typical pump stations, not the final list of selected options. During the development of plans and specifications, design and equipment selection will begin, based on design computations, operating procedures and assumptions, and analysis of available alternatives. Detailed design work which will develop the preliminary design includes the collection of specific pump manufacturer and pump drive data, selection of the type of intake and discharge, designation of auxiliary equipment, and determination of final station layout.

Table A SGGE Pumping Stations				
Name	**Capacity CFS**	**Station Size**	**Number of Bays**	**Pump Mix** (Number & CFS of each pump)
Miller	**1250**	**Large**	**6**	**4 x 125 2 x 375**
Merritt	**800**	**Medium**	**5**	**2 x 80 3 x 213**
Faka Union	**2630**	**Large**	**8**	**2 x 125 2 x 250 4 x 470**
Private Lands Levee	**100**	**Small**	**2**	**2 x 50**

B. MECHANICAL PUMPING STATION DESIGN CRITERIA

2. Small-Sized Pumping Station.

One small-sized pumping station which will provide interior flood control protection to the Private Lands levee system will be constructed:

Private Lands Levee Pump Station (100 CFS)

The small-sized pumping station will have two 50 CFS pumping systems, so that the station will have full back-up flood control capacity in case of equipment or maintenance problems. The station will use axial-flow vertical-shaft pumps, with power provided by diesel engines through right angle reduction gear drives. The conventional discharge arrangement is the same as that described for a medium-sized pumping station.

The small-sized pumping station will be configured similarly to the five-bay pump station shown on Plates M-1 and M-2, except it will only have two bays and will not have an office or lavatory. The pumps are expected to run at no less than 600 rpm with an efficiency of about 80%. The diesel engine pump drives will be rated 100 to 150 horsepower each.

A small-sized pumping station will include various support items, including the following:

a. Diesel fuel system, including vaulted double-wall aboveground fuel storage tanks capable of holding enough fuel to operate the emergency generator continuously for 14 days.

b. Hoisting system or capability for maintenance or repair of the pumping equipment.

c. Ventilation system to provide fresh air in the pump bays and generator area.

d. Stilling wells containing float switches to be used for pump operations and water level monitoring.

e. Stand-by generator sized to provide electrical power for pump station auxiliaries.

3. Medium-Sized Pumping Station.

The single SGGE pumping station categorized as medium-sized is:

Merritt Pump Station (800 CFS Total)

This pumping station will have five pumping systems, and will use axial-flow vertical-shaft type pumps. Power to the pumps will be provided by diesel engines through right angle reduction gear drives. Direct-drive electric motors will not be used for flood control pump capacity because of the need to guarantee operation during power outages. The pumps will be designed with conventional discharges, which means the water is lifted and ejected above the maximum water discharge elevation through a straight pipe. The end of the discharge pipe is fitted with a flap valve to prevent return flow.

The medium-sized pumping station will be configured similarly to the arrangement shown on Plates M-1 and M-2. The pumps are expected to run at less than 500 rpm with an efficiency of about 80%. The diesel engine pump horsepower requirements will range from about 160 to 600 horsepower each.

The medium-sized pumping station will include the following support items, some of which are described in greater detail in the large-sized pump station section:

a. Diesel fuel system, including vaulted double-wall aboveground fuel storage tanks capable of holding enough fuel to operate all engine driven pumps and the stand-by generator continuously for 7 days. Each diesel pump drive and generator engine will be provided with an intermediate day tank system.

b. Hoisting system for maintenance or repair of the pumping equipment.

c. Bathroom facility with a water closet, lavatory and shower.

d. Kitchen-type sink.

e. Potable water system and a septic system for the plumbing fixtures.

f. Ventilation system to provide fresh air in the pump bays, generator area, and toilet room.

g. Air-conditioning system for the office.

h. Stilling wells containing float switches to be used for pump operations and water level monitoring.

i. Stand-by generator sized to provide electrical power for pump station auxiliaries.

j. Engine control system for each pump drive.

k. Automatic trash rack and rake system for each pump intake bay.

4. Large-Sized Pumping Stations.

The large-sized pumping stations are listed below:

Faka Union Pump Station (2630 CFS Total)

Miller Pump Station (1250 CFS Total)

The large-sized pumping stations will have six or eight pumping systems, and will be configured similarly to the arrangement shown on Plates M-3 and M-4. The fuel system will be similar to that shown on Plate M-5. An in-depth description of a large-sized pumping station follows, with the support items and design features listed and discussed. Most of the same basic features are also found in small and medium-sized pumping stations.

a. A typical large-sized pumping station may have up to five large pumps over 72" in diameter. The large pumps may be designed with formed suction intakes (FSIs), an arrangement using rectangular pipe for the intake and discharge, which has been shown to be more efficient than typical suction bell intakes. FSI design requirements will be evaluated, and a cost-benefit analysis conducted, during the preparation of plans and specifications.

b. Large-sized pumping stations may also incorporate smaller electric motor-driven or diesel engine-driven pumps.

c. In order to save on the engine size needed to overcome the start-up head for large pumps, siphoning systems can be used to fill the entire chamber of the pump

above its summit. For all normal operation, priming would be accomplished by means of the station vacuum system; however, with the impeller submerged as shown and depending on the characteristics of the equipment offered, the pumps should be self-priming (in an emergency). However, the engines may be subjected to momentary overload. The impeller would be of cast steel, ductile iron, or aluminum bronze construction with the impeller housing and diffuser sections either of cast or welded steel construction, all at the option of the manufacturer. The discharge elbow would be a steel weldment with the remainder of the pump system to be formed in the masonry substructure. Each pump would be provided with an automatic water lubrication system for its bearings.

C. LARGE PUMPING STATION FEATURE DESCRIPTIONS

A typical large-sized pumping station will have the following support items and systems:

5. Pump Drive Engines.

The main engines will be standard model full-diesel types, 2 or 4 cycle, with mechanical injection and heat exchanger cooling. Diesel engine horsepower (hp) will range from about 275 to 1400 hp.

6. Engine Auxiliary Systems.

a. The fuel system for each main engine will consist of a day tank (typically up to 800 gal. capacity) to supply the diesel engine. The day tank will have automatic operation in sending and receiving fuel and controlling the level of the fuel inside of the day tank. The day tank will have a fuel supply transfer pump and a fuel return pump to send excess fuel back to the aboveground storage tank. A similar day tank and transfer pump will be provided for the engine generator sets. The actual location of the main engine fuel oil day tank will depend on the engine manufacturer.

b. The main lubricating oil pump for each main engine will be driven directly by the engine. The engine lubricating oil system will include: (a) a separate motor-driven pre-lubricating oil pump (if applicable) for maintaining pressure in the system during starting and shutting down, (b) a shell-and-tube oil cooler, and (c) a bypass filter system. A common drain tank-and-pump assembly would be provided to all engine units for use during servicing and overhaul.

c. Cooling of each main engine will be by means of a closed system consisting of a shell-and-tube heat exchanger, overhead expansion tank, and engine-driven jacket water-circulating pump with proper heat balance maintained by the thermostatically controlled proportioning valve. Water for cooling the heat exchanger will be provided

by the raw water system described below. An auxiliary motor-driven jacket water pump will also be provided for cooling after shutdown.

d. Starting Air System for the main engines and for the engine generator sets will consist of a combination engine-motor-driven compressor on the operating floor with air receiver tanks located on the auxiliary equipment platform at the intake side of the station. Normal operation of the compressor would be by motor with engine drive for initial charging of the system and for standby.

7. Transmissions. Power will be transmitted from the engines to the pumps by means of right-angle type gear reducer units. These units will incorporate the hollow-shaft principle and will be designed for an application factor of 2.0 times the maximum input power. Thrust load due to hydraulic unbalance and an anti-friction type bearing located within the reducer unit will carry the weight of pump rotating elements. Connection between reducer and engine will be by flexible coupling to compensate for misalignment and vibration or shock transmission. The reducer will be provided with forced lubrication from a direct connected positive displacement pump with cooling of the oil by an external system. To prevent reverse rotation, the transmission would be fitted with an anti-reverse rotation clutch. The backstop clutch would be mounted to the low speed, or intermediate speed shaft with the torque being transmitted directly to the gear housing.

8. Backflow Control: Backflow Gates. Siphon-discharge type pumps have their discharge pipe below water. To eliminate water backing up into the pump, there must be backflow control at the discharge outlet. The method to be used will have each pump discharge tube provided with twin vertical-lift type gates with relief flaps located at the siphon discharge terminus as shown on Plate M-3. Primary functions of the gates are to protect against backflow during pump shut-down and non-pumping periods when the discharge pool is above the invert (summit), and to prevent possibility of reverse siphoning due to incomplete breaking of prime during shut-down of pumps. Each gate will be raised and lowered by a single screw-stem with a Limitorque-type electric motor operator controlled from within the station.

Another means of preventing backflow will also be incorporated. A means to allow application of compressed air, to the summit of the pump, will be provided as a secondary (emergency) means of preventing backflow.

9. Raw Water System. The raw water for the main engine heat-exchanger and engine-generator sets, as well as for station service and domestic use, would be provided by a system of deep-well turbine type pumps installed in a common raw water intake structure located on the intake side of the station. Traveling screens will be provided at the raw water structure to effectively prevent trash or debris from entering the raw water pumps.

10. Vacuum System. A station system will be provided to insure adequate priming of the main pumps. The system may also be used to produce a low-pressure air lock within the main pump discharge tubes if required to assist in preventing backflow during periods of high discharge stages. The vacuum pump would be a wet-type centrifugal unit driven by electric motor and would be located on the main operating floor. Lines will extend to the station vacuum header, which in turn will connect through prime and vacuum breaker valves to each main pump discharge elbow. The priming valve will be a hand wheel operated gate and the vacuum breaker a lever-type quick opening gate, both located in the vicinity of the respective engine. Since the impellers of the vertical pumps will be submerged, the pumps may be considered as self-priming in an emergency by subjecting the engines to momentary overload. The vacuum system for the vertical pumps is considered of secondary importance and only the single motor-driven vacuum pump will be provided.

11. Fuel Oil Storage System. Aboveground Storage Tanks (AST) will be located at a safe distance from the station. ASTs shall be concrete-vaulted and have a dual containment feature. Fuel capacity may be as much as 50,000 gallons and several tanks may share this capacity. Fuel capacity should be for 7 days, 24-hour/day continuous operation at maximum fuel consumption rate. The tanks will be filled from truck transport by means of lines extending to an unloading pump pit. The tanks will be connected to the station supply header.

12. Dewatering System. A dewatering system will permit complete draining of individual main pump forebays or the raw water intake sump as necessary for major overhaul or inspection. The system will consist essentially of a motor-driven centrifugal pump unit on the intake side of the station at the end opposite from the raw water pumps, with a station-dewatering header connecting to all forebays and the raw water sump.

13. Station Service System. The station service system will provide raw water for secondary fire protection, station washdown and general service, and by cross–connection to the station dewatering header, a means of backflushing the dewatering system. The system will connect to hose outlets strategically located throughout the station, both inside and outside, and will be fed by either engine-generator raw water pump not being used for engine cooling.

14. Station Crane/Hoist. For a large pumping station, double-girder, overhead bridge- type electric crane will typically be used. Crane/hoist shall be capable of handling up to 30-ton loads. Crane/hoist will handle pumping station equipment, such as, main engine, transmission, or pump components during initial installation as well as for general service thereafter.

15. Diesel Engine-Generator Sets. Large pumping stations may use up to three diesel engine-driven generator sets (genset) up to 500 kW each. These generators must provide sufficient power to operate the station at full capacity, including running all auxiliary equipment, continuously for as long as one week. One genset may also provide general standby. Each generator will most typically be rated for 277/480 volts, 3 phase, and engine speeds not to exceed a maximum of 1,800 rpm. The engines may be air-start, 2 or 4 cycle, and water-cooled by unit-mounted heat exchanger, with raw water provided by one of the generator raw water pumps.

16. Potable Water and Plumbing. Large-sized pumping stations will require a potable water supply and plumbing, including a septic system. A filtered water system will be necessary for the station to supply water to such things as a bathroom (sink, shower, and toilet), office, maintenance shop, and control room. The system will provide water for sanitary uses and may supply water for jacket-water makeup for the engines.

17. Air Conditioning. A small split-system air conditioning system is necessary for the control room.

18. Ventilating System. A system of air inlet openings and exhaust fans will be provided for ventilation of the operating floor area. The air inlet louvers typically will be of the combination type having weatherproof fixed blades on the outside in combination with manually adjustable louvers on the interior. Bird screening will also be provided over the openings. The wall type exhaust fans would have manually operated shutters for natural or power ventilation. Air inlets and exhaust fans would be sized to provide approximately one air change every 2 minutes.

19. Trash Rake. Trash rake/rack system may be one of two types: an automatic, continuously rolling, flex rake and trash rack system such as that manufactured by Duperon, or an electrically, hydraulically, and/or pneumatically powered rail-mounted traveling trash rake and hoist car assembly. In the latter case, raking operations and car travel will be pushbutton controlled by the operator at the car. The system selected shall be similar to those that have proven satisfactory at previously completed project stations.

20. Stilling Wells. Two stilling wells will be necessary for detecting water levels in the upstream and downstream sides of the pumping stations.

21. Pump Bay Water Level Detection. A water level detection device in each pump bay will be necessary for detecting pump shut-off low water level. These detection devices may either be float/switch type or ultrasonic transmitter/sensor type.

22. Pump Model Tests. The specifications will require that a series of model tests be performed to verify performance and cavitation limits of the proposed pump. The contractor will be required to construct one complete pumping system to the necessary scale model. The pumping system will include the forebay, pump, and discharge tube with a simulated backflow gate with relief openings. All tests for determination of compliance with guarantees of capacity and/or efficiency will be accomplished using prototype heads. The efficiency of the prototype will be considered to be the efficiency of the model pump as determined by the model tests at specified conditions. Final acceptance of the prototype pumps (guarantees of capacity and efficiency) will be based on model test results, and these results will be used for the purpose of developing final anticipated prototype performance curves. The specifications will cite a minimum value of efficiency for purposes of bid rejection. Bidders will be required to guarantee an efficiency at least equal to the minimum with the rejection of the model test and equipment should the model test fail to produce guaranteed efficiency and equivalent capacity. The contractor will also model the formed suction intake based on the pump diameter selected.

SOUTHERN GOLDEN GATE ESTATES
COLLIER COUNTY, FLORIDA
ELECTRICAL DESIGN

ATTACHMENT TO APPENDIX C (ALT-3D)
DESIGN AND COST ESTIMATES

A. INTRODUCTION

1. General. Each of the four pumping stations proposed in this alternate would require at a minimum 120-volts electric power. Some pieces of equipment within the stations will require 480-volts electric power. New electric service for the stations would be routed from the existing electric line along Berson Boulevard (52nd Avenue S.E.). The new service would require the construction of new distribution line along Miller Canal, Faka Union Canal and Prairie Canal for the respective pumping stations.

Table 3D-1
Pumping Stations

Name	Capacity cfs	Station Size	# of Bays
Miller	1250	Large	6
Faka Union	2630	Large	8
Merritt	800	Medium	5
Private Lands	100	Small	2

2. Proposed Plan. The proposed plan is to build four new electric distribution lines with concrete poles along the canal to the respective pumping station. The voltage of the existing line is unknown, however, it is anticipated that a ground-mounted, three phase, 480-volt transformer will be required at each pumping station.

B. ELECTRICAL DESIGN CRITERIA

3. Electrical Design Criteria. Detailed electrical calculations were not prepared due to the undefinitized nature of the concept design information. Preliminary electric data included construction of new electric service line, pumping station area lighting requirements, transformer requirements, and emergency generator requirements. No energy study analyses have been performed. The required level electrical design for this project would be addressed during preparation of the contract plans and specifications.

C. DESIGN AND CONSTRUCTION

4. New Electric Service. Four new electric service lines to the respective pumping stations:

Miller Pump Station
Faka Union Pump Station
Merritt Pump Station
Private Lands Levee Pump Station

5. Transformer. The pad-mounted transformer will be sized when electric loads for the respective stations are known.

6. Emergency Generator Set/Transfer Switch. Although it is anticipated that the pumps will be diesel engine driven, an emergency generator is needed at each respective station to provide emergency power to the station lighting, the diesel engine control panel, the fuel transfer system and the station alarm/annunciation panel(s). An automatic transfer switch is normally prescribed for unmanned stations or stations with a flood control mission.

7. Water Level Sensors. Each station will require water level sensors to measure head and tail water levels for each bay.

8. Programmable Logic Controllers (PLC). A PLC is required for each diesel engine and an additional PLC will be needed to interface the station sensors and alarms with the diesel engine PLC.

9. Trash Rake/Rack System. Each bay of each pumping station will require a self-cleaning trash rake/rack system. The trash rake/rack system shall have two operating panels with one located inside the station and one located outside the station along side pump station with unobstructed view of the respective trash rake. The operating panel inside the station shall have main power, hand-off-auto selector switches, stop, forward, jog reverse push buttons, ready, hand, overtorque and emergency stop indicator lamps. The operating panel outside the station shall have forward, jog reverse, stop push buttons and 20A GFCI receptacle. The trash rake/rack system shall be the model as manufactured by Duperon or an equivalent.

10. Telemetry. Each pumping station will be set up for remote operation from an off-site location. The connection to the network is the responsibility of the local sponsor.

11. Single-Line Diagram. Typical single-line diagram drawings for medium and large pumping station are shown on Plates E-1 through E-5.

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Attachment A

Plates

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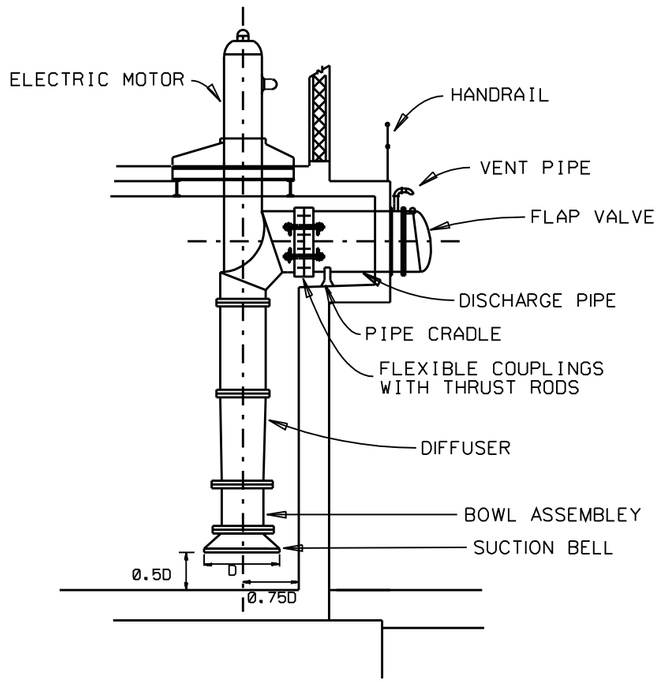

ELECTRIC MOTOR-DRIVEN PUMP

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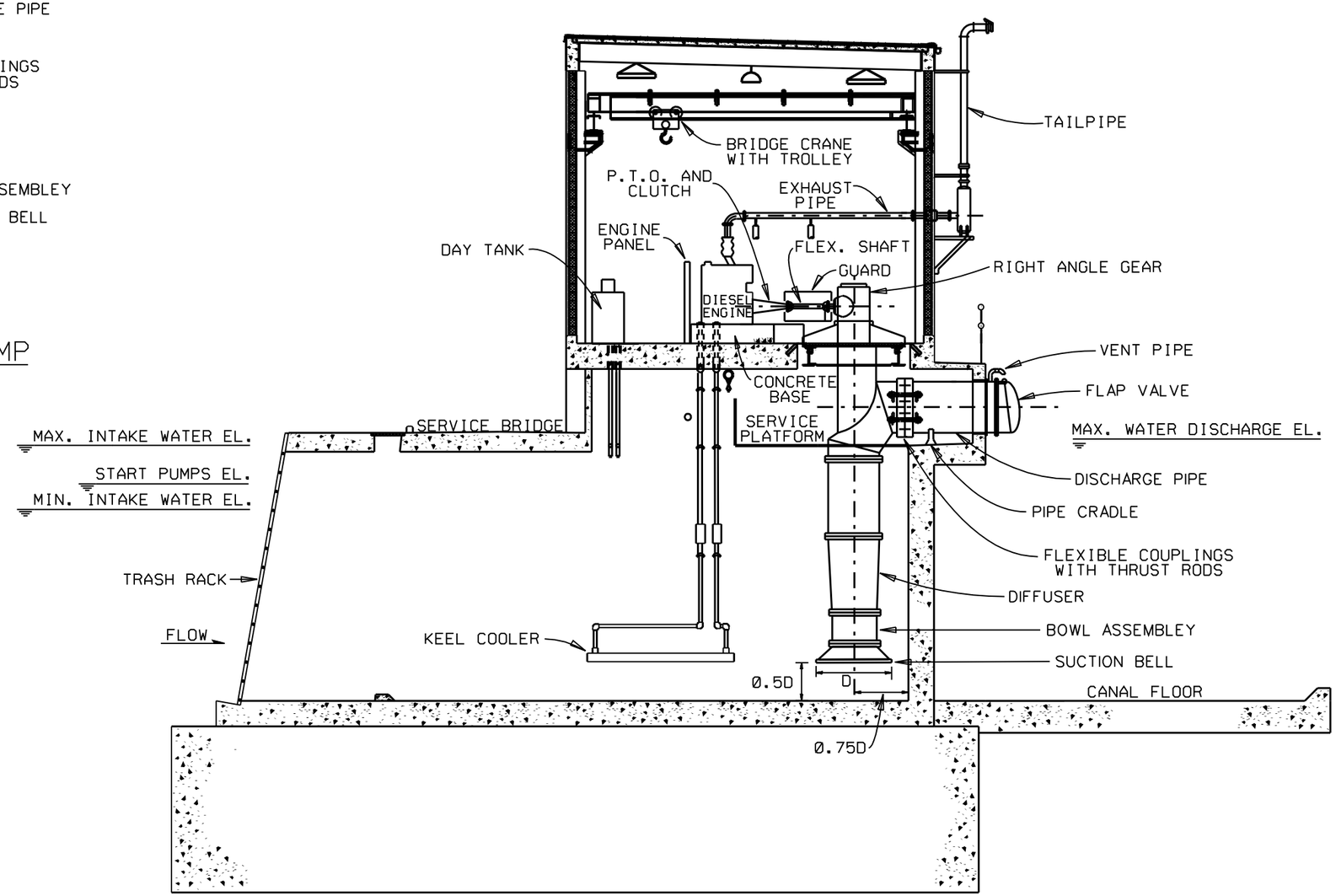

MEDIUM-SIZED PUMPING STATION SECTIONS

DIESEL ENGINE-DRIVEN PUMP

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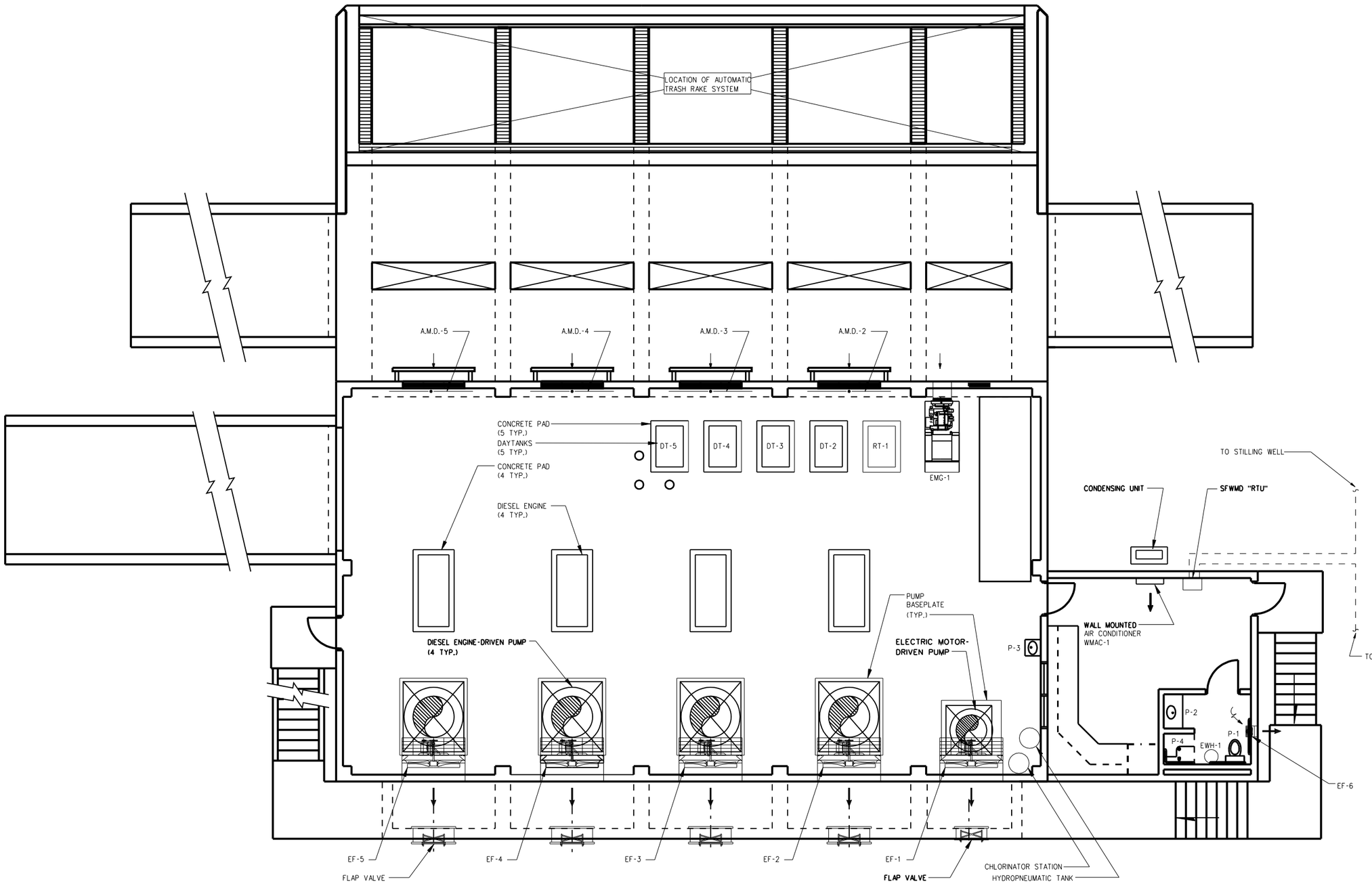
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
MECHANICAL
MEDIUM-SIZED PUMPING STATION SECTION

PLATE
M-1



MEDIUM-SIZED PUMPING STATION PLAN

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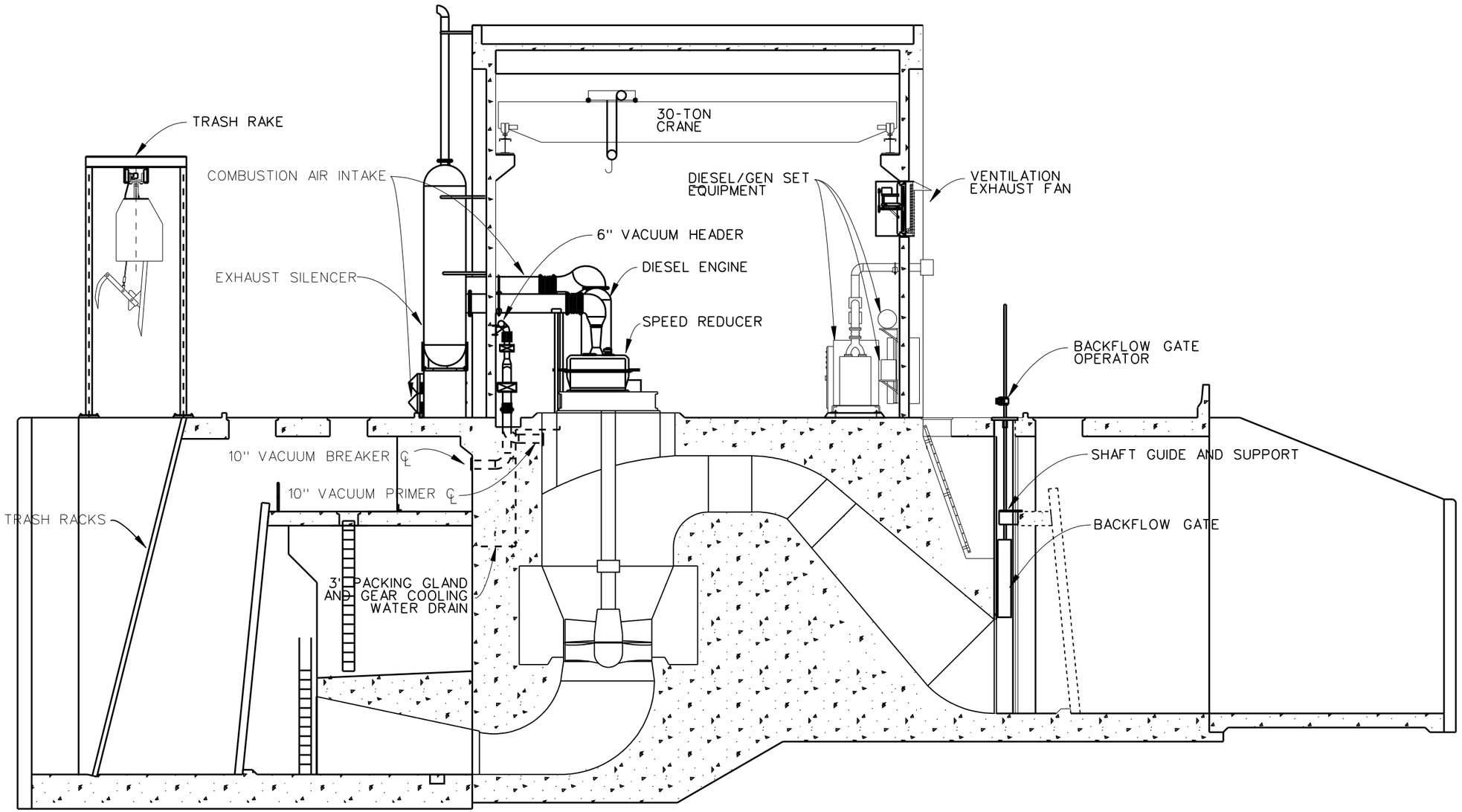
PROJECT IMPLEMENTATION REPORT
MECHANICAL
MEDIUM-SIZED PUMPING STATION PLAN

PLATE
M-2



LARGE-SIZED PUMPING STATION SECTION

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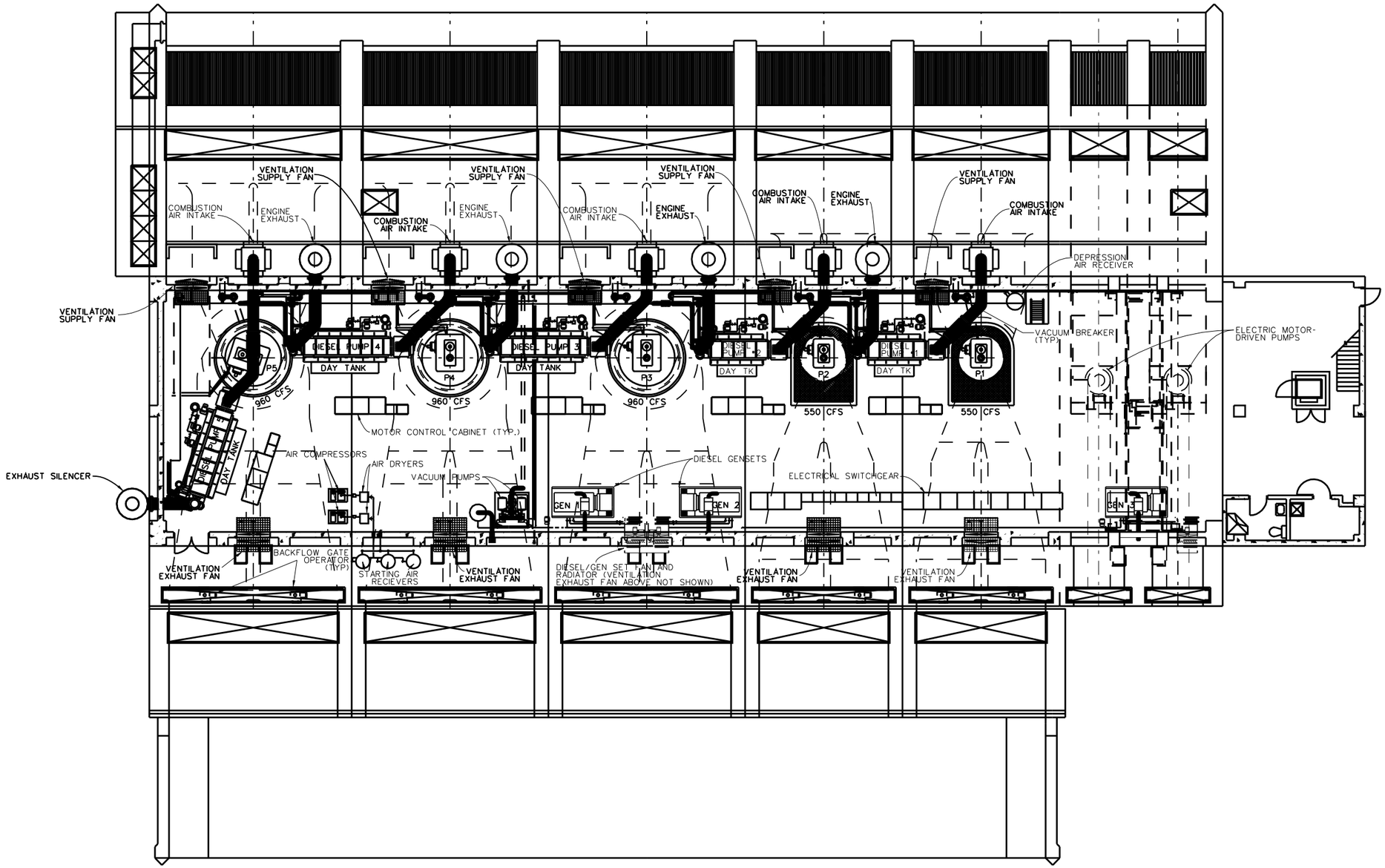
MECHANICAL
LARGE-SIZED PUMPING STATION SECTION

PLATE
M-3



LARGE-SIZED PUMPING STATION PLAN

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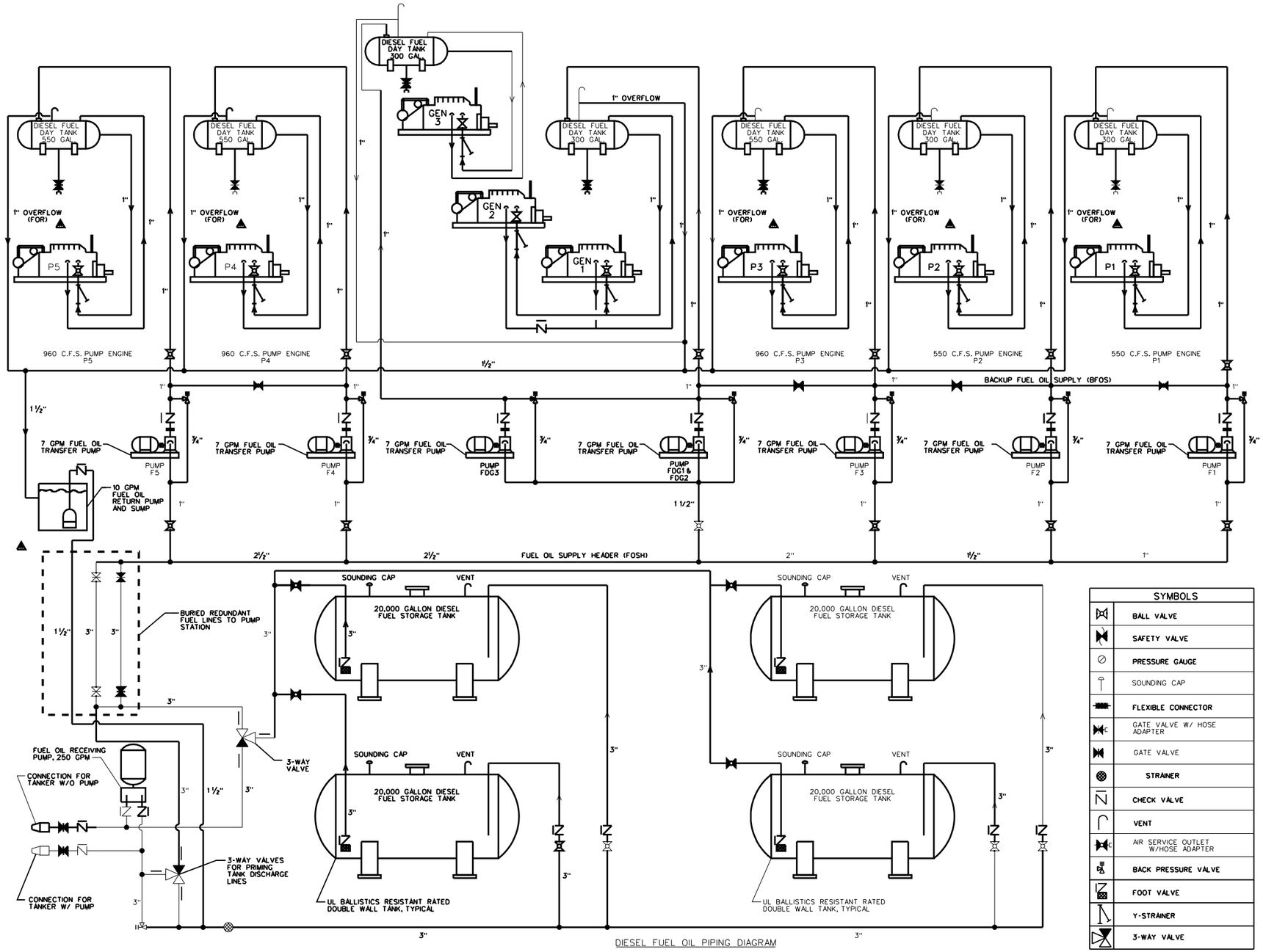
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
MECHANICAL
LARGE-SIZED PUMPING STATION PLAN

PLATE
M-4



DIESEL FUEL OIL PIPING DIAGRAM

SYMBOLS	
	BALL VALVE
	SAFETY VALVE
	PRESSURE GAUGE
	SOUNDING CAP
	FLEXIBLE CONNECTOR
	GATE VALVE W/ HOSE ADAPTER
	GATE VALVE
	STRAINER
	CHECK VALVE
	VENT
	AIR SERVICE OUTLET W/HOSE ADAPTER
	BACK PRESSURE VALVE
	FOOT VALVE
	Y-STRAINER
	3-WAY VALVE

LARGE-SIZED PUMPING STATION FUEL SYSTEM

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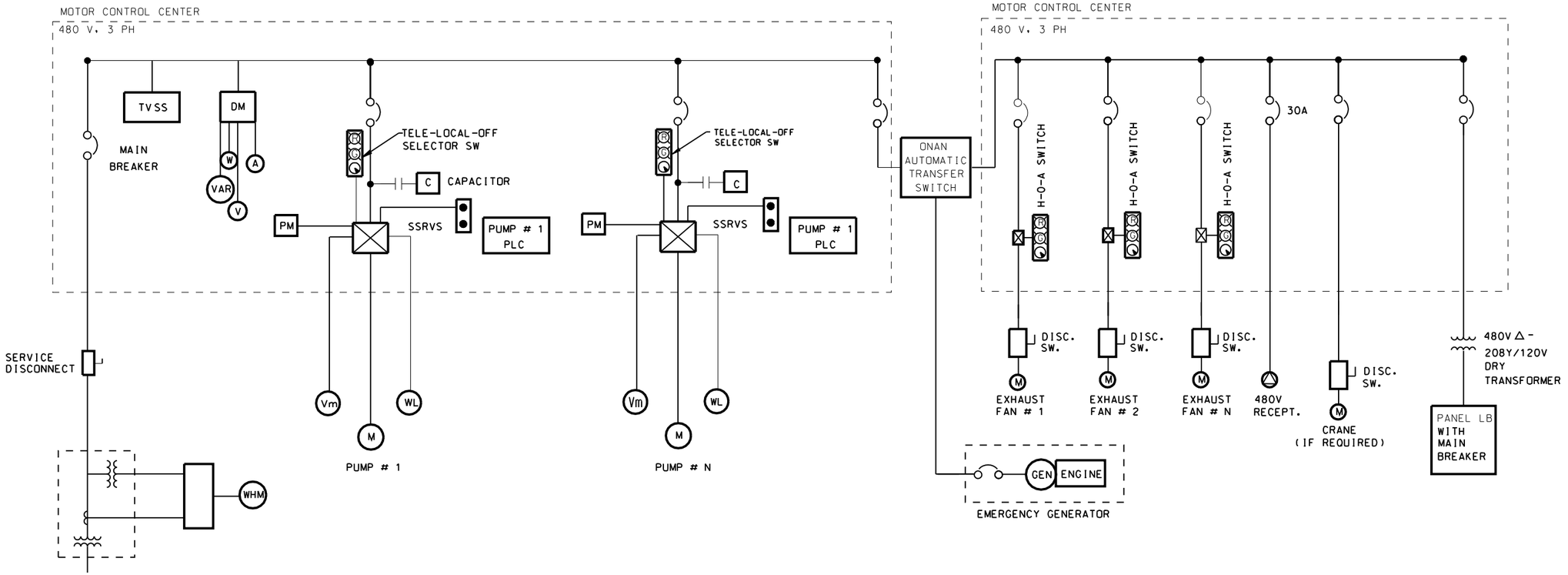
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
MECHANICAL
LARGE SIZED PUMPING STATION FUEL SYSTEM

PLATE
M-5



MEDIUM SIZE PUMP STATION WITH ELECTRIC PUMPS
N.T.S.

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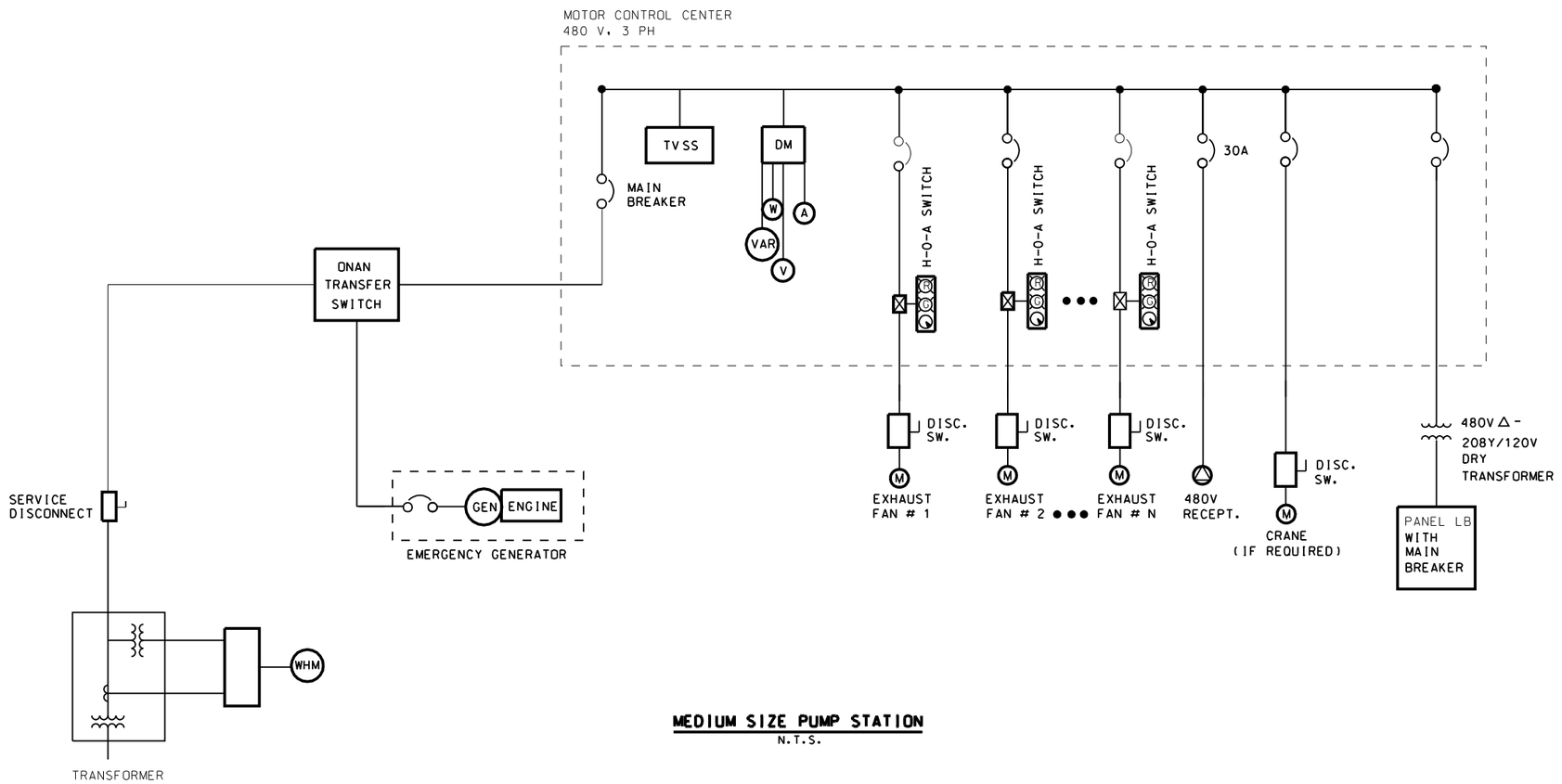
ELECTRICAL
MEDIUM SIZE PUMP STATION WITH ELECTRIC PUMPS

PLATE
E1



MEDIUM SIZE PUMP STATION
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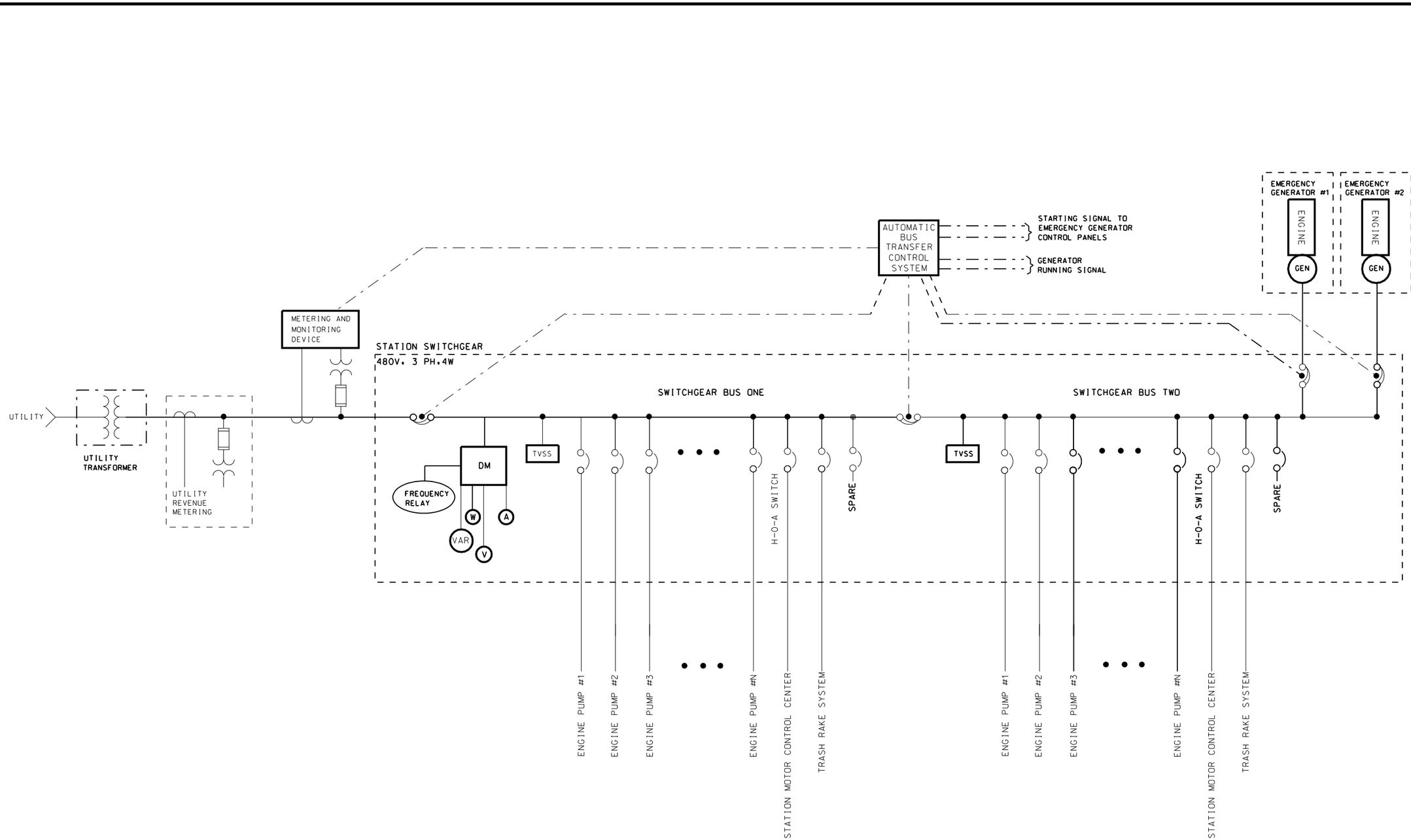
SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
ELECTRICAL
MEDIUM SIZE PUMP STATION

PLATE
E2



LARGE PUMP STATION SINGLE LINE DIAGRAM

N.T.S.

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SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
ELECTRICAL
LARGE PUMP STATION SINGLE LINE DIAGRAM

PLATE
E3

LARGE PUMP STATION MOTOR CONTROL CENTER SINGLE LINE DIAGRAM

N.T.S.

LEGEND

(CS) - CONTROL SWITCH
EPCP - ENGINE PUMP CONTROL PANEL
MCP - MANUAL CONTROL PANEL
REM - REMOTE
(CN) CONTACTOR

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SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
ELECTRICAL
LARGE PUMP STATION MOTOR CONTROL CENTER SINGLE LINE DIAGRAM

PLATE
E4

LARGE PUMP STATION, ENGINE CONTROL CENTER, MCC SINGLE LINE DIAGRAM
N.T.S.

LEGEND

CN CONTACTOR

CS CONTROL SWITCH

MCP MANUAL CONTROL PANEL

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SOUTHERN GOLDEN GATE ESTATES
PROJECT IMPLEMENTATION REPORT
ELECTRICAL
LARGE PUMP STATION ENGINE CONTROL CENTER MCC SINGLE LINE DIAGRAM

PLATE
E5

APPENDIX D

ENVIRONMENTAL

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Introduction to Appendix D: Environmental.

Appendix D of the Picayune Strand Final PIR/EIS consists of the 14 subsections listed in the following table. These 14 documents are referenced within the PIR main report. The contents of most of the subsections are clearly identified by their titles. Two of the subsections are discussed below.

The section titled, "FWS Comment Letter July 13, 2004," contains the detailed U.S. Fish and Wildlife Service (FWS) comments that were attached to the Department of Interior comments received during the public and agency review of the draft PIR from May 14, 2004 to July 13, 2004. The main Department of Interior comment letter and responses to the comment letter are contained in Appendix G: Comments and Responses.

The section titled, "FWS/FWC Comment and Response Table," contains summaries of the FWS comments contained in the FWS Comment Letter July 13, 2004 reproduced in Appendix D, and summaries of the Florida Fish and Wildlife Commission (FWC) comments submitted via the Florida State Clearinghouse. The full FWC comments are reproduced in Appendix G: Comments Received. Many of the FWS and FWC comments are nearly the same. Such comments were entered only once. Each entry in the Response Table identifies whether the comment is from the FWS, the FWC, or both.

Appendix D Subsection	Number of Pages
Coastal Zone Consistency Evaluation	4
Preliminary 404(b)(1) Evaluation	5
Hydrologic Performance Measures	13
Summary of HTRW Phase I and II Assessment	15
HTRW proposed actions	3
Estuary Report & Supplement	38
SFWMD Resource Assessment	39
Endangered Species Act coordination letters	10
Biological Assessment Oct 20, 2004	83
Planning Aid Letter Oct 27, 1999	18
Planning Aid Letter Feb 2, 2001	10
Planning Aid Letter Jan, 17, 2003	5
Planning Aid Letter Aug 11, 2003	6
FWS Comment Letter July 13, 2004	52
FWS/FWC Comment and Response Table	45
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FLORIDA COASTAL ZONE MANAGEMENT PROGRAM
FEDERAL CONSISTENCY EVALUATION PROCEDURES
ENVIRONMENTAL RESTORATION
SOUTHERN GOLDEN GATE ESTATES PROJECT
COLLIER COUNTY, FLORIDA

1. Chapter 161, Beach and Shore Preservation. The intent of the coastal construction permit program established by this chapter is to regulate construction projects located seaward of the line of mean high water and which might have an effect on natural shoreline processes.
Response: The proposed action does not involve activity on the beach or any coastal shoreline.

2. Chapters 186 and 187, State and Regional Planning. These chapters establish the State Comprehensive Plan, which sets goals that articulate a strategic vision of the State's future. Its purpose is to define in a broad sense, goals, and policies that provide decision-makers directions for the future and provide long-range guidance for an orderly social, economic and physical growth.
Response: During the planning process the proposed project has been coordinated with various Federal, State and local agencies who were part of the Project Delivery Team (PDT). The project would provide for ecosystem restoration and improvement in surface and ground water quality and quantity.

3. Chapter 252, Disaster Preparation, Response and Mitigation. This chapter creates a state emergency management agency, with the authority to provide for the common defense; to protect the public peace, health and safety; and to preserve the lives and property of the people of Florida.
Response: The proposed project would have little or no impact on disaster preparation, response, or mitigation.

4. Chapter 253, State Lands. This chapter governs the management of submerged state lands and resources within state lands. This includes archeological and historical resources; water resources; fish and wildlife resources; beaches and dunes; submerged grass beds and other benthic communities; swamps, marshes and other wetlands; mineral resources; unique natural features; submerged lands; spoil islands; and artificial reefs.
Response: The proposed project would provide for ecosystem restoration and associated benefits.

5. Chapters 253, 259, 260, and 375, Land Acquisition. These chapters authorize the state to acquire land to protect environmentally sensitive areas.
Response: Hydrologic benefits of the proposed project would take place within state owned property known as the Picayune Strand State Forest, Fakahatchee Strand State Preserve, and Collier Seminole State Park. The project is consistent with this chapter.

6. Chapter 258, State Parks and Aquatic Preserves. This chapter authorizes the state to manage state parks and preserves. Consistency with this statute would include consideration of projects that would directly or indirectly adversely impact park property, natural resources, park programs, management or operations.
Response: The Picayune Strand State Forest is made up of SGGE and the South Belle Meade state owned properties. The project goal is environmental restoration of the SGGE lands, which will provide benefits to surrounding state lands including South Belle Meade, Fakahatchee Strand State Preserve, and Collier Seminole State Park.
7. Chapter 267, Historic Preservation. This chapter establishes the procedures for implementing the Florida Historic Resources Act responsibilities.
Response: This project is being coordinated with the State Historic Preservation Officer (SHPO) throughout the planning process, and will be in full compliance when SHPO provides concurrence. A Project Area archeological survey will be completed during the DDR phase of the project.

8. Chapter 288, Economic Development and Tourism. This chapter directs the state to provide guidance and promotion of beneficial development through encouraging economic diversification and promoting tourism.
Response: The proposed project would not adversely impact beneficial development, economic diversification or tourism.

9. Chapters 334 (Transportation Administration), 335 (State Highway System), 338 (Intrastate Highway System and Toll Facilities) and 339, Public Transportation. These chapters authorize the planning and development of a safe, balanced and efficient transportation system.
Response: The proposed project would not adversely impact public transportation systems, including U.S. 41 (Tamiami Trail), I-75 ("Alligator Alley") and S.R. 29. The area proposed for project construction lies south of I-75, north of U.S. 41, and west of Fakahatchee Strand State Preserve, which is itself west of FL-29. Culverts will be enlarged to convey flows under Tamiami Trail as noted in the project description. The project is consistent with the goals of these chapters.

10. Chapter 370, Saltwater Living Resources. This chapter directs the state to preserve, manage and protect the marine, crustacean, shellfish and anadromous fishery resources in state waters; to protect and enhance the marine and estuarine environment; to regulate fishermen and vessels of the state engaged in the taking of such resources within or without state waters; to issue licenses for the taking and processing products of fisheries; to secure and maintain statistical records of the catch of each such species; and, to conduct scientific, economic, and other studies and research.
Response: The proposed action is expected to benefit saltwater living resources. The project is consistent with the goals of this chapter.

11. Chapter 372, Living Land and Freshwater Resources. This chapter establishes the Game and Freshwater Fish Commission and directs it to manage freshwater aquatic life and wild animal life and their habitat to perpetuate a diversity of species with densities and

distributions, which provide sustained ecological, recreational, scientific, educational, aesthetic, and economic benefits.
Response: The proposed project would have an overall beneficial effect on freshwater aquatic life, upland wildlife, and the water quality they depend on.

12. Chapter 373, Water Resources. This chapter provides the authority to regulate the withdrawal, diversion, storage, and consumption of water.
Response: This project would benefit the quality and quantity of surface water resources as described by this chapter.

13. Chapter 376, Pollutant Spill Prevention and Control. This chapter regulates the transfer, storage, and transportation of pollutants and the cleanup of pollutant discharges.
Response: The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. A spill prevention plan will be required.

14. Chapter 377, Oil and Gas Exploration and Production. This chapter authorizes the regulation of all phases of exploration, drilling, and production of oil, gas, and other petroleum products.
Response: This project does not involve the exploration, drilling or production of gas, oil or petroleum product and therefore, this chapter does not apply.

15. Chapter 380, Environmental Land and Water Management. This chapter establishes criteria and procedures to assure that local land development decisions consider the regional impact of proposed large-scale development on natural systems.
Response: The proposed project would restore the natural systems of the SGGE subdivision development site. The project is consistent with the goals of this chapter.

16. Chapter 388, Arthropod Control. This chapter provides a comprehensive approach for abatement or suppression of mosquitoes and other pest arthropods within the state.
Response: In compliance with Florida Statute 388.4111, all lands contained within the SGGE Study Area have been evaluated and subsequently designated as environmentally sensitive and biologically highly productive. Such designation is appropriate and consistent with the previously documented natural resources and ecosystem values and affords the appropriate protection for these resources from arthropod control practices that would impose a potential hazard to fish, wildlife, and other natural resources existing on this property. After approval of the Ten-Year Picayune Strand Resource Management Plan , the local arthropod control agency will be contacted and will be provided a description of the management objectives for LGSF. The local arthropod control agency must then prepare a public lands control plan that is subsequently approved by the DOF, prior to conducting any arthropod control activities for PSSF. The project complies with the intent of this chapter.

17. Chapter 403, Environmental Control. This chapter authorizes the regulation of pollution of the air and waters of the state by the Florida Department of Environmental Regulation (now a part of the Florida Department of Environmental Protection).

Response: The Florida Department of Environmental Protection will review this project during the planning process. Environmental protection measures will be implemented to ensure that no lasting adverse effects on water quality, air quality, or other environmental resources will occur. Water Quality Certification will be sought from the State prior to construction. The project complies with the intent of this chapter.

18. Chapter 582, Soil and Water Conservation. This chapter establishes policy for the conservation of the state soil and water through the Department of Agriculture. Land use policies will be evaluated in terms of their tendency to cause or contribute to soil erosion or to conserve, develop, and utilize soil and water resources both onsite or in adjoining properties affected by the project. Particular attention will be given to projects on or near agricultural lands.
Response: The proposed project will restore natural soil building processes. It is not located on any highly productive agricultural lands. The project will include necessary measures to protect any nearby affected agricultural lands. The project complies with the intent of this chapter.

PRELIMINARY SECTION 404 (b)(1) EVALUATION
ENVIRONMENTAL RESTORATION
SOUTHERN GOLDEN GATE ESTATES CERP PROJECT
COLLIER COUNTY, FLORIDA

I. Project Description

a. Location The Southern Golden Gate Estates (SGGE) hydrologic restoration Project Area is comprised of approximately 59294 acres (93 square miles) in Collier County, Florida. An extensive description of the project area can be found in Section 01 subsection 1.1 and 1.4 of this report. The project location is further described in Figures 1-1 through 1-5 as between Interstate 75 and U.S. Highway 41, southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands Aquatic Preserve and the Ten Thousand Islands National Wildlife Refuge, east of the Belle Meade State Conservation and Recreation Lands Project Area, northeast of Collier Seminole State Park, and west of the Fakahatchee Strand State Preserve. SGGE in combination with the South Belle Meade CARL tract will be managed by the Florida Division of Forestry as the Picayune Strand State Forest. This project can be located on the following USGS quad maps: Belle Meade NE and SE, Royal Palm Hammock, Weavers Station, Deep Lake SW, and Catherine Island in Collier County, Florida.

b. General Description. The objective of this project is to restore the ecological function of the Southern Golden Gate Estates (SGGE) region to a state as similar as possible to historic conditions existing prior to its development into a real estate subdividion prior to the 1960's. Development of SGGE created about 48 miles of canals and 279 miles of primary and secondary roads. The area has low topographic relief and poorly defined drainage patterns. Plugging the canals and removing most roads is expected to return the hydrology to a more natural sheetflow regime, which would restore native plant communities and improve both estuarine and upland habitat for fish and wildlife resources. Tentatively recommended alternative 3D would plug 42 miles of the Miller, Prairie, Faka Union, and Merritt canals and remove 227 miles of roads. The remaining 52 miles of road would be managed by the Florida Division of Forestry for landowner, public, and maintenance access. This alternative would tie together a contiguous block of habitat including the Florida Panther National Wildlife Refuge, Ten Thousand Islands National Wildlife Refuge, Belle Meade CARL tract, Collier Seminole State Park, Ten Thousand Islands Region, and Fakahatchee Strand State Preserve (Figure 1-1).

c. Authority and Purpose The Southern Golden Gate Estates Hydrologic Restoration PMP and PIR planning process is authorized under Section 601 of the Water Resources Development Act (WRDA) of 2000 as part of the Central and Southern Florida (C&SF) Comprehensive Everglades Restoration Plan (CERP). See Sections 1-2 through 1-4 for an in depth discussion of project authority and purpose.

d. General Description of Dredged or Fill Material Duever, et al. (1986) classified four major soil groups (rock, sand, marl, and organics) in the Big Cypress National Preserve. These major soil groups are also found in the SGGE area. Fractured limestone rock is generally found at shallow depth with outcrops occurring throughout the Project Area. Spoil materials from the original construction of the canals and roads are a combination of the above soils and limestone rock.

e. Quantity of Material. Table 1 contains the approximate yardage of material that would be moved in the Alternative 3D construction process.

Table 1 Alternative 3D Construction Quantities

FEATURE	FILL (CY)	EXCAVATION (CY)	CLEARING (AC)
ROAD DEGRADING (260 mi)		**4,570,000**	**4718.0**
Asphalt Removal (included above)		50,040	
LEVEES			
6Ls Ranch	600,000		206.4
Port of Island	224,000		36.7
41E	31,533		9.9
41W	13,933		4.4
Private Lands	162,800		51.0
	1,032,266		**308**
ACCESS ROAD (11.2 mi)	608,900		41.0
	608,900		**41**
CANAL PLUGS			
Prairie (16 Plugs)	89,600		
Merritt (23 Plugs)	128,800		
Faka Union (18 Plugs)	151,200		
Miller (26 Plugs)	145,600		
(83 Total Plugs)	**515,200**		
SPREADER CANALS			
1 - Miller Canal	15,333	37,000	10.3
2 - Faka Union Canal	23,937	57,760	16.1
3 - Merritt Canal	4,940	11,920	3.3
	44,210	**106,680**	**29.7**
PUMP STATIONS			
1 - Miller Canal	21,000		2.0
2 - Faka Union Canal	21,000		2.0
3 - Merritt Canal	21,000		2.0
	63,000		**6**

CONNECTOR CULVERTS Everglades and I-75		**3,890**	**1**
TOTALS	**2,263,576**	**4,680,570**	**5,104**

f. Source of Material. All fill and berm material would be recovered from road surfaces, road subsurfaces, and road/canal spoil generated during the original construction.

g. Description of the Proposed Discharge Site. Tentatively recommended alternative plan 3D includes plugging and filling the Merritt, Miller, Faka Union, and Prairie canals. The construction of three pump stations would include excavation and fill for spreader channels and pump station pads. . Levees would be constructed to protect various private properties from project rehydration. Approximately 11 miles of access road would be required to the pump stations. Connector culverts would be installed under Everglades Boulevard in the I-75 borrow canals. Roadbeds and associated spoil berms would be graded into the roadside ditches or used as canal fill. Filing of the canals and roadside ditches would take place mostly under dewatered conditions, although isolated pockets of hydrated wetlands may be encountered. There should be little impact to downstream water clarity, turbidity, or sedimentation. Any turbidity impacts would be temporary, localized, and should disappear shortly after construction activities cease. Recognized relevant Best Management Practices (BMP) for water quality parameters applicable to project construction would be included in the contract plans and specifications.

II Project Components

c. Spreader Channels. The purpose of the spreader channels is to direct water away from the pump stations and facilitate the restoration of sheet flow.

d. Road Removal. There are approximately 279 miles of roadway in the SGGE Project Area. The proposed plan would remove and abandon 227 miles of road. Approximately 21 miles of asphalt paved roads on Miller, Everglades, and Stewart Boulevards would have the asphalt removed and be maintained as all season public access gravel roads. 7 miles of secondary gravel road would be maintained as is and 24 miles would be lowered to ambient grade and maintained for restricted maintenance access by the Florida Department of Forestry.

f. Canals. The canals in SGGE have been responsible for the overall degradation of the hydrology and ecology of the area. Complete elimination of channelized flow in the Merritt, Miller, Faka Union, and Prairie canals would be accomplished by plugging and filling each canal south of the pump stations located downstream of Interstate 75 (I-75). Materials to be used for fill are the spoil berms from canal construction. Roadbeds with the exception of asphalt surfaces and associated roadside spoil berms would also be used as fill. Asphalt from the road surfaces, tested as part of the HTRW Phase I and Phase II URS Assessment, was found to be nontoxic and would be stockpiled to be used by DOF for road maintenance.

III. Factual Determinations

a. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. The project lies within Florida's coastal lowlands, in a region that is less than 13 feet above sea level. Small depressions having no surface drainage are common. The natural topography of the area is nearly flat, with the exception of unnatural features such as roadways, canals, berms, and trams.

(2) Sediment Type. According to the NRCS soil survey (Luidahl, et. al, 1998), this area consists of soils that are very poorly drained. The surface layer (top 5 inches) is typically black muck (organic mud). The subsurface layer (5 - 10 inches) is dark gray fine sand, and the substratum (10 - approx. 80 inches) is fine sand. Limestone outcrops were observed in the eastern portion of the project. Limestone can be encountered from the ground surface to a depth of 36 inches.

(3) Excavated/Fill Material Movement. Once the material is in place, movement is not expected. Some minor erosion may occur in specific areas if high rain events induce flooding during or immediately after construction.

(4) Physical Effects on Benthos. The benthos in the ponded areas adjacent to the roads, and in the canals that are being filled would be buried under the fill material, however these highly prolific organisms are expected to quickly re-establish in the natural wetlands restored through improved hydrology.

b. Water Circulation, Fluctuation and Salinity Determination. Canal discharge records measured at the gauging station located upstream from the outfall weir of the Faka Union Canal (FU #1) are available starting in 1969. The average discharges for the period of record are 115 cfs during the dry season (November through May) and 460 cfs during the wet season (June through October), with an extreme discharge of 3,200 cfs occurring right after the canals were built. Construction of alternative 3D would reduce the average annual discharges over Faka Union weir #1 to more natural flows. See Sections 3.14 and 9.14 Estuarine Resources and the Estuary Analysis in Appendix D for more information on salinity effects in the estuaries and bays of the downstream Ten Thousand Islands Region.

c. Suspended Particulate/Turbidity Determinations. During project construction a temporary short-term increase in suspended particulates may occur in the canals and ponded areas associated with road removal.

d. Contaminant Determinations. No toxic materials would be part of the spoil materials to be used in construction of any of the fill areas. In the HTRW Assessment by URS the asphalt road surfaces have been determined to be non-toxic. This asphalt will be disposed of in a manner consistent with EPA and DEP requirements.

e. Aquatic Ecosystem and Organism Determinations. No long-term adverse impacts on aquatic organisms are anticipated. Wetland and estuarine ecosystems are expected to greatly improve because of implementation of tentatively recommended alternative 3D.

f. Proposed Placement Site Determinations. Spoil material would be used to fill the Merritt, Miller, Faka Union, and Prairie canals and bring the road side ditches to ambient grade along both sides of all roads to be removed. There would be no long-term adverse impacts to the SGGE project area resources as a result of the placement of the spoil material.

g. Determination of Cumulative Effects on the Aquatic Ecosystem. The proposed project would not cause or contribute to violations of State Water Quality Standards, jeopardize the existence of any federally endangered or threatened species nor impact a marine sanctuary. No significant degradation is expected and all appropriate and practicable steps have been taken to minimize impacts. Improvements to upland and wetland habitats are predicted with the construction of alternative 3D. The filling of the canals and removal of the roads is expected to reestablish a more natural sheet flow, which would restore wetland habitat and improve estuarine water quality.

IV. Findings of Compliance or Non-Compliance with the Restrictions on Discharge.

a. No significant adaptations of the guidelines were made relative to this evaluation.

b. No practicable alternative exists which meets the project objectives that does not involve discharge of fill into waters of the United States.

c. After consideration of disposal site dilution and dispersion, the discharge of fill materials will not cause or contribute to, violations of any applicable State water quality standards for Class III waters. The discharge operation will not violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

d. The filling of the canals and the removal of roads in Southern Golden Gate Estates will not jeopardize the continued existence of any species federally listed as threatened or endangered or result in the likelihood of destruction or adverse modification of any critical habitat as specified by the Endangered Species Act of 1973, as amended.

e. The placement of fill material will not result in significant adverse effects to human health and welfare, including municipal and private water supplies, recreational and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. No significant adverse effects will occur on ecosystem diversity, productivity, and stability; or economic, recreational, and aesthetic values.

f. On the basis of the guidelines for placement of the fill material, tentatively recommended alternative 3D is specified as complying with the requirements of the Clean Water Act of 1972 as amended.

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Hydrology Performance Measures for SGGE
February 2004

This appendix contains tables that show the results for the hydrology PMs used to evaluate the final three restoration alternatives in Southern Golden Gate Estates. They include average wet and dry season water level measures and annual max and min water level measures.

There are four sets of tables and text for the above measures, and a map showing the location of the 32 Indicator Regions. The map is labeled as being monitoring wells, which do exist in Indicator Regions 1-24, but not in Indicator Regions 25-32.

In summary, the hydrology PMs show few differences between the top three alternatives, although Alternative 3D is still marginally better.

Average 1994 Dry Season Water Levels (April 1 – June 1)

Post-restoration dry season water levels in SGGE and the adjacent lands were between 65 and 129% of natural conditions, while future without project conditions were 28 and 101%. If we only look at the area within SGGE, the range of post-restoration dry season water levels relative to natural conditions is still the same, but it is reduced to 28-85% for future without project conditions.

Dry season water levels were typically less affected by the existing drainage in Indicator Regions in adjacent portions of Belle Meade and Fakahatchee than those within SGGE. However, Indicator Region 5 also shows relatively little effect due to its distance from Prairie Canal, which ends over a mile downstream of it.

The uppermost tier of Indicator Regions showed little difference between pre- and post-restoration dry season water levels. This would be expected since this area is upstream of where restoration is designed to occur. Otherwise there were typically large increases in dry season water levels between pre- and post-restoration conditions for all three alternatives.

Dry season water levels associated with the three alternatives were typically still less than they were under natural conditions, although they were much closer to natural conditions than prior to restoration. The only

consistent exception was in the area below the east-west portion of the canal system, where they were slightly higher than under natural conditions. It is difficult to explain why they would be higher than natural in this area compared to area immediately upstream.

There were few differences among the alternatives within the Indicator Regions. The largest differences were in IRs 12 -13 and 18 -19, where the unfilled Miller Canal in Alternative 12 resulted in lower dry season water levels than in the other two alternatives where Miller Canal was filled. The only other relatively large difference was the lower dry season water level for Alternative 6 in IR 9, which was upstream of the restoration associated with this alternative. Thus, Alternative 3D was only marginally better than Alternatives 6 and 12 in terms of dry season water levels.

Average 1994 Wet Season Water Levels (July 1 – October 1)

Post-restoration wet season water levels in SGGE and the adjacent lands were between 72 and 119% of natural conditions, while future without project conditions were 51 and 100%.

Wet season water levels were typically less affected by the existing drainage in Indicator Regions in adjacent portions of Belle Meade and Fakahatchee than those within SGGE. However, Indicator Region 5 also shows relatively little effect due to its distance from Prairie Canal, which ends over a mile downstream of it.

The uppermost tier of Indicator Regions showed little difference between pre- and post-restoration wet season water levels. This would be expected since this area is upstream of where restoration is designed to occur. Otherwise there were typically large increases in wet season water levels between pre- and post-restoration conditions for all three alternatives.

Wet season water levels associated with the three alternatives were typically still less than they were under natural conditions, although they were much closer to natural conditions than prior to restoration. There were only a few Indicator Regions, particularly in the southwestern portion of SGGE, where they were slightly higher than under natural conditions.

There were few differences among the alternatives within the Indicator Regions. The largest differences were in IRs 12 -13 and 18 -19, where the unfilled Miller Canal in Alternative 12 resulted in slightly lower wet season water levels than in the other two alternatives where Miller Canal was filled.

The only other relatively large difference was the lower wet season water level for Alternative 6 in IR 9, which was upstream of the restoration associated with this alternative. Thus, Alternative 3D was only marginally better than Alternatives 6 and 12 in terms of wet season water levels.

Maximum 1994 Water Level

Post-restoration maximum water levels in SGGE and the adjacent lands were between 75 and 118% of natural conditions, while future without project conditions were 60 and 101%.

Maximum water levels were typically less affected by the existing drainage in Indicator Regions in adjacent portions of Belle Meade and Fakahatchee than those within SGGE. However, Indicator Region 5 also shows relatively little effect due to its distance from Prairie Canal, which ends over a mile downstream of it.

The uppermost tier of Indicator Regions showed little difference between pre- and post-restoration maximum water levels. This would be expected since this area is upstream of where restoration is designed to occur. Otherwise there were typically moderate to large increases in maximum water levels between pre- and post-restoration conditions for all three alternatives.

Maximum water levels associated with the three alternatives were typically still less than they were under natural conditions, although they were much closer to natural conditions than prior to restoration. There were only a few Indicator Regions, particularly in the southwestern portion of SGGE, where they were slightly higher than under natural conditions.

There were few differences among the alternatives within the Indicator Regions. The largest differences were in IRs 12 -13 and 18 -19, where the unfilled Miller Canal in Alternative 12 resulted in slightly lower maximum water levels than in the other two alternatives where Miller Canal was filled. Another relatively large difference was the lower maximum water level for Alternative 6 in IR 9, which was upstream of the restoration associated with this alternative. Thus, Alternative 3D was only marginally better than Alternatives 6 and 12 in terms of maximum water levels.

Minimum 1994 Water Level

Post-restoration minimum water levels in SGGE and the adjacent lands were between 55 and 166% of natural conditions, while future without project conditions were 27 and 99%. If we only look at the area within SGGE, the range of post-restoration dry season water levels relative to natural conditions is still the same, but it is reduced to 27-89% for future without project conditions.

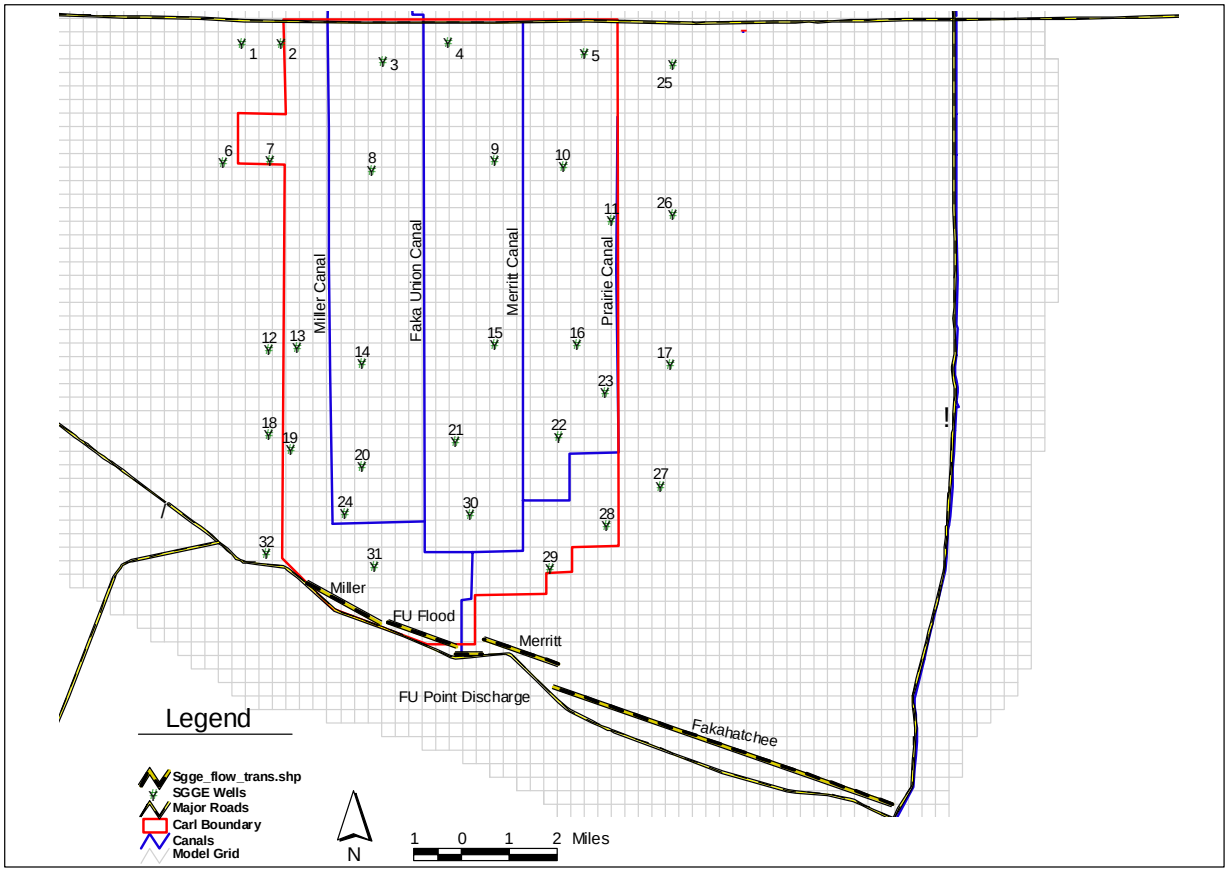
Minimum water levels were typically less affected by the existing drainage in Indicator Regions in adjacent portions of Belle Meade and Fakahatchee than those within SGGE. However, Indicator Region 5 also shows relatively little effect due to its distance from Prairie Canal, which ends over a mile downstream of it.

The uppermost tier of Indicator Regions showed little difference between pre- and post-restoration minimum water levels. This would be expected since this area is upstream of where restoration is designed to occur. Otherwise there were generally large increases in minimum water levels between pre- and post-restoration conditions for all three alternatives.

Minimum water levels associated with the three alternatives were typically still less than they were under natural conditions, although they were much closer to natural conditions than prior to restoration. There were only a few Indicator Regions, particularly in the southwestern portion of SGGE, where they were slightly higher than under natural conditions. While the percentage increases in IRs 31-32 may seem large, this is primarily a reflection of their low elevation above sea level. The actual increase in minimum water level is only about 0.5 ft, which is not ecologically significant.

There were few differences among the alternatives within the Indicator Regions. The largest differences were in IRs 12 -13, 18 -19, and 24, where the unfilled Miller Canal in Alternative 12 resulted in lower minimum water levels than in the other two alternatives where Miller Canal was filled. Another relatively large difference was the lower minimum water level for Alternative 6 in IR 9, which was upstream of the restoration associated with this alternative. Thus, Alternative 3D was only marginally better than Alternatives 6 and 12 in terms of minimum water levels.

South Golden Gate Estates
Monitoring Wells & Flow Transects



Southern Golden Gate Estates 1994 Minimum Water Level													
		Elevation above Sea Level (ft)						Percent of Natural					
Ind. Reg.	Site	NAT	EXIST	FWO ALT 3D	ALT 6	ALT 12		NAT	EXIST	FWO ALT 3D	ALT 6	ALT 12	
1	BM	8.91	6.61	6.61	6.59	6.58	6.59	1.00	0.74	0.74	0.74	0.74	0.74
2	SGGE	9.78	6.05	6.18	6.15	6.11	6.15	1.00	0.62	0.63	0.63	0.63	0.63
3	SGGE	8.36	5.92	5.26	6.67	6.75	6.68	1.00	0.71	0.63	0.80	0.81	0.80
4	SGGE	8.52	6.59	6.07	7.24	7.16	7.20	1.00	0.77	0.71	0.85	0.84	0.84
5	SGGE	10.25	9.29	9.12	9.84	9.79	9.84	1.00	0.91	0.89	0.96	0.96	0.96
25	FAKA	10.90	11.04	10.78	10.71	10.71	10.71	1.00	1.01	0.99	0.98	0.98	0.98
6	BM	7.46	6.64	6.56	6.59	6.51	6.51	1.00	0.89	0.88	0.88	0.87	0.87
7	SGGE	7.68	5.82	5.67	6.22	5.96	5.98	1.00	0.76	0.74	0.81	0.78	0.78
8	SGGE	7.51	4.71	4.48	6.09	5.73	6.05	1.00	0.63	0.60	0.81	0.76	0.81
9	SGGE	8.27	5.17	5.41	8.28	5.98	7.55	1.00	0.63	0.65	1.00	0.72	0.91
10	SGGE	8.45	3.67	3.83	7.10	6.64	7.11	1.00	0.43	0.45	0.84	0.79	0.84
11	SGGE	7.65	2.97	2.92	6.93	6.55	6.95	1.00	0.39	0.38	0.90	0.86	0.91
26	FAKA	8.27	6.12	6.13	7.93	7.59	7.50	1.00	0.74	0.74	0.96	0.92	0.91
12	BM	3.92	3.27	3.29	4.29	4.31	3.46	1.00	0.83	0.84	1.09	1.10	0.88
13	SGGE	4.34	3.42	3.28	4.75	4.68	4.26	1.00	0.79	0.76	1.09	1.08	0.98
14	SGGE	5.60	2.19	2.19	5.42	5.39	5.26	1.00	0.39	0.39	0.97	0.96	0.94
15	SGGE	6.84	2.14	2.10	5.94	5.62	5.83	1.00	0.31	0.31	0.87	0.82	0.85
16	SGGE	6.07	2.06	2.05	5.69	5.69	5.69	1.00	0.34	0.34	0.94	0.94	0.94
17	FAKA	5.40	3.83	3.83	5.46	5.47	4.97	1.00	0.71	0.71	1.01	1.01	0.92
18	BM	3.14	1.87	1.95	3.85	3.93	2.07	1.00	0.60	0.62	1.23	1.25	0.66
19	SGGE	4.26	1.63	1.74	3.92	3.92	2.36	1.00	0.38	0.41	0.92	0.92	0.55
20	SGGE	4.04	1.37	1.43	3.44	2.92	3.15	1.00	0.34	0.35	0.85	0.72	0.78
21	SGGE	4.77	1.35	1.36	5.64	4.83	5.35	1.00	0.28	0.29	1.18	1.01	1.12
22	SGGE	4.89	1.30	1.32	4.28	4.41	4.26	1.00	0.27	0.27	0.88	0.90	0.87
23	SGGE	5.47	1.53	1.52	4.92	5.01	4.87	1.00	0.28	0.28	0.90	0.91	0.89
24	SGGE	2.87	1.18	1.07	3.25	3.47	1.93	1.00	0.41	0.37	1.13	1.21	0.67
30	SGGE	3.09	1.09	1.08	2.58	2.50	2.54	1.00	0.35	0.35	0.84	0.81	0.82
32	BM	1.19	1.31	0.46	1.76	1.68	1.69	1.00	1.10	0.39	1.48	1.42	1.43

31	SGGE	1.57	0.79	0.80	2.60	2.45	2.01	1.00	0.51	0.51	1.66	1.56	1.28
29	SGGE	2.16	1.13	1.03	1.75	1.97	1.76	1.00	0.52	0.48	0.81	0.91	0.82
28	SGGE	2.98	1.40	1.47	2.67	2.82	2.64	1.00	0.47	0.49	0.90	0.94	0.89
27	FAKA	4.18	2.57	2.58	3.59	3.64	3.58	1.00	0.61	0.62	0.86	0.87	0.86
									0.59	0.56	0.96	0.94	0.88

90-100		101-110	Light Blue
80-89		111-120	Sea Green
70-79		121-130	Turquoise
60-69		131-140	Yellow
50-59		141-150	Orange
40-49		151-160	Red

Southern Golden Gate Estates 1994 Maximum Water Level													
		Elevation above Sea Level (ft)						Percent of Natural					
Ind. Reg.	Site	NAT	EXIST	FWO ALT 3D	ALT 6	ALT 12		NAT	EXIST	FWO ALT 3D	ALT 6	ALT 12	
1	BM	11.28	10.01	10.04	9.92	9.93	9.92	1.00	0.89	0.89	0.88	0.88	0.88
2	SGGE	11.46	9.44	9.48	9.36	9.37	9.37	1.00	0.82	0.83	0.82	0.82	0.82
3	SGGE	11.54	8.53	8.84	8.70	9.30	8.73	1.00	0.74	0.77	0.75	0.81	0.76
4	SGGE	10.77	9.34	9.29	9.61	9.66	9.57	1.00	0.87	0.86	0.89	0.90	0.89
5	SGGE	12.18	12.29	12.36	12.42	12.42	12.42	1.00	1.01	1.01	1.02	1.02	1.02
25	FAKA	11.89	12.02	12.00	12.03	12.05	12.03	1.00	1.01	1.01	1.01	1.01	1.01
6	BM	10.33	9.17	9.16	9.16	9.30	9.12	1.00	0.89	0.89	0.89	0.90	0.88
7	SGGE	10.08	8.42	8.37	8.45	8.39	8.39	1.00	0.84	0.83	0.84	0.83	0.83
8	SGGE	9.77	7.58	7.56	8.80	8.29	8.38	1.00	0.78	0.77	0.90	0.85	0.86
9	SGGE	9.84	6.97	7.08	9.58	7.83	8.84	1.00	0.71	0.72	0.97	0.80	0.90
10	SGGE	9.93	7.66	7.55	9.04	8.60	11.09	1.00	0.77	0.76	0.91	0.87	1.12
11	SGGE	9.19	6.14	6.21	8.93	8.70	8.93	1.00	0.67	0.68	0.97	0.95	0.97
26	FAKA	9.36	9.30	9.30	9.48	9.47	9.44	1.00	0.99	0.99	1.01	1.01	1.01
12	BM	6.17	6.22	6.26	6.87	6.91	6.24	1.00	1.01	1.01	1.11	1.12	1.01
13	SGGE	6.65	5.74	5.69	6.89	7.17	5.99	1.00	0.86	0.86	1.04	1.08	0.90
14	SGGE	7.19	4.54	4.54	6.86	7.10	6.63	1.00	0.63	0.63	0.95	0.99	0.92
15	SGGE	8.35	5.87	5.84	7.93	7.42	7.80	1.00	0.70	0.70	0.95	0.89	0.93
16	SGGE	8.29	6.16	6.11	7.97	7.65	7.90	1.00	0.74	0.74	0.96	0.92	0.95
17	FAKA	7.87	7.83	7.84	7.93	7.91	7.93	1.00	1.00	1.00	1.01	1.01	1.01
18	BM	5.09	4.91	4.91	5.58	5.62	5.10	1.00	0.96	0.96	1.10	1.10	1.00
19	SGGE	5.19	4.69	4.70	5.52	5.56	5.10	1.00	0.90	0.91	1.06	1.07	0.98
20	SGGE	5.56	3.39	3.84	5.62	5.40	5.55	1.00	0.61	0.69	1.01	0.97	1.00
21	SGGE	6.37	4.30	4.28	7.35	7.51	7.25	1.00	0.68	0.67	1.15	1.18	1.14
22	SGGE	7.12	4.70	4.65	6.68	6.58	6.71	1.00	0.66	0.65	0.94	0.92	0.94
23	SGGE	7.83	5.44	5.37	7.75	7.61	7.81	1.00	0.70	0.69	0.99	0.97	1.00
24	SGGE	4.42	3.01	2.81	4.73	4.94	4.98	1.00	0.68	0.63	1.07	1.12	1.13
30	SGGE	4.74	2.93	2.84	4.35	4.30	4.28	1.00	0.62	0.60	0.92	0.91	0.90
32	BM	3.17	2.48	2.38	3.29	3.31	3.18	1.00	0.78	0.75	1.04	1.05	1.00

31	SGGE	3.54	2.77	2.82	3.95	3.96	3.94	1.00	0.78	0.80	1.12	1.12	1.12
29	SGGE	4.50	3.57	3.70	3.64	3.66	3.67	1.00	0.79	0.82	0.81	0.81	0.81
28	SGGE	5.62	5.27	5.28	5.43	5.41	5.43	1.00	0.94	0.94	0.97	0.96	0.97
27	FAKA	5.65	5.47	5.47	5.55	5.53	5.54	1.00	0.97	0.97	0.98	0.98	0.98
									0.81	0.81	0.97	0.96	0.96

90-100		101-110	Light Blue
80-89		111-120	Sea Green
70-79		121-130	Turquoise
60-69		131-140	Yellow
50-59		141-150	Orange
40-49		151-160	Red

Southern Golden Gate Estates 1994 Average Dry Season Water Levels (April 1 - June 1)													
		Elevation above Sea Level (ft)						Percent of Natural					
Well No.	Site	NAT	EXIST	FWO	ALT 3D	ALT 6	ALT 12	NAT	EXIST	FWO	ALT 3D	ALT 6	ALT 12
1	BM	9.44	7.15	7.15	7.12	7.09	7.12	1.00	0.76	0.76	0.75	0.75	0.75
2	SGGE	9.95	6.29	6.44	6.47	6.47	6.48	1.00	0.63	0.65	0.65	0.65	0.65
3	SGGE	8.94	6.15	5.88	7.10	7.14	7.10	1.00	0.69	0.66	0.79	0.80	0.79
4	SGGE	9.48	6.88	6.51	7.67	7.52	7.68	1.00	0.73	0.69	0.81	0.79	0.81
5	SGGE	11.04	9.63	9.39	10.35	10.24	10.34	1.00	0.87	0.85	0.94	0.93	0.94
25	FAKA	11.24	11.30	11.00	11.03	11.02	11.03	1.00	1.01	0.98	0.98	0.98	0.98
6	BM	8.15	6.92	6.88	7.03	6.96	6.97	1.00	0.85	0.84	0.86	0.85	0.86
7	SGGE	8.71	6.12	6.01	6.54	6.33	6.34	1.00	0.70	0.69	0.75	0.73	0.73
8	SGGE	8.25	5.00	4.88	6.37	5.96	6.30	1.00	0.61	0.59	0.77	0.72	0.76
9	SGGE	8.49	5.66	5.73	8.49	6.24	7.95	1.00	0.67	0.67	1.00	0.74	0.94
10	SGGE	8.64	4.92	4.82	7.38	6.96	7.38	1.00	0.57	0.56	0.85	0.81	0.85
11	SGGE	8.24	3.40	3.34	7.27	6.92	7.28	1.00	0.41	0.41	0.88	0.84	0.88
26	FAKA	8.69	6.50	6.47	8.76	8.59	8.36	1.00	0.75	0.74	1.01	0.99	0.96
12	BM	4.16	4.04	3.99	5.03	5.13	4.24	1.00	0.97	0.96	1.21	1.23	1.02
13	SGGE	4.55	3.80	3.67	5.66	5.62	4.50	1.00	0.84	0.81	1.24	1.23	0.99
14	SGGE	5.89	2.47	2.43	5.59	5.58	5.45	1.00	0.42	0.41	0.95	0.95	0.93
15	SGGE	7.02	2.65	2.62	6.43	6.00	6.23	1.00	0.38	0.37	0.92	0.85	0.89
16	SGGE	6.67	2.57	2.53	6.06	6.02	6.05	1.00	0.38	0.38	0.91	0.90	0.91
17	FAKA	5.89	4.10	4.11	5.71	5.70	5.70	1.00	0.70	0.70	0.97	0.97	0.97
18	BM	3.65	2.69	2.76	4.10	4.20	3.14	1.00	0.74	0.76	1.12	1.15	0.86
19	SGGE	4.32	2.71	2.86	4.18	4.23	3.01	1.00	0.63	0.66	0.97	0.98	0.70
20	SGGE	4.39	1.54	1.61	3.79	3.30	3.37	1.00	0.35	0.37	0.86	0.75	0.77
21	SGGE	5.36	1.52	1.53	5.80	5.63	5.70	1.00	0.28	0.29	1.08	1.05	1.06
22	SGGE	5.64	1.56	1.56	4.58	4.80	4.56	1.00	0.28	0.28	0.81	0.85	0.81
23	SGGE	5.97	1.80	1.78	5.34	5.43	5.34	1.00	0.30	0.30	0.90	0.91	0.89
24	SGGE	3.25	1.28	1.19	3.34	3.60	3.26	1.00	0.39	0.37	1.03	1.11	1.00
30	SGGE	3.84	1.21	1.26	2.83	2.93	2.71	1.00	0.32	0.33	0.74	0.76	0.71
32	BM	1.54	1.46	0.68	1.88	1.86	1.84	1.00	0.94	0.44	1.22	1.20	1.19

31	SGGE	2.10	0.87	0.97	2.71	2.68	2.67	1.00	0.42	0.46	1.29	1.28	1.27
29	SGGE	2.66	1.62	1.66	2.90	3.04	2.83	1.00	0.61	0.63	1.09	1.14	1.06
28	SGGE	3.52	2.84	2.93	3.90	3.95	3.88	1.00	0.81	0.83	1.11	1.12	1.10
27	FAKA	4.50	3.10	3.19	4.08	4.11	4.08	1.00	0.69	0.71	0.91	0.91	0.91
									0.61	0.60	0.95	0.94	0.90

90-100		101-110	Light Blue
80-89		111-120	Sea Green
70-79		121-130	Turquoise
60-69		131-140	Yellow
50-59		141-150	Orange
40-49		151-160	Red

Southern Golden Gate Estates 1994 Average Wet Season Water Levels (July 1 - October 1)													
		Elevation above Sea Level (ft)						Percent of Natural					
Ind.	Site	NAT	EXIST	FWO	ALT 3D	ALT 6	ALT 12	NAT	EXIST	FWO	ALT 3D	ALT 6	ALT 12
Reg.													
1	BM	10.91	9.43	9.48	9.36	9.37	9.37	1.00	0.86	0.87	0.86	0.86	0.86
2	SGGE	10.71	8.96	9.06	8.95	8.95	8.95	1.00	0.84	0.85	0.84	0.84	0.84
3	SGGE	10.08	7.65	8.08	7.71	8.29	7.72	1.00	0.76	0.80	0.77	0.82	0.77
4	SGGE	10.37	8.38	8.30	8.43	8.51	8.43	1.00	0.81	0.80	0.81	0.82	0.81
5	SGGE	12.05	11.87	11.87	12.21	12.19	12.21	1.00	0.99	0.99	1.01	1.01	1.01
25	FAKA	11.59	11.69	11.56	11.58	11.59	11.58	1.00	1.01	1.00	1.00	1.00	1.00
6	BM	9.60	8.86	8.88	8.89	9.01	8.86	1.00	0.92	0.92	0.93	0.94	0.92
7	SGGE	9.66	7.92	7.83	8.06	7.92	7.88	1.00	0.82	0.81	0.83	0.82	0.82
8	SGGE	9.34	6.46	6.44	7.95	7.15	7.43	1.00	0.69	0.69	0.85	0.77	0.79
9	SGGE	9.34	6.32	6.52	9.10	6.69	8.43	1.00	0.68	0.70	0.97	0.72	0.90
10	SGGE	9.39	6.76	6.62	8.46	7.45	8.45	1.00	0.72	0.71	0.90	0.79	0.90
11	SGGE	8.92	4.93	4.93	8.40	7.56	8.40	1.00	0.55	0.55	0.94	0.85	0.94
26	FAKA	9.07	8.71	8.71	9.18	9.17	9.24	1.00	0.96	0.96	1.01	1.01	1.02
12	BM	5.73	5.62	5.64	6.30	6.29	5.62	1.00	0.98	0.98	1.10	1.10	0.98
13	SGGE	6.33	4.95	4.95	6.58	6.67	4.97	1.00	0.78	0.78	1.04	1.05	0.78
14	SGGE	6.78	3.97	3.98	6.43	6.66	6.18	1.00	0.59	0.59	0.95	0.98	0.91
15	SGGE	7.84	4.39	4.43	7.43	7.13	7.28	1.00	0.56	0.57	0.95	0.91	0.93
16	SGGE	7.89	4.69	4.66	6.86	6.69	6.85	1.00	0.59	0.59	0.87	0.85	0.87
17	FAKA	7.47	5.68	5.72	7.18	7.13	7.20	1.00	0.76	0.77	0.96	0.95	0.96
18	BM	4.75	4.21	4.27	5.10	5.13	4.36	1.00	0.89	0.90	1.07	1.08	0.92
19	SGGE	4.86	3.97	4.03	5.10	5.14	4.42	1.00	0.82	0.83	1.05	1.06	0.91
20	SGGE	5.31	2.86	3.21	5.24	4.98	5.07	1.00	0.54	0.60	0.99	0.94	0.96
21	SGGE	5.99	3.19	3.29	6.81	7.12	6.71	1.00	0.53	0.55	1.14	1.19	1.12
22	SGGE	6.62	3.33	3.38	6.08	6.33	6.09	1.00	0.50	0.51	0.92	0.96	0.92
23	SGGE	7.45	3.71	3.83	6.73	6.26	6.74	1.00	0.50	0.51	0.90	0.84	0.90
24	SGGE	4.03	2.03	2.32	4.27	4.51	4.24	1.00	0.50	0.58	1.06	1.12	1.05
30	SGGE	4.35	2.35	2.44	4.00	4.13	3.92	1.00	0.54	0.56	0.92	0.95	0.90
32	BM	2.71	2.01	1.74	2.73	2.75	2.61	1.00	0.74	0.64	1.01	1.01	0.96

31	SGGE	3.05	2.16	2.50	3.55	3.58	3.48	1.00	0.71	0.82	1.16	1.17	1.14
29	SGGE	3.81	2.96	3.17	3.31	3.34	3.31	1.00	0.78	0.83	0.87	0.87	0.87
28	SGGE	4.73	4.29	4.38	4.88	4.87	4.88	1.00	0.91	0.93	1.03	1.03	1.03
27	FAKA	5.45	4.13	4.18	5.15	5.12	5.15	1.00	0.76	0.77	0.95	0.94	0.95
									0.74	0.75	0.96	0.95	0.93

90-100	101-110	Light Blue
80-89	111-120	Sea Green
70-79	121-130	Turquoise
60-69	131-140	Yellow
50-59	141-150	Orange
40-49	151-160	Red

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M E M O R A N D U M

TO: Ruth Clements, Deputy Department Director, Land Acquisition

FROM: Robert Taylor, Lead Engineer, Land Acquisition Support Division

DATE: October 7, 2003

SUBJECT: Phase I/II Environmental Site Assessment & Ecological Risk Assessment
Southern Golden Gates Estates Project Area
Collier County

This memorandum is intended to summarize the results of the attached Phase I/Phase II Environmental Site Assessment (ESA) and Ecological Risk Assessment of the Southern Golden Gates Estates (SGGE) Project Area. The SGGE project area is located in southwestern Collier County, Florida, and comprises an area of approximately 55,000 acres, or 94 square miles, situated between Interstate 75 (Alligator Alley) and U.S. Highway 441 (Tamiami Trail). The SGGE is currently part of the Picayune Strand State Forest. The SGGE measures approximately 13 miles long in the north-south direction and 7 miles wide from east to west. The following is a summary of the Townships, Ranges, and Sections which comprise the SGGE.

Township (south)	Range (east)	Sections
50	27	1, 12, 13, 24, 25, 36
50	28	1 through 36
51	27	1, 12, 13, 24, 25, 36
51	28	1 through 35
52	27	1
52	28	4, 5, 6, 9

The purpose of the assessment activities was to identify areas of concern and confirm the presence, or absence, of soil/groundwater contamination or contaminated media associated with the previous and current activities conducted on these areas. The Phase I ESA was performed in general accordance with American Society for Testing and Materials Standard Practice for Environmental Site Assessments (ASTM Practice E 1527-00). This method has been used as a guide to ensure appropriate inquiry into the environmental characteristics and conditions of the site consistent with good commercial/customary engineering and environmental practices. The attached reports were completed by URS Corporation Inc. (URS) pursuant to the request of Ananta Nath.

As part of the Comprehensive Everglades Restoration Program (CERP), the District has developed a conceptual plan to restore the hydrologic flow in the SGGE project area. Included in the plan was the acquisition of approximately 55,000 acres by the Florida Department of Environmental Protection (FDEP) during the 1990s and continuing up until 2002. Restoration of the hydrologic flow will consist of removing the asphalt and gravel roads within the SGGE, plugging portions of the four major canals, the installation of a series of pump stations, and the excavation of lateral "spreader" canals.

Within the SGGE, there are three different types of land use: 1) rural homesteads, both occupied and abandoned; 2) undeveloped or preserved areas; and 3) abandoned/active agricultural areas. In the 1930s and 1940s, the lumber industry harvested pine and cypress trees from the SGGE and surrounding areas. Also during this time frame, an approximate 1,450 acre tract of land bordering the southeast part of the SGGE, known as Dan House Prairie, was used for growing tomatoes. During the 1950's, the SGGE project area was sub-divided into 1.5-acre residential tracts for re-sale. Investors who purchased the 1.5-acre parcels were, for the most part, absentee owners. In the early 1960s several areas in the southwest portion of the SGGE were cleared and cultivated. A review of the historical aerial photographs indicates that farming activities on this section of the property was conducted for less than 5 years. The majority of the parcels in the SGGE remained undeveloped during this period.

No other development occurred until the mid 1960s, when Gulf Atlantic Realty made a failed attempt to develop the SGGE into residential development. Four drainage canals, the Miller Canal, Faka Union Canal, Merritt Canal, and Prairie Canal were excavated to drain the SGGE. In the southern portion of the SGGE, lateral, east to west canals were excavated connecting the Miller, Merritt and Prairie Canals to the Faka Union Canal just north of the Port of the Islands Community on U.S. Highway 41. A series of bridges and a network of asphalt and gravel roads were constructed throughout the SGGE with the exception of the north-central portion which remained undeveloped. In the early 1970s, further improvements in the SGGE were halted due to the bankruptcy of Gulf Atlantic Realty. In the 1960s and continuing up until the mid 1990s, individual residential homes and sheds were built and mobile homes and campers set up/established, including several small-scale landscape nurseries, sparsely located throughout the upper two-thirds of the SGGE.

Prior to the acquisition of the privately owned properties within the SGGE, the FDEP retained Westinghouse Remedial Service (WRS) and Dames & Moore to conduct Phase I Environmental Site Assessments on these properties. Reviews of these Phase I ESAs indicated that areas of potential environmental concern were identified. The concerns identified were related to current/historical agriculture use, as well as suspected point sources associated with homesteads, maintenance activities, and dumping.

In an effort to evaluate residual concentrations of pesticides in the surficial soils in the general site vicinity, the FDEP in 2000 conducted site investigations at the current and former agricultural fields along the western portion of the SGGE and further to the west within the neighboring Belle Meade area. These investigations included the collection and laboratory analyses of soil samples from the former cultivated areas for residual pesticides. Results of the laboratory analysis indicated elevated concentrations of organochlorine pesticides, specifically chlordane, and to a lesser extent, 4,4-DDE, 4,4-DDD, dieldrin, and endosulfan I. The concentrations exhibited in the soil samples exceeded the FDEP Sediment Quality Assessment Guidelines (SQAG), indicating a potential for significant negative environmental impacts associated with restoration of the hydrologic flow at the former agricultural areas. The FDEP recommended that additional soil samples be collected to evaluate the extent of soil impacts and that the groundwater quality be evaluated in the former agricultural fields. This information was published in the "*Organochlorine Sampling in Watersheds for Rookery Bay NERR Managed Estuaries*" report. The FDEP subsequently submitted the aforementioned information to the U.S. Fish & Wildlife Service (USFWS) for review of the potential concerns. The USFWS' review of the information concluded that additional assessments and evaluations would be required to estimate the potential risk to the trustee species.

The preliminary review of the FDEP, WRS and Dames & Moore reports, as well as the current and historical aerial photographs of the SGGE, initially identified 69 potential areas of concern, such as natural and/or man-made cleared land, homesteads and/or developed lands, and remnants of past agricultural activities including pastureland. Based on the review of aerial photographs and the aerial reconnaissance of these 69 areas, a total of 26 areas of concern were identified to require further investigations via a ground reconnaissance based on either their current or historical land use. During the ground reconnaissance, an additional four areas of concern were identified. Eighteen of these areas of concern consisting of cultivated lands and potential point sources were determined to require additional Phase II ESA investigations. The attached table summarizes the 30 areas of concern and the resulting 18 areas which required Phase II ESA investigations.

In an effort to evaluate the project area, representatives from the USFWS accompanied the District on an aerial reconnaissance flight of the site. The purpose of the flight was to evaluate areas of concern, including suspected point source areas, and the former cultivated areas. A subsequent meeting was held to review the findings of the over flight and designate areas requiring further investigation. The purpose of the over flight and meeting was to obtain some preliminary concurrence from USFWS on additional assessment/corrective actions. No additional areas of concern were identified during the second aerial flyover.

Concurrent with the Phase I ESA activities, URS, in coordination with the Environmental Engineering Unit, developed a comprehensive work plan to evaluate the 18 areas of concern and suspected point sources that were identified during the Phase I ESA. A copy of the work plan was submitted to the USFWS for their review and comment. Upon receipt of the USFWS comments, the Phase II ESA assessment activities were implemented. The Phase II ESA activities included the collection of soil, sediment and groundwater from both the cultivated areas and the suspected point sources. The samples collected were analyzed for pesticides, herbicides, selected metals and petroleum products, as appropriate.

Soil samples were collected from the former cultivated areas to determine the presence and concentrations of residual agrochemicals and trace metals. These composite samples were collected within the cultivated areas in 25 or 50-acre grids according to the USFWS draft protocols and as agreed upon during a November 2002 meeting with USFWS. The blocks were further subdivided into ten 2.5-acre blocks for the 25-acre grids and 5-acre blocks for the 50-acre grids. A discrete sample was collected from each of the blocks within the grids and composited as one sample for laboratory analysis.

Groundwater samples were collected from temporary groundwater monitoring wells installed within the former cultivated areas and at select point source locations to evaluate shallow groundwater quality. A limited number of background samples were also collected from undeveloped areas. Sediment samples were collected from interior drainage ditches to evaluate agrochemical runoff and their potential accumulation within the sediments.

To ensure accuracy and precision of the laboratory analysis an enhanced laboratory quality control/quality assurance (QA/QC) program was implemented to ensure that data quality objectives (DQO) were met. The enhanced QA/QC included the collection and analysis of approximately 5% split and 5% duplicate samples, and the review of laboratory QA/QC data. Jupiter Environmental Laboratories was the lab contracted to analyze the samples. The split samples were submitted to U.S. Biosystems, Inc. The results of the laboratory QA/QC indicated that the laboratory analysis was generally consistent in that the duplicate samples exhibited similar detected parameters at comparable concentrations and met the DQO for the project.

In light of the future intended use of the subject property and the conversion of soils at the site to sediments post-inundation, soil and sediment samples results were evaluated with respect to the Sediment Quality Assessment Guidelines using the values established in the *Consensus-Based Sediment Quality Guidelines for Freshwater*, published by McDonald Environmental Service Ltd. in 2000 as adopted by the Florida Department of Environmental Protection (FDEP). Groundwater samples were compared to the Florida Administrative Code Chapter 62-777 Groundwater Cleanup Target Levels (GCTL).

Based on the reviewed historical information, previous site studies, and the results of the Phase I and II ESA, the SGGE was divided into four (4) distinct areas based on land use which were designated as follows: Interior Area, Former Agriculture Area-Southeast (FASE) which represents approximately 1,450 acres of cultivated land located on the southeast border; Former Agriculture Area-West (FAW) which represents approximately 750 acres of cultivated and uncultivated land; and, Former Agriculture Area- Northeast (FANE) which represents three farms and non-cultivated land totaling approximately 600 acres. See the attached figure1 for a location of specific areas.

Interior Area:

The Interior Area represents approximately 50,000 acres of the SGGE or 91% of the SGGE. Ninety-three (93) soil samples were collected from six landscape nursery/grove areas and 10 soil samples were collected from smaller farm operations within the interior portion of the SGGE. In addition to the cultivated areas, soil samples were collected from areas of potential point sources (i.e. irrigation pump wells, agrochemical mixing areas, etc). Soil samples were analyzed for organochlorine pesticides and chlorinated herbicides. Concentrations of 4,4-DDD, 4,4-DDE and chlordane were detected in 3 soil samples from a former vegetable garden. Concentrations of 4,4-DDD and 4,4-DDE were also detected in 3 samples from cultivated areas of two nursery/grove areas. Concentrations of these residual pesticides were below or slightly above the SQAG TECs. Organochlorine pesticides and chlorinated herbicides were not detected at any of the potential point source areas.

Forty-six homesteads were identified within the 50,000 acre interior area of the SGGE. The homesteads typically consisted of a wooden, cinderblock structure, and/or mobile home trailers. The homesteads included potable water wells and a septic system. Of the 46 homesteads, six were also rudimentary landscape nursery/orchard operations which ranged in size from 1.3 acres up to 14.5 acres. It should be noted that one of the six landscape nursery/orchard operations (Area 6) was also included in the FANE evaluation. No extensive infrastructures, i.e. chemical storage or mixing areas, equipment staging or repair buildings, or processing areas were observed. The landscape nursery/orchard cultivated areas were typically irrigated using small diameter potable wells, an aboveground pump and aboveground piping. Also, four of the homesteads had vegetable gardens or hobby farms. The hobby farms were very limited in aerial extent; always less than 1/3 acres. There were no indications of extensive application of agrochemicals at any of the landscape nursery/orchard operations or at the hobby farms.

The Ecological Risk Assessment (ERA) indicated that the residual levels of pesticides exhibited in the Interior Area do not appear to pose a significant risk to aquatic animals or terrestrial animals and it is not anticipated that it will affect the trustee species.

In addition, 23 groundwater samples were collected at the six nursery/grove areas and the small farming operations and were analyzed for organochlorine pesticides as well as metals. **No organochlorine pesticides were detected in the 23 samples. Low concentrations of metals below GCTLs were detected in the groundwater samples**.

Former Agriculture Area- Southeast (FASE):

The FASE represents approximately 1,450 acres of cultivated land which was reportedly used for the cultivation of tomatoes in the 1930s. No farm support buildings, chemical storage areas or processing areas were identified. The former cultivated areas, which are located on the southeast boundary of the SGGE, were subdivided into twenty-nine 50-acre grids for sampling purposes in accordance with the USFWS protocol. One composite soil sample was collected from each of 14 randomly selected grids and analyzed for organochlorine pesticides and metals. The analysis of composite soil samples exhibited concentrations of organochlorine pesticides (4, 4-DDD 4, 4, 4-DDE), and Selenium at levels above the USFWS guidelines.

Based on the detected selenium an organochlorine pesticides level, an Ecological Risk Assessment (ERA) statistical review was conducted**.** The ERA results indicates that selenium as well as the organochlorine pesticides does not appear to pose any significant risk potential to aquatic plants or animals. **However, levels of selenium in soils may pose a minimal risk potential for small ground foraging mammals but it is not likely that it will affect the trustee species. The projected surface water concentrations are estimated to fall below a critical concentration.**

Groundwater samples from two monitor wells installed in the FASE did not exhibit elevated concentrations of organochlorine pesticides or metals.

.**Former Agricultural Area-Northeast (FANE):**

The FANE represents approximately 600 acres of cultivated and uncultivated land, which was used for the cultivation of landscape plants and groves from the 1970s to 2000. No farm support buildings, chemical storage areas, or processing areas were identified at two of the former cultivated areas. A chemical storage shed, a collapsed greenhouse, and an abandoned irrigation system were observed at a recently abandoned landscape nursery operation. For sampling purposes, the

combined 600 acres were subdivided into twenty-four 25-acre grids and one composite soil sample was collected and analyzed from each of the 24 grids as agreed upon by the USFWS. One of the 24 samples exhibited 4,4-DDD above the SQAG Probable Effects Concentration (PEC); one of the 24 samples exhibited 4,4-DDT above the SQAG Threshold Effects Concentration (TEC); and three of the 24 samples exhibited toxaphene above the SQAG PEC. Organochlorine pesticide concentrations in individual soil samples collected from these grids could not duplicate composite sample results. Therefore, it would appear that the residual organochlorine pesticides were not consistently applied over the FANE, and are limited to localized areas and at low concentrations.
Two of the 24 composite soil sample exhibited selenium at levels above the USFWS guidelines. To further evaluate selenium levels in the grid with the highest initial selenium concentration, 10 individual soil samples were collected and analyzed. Two of the 10 samples exhibited concentrations of selenium below the USFWS guideline of I mg/kg. **Based on the ERA, the levels of selenium in soils found in the FANE may pose a minimal risk potential for certain small ground foraging mammals but it is not likely to affect the trustee species.**

Groundwater was collected and analyzed from 9 monitor wells installed within the FANE including 4 wells at potential point sources. **Groundwater samples collected from the FAW did not exhibit detectable concentrations of organochlorine pesticides. Concentrations of metals were detected in groundwater samples below their respective GCTLs.**

Former Agricultural Area-West (FAW):

The FAW represents approximately 750 acres of cultivated and uncultivated land, which was cleared in the early 1960s and used for the cultivation of row crops. No farm support buildings, chemical storage areas or processing areas were identified associated with the farming activities in this area. Soil samples collected within this general area by the FDEP in 2000 exhibited elevated levels of chlordane and, to a lesser extent, 4,4-DDD, dieldrin and other organochlorine pesticides.

For sampling purposes, the combined 750 acres were subdivided into thirty, 25-acre grids and one composite soil sample collected from each of the 30 grids. The soil sampling indicated that organochlorine pesticides chlordane and dieldrin were detected above their SQAG in grids 1, 13, 16, 21, 27, and 30. The impacted soils in the 6 grids make up approximately 150 acres.

Groundwater samples collected from the FAW did not exhibit detectable concentrations of organochlorine pesticides. Concentrations of metals were detected in groundwater samples below their respective GCTL.

Based on the sediment desorbtion, toxicity, and bioaccumulation tests, the levels of chlordane and dieldrin at the FAW does appear to pose a significant risk potential for sediment dwelling organisms, and these residual organochlorine pesticides do pose some risk potential to aquatic receptors and piscivorous birds. The former cultivated areas that are impacted with chlordane and dieldrin in the FAW are situated on the perimeter of the project. Prior to implementing restoration activities/inundation flooding in this area corrective action will be required to reduce the potential ecological risks in this area.

Miscellaneous Areas:

During the Phase I and Phase II ESAs, the assessment included the review of potential disposal options of the on-site asphalts roads. These asphalt-paved roads were constructed as part of the failed residential development in the northern 3/4th of the SGGE. The asphalt portions of the roads are to be excavated and the crushed limerock base and gravels roads "de-graded" as part of the hydrologic flow restoration.

Core samples were collected and analyzed from the paved roads asphaltic material to evaluate the suitability of this material to be used as fill for the abandonment of the four existing canals. The asphaltic material was analyzed for petroleum residual organics and polynuclear aromatic hydrocarbons. No parameters were identified in detectable concentrations. It is recommended that the data be submitted to the FDEP for regulatory concurrence prior to use as fill material. Even with the absence of petroleum constituents, it is anticipated that the FDEP will require additional evaluations to demonstrate the appropriateness of using the asphalt material for fill in the canals at or below the water table. In the event that this material is proposed for use as fill in the canals, a comprehensive plan will be required for submittal to and approval by the FDEP. This comprehensive plan will need to include at a minimum, the methodology for removal and placement of the asphalt material in the canals, the proposed volumes, the locations and approximate position (i.e. upper portion, base, etc.) in the canals where the asphalt material will be placed.

Several areas of potential concern were identified at the Port of the Island complex, located at the southern portion of the SGGE. These areas of concern consisted of a skeet shooting range, a mobile home park, the resort complex, a water and wastewater treatment plant, and residential properties along Faka Union Canal which will be bermed as part of the restoration process. **It is recommended that the District Project Manager periodically obtain and review data from the water treatment plant's groundwater and surface water monitoring program for potential lead impacts originating from the skeet shooting range.**

Clandestine dumping of solid wastes has occurred throughout the SGGE project area. Solid waste was observed scattered at the terminus of the gravel roads and a large accumulation at one area (Area 43), which was used as an unregulated solid waste dump. **It is recommended that, in the areas where there area significant amounts of solid waste, these materials be removed from the SGGE and properly disposed or recycled prior to restoring the hydroflow. Because of the vegetative overgrowth, the solid wastes were not quantified; additional volumes of solid waste may also be uncovered during the clearing or burning of areas within the SGGE.**

Conclusions/Recommendations

In summary, the SGGE consists of approximately 55,000 acres of land, in which an estimated 50,000 acres, or 91%, is represented within the Interior Area, which is mostly undeveloped land with no major cultivated areas. Of the approximately 55,000 acres evaluated, the Phase III ERA identified approximately 194 acres that poses a potential ecological risk to the project. Of the 194 acres, 163 acres will require additional assessment or corrective actions. The FAW consisted of 138 acres and the FANE included 25 acres that will require either additional assessment or corrective actions. The FASE included 31 acres that pose a potential ecological risk but are not recommended for additional assessment or corrective actions. Forty-six homesteads were identified within the 50,000 acre interior area of the SGGE. The homesteads typically consisted of a wooden, cinderblock structure, and/or mobile home trailers and included a potable water well and a septic system.

The results of Phase I/II and Ecological Risk assessment of the Interior Area identified no significant impacts which would inhibit the proposed restoration activities within this area. It is recommended that the homesteads be surveyed for potential asbestos containing materials, the potable wells abandoned, and the septic system decommissioned. It is important to note that the FWS has not completed their review of this section of the property.

In addition to the interior section of the SGGE, three former agriculture areas were identified within the project foot print. These areas included approximately 1450 acres located in the southeast section of the property identified as the FASE; 600 acre located in the northeast section of the property identified as the FANE; and 750 acre located in the western section of the property identified as the FAW. These approximately 2,800 acres of former agricultural areas represent 5% of the SGGE**.**

FASE

The soil sampling identified selenium above the USFWS 1 mg/kg in two sampling grids. The two impacted areas were located within sampling grids 25 and 29, measuring approximately 12 acres in grid 25 and 19 acres in grid 29. The results of the ERA indicated that levels of selenium in soils found within two areas at FASE may pose a minimal risk potential for small ground foraging mammals and it is unlikely that it will affect the trustee species. Based on the results of the selenium desorption tests, the statistical review, and groundwater analytical results, it is recommended that no additional assessments or corrective activities be conducted in the FASE. **This section of the SGGE should be acceptable for the District's proposed future use of the property. It is important to note that the USFWS has not completed their review of this section of the property**.

FANE

The soil sampling identified toxaphene in grids 1, 11, and 14 located within the FANE area above the SQAG. Confirmation soil samples collected from these 3 grids indicated that toxaphene impacts were limited in concentration and aerial distribution. The ERA indicated that there is weak evidence that the upper level trophic fish have some potential risk from residual toxaphene in the FANE area. The 4,4-DDD and 4,4-DDE levels within the FANE area are not predicted to pose any significant risk potentials to ecological resources. Additionally, levels of selenium above the USFWS 1 mg/kg guideline were identified in grid 22. However, the high selenium levels were not confirmed. Until further investigations are conducted, it should be assumed that a portion of grid 22 may be impacted elevated concentrations of selenium. Based on the results of the ERA, soils impacted with selenium in the FANE may pose a minimal risk potential for certain small ground foraging mammals, however; it is unlikely that selenium concentrations will affect the USFWS trustee species.

According to verbal comments by the FWS, it is recommended that additional assessment activities be conducted in Grid 22 of the FANE to confirm the absence/presence of a potential point source area of selenium. No other additional assessment /corrective actions are recommended. Upon completion of the additional assessment, corrective actions for selenium grid 22 should be revaluated for the suitability of the District's proposed use including flooding and inundation.

FAW

The soil sampling indicated that organochlorine pesticides chlordane and dieldrin were detected above their SQAG in grids 1, 13, 16, 21, 27, and 30. The impacted soils in the 6 grids make up approximately 138 acres of the 750 acre FAW area. The results of the ERA indicated the impacted soils pose a potential ecological risks to aquatic receptors and piscivorous birds. Based on this risk, the southwest boundary of the proposed restoration may need to be shifted so that portions of the former cultivated areas are excluded. It is recommended that the District Project manager and design team consider implementing a final design that would minimize the ecological risk associated with inundating/flooding this area. Design modifications that could minimize ecological risk may include shifting the southwestern boundary, site grading, depth/time interval of flooding and operations at the SGGE. A site biologist should be included in the final design discussions. This step should be conducted prior to developing/ implementing a corrective action plan to address impacted soil. It is important to note that in the event the southwest boundary is moved, equivalent ecological risk will be realized if the area out side of the project area is allowed to passively flood.

In the event that relocating the southwest boundary to exclude the impacted area is not a reasonable alternative, corrective actions may be required to minimize the potential risks to ecological receptors. Prior to conducting any corrective actions chlordane and dieldrin impacts soils will need to be further delineated. An additional 80 to 100 soil samples should be collected in the cultivated areas where elevated chlordane and dieldrin were detected. Soil samples should be collected from 0-6-inches and a select number of samples collected from 6-inches to 2 feet bls to evaluate the vertical extent of impacts.

Corrective actions of soil impacts could consist of the following options: 1) excavating the chlordane and dieldrin impacted soils; 2) capping the impacted soils with clean fill; 3) soil inversion; and 4) reuse of soil as material used to construct the proposed berms.5) formal consultation under Section 7 of the Endangered Species Act with the FWS.

Option # 1; the cost to excavate and transport impacted soils approximately (150 acre to a depth of one foot) or 242,000 cubic yards offsite for disposal is enormous. Based on the cost to excavate and transport impact material offsite, this option was not considered feasible. Likewise with Option # 2; placing a 2-foot thick cap over of the (150 acre) impacted soils is also not practical. The approximate amount of clean fill required to cover the impacted areas is estimated at 484,000 yards.

Option # 3; soil inversion is a relatively new concept that the District is considering. It was initially considered for citrus groves where untilled soils had been impacted with copper. It should be noted that since soils in these former cultivated areas have been tilled as part of the agricultural process, it is likely that this technique would not be as effective as with soils that have not previously been tilled. After review of the soil inversion pilot test results, this methodology will be evaluated for its effectiveness and applicability to the FAW.

Option # 4 would require that the identified impacted soils approximately (150 acre to a depth of one foot) or 242,000 cubic yards would be excavated and used in an area were they would not pose an ecological risk. An example would be the interior portions of one or more of the berms that will constructed as part of the hydrological flow restoration. The preliminary plan for the site indicates a main north-south soil berm will be constructed on the west portion of the SGGE through the section of the property identified as FAW. The utilization of the impacted soils in construction of the berm will lower/eliminate the potential ecologic risk in an efficient and effective manner.

Option #5 In the event that the District elects to not implement corrective actions or if corrective action is determined to be ineffective and/or infeasible, formal consultation under Section 7 of the Endangered Species Act with the FWS will be required to proceed with the construction of the reservoir. Formal consultation is required if District actions may affect a listed species (designated as threatened or endangered in Section 4 of the Endangered Species Act). The District is presently utilizing the informal consulting process with the FWS. The FWS is mandated and responsible under the Endangered Species Act to make a determination of jeopardy for the species at issue. Such a determination is made by the FWS, in consultation with the District, through three (3) potential report vehicles: biological opinions, incidental take statements, and/or biological assessments. The potential outcomes from formal consultation include:

- A finding that the action (water control structure construction and use) *is not likely to adversely affect* the listed species. However, if a finding that the action *is likely to adversely affect* the listed species then the following actions may be taken;

    - Recommendations of reasonable and prudent *alternatives* which when implemented would avoid any jeopardy to the listed species;

    - Recommendations of reasonable and prudent *measures* which when implemented would reduce or minimize the amount or extent of *incidental take;*

- Issuance of an incidental take permit to the District allowing for the construction and operation of a water control structure under provisions contained within the permit; or

- Restriction of the District's proposed actions.

It is uncertain at this juncture what specific outcome would result from a formal consultation specific to the SGGE project area.

Costs associated with the Phase II/Phase III Ecological Environmental Risk Assessment described in this memorandum total $248,921.00. These expenditures were addressed in Work Order No. 24 (Contract No. C-12474/URS). Draft copies of the URS reports were submitted to the USFWS - Vero Beach, Florida office for their independent review and comments. The District has received a comment letter from FWS dated October 1, 2003 addressing the FANE. A copy of the FWS comment letter is attached. A response to FWS comments on the FANE is currently being drafted and will be submitted to FWS to address their comments. It is anticipated that the USFWS will issue comments and/or concurrence for the remainder of the site within 60 days from receipt of the Finial report. The finding within the Phase III ERA should be consider prior to implementing the proposed restoration plans at the SGGE, including all earthwork activities, inundation or flooding .

Should you have any questions, or require additional information, please contact me at extension 2264.

RT\mem
Attachment

c: Tom Olliff (w/o attachment)
Clarence Tears (w/o attachment)
Ananta Nath
Juan Diaz-Carreras
Tom McCracken (w/o attachment)
Eva Shea (w/o attachment)
Bob Kukleski (w/o attachment)
Fred Davis (w/o attachment)
Jim Bridgeman (w/o attachment)

TABLE 1
30 AREAS OF CONCERN

Area ID	Type/Use	Comments	Recommendations
1	Former cultivated land and overgrown areas	Prior to 1986, the northern portion of Area 1 was cultivated. From at least 1986 to before 1996 the lower 12 acres were cultivated.	Conduct Phase II ESA
5	Homestead	Area 5 was developed between 1986 and 1993.	Conduct Phase II ESA
6	Landscape nursery and orchard	The south portion of Area 6 was under cultivation by 1986. By 1993, the northern part was cultivated. This landscape nursery and orchard had been in operation up until at least 1999.	Conduct Phase II ESA
7	Former cultivated area	Area 6 was cleared in 1986 and appeared to be used for cultivation. The 1996 aerial photograph depicted Area 7 as being fallow.	Conduct Phase II ESA
11	Hunting camp	This area did not appear to be cultivated. This area appeared clear of vegetation in the 1986 photograph and several structures noted.	No Further Action
17	Former cleared land	In 1973 this area was cleared of vegetation and some type of earthwork activity was evident.	No Further Action
19	Former animal farm	The area was cleared in the 1986 aerial photograph. The site was reported used as a pig farm in the late 1990s.	No Further Action
20	Homestead	Homestead that has been present since at least 1986.	No Further Action
23	Former cultivated area, grassland prairie, cattle grazing	Reportedly used to cultivate tomatoes in the 1930s.	Conduct Phase II ESA
24	Grassland prairie, cattle grazing	No cleared areas or manmade structures.	No Further Action
32	Vegetable garden, homestead, cleared land	On the 1986 aerial photograph, with the exception of a few scattered trees, the area was cleared of vegetation.	Conduct Phase II ESA

Area ID	Type/Use	Comments	Recommendations
38	Homestead	In the 1986 aerial photograph the area had been cleared and a building constructed.	No Further Action
39	Cleared staging area	Cleared after 1986. No potential environmental impacts noted.	No Further Action
40	Landscape nursery, homestead, and cleared land	Appeared to be one contiguous area which was cleared after 1996.	Conduct Phase II ESA
41	Residential houses, and cleared land	This area was developed prior to 1986 with homesteads.	No Further Action
42	Landscape nurseries, homestead,	Cultivation in this area began between 1973 and 1986.	Conduct Phase II ESA
42W	Landscape nursery, homestead	Cultivation in this area began between 1973 and 1986.	Conduct Phase II ESA
43	Homestead, solid waste disposal area	The solid waste dumping began between 1993 and 1996.	Remove Solid Waste - No Further Action
43N	Cultivated area was used for growing fruit trees	Cultivation began in this are between 1973 and 1985.	Conduct Phase II ESA
46	Homestead, limerock mining	Limerock mining operation reportedly began in October 2001.	No Further Action
48	Orchard and landscape nursery, cleared land, homestead	Reportedly began operations in late 1980s	Conduct Phase II ESA
48A	Landscape nursery and homestead	Identified during ground reconnaissance.	Conduct Phase II ESA
57	Natural grassland prairie		Conduct Phase II ESA
58	Natural grassland prairie		Conduct Phase II ESA
59	Tree stands, grassland prairies and mudflats		No Further Action
60	Former agriculture area	Cultivated in the 1960s.	Conduct Phase II ESA
63	Former agriculture area	Cultivated in the 1960s.	Conduct Phase II ESA
64	Former agriculture area	Cultivated in the 1960s.	Conduct Phase II ESA
64W	Former agriculture area	Cultivated in the 1960s.	Conduct Phase II ESA
65	Storage lot for campers, mobile homes, several panel trucks and motor homes	This area appeared clear of vegetation in the 1996 aerial photograph.	No Further Action

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Remediation Actions for HTRW in SGGE
Proposed by South Florida Water Management District
September 15, 2004

In November 2002, the South Florida Water Management District (District) retained URS to conduct a Phase I/II Environmental Site Assessment on the 55,000 acre Southern Golden Gates Estates (SGGE) property. URS identified four areas in the SGGE property that required additional (Phase II) assessment: FANE, FASE, Interior, and FAW. Upon completion of its Phase II activities and its September 2003 report submittal, URS obtained concurrence from the US Fish and Wildlife Service (USFWS) that no additional assessment or corrective action is warranted within the interior section and the FANE. It is the District's understanding based on verbal conversation that no addition assessment or corrective action is warranted associated with the FASE. Consequently, approximately 54,250 of the 55,000 acres (98.6%) are suitable for the intended project use. Additional assessment and corrective action, however, are warranted within the 750 acre FAW.

Belle Meade Area
In its March 23, 2004 comment letter on the URS report, USFWS also required that additional assessment be conducted on that portion of the adjacent (to the west) Belle Meade area property of the Picayune Strand State Forest that would become flooded as part of the SGGE project restoration effort (approximately 3,530 acres to be flooded according to the Alt3D model). An assessment of suspected former agricultural areas (approximately 334 acres) on the adjacent Belle Meade area property is currently being conducted. It should be noted that authorization for site access on at least one private property may be an issue. Potential remediation costs on those portions of the Belle Meade area property that are subject to inundation cannot be developed until the assessment is completed.

Of the five areas in the SGGE project area (FASE, FANE, Interior, Belle Meade area, and FAW), two remain as potential risks to threatened and endangered species: Belle Meade area (up to 334 acres) and the 750 acre FAW. As described above, assessment on Belle Meade area is ongoing. A more detailed discussion of FAW follows.

FAW
The URS report identified 150 acres of chlordane, dieldrin, and selenium impacts in the 750 acre FAW in the southwest portion of the property that represent risk to threatened and endangered species. Additionally, USFWS required that chlordane and dieldrin data from an FDEP investigation conducted in 2000 be incorporated in any ecological risk assessment and/or corrective action for the SGGE property (the USFWS also required that data from the Belle Meade area assessment be included in any ecological risk assessment and/or corrective actions). The District retained Environmental Consulting & Technology, Inc. (ECT) in March 2004 to evaluate remedial options with potential corrective action costs within FAW.

Selenium
ECT evaluated the distribution of selenium that was detected by URS in June 2003 in composite samples representing eight 25-acre parcels, Grids 23-30 in the FAW. Since no selenium was detected above the 1.0 mg/kg threshold, ECT proposed no further action with

respect to selenium impacts. Nevertheless, as discussed with the USFWS, ECT will re-sample grids 29 and 30 (25 acres each) with the USFWS to confirm results in these two grids. It is anticipated that the selenium re-sampling will return results less than the guidance concentration. In the event the guidance concentration is exceeded, corrective action may be required.

Chlordane and Dieldrin

ECT conducted expanded sampling within the 150 acres of the FAW to delineate both the spatial and vertical extent of chlordane and dieldrin impacts and for remediation feasibility purposes. Several sampling locations were placed within the cypress swamp areas intentionally to verify the absence of any organochlorine impacts within background locations. The additional sampling and ecorisk modeling indicated dieldrin concentrations do not represent risk to threatened and endangered species. Based on discussions with USFWS it was agreed that a soil chlordane concentration above 100 ug/kg poses an unacceptable risk and would require corrective actions. With the application of this 100 ug/kg contour, ECT, URS, and FDEP data indicate impacts of approximately 36 acres exceeding the 100 clean up value.

Based on the extent of impacts, a remedial approach was developed that could effectively balance the reduction of risk to an acceptable level and reasonable restoration costs. The remediation strategy is predicated on USFWS' conceptual agreement that (1) the FDEP "hotspots" will be delineated and (2) three remediation approaches will be applied, based on the severity of chlordane impacts. The three remediation approaches are:

- Soil inversion by plowing of 8 acres (low-level chlordane impacts, e.g., between 100 ug/kg and 200 ug/kg);
- Soil inversion by burial and capping of 21 acres (by trackhoe/pan scraper) with native, subsurface soils (medium level impacts, e.g., between 200 ug/kg and 1,000 ug/kg); and
- Excavation and disposal of 7 acres for high impacts (e.g., greater than 1,000 ug/kg).

The vertical profile of chlordane impacts indicated that chlordane concentrations attenuated below the 100 ug/kg threshold at 12" below grade on every occasion.

Soil inversion by plowing is considered a viable alternative for chlordane impacts up to 200 ug/kg since, under worst-case conditions (i.e., that soil inversion by plowing mixes, rather than inverts), soils would be blended to half the concentration.

Soil inversion by burial and capping with native in-situ soil is considered a viable alternative for the concentration range between 200 ug/kg and 1,000 ug/kg since capping will be achieved with no mixing. Burial of chlordane at 12 to 24 inches will be effective in eliminating all major exposure pathways to wildlife, in this chlordane concentration range. If the area with the buried chlordane is covered with water, the zone within which the chlordane would reside would be below the "bioturbation zone" (e.g., see Bosworth and Thibodeaux 1990), become anoxic and devoid of all multiple celled organisms. The presence of tap roots is possible but the transport of chlordane from root material is expected to be minimal at best (e.g., Trapp and McFarlane 1995). Diffusion of chlordane from this layer would be limited

by the low porosity at such a sediment depth (e.g., USEPA 1984). Therefore it is believed that this alternative is an appropriate and effective methodology.

In order to support USFWS' mandate to protect Trustee species and on behalf of the District's interest, ECT proposed to excavate and remove soils with chlordane impacts greater than 1,000 ug/kg.

Corrective action costs were estimated based on assumptions of areal extent of impacts, unit costs from the 2004 Means Construction Cost Estimating manual, and unit costs obtained from contractors. The estimated corrective action cost for the 36 acres in FAW is $1,690,000.

ECT released its draft report on August 16, 2004. Copies were made available to District project personnel, USFWS, and FDEP. The draft report is currently under review by USFWS for agreement on technical approach.

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Alternative Benefit Analysis for Estuaries Affected by South Golden Gate Estates Restoration

Michael Savarese, Michael Shirley, and Todd Hopkins

Draft: January 28, 2004

Methodology

Introduction

Two methodologies were employed to assess the relative effectiveness of the various alternatives on estuarine restoration. The first technique utilizes an empirically based relationship between measured salinity and flow entering estuarine bays. Unfortunately, only one estuary within the Ten Thousand Islands affected by SGGE restoration (Faka Union Bay), albeit the one most ill-effected by the existing SGGE canal system, has been monitored thoroughly enough to permit the use of this technique. The second technique is more model-dependent and utilizes a similarity metric approach in which the relative effectiveness of an alternative is based upon how close the flow generated by a modeled alternative approaches the flow predicted by the pre-alteration, natural system model. The relative benefits provided by the alternatives for Blackwater and Pumpkin Bays must be analyzed in this way. This second approach will also be applied to Faka Union. This will permit a comparison between the empirically based and model-based methods, hopefully yield commensurate results, and thereby demonstrate the reliability of the model-dependent approach.

The other bays affected by the SGGE restoration (Buttonwood and Wood River) will not be analyzed; no field ecologic, hydrologic, or water quality monitoring studies have been conducted in these estuaries. Blackwater, Pumpkin, and Faka Union Bays, however, represent the western-most, mid-region, and eastern-most estuaries respectively affected by restoration, and therefore should be indicative of the overall performance of the Ten Thousand Islands. The locations of all bays discussed in the report are shown in Figure 1.

Empirically Based Approach for Faka Union Bay

Continuous salinity monitoring, with 30-minute periodicity, has been conducted by FDEP - Rookery Bay NERR since the beginning of 2000. The monitoring station is located in the upper end of Faka Union Bay, just downstream from the mouth of the Faka Union trunk canal. During this same time interval, stage height and volume flux (in cubic feet per second [cfs]) were monitored just upstream of the fixed crest weir located at the upper end of the Faka Union trunk canal near Port of the Islands. From these data, a calibration equation relating salinity to freshwater flow was derived through regression analysis (Figure. 2).

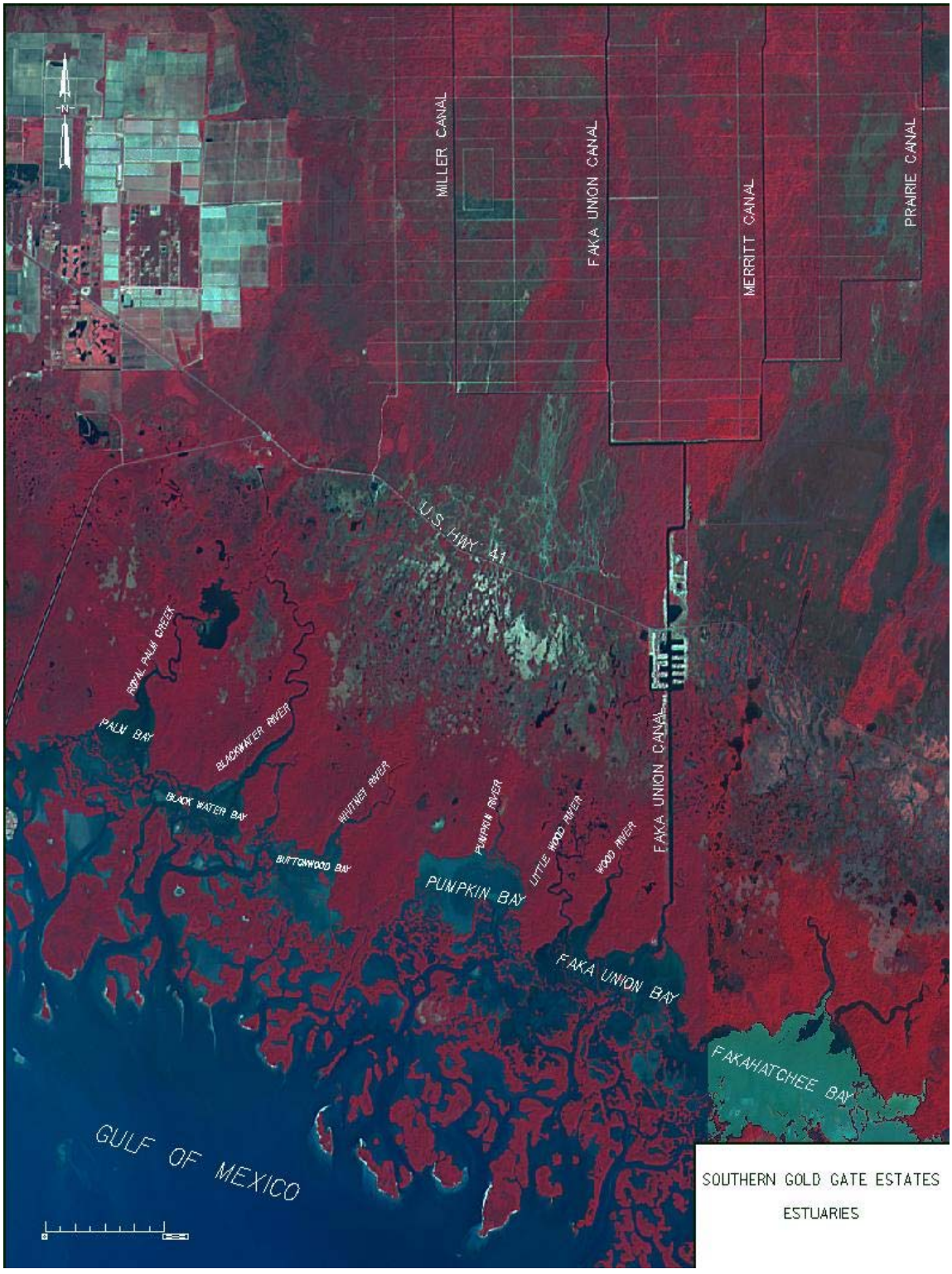

Figure 1 Locations of estuaries and bays in relation to the Southern Golden Gate Estates canal system.

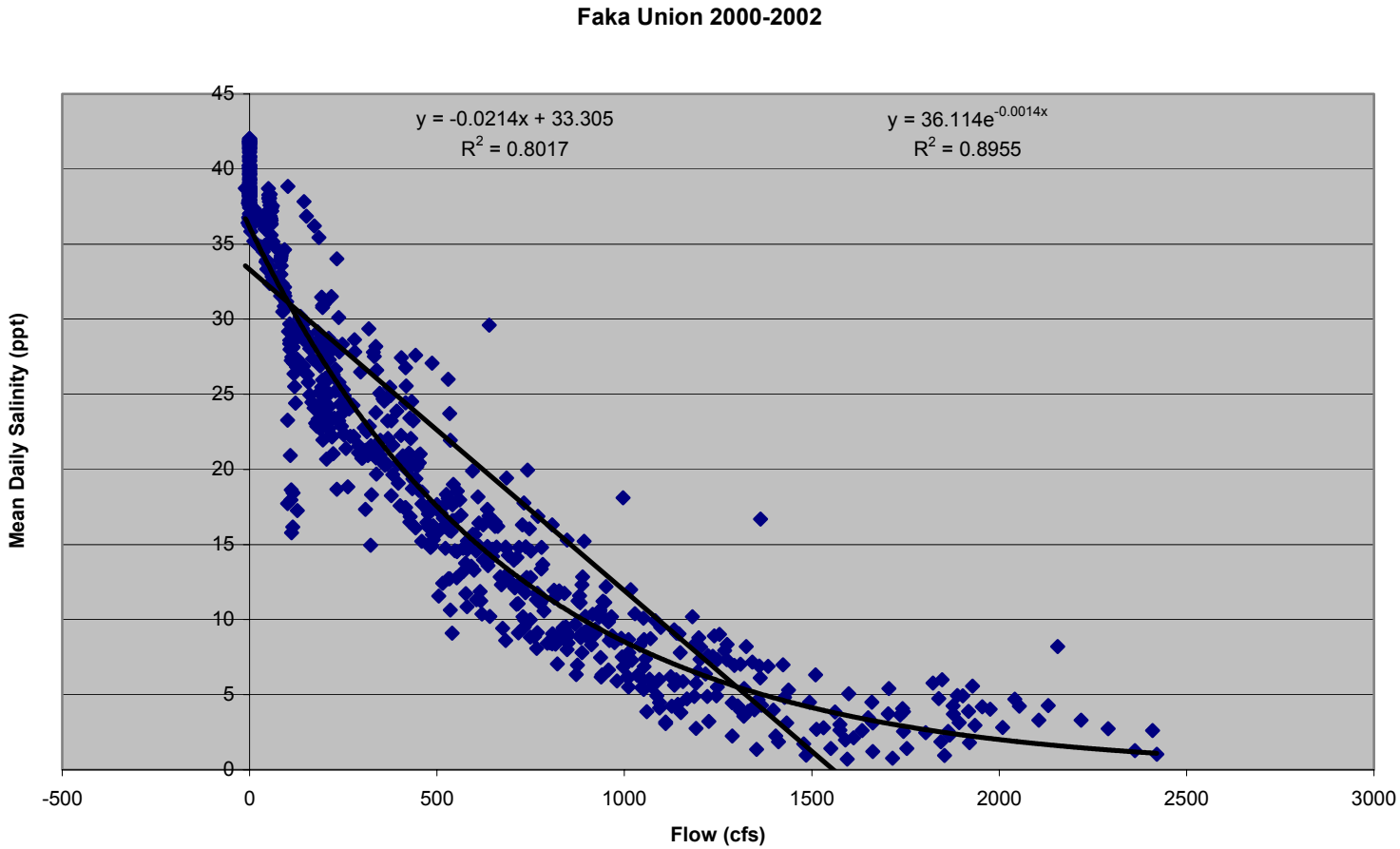

Figure 2 The relationship between mean daily flow (in cubic feet per second) measured above the fixed weir at Port of the Islands on the Faka Union trunk canal and mean daily salinity (ppt) monitored from a datasonde at the mouth of the Faka Union trunk canal for the years 2000-2002. Regression functions employing a linear and exponential model are provided. The exponential function provides a better fit; this equation was used to evaluate the relative effectiveness of the restoration alternatives

Two ecological performance measures (e.g., oysters and nekton communities) were chosen to assess the estuarine response to restoration. Each of these biologic components requires a range of salinities during specific intervals of the year to remain vital and productive. Consequently, these salinity requirements will be used to target given flows (in cfs) using the salinity to flow calibration equation. The effectiveness of an alternative is determined by how close a modeled alternative can come to achieving the flow needed to produce a given salinity required by the performance measure. Performance measure comparisons are made while applying an assumption of "spatial homogeneity" (Savarese & Volety 2001). The estuaries within the Ten Thousand Islands have similar geomorphologies (i.e., similar bay distributions and sizes, watershed areas, and drainage lengths), suggesting that prior to human alteration they had similar hydrologies. Consequently, it is appropriate to assume that spatially homologous points along the onshore-offshore estuarine axis within the estuaries had similar water quality characteristics and similar ecologies when the estuaries were in their natural state. Spatial homologues are sites within the estuarine systems that are similarly positioned geomorphically and are located at equal distances upstream from the outermost marine coastline. Similar methods of comparison, using onshore-offshore distance, have been advocated by Coen et al. (1999b).

Five spatially homologous regions were mapped within Blackwater, Faka Union, and Fakahatchee estuaries (Savarese & Volety 2001, Savarese et al. 2003) among which performance measures were compared (Figures 3 and 4). Homologue 1 is located furthest upstream and homologue 5 is positioned furthest downstream.

The hydrologic model output for the various alternatives is in units of total volume flux passing through one of five flow-ways (from west to east: Miller, Faka Union, FU#1, Merritt, and Fakahatchee; see flow-way map, Figure 5. The total volume of freshwater entering Faka Union Bay is the sum of flow passing through the FU#1 and Merritt flow-ways. Consequently, the values from both flow-ways were added for each alternative. It is this total modeled flow that was used to predict salinities within Faka Union Bay.

Similarity Metric Approach

Empirically measured flow data for the remaining bays do not exist. Stage gauges have been monitoring flow at some of the US 41 culverts across the SGGE flow-ways; however, these are only quantifying part of the volume flux entering an entire bay. Consequently, there is no direct measurement of total flow to a bay to compare against the model output. Additionally, salinity-monitoring data exist only for Blackwater Bay, making it impossible to develop a salinity to flow calibration even if flow-monitoring data were available.

One can assume that the natural conditions of flow to the Ten Thousand Islands were ideal for the health of the estuarine system. In addition, an ideal restoration design would restore the natural, pre-altered conditions to the estuaries. The relative effectiveness of the restoration alternatives for the estuaries can be quantified by comparing the predicted flow from a given alternative to the flow generated under natural conditions. This yields a similarity metric for each alternative for each flow-way that serves as a measure of relative effectiveness. Similarity metrics, such as Jaccard, Sorenson, or Bray-Curtis, are widely used in terrestrial and aquatic ecology for comparisons between a reference site and a restoration site (Southwood 1978, Clarke & Warwick 1994, Marzluff & Ewing 2001, Slocum et al. 2003).

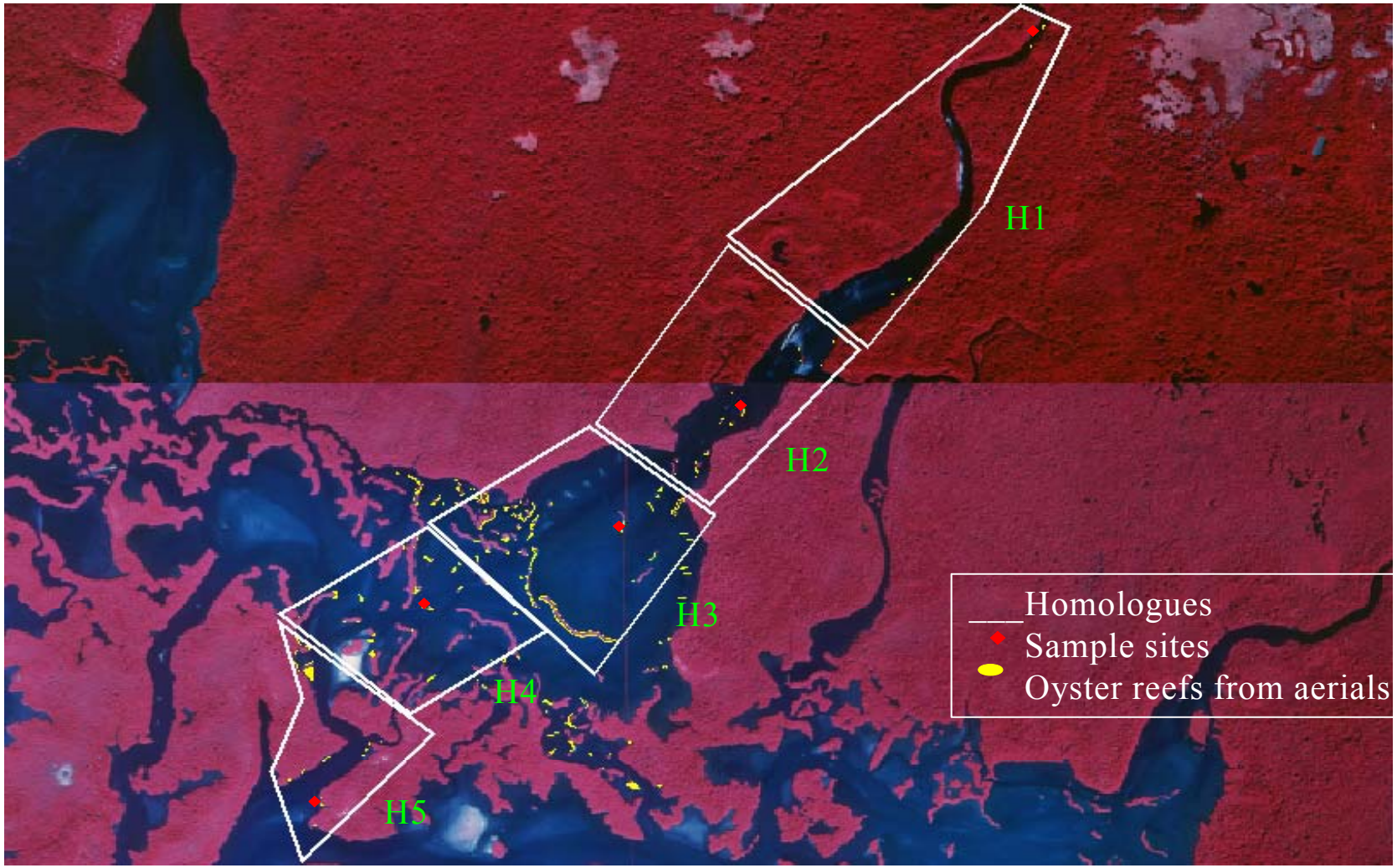

Figure 3 Spatial homologues and oyster reef distribution in Blackwater Bay.

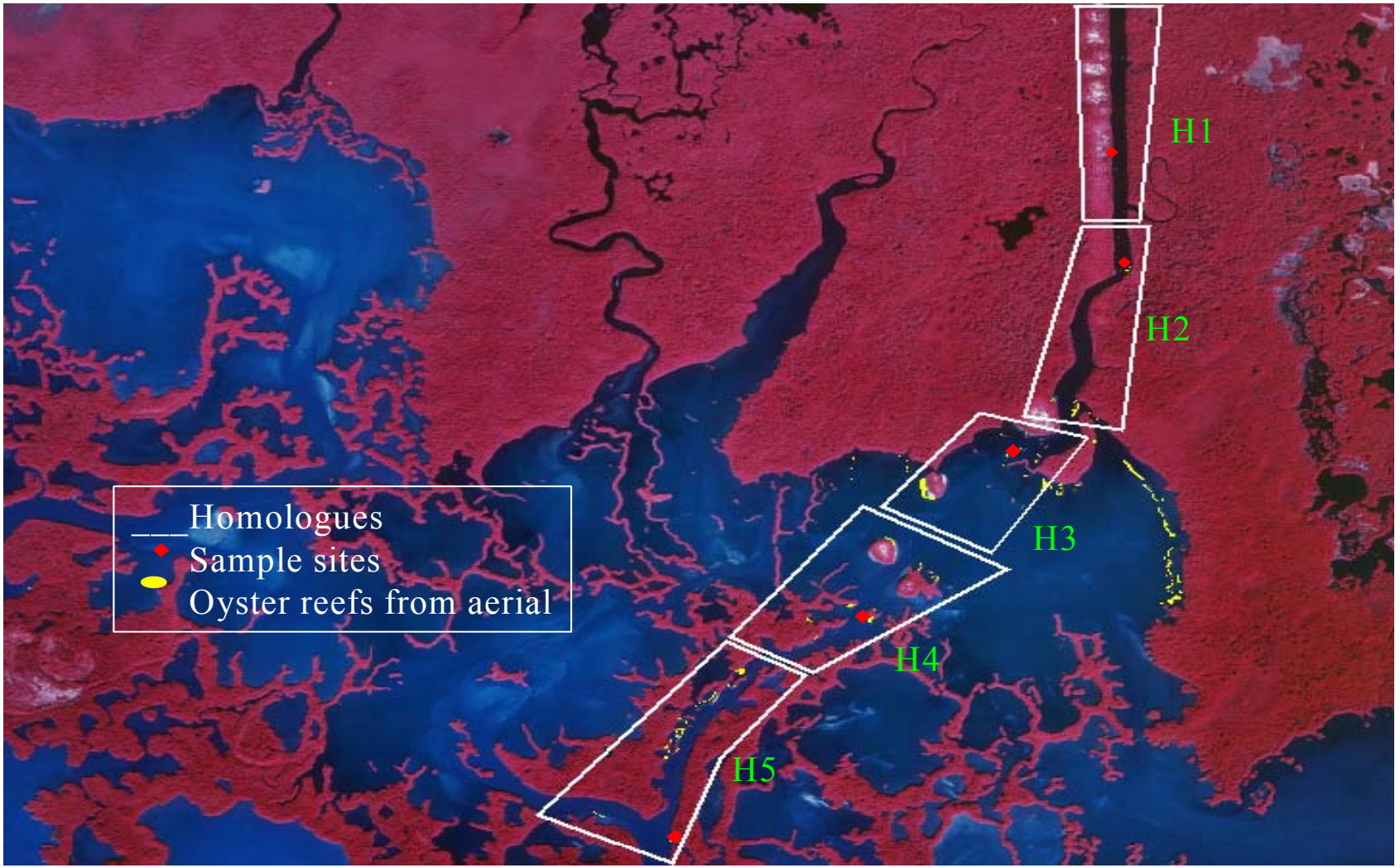

Figure 4 Spatial homologues and oyster reef distribution in Faka Union canal and Faka Union Bay.

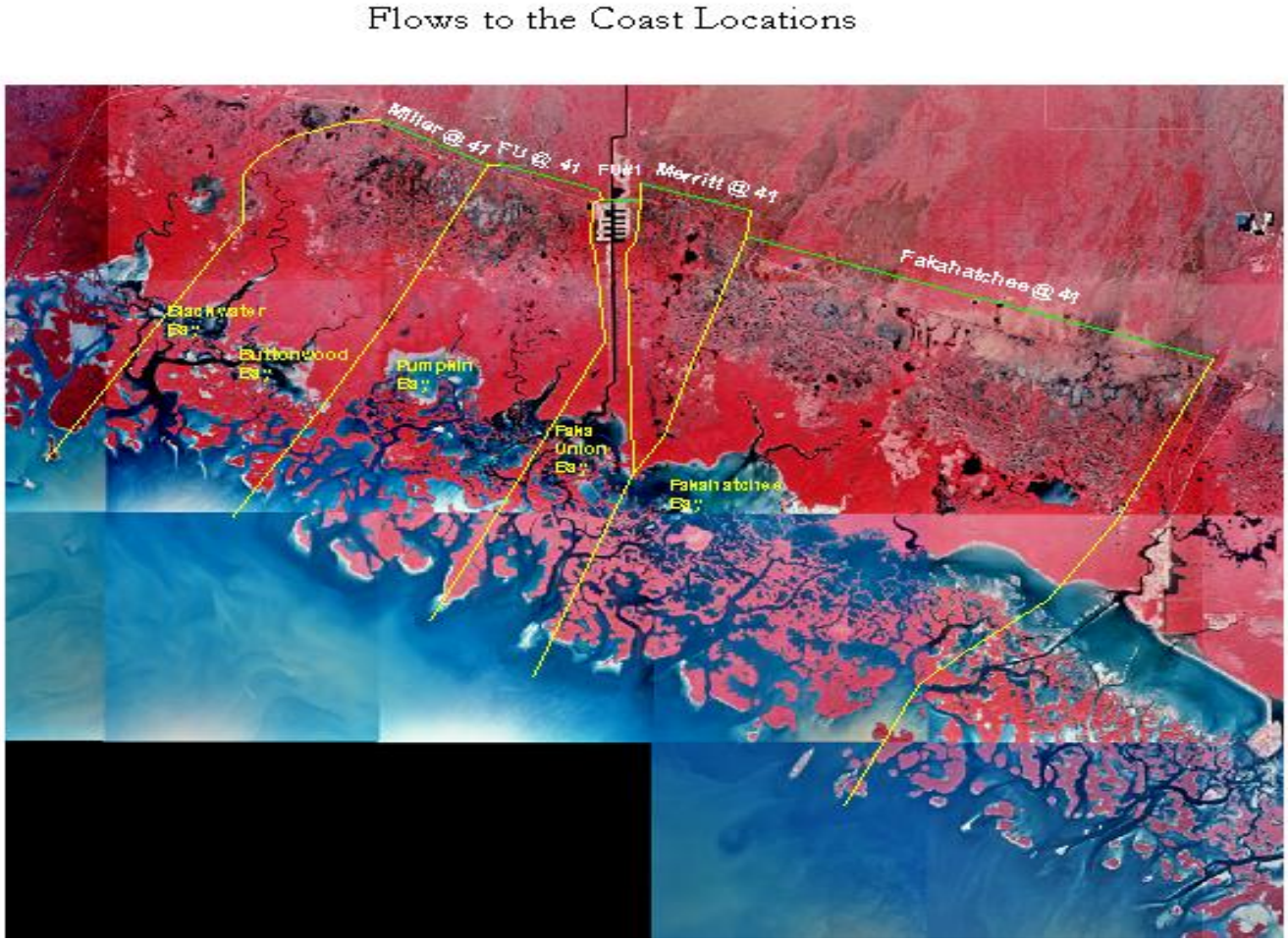

Figure 5 Map of flow-ways. Monthly flows of water across these transects were predicted using the MIKESHE model

Fakahatchee Bay is the estuary least affected by SGGE and therefore serves as a natural reference against which the other estuaries can be compared. The test metric, called "percent similarity", is structured after the Bray-Curtis similarity coefficient (Bray 1957) and is defined as:

$$\% \text{ Similarity} = \text{Abs}\left[(d_{exist} - d_{alt}) / (d_{exist} + d_{alt}) \right] * 100, \quad (1)$$

where d_{exist} is the 'difference ratio' comparing the existing conditions of an estuary (x, either Faka Union, Pumpkin, or Blackwater) to the natural conditions of the same estuary, normalized against conditions at Fakahatchee. As an equation,

$$d_{exist} = \text{Abs}\left[(x_{exist} / \text{Faka}_{exist}) - (x_{natl} / \text{Faka}_{natl}) \right] . \quad (2)$$

Similarly, the difference ratio of the alternative in question (alt) is defined as,

$$d_{alt} = \text{Abs}\left[(x_{alt} / \text{Faka}_{alt}) - (x_{natl} / \text{Faka}_{natl}) \right] . \quad (3)$$

Percent similarities were compared among the alternatives in two ways. First, graphical output for each alternative was visually compared. Second, and in order to more objectively compare effectiveness, the best performing alternatives each month were scored (3 pts for best performing, 2 pts for second best, and 1 pt for third best; see, for example, Table 2) and the scores were summed for the year. The relative total scores for the year were used to rank the effectiveness of the alternatives.

The model output for flow traveling through the Miller flow-way supplies water to both Blackwater and Buttonwood Bays. To determine flow to Blackwater Bay, it was assumed that approximately half the flow entered each of the two bays. Consequently, model output from the Miller flow-way was halved to obtain flow to Blackwater. A similar assumption was made for flow to Pumpkin Bay. The "Faka Union" flow-way supplies flow to both Pumpkin and Wood River Bays. The model output from this flow-way was also halved to obtain flow to Pumpkin.

Evaluation of Alternatives in Faka Union Estuary

Empirically Based Approach Using Oysters

Four aspects of the physiology and ecology of the American oyster (*Crassostrea virginica*) are used to predict the relative effectiveness of the various restoration alternatives. Because oyster reefs are considered to be a valued ecosystem component of Southwest Florida's estuaries and because the relationship between salinity and ideal conditions of oyster physiology and ecology is understood (Savarese & Volety 2001), these measures can be used to analyze the relative effectiveness of an alternative at promoting oyster health and abundance. In addition, the same metrics will serve as performance measures of restoration effectiveness after the preferred alternative is implemented. The four aspects are as follows:

1. Aerial extent of oyster reefs.

Target: Extent of oyster reefs should increase markedly at homologue 3, the region of the estuary with greatest accommodation space for reefs. This homologue should have the greatest area of reef coverage. Homologues 2 & 4 should also show an increase, have comparable reef areas, and be intermediate in aerial coverage. Homologues 1 and 5 should also increase in reef area (at present there are no living reefs at homologue 1 and few at 5). Because there is minimal accommodation space at homologue 1, appreciable increase in reef area is not expected. Therefore, in order from greatest to least aerial extent, the pattern of reef extent should be: 3, 2 = 4, 5, and 1.

2. Oyster living density.

Target: Under natural conditions, homologue 3 would have the greatest living density, followed by 2 and 4, then 5, and 1 (the same order as seen for reef area). Under existing conditions, homologue 5 has the greatest living density, and the numbers decrease orderly from homologues 4 through 2. Homologue 2 presently has very low living densities, and no living oysters are found at homologue 1. Consequently, an alternative with a high degree of restoration should cause an increase in density at homologues 1-3, a substantial decrease at homologue 5, with homologue 4 remaining relatively unchanged.

3. Recruitment.

Target: Oyster living density and reef aerial extent are essentially a function of larval recruitment; recruitment must first occur before growth and high survival rate can generate reefs and high living densities. Under existing conditions, oysters are not recruiting to homologues 1 and 2, while recruitment is successful at homologues 3-5. Restoration to natural conditions would restore successful recruitment to homologues 1 and 2, and remain at homologues 3-5.

4. Condition index.

Target: Condition index (oyster tissue mass divided by shell mass) is a measure of the physiological status of an individual oyster. During non-breeding times (November through May), physiological stress caused by disease or poor water quality typically generates low condition index values. Condition indices are presently depressed at all homologues in Faka Union relative to less altered estuaries (Fakahatchee Bay in the Ten Thousand Islands and Estero Bay). Restoration to natural conditions should cause condition index to increase at all homologues with homologues 3-5 having the highest and relatively comparable values.

Relationship Between Flow and Salinity

Salinity is critical to the reproduction, development, and growth of the American oyster. Oysters require a narrow range of salinities for successful spawning (between 15-25 ppt) during the months of May through July. Food availability is greatest between 15 and 35 ppt, so growth is maximized under these conditions. Finally predation and disease (caused by the parasite *Perkinsus*) can cause high mortality within oyster populations. Infrequent freshets effectively reduce predation pressures and significantly reduce the number of infectious parasites. Consequently, periods of lower salinity (< 15 ppt) are also needed.

Because the hydrologic models yield freshwater flows delivered to the estuaries, it is necessary to relate flow (in cfs) to estuarine salinity. Freshwater flow into Faka Union Bay has been monitored for many years from a stage gauge at Port of the Islands, just upstream of

the fixed weir on the Faka Union trunk canal. Since 2000, Rookery Bay NERR has been monitoring salinity at the mouth of the trunk canal. The relationship between flow and salinity for Faka Union was obtained by regression analysis (Figure. 2); the exponential function relating salinity to flow was used to evaluate the effectiveness of the flows generated by the various restoration alternatives.

Results & Interpretation

Flows between 300-500 cfs generate the ideal salinities for oyster reproduction during May through July. To maximize growth, flows between 100-500 cfs are needed throughout the year. Lastly, flows ranging between 500-1000 cfs are required occasionally to minimize the ill effects of disease and predation.

The total freshwater flows delivered to Faka Union Bay throughout the calendar year for each of the modeled alternatives were used to predict the effects upon oyster habitat (Figure. 6). Table 1 evaluates the relative habitat quality for oysters for each of the alternatives. Alternatives 3D and 6 perform the best for maximizing oyster health. The mean value for the four oyster performance measures is 0.94 for both these alternatives. Alternative 19 does almost as well, scoring 0.88. Alternatives 7 and 12 perform at a secondary, but acceptable level, with scores of 0.50. All remaining alternatives perform at unacceptable levels for oyster reef structure and function.

Empirically Based Approach Using Nekton (fish, shrimp, blue crabs)

Many of the nektonic species, composed principally of fish and crustaceans, utilizing the estuaries are dependent upon oyster reefs for food. Consequently, the same conditions favorable for oyster health and reef development favor the nekton. Timing of reproduction of fish and crustacean species dependent upon reefs may differ from those months critical to the biology of oysters themselves. This generates specific salinity targets for different times of the year for these organisms. In addition, many fish and crustacean species critical to estuarine structure and function have specific salinity tolerances for other physiological functions. These were also used to target particular salinities.

Among the best indicator fin-fish species are mullet, sea trout, and redfish *(Mugil* sp., *Cynoscion* sp., *Sciaenops ocellatus)*. The critical months of reproductive activity for these species are, respectively, October, March-May, and November. Shrimp and blue crabs *(Penaeus duorarum*, *Callinectes sapidus*) are estuarine indicators among the crustaceans; their reproductive months span from May-June and September-October. The relative abundance of two year-round reef-resident crabs, the stenohaline *Petrolisthes armatus* and the euryhaline *Eurypanopeus depressus*, is highly dependent upon salinity and its variability.

Pink shrimp is an important commercial species in South Florida. The Ten Thousand Islands area contains nursery grounds for shrimp recruited to fishing grounds near Sanibel Island (Costello & Allen 1966). Laboratory experiments with juvenile pink shrimp from Florida Bay indicate a low tolerance to salinity extremes, especially low salinity (Browder et al. 2002). The relationship of survival and growth to temperature and salinity is encapsulated in a simulation model (Browder et al. 2002).

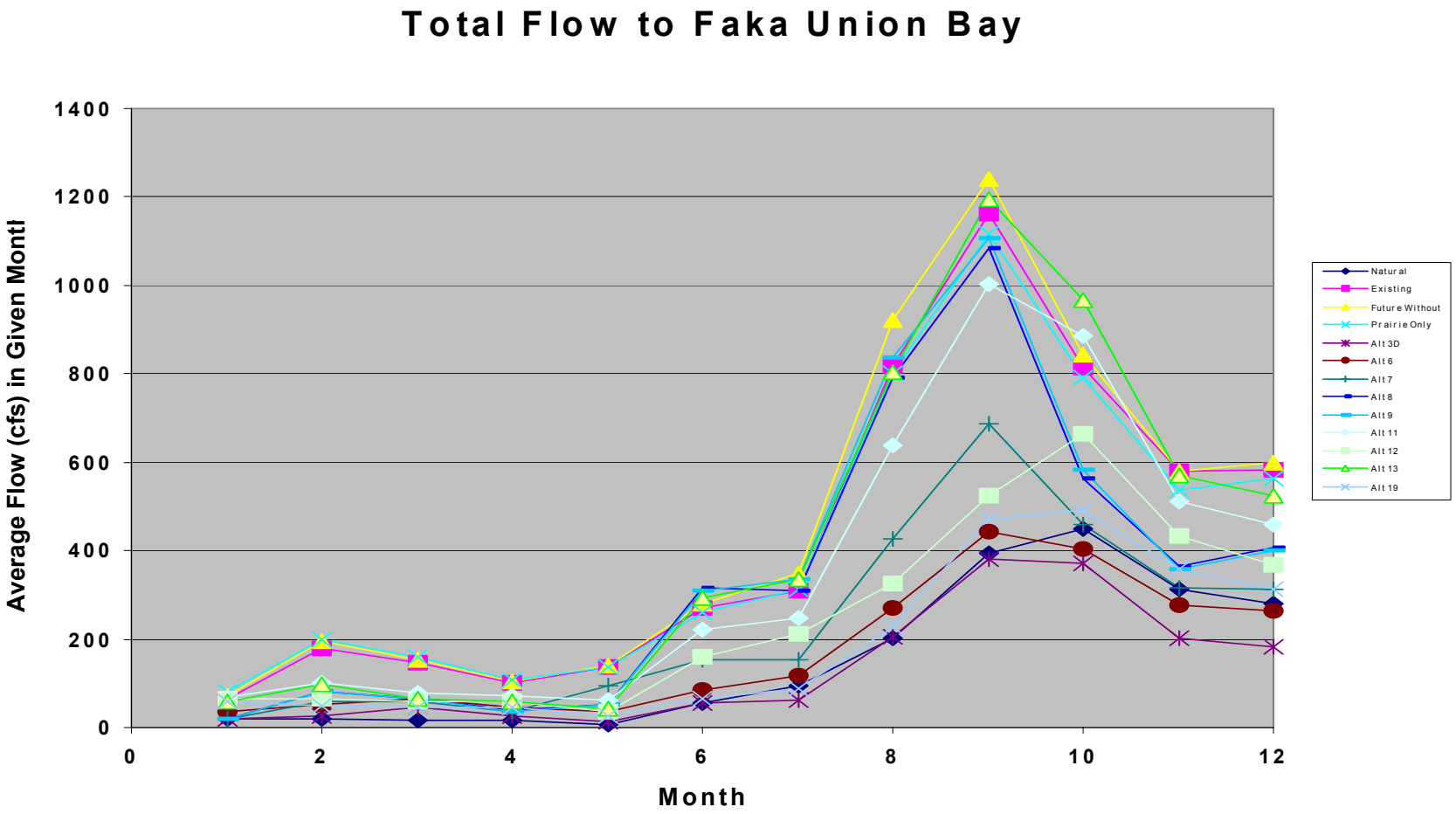

Figure 6 The average daily flow (in cubic feet per second) delivered to Faka Union Bay for each month in a calendar year for each alternative. Total flow is the sum of freshwater moving through the "FU #1" and "Merritt at 41" flow-ways and entering Faka Union Bay.

Table 1. Quality values associated with each of the alternatives for each of the oyster performance measures in Faka Union Bay.

Value of 0.00 represents no restoration of conditions relative to existing situation. A perfectly restored system (i.e., under natural conditions) would score 1.00. Values ranging between 0.00-1.00 represent relative states of improvement analogous to percent restoration scores (0.50 is a 50% restoration towards natural conditions for a given performance measure).

Measure	***Natl***	***Exist***	**Future Without**	**Prairie**	**3D**	**6**	**7**	**8**	**9**	**11**	**12**	**13**	**19**
Reef aerial extent	1.00	0.00	0.00	0.00	1.00	1.00	0.50	0.00	0.00	0.00	0.50	0.00	1.00
Living density	1.00	0.00	0.00	0.00	0.75	1.00	0.75	0.00	0.00	0.25	0.75	0.00	1.00
Recruitment	1.00	0.00	0.00	0.00	1.00	0.75	0.50	0.00	0.00	0.25	0.50	0.00	0.75
Condition index	1.00	0.00	0.00	0.00	1.00	1.00	0.25	0.00	0.00	0.00	0.25	0.00	0.75
Average score	**1.00**	**0.00**	**0.00**	**0.00**	**0.94**	**0.94**	**0.50**	**0.00**	**0.00**	**0.13**	**0.50**	**0.00**	**0.88**

The blue crab was one of the more abundant macroinvertebrate species in Faka Union and Fakahatchee bays in the early 1970s (Carter et al. 1973, Evink 1975) and Faka Union, Fakahatchee, and Pumpkin bays in the early 1980s (Browder et al. 1986). Besides its commercial importance, this species is a major prey item for large fish, wading birds, and sea turtles (Van Heukelem 1991). It is an opportunistic omnivore (Darnell 1959). This species is dependent on estuaries during several life stages. Browder et al. (1986) found significantly higher blue crab abundances in Pumpkin Bay than in Faka Union Bay. Blue crab abundance varied seasonally, being highest in winter and spring and lowest in summer and fall. Abundance was significantly higher in Pumpkin Bay in summer and fall and Fakahatchee Pass in winter.

Blue crabs have different salinity requirements or preferences at different life stages (Pattillo et al. 1997). Juveniles prefer seagrass habitat but also use salt marsh habitat and have been found in greatest numbers in the low to intermediate salinities (2-21 ppt) characteristic of upper and middle estuaries. Adult males spend most of their time in low salinity water (< 10 ppt). Females move from higher to lower salinities as they approach their terminal molt in order to mate. Females with eggs are usually found at 23-33 ppt. Spawning usually occurs from 2 to 9 months following mating. In North Carolina, spawning usually occurs in the spring by females that mated during August-September of the previous year. Two spawning peaks typically occur in the Gulf of Mexico, one in late spring and the other in late summer or early fall. The optimum salinity for hatching is 23-28 ppt (observed, 10.2-32.6 ppt). Larvae are usually found at > 20 ppt. Optima of 16-43 ppt were reported for survival and 11.5-35.5 ppt for development. The best strategy to promote high blue crab density may be to maintain a broad salinity gradient and provide the natural timing of flow in relation to rainfall. The species is very sensitive to pesticides and heavy metals, especially during early life stages.

Shirley et al. (1997) studied the recruitment dynamics of crabs on oyster reef habitats in Henderson Creek and Blackwater River (May 1996 to April 1997) relative to salinity fluctuations. Recruitment of juvenile porcellanid (stenohaline) and xanthid (euryhaline) crabs to both estuaries was similar, peaking in the early wet season. In contrast, significantly fewer adult stenohaline crabs were found in Henderson Creek than in Blackwater River. Site-specific differences in salinity fluctuations were also observed. This study concluded that the altered freshwater inflow into Henderson Creek adversely affected stenohaline crab populations. The Rookery Bay Reserve staff continues to monitor crab populations on oyster reefs within Henderson Creek and Blackwater River and has expanded this study to include Fakahatchee Bay and Faka Union Bay. These data indicate that altered freshwater inflow is reflected in the relative abundance of stenohaline and euryhaline oyster reef crab populations (Shirley et al. 2002). The two crab groups include species such as *Eurypanopeus depressus* (euryhaline) and *Petrolisthes armatus* (stenohaline) known to be important items in the diet of fish and birds. Once they recruit to a reef, these species must remain on the reef and tolerate conditions at that location in order to survive. Once recruited to a reef, they cannot move to another area to escape unfavorable conditions. The extreme salinity fluctuations that occur in Faka Union Bay as a result of the canal system may limit the abundance of both of these species. The relative abundance of the two species at a site can provide an index of recent prevailing conditions (i.e., low and fluctuating or high and relatively stable) (Shirley et al. 2002).

To accommodate these needs, 3 performance measures and targets have been defined:

1. Relative abundance of stenohaline and euryhaline crabs on oyster reefs.

Target: The ratio of the > 5 mm size class of stenohaline (*Petrolisthes armatus*) and euryhaline (*Eurypanopeus depressus*) crabs (total *P. armatus* +1)/total *E. depressus* +1) on reefs in Faka Union Bay should not be statistically different ($p = 0.05$) from the ratios of these species calculated from populations sampled on oyster reefs in Fakahatchee Bay. These numbers change depending on the season and year (wet or dry), reflecting natural shifts in these populations and habitat suitability in response to natural freshwater inflows.

2. Density of the blue crab (*Callinectes sapidus*) in various life stages.

Target: The density or relative density of various life stages of blue crabs in Faka Union Bay should be within 10% of density in homologous habitat in Fakahatchee.

3. Abundance and composition of dominant fish species and pink shrimp.

Target: Fish abundances in Faka Union should not be lower than those in the reference bay of highest abundance, Pumpkin or Fakahatchee Bays. Abundance in Faka Union Bay should not be more depressed than in Fakahatchee Bay at the onset of the rainy season. Composition should be similar (75% by Bray Curtis) to composition in Fakahatchee and Pumpkin bays. Evenness (among dominants) should be similar (within 10%) to that in Fakahatchee and Pumpkin bays. Based on the salinity to flow calibration for Faka Union (Figure. 2) and the above mentioned ecological performance measures, the following hydrologic targets are derived:

a) The number of days (or percent of year) of average canal discharge > 500 cfs should be minimized to reduce the frequency and duration of freshets.
b) The number of days (or percent of year) of average canal discharge < 50 cfs should be minimized to extend flow into the dry season.
c) The number of days (or percent of year) of average canal discharge 300-500 cfs should be maximized to improve reproductive conditions for estuarine fish, shrimp, and crabs.

While this suite of performance measures is meant to be applied to daily outflow data, this evaluation will use them for alternative evaluation by determining first, which alternative has the minimum number of months with flows above 500 cfs and below 50 cfs, and second by examining the magnitude of the flows above or below the 500/50 cfs limits as a means of judging restoration potential. Thus, we can assume that an alternative which exhibits few or no flows outside of the 50/500 cfs limits or with many small excursions outside of this limit will create a more natural flow regime and effect a greater restoration.

Results and Interpretation

Table 2. Relative effectiveness of the 5 best alternatives for the nekton performance measures. Shown are (1) number of months where critical flow levels are violated for each modeled alternative, and (2) the total flow (in cfs) summed over the months when critical levels were violated.

Alternative Number	6	19	3D	7	12
# months flows were above/below 500/50 limits	2	4	4	3	4
Sum of flows above or below limits (cfs)	19	36	91	232	497

Alternative 6 performs best for this suite of performance measures (Table 2), with only two months outside the flow limit threshold (January and May both with 36 and 45 cfs respectively). Alternative 19 is the next best with four months falling outside the flow limits (February, March April, 48, 45 and 44 cfs respectively, and May with 27 cfs). Alternative 3D was the third best with four months outside the limits: January 20 cfs, February 26 cfs, April 27 cfs and May 14 cfs. Alternative 7 was the fourth best with three months outside the limit (January, 19 cfs and April, 35 cfs) and with September flows of 686 cfs being quite a bit over the desired flows. Alternative 12 was the fifth best with four months outside the limit, two months above (September 523 cfs and October 665 cfs) and two months below (May 37 cfs and July 213 cfs). It should be noted for both Alternative 7 and 12 that occasional flows over 500 cfs are beneficial for oysters (see section A above). The remaining alternatives were much less acceptable as judged by this suite of performance measures.

Similarity Metric Approach

A visual assessment of the graphs depicting total monthly flows (Figure. 6) and the percent similarity metric for Faka Union, comparing the performance of an alternative against the modeled natural conditions (Figure. 7), shows that alternatives 3D, 6, and 19 perform best during the wet season (June through September), scoring greater than 72% restoration for each of these months. These results agree well with the empirically based results for Faka Union. During the dry season, the remaining months of the calendar year, variability in performance is great. Alternatives 3D, 6, and 19 do reasonably well (defined as having percent similarity > 40%) in all months but January, October, November for 3D and 6. Alternative 19 performs most consistently throughout the year. Alternatives 7 and 12 form a class of next-best performers. Wet seasons exhibit percent similarity values between 40-90% for both during the 4 months. Neither of these alternatives performs below 40% for any month throughout the year. These results also agree well with the empirically based method for Faka Union.

Results from the second method used to more objectively assess the alternatives, through the scoring of the three best performing alternatives each month, are depicted in Table 3. When the year is scored in its entirety for just Faka Union Bay, the 3 best-performing alternatives, from highest to lowest, are: 6, and 3D = 19, scoring 15 and 13 points respectively (top portion of Table 3). A second grouping occurs with alternative 12 followed by 7, 8, and 9 with equal scores. During the dry season only, the order is: 6, 12, 7, 3D = 9, and 19. Finally, for the wet season, the order is: 19, 3D, 6, 8, and 12 = 9. Alternatives 3D, 6, and 19 were ranked the best in both the visual assessment and the scoring assessment when all months are considered. Alternatives 7 and 12 form a second-best grouping in both the visual assessment and the scoring assessment for all months. When just the wet or dry season months are considered, the similarity between the visual and scoring approaches is less pronounced. However, alternatives 3D, 6, and 19 are among the top scoring alternatives.

The generally congruent results yielded by both the empirical and theoretical approaches applied to Faka Union suggest that the utilization of the theoretically based method for the remaining estuaries, Blackwater and Pumpkin Bays, is reasonable and should provide meaningful results.

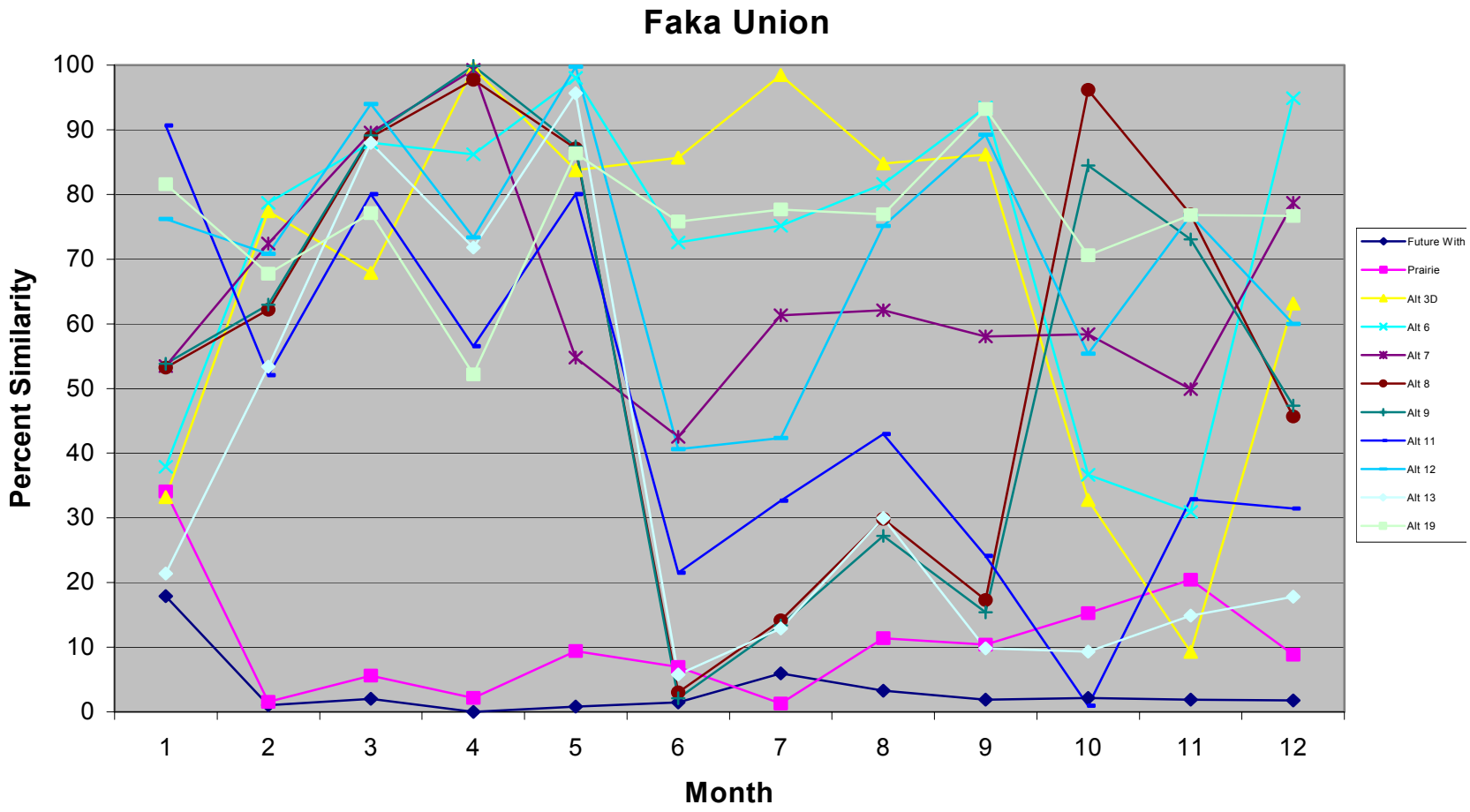

Figure 7 Percent similarity for Faka Union (see explanation of measure in Methods) is plotted for each alternative for each month in a calendar year. 100% similarity indicates natural conditions are likely to be achieved. 0% similarity indicates no improvement relative to existing conditions

Table 3. Shows scores for best performance (compared against natural conditions) for each of the 3 estuaries. The best performing alternative for each month is awarded 3 pts; second best, 2 pts; and third best, 1 pt. Points are totaled overall (for the entire year) and for the dry and wet seasons separately.

Faka Union											
Month	**Future Without**	**Alt 17 Prairie**	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
1								3	1		2
2			2	3	1						
3					2		1		3		
4			2		1		3				
5				2					3	1	
6			3	1							2
7			3	1							2
8			3	2							1
9				3					1		2
10						3	2				1
11						3			1		2
12				3	2						1
overall			13	15	6	6	6	3	9	1	13
dry season			4	8	6	0	4	3	7	1	3
wet season			9	7	0	6	2	0	2	0	10
Pumpkin											
Month	**Future Without**	**Alt 17 Prairie**	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
1			1	3	2						
2				2	3				1		
3			2	3	1						
4				3	2				1		
5				2	3				1		
6			2		3	1					
7				3	1				2		
8					3	1			2		
9			3	2					1		
10			1	2					3		
11			1	3					2		
12			1	3					2		
overall			11	26	18	2			15		
dry season			4	16	11	0			5		
wet season			7	10	7	2			10		

Blackwater											
Month	Future Without	Alt 17 Prairie	Alt 3D	Alt 6	Alt 7	Alt 8	Alt 9	Alt 11	Alt 12	Alt 13	Alt 19
1			3	1			2				
2			3				1		2		
3			1	2			3				
4			3	2	1						
5			1		2	3					
6			3	1	2						
7			3		1	2					
8			3			2		1			
9					3			1			2
10				1					2		3
11				3	1						2
12					3				2		1
overall			20	10	13	7	6	2	6		8
dry season			11	5	6	3	6	0	4		1
wet season			9	5	7	4	0	2	2		7
Totals For 3 Estuaries											
overall		0	44	51	37	15	12	5	30	1	21
dry season		0	19	29	23	3	10	3	16	1	4
wet season		0	25	22	14	12	2	2	14	0	17

Similarity Metric Based Evaluation of Alternatives in Blackwater and Pumpkin Bays and All Bays Combined

Results for Blackwater Bay

Figure 8shows the total flow to Blackwater Bay predicted by each alternative, and Figure 9 depicts percent similarity, comparing the performance of an alternative against the modeled natural conditions (see Methods), for each alternative for every month of a calendar year.

The alternatives that exhibited relatively high values of percent similarities for Faka Union based on visual assessment (alternatives 3D, 6, and 19; then 7, 12) did not perform as well for the Blackwater simulations (Figure. 9). Alternative 3D performs the best overall with values exceeding 68% for months February through August. Alternative 6 does reasonably well between March through June and in October and November (values > 40%). Alternative 19 performs poorly for most of the year (< 30%) except for September through December. Alternative 7 does well most of the year with values > 40% for all months other than January, February, April, and August. Finally, alternative 12 performs well (> 40%) in only the months of February, June, and October through December. Alternative 8 is the only additional alternative that performs comparably to 7 and 12.

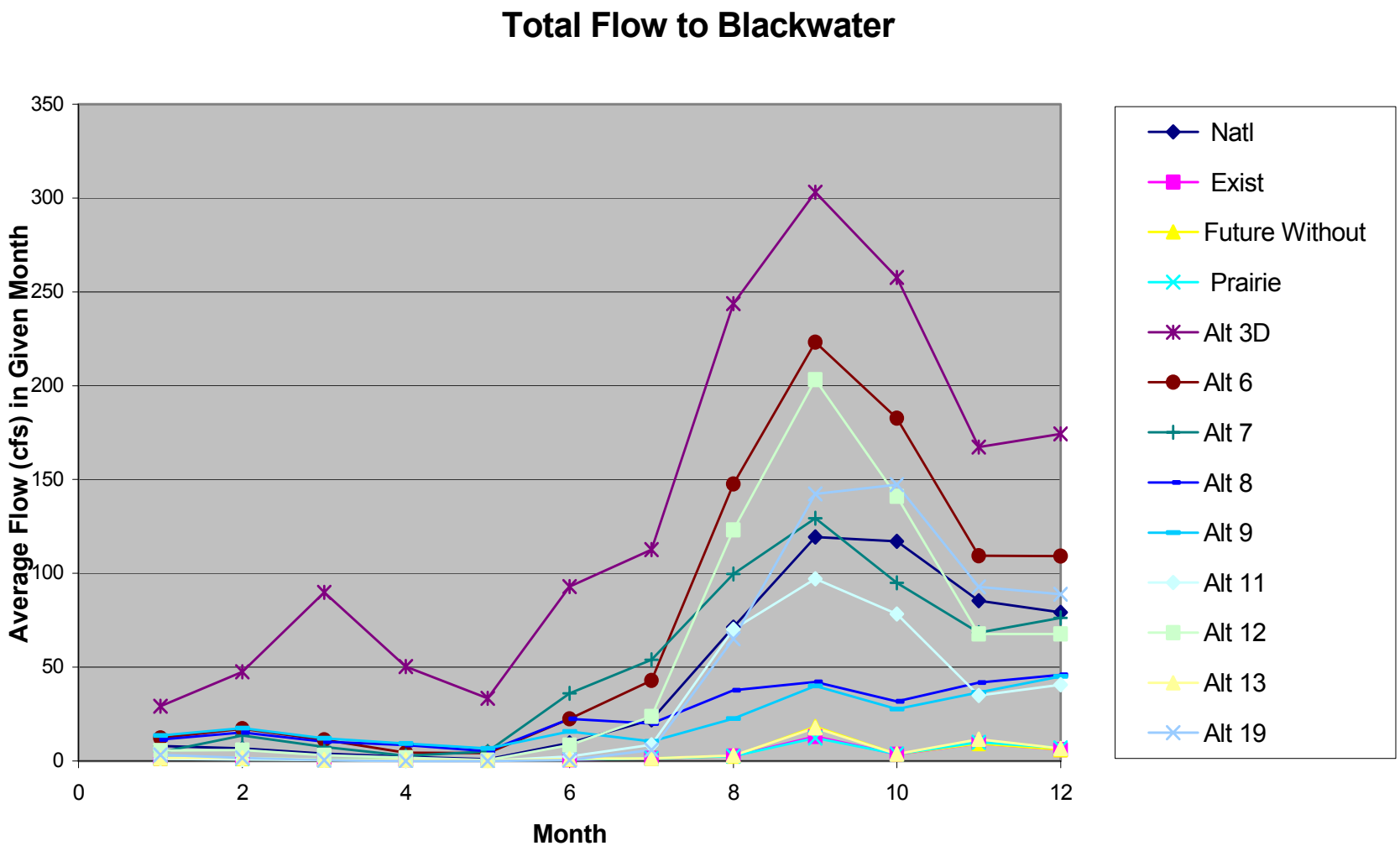

Figure 8 The average daily flow (in cubic feet per second) delivered to Blackwater Bay for each month in a calendar year is plotted for each alternative. Total flow is calculated as half the freshwater moving through the "Miller at 41" flow-way.

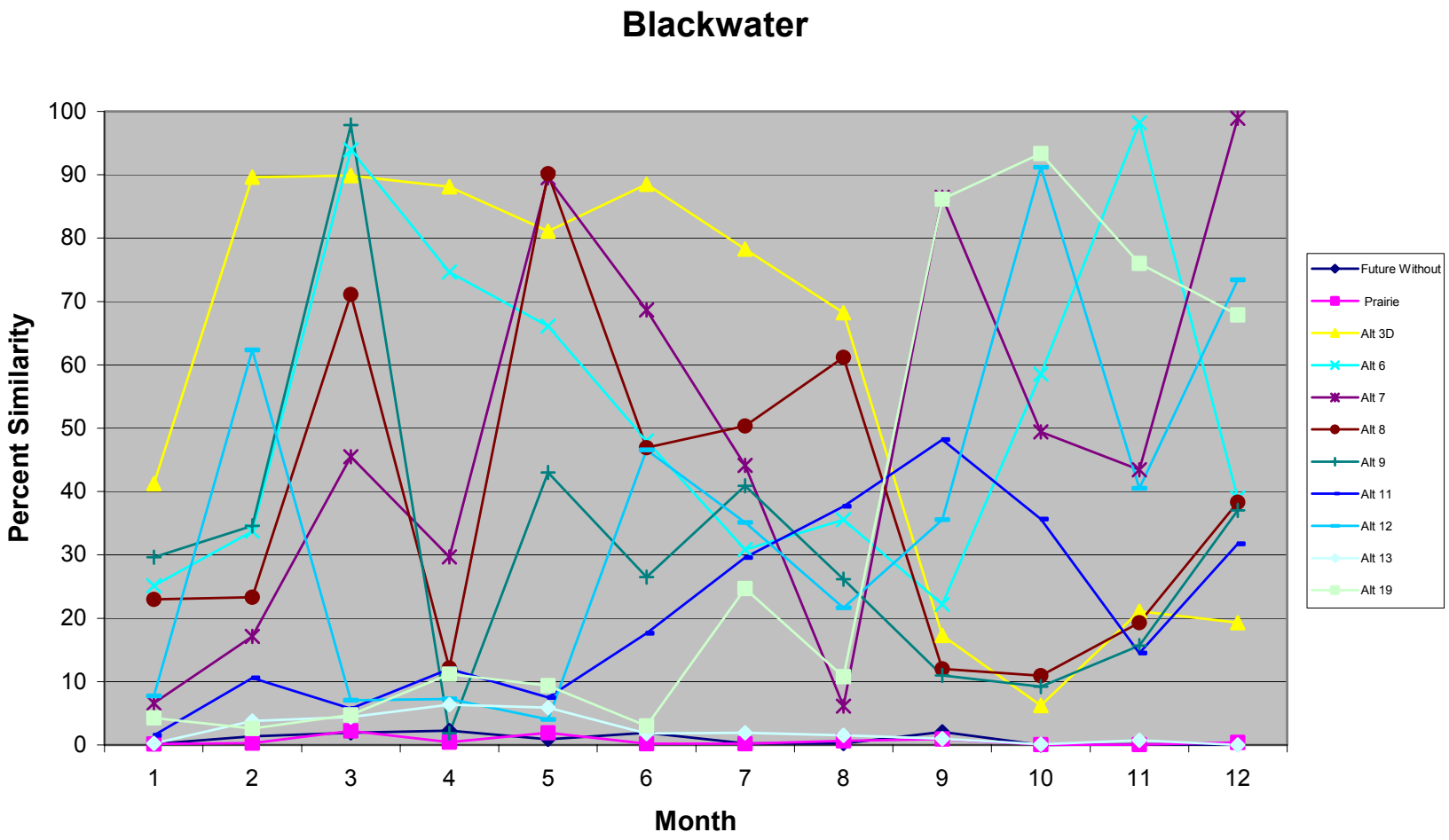

Figure 9 Percent similarity for Blackwater (see explanation of measure in Methods) is plotted for each alternative for each month in a calendar year. 100% similarity indicates natural conditions are likely to be achieved. 0% similarity indicates no improvement relative to existing conditions.

Assessment through scoring of the 3 best performing alternatives each month (see Methods) shows alternative 3D the lead scorer in both the wet and dry seasons and for the year in its entirety (Table 3). Alternative 7 performs second best also in all three categories (dry, wet, and overall). Finally, alternative 6 falls in third place for the entire year.

Considering both the visual and scoring results in concert, alternative 3D is best for Blackwater restoration, followed by 7 then 6.

Results for Pumpkin Bay

Figures 10 and 11 show similar results for Pumpkin Bay.

Visual assessment of percent similarity (Figure. 11) places the best-performing alternatives, in order from highest to lowest: 6, 12, and 7. Alternative 6 performs well (> 40%) for March, April, July, September, October, and December. Alternative 12 performs consistently well for most of the wet season (July through October) with values > 45%. Alternative 7 performs well (> 40%) in only the months of June and August. The remaining alternatives perform poorly.

Assessment through scoring of the 3 best performing alternatives each month (see Methods) shows alternative 6 the lead scorer in both the wet and dry seasons and for the year in its entirety (Table 3). Alternative 7 scores second best for the entire year and the dry season; alternative 12 scores second best in the wet season. Alternative 3D finishes fourth for the entire year.

Taken in concert, alternative 6 does the best at restoring natural conditions to Pumpkin Bay, followed by 7 and 12 performing equally well.

Results for All Three Bays Combined

Assessment through scoring of the three best alternatives was also completed for the three bays collectively by summing scores among the bays (Table 3). Results show that alternative 6 performs the best. It scores much better than any other alternative for the entire year and for the dry season; during the wet season, it falls second to alternative 3D. Alternative 3D performs second best, scoring second highest overall and highest during the wet season. Alternative 7 performs third best by scoring third overall and second in the dry season.

Predicted Response of Oyster Habitat to Restoration

Of the various proposed ecological performance measures, oyster reef area is the most easily quantified spatial predictor of habitat value. Oyster reefs are considered an important valued ecosystem component of the Ten Thousand Islands (sea grass beds are uncommon); they support a diverse and biomass-rich biota; and reefs provide foraging habitat for both resident and transient fish, crabs, and shrimp in the estuary. These latter two roles are justifications for utilizing reef-dependent crabs and the nekton (fish, shrimp, blue crabs) as additional performance measures. Consequently, the increase in potential reef habitat predicted for a given restoration alternative will be used as an indicator of relative benefit.

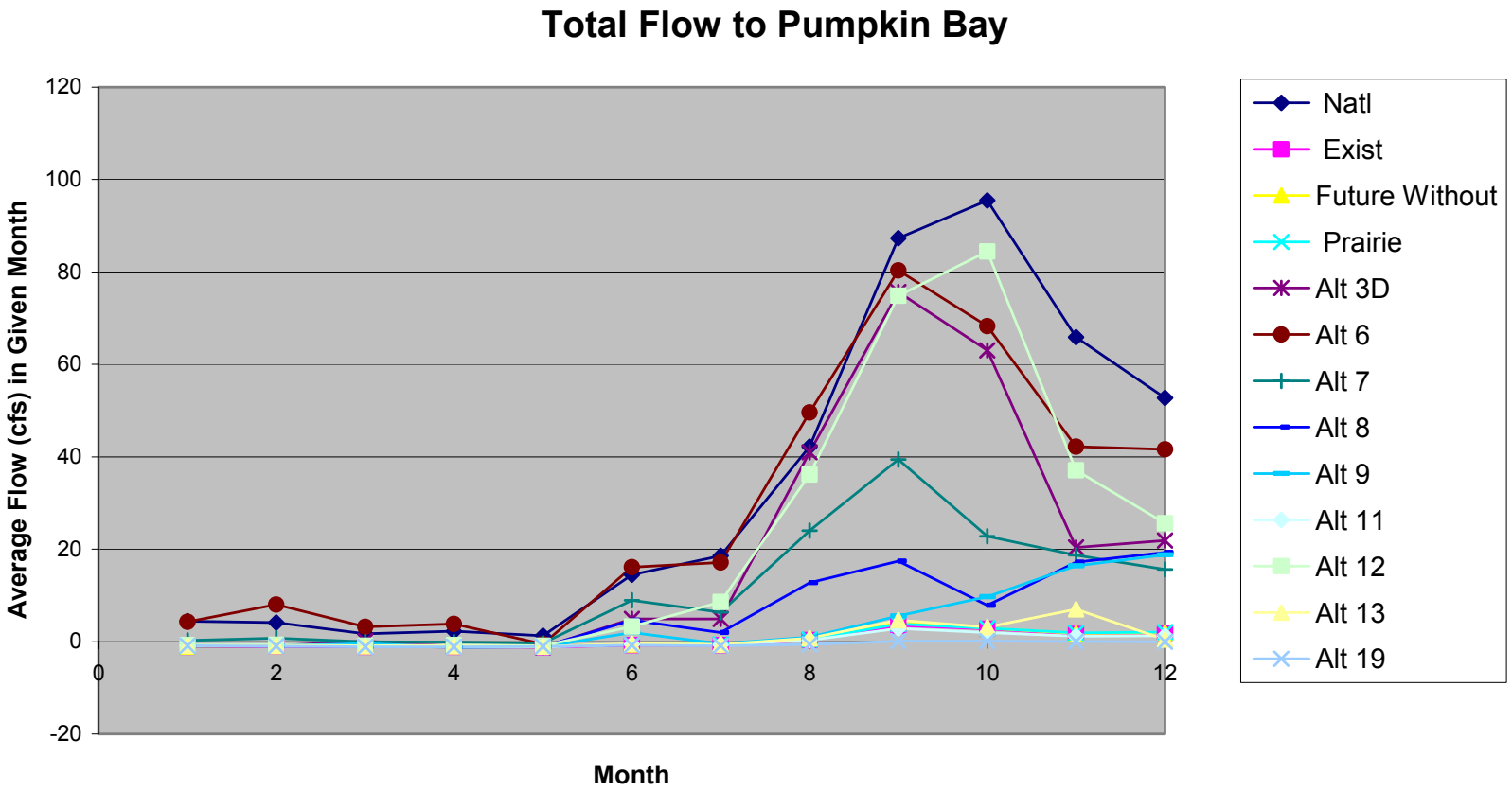

Figure 10 The average daily flow (in cubic feet per second) delivered to Pumpkin Bay for each month in a calendar year is plotted for each alternative. Total flow is calculated as half the freshwater moving through the "Faka Union at 41" flow-way.

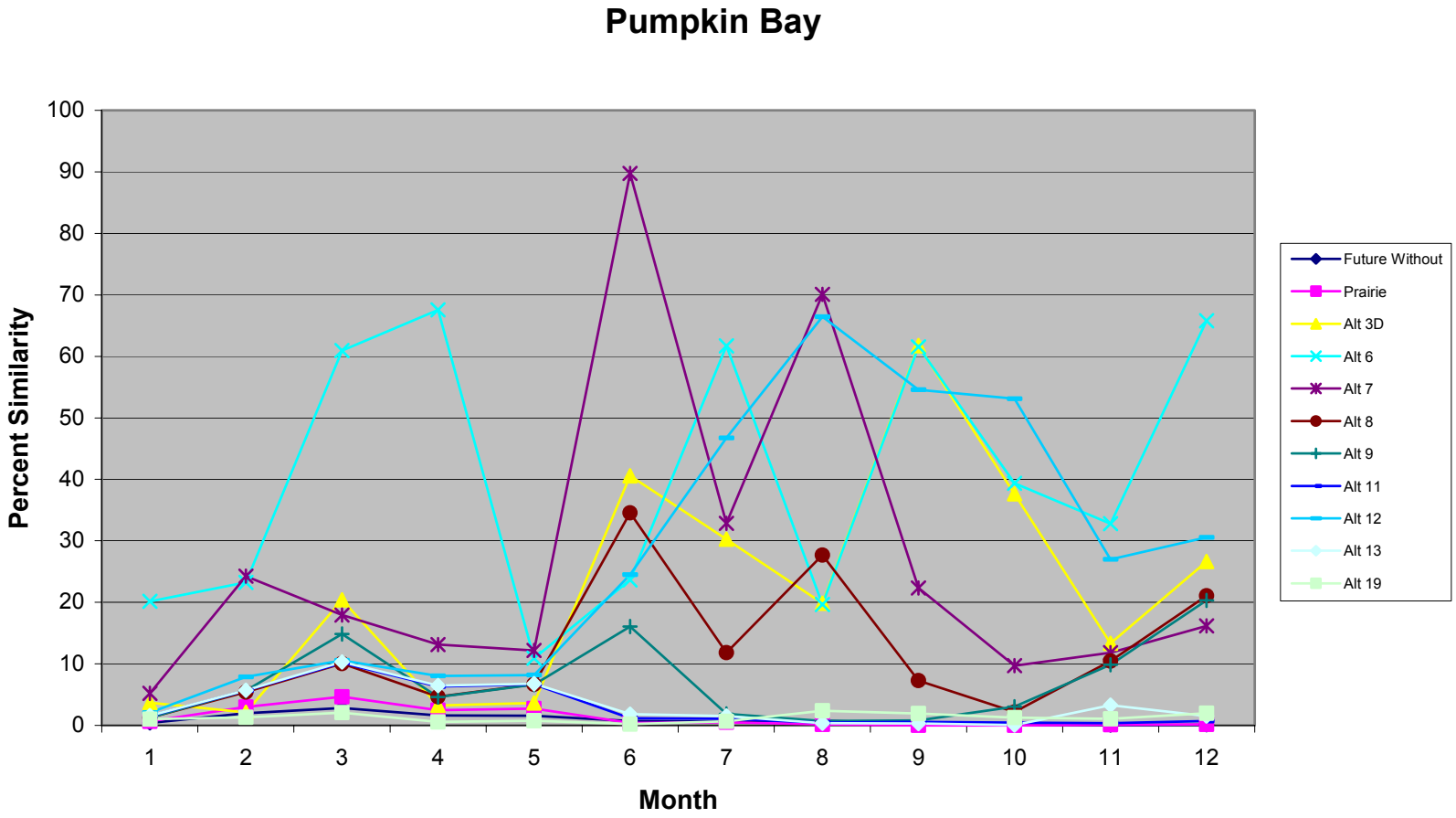

Figure 11 Percent similarity for Pumpkin is plotted for each alternative for each month in a calendar year. 100% similarity indicates natural conditions are likely to be achieved. 0% similarity indicates no improvement relative to existing conditions.

Savarese and Volety (2001) mapped the distribution of present-day oyster reefs in two estuaries of the Ten Thousand Islands area affected by SGGE restoration, Blackwater Bay and Faka Union Bay (Figures. 3 & 4). Blackwater's water quality conditions are ideal for reef development. Its total reef area is viewed as the maximum achievable reef coverage for any bay. Blackwater at present has approximately 1.74% of its available reef accommodation space covered by reef, while Faka Union Bay, whose water quality conditions are severely degraded for reef development, has only 1.04% of its accommodation space covered by oyster reef (Table 4). If Faka Union were fully restored to natural conditions and one assumes a similar percent reef coverage for Faka Union as seen in present-day Blackwater, then Faka Union would have approximately 33,100 m^2 of reef (1.74% x total wetted area).

Table 4. Aerial distribution of oyster reefs within two estuaries of the Ten Thousand Islands: Blackwater and Faka Union as measured by Savarese & Volety (2001). "Reef Area" = total estuarine area, in square meters, occupied by oyster reef within that estuary; "Accommodation Space" = total area of estuary between river or canal mouth and the outer coast that is available for oyster reef development; "Percent Reef Coverage" = percent of the accommodation space occupied by oyster reef within an estuary; "Total Wetted Area" = total subtidal and deep intertidal area of inner bay.

Location	*Reef Area (m^2)*	*Accommodation Space (m^2)*	*Percent Reef Coverage*	*Total Wetted Area of Bay (m^2)*
Faka Union	24,270	2,334,685	1.04%	1,902,090
Blackwater	35,365	2,034,695	1.74%	1,011,750

The empirically based analysis of relative performance of the restoration alternatives presented in the previous section was used to predict the expected increase in potential reef habitat within Faka Union Bay (using average scores in Table 1). Existing conditions, the Future Without and prairie-only alternatives, and alternatives 8, 9, 11, and 13 are all expected to provide no increase of reef area through time. Consequently, these alternatives provide no improvement in oyster habitat. Alternatives 3D, 6, 7, 12, and 19 should increase the aerial extent in reef coverage over the next 50 years. Table 5 presents the predicted increase and final quantity of reef habitat for the alternatives.

Predicted Response of Nekton to Restoration

As the fish, shrimp, and blue crab utilize the entire area of the bays, one can calculate the predicted amount of restored habitat for each alternative. By calculating the average annual similarity metric for each alternative (averaging the metric over 12 months) (Table 6), and multiplying by the spatial extent of potential habitat (the entire bay for nekton) one determines the estimated acreage of habitat restored for each alternative (Table 7). By restoring the volume, timing and distribution of freshwater flow into the Faka Union, Pumpkin and Blackwater Bays, the top three alternatives from Table 3, alternatives 6, 3D, and 7 restore from 577 to 692 acres of high quality estuarine habitat for fish, shrimp, and blue crabs.

Table 5. Increase and final values of oyster reef habitat units for Faka Union Bay.

	Natural	Future Without	Alt 17 (Prairie)	Alt 3D	Alt 6	Alt 7	Alt 8	Alt 9	Alt 11	Alt 12	Alt 13	Alt 19
PM factor	1	0	0	0.94	0.94	0.5	0	0	0	0.5	0	0.88
(quality factor from table 1 of the estuary report 23oct03)												
(represents gain relative to full restoration of 1.0 for the Natural condition)												
gain in HU	13315	0	0	12516	12516	6657	0	0	0	6657	0	11717
(gain in Habitat Units of oyster for each alternative.)												
(Based on product of quality (PM factor) and area (maximum potential gain of 13,315))												
total HU	33096	19782	19782	32297	32297	26439	19782	19782	19782	26439	19782	31499
of oyster (m2)												
(sum of starting condition, 19,782 and gain in HU)												

Table 6. Similarity indices (average annual difference ratio, see text for formula) for alternatives and the future without project condition, based on the revised model predictions for flows to the coast

Average Annual Difference Ratio for Nekton												
(shrimp, blue crab, fish, reef crab)												
		Future Without	**Alt17 (Prairie)**	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
Faka Union		0.033	0.106	0.685	0.728	0.650	0.560	0.547	0.455	0.711	168.66	357.43
Pumpkin		0.010	0.014	0.252	0.467	0.311	0.137	0.082	0.034	0.325	17.83	6.81
Blackwater		0.005	0.003	0.305	0.277	0.260	0.203	0.165	0.112	0.192	5.78	82.06
											192.27	446.30

Table 7. Estimated habitat units for each alternative and the future without project condition.

Estimated Acres of Potential Restoration												
Nekton (shrimp, blue crab, fish)												
	Acres											
	Open Water		((average annual difference ratio) X number of potential restoration acres)									
	Surface Area	**Future Without**	**Alt 17 (Prairie)**	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
Faka Union	470	15.74	49.89	321.93	342.35	305.68	263.22	257.00	213.77	334.30	168.66	357.43
Pumpkin	540	4.91	6.68	118.44	219.26	146.38	64.36	38.53	15.76	152.83	17.83	6.81
Blackwater	250	2.33	1.55	143.51	130.38	121.99	95.56	77.77	52.53	90.06	5.78	82.06
	Totals	22.98	58.12	583.88	691.99	574.05	423.14	373.30	282.06	577.20	192.27	446.30
Rank (Best =1)		**11**	**10**	**2**	**1**	**4**	**6**	**7**	**8**	**3**	**9**	**5**
Reef crab habitat												
	Acres	**Future Without**	**Alt 17 (Prairie)**	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
	Potential Oyster											
	Habitat											
Faka Union	8.178	0.27	0.87	5.60	5.96	5.32	4.58	4.47	3.72	5.82	2.93	6.22
Pumpkin	9.396	0.09	0.12	2.06	3.82	2.55	1.12	0.67	0.27	2.66	0.31	0.12
Blackwater	4.35	0.04	0.03	2.50	2.27	2.12	1.66	1.35	0.91	1.57	0.10	1.43
	Totals	0.40	1.01	10.16	12.04	9.99	7.36	6.50	4.91	10.04	3.35	7.77
Rank (Best =1)		**11**	**10**	**2**	**1**	**4**	**6**	**7**	**8**	**3**	**9**	**5**

Preferred Alternative for All Estuaries

After integrating the results of the empirical analyses for Faka Union and the theoretical analyses for Faka Union, Pumpkin, and Blackwater Bays (Table 8), alternative 6 is viewed as the preferred alternative for estuarine restoration. Alternative 6 is one of two (of 3D and 6) best performers for the oyster-based and the best for the nekton-based empirical analysis for Faka Union, is among three of the best performing models for the visually based theoretical analysis for Faka Union (among 3D, 6, and 19), is the best performing model for the visually based theoretical analysis for Pumpkin Bay, and is the best performer for the scoring-based theoretical analysis for Faka Union Bay, Pumpkin Bay, and all bays combined. Alternatives 8, 9, 11, and 13 were judged inadequate with regard to restoration benefit.

Table 8. Preferred alternative for estuaries affected by SGGE restoration. Performance of each alternative ranked for each of the assessment methods: empirical approach using oyster and nekton performance measures; similarity metric approach via visual assessment of percent similarity graphs for Faka Union (FU), Blackwater (BW), and Pumpkin (PU) Bays; and similarity metric approach via performance scoring for FU, BW, PU, and all three bays combined.

Assess Method	**Alt 3D**	**Alt 6**	**Alt 7**	**Alt 8**	**Alt 9**	**Alt 11**	**Alt 12**	**Alt 13**	**Alt 19**
Oyster PM in FU	1st	1st	3rd				3rd		2nd
Nekton PM	3rd	1st							2nd
Visual FU	1st	1st	2nd				2nd		1st
Similarity Metric FU	2nd	1st					3rd		2nd
Visual BW	1st	2nd	2nd				3rd		
Similarity Metric BW	1st	3rd	2nd						
Visual PU		1st	3rd				2nd		
Similarity Metric PU	4th	1st	2nd				3rd		
Similarity Metric All Bays	2nd	1st	3rd						
Preferred:	**2nd**	**1st**	**3rd**				**5th**		**4th**

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Alternative Benefit Analysis for Estuaries Affected by South Golden Gate Estates Restoration

Supplement to Original Report

Michael Savarese, Michael Shirley, and Todd Hopkins

Draft: January 30, 2004

Introduction

The prior assessment of relative benefit of alternatives affected by SGGE restoration, for both the terrestrial and estuarine ecosystems, identified 5 leading candidates: alternatives 3D, 6, 7, 12, and 19. Of these, alternatives 3D and 6 performed best for the estuaries; alternatives 7 and 19 performed relatively poorly for the terrestrial system. Consequently, a short list of 3 alternatives was generated for further modeling and analysis and includes alternatives 3D, 6, and 12. Modeling improvements were made and these 3 alternatives were re-evaluated relative to natural, existing, and future "without project" conditions.

This document assesses the relative benefit of alternatives 3D, 6, and 12 specifically for the three estuaries (Blackwater, Pumpkin, and Faka Union bays) using the same methodologies described in the original estuarine performance report. In order to simplify the analysis at this stage not all assessment methods were employed (see Table 8). Performance was compared using the "similarity metric" approach. Similarity indices were recalculated for each of the 3 alternatives (over a 12-month period) for each of the 3 estuaries. Graphical results were generated for each estuary, and relative effectiveness at approximating the natural conditions was then visually assessed. In addition, the best alternatives were scored monthly and the scores were used to more objectively judge performance relative to natural conditions (see original report for further explanation).

Total flows to the 3 estuaries affected by restoration, Faka Union, Pumpkin, and Blackwater, and to Fakahatchee, the pristine control, as predicted by the new modeling runs, are depicted in Figures 12-15.

Similarity Metric-based Evaluation of Alternatives

Results for Faka Union Bay

Alternative 3D performs better than the other alternatives for most of the wet season, approximating natural conditions by over 80% (June - September; Figure 16). Alternative 6 finishes second during these months. Late in the dry season, February through May, alternative 3D performs as well as alternatives 6 and 12; all three alternatives exhibit > 70% similarity. Alternative 12 out-performs 3D and 6 in October, November, and January at similarities > 60%. Alternative 3D performs best in the monthly ranking, scoring 26 points, followed by 6 and 12 with 23 points each (Table 9). The integration of all these results demonstrates that the order of effectiveness for Faka Union is: 3D > 6 > 12.

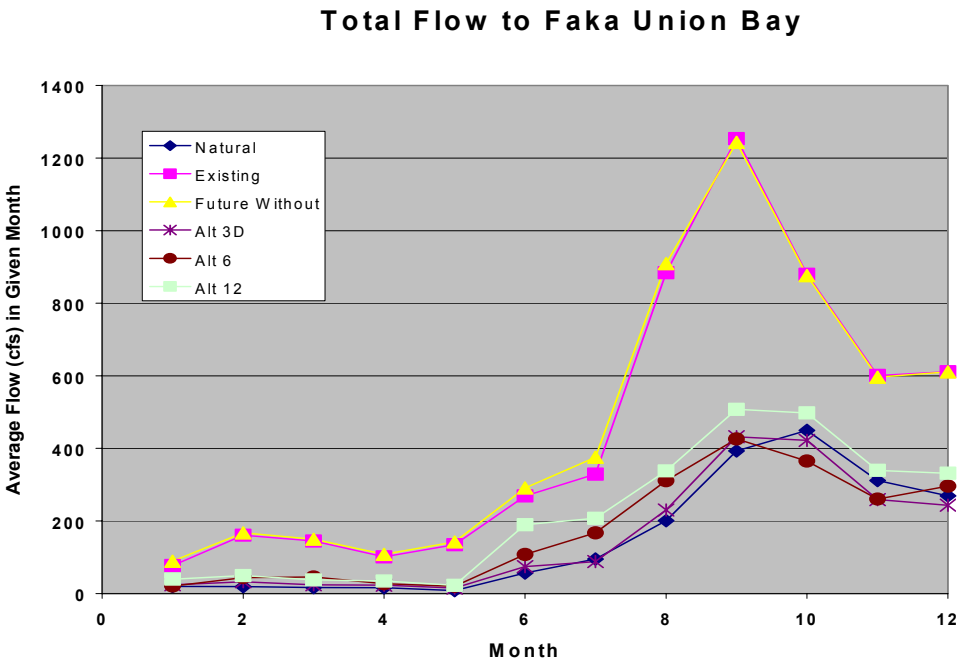

Figure 12 – Total monthly water flows into Faka Union Bay predicted by the various modeled alternatives (natural, existing, future without project, 3D, 6, and 12). The Y-axis shows the flow amount in cubic feet per second, the X-axis shows the months of the year, January (1) through December (12).

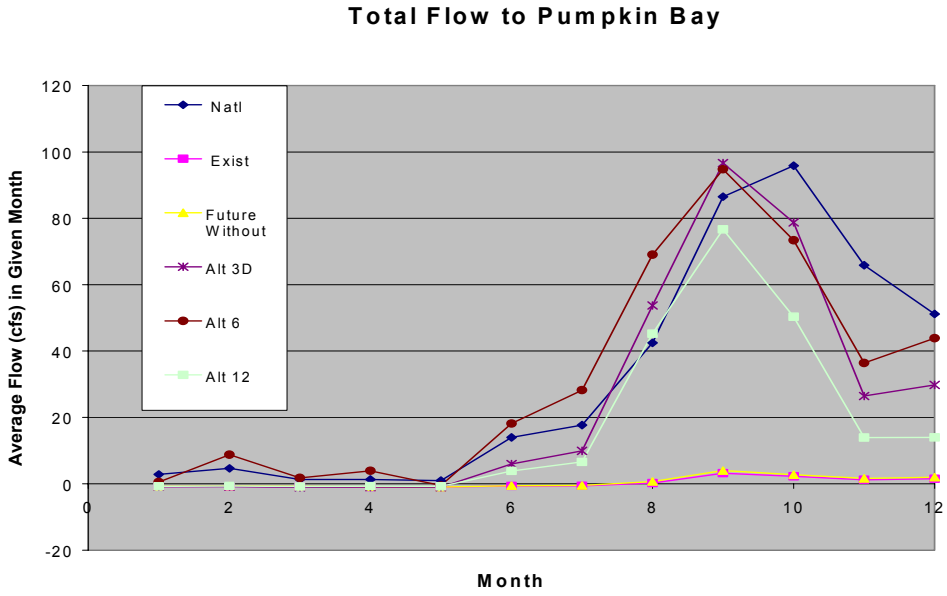

Figure 13 – Total monthly water flows into Pumpkin Bay predicted by the various modeled alternatives (natural, existing, future without project, 3D, 6, and 12). The Y-axis shows the flow amount in cubic feet per second, the X-axis shows the months of the year, January (1) through December (12).

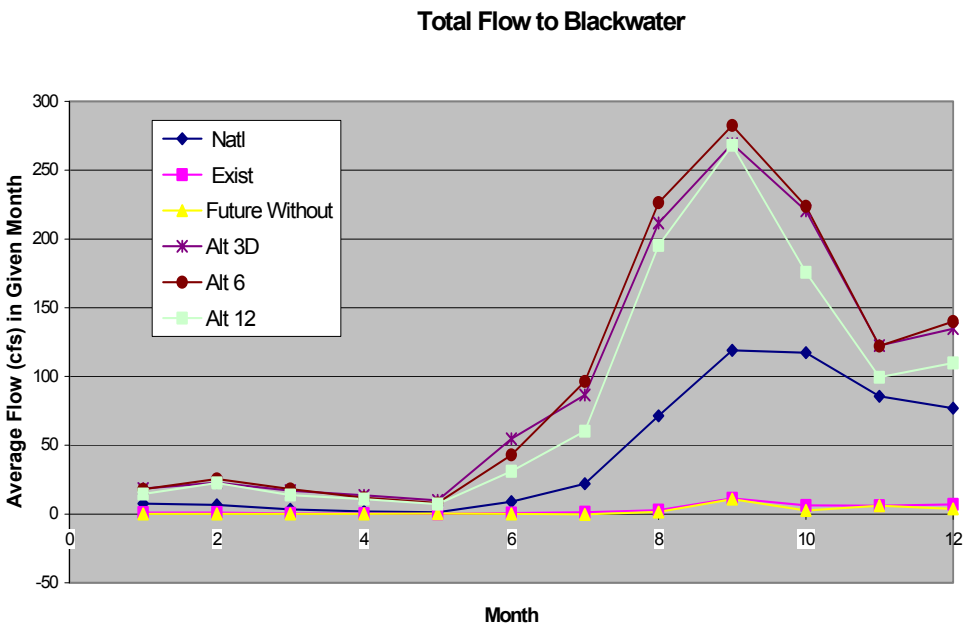

Figure 14 - Total monthly water flows into Blackwater Bay predicted by the various modeled alternatives (natural, existing, future without project, 3D, 6, and 12). The Y-axis shows the flow amount in cubic feet per second, the X-axis shows the months of the year, January (1) through December (12).

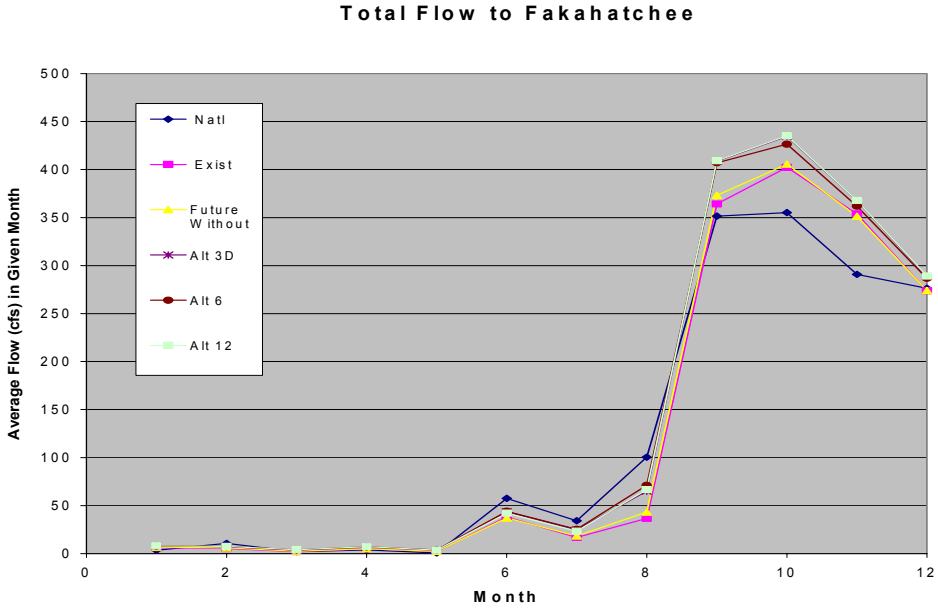

Figure 15 - Total monthly water flows into Fakahatchee Bay predicted by the various modeled alternatives (natural, existing, future without project, 3D, 6, and 12). The Y-axis shows the flow amount in cubic feet per second, the X-axis shows the months of the year, January (1) through December (12).

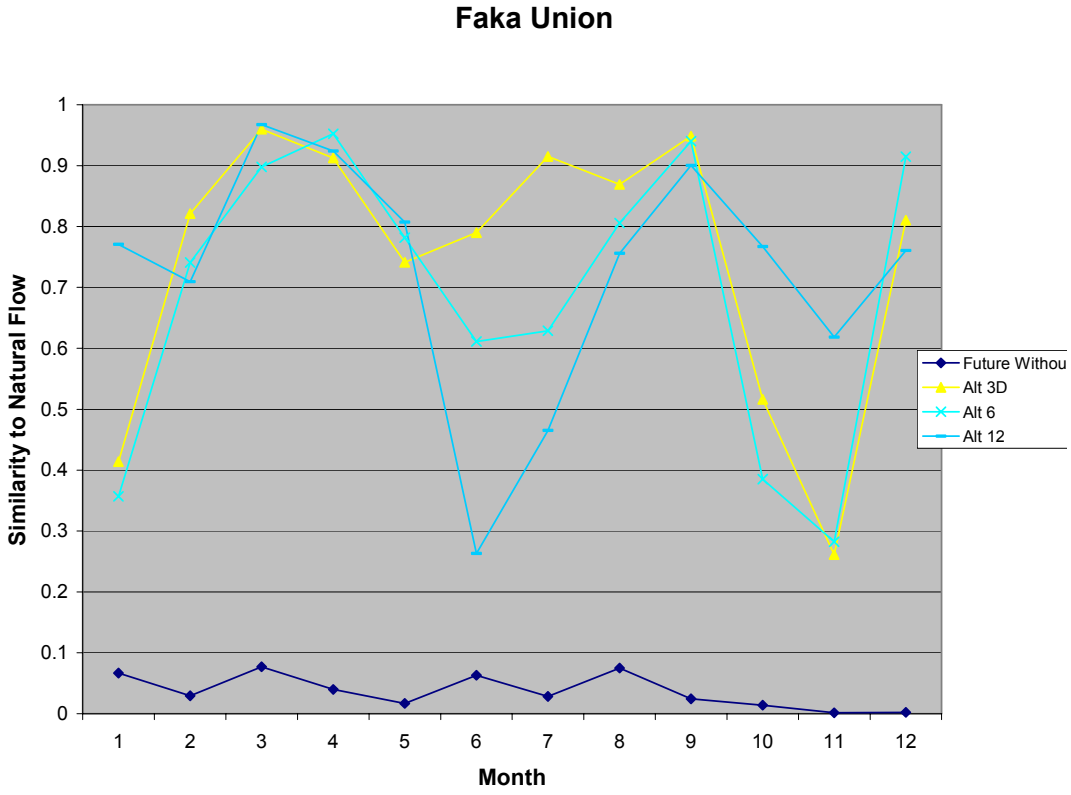

Figure 16 – Evaluation of Alternatives based on similarity to natural conditions in Faka Union Bay. On the Y-axis, a value of 1.0 indicates a perfect restoration to natural conditions, 0.0 indicates no improvement towards natural conditions. The X-axis shows the months of the year, January (1) through December (12).

Table 9 – Points awarded for monthly ranking of alternative plans for each bay. Best performing alternative in a month is awarded 3 points; 2nd best performing, 2 points; and 3rd best, 1 point. Total points awarded per alternative are summed for the entire year and for the wet and dry seasons separately.

Canal	Month	Alt. 3D	Alt. 6	Alt. 12
Faka Union	1	2	1	3
	2	3	2	1
	3	2	1	3
	4	1	3	2
	5	1	2	3
	6	3	2	1
	7	3	2	1
	8	3	2	1
	9	3	2	1
	10	2	1	3
	11	1	2	3
	12	2	3	1
Pumpkin	1	1	3	2
	2	1	3	2
	3	1	3	2
	4	1	3	2
	5	1	3	2
	6	3	1	2
	7	3	1	2
	8	1	2	3
	9	3	2	1
	10	3	2	1
	11	2	3	1
	12	2	3	1
Blackwater	1	2	3	1
	2	2	3	1
	3	3	2	1
	4	3	2	1
	5	1	2	3
	6	3	2	1
	7	2	3	1
	8	3	2	1
	9	2	3	1
	10	2	1	3
	11	2	1	3
	12	2	1	3
Overall		**75**	**77**	**64**
Dryseason		**31**	**43**	**34**
Wetseason		**44**	**34**	**30**

Results for Blackwater Bay

Visual assessment of Figure 17 shows that alternative 3D and 6 perform equally well for most of the year (January - April; June - December). Both approximate natural conditions better than alternative 12 in all months except May and October through December. Percent similarities for the critical wet season months exceed 60% (June - August) for 3D and 6. Monthly ranking yields similar results (Table 9). Alternative 3D scores 27 points, alternative 6 scores 25 points, and alternative 12 scores 20. Overall, alternatives 3D and 6 perform equally well for Blackwater Bay, trailed by alternative 12.

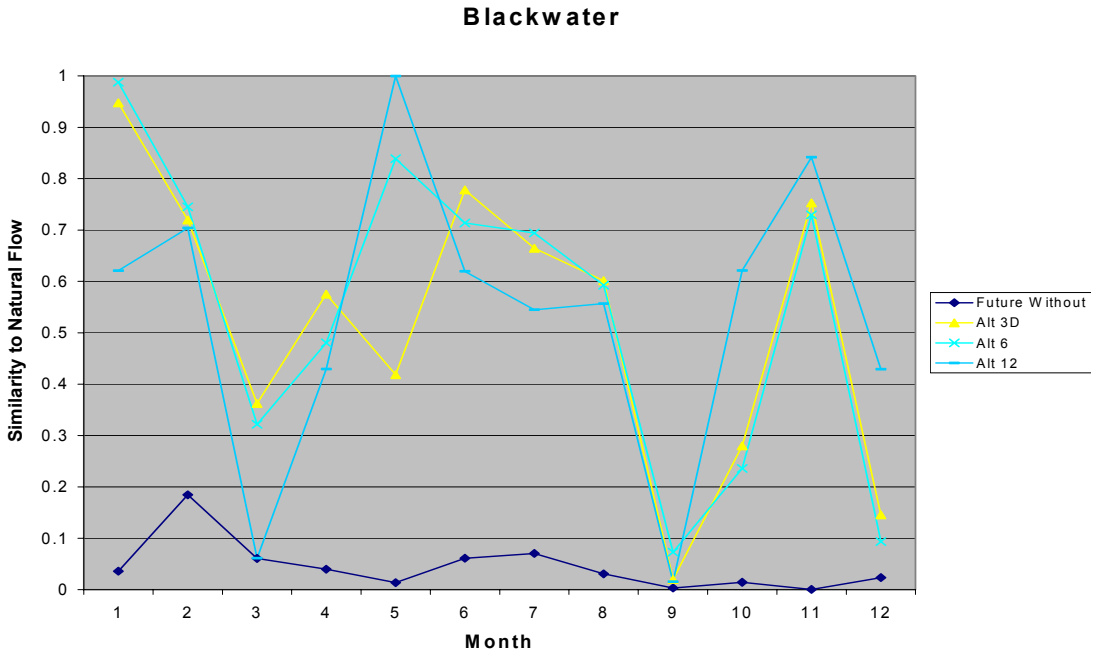

Figure 17 - Evaluation of Alternatives based on similarity to natural conditions in Blackwater Bay. On the Y-axis, a value of 1.0 indicates a perfect restoration to natural conditions, 0.0 indicates no improvement towards natural conditions. The X-axis shows the months of the year, January (1) through December (12).

Results for Pumpkin Bay

Percent similarities for Pumpkin Bay are relatively low (< 50%) for all alternatives during most months (Figure 18). Alternative 3D out-performs 6 in June and July; 6 out-performs 3D in January - April and in October - December. Alternative 12 ranks in second place for portions of the wet season. Monthly scoring places alternative 6 in first with 29 points, followed by 3D with 22 and 12 with 21 (**Table 9**). Overall, after integrating results from both methods, alternative 3D and 6 are roughly equal in their performance, followed by 12.

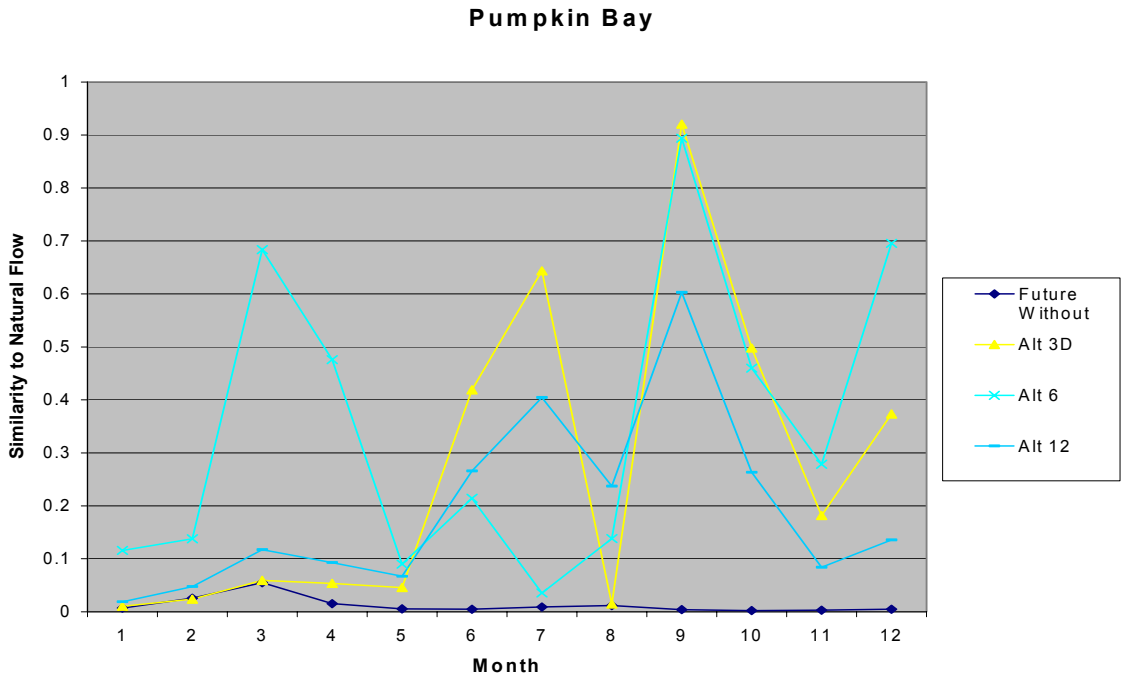

Figure 18 - Evaluation of Alternatives based on similarity to natural conditions in Pumpkin Bay. On the Y-axis, a value of 1.0 indicates a perfect restoration to natural conditions, 0.0 indicates no improvement towards natural conditions. The X-axis shows the months of the year, January (1) through December (12).

Rank Scoring Overall

When the scoring results are combined for the three estuaries, alternatives 3D or 6 lead, depending upon whether the dry or wet season is considered (Table 9). During the wet season, 3D beats 6 with a score of 44 to 34 (with 12 scoring 30 points); during the dry season, 6 beats 12 with a score of 43 to 34 (with 3D scoring 31). For both seasons combined, alternatives 6 and 3D are almost indistinguishable, with 77 and 75 points respectively, followed by 12 with 64 points.

Habitat Units

The average similarity indices for each bay and each alternative are shown in Table 10. Habitat units are calculated by multiplying the similarity (or quality) index with the acres of habitat to which the index applies. The habitat units for each bay and alternative are shown in Table 11. Alternative 6 provides the most habitat units, closely followed by Alternative 3D. Alternative 12 provides the fewest habitat units.

Table 10. Similarity indices (average annual difference ratio, see text for formula) for three alternatives and the future "without project" condition, based on the revised model predictions for flows to the coast.

	Existing Conditions	Future Without	Alt 3D	Alt 6	Alt 12
Faka Union	0.036	0.036	0.747	0.692	0.726
Pumpkin	0.012	0.012	0.270	0.351	0.195
Blackwater	0.045	0.045	0.522	0.542	0.537

Table 11. – Habitat Unit scores for each Bay and Alternative Plan

Nekton (shrimp, blue crab, fish)	Bay	Open Water Habitat (Acres)	Future Without	Alt. 3D	Alt. 6	Alt. 12
	Faka Union	470	17.14	350.91	325.01	341.13
	Pumpkin	540	6.60	145.87	189.77	105.08
	Blackwater	250	11.22	130.53	135.55	134.24
	Totals		*34.96*	*627.31*	*650.33*	*580.45*
	Rank (Best = 1)		*4*	*2*	*1*	*3*
Oyster Reef Habitat	**Bay**	**Potential Oyster Habitat (Acres)**	**Future Without**	**Alt. 3D**	**Alt. 6**	**Alt. 12**
	Faka Union	8.178	0.30	6.11	5.66	5.94
	Pumpkin	9.396	0.11	2.54	3.30	1.83
	Blackwater	4.35	0.20	2.27	2.36	2.34
	Totals		*0.61*	*10.92*	*11.32*	*10.10*
	Rank (Best = 1)		*4*	*2*	*1*	*3*

Preferred Alternative

The integration of all results from the similarity-metric approach indicates that alternatives 3D and 6 perform equally well for estuarine restoration. When the effects upon acres of potentially restored habitat are compared (Table 10), these alternatives improve roughly the same areas of nekton and oyster reef habitat.

RESOURCE ASSESSMENT OF SOUTHERN GOLDEN GATE ESTATES HYDROLOGIC RESTORATION

South Florida Water Management District
Mike Duever
September 2004

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PLANT COMMUNITIES ASSESSMENT

The South Golden Gate Estates (SGGE) was originally dominated by wetland communities, particularly cypress forest and to a lesser extent, herbaceous wet prairies. Even those sites normally designated as uplands, particularly islands of mesic pine flatwoods, often had water at or above the ground surface for at least short periods during wetter portions of the year. Subsequent to drainage, upland pines, cabbage palms, and hardwoods have invaded many of the cypress forests. In addition, severe and frequent fires have eliminated many of the pine and cypress trees, furthering the conversion of these lands to early successional stages of upland or shallow wetland plant communities. The character of the original SGGE has also changed as a result of the invasion of exotic plant species, particularly Brazilian pepper, onto drained and disturbed sites.

The long-term goal of the proposed restoration is to return the hydrology and the associated biological communities of the areas downstream of the locations where changes are specified in each restoration alternative to a condition comparable to that which existed in SGGE prior to drainage. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return these portions of SGGE to their pre-drainage character, including the plant communities and wildlife populations that they originally supported.

Methods

There were two types of plant community maps used in our analyses of SGGE restoration. The first was two plant community maps provided by the Natural Resources Conservation Service (NRCS) in July 2001 (Figure 1). These were detailed maps of the distribution of major plant community types in SGGE based on 1940 and 1995 aerial photographs. The other type of map was based on hydrology parameters calculated by the MIKE SHE model for natural , existing, and 2050-without-project base conditions (e.g., Appendix A, Figure A-79), and for the restoration alternatives. Plant community distributions were predicted based on the relationship between the hydrologic characteristics of each major community type and on average wet season water depths (July 1 through October 1) as predicted by the model.

One problem with making comparisons between the MIKE SHE and NRCS maps is that they have different boundaries, particularly along the coast. The MIKE SHE hydrology model was not designed to deal with tidal influences. The use of a constant mean high tide boundary at its southern periphery was required by the characteristics of the model. Regardless, the lack of data on topography and water circulation patterns would have greatly limited the usefulness of any existing model in this area. Thus, the model minimizes the amount of area influenced by tides by leaving out most the saline estuarine habitat (Ms, Mg, WAT) located south of Tamiami Trail, which are included in the NRCS maps. In addition, the MIKE SHE model extended coverage to the west of SGGE to try to minimize problems with model boundary conditions and increase the accuracy of the model within the area of interest. This boundary on the NRCS map, however, is somewhat closer to the Miller Canal. These differences become significant when we try to compare plant community acreages and percentages between natural and current conditions between the two types of maps.

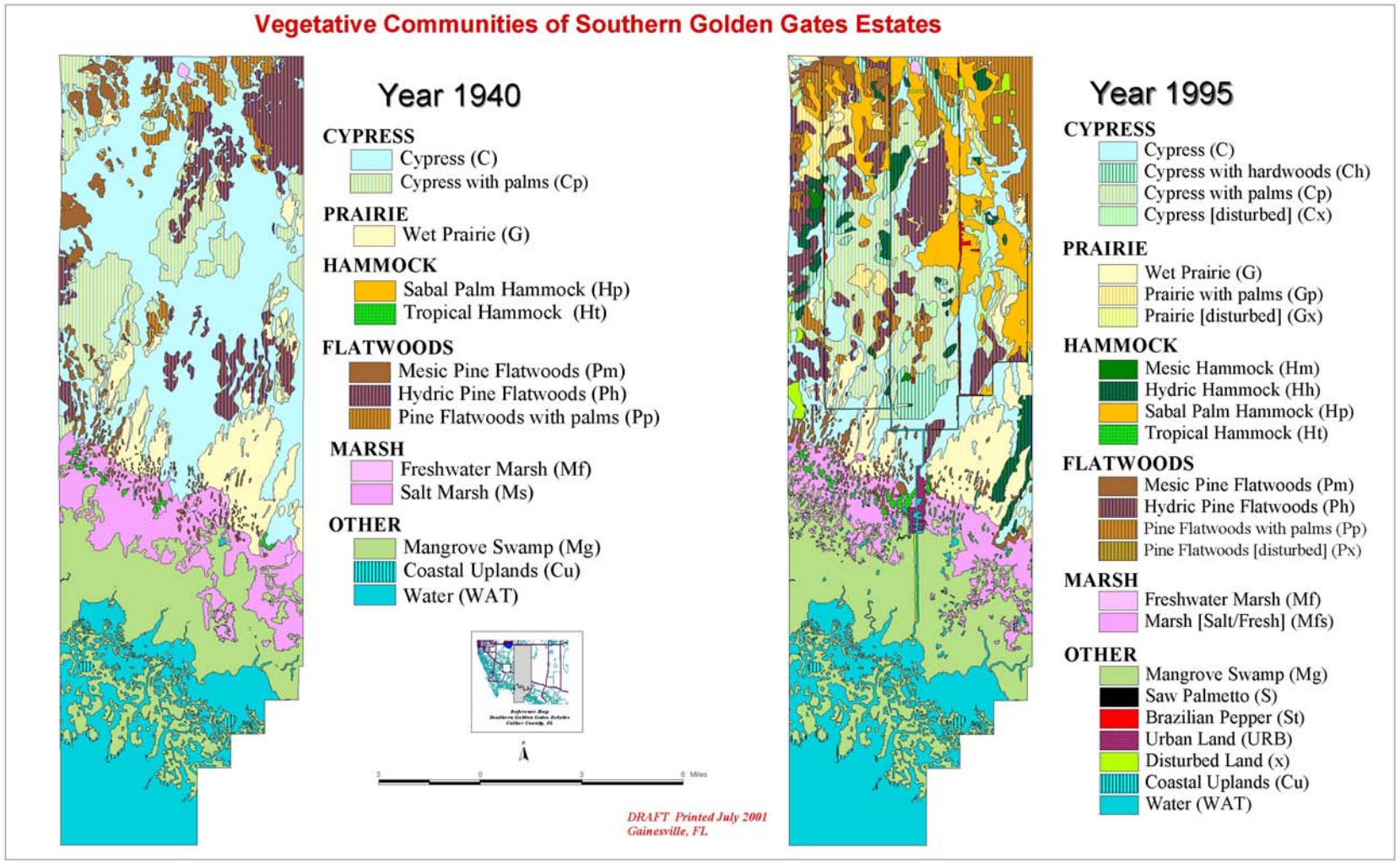

Figure 1. Vegetation Maps of Southern Golden Gate Estates for 1940 and 1995 produced by the Natural Resources Conservation Service.

Another difference is the quarter mile cell size of the model, which does not allow for the inclusion of small features or features with a lot of edge, both of which can be more precisely shown on the NRCS map. In the model, the former are usually incorporated into larger features, and the latter tend to be erratically distributed because of the necessity to produce average values for each cell.

The NRCS plant community maps provide excellent documentation about where changes have occurred from natural to current conditions. They also represent a valuable baseline with which to compare future change following restoration, particularly where a return to natural conditions is the restoration target. However, while the NRCS maps provide good estimates of plant community acreages for natural and current conditions, they are not able to provide estimates of restored condition acreages. The only acreage estimates for restoration conditions are those that can be calculated based on the hydrology model. Thus, since these two sets of maps cover somewhat different areas, the only fair comparison of plant community acreages for the three base conditions with the restoration alternatives would be one based on the hydrology model, which is the approach we have taken in this report.

Description Of Communities

The descriptions of the plant communities are somewhat modified, primarily in their format rather than in their content, from those produced by Jim Burch for SGGE (2000). The Florida Land Use, Cover and Forms Classification System (FLUCCS) codes are from the Florida Department of Transportation (1999). Hydrology and plant community relationships (Table 1) are based on Duever et al. (1975) and Duever (1984).

Cypress Forest

Cypress forests (C) (FLUCCS: 621 Cypress) in SGGE are dominated by bald cypress *(Taxodium distichum*), and occasional hardwoods such as red maple (*Acer rubrum*), pop ash (*Fraxinus caroliniana*), or pond apple (*Annona glabra*), where these hardwoods provide less than 30 percent canopy cover. Ground cover can be sparse to dense, and can be submerged or emergent in standing water during normal wet season conditions. Epiphytic bromeliads and orchids are locally common in trees and ferns are common on palm trunks. Normal wet season water depths are relatively deep (12 to 24 inches) and hydroperiods are long (6 to 10 months) (Table 1). Cypress forests that are found on shallower sites usually have dense almost monospecific stands of cypress. On deeper sites, hardwoods typically form a subcanopy under an open cypress canopy. These communities may occur on any type of soil, including sand, marl, rock, and organic, although the cypress and mixed hardwood forests are found more frequently on deep organic soils. One variation of the cypress forest is cypress-with-palms (Cp), which were typically shallow cypress communities in 1940 and drained cypress communities in 1995. Almost 40,000 acres of the lands within SGGE were cypress forest in 1940 (C, Cp) (Table 2), based on the NRCS vegetation map (Figure 1).

Average Wet Season Water Level (in)	Hydroperiod (mon)	SGGE Non-Tidal Plant Communities	Non-Hydrologic Influences	Relative Abundance in SGGE	
				Natural	Current
≤-6	0	Tropical Hammock	No Fire	++	++
≤2	≤1	Mesic Pine Flatwoods	Fire	+++	+++
		Palmetto Prairie	>>>Fire	0	0
		Mesic Hammock	No Fire	0	++
		Brazilian Pepper	Exotic	0	++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
2 – 6	1 - 2	Hydric Pine Flatwoods	Fire	+++	+++
		Hydric Hammock	No Fire	0	+++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
6 – 12	2 - 6	Wet Prairie	Fire	+++	+++
12 – 24	6 - 10	Marsh	Fire	++	++
		Cypress Forest	< Fire	++++	++++
>24	>10	Open Water		0	0

Table 1. Hydrologic regimes and other environmental factors that maintain the major plant community types. Relative abundance of these communities during natural and current conditions is indicated by the number of pluses from low abundance (+) to high abundance (++++). A zero (0) indicates the community is not present

.Name	Veg. Symbol	1940 Acres	Percent (H)		1995 Acres	Percent (C)		Difference (1995-1940)	
Cypress	C	30583.1	30.5%		10567.1	10.5%		-20016.0	-19.9%
Cypress with hardwoods	Ch	0.0	0.0%		2845.7	2.8%		2845.7	2.8%
Cypress with palms	Cp	8758.1	8.7%		9025.6	9.0%		267.5	0.3%
Coastal Uplands	Cu	301.9	0.3%		301.9	0.3%		0.0	0.0%
Cypress (disturbed)	Cx	0.0	0.0%		1246.2	1.2%		1246.2	1.2%
Wet Prairie	G	7619.3	7.6%		7031.0	7.0%		-588.3	-0.6%
Prairie with palms	Gp	0.0	0.0%		2043.6	2.0%		2043.6	2.0%
Prairie (disturbed)	Gx	0.0	0.0%		161.8	0.2%		161.8	0.2%
Hydric Hammock	Hh	0.0	0.0%		2574.2	2.6%		2574.2	2.6%
Mesic Hammock	Hm	0.0	0.0%		139.8	0.1%		139.8	0.1%
Sabal Palm Hammock	Hp	55.8	0.1%		7286.4	7.3%		7230.7	7.2%
Tropical Hammock	Ht	264.9	0.3%		688.6	0.7%		423.7	0.4%
Freshwater Marsh	Mf	512.1	0.5%		94.7	0.1%		-417.5	-0.4%
Marsh (Salt/Fresh)	Mfs	8574.2	8.5%		6480.4	6.5%		-2093.8	-2.1%
Mangrove	Mg	16564.5	16.5%		18417.3	18.3%		1852.8	1.8%
Hydric Pine Flatwoods	Ph	7141.2	7.1%		5852.9	5.8%		-1288.3	-1.3%
Mesic Pine Flatwoods	Pm	2908.0	2.9%		1983.0	2.0%		-924.9	-0.9%
Pine Flatwoods with palms	Pp	2408.0	2.4%		6478.1	6.5%		4070.2	4.1%
Pine Flatwoods (disturbed)	Px	0.0	0.0%		48.2	0.0%		48.2	0.0%
Saw Palmetto	S	0.0	0.0%		6.2	0.0%		6.2	0.0%
Brazilian Pepper	St	0.0	0.0%		273.1	0.3%		273.1	0.3%
Urban Land	URB	0.0	0.0%		298.8	0.3%		298.8	0.3%
Water	WAT	14721.9	14.7%		15843.8	15.8%		1121.9	1.1%
Disturbed Land	x	0.0	0.0%		725.0	0.7%		725.0	0.7%
Total:		100412.9	100.0%		100413.5	100.0%			

Table 2 Acreages and percentages of each Southern Golden Gate Estates plant community in 1940 and 1995, based on Natural Resource Conservation Service maps (Figure 1).

Following drainage of SGGE, the original cypress forest (C) has been reduced by about 20,000 acres based on the NRCS map (Table 2). Although there was little change in the acreage of the cypress-with-palms community (Cp), there were large shifts in where this community was found (Figure 1). It now occupies areas within the south-central project area that were largely cypress (C) in 1940. Much of the original cypress and cypress with palms community (C, Cp), has been replaced by sabal palm hammock (Hp) or one of the pine flatwoods (P) communities. This is the single most significant change in plant community structure resulting from the drainage of SGGE.

A small portion of the cypress forest (C) at scattered locations throughout the original cypress communities has been converted to cypress-with-hardwoods (Ch) (FLUCCS: 630 Wetland Forested Mixed) due to a lack of fire, which has allowed succession to proceed (Table 2) (Figure 1). These forests are dominated by bald cypress and a variety of hardwoods, such as red maple, pop ash, or pond apple, where these hardwoods provide more than 30 percent canopy cover. Epiphytic bromeliads are common in trees, and ferns are common on palm trunks. Drier conditions have undoubtedly facilitated the invasion of hardwoods into the original cypress forests, where severe fires have not yet occurred.

Currently there are about 1,200 acres of the original cypress that are classified as disturbed (Table 2) (Figure 1). Disturbed cypress forest (Cx) are cypress forests that have been significantly altered as evidenced by physically altered soils; large areas of charred, dead trees; dominance or partial dominance by ruderal species such as saltbush (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*), muscadine grape (*Vitis munsoniana*), poison ivy (*Toxicodendron radicans*) or Brazilian pepper (*Schinus terebinthifolius*).

Restoration of cypress communities to their original condition on sites where a natural hydrology has been restored will likely take many decades. Since the original canopy cypress were probably about 100 to 200 years old, where they have been eliminated or greatly reduced in numbers such as in the disturbed areas, it will take longer. Where most of the older cypress are still present, but have been invaded by palms or hardwoods, it should take less time, on the order of a few decades. The application of an appropriate fire regime (Figure 2) and/or mechanical clearing would expedite the recovery of these latter sites. Certain areas will not be restored to their natural condition. Examples would be lands located: 1) upstream of pump and spreader systems, or 2) in the vicinity of portions of canals that will not be filled, or 3) along canals with control structures that cannot be kept fully closed during the 10 year or less event flood conditions. They will likely remain in a drier condition that would support pine flatwoods and palm or hardwood hammock communities, with the actual vegetative composition of these communities depending on the prescribed fire and exotic plant management programs that will exist in the future. Also, the footprint of any areas where canals and roads have not been completely removed will obviously not be restored.

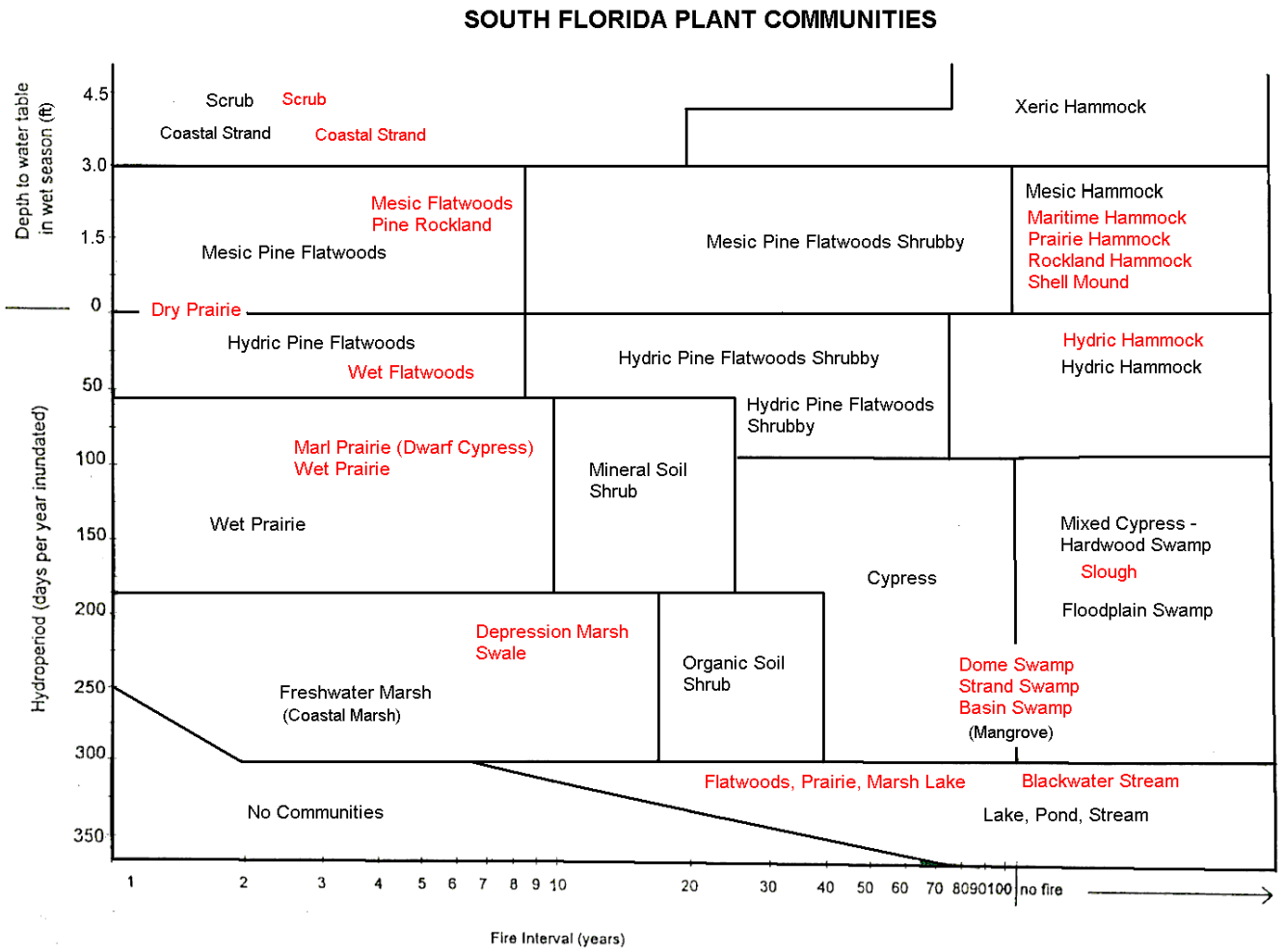

Figure 2. Synthesis of hydrologic and fire regimes for South Florida plant communities. Community names in red are those found in the Florida Natural Area Inventory (1990). Names in black are a synthesis of hydrology – fire related plant communities developed by a subcommittee of the South Florida Interagency Fire Management Council.

Freshwater Marsh

Freshwater marsh communities (Mf) (FLUCCS: 641 Freshwater Marshes) are low diversity herbaceous communities dominated by tall, dense stands of grasses and forbs. They have relatively long hydroperiods (6 to 10 months) and deep wet season water depths (12 to 24 inches) (Table 1). They are found primarily on organic soils. Fires are frequent, and retard the invasion of woody vegetation. However, marshes can have occasional bald cypress, where these trees produce less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940 there were only a few small freshwater marshes in SGGE (Table 2), with most of them located in the northern portion of the salt marshes near the coast (Figure 1).

The conversion of sheetflow across the whole width of SGGE to a point discharge out of the Faka Union Canal would be expected to have converted all of the freshwater marshes along the coast to salt marsh. However, it is impossible to tell if this has actually happened, since the 1995 plant community classification has combined salt and fresh marsh into a single class (Mfs) along the coast (Figure 1). The one freshwater marsh near the north boundary of SGGE is still present, even after drainage.

It may be difficult to reestablish the isolated freshwater marshes located in the area dominated by coastal salt marshes that might have been lost following drainage even if natural freshwater sheetflow is returned to the area. If there are not appropriate seed sources at the sites, their isolation may make it difficult for the marsh community to recolonize these sites, at least over the short term. Sea level rise could add an additional impediment to their reestablishment.

Wet Prairie

Wet prairies (G) (FLUCCS: 643 Wet Prairies) are high diversity herbaceous communities dominated by short, open stands of grasses, sedges and forbs. They have relatively short hydroperiods (2 to 6 months) and shallow wet season water depths (6 to 12 inches) (Table 1). They are found on mineral soils, including sand, marl, and rock. Fires are frequent, and retard the invasion of woody vegetation. However, wet prairies can have occasional slash pine (*Pinus elliottii*) or bald cypress, where these trees produce less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940, wet prairies originally occupied approximately 7,600 acres (Table 2) and were most extensive just upstream of the brackish marshes along the coast, with smaller scattered areas in the northern and eastern portions of SGGE (Figure 1).

Since SGGE has been drained, there has been only a small decrease in their acreage (Table 2), and a small change in the distribution of wet prairies (Figure 1). They are still most widespread just upstream of the coastal brackish marshes, with scattered smaller wet prairies further north, particularly along the eastern side of SGGE. The lack of change between 1940 and 1995 in the larger, more downstream wet prairies is most likely due to their low elevation and proximity to the coast, which could reduce the ability of the canals to drain these sites.

There is currently a substantial acreage of wet prairie with palms (Gp) (Table 2) in the northwest and central project area on sites that were cypress forest prior to drainage (Figure 1). These probably represent sites where sabal palm (*Sabal palmetto*) invaded following drainage,

and subsequent fires eliminated the cypress. There are some small areas of disturbed wet prairie (Gx) that were cypress forest and are now at least partially dominated by ruderal species such as saltbush, wax myrtle, muscadine grape, poison ivy, or Brazilian pepper. Again fires have probably eliminated the cypress, and with the drier conditions following drainage, early succession upland species are now invading these sites.

Since most of the wet prairie acreage is still currently intact in the southern portion of SGGE, restoration of this habitat to a natural condition should be relatively expeditious, once the natural hydrology has been restored. Some small areas will not be restored, including those upstream of the pumps and spreader canals, where canals are not plugged, where control structures are not kept closed during up to the 10 year event floods, and where canals and roads will not be completely removed. Otherwise the restored hydrology, and an appropriate fire regime (Figure 2) and exotic control program would likely restore most of the altered SGGE wet prairies to their original condition within a decade.

Pine Flatwoods

Most of the SGGE upland communities present in 1940, making up about 12,500 acres (Table 2), were islands of pine flatwoods (P) (FLUCCS: 411Pine Flatwoods) that were scattered throughout the area and decreased in both size and aerial coverage as one moved from north to south through SGGE (Figure 1). Pine flatwoods have an open canopy dominated by slash pine. They typically have water slightly above (<6 inches) or below ground during the peak of the wet season and short hydroperiods (<2 months). They can occur on sand or rock substrates. Compared to hydric pine flatwoods (Ph) (FLUCCS: 625 Hydric Pine Flatwoods), which have deeper wet season water depths (2 - 6 inches) and a longer hydroperiod (1 - 2 months), mesic pine flatwoods (Pm) are more elevated with shallower wet season water depths (<2 inches) and a shorter hydroperiod (<1 month). Mesic flatwoods are more likely to be dominated by dense saw palmetto (*Serenoa repens*), while hydric pine flatwoods are more likely to be dominated by a dense and diverse herbaceous ground cover of grasses, sedges, and forbs. Pine flatwoods with an abundance of sabal palms (Pp) in the subcanopy were also common, particularly in the northern portion of SGGE. The open character of the canopy and shrub strata and the dense groundcover are maintained by intense and frequent fires. Epiphytes are not common due to the small number of trees and their limited branching, as well as the frequent fires.

Currently there is a moderate reduction in the acreage of mesic and hydric pine flatwoods (Table 2), although they generally have a very different distribution from where they occurred in 1940 (Figure 1). The one area where mesic pine flatwoods occurred in both 1940 and 1995 was along both sides of the coastal boundary between fresh and saltwater communities in the vicinity of Tamiami Trail. Hydric pine flatwoods have tended to expand into what were cypress communities in 1940, but where they originally occurred at that time, they have since been largely replaced by palm or hammock forests.

There has been a substantial increase in the acreage of pine flatwoods that have been heavily invaded by sabal palms (Pp), which provide 30 percent or more shrub cover (Table 2). These palms are usually of similar size and appear to be even-aged. Dense palm stands occur on calcareous substrates in both natural uplands and uplands created by drainage (Figure 1).

Otherwise, disturbed pine flatwoods (Px) are limited in extent, but can be identified by the presence of physically altered soils; large areas of charred, dead trees; and dominance or partial dominance by ruderal species such as saltbush, wax myrtle, muscadine grape, poison ivy, or Brazilian pepper.

A small area of dense shrubby saw palmetto (S) (FLUCCS: 321, Palmetto Prairies) is indicated as being present near the southwestern corner of the canal system (Table 2) (Figure 1). Slash pines may occur in this community, but are not common, and the ground cover is a sparse mix of mesic grasses and herbs. This community is essentially a mesic pine flatwoods where a high fire frequency has eliminated or prevented the invasion of pines.

Restoration of pine flatwoods communities to their original condition will likely take several decades, once a natural hydrology has been restored. Since the canopy pine were probably about 50 to 100 years old, where they have been eliminated or greatly reduced in numbers, it will take longer. Where most of the older pine are still present, but have been invaded by palms or hardwoods, it should take less time. The application of an appropriate fire regime (Figure 2) and/or mechanical clearing would expedite the recovery of these latter sites. Certain areas are not expected to be restored, such as those located upstream of the pumps and spreader systems, where canals are not plugged, or where control structures are not kept closed up to the 10 year event flooding conditions. Also, those areas where canals and roads have not been completely removed will not be restored.

Hammocks

There was only a very small acreage of hammock in 1940 (Table 2), most likely because of frequent fires in areas dry enough to support these communities. These communities typically have water slightly above (<6 inches) or below ground during the peak of the wet season, and short hydroperiods (<2 months). They can occur on sand or rock substrates. Those dominated by hardwoods are relatively intolerant of fire, while the sabal palm hammocks are not only tolerant but thrive with frequent severe fires.

In 1940 there was only a small area of sabal palm hammock (Hp) (FLUCCS: 428, Cabbage Palm) near the northeast corner of SGGE (Figure 1). This community has an almost monospecific canopy of palms with few shrubs and little groundcover because of the dense canopy. Epiphytic ferns are common on sabal trunks.

Numerous small tropical hammocks (Ht) (FLUCCS: 426, Tropical Hardwoods) were originally found scattered in the more upstream portions of the salt marshes along the coast (Figure 1), where proximity of the warm Gulf waters moderates freezing temperatures associated with winter cold fronts. These forested communities are dominated by a variety of hardwoods with tropical affinities, such as gumbo limbo (*Bursera simaruba*), mastic *(Mastichodendron foetidissimum*), or strangler fig (*Ficus aurea*). Sabal palms and live oaks (*Quercus virginiana*) may be common, but are not dominant. Shrub density is moderate and includes small hardwoods such as myrsine (*Rapanea punctata*), wild coffee (*Psychotria nervosa*), or indigo berry (*Randia aculeata)*, and seedlings of the canopy species. Ground cover is usually sparse because of the dense canopy. Epiphytic ferns, bromeliads and orchids are common on the hardwoods and palms.

Following drainage of SGGE, hammocks have expanded from a little over 400 acres in 1940 to over 10,000 acres in 1995 (Table 2). Drainage has created drier conditions suitable for hammock communities, although the associated more frequent and intense fires would tend to eliminate the hardwoods over the long run, leaving primarily palm hammocks.

The tropical hammocks had more than doubled in acreage from 265 to 689 acres by 1995 (Table 2). Their distribution in SGGE is similar to what it was in 1940, but in addition, they are now occupying numerous small islands in the coastal salt marshes that had previously supported mesic pine flatwoods (Figure 1). This would suggest a decrease in fire frequency in this area over the last 50 years, since sea level is more likely controlling water levels rather than changes associated with the SGGE canal system. However, it is possible that the less salt tolerant pine have been replaced by more salt tolerant tropical hardwoods, as a result of the reduction of freshwater flows following drainage of SGGE.

Most of the new upland sites created as a result of drainage have a shallow soil depth over limestone. In addition, drier conditions have promoted the occurrence of frequent and severe fires. This combination of environmental conditions has created an ideal setting for the rapid expansion of the sabal palm hammock community from about 55 acres to almost 7,300 acres (Table 2). This expansion has occurred primarily in the northern and eastern portions of SGGE in cypress habitats, particularly those that tend to be closer to canals (Figure 1).

The lower elevation and wetter hydric hammock (Hh) (FLUCCS: 433, Western Everglades Hardwoods) and slightly higher elevation but still moist mesic hammock (Hm) were not recorded as being present in 1940. In 1995, they occupied over 2,700 acres, although mesic hammock represented only 140 acres (Table 2). They are dominated by sabal palms and hardwoods such as red maple, swamp bay (Persea palustris), and several oaks including live oak on drier sites, or laurel oak (*Quercus laurifolia*) on wetter sites (Figure 1). Bald cypress also occurs on wetter sites, but is not common. Shrub density is sparse to moderate, and usually made up of small hardwoods including myrsine, wild coffee, indigo berry, or dahoon holly (*Ilex cassine*), and seedlings of the canopy species. Ground cover is variable, often dominated by ferns. Epiphytic bromeliads are common in trees and ferns are common on palm trunks. These two communities have primarily replaced cypress communities. The replacement by hydric hammock of a large area of cypress along the eastern boundary of SGGE to the south of Prairie Canal, which is probably less affected by drainage, suggests that lack of fire is also playing a role in this conversion.

Restoration of SGGE would be expected to substantially reduce the coverage of hammocks once a natural hydrology has been reestablished. However, restoration is likely to require more than just fixing the hydrology. A restored hydrology could be expected to eliminate or at least severely stress substantial areas of all of the hammock types, except the tropical hammocks near the coast where water levels have probably not been substantially altered. A combination of a restored fire regime (Figure 2) and some amount of mechanical clearing will probably also be required to remove hardwoods or palms that have become established either on shallower wetlands or on pine flatwoods sites.

Coastal Wetlands and Estuaries

There has been a substantial decrease in acreage of salt marsh (Ms) (FLUCCS: 642 Saltwater Marshes), and moderate increases in mangrove swamp (Mg) (FLUCCS: 612 Mangrove Swamps) and water (WAT) (FLUCCS: 540 Bays and Estuaries) between 1940 and 1995 at the southern edge of SGGE project boundary (Table 2). The general northward advance of mangroves into the salt marshes is likely to be at least partially due to reduced freshwater flows from SGGE (Figure 1). However, other factors such as a reduced fire frequency, as also suggested by the conversion of pinelands in the same area to fire-intolerant hammock communities, and sea level rise could be involved. There are also more lakes within the 1995 mangrove community than are indicated in the 1940 vegetation map. That could be associated with some of these same influences. Unfortunately, since the boundaries of the hydrology model do not include this area, it is impossible to clearly sort out the relative importance of these various influences.

Other Communities

There are several other communities that represent substantial acreages in 1995, but were not present in 1940. These include urban land, disturbed land, and Brazilian pepper (Table 2). The acreage of one plant community, coastal uplands, has not changed over this same time period.

Urban land is a residential–resort–marina complex that is not included in the restoration effort (Figure 1).

Disturbed lands are primarily associated with agricultural activities (Figure 1). Soil disturbance associated with activities on these lands will make it very difficult to restore natural communities over the short term, but given a return to natural processes, including hydrology and fire, they are likely to recover over the long term. Mechanical treatment will be required to eliminate unnatural ground contours and established exotic or nuisance plant species.

Brazilian pepper (***S****chinus* ***t****erebinthifolius*) (St) (FLUCCS: 422, Brazilian Pepper) forms a nearly complete shrub layer, sometimes with other trees such as slash pine, bald cypress or sabal palm as canopy emergents. There is typically little ground cover in these very dense thickets and epiphytes seldom occur. This community in SGGE occurs primarily as a result of soil disturbance associated with the canals and adjacent spoil piles (Figure 1). The biggest part of this problem will be dealt with where the spoil is returned to the canals and a more natural hydrology is restored.

Modeled Changes In Plant Communities

It is important to be aware that the greatest value of the MIKE SHE model used in this study is its ability to quantitatively estimate future conditions when certain features of a system are altered in specific ways. Real ecosystems are far too complex to represent accurately in a model. However, the ability of a model to synthesize our current understanding of the major features and processes operating within an ecosystem allows us to manipulate the model so that we can then evaluate the implications of those specific manipulations much more precisely than

would otherwise be possible. The MIKE SHE model has permitted us to compare water levels, and by extension the major plant communities associated with natural, existing, and 2050-without-project base conditions, as well as those associated with each of the restoration alternatives.

Restoration Alternatives

Model simulations and detailed evaluations were done for ten restoration alternatives, including Alternatives 3d, 6, 7, 8, 9, 11, 12, 13, 17, and 19. Other alternatives were proposed, but were not quantitatively evaluated. Most of these scenarios involved removing virtually all of the SGGE roads, except the public access route along Everglades and Stewart Boulevards between Janes Scenic Drive and North Golden Gate Estates, those needed to maintain pumps and for management purposes, and some for access to private property adjacent to SGGE. In Alternative 17 only those roads in the vicinity of Prairie Canal are removed. A summary of the major components in each of these alternatives is shown in (Table 3).

Alternative 3d involved three pumps, one each on Miller, Faka-Union and Merritt Canals, a dike at each pump to keep water from moving overland to the north after being pumped from each canal, and spreader canals to recreate sheet flow downstream of the pumps. Pumping rates were based on actual flows measured at the outlet of the canal system just north of Tamiami Trail. These flows were apportioned among the four canals, with 50 percent coming from the Faka-Union Canal, 20 percent each from Miller and Merritt Canals, and 10 percent from Prairie Canal.

Alternative 6 was designed to create a passive water management system . It involved filling all of Prairie Canal and the other three canals south of Stewart Blvd.

Alternative 7 was similar to Alternative 6, with small pumps and associated spreader canals located at the top of the filled portions of Merritt, Faka Union, and Miller Canals.

Alternative 8 was created to deal with increased flooding in North Golden Gate Estates (NGGE), without using pumps. It maintains the conveyance of Miller and Faka Union Canals, and transfers upstream flows into Merritt Canal to a widened Faka Union Canal. Prairie and Merritt Canals are filled, except for a small portion at the north end of Merritt Canal. Control structures and other features will be located in Miller and Faka Union Canals to limit dry season drainage of SGGE and to enhance sheetflow through the area, while allowing uninhibited conveyance of flood flows.

Alternative 9 is similar to Alternative 8, with all but a small northern section of Miller Canal filled and its flows transferred to a widened Faka Union Canal.

Alternatives 11, 12, and 13 all involve filling canals, most of which require installation of pumps and spreader canals below the pumps, and installing weirs in the remaining canals that are not filled. In all three alternatives, Prairie and Merritt Canals would be filled (Table 3). Faka Union Canal would be filled in Alternative 12, while Miller Canal would be filled in Alternative 11.

	ALTERNATIVES									
COMPONENTS	**3D**	**6**	**7**	**8**	**9**	**11**	**12**	**13**	**17**	**19**
Improve conveyance Faka Union Canal North of I-75										X
Improve conveyance Faka Union Canal South of I-75				X	X					
Plug Prairie Canal	X	X	X	X	X	X	X	X	N-S	X
Plug Merritt Canal	X	S1/3	S1/3	X	X	X	X	X		X
Plug Faka Union Canal	X	S1/3	S1/3				X			
Plug Miller Canal	X	S1/3	S1/3		X	X				X
Merritt Pump/Spreader Canal	X		X			X	X	X		X
Faka Union Pump/Spreader Canal	X		X				X			
Miller Pump/Spreader Canal	X		X			X				X
Merritt-to-Faka Union Connector Canal (with weir)				X (w)	X (w)					X
Miller-to-Faka Union Connector Canal (with weir)					X (w)					X
Faka Union Canal Weirs				4	4	3		3		
Miller Canal Weirs				5			3	3		
Faka Union Canal Weir and Small Pump						1				2
Berms on Both Sides of Upper Faka Union Canal										X
Berm on West Side of Lower Faka Union Canal	X	X	X	X	X	X	X	X		X
Private Lands Berms	X	X	X	X	X	X	X	X		X
Road Removal (Partial/Most)	Most	Most	Most	Most	Most	Most	Most	Most	Partial	Most

Table 3. A synopsis of the major components of each restoration alternative. S1/3 indicates the southern third of the canal will be plugged. N-S indicates that only the north-south section of the canal will be plugged. Numbers indicate the number of weirs to be installed. Partial road removal indicates only those roads in the vicinity of the canal will be removed.

Alternative 17 only involves filling of the north-south section of Prairie Canal and removal of roads east of Patterson Blvd and south of 79th Ave.

The main features of Alternative 19 involve filling all but Faka Union Canal, and creating a spreader canal along the south side of I-75 that connects Miller, Faka Union, and Merritt Canals. Pumps located on the spreader canal on both sides of Faka Union Canal would move water onto the SGGE land surface, and levees along the northern two-thirds of Faka Union Canal in SGGE are intended to keep this water from re-entering the canal. Gates and small pumps at the upper and lower end of the bermed section of this canal in SGGE are meant to move water upstream during the dry season to reduce flows to the coast at this time of year.

Hydrology – Plant Community Resource Evaluation

There were two phases in the SGGE Resource Evaluation. The first evaluated the ten alternatives, including 3d, 6, 7, 8, 9, 11, 12, 13, 17, and 19, and identified 3d, 6, and 12 as the three best alternatives. During the second phase, additional improvements were made in the MIKE SHE/MIKE11 model, so that the new output for alternatives 3d, 6, and 12 could not be compared with the output for the other seven alternatives, which was produced by an earlier version of the model. Thus, the second phase of the SGGE Resource Evaluation discusses only alternatives 3d, 6, and 12.

Wet season water depths (July 1 to October 1) were the primary hydrologic data used to evaluate environmental conditions associated with the three bases and ten alternatives. The data were for 1994, which was considered an average year for the period of record from 1988 to 2000. In addition, using the MIKE SHE/MIKE11 model we evaluated similar environmental conditions in the public lands adjacent to SGGE. These included Fakahatchee Strand (FS) to the east, Belle Meade (BM) to the west, and the Florida Panther National Wildlife Refuge (FPNWR) to the northeast in Phase One. Collier Seminole State Park was added in Phase Two.

Average wet season water levels from July 1 through October 1 are considered to be closely related to hydroperiod (Table 1). These two hydrologic parameters are important determinants of the long-term distribution of the major types of plant communities in the Big Cypress (Duever 1984). Based on this correspondence between water depths and major plant community types, we estimated the acreage of each community from the number of cells (each cell equals 51.65 acres) within each range of water depths that is associated with each Base and Restoration Alternative. The 2003 version of the MIKE SHE model has incorporated numerous improvements in the data upon which it is based. The spatial pattern of relative water depths is generally reasonable in that the deeper wetlands are where they ought to be. As discussed previously, since the pattern of plant communities on the MIKE SHE maps will not closely match those shown on the NRCS maps, our analyses will compare relative plant community distributions and acreages provided by the MIKE SHE/MIKE11 model for each of the three base conditions with the ten restoration alternatives. Comparison of alternatives with the natural condition will allow us to assess how close the alternative brings us to meeting our restoration target, which is the natural condition. Comparison of the alternatives to the 2050-without-project condition allows us to calculate restoration benefits in terms of habitat units as required by the federal process, while comparison with existing conditions provides a sense of how the current SGGE will be changed by each alternative.

Phase One

Natural Base. Based on average wet season water depths predicted by the MIKE SHE model, the major flowway in SGGE is a cypress strand located along the central portion of the Faka Union Canal in SGGE (Appendix A, Figure A-79). This forested wetland extends north-northeast to the upper end of the Merritt Canal and south-southwest to the lower end of the north-south portion of Miller Canal. Wet prairie surrounds the main strand, and forms a major slough extending southeast from the main strand to the junction of the Faka Union Canal and U.S. 41. There are also several flowways dominated by a mix of cypress and wet prairies that flow from the northwest into the main cypress strand. Upland communities are most prominent at the north and south ends of Prairie Canal and the south end of north-south portion of the Faka Union Canal.

Water depths appropriate for cypress and marsh communities and the associated slightly deeper open waters made up 32 percent of the SGGE model area, wet prairie made up 33 percent, and mesic and hydric communities made up 15 and 19 percent, respectively (Figure 3, Table 4).

One thing to remember when evaluating differences in above-ground water depths between the Natural Base and the other two Bases and all of the Alternatives is that the upland areas in the Natural condition will still likely be upland areas under all of the other conditions. Thus, while groundwater levels may have risen following implementation of a restoration alternative, this would not be expected to be reflected in an increase in wetlands in these areas, unless more water was present than under natural conditions.

Existing Base. With the exception of only minor areas of wetland communities in the northeast corner of SGGE and just north of Tamiami Trail, the MIKE SHE model indicates that 90% of SGGE currently supports mesic communities (Appendix A, Figure A-80). However, in reality there are significantly greater acreages of wetland communities on the current landscape as shown in the NRCS map (Table 2). It is important to remember that the MIKE SHE model estimates hydrologic conditions, not plant communities, and that we are making the assumption there is a correspondence between patterns of long-term hydrology and major plant communities. Given the short time since drainage, SGGE plant communities are still in transition from their Natural pre-drainage condition to an ecosystem that will be created over the long term in response to the new combination of hydrologic, fire, and edaphic conditions that currently exist, as modified by the mix of invasive species that are coming to dominate parts of the area. Thus, it is not unexpected that the current plant communities are not necessarily distributed as predicted by the model, although they are well on their way to the establishment of this new drier ecosystem.

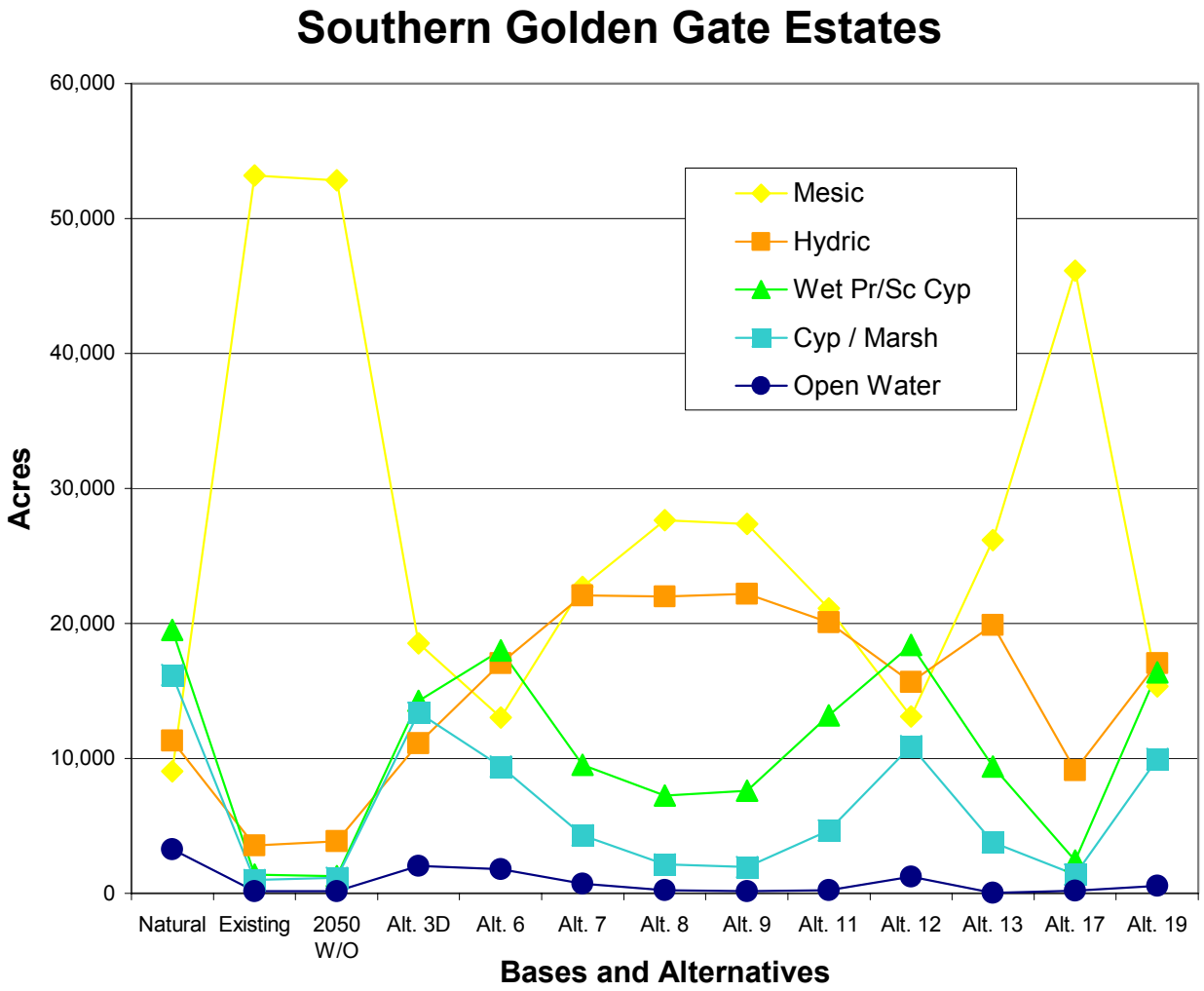

Figure 3. Acreages of hydrologically related SGGE plant communities predicted by the MIKE SHE model for the three Base conditions and for each of the initial ten restoration Alternatives.

Plant Communities	Aver. Wet Season Water Depth (ft)	South Golden Gate Estates Base Conditions and Restoration Alternatives												
		Natural	Existing	2050 W/O	Alt. 3D	Alt. 6	Alt. 7	Alt. 8	Alt. 9	Alt. 11	Alt. 12	Alt. 13	Alt. 17	Alt. 19
		South Golden Gate Estates Plant Community Acreages												
Mesic	**< 0.2**	9,039	53,203	52,841	18,544	13,017	22,728	27,634	27,376	21,126	13,120	26,188	46,643	15,341
Hydric	**0.2 - 0.5**	11,312	3,564	3,874	11,105	17,045	22,056	22,004	22,211	20,093	15,651	19,886	8,833	17,045
Wet Pr / Sc Cyp	**0.5 - 1**	19,525	1,395	1,291	14,257	18,027	9,504	7,231	7,593	13,172	18,388	9,401	2,324	16,374
Cyp / Marsh	**1 - 2**	16,167	981	1,136	13,378	9,401	4,287	2,169	1,963	4,649	10,899	3,771	1,395	9,969
Open Water	**> 2**	3,254	155	155	2,014	1,808	723	258	155	258	1,240	52	103	568
Totals		59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298	59,298
		South Golden Gate Estates Plant Community (Percent of Natural)												
Mesic	**< 0.2**	100	589	585	205	144	251	306	303	234	145	290	516	170
Hydric	**0.2 - 0.5**	100	32	34	98	151	195	195	196	178	138	176	78	151
Wet Pr / Sc Cyp	**0.5 - 1**	100	7	7	73	92	49	37	39	67	94	48	12	84
Cyp / Marsh	**1 - 2**	100	6	7	83	58	27	13	12	29	67	23	9	62
Open Water	**> 2**	100	5	5	62	56	22	8	5	8	38	2	3	17
		South Golden Gate Estates Plant Community (Percent of Existing)												
Mesic	**< 0.2**		100	99	35	24	43	52	51	40	25	49	88	29
Hydric	**0.2 - 0.5**		100	109	312	478	619	617	623	564	439	558	248	478
Wet Pr / Sc Cyp	**0.5 - 1**		100	93	1022	1293	681	519	544	944	1319	674	167	1174
Cyp / Marsh	**1 - 2**		100	116	1363	958	437	221	200	474	1111	384	142	1016
Open Water	**> 2**		100	100	1300	1167	467	167	100	167	800	33	67	367
		South Golden Gate Estates Plant Community (Percent of 2050 W/O)												
Mesic	**< 0.2**			100	35	25	43	52	52	40	25	50	88	29
Hydric	**0.2 - 0.5**			100	287	440	569	568	573	519	404	513	228	440
Wet Pr / Sc Cyp	**0.5 - 1**			100	1,104	1,396	736	560	588	1,020	1,424	728	180	1,268
Cyp / Marsh	**1 - 2**			100	1,177	827	377	191	173	409	959	332	123	877
Open Water	**> 2**			100	1,300	1,167	467	167	100	167	800	33	67	367
		South Golden Gate Estates Plant Community Acreages (Percent of Total Acres)												
Mesic	**< 0.2**	15	90	89	31	22	38	47	46	36	22	44	79	26
Hydric	**0.2 - 0.5**	19	6	7	19	29	37	37	37	34	26	34	15	29
Wet Pr / Sc Cyp	**0.5 - 1**	33	2	2	24	30	16	12	13	22	31	16	4	28
Cyp / Marsh	**1 - 2**	27	2	2	23	16	7	4	3	8	18	6	2	17
Open Water	**> 2**	5	0	0	3	3	1	0	0	0	2	0	0	1
Totals		100	100	100	100	100	100	100	100	100	100	100	100	100

Table 4. Acreages of the major SGGE plant community types predicted by the MIKE SHE model for the three bases and ten Phase One restoration alternatives. Percentages (x100) for each community type acreage are also calculated as a function of their acreage of each in the three base scenarios and as a function of the total SGGE acreage for each scenario.

Looking at differences between Natural and Existing above ground water depths, where each of the three wetland classes originally occupied 19-33% of SGGE, they currently occupy only 2-6% of SGGE. (Table 4, Figure 3).

2050-Without-Project Base. With the canals in place for many years, the MIKE SHE model still estimated that 89% of SGGE was dominated by mesic communities (Appendix A, Figure A-81). Some mix of pine flatwoods or palm hammocks will occur where fires are frequent, while a variety of types of hardwood hammocks will occur where fires have been infrequent. Wet prairies, marshes, and cypress were still confined to relatively small areas in the northeastern corner of SGGE and north of Tamiami Trail.

Conditions in SGGE are essentially identical in the Existing and 2050-Without-Project Bases. Thus, looking at differences between Natural and 2050-Without-Project above ground water depths, conditions remain similar to those in the Existing Base with only about 2-7% of SGGE occupied by each of the three wetland classes (Table 4, Figure 3).

Alternative 3d. This restoration design increased water depths substantially from the 2050-Without-Project Base condition in most of the areas downstream of the pumps, while retaining the drained condition upstream of the pumps . Maintenance of some of the mesic communities acreage in the northwest corner of SGGE was intentional to maintain upland habitat for wildlife in this area. This was accomplished by locating the pumps and spreader canals on Miller and Faka Union Canals some distance south of I-75. Otherwise, the pattern of plant communities was generally similar to that in the Natural Base condition. However, there were more extensive areas of lower water levels in the northern portion of SGGE below the pumps and higher water levels over a larger area in the southern and southwestern portions. The major cypress strand and associated open water in the vicinity of the filled Faka Union Canal was reestablished. It now extends to the northeast along the upper portion of Merritt Canal and to the southwest along the lower portion of Miller Canal and the lands below the southwest corner of the SGGE canal system. Wet prairies surround the major cypress strand, and now dominate a broader area to the east, south, and southwest than they did under Natural conditions. The area around Prairie Canal approximates Natural conditions in this alternative. It appears that water being passed by the pumps is being captured by the major flowway and is being moved rapidly to the south and southwest, resulting in larger areas of wetlands there and smaller areas of wetlands to the north below the pumps compared to Natural conditions.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 3d and the three Bases (Table 4, Figure 3). However, these differences were among the smallest for the alternatives, when compared to the Natural Base. The acreage of upland mesic communities were still about double what they were under Natural conditions, with about half of this increase due to area intentionally left drained north of the pumps. Hydric community acreages are similar, while the wet prairie and cypress communities were approximately 75-85% of their pre-drainage acreage, and open water, which is primarily a deeper cypress habitat, was about two-thirds of its pre-drainage acreage. When compared to both the Existing and 2050-Without-Project Bases, 3d has about a third of the acreage of upland mesic communities, approximately 3 times as much hydric acreage, and over 10 times as much acreage of each of the wet prairie, cypress, and open water communities.

Alternative 6. This alternative had one of the lowest acreages of upland mesic communities (22% of SGGE) of all of the restoration alternatives (Table 4). The increased wetland area was made up largely of the shallower hydric and wet prairie communities, while the acreage of cypress decreased from that in Alternative 3d, and open water occupied a similar acreage. The wetter-than-Natural conditions in the southern half of SGGE were similar to those found in Alternative 3d. The northwestern portion of SGGE was somewhat wetter than in 3d because the pumps were not pulling water out of this area. It was interesting that the area in the northern portion of Prairie Canal was wetter than under either Natural or Alternative 3d conditions. The blocking of Merritt Canal near I-75 in Alternative 3d raised water levels in this area, and it appeared that these overland flows were then captured by the major flowway and carried quickly to the southwest, as appeared to occur under Natural conditions. In Alternative 6, flows continued south in Merritt Canal, but were then blocked below Stewart Blvd. This could have then backed water up north of Stewart, but not to the extent that it would be entrained in the southwestward flowway, resulting in the observed higher water levels in the northeastern portion of SGGE.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 6 and the three Bases (Table 4, Figure 3). Compared to the Natural Base, acreages of mesic and hydric communities were about 1.5 times greater, wet prairie was about the same, and the acreage of cypress and open water communities were reduced to about 60%. When compared to both the Existing and 2050-Without-Project Bases, Alternative 6 had about a quarter of the acreage of upland mesic communities, and approximately 4.5, 13, 9, and 12 times as much acreage of hydric, wet prairie, cypress, and open water communities, respectively.

Alternative 7. This alternative produced a similar pattern of water depths to that seen in Alternative 6, but the area affected and the depths present were greatly reduced. Logically, when compared to Alternative 6, the pumps and spreader canals should have increased water depths below the pumps and reduced them above the pumps, although the size of the pumps were much smaller than those used in Alternative 3d. While there was some reduction in water depths upstream, there was a much greater reduction downstream. A possible explanation is problems with the way the pumps and spreaders were modeled in Alternative 7, since the pattern of water depths in the area around Prairie Canal was similar in both Alternatives 6 and 7, where the canal was only filled and no pumps were used.

SGGE was much drier in Alternative 7 compared to the Natural Base. Mesic acreage was 2.5 times greater, and the acreage of the shallow hydric communities was twice as great (Table 4, Figure 3). Acreage of wet prairie was only 50% and cypress and open water only about 25% of that in the Natural condition. . In Alternative 7, the large central wetland along Faka Union Canal was greatly reduced, although wetlands were still more extensive along Prairie Canal, probably for the same reason as was discussed in Alternative 6. There were major quantitative differences in acreages of the above ground water depth classes between Alternative 7 and Existing and 2050 Without Project Bases. Alternative 7 has about half of the acreage of upland mesic communities, and approximately 4 to 7 times as much acreage of hydric, wet prairie, cypress, and open water communities.

Alternative 8. Wetland restoration associated with Alternative 8 is primarily limited to the area around Prairie Canal. Filling of Merritt Canal and the weirs in the other canals did result in additional localized wetland restoration, which were primarily hydric communities, and to a lesser extent, wet prairies. The lack of restoration was likely due to the routing of water from Merritt Canal to an enlarged Faka Union Canal and the limited ability of the weirs in Faka Union and Miller Canals to create overland flow and limit dry season drainage.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 8 and the three Bases (Table 4, Figure 3). In Alternative 8, acreages of cypress and wet prairie communities are about 10% and 40%, respectively of those in the Natural Base, while acreages of hydric and mesic communities are 2 and 3 times higher, respectively. When compared to both the Existing and 2050-Without-Project Bases, Alternative 8 has about half of the acreage of upland mesic communities, approximately 6 times as much acreage of hydric and wet prairie, and about twice as much acreage of cypress and open water communities.

Alternative 9. There was little difference in the plant community patterns or acreages between Alternatives 8 and 9. There was some additional wetland restoration along the Miller Canal now that it had been filled, but this was limited because most of its water coming from NGGE was now routed east to an even more greatly enlarged Faka Union Canal. Again, the weirs in Faka Union Canal did not seem to be able to restore overland flows, except in limited areas.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 9 and the three Bases (Table 4, Figure 3). In Alternative 9, acreages of cypress and wet prairie communities were again about 10% and 40%, respectively, of those in the Natural Base, while acreages of hydric and mesic communities were about 2 and 3 times higher, respectively. When compared to both the Existing and 2050-Without-Project Bases, Alternative 9 had about half of the acreage of upland mesic communities, approximately 6 times as much acreage of hydric and wet prairie, about twice as much acreage of cypress, and the same acreage of open water communities.

Alternative 11. Most of the wetland restoration in Alternative 11 occurred in the Prairie and Merritt Canals, particularly in their northern portions where water depths were generally deeper than in the Natural Base condition. Filling of Miller Canal and the weirs in the Faka Union Canal did result in additional localized wetland restoration. The lack of more complete restoration was likely due to a number of factors, particularly the presence of the Faka Union Canal in the center of the major SGGE flowway, which allowed this canal to quickly drain this surface feature. Another factor was the weirs in Faka Union Canal, which had a very limited ability to create the amount of overland flow that occurred in the Natural Base. In addition, the natural surface topography facilitated the movement of surface flows from the upper portions of the plugged Miller and Merritt Canals to the Faka Union Canal, where they were sent quickly to the estuary.

There were large quantitative differences in acreages of the above ground water depth classes between Alternative 11 and the Natural Base (Table 4, Figure 3). Mesic and hydric communities occupied about twice the pre-drainage acreage. Among the deeper wetland communities, wet prairie occupied only about two-thirds of its original acreage, and cypress only about a third. When compared to both the Existing and 2050-Without-Project Bases, Alternative 11 has about 40% of the acreage of upland mesic communities, and approximately 5, 10, 4, and 1.5 times as much acreage of hydric, wet prairie, cypress, and open water communities, respectively.

Alternative 12. This alternative increases water depths over a significant portion of SGGE. Cypress water depths occur over extensive areas of the deep flowway in the central portion of the Faka Union Canal in SGGE, and extend to the northeast to the upper end of Merritt Canal. This cypress wetland does not extend southwest to the Miller Canal, as it did in Alternative 3d, because the two weirs do not appear to adequately reduce drainage in the north-south section of Miller Canal so as to maintain overland flow in this area. There was some open water present in the deeper portions of this flowway in the vicinity of the Faka Union Canal. Water levels were also raised to the east of the large cypress wetland so that wet prairie water depths extend almost the whole length of Merritt Canal and the northern portion of Prairie Canal. The weirs in the southern east-west portion of Miller Canal appear to be moving water into the wetlands north of Tamiami Trail, creating marsh and wet prairie water depths.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 12 and the three Bases (Table 4, Figure 3). However, these differences were among the smallest among the alternatives, when comparing Alternative 12 to the Natural Base. Acreages of mesic and hydric communities were about 1.4 times those in the Natural Base condition, while wet prairie acreage was similar and cypress was about two-thirds. When compared to both the Existing and 2050-Without-Project Bases, Alternative 12 has about a quarter of the acreage of upland mesic communities, and approximately 4, 14, 10, and 8 times as much acreage of hydric, wet prairie, cypress, and open water communities, respectively.

Alternative 13. There is a small area of cypress water depths at the north end of Merritt Canal, which is bordered by wet prairie to the south, east, and west. The wet prairie extends along the northern half of Prairie Canal and much of the length of Merritt Canal. Hydric communities border the wet prairie and occupy much of the area between Prairie and Faka Union Canals. Otherwise there are only small, scattered wetlands west of Faka Union Canal and north of Tamiami Trail, as the weirs do not appear to be creating overland flow along Faka Union and Miller Canals.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 13 and the three Bases (Table 4, Figure 3). Compared to Natural conditions, there was approximately three and two times the acreage of mesic and hydric communities, respectively, and only half and a quarter of the wet prairie and cypress acreages, respectively. When compared to both the Existing and 2050-Without-Project Bases, Alternative 13 has about half of the acreage of upland mesic communities, approximately 3 to 7 times as much acreage of hydric, wet prairie, and cypress communities, and about a third of the acreage of open water communities.

Alternative 17. Greater water depths, supporting primarily hydric communities, were present in the northern portion of Prairie Canal as a result of filling the north-south portion of the canal. Groundwater levels increased along the whole length of the canal, but the topography of the southern portion is apparently sufficiently high that the water table did not rise above the ground surface, either under Natural Base or Alternative 17 conditions.

Since Alternative 17 was designed to affect only a small portion of SGGE, it was not surprising that there were still relatively large differences in acreages of the above ground water depth classes between Alternative 17 and the Natural Base and relatively small differences between the alternative and both Existing and 2050-Without-Project Base conditions (Table 4, Figure 3). The upland mesic communities still made up over 5 times the acreage that was present in the Natural Base. In terms of wetlands, hydric communities made up about three-quarters, and wet prairie, cypress, and open water only about 3-12% of the acreage present in the Natural Base. When compared to both the Existing and 2050-Without-Project Bases, Alternative 17 has only slightly less acreage of upland mesic communities. The largest increase in wetlands was a 1.5-2.5 times increase in the acreages of hydric and wet prairie communities, and an only slightly increased acreage of cypress.

Alternative 19. This alternative produced a pattern of increased water depths that was similar to Alternative 3d, which had a deep cypress flowway centered on the Faka Union Canal and extending northeast to Merritt Canal and southwest to Miller Canal. The main differences were that there were more wetlands further north because the pumps and spreader canal were located further north, and fewer wetlands further south because Faka Union Canal was left open and continued to drain this and the surrounding areas. The latter factor also accounted for the reduction in the large open water area that was present in Alternative 3d. The main flowway is bordered by wet prairie, which extends south along Merritt Canal and east across the central portion of Prairie Canal. Hydric communities fringe the wet prairie and extend along the northern portion of Prairie Canal and the southern portion of Merritt Canal. Miller Canal is bordered by primarily wet prairie communities, and some hydric and cypress communities. Filling three of the canals has increased water depths around them. In addition, the berm bordering the northern portion of the Faka Union Canal in SGGE, along with pumping from the spreader canal south of I-75, appears to be maintaining above ground water depths in lands adjacent to this portion of the canal. The area around the northern portion of Prairie Canal has slightly deeper water depths than in the Natural Base.

Compared to most of the other alternatives, there were relatively minor quantitative differences in acreages of the above ground water depth classes between Alternative 19 and the Natural Base, and major differences between it and the Existing or 2050-Without-Project Bases (Table 4, Figure 3). Alternative 19 had only about 1.5 times the acreage of mesic and hydric communities as did the Natural Base. It had an only slightly lower acreage of wet prairie, and about two-thirds the acreage of cypress. When compared to both the Existing and 2050-Without-Project Bases, Alternative 19 has about a third of the acreage of upland mesic communities, and approximately 5, 12, 9, and 4 times as much acreage of hydric, wet prairie, cypress, and open water communities, respectively.

Phase One Summary. Since the target for SGGE restoration was pre-drainage Natural system conditions, the best Alternatives were those that most closely approximated that condition, not necessarily those providing the largest amount of wetlands. In this analysis we focused on acreage of the major plant community types associated with particular hydrologic regimes, the only information that the model was able to provide. We did not specifically focus on restoring the original distribution of major types of plant communities. This was accomplished to varying degrees depending on the Alternative simply because of the topography in SGGE. However, other areas were wetter or drier than they were originally due the location of features in each Alternative, such as which canals were filled and where, location and size of pumps, location of weirs, presence of berms, etc. There really was no way of restoring the original distribution of communities in SGGE as long as drainage of NGGE had to be maintained.

When looking at which Alternatives most closely approximated the pre-drainage Natural condition, there were three that came the closest (Table 4). These were Alternatives 3d, 6, and 12. Alternatives 6 and 12 most closely approximated the original acreage of the mesic communities, followed by Alternatives 3d and 19. Alternatives 3d and 17 were closest in terms of hydric communities, followed by Alternatives 6, 12, and 19. Alternatives 6, 12 and 19 were closest for the wet prairies, followed by Alternatives 3d and 11. Alternative 3d was closest for cypress, followed by Alternatives 6, 12, and 19. Alternatives 3d and 6 were closest for open water, followed by Alternative 12.

Phase Two

The new model runs for the three Bases and Alternatives 3d, 6, and 12 were completed in December. There were relatively small differences in the SGGE water depth / plant community acreages for the three Bases or Alternative 3d. However, there were substantial differences for Alternatives 6 and 12 (Table 5).

Requirements for protecting private property from flooding within the restoration area mandated the creation of berms around these sites. Within SGGE this amounted to 930 acres. While the berms were not included in the MIKE SHE model, in assessing restoration these areas were included in the acreage numbers as mesic communities, regardless of their plant community designation on the average wet season water depth maps. Since these berms would only exist as part of a restoration alternative, this adjustment of the data was not done for the three Bases.

Natural Base. Based on average wet season water depths predicted by the MIKE SHE model, the major flowway in SGGE is a cypress strand located along the central portion of the Faka Union Canal (Figure A-79). This forested wetland extends north-northeast to the upper end of the Merritt Canal and south-southwest to the lower end of the north-south portion of Miller Canal. Wet prairie surrounds the main strand, and forms a major slough extending southeast from the main strand to the junction of the Faka Union Canal and U.S. 41. There are also several flowways dominated by a mix of cypress and wet prairies that flow from the northwest into the main cypress strand. Upland communities are most prominent at the north and south ends of Prairie Canal and the south end of north-south portion of the Faka Union Canal.

Southern Golden Gate Estates Base Conditions and Restoration Alternatives							
Plant Communities	Aver. Wet Season Water Depth (ft)	Natural	Existing	2050 W/O	Alt. 3D	Alt. 6	Alt. 12
Southern Golden Gate Estates Plant Community Acreages							
Mesic	**< 0.2**	9,194	55,058	54,078	18,388	26,394	22,210
Hydric	**0.2 - 0.5**	11,260	2,273	3,254	10,433	7,386	11,156
Wet Pr / Sc Cyp	**0.5 - 1**	19,420	878	1,033	14,720	11,363	14,152
Cyp / Marsh	**1 - 2**	16,166	930	826	13,739	11,518	10,433
Open Water	**> 2**	3,254	155	103	2,014	2,634	1,343
Totals		59,294	59,294	59,294	59,294	59,294	59,294
Southern Golden Gate Estates Community (Percent of Natural)							
Mesic	**< 0.2**	100	599	588	200	287	242
Hydric	**0.2 - 0.5**	100	20	29	93	66	99
Wet Pr / Sc Cyp	**0.5 - 1**	100	5	5	76	59	73
Cyp / Marsh	**1 - 2**	100	6	5	85	71	65
Open Water	**> 2**	100	5	3	62	81	41
Southern Golden Gate Estates Plant Community (Percent of Existing)							
Mesic	**< 0.2**		100	98	33	48	40
Hydric	**0.2 - 0.5**		100	143	459	325	491
Wet Pr / Sc Cyp	**0.5 - 1**		100	118	1677	1294	1612
Cyp / Marsh	**1 - 2**		100	89	1477	1238	1122
Open Water	**> 2**		100	66	1300	1700	867
Southern Golden Gate Estates Plant Community (Percent of 2050 W/O)							
Mesic	**< 0.2**			100	34	49	41
Hydric	**0.2 - 0.5**			100	321	227	343
Wet Pr / Sc Cyp	**0.5 - 1**			100	1,425	1,100	1,370
Cyp / Marsh	**1 - 2**			100	1,663	1,394	1,263
Open Water	**> 2**			100	1,995	2,557	1,304
Southern Golden Gate Estates Plant Community Acreages (Percent of Total Acres)							
Mesic	**< 0.2**	16	93	92	31	45	37
Hydric	**0.2 - 0.5**	19	4	5	18	12	19
Wet Pr / Sc Cyp	**0.5 - 1**	33	1	2	25	19	24
Cyp / Marsh	**1 - 2**	27	2	1	23	19	18
Open Water	**> 2**	5	0	0	3	4	2
Totals		100	100	100	100	100	100

Table 5. Acreages of the major SGGE plant community types predicted by the MIKE SHE model for the three bases and three Phase Two restoration alternatives. Percentages (x100) for each community type acreage are also calculated as a function of their acreage of each in the three base scenarios and as a function of the total SGGE acreage for each scenario.

Water depths appropriate for cypress and marsh communities and the associated slightly deeper open waters made up 32 percent of the SGGE model area, wet prairie made up 33 percent, and mesic and hydric communities made up 16 and 19 percent, respectively (Table 5, Figure 4).

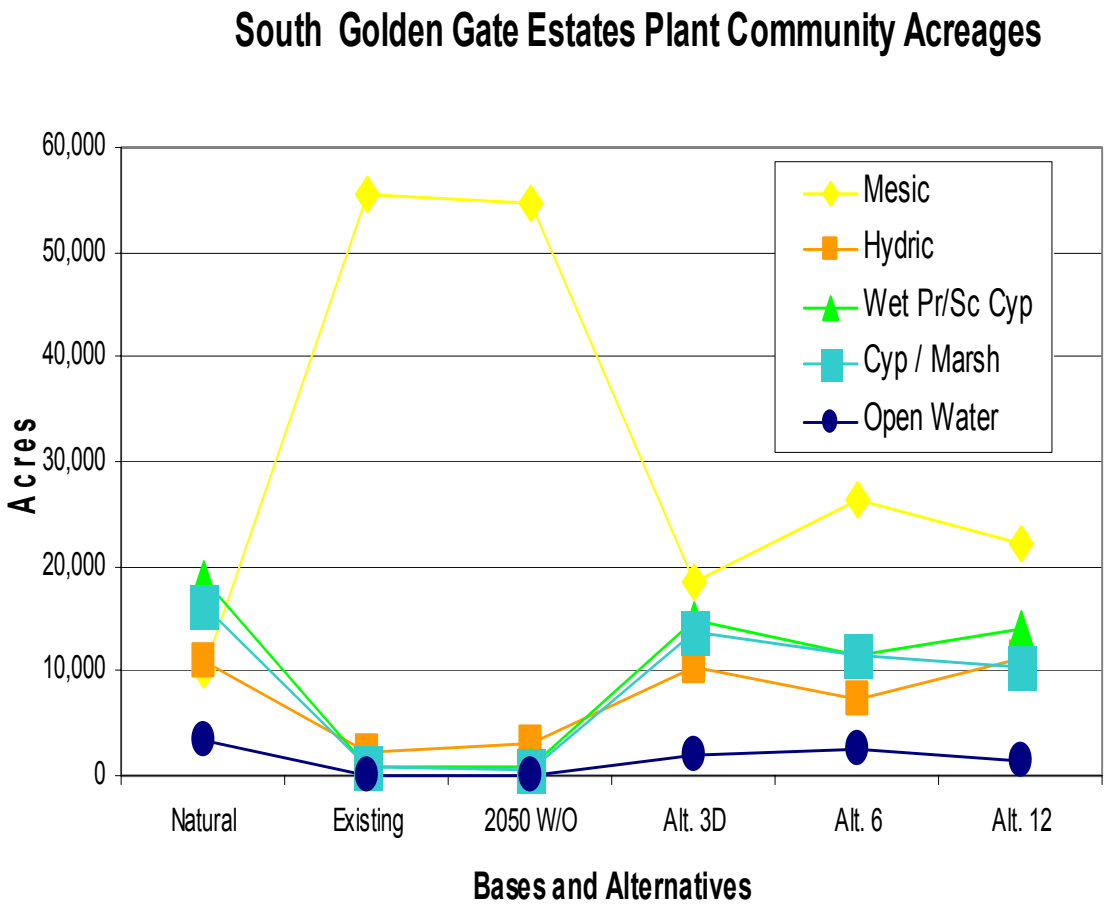

Figure 4. Acreages of the hydrologically related SGGE plant communities predicted by the MIKE SHE model for the three Base conditions and for each of the final three restoration Alternatives.

One thing to remember when evaluating differences in above-ground water depths between the Natural Base and the other two Bases and all of the Alternatives is that the upland areas in the Natural condition will still likely be upland areas under all of the other conditions. Thus, while groundwater levels may have risen following implementation of a restoration alternative, this would not be expected to be reflected in an increase in wetlands in these areas, unless more water was present than under natural conditions.

Existing Base. With the exception of only minor areas of wetland communities in the northeast corner of SGGE and just north of Tamiami Trail, the MIKE SHE model indicates that 93% of SGGE currently supports mesic communities (Figure A-80). However, in reality there are significantly greater acreages of wetland communities on the current landscape as shown in the NRCS map (Table 2). It is important to remember that the MIKE SHE model estimates hydrologic conditions, not plant communities, and that we are making the assumption there is a correspondence between patterns of long-term hydrology and major plant communities. Given the short time since drainage, SGGE plant communities are still in transition from their Natural

pre-drainage condition to an ecosystem that will be created over the long term in response to the new combination of hydrologic, fire, and edaphic conditions that currently exist, as modified by the mix of invasive species that are coming to dominate parts of the area. Thus, it is not unexpected that the current plant communities are not necessarily distributed as predicted by the model, although they are well on their way to the establishment of this new drier ecosystem.

Looking at differences between Natural and Existing above ground water depths, where each of the three wetland classes originally occupied 19-33% of SGGE, they currently occupy only 1-4% of SGGE. (Table 5, Figures 4).

2050-Without-Project Base. With the canals in place for many years, the MIKE SHE model still estimated that 91% of SGGE was dominated by mesic communities (Figures A-81). Some mix of pine flatwoods or palm hammocks will occur where fires are frequent, while a variety of types of hardwood hammocks will occur where fires have been infrequent. Wet prairies, marshes, and cypress were still confined to relatively small areas in the northeastern corner of SGGE and north of Tamiami Trail.

Conditions in SGGE are essentially identical in the Existing and 2050-Without-Project Bases. Thus, looking at differences between Natural and 2050-Without-Project above ground water depths, conditions remain similar to those in the Existing Base with only about 1-5% of SGGE occupied by each of the three wetland classes (Table 5, Figure 4).

Alternative 3d. This restoration design increased water depths substantially from the 2050-Without-Project Base condition in most of the areas downstream of the pumps, while retaining the drained condition upstream of the pumps (Figure A-82). Maintenance of some of the mesic community acreage in the northwest corner of SGGE was intentional to maintain upland habitat for wildlife in this area. This was accomplished by locating the pumps and spreader canals on Miller and Faka Union Canals some distance south of I-75. Otherwise, the pattern of plant communities was generally similar to that in the Natural Base condition. However, there were more extensive areas of lower water levels in the northern portion of SGGE below the pumps and higher water levels over a larger area in the southern and southwestern portions. The wetter-than-Natural conditions in the southern half of SGGE were probably due to the increased amount of water moving south to maintain drainage in NGGE. The major cypress strand and associated open water in the vicinity of the filled Faka Union Canal was reestablished. It now extends to the northeast along the upper portion of Merritt Canal and to the southwest along the lower portion of Miller Canal and the lands below the southwest corner of the SGGE canal system. Wet prairies surround the major cypress strand, and now dominate a broader area to the east than they did under Natural conditions. The area around Prairie Canal approximates Natural conditions in this alternative, except for the absence of the band of wetlands across the center of the canal. There appears to be an artificial barrier to east-west flow between Merritt and Prairie Canals as suggested by the straight edge between the mesic and hydric communities in this area. As a result, water being passed by the Merritt Canal pump is being captured by the major flowway and is being moved rapidly to the south and southwest, resulting in larger areas of wetlands there and smaller areas of wetlands to the north below the pumps compared to Natural conditions.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 3d and the three Bases (Table 5, Figure 4). However, these differences were the smallest for the three alternatives, when compared to the Natural Base. The acreage of upland mesic communities were still about double what they were under Natural conditions, with about half of this increase due to the area intentionally left drained north of the pumps. Hydric community acreages are similar, while the wet prairie and cypress communities were approximately 75-85% of their pre-drainage acreage, and open water, which is primarily a deeper cypress habitat, was about two-thirds of its pre-drainage acreage. When compared to both the Existing and 2050-Without-Project Bases, 3d has about a third of the acreage of upland mesic communities, approximately 4 times as much hydric acreage, and 13-17 times as much acreage of each of the wet prairie, cypress, and open water communities.

Alternative 6. This alternative had the highest acreage of upland mesic communities (45% of SGGE) of the three restoration alternatives (Table 5, Figure A-83). There was a smaller acreage of all wetland communities compared to Alternative 3d, except open water, and for the two shallower wetland classes when compared to Alternative 12. The wetter-than-Natural conditions in the southern half of SGGE were similar to those found in Alternative 3d, and again were probably due to the increased amount of water moving south to maintain drainage in NGGE.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 6 and the three Bases (Table 5, Figure 4). These differences were generally greater than those for the other two alternatives, when compared to the Natural Base. The acreage of mesic communities were almost 3 times greater, while the three wetland communities were about 60-70% of the Natural condition. When compared to both the Existing and 2050-Without-Project Bases, Alternative 6 had about half of the acreage of upland mesic communities, approximately 2-3 times as much acreage of the hydric communities, and 11-17 times as much acreage of wet prairie, cypress, and open water communities.

Alternative 12. This alternative increases water depths over a significant portion of SGGE. Cypress water depths occur over extensive areas of the deep flowway in the central portion of the Faka Union Canal in SGGE, and extend to the northeast to the upper end of Merritt Canal (Figure A-84). This cypress wetland does not extend southwest to the Miller Canal, as it did in Alternative 3d, because the two weirs do not appear to adequately reduce drainage in the north-south section of Miller Canal so as to maintain overland flow in this area. There was some open water present in the deeper portions of the main flowway in the vicinity of the Faka Union Canal. Water levels were also raised to the east of the large cypress wetland so that wet prairie water depths extend almost the whole length of Merritt Canal. The weirs in the southern east-west portion of Miller Canal appear to be moving water into the wetlands north of Tamiami Trail, creating marsh and wet prairie water depths.

There were major quantitative differences in acreages of the above ground water depth classes between Alternative 12 and the three Bases (Table 5, Figure 4). These differences were approximately intermediate between the two other alternatives, when comparing Alternative 12 to the Natural Base. Acreages of mesic communities were about 2.4 times those in the Natural Base condition, while the hydric community acreage was similar, and the other two wetland

communities were about 65-75% of Natural Base condition. When compared to both the Existing and 2050-Without-Project Bases, Alternative 12 had about 40% of the acreage of upland mesic communities, approximately 3.5 times as much acreage of hydric, and 8-16 times as much acreage of wet prairie, cypress, and open water communities.

Phase Two Summary. Since the target for SGGE restoration was pre-drainage Natural system conditions, the best Alternatives were those that most closely approximated that condition, not necessarily those providing the largest amount of wetlands. In this analysis we focused on acreage of the major plant community types associated with particular hydrologic regimes, the only information that the model was able to provide. We did not specifically focus on restoring the original distribution of major types of plant communities. This was accomplished to varying degrees depending on the Alternative simply because of the topography in SGGE. However, other areas were wetter or drier than they were originally due the location of features in each Alternative, such as which canals were filled and where, location and size of pumps, location of weirs, presence of berms, etc. There really was no way of restoring the original distribution of communities in SGGE as long as drainage of NGGE had to be maintained.

When looking at which Alternatives most closely approximated the pre-drainage Natural condition, not surprisingly all three were fairly similar (Table 5). Alternatives 3d most closely approximated the original acreage of the mesic communities, followed by Alternative 12. Alternative 12 was closest in terms of hydric communities, followed by Alternative 3d. Alternative 3d was closest for the wet prairies, followed by Alternative 12. Alternative 3d was closest for cypress, followed by Alternative 6. Alternative 6 was closest for open water, followed by Alternative 3d. When ranking them 1, 2, and 3 for each major community type and summing the ranks, Alternative 3d resulted in the closest acreage distribution by major community type to the pre-drainage Natural condition.

WILDLIFE

The presence and health of wildlife populations are a function of the habitats available to support them. Given the dramatic changes in hydrologic and fire regimes in SGGE over the past thirty years, wildlife populations in SGGE have undoubtedly changed from those present in the area during Natural pre-drainage conditions. A preliminary list of wildlife recently recorded from Picayune Strand State Forest, which includes both SGGE and the adjacent Belle Meade Conservation and Recreation Lands project is found in Appendix I of this report. The Natural SGGE wetland habitat is being replaced by terrestrial communities, most of which are in early stages of the transition and thus appear to be in a very disturbed condition. This has obvious implications for wetland dependent species such as amphibians, otters, and wading birds and the forage fish and aquatic invertebrates upon which they depend, all of whose populations have likely been greatly reduced in SGGE since drainage.

Some terrestrial species have undoubtedly become more abundant as the upland habitats have become more widespread in SGGE. However, even some of these species may not be able to tolerate conditions in some of the new terrestrial habitats, such as the intensity of the fires that

are occurring as a result of drainage and the steadily increasing abundance of palms. The lack of fire in other portions of SGGE is allowing the development of dense woody vegetation that is not suitable for species adapted to the open character of pine flatwoods with its dense herbaceous groundcover, which was previously the dominant upland community in SGGE.

LISTED SPECIES

Important characteristics of panther habitat are areas with little human activity and habitat for prey species, particularly deer and hogs. While some researchers have reported that panthers prefer forested habitats, others have suggested they utilize a wider range of habitats. The latter would seem to be more consistent with the distribution of their prey. Deer are known to be an edge species, that is, they do best in areas where there is extensive contact between forested and open herbaceous communities. Hogs are another favored prey species. They seem to utilize all of the plant communities in SGGE, and to particularly like to forage in newly exposed substrates as the surface water recedes downslope during the dry season. While some of the deeper restored SGGE wetlands may not provide ideal habitat for panthers during the wet season, there are adequate areas of uplands at this time of year, and the deeper sites can provide important habitat during the dry season. Removal of most of the road system and deeper and longer inundation will benefit the panther because of reduced human use of the area. Thus, it would be reasonable to expect an increase in panther use and perhaps panther breeding activity in SGGE following restoration.

The Big Cypress fox squirrel and red-cockaded woodpecker are species that would ordinarily benefit from the increase in upland habitat. However, the lack of fire in some areas is expanding the distribution of hardwood hammocks into pine flatwoods, making these areas unsuitable for the woodpecker. In other areas, the increase in palms and the associated high fire intensities will likely eliminate most other trees in hardwood hammock and pine flatwood communities that might otherwise provide habitat for these species.

Restoration could also benefit the wood stork by providing additional foraging habitat within a reasonable distance of the large rookery at Corkscrew Swamp. Breeding success of this species in South Florida has declined drastically over the last 50 years, primarily due to the loss of seasonal wetlands.

The significantly reduced duration of flooding in SGGE has likely had dramatic impacts on tropical vegetation due to the loss of freeze protection from the moderating influence of standing water when winter cold fronts pass through the area. This is particularly important to epiphytic orchids, bromeliads, and ferns, which are exposed to the effects of freezes. Rooted tropical vegetation would also be affected by loss of aboveground stems and leaves, but most are likely to resprout from their roots, although with repeated freezes, they too may eventually succumb.

COMMUNITY CHANGES FOLLOWING RESTORATION

It is important to remember that the SGGE plant communities are still in transition from their Natural condition. They are by no means a stable ecosystem that can be expected to maintain their current characteristics over the long term. In the absence of restoration, they will still succeed towards an ecosystem that will be created in response to the new combination of hydrologic, fire, and edaphic conditions that currently exist, as modified by the mix of invasive species that are coming to dominate parts of the area. Thus, it is unrealistic to plan for the future of SGGE and its plant and animal populations on the assumption that what currently exists is its likely future condition, with some modification based on active management. It is unlikely that fire has yet finished altering plant communities that existed prior to drainage. It is also unlikely that the spread and structural development of the palm communities has yet stabilized. Thus, regardless of whatever restoration may or may not be planned for SGGE, one must look at the current ecosystem and the processes affecting it from a long-term perspective to evaluate what will likely be the final result of each alternative. This perspective will allow for better decisions about whether trying to protect what currently exists in SGGE or portions of it is even feasible and will really accomplish project goals.

The long-term goal of the proposed restoration alternatives is to return the hydrology of portions of the area to a condition comparable to that which existed in SGGE prior to drainage. This will involve the reestablishment of a predominantly wetland ecosystem within portions of South Golden Gate Estates and the reduction or elimination of point discharges to coastal waters. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return those portions of SGGE to their pre-drainage character, including the plant communities and wildlife that it supported at that time. This will mean that those new plant and animal communities that have developed under the current hydrologic and fire regimes, but were not present prior to drainage, will be eliminated during the decades following restoration, and will be replaced by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in SGGE prior to construction of the canal system, but have become established in new areas as a result of drainage, will likely return to their original distribution.

However, these changes will not happen in a few years. The time frame for restoration of the original communities will be variable depending on the type of community to be reestablished and the degree to which they have been disturbed, particularly by severe fires. Loss of the older forest trees will require at least many decades to replace them, during which time the sites will be dominated by earlier successional communities, most likely willow in the cypress swamps and a mixture of wax myrtle and herbaceous species in the pine flatwoods. Lost organic soils in some of the deeper wetlands will require centuries to replace, and in the meantime these sites will be dominated by either deeper wetland communities, such as pop ash or pond apple sloughs, or open water.

It is also important to be aware that during these transitions following restoration, much of the upland vegetation that has invaded areas that were originally wetlands will die, and the woody material may take up to a decade for most of it to decompose. Where dominant species have been eliminated from a site following drainage, there can be substantial lags in the time it takes for seeds of these species to get to a restored site, to successfully germinate and then survive and grow to a size where they again dominate the site. Thus, the plant communities on these sites may actually look worse than they did prior to restoration for some time before they start to develop their desired character. Also, during this period it is important to monitor for invasive plant species and eradicate them while their populations are still small.

OTHER CONSIDERATIONS

Water Quality

There is some concern about the quality of water coming down canals from NGGE, particularly in terms of phosphorus coming from the increasing numbers of septic tanks in the area. There did seem to be somewhat elevated Total Phosphorus levels during the 1999 and 2000 dry seasons at Merritt and Faka Union Canals where they cross I-75. This and nutrients derived from vegetation killed as a result of restoration efforts could potentially encourage the growth of nuisance plant species. It will be important to monitor those portions of SGGE where these inflows are occurring for nuisance species, e.g. cattails and primrose willow, and provide control before they come to dominate sites. If phosphorus levels become sufficiently high as NGGE develops, it may become necessary to institute some sort of treatment of canal inflows to protect the character of the majority of SGGE's native communities. One option would be to identify a "water treatment area", which could function as a buffer between the canal inflows and the portion of SGGE that is to be restored to Natural condition. In other areas, where nutrient inputs may be associated with dying and decomposing vegetation, this should be a temporary problem that could be dealt with by mechanical and/or herbicide treatment until the native community has become established.

Adjacent Lands

Most of the lands surrounding SGGE are in public ownership or are scheduled for acquisition. The primary purpose of their acquisition has been for conservation of their natural resources. Fakahatchee Strand State Preserve lies immediately to the east of SGGE, the Belle Meade Conservation and Recreation Lands Project to the west, Ten Thousand Islands National Wildlife Refuge and Collier Seminole State Park to the south, and the Florida Panther National Wildlife Refuge along the eastern portion of the northern boundary of SGGE (Figure 5).

Water table gradients from SGGE into Fakahatchee Strand have been monitored by the State Preserve staff since 1987. Data from these monitoring wells and an earlier United States Geological Survey study (Swayze and McPherson, 1977) have shown that water table drawdowns associated with the SGGE canals have extended over two miles into Fakahatchee Strand. The plant communities in the areas affected by this drawdown have been moderately-to-severely impacted, most obviously by wildfires that have changed the character of these lands, particularly as one gets closer to the easternmost SGGE canal. Similar impacts are most likely

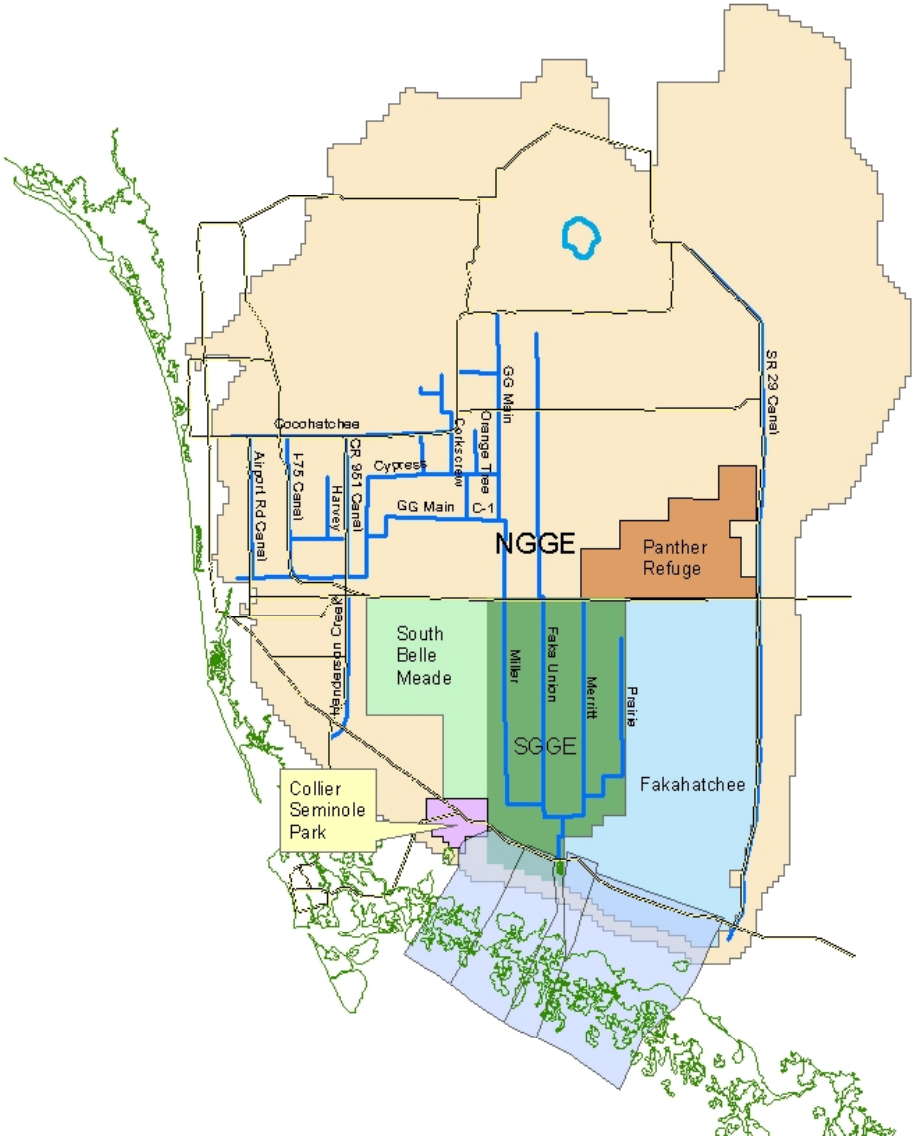

Figure 5. Non-estuarine public lands adjacent to SGGE that were utilized in the inland benefits analyses.

occurring on Belle Meade and the inland portions of Collier Seminole State Park. Changes on the Ten Thousand Island National Wildlife Refuge and coastal portions of Collier Seminole State Park are more likely associated with alterations in salinity due to reduced overland freshwater flows that are currently diverted to the Faka Union Canal. Although not documented at this time, it is likely that the distribution of plant and animal communities within this freshwater – saline transition zone downstream from SGGE have been significantly modified by drainage associated with the SGGE canal system.

All of the restoration alternatives will help to restore the hydrologic and fire regimes and thus the associated biotic resources on all of the surrounding public lands, although to different degrees depending on the alternative and the proximity of the lands to SGGE. Some of these public lands were within the BCB model domain, and we were able to estimate hydrologic changes that are likely to occur on these lands as a result of the various SGGE restoration alternatives. The model was not able to address hydrologic changes for lands with tidal influences, such as those in the Ten Thousand Islands National Wildlife Refuge and tidal portions of Collier Seminole State Park.

Fakahatchee Strand State Preserve. The Natural Base condition of Fakahatchee Strand State Preserve (FSSP), as depicted using the MIKE SHE model wet season water depth classes, has as its core a large cypress wetland that begins about four miles south of I-75 and extends south to about three miles north of Tamiami Trail (Appendix A, Figure A-79). Wet Prairies surround the cypress strand and extend south to the model boundary below Tamiami Trail. Hydric communities fringe the wet prairies and intermingle with them in the vicinity of Tamiami Trail. Wet prairie and hydric communities occupy the areas south of the eastern half of the SGGE canal system. Mesic communities dominate the eastern and northern borders of the Preserve, as well as its western border adjacent to Prairie Canal. The lack of continuity of the deep cypress strand north to and across I-75 is believed to be an artifact of the new topography in this area that was used in the 2003 version of the MIKE SHE model.

In the Existing and 2050-Without-Project Bases, the water depth classes have a generally similar pattern of distribution to the Natural Base (Appendix A, Figures A-80 and A-81, respectively). However, the cypress and wet prairie communities have been reduced by approximately a third, while the hydric communities has increased by about 40%, and the acreage of the mesic communities has not changed (Table 6). The loss of the wetland communities has occurred primarily adjacent to and downstream of SGGE, where there has been an increase in the occurrence of mesic communities. Hydric communities have increased primarily along the eastern portion of the Preserve from I-75 south for about two-thirds of the distance to Tamiami Trail, but there has also been an increase at the north end of Prairie Canal. In these areas, they have replaced the drier mesic communities. The increase in hydric

Table 6. Acreages of hydrologically-related plant communities associated with the three Base scenarios and the ten restoration Alternatives on public lands adjacent to SGGE.

Plant Communities	Aver. Wet Season Water Level (ft)	Natural	Existing	Without	Alt. 3D	Alt. 6	Alt. 7	Alt. 8	Alt. 9	Alt. 11	Alt. 12	Alt. 13	Alt. 17	Alt. 19
		Panther Refuge Plant Community Acreages												
Mesic	**< 0.2 ft**	10,641	4,959	5,165	5,424	5,062	5,372	5,062	5,269	5,114	5,114	5,165	5,062	5,114
Hydric	**0.2 - 0.5 ft**	5,940	10,950	10,434	10,485	10,692	10,485	10,589	10,537	10,486	10,537	10,486	10,537	11,002
Wet Pr / Sc Cyp	**0.5 - 1 ft**	6,198	7,696	7,851	7,851	7,696	7,800	7,800	8,006	7,903	7,748	7,851	7,800	7,490
Cyp / Marsh	**1 - 2 ft**	2,169	1,343	1,498	1,188	1,498	1,291	1,498	1,136	1,446	1,550	1,446	1,550	1,343
Open Water	**> 2 ft**	0	0	0	0	0	0	0	0	0	0	0	0	0
Totals		24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948	24,948
		Fakahatchee Strand Plant Community Acreages												
Mesic	**< 0.2 ft**	25,051	26,963	26,188	22,056	18,750	21,074	20,971	22,831	20,093	19,215	20,041	23,296	22,727
Hydric	**0.2 - 0.5 ft**	22,211	30,114	29,855	32,024	31,767	32,024	31,147	31,198	31,715	31,560	31,663	31,198	31,767
Wet Pr / Sc Cyp	**0.5 - 1 ft**	22,211	16,322	17,200	18,130	21,229	19,060	19,938	18,492	19,990	20,971	20,145	18,388	18,182
Cyp / Marsh	**1 - 2 ft**	10,692	6,767	6,922	7,955	8,161	7,955	8,110	7,645	8,316	8,213	8,316	7,283	7,490
Open Water	**> 2 ft**	0	0	0	0	258	52	0	0	52	207	0	0	0
Totals		80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165	80,165
		Belle Meade Plant Community Acreages												
Mesic	**< 0.2 ft**	6,147	11,519	10,486	9,814	8,471	8,781	8,626	8,988	8,781	8,884	9,039	9,349	9,039
Hydric	**0.2 - 0.5 ft**	7,180	8,006	8,264	6,922	6,508	6,612	6,457	6,973	6,560	6,663	6,870	7,128	6,508
Wet Pr / Sc Cyp	**0.5 - 1 ft**	8,780	7,593	7,748	8,368	8,472	8,935	9,452	9,401	8,884	8,988	8,988	9,143	8,884
Cyp / Marsh	**1 - 2 ft**	7,490	2,841	3,409	4,545	6,043	5,217	4,855	4,236	5,320	5,062	4,700	3,977	5,062
Open Water	**> 2 ft**	465	103	155	413	568	517	671	465	517	465	465	465	568
Totals		30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062	30,062

When evaluating the SGGE restoration alternatives, their primary areas of influence in FSSP are the lands adjacent to Prairie Canal and south of the eastern half of SGGE. Given the large acreage of the Preserve relative to the area affected by the alternatives, there were only small changes in the acreage percentages of the water depth classes relative to any of the Bases (Table 6).

The general pattern of change in the distribution of water depth classes in Fakahatchee Strand State Preserve near Prairie Canal was for an increase in hydric and wet prairie communities along the canal for almost all of the alternatives. In the Natural Base, most of the canal was bordered by mesic communities, which acreage was further increased in the other two Bases. Alternative 3d produced a small area of wetland acreage at the northern end of the canal. The wetland acreage was somewhat greater in Alternative 17. However, the largest acreage of wetlands along Prairie Canal did not occur unless Merritt Canal was also filled and set up with a pump and spreader system (Alternatives 11, 12, and 13). When Merritt Canal was filled (Alternatives 8 and 9), even for only about half of its length (Alternatives 6 and 7), there was almost as large an area of increased wetland acreage as in Alternatives 11, 12, and 13. Filling Merritt Canal, but diverting its flows to Faka Union Canal (Alternative 9), even with a pump on the connector canal (Alternative 19), did not produce as much wetland acreage in the vicinity of Prairie Canal. Alternative 3d had a pump and spreader canal at the top of the filled Merritt Canal that was intended to be essentially identical to the same feature in Alternatives 8, 9, 11, 12 and 13, but there is reason to believe that it was not set up properly in the model, so that it did not produce as much wetland acreage as would be expected.

The general pattern of change in the distribution of water depth classes in Fakahatchee Strand State Preserve in the area south of the eastern half of SGGE varied from a predominantly wetland system (Natural Base) to a predominantly mesic system (Existing and 2050-Without-Project Bases). In Alternative 17, only the north-south portion of Prairie Canal was filled and its downstream east-west portion probably recaptured most of the water that had become overland flow. Thus, it is not surprising that this alternative exhibits a water depth classes pattern very similar to the Existing and 2050-Without-Project Bases in the area south of SGGE. Alternatives 8 and 9 are somewhat but not much wetter. Alternatives 7, 11, 13, and 19 are the next wettest, while Alternatives 3d, 6, and 12 have water depth patterns that are most similar to those in the Natural Base. The last three are the only alternatives that created sheet flow in the eastern two-thirds of SGGE by filling at least the lower half of the three easternmost canals. The previous four all filled at least the lower half of the two easternmost canals. Although in Alternatives 8 and 9 the two easternmost canals were filled, the water coming into Merritt Canal had been diverted to Faka Union Canal, so it was less likely to reach the area south of the eastern half of SGGE.

Florida Panther National Wildlife Refuge. The Natural Base condition of the Florida Panther National Wildlife Refuge (FPNWR), as depicted using the MIKE SHE model wet season water depth classes, appears as a primarily mesic system, with fingers of hydric, wet prairie, and cypress communities extending into it from all directions (Appendix A, Figure A-79). The lack of continuity of the deep cypress strand in Fakahatchee Strand State Preserve to and across I-75 into the FPNWR is believed to be an artifact of the new topography that was used in the 2003 version of the MIKE SHE model.

In the Existing and 2050-Without-Project Bases, the water depth classes have a generally similar pattern of distribution to the Natural Base (Appendix A, Figures A-80 and A-81, respectively). However, the Refuge is generally wetter, particularly in terms of hydric and wet prairie communities (Table 6). Mesic communities acreages are only about half of what they were in the Natural Base, and rather than forming a central core on the Refuge, they are now scattered islands. Hydric and wet prairie communities acreages are approximately 1.8 and 1.2 times greater, respectively. Cypress acreage has been reduced by about a quarter of what was present in the Natural Base.

While there were small differences in the water depth class acreages among the various alternatives, it was not possible to identify any alternatives that were likely to have any detectable effects on the FPNWR. Actually, if the model is even approximately correct, changes in the FPNWR ecosystem between the time of the Natural and Existing Base conditions have been far more significant to the Refuge than anything proposed in the SGGE restoration effort. Examination of the model maps suggests that there is a large area from the northern boundary of the Refuge north to Immokalee that is much drier than it was during Natural Base conditions. It is possible that all of this water is currently being moved south, not just down into the FPNWR, but also into the eastern portion of the FSSP and western portion of the Big Cypress National Preserve.

Belle Meade Conservation and Recreation Lands. The Natural Base condition of the inverted-L-shaped Belle Meade area, as depicted using the MIKE SHE model wet season water depth classes, has a large area of mesic communities with some fringing hydric, wet prairie, and cypress communities along its smaller leg that extends south from the larger northern portion of the area (Appendix A, Figure A-79). The larger northern area has extensive areas of cypress, particularly in the portion bordering I-75. These are bordered by wet prairie, which gradually changes into a mixture of all of the communities as one moves to the south. The topography used in the Natural Base was the same southwest Florida regional topography that was used in the SGGE, FSSP, and FPNWR portions of this evaluation assessment.

In the Existing and 2050-Without-Project Bases, the water depth classes have a much patchier pattern of distribution compared to the Natural Base (Appendix A, Figures A-80 and A-81, respectively). A large part of this difference is due to the use of recent LIDAR topographic data for the Existing, 2050-Without-Project Base models and a more smoothed pre-development topography for the Natural Base . Other significant influences are drainage associated with development on all sides of Belle Meade. NGGE is cutting off overland flows from the north. Henderson Creek Canal is draining water from the western edge of the area. A large agricultural area southwest of Belle Meade has lowered water tables in their fields by pumping water out during wet periods and raised them by irrigating during dry periods. The former lowers water levels in lands adjacent to the fields, while raising it in areas to which the water is being pumped. The latter raises water levels in lands adjacent to the fields and downstream from them due to seepage, while lowering water tables in the general area as a result of groundwater pumping.

General water depth patterns in the Existing and 2050-Without-Project Bases and all of the Alternatives show mesic communities in the northwest corner and along the western border

of Belle Meade. The lands bordering SGGE have been drained by Miller Canal. The large northern portion is drier than in the Natural Base with a mix of mesic, hydric, and wet prairie communities. There is some cypress in the southern part of this area. In the southern leg, with the exception of the drained lands bordering SGGE, it is variously wetter or drier than the Natural Base, with a mix of primarily hydric and wet prairie communities.

Among the possible restoration components that have been proposed for SGGE, structural changes in the Miller Canal would be expected to have the most significant effects on Belle Meade. However, as with Fakahatchee Strand, only a small portion of Belle Meade is influenced by actions in SGGE, so that responses in terms of acreages within Belle Meade were expected to be small (Table 6). Comparing the acreages of the various plant communities in each Alternative with those in the Natural condition has proven very difficult. This is due to a number of factors, including the difference in topography between the Natural and Alternative conditions and the many other influences on Belle Meade, which were described above. Thus, one is left with having to assume that eliminating drainage associated with the Miller Canal will benefit adjacent habitats in Belle Meade, and the more of the canal that is filled, the greater the benefit.

Collier Seminole State Park. Plant community acreages were not available for all of the initial ten Alternatives. However, similar problems with interpreting these data to those described for Belle Meade would likely have made evaluating the relative merits of the Alternatives difficult for this site.

Land Management Needs

One of the important considerations about the restoration of SGGE is that while a restored hydrology is crucial to meeting our goals, it is not sufficient to meeting them. As has been stated repeatedly, an appropriate fire regime was a major factor in creating and maintaining the Natural communities, and it will be necessary to bring them back. There is also the option of making a management decision to implement a different fire regime in parts or all of SGGE, if this was considered appropriate to meeting certain objectives. One example might be to reduce the fire frequency to allow for the presence of a greater number of mesic and hydric hammocks or merely a larger number of hardwoods in the pine and cypress communities, but at the expense of herbaceous species and high-quality browse.

Another important consideration is the problem of invasive exotic and native plants. While an improved hydrology will help with certain of these problem species at certain sites, herbicides and mechanical control programs will need to be instituted to deal with some species and will also be necessary in some locations where hydrology cannot do the whole job. These programs will also be necessary where hydrologic restoration is not planned, such as in the northwestern corner of SGGE in Alternative 3d or along any remaining sections of road and canals. It will be important to work to minimize the chances of bringing new invasive species in during the restoration effort and to be prepared to deal quickly with any that might appear. Known problem species that can be carried to a site on heavy equipment include cogon grass, torpedo grass, elephant grass, climbing fern, among many others.

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

October 20, 2004

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Mr. Duck:

We have received your letter dated October 20, 2004, transmitting the Biological Assessment (BA) for the Picayune Strand Restoration Project, formerly known as the Southern Golden Gate Estates Restoration Project. You have requested our quick concurrence and continued informal consultation regarding the potential effects of this project on federally listed species and designated critical habitats pursuant to the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*), including the red-cockaded woodpecker (*Picoides borealis*), the bald eagle (*Haliaeetus leucocephalus*), the Everglade snail kite (*Rostrhamus sociabilis plumbeus*) and Everglade snail kite critical habitat, the eastern indigo snake (*Drymarchon corais couperi*), the American crocodile (*Crocodylus acutus*) and American crocodile critical habitat, the West Indian manatee (*Trichechus manatus*) and West Indian manatee critical habitat, the wood stork (*Mycteria americana*), and the Florida panther (*Puma concolor coryi*).

Based on the assessment and the project commitments and conservation measures provided in this BA, the U.S. Army Corps of Engineers (Corps) has determined that the project "may affect, but is not likely to adversely affect" the red-cockaded woodpecker, bald eagle, Everglade snail kite, eastern indigo snake, American crocodile, and West Indian manatee critical habitat and will have "no effect" on the Everglade snail kite critical habitat and American crocodile critical habitat. Additional data will be required to complete analysis for the wood stork, the Florida panther, and the West Indian manatee and therefore the Corps has been unable to determine the effects of the project for these species at this time. We will continue to work with your staff, as requested, to complete necessary analyses for these species.

The endangered red-cockaded woodpecker has not been documented within the project boundaries though habitat suitable for nesting and foraging does occur. Four occupied clusters have been identified about 2 miles west of the project in the Belle Meade tract of the Picayune Strand. About 37 miles to the east of the project, approximately 40 clusters have been reported in the Big Cypress National Preserve (BCNP). Although some potential woodpecker pine flatwood habitat would be lost by this project, the remaining flatwoods would be protected and/or restored, potentially to the point of supporting additional clusters. Because this project is

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expected to expand available habitat for the Belle Meade population and connect to or augment the BCNP population, the Corps determined that this species "may be affected, but is not likely to be adversely affected" by this project.

The endangered Everglade snail kite has occasionally been observed using the project canals, marshes of the Ten Thousand Islands National Wildlife Refuge, ditches along U.S. Highway 41, and agricultural lands to the west of the project. Because of the low numbers of snail kites that use the project's sub-optimal habitats and the relatively limited creation of habitat suitable for snail kites by this project, the Corps determined that this species "may be affected, but is not likely to be adversely affected" by this project. Because no designated critical habitat is located within the project action area, the Corps determined that this project would have "no effect" on Everglade snail kite critical habitat.

The endangered American crocodile occurs in the project action area. However, successful reproduction has not been documented. The project would likely provide additional flows to the estuaries and bays adjacent to Faka Union Bay which may improve habitat conditions. The Corps determined that this project "may affect, but is not likely to adversely affect" this species. Because no designated critical habitat is located within the project action area, the Corps determined that this project would have "no effect" on American crocodile critical habitat.

The threatened bald eagle is known to nest within and adjacent to the project boundaries. Because appropriate protection measures will be implemented during construction and operation of this project, the Corps determined that this project "may affect, but is not likely to adversely affect" this species.

The threatened eastern indigo snake is present within the project boundaries and adjacent public and private lands. It is expected that the project will restore wetlands and protect remaining uplands. In addition, the implementation of standard construction protection measures, the reduction of human disturbance, and management of habitat after project construction should minimize effects to this species. The Corps determined that this project "may affect, but is not likely to adversely affect" this species.

The endangered West Indian manatee heavily uses the Port of the Islands basin located near the mouth of the Faka Union Canal during the winter months. This is the second largest warmwater refugia for manatees in southwest Florida and can support up to 300 individuals during cold weather. The project is expected to restore appropriate estuarine flows and depth which is expected to change manatee movements. The Corps has been unable to determine the effects of the project on the West Indian manatee and that additional analysis is needed.

The endangered wood stork uses suitable habitats throughout the project area. Three active nesting colonies occur near the project area, including Audubon's Corkscrew Swamp Sanctuary which is the largest historic nesting colony in the U.S. The north portion of the project area falls within the core foraging area for this rookery. The project would likely result in increased wetland coverage, including shallow wetland habitats 2 to 15 inches deep suitable for wood stork

foraging. Although increased wetland habitat coverage is anticipated with the project, the lack of an operating plan for restoration and a detailed wetland map of post-project wood stork habitat conditions has not been completed. The Corps has been unable to determine the effects of the project on the wood stork and that additional analysis is needed.

The endangered Florida panther occurs within the project area. The project will reduce upland habitats used by this species. The project will restore wetland habitats to more natural conditions and protect remaining upland habitats, as well as reduce human disturbance, within the project boundaries. These changes might result in an increased prey base and increase the availability of breeding and sheltering habitats for this species, but specific data is unavailable. The Corps has been unable to determine the effects of the project on the Florida panther and that additional analysis is needed.

Since the detailed design and final locations of all project components are still being refined and may change prior to construction, the Corps has been unable to determine the project effects on wood storks, Florida panthers, and West Indian manatees and that additional data is necessary to complete analyses for these species. We will continue to work with your staff to complete necessary analyses for these species. Also if assumptions regarding project description, construction activities, modeling outputs, Operation Manuals, the Ecological and Water Quality Monitoring Plan, the adaptive assessment component of the Monitoring Plan, the Florida Division of Forestry Maintenance Plan, the Invasive Species Management Plan, or other anticipated effects to listed species change, we will continue to consult with you to complete additional analyses.

The Service concurs with your determinations that the Picayune Strand Restoration Project "may affect, but is not likely to adversely affect" the red-cockaded woodpecker, the bald eagle, the Everglade snail kite, the eastern indigo snake, the American crocodile, and West Indian manatee critical habitat and will have "no effect" on Everglade snail kite critical habitat and American crocodile critical habitat. We look forward to continuing consultation with you for the wood stork, the Florida panther, and the West Indian manatee.

Please contact me at 772-562-3909 if you have any questions regarding this letter. Thank you for your continued efforts to protect and restore federally listed species and critical habitats in south Florida through the Comprehensive Everglades Restoration Program.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

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DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
JACKSONVILLE, FLORIDA 32232-0019

REPLY TO
ATTENTION OF

Planning
Environmental Branch

20 October 2004

Mr. James J. Slack
Field Supervisor
U.S. Fish and Wildlife Service
1339 20th Street
Vero Beach, FL 32960-3559

Dear Mr. Slack:

Enclosed is our Biological Assessment (BA) of potential effects on federally listed species and designated critical habitats pursuant to the Endangered Species Act for the Picayune Strand Restoration Project, formerly known as the Southern Golden Gate Estates Restoration Project. Based on the assessment and the project commitments and conservation measures provided in this BA, the Corps has determined that the project "may affect, but is not likely to adversely affect" the red-cockaded woodpecker, the bald eagle, the wood stork, the Everglade snail kite, the eastern indigo snake, the American crocodile, and West Indian manatee critical habitat, and will have "no effect" on the Everglades snail kite critical habitat and America crocodile critical habitat. For the Florida Panther, West Indian Manatee and Wood Stork we have been unable to determine the effects of the project upon these species at this point in time. Accordingly additional data will be required to complete analysis for the Florida Panther, West Indian Manatee and Wood Stork.

Under the Comprehensive Everglades Restoration Plan (CERP) we expect that overall quality and quantity of endangered species populations and habitats will benefit significantly. It is a principle of CERP that we will use adaptive assessment and manage projects to assure restoration goals are achieved. Therefore, we reaffirm our commitment to refine project design, and implement the ecological monitoring and assessment plan and the operations manual, and cooperate with the non-Federal sponsor to finalize the management plan for Picayune Strand State Forest. As we work with the non-Federal sponsor and Division of Forestry to refine the land management we will restrict any use of project lands, or any operational scheme that would result in permanent direct adverse impacts to listed species. In accordance with our Federal stewardship responsibilities for project lands under ESA and FWCA, we assure you that we will continue coordination for

the conservation and eventual recovery of listed species in the project area.

Species and critical habitat identified during informal consultation as potentially affected by the project include the red-cockaded woodpecker, the bald eagle, the Everglade snail kite and Everglade snail kite critical habitat, the eastern indigo snake, the American crocodile and American crocodile critical habitat, the West Indian manatees and West Indian manatee critical habitat, the wood stork, and the Florida panther.

During the preparation of this BA, we have been in contact with Dr. James Reid of the U.S. Geological Survey, Mr. Jim Beever and Mr. Daryl Land of the Florida Fish and Wildlife Conservation Commission, Mr. Terry Doyle from the Panther National Wildlife Refuge, as well as Ms. Kim Dryden and others on your staff. Mr. John Kremer, U.S. Army Corps of Engineers, has been especially important in organizing this interagency coordination. We acknowledge and appreciate their cooperation and help in developing this BA. From the information presented in the BA, we have determined the potential effects of the recommended plan, Alternative 3D.

Although the endangered red-cockaded woodpecker (*Picoides borealis*) has not been documented within the project boundaries, habitat suitable for nesting and foraging does occur. Four occupied clusters have been identified about two miles west of the project in the Belle Meade tract of the Picayune Strand. About 37 miles to the east of the project, about 40 clusters have been reported in the Big Cypress National Preserve. Although some potential woodpecker pine flatwood habitat would be lost by this project, the remaining flatwoods would be protected and/or restored, potentially to the point of supporting additional clusters. Because this project is expected to expand available habitat for the Belle Meade population and connect to or augment the BCNP population, we have determined that the project may affect, but is not likely to adversely affect, this species.

The endangered Everglade snail kite (*Rostrhamus sociabilis plumbeus*) has occasionally been observed using the project canals, marshes of the Ten Thousand Islands National Wildlife Refuge, ditches along U.S. 41, and agricultural lands to the west of the project. Because of the low numbers of snail kites that use the project's sub-optimal habitats and the relatively limited creation of habitat suitable for snail kites by this project, we

have determined that the project may affect, but is not likely to adversely affect, this species. Because no designated critical habitat is located within the project action area, we have determined that this project would have no effect on Everglade snail kite critical habitat.

The endangered American crocodile (*Crocodylus acutus*) is known to occur in and near the project action area; however, successful reproduction has not been documented. It is anticipated that this project would provide additional flows to the estuaries and bays adjacent to Faka Union Bay, which may improve habitat conditions. Consequently, we have determined that this project may affect, but is not likely adversely to affect, this species. Because no designated critical habitat is located within the project action area, we have determined that this project would have no effect on American crocodile critical habitat.

The threatened bald eagle (*Haliaeetus leucocephalus*) is known to nest within and adjacent to the project boundaries. Because appropriate protection measures will be implemented during construction and operation of this project, we have determined that this project may affect, but is not likely to adversely affect, this species.

The threatened eastern indigo snake (*Drymarchon corais couperi*) is present within the project boundaries and adjacent public and private lands. However, it is expected that the project will restore wetlands and protect remaining uplands. In addition, the implementation of appropriate measures to protect this species during construction of the project, reduced human disturbance, and on-site habitat management after project construction should avoid take of this species. Therefore, we have determined that this project may affect, but is not likely to adversely affect this species.

The endangered West Indian manatee (*Trichechus manatus*) heavily uses the Port of the Islands (POI) basin located near the mouth of the Faka Union Canal during the winter months. This is the second largest warm water refugium for manatees in southwest Florida and can support up to 300 individuals during cold weather. We have determined that the project may affect, but is not likely to adversely affect West Indian manatee critical habitat. Since the project is expected to change the manatee movement due to restoration of appropriate estuarine flows, we

have been unable to determine the effects of the project upon this species at this time. Additional data will be required to complete analysis for this species.

The endangered wood stork (*Mycteria americana*) is known to use suitable habitats throughout the project area. Three active nesting colonies occur near the project area, including Audubon's Corkscrew Swamp Sanctuary, which is the largest, historic nesting colony in the U.S. The northern portion of the project area falls within the core foraging area for this rookery. It is anticipated that the project would result in increased wetland coverage, including habitat suitable for wood stork foraging (shallow wetlands 2 to 15 inches deep). Consequently, given the above and the implementation of appropriate project operating criteria and an adaptive management process, we have been unable to determine the effects of the project upon this species at this time. Additional data will be required to complete analysis for this species.

The endangered Florida panther (*Felis concolor coryi*) is known to occur within the project area. This project will reduce upland habitats used by this species. We also expect the project to restore wetland habitats to more natural conditions and protect remaining upland habitats, as well as reduce human disturbance, within the project boundaries. We believe these changes would result in an increased prey base and increase the availability of breeding/sheltering habitats for this species. Consequently, we have been unable to determine the effects of the project upon this species at this point in time. Additional data will be required to complete analysis for this species.

Some conclusions have been made about potential project effects for project components that are based upon a design that is still being refined and may change prior to initiation of construction activities that may affect analysis of potential effects to listed species. The Corps will continue to coordinate development and analysis for these project components, including the modeling assumptions and outputs, the Operation Manuals, the Ecological and Water Quality Monitoring Plan, the adaptive assessment component of the Monitoring Plan, the Florida Division of Forestry Management Plan, the Invasive Species Management Plan, and will reinitiate consultation if the project changes, or if anticipated effects to species or critical habitats change based on new or modified assumptions.

We request your concurrence with our determinations of "may affect, but is not likely to adversely affect" for the red-cockaded woodpecker, the bald eagle, the Everglade snail kite, the eastern indigo snake, the American crocodile, and West Indian manatee critical habitat and "no effect" for Everglade snail kite critical habitat and American crocodile critical habitat. We also request your continued informal consultation for wood storks, Florida panthers, and West Indian manatees until analyses are completed and we can make additional determinations of "may affect, not likely to adversely affect" or "may affect, likely to adversely affect" for these species.

Thank you for you prompt attention to this letter and your continued support to resolve endangered species issues for this project. Please provide us with your concurrence or comments on our determinations as soon as possible so we may complete the Project Implementation Report on schedule.

Sincerely,

James C. Duck
Chief, Planning Division

Enclosure

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PICAYUNE STRAND RESTORATION PROJECT
(Southern Golden Gate Estates Hydrologic Restoration Project)

BIOLOGICAL ASSESSMENT

OCTOBER 20, 2004

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PICAYUNE STRAND RESTORATION PROJECT
(Southern Golden Gate Estates Hydrologic Restoration Project)

BIOLOGICAL ASSESSMENT

October 20, 2004

EXECUTIVE SUMMARY

Species and critical habitat identified during informal consultation as potentially affected by the Picayune Strand Restoration Project include federally listed as endangered American crocodile (*Crocodylus acutus*), Kemp's ridley sea turtle (*Lepidochelys kempi*), Atlantic green sea turtle (*Chelonia mydas mydas*), red-cockaded woodpecker (*Picoides borealis*), wood stork (*Mycteria americana*), Everglade snail kite (*Rostrhamus sociabilis plumbeus*), Florida panther (*Puma concolor coryi*), West Indian manatee (*Trichechus manatus*), and smalltooth sawfish (*Pristis pectinata*), and threatened eastern indigo snake (*Drymarchon corais couperi*), loggerhead sea turtle (*Caretta caretta*), and bald eagle (*Haliaeetus leucocephalus*). Candidate species that could be potentially affected by the project are goliath grouper, (*Epinephelus itajara*), mangrove rivulus (*Rivulus marmoratus*), and sand tiger shark (*Odontaspis Taurus*). Critical habitat has been designated for the American crocodile, Everglade snail kite, and West Indian manatee.

Based on this biological assessment (BA) and the project commitments and conservation measures described in this BA, the Corps has determined that the project "may affect, but is not likely to adversely affect the red-cockaded woodpecker, bald eagle, Everglade snail kite, eastern indigo snake, and American crocodile, and West Indian manatee critical habitat, and that the project will have "no effect" on Everglade snail kite critical habitat and American crocodile critical habitat. The Corps has also determined that it does not have sufficient information to reach an effects determination for the wood stork, Florida panther, and West Indian manatee at this time.

Consultation on listed and candidate fish and sea turtles at sea has been coordinated with the National Oceanic and Atmospheric Administration Fisheries.

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CONSULTATION SUMMARY

Project Authority

The Picayune Strand Restoration Project (PSRP, formerly known as Southern Golden Gate Estates, or SGGE) was authorized under the Restudy of the Central and Southern Florida Project of the U.S. Army Corps of Engineers and South Florida Water Management District. The Restudy was authorized by section 309 (1) of the Water Resources Development Act (WRDA) of 1992 (P.L. 102-580). Section 528 of the WRDA of 1996 provided further guidance for the Restudy including Critical Projects, which originally included the former SGGE project. Section 601 of the WRDA of 2000 approved the Comprehensive Everglades Restoration Plan (CERP), identified the PSRP as an "Other Project Element", and required specific authorization of the project within the CERP, including a project description and a Project Implementation Report (PIR).

Coordination with Service and District

The Service provided an October 27, 1999, Planning Aid Letter (PAL) that outlined project concerns including federally listed species. The Corps provided a Biological Assessment (BA), dated October 17, 2001, that requested initiation of consultation under the Endangered Species Act (ESA) on the West Indian manatee, the red-cockaded woodpecker, the Florida panther, the wood stork, the snail kite, and the eastern indigo snake. The Corps concluded in this first BA that an earlier version of the recommended plan would be "beneficial" to the wood stork and American crocodile; and "may affect, but would not be likely to adversely affect" the Florida panther, eastern indigo snake, red-cockaded woodpecker, and West Indian manatee. The Service did not respond to this initial request for concurrence for the following reasons: 1) several immediate changes in the project development schedule; 2) the lack of details provided with the identified selected plan; 3) subsequent development of new alternatives; 4) pending results of several iterations of the hydrological model; and 5) a change in the hydrological model platform.

The Service completed ESA consultation with the Corps on the Prairie Canal Early Start portion of the PSRP in October 2003. The Service concurred with the Corps' determination that that the backfill of Prairie Canal on the eastern extent of the project "may affect, but is not likely to adversely affect" the Florida panther, the wood stork, the Everglade snail kite, the West Indian manatee and West Indian manatee critical habitat, the American crocodile, the red-cockaded woodpecker, the eastern indigo snake, and the bald eagle. This concurrence was based on a project proposal developed by the applicant, the District, which included pre-project wildlife surveys, construction protection plans for affected listed species, and post-restoration project monitoring and reporting.

On August 5, 2004, the Corps met with the Service to address comments on listed species consistent with the July 8 and July 13, 2004, PAL and the Department of the Interior (DOI) comments. The Service also requested additional information on the West Indian manatee including project effects on its warm water refugia and critical habitat. The Service and the

United Stated Geological Service (USGS) also provided the Corps with updated information on the status of the southwest Florida regional population of the manatee and USGS manatee studies conducted in the project vicinity.

The Service has actively assisted the Corps in development of a modified BA for the PSRP as the project plan has developed. This extensive informal consultation process was intended to minimize the effects of the project on federally listed species.

PROJECT DESCRIPTION

Project Location

The PSRP (formerly Southern Golden Gate Estates [SGGE] Hydrologic Restoration Project) area encompasses about 93-square miles (59,294 acres) of sensitive environmental landscape within the Big Cypress Watershed in Collier County, southwest Florida, between Interstate Highway 75 and U.S. Highway 41 (US 41). The project is located northwest of Everglades National Park (ENP), west of Big Cypress National Preserve, southwest of the Florida Panther National Wildlife Refuge (NWR), north of the Ten Thousand Islands NWR and Rookery Bay National Estuarine Research Reserve (NERR), Cape Romano/Ten Thousand Island (TTI) Aquatic Preserve, northeast of Collier Seminole State Park, west of the Fakahatchee Strand Preserve State Park, and east of the Belle Meade Conservation and Recreation Land (CARL) project area (Fig. 1). The PSRP and the Belle Meade CARL areas constitute the Picayune Strand State Forest which is managed by the Florida Division of Forestry. The completion of this restoration project in the midst of significant areas of State and Federal conservation lands will result in a total contiguous public land holding of about 2,602,144 acres in southwest Florida.

The PSRP study area is defined as the 682-square-mile area (about 436,320 acres) that was evaluated for effects from the hydrological and ecological restoration of the PSRP (Fig. 2). This is the area that may potentially be impacted directly, indirectly, or cumulatively by the implementation of the recommended plan, Alternative 3D, as described in the Final Integrated Project Implementation Report and Environmental Impact Statement (FPIR/EIS) (Corps 2004).

Description of Proposed Action

The overall purpose of this project is to restore more natural hydrologic and ecological conditions in the PSRP similar to that which existed prior to the start of construction of the real estate development of SGGE in the 1960s, which created about 48 miles of canals and 279 miles of primary and secondary roads throughout the wetlands area. Plugging of the canals, reduction in the number of miles of roadway, and a return to more natural hydrology are expected to restore native plant communities and improve habitat for fish and wildlife resources, including State and federally listed species. This project would also have a beneficial ground water effect on the upland habitats that are upstream of the pumps.

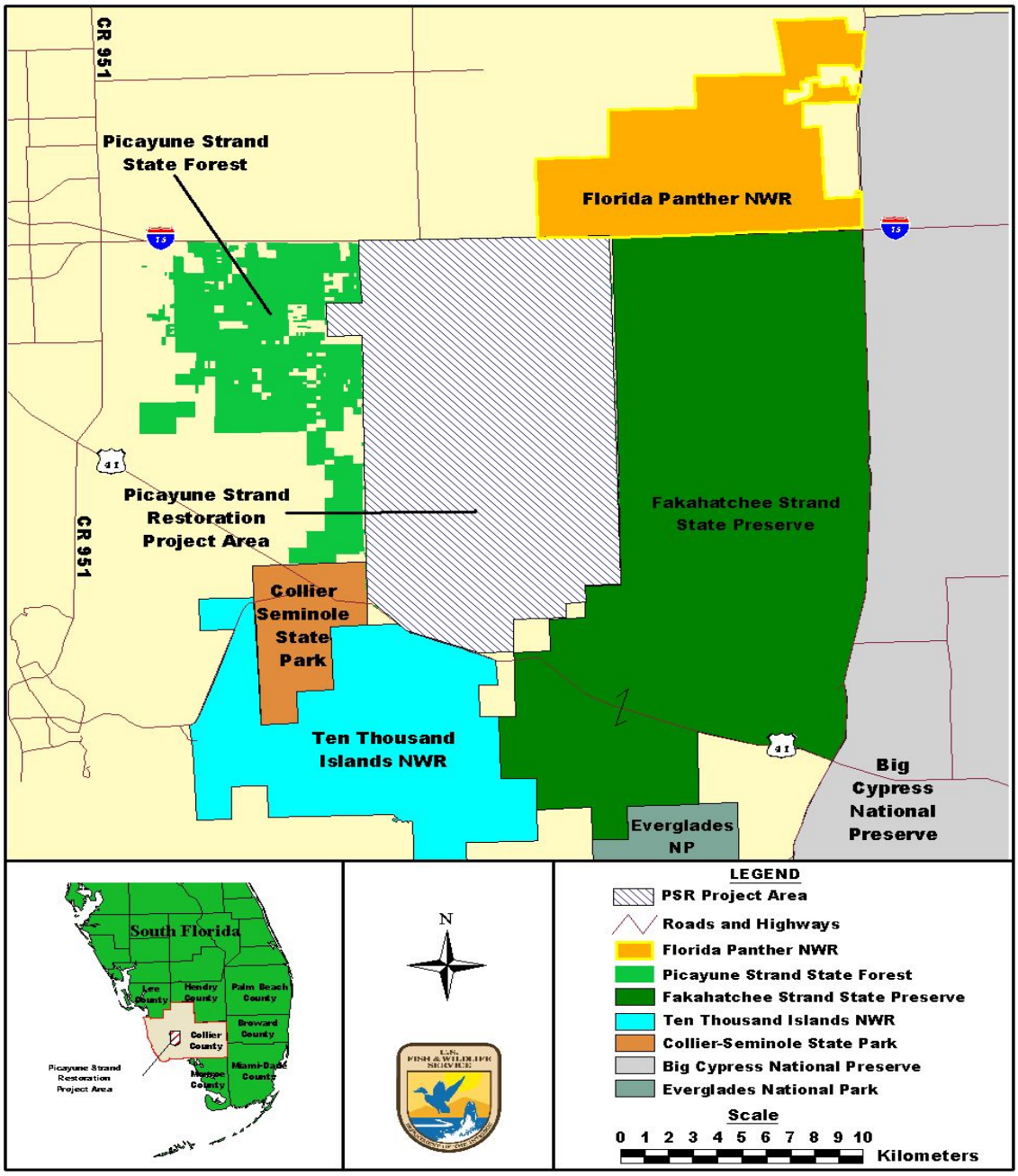

Figure 1. Location of the Picayune Strand Restoration Project area and adjacent public lands.

This Biological Assessment (BA) and the environmental benefits of the project are based on evaluation of data resulting from the South Florida Water Management District's (District) MIKE SHE hydrologic modeling of Alternative 3D, the preferred plan. These data are described in Duever (2004).

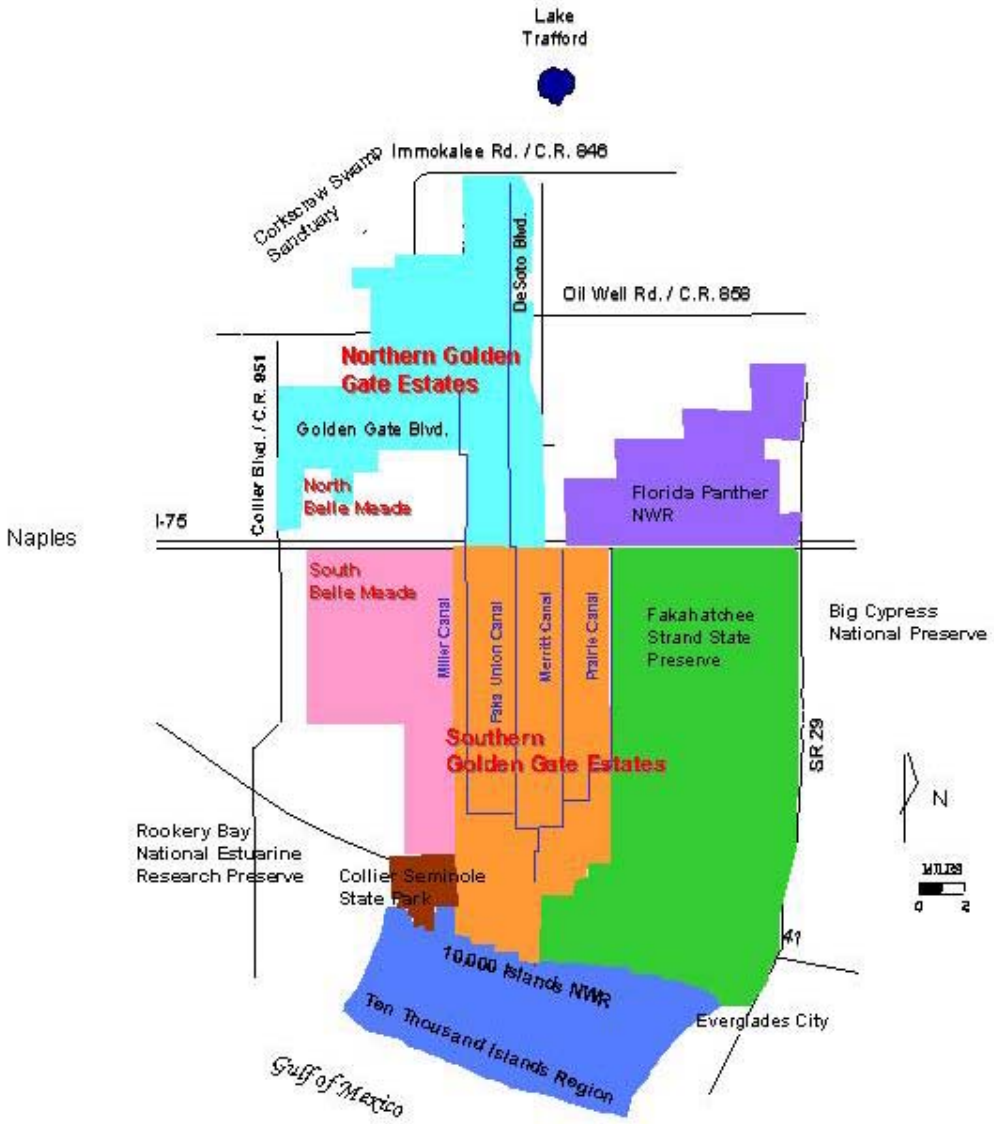

Figure 2. Location of 682 square mile (436,320 acre) Picayune Strand Restoration Project study area.

Project Objectives

The objectives of the PSRP as outlined in the FPIR/EIS (Corps 2004) are to:

- Re-establish historic flowways, sheetflow, and wetland hydroperiods;
- Reduce point-source discharges to improve the health of downstream estuaries;
- Improve aquifer recharge for water supply and improve salinity regimes in downstream estuaries by spreading freshwater discharges as sheet flows;

- Restore and enhance fish and wildlife resources, including listed species such as the Florida panther (*Puma [=Felis] concolor coryi*), Florida black bear (*Ursus americanus floridanus*), and wood stork (*Mycteria americana*);
- Protect rare habitat such as tropical hammocks and rare plant species including orchids and bromeliads, preserve upland habitat, and control invasive exotic plants;
-
- Avoid overdrainage of adjacent sensitive ecosystems;
- Provide resource-based recreational opportunities; and
- Provide contiguous conserved habitat for the greater Everglades ecosystem including the Florida Panther and TTI National Wildlife Refuges (NWR), Fakahatchee Strand Preserve State Park, Collier Seminole State Park, and the Belle Meade portion of [Picayune Strand State Forest] PSSF.

Alternative 3D – Recommended Plan

The recommended plan or Preferred Alternative, Alternative 3D, is depicted in Figure 3. Features of the Preferred Alternative are described as follows.

Canal Plugs

Eighty-three canal plugs would be placed in the four canals. The approximate locations of the plugs are shown in Figure 3. The source material for the canal plugs and swale blocks would be the spoil from the original canal and swale excavations, and the demolition and degrading of the roads.

Three spreader canals will be constructed that run in an east-west direction across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The spreader canals will be located immediately downstream of the proposed pump stations. The pumps have been designed to have discharge pipe free fall into the spreader canals, which will act as a plunge pool for energy dissipation and to aerate the water. The discharge waters will then be conveyed overland to the downstream project area. The length of the spreader canals were optimized for restoration pumping rates. For the Miller, Faka Union, and Merritt pump stations, the spreader canal lengths will be approximately 4,500 feet, 7,000 feet, and 1,400 feet, respectively. They will serve to distribute the flows along the overland areas to emulate the historic sheet flow of the area.

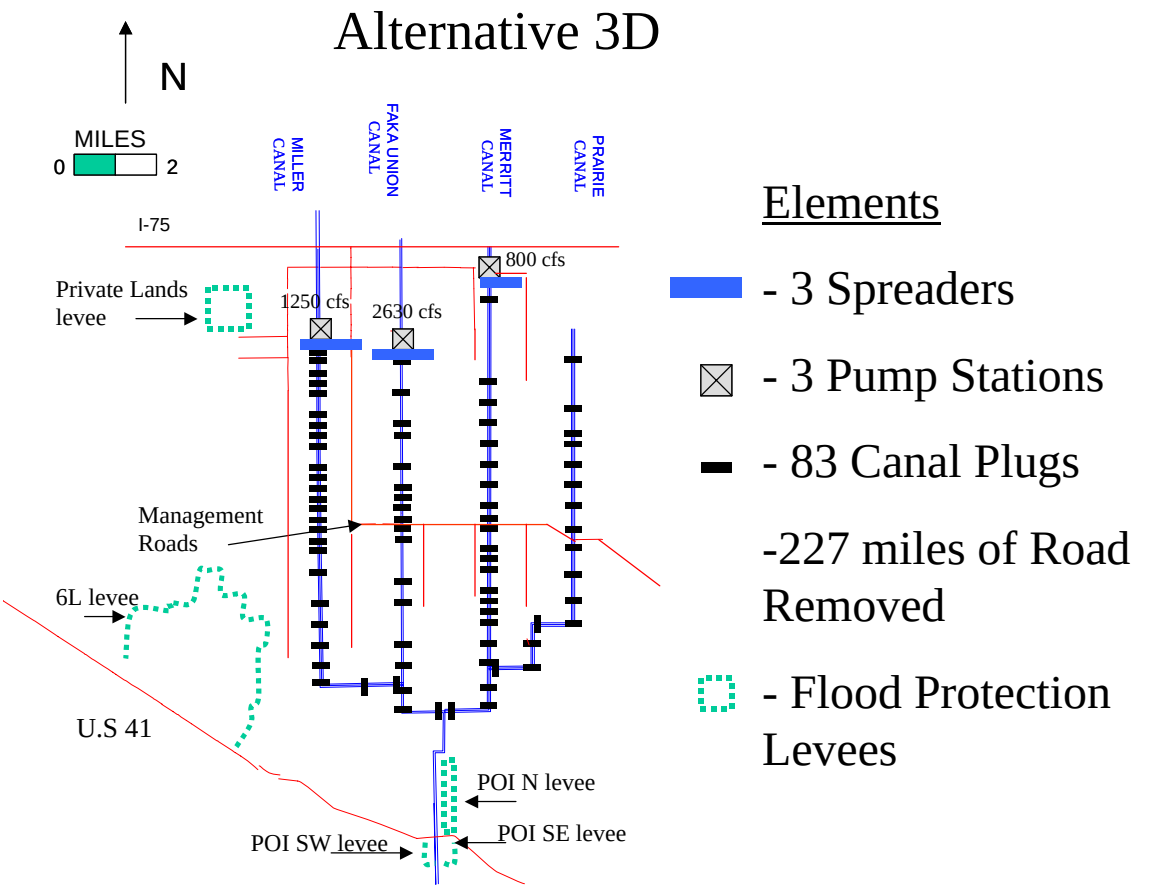

Figure 3. Alternative 3D, the preferred alternative from the Final Project Implementation Report/Environmental Impact Statement (Corps 2004) for the Picayune Strand Restoration Project.

Pump Stations

Pump stations would be constructed on the Miller, Faka Union, and Merritt Canals (Fig. 3). The Miller Pump Station would be constructed on the Miller Canal near 64th Avenue SE. The Miller Pump Station would have two 375 cfs pumps and four 125 cfs pumps, for a total capacity of 1,250 cfs at 6 bays. The Faka Union Pump station would be constructed on the Faka Union Canal near 66th Avenue SE. The Faka Union Pump Station would have two 125 cfs pumps, two 250 cfs pumps, and four 470 cfs pumps, for a total capacity of 2,630 cfs at 8 bays. The Merritt Pump station would be constructed on the Merritt Canal near 54th Avenue SE. The Merritt Pump Station would have two 80 cfs pumps and three 213 cfs pumps, for a total capacity of 800 cfs at 5 bays. The pumps would be utilized to maintain flow through the project area during flood events and to help distribute water for restoration. A small 100 cfs pump station will be required for interior drainage of the Private Lands levee system.

Levees

Five levees would be constructed that would protect existing development from elevated water levels. The locations of each levee are shown in Figure 3. A ring levee would be built in the southern end of the SGGE to protect the POI Waterfront RV Resort and other structures from being flooded by the higher water and sheet flow from the north and northeast. The levee would be on the eastern side of the Faka Union Canal, south of the "T" (the intersection where the four SGGE canals join to form one canal), and north of U.S. 41. The levee would be about three miles in length. The typical levee section will be 15 feet wide, 9 feet high, and have 1:3 side slopes. The resultant amount of fill would be approximately 224,000 cy. The source material for the levee would be from the spoil from the original canal and swale excavations and road demolition work. A second levee would protect the POI development southeast of the intersection of the Faka Union Canal and US 41. The levee would be about 0.8 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. A third levee would be constructed to protect the POI development southwest of the intersection of the Faka Union Canal and US 41. The levee would be about 0.36 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. The agricultural area in southern Belle Meade is surrounded by a levee or berm to assist the farm operators with managing water levels on their properties. A new, improved perimeter levee (6L's levee in Figure 3) would be constructed to ensure that the higher water levels expected from the recommended plan will not flood the agricultural area. The levee would be about 12 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. A ring levee would be constructed around the set of private residential properties located in northeastern Belle Meade, adjacent to the northwest corner of SGGE. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes.

Roads

About 227 of the 279 miles of roads existing in the PSRP would be degraded to existing grade to allow for sheetflow. About 219 miles of these roads are constructed of crushed limestone and 60 miles are paved with asphalt. The road material would be removed with standard earth-moving equipment. Asphalt would be removed off-site and disposed of according to State regulations. Native trees and other native vegetation growing adjacent to and in the roads would be left in place as much as practicable. Non-native vegetation, especially invasive vegetative species would be removed consistent with the invasive, non-native species monitoring and maintenance plan. Demolished roads would generally become impassable by vehicles. Some of the road material would be used for construction of the canal plugs and flood protection levees. Any remaining material would be placed in the canals to supplement the canal plugs.

About 52 miles of existing road would remain in the PSRP. Stewart Boulevard would remain between Jane's Scenic Parkway and Everglades Boulevard. Everglades Boulevard would remain between Stewart Boulevard and I-75. Berson Boulevard west of the Merritt Canal would remain. These roads would be modified with a mix of low

water crossings and with culverts to allow water to flow under or over them. Portions of the north-south Miller, DeSoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but would remain available for use during the dry season.

Up to four miles of new, unpaved roads would be constructed from Berson Boulevard southward to the sites of the three proposed pump stations. The design and exact location of these roads has not been finalized. The "PSSF Post Restoration Road Plan, Final Draft" (DOF 2003) describes road location, maintenance, and management post-restoration. "Primary Roads" which include Berson Boulevard, the northwestern portion of Miller Boulevard, Everglades Boulevard, and Stewart Boulevard to the existing Jane's Scenic Drive in Fakahatchee Strand Preserve, will be open to the public year round and will require alteration to accommodate sheetflow restoration. "Secondary Roads" will be gated roads that will be maintained at ambient grade, utilizing low water crossings, geoweb – a cell-based stabilization product, or other methods to stabilize the roadbed. The main purpose of these roads will be for DOF management access. "Service Roads" are described as unstabilized dirt trails, used seasonally for management purposes. Some gated roads or banks of canals will be maintained for prescribed burn or exotic plant control management. Additionally, "Temporary Roads" are anticipated to be maintained or constructed consistent with individual projects, followed by restoration and permanent closure. An agreement between the Board of Trustees of the Internal Improvement Trust Fund, the District, and Collier County, Florida, vacates county road easements within the PSRP. This agreement references the Road Plan and sets forth conditions under which the parties agreed to the vacation. This agreement is not part of the Federal project. Aspects of the plan, if proposed through the DOF Resource Management Plan, will be reviewed by the United States Department of the Interior (DOI) under separate federal nexus.

Culverts

New culverts would be constructed under U.S. 41. The culverts would supplement the bridges and culverts that exist today. The culverts are identified as 42A, 46A, 51A, 51B, 51C, 55A, 62A, 66A, and 66B in the Letter Report and Environmental Assessment for the Tamiami Trail Culverts Critical Project. Culverts would be constructed under Everglades Boulevard immediately south of I-75 to connect the drainage/borrow canals adjacent to the southern side of I-75. Culverts and low water crossings would be constructed on Stewart Boulevard and other roads that would remain within PSRP. The number, size, and specific location of these culverts will be determined during the Detailed Design and Engineering phase. Culverts would be required for interior drainage of the leveed areas. They would convey runoff off- site to reduce the amount of interior flooding that could occur during storms.

Land Acquisition

The total estimated land requirement for the project is about 64,670 acres. There are 55,247 acres in the Southern Golden Gate Estates CARL Area, which will be acquired in fee title. A perpetual flowage easement will be required over about 9,021 acres in the

PSSF, which may be hydrologically impacted in an average wet season condition with an increase in the water depth of 0.5 to over 2.0 feet. An additional 397 acres will be required in fee title for construction and maintenance of the five levees, and an additional temporary easement will be required over 5 acres needed for construction of the culverts under U.S. 41, Tamiami Trail.

Operational Features

The Preferred Alternative description indicates that the Corps will prepare a Project Operating Manual and provide it to the District prior to final turnover of the project. As the project proceeds, interim operations and maintenance, and interim operating manuals for operation of the pumps and the spreader canals, will be provided to District for each completed project feature. Upon completion of the project construction and an operational testing and monitoring phase, a set of final operation manuals will be assembled by the Corps and provided to the District which would be responsible for operating the pump stations. The Corps will monitor operation implementation. The Corps retains the authority to change the operation manuals or work with the District to update the operation manuals and to develop an adaptive management process as necessary if initial operations fail to achieve the desired PSRP hydrological and ecological restoration goals.

The non-runoff phase of operation is characteristic of the dry period (mid-October to April) across the PSRP landscape and is maintained by gravity flow. Many of the roads that obstruct the historic flow ways will be degraded to natural ground level. As waterflow in the canals encounters the canal plugs, it will form a series of pools. The plan indicates that the operation of the pump stations during this period will be necessary if gravity flow is not adequate to maintain the optimum canal stages.

The plan indicates that the flood control phase of operation is characteristic of periods of high discharges during the wet season (May to mid-October), particularly during runoff events, and during severe tropical storms in order to remove excess runoff or regain canal storage. Continuous operation of the pump stations during the wet season is anticipated.

Listed Species Guidelines

Disturbance to listed species will be minimized or avoided by limiting construction and other disturbances during critical times. Other listed species recommendation will also be incorporated from the Eastern Indigo Snake Standard Protection Measures (Service 2002), Southeastern Bald Eagle Management Guidelines (Service 1987), and Management Guidelines for the Wood Stork in the Southeastern Region (Ogden 1990).

Adaptive Assessment and Monitoring

The intent of the PSRP Ecological and Water Quality Monitoring Plan (Appendix H of the FPIR/EIS) is to determine if the anticipated hydrologic, vegetative, wildlife and estuarine benefits of the project are being achieved and to support the adaptive

management process over the 50-year life of the project. The plan proposes to monitor ecosystem responses to the changes in hydroperiod depth and duration, and changes in flows to the estuaries resulting from implementation of recommended Alternative 3D. The estimate for the average annual monitoring and adaptive assessment activities described in Section 8.4 and Appendix H of the Draft PIR/EIS is $602,098.00 Much of the monitoring is "front-loaded", with the most intensive monitoring scheduled for the early years of the project, when the most rapid ecosystem change is expected to occur.

Cumulative Effects - Site Management Features

The Florida Division Of Forestry (DOF) will manage the PSRP land as a unit of the Picayune Strand State Forest. DOF has prepared a Draft Environmental Assessment (EA) (DOF 2001) and is preparing a Ten-Year Resource Management Plan that will detail management activities to complement the hydrologic restoration of the PSRP project. The CARL project proposal sets forth the purpose for land acquisition of the project site as follows:

- Preservation of habitat critical to or providing significant protection for endangered species;

- Restoration of an altered ecosystem to correct environmental damage that has occurred over the past 40 years, including:
    - Restoration of natural patterns of waterflow into the Fakahatchee Strand.
    - Restoration of productive wetlands systems,
    - Reduction of water losses – increased amount of freshwater entering the aquifer.
    - Improvement of productivity (natural systems ad functions) in the bays and estuaries, and
    - Furtherance of the objectives of the Big Cypress Area of Critical State Concern (Chapter 28-25 F.A.C., Chapter 380 F.S.); and

- For use as a State preserve or wildlife management area;

Consistent with these purposes, DOF has developed the following objectives to manage the site:

- Restore, maintain and protect all native ecosystems; including, the health and diversity of native biological communities (flora and fauna) associated with these natural areas;

- Ensure the long-term viability of populations and native species considered rare, endangered, threatened, or of special concern;

- Restore, maintain and protect hydrologic functions related to the quality and quantity of water resources and the health of associated wetland and aquatic natural communities;

- Protect and preserve known archeological and historical resources;

- Restore and maintain forest health and productivity by practicing sustainable forest management utilizing sound silvicultural techniques to create an old growth forest that yields multiple ecological benefits;

- Provide research, education and interpretive opportunities related to natural resource and ecosystem management;

- Provide for compatible public access, integrating human use through a program of resource-based forest recreation, not emphasizing any particular use over the others, or over the restoration, maintenance and protection of native ecosystems; and

- Provide necessary resources in order to accomplish all identified goals and objectives.

The draft Preferred Alternative B of the EA is Multiple Use Management which includes exotic species control management, prescribed burning, wildfire control, forest product sales, and dispersed recreation such as camping, hunting, fishing, hiking, horseback riding, and mountain biking. The details of the onsite management plan and their effects on listed species and fish and wildlife resources will be reviewed by the DOI consistent with the Interim Use Agreement, the FWCA, and ESA. In April 1998, the DOI and the DEP executed a grant agreement under the Farm Bill (FB) (Section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which gave DEP $25 million in Federal funds to acquire approximately 20,250 acres in the PSRP. The FB3 grant agreement with DEP provides that conservation lands acquired under the agreement will be used and managed for conservation purposes within the scope and authorities of the FB and the Fish and Wildlife Coordination Act (FWCA). The framework agreement requires that all FB funds spent on land acquisition will be matched by non-Federal funds on a dollar-by-dollar basis. Issues that will affect resources include: 1) road access for private property and off-road vehicle (ORV) use; 2) the type, location, frequency, and effects of ORV use, 3) forest productivity and harvest; 4) the extent and type of hunting; 5) the extent and type of passive recreational uses; 6) prescribed and wildfire management; 7) listed species management; and 8) exotic and invasive plant and animal control.

Extensive recreational uses, particularly illegal ORV use and hunting, occurred prior to DOF management, but are now either prohibited (*e.g.*, ORVs) or managed (hunting consistent with FWC's Wildlife Management Area designation). These uses affect restoration of fish and wildlife resources on PSRP and adjacent State and Federal lands. Proposed recreational uses must be consistent with restoration objectives and applicable

State and Federal laws, and will be reviewed as such by the DOI.

HISTORIC AND CURRENT CONDITIONS

Project Site History

In the late 1950s, Gulf American Corporation (GAC) began purchasing an area of 173 square miles (110,620 acres) in Collier County, Florida for a vacation and retirement community, later marketed worldwide. The Golden Gate Estates (GGE) subdivision was approved in 1960, and included 183 miles of drainage canals with 25 water control structures and 813 miles of roads spaced at intervals of one-quarter mile. The area is characterized by nearly flat terrain with cypress wetlands, pine islands, wet and dry prairies, and several deeper wetland strands and sloughs including the adjacent Camp Keais and Fakahatchee Strands. Most of the land is inundated from at least July 1 to October 1 after the onset of the rainy season, and historically drained to the downstream estuaries of the Gulf of Mexico through surface water movement in the form of shallow sheetflow. Two major canal systems, Golden Gate and Faka Union, were constructed in the early 1960s and between 1968 and 1971, respectively, to drain this area into Naples and Faka Union Bays (Corps 1980). These drainage systems channelized surface water runoff and altered each subbasin's hydrologic response to rainfall. The canals also circumvented drainage to downstream estuaries of the Blackwater, Pumpkin, Wood, and Little Wood Rivers. On December 16, 1966, the Corps issued a permit to dredge an entrance channel connecting the Faka Union Canal with the mouth of the Faka Union River. The construction of this canal generated a major point source freshwater discharge in Faka Union Bay which has altered estuarine resources in portions of the TTI.

Land Use

A large portion of the Faka Union Canal watershed is part of the GGE development, zoned for single-family residential land use. Some previously farmed areas in the northern part of the watershed are now zoned for residential and commercial use. The residential zoning in the GGE is low density with a minimum lot size of 1.25 acres. Rapid growth in the greater project region over the past two years has resulted in an almost 20 percent increase in the number of individual homeowner estates being developed in the area directly north of the PSRP (North Golden Gate Estates) (CSWD 2002). The remaining area is used for agriculture, predominantly vegetable farming, except in areas of persistent flooding. The most populated areas of GGE are north of Alligator Alley (Interstate 75 [I-75]) and west of Everglades Boulevard in NGGE. Telephone and electric services are not available in most areas south of Alligator Alley (Southern Golden Gate Estates [SGGE]) and the area remains generally undeveloped. An exception is a small urban area, Port of the Islands (POI), located south of the PSRP adjacent to the northern portion of the main Faka Union Canal (District 2001).

Inland Habitat

The PSRP area was originally dominated by wetland communities, particularly cypress forest and, to a lesser extent, herbaceous wet prairies. Even those sites normally designated as uplands, particularly islands of mesic flatwoods, often had water at or

above the ground surface for at least short periods during wetter portions of the year. After drainage, upland pines, palms, and hardwoods invaded many of the cypress forests. In addition, severe and frequent fires eliminated many of the pine and cypress trees, furthering the conversion of these lands to earlier shrubby successional stages of upland or shallow wetland plant communities. The character of the original PSRP has also changed as a result of the invasion of exotic plant species, particularly Brazilian pepper (*Schinus terebinthifolius*), into drained and disturbed sites.

Plant community maps developed by the Natural Resource Conservation Service (NRCS) (Table 1) indicate where changes have occurred from pre-development to current condition. PSRP plant communities are described using the Florida Land Use Cover and Forms Classification System (FLUCCS) (DOT 1999). They represent a valuable baseline with which to compare future change following restoration, particularly where a return to pre-development (natural) condition is the restoration target. However, while the NRCS maps provide good estimates of plant community acreages for natural and current conditions, they are not able to predict an estimate of restored condition acreages. The only acreage estimates for restoration conditions are those that can be calculated based on the hydrology model. Thus, since these two sets of maps cover somewhat different areas, the only approach that would provide all three conditions for comparing plant community acreages is the one based on the hydrology model (Duever 2004).

The MIKE SHE model used in this study quantitatively estimates the hydrologic response of the system when certain system features are altered. The model does not represent real ecosystems. However, the value of the model is in its ability to synthesize major features and processes operating within an ecosystem and to evaluate specific manipulations more accurately than would otherwise be possible. The MIKE SHE model permits comparison of water levels, and by extension, major plant communities associated with pre-development, existing, and 2050-without-project conditions, as well as those conditions associated with each of the restoration alternatives. Modeled scenarios assume removal of virtually all the PSRP roads except the public access route along Everglades and Stewart Boulevards between Janes Scenic Drive and NGGE (Duever 2004).

The MIKE SHE and NRCS maps have different inland boundaries. In addition, the MIKE SHE model extends coverage to the west of the PSRP to try to minimize problems with model boundary conditions and to increase the accuracy of the model within the area of interest. This same boundary on the NRCS map, however, is somewhat closer to the Miller Canal. These differences are significant when comparing plant community acreages and percentages between pre-development, current, and restored conditions between the two sets of maps. The quarter-mile cell size of the model does not allow for development of plant community maps which include small features or features with a lot of edge, both of which can be more precisely shown on the NRCS map (Duever 2004).

Table 1. Acres and percent of each plant community in 1940 and 1995 in the Picayune Strand Restoration Project. Historic percent of area in each plant community is in the column labeled "Percent (H)." Current percent of area in each plant community is in the column labeled "Percent (C)." Change in acres and percent between the two time periods is shown in the columns under "Difference (1995-1940)."

Plant Community Name	Symbol	1940 Acres	Percent (H)	1995 Acres	Percent (C)	Difference (1995-1940) acres/percent	
Cypress	C	30,583.1	30.5	10,567.1	10.5	-20,016.0	-19.9
Cypress with hardwoods	Ch	0.0	0.0	2,845.7	2.8	2,845.7	2.8
Cypress with palms	Cp	8,758.1	8.7	9,025.6	9.0	267.5	0.3
Coastal Uplands	Cu	301.9	0.3	301.9	0.3	0.0	0.0
Cypress (disturbed)	Cx	0.0	0.0	1,246.2	1.2	1,246.2	1.2
Wet Prairie	G	7,619.3	7.6	7,031.0	7.0	-588.3	-0.6
Prairie with palms	Gp	0.0	0.0	2,043.6	2.0	2,043.6	2.0
Prairie (disturbed)	Gx	0.0	0.0	161.8	0.2	161.8	0.2
Hydric Hammock	Hh	0.0	0.0	2,574.2	2.6	2,574.2	2.6
Mesic Hammock	Hm	0.0	0.0	139.8	0.1	139.8	0.1
Sabal Palm Hammock	Hp	55.8	0.1	7,286.4	7.3	7,230.7	7.2
Tropical Hammock	Ht	264.9	0.3	688.6	0.7	423.7	0.4
Freshwater Marsh	Mf	512.1	0.5	94.7	0.1	-417.5	-0.4
Marsh (Salt/Fresh)	Mfs	8,574.2	8.5	6,480.4	6.5	-2,093.8	-2.1
Mangrove	Mg	16,564.5	16.5	1,8417.3	18.3	1,852.8	1.8
Hydric Pine Flatwoods	Ph	7,141.2	7.1	5,852.9	5.8	-1,288.3	-1.3
Mesic Pine Flatwoods	Pm	2,908.0	2.9	1,983.0	2.0	-924.9	-0.9
Pine Flatwoods with palms	Pp	2,408.0	2.4	6,478.1	6.5	4,070.2	4.1
Pine Flatwoods (disturbed)	Px	0.0	0.0	48.2	0.0	48.2	0.0
Saw Palmetto	S	0.0	0.0	6.2	0.0	6.2	0.0
Brazilian Pepper	St	0.0	0.0	273.1	0.3	273.1	0.3
Urban Land	URB	0.0	0.0	298.8	0.3	298.8	0.3
Water	WAT	14,721.9	14.7	15,843.8	15.8	1,121.9	1.1
Disturbed Land	x	0.0	0.0	725.0	0.7	725.0	0.7
Totals:		100,412.9	100.0	100,413.5	100.0		

Estuaries

The PSRP is located within the watershed of the TTI estuary. Faka Union Bay receives the majority of freshwater input from the PSRP through the main Faka Union Canal which collects flows from four project canals to the north. The canal system drains about 200,000 acres, receiving direct drainage from as far upstream as Corkscrew Swamp, 32 miles to the north. Faka Union Canal discharge records from a gauging station located upstream from the main outfall weir are available since 1969. These records indicate that

average discharges over the period of record were 115 cfs during the dry season (November through May) and 460 cfs during the wet season (June through October), with an extreme discharge of 3,200 cfs occurring right after the canals were built (Abbott and Nath 1996).

Although exact figures are not available based on the lack of an estuarine model and ground-truthing for plant communities, changes in estuarine communities between 1940 and 1995 indicate that the reduction of freshwater flows to the estuary may have increased the extent of mangroves south of the project boundary by about 1,853 acres and decreased brackish marshes by 2,094 acres. These estimates should be considered to be very tentative based on the limited data.

Bays adjacent to the TTI historically received freshwater input from the PSRP wetlands but flows were disrupted or circumvented by road development and the Faka Union Canal network. Alterations in timing and quantity of freshwater flows into an estuary can impact natural biodiversity of the estuary by affecting food availability, predation pressure, and reproductive success, as well as directly causing chronic and acute stress. Freshwater inflow can influence primary productivity, zooplankton biomass, and nekton (small aquatic organism) abundance by influencing nutrient concentrations. Flow alterations have resulted in large fluctuations in salinity and water quality, which in turn impact critical estuarine biota. Salinity is a major ecological variable that controls important aspects of the estuarine community structure and food web (Myers and Ewel 1990). Salinity data collected at 30-minute intervals over three years within Faka Union and Fakahatchee Bays (Reference Site for the area; considered the bay least altered due to installation of the Faka Union canal system) indicate alterations in salinity pattern and fluctuation (O'Donnell, unpublished data). For instance, the average salinity measurements for Faka Union Bay have been consistently lower in comparison to Fakahatchee Bay during this three- year period.

Riverine mangrove wetlands occur in floodplains near the mouth of freshwater systems and may be composed of all native mangrove species. These wetlands receive nutrients from freshwater flows and are most sensitive to variations in these flows, as well as variations in water quality. Decreasing riverine runoff through channelization of adjacent drainages reduces inputs of nutrients and sediments to these forests and reduces water ventilation of mangrove roots (Lugo 1976). Even though mangroves are adapted to saline water, reduction of freshwater inflow can lead to hypersaline conditions, especially near the end of the dry season. Mangrove growth slows under hypersaline conditions, reducing nutrient export to the estuaries.

Point source discharges, like Faka Union main canal, may increase sediment and turbidity in the water column resulting in limited light penetration and reduced seagrass and algal growth. Seagrasses provide food and habitat for many estuarine species, and low algal productivity can reduce the productivity of aquatic invertebrates, an important food source of many fish. Siltation is known to have deleterious effects on epiphytic organisms that are found on mangrove prop roots. High turbidity levels affect fish feeding and growth because the ability of fish to find and capture food is impaired at

higher turbidity levels. In addition, gill function in some fish may be impaired after prolonged exposure to high turbidity levels. Sediments can also be contaminated with potentially toxic concentrations of metals, herbicides, and pesticides. Unnatural sediment deposition can limit the quality of the benthic communities (*e.g.*, seagrasses and oyster bars) by abrasion, habitat loss, and reduction of dissolved oxygen concentrations. These limitations, in combination with "freshwater shock," negatively affect the overall ecological health of an estuary.

Sediment loads can also increase oxygen demand. When turbidity is largely due to organic material, dissolved oxygen depletion may occur. Organics contain excess nutrients that encourage microbial breakdown, a process that requires valuable dissolved oxygen. The concentration of dissolved oxygen in the estuary is crucial to fish production, and fish kills often result from extensive or extended oxygen depletion.

The MIKE SHE and NRCS maps have different estuary boundaries, particularly along the coast. The MIKE SHE hydrologic model does not incorporate tidal influences. The use of a constant mean high tide boundary at its southern periphery is required by the model characteristics. The lack of data on topography, microtidal regime and variable water circulation patterns generated by winds would have greatly limited the usefulness of any model in this area. As a result, the model minimizes the amount of area influenced by tides by leaving out most the saline estuarine habitat located south of Tamiami Trail, which is included in the NRCS maps.

Water Quality

The PSRP site has almost no residential development, but the infrastructure of roads, canals, and levees within the project area are defining features of existing ecological conditions. The water quality condition for the PSRP area is primarily affected by the historic and existing land use characteristics described above.

The Florida Department of Environmental Protection's (DEP's) Impaired Waters Rule Assessment determined the following conditions at locations within and adjacent to the project area:

- Faka Union Canal meets standards for dissolved oxygen, fecal coliform, and turbidity;
- Estuaries receiving flow from the Faka Union Basin meet standards for dissolved oxygen, chlorophyll, fecal coliform, and turbidity but are listed as impaired based on the concentrations of bacteria in shellfish; and
- Blackwater River meets standards for dissolved oxygen, chlorophyll, fecal coliform, and turbidity.

The TTI are designated as Outstanding Florida Waters (OFW) by the DEP. The OFW designation provides that the State cannot issue permits for direct discharges which would lower ambient water quality or for indirect discharges which would significantly degrade water quality. Permits for new dredge and fill projects must clearly be in the

public interest. The United States Geological Survey (USGS), Collier County and DEP are conducting significant ground/water and water quality studies within the PSRP boundaries and downstream estuaries. A Water Quality Monitoring Plan has been developed as part of this project (Appendix H in the FPIR/EIS).

Contaminants

In February and March 2000, the DEP conducted site investigations at the current and former agricultural fields on the western portion of the project site and further to the west in the Belle Meade area. These investigations included site visits, as well as the collection and laboratory analyses of soil samples for residual pesticides from the former cultivated areas. Results of the laboratory analysis exhibited elevated concentrations of organochlorine pesticides, specifically chlordane and to a lesser extent 4,4-DDE, 4,4-DDD, dieldrin, and endosulfan I.

In September 2000, DEP contracted (WRS Infrastructure & Environment) to perform a preliminary overview assessment of three tracts of land within the PSRP area. Identified in this study were "areas of high environmental concern" including areas of stressed vegetation, agricultural lands, or areas where greenhouses, shade houses, or nurseries; areas of commercial land use; areas with large piles of discarded solid wastes; and areas with machinery storage and/or multiple abandoned vehicles. In November 2000, the District retained URS Corporation (URS) to complete a Phase I and II Environmental Site Assessment. A work plan for this study was presented to the Service for review and comment and was subsequently revised and approved. URS conducted a Phase I and II Environmental Site and Ecological Risk Assessment of the PSRP, resulting in a September 30, 2003, report. The report included sampling and assessment activities for the entire PSRP site and divided it into four areas: the Former Agriculture Area Northeast (FANE), Former Agriculture Area Southeast (FASE), Former Agriculture West (FAW), and the Interior area. The 1,450-acre FASE is located on the southeast boundary of the PSRP and was formerly utilized for tomato cultivation in the 1930s. The 750-acre FAW is located on the western project boundary and contains both cultivated and non-cultivated land last farmed in the early 1960s. The 600-acre FANE is located in the northeast project area and consists of three small farms of cultivated and non-cultivated land. One of the farms was a recently abandoned 23-acre grove/landscape nursery operation. In addition to the three former agricultural areas, 46 homesteads were identified within the 50,000-acre project interior. Some of the homesteads include rudimentary landscape nursery/orchard operations, vegetable gardens, or hobby farms. Follow-up analyses of selenium soil concentrations and desorption testing in the FASE were conducted by URS as a supplement to the Phase I and II Assessment and the results were provided in their July 9, 2004, report.

The interior areas were extensively sampled in accordance with established protocol. No significant areas of concern or point sources were identified. URS did note large areas of solid waste and recommended that the waste be removed prior to hydrologic restoration. URS also recommended pre-demolition asbestos surveys for homesteads in the Interior area. The Service supports these recommendations.

Initial sampling of the FANE identified elevated levels of selenium. However, two repeat sampling efforts performed by URS for grid 22 of the FANE portion of the property did not detect selenium at any level of concern. Therefore, the Service is of the opinion that rehydration and restoration of this area (Prairie Canal) should not present a risk to fish and wildlife resources.

Sampling by the DEP in 2000 and again by URS in 2003 revealed high levels of chlordane and, to a lesser extent, dieldrin in the FAW. The Service identified several miscalculations, errors, and other problems with the k_{oc} and k_{ow} values for dieldrin and chlordane presented in the District's Ecological Risk Assessment (ERA) completed on September 30, 2003. These errors could lead to a significant underestimation of risk to fish and wildlife resources. In a letter to the District dated March 23, 2004, the Service recommended either repeating the laboratory studies and recalculating the k_{oc} and k_{ow}, or using the literature values for these parameters in the ERA. In subsequent discussions, the District has verbally agreed to use the literature values of these parameters in risk calculations for this property, rather than repeating the laboratory studies.

Based on the literature values of the k_{oc} and k_{ow}, the Service calculated cleanup goals of 100 ppb and 6 ppb for chlordane and dieldrin, respectively. All soil locations with measured concentrations above these levels will require delineation and some type of remediation in order to prevent adverse effects to piscivorous birds. The District has verbally concurred with these cleanup goals and is currently conducting further sampling and analysis to delineate areas within the FAW requiring cleanup. The Service has recently received a report entitled “Additional Scope Sampling Program for Southern Golden Gate Estates” prepared for the District by Environmental Consulting and Technology, Inc. This document, which is currently under review by the Service, reports the results of additional sampling in the FAW and recommends remediation of approximately 36 acres with chlordane concentrations above 100 ppb. In its March 23, 2004 letter, the Service also recommended that a sampling plan be developed to assess the extent of contamination and remediation that may be necessary on those (primarily public) lands west of SGGE that will be affected by this project. Additional delineation sampling is planned for both the FAW and the adjacent Belle Meade property.

High selenium levels were found in the FASE, particularly in Grids 25 and 29 and sediment sample SED-6. The conclusion of the District’s September 30, 2003 ERA report states that selenium levels found in grids 25 and 29 of the FASE could pose risk to small mammals. The Service believes that the highest of these levels may also pose a risk to trust resources (i.e., wading birds, waterfowl) that may utilize these restored wetlands. The 95% UCL for selenium in Grid 29, using all of the data for that grid, was 3.19 ppm. A similar value for Grid 25 was 2.29 ppm. These levels are at or above a concentration known to have produced reproductive failure in birds. Follow-up analyses of selenium soil concentrations and desorption testing in the FASE were conducted by URS as a supplement to the Phase I and II Assessment and the results were provided in their July 9, 2004, report. Unfortunately, the resampling did not result in the desired delineation of the contaminated zone. However, a subsequent review of the existing

hydrologic modeling data and vegetation maps for the SGGE suggests that the FASE portion of this property will not experience much of a change from the existing condition with the project. Therefore, the Service does not believe that the level of Se exposure to trust resources (including federally listed threatened and endangered species) in the FASE would likely increase over that of the existing condition as a result of this wetland restoration project as proposed.

Roadbeds

Four asphalt core samples were collected throughout the PSRP site to determine if the use of removed asphalt road beds for fill would increase risk to fish and wildlife resources. Asphalt core samples indicated that the substrate was relatively inert. However, the Service believes that asphalt roadbed should be used as a last resort, only after all gravel roadbeds have been removed. If sufficient amounts of fill are not available on-site to complete restoration, the District will utilize other sources of fill outside the project impact area.. The Corps and the District have determined that all removed asphalt will be taken off the property for disposal, in accordance with State regulations. No asphalt will be re-used on-site as fill.

Exotic/Invasive Terrestrial Species

South Florida's subtropical climate provides an excellent growth environment for the rapid spread of exotic plants that can cause extensive alterations to an area's natural ecosystems. Environmental changes caused by extensive hydroperiod alterations in the project area have been an important factor in exotic plant invasion. Exotic plant species are associated with draining or disrupted fire and hydrologic regimes. Exotic plant invasion can result in partial or total displacement of native plants, loss of wildlife habitat, and the degradation of public use areas. Non-indigenous plant or animal species that persist in the project area may harm or displace native species and alter ecosystem functions. Brazilian pepper and melaleuca are among the most prolific invasive species, although other introduced plant and animal species may locally or regionally imperil fish and wildlife resources. Increased nutrient loads may lead to the proliferation of nuisance species such as cattails (*Typha* spp.) or primrose willow (*Ludwigia peruviana*).

Brazilian pepper does not become established in deeper wetland communities and rarely grows on sites inundated longer than three to six months (LaRosa et al. 1992). Results of experiments conducted by the Sanibel-Captiva Conservation Foundation on Sanibel Island, Florida (1990-1991), and the effects of a substantial rainfall in 1995 suggest that Brazilian pepper can be stressed or killed by flooding. Successful invasion appears to be a function of seed dispersal to an area, germination of introduced seeds, and seedling survival (Ewel et al. 1982). The long-term goal of the PSRP is to return the hydrology of the area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage. With a combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program, it is reasonable to expect the PSRP to approach its pre-drainage character, including the plant communities and wildlife that it supported at that time. Invasive plant and animal control

is an integral part of a comprehensive ecosystem restoration program. Preventing establishment of invasive species and early intervention after these species are introduced is much more attainable and cost-effective than management after their dispersal and establishment. It will be important to continually monitor for the presence of exotic/invasive plant species and implement control measures while their populations are still small. Initial observations of the Prairie Canal Early Start Project indicate that invasion of Brazilian pepper seedlings on substrates that have been disturbed by restoration activities and fire (in the presence of seed source) will be a primary concern.

It should be noted that the ability of the selected plan to reduce exotic vegetation is based on the assumption that an Exotic/Invasive Species Management Plan will be implemented as part of the selected alternative. Periodic inventories and timely control of newly discovered invasive species will allow the land manager, DOF, to be proactive in protecting public lands. The management plan should have three components: 1) best management practices to implement during construction activities that reduce the spread of exotic plants; 2) initial aggressive treatment and management of substrates that are disturbed by restoration activities where invasive plant seedlings are evident; and 3) extensive site management/control activities by the land manager. Without such a plan, exotic vegetation would re-infest the project area and the existing condition would persist and worsen.

Non-indigenous amphibian, reptile, and mammal populations which may be present in the project area can change complex ecosystem relationships or reduce the food supply for native predators (DEP 1994). Feral hogs in the PSRP area degrade wildlife habitat, compete directly with native wildlife for food, and act as a reservoir for diseases communicable to man and domestic animals. Feral hog habitat includes the flatwoods, freshwater marshes, ponds, sloughs, and cabbage palm hammock plant communities. In general, most low and medium hog populations occur where habitat quality is limited. The detrimental effects of wild hogs are multi-faceted and result from their movements, habitat utilization, and food habits. Their rooting disrupts vegetative communities and successional patterns, as well as altering nutrient cycling. Therefore, they can have both direct and indirect effects on some fauna either through predation or alteration of the forest floor habitat (Tate 1983). It is hypothesized that the wild hog is a fairly significant competitor for food with a number of other wildlife species such as deer, turkey, squirrels, and even waterfowl (Thompson 1977). Trapping, sport hunting, and agricultural depredation control measures have been implemented to suppress populations in some areas of Florida where feral hogs are having detrimental effects.

Non-native Invasive Fish Species

Non-native fish species, as well as non-native plants and other exotic animals, are also a potentially obstacle to achieving restoration in the project area. It remains difficult to assess the threat from non-native fish and measure ecological impacts due to variability in occurrence, density, and biomass within different habitats and geographic areas over time (Traxler et al. 2000).

Canals, canal sections, or deeper ditches that remain on the PSRP site will provide permanent habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could disperse predatory fish to isolated wetlands where increased predation on small fishes could reduce the forage base for wading birds, such as wood storks.

The following exotic fish species were collected in the PSRP area: walking catfish (*Clarias batrachus*), pike killifish (*Belonesox belizanus maxillosus*), oscar (*Astronotus ocellatus*), black acara (*Cichlasoma bimaculatum*), Mayan cichlid (*Cichlasoma urophthalamus*), spotted tilapia (*Tilapia mariae*), and blue tilapia (*Oreochromis aureus*). Both walking catfish and pike killifish are considered predators on native aquatic animals, are highly drought-tolerant, and use solution holes as refuges. The Mayan cichlid is a predator on native aquatic animals and competes for nest sites with native sunfishes. All nonindigenous fish species collected thus far in the PSRP area have the potential for ecosystem damage via predation, local nesting competition, habitat disturbance, and/or spread of exotic parasites (D. Ceilley, pers. comm. 2004). Preliminary indications are that most of the exotic fish will be confined to disturbed canal remnants after project completion. However, because of the potential current and future threat resulting from non-native fishes and the broad policy-level support for action against invasive species, project monitoring plans should identify non-native fishes and the extent to which these fishes invade adjacent restored habitats to determine if control measures are necessary. The Monitoring and Adaptive Assessment Plan (Appendix H) provides for yearly sampling of inland fish and wildlife until construction is complete, followed by sampling at 5-year intervals during the rest of the project; the purpose of sampling is to identify problems and implement control measures before problems become too severe.

DESCRIPTION OF FEDERALLY LISTED SPECIES AND DESIGNATED CRITICAL HABITAT

The Corps coordinated potential effects to federally listed species with the Service and with NOAA Fisheries, together referred to as the Services, as appropriate. Specifically, coordination with NOAA Fisheries included listed fish, marine plants, and sea turtles at sea. Coordination with the Service will include other listed plants and animals. Twelve federally listed animal species and three candidate fish species are present or potentially present in the project area (Table 2). There are no federally listed plant species in the project area. Many of these listed species have been previously affected by habitat impacts resulting from wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation. The PSRP has the potential to greatly benefit most, if not all, of these species. Those species not directly affected by the project include species that are rare in the project area or utilize estuarine habitat that is only indirectly affected by the restoration project.

Table 2. Federally listed threatened (T), endangered (E), or candidate (C) species that might occur within the PSRP area.

REPTILES		
American crocodile	*Crocodylus acutus*	E
Eastern indigo snake	*Drymarchon corais couperi*	T
Loggerhead sea turtle	*Caretta caretta*	T
Kemp's ridley sea turtle	*Lepidochelys kempi*	E
Atlantic green sea turtle	*Chelonia mydas mydas*	E
BIRDS		
Red-cockaded woodpecker	*Picoides borealis*	E
Wood stork	*Mycteria americana*	E
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E
Bald eagle	*Haliaeetus leucocephalus*	T
MAMMALS		
Florida panther	*Puma concolor coryi*	E
West Indian manatee	*Trichechus manatus*	E
FISH		
Consultation on listed fish will be coordinated with the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries).		
Smalltooth sawfish	*Pristis pectinata*	E
Goliath grouper	*Epinephelus itajara*	C
Mangrove rivulus	*Rivulus marmoratus*	C
Sand tiger shark	*Odontaspis taurus*	C

EFFECTS OF THE PROPOSED ACTION

General Project Effects. General effects can be of either short duration (associated with construction or start-up activities) or can last for the life of the project. It is the intention of the action agencies (Corps and District) to minimize adverse effects of construction activities by avoiding significant habitat elements of listed species, and by utilizing all appropriate safeguards, including timing to avoid reproductive "windows", use of observers, re-location where required, cleaning equipment to avoid further introduction of exotics, and other actions recommended by resource specialists. In order to avoid sensitive habitats for listed species more detailed surveys to identify specific, species related habitat elements will be carried out, if the project is approved, during the Preconstruction Engineering and Design (P.E.D.) phase. Appendix H accounts for these detailed surveys under "listed species." However, all construction activities include generation of noise, disturbance of soil, earth movement, and deposit of fill in open canals. To the extent practicable, the Corps will coordinate construction staging areas and timing of actions with the Service and FWC to avoid adverse impacts on listed species.

Inland Habitat Alteration

Table 3 indicates anticipated habitat changes based on hydroperiods associated with the major existing wetland communities in southwest Florida. Hydrology and plant community relationships are based on Duever et al. (1975) and Duever (1984). Only major plant communities are identified in Table 3, although 24 different plant communities and land use categories have been mapped for purposes of identifying the impacts of drainage on the landscape between pre-development (1940s) and 1995 (Table 1). The major effects of the drainage associated with the existing canal and water management infrastructure within the project are the loss of cypress forest and herbaceous wet prairies. Historically, small areas of pine flatwoods normally designated as uplands were located in narrow strands in elevated areas of the project and in the northwest project corner. Hydric flatwoods, which often have water at or above the ground surface for at least short periods during wetter portions of the year, were the majority of the remaining flatwoods. Due to the variable nature of shallow wetland hydroperiods and site topography over time, many on-site plant communities historically contained elements of both uplands and wetlands which were periodically affected by fire, freeze, drought, flood, and hurricane events. After drainage, upland pines, cabbage palms, and hardwoods invaded many of the cypress forests. Severe and frequent fires eliminated many of the pine and cypress trees, furthering the conversion of these lands to earlier successional shrubby states of upland or shallow wetland plant communities. Exotic plant species, particularly Brazilian pepper, have changed the character of many habitats, especially adjacent to the site's extensive canal and roadway network. Because the site is significantly affected by drainage features upstream of the project, primarily NGGE, the project goals were developed with acknowledgment that habitat restoration would include a balance of project management features to restore as much of the site as possible to pre-drainage character. There was also consideration of upland restoration and protection, acknowledgment of interim and post-restoration management, and post-restoration operational features related to the effects of the project on fish and wildlife and listed species concerns (Duever 2004).

Table 3. Hydrologic regimes and other environmental factors that maintain the major plant community types. Relative abundance of these communities during natural and current conditions is indicated by the number of pluses from low abundance (+) to high (++++) abundance. A zero (0) indicates the community is not present.

Average Wet Season Water Level (inches)	Hydroperiod (Month)	PSRP Non-Tidal Plant Communities	Non-Hydrologic Influences	Relative Abundance in PSRP	
				Natural	Current
≤-6	0	Tropical Hammock	No Fire	++	++
≤2	≤1	Mesic Pine Flatwoods	Fire	+++	+++
		Palmetto Prairie	Fire	0	0
		Mesic Hammock	No Fire	0	++
		Brazilian Pepper	Exotic	0	++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
2 – 6	1 - 2	Hydric Pine Flatwoods	Fire	+++	+++
		Hydric Hammock	No Fire	0	+++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
6 – 12	2 - 6	Wet Prairie	Fire	+++	+++
12 – 24	6 - 10	Marsh	Fire	++	++
		Cypress Forest	Fire	++++	++++
>24	>10	Open Water		0	0

Tables 4a and 4b indicate that the model results based on the Alternative 3D will result in significantly more mesic flatwoods (9,194 acres) and less hydric flatwoods (827 acres) and wet prairie (4,700 acres) than pre-drainage conditions. These plant communities would replace significant acreage (2,427 acres) of pre-drainage cypress forest and some freshwater marsh. While Alternative 3D might appear to fall short of restoring cypress forests on the project site to pre-drainage conditions, the following should be considered when assessing the project restoration benefits: 1) pre-development cypress communities (based on analysis of soils maps) often included mixed canopies of pines, palms and hardwoods, especially in short-hydroperiod cypress forests as opposed to deeper cypress stands, and therefore there may be an over-estimate of the original extent of cypress forest; 2) project design considerations purposely included protection of upland plant communities in the northern and northwest project boundaries to minimize downstream project effects to listed species such as the Florida panther and red-cockaded woodpecker, and rare plant communities such as tropical hammocks; and 3) significant restoration in the quality and function of 12,809 acres of cypress forest from the existing condition is anticipated under Alternative 3D.

Table 4a. Acres and acre difference of major PSRP plant communities: 1940 = pre-development target, 1995 = (modeled) existing conditions, and Alternative 3D = projected with implementation of Alternative 3D.

Plant Communities	1940 Natural (Acres)	1995 Existing (Acres)	Projected Alt. 3D (Acres)	Difference Natural to Existing Ac Change	Difference Natural to 3D Ac. Change	Difference Existing to 3D (Ac. Change)
Mesic	9,194	55,058	18,388	45,864	9,194	-36,670
Hydric	11,260	2,273	10,433	-8,987	-827	8,160
Wet Pr /Sc Cyp	19,420	878	14,720	-18,542	-4,700	13,842
Cyp / Marsh	16,166	930	13,739	-15,236	-2,427	12,809
Open Water	3,254	155	2,014	-3,099	-1,240	1,859
Total	59,294	59,294	59,294			

Table 4b. Percent and percent difference of major PSRP plant communities: 1940 = pre-development target, 1995 = existing conditions, and Alternative 3D = projected with implementation of Alternative 3D.

Plant Communities	1940 Natural (% Total)	1995 Existing (% Total)	Projected Alt. 3D (% Total)	Difference Natural to Existing (%Change)	Difference Natural to 3D (%Change)	Difference Existing to 3D (% Change)
Mesic	16	93	31	599	200	33
Hydric	19	4	18	20	93	459
Wet Pr /Sc Cyp	33	1	25	5	76	1,677
Cyp / Marsh	27	2	23	6	85	1,477
Open Water	5	0	3	5	62	1,300
Total	100	100	100			

Estuarine Habitat Alteration

Restoration of freshwater wetland and pre-development sheetflow conditions in the PSRP will reduce point discharges and improve the health of downstream estuaries. Restoration could result in a more natural salinity regime that, in turn, would increase the productivity of seagrasses, oysters, fish, and other estuarine-dependent species. However, freshwater flow to the estuaries may be altered in a way that is not beneficial. A carefully engineered design combined with year-round management and adaptive assessments of these flows is critical to project success. Designs that do not depend on structural components might better approximate the natural system and prevent management decisions that may be driven by flood control issues but no such design was capable of meeting the constraint of not worsening flood conditions in NGGE. Careful management to prevent point source discharges during most of the year or even over several years can be neutralized by one incorrect management decision at a critical time.

Conversely, a reduction in flow resulting from too much water being held in the watershed (more likely during the dry season) can create lower salinities that would be harmful if prolonged (one week or more). Water held in canal systems in NGGE for purposes of water supply can actually damage downstream estuaries. Poor timing and gradual versus rapid releases of freshwater flow into the estuary can affect reproductive and migration cycles of estuarine species. Detailed estuarine mixing models to predict the effects of the project plan and any operational plan for water management are not available. Therefore, development of a conservative Operational Manual that favors estuarine protection strategies is critical. Operations should incorporate adaptive management strategies based on the impacts of water management practices on the downstream estuary as indicated by project monitoring plans. The Service has recommended development of an estuarine mixing model to examine the relationship between Faka Union Canal outflows and Faka Union Bay and adjacent bay salinity isohalines under various operational alternatives, but the Corps does not believe that the data required to develop such a model currently exist.

There is a strong connection between freshwater outflows from the southwest Florida coast, Florida Bay, and the upper Keys (Lee et al. 2002). The Service recommended consideration of benefits or adverse effects of water management related to this project with regard to their potential for restoration of the larger marine ecosystem, including the Florida Keys National Marine Sanctuary. The Corps has considered this suggestion, but does not believe that changes proposed in the PSRP would lead to significant changes in the water budget of the more remote Florida Bay/Keys ecosystem, because no new source of water has been developed; only the timing and distribution will change. The volume of water arriving at the spreader canal and pumps will not be greater or lesser than it is at present but the means of delivering the water (as partial sheetflow rather than channeled flow) will change. Converting the present channeled flow into extensive sheetflow will affect the timing of the arrival of water at the coast, spreading out the annual hydrograph, as the now-overdrained shallow aquifer becomes recharged with water. This means that pulses of freshwater will peak later and more slowly, and be spread over a much wider area than at present. Due to recharge of the shallow aquifer during the wet season, later dry season runoff will decrease much more slowly than at present. During average periods and dry years, ground water storage and evapotranspiration in the project area will increase, causing an overall reduction in delivery to the coast, but a more even and favorable distribution of the delivery.

Contaminants Remediation

The District and URS have assessed potential ecological risks on the PSRP property. The Phase I and II Environmental Site and ERA is well-designed, was coordinated early and throughout the plan development process with the Service, is comprehensive in scope, and represents the state-of-the art in ecological risk assessment.

Current levels of chlordane and, to a lesser extent, dieldrin that are present on the FAW portion of the property represent a risk of adverse effects to piscivorous, or fish species, including the bald eagle and wood stork, due to flooding of the property and subsequent

release of these contaminants into the food chain. The Service has recommended cleanup goals of 100 ppb and 6 ppb for chlordane and dieldrin, respectively. All soil locations with measured concentrations above these levels will require delineation and some type of remediation in order to prevent adverse effects to piscivorous birds. The District has verbally concurred with these cleanup goals and is currently conducting further sampling and analysis to delineate areas within the FAW requiring cleanup. As proposed in its Draft Additional Scope Sampling Program, the District has suggested that (1) all soils with greater than 1,000 ppb chlordane will be excavated and disposed off site; (2) all soils containing between 200 and 1,000 ppb will undergo soil inversion by burial and capping with native subsurface soils; and (3) all soils containing between 100 and 200 ppb will undergo soil inversion by plowing. All three types of remediation will destroy existing habitat for federally listed species in those areas. The District's contractors are still in the process of sampling in the FAW and the adjacent Belle Meade property to delineate all areas that will require remediation. The Service will review these recommendations as they become available.

Exotic/Invasive Species

Federal agencies have been provided a mandate to address invasive exotic species under Executive Order (E.O.) 13112: Invasive Species. Under this E.O., Federal agencies are directed to identify appropriate control practices and means to reduce the spread of exotic species, and use relevant programs and authorities to prevent, control, monitor, and research invasive species. It further directs Federal agencies not to fund projects that are likely to promote the introduction or spread of exotic species.

The FPIR/EIS assumes that the managing entity, DOF, will be responsible for removal and control of invasive/exotic species on the project site. Discussions with the Service, District, and DOF indicate, however that the managing entity, DOF, does not currently have sufficient staff or funds to control exotic plants and some exotic animals on the project site. There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive species, especially in the short term, or whether more intensive management activities may be necessary on a short or long-term basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species. Development of a detailed Exotic/Species Management Plan, and provisions for funding the management activities identified in the plan, in cooperation with DOF, will be necessary to implement and realize the restoration benefits of the recommended plan. The Corps has committed verbally to the Service to assist in development of the Management plan and to identify potential invasive species control actions that may be compatible with the Monitoring and Ecological Assessment plan.

Improved Water Quality

Implementation of the restoration plan will improve the water quality of coastal estuaries. This would occur by moderating the large salinity fluctuations caused by freshwater point-source discharges through the Faka Union Canal and distributing these discharges via overland sheetflow to the downstream estuaries.

Increasing development pressure north of the project area raises concerns over the elevation of nutrient loads and fecal coliform concentrations in the surface waters of the project area. This and other nutrients derived from vegetation killed as a result of restoration efforts could potentially encourage the growth of nuisance plant species. It would be important to monitor the PSRP for nuisance species (*e.g.*, cattails and primrose willow) and provide control measures before they spread and dominate an area. If phosphorus levels become sufficiently high as NGGE develops, it may become necessary to treat canal inflows to protect the character of the PSRP's natural plant communities.

The NGGE may be contributing nutrient concentrations that can cause algal blooms under certain environmental and seasonal conditions. Data from monitoring sites located at the inflows of the project area along the Faka Union and Merritt Canals indicate mean phosphorus concentrations of 15 parts per billion (ppb). The estuarine sampling site located at the outfall of the Faka Union Canal weir averaged 20 ppb. An outlying concentration of 150 ppb was also obtained at the estuarine site. While there have been no indications that these concentrations have caused algal blooms within the study area (*i.e.*, chlorophyll is used as an indicator of nutrient enrichment, and no violations for chlorophyll were found at the Faka Union site going into the estuary or in monthly data collected within the estuaries), the downstream estuarine systems are classified as extremely oligotrophic, or having low levels of nutrients. Impairment of water quality from sustained high levels of nutrients would be a concern. The Ecological Monitoring and Assessment Plan (Appendix H) provides for regular water quality sampling for total P at inland and estuarine sites. Any changes in concentrations would be noted.

Another potential impact to the water quality of receiving waters after sheetflow is reestablished would be the presence of extensive off-road vehicle trails in the southwestern portion of the project area. Flow across these denuded areas could increase sedimentation effects on the marsh vegetation and elevate turbidity levels in the creeks to the south. The current DOF management plan does not provide for ORV use. The damaged area was caused by unauthorized activities.

Several of the primary goals of this project provide excellent opportunities for water quality improvements. Science-based performance measures should be employed in order to insure benefits to water quality. Water quality performance measures for the PSRP should focus on specific restoration targets for estuaries. Achieving restoration targets in the downstream estuaries will also indicate success in achieving water quality objectives for the freshwater components of the project area. Protocols for waterflow through the Faka Union Canal should enable flows to closely mimic the salinity regime occurring in Fakahatchee Bay. The Fakahatchee estuarine area is mainly influenced by Fakahatchee Strand which closely mirrors an unaltered Everglades system and would simulate the natural freshwater to saltwater interface relationship that once occurred throughout the TTI area.

The Service has expressed concern about the quality of the water that will be received by TTI NWR from Faka Union Canal and through Bad Luck Prairie. These concerns include contaminants and nutrients, such as phosphorus.

Improved Road Plans

In August 2000, the PSRP PDT approved a plan that specifies the disposition of PSRP project roadways after restoration and included road location, type of use, and grade (elevation). A modified road plan, dated March 2003 was developed by DOF, the Corps, and the District and was included in a 2003 memorandum of understanding (MOU) between Collier County, the District, and DEP. Issues that have not been resolved with regard to this plan include: 1) extension of Miller Boulevard as a primary road further south and its effects on hydrologic restoration and listed species (we will provide the acres of impact when we have quantified them); 2) the amount, type, and management of proposed public access and use on project roadways as specified in the MOU and its implementation through the DOF management plan; 3) design of hydrological restoration across east-west roadways; 4) project infrastructure roadway location and effects, especially pump access roadway improvements to Berson Boulevard or existing canal berms north of the pump station locations (we will also provide the acres of this impact when we have quantified them); 5) multiple-use issues as proposed in a future resource management plan; and 6) elevation of roadways remaining in the project. The details of the road plan will be finalized in the Detailed Design and Engineering phase in cooperation with DOF and the Service. The acres of impact that have not been calculated yet are necessary to quantify impacts to several listed species.

Appropriate Size and Location of Levees

Flood protection levees that will protect private or public property from flooding that may result from project construction and operation will have an effect on fish and wildlife resources and listed species. The exact scope and location of these levees will be determined in the Detailed Design and Engineeering phase. These berms may have a minimal potential to: 1) reduce restoration benefits on both the project site and adjacent public lands; 2) impact fish and wildlife resources both on and off the project site; 3) conflict with previously agreed to mitigation areas or project purposes on adjacent property where Service consultation under the FWCA and ESA has occurred; and 4) introduce exotic plants. The Corps and the Service will cooperate to modify levee designs and location and adjust construction staging to avoid loss of restoration benefits or adversely affect listed species. Once the levee design has been finalized, the acres of impact will be calculated. These include the levees around the agricultural areas located west and southwest of the project area, levees that are constructed to access pump stations, and levees on TTI NWR adjacent to Faka Union Canal.

Operational Plans

Since the completion of the draft PIR/EIS (Corps 2004), additional modeling was initiated to refine and optimize the Operational Plan. After input from the Service, the Corps and District modelers have acknowledged errors of 0.5 to 1.3 feet in the operational on/off criteria for two pump stations that transmit water from NGGE to SGGE. These errors were reproduced from an outdated operations manual. They will be addressed in the next version of the operations manual. The Operational Plan will be updated during P.E.D., if the project is approved, to reflect the new modeling results since the Operational Plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics will be updated to ensure consistency between project modeling and project assurances. The Corps will modify the Operational Plan to reflect updated modeling and correct the operational errors identified by the Service. . These modifications may include dry season releases or retention of water to benefit fish and wildlife resources, based on the monitoring and adaptive management process. Model updates and changes to potential effects analyses on listed species will continue to be coordinated with the Service(s).

Implementation of Monitoring Plans

The Corps, District, DOF, and the Service have prepared an Ecological and Water Quality Project Monitoring Plan (Appendix H of the FPIR/EIS) and associated budget. This plan would provide for baseline, construction, and post-restoration monitoring of water quality, ground and surface waters, vegetation, wading birds, aquatic fauna, small mammals, oyster health and ecology, oyster reef fish populations, nekton, mangrove/salt marsh vegetation boundary, and Federal and State listed species. The Plan now also includes aquatic fauna components and funds for listed species/habitat surveys. The Corps will modify this plan consistent with the Service(s) input. The Service has indicated that it is absolutely essential that this plan be completed and funded for the Service to support this project.

Assurances

The PSRP restoration project is primarily aimed at rehydrating over-drained wetlands in the project area. Through accomplishment of the project's purpose, improvements in the quantity, timing, and distribution of flows to the estuaries should be achieved by reducing damaging point source flows that currently exist. Since the project is hydrologically isolated from the regional system and designed to increase water levels within the project footprint, meeting the assurances required by WRDA is relatively straightforward in that an analysis of overall regional water management changes is not required. If modeling is correct, the benefits of the PSRP plan will be achieved for the natural system.

The Service has recommended that the estuarine subteam of the PDT be consulted on the spatial and temporal scale chosen to evaluate the existing legal sources for the downstream estuary. Graphics indicate that total flows may be met on an average annual basis but not on a spatially distributed seasonal basis. The temporal and spatial scales for

the evaluation of existing legal sources for fish and wildlife should to the greatest extent practicable be consistent with the opinion of the scientific and technical teams responsible for selecting performance measure targets and performing evaluations of fish and wildlife resources.

Corps and District modelers have acknowledged errors of 0.5 to 1.3 feet in the operational on/off dry season criteria for two pump stations that transmit water from NGGE to SGGE. These errors will be corrected in model runs in the PED phase of this project.

Service hydrologists have indicated the model may significantly underestimate the exchange of water between the canal and the aquifer, affecting project predictions for benefits or impacts to fish and wildlife resources. The Service has also expressed concern that the model does not accurately represent the volume and distribution of flows to the downstream estuary. The flows calculated by the model are tightly linked to the use of unrealistic canal extensions from SGGE to the coast and assumptions for various input parameters such as flood plain cross sections, flood codes, and other aquifer parameters. In a meeting on August 10, 2004, the Corps and the District acknowledged a number of these issues and made a commitment to provide additional information to address them during the PED phase of this project.

Currently the draft Project Operating Manual is based on a model that contains operational errors. To ensure consistency between the project modeling, Project Operating Manual and the project assurances, text of the Operating Plan should be updated to reflect the final operational plan after errors are corrected. The Project Operating Manual is the link between the water identified to be reserved for the natural system, based on the expected performance of the plan, and the actual deliveries for the natural system.

Specific Effects of Project Construction

Construction activities proposed under the recommended alternative that may result in the removal of native vegetation, including some ecologically valuable habitat include: the removal and grading of selected roads, ditches, and berms; the construction of canal plugs, spreader canals, pump stations, and earthen berms around private property.

The recommended plan design features will have the following specific effects:

- Pump Stations, Spreader Channels and Berms. The length of the three spreader canals associated with Alternative 3D is 12,900 feet (2.4 miles). If the width of construction associated with this feature is 60 feet (no scaled cross-section was available for review), impacts to 17.77 acres of habitat are associated with the spreader swale.. No cross-sections are available for an intake canal or berm associated with this spreader canal. However, estimating a 60-foot intake canal and 50–foot berm for a distance of 12,900 feet, total habitat impacts associated with this feature could be 32.58 acres. The majority of this impact would be to pine flatwoods and cabbage palm forest. It is estimated that approximately four

miles of new roadway construction may be associated with construction of access to the spreader canal, berm, and pump station features. Pump stations will be constructed on berms in association with the spreader and berm design as described above. Only minor habitat impacts are expected. The acres of impact from the construction of these features and the four miles of road on wetlands has not been calculated yet, but will be provided later.

- Road Demolition. Roads in PSRP are elevated a few inches to a foot above the adjacent ground and they intercept water that would otherwise flow across the ground surface. Roads provide disturbed habitat which serves as introduction sites for exotic plant species like Brazilian pepper. Ditches located parallel to the roads intercept surface and groundwater and limit historic flow patterns. Road demolition is defined as reducing the elevation of the road to match the adjacent land surface. Material would be pushed aside and leveled. Excess fill would be pushed into project canals to serve as plugs. A 150-foot clearing limit is estimated for paved and unpaved roadway demolition or degradation. Of this150 feet, approximately 20 feet may be paved or filled road surface, 30 feet is roadside swales, and approximately 60 feet is spoil berm or rocks.

  The estimated maximum impacts to habitat associated with degradation of roads for a maximum of 70 feet (150 feet minus road and spoil berm) for 227 miles of roadway is 8.48 acres per mile of roadway or 1,925 acres. About 30 feet is typically degraded herbaceous wetlands (3.64 acres per mile of roadway or 826.2 acres). Approximately 40 feet is typically pine, cabbage palm, or exotic vegetation that invaded areas adjacent to roadways after drainage (4.85 acres per mile of roadway or 1,101 acres). The acres of impact by cover type has not been calculated yet, but will be provided. These areas are expected to be restored to pre-development vegetation condition.

- No extension of Miller Boulevard beyond its existing configuration is proposed in the FPIR.

- Canal Plugs/Canal Backfill/Swale Blocks. There are 48 miles of canals in the PSRP with a typical width of 100 feet. Canal depth varies, submerged aquatic vegetation coverage varies, and the location and size of the canal plugs is very preliminary. There is limited information available to estimate habitat impacts to aquatic species within the canals. Assuming the entire canal system is considered to have some habitat value, there is potential for the following fill impacts (according to the Clean Water Act Section 404 (b)(1) evaluation in Appendix D) 515,200 cubic yards (cy) of fill in all canals, divided as follows: 89,600 cy. in Prairie Canal (16 plugs); 128,800 cy in Merritt Canal (23 plugs); 151,200 cy in Faka Union Canal (18 plugs); and 145,600 cy in Miller Canal. This does not include littoral shelves because this type of habitat is lacking in most of the canal system due to the vertical canal banks. At present there is no information available on the location of or size of swale blocks that may be constructed in some roadside ditches. This issue will be addressed in the Detailed Design and

Engineering phase of this project. The acres of impact to wading bird foraging habitat will be calculated to quantify potential impacts to wood storks, but it should be noted that only the swales, not the deep canals, are currently providing this function.

- "T" canal. Alternative 3D, although conceptually indicating the location and number of canal backfill and plugs, appears to limit plugs in the east-west portion of the "T" canal north of Bad Luck Prairie, U.S. 41, and the TTI NWR. If the "T" canal is not backfilled to the maximum extent, anticipated benefits to downstream freshwater wetlands and estuaries may be reduced. Although it is anticipated that during wet season conditions the canal would have limited effect, the canal would still act as a major drainage feature during the dry season. This issue will be addressed in the Detailed Design and Engineering phase of this project. Drainage could impact wading bird foraging habitat and will be calculated to quantify potential impacts to wood storks.

- Existing Weir structures. Five internal weirs would remain unaffected, although concreted and sheetpile sections of these structures could be left intact if they created no environmental problems. Lucky Lake weir in Merritt Canal would be removed and replaced by a pump and spreader swale system. See comments in the Operations effects with regard to this weir removal.

- Berms along Canals. One levee is proposed to parallel the Faka Union Canal (POI N. of US 41). This berm will only protect the existing POI residential area. y. During PED phase the Corps will provide calculations of impacts by habitat type will be provided. Where there are existing berms along the canals, no additional impact to habitat is anticipated.

- Levees. Levee construction associated with POI development flood protection is estimated to impact 7.15 acres. About 0.5 acres of this impact may occur within the TTI NWR. Once the PED phase is completed, additional calculation of impacts by habitat type will be provided.

- Culverts. The selected plan does not reference the culverting of Stewart Boulevard which acts as an east-west barrier to sheetflow across the project. The design (elevation, capacity, etc.) and location of these culverts will affect surface waterflow across the site. This issue will be addressed during the PED phase of this project. Once the Detailed Design and Engineer phase is completed, additional calculation of impacts by habitat type will be provided.

Exotic Plant Removal. Exotic plant species, such as melaleuca and especially Brazilian pepper, are common in the project area. Brazilian pepper and other exotics will be physically removed from berms and portions of roads that are degraded. Removal will include mechanical control with associated herbicide applications to prevent resprouting. The exact acreage of exotic plant removal along roads is unavailable but is estimated to

be approximately 2,752 acres based on removal of a 100-foot swath of exotic plants along 227 miles of roadway.

Exposed soils associated with construction activities create the potential for introduction and establishment of exotic and nuisance plant species. Exotic plant seedling growth has already been observed in some portions of the Prairie Canal backfill project (Duever, personal communication, January 28, 2004). Complete invasion of restored areas by exotic plants could limit restoration benefits by more than 4,709.12 acres (approximate footprint of disturbance associated with canal and road removal). This scenario is unlikely where native vegetation will likely compete with exotic vegetation, but indicates the importance of monitoring and management efforts.

Fish and Wildlife Disturbance. Noise, fumes, light and human presence associated with mobilization of equipment and temporary construction activities may disturb roosting or foraging wading and waterbirds as well as breeding birds including the endangered wood stork. Disturbance to wood stork rookeries foraging areas will be avoided by construction activities and other disturbances during the breeding season or when foraging areas are appropriately flooded; it is understood that storks would not forage unless the isolated wetlands in question retain water.. However, these activities appeared to have minimal impact on other wildlife foraging in canal remnants as they became habituated to the relatively small level of construction traffic and human presence associated with the Prairie Canal Early Start project. Phasing will confine construction activities and access routes, and staging areas will likely be designated. Construction and other activities (e.g., exotic plant control, the use of heavy equipment, etc.) will conform to the eastern indigo snake standard protective measures, southeastern bald eagle management guidelines, and management guidelines for the wood stork in the southeastern region.

Construction will result in disturbance and loss and modifications of fish and wildlife habitat. Noise, fumes, light and human presence associated with mobilization of equipment and temporary construction activities may alter fish and wildlife movement. Foraging, breeding, denning, or dispersal may be disrupted. The overall restoration project will likely have beneficial effects on fish and wildlife, though habitat loss and modification will result from both construction and changes in hydrology. Wildlife may be impacted by road, ditch, and berm grading; canal plug, spreader canal, pump station, and earthen berm construction; and hydrologic alteration (i.e., increase in water depths (0.5-3.0 feet), duration, timing, etc.). Hydrologic and resulting vegetation changes will alter fish and wildlife communities as well.

Fish and Wildlife Benefits. Wading birds, particularly long-legged waders such as great blue herons and great egrets, wood storks, and small alligators were observed to forage heavily on insect, fish, amphibian, and reptiles that were trapped in or colonized canal remnants isolated by backfilling activities in the Prairie Canal Early Start portion of the PSRP in dry season conditions. Similar conditions would occur throughout the project site. However, this would only be a temporary benefit associated with construction activities.

Fish and wildlife will benefit from habitat acquisition, removal of access roads, removal of exotics, and restoration of hydrology. Water levels should mimic more natural patterns suitable for maintaining fish and wildlife abundance and distribution.

Existing Contaminants and Disposal/Use of Soils. It is anticipated that all contaminated areas identified on the site will be remediated consistent with coordination with the District. There is a possibility that isolated areas may be activated by project construction. Asphalt from degraded roadways will be disposed of off-site in accordance with State and Federal regulations

Fire Management. Canal fill and plugs will temporarily increase the access points to Fakahatchee Strand State Reserve, potentially increasing the potential for illegal access, and illegal activities such as arson. Canals function as fire breaks which would be partially eliminated by canal backfill activities.

Other Resource Management. Elimination of ongoing aquatic weed control activities for canal maintenance in major canals would restrict the conveyance capacity of the remnant canals and help reduce channelized flow. Since the canals south of I-75 would cease to act like canals, existing weir structures would become obsolete.

Specific Effects of Project Operation

1. Upland/Freshwater Wetland Habitats

Pumps. Pump stations would be constructed and operated in association with spreader channels and berms. The pump stations would operate to provide flows for restoration during much of the year. During storms, the pump stations would be operated to ensure that there are no adverse impacts to the existing levels of flood protection for NGGE.

The operation of high-volume pumps to move water from NGGE represents a potential threat to fish and other aquatic resources. Pumps can cause direct loss of fish, amphibians, invertebrates, and other aquatic life through impingement and entrainment. This project calls for the installation of three large pumps that connect to canals and discharge to a downstream spreader swale system. It is anticipated that an unspecified area of habitat located downstream of the spreader swale system will likely be altered to a different habitat type (most likely from upland to some type of wetland) or remain in a disturbed condition due to fluctuation in water levels associated with pump operations. The significance of this impacted area on fish and wildlife, including listed species, is presently undetermined. This issue will be addressed in the PED phase of this project. Once the project operations commence, additional calculation of impacts by habitat type will be provided.

Exotic/Invasive Vegetation. The restoration of hydrology is expected to reduce the coverage/density of exotic and nuisance plant species after an extended time period as a result of a more natural hydroperiod regime. The effect of rehydration on mature stands

of Brazilian pepper, the principal exotic plant invader, will likely be minimal in the short-term as this species can withstand some inundation. This is evidenced by Brazilian pepper invasion of many agricultural retention or detention areas which may experience extended inundation or pulsed stormwater management in the project vicinity. Rehydration is more likely to result in benefits over the project life in concert with aggressive exotic plant management. If the project hydrologic models are in error, the proposed adaptive assessment and monitoring should detect undesirable effects. Specifically, continued over-drainage might contribute to the maintenance of conditions that favor exotic and invasive species, especially seed germination. Dry season operations may be particularly important as they may create bare substrates or favor germination.

Fire Management. Restored hydrology should contribute to improved fire management on the entire project site, but especially south of the spreader swale and pump operations area. Groundwater conditions will improve fire management north of this area, but to a lesser extent. If the project hydrologic models were determined to have a high margin of error, and the water management structures and operational plan are based on flawed predictions, there is a potential for a reduction or elimination of project benefits. Project habitat restoration benefits would be reduced by lack of restoration of pre-development hydroperiods that continue to favor wildfire conditions

Adjacent Public Lands. Restored hydrology should contribute to the maintenance or improvement of dry season conditions on Florida Panther NWR north of the project if the Lucky Lake weir function is approximated by the pump and spreader swale system on Merritt Canal. Restored hydrology on TTI NWR should contribute to the southward movement of salt-tolerant habitat on the refuge consistent with pre-development conditions, unless sea level rise is determined to be a causal factor in replacement of brackish marsh by mangrove.. If the project hydrologic models were determined to have errors, or if operation of the proposed system were to go beyond maintenance of existing flood conditions towared increased flood control in NGGE, there is a potential for continued overdrainage or increased flooding of adjacent public lands. Project operations will be continuously monitored to avoid these undesirable effects. Current model runs predict limited effects on water levels on the Florida Panther NWR. The refuge would benefit from additional water at specific times of the year to mitigate for drainage effects of adjacent and upstream development. An excess of water on TTI NWR, the southwest portion of PSSF, Collier Seminole State Park, and Fakahatchee Strand Preserve State Park could actually result in alteration of habitats that would impact uplands, relocate brackish and saltwater interfaces further south than the natural condition, or cause disturbed conditions that contribute to invasive or exotic plant proliferation.

2. Estuarine Restoration

General Benefits

Estuarine resources will be positively affected by the restoration of a more natural waterflow regime. The sheetflow disrupted by the PSRP canal system has grossly altered

water quality in an 83-square mile area within the TTI (a rectangular area roughly defined by U.S.41 to the north, the outer island coastal margin in the south, Blackwater Bay in the west, and Fakahatchee Bay in the east). When this area is added to the region within PSRP, the total area that would benefit from the restoration is significantly increased.

The freshwater input to four major estuarine systems (from west to east: Blackwater River, Pumpkin Bay, Faka-Union Bay, and Fakahatchee Bay) and the smaller intervening estuaries, has been severely altered by the project canal system. Faka Union Bay, the estuary immediately downstream of the canal system, experiences freshwater inundation during the rainy season. This inundation significantly reduces salinity along with other co-varying physical quality parameters. Sheetflow to the estuaries west of Faka Union has been substantially reduced and this has artificially increased salinity during the rainy season. The impacts to water quality in Fakahatchee Bay, east of Faka Union Bay, are not as clear because this system has not been monitored as extensively. We suspect, however, that this system has also experienced freshwater reduction. All engineering alternatives should improve freshwater delivery to these estuaries, with the recommended alternative providing the maximum habitat restoration benefit. Determination of estuarine benefits is hampered by the lack of detailed information on flows directly into each bay or estuary. Modeling output for this project only provides flows crossing the Tamiami Trail which lies approximately ½ to 1 mile from the heads of the bays to the southwest. Nevertheless this alternative is expected to restore the pre-alteration seasonal timing and discharge of sheet flow to the TTI, and to reduce point-source fresh water surges into Faka Union Bay and restore more natural pre-development flows to Palm Bay, Blackwater Bay, Buttonwood Bay, Pumpkin Bay, and Fakahatchee Bay. The NOAA Fisheries website lists the TTI Estuary as Essential Fish habitat (EFH) for adult and juvenile brown shrimp (*Penaeus aztecus)*, gray snapper (*Lutjanus griseus)*, gulf stone crab *(Menippe adina)*, pink shrimp *(Penaeus duorarum)*, red drum (*Sciaenops ocellatus)*, Spanish mackerel *(Scomberomorus maculates)*, spiny lobster *(Panulirus argus)*, stone crab *(Menippe mercenaria)*, and white shrimp *(Penaeus setiferus)*. Restoration of sheetflow will benefit EFH for all estuarine fauna. NOAA Fisheries has concurred with this evaluation.

Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternatively, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. All estuarine habitats, including aquatic vegetation beds, oyster reefs, soft-bottom embayments, sand or mud shoals, fringing mangrove forests, and the open water nekton depend upon fresh and marine water mixing. Brackish water conditions provide nutrient and dissolved oxygen enrichment which promotes productivity. These conditions also provide refugia from predators and an ideal setting for reproduction and juvenile growth and development for those species adapted to the estuarine environment. Ultimately, the health of the entire estuarine system is predicted to improve.

National Interest Lands

Successful restoration should restore benefits to estuaries in the TTI NWR, Rookery Bay NERR, and ENP. Model predictions of benefits to the estuaries will be re-visited during the PED phase of the Federal project, if it is approved.

3. Land Management

The land acquisition element of the project has allowed for the consolidation of 59,294 acres of habitat for management together with the 15,000 acres of the adjacent Belle Meade tract of the PSSF. In concert with other State and Federal lands, public landholdings in this area are more or less contiguous, with the exception of roadways and some outparcels, and total 2,602,144 acres. This contiguous ownership fosters improved management activities both on the project and adjacent public lands, including: 1) prescribed and wildlife management; 2) habitat connectivity; 3) exotic/invasive species management; 4) law enforcement; 5) fish and wildlife habitat management; 6) recreational access; and 7) listed species management and recovery efforts that may contribute to species recovery, especially for wide-ranging species such as the Florida panther, Florida black bear, West Indian manatee and wood stork.

Effects to Specific Listed Species and Designated Critical Habitat

West Indian Manatee and West Indian Manatee Designated Critical Habitat

Published occurrences of manatees in Collier County date back to at least 1930 (Hartman 1974, Beeler and O'Shea 1985), although manatee remains in Indian middens demonstrate their presence in this area well before European colonization. Aerial surveys conducted in the mid-1970s through the early 1980s documented manatee distribution throughout the region, particularly near the mouth of Faka Union Canal (Beeler and O'Shea 1985). It is likely that manatees used the Faka Union River before the canal was dredged in the mid-1960s.

One hundred twenty-six watercraft-related manatee deaths out of 464 total deaths were documented from Collier County from October 1979 through August 2004. Documented deaths from January 1985 through March 2001 have been concentrated in Naples, Marco Island, and POI/Faka Union Canal, with substantial numbers also occurring near Cape Romano, and in Chokoloskee Bay, Barron River, and Tamiami Canal. Carcasses were also recovered in the Blackwater River, Halfway Creek, Turner River, and Lopez River. As recently as May 20 and May 31, 2004, two watercraft-related manatee deaths occurred in Faka Union Canal downstream of the PSRP.

The increase in the number of manmade warm-water sources over the years has influenced manatee migratory patterns. Manatees frequent coastal, estuarine, and riverine habitats and are capable of extensive north-south migrations throughout the year (Reeves *et al*. 1992) and as a result, abundances in regional populations change seasonally (Hartman 1974). There are 17 major aggregation sites in Florida (Garrott *et al.* 1994). These aggregation sites occur at or near manmade or natural warm-water

refugia. Manatees will migrate to these warmer areas when water temperatures drop below 20 degrees C. Large aggregations of manatees occur at these warm-water areas. With the rise in water temperatures in the spring, some manatees may begin to migrate away from their winter refugia, while others remain relatively close. Manatees often return to the same winter refugia each year (Powell and Rathbun 1984, Reid *et al*. 1991). In the winter, manatees stay closer to warm-water during the day, then move to vegetated areas in the late afternoon or at dusk to feed.

The Port of the Islands (POI) basin, located within the marina and residential canals of the upper Faka Union Canal just south of U.S. 41, is the second largest warm water refugium in southwest Florida (behind the Florida Power and Light powerplant within the Caloosahatchee River in Lee County). This basin has been documented to support as many as 300 manatees during periods of cold winter weather. The basin depth is probably the key feature responsible for creating a "passive" warm water refugium for this species (see comments below on manatee winter use patterns).

Cold dry season use of the warm water refugia marina basin at POI consists of bottom resting in the warmer waters of the marina basin which is 10 to 14 feet deep. Faka Union Canal, which provides access to the marina basin, is approximately six feet deep. Warmer water temperatures associated with the marina depth and the presence of saltwater on the basin bottom and a freshwater lens on the top of the basin; combine to attract manatees to the site. The volume, location, and flow of freshwater may affect marina basin temperature (temperature stratification). In most years, the marina basin receives limited rainfall in the winter when manatees are using the area for shelter from cold. Fresh water entering the marina basin over the Faka Union weir is probably colder than saltwater in the basin, but there are no data to verify this assumption, as there may be groundwater input into the Faka Union Canal north of the weir. Fresh water likely leaks around the weir when flow does not overtop it due to the porosity of the surrounding rock. Saltwater input to the marina basin is probably tidal but in the absence of a freshwater head, saltwater may also be entering the basin and canal through groundwater. Data are not available to support these assumptions. The POI marina basin is a targeted overwintering site for manatees. Manatees that use this site tend to use it exclusively (J. Reid, personal communication, September 15, 2004).

After passage of cold fronts and depending on adjacent Gulf of Mexico and inland bay temperatures, manatees move to inshore bays which provide warm water refugia at night. At high tide during the daytime, manatees move to shallow inshore bays to absorb solar heat. During the wet season, manatees are distributed throughout the TTI and make fewer trips to the POI marina basin. Freshwater input into the marina basin during the spring dry season (April to May) may be an important factor in determining effects of the project on manatees (J. Reid, personal communication, September 15, 2004).

The 35,000-acre TTI NWR is located directly south of the PSRP in Collier County and was created to protect important mangrove and marsh habitats, native wildlife, and the endangered species of the area including the American crocodile, three sea turtle species, and the West Indian manatee. The TTI NWR initiated studies on the potential effects of

the PSRP project on manatees in August 1999. As part of their research contribution to the CERP, the Service's, TTI NWR and the USGS/Sirenia Project (USGS 2000) initiated additional studies in June 2000. The major objectives of the study were to determine distribution, movements, and habitat use by manatees associated with coastal waters and rivers, and to develop a population-level model to predict manatee response to changes in hydrology achieved by the PSRP as well as the overall CERP. Aerial distribution surveys have been conducted from August 1999 to February 2002 and March 2004 to the present using strip-transect aerial survey methods (Doyle, personal communication. August 30, 2004; and Lefebvre 2002). Radio tracking using satellite telemetry based on Argos and GPS systems have been conducted continuously since June 2000. In addition, preliminary spatial analysis of Argos and GPS data were conducted using GIS techniques to show potential changes in habitat use patterns associated with changes in availability of fresh water. These data provide the basis for the first detailed analysis of manatee use patterns in the TTI/Everglades National Park area. Methods and preliminary results of this study are provided below.

Strip-Transect Aerial Surveys. This approach has been used successfully to estimate manatee abundance in the Banana River, Florida (Miller *et al*. 1998). A total of 22 surveys were flown during warm months (June to October) of 2000, 2001, 2002, covering most of the TTI. Each survey consisted of 30 transects roughly 1 km apart, with a strip width of approximately 250 m. Estimated number of manatees ranged from 39 to 237 in the 167-km^2 study area.

Radio-tracking study. The radio-tracking study provides data critical for documenting the pre-restoration habitat use by manatees within the region affected by the PSRP. Two types of radio-tags were used for this study: Argos PTTs and GPS tags. The GPS tag acquires locations every 15 to 30 minutes and are more accurate than the Argos data (approx. 30 m vs. 150 m or more), but the battery life expectancy is shorter (8 weeks vs. 7 months). The Argos data provides region-wide, long-term coverage suitable for revealing general patterns of habitat use, while the GPS data shows fine details of travel pathways and time spent in specific areas. Through December 2003, Argos and GPS data were obtained for 25 and 10 manatees, respectively. A preliminary analysis of the Argos radio tracking data indicates that manatees in this region alter their movement patterns and habitat use in response to seasonal changes in temperature. During periods of intense cold, where gulf temperatures fall below 20 degrees C, telemetry locations occur in the Faka Union Canal, inland rivers, or inshore bays, suggesting that these areas provide important thermal refugia to manatees. In comparison, during the warm season, manatees are distributed across a much broader region, and the majority of the telemetry locations occur in offshore areas where seagrass beds are found. Aerial surveys of manatees conducted by the Service also confirm these distribution patterns (Doyle, personal communication, August 30, 2004).

A preliminary analysis of the GPS radio tracking data suggests some important habitat requirements for manatees in this region. GPS radio tracking data for ten manatees shows all animals making large movements (tens of kilometers) to and from seagrass beds in offshore areas and the Faka Union Canal or rivers that provide access to

freshwater. These animals show a pattern which may be typical for many manatees in this region, *i.e.*, multiple days of feeding on offshore seagrass beds followed by rapid, directed movement to a distant source of freshwater. Following a brief residence time at this freshwater site (often only a few hours), tracked individuals show a directed movement back to offshore areas. These large movements suggest that the availability of freshwater is an important determinant in manatee distribution and abundance in this region (J. Reid, personal communication, August 30, 2004).

The striking difference in seasonal (cold season vs. warm season) use of the Faka Union Canal by radio-tagged manatees is undoubtedly related in large part to the warmer water temperatures in the Faka Union Canal during the winter. However, throughout the year all manatees tracked to date made frequent moves into the canal and rivers. The Faka Union Canal is heavily used all year, presumably because it is a reliable source of freshwater compared to surrounding rivers and creeks. Depending upon the relative availability of freshwater in the canal vs. neighboring waterways after restoration, manatee use of the canal may be reduced during the wet and dry season (Lefebvre et al. 2001).

To analyze the relationship between flow and temperature at Weir #1 to manatee cold stress deaths in the Faka Union Canal, the Service compared the Mike-She model results to the available flow and temperature data (Fig. 4). The results of this analysis indicate that there is a correlation between flow, temperature and manatee deaths in the Faka Union Canal. Not unexpectedly, manatee cold stress deaths are clustered during period of low flow and low temperature.

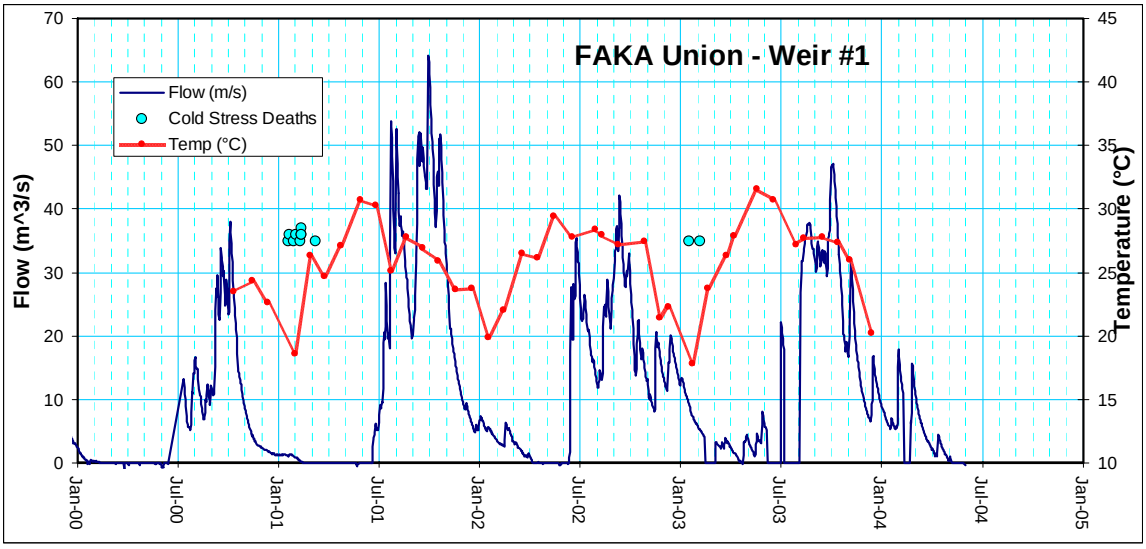

Figure 4. Comparison of measured flow and water temperature at Faka Union Weir #1 to documented manatee cold stress (January 2000 to January 2005).

The Service also compared the measured and modeled without-project condition flows to the modeled with-project flows at weir #1 for three alternatives (3D, 6, and 12). Over the two-year period of record, flows for all three alternatives are decreased by over an order

of magnitude at the weir, regardless of the season, when compared to the without-project condition (Fig. 5). This amount of flow reduction may represent a significant shift in the suitability (available warm-water carrying capacity) of this habitat for manatees, of which the ramifications are unknown.

The Service is concerned that potential changes in ground water in-flows to the marina basin at Port of the Islands in the with-project condition may affect the temperature regime in thermal basin used by overwintering manatees. Monitoring groundwater in-flows for the without-project condition and monitoring ground water in-flows during the with-project condition are needed in this regard.

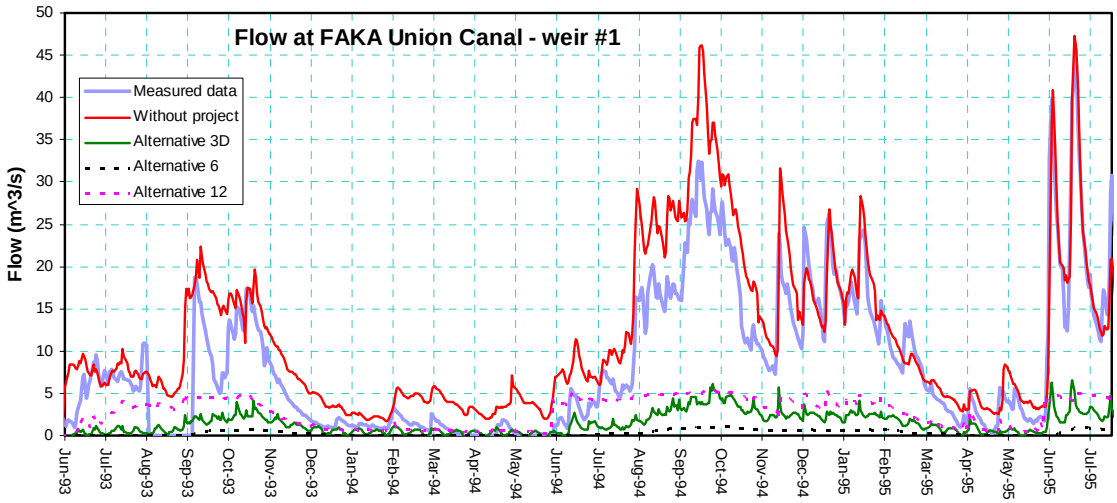

Figure 5. Comparison of the measured and modeled without-project condition flows to the modeled with-project flows at Faka Union Weir #1 for three alternatives (3D, 6, and 12).

Manatee critical habitat was designated in 1976, although no specific primary or secondary constituent elements were included in the designation (50 CFR 17.95). The project area has features essential to the conservation of the manatee, including warm water refugia, reliable sources of fresh water, and foraging habitat (seagrass beds) adjacent to relatively deeper waters with little boat traffic.

Seagrasses are the predominant food used by manatee in coastal areas. Provancha and Hall (1991) reported a preference for manatee grass (*Syringodium filiforme*) and shoalgrass (*Halodule wrightii*) over the macroalga, *Caulerpa* spp., in the upper Banana River on the east coast of Florida. Inland bays of the TTI are generally characterized as "muddy" bays. Data from field studies conducted in the early 1970's (almost immediately after upstream canal and subdivision construction) indicate that approximately 52 percent of Fakahatchee Bay east of the PSRP project and 76 percent of Faka Union Bay directly downstream of the project have mud bottoms. In those bays most directly affected by the project, green filamentous algae constitute the major

standing crop biomass during winter (dry season) months, with seagrasses and red-macro algae present in sparser amounts. During the wet season, seagrasses increase dramatically in the more pristine estuary of Fakahatchee Bay east of the project, while algae, particularly red macro-algae, continued to predominate in the impacted Faka Union Bay (Carter et al. 1973).

The projected reduction of average freshwater flows in the Faka Union Canal during the dry season (November to May) is likely to influence manatee use of the canal and their distribution throughout the region. Project alternatives will reduce wet season freshwater discharges in the Faka Union Canal as well, which should restore watershed connections to the adjacent Blackwater, Pumpkin, and to a lesser degree Fakahatchee Bay estuaries. Restoration of the watershed may contribute to additional manatee use of these natural freshwater sources as opposed to the existing freshwater point-source discharges from Faka Union Bay. However, USGS biologists hypothesize that during cold periods (water temperature less than 20ºC), manatees will continue to aggregate in the POI basin south of the PSRP, in part because of thermal buffering provided by the deeper water, as well as to drink freshwater seeping through the weir at the head of the canal. During warmer periods (water temperature greater than20ºC), manatee use of the canal may depend on the availability of freshwater at the canal versus at nearby rivers. Use of the canal may decrease significantly, particularly if adjacent rivers are receiving greater freshwater input than the canal and are closer to feeding areas. The effects of the project on manatees should be considered for three seasons: spring (dry season), summer/fall (wet season) and winter (cold dry season). USGS is currently in the fourth year of monitoring manatees in the TTI and will complete a second year of monitoring this winter which will focus on manatee behavior during the cold dry season. USGS is also monitoring manatees in Whitewater Bay. The Service began monitoring manatees in 1999 using aerial surveys; this work continues.

Because use of the Faka Union Canal brings manatees into proximity with boats, it is possible that boat-related deaths and injuries in this region will be reduced (two manatees that died as a result of watercraft-related injuries were recovered in the canal in May of 2004) if manatees become less reliant on the canal as their major source of fresh water and do not seek areas of higher boat traffic. A change in manatee use of the Faka Union Canal during periods of cold stress could also change exposure to boat traffic, but this effect is less likely provided the thermal buffering in the canal is not changed due to restoration. However the presence of idle speed zones in the Faka Union canal vs. limited or non-existent speed zones in manatee habitat outside of the canal is a factor in the continuing analysis of project effects on the manatee.

Monitoring of the effects of the project on manatee behavior is necessary to determine the project effects and monitor potential incidental take of the manatee population. Initial baseline studies of manatee movements in the TTI area have been conducted by the Service, FWC, and USGS. The Monitoring and Adaptive Assessment Plan includes cooperative funding of monitoring of manatee movements, contingent upon project approval, during construction and post-construction to assess restoration benefits and minimize effects on the manatee population. Funds for pre-construction monitoring are

expected to become available after project approval. Funding for this monitoring is included in the project monitoring plan.

Because there is currently no estuarine model for the project that can quantify changes in flow to individual downstream estuaries, an evaluation of proposed alternatives is based on estimating changes in point source discharges in relation to existing conditions. The preferred plan will result in changes in surface water discharge rates and timing from the Faka Union Canal to downstream estuaries as well as overland flow to adjacent estuaries from rivers receiving additional overland flow from the restored watershed. Information on the volume, rate, and timing of freshwater releases through this system will need to be monitored and reported to better define the anticipated effects of the project on manatees and manatee critical habitat. Information on the Faka Union basin water temperature and salinity will be necessary to determine the effect of the project on the warm water refugia at the site.

Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW) population in the lower Florida peninsula from Orlando south is limited to approximately 244 occupied clusters (DeLotelle and Guthrie 2000). In 1992, approximately 25 occupied, 10 undetermined, and 11 abandoned clusters occurred in the east Naples area including the Belle Meade tract of PSSF adjacent to the PSRP (Kim Dryden, Service, personal communication, 1999).

South Florida contains support populations necessary for the recovery of red-cockaded woodpeckers. Statewide protection and restoration efforts focus on acquiring, managing, and restoring habitat surrounding these populations. Lands acquired in southwest Florida for RCW conservation should be contiguous with publicly-owned conservation lands that contain red-cockaded woodpecker clusters (Beever and Dryden 1992).

The Belle Meade tract of PSSF covers about 14,460 acres. In combination with the 59,294-acre PSRP, the project area provides an opportunity to support between 20 to 30 RCW clusters, assuming population expansion techniques and exotic plant species control are successful (DeLotelle and Guthrie 2000). The Belle Meade population of RCWs includes four occupied and 11 abandoned clusters located in mesic and hydric pine flatwoods. Approximately 40 RCW clusters are located 15 miles east of the PSRP in the BCNP.

Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse understory and ample old-growth pines, constitute primary RCW nesting and roosting habitat. In southwest Florida (Charlotte, Collier, and Lee Counties), hydric slash pine (*P. elliotii* var. *densa*) flatwoods provide the preferred nesting and foraging habitat for the RCW (Beever and Dryden 1992). This community has been maintained by fire and hydroperiod, and therefore does not have the dense midstory more typical of xeric and mesic flatwoods in southwest Florida. Also, hydric pine flatwoods were not as accessible to historic forestry, agriculture, and land clearing practices as the xeric and mesic communities due to their wetland status.

The project site is not currently documented as RCW habitat, although active clusters are located in the adjacent Belle Meade portion of PSSF (two miles west of the PSRP) and in BCNP (37 miles east of the project). Although systematic surveys have not been conducted recently for RCWs, the project area has been thoroughly visited by biologists and RCWS have not been detected (K. Dryden, personal communication, September 14, 2004). Habitat evaluations based on the hydrological models indicate that a significant acreage of flatwoods will be replaced by cypress and other wetland communities as a result of the restoration. Although flatwoods will be lost, it is the intent of the restoration to improve the quality of the remaining pine flatwoods and potentially restore a forest that can support additional RCW clusters. It is also the intent of the restoration to protect pine strands that under natural condition were located on slightly elevated ridges that ran parallel to the southwesterly wetland flow patterns on the site. The geographic location of flatwoods communities on the post-restoration site will also be important in enhancing regional RCW populations. Forest restoration would contribute to adjacent public lands management of this endangered species, and possibly contribute to regional recovery of the RCW population in southwest Florida by increasing the number of RCW clusters/foraging habitat and providing a forested "bridge" of habitat for RCWs to disperse over a wider landscape.

Table 4a describes project habitat changes after restoration and shows the occurrence of 8,367 acres more of potential RCW habitat (mesic and hydric pine) than existed during pre-development. However, Table 4a also indicates that 28,510 acres of existing (1995) potential RCW habitat will be lost as a result of restoration activities. These figures would appear to indicate that a loss of available RCW habitat would occur following restoration. However, an analysis of habitat acres fails to consider the importance of the restoration of the landscape to unfragmented habitat. Increasing the quality of the available habitat through restoration is an important part of this effect determination. These and other issues are summarized as follows:

1. Model and GIS vegetation predictions – Habitat descriptions for the existing acres of mesic pine flatwoods/mesic hammock include areas of wetlands that have been invaded by cabbage palm and slash pine since 1940. A portion of this acreage is dominated by cabbage palm hammock or mesic flatwoods that are invaded by cabbage palms and other vegetation as a mid-story component. Evaluation of areas of cypress forest in the restoration area also indicates that hydric pine stands or mixed pine/cypress may be indicated as cypress by the GIS. Therefore, the estimates of existing mesic flatwoods appear to be inflated, making the loss of these flatwoods to the restoration proposal less significant. Conversely, available pine canopy may be indicated by the models and GIS as cypress, therefore underestimating the post-restoration pine canopy available for use by the RCW. RCWs also forage in, but do not appear to prefer, cypress in south and central Florida (R. DeLotelle, personal communication, 1996), indicating that cypress forest restoration may also benefit RCWs.

2. Available habitat condition – Flatwoods with significant midstory components are not preferred by the RCW, indicating that a portion of the existing mesic flatwood/mesic hammock acres on the PSRP may be, and were historically, unavailable for RCW use. Cabbage palm midstory invasion in some areas may not be manageable within budget and personnel constraints, and removal of cabbage palm in some areas may be inconsistent with natural succession and biodiversity objectives.

3. Landscape connection – RCW clusters within the Belle Meade portion of the PSSF and BCP are separated by about 37 miles. Dispersal for RCWs has been documented up to 56 miles but an outside estimate of 7.5 miles was used by Cox et al. (1994) in modeling Strategic Habitat Conservation Areas in Florida for this species. RCWs in Florida traveled an average distance of 25 km with young birds moving farther than adults (R. DeLotelle, personal communication, July 28, 2004). Restored flatwoods on the PSRP may not be immediately available to form a natural dispersal bridge between the BCP and PSSF RCW populations. However, long-term management of this species on the project site could increase the viability of the regional population by increasing the gene pool and offering opportunities for translocation. Pineland management within the project areas may also be critical to the adjacent smaller Belle Meade RCW population which was in decline prior to public acquisition.

4. Prescribed fire and listed species management – recent and recurring wildfire from overdrainage and arson-- has reduced pine habitat significantly from 1995 conditions on the project site. Restoration of hydrology on the site, combined with prescribed fire management by the site manager, DOF, should restore flatwoods lost to wildfire and provide a better base for pine seed generation. Reforestation of pines should also benefit RCWs. While old growth pine stands may take 60 to 70 years to regenerate, RCWs in southwest Florida do forage on younger pines, so forage habitat could be increased with management within 5 to 10 years after restoration.

The largest contiguous block of mesic flatwoods habitat on the restoration site is located in the northwestern project corner and has been deliberately omitted from rehydration in an attempt to protect flatwoods habitat for the RCW and Florida panther, although protection of NGGE from additional flooding was also a significant factor in the omission of this habitat from hydrologic restoration. This area is contiguous with pine canopy to the west within the Belle Meade portion of the PSRP which is currently being managed by the DOF to increase the RCW population on that site.

In summary, the acquisition and restoration of the PSRP will establish a contiguous block of public land adjacent to the existing active RCW clusters in the Belle Meade portion of the PSRP west of the project site. Under management for pineland restoration, the PSRP may contribute to the recovery of the Belle Meade RCW population by expanding the available habitat to the project site, and by connecting and augmenting the larger populations in BCP to the east.

Florida Panther

The Florida panther is presently only found in Florida and occupies most of the counties in Central and South Florida. Public and private lands south of the Caloosahatchee River in south Florida support the only breeding population of the Florida panther, but dispersing individuals range north of the river. The PSSF, Fakahatchee Strand Preserve State Park, Florida Panther NWR, Big Cypress National Preserve, Big Cypress Seminole Indian Reservation, and ranches located in Hendry County and northeastern Collier County provide a contiguous landscape and are an integral part of the habitat mosaic that helps support the only extant breeding puma population east of the Mississippi River. The survival of the Florida panther is dependent on protection and enhancement of this extant population, associated habitats, and prey resources in south Florida. Recovery of the Florida panther is dependent upon establishing three viable, self-sustaining populations within the historic range of the species (i.e., the southeastern United States) (Service 1999) and removing species threats. Panthers require adequate cover for resting and denning sites, sufficient prey, and a relative lack of disturbance in terms of road hazards and human activity.

Adult male panthers maintain large, virtually exclusive home ranges, which encompass the ranges of up to six adult females and their dependent offspring (Land 1994). Home ranges of resident adults are generally stable unless influenced by the death of other residents (Land 1994). Maehr et al. (1991a) found home range overlap in Florida panthers to be extensive among resident females and limited among resident males (Maehr et al. 1991a). Telemetry data indicate that panthers typically do not return to the same resting site day after day, with the exception of females with kittens or panthers remaining near kill sites for several days. The presence of physical evidence such as tracks, scats, and urine markers confirm that panthers move about within extensive home ranges, visiting all parts of the range regularly in the course of hunting, breeding, and other activities (Maehr 1997, Comiskey et al. 2002). Males travel widely throughout their home ranges. Females without kittens also move extensively within their ranges (Maehr 1997).

Panthers require large areas to meet their needs. Comiskey et al. (2002) examined the home range size for 50 adult panthers (residents greater than 1.5 years old) monitored in south Florida for the period from 1981 to 2000 and found resident males had a mean home range of 160,682 ac and females had a mean home range of 97,927 ac. Numerous factors influence panther home range size and the reproductive success of females, including habitat quality, prey density, and landscape configuration (Belden 1988, Comiskey et al. 2002).

Panthers are capable of moving large distances in short periods of time. Hornocker (1970) reported western pumas traveled 100 mi from an initial capture location. Maehr et al. (2002a) found a young Florida panther male dispersed 139 mi over a seven-month period, followed by a secondary dispersal of 145 mi. Panther dispersal tends to be interrupted by natural barriers (e.g., large water bodies) and anthropogenic barriers (e.g.,

highways, urban areas, large expanses of row crops and improved pasture) (Maehr et al. 2002a, Beier et al. 2003).

Telemetry monitoring and ground tracking indicate that panthers use the mosaic of habitats available to them as resting and denning sites, hunting grounds, and travel routes. These habitats include cypress swamps, hardwood hammocks, pine flatwoods, seasonally flooded prairies, freshwater marshes, and some agricultural lands. Although telemetry monitoring indicates that forest is a preferred cover type for daytime rest, panthers use non-forest cover types, including areas disturbed by humans (e.g., Belden et al. 1988, Maehr et al. 1991a, Maehr and Cox 1995, Comiskey et al. 2002).

Figure 6 and Figure 7 depict telemetry data from radio-instrumented panthers over the last two decades at a project site and regional scale, respectively**.** Telemetry data indicate daytime locations of panthers only and can be used to make inferences about daytime habitat use only (Beier et al. 2003). Since panthers can travel large distances and are most active at dawn and dusk, it is especially important to recognize the limitations of telemetry data. In addition, telemetry data are available for a subset of the panther population (i.e., individuals are often not collared) at certain times (i.e., generally three mornings per week). Location error occurs in all telemetry studies (Beier et al. 2003). Telemetry data do not represent nocturnal habitat use or reflect habitat use when the animal is most active (i.e., dawn and dusk).

Within the project area, telemetry indicates that the Fakahatchee Strand Preserve State Park east of the PSRP, Florida Panther NWR northeast of the project, PSSF west of the PSRP area, and private lands northeast of the project are heavily used by panthers. Telemetry data for the PSRP indicate reduced occurrence, possibly consistent with degraded habitat and human disturbance associated with 279 miles of primary and secondary roadways (Land, personal communication, 2001). Three den sites are located in the PSRP area, one in the central portion of the project and two in the extreme northeastern corner of the property in proximity to Fakahatchee Strand Preserve State Park and the Florida Panther NWR (Service 2004).

In general, the lack of frequent home range vacancies makes the likelihood of male panther recruitment into the population low (Maehr 1990). Females are readily recruited into the population as soon as they are capable of breeding (Maehr et al. 1991). Males appear to have more difficulty being recruited. Without large areas of suitable habitat to accommodate dispersal, young males have few opportunities for recruitment as residents. As a result, the panther's ability to increase and outbreed has been severely restricted. Successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr et al. 1991). The PSRP area is utilized primarily by sub-adult male panthers, which disperse through the site to the Belle Meade portion of PSSF from Fakahatchee Strand.

According to McBride (2003), eight panthers were known to use Fakahatchee Strand State Preserve and Picayune Strand State Forest in 2003. Since this survey unit straddles the project area, it is reasonable to assume that at least eight panthers used portions of the

project area during 2003. The eight panthers included two collared panthers (#54, and #83), three uncollared females (unspecified age), two uncollared males (unspecified age), and one yearling with #83 (unspecified sex) (McBride 2003 in FWC 2003). In addition, in 2003 another 12 panthers were known to use habitat to the north of the project site, including Florida Panther NWR, Corkscrew Swamp Sanctuary, and CREW WMA (i.e., survey unit #5) (McBride 2003 in FWC 2003). In addition, in 2003 another 24 panthers were known to use habitat east of the project site, including Big Cypress National Preserve north of US 41, south of I-75 (i.e., survey unit #3) (McBride 2003 in FWC 2003). Since panthers maintain large home ranges and are capable of traveling large distances, it is reasonable to assume that at least some of the panthers in the adjacent survey units make use of habitat within the project site at least some part of the time (i.e., for dispersal, feeding, or breeding). The entire project site is within the Primary Zone according the Florida Panther Subteam of the Multi-species Recovery Implementation Team (Florida Panther Subteam 2002). The Panther Subteam defines the Primary Zone as "All lands essential for the survival of the Florida panther in the wild" (Florida Panther Subteam 2002).

White-tailed deer (*Odocoileus virginianus*) and wild hog (*Sus scrofa*) are important prey items for the Florida panther throughout South Florida (Maehr et al. 1990). Deer and hog density information is not available for the immediate project area. Deer densities may be affected by habitat quality and human disturbance. Deer densities on overdrained private lands being developed northwest of the project area averaged 1 deer/591 acres (Turrell & Associates, Incorporated 2001). Deer density in the BCNP's Corn Dance Unit east of the project was predicted to be 1 deer/165 to 250 acres. Predictions of deer density in Fakahatchee Strand were estimated to be higher than 1 deer/18.2 acres (McCown 1991). Deer densities in the Mullet Slough area of BCNP yielded an estimated density range of 1 deer/93 acres and 1 deer/250 acres. The Stairsteps unit of BCNP supports densities of 1 deer/190 to1/218 acres from track count estimates. Aerial surveys for the same units used after 1982 estimated deer densities at 1 deer/60 to 2,643 acres. Harlow (1959) predicted deer density in wet prairie habitat in Florida to be 1 deer/115 acres. Panther prey density, especially deer, is an important factor in evaluating the panther habitat. The type of prey available to the panther affects the health and distribution of the panther, as well as its ability to breed and support young. Based upon the project information, it is difficult to determine how the planned construction will change hydrology and vegetation and how these changes will affect the availability, abundance, or distribution of panther prey (i.e., white-tailed deer, wild hog, rabbits, raccoons, or armadillos).

Because of their wide-ranging movements and extensive spatial requirements, panthers are particularly sensitive to habitat fragmentation (Harris 1985). Past land use activity, hydrologic alterations, road construction, invasion of exotic plants, and lack of fire management have affected the quality and quantity of panther habitat. The effects of invasion by exotic plants, such as melaleuca, on panther use of natural habitats are unknown.

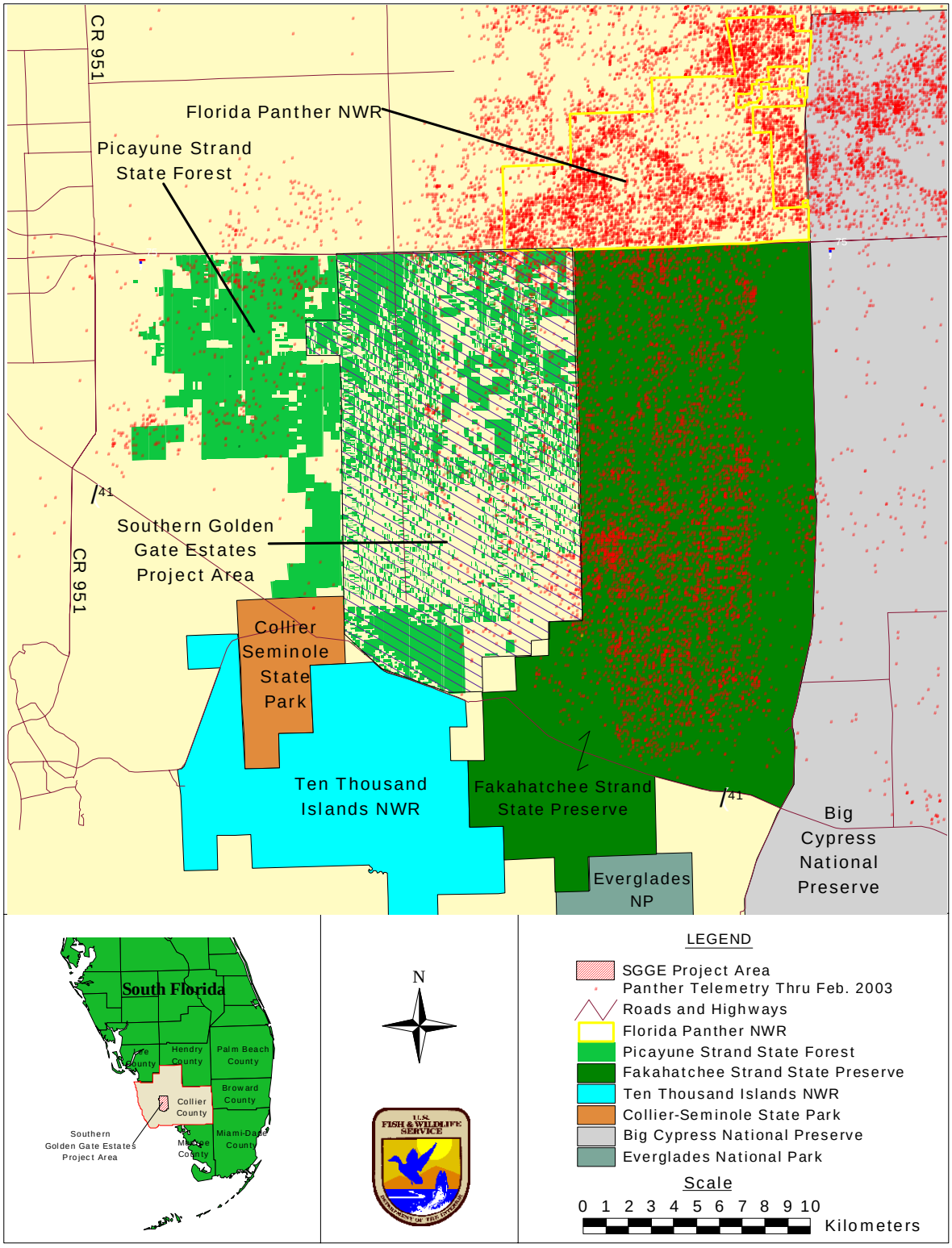

Figure 6. Panther telemetry information for the Picayune Strand Restoration Project area.

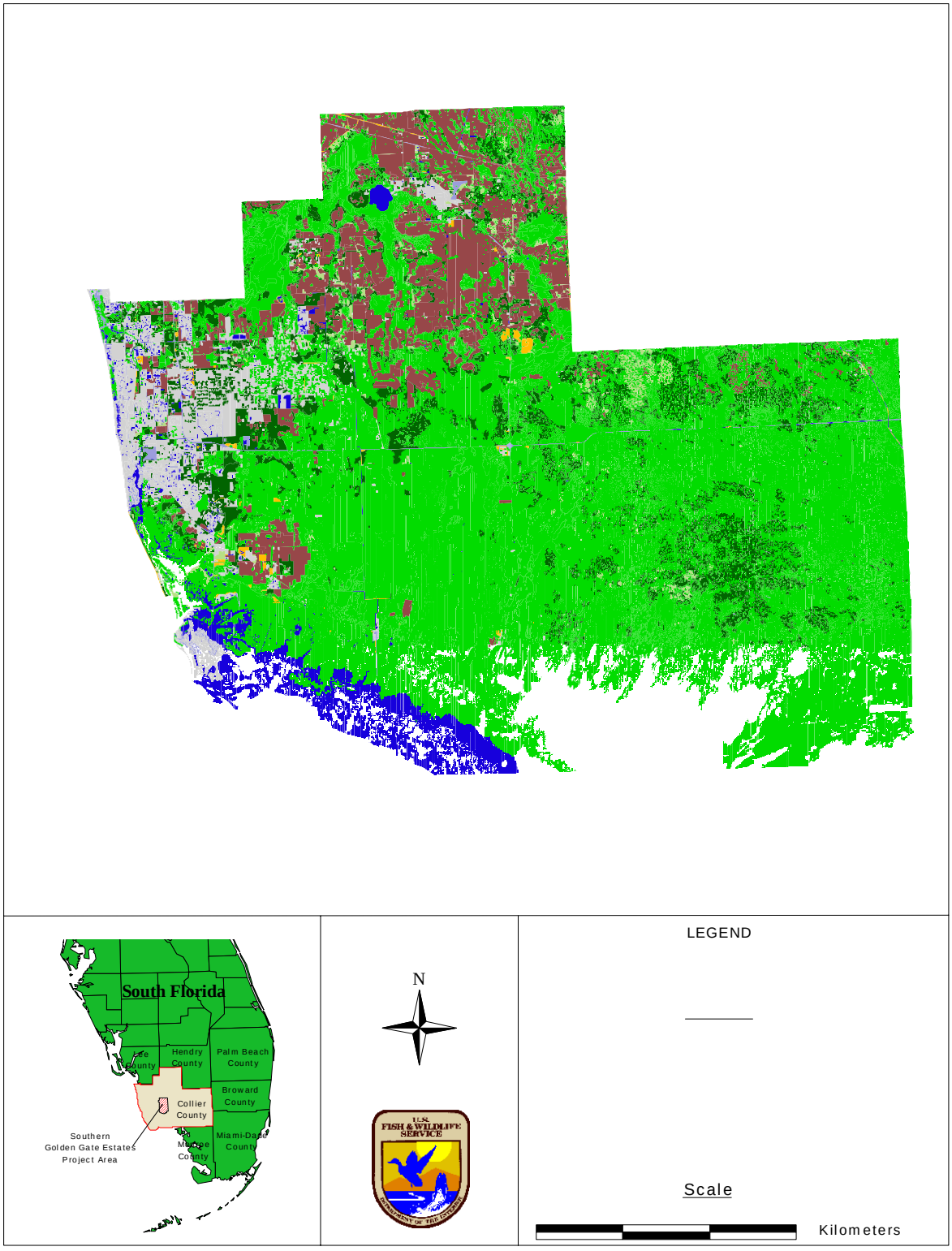

Figure 7. Panther telemetry information for the Picayune Strand Restoration Project region. (Figure is incomplete as supplied by FWS, but reference FCAR, Appendix D)

The FWC has documented 58 panther deaths and 7 injuries caused by collisions with vehicles from 1972 through June 2003, primarily in Collier and Hendry Counties (FWC 2001, 2003). Although several panthers are killed by vehicles each year, this is not the largest source of mortality. Intraspecific aggression (males killing other cats) continues to the most significant source of mortality. In an analysis of the causes of mortality for 77 radiocollared panthers from 1981 through June 2003, FWC found 42 percent of mortality was due to aggression, 23 percent to unknown causes, 21 percent to vehicles, 6 percent to other causes, 5 percent to infection, and 3 percent to disease (FWC 2003). During July 2002 through June 2003, there have been 26 documented panther mortalities, including: ten from vehicular trauma, eight from intraspecific aggression, five at the Seminole Indian Reservation from unknown causes, two from other causes, and one from illness associated with feline leukemia virus (FeLV) (FWC 2003). The extent of panther mortalities during the 2002-2003 study year is somewhat tempered by the birth of 17 kittens (FWC 2003). From 1990-2003, the number of births in the radiocollared panther population exceeded the number of radiocollared panther deaths (FWC 2003).

It is expected that the project will increase the panther's ability to feed, breed, and shelter as a result of hydrologic restoration of wetlands and protection and management of uplands on the project site. To restore panther habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to natural conditions. Since small changes in water elevation (*e.g.*, six inches) or hydroperiod (*e.g.*, one month) can completely alter plant communities in southwest Florida, it is critical that: 1) predicted water elevations/hydroperiods be as accurate as possible; 2) adaptive management seek to monitor restoration effects on vegetation; 3) panther prey be evaluated in an adaptive management program; and 4) water management of the site be strictly conducted and monitored. A major feature of the restoration is the removal of the majority of the 279 miles of road grid. This is important to the panther because it would reduce vehicle-related mortality, decrease human disturbance to panthers and panther prey, reduce exotic plant invasion which tends to be more severe near disturbed roadsides, and result in thousands of acres of restored habitat. Since the project will be managed as a State forest by the DOF, it is also important that the road plan be reviewed with regard to potential effects on the panther from loss of habitat and recreational uses, including hunting and ORV use.

The 26,400-acre Florida Panther NWR is located in Collier County and is part of a large watershed that originates in the CREW area and Okaloacoochee Slough systems to the north which flow downstream to Fakahatchee Strand and the PSRP to the TTI system. The refuge is primarily pine and cypress forest and hardwood hammock, and is managed to create optimum habitat conditions for the Florida panther.

The Florida panther will likely benefit from habitat acquisition, removal of access roads, removal of exotics, and restoration of hydrology, provided that water levels are suitable for maintaining or enhancing prey availability, distribution, or abundance while not reducing den site suitability, availability, or success.

Although the project will have benefits to the panther, construction and implementation is anticipated to result in disturbance and result in temporary and permanent losses and modifications of panther habitat. Noise, fumes, light and human presence associated with mobilization of equipment and temporary construction activities may alter panther movement within established home ranges. Hunting, breeding, denning, or dispersal may be disrupted or adversely affected. Although the overall restoration project will likely have beneficial effects on the panther, habitat loss and modification will occur as a result of both project construction and changes in hydrology during implementation. Adverse effects to the panther may be associated with the grading of roads, ditches, and berms; the construction of canal plugs, spreader canals, pump stations, and earthen berms; and the alteration of hydrology (i.e., increase in water depths (0.5 to 3.0 feet)) within the project site. Based upon the project information, it is difficult to determine how the planned construction will change hydrology and vegetation and how these changes will affect the availability of suitable den locations, denning behavior, or reproductive success. Resulting changes in hydrology may affect panther movement and dispersal. Changes in hydrology will likely also affect panther prey availability, abundance, or distribution.

Service biologists have stated that additional analysis is necessary to fully assess potential project effects to the Florida panther. The Corps will provide additional analysis and work with the Service to maximize benefits and minimize impacts to the panther during the Preconstruction Engineering and Design phase, if the Federal project is approved.

Everglade Snail Kite and Everglade Snail Kite Designated Critical Habitat

The range of the endangered Everglade snail kite is restricted to habitats in south and The Corps will continue developing project operational manuals in a collaborative process with the District, Department of Interior and other public agenciescentral Florida. Snail kites are nomadic in response to water depth, hydroperiod, food availability, and other habitat changes (Sykes 1978, 1983a; Beissinger and Takekawa 1983; Bennets et al. 1994). The snail kite feeds almost exclusively on apple snails (*Pomacea paludosa*) in Florida. The abundance of apple snails, is closely linked to water regime (Kushlan 1975; Sykes 1979, 1983a). Drainage of Florida's interior wetlands has reduced the extent and quality of habitat for both the snail and the kite (Sykes 1983b). The kite nests over water, and nests become accessible to predators in the event of unseasonal drying (Beissinger 1986, Sykes 1987).

In dry years, the snail kite depends on water bodies which normally are suboptimal for feeding, such as canals, impoundments, or small marsh areas which are often remove from regularly used sites (Beissinger and Takekawa 1983; Bennetts et al. 1988; Takekawa and Beissinger 1983, Kitchens et al. 2002). These secondary or refuge habitats are vital to the continued survival of this species in Florida. The snail kite has a highly specific diet composed almost entirely of apple snails. The principal threat to the snail kite is the loss or degradation of wetlands. Nearly half of the Everglades wetlands have been drained for agriculture and urban development (Davis and Ogden 1994). The development of the SGGE subdivision is a classic example of this severe landscape alteration.

An adult Everglade snail kite was observed foraging along the Miller Canal in the PSRP on May 4, 2001, by Service and DOF staff (T. Doyle, personal communication, July 6, 2004). Snail kites have also been observed in the marshes of the Ten Thousand Islands NWR as well as the agricultural area west of the project site. A snail kite was observed foraging in ditches adjacent to U.S. 41, approximately 6 miles southwest of the project site (K. Dryden, personal communication, June 15, 2002). Snail kites are also present in wetlands within Lostman's and Okalacoochee Sloughs, Hinson Marsh, and the East Loop and Corn Dance Units of BCP east of the project site (Service 2000).

Current use of the project site appears to be minimal. Snail kites could potentially use project canal systems on an infrequent basis in the future if canal remnants supported forage (apple snails) or nesting habitat after aquatic weed control activities were terminated. However, remnant canal areas may be too deep to support the aquatic vegetation required for snail kite habitat.

The project area, once restored, is unlikely to support snail kite nesting because of the relatively small area and lack of contiguity among wetlands in the area. However, peripheral wetlands that support apple snails may be a critical component of snail kite habitat in that they may provide the only foraging opportunities for kites during regional droughts or other events that make other portions of the kite's range temporarily unsuitable.

The PSRP area does not include designated critical habitat for the Everglade snail kite.

Wood Stork

The wood stork is known to forage within suitable wetland habitats throughout the project area. Suitable wood stork foraging habitat consists of shallow wetlands with water depths of 2 to 15 inches. From January through June 2001, the Corps conducted monthly aerial wading bird surveys of the PSRP site and surrounding public and private lands. These surveys indicated that wading bird numbers were generally low during those months. Almost no surface water or wading birds were observed within the project area. The only water present in the PSRP was in canals with steep banks and deep water making these areas inaccessible to foraging wading birds. Drought conditions may have been a contributing factor to the low number of birds recorded. However, the excessive drainage by the PSRP canal network indicated that these conditions may not be that far removed from a normal dry season in the PSRP area. Twenty-seven wood storks were sighted during six survey flights (Nelson et al. 2001).

Three active wood stork nesting colonies are known to occur near the project area. Two of these colonies are located at Audubon's Corkscrew Swamp Sanctuary within the Corkscrew Regional Ecosystem Watershed (CREW), northeast of the project site (Fig. 8). Audubon's Corkscrew Swamp Sanctuary (Corkscrew) contains the largest historic and current wood stork colony in the United States. The third wood stork nesting colony is located east of the project site just north of the Fakahatchee Strand Preserve State Park.

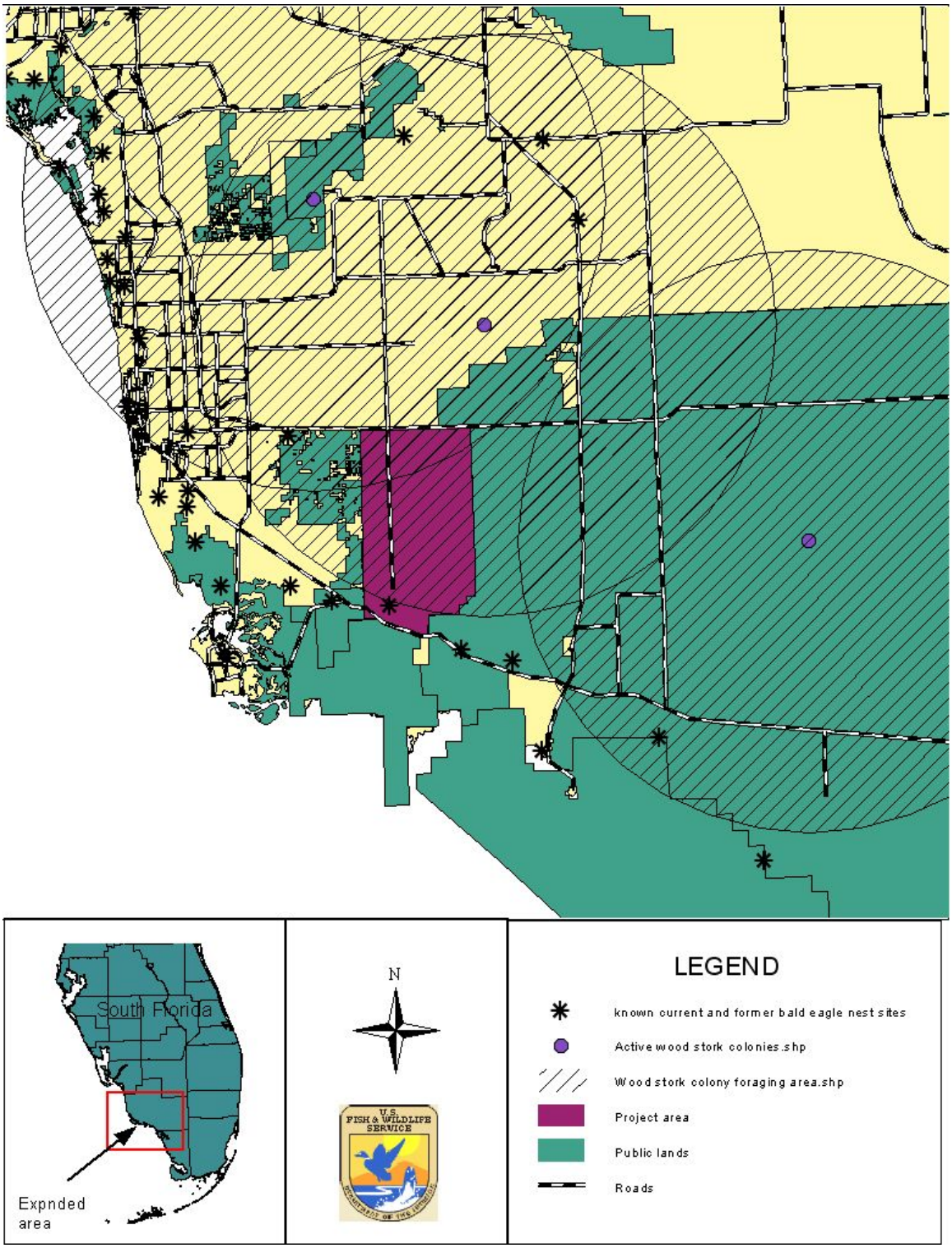

Figure 8. Wood stork colony foraging areas and known current and former bald eagle nest sites relative to the Picayune Strand Restoration Project site.

During the wood stork breeding season, feeding areas near the Corkscrew colony play an

important role in chick survival and provide enhanced opportunities for newly fledged birds to learn effective feeding skills. Wetlands within 30 kilometers (km) of rookery sites have been described as core foraging areas for wood storks (Cox et al. 1994). However, they may forage as far as 75 km from rookery sites (Ogden, personal communication, August 1, 2000). Wood stork nest surveys have been conducted within these nesting colonies by the State of Florida. Data for the two colonies located in the CREW indicate that 1,722 nests were constructed in 2000 and 1,240 nests were reported in 2002. Service data indicate estimates of 1101 nests in 2003. No wood stork nesting occurred in 2001. Additional data collected by the National Audubon Society indicate that 2,538 wood storks fledged during 2000 and 3,160 fledged during 2002.

The most recent nesting data for the colony located north of the Fakahatchee Strand Preserve State Park indicate that 50 nests were observed during 1999 and 25 observed during 2000. No data are available for 2001 or 2002. Historic nesting data were unavailable for the nesting colony located north of the Fakahatchee Strand Preserve State Park; however, nesting and fledgling data have been collected within Corkscrew since 1958. On average over the last 44 years in Corkscrew, 1,654 nests have been initiated yearly, producing an average of 2,161 fledged young, or 1.3 young fledged per nest. However, the 44-year average is somewhat misleading. Before 1968, as many as 5,000 wood stork nests were annually initiated. Nesting activity peaked in 1961 when 6,000 nests produced a record 17,000 young fledged, or 2.8 fledged young per nest. The production of wood stork colonies varies considerably between years and locations, apparently in response to differences in food availability. Colonies that are limited by food resources may fledge an average of 0.5 to 1.0 young per active nest; whereas colonies that are not limited by food resources may fledge between 2.0 and 3.0 young per active nest (Ogden 1996). The 44-year average indicates that the two colonies at Corkscrew are generally limited by food resources. During the year 2002, these colonies were not limited by food resources. No data on nest productivity is available for the colony north of Fakahatchee Strand Preserve State Park. However, based on the overlapping core foraging areas, it is likely that these birds face many of the same foraging conditions as those nesting within Corkscrew.

The ability of wood storks to forage successfully affects their decision to nest at historic rookeries and determines whether nest failure or fledgling survival will occur. Survey data show that the Corkscrew colonies represent an average of 12 percent (510 out of 4,065 nests based on a four-year average) of the Florida population. On average, the South Florida sub-population represents 53 percent of the Florida population and 34 percent of the southeastern U.S. population. Storks nesting in the BCB, under pre-drainage conditions (1930s to 1940s), formed colonies between November and January (December in most years) regardless of annual rainfall and water level conditions (Ogden and Davis 1994). In response to deteriorating habitat conditions in South Florida, wood storks in this region delayed the initiation of nesting until February or March, or about two months**,** in most years since the 1970s. This shift in the timing of nesting is believed to be responsible for the increased frequencies of nest failures and colony abandonment in this region over the last 20 years. Colonies that start after January in South Florida risk having young in the nests when May to June rains flood marshes and disperse forage fish.

Historic data on colony locations identify the Everglades basin and Corkscrew colonies as the primary nesting locations for wood storks in South Florida (Ogden and Nesbitt 1979). In the late 1950s and early 1960s, the Corkscrew colonies accounted for 51 percent of the Florida population.

The primary factors affecting wood stork habitat within the project study area are the loss and alteration of wetlands due to development and agriculture. Secondary factors such as weather (freezes and hurricanes), parasites, disease, and chemical contamination may affect wood storks but there is insufficient information available to discuss the effects of these factors on this species.

Development pressures due to ongoing population growth in Collier and Lee County continue to threaten wetlands in the action area. Data from the U.S. Census Bureau indicate that from 1968 to 2000 the human populations of Collier, Hendry, and Lee Counties have increased by 94, 78, and 88 percent, respectively. The population of this three-county area was estimated at 731,675 during the 2000 census, and is expected to continue to grow with a concomitant increase in wetland filling for development.

Using a Geographic Information System (GIS) database, the Service estimates that the 30 km (18.6 mile) core foraging area around the Corkscrew wood stork colonies is about 695,593 acres and is comprised of 58 percent uplands and 42 percent wetlands. Twenty-one percent of the core foraging area wetlands are located on public lands; the majority (79 percent) is located on private lands. The northern portion of the PSRP area is located in the core foraging area of the Corkscrew sanctuary wood stork colony. However, the entire PSRP area is located within 75 km of the wood stork colony. Wetlands on public lands, except where degraded by historical drainage activities such as in the PSRP, are generally considered secure from direct alteration. However, management practices on private lands could indirectly influence surface water flow (and wetland protection or restoration) on adjacent public lands. Almost the entire project area is within the CFA for the colony north of Fakahatchee Strand which did not support wood storks in 2003 and 2002.

Wetland alteration on private lands, although regulated, is common in the project study area. The Service's GIS analysis of National Wetlands Inventory data indicates that the functions of 31,969 acres of wetlands, or 11 percent of the total wetlands in the core foraging area of the Corkscrew sanctuary nesting colonies, have been diminished by ditching and draining, excavation, and impoundment. Another 24,272 acres have been lost to development (eight percent of total wetlands). It is important to note that although many wetlands remain unaltered, changes in land use patterns around these wetlands have isolated them from larger systems and diminished their value as foraging and nesting habitats for wood storks.

Wood storks forage most effectively in shallow-water areas with highly concentrated prey (Ogden *et al.* 1978, Browder 1984, Coulter 1987). In South Florida, low, dry-season water levels are often necessary to concentrate fish to densities suitable for effective foraging by wood storks (Kahl 1964, Kushlan *et al.* 1975). As a result, wood storks will

forage in many different shallow wetland depressions where fish become concentrated, either due to local reproduction by fishes, or as a consequence of seasonal drying.

Canals are common in the action area and significantly influence the hydrology of wetlands and other surface waters important to wood storks. Wang and Browder (1983) conducted a study in southwest Florida and found that the water table in the study area dropped about 1.5 to 2.0 feet after construction of canals. Another southwest Florida study found that the water table dropped approximately 2.0 feet, as far as 6,000 feet from the canal (Swayze and McPherson 1977). Black et al. (1974) estimated that, after construction of the canals, annual runoff from SGGE increased to about 17 inches.

It is critical that natural hydroperiods be established in post-restoration wetlands to support surface water connections (sheetflow) between wetlands to allow fish dispersal and establish dry-season or drought-resistant refugia, increase the extent and quality of wetlands, decrease competition between forage fish species, reduce predation on forage fishes, and reduce unwanted exotic fish species that compete with forage fishes.

Canals that remain on the site will provide permanent habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could allow predatory fish access to isolated wetlands and increase predation of small fishes on the site, reducing the small fish forage base used by wading birds, including wood storks.

Since minor changes in water elevations and hydroperiods can completely alter plant communities in southwest Florida, it is critical that: 1) predicted water elevations/hydroperiods be as accurate as possible; 2) adaptive management seek to monitor restoration effects on vegetation; and 3) water management of the site be strictly conducted and monitored. Operational plans for project infrastructure are critical in determining the effects of the project on wood storks. During wet years, water management practices could prevent the formation of shallow pools that concentrate wood stork forage fishes. During dry years, water management practices could over drain the freshwater sloughs, reduce freshwater flows into the downstream estuaries, and reduce wetland productivity of wood storks forage fishes. Variable water management practices could increase or decrease frequencies of wood stork nest failure in area rookeries. Habitat changes resulting from operation of the project will be calculated and provided to estimate impacts to wood storks.

Bald Eagle

Bald eagles are considered a water-dependent species typically found near estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats (Service 1999). Their distribution is influenced by the availability of suitable nest and perch sites near large, open water bodies, typically with high amounts of water-to-land edge. The bald eagle is an opportunistic feeder, but in South Florida the bulk of its diet is fish. Bald eagle use varies in the PSRP area but is primarily confined to foraging activities. Bald eagle nests in Collier County are located within 10 miles of coastal estuaries, although most are

located within two miles. Bald eagles in Collier County typically nest in pine trees, but are also known to nest in cypress.

The proximity of two bald eagle nests reported northwest of POI in Fakahatchee Strand and potentially in the southeastern portion of the project is under review (Fig. 8). A bald eagle nest is located approximately five miles west of the project site in the Belle Meade tract of PSSF. There are several known bald eagle nests in the vicinity of the project site and on the site. One nest is documented from the southern portion of the project area, but this nest has been inactive since 2000. An active nest may occur in the vicinity of the proposed 6L levee shown on Figure 3. This active nest site and any others identified will be monitored during the PED phase of the project, if approved, and protected consistent with the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (Service 1987) during construction.

Eastern Indigo Snake

The eastern indigo snake is a large, black, non-venomous snake that is widely distributed throughout South Florida. Dramatic population declines have been caused by over-collecting for the domestic and international pet trade, as well as mortality caused by rattlesnake collectors who gassed gopher tortoise burrows to collect snakes. Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977, Moler 1985). Habitat loss and fragmentation by residential and commercial expansion are more significant threats to the eastern indigo snake in southwest Florida. Lawler (1977) noted that eastern indigo snake habitat has been destroyed by residential and commercial construction, agriculture, and timbering. Extensive tracts of wildland are the most important refuge for large numbers of eastern indigo snakes (Diemer and Speake 1981, Moler 1985). Additional human population growth will increase the risk of direct mortality of the eastern indigo snake from property owners, domestic animals, and highway mortality.

The eastern indigo snake is present within project boundaries and on adjacent private and public lands in the region. The PSRP area, along with NGGE, is known to be a popular collection site for amphibians and reptiles due to the accessibility associated with the 279-mile roadway grid (L. Jones, personnal communication, August 1, 1998). No specific survey data is available for the project area.

It is expected that the project will increase the eastern indigo snake's ability to feed, breed, and shelter, as a result of hydrological restoration of wetlands and protection and management of uplands on the project site. To restore indigo habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to natural conditions. It is also critical that the majority of the 279 miles of road grid be removed and that post-project site habitat management occurs. . Reduction in disturbance due to road removal and degrading, and controlled access to prevent illegal take by reptile collectors are factors that should improve survival of the species in the project area.

American Crocodile and American Crocodile Critical Habitat

The current distribution of the American crocodile is limited to extreme South Florida, including coastal areas of Collier and Lee Counties. The distribution of crocodiles during the non-nesting season may vary considerably between years since adult crocodiles can disperse great distances (Kushlan and Mazzotti 1989). The majority of crocodiles are present in the vicinity of core nesting areas, located near Biscayne and Florida Bays (Kushlan and Mazzotti 1989). Crocodiles do nest in Southwest Florida, but successful crocodile reproduction has not been documented. However, several small groups and individual crocodiles have been documented from Sanibel Island and Pine Island, Lee County, south to the Fakahatchee River, Collier County. Crocodiles have been reported in Rookery Bay north of Marco Island and at the Eagle Creek Country Club just southwest of State Road (SR) 951 and U.S. 41. A crocodile was killed on U.S. 41 near the Faka Union Canal in 1997 (Lennie Jones, pers. comm.., August 1, 1998). As many as eleven adult crocodiles have frequented manmade borrow pits at the Marco Airport site, approximately 9.5 miles west of the PSRP. These crocodiles have repeatedly nested unsuccessfully on an adjacent elevated berm called the "Road to Nowhere." Crocodiles have been reported in the Fakahatchee River southeast of the project site by National Park Service (NPS) and DEP staff in 2002 and 2003. The 35,000-acre TTI NWR is located directly south of the PSRP in Collier County and was created to protect important mangrove and marsh habitats, native wildlife, and the endangered species of the area including the American crocodile.

Drainage canals and impervious surface runoff associated with the SGGE subdivision development have changed the seasonal timing and discharge of sheetflow to Pumpkin, Blackwater, Faka Union, and to a lesser extent, Fakahatchee Bays. Point source discharges have potentially reduced the production of fish and other aquatic species that provide forage for the American crocodile. The timing and frequency of the freshwater hydroperiod influences the health of the estuarine environment in south Florida and may be one of the most important large-scale factors influencing crocodile populations. When added to all other natural and anthropogenic sources of mortality, such habitat changes could have negative effects on crocodile nesting and hatchling survival. As advances in water management are made in south Florida, research is expected to continue to assess the effects on the American crocodile of changes in the amount and timing of water delivery (F. Mazzotti, telephone comm., November 14, 1996). Maintenance of osmotic balance requires access to low salinity water for juvenile crocodiles. Temperature changes related to freshwater input may be a factor in influencing forage activities. Because there is not estuarine model that can quantify changes in flow to individual downstream estuaries, an evaluation of project effects is difficult except that the project can be expected to improve the existing condition. However, some minimal flow and seasonal fluctuation should be maintained from Faka Union canal, even post-restoration, to maintain the health of the downstream estuary. This additional flow could be considered an additional project benefit, as dry season flows are limited under the existing condition.

The restoration will have little direct effect on crocodile nesting or resting habitat unless potential undefined behavioral changes result from alterations in freshwater flow. Natural hydroperiods will likely provide sufficient freshwater to periodically flush sediment from creek beds and maintain deepwater refugia for breeding adults. Restored hydroperiods also will decrease average salinities during late summer, when hatchlings require low-salinity water.

The PSRP area does not include designated critical habitat for the American crocodile.

Estuarine Fishes

One endangered and three candidate estuarine fish occur or may occur in estuaries downstream of the project. These fish species are the smalltooth sawfish, mangrove rivulus, Goliath grouper, and sand tiger shark which are under the jurisdiction of the NOAA Fisheries and will not be further discussed in this BA. The Corps has completed consultation on these species with NOAA Fisheries.

Sea Turtles

Three species of federally listed sea turtles have the potential to be affected by the project. They are the Atlantic loggerhead turtle (*Caretta caretta*), Atlantic green turtle (*Chelonia mydas*), and Atlantic ridley turtle (*Lepidochelys kempii*). Sea turtle nesting is not expected to be affected by the project. Swimming sea turtle species are under the jurisdiction of NOAA Fisheries and will not be further discussed in this BA. The Corps has completed consultation on these species with NOAA.

PROJECT COMMITMENTS AND CONSERVATION MEASURES

In order to reduce or eliminate adverse effects of the restoration project, the Corps will commit to continuing work with the Service in an open and collaborative interchange to assure conservation of listed species and habitat conservation. Funding estimates shown in the PIR under the Ecological Monitoring and Assessment Plan (PIR Appendix H) include funds for population and habitat monitoring already agreed to among the Service, Florida FWC, SFWMD and USACE. This monitoring and assessment plan will be in effect prior to construction, during the construction and during the operational phase. e. Conservation measures also include standard construction specifications to protect endangered species, including timing requirements to fulfull nesting “windows” , buffer zones, educational programs, presence of observers, pre-construction surveys for endangered species, nesting sites, isolated wetlands on the project of importance to the wood stork, special provisions for supplemental water at the POI Faka-Union weir to assure manatee needs are met, and restrictions on vehicle (including off-road vehicle) access to project lands In keeping with the principles of adaptive assessment and management, the Operations manual, as well as the Ecological Monitoring and Assessment Plan included in the FPIR may be modified as a result of ongoing coordination with the Service, or in light of additional information obtained through surveys, new modeling or Operations Plan re-evaluation during the P.E. D. phase, if the Federal project is approved. If new information on species, habitat, or

preconstruction surveys indicate changes in either structures or operations are justified, this information will be fully coordinated with FWS to obtain recommendations or concurrence. If new information indicates changed project or species conditions, coordination will be re-opened as necessary. The Monitoring and Ecological Assessment Plan will be subject to revision in keeping with the spirit of adaptive management, and operations of the project will be subject to change based on the outcome of initial and subsequent monitoring results.

A. West Indian Manatee

1. Cooperation will continue with USGS staff to develop studies and exchange information on the hydrologic effects of restoration of PSRP. Other ongoing studies of manatee distribution in the Greater Everglades have already been undertaken in cooperation with FWS and FWC as part of the RECOVER Adaptive Assessment and Monitoring program.

2. Cooperate in ongoing comprehensive aerial survey (currently conducted by the Service and DEP) and radio telemetry studies in the warm water refugia at POI marina, Faka Union canal, and the project area region to provide data for the spatially-explicit model and to document the distribution and status of the manatee population during project construction and post restoration for the 50-year project life. The current Monitoring Plan provides funding for cooperation with these surveys.

3. Conduct construction activities consistent with the Standard Manatee Construction Protection Guidelines if in-water activities (currently not anticipated) are needed at Faka Union Canal south of Faka Union Weir No. 1.

4. Conduct baseline and post-project seagrass surveys in upper affected bays of the Ten Thousand Islands as detailed in the final Monitoring and Assessment Plan (Appendix H).

5. Prior to construction, if the Federal project is approved, we will provide design details on the following PSRP project features: provide the Service with an assessment of the following information on warm water refugia conditions at POI marina basin and Faka Union Canal:

    a. POI marina depth and configuration (data will be collected by SFWMD as agreed to in the August 5, 2004 meeting on PSRP).
    b. Faka Union canal depth and configuration pre and post-project construction from the Faka Union weir north to the “T” canal (which will be plugged) (Already provided to Service along with Mike 11 model)
    c. Bathymetric information for Faka Union Bay may be available from Rookery Bay NERR data, if so it will be provided to the Service. .
    d. Pre and post-project freshwater inflow monitoring data including wet, dry and average years, for all seasons, after monitoring stations are established.

Additionally flow at the weir will be monitored after construction and data will be available to the Service.

e. Groundwater levels will be tracked from a monitoring well to be installed near the weir, according to prior discussions with the Service during the Aug 5, 2004 meeting on manatee issues.

f. The Corps has already coordinated a preliminary evaluation that indicates that the anticipated reduction in dry-season freshwater inputs to Faka Union estuary will not adversely affect basin stratification; this evaluation will be updated during the P.E. D. phase of the project, if it is approved.

g. A supplemental source of freshwater will be provided at the F-U weir using a small local groundwater well. This water supply will be provided at any time that freshwater discharge over the weir is judged to be inadequate by manatee biologists

h. During the P.E.D. phase the Corps will assess the effects of pulsed releases, if any or other operational procedures on manatees.

i. Effects of identified contaminant remediation areas on manatees, if any.

7. The Corps and SFWMD have committed to the following actions regarding manatee use of project structures including the Faka Union Weir:

   a. Pipe construction to supply fresh water over weir to marina basin.
   b. Groundwater pumping (part of 'a' above).
   c. Agreement for "Minimum Flow" level for manatees in marina basin (part of 'a' above).

8. Monitor the estuarine health and water quality in the Faka Union Estuary and Bay consistent with the Monitoring Plan.

B. Florida Panther

1. Conduct 1-year pre-construction project baseline and post-project (5-year intervals for 50 years) prey density studies using aerial transects consistent with FWC-recommended methodology or available infra-red detection technology (The Service recommends contracting directly with FWC). This prey density survey is included in the Monitoring Plan (App H). .

2. Prior to construction, contract with FWC to assess and characterize pre-project panther telemetry in the project area including Fakahatchee Strand Preserve State Park, BCP, the Belle Meade portion of PSSF, and Florida Panther NWR. Assess and characterize post-construction project panther telemetry, including abundance and distribution of panthers over landscape, changes in habitat utilization if any, numbers of breeding females, and changes in population age distribution. Post-project assessments will be conducted every 3 years and provided to the Service.

3. Prior to and during construction, coordinate with FWC to determine if panther denning activities are occurring in potential project construction areas. If denning is occurring during construction phases, obtain recommendations for construction buffers from FWC if determined to be necessary by FWC and the Service.

4. during the PED phase evaluate the potential effects of final project road plan location, design, and proposed road access/use plans on the Florida panther.

5. Prior to construction, evaluate the potential effects of project phasing ~~plan effects~~ on the Florida panther. Prohibit construction access through Fakahatchee Strand Preserve State Park and designate minimal access construction route to each project phase. Post panther warning signs consistent with Service recommendations along construction routes.

6. Provide for dissemination of information on the panther to contractors and construction personnel at a pre-construction briefing. The information will be developed in coordination with and approved by the Service.

7. Assess DOF recreational use or management plan effects on the Florida panther if adopted as part of the Federal project. The Corps concurs that recreational use of lands acquired for the Federal project must not conflict with panther or panther habitat conservation requirements.

8. Assess plant community succession as part of the final Monitoring plan. Vegetation sampling has been designed to permit prediction of effects on panther and panther prey. Further details of the assessment will be developed cooperatively with Service and FWC staff during the P.E.D. phase of the project.

9. Coordinate Federal project components with Ten-Year PSSF Resource Management Plan, when approved.

10. Monitor and document DOF fire regimes to assess their effects on plant communities. The details of this assessment will be included in a modified Monitoring Plan to be developed in detail during the P.E.D. phase, if the Federal project is approved, and in conjunction with the development and approval of the Ten-Year PSSF Resource Management Plan.

C. Wood Stork/Everglade Snail Kite/Eastern Indigo Snake Habitat

1. Monitor the hydrological effects of the project design consistent with the Monitoring Plan by: (1) conducting a baseline vegetation transect study prior to construction consistent with the 1999 NRCS vegetation sampling methodology; (2) resampling with the 1999 NRCS vegetation sampling methodology at 1, 3, and 5 years following project construction, and then every 5 years for the remainder of the 50-year project life; (3) sampling one or more permanently marked 50-m transects at each of the new District well sites prior to construction within

representative plant communities consistent with Main et al. (2000); (4) adding one 50-m transect to each NRCS vegetation sampling plot prior to construction, consistent with Main et al. (2000); and (5) resampling 50-m plots consistent with Main et al. (2000) at 1, 3, and 5 years following project construction, and then every five years for the remainder of the 50-year project life. Assess the effects of the information provided consistent with recommendations in a Monitoring Plan. . As noted previously, details of individual Monitoring plan components and methods will be developed cooperatively during the P.E. D. phase of the project. Sufficient funds have been estimated to conduct these surveys as shown in Appendix H.

2. Monitor the water quality effects of the project consistent with the Monitoring Plan.

3. Monitor the surface water and groundwater effects of the project consistent with the Monitoring Plan.

4. Conduct a detailed assessment of project operational effects on project wetlands consistent with a Project Operations Manual . Modify the Operations Plan, as necessary, through an adaptive management process that will include reporting, assessment, and recommendations based on the evaluation of the operations plan's consistency with restoration objectives. The details of this adaptive management process will be included in the Monitoring Plan but are adequately discussed in general CERP literature. Adaptive management is required when significant uncertainty exists as to the outcome of a modeled future.

5. Coordinate Federal project components with the Ten-Year PSSF Resource Management Plan, when approved.

6. Monitor and document Division of Forestry fire regimes to assess their effects on wetland plant communities, including hydroperiods.

The Monitoring Plan has been modified too include sampling Inland Aquatic Fauna. Details of all sampling methods used in CERP projects are undergoing documentation under the CERP Adaptive Management directive, and will be further documented in appendices to the final Ecological Monitoring and Adaptive Assessment Plan for PSRP, as they are too voluminous to be included in the main Plan text.

Monitor fish and wildlife and vegetation in lands where project benefits are predicted in accordance with the ecological monitoring and assessment plan (Appendix H).

D. Eastern Indigo Snake

1. Adopt the Standard Eastern Indigo Snake Protection Measures during all construction on the project.

2. Provide for dissemination of information on the eastern indigo snake to contractors and construction personnel at pre-construction briefings. The information will be developed with and approved by the Service.

3. Once the PED phase is completed, additional calculation of impacts and benefits by habitat coved type will be provided. . However, USACE notes that it is expected that overall project effects will be positive.

If possible and subject to funds availability, work with researchers to develop a post-project monitoring strategy to gain more information on eastern indigo snake habitat use as well as their response to this type of restoration project.

E. Wood Stork

1. Monitor and assess the yearly productivity of stork nesting colonies within 30 km of the project site, using existing information sources at FWC and Audubon's Corkscrew Swamp Sanctuary. The details of this assessment will be included in appendices to the Monitoring Plan as noted above. . Provide this information to the Service.

2. Prior to construction, conduct a new baseline wading bird survey consistent with Nelson et al. (2001) as modified. Because the 2001 survey was conducted during the dry season of a drought year, a new baseline survey should be conducted. However, at a minimum, a wet season baseline survey (July 1 through October 1) should be conducted prior to construction. Resampling should occur on a yearly basis during project construction, one year after completion of physical construction, and then at five-year intervals for the remainder of the project life. The details of this assessment will be included in the PED phase updates and appendices to the Monitoring Plan.

3. Provide for dissemination of information on the wood stork to contractors and construction personnel at pre-construction briefings. The information will be developed in coordination with and approved by the Service.

4. Assure that non-federal sponsor remediation of contaminants has occurred prior to acceptance of sponsor certification of lands to the Federal government. Residual contaminants should represent insignificant risks to wood storks due to bioaccumulation in the food chain.

5. Adopt the *Habitat Management Guidelines for the Wood Stork in the Southeast Region* (Ogden 1990).

F. Everglade Snail Kite

1. Provide for dissemination of information on the Everglade snail kite to contractors and construction personnel at pre-construction briefings. The information will be developed in coordination with and approved by the Service.

G. Red-Cockaded Woodpecker

1. Prior to construction, conduct/assess baseline population surveys of RCWs within Belle Meade, PSRP, Fakahatchee, and Big Cypress Preserve. The Ecological Monitoring and Assessment Plan (PIR Appendix H) provides for surveys in the PSRP project area. The Corps will assess the results of surveys of other areas, as available from land managers or State of Florida resource agencies.

2. Conduct/assess post-project baseline population surveys of RCWs in PSRP and immediate areas affected by the project. Additional census data may be generated by other agencies, and will be provided as available to the Service. Sampling will occur at five-year intervals beginning five years after project completion and continue monitoring/assessment on five-year intervals for the remainder of the 50-year project life, as provided in the Ecological Monitoring and Assessment Plan, Appendix H.. Provide this information to the Service.

3. Monitor and document DOF fire regimes and timber cruise and harvest to assess their effects on pinelands used for RCW forage and nesting habitat.

4. Coordinate Federal project components with the Ten-Year PSSF Resource Management Plan, when approved.

5. Provide for dissemination of information on the red-cockaded woodpecker and its nesting habitat to contractors and construction personnel at pre-construction briefings. The information will be developed in coordination with and approved by the Service.

H. Bald Eagle

1. Prior to construction, determine if bald eagle nests recently identified near POI and in Fakahatchee Strand Preserve State Park will be impacted by the project according to the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (Service 1987). Prior to each construction phase, review the known location of eagle nest to ensure that additional effects will not occur. Conduct detailed aerial survey for active nests in the vicinity of known former eagle nests.

2. Provide for dissemination of information for protection of the bald eagle and its nesting habitat to contractors and construction personnel at pre-construction briefings. The information will be developed in coordination with and approved by the Service.

3. Assure that non-federal sponsor certification of lands to the Corps includes assurance relative to the level of risk to bald eagles represented by any residual contaminants.

4. The Corps uses and has adopted the *Habitat Management Guidelines for the Bald Eagle in the Southeast Region* (Service 1987).

I. American Crocodile

The Corps will attempt to obtain information on crocodile nesting in lands outside of but adjacent to PSRP project lands and will provide this information to the Service as available. At present no information appears to indicate that crocodile nesting has been initiated on these lands

1. The Corps cannot commit to developing an estuarine mixing model for the TTI Estuary, as noted in the text of this BA, as data required for such a model do not currently exist.

J. Adaptive Assessment

1. During P.E.D. develop a detailed Adaptive Assessment protocol with the SFWMD, Service and cooperators from State resource agencies in a modified Monitoring Plan for the project. The protocol will identify performance indicators consistent with project objectives, a data review strategy for the Monitoring Plan, Operations Manual, and DOF Resource Management Plan. The strategy would also identify the parties responsible for review, actions that will be taken when performance indicators are not met in accordance with RECOVER guidelines and Programmatic Regulations for CERP..

2. Coordinate Federal project with Ten-Year PSSF Resource Management Plan of the Florida Division of Forestry, when approved.

K. Ecological and Water Quality Monitoring Plan

1. Funding has been proposed for surveys and monitoring of inland and aquatic fauna in the revised Monitoring Plan, Appendix H. The Corps acknowledges the contributions of the ecosystem working group of the PSRP PDT to developing this plan. Details of sampling and analysis methods will be provided in the final Monitoring Plan to be developed, if the project is approved, during the P.E. D. phase. Standard sampling techniques used in ongoing monitoring by subject matter experts will be referenced or cited as appropriate.

2. Approval and funding of the Plan depends on Congressional approval of the PIR. The current proposed budget for the Plan is noted in the FPIR and Appendix H. If the project is approved, the Monitoring Plan has a current cost of just over $30,100,000 spread over the project life. Baseline surveys and pre-construction data collection are expected to cost $3,7 million dollars; construction –phase

monitoring is estimated at about $3.8 million; and monitoring and assessment during operations are expected to cost $22.7 million dollars. Qver the project life, all monitoring will average about $550,000 per year. Pre-construction surveys and construction –phase monitoring of listed species are expected to cost $500,000 and $750,000 respectively. Additional funds are provided for supporting ES habitat studies. Implement the Water Quality and Hydrological Monitoring sections of the Monitoring Plan.

3. The Monitoring and Assessment plan provides for Pre-Construction surveys (time and budget) for the following listed species a) red-cockaded woodpeckers; b) Florida panther prey base survey; c) wading bird (wood stork) baseline; d) West Indian manatee; e) bald eagle nests if necessary; f) eastern indigo snakes, as necessary and feasible using the most appropriate scientific methods; g) baseline aquatic fauna (wood stork) and West Indian manatee surveys; and h) construction-related specific site surveys based on phasing.

L. Operational Plan

1. Ecosystem restoration is the primary purpose of the operational plan, with flood control maintenance as a constraint. The Operational Plan should include the regulation schedules, operating criteria, and additional provisions as may be required to collect, analyze, and disseminate basic data. Detailed operating instructions to ensure that the project meets the restoration goals and targets will be further developed during the P.E. D. phase and will be tied to the restoration objective and WRDA 2000 constraints relative to flooding. The Corps and the District will coordinate with the Service to ensure that the ecological objectives of the restoration project are met using real-time operational criteria and rules.

2. The Corps will modify the Project Operations Manual as more detailed hydrologic information becomes available during the P.E.D. (pre-construction) phase, construction and project operations. Phase.. The water resource allocation for the natural system as described in the FPIR/EIS should be utilized. The Corps will continue developing project operational manuals in a collaborative process with the District, Department of Interior and other public agencies

A. provide a description of how monitoring locations at different habitat types will be used to assess operational success;

B. include documentation of the canal design optimums;

C. include a map depicting ecological and hydrological trigger locations and optimum stages and locations.

3. In addition, the Operations Manual and Operational Plans will be coordinated with DOF and the components of the Ten-Year PSSF Resource Management Plan, when approved.

M. Invasive/Exotic Plants and Animals

1. Prior to construction, and in cooperation with the WMD and Florida DOF, develop an Invasive/Exotic Plant and Animal Management Plan, in coordination with the Corps' Comprehensive Everglades Restoration Plan's Project Management Plan for the Melaleuca Eradication and Other Exotic Plants Project and the DOF Ten-Year Resource Management Plan. The plan will include implementation of control measures to reduce the presence, spread, and associated negative effects of exotic plants and animals.

2. Target Category I and II non-native plant species for control as identified on the Exotic Pest Plant Council's annually updated list of Florida's Most Invasive Species. Category I species include non-native plants that invade and disrupt Florida native plant communities. Category II plants have the potential to invade and disrupt natural succession processes. Both Category I and II exotics are considered invasive and a threat to the function and ecological stability of Florida's natural communities.

3. Include measures and/or best management practices to control exotic plants during all phases of project construction and operation throughout the entire project area. Measures already discussed and committed to by the Corps include writing project specifications requiring cleaning (washing) of contractor equipment prior to entering the project work area to avoid introduction of seeds or propagules of invasive species.

N. Hydrological Modeling

1. Perform detailed design and engineering activities and modeling where necessary during the PED phase..

2. Develop in cooperation with endangered species subject matter experts, project performance indicators and guidelines for the wet and dry season.

3. The Project Development team has used model output representing responses to a range of meteorological conditions, such as 1988-2000 period simulated for project assurances, to evaluate effects to fish and wildlife resources.

Perform a QA/QC of the operational criteria in the model for Alternative 3D and the existing conditions simulation during PED.

O. Contaminants

1. All asphalt currently covering roads slated for removal will be disposed of off-site. No asphalt will be used as canal fill.

2. High selenium levels were initially found in the FASE, particularly in Grids 25 and 29 and sediment sample SED-6. Subsequent surveys identified lower levels of contamination or were inadequate to effectively delineate the extent of the contaminated zone. High levels of selenium were measured in eight grids (Grids 23-30) during composite sampling of Area 64W in the FAW. One of these, Grid 30, contained an extremely high selenium level (6 ppm). No follow-up sampling for selenium to confirm and delineate the extent of the contamination. The Service believes that the highest of these levels poses risks to small mammals and may also pose a risk to trust resources (*i.e.*, wading birds including wood storks, waterfowl) that may utilize these restored wetlands. Before inundating these grids, particularly Grid 30, it will be necessary to return to the FASE and FAW and complete additional selenium sampling. If some of these reported concentrations prove to be accurate, non-Federal sponsor remediation of some or all of these grids will occur consistent with Service recommendations before the non-Federal sponsor will certify the lands to the Federal government before hydrologic restoration

3. Approximately 50 acres of chlordane-impacted soil is present in the FAW. These soils are located in grids 1, 13, 16, 21, 27, and 30. An additional 6.7 acres of dieldrin-impacted soil was delineated in grid 1 of the FAW. These areas will be remediated or capped with clean fill by the non-Federal sponsor to form upland areas, thereby preventing liberation of chlordane or dieldrin into restored areas of the PSRP.

P. Assurances

1. The Corps affirms that all of the water made available by this project is necessary for restoration of the natural system, and should be identified, dedicated, and managed for the natural system.

2. Water to be dedicated and managed for the natural system includes the beneficial portions of baseline water and additional project water from various sources. The expected level of ecological restoration is achieved through a combination of groundwater and surface water within the project footprint. Project level benefits include all beneficial surface and sub-surface water made available to the natural system, rather than just the volume of water held in surface water storage within the project footprint;

3. The Corps has stated that both the baseline water and the additional water produced or redirected from this project are needed to achieve the goals and

objectives of CERP, as well as to ensure the benefits of the Plan for restoration and preservation of the natural system as required by WRDA 2000; and b) this baseline water should be protected consistent with Federal and State law, and the project water made available should be reserved by the State.

DETERMINATIONS OF EFFECT

Due to the importance of this project to federally protected species, particularly the West Indian manatee, wood stork, and Florida panther, and the significant contribution of Federal funds to project acquisition ($38 million from the DOI) and project development from the Corps' proposed construction and adaptive assessment and monitoring budget the Corps embraces full compliance with the Endangered Species Act. The intent of the Corps is to operate the project for the benefit of listed species and other fish and wildlife..

Determinations of "may affect, but not likely to adversely affect" may be provided for projects that affect a listed species, but these impacts must be insignificant, discountable, or completely beneficial. Beneficial effects are contemporaneous positive effects without any adverse effects to the species. Insignificant effects relate to the size of the impact and never reach the scale where take occurs. Discountable effects are those effects that are unlikely to occur.

Based on the assessment and the project commitments and conservation measures provided in this BA, the Corps has determined that the project "may affect, but is not likely to adversely affect" the red-cockaded woodpecker, the bald eagle, the Everglade snail kite and the eastern indigo snake, and the American crocodile and West Indian manatee critical habitat and is likely to have "no effect" on Everglade snail kite critical habitat and American crocodile critical habitat.

Because design and construction-level details of project structural components will not be complete until the end of the PED phase, and the final locations of canal plugs, roads, spreader canals, berms, levees, and other project features have not been finalized, we are unable to accurately estimate the amount of impact to wetland habitat that will result from construction of these project components. Additionally, until modeling results are re-evaluated and an operational plan is complete, we are unable to accurately estimate the amount of wetland restoration/rehydration that will result from this project. Both the acreage of wetlands impacted and the wetlands improved or restored are needed to evaluate the effects of this project on wood stork foraging opportunities. Additional analysis on estimated change in habitat cover type is needed to evaluate effects of the project on Florida panther. Information on potential changes in POI freshwater sources and warmwater refugia is necessary to complete an evaluation of potential project effects to the West Indian manatee. Consequently, the Corps has been unable to reach a determination of effects for the wood stork, Florida panther, and West Indian manatee at this time.

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United States Department of the Interior

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October 27, 1999

Mr. James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Attention: Kenneth Dugger

Dear Mr. Duck:

This Planning Aid Letter is submitted in compliance with the Scope of Work for the Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project. This report is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 *et seq.*) but does not constitute the final report of the Secretary of the Interior as required by section 2(b) of the FWCA. The purpose of this letter is to highlight potentially significant fish and wildlife issues or concerns, define fish and wildlife resource opportunities, and identify informational needs for plan formulation of the proposed project.

I. Background Information

Authorization of a Golden Gate Estates Feasibility Study was initiated by the Corps of Engineers (Corps) in 1978 to consider various alternatives to water resource problems resulting from the extensive canal systems of Golden Gate Estates. A Reconnaissance Report for Golden Gate Estates was issued by the Corps in 1980 (Corps 1980). In 1986, the Corps released a Golden Gate Estates Feasibility Report (Corps 1986). At that time, the Corps recommended no Federal involvement for implementation of modifications to the Faka Union Basin portion of the Golden Gate Estates water control system. In February 1992, Governor Lawton Chiles issued a directive to the South Florida Water Management District (SFWMD) to "...develop a conceptual hydrologic restoration plan for Southern Golden Gate Estates, using the Corps' Feasibility Report as a primary reference." In February 1996, the SFWMD, Big Cypress Basin completed the "Hydrologic Restoration of Southern Golden Gate Estates - Conceptual Plan" (Abbott and Nath 1996).

The Water Resources Development Act (WRDA) of 1996 (P.L. 104-303) authorized the Secretary of the Army, in cooperation with a non-Federal project sponsor and the South Florida Ecosystem Restoration Task Force, to provide the determination as to whether a nominated critical restoration project for the south Florida ecosystem will produce independent, immediate

and substantial restoration, preservation, and protection benefits. The SGGE Hydrologic Restoration Project was ranked seventh on the critical restoration project list by the South Florida Ecosystem Restoration Working Group. A critical project letter report was submitted by the Corps' Jacksonville Planning Division and approved by Corps Headquarters. The identified SGGE restoration project has since been removed from the WRDA of 1996 critical project funding authorization by the Corps (K. Dugger, Corps, personal communication 1999) since the Corps has determined that Federal funds used to purchase lands within the SGGE exceed the $25 million allowable for the project to qualify as a critical restoration project under the WRDA of 1996. The Corps has included the SGGE restoration project in the overall Central and Southern Florida Project Comprehensive Review Study (Restudy) (Corps 1999), which may provide an alternative authorization and funding authority for implementation of the SGGE restoration project.

The purpose of the SGGE Hydrologic Restoration Project, proposed by the Corps and the SFWMD, as described within the critical project letter report, is to restore altered hydrologic function to a 94 square mile area within the SGGE (Figure 1). The proposed project is designed to re-establish historic flow-ways and reduce large, adverse point source freshwater discharges to the Ten Thousand Islands estuarine system located downstream from the project area.

The implementation of the project is entirely contingent upon acquisition of lands. The Department of the Interior and the Florida Department of Environmental Protection (FDEP) executed a grant agreement under the Farm Bill (Section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which gave FDEP $25 million in Federal funds to acquire approximately 20,250 acres in the SGGE. The FB3 Grant Agreement developed with FDEP provides that conservation lands acquired under the agreement will be used and managed for conservation purposes within the scope of authorities of the Farm Bill and the FWCA. The framework agreement requires that all Farm Bill funds spent on land acquisition will be matched by non-Federal funds on a dollar-by-dollar basis. To date, nearly 45,000 acres of targeted lands have been purchased within the SGGE. Land acquisition negotiations within the SGGE are continuing under the direction of FDEP with the remaining land owners.

II. Description of Study Area

The approximately 94 square mile area (60,160 acres) known as the SGGE is located in Collier County between Interstate 75 and U.S. Highway 41 (Figure 1). It is located southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands Estuary, east of the Belle Meade State Conservation and Recreation Lands Project Area, west of the Fakahatchee Strand State Preserve, and encompasses the Picayune Strand State Forest. Significant alterations to the area's hydrology and vegetative communities have occurred within the SGGE since the cypress logging operations in the 1940s and 1950s. Land drainage activities, begun in southwest Florida with the diversion and channelization of the Caloosahatchee River, accelerated in the Golden Gate Estates area during the 1920 to 1950 time period (Tabb *et al.* 1976). The construction and completion of the Faka Union Canal System within the SGGE occurred

between 1968 and 1971. About 48 miles of canals, contained within 4 main canals, were built within the SGGE as part of the proposed residential development project (Figure 2). The resulting hydrologic effect of these large canals has been severe over-drainage of the area and large point source freshwater discharges to downstream estuarine systems. Adverse changes to vegetative communities have also been noted, the most severe of which is the increased frequency of fire within the drained areas and the invasion of exotic vegetative communities. It is estimated that the Golden Gate and Faka Union Canal systems have increased drainage 16 times faster than historic conditions, lowered water tables by 2 to 4 feet, and reduced hydroperiods by 2 to 4 months, resulting in a dramatic increase in forest fires and annual runoff (Gore 1988). The over-drainage effects of the Faka Union Canal system and other canal systems within the Big Cypress Basin have been documented in more detail within several previous reports (Tabb *et al.* 1976, Carter *et al.* 1973, Corps 1980, Corps 1986, Gore 1988, etc.). Tabb *et al.* (1976, p. vii) summarized the seriousness of these altered conditions within the Golden Gate Estates region as follows:

> "In our opinion, with the exception of the Okeechobee-Kissimmee Basin, the overdrainage of the Golden Gate Estates area presents a greater threat to human and natural systems than any other currently existing situation in south-central Florida."

A. Fish and Wildlife Resources

The ecological communities of south Florida represent a continuing succession beyond the primary stage (*i.e.*, the initial development of a biological community not previously occupied), resulting in the development of a mosaic of pine forest, cypress strands, hardwood hammocks, coastal mangrove forests and salt marsh, sawgrass plains, and wet prairies (Carter *et al.* 1973). Leighty *et al.* (1954) described the SGGE area as largely bald cypress swamp and short grass prairies, with occasional mesic hammocks or flatwood communities. As historic cypress strands within the SGGE became drier due to the canal-induced drawdown, there was a vegetative succession toward a mixed cypress-hardwood-cabbage palm system. Additionally, as a result of these abnormally dry conditions, fire now frequently burns farther from prairies and flatwood communities into adjacent cypress strands or other hydric forested systems, altering species composition (Burch *et al.* 1998). The cabbage palm forest has now become almost a pure biotype within many areas of the SGGE region, often forming dense populations. An inventory and analysis of biological communities within the SGGE is currently in progress under the direction of the Natural Resources Conservation Service (NRCS) to describe the current plant communities within the SGGE. Preliminary results indicate changes in species composition with wetland communities becoming less hydric in conjunction with lower numbers of wetland indicator species at almost all sites surveyed (Burch *et al.* 1998). Despite these vegetative community changes and the continued impact to historic plant communities from the altered hydrologic regime imposed by the Faka Union Canal system, the SGGE region provides important fish and wildlife refugia within a region that is rapidly losing much of its natural communities through conversion and degradation of habitat.

Comprehensive surveys have not been completed for fish and wildlife species within the SGGE. Tabb *et al.* (1976) provided a literature survey and review of the fauna of Golden Gate Estates (both the northern and southern portions) and also completed a six-month field study in 1975 and 1976. Results of this field work identified 10 mammalian species, 23 reptilian species, 8 amphibians, 19 species of fish, 90 avian species, and numerous aquatic and terrestrial invertebrates (Tabb *et al.* 1976). The following is a list of federally listed threatened (T) or endangered (E) species known or expected to occur within the SGGE area:

Florida panther	*Puma concolor coryi*	E
Red-cockaded woodpecker	*Picoides borealis*	E
Wood stork	*Mycteria americana*	E
Eastern indigo snake	*Drymarchon corais couperi*	T

The Florida panther and the introduced Texas cougar (*P.c. stanleyana*) are known to use the SGGE area for foraging, denning, and sheltering habitat based on radio-telemetry investigations conducted by the Florida Fish and Wildlife Conservation Commission (FWC). In addition, the West Indian manatee (*Trichechus manatus*), federally listed as endangered, is a year-round resident of the estuarine waters south of the SGGE (*i.e.*, Ten Thousand Islands estuary) and the Faka Union Canal is the second largest refugia for manatees on the west coast of Florida.

Numerous State-listed threatened, endangered, and species of special concern have been observed within the SGGE project area, including freshwater wading birds, such as the reddish egret (*Egretta rufescens*) and tricolored heron (*Egretta tricolor*), the Florida black bear (*Ursus americanus floridanus*), and the Big Cypress fox squirrel (*Sciurus niger avicennia*), a Federal candidate for listing. The Audubon WatchList for the State of Florida (Muehter 1998) also includes several avian species known to inhabit the SGGE region [*i.e.,* American swallow-tailed kite (*Elanoides forficatus*), clapper rail (*Rallus longirostris*), loggerhead shrike (*Lanius ludovicianus*)]. State WatchLists serve as an additional tool designed to help promote the conservation of local bird populations and serves as an early warning system that focuses attention on at-risk bird species before they become endangered.

III. Fish and Wildlife Resource Concerns and Planning Objectives

A. Introduction

Because of the unique link with surface water storage, alterations in hydrology in south Florida can produce significant changes in plant and animal community structure. In the case of the SGGE region, the increased drainage produced by an extensive canal system, to a large degree, has produced vegetative communities within the SGGE that look and function much different from historic ecological systems. In particular, increased fire frequency and the invasion of exotic and nuisance species are adversely affecting the fish and wildlife resources associated with the SGGE area. The drainage system imposed by the canals has also reduced the retention time of rainfall, resulting in a reduction of nutrient uptake by plants, which can affect water quality, as

well as a reduction in the retention time for water to infiltrate the soil for aquifer replenishment (Liudahl *et al.* 1998).

B. Fish and Wildlife Resource Concerns

The extensive Faka Union Canal system constructed within the SGGE was designed to permit rapid runoff of annual rainfall, thereby preventing surface flooding of the properties that were included within the large, proposed subdivision. Resource concerns related to the over-drained conditions imposed by the canal system include:

- annual loss of large quantities of freshwater and lowering of groundwater levels as a result of the four major canals within the SGGE,
- large point source freshwater discharges to the downstream estuarine systems as well as disrupted hydroperiods in coastal marshes and adjacent bays due to the reduced surface water flow,
- increased fire frequency, coupled with the loss of organic soils, and other adverse ecological effects (*e.g.*, exotic plant invasion) imposed by over-drained conditions.

Other concerns include the extensive road infrastructure created within the SGGE as part of the proposed development project in the 1960s. Nearly 375 miles of roads, intersecting at quarter-mile intervals, were created within the SGGE area (Figure 3). Roadways can alter flow patterns, provide a vector for introduction of exotic species, and provide human access to remote natural areas increasing the potential for disturbance to wildlife (*e.g.*, poaching) and increased fires and trash. Roads also reduce the natural canopy that, in conjunction with water availability, provides moderating temperature and humidity conditions necessary for certain plant species such as orchids and bromeliads. Bromeliads not only provide refuge for a variety of frogs, lizards, snails, and insects, but also serve as a foraging area for insectivorous birds such as the blue-gray gnatcatcher (*Polioptila caerulea*) and yellow-throated warbler (*Dendroica dominica*) (Carr 1973).

C. Planning Objectives

Restoration of a historic hydrologic regime for the SGGE region is the primary planning objective for this project. Correction of the overdrainage effects produced by the extensive canal system should receive the highest priority when planning for this restoration project. Restoration of an *appropriate* hydrologic regime coupled with the removal of invasive and exotic plant species would provide significant inroads in returning this region of southwest Florida to an area that provides a functioning ecosystem that can continue to support important fish and wildlife resources.

However, it is important to recognize the other hydrologic extreme when identifying restoration objectives. An extended hydroperiod and/or undesirable deep water conditions can produce flooding events and subsequent conversion/degradation of desired native plant communities, particularly historic upland areas, resulting in the loss of valued fish and wildlife habitat. Therefore, it is critical that hydrologic restoration efforts, particularly large-scale projects, recognize the appropriate hydrologic regime for an accurately defined watershed and design the project accordingly.

IV. Description of Alternative under Consideration

The SFWMD conceptual restoration plan for the SGGE was designed to provide a detailed hydrologic restoration plan with the primary objectives of reducing overdrainage and restoring historic sheetflow patterns while maintaining the existing levels of flood protection for those areas north of the SGGE area (Abbott and Nath 1996). The conceptual plan developed five alternative operational and structural configurations and each was evaluated as to its performance in meeting project objectives. The alternatives evaluated ranged from partial restoration to a large-scale approach using spreader channels, swale and road removal, placement of canal blocks, and installation of flood control pumps. One alternative, Alternative 3C (Figure 4), was determined to be the best configuration in achieving the desired objectives of the proposed project. Alternative 3C involves the removal of 130 miles of roads within the SGGE and the installation of 83 canal plugs. Canal maintenance south of the spreader channels would be discontinued and groundwater monitoring would be continued under this alternative. Additional recommendations included as part of the restoration plan include: maintenance of a travel corridor for fire management by the Florida Division of Forestry (Picayune Strand State Forest) and for recreational public access, collection of streamflow data of three canals at Interstate 75 on the north project boundary, continued groundwater monitoring programs, determination of performance criteria for the project, maintenance of optimal flowways, and development of a phased approach for project implementation (Abbott and Nath 1996).

During the development of the conceptual hydrologic restoration plan for the SGGE, the SFWMD determined that additional baseline information was needed relative to topography, soils, vegetation, canal hydraulics, and hydrologic-hydraulic modeling programs. The SFWMD also determined that additional data were necessary for the development for an overall Big Cypress Basin Watershed Management Plan. The SFWMD requested watershed planning assistance under the P.L. 83-566 program initiative from the NRCS to collect additional information regarding the analysis of soils, vegetative community surveys, canal cross-section data, and groundwater levels in the SGGE watershed. In addition, it was determined that the analysis performed by the Hydrologic Simulation Program-Fortran for the conceptual plan was inadequate to provide both detailed evaluation of structural alternative measures and specific answers on the limits of inundation and hydroperiod regime under consideration within the proposed alternatives (NRCS 1997). The NRCS watershed planning assistance study currently in progress is being guided by a multi-agency team (*i.e.*, SGGE Interagency Technical Committee) with representatives from the NRCS, SFWMD, FWC, the Corps, Fish and Wildlife Service

(Service), United States Geological Survey-Biological Resources Division, FDEP, Florida Division of Forestry, Florida Park Service, and the Conservancy of Southwest Florida. The information gathered through this study is critical for providing accurate vegetative community maps to be used in conjunction with modeling outputs for predicting changes related to the water level changes as a result of implementation of the proposed restoration project.

The SFWMD has recently developed a two-dimensional hydrologic/hydraulic/hydrodynamic model (WETFLOW) to simulate and demonstrate flow patterns and the duration and depth of inundation (A. Nath, SFWMD, personal communication 1999). Three modeling scenarios have been evaluated in this modeling exercise: hypothetical natural conditions, existing conditions, and restored conditions (*i.e.,* Alternative 3C). The physical parameters used in WETFLOW are topographic elevations and Manning's friction coefficient for each defined grid. The configurations of the canals and water control structures and the elements of the restoration plan were represented in terms of topographic elevations. Basic hydrologic input includes inflow and outflow boundary conditions, rainfall and loss parameters. The model's boundary conditions provide several assumptions relative to tidal influences, east-west overland flow and the model boundaries do not extend beyond Interstate 75 to the north.

Preliminary results from this modeling effort has been provided to the Service through inundation maps, which identify the general areas of inundation for each scenario. The model results predict little variation of depth for average monthly duration during the wet season. However, the model does not include ground water effects within the system. The Service anticipates that, as funding and time permit, additional opportunities for developing a more detailed water budget analysis of the proposed restoration plan will become available.

V. Description of Potential Adverse and Beneficial Effects

In order to evaluate potential impacts and benefits of the proposed project to fish and wildlife resources, the Service requires detailed and accurate hydrological predictions (*i.e.*, depth and duration) for the proposed restoration of sheetflow within the SGGE. This information is necessary to evaluate the potential impacts to historic upland communities, which are important for the Florida panther and migratory birds, among others, but also to ensure that favorable hydrological conditions will be established to support foraging requirements of Federal and State-listed wading birds. In addition, it is important that the downstream effects of this proposed hydrologic regime of the project be evaluated to assess potential impacts to the West Indian manatee and estuarine systems.

The current inundation maps provided to the Service provide a necessary first step in providing hydrological predictions. It is important that this effort be linked with the vegetative maps being produced by NRCS (both historic and current) and to soil surveys of the SGGE region. Because the SGGE restoration project is now contained within the larger Restudy Comprehensive Plan, the Service is under the assumption that the Corps will be designing and constructing project components. There may be additional modeling conducted by hydrologists within the Corps in

addition to the modeling efforts being conducted by the SFWMD. Additional operational details, based on the revised modeling results, are also necessary for a complete evaluation of the project impacts.

With the information currently available for review, the Service recognizes the following potential concerns related to the implementation of the proposed SGGE restoration project: inundation of historic upland habitats, creation of extended hydroperiods and/or excessive deep water conditions (*i.e.*, water storage areas), and construction-related impacts such as noise, pollution, introduction of contaminants and the potential of these impacts to adversely affect listed species. This project also may produce short-term adverse effects that will need to be evaluated once detailed project plans and design features are available.

The Service also believes that there is the potential for tremendous benefits incurred as a result of this restoration project if properly designed and implemented. In addition to potential benefits to listed species, there are opportunities to provide improved habitat quality for migratory landbirds, wading birds, wetland-associated amphibians and reptiles, and a variety of both aquatic and terrestrial invertebrates, the latter of which constitute an important component of functioning wetland ecosystems.

VI. Discussion

A. Fish and Wildlife-related Problems and Opportunities

The SGGE region represents both an area under tremendous hydrologic stress and an area with tremendous potential for fish and wildlife usage. The overdrainage effect has created adverse hydrologic conditions that continue to compound. That is, drier conditions increase fire frequency, cause a loss of native forested systems, and produce an invasion of exotic and nuisance plant species, which establishes plant communities that bear little resemblance to historic conditions, resulting in substantially less valuable fish and wildlife habitat. In addition, the large point source freshwater discharges, combined with a significant reduction of overland flow to estuarine marshes, continues to produce adverse effects on coastal estuarine communities.

The above identified potential impacts can be alleviated or minimized by defining restoration goals (*i.e.*, hydrologic regime) and designing project components to achieve these goals. The Service is aware that the SFWMD has defined flood control protection as one of the goals for the SGGE project. This intent must be compatible with the overall restoration goals defined for this project, particularly in light of the Farm Bill grant agreement guiding the land acquisition efforts.

The implementation of the SGGE restoration project provides an important opportunity for implementing recovery efforts for listed species such as the Florida panther, wood stork, and the red-cockaded woodpecker. For the Florida panther, recovery efforts that protect or enhance Florida panther populations, associated habitats, and prey resources, as well as maintaining

habitat linkages (*i.e.*, movement corridors), all represent opportunities that are contained within the project goals. The SGGE region is identified within the *Florida Panther Habitat Preservation Plan* (Logan *et al.* 1993) as Priority 1 habitat (lands most frequently used by Florida panthers and/or lands of high quality native habitat suitable for the Florida panther). For the red-cockaded woodpecker, the implementation of this restoration project may enhance the continued survival of the adjacent Belle Meade population of this species and may result in an range expansion of this population into the SGGE region with the implementation of appropriate management practices. Foraging activity by wading birds, such as the wood stork, are likely to be under-represented in the SGGE region, due to the altered hydrologic regime created by the canal systems. The largest wood stork rookery in the United States is located at the Corkscrew Swamp Sanctuary, approximately 23 km to the northwest of the SGGE area. Kautz *et al.* (1994) noted that wood storks may travel up to 30 km from rookeries to forage in appropriate wetland habitats during the breeding season. Thus, restoration of historic wetland regimes within 30 km of the Corkscrew colony can be important for breeding success.

B. Informational Needs

There are a number of informational needs that can be identified for the proposed hydrologic restoration project for the SGGE region that are necessary to proceed with detailed planning beyond the current conceptual stage. Of critical importance is the development of a hydrologic model that best reflects the SGGE region and the mosaic of habitats represented within the region. It is important that the model be verifiable and accurately reflect the current hydrologic conditions and functioning hydrologic connections of surrounding lands.

The results of vegetation mapping surveys and the historic 1944 aerial orthoquads currently being delineated and digitized by the NRCS are also a key information need required for providing an accurate review of this project. It is important that these maps have the capability of being overlain with the inundation maps currently being produced by the WETFLOW model. A more comprehensive analysis incorporating surface and groundwater flow interactions would provide additional refinement to results from the WETFLOW model. The Service believes that it would be appropriate to have a trained hydrologist evaluate the model results and be able to provide predictions as to the hydrologic effects of the proposed project to the SGGE region. It would also be important to complete a ground water modeling analysis that links both surface water and ground water resources.

The Service also recognizes that there is a large gap in baseline information of the fish and wildlife resources represented within the SGGE area. Fish and wildlife surveys, both pre- and post-restoration, are important in determining the success of this restoration project. The Service has been working with the FWC and the Picayune Strand State Forest to develop survey protocols for these baseline investigations. However, no funding mechanism has been identified for these studies, which are essential in order to evaluate potential effects on listed species and other trust resources.

Limited vegetation surveys within the SGGE are currently being conducted by the NRCS under the watershed assistance study. This study and other surveys are important for identifying current plant communities as well as noting other rare and unique plants. For example, a survey conducted in SGGE near the Port of the Islands resort (north of U.S. Highway 41) recorded a population of the hand fern (*Ophioglossum palmatum*), a State-listed (endangered) plant within a sabal palm stand (Staats 1999).

Both upstream and downstream effects to this subregion of the Big Cypress Basin watershed will need to be described for this large hydrologic restoration project including surrounding the State/Federal public lands complex. Based on the information currently available for review, the Service is unclear as to the extent of the hydrologic "zone of influence" that will be created by this project due to the implementation of project components constructed for the purpose of flood control. Downstream effects to the Ten Thousand Islands estuary will also need to be detailed, particularly because of the significant West Indian manatee usage within the Faka Union Canal system. In addition, a salinity model for the Faka Union, Pumpkin, and Fakahatchee Bays would provide useful information regarding the anticipated changes to the salinity regime as a result of reduction in point source discharges and the restoration of sheetflow across the SGGE region.

Due to the size and scope of the proposed project and the number of listed species present within the SGGE region, the Service anticipates that the Corps will complete a biological assessment to assess impacts to listed species. This assessment should provide an analysis of the effects of the action on listed species and related habitats, including consideration of cumulative effects, and will assist the Corps in making a determination as to whether listed species or habitat are likely to be adversely affected by the action.

Other information needs include a review of potential effects of pollutants, particularly as a result of construction activities but also as a result of the roadways currently in place within the SGGE. This is particularly important since the canal blocks may be comprised of road materials currently scheduled for removal. Current flow patterns from farm fields to the northeast of the SGGE should also be evaluated as a potential contributor to pollutant loads relative to the expected increased inundation of the area. Additional design details, both structural and operational, will also provide important information regarding construction-related impacts of the project.

VII. Recommendations

The Service recommends that any proposed hydrologic restoration project within the SGGE region be developed and implemented using a phased approach, in conjunction with an adaptive management evaluation methodology. It is also essential that the Corps and local sponsors of the proposed project recognize that a Big Cypress Basin watershed approach is required for development of any proposed project. The hydrological connections between SGGE and other sub-basins relate to other stakeholders in the region including two National Wildlife Refuges, Florida State Preserve, Florida Division of Forestry, the Miccosukee Indian Tribe of Florida,

Everglades National Park, and the Big Cypress National Preserve. It is important that any identified implementation plan contain inherent flexibility so that project components can be "fine-tuned" as conditions dictate.

It is also important that the Corps and the SFWMD provide coordination between Federal, State, and local cooperating agencies and promote resolution of natural resource management issues for this extensive restoration project. In particular, cooperative efforts must be extended to the Picayune Strand State Forest, since this agency currently manages most of the area that will be affected by the implementation of the project. It is essential that all management agencies recognize the requirement that the proposed project must be compatible with intended uses inherent within the Farm Bill Grant Agreement under which the land acquisition funds have been made available. In particular, issues related to the establishment of roadways and compatible recreational uses will need to be resolved early in the planning process.

The Service also recommends that a process be identified for the implementation of the additional resource management measures proposed for this project contained within the conceptual plan. These include the continuation and enhancement of the existing ground water monitoring program within the SGGE, collection of additional streamflow data on the main canals, measurement of downstream water quality and quantity discharges, and determination of quantitative and qualitative success criteria for the project.

Establishment of performance measures for the SGGE restoration project would assist in ensuring that the project achieve restoration goals that were established within the conceptual plan. Examples of these performance measures could include establishment of stage duration curves and validation with modeling results, water budget analysis, downstream salinity regimes, and biological indicators such as increased usage by wetland dependent fauna, such as wading birds. The upland criteria addressed within the conceptual plan can be used to ensure that historic upland areas identified within the SGGE are not adversely affected by the conditions proposed within the project. These criteria should, however, be validated with on-site investigations and correlated with recent soil survey and plant community investigations (see Liudahl *et al.* 1998 and Burch *et al.* 1998).

VIII. Summary of Findings

The restoration of the SGGE region has been an important focus for a number of individuals, organizations, and agencies for several decades. It is important to recognize the diligent planning efforts of these individuals and the resolute desire to restore an important resource area of southwest Florida. It is also essential that the Corps recognize the potential effects of this restoration project on adjacent public lands, including potential benefits and conflicts. The hydrologic restoration of the SGGE region should therefore proceed with definitive answers as to potential impacts and benefits generated by a proposed plan.

The Service believes that results from a verifiable and complete model (both upstream and downstream of SGGE) are necessary for a meaningful evaluation of this project. Modeling efforts currently underway within the SFWMD should be expanded to include those portions of the basins hydrologically connected to the SGGE region. The Service has identified a number of informational needs that will be necessary for our agency to provide the Corps with a more complete review of potential impacts to fish and wildlife resources, particularly listed species. The Service views the SGGE region as underutilized relative to fish and wildlife trust resources and recognizes the important opportunity presented to achieve recovery objectives for a number of listed species.

Sincerely yours,

David L. Ferrell
Supervisor
South Florida Restoration Projects

Attachments
1. Literature Cited
2. Figures 1-4

cc:
FWS, State Supervisor, Vero Beach, FL (Steve Forsythe)
FWS, Project Leader, Vero Beach, FL (Jay Slack)
FWS, Florida Panther and Ten Thousand Islands NWR, Naples, FL (Jim Krakowski, Terry Doyle, Kim Dryden)
FWS, South Fla. Field Office, Vero Beach, FL (Allen Webb)
NRCS, Gainesville, FL (Rosalind Moore)
SFWMD, Big Cypress Basin, Naples, FL (Ananta Nath, Tomma Barnes)
FWC, Punta Gorda, FL (Jim Beever)

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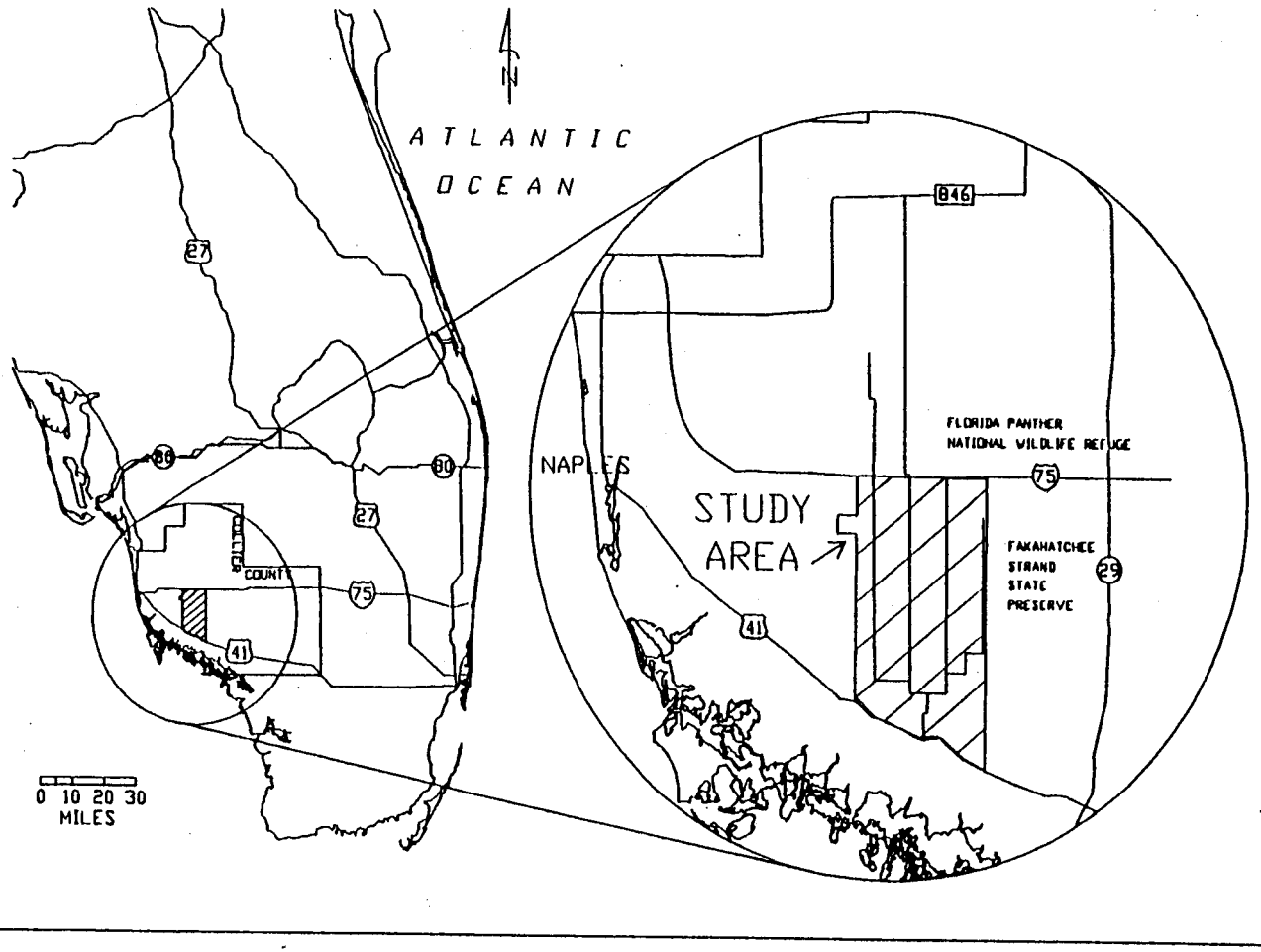

FIGURE 1. Project Location Map

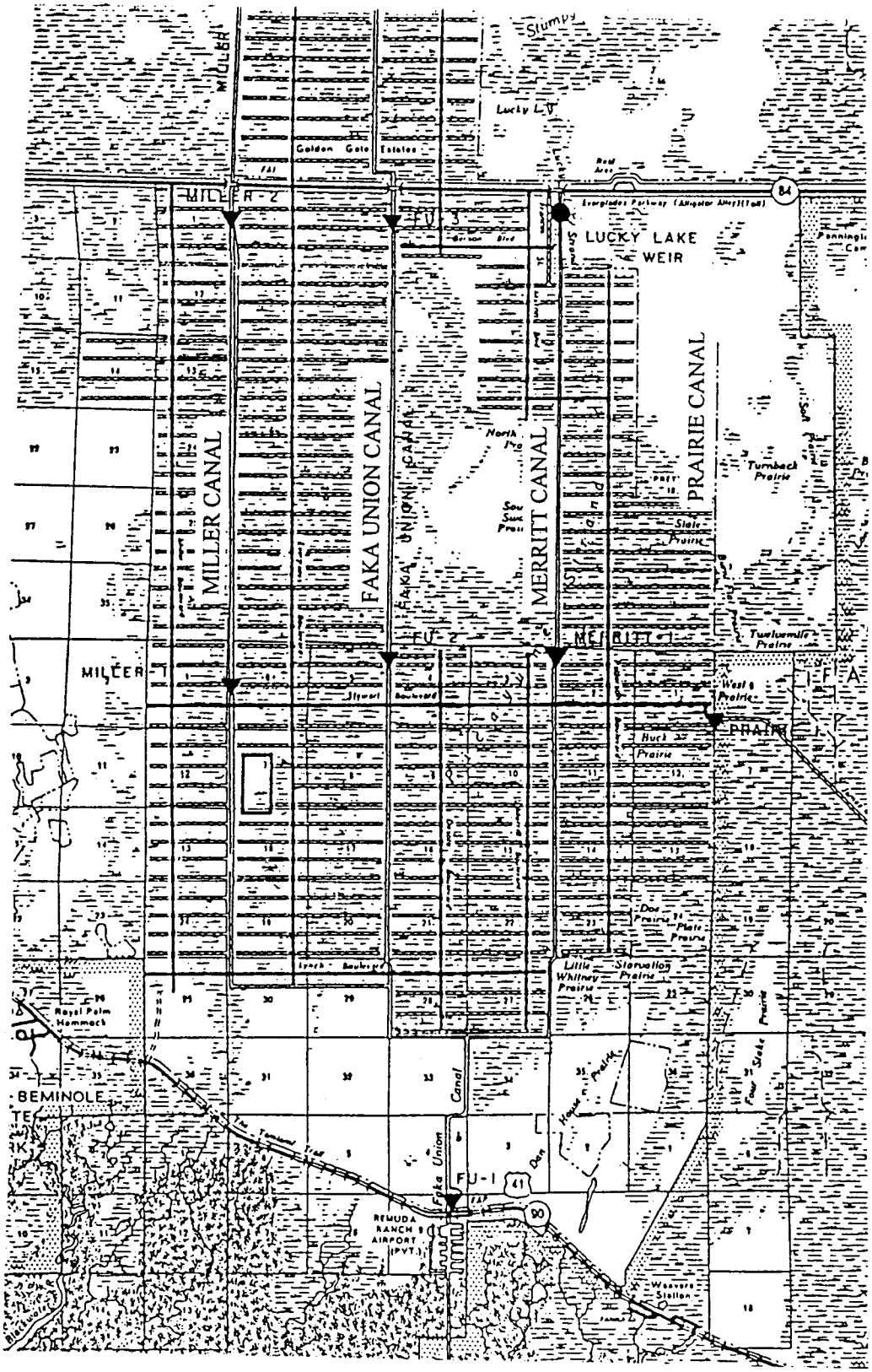

Figure 2. SGGE Canal System.

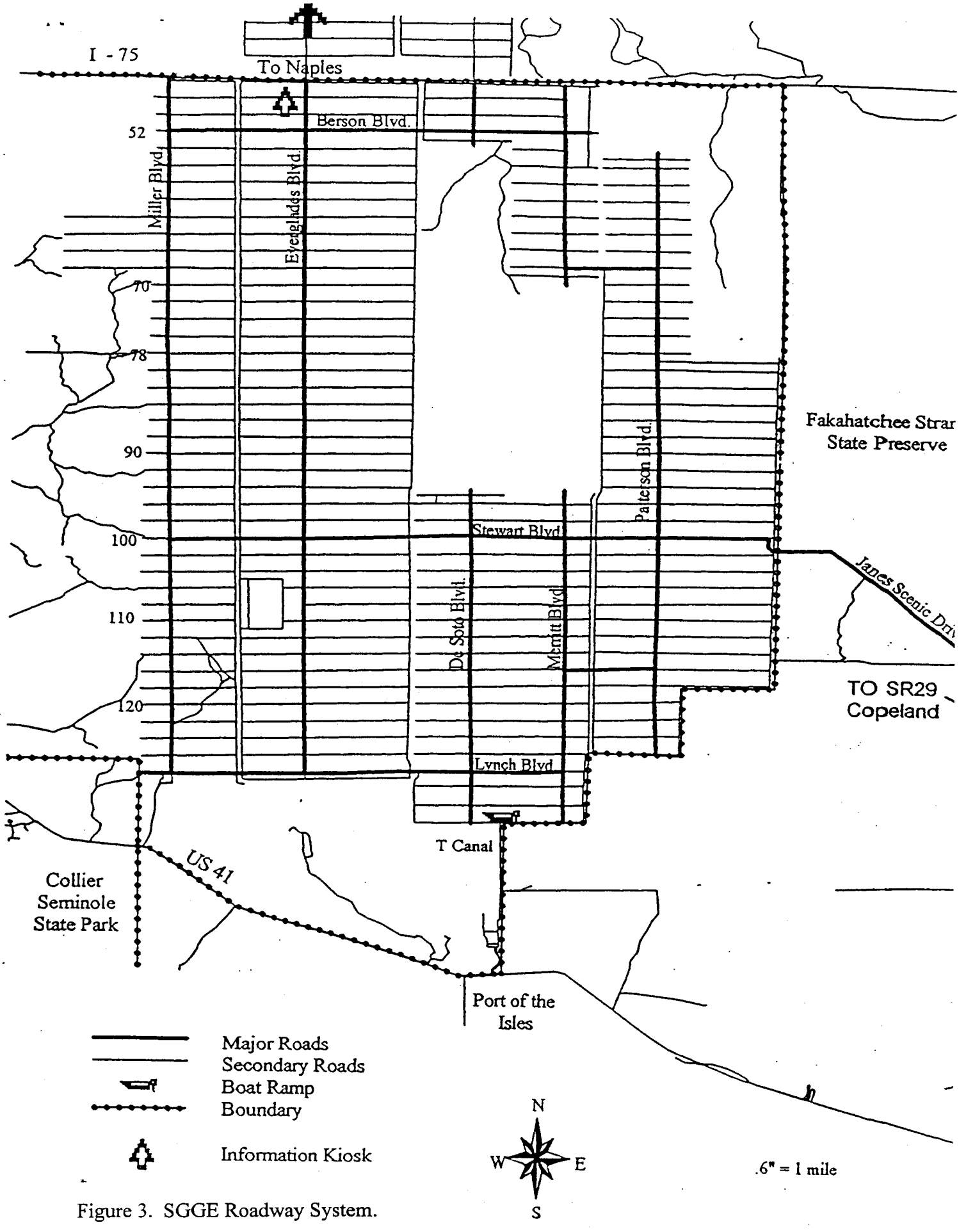

Figure 3. SGGE Roadway System.

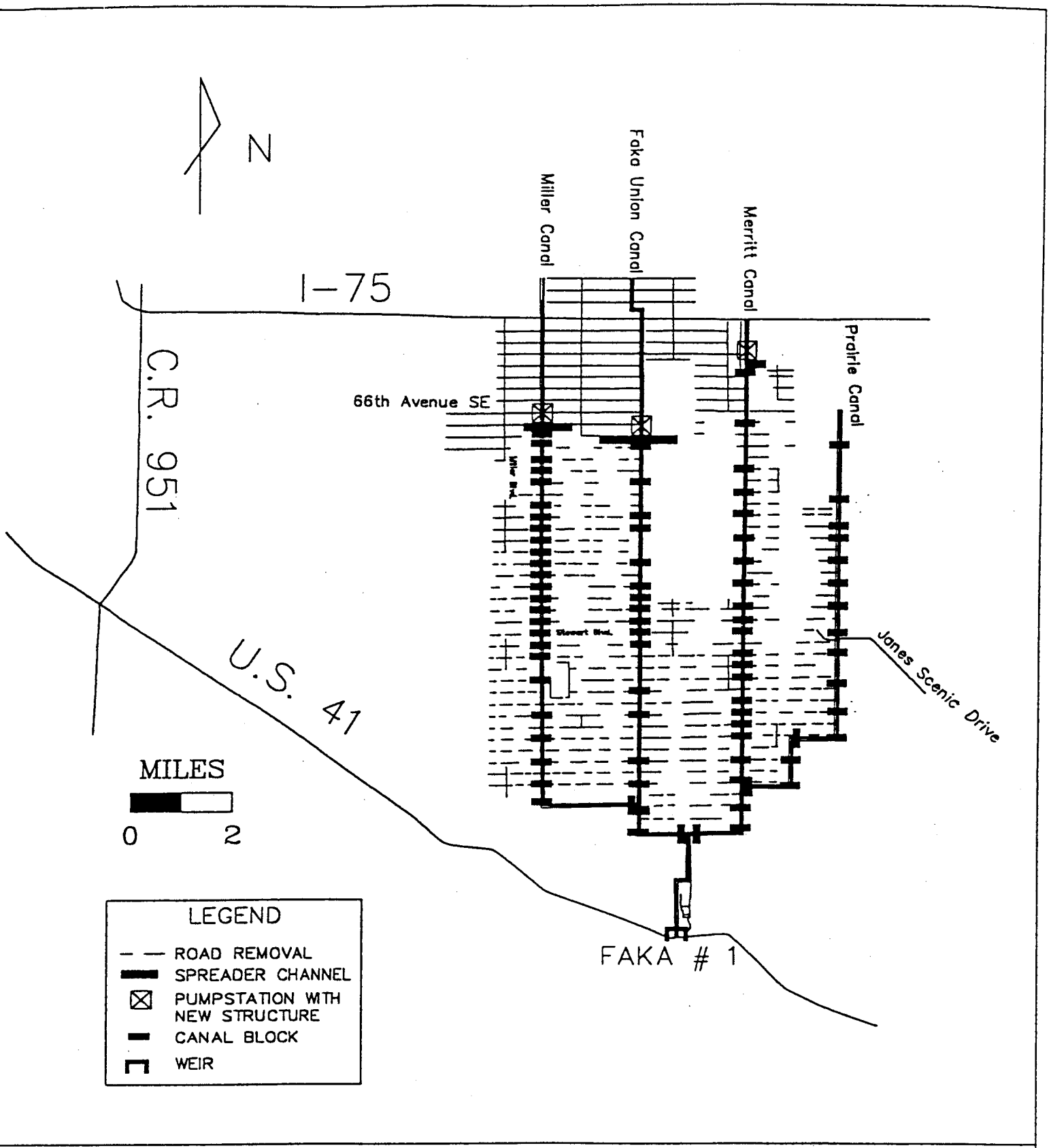

FIGURE 4. Recommended Plan Southern Golden Gate Estates Hydrologic Restoration

February 2, 2001

Mr. James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

The Fish and Wildlife Service (Service) has reviewed the Preliminary Draft Southern Golden Gate Estates (SGGE) Project Management Plan (PMP) dated December 19, 2000, and provides these comments in accordance with the Fish and Wildlife Coordination Act (FWCA) (16 U.S.C. 661 *et seq*.) and section 7 of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. 1531 *et seq*.).

The Service appreciates the coordination of the Corps of Engineers (Corps) with various State and Federal agencies through the SGGE Interagency Technical Committee. The Service recognizes that many important details of the study will be presented at a later date, and that environmental evaluations will be required later in the plan formulation process. Additional Planning Aid Letters or Reports and an FWCA Report will be prepared as planning proceeds.

I. Authority, Description, and Purpose of the Project

The SGGE project is included in the Comprehensive Everglades Restoration Plan (CERP), authorized by the Water Resources Development Act (WRDA) 2000, as an "Other Project Element" (OPE). Detailed design of the SGGE project is currently unfunded and is proposed for submission to Congress for possible funding under WRDA 2002. The Department of the Interior and the Florida Department of Environmental Protection (FDEP) executed a grant agreement under the Farm Bill (FB) (section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which gave FDEP $25 million in Federal funds to acquire approximately 20,250 acres in the SGGE. The FB3 Grant Agreement developed with FDEP provides that conservation lands acquired under the agreement will be used and managed for conservation purposes within the scope of authorities of the Farm Bill, FWCA, and other applicable Federal law.

The approximately 94-square mile SGGE area (60,160 acres) is located in Collier County in southwest Florida between Interstate 75 and U.S. Highway 41 (US 41). The project and the adjacent Belle Meade Conservation and Recreational Lands (CARL) project are included in the Picayune Strand State Forest, managed by the Florida Division of Forestry (FDOF). The project is strategically located in the center of significant areas of State and Federal conservation lands as referenced in the project objectives. The construction and completion of the Faka Union Canal system, including 48 miles of canals contained within four main canals, occurred within the SGGE between 1968 and 1971, as part of a residential

development project. These large canals have severely over-drained the area and generate large point-source freshwater discharges to the downstream estuarine system. The Golden Gate and Faka Union Canal systems have increased drainage to an estimated 16 times faster than historic conditions, lowered water tables by 2 to 4 feet, and reduced hydroperiods by 2 to 4 months; resulting in a dramatic increase in forest fires and annual runoff within the Big Cypress Basin (Gore 1988). This drainage has also caused significant changes in vegetation, including invasion by native cabbage palm (*Sabal palmetto*) and transitional or upland vegetation; as well as exotic plants, primarily Brazilian pepper (*Schinus terebinthifolius)* and melaleuca (*Melaleuca quinquenervia*).

As outlined in the PMP, the objectives of the SGGE project are:

- re-establish historic flow-ways, sheetflow, and wetland hydroperiods;
- reduce point discharges of fresh water to improve the health of downstream estuaries;
- maintain flood protection for developed areas north of the project;
- improve aquifer recharge for water supply and to provide a saltwater intrusion barrier;
- restore and enhance fish and wildlife resources including listed species such as the Florida panther (*Puma concolor coryi*), Florida black bear (*Ursus americanus floridanus*), and wood stork (*Mycteria americana*);
- protect rare habitats such as tropical hammocks and plant species, including orchids and bromeliads;
- preserve upland habitat;
- control invasive exotic plants;
- improve water quality of stormwater runoff;
- reduce or eliminate over-drainage of adjacent sensitive ecosystems;
- provide resource-based recreational opportunities; and
- provide contiguous habitat conservation for the greater Everglades ecosystem including the Florida Panther National Wildlife Refuge (FPNWR), Fakahatchee Strand State Preserve, Ten Thousand Islands National Wildlife Refuge (TTINWR), Collier Seminole State Park, and the Belle Meade CARL area.

II. General Comments

The Service has five primary concerns with regard to this project: (1) the long-standing need for detailed and accurate hydrological restoration design information (*i.e.*, water depth and duration) and ecosystem models in order to evaluate and avoid potential impacts to historic upland communities, but also to ensure that favorable hydrologic conditions will be established to support wetland-dependent species; (2) implementation of actions to benefit and/or to minimize potential adverse effects on State and federally listed species; (3) surveying and documenting sufficient baseline information in the planning phase to assess the best possible design to sustain downstream estuarine productivity; (4) modeling the effects of the hydrological design on fish and wildlife habitat located primarily, but not entirely, on public conservation lands that surround and are adjacent to the project; and (5) development of a detailed water management plan.

The PMP should include references to models (such as the Natural Systems Model) or other analysis that can predict habitat changes resulting from the restoration and that will expand upon hydrological modeling currently being developed by the South Florida Water Management District (SFWMD). Adequate assessment of the benefits and impacts to fish and wildlife resources cannot be conducted without detailed hydrological modeling.

The SGGE project has the potential to beneficially affect (or negatively impact, if poorly designed) many State and federally listed species. The ecological significance of the SGGE project is attributable to several characteristics of the area:

- located in the center of large complexes of public land;
- strategic to a regionally declining wood stork population and potentially supporting the largest historical wood stork rookery in the United States;
- directly impacting the second largest warm water refugia for the West Indian manatee (*Trichechus manatus*) on the southwest coast;
- potentially restoring a large area of manatee critical habitat; and
- potentially improving 60,160 acres of Florida panther habitat by increasing habitat quality and decreasing human disturbance.

The PMP should place more emphasis on provisions for baseline studies of listed species and other fish and wildlife so that an accurate Biological Assessment can be prepared and project design can include measures to benefit, or at least minimize adverse effects to, listed species.

The SGGE project will reduce freshwater flow to Faka Union Canal from 260 cfs to 2 cfs annually and redistribute this freshwater runoff through culverts and bridges along six miles of US 41. This redistributed flow may result in significant changes in the estuaries of the TTINWR, Collier-Seminole State Park, Fakahatchee Strand and the State-designated Ten Thousand Islands Aquatic Preserve. Potentially affected fish and wildlife habitat on public lands include coastal strand and hammock, pine (*Pinus elliottii*)-cabbage palm-oak (*Quercus* spp.) forest, fresh and saltwater marshes, mangrove forest, submerged vegetated bottom (seagrasses), and submerged non-vegetated bottom, including tidal flats, live bottom, and oyster bars. The potential effects of the project on the estuaries of Everglades National Park to the southeast are unknown. Research indicates that freshwater discharges from southwest Florida affect Florida Bay and the Florida Keys. Concerted effort is needed to improve the baseline information for the estuaries, including conducting literature searches, summarizing current research efforts, and conducting baseline studies in the estuaries. This would provide the necessary information to design, assess, and monitor the project. The PMP does not provide enough emphasis on this project planning need and should, with the assistance of affected agencies, be revised accordingly by insertion of additional planning tasks.

III. Specific Comments

Overall Project Plan

3.1 Description Include a description of vegetation changes, such as cabbage palm invasion and upland or transitional vegetation intrusion, in the description of adverse effects of over-

drainage. These vegetation changes are more ecologically significant than exotic plant invasion within the project boundary.

3.1.1 Description of Study Area Add a short paragraph and more detailed map (*e.g.*, add Northern Golden Gate Estates [NGGE]) outlining the difference between Golden Gate Estates in total and subsequently the NGGE and SGGE areas. This additional information would be helpful in differentiating project studies which were performed for the entire subdivision, later studies for SGGE only, and current project proposals. This may avoid public confusion over the project boundaries during the scoping process.

3.2.1 Project Background The project background should be expanded to include recent efforts and project status, including the Farm Bill monies as noted elsewhere in the PMP, and current status of the acquisition (contact FDEP).

3.2.2 Historical Development of Golden Gate Estates, 4.1.3 Natural Ecosystems Management, and 4.1.4 Water Quality Include a discussion of the actual impacts to estuaries resulting from modification of the estuarine salinity regime, nutrient loading, sediment deposition, increased turbidity, and potential pollutants. These physical changes should be linked to ecological consequences, such as changes in fish populations, reduction in seagrass beds, and reduction in biodiversity as outlined under the Water Quality section. Please include citations for the sources of information in the Water Quality section.

3.3 Related Projects The PMP indicates that many of the elements contained in the Big Cypress Basin Watershed Plan **(**SFWMD 1999**)** may directly or indirectly enhance the SGGE project. The Service believes that many flood control and water supply elements of the former plan have not been assessed for system-wide ecological effects on listed species and other fish and wildlife resources. Although the Big Cypress Watershed Plan can provide baseline information and is an important reference to be considered in the development of the SGGE plan in carrying out the SGGE planning effort itself, the Corps and its planning partners will determine to what extent elements of the former plan may enhance the latter. We recommend that the current wording in the PMP be modified to characterize the Big Cypress Watershed Plan as potentially supporting information.

4 Project Scope Please add a subsection on State and federally listed species. Add references to Faka Union Canal as a passive warm-water refugia for the endangered manatee and references to downstream estuaries as manatee critical habitat. Note the importance of the SGGE project to the potential recovery of the wood stork and Florida panther. A copy of the TTINWR Comprehensive Plan and sections of the Florida Fish and Wildlife Conservation Commission's (FWC) Closing the Gaps in Florida's Wildlife Conservation System (Cox *et al.* 1994) have been forwarded to the Corps as potential text.

4.1.1 Water Supply The PMP references a 21 mgd City of Naples wellfield permit adjacent to the Faka Union Canal. Other existing or proposed (under SFWMD review) wellfield permits in the SGGE should be listed in the PMP.

4.1.2 Flood Control The NGGE area immediately north of the SGGE project boundary includes significant areas of wetlands which were specifically assessed in the Corps' Environmental Impact Statement for Improving the Regulatory Process in Southwest Florida (Corps 2000) and have been the subject of intensive interagency coordination under section 404 of the Clean Water Act. The flood control measures referenced in this paragraph are not balanced with a discussion of reducing impacts to wetlands in this area. It should not be the goal of the SGGE project to impact wetlands in the area north of the project through pumping or drainage; some areas of NGGE have not been substantially developed. References should be deleted from the PMP in regard to using the SGGE project to "enhance" flood control in NGGE.

5 Work Breakdown Structure Add listed species, other fish and wildlife, baseline vegetative surveys, mapping, and studies in the Project Implementation Report Phase elements.

11.8 Public Outreach and Involvement Add the Big Cypress Basin Project Coordination Team and Big Cypress Basin Science Subgroup as contacts in this section.

11.9 Environmental and Ecological Add the National Marine Fisheries Service (NMFS) due to their designation of Essential Fish Habitat and the need for them to assist the Corps in identifying potential effects to sea turtles in the project area. Add the U.S. Geological Survey (USGS) because of their ongoing research in the project area.

11.11 Water Control Water regulation schedules (volume, timing, flow rates, and emergency contingencies) may be more important in determining the success of the restoration project than the project design. The PMP should include preliminary water management assessments that will be more specifically defined in the detailed design stages of planning.

12 Restoration, Coordination, and Verification (RECOVER) Integration The PMP indicates that the hydrological restoration will affect 113 square miles or 19 additional square miles outside the 94-square mile project boundary, including public lands within several State and Federal parks, preserves, State Forests, and NWRs. Based on updated hydrological analysis by the SFWMD, this area likely may need to be expanded. The PMP should provide for expansion of project planning to affected portions of these areas. The PMP should also reference the design and objectives of the Tamiami Trail Critical Restoration Project, which will directly influence the success of the SGGE project restoration.

Appendix BB Draft Picayune Strand State Forest Post Restoration Road Plan

This road plan and the referenced 5-year management plan are subject to additional review by the Department of the Interior in cooperation with FDOF and FDEP, consistent with the Federal actions related to funding under the Farm Bill. The Service has the following preliminary comments:

- Add an objective stating that the Road Plan will not compromise the hydrological restoration effort and will be consistent with the SGGE project design.
- Service roads, prescribed burn boundaries, and temporary roads should be described as being at ambient grade, consistent with the definition of "secondary roads," with

the exception of canal banks unless removed by the restoration proposal.

- Providing access to private lands might conflict with the hydrological restoration by requiring additional roads, adverse effects to listed species, or fish and wildlife impacts that alter the restoration value of the SGGE project. Alternative access may be available, and until the details of the access proposal are provided, the Service cannot recommend approval of this provision.
- The Service does not dispute the use of these roads by wildlife as described. However, due to the open nature (maintained by prescribed fire) and shallow water depths of the habitat types in the SGGE project, the proposed rationale for maintaining roads to provide travel corridors for wildlife is unnecessary.

Appendix O Water Quality and Permitting Plan

Please include a statement acknowledging that the USGS and FDEP have performed, and continue to conduct, significant groundwater and water quality studies within the project boundaries and downstream estuaries.

Appendix Q Environmental Plan

IMPACT ASSESSMENT

- Add the NMFS and USGS in the description of cooperative studies.

Biological and Field Investigations and Biological Assessment

- Additional field investigations may be necessary to gather adequate information as a basis for the Corps to prepare the Biological Assessment to address potential listed species impacts under section 7 of the ESA. See our comments under Fish and Wildlife Studies below and Project Scope above. Project schedule constraints on accumulation of baseline information, project funding projections, and potentially conflicting project design needs make early coordination efforts on listed species issues essential. We believe that the Corps has been receptive to these concerns, but take this early opportunity to provide these specific issues for your consideration for planning and funding purposes. Also see comments under Fish and Wildlife Studies below and Project Scope above. Preliminary recommendations for additional studies/surveys are as follows:

1) baseline information on manatee and four species of sea turtles; information on effects of freshwater discharges on manatee and sea turtle distribution, relative abundance, and habitat use; effects of freshwater on manatee warmwater refugia; effects of freshwater discharges to manatee critical habitat (including submerged aquatic vegetation density and species composition); and effects on manatee movement to other freshwater sources or warmwater refugia as a result of freshwater distribution (contact USGS, TTINWR, NMFS, and FWC for information);

2) baseline information and surveys on wading bird and raptor use of the project area and surrounding affected lands, with emphasis on the wood stork and snail kite (*Rostrhamus sociabilis plumbeus*);

3) baseline information and modeling of existing information on the Florida panther (currently being coordinated with the Corps and FWC); and

4) baseline information and surveys as appropriate, on other Federal listed species, including the red-cockaded woodpecker (*Picoides borealis*) (surveys necessary), eastern indigo snake (*Drymarchon corais couperi*) (no survey necessary), bald eagle (*Haliaeetus leucocephalus*) (no survey necessary), and American crocodile (*Crocodylus acutus*) (surveys necessary).

EXOTIC SPECIES

This section should include a short paragraph on the presence and potential control of exotic fish species in project canals.

FISH AND WILDLIFE STUDIES

Studies should be listed as being cooperatively conducted by the Service and the Corps, subject to the Scope of Work for transfer funding between the agencies. The Scope of Work should take into account the delay in the preparation of hydrological and natural system modeling until March 2001 and allow sufficient time to prepare appropriate Planning Aid Letters/Reports and an FWCA Report.

Some fish and wildlife surveys currently being performed by the FDOF and FWC, as discussed by the SGGE Interagency Technical Committee, may be sufficient to provide some of the needed information. However, some of the referenced surveys are too limited in scope and analysis to provide sufficient information. Preliminary recommendations for additional studies/surveys are as follows:

1) baseline surveys on migratory birds (coordinate with FDOF and FWC);

2) baseline information on wading bird use of the project area and surrounding affected lands, with emphasis on the wood stork and snail kite for Biological Assessment purposes (currently being coordinated with Corps with recommendations for increase in scope);

3) baseline fish and wildlife studies that cover several species guilds which can be used to monitor restoration success, with particular emphasis on downstream estuarine indicators such as fish populations and benthic invertebrates (FDOF and FWC surveys will partially, but not completely provide some of the needed information; estuarine components should be considered as additional needs); and

4) baseline information on the status of orchids, bromeliads, and other rare plant species, as well as rare and unique habitats such as tropical hammocks.

Appendix T

A contingency plan for managing exotic aquatic plants in SGGE canals should be included.

Comments or questions regarding these comments should be directed to Kim Dryden at the Service's Southwest Florida suboffice at (941) 353-2873. Thank you for the opportunity to provide this input early in the planning process.

Sincerely yours.

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Major John Chaput, Corps, Jacksonville, Florida
Ananta Nath, Big Cypress Basin, SFWMD, Naples, Florida
Kim Dryden, Service, Ecological Services, Naples, Florida
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Cindy Dohner, Service, Atlanta, Georgia
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John Donohue, Big Cypress National Preserve, Ochopee, Florida
James E. Billie, Chairman, Seminole Tribe of Florida, Hollywood, Florida
Billy Cypress, Chairman, Miccosukee Tribe of Indians of Florida, Miami, Florida
Richard Harvey, EPA, West Palm Beach, Florida
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bcc: Reading
KDryden:bb:02/02/01(a:\draftsggepal.wpd)

August 11, 2003

James C. Duck
Chief, Planning Division
U.S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Duck:

This Fish and Wildlife Service (Service) Planning Aid Letter addresses the Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project which is a part of the Comprehensive Everglades Restoration Plan (CERP). The purpose of this letter is to call your attention to how the Standard Project Flood (SPF) and Standard Project Storm (SPS) levels are being calculated and, in our opinion, potentially applied inappropriately in the planning and design of the SGGE Restoration Project. We believe this issue also may affect the planning and design of other CERP projects. This letter is provided in accordance with the Fish and Wildlife Coordination Act (FWCA) of 1958, as amended (48 Stat. 401; 16 U.S.C. 661 *et seq*.) but does not constitute the final report of the Secretary of the Interior as required by Section 2(b) of the FWCA.

Introduction

A final SGGE Project Implementation Report, Environmental Impact Statement, and the FWCA Report were scheduled for completion in June 2003. This schedule slipped in order for the
U.S. Army Corps of Engineers' (Corps) Jacksonville District to respond to a number of questions and concerns expressed by the Corps' Washington office at an Issue Resolution Conference in Jacksonville on May 12 through14, 2003. Some of the Corps' Washington office concerns were directed toward the uncertainty of project benefits (sensitivity of data verses model projections in Project Formulation Comment No. 2g), determining the effects of each alternative (National Environmental Protection Agency Compliance Comment 5q), evaluating existing "level of service" for flood protection under the savings clause (Legal Compliance Comment No. 6a), and understanding without-project conditions relative to flooding (Report Processing Comment No. 7e). An issue that would have significant bearing on each of these concerns is the application of meteorological and hydrological data in determining the spatial distribution of the 5-day SPS and subsequent SPF for the SGGE Restoration Project. Without a realistic estimation and standardized application of the SPS and SPF during project planning, we believe it would be difficult to effectively formulate project alternatives, maximize restoration benefits to fish and wildlife habitats, and protect other stakeholder interests, such as flood protection and water supply, in the SGGE Restoration Project and other CERP projects using regional hydrological simulation models.

Background Information and Concerns

Application of a SPF is a common engineering practice in water resource projects where the primary objective is "flood damage reduction." The literature is replete with methodologies to follow in order to design projects that minimize risk from flood damages and economic loss. However, when the objective of the project is ecosystem restoration rather than flood damage reduction, the body of knowledge appears to fall considerably short of ensuring that the maintenance of current levels of flood control does not act as an overly conservative constraint in achieving environmental benefits. We are concerned that the methodology used in the SGGE Restoration Project to generate the spatial distribution of all design storms with a 5-day return period overestimates runoff volumes and corresponding peak discharges. This bias could potentially result in reduced environmental restoration benefits due to overly conservative flood protection constraints on the project. By significantly increasing projected runoff volumes, this methodology could result in overdrainage of upstream habitats by increasing the design capacity of structures and canals to remove inflated volumes of water. The negative environmental effects of this overdrainage might easily be overlooked if the assessment models underpredict the frequency and duration of water level declines of both surface and ground waters. The combination of these factors could prevent the project from achieving restoration objectives because the predicted water volumes would not be available for ecosystem needs.

Documentation of the methodology used to generate and apply the design storms proposed for the SGGE Restoration Project modeling suggests that SPS rainfall is applied over all parts of the model domain at the same time (Pathak, personal communication, 2003). To apply the SPS at the spatial extent proposed, one must assume that a strong correlation between adjacent stations exists during these events. However, rainfall across the landscape is never a continuous surface. Instead it is one that displays distinct and abrupt discontinuities. Observed data from 1900 to 1999 suggest that less than 14 percent of the rain gauges in southwest Florida recorded 14 inches or more during 5-day events. In fact, throughout all of south Florida, only 23 percent of rain gauges recorded 5-day maximum rainfall events over 14 inches (Pathak 2001). The 5-day,
1-in-100 year return period SPS applied in SGGE Restoration Project modeling assumes that approximately 90 percent of the 1,500 square-mile model domain receives 14 inches or more rainfall. The documentation also assumes that 70 to 80 percent of the 5-day maximum rainfall is uniformly laid down over the 1,500 square mile model domain without any temporal variability. It is extremely unlikely that such an extreme rainfall would occur simultaneously over the entire 1,500-square mile model domain as very little correlation is observed for these short-duration events, particularly as distance between stations in the network increases (Pathak 2001).

Spatial variation in rainfall amounts for shorter durations, such as 1-, 3- and 5-day periods, is significantly greater than monthly, seasonal and annual rainfall. Temporal variation is also considerable, contributing to the significant differences in rainfall totals recorded at stations that are near one another. Errors in estimating temporal and spatial rainfall may be

compounded during application of hydrological models. One study by the U.S. Geological Survey (USGS) used five different models commonly accepted for calculating runoff volume from small watersheds and concluded under and over-estimate errors in peak discharges ranged from 50 to more than 300 percent, respectively (Trommer *et al.* 1996). The study was conducted on several watersheds in west-central Florida and determined that the models extrapolated data beyond the ranges tested to establish empirical relationships. These are important considerations when developing a methodology to generate spatial patterns of rainfall for application in ecosystem restoration efforts with the constraint of maintaining an existing level of flood control and water supply. Although the Service understands the difficulties in building rainfall data sets that incorporate spatial and temporal variability at daily time steps, significant natural resources are at stake. We believe it is essential that every effort be made to evaluate possible methods, document selected procedures, and minimize potential errors and bias in the development and application of the SPS and SPF for the SGGE Restoration Project.

Proposed Goals

It is important that the hydrological and meteorological data used to determine the spatial distribution, duration and timing of the SPS, and the hydrological data used to generate the SPF are calculated properly. This can be accomplished, in part, by insuring the following goals are met:

1. Statistical soundness. If the magnitude, spatial distribution and/or duration of the SPS are overestimated, then it is likely that the SPF would be overestimated, resulting in the overdesigning of project structures. The proper application of a statistically unbiased SPF would help in designing project alternatives that focus on critical infrastructure and allow remaining resources to maximize wetland and coastal habitat restoration efforts.

2. Scientific credibility. Without sound applications of the SPS and SPF, impact assessments on flood protection, water supply, and fish and wildlife benefits may be inaccurate and vulnerable to challenge. To avoid these problems, we should strive to develop and apply methods that fully allow us to meet the ecosystem restoration objectives of the project given existing constraints

3. Consistency. The consistent application of an identified hydrological data set (*e.g.*, 36-year historical record) for each regional CERP project is necessary to assess and compare systemwide effects. If different hydrological data or criteria are used to evaluate the effects on different affected parties (*e.g.*, flood protection vs. ecological values), then the equitable balancing of project benefits and costs between stakeholders will be more difficult, if not impossible. The guiding principle for this goal is that the hydrological and meteorological data sets for assessing environmental restoration, flood control and water supply objectives should be the same.

4. Transparency. All stakeholders should have equal access to hydrological/meteorological data and model assumptions. This would significantly increase the level of comfort among stakeholders and improve public support for this project.

Recommendations

The four goals above can be effectively achieved by developing guidance on the consistent application of hydrological and meteorological data in developing the SPS and SPF for all CERP projects that conduct flooding assessments using input data from regional rainfall models. We recommend this be accomplished by:

1. A "white paper". Organize an interagency team (*e.g*., Service, USGS, Corps and South Florida Water Management District [SFWMD]) to draft a "white paper" that identifies the issues and proposes various options. This would be reviewed by the Corps and provided to the SFWMD with a request for peer review that would focus on reviewing hydrological and meteorological data applied in the SGGE Restoration Project and developing recommendations to resolve the issue; and

2. A separate CERP Guidance Memorandum on Flood Damage Assessment Procedures (CGM). It appears that SPS/SPF may not be developed or used consistently between projects under the CERP. Because the design and operation of CERP projects, both individually and systemwide, are critically dependent on these estimates in many instances, it might be prudent to develop a separate CGM on Flood Damage Assessment Procedures. We envision this CGM would provide specific guidance on the accepted use and consistent application of data for developing the SPS/SPF for all CERP projects. We also recommend that the working group in charge of developing this CGM include hydrologists from the Service with in-depth knowledge of our concerns regarding the SGGE Restoration Project and other CERP projects.

Recently, the SFWMD proposed that it develop the Prairie Canal portion of the SGGE Restoration Project by itself with a target date of October 2003. Because the MIKE-SHE hydrological model will be used to compare all SGGE Restoration Project alternatives, we expect the SFWMD to apply it in the assessment and design of this Prairie Canal component as well. Although we applaud SFWMD for stepping forward on its own with a plan to develop part of the SGGE Restoration Project, a number of issues must be addressed before construction. Some of these issues are consultation under the Endangered Species Act, permit review under Section 404 of the Clean Water Act including assessment of total project impacts, review of hydrological models including the assumptions supporting the project design, assessment of potential effects on Federal lands (Florida Panther and Ten Thousand Islands National Wildlife Refuges) and identification of a preferred alternative for the SGGE Restoration Project. Without the successful completion of these planning efforts, overcommitment of funds may occur on project features that may be inappropriately

designed or do not address project objectives adequately and efficiently. This scenario could potentially result in reduced opportunities for ecosystem restoration, as well as adverse impacts to fish and wildlife values, including federally listed species and their habitats.

The Service appreciates this opportunity to explain our concerns regarding the application of the SPS and SPF in the planning and design of the SGGE Restoration Project and possibly other CERP projects. Under the proposed planning schedule, it is clear that we have much to do in a short period of time. We believe the efficient accomplishment of these tasks can be greatly assisted by a concerted effort to improve communications within and between the partnering agencies. We are committed to continuing our participation in the planning process, including development and assessment of project alternatives consistent with the CERP goals. If you have any questions regarding these comments, please contact Carl Couret at 772-562-3909,
extension 302.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

cc:
Corps, Jacksonville, Florida, (Carl Overstreet, John Kremer, James Vearil)
DEP, Rookery Bay NERR, Naples, Florida (Gary Lytton)
DOI, S FL Ecosystem Restoration Task Force, Miami, Florida (Rock Salt)
FDOF, Naples, Florida (Sonja Durrwachter)
FGCU, Estero, Florida (Mike Savarese)
FWC, Punta Gorda, Florida (Jim Beever)
Service, Jacksonville, Florida (Miles Meyer)
Service, Naples, Florida (Kim Dryden)
Service, Ten Thousand Islands NWR, Naples, Florida (Layne Hamilton)
SFWMD, Big Cypress Basin, Naples, Florida (Clarence Tears, Mike Duever)
SFWMD, Fort Myers, Florida, (Janet Starnes)
USGS, Miami, Florida (Ronnie Best)

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USFWS DETAILED COMMENTS

July 13, 2004

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ATTACHMENT (Fish and Wildlife Service comments)

Southern Golden Gate Estates (SGGE) is an 86-square-mile (55,247 acres) portion of a 173-square-mile (111,053 acres) Golden Gate Estates subdivision purchased and constructed from the late 1950s to the 1970s as a vacation and retirement community in Collier County, Florida. Golden Gate Estates Subdivision infrastructure included 183 miles of drainage canals, 25 water control structures, and 813 miles of roads. The SGGE project includes 19,992 platted parcels, 279 miles of roads, 251 culverts, 10 bridges, 48 miles of drainage canals, and 8 weirs. Surface water runoff is captured by massive canals in an area that was historically characterized by sheetflow conditions across nearly flat terrain inundated by subtropical rains. Watershed habitat alterations included conversion of wetland habitat to uplands, exotic plant species invasion, and loss of plant diversity due to severity and frequency of wildfire and susceptibility to freeze damage. Cypress-dominated wetlands were replaced with mesic flatwoods and fire-tolerant cabbage palm (*Sabal palmetto*). Point-source discharges to the downstream estuary of Faka Union Bay eliminated or severely impacted oyster (*Crassostrea virginica*) and seagrass beds and altered fish population structure. Reduced freshwater flows into adjacent estuaries have resulted in the dominance or movement of salt-tolerant plants and animals into more inland areas, and creation of hypersaline conditions in some receiving waters.

During the development of the PIR for this project, 22 alternative plans were evaluated based on the following objectives:

- re-establish historic flow-ways, sheetflow and wetland hydroperiods;
- reduce point discharges to improve the health of downstream estuaries;
- maintain flood protection for developed areas north of the project;
- improve aquifer recharge for water supply and to provide a saltwater intrusion barrier;
- restore and enhance fish and wildlife resources including State and federally listed species such as the Florida panther (*Puma concolor coryi*), Florida black bear (*Ursus americanus floridanus*), and wood stork (*Mycteria americana*);
- protect rare habitat such as tropical hammocks and plant species including orchids and bromeliads;
- preserve upland habitat;
- control invasive exotic plants;
- improve water quality of stormwater runoff;
- reduce or eliminate overdrainage of adjacent sensitive ecosystems, primarily in public ownership;
- provide resource-based recreational opportunities; and
- provide contiguous habitat conservation for the greater Everglades ecosystem.

The tentatively recommended project plan, Alternative 3D, will include at least 83 canal plugs to be placed in the four major project canals: Miller, Faka Union, Merritt, and Prairie. The source material for the canal plugs will be the spoil from the original canal and swale excavations, as well as that spoil obtained from the demolition and degrading of project

roads. 260 of the 279 miles of roads would be graded to lower their elevations to the same level as the surrounding ground, and 227 miles of these degraded roads would be abandoned and allowed to revegetate. The remaining paved roads would connect Janes Scenic Drive in Fakahatchee Strand to Stewart and Everglades Boulevards and North Golden Gate Estates (NGGE), and provide access to a small number of property owners in the Belle Meade portion of Picayune Strand State Forest to the west. Pump stations will be constructed on three of the four project canals and three spreader channels will be constructed immediately downstream of the proposed pump stations to distribute water overland to emulate historic sheetflow. The northwest portion of the project site will not be restored to sheetflow conditions to protect upland habitat important to listed species and accommodate flood control maintenance in NGGE. Five levees would be constructed to protect existing development at Port of the Islands, a major agricultural area west of the project, and private residential areas northwest of the project site from elevated water levels. The cost of the construction and real estate for the tentatively recommended plan is estimated to be $362,612,000. Annual operation and maintenance is estimated to cost $2,129,000. Annual monitoring is estimated to cost $700,000.

A substantial feature of this project restoration effort is the completion of a land acquisition program that has been ongoing since State efforts to acquire the project site began in 1985. The SGGE subdivision originally included 22,000 lots with more than 17,000 individual landowners scattered worldwide. In April 1998, the Department of the Interior (DOI) and the Department of Environment Protection (DEP) executed a grant agreement under the Farm Bill (FB) (Section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which ultimately resulted in approximately $38 million in Federal funds for land acquisition. Land acquisition efforts are now over 99 percent complete, with only two parcel negotiations outstanding.

General Comments

The Fish and Wildlife Service (Service) finds that the draft PIR/EIS present a balanced description of the Interagency Technical Committee and Project Delivery Team's (PDT's) evaluation process, and the benefits expected through implementation of the SGGE Ecosystem Restoration Project. The Service expects the tentatively selected alternative, Alternative 3D, will provide fish and wildlife resource benefits to the 86-square mile SGGE project site, adjacent public lands, and the 98-square miles of downstream coastal estuaries. It is expected that the restoration plan will restore 36,200 acres of wetlands, raise groundwater elevations in uplands, decrease the severity and frequency of wildfire, restore a hydrologic regime that supports subtropical plant species, assist in the recovery of listed species and migratory birds, and improve coastal fisheries.

We appreciate the complexity of the hydrological models that support project alternative selection and project benefit analysis. We recognize these models as tools for reasonable approximation of project plan design effects on fish and wildlife resources. However, the Service has significant concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and application of design storm.

Our consistent participation in project development and analysis as members of the PDT since 1997 reinforces our belief that all reasonable, cost-effective alternatives have been considered. However, we are also cognizant of the limitations posed by extensive assessment requirements under severe time constraints. This project alternative development and assessment is only the initial step in developing a final design that integrates construction infrastructure with operations management and adaptive monitoring and assessment.

The principal focus of our comments is additional project design development that will: (1) de-emphasize engineered structure reliance, particularly the size of the pumps; (2) refine hydrological models; (3) develop an operations management plan that emphasizes operations for restoration over flood control; (4) finalize a modified Adaptive Assessment and Monitoring plan; (5) provide a complete analysis to ensure compliance with the Savings Clause and to identify water made available by the project to be reserved under Florida law; (6) develop an estuarine mixing model; (7) document extensive changes in the watershed that have resulted from explosive development and water management, and determine whether these changes have been considered; (8) remediate contaminated areas and address contaminants in areas outside of the project but affected by the project; and (9) address all effects to adjacent public lands. We have not included editorial comments except in those cases where we believed the reader's understanding would be significantly improved.

Appendix D includes the draft Fish and Wildlife Coordination Act Report (FWCAR) for the tentatively selected plan. This report was prepared in January 2004 at the request of the Corps in order to meet accelerated deadlines for preparation of the draft PIR/EIS for the project. Due to subsequent project report preparation delays, substantial portions (including the Operation Management Plan, Section 12-Assurances, and some hydrologic model information) of the draft PIR/EIS were not available for Service review at the time of the draft FWCAR preparation**.** The draft FWCAR will be modified and re-submitted to the Corps prior to the final PIR/EIS and subsequent to these comments under the National Environmental Policy Act.

Throughout the text there are frequent references to the actions or decisions of the PDT. While the PDT did assess the majority of the project, it should be noted that specific hydrologic modeling and analysis, flood analysis, Level of Service considerations, some alternatives development, development of the operations management plan, and cost considerations were not products of the PDT process, but were the result of decisions made by one or both of the project sponsors. The document should be edited to reflect these considerations so that government agency comments on the PIR do not appear to conflict with perceived actions of government agency representatives who were PDT members.

Specific Comments

Summary

Page vii

The Ten Thousand Islands National Wildlife Refuge (NWR) should be included in the calculation of hydrology habitat units and biotic habitat units. See comments in Section 6 for more details.

Section 1, Study Purpose and Need

Figures 1-1, 1-2, 1-3, and 1-5 should be reconciled to indicate: 1) overlap of Picayune Strand State Forest with the South Belle Meade Area; and 2) overlap of Ten Thousand Islands Estuary with the Ten Thousand Islands National Wildlife Refuge/Aquatic Preserve/and National Estuarine Research Reserve. Text descriptions of the Planning, Project, and Study Areas are not well reconciled with the map and map keys. The Project Area Description in Section 1.4.4 and Figure 1-5 describes affected areas but does not include portions of Fakahatchee Strand south of the SGGE Conservation and Recreational Lands (CARL) boundary. Since this area is affected by the project, this area should have been modeled and included in the project effects. Figure 1-4 should be improved to more accurately represent the boundaries for the various land management units.

Page 2-7, Section 2.5, Fish and Wildlife Resources

The Service recommends this section be expanded. The fish and wildlife resources of the project area reflect the distinctive biogeography of the region and should be further described in this PIR/EIS in order to demonstrate both the uniqueness and vulnerability of project resources. The SGGE project is unique in its location in a subtropical climate subject to intense seasonal rainfall and occasional catastrophic events like hurricanes. Plant communities have been established in recent geological times in frequently flooded nutrient-poor coral, marl, and sand substrates. The project's location on the South Florida peninsula subjects the flora and fauna to natural invasion and migration of plants and animals from the West Indies and has elements of flora and fauna that have evolved after isolation from populations in western states during post glacial periods. The project area is also located within and upstream of the largest mangrove swamp in North America.

Section 2.3, Plant Communities

There are several inconsistencies which should be resolved in this section, including:

- Page 2-1: There is a different definition of the Project Area here than on page 1-14.

- Page 2-3: Saltmarsh is listed as a dominant ecological community, but freshwater marsh is so-listed on page 1-13. The marsh south of US41 is accurately described as brackish marsh.

- Table 2-1: does not identify Coastal Wetlands and Estuaries, which are discussed later in Section 2.3.6.

Page 2-8, Section 2.6, Threatened and Endangered Species

The Service recommends expansion of this section to include more technical information on the historic or pre-drainage status of listed species. In particular, the status of the West Indian manatee should be revised to describe it as a native species rather than a recent arrival as implied by the context of the text in the PIR/EIS. The location of the largest wood stork colony in North America at Audubon's nearby Corkscrew Swamp Sanctuary should be documented in the text to provide context for later discussions of the importance of restoring the project's short-hydroperiod wetlands which are utilized as forage habitat by the wood stork. The Service recommends that the Corps use of the South Florida Multi-Species Recovery Plan, biological opinions, individual listed species recovery plans, and available literature citations in these documents as information sources. The Service will assist in the compilation of this text.

Page 2-11, Section 2.6.9, Endangered Plants

This section should be revised to show the status of those endangered plants that are expected to occur in the project area based on known habitat, distribution, and ecology of the SGGE pre-development landscape.

Page 2-11, Section 2.6.10, Essential Fish Habitat

This section should be revised to indicate what elements of Essential Fish Habitat potentially existed in a pre-drainage condition based on available studies and historic descriptions of Gulf of Mexico fisheries. Text from Section 2.11 (Estuarine Resources) should be incorporated and cross-referenced.

Page 2-13, Section 2.9, Climate

This section should be expanded to show historical freeze, drought, flood, or hurricane occurrences which affected the project environment.

Page 2-13, Section 2.10, Hydrology

This section should be revised consistent with our comments for Section 3.10, Existing Condition Hydrology, and Section 3.10.3, Water Management, on pages 3-19 and 3-22, as well as our comments on documenting existing wetlands in NGGE under Section 3.3, Plant Communities, on Page 3-2.

Page 3-1, Section 3, Existing Conditions

Page 3-1, Section 3.1, Introduction

This section describes the existing condition consistent with the Comprehensive Everglades Restoration Plan (CERP) as of the year 2000. In subsequent sections of the PIR/EIS, existing condition appears to be updated to 2003. The existing condition year should be consistent across all analyses and descriptions. We recommend 2003 or more recently, given the issuance of a significant number of permits that resulted in loss of fish and wildlife and water resources in the project watershed between 2000 and now. See our comments on page 12-8, Section 12.2.3.

Page 3-1, Section 3.2, General Environmental Setting

This section should be clarified. The notation "north of the Ten Thousand Islands NWR" should be replace the appropriate text in "...marine preserves and refuges that constitute the Ten Thousand Islands Region...". Also, there are 6 major embayments as shown in Figure 3-2. Thus, Palm Bay and Buttonwood Bay should be added to the list and Blackwater River should be changed to Blackwater Bay.

Page 3-2, Section 3.3, Plant Communities

This section and Table 3.2 should include actual, as well as percentages of acreages of plant community changes in 1940 vs. 1995. Year 1995 plant communities and plant community acreage and percentage of habitat predicted by hydrologic models for year 2000 should be included in Table 3.2 so that model predictions for expected habitat versus actual habitat analysis can be prepared to determine model prediction accuracy.

This section should also contain information on exotic plant species, including their ecology and distribution in the project area.

The Service strongly recommends, and has recommended throughout the project development process, that this document include a discussion of the existing wetlands in NGGE. This is extremely important for three reasons: (1) there is an extensive history of controversy over jurisdiction, location, protection, and mitigation for wetlands in NGGE involving the Corp's Clean Water Act section 404 permitting program; (2) as development increases in NGGE, there will be continued misconception that seasonally-inundated wetlands are actually flooded uplands; and (3) given a false perception that these NGGE areas are flooded as opposed to naturally occurring wetlands, there will be public perception that the SGGE project is responsible. Public pressure to change the Operations Management Plan to accommodate flood control in NGGE would likely affect project benefits for fish and wildlife resources. In our comments on Section 5, Problems, Opportunities, and Objectives, we reiterate this recommendation. It should be noted that this information (Collier County vegetation mapping and hydric soils) has been provided to the Corps on at least two separate occasions while the issue was under discussion by the PDT.

Page 3-10, Section 3.6, Threatened and Endangered Species

This section should provide more detailed information on the existing status of listed species in the project area. The Service is assisting the Corps in the preparation of a Biological. Our draft FWCAR provides additional references for this section.

Page 3-13, Section 3.6.4, Florida Panther

Statements regarding the presence of this species appear to be conflicting in the text. This section should be revised to indicate that panther use of the project area has been verified.

Page 3-17, Section 3.6.11, Essential Fish Habitat

This section should describe the components, authorization, and determination process for the Essential Fish Habitat designation, as many reviewers may not be familiar with this designation.

Page 3-18, Section 3.7.2, Soils

This section would benefit from a discussion of the seasonal oxidation process and effects of frequent fires under natural conditions on the thin layer of detritus that forms in shallow or short hydroperiod wetlands in sub-tropical Florida. These processes naturally oxidize organic deposits, leaving only staining or spodic layers in the soil horizon as evidence of hydrology. "Muck" layers are not typical of short-hydroperiod wetlands of recent geological age in areas of seasonal drawdown with frequent fire.

Page 3-19, Section 3.9, Climate

This section appears to address changes in hydrology, not climate, and should be revised to address temperature, wind, and precipitation. The effects of climate on the existing drained habitat condition would include loss of sub-tropical plant species from fire and freeze, and potential loss of trees from high winds resulting from vulnerabilities due to soil oxidation or forest structure (thinning from fire and disease).

Page 3-19, Section 3.10, Water Supply, Water Quality, Water Management

This section should include an analysis of recent and extensive changes in stormwater management, water use, and water quality associated with the issuance of nationwide and individual Clean Water Act section 404 permits by the Corps and Environmental Resource Permits by the South Florida Water Management District (District) and the DEP. The Service provided information on recent significant projects to the District and the Corps during the PIR and hydrologic model development processes, and as cooperators with the EPA in the EIS for the Corps Regulatory Process in southwest Florida. Additional information on watershed alteration is available from the Lower West Coast Water Supply Plan, the South Lee County Watershed Plan, the Estero Bay Watershed Plan, the Big Cypress Basin Watershed Plan, and the Southwest Florida Feasibility Study.

This section should be revised to include recent and significant hydrological changes to the upper watershed and areas downstream of the project. The project receives water from: 1) swale and canal discharges at low Levels of Service in a rapidly developing but low density NGGE residential area; and 2) discharges from significant agriculture areas to the north of Panther NWR and Fakahatchee Strand. Changes to the Big Cypress Watershed that have resulted in diversion of water to the Imperial and Cocohatchee Watersheds from the Estero Bay Watershed and the Corkscrew Regional Ecosystem Watershed (CREW) areas should be detailed. Reference to watershed flow changes as detailed in the South Lee County Watershed Plan should be discussed with reference to this project and adjacent Fakahatchee Strand. The PIR should address recent changes in stormwater management associated with the canals adjacent to Bird Rookery Swamp, Immokalee Road, Cypress Canal, the four-laning of I-75, management measures at the Lucky Lake weir south of the Panther NWR, problems with water flow under U.S. 41 to the south of the project, agricultural areas north of Panther NWR that discharge through the Refuge to the project site, and influences of the significantly diked agricultural area that occurs southwest of the project in the Belle Meade portion of Picayune Strand State Forest.

We believe any discussion of existing and future hydrologic conditions that do not include an analysis of off-site areas where significant project features would be constructed, omits important information from the analysis. In particular, levee construction associated with the project condition at the agricultural area and Port of the Islands sub-division should affect the hydrology of these areas as discussed in the Pre-drainage, Existing, and Without Project Hydrology sections.

Page 3-20 and 3-27, Sections 3.10.1 and 3.12.2, Water Supply and Water Demand

These sections should indicate actual (as well as permitted) water use of the City of Naples well field and detail conditions which lead to reported residential well failure and canal drawdown in the vicinity of this well field under recent drought conditions. Limitations on future expansion of this well field, as discussed by the PDT, should be identified. The NGGE well field is mentioned on page 3-27. The report should identify the area that is supplied or influenced by this well field and if project water is affected by this well field. Water shortage areas and areas with salinity problems, as mentioned on page 3-27, should be identified and the project effect on these areas, if any, should be discussed in the text.

This section should estimate existing and potential self-supply for the 101-square mile area of NGGE. This section should include a discussion of the permitted water use for agriculture north of Panther NWR and in the Belle Meade area and its influence, if any, on this project. This information is necessary to evaluate the Savings Clause and Reservations determinations, and the Operations Management Plan. Understanding the effects of these water demands are particularly important for dry season water deliveries to the project and downstream estuaries. The water demands of the Port of the Islands community well field should be identified.

Page 3-21, Section 3.10.2, Water Quality

Rookery Bay National Estuarine Research Reserve collects continuous data in Blackwater and Pumpkin Bays, and should be recognized in the text.

Page 3-24, Section 3.11, Estuarine Resources

The dates and a brief synopsis of the Marco Island and adjacent (Deltona Corporation) development should be expanded upon in this section due to the cumulative effects these very large projects would have on the project area's estuarine resources (in particular, manatees, seagrasses, and mangroves).

This section should include a detailed discussion of the condition (location, size, depth) and history of construction of the Faka Union Canal below U.S. 41. There is some confusion as to whether this canal was permitted by the Corps. This canal severed estuarine creeks and the original Faka Union River upon construction. As a result, the effects associated with this canal include salinity changes in the marsh and mangrove systems on the adjacent Ten Thousand Islands NWR. This canal, its condition, and its fresh water transport, influence manatee distribution and behavior.

This section would benefit by addition of a discussion of recreational and commercial fisheries resources in the area.

Page 3-28, Section 3.14, Hazardous, Toxic, and Radioactive Wastes (HTRW)

Findings of the HTRW (Existing Condition) section are consistent with an Environmental Risk Assessment (ERA) completed on September 30, 2003, regarding soil contamination at SGGE. The Service identified several miscalculations, errors, and identified other unresolved issues in the ERA and submitted corrective recommendations to the District by letter dated March 23, 2004. The District and URS are currently in the process of addressing Service concerns regarding the ERA and the outcome of recommended corrections could change the results of the ERA. At this time, outstanding concerns and accompanying recommendations are as follows:

- The ERA calculates site-specific organic carbon partition coefficients (k_{oc}) and octanol-water partition coefficients (k_{ow}) values for dieldrin. The k_{oc} value calculated is much higher than literature values, while the k_{ow} is much lower. The document suggests "weathering" as a possible explanation. The Service feels that it is unlikely that weathering alone can explain both an increase in one value and a decrease in the other. The k_{ow} is a physical constant for dieldrin and should not change due to weathering. Additional explanation is needed to justify the use of these values in the ERA. Table 18 of the ERA contains major errors which result in the incorrect calculation of the site-specific k_{oc} and k_{ow} for chlordane. As a result, all HQs for chlordane reported in this ERA are incorrect and need to be recalculated. Total chlordane should equal the sum of the alpha chlordane and the gamma chlordane

isomers. In the desorption portion of this Table 18, total chlordane is incorrectly given the same value as alpha chlordane, ignoring the gamma chlordane isomer. Similarly, in the bioaccumulation portion of Table 18, lipid concentrations are based only on alpha chlordane instead of total chlordane as they should be. Correction of these errors may result in significant changes in the HQs for all species presented in this document.

- Even after correcting the mathematical errors discussed above, the site-specific k_{oc} for chlordane, as calculated in this report, is approximately 15 times greater than the values reported in the published scientific literature. If accurate, this means that chlordane in this soil would be released much more slowly than expected, resulting in greatly reduced risk to wildlife receptors. The Service encourages obtaining and using site-specific data where possible. Given the large discrepancies with literature values, and the fact that a number of non-detects were obtained in the desorption study, the Service recommends repeating the desorption studies for chlordane to confirm the initial result. Material for the repeat study could be obtained during follow-up sampling activities.

- If the original site-specific k_{oc} result cannot be confirmed, the Service recommends a cleanup criterion of 100 ppb (ug/kg) for chlordane. While still well above the State's Probable Effect Concentration (PEC) of 18 ppb, this level should represent insignificant risks to Federal trust resources. All soil locations with measured concentrations above this level would require delineation and some type of remediation. It should be recognized that soils containing between 18 and 100 ppb of chlordane may still result in some impairment of the benthic community in localized areas of the Former Agriculture Area-West (FAW).

- If the original site-specific k_{oc} for chlordane is confirmed by the repeat study, the cleanup criterion for protection of piscivorous birds could be as high as 1.5 ppm (mg/kg). This would mean that only a few isolated locations would require remediation for protection of Federal trust resources. None of the District sampling results exceeded 1.5 ppm chlordane, while only four DEP samples (Brandt-Williams and Shirley 2000) exceeded this level. However, the Service does not endorse leaving up to 1.5 ppm chlordane in place in the soil, because this would almost certainly result in severe impacts to the prospective benthic community in the FAW.

- Similar to the situation for chlordane, the site-specific k_{oc} value for dieldrin obtained in this ERA falls far outside the range of k_{oc} values reported in the literature for a variety of soil types. In addition, the site-specific k_{ow} reported in this assessment is substantially lower than the literature values. If accurate, this means that dieldrin in this soil would be released to water much more slowly, and taken up by organisms less readily, than would be predicted by literature values. The result of using these site-specific values could be to underestimate risk to wildlife receptors by more than 100-fold. The Service does not feel that discrepancies of this magnitude can be accounted for by weathering alone. One possible explanation is that the desorption and bioaccumulation studies for dieldrin had not yet reached steady state at the

termination of the studies. The Service is uncomfortable with the use of these values and recommends that literature values for the k_{oc} and k_{ow} be used instead. Based on the literature values, the Service recommends a clean-up criterion for dieldrin of 6 ppb. This level was exceeded in only one grid (Grid 1 of the FAW).

- In striking contrast to the URS data provided in the ERA, sampling activities conducted by the DEP indicated large areas of high chlordane contamination within the SGGE FAW and the adjacent Belle Meade property. 42 of 134 discreet samples collected by the DEP in these areas exhibited concentrations above the 100 ppb suggested clean-up criterion. The mean chlordane concentration for the entire area sampled by DEP was 222 ppb, compared with 5 ppb determined by URS. Similarly, the DEP 95 percent UCL was 343 ppb compared with 8 ppb from URS data. Since there is no reason that we are aware of to question the validity of the DEP data, this data must be given equal consideration with the URS data. The Service recommends combining the DEP data with the URS data in all statistical calculations, in order to obtain an unbiased idea of the total areal extent and magnitude of chlordane contamination. All HQs for chlordane should be recalculated based on this combined dataset.

- When evaluating impacts to Federal trust resources from a project, the Service must consider all impacts, even if they occur outside the project boundary. Raising the water table in SGGE will rehydrate areas of the adjacent former agricultural lands to the west, attracting wading birds and other trust resources to those areas. Sampling conducted by the DEP in the adjacent Belle Meade area showed even higher levels of chlordane than those found on the SGGE property. The Service strongly recommends that the SGGE restoration project not be implemented until a plan has been developed to assess the extent of contamination and remediation processes that may be necessary on those (primarily public) lands west of SGGE that will be affected by this project.

- The Service has recommended several corrections and changes in methods that may have a significant impact on the outcome of this ERA, including: (a) combining URS and DEP data, (b) correcting mathematical errors involved in the chlordane k_{oc} and k_{ow}, (c) repeating the desorption/bioaccumulation studies needed to determine these values, and/or (d) using literature values of physical parameters (k_{oc} and k_{ow}) for chlordane and dieldrin. Because any of these changes will cause changes in the estimated risks, it will be necessary to recalculate all HQs for chlordane, dieldrin, and selenium. All tables and associated text, where HQs for these contaminants are presented or discussed, will require revision.

The above comments and recommendations apply to only a few hundred acres of this 55,000-acre property. Within this context, the vast majority of this site is entirely suitable for its proposed use in its present condition.

Page 3-33, Section 3.16, Recreation

This section should identify the year that the Florida Division of Forestry (DOF) began management activities related to recreation in the SGGE portion of Picayune Strand State Forest, as well as those management activities listed in the Interim Management Plan Agreement between DOF, DEP, and DOI. This date is important as extensive recreational uses, particularly illegal OHV use, and hunting occurred prior to DOF management. ATV use is not currently under management by the DOF as it is a prohibited activity in most State forests. Hunting is currently being considered as a managed use in the forest. This section should reference DOI and DEP oversight of the mentioned Ten Year Management Plan consistent with previously adopted Interim Management Plans, protocol agreements, and Farm Bill 3. Types of recreational uses on the adjacent Fakahatchee Strand State Reserve should be outlined in this section to depict the full range of recreation in the project area, especially since the main access to the SGGE project from the southeast will be through Fakahatchee Strand.

Section 4, Future Without Project

Page 4-10, Section 4.6.4, Florida Panther

Although there are examples of panther/human encounters associated with the presence of prey in NGGE, there is no evidence that a partial percentage of this type of residential development would increase wild prey to the extent that panther/human encounters would increase. This discussion should be deleted.

Page 4-11, Section 4.6.7, Snail Kite

The "no action" phrase should be replaced with "without project".

Page 4-11, Section 4.6.8, West Indian Manatee

The last sentence in this discussion addresses critical habitat and boat-related mortality concurrently. This is excerpted from the Service's draft FWCAR report in Appendix D and will be modified as follows: "Effects to critical habitat such as seagrasses would be difficult to quantify due to the lack of a monitoring program and an estuarine mixing model. Changes in manatee distribution or use of the marina basin as a warmwater refuge that might result from changes in stormwater management in the upper watershed may expose manatees to additional cold stress, or boat-related mortality or injury; depending on changes in manatee behavior or distribution."

Page 4-12, Section 4.6.9, Wood Stork

This section should reference the potential for additional declines in wood stork productivity at Audubon's Corkscrew Sanctuary wood stork rookery. We are specifically interested in declines that may directly or indirectly result from additional development and associated wetland impacts.

Page 4-13, Section 4.9, Climate

The text should discuss trends in sea level change, particularly the rate of relative rise and the anticipated effects on storm (wind and surge) frequency and magnitude, saline intrusions, and plant and animal conservation. We recommend citing evidence that the northern encroachment of mangroves into the brackish marshes may, in part, be attributable to sea level rise.

Pages 4-13 to 4-15, Sections 4.10, 4.10.1, 4.10.2, and 4.10.3, Water Supply, Water Quality, and Water Management

These sections should be modified to include potential effects of additional development in NGGE on the SGGE project.

Page 4.15, Section 4.11, Estuarine Resources

These sections should be modified to include potential effects of additional development in NGGE on the SGGE project. Further, we suggest explaining the assumption that the health of the Faka Union estuary would not continue to decline under current trends. The assumption seems counterintuitive to us.

Page 4-20, Section 4.18, General Environmental Setting for Other Lands

There are several agencies involved in managing the Ten Thousand Islands Region, including the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park. These agencies and their work should be identified.

Section 5, Problems, Opportunities, and Objectives

This section should include the significant input of other State and Federal landholders and land managers with regard to project effects on their lands. This should also be included in Section 5.1, Public Concerns, as non-governmental stakeholders have also expressed these concerns.

Page 5-1, Section 5.1, Public Concerns

The discussion of NGGE flooding and environmental projects should include data about the remaining wetlands in NGGE, including their extent and hydrology, and the history of the controversy and protection efforts surrounding these wetlands. This may be critical to the future of SGGE because, as NGGE develops and knowledge of today's conditions ebb from public consciousness, the public may erroneously come to believe that seasonal inundation of wetlands in NGGE is a flooding effect caused by the project. This misperception may lead to public pressure to increase drainage to SGGE and to change the Operational Management Plan in the future.

Page 5-2, Section 5.2, Problems and Opportunities

We suggest adding a couple of items to the discussion. First, the interception of freshwater that would normally travel as sheet-flow to the downstream brackish marshes and eventually to the bays has increased salinities, and facilitated the northward invasion of salt-tolerant species, with associated changes to wetland communities. Second, construction of the Faka Union canal has influenced freshwater wetlands by allowing salt water to intrude into those areas and disrupting tidal flow patterns west of the berm.

Page 5-3, Section 5.2, Problems and Opportunities

Table 5-1, as well as Table 3-2, on page 3-6 and Table 6-7 on page 6-70 indicate without project acreages of certain habitats that seem inconsistent with the expected increased project drainage under that condition. These tables should be reconciled or explanations provided in the text for their apparently inconsistent predictions.

We recommend eliminating the word "critical" from the first sentence on page 5.4 with reference to panther habitat. The word "critical" has specific connotations relative to the Endangered Species Act when used as an adjective before "habitat."

Page 5-4, Section 5.3.1, Planning Goal

Chapter 9 of the "Yellow Book" gives the restoration and enhancement of *wetlands on adjacent public lands* equal consideration as a project purpose (see page 1-10). Because of extensive public lands interests, including two National Wildlife Refuges, a National Estuarine Research Reserve, and the Everglades National Park, this purpose should be emphasized in this section consistent with that directive.

Page 5-5, Section 5.3.2, Planning Objectives

This section should specify that the multi-agency PDT formulated and developed consensus on the project objectives. The PDT would consider the development of these objectives to be one of the most significant products of the process.

Page 5-8, Section 5.3.3, Planning Constraints

Regarding the statement "adversely affect" in the last sentence on the page should be replaced with "jeopardize the continued existence of," please see our comments under Page 6-7, Section 6.3.1, as follows for a discussion of flood maintenance constraints in NGGE.

Section 6, Plan Formulation and Alternative Evaluation

We believe that there should be further consideration of how the cost to benefit ratios are constructed for other land management units. Specifically, the Ten Thousand Islands NWR, which is likely to be directly affected by the proposal, should be included in the analysis.

Habitat Units should be estimated for the refuge using the South Florida Assessment Method. This methodology was used for Collier-Seminole State Park (which is surrounded on 3 sides by the refuge) and Fakahatchee Strand State Preserve (which shares a common boundary), both of which extend to the estuary.

Inland Habitats (primarily north of US41) and Estuarine Habitats (nekton and oysters in the bays) have been analyzed and documented. However, a large area, between US41 and the bays, does not appear to be considered by either analysis. The affect of this project on this area should to be evaluated.

Page 6-7, Section 6.3.1, First Iteration, Management Measures Considered, Pump Stations

The Service continues to have concerns about the applicability of the 100-year storm flood control standard for determining the pump size for this project. Application of this standard could result in drawdown of wetlands in NGGE, over-inundation of SGGE and other project resources, and discharges to downstream estuaries in perceived flood situations or in storms of 10, 25, or 50-year frequency. It would appear that designing a 100-year storm pump system to pump out canals that have less than a 10-year storm capacity in a flooding event which may render all infrastructures unusable, may not be cost effective or operationally tenable.

This concern extends to flood insurance and vague references to a floodplain management plan in the PIR. We acknowledge concerns about perceived "takings" of private property, but suggest that language such as "baseline for floodplain management and the National Flood Insurance Program [NFIP]" be explained. The NFIP is not intended to foster development in flood hazard areas; neither is it intended to define property rights. The NFIP and flood rate maps constitute aspects of a program that assign probabilities to flood events, subsidize flood insurance in certain areas if specified conditions are met, and limit liabilities to lenders. The relationships between the proposed action, a range of pump capacities, NGGE hydrology, flood insurance and other NFIP programs, and "floodplain management" should be comprehensively described.

Page 6-15, Section 6.3.3, Analysis Screening and Concerns, First Iteration

The PIR should provide information regarding estimates of real estate acquisition for NGGE as referenced in paragraph two on this page and in Table 6-18, 6-19, and 6-22 on page 6-103 for Alternative 6. Acquisition in portions of NGGE was considered during the alternative selection process included as a potential means to increase the area of hydrologic restoration in SGGE, reduce pump size, reduce engineered infrastructure, and protect wetland resources in existence under current condition in NGGE. There was considerable discussion and no agreement on the area potentially affected by flooding, the threshold at which flooding was acknowledged as impacting residents (increases in stage or duration), nor which models (MIKESHE or other) were used to assess this issue. The Service is of the opinion that the area of NGGE calculated for purchase in Alternative 6 may be overestimated. More precise

information should be provided to help determine the actual potential cost of this project to insure that it is weighed against other alternatives accurately.

Page 6-52, Section 6.6.1, Hydrologic and Hydraulic Modeling

We caution that changes in models are not attributable to the PDT, although some PDT members, primarily project co-sponsors, did make model change decisions. This is important only in that this section implies more involvement or knowledge of model changes by the entire PDT than actually occurred.

Pages 6-54 and 6-60, Section 6.6.3, Inland Habitat Changes

We recommend including the Ten Thousand Islands NWR, and the significant infestations of Brazilian pepper south of US 41 be included in the analysis. Further, the assertion that Brazilian pepper will not reinvade sites after hydrology has been restored should be supported with references.

Pages 6-56 through 6-62, Section 6, South Florida Assessment Method

This section should describe how or if SFAM assesses inter-annual variability in water depths and their duration. For example, it would be interesting to know whether the SFAM indices reported in Table 6-4 represent a one-to-one spatial mapping, or, total acreage for the regions of interest. A more thorough description that explains how these indices are calculated should be provided.

Page 6-62, Section 6.6.3, Inland Habitat Changes

Values for parameters should also be calculated for the Ten Thousand Islands NWR, since the values are not limited to areas that were hydrologically modified.

Page 6-63, Section 6.6.4, Estuarine Habitat Change

The assumption that Fakahatchee Bay has had minimal impacts from human activities is arguable. The explanation for the assumption should be improved. The SGGE canal system has likely intercepted some sheetflow that would normally flow into this bay, the construction of logging trams and US41 has altered to some degree the distribution of that sheet flow, and excessive freshwater flowing into Faka Union Bay extends to a varying degree into the western portion of Fakahatchee Bay. While Fakahatchee Bay may be relatively pristine compared to other bays affected by this project, we caution against carrying the comparison too far.

Page 6-70, Table 6.7 Water Depths and Major Plan Community Types

Data in Table 3-2 reports that the percent of Mesic Pine Flatwoods in 1995 was 2 percent. Yet, in Table 6-7, Mesic Pine Flatwoods represent 94 percent of the area. Please explain the large differences between the NCRC maps and the output from MIKESHE vegetation model.

Page 6-74, Section 6.7.2, Inland Performance Measures

It is not clear that Table 6-7 supports the conclusion that "the only areas that have not changed in water depth are areas that were and still are upland or coastal marsh communities." There has consistently been an approximate 4' difference in water levels between the wet and dry season in the northern marshes of the Ten Thousand Islands NWR, with water levels being approximately 2' above ground during the wet season and 2' below ground during the peak of the dry season. This is inconsistent with the assumption that "coastal marshes are probably more strongly influenced by Gulf of Mexico water levels than flows through SGGE." The table, the conclusion, or both should be modified for accuracy, precision, and consistency.

Page 6-83, Section 6.7.3, Inland Habitat Units

We recommend the authors review the numbers in Figure 6-11. The figure shows a 100 percent increase in Biota Habitat Units for Alternative 3D, with project, when it appears to be closer to 30 percent (40,000 to 52,000). Also, the figure shows a 100% decrease without project. This appears to be closer to a 15 percent decrease (40,000 to 35,000).

Page 6-85, Section 6.7.4, Estuarine Performance Measures

The derivation of the performance measure for nekton should be reiterated or referenced to previous sections of the document and the geographic location for the nekton flow performance measure should be included in the PIR. An analysis of the flow/salinity or stage/salinity relationship should be performed for the flow transects used, or, if conducted, the analysis should be reported.

Page 6-93, Section 6.7.6, Generalized Alternative Comparison Table

The Evaluation Matrix for Study Area Lands Affected by the SGGE Project (Table 6-17) should include the Ten Thousand Islands NWR. This is especially important considering the number of important Environmental Quality variables that may be affected on the refuge.

Page 6-101, Section 6.8.3, Water Supply Benefits, Municipal and Industrial Water Supply, Agricultural Water Supply

This section states that a "...key design criterion and goal throughout the development of the SGGE system components has been that municipal and industrial water supply will remain the same or be increased with the SGGE plan..." The basis underlying this assumption, and related design criteria based on this assumption should be clearly identified.

This section also states that groundwater levels may rise as a result of the project and yield more water for the ecosystem and potentially more water for municipal and industrial use. It would be helpful if this section also identifies the volume of the additional yield that will be available for the natural system, and which areas are being considered for the benefits of this

additional groundwater. Groundwater benefits to NGGE (outside project area) that might potentially occur should be balanced through the application of some of that additional water for the restoration of wetlands and other aquatic resources in NGGE. A water accounting system would help ensure that project water is not diverted for non-project uses.

The Belle Meade agricultural area is an area of known saltwater intrusion which affects agricultural operations. Groundwater benefits may occur to alleviate this situation. Since the land use in this area may change (development may be intensified) under recent changes to the Collier County Comprehensive Plan, we recommend that all water be reserved for the natural system. Clearly and unequivocally reserving the waters for environmental restoration will ensure that potential water supply needs associated with intensifying land use do not decrease fish and wildlife benefits of the project.

Page 6-103, Section 6.8.6, Costs of Alternatives

See comment regarding computation of real estate costs for Alternative 6 on page 6-15 as portrayed in Table 6-18, 6-19, and 6-22.

Page 6-107, Section 6.8.6, Costs of Alternatives, Groundwater Impacts

The document should identify or delineate the portions of the Ten Thousand Islands region with a one-foot increase in groundwater levels.

Page 6-116, Section 6.8.8, Cost Effectiveness and Incremental Cost Analysis

The Ten Thousand Islands NWR should be included in Table 6-22 (and Table 6-17), and subsequent comparisons.

Page 6-136, Section 6.8.11, Risk and Uncertainty Analysis-Uncertainty of Project Benefits

We suggest clarifying whether the topography sensitivity analysis demonstrates that SFAM is reliable even if there is a lot of uncertainty in the topography, or, indicates that SFAM metrics are insensitive to changes in topography.

Section 7, RECOVER Evaluation

This section should include recommendations for additional analysis and requests for information that were contained in previous RECOVER reports.

Section 8, Recommended Plan

Page 8-2, Section 8.2.2, Pump Stations

The Service believes that these pumps may represent an over-design based on a 100-year storm that may affect project area resources within and outside project boundaries. The Service recommends reducing the number of pumps or replacing them with a number of

smaller capacity pumps as part of the design and construction phase of this project if it is indeed over-designed.

Pages 8-2 and 8-3, Section 8.2.3, Levees

The effects of levees on listed species should be addressed. The levee around Port of the Islands and south of U.S. Highway 41 should be examined to determine effects on the adjacent Ten Thousand Islands NWR and potential benefits associated with blockage of sheetflow from refuge lands to the canal system. The Service believes that the levee proposed around the agricultural area in Belle Meade extends too far west, exceeds the limits of the project's effects, and would act to cut off surface water movements through this area. This levee was not previously reviewed by the PDT or the Service and deserves further scrutiny. Alternatives to the ring levee around private residential properties located in northeastern Belle Meade should be examined to minimize effects to wetlands.

The levee construction around Port of the Islands south of US41 may restore ecological integrity by preventing tidally influenced salt water from intruding into adjacent fresh water marshes as is currently the case. If feasible, breaks in the southern half of the existing berm on the west side of the Faka Union Canal should be considered as they may facilitate tidal water interchange to the area between the canal and the Wood River and divert some tidal waters from building up in the Port of the Islands basin.

Page 8-3, Section 8.2.4, Roads

The road plan that was approved at various points in the planning process by various parties should be included in this document. The Service is concerned about the location of the paved portion of Miller Boulevard extending too far south with reference to its potential effects on surface water movement to Belle Meade and listed species. The majority of the road plan is acceptable. Proposed uses and types of road access will be reviewed in the DOF Ten Year Management Plan. The first paragraph of this section ends with the statement that remaining material from road destruction would be spread across the landscape. Disposal of this material could adversely affect adjacent habitats unless criteria are developed to protect sensitive areas. Please incorporate a more detailed description of road deconstruction as developed by members of the PDT and described in the Prairie Canal Early Start permit. After road degradation is completed adjacent to Prairie Canal, the Service may have additional recommendations based on an adaptive assessment process.

Pump access roads should be minimized where possible by placement along existing roads or canals.

Page 8-4, Section 8.2.5, Culverts

There is no reference to the culverts under Stewart Boulevard. The text should explain whether the road is to be cut to grade, or culverted.

Page 8-4, Section 8.3, Operational Features

We remain concerned that issues discussed (or not) in this section could undermine all assumptions concerning ecosystem benefits and may affect listed species. Issues include the drawdown of wetlands in NGGE, overinundation of SGGE, dry season discharges of water beneficial to the downstream ecosystem, groundwater recharge of the NGGE canal system for use by wellfields, pump size, reporting procedures, and emergency water and fire management protocol. We recommend the text reference the draft Water Control Plan in Section VII of Appendix A, and incorporate the results of ongoing discussions.

The Service provides additional comments with regard to this plan in Appendix A section of this document. However, the Service believes the proposed plan is a flood control plan, not a plan maximized for restoration. Additional model runs and discussion of this issue are forthcoming, but this issue was identified early in the planning process and has not been addressed to the Service's satisfaction.

Page 8-6, Section 8.5, Adaptive Assessment and Monitoring

The Service is currently assisting in the development of a more detailed plan that will replace the plan in Appendix H of this document. The Service believes that this Plan is critical to achieving and documenting ecosystem benefits. Elements of this Plan are also necessary to minimize effects to federally listed species.

Page 8-11, Section 8.7.2, Cost Sharing of Adaptive Assessment and Monitoring

The document should specify the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park, rather than the less accurate term, Ten Thousand Islands area.

Page 8-13, Section 8.8.3, Detailed Design Phase

The Service will continue to be integrally involved in the detailed design of this project. The detailed design phase should include remediation of contaminants, refinement of hydrologic models, water control plans, project phasing, and the adaptive assessment and monitoring process.

Section 9, Environmental Effects

Page 9-4, Section 9.5, Fish and Wildlife Resources

The Service's Recommendation No. 2, as listed under this section is intended to establish: (1) baseline fish and wildlife surveys that would be repeated mid-construction and post-project as deemed appropriate; and (2) surveys to avoid impacts to fish and wildlife resources resulting from actual construction activities. The Adaptive Assessment and Monitoring Plan will address this first task; some pre-construction surveys will be required to minimize

effects to listed species (consistent with the Prairie Canal Early Start Project). Our response to comments under Recommendation No. 6 is included in comments on Section 8.3 on page 8-4. Our response to comments under Recommendation No. 12 is included in comments on Section 11.18 on page 11-5. Our response to comments under Recommendation No. 13 is our PAL to the Corps, dated August 11, 2003, which addresses design storm and other model issues and assumptions.

Page 9-15 and 9-16, Section 9.10, Hydrology

The text should be revised to reflect the intent of this project to restore hydrology, including hydroperiod and inter-annual variability, to SGGE. The second sentence of paragraph 3 indicates that coastal estuaries in the project vicinity presently receive, under most conditions, sufficient flows of fresh water. The Service does not agree with this statement and believes it conflicts with the project objectives to restore fresh water to estuaries that are blocked from upstream watersheds by the SGGE subdivision.

Preliminary discussions with the District indicate that no additional water beyond ecosystem needs will be made available as a result of this project. Despite this, text within the PIR appears to be setting the stage for use of some unquantified portion of water in excess of natural system needs. The third paragraph on this page states that the state reservation rule "will be conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved." The last sentence in this section on page 9-16 states that "this adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project." This again seems to inappropriately set the stage for configuring and operating a system that will generate some unknown portion of additional water for uses other than the natural system.

Page 9-17, Section 9.10.3, Water Management

This section allows for the changes in the Water Control and Operations Plan based on the water resource allocation for the natural system. This emphasizes the importance of Section 12 (Assurances) of this document and the Water Control Plan. The Service has significant concerns with regard to both these issues. See our Section 12 and Appendix A comments on these issues.

Page 9-20, Section 9.12.3, Water Demand

Final figures for water demand do not currently contain accurate predictions for self-supply for the NGGE area. Without these predictions, water demands cannot be accurately assessed.

Page 9-25, Section 9.18, Environmental Effects on Adjacent Lands

Heavy equipment entering and leaving the construction areas should be decontaminated to avoid the transport of exotic and nuisance species to adjacent public lands.

Section 10 Public Involvement

Page 10-11, Section 10.7.1 U.S. Fish and Wildlife Service

Provide references to all written correspondence from the Service, including the August 11, 2003, Planning Aid Letter (PAL).

Section 11 Compliance with Federal Environmental Statutes

Page 11-1, Section 11.2, Endangered Species Act of 1973, As Amended

The last sentence in the first paragraph under this section should be revised from "completion of BA" to "completion of consultation under section 7 of the ESA."

The last sentence on this page should be deleted. The project has not been fully coordinated under the ESA and the Service does not agree that at this stage of the planning, the Corps is in full compliance with ESA. We are continuing to work very cooperatively with the Corps to complete this consultation.

Page 11-2, Section 11.3, Fish and Wildlife Coordination Act of 1958, As Amended

This document should include references to and conclusions of all PAL's provided by the Service on this project, including our August 11, 2003, PAL. The FWCAR contained in Appendix D is a draft document that solicits comments from other State and Federal agencies for incorporation. The draft FWCAR was prepared, at the request of and in cooperation with the Corps, before many of the sections of this draft PIR were available for Service review. As evidenced by this correspondence, there are additional issues and conservation recommendations that will be incorporated into the Final FWCAR. Until this process in finalized, there should be acknowledgement that full compliance has not been achieved under the Fish and Wildlife Coordination Act.

Page 11-4, Section 11.12, Marine Mammal Protection Act of 1972, As Amended

The Service does not agree that the project is in full compliance with this Act, although all parties continue to work towards compliance. In particular, the Service has requested additional information on freshwater discharges to the manatee warmwater refugia within the Faka Union canal and Port of the Islands marina basin.

Page 11-4, Section 11.13, Estuary Protection Act of 1968

The Service does not agree that the project is in full compliance with this Act, although all parties continue to work cooperatively to assure compliance.

Page 11-5, Section 11.17 - E.O. 13089, Coral Reef Protection

The interpretation of this Executive Order generally differs from the description in this section. Although there are no documented coral reefs in the SGGE Study Area, coral reefs in other areas may be affected by this proposal and should be discussed and analyzed if warranted.

Page 11-5, Section 11.18 E.O. 13112, Invasive Species

The document does not identify the referenced "feasible/prudent measures to reduce invasive species infestations and minimize risk of introducing new invasive." The managing entity, DOF, does not currently have sufficient staff or funds to control exotic plants (in particular, Brazilian pepper) and some exotic animals on the project site. There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive species, especially in the short term, or whether more intensive management activities may be necessary on an initial or perpetual basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species. The Service believes that additional discussion and a separate Invasive Species Management and Monitoring Plan should be developed as part of this project.

Page 11-5, Section 11.19, Federal Water Project Recreation Act

Until the DOF management plan is developed in its entirety and approved, it is difficult to determine compliance with this Act.

Page 11-7, Section 11.30, Water Resource Development Act of 2000, Section 601

The Service is of the opinion that until there is agreement on the identification of water reserved for the natural system, legal users, and "appropriate quantity, timing, and distribution of water for the natural system", this project cannot be determined to be in compliance with this Act. While Section 12 identifies a methodology for determining water reservations, the methodology is based on conceptual models, does not identify the exact quantity attributed to each legal user, and is unclear as to how timing and distribution of water needed by the system are being determined.

Section 12, Project Assurances

General Comments

The SGGE project is primarily aimed at reducing over-drainage to restore wetlands in the project area. Through accomplishment of its purpose, the project will also improve the quantity, timing, and distribution of flows to the estuaries by reducing point source flows that currently damage the ecosystem. Since the project is hydrologically isolated from the regional system and designed to increase water levels within the project footprint, meeting the assurances required by WRDA should be relatively straightforward in that an analysis of overall regional water management changes is not required. We believe that the methods employed to identify water made available for restoration of the natural system are largely adequate, but somewhat incomplete. We suggest the following changes:

- Fully document the methods used to perform evaluations (see specific comments below);

- Insert key information into the assurances section -
    - Evaluate Savings Clause compliance for fish and wildlife habitat areas that are outside the project footprint, but could be affected by the project (with the exception of the estuary at the downstream end of the Faka Union canal; please see comments on section 12.5.2 for specific areas that should be evaluated),
    - Substantiate the claim that the WRDA 2000 Savings Clause for level of service for flood protection is provided (see section 12.1.2.1 [page 12-2]),
    - Affirm that all of the water made available by this project is necessary for restoration of the natural system, and should be identified, dedicated, and managed for the natural system (in general, no water should be "excess" or available for other uses),
    - Repeat the language found in Section 601 (h) (1) in WRDA 2000 regarding assurance of project benefits in Section 12.12 (although this language describes the purpose of CERP in Section 1.4.1, reiteration of this language in this part of the document remind reviewers and decision makers of the benefits of CERP),
    - Anticipate and reinforce Section 13 concepts by clearly stating in this section that (1) both the beneficial baseline water and the additional water produced or redirected from this project are needed to achieve the goals and objectives of CERP, as well as to ensure the benefits of the Plan for restoration and preservation of the natural system as required by WRDA 2000, and (2) both beneficial baseline water and additional project water should be reserved for natural resources by the State, and,
    - Provide a comprehensive discussion of the relationship between the pre-CERP baseline, the Savings Clause, and the level of service for flood protection, as set forth in the Programmatic Regulations, in Section 12.1.3.

We also emphasize that the methods employed in the present PIR would require additional expansion for evaluation of future Comprehensive Everglades Restoration Plan (CERP) projects that have significant effects on regional water or that intentionally transfer existing sources through project modifications. We anticipate that this more complete and detailed set of procedures will be outlined in the forthcoming guidance memoranda on procedures for identifying water made available for restoration and for evaluating project effects on existing legal sources.

The assurances evaluation, model output graphics, and evaluations based on the graphics should be updated to reflect the final operational plan and to ensure consistency between project modeling and project assurances. The operational plan is the link between the water identified to be reserved for the natural system, based on the expected performance of the plan, and the actual deliveries for the natural system. Modeling to refine and optimize the operational plan commenced after completion of the draft PIR, so the currently available information may not be the best available.

The organization of the assurances section is confusing in that the analysis of water being made available for restoration and other purposes is not clearly distinguished from the analysis of existing legal sources. Although there is a section entitled "Effects on Existing Legal Sources of Water," there is no comparable section entitled, "Identification of Water Made Available for Restoration and Other Uses," nor one entitled "Effects on Existing Level of Service for Flood Protection." We suggest the following reorganization:

a. Retain Section 12.2 "Principles for Identifying Water for the Natural System," but move Section 12.2.3 "Description of Methods Used to Evaluate Project Effects on Existing Legal Sources" to current Section 12.5,
b. Combine Section 12.3 and 12.4 and re-title as "Quantification of Water Made Available for the Natural System,"
c. Add a section entitled "Effects on December, 2000, Level of Service for Flood Protection,"
d. Reword Sections 12.5.2 and 12.5.3 to provide more concise statements as to whether there is a Savings Clause elimination or transfer of existing legal sources as to each of the potentially affected existing legal sources, and,
e. Consolidate the statements about elimination or transfer that are spread between Sections 12.5.2 "Identification of Existing Legal Sources of Water," and Section 12.5.3 "Elimination or Transfer of Existing Legal Sources" into a concise statement in Section 12.5.3.

Lumping the entire project footprint may be too coarse of a spatial resolution to adequately capture restoration benefits across different landscape types, especially where sloughs are interspersed with shallower sheetflow wetlands and upland pine strands. Although an aggregate quantification of water provided to the SGGE area provides a description of the overall increase in available water, we believe that this should be supplemented with an analysis of indicator regions for different habitat types or monitoring locations that will be used to assess actual deliveries of water by the project.

It is important that the Savings Clause evaluations consider all existing legal sources that could be affected by a project. Graphics in Appendix A show that canal levels in NGGE are lower during the wet season than existing levels, yet the report states that there are no Savings Clause issues in this area. Graphics that demonstrate that the water available to the wetlands in NGGE and other areas has not been reduced should be included in the text. See our comments on Sections 3.10 (page 3-19), 5.2 (page 5-2), and 5.33 (pages 5-5 to 5-8).

Analysis of the project benefits and effects is hindered by inconsistent terminology, mislabeled graphics, the lack of graphics of supporting conclusions, missing locater maps, incomplete documentation of methods, and references to graphics outside section 12 that are missing exact figure numbers. We offer the following suggestions:

a. Include a locater map that identifies the estuarine flow transect locations.
b. Include documentation of the methods used to calculate the volume probability curves and estuary delivery graphics for all time periods: average annual, wet season, dry season, average year, dry year, and wet year,
c. Identify the time step used to compare project stages to their natural system targets,
d. Include a narrative description and map illustration of the project footprint (model grid area) used to calculate volume probability curves,
e. Include a description or definition of the natural system trace on the performance measure graphs, and clarify whether this is the same simulation referred to elsewhere in the document as the pre-drainage condition, the natural condition, and the natural systems model (NSM),
f. Apply consistent terminology is used throughout the document, such as the use of "NSM" vs. "natural system" vs. "pre-drainage condition," or the use of "existing 2000 condition" vs. "existing 2003 condition" vs. "pre-CERP baseline,"
g. Summarize modeling results and conclusions,
h. If warranted, reference any non-section 12 graphics that may relate to project assurances,
i. Make the x-axis scales (time steps) on graphics 12-11, 12-12, 12-13, 12-19, 12-20, 12-21, 12-23, 12-24, 12-25, 12-27, 12-28 and 12-29 uniform, and
j. Document the selection of the representative wet, dry and average years, and, justify the use of two different dry years to evaluate estuary deliveries (in the existing legal sources section, Figure 12-21 uses 2000 as the representative dry year; however, 1990 was used in the project effects section in Figure 12-13).

Volume probability curves obscure timing and are difficult for some readers to relate to on-the-ground restoration benefits. If use of volume probability curves based on depth is the preferred method, we recommend that water quantities be expressed in terms of beneficial depth, a more relevant measure for biogeochemical understanding, to supplement volumetric values. We also recommend that the distribution of annual values for the 1988-2000 period be documented using a frequency-of-return graph.

Specific Comments (Section 12, Project Assurances)
Pages 12-1 to 12-3, Section 12.1.2, Water Resources Development Act (WRDA 2000)

The language found in Section 601 (h) (1) should be inserted prior to the discussion of Section 601 (h) (4) (A) of WRDA 2000. Section 601 (h) (1) states the following:

> *The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized."*

The above quotation from WRDA 2000 includes paragraph 601(h)(4)(B) entitled the maintenance of flood protection, as well as paragraph 601(h)(4)(A) on existing legal sources. However, this section does not evaluate the WRDA 2000 Savings Clause for level of service for flood protection. This is an important oversight, and we suggest that a subsection of Section 12 be devoted to this topic.

Page 12-4, Section 12.1.3, Programmatic Regulations (33 CFR Part 385)

We recommend that the following language be inserted in Section 12.1.3:

> *The Programmatic Regulations provide that a pre-CERP baseline be developed to aid the Corps of Engineers and the District to implement the Savings Clause in determining if existing legal sources of water will be eliminated or transferred. The pre-CERP baseline is one of the tools to be utilized in this determination. The Programmatic Regulations also provide that each Project Implementation Report consider the operational conditions developed in the pre-CERP baseline to demonstrate that the levels of service of flood protection in existence on the date of enactment of WRDA 2000 and in accordance with applicable law will not be reduced by implementation of the project.*

We recommend removal of the phrase "Department of Interior" from the first sentence of paragraph two so that it is consistent with the Programmatic Regulations and reads "… water supply for fish and wildlife is to be identified by the Corps of Engineers and the South Florida Water Management District in consultation with several other Federal, State, Tribal, and local agencies."

Pages 12-6 to 12-7, Section 12.2.1, Principles for Identifying Water for the Natural System-Background

The PIR should ensure that all water made available by a project and that contributes to identified ecosystem benefits, is quantified. This should include not only the main project

area but also any natural areas where beneficial changes in quantity, timing or distribution of water have contributed to selection or justification of the project plan. We recommend that the final report include a summary of all natural areas for which hydrologic benefits have been quantified for the project, and that the water made available to these areas is identified in Section 12.

The last paragraph states that the recommended plan effects were modeled using a hydrologic simulation model. We recommend that the PIR reference the hydrologic simulation model documentation.

Page 12-7, Section 12.2.2, Quantity, Timing, Distribution, and Water Quality

We recommend replacing the phrase "period of record" with "period of simulation" where appropriate to distinguish between the historical period of hydrologic record and the period of simulation of the hydrological models. Also, the report states that the entire range of historic climatic conditions is represented in the modeling:

> S*ince the hydrologic performance measures reflect preferred stages, depths, hydroperiods, etc. under a range of hydrologic conditions representative of historic conditions, a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of beneficial water deliveries available from project features though the entire range of historic climatic conditions.*

The text should clarify whether the period of simulation (1988 through 2000) is the largest historical period of record available, or, a subset representative of historical conditions experienced in the basin. If the latter is the case, then documentation or supporting references should be included to show that the subset of years selected is representative of historical conditions.

Page 12-8, Section 12.2.3, Description of Method Used to Evaluate Project Effects on Existing Legal Sources

The first two sentences indicate that Table 12-1 lists "Existing legal sources" of water. However, the table lists the overall sources of water for the Faka Union Canal watershed, whereas the "existing legal sources" are defined operationally as the portion of these sources that is used as water supply by the specific Savings Clause beneficiaries that are listed later in Table 12-1 (page 12-8). This section is likely to foster a misinterpretation that all water entering the watershed is an "existing legal source." We recommend changing the words "existing legal source" and "legal source" in the first paragraph and in Table 12-1 to simply "source." "Existing legal sources" can then be defined in terms of the specific Savings Clause beneficiaries described in Section 12.5.2 and Table 12-3. In the last sentence of this section, we recommend replacing the word "existing" with "2000" so that the sentence reads "the hydrologic model simulates the pre-CERP baseline (2000) conditions …" Additionally, clarification of the difference between the existing condition and the pre-CERP baseline is warranted throughout this section. The majority of the document defines the existing

condition as 2003 conditions while page 12-8 describes the existing condition as the pre-CERP baseline or year 2000 conditions.

It is not clear whether the model simulations for the pre-CERP baseline, and the with-project scenarios are identical (except for assumed project features). We suggest adding a clarifying statement, including, if necessary, a description of any differences. To facilitate the evaluation of SGGE project affects on water quantity and quality, SGGE project features should be the only difference between the model simulation inputs.

Page 12-9, Section 12.2.4, Regional Scale Effects

The report states that the primary regional-scale benefit of this project is to improve the timing and distribution of freshwater flows and reduce damaging point source flows to the downstream estuary. Yet, the graphics supplied in the draft PIR do not clearly demonstrate how timing and distribution are improved. The volume probability curves for estuary deliveries lump all flow categories together including open channel flow through Faka Union Canal and ground- and surface- water fluxes across all four transects. We suggest the PIR include graphics that distinguish between flows within each transect, and identify the portion of water delivered by each source within each transect. Bar charts could be used to easily identify flows by source for each transect if the bars were divided vertically by source and color coded.

Page 12-9, Section 12.2.4.1, Estuary Deliveries

The second sentence in Section 12.2.4.1 states "water made available by the project and delivered by the sheetflow to the coastal estuaries within the identified estuarine targets is considered to be a beneficial delivery and is therefore identified for the natural system."

While this is true, we recommend that the sentence be revised to include all sources of beneficial water delivered to the estuaries: structural flow from canals, groundwater flow, and sheet flow.

Pages 12-9 to 12-10, Section 12.2.5.1, Natural Areas

The last sentence in this paragraph should be revised to read "the quantity of water delivered to or retained within the project that results in wetland hydropatterns that fall within targets is considered beneficial water that is identified for the natural system." The expected level of ecological restoration is achieved through a combination of groundwater and surface water within the project footprint. We believe that project level benefits should include all beneficial water made available to the natural system, rather than just the volume of water held in surface water storage within the project footprint.

Pages 12-11 to 12-13, Section 12.3, Procedures for Quantification of Water for the Natural System

The PIR should describe how the volume probability curves are calculated for the natural areas and the estuaries at each of the different time periods: dry year, wet year, average year, dry season, wet season, and average annual. The description should identify the time steps used to calculate the averages, and identify the information used to generate the estuary delivery graphics, such as surface water, ground water, or other source.

Since Conservation of Mass is the applicable scientific principle for identification of water quantities, the quantification of basin storage and all inflows and outflows is required. Typically, this is reported by a water budget which reports volumes for all significant components of the hydrologic system: structural flows, evapotranspiration, rainfall, groundwater flow, etc. The PIR should include water budgets for the project footprint depicting structural inflows and outflows, groundwater flow across the project boundaries, rainfall, and evapotranspiration.

Pages 12-10 to 12-13, Section 12.3, Procedures for Quantification ofWater for the Natural System

Section 12.3 should distinguish between beneficial baseline water to be protected and additional water produced or redirected by the project. It is unclear from the PIR whether all water delivered to the estuaries is additional water produced or redirected by the project and therefore water to be reserved by the State, or if a portion of this water is existing beneficial baseline water to be protected by the State. There also needs to be a similar discussion for natural areas as to the beneficial baseline water for natural areas and the additional water produced or redirected by the project.

Page 12-11, Section 12.3.1, Procedures for Quantification of Water for the Natural System

The second paragraph states "a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of water deliveries that are beneficial to the natural system from project features…" Volume probability curves based on depth neither represent all the water nor only the water delivered from project features. This method includes quantities from other sources, such as rainfall, and omits structural inflows from project features if these are stored as groundwater. We suggest rephrasing this statement as, "a probabilistic approach has been selected utilizing volume probability curves to depict the distribution of volumes of water that provide natural system benefits as a result of project features…"

Page 12-12 to 12-13, Section 12.3.2.1, Identification of Water to be Reserved

We suggest the second sentence be changed to reflect all time intervals used to describe project effects: annual average, wet season, dry season, wet year, dry year, and average year.

We agree that the combination of the operational plan and the graphics depicting additional water made available by the project should comprise the water identified to be reserved for the natural system by the State of Florida. However, we feel that the volume probability curves based on depth do not capture all water being delivered by the project features for restoration and protection of fish and wildlife resources. We refer to our comments above on section 12.3.1 related to volume probability curves.

We suggest the PIR include individual sections describing methods used to calculate wet year, dry year, and average year and provide the rationale for selecting the representative years. We also suggest that the documentation of the wet, dry and average season be expanded in the PIR, checking to ensure that the definitions for wet season and dry season are consistent with those used in other sections of the report.

Pages 12-11 to 12-13, Section 12.3.2, Beneficial Delivery Volume Probability Curves

Similar to our above comments for section 12.3, the text should include a description of how the volume probability curves were calculated. We also reiterate our general section request for documentation of the selected representative wet, dry and average years.

Pages 12-13 to 12-23, Section 12.4, Project Results

The discussion in Section 12.4 only identifies additional beneficial water made available by the project. The beneficial baseline water should also be identified.

Pages 12-13 to 12-14, Section 12.4.1, Project Results, Background

Table 12-2 lists the targets and sources of beneficial water for each restoration area. We suggest groundwater flow and structural flow from Faka Union Canal be added to the list of sources for Faka Union bay and downstream coastal estuaries. We also suggest groundwater be added to the list of sources of beneficial water for the natural area restoration.

Pages 12-14 to 12-15, Section 12.4.2.1, Project Footprint

We suggest that a map and text describing the project footprint be included in the PIR.

Page 12-19, Section 12.4.3.1, Estuary Deliveries

The claimed benefit of reductions in point source flows from Faka Union is undermined by Figure 12-7, on page 12-19, which indicates that flows delivered by the canal are below target flows for 3-4 months (September through December) of the year. This should be clarified.

Page 12-24, Section 12.5.2, Identification of Existing Legal Sources of Water

It is central to the intent of the Savings Clause that it applies to all existing legal sources potentially affected by a project. It is probably of most importance to users of the existing

legal sources that lie outside a project area and are not expected to benefit from it. Table 12-3 on Page 12-24 identifies the existing legal sources for water supply in the project study area. Local basin storage and runoff and the surficial aquifer are identified as the sources for fish and wildlife, agricultural, urban, and ENP. Yet, only a portion of ENP estuaries is affected, but a large portion of the Ten Thousand Islands NWR is affected. These sources were solely evaluated by analyzing changes in surface water and ground water storage within the project footprint.

The analysis of existing legal sources in the project area should provide graphics and interpretive text demonstrating that existing legal sources for fish and wildlife within the basin, but outside the project footprint, have been protected. Specifically, we recommend evaluating model results for indicator regions within the following areas that were identified by agencies participating in the WRAC pre-CERP baseline issue team discussions: Corkscrew Swamp Sanctuary, Collier Seminole State Park, 10,000 Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Preserve, Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, and wetlands in NGGE**.**

We also recommend evaluations for the Belle Meade portion of Picayune Strand State Forest, CREW, estuarine resources in Estero Bay, Henderson Creek, and the Gordon River. Additionally, water budgets for the project footprint and NGGE should be included in the PIR to summarize structural inflows and outflows, groundwater seepage, evapotranspiration, and rainfall. We also recommend including graphs of boundary fluxes along the northern and

western boundaries of the model for the with- and without-project conditions, in order to demonstrate that the project will not have any effects outside the model domain.

Pages 12-27 to 12-30, Section 12.5.4, Identification of Project Effects on Existing Legal Sources of Water

Graphics 12-14 through 12-16 should include a trace for the natural system, or target. The target is necessary to illustrate that all of the water that the natural system is receiving is actually beneficial.

The estuary graphics used to perform the existing legal source analysis evaluate the sum of all flows to the estuary. While it appears that the project passes the existing legal source test on that basis, Figure 12-7 indicates that delivery targets from Faka Union Bay may not be met at the end of the wet season and beginning of the dry season during an average year. Meeting the total flow requirements of the estuary may be acceptable for restoration, but deficiencies in any source of water should be documented and explained. We recommend that the estuarine evaluation team for the SGGE project be consulted on this issue. Effects on the West Indian manatee may also need to be addressed.

We suggest the PIR explain why 2000 was used as the representative dry year for analysis of estuary deliveries in the existing legal sources section while 1990 was used as the representative dry year for all other analyses in the document.

Page 12-31, Section 12.6.1.3, Water Supply

This section states "one of the incidental project benefits of the recommended plan will be to improve the aquifer recharge in and adjacent to the study area; therefore, supplies of water to meet the demands of existing legal users are not expected to be adversely impacted by project implementation." We recommend the PIR include graphics or references to graphics used to arrive at this conclusion.

Page 12-33, Section 12.6.1.5, Flood Protection

This section states "more detailed information including maps illustrating the comparison between existing and with project conditions can be found in Appendix A of this report." We recommend the PIR include references to specific graphics that were used in the analysis or include them in the assurances section.

Page 12-37, Section 12.6.3.1, Water Supply Assurance

The text in this section could be misinterpreted. Increased volumes of water in surface water and groundwater storage within the project footprint are considered adequate assurances that water supply for existing legal users shall not be diminished through project implementation. However, this quantity of water should not be confused for excess water that is available for other uses such as water supply. The combination of increased groundwater and surface water levels within the project footprint are responsible for the restoration benefits expected and can not be made available to other users, such as water supply, without witnessing a reduction in restoration levels. We suggest the text be modified to clarify this distinction, including a discussion of what water may be made available for other uses, if any.

Page 12-42, Section 12.6.3.2, Flood Protection Assurance

This section states "detailed analysis for flood protection for the project area can be found in Appendix A." We suggest the PIR include specific references to the graphics in Appendix A that were used to perform project assurance analyses and a narrative describing the conclusions that were drawn from them.

Section 13, Recommendations

(1) We strongly support recommendations that protect baseline water, as well as the reservation of additional project water for the natural system, by the State of Florida. Water made available by CERP projects over and above existing levels cannot be treated as "stand alone" contributions toward restoration because the benefits of "new" CERP water depend on the interaction between new and already-existing water in natural systems. Additionally, many natural areas within the CERP domain are not short of water but have too much, at least some of the time. The restoration of these areas depends on the protection of existing baseline water. We, therefore, strongly support the recommendation that the local sponsor act to protect both baseline and new project water for the natural system.

(2) Recommendations contained in Section X of the draft FWCAR in Appendix D of this plan, and any other recommendations that will be incorporated in the final FWCAR, should be instituted as part of this project plan commitment.

(3) Due to the importance of this project to federally protected species, particularly the West Indian manatee, wood stork, and Florida panther, and the significant contribution of federal funds to project acquisition and development from the DOI and the Army Corps of Engineers, the Corps should embrace full compliance with the Endangered Species Act. In particular, Section 7(a) (1) directs federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the *conservation* of endangered and threatened species listed pursuant to section 4 of the Act. This portion of the Act sets forth actions beyond the standard of consulting with the Service to assure that agency actions are not likely to jeopardize the continued existence of any endangered or threatened species or its critical habitat. The Service is assisting the Corps in developing a plan that goes beyond avoidance of adverse effects to provide beneficial effects to listed species.

(4) Due to the complexity and resulting uncertainty associated with hydrologic modeling and the importance of development of an operations management plan that focuses on restoration benefits, the Corps should specifically commit to the continued development of an Adaptive Monitoring and Assessment Plan for this project. This plan is currently being developed and will be significantly modified beyond the plan included in this document.

Section 16, References

Page 16-1

Literature citations in this section appear to be missing from the draft FWCAR literature cited section.

Appendices

Appendix A, Draft Hydrology and Hydraulics

General Comments

The documentation of the hydrologic modeling performed contains many editorial errors, omissions, and inconsistencies that make it difficult to evaluate. Many of the conclusions drawn within particular sections of the document are not supported by accompanying graphics of model results. Likewise, text descriptions of many graphics are missing. Legends on graphics are mislabeled or labeled with insufficient information to analyze them accurately. These problems are compounded by differences in aggregation levels and period of record, errors in scale bars, multiple measurement systems (feet vs. meters), multiple datum (NGVD29 vs. NAVD88), and contradictory text and figures. We offer the following specific recommendations for this text section:

1. It appears that several different modeling efforts were completed for different evaluation requirements. However, the report did not adequately document the various efforts or clearly indicate for each section which modeling effort was used. Clarification of the general modeling process undertaken for the project is necessary, including the process that was used to iteratively step through proposed changes to structural features and operational criteria.

2. Include a clearly labeled location map that identifies the well fields, chainages, monitoring locations in NGGE and SGGE, major roads, canals, and water control structures.

3. For each alternative evaluated, provide a table of operational criteria and a description of the alternative.

4. Provide a graph of boundary fluxes along the northern and western boundaries of the model for the with- and without-project conditions to demonstrate that the project will not have any effects outside the model domain.

5. Include water budgets for watersheds in the model domain, NGGE and SGGE. This would help the reader to understand the sources and destinations of water in the project impact area.

6. There appear to be more than one existing condition alternative used in the modeling. We believe a single existing condition alternative should be used. If it is necessary to have more than one existing condition, please provide adequate description for the differences and rationale for their use.

7. Provide a narrative summary of the modeling results including specific elements of the figures and maps from which conclusions are drawn.

8. When summarizing the spatial modeling results, provide maps depicting differences relative to a single alternative (*i.e.*, Alt 3D relative to Existing Conditions).

9. Use consistent units and one vertical datum.

10. Label all graphics with the proper units and vertical datum.

11. Remove duplicate figures between the sections in the main body of the PIR and appendices or replace them with a reference to the page number where they can be found.

12. Correct scale bar errors on map figures.

13. Temporal aggregation levels should not be mixed. In particular, avoid mixing weekly hydrographs with daily hydrographs.

14. Analysis windows (*e.g.*, dry season, wet season, dry year, or wet year) should be consistent throughout the analysis.

15. Correct contradictions between text descriptions and accompanying figures and conflicting text descriptions in different sections of the report.

16. Label pages in the appendix with page numbers.

17. Evaluate ecological restoration based on a period of simulation that includes a variety of meteorological conditions with inter- and intra- annual variability. The inclusion of these periods in the SFAM reduces the overall uncertainty in its application.

Specific Comments (Appendices)

Page A-15, Section IV.B, Topography

In this section, the vertical datum for the study is identified as the 1988 North American Vertical Datum (NAVD). It is not clear whether this is the same vertical datum that is used throughout the report, such as in the assurances evaluation and in the operational plan. It is distracting to convert between datums and units while reading the report. If multiple datums must be used, clearly identify the datum used on each graphic and provide a conversion chart.

Page A-17, Section IV.C., Tributaries

We are concerned that the model does not adequately simulate surface water flow and the connection that exists between surface and ground waters. The second sentence on this page states that a field investigation of aquifer impacts from the drainage canals in SGGE showed a drop in the water table of approximately 2 feet at a distance of 6,000 feet from the canal. This indicates that the surface water and ground water are very closely connected. However, the modeling output included in this report does not show the same degree of connection. Stages in the canals in NGGE are raised 2.3 feet during the dry season with minimal or no corresponding increases in groundwater stages (*e.g.*, Figures A-89 through A-89B and Figures A-90 through A-90B).

Page A-21, Section V.B.3., MIKESHE Evapotransporation Module (ET)

Since evapotransporation constitutes a large portion of the water budget in south Florida, a description of how evaporation from the free water surface and soils is simulated in the model should be included. Also, include a description of the ranges of LAI and K_c and a reference to the data or available literature used to select their values. The inclusion of documentation for the ranges of K_c for given land uses, *e.g.* cypress, would allow reviewers to determine whether the variation is spatial or temporal.

Page A-22, Section V.B.D, Input Data and Model Setup

We are concerned that relative alternative-to-alternative comparisons may be complicated by parameters, such as floodplain topography and floodplain codes, that could change values between alternatives. Model-to-model comparisons should identify which model input parameters remain consistent between alternatives, and which ones change. When model input parameters change between alternatives, the change should be documented. We recommend using either a tabular or a graphical format, and inclusion of the documentation in the report.

Page A-22, Section V.D.1., Meteorological Data

When the performance measure of the project is evaluated for only a small subset of years or meteorological conditions, it is critical to ensure that the years or conditions chosen are actually representative of the historic meteorological conditions. The text states that the 1988-2000 period of record represents the complete period of record for this area. If this is a subset of the available period of record, we recommend the PIR provide an analysis supporting the selection of 1988-2000 rainfall as a representative sample.

We recommend the PIR provide data supporting the selection of the wet, dry, and average periods as represented by 1994, 1995 and 2000, respectively. Also an explanation of why these selected periods change throughout the analysis would be helpful. For example, in this section 2000 is defined as the average year, but in Section 12 it is the dry year. Once selected, we believe the representative years used to evaluate the project should not be changed.

Pages A-23 and A-31, Section V.D.2. Land Use V.F. 1. Natural Systems Model (NSM)

Since NSM is used as the target for restoration, it is critical to understand the assumptions used to develop it. Additional documentation of the methodology used to generate the pre-development (Natural) condition shown on Figure A-7 should be provided. The new material should identify the land use coverage used in the Natural System Model (NSM) simulation, too. Because the NSM is a critical part of the plan formulation process, complete descriptions of the NSM are important. For example, the documentation should:

- Explain the relevance of descriptions for agriculture and other urban land uses, which appear in the legend of Figure A-7,
- Compare the spatial fit of Figure A-7 with the NCRS categories depicted in Figure 3-1,
- Explain how the period of record in MIKESHE relates to Figure A-7,
- Identify the assumptions underlying canal removal inputs, and,
- Describe how input parameters such as Manning's n, time constants, drainage depths, and detention storage were changed.

Page A-24, Section V.D. 4, Topographic Data

A more complete description of the detention storage coefficient, including references and maps explaining how a spatial value was assigned to each alternative, should be provided. We suggest the text clarify how, if at all, its values were changed after calibration to simulate the alternatives.

Page A-25, Section D.4, Canal Network, Hydrological Data

We suggest selecting a local tidal stage boundary instead of what is currently proposed. Data from the Ten Thousand Islands NWR indicate that tidal influences do not extend much beyond the headwaters of the major bays. Thus, the southern boundary of the hydrologic model could be extended much farther south than it currently is. This would partially address the assessment's gap between inland and estuary areas.

Page A-25, Section V.D.4.a., Roughness Coefficients

To ensure model-to-model comparisons are true relative comparisons, Manning's n values for the overland flow module for each vegetation type should be provided. If these values change between alternatives, we recommend these changes be documented in the PIR.

Page A-27, Section V.D.8., Irrigation Data

It may not be appropriate to assume drip irrigation for all residential and agricultural irrigation in the entire model domain. This assumption would result in significantly reduced demands compared to conventional methods and could potentially result in the over-estimation of water available for environmental restoration. We believe that further explanation of the decision to assume drip irrigation values for all irrigation demands in the domain is warranted.

Page A-27, Section V.D.9., Summary of Model Parameters

The missing, but requisite, determination that quantifies the significance of varied drainage depths and time constants during calibration should be included in the section. Without providing some measure of how changing these variables influences simulated flows and stages, the uncertainty in relative comparisons between alternatives can not be assessed.

Page A-29, Section E.2, Initial Boundary Conditions

There may not have been tidal data available before 2000, but there is now, including data from Faka Union Bay. The newly available tidal data should be used in the modeling and the later stages of Alternative evaluation

Page A-30, Section V.E.5., Calibration, Verification, and Validation

The text should be modified to explain why the model was calibrated and verified over the same time interval, 1995–1999. Typically, models are verified during a different time interval than that used for calibration to ensure that they adequately represent the physical system.

Page A-32, Section V.F.2., Existing Natural Systems Model

Two different simulations of the existing condition are used in this report. They appear to differ only by the simulation of FU-4. Please define each one and their intended purpose.

Explain how the existence of and removal of the roads and ditches were modeled using the MIKESHE drainage component. Table A-1 does not include a specific reference to the drainage component. Describe what the drainage component is and how it was used to simulate the roads and ditches.

Pages A-33, 34, and 35, Section VF.4., Restored Conditions Alternative 3D

Figure A-40 does not accurately depict Alternative 6 as described. Figure A-40 indicates that structures Miller 2, FU-3, and Lucky Lake were removed whereas the text states that Miller 1, FU-2 and Merritt 1 should have been removed. This discrepancy should be clarified. If the correct version was used in the model for Alternative 6, explain why the stage for Alternative 6 in Figures A-89 through A-89B is higher that all of the other scenarios modeled. This is important since the results could be due to the leaky structure, or, more significantly, a datum shift that occurred in Alternative 6. A datum shift could affect the ranking of alternatives.

Rationale should be included as to why Alternatives 3D, 6, and 12 were simulated for the period 1994-1999, but analysis windows for the graphics presented are only for the "average" year, 1994. To accurately describe the ecological restoration potential of the project, a range of conditions and seasons should be evaluated.

We are concerned with the methods used to simulate the floodplains. Please explain the conceptualization and rationale for using floodplains based on topography. Given documented stability problems associated with modeling of the canal plugs, we are concerned with our ability to accurately evaluate alternatives using model output. The third bullet on page A-34 states that adding the canal plugs caused model stability problems. Since the canal plugs are a critical part of the project design, it is extremely important that the modeling tool be capable of evaluating their effects. In fact, the geotechnical section of the report mentions the need for more modeling to simulate the flow around these plugs.

The first bullet on Page A-35 that describes how east-west flow was established in the model is not entirely clear. Document the reasons and actual changes in the floodplain codes between alternatives or after calibration. If the floodplains were added to the model following calibration, a description should be included addressing how they affected the

calibration of the model. It is our understanding that the floodplain code is an input flag that allows surface water to flow over the bank from the floodplain in the MIKE11 network. The code should not enable surface water flows to enter a plugged canal that a floodplain traverses and travel a path independent of the physical constraints that exist. If floodplains were evident in the original topography, they should have been included in the existing conditions simulation rather than added later. Please explain how changing floodplain codes between alternatives might affect accurate "apple to apple" comparisons of alternatives. The explanation should allow reviewers to assess whether these changes between alternatives affect the relative ranking of alternatives, and ultimately, the selection and implementation of an alternative.

The second bullet on Page A-35 states that Alternative 3D was simulated from 1994 through 1999 and for an average year. Yet, the time scales on the graphics in the document vary (*e.g.*, 1993 through 1995, 1995, 1994, and 1988 through 2000). We are assuming that different time scales were used in different modeling exercises to meet different requirements in this report. Provide a description of all modeling efforts that are included in this report and specify which was used for evaluation in each section.

Pages A-35, A-36, Section V.F. 4., Restored Conditions Alternatives 6 and 12

Please refer to comments on Page A-33-34 above. If these parameters were adjusted during or after calibration, documentation is necessary.

Page A-38, Section VI.A, Hydrology and Hydraulics Modeling for Flooding, Existing Condition

Please clarify the following statement:

> *It is generally considered that depth of the overland flow is very small and the influence of the overland flow boundary will mainly be limited to adjacent cells.*

The northern and eastern boundaries of the model domain include Corkscrew Swamp Sanctuaries and Big Cypress National Preserve, which are areas where water depth and overland flow are significant components of the hydrologic cycle.

Page A-38, Section VI.G, Modeling Results for Restoration

Model results for some or all of the seven well sites on the Ten Thousand Islands NWR should be included, in addition to the 32 wells modeled in Figures A-47 through A-78.

Page A-39, Section VI.A., Hydrology and Hydraulics Modeling for Flooding, Existing Condition

The first paragraph on page A-39 states:

…an accurate representation of the topography at the modeled grid level may not have been attained due to the 1500-foot by 1500-foot grid cell discretization…procurement of more detailed topographic data input is recommended to verify the final plan during the detailed design stage of the project.

We concur that accurate topographic data are essential and should be incorporated when available. However, this may result in the need for recalibration of the model and could potentially change the predicted hydrological effects. If this is done, we recommend that project modeling be updated to confirm and recalculate the project benefits to ensure that existing legal sources have been protected, and update the calculation of water made available by the project and subject to state reservations.

Page A-40, Section VI A. 1.b., Rainfall

We are concerned that the spatial distributions of rainfall for the 10-year, 25-year, and 100-year return periods for the BCB model depicted in Figures A-85 through A-87 are an over-estimation of extreme rainfall that is not observed in the historical record. Please explain how there could be uniform rainfall of the same return period at every station in the model domain at the same time. The assumption that the temporal distribution is the same for each station over the same 5 days seems incorrect because it implies that there is no forward movement of the storm towards and away from the project area. These factors contribute to an over-estimation of run-off because infiltration is exceeded simultaneously at all locations, resulting in significant over-estimation of necessary conveyance capacity. Please explain why the historical rainfall record is not sufficient for evaluating and assessing flood control objectives. During the 1988-2000 period, two tropical storms were recorded, a 1-in-10 and 1-in-25-year events. This period also included a wet season which has been described as one of the wettest on record. Please include graphics for the monitoring locations in NGGE and SGGE with the same analysis window (100-year storm) as the "Real Estate Takings Analysis" to assist in assessing potential impacts, such as excessive water depths and hydroperiods in NGGE and SGGE.

Page A-41, Section VI.A.1.c., Antecedent Moisture Conditions

Provide documentation on the selection of June 1993 through July 1995 as representative of average meteorological conditions.

The section describing antecedent moisture conditions is not clear. Please explain why extremely wet conditions were used as an antecedent moisture condition. It seems like several different modeling efforts are described in the report with different periods of simulation and assumptions. Please also distinguish which simulations and evaluations used this antecedent moisture condition.

Page A-42, Section VI.A.3., Calibration, Verification, and Validation

The documentation of the calibration results is inadequate; it does not provide the information reviewers need to determine if the model is accurately simulating physical

conditions. The report states that 57 groundwater monitoring stations, 26 river/canal staff gauges and 5 flow gauges were used in model calibration. Calibration results for all stations should be referenced or included. Also, the report states that the model was verified and validated by comparing two tropical storm events. This model is being used to quantify restoration benefits during all meteorological conditions. Explain why verifying the model only for large storm events is adequate. Also provide a clearer description confirming whether the statistics in Tables A-11 and A-12 represent calibration and verification of the BCB for tropical storms Jerry and Harvey or for the 1995-1999 period of simulation.

Page A-45, Section VI.B.3., Project Features for Alternatives

Change the wording from "the primary features of environmental restoration are the pump stations and spreader channels" to "the primary features of environmental restoration are the canal plugs and removal of roads augmented by the pump stations and spreader channels."

Page A-50, Section VI.B.3.b.vi., Alternative 6, Removal of Existing Structures

Descriptions of Alternative 6 elsewhere in the document do not describe the removal of the Miller-2, FU-3, and Lucky Lake structures as indicated on page A-36. This particular description states that it would "remove existing Miller-1, FU-2, and Merritt-1 structures." The text should clarify which section contains the correct assumptions with respect to removed structures and verify that the modeling, analysis, and graphics presented in DPIR are consistent with the guidance from PDT during the plan formulation process. The operational criteria for the structures simulated in all alternatives should be provided. If the wrong structures were removed in the model, the ranking of alternatives needs to be reevaluated.

Page A-55, Section VI.C.2.a., Alternative 6, With Project Condition

We recommend a description be provided showing which aspects of the figures noted support the conclusion that Alternative 6 will adversely affect the existing flood condition north of the project area. If possible, provide relative difference maps which include a "no difference classification" based on the accuracy and precision of the model.

Page A-55, Section VI C.2.a., Alternative 6, With Project Conditions

Figures A-89A and Figure A-90 show chainages located upstream of FU-3 and Miller-2, as well as I-75 in NGGE on the Faka Union and Miller canals, respectively. For both of these canals, a 2.0 ft. increase is observed in the Alternative 6 canal stage over the existing. If Miller-2, FU-3 and Lucky Lake are simulated in Alternative 6, verification of the operational criteria for these structures should be provided. Additionally, the PIR should verify whether the weir crest elevation for Miller-2 and FU-3 structures is 6.2 ft NGVD29 and the open/close wet and dry season criteria are 6.7/6.2 and 7.2/6.45 (NGVD29), respectively. We recommend verification that the flood plain and drain codes simulated in Alternative 3D are the same as in the Alternative 6 simulation downstream of the structures. Discrepancies

between alternatives or errors in modeled structures could potentially result in a different ranking of alternatives.

Section VII, Draft Water Control Plan

General Comments

We recognize the difficulty associated with designing an operational plan from hydrologic models for the purpose of ecosystem restoration. However, the draft operational plan in this report is difficult to evaluate and does not appear to reflect operations developed for the purposes of environmental restoration. We offer the following recommendations to help improve the draft plan:

- Consolidate all drafts into one official document (the Service has received updated plans);
- Clarify which vertical datum was used an ensure accurate conversions were incorporated in the modeled input;
- Use the selected vertical datum and measurement system consistently throughout the report;
- Modify the operational criteria to create a gradual time/volume-step up and down that mimics the natural system fluctuations that occur between the wet and dry seasons;
- Design the minimum pump intake water at elevations that would prevent potential over-drainage of fish and wildlife habitats in NGGE and further upstream;
- Include a series of iterative field tests as part of the operational testing and monitoring phase;
- Incorporate a restoration-based operations system, such as a rainfall driven operational system for NGGE and SGGE;
- Provide a description of how monitoring locations for different habitat types will be used to assess operational success;
- Describe how adaptive management will be incorporated;
- Include documentation of the canal design optimums and the rationale for their selection;
- Check the conditional logic statements to ensure that they allow the pumps to turn off;
- Include a map depicting trigger locations noted in Tables A-18 through A-20; and,
- Provide documentation of the selected trigger locations.

Since the completion of the draft PIR, modeling has been initiated to refine and optimize the operational plan. It is imperative that the operational plan in the final draft be updated to reflect the results since the operational plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan, and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics should be updated in the final report to ensure consistency between project modeling and project assurances.

Specific Comments (Section VII, Draft Water Control Plan)
Page A-59, Section VII.A.1, Development of the Project Operations Manuals

The +/- 0.2 ft flexibility noted as necessary for the operational criteria shown in Tables A-18 through A-20 should be specified more clearly with respect to the frequency and duration of deviations. If this information can not be provided based on modeling or hydraulic analyses already completed, then the basis for the proposed deviation should be evaluated as an element of the field tests proposed during the Operational Testing and Monitoring Phase.

Page A-60, Section VII.A.4, Hurricane or Tropical Storm Regulations

Operational criteria associated with hurricanes, tropical storms, and droughts should be clearly documented in the Draft Operations Manual and included in the modeling. The documentation should include the sequence of steps returning back to normal operations.

Page A-63, Section VII.B.2.b, Alternative 3D Constraints-Storm Events

A large portion of the effective conveyance capacity of the SGGE canal system has been replaced by an overland flow path. This suggests that the tailwater conditions at FU-1 should no longer act as a constraint on pump capacity. Please clarify this apparent contradiction.

Page A-64, Section VII.B.3, Alternative 3D Overall Plan for Water Control

The draft PIR statement that waters routed from NGGE through the Miller, Faka Union and Merritt Canals will discharge at the southern extent of the Project through FU-1 concerns us. This appears to conflict with the goals and objectives of the project, which are to eliminate or reduce these point source flows. Further clarification is necessary regarding the statement that operations of the existing structure FU-1 and the newly constructed pump stations will be coordinated for flood control purposes. It is suggested that reference to FU-1 be removed or operational criteria for FU-1 supported by modeling or hydraulic analysis completed be added to Tables A-18 through A-20.

We recommend the PIR provide a reference to the section that documents how the conveyance capacities of the Miller, Faka Union and Merritt Canals system were analyzed to determine the optimal canal elevation. We suggest the canal optimums be presented in tabular format for easy reference.

Page A-65, Section VII.B.4, Alternative 3D-Standing Instruction to Operators

The language “optimum elevations in the plan shall be followed” and the supporting analysis should be referenced to the section of the PIR in which they are found.

Page A-65, Section VII.B.5, Alternative 3D-Pump Operations

The text and Tables A-18 through A-20 for the operations do not appear to match figures reported elsewhere in the appendix or in the Operation Schedule of Water Control Structures, dated January 2000. The "savings and takings" modeling results of Miller and Faka Union Canals for Alt 3D and Alt 12 have dry season stages of 7.2 ft NAVD88 or 8.5 ft NGVD29. The dry season criteria specified in Operation Schedule of Water Control Structures, dated January 2000, is 7.2 ft NGVD29. The 1.3-ft difference is a significant departure from the existing control for these reaches of the canals. If a vertical datum conversion error was made, the rankings of the alternatives might be incorrect. We recommend clarifying these points in the text.

Page A-66, Section VII.B.9, Alternative 3D-Fish and Wildlife

The meaning of the following should be explained: "… the SGGE Project construction will require below water table excavation for canal construction and improvement, which will improve fish habitat, especially during dry-out periods." The Service is not aware of any new canal construction or improvement that is included as part of Alternative 3D unless spreader channels or swales are considered new canals. Deep canals, channels, or ditches are not necessarily beneficial, because of the potential refugia they offer exotic fish, as well as larger piscivorous fish, which prey on more desirable forage fish during drawdown periods. Smaller forage fish are prey for wood storks and other wading birds.

Table A-1

In the row for the MIKESHE unsaturated zone module, we suggest replacement of the phrase "Richards equation/gravitational flow" with the correct governing equation used in this model. While it is true that the MIKESHE code has the capability of using the Richards equation, the most rigorous method of simulating flow in the unsaturated zone, it was not used for the Big Cypress Basin model, presumably because of computational time restraints.

Table A-11

Provide a narrative discussion of this MAE data in this table with regard to time, shape, and bias between the simulated and observed data. Some of the errors in this table are rather high for Florida; one is almost five feet. This could indicate that calibration is not as good as it should be. Provide a map showing the locations in the table so that the spatial distribution of the errors can be determined. In particular, report on whether the errors are randomly distributed, or, alternately, whether certain areas of the model more accurate than others. Since other statistics, such as root mean square error, coefficient of correlation, and Nash-Sutcliffe Efficiency, are routinely available in MIKE post processing utilities, they should be included in the

Figure A-2

The figure should include the Ten Thousand Islands NWR boundary rather than just the Collier-Seminole State Park boundary.

Figure A-3

The figure indicates that mangrove occur immediately south of US41. The habitat in that area is primarily brackish marsh.

Figures A-14 through A-18

These maps show surfaces related to the various aquifers and confining units, but are difficult to understand without units. Label the graphs with the units of measurement and specify whether the numbers represent the absolute elevations for the top or the base of the presented unit.

Figures A-19 through A-23

The spatial distributions of the hydraulic conductivities data are shown in a peculiar bull's-eye pattern. The significance of this pattern should be explained. We could not determine whether they represent karst features or are an artifact of the interpolation method, for example. The text should also provide a reference to data that supports the range of values used and an explanation of why the conductivities are aligned linearly along the Merritt Canal.

Figures A-24 through A-33

We recommend the PIR include the MIKE11 canal network on all graphics of the input parameters. If MIKE11 is used to simulate floodplains including sloughs and strands, include those on the graphics and provide a description of instability problems if any exist.

Figure A-47

It appears that the existing and future without project traces are of weekly hydrographs while the proposed project scenario traces are of daily hydrographs. The PIR should provide an explanation describing why different temporally aggregated hydrographs are necessary.

Figures A-89 through A-90S

These graphics are difficult to evaluate without reference to exact physical locations of the chainages, therefore, a location map that depicts the geographical locations of the chainages should be provided. The ground surface elevation on the graphs should also be included. A table of the structural operations as they exist in the model would be extremely useful for evaluating this section. Alternatively, the open and close criteria for the wet and dry season should be included on the graphics. Hydrographs for various chainages, or cross sections,

should be selected that allow the reader to evaluate the open and close criteria or weir crest elevations at all of the structures.

Figures A-89 through A-122

Specify whether the datum NGVD29 or NAVD88 is used. It would improve document clarity if the same vertical datum were used throughout the report. Otherwise, the PIR should provide an explanation of why two vertical datums are necessary and provide a conversion chart. We recommend the modelers verify that conversion of operational criteria between datums to be included in the model is correct. Per the operation schedule in the Big Cypress Basin Operation Schedule of Water Control Structures, dated January 2000, the crest elevation of both FU-3 and Miller 2 is 6.2 feet NGVD29. Their wet season and dry season open/close elevations are 6.7 / 6.2 and 7.2 / 6.45, respectively. In figures A-89 through A-89B, the dry season criterion for Alternative 3D is near 7.2 feet NAVD88 or 8.5 feet NGVD29. The increased dry season operational stages at these locations appear to be a significant departure from those that were previously published. If datum conversion errors exist, the ranking of alternatives may not be correct.

Appendix D, Resource Assessment

Inferences drawn from changes in plant communities between 1940 and 1995 should be conservative, and the appropriate caveats added to the text. Ground truthing of the 1995 Digital Orthophotographic Quarter Quadrangles (DOQQs) was not as thorough in the area south of US41 as it was within the SGGE. There was no ground truthing of the DOQQs east of the Faka Union Canal. Plant communities were inferred based upon soil type, as described in the 1998 Soil Survey of Collier County Area, Florida. Discrepancies between marsh and mangrove communities associated with the same soil type prompted staff of the Ten Thousand Islands NWR to delineate marsh occurring within the soil type associated with mangrove for the area west of the Faka Union Canal. This delineation was not conducted east of the Faka Union Canal, nor for the 1940 photography.

Page 3

Please explain whether the predicted plant communities were based on average hydrology simulated by MIKESHE for 1988-2000, or for 1994. We recommend the PIR include documentation of the steps required to generate the “pre-drainage” vegetation map and how MIKESHE was used.

Explain why the definition of the wet season was chosen as July 1 through October 1. We are particularly concerned that the definition in this section is different from other sections and the standard definition of wet season. This definition of the wet season omits the peak of the wet season.

Page 9, Freshwater Marsh

We believe that discussing the difficulty of reestablishing fresh water marshes from salt marshes is premature. The quality control and assurance processes, particularly ground truthing, associated with habitat identification using the 1995 DOQQs limits our ability to distinguish between freshwater and salt marsh community types. It is unknown whether or not freshwater marshes have been converted to salt marshes.

Page 14, Hammocks

We urge caution on the inferences made concerning tropical hammocks. The data used to support the inferences have not been verified for accuracy. Discrepancies in the 1940 and 1995 data were noted, but not verified.

Page 16, Coastal Wetlands and Estuaries

Discrepancies in the available information should be incorporated into this discussion. Open water areas were not mapped accurately from the 1940 data. There are several large lakes, depicted in the 1954 Soil Survey maps that do not appear on the NRCS 1940 Vegetation Community map. The Little Wood River does not appear, either.

Page 21

Provide a reference that supports the statement that average wet season water levels from July 1 through October 1 are considered to be closely related to hydroperiod. Additional analysis relating average water depth during the period from July 1 through October is necessary since the pattern of plant communities on the MIKESHE maps do not closely match those on NCRS maps.

Page 23

The PIR should explain why the MIKESHE vegetation model converts the hydric flatwoods in the existing conditions land use shown in Figure A-3 to 90% mesic communities in the existing condition output. If this is an error, restoration benefits would need to be reevaluated.

Page 46

We recommend adding the Ten Thousand Islands NWR and Collier-Seminole State Park boundaries.

Appendix H, Draft Ecological and Water Quality Monitoring Plan

General Comments

The Service is coordinating with the District, Corps, DEP, DOF, USGS, Sirenia, FWC, The Conservancy of SW Florida, and Florida Gulf Coast University (FGCU) in a significant re-write and improvement of the referenced Monitoring Plan. The revised plan will be completed in time for insertion in the final PIR/EIS.

In general, each element of this monitoring should specify targets, envelops, or thresholds as either flow or stage at known locations for the range of meteorological conditions to be experienced over the planning horizon. It would be desirable that these be qualified and quantified, and ready for use during the construction, testing, and monitoring of the operational phases noted in Appendix A.

Additional maps of vegetation transects, well sites, and fish and wildlife sampling transects or sites are currently being developed and should be included in this appendix.

Specific Comments (Appendix H, Draft Ecological and Water Quality Monitoring Plan)
Page H -1, Introduction

Please include a brief description of how the information learned will be used to improve performance measures used in the modeling, and potentially to enhance the model itself.

Page H-4, Section H.4.2., Hydrologic

Explain how the monitoring network shown in Figure H-1 can be used to determine whether or not a preferential flow path remains in the plugged canals. Explain in detail how collected information will be fed back into the operational plan.

We recommend that rain gauges be co-located at any of the stage monitoring locations proposed; and that ground water/surface water (nested well clusters) data collection be correlated to improve our understanding of the ground water/surface water interaction.

Page H -5, Section H.4.2, Hydrologic

Restoration is defined as the pre-development condition of the uplands and wetlands. Please clarify whether this is a hydrological or an ecological target.

Page H-12, Section H.4.5.1.A ,West Indian Manatee

The aerial distribution and strip-transect surveys were funded by the Ten Thousand Islands NWR, not the USGS Place-Based Studies.

Page H-16, Table H-2

Additional State-Listed plants that occur in the Ten Thousand Islands NWR and Collier-Seminole State Park include barbed-wire cactus, satinleaf, butterfly orchid, wild cotton, shell mound prickly pear, inkberry, bay cedar, inflated wild pine, common wild pine, twisted air plant, and giant wild pine.

Page H-26, Figure H-5

Rookery Bay National Estuarine Research Reserve has a continuous *in-situ* monitoring site in Pumpkin Bay, which should be identified.

Summary

The Service supports authorization of the SGGE Ecosystem Restoration Project to proceed to final PIR and detailed design. Although we find that the draft PIR/EIS provide a balanced and accurate description of the environmental impacts of the plan, the recommended changes contained herein are intended to allow for equal consideration of wildlife conservation with other features of the project, minimize incidental take of federally listed species, and to improve the public's understanding of the plan's anticipated ecological benefits.

We find that the Service's recommendations have, in most cases, been incorporated in this project's planning. We call your attention, however, to our specific comments on Sections 12, Appendix A, and comments on Contaminants, exotic plant management, pump size, and the Adaptive Monitoring and Assessment Plan. As detailed design proceeds, we are committed to providing expert technical assistance on the protection of threatened and endangered species and the conservation of fish and wildlife and their habitats. We see a need for further planning and coordination for the following issues:

1. O&M plan/manual development;
2. Savings Clause and Reservations requirements;
3. Monitoring and Assessment Plan;
4. Exotic Species Management Plan;
5. Hydrologic modeling;
6. Alternative development and project design;
7. Remediation of contaminated areas;
8. Project effects on public lands;
9. Protection of federal trust species and other trust resources; and,
10. Watershed changes related to storm water management and development permit.

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Comment Number	Organization / Agency	Comment	Response
USFWS-1	U.S. Fish and Wildlife Service	The Fish and Wildlife Service (Service) finds that the draft PIR/EIS present a balanced description of the Interagency Technical Committee and Project Delivery Team's (PDT's) evaluation process, and the benefits expected through implementation of the SGGE Ecosystem Restoration Project. The Service expects the tentatively selected alternative, Alternative 3D, will provide fish and wildlife resource benefits to the 86-square mile SGGE project site, adjacent public lands, and the 98-square miles of downstream coastal estuaries. It is expected that the restoration plan will restore 36,200 acres of wetlands, raise groundwater elevations in uplands, decrease the severity and frequency of wildfire, restore a hydrologic regime that supports subtropical plant species, assist in the recovery of listed species and migratory birds, and improve coastal fisheries.	Support of FWS for Alt 3D is noted. Alternative 3D is the selected plan /preferred alternative in the final PIR/EIS. Service detailed comments have largely been responded to in appropriate text paragraphs, as cited.
USFWS-2	U.S. Fish and Wildlife Service and Florida FWC	We appreciate the complexity of the hydrological models that support project alternative selection and project benefit analysis. We recognize these models as tools for reasonable approximation of project plan design effects on fish and wildlife resources. However, the Service has significant concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and application of design storm.	The Corps and the Water Management Distsrict are committed to continuing a collaborative dialog with Service staff. If the project is approved and authorized by Congress, we expect to continue to collaborate with Service staff during the Detailed Design phase. While we believe we understand your concerns, we cannot conduct further modeling during the PIR phase due to time and budgetary limitations.
USFWS-3	U.S. Fish and Wildlife Service and Florida FWC	Our consistent participation in project development and analysis as members of the PDT since 1997 reinforces our belief that all reasonable, cost-effective alternatives have been considered. However, we are also cognizant of the limitations posed by extensive assessment requirements under severe time constraints. This project alternative development and assessment is only the initial step in developing a final design that integrates construction infrastructure with operations management and adaptive monitoring and assessment.	We concur that development of the selected plan and refinement of design features, as well as additional data collection to support the design, will occur during the detailed design phase of the project, if authorized.
USFWS-4	U.S. Fish and Wildlife Service	The principal focus of our comments is additional project design development that will: (1) de-emphasize engineered structure reliance, particularly the size of the pumps; (2) refine hydrological models; (3) develop an operations management plan that emphasizes operations for restoration over flood control; (4) finalize a modified Adaptive Assessment and Monitoring plan; (5) provide a complete analysis to ensure compliance with the Savings Clause and to identify water made available by the project to be reserved under Florida law (6) develop an estuarine mixing model; (7) document extensive changes in the watershed that have resulted from explosive development and water management, and determine whether these changes have been considered; (8) remediate contaminated areas and address contaminants in areas outside of the project but affected by the project; and (9) address all effects to adjacent public lands. We have not included editorial comments except in those cases where we believed the reader's understanding would be significantly improved.	We agree to consider your comments. Since the Service provided a Draft Coordination Act Report, model and design refinements have occurred, the draft ecological monitoring plan has been revised, an operational plan draft has been prepared and many sections on biologic resources have been amplified or revised by incorporation of information provided by your agency. However, we cannot commit to implementing the following recommendations contained in this comment: (1) Estuarine modeling is not anticipated (the estuarine zone is beyond the scope of the models; hydrodynamics are tidally influenced and bathymetric information is not available); (2) watershed changes will be considered, but only as they influence model outputs. Furthermore, we cannot address all effects to all adjacent public lands, especially adjacent tidal lands (the Ten Thousand Islands NWF or the outer ENP lands), because as noted above our models do not reach that far and development of a tidal model is beyond the scope and budget of this project.

Comment Number	Organization / Agency	Comment	Response
USFWS-5	U.S. Fish and Wildlife Service	Appendix D includes the draft Fish and Wildlife Coordination Act Report (FWCAR) for the tentatively selected plan. This report was prepared in January 2004 at the request of the Corps in order to meet accelerated deadlines for preparation of the draft PIR/EIS for the project. Due to subsequent project report preparation delays, substantial portions (including the Operation Management Plan, Section 12-Assurances, and some hydrologic model information) of the draft PIR/EIS were not available for Service review at the time of the draft FWCAR preparation. The draft FWCAR will be modified and re-submitted to the Corps prior to the final PIR/EIS and subsequent to these comments under the National Environmental Policy Act.	Comment Noted
USFWS-6	U.S. Fish and Wildlife Service and Florida FWC	Throughout the text there are frequent references to the actions or decisions of the PDT. While the PDT did assess the majority of the project, it should be noted that specific hydrologic modeling and analysis, flood analysis, Level of Service considerations, some alternatives development, development of the operations management plan, and cost considerations were not products of the PDT process, but were the result of decisions made by one or both of the project sponsors. The document should be edited to reflect these considerations so that government agency comments on the PIR do not appear to conflict with perceived actions of government agency representatives who were PDT members.	Technically speaking, the PDT is the Federal Action agency and the non-Federa sponsor, plus other Federal and State agencies that are stakeholders by law or regulation. The public and representatives of non government agencies have always been welcome at PDT meetings, but are not technically part of the decision making group. The ecosystem techncial sub-group and the modeling technical group met frequently over the past months, both before and after public coordination of the draft PIR/EIS. FWS chaired the ecosystem sub-team, and its contributions to the benefits evaluations and basic resource information are gratefully acknowledged. Decisions regarding alternatives to carry forward for final analysis, cost-benefit calculations, and identification of the tentatively selected plan, are all functions of the Corps and the non-Federal sponsor. Identification of the tentatively selected plan (TSP) was communicated to DOI agencies through the Fish and Wildlife Service, and to other State agencies through the WMD.
USFWS-7	U.S. Fish and Wildlife Service	Summary. Page vii . The Ten Thousand Islands National Wildlife Refuge (NWR) should be included in the calculation of hydrology habitat units and biotic habitat units. See comments in Section 6 for more details.	The model does not extend into tidally influenced waters,and if it did it would not account for tidal fluctuations. Benefits to oyster communities are estimated using predictions of average salinity in upper (inner) estuaries, using flows at cross-sections of feeder creeks. It is not possible to estimate benefits over the entire TTI National Wildlife Refuge. Common sense would suggest they are not highly significant. The total amount of water added to the outer system would not change but the points of delivery would spread out. Although we are certain tha the overall effect would be positive, it cannot be quantified.
USFWS-8	U.S. Fish and Wildlife Service and Florida FWC	Section 1, Study Purpose and Need. Figures 1-1, 1-2, 1-3, and 1-5 should be reconciled to indicate: 1) overlap of Picayune Strand State Forest with the South Belle Meade Area; and 2) overlap of Ten Thousand Islands Estuary with the Ten Thousand Islands National Wildlife Refuge/Aquatic Preserve/and National Estuarine Research Reserve. Text descriptions of the Planning, Project, and Study Areas are not well reconciled with the map and map keys. The Project Area Description in Section 1.4.4 and Figure 1-5 describes affected areas but does not include portions of Fakahatchee Strand south of the SGGE Conservation and Recreational Lands (CARL) boundary. Since this area is affected by the project, this area should have been modeled and included in the project effects. Figure 1-4 should be improved to more accurately represent the boundaries for the various land management units.	Some language has been added in the Introduction to clarify nomenclature and federal/state jurisdiction in these overlapping areas, but for purposes of public coordination it is simpler and clearer to refer to the "Ten Thousand Islands Region."

Comment Number	Organization / Agency	Comment	Response
USFWS-9	U.S. Fish and Wildlife Service and Florida FWC	Page 2-7, Section 2.5, Fish and Wildlife Resources. The Service recommends this section be expanded. The fish and wildlife resources of the project area reflect the distinctive biogeography of the region and should be further described in this PIR/EIS in order to demonstrate both the uniqueness and vulnerability of project resources. The SGGE project is unique in its location in a subtropical climate subject to intense seasonal rainfall and occasional catastrophic events like hurricanes. Plant communities have been established in recent geological times in frequently flooded nutrient-poor coral, marl, and sand substrates. The project's location on the South Florida peninsula subjects the flora and fauna to natural invasion and migration of plants and animals from the West Indies and has elements of flora and fauna that have evolved after isolation from populations in western states during post glacial periods. The project area is also located within and upstream of the largest mangrove swamp in North America.	Again, the aim of the authors was to provide an analytic rather than an encyclopedic discussion of fish and wildlife resources. In revising the draft PIR/EIS we frankly looked for opportunities to reduce its bulk, rather than adding to it. Although the information provided in this paragraph is interesting, it is not necessarily more relevant to the existing conditons/problems and opportunities discussion than that already provided in the text. Your information is reproduced here and in the Coordination Act Report, but will not be added to the text.
USFWS-10	U.S. Fish and Wildlife Service	Section 2.3, Plant Communities. There are several inconsistencies which should be resolved in this section, including: · Page 2-1: There is a different definition of the Project Area here than on page 1-14. · Page 2-3: Saltmarsh is listed as a dominant ecological community, but freshwater marsh is so-listed on page 1-13. The marsh south of US41 is accurately described as brackish marsh. · Table 2-1: does not identify Coastal Wetlands and Estuaries, which are discussed later in Section 2.3.6.	Project area definition has been checked for consistency throughout. The term "brackish marsh" will be used. Coastal Wetlands will be added to the referenced Table.
USFWS-11	U.S. Fish and Wildlife Service	Page 2-8, Section 2.6, Threatened and Endangered Species. The Service recommends expansion of this section to include more technical information on the historic or pre-drainage status of listed species. In particular, the status of the West Indian manatee should be revised to describe it as a native species rather than a recent arrival as implied by the context of the text in the PIR/EIS. The location of the largest wood stork colony in North America at Audubon's nearby Corkscrew Swamp Sanctuary should be documented in the text to provide context for later discussions of the importance of restoring the project's short-hydroperiod wetlands which are utilized as forage habitat by the wood stork. The Service recommends that the Corps use of the South Florida Multi-Species Recovery Plan, biological opinions, individual listed species recovery plans, and available literature citations in these documents as information sources. The Service will assist in the compilation of this text.	The section has been somewhat expanded. However, in keeping with Corps planning regulations and NEPA regulations issued by CEQ, we have tried to keep the discussion in the main report brief and relevant to existing conditions and recovery targets in the project area. This is consistent with our need to maintain the PIR/EIS as an analytical planning document. Additional information is provided in FWS Coordination Act Reports and in the Biological Assessment. Specific information on Corkscrew Swamp Sanctuary and more information on the West Indian Manatee have been incorporated. Some of this information comes from materials provided by FWS during a meeting held at the FWS South Florida Ecosystem office on Aug. 5, 2004, and some comes from internet and other sources. We acknowledge your assistance in identifying sources.
USFWS-12	U.S. Fish and Wildlife Service and Florida FWC	Page 2-11, Section 2.6.9, Endangered Plants. This section should be revised to show the status of those endangered plants that are expected to occur in the project area based on known habitat, distribution, and ecology of the SGGE pre-development landscape.	The recommended information is provided in the Environmental Appendix. Information is provided on known species, not on historic ranges. One of the problems with providing too much detail on occurrences of endangered plants is that it may provide information to "collectors," as has occurred in the past. Critical habitat has not been determined for many rare plants, specifically to avoid the risk of over-collection.

Comment Number	Organization / Agency	Comment	Response
USFWS-13	U.S. Fish and Wildlife Service and Florida FWC	Page 2-11, Section 2.6.10, Essential Fish Habitat . This section should be revised to indicate what elements of Essential Fish Habitat potentially existed in a pre-drainage condition based on available studies and historic descriptions of Gulf of Mexico fisheries. Text from Section 2.11 (Estuarine Resources) should be incorporated and cross-referenced.	"Essential Fish Habitat" is a term used in a specific way pursuant to The Magnuson-Stevens Fisheries Conservation and Management Act. EFH is defined in each fisheries region by NOAA, Fisheries. The law's intention is discussed in the PIR chapter on Environmental Compliance. This is a specific requirement administered by NOAA fisheries, which has indicated its concurrence with the information presented in the text.
USFWS-14	U.S. Fish and Wildlife Service	Page 2-13, Section 2.9, Climate. This section should be expanded to show historical freeze, drought, flood, or hurricane occurrences which affected the project environment.	At this time no additional information has been provided. Historic climate data from the region is surprisingly sparse and incomplete.
USFWS-15	U.S. Fish and Wildlife Service	Page 2-13, Section 2.10, Hydrology. This section should be revised consistent with our comments for Section 3.10, Existing Condition Hydrology, and Section 3.10.3, Water Management, on pages 3-19 and 3-22, as well as our comments on documenting existing wetlands in NGGE under Section 3.3, Plant Communities, on Page 3-2.	Time does not permit expansion or discussion of NGGE wetlands. It is the project designers' intention that no adverse effects on NGGE wetlands be caused by the project. Since these wetlands are not within the project area it is uncertain to us what purpose would be served by analyzing them in depth. We note that the NGGE area is undergoing some development. Wetlands outside the project area would be regulated under the 404 process.
USFWS-16	U.S. Fish and Wildlife Service	Page 3-1, Section 3.1, Introduction. This section describes the existing condition consisten with the Comprehensive Everglades Restoration Plan (CERP) as of the year 2000. In subsequent sections of the PIR/EIS, existing condition appears to be updated to 2003. The existing condition year should be consistent across all analyses and descriptions. We recommend 2003 or more recently, given the issuance of a significant number of permits that resulted in loss of fish and wildlife and water resources in the project watershed between 2000 and now. See our comments on page 12-8, Section 12.2.3.	Concur. Text will be revised to show that the planner's "existing condition" is supposed to be the date of approval of the 2000 Water Resources Development Act (WRDA 2000). This analysis can be updated during the detailed design phase of the project, for time does not permit such an analysis (2000-2003, outside of project area) now.
USFWS-17	U.S. Fish and Wildlife Service	Page 3-1, Section 3.2, General Environmental Setting. This section should be clarified. The notation “north of the Ten Thousand Islands NWR” should be replace the appropriate text in “...marine preserves and refuges that constitute the Ten Thousand Islands Region...”. Also, there are 6 major embayments as shown in Figure 3-2. Thus, Palm Bay and Buttonwood Bay should be added to the list and Blackwater River should be changed to Blackwater Bay.	Concur. Text has been changed in the report Introduction to introduce the formal nomenclature of all the Reserves, Parks, Refuges and other public lands that collectively constitute the Ten Thousand Islands Region.
USFWS-18	U.S. Fish and Wildlife Service and Florida FWC	Page 3-2, Section 3.3, Plant Communities. This section and Table 3.2 should include actual, as well as percentages of acreages of plant community changes in 1940 vs. 1995. Year 1995 plant communities and plant community acreage and percentage of habitat predicted by hydrologic models for year 2000 should be included in Table 3.2 so that model predictions for expected habitat versus actual habitat analysis can be prepared to determine model prediction accuracy. This section should also contain information on exotic plant species, including their ecology and distribution in the project area. The Service strongly recommends, and has recommended throughout the project development process, that this document include a discussion of the existing wetlands in NGGE. This is extremely important for three reasons: (1) there is an extensive history of controversy over jurisdiction, location, protection, and mitigation for wetlands in NGGE involving the Corp’s Clean Water Act section 404 permitting program; (2) as development increases in NGGE, there will be continued misconception that seasonally-inundated wetlands are actually flood	There is no time to do all of the analyses and calculations recommended by the service for the PIR/FEIS. We can commit to re-visiting the status of NGGE wetlands during detailed design, should the project be approved and authorized. During the PED phase we will also have better data on topography, groundwater fluctuations and plant community coverage than at present.

Comment Number	Organization / Agency	Comment	Response
USFWS-18 Conclusion		(3) given a false perception that these NGGE areas are flooded as opposed to naturally occurring wetlands, there will be public perception that the SGGE project is responsible. Public pressure to change the Operations Management Plan to accommodate flood control in NGGE would likely affect project benefits for fish and wildlife resources. In our comments on Section 5, Problems, Opportunities, and Objectives, we reiterate this recommendation. It should be noted that this information (Collier County vegetation mapping and hydric soils) has been provided to the Corps on at least two separate occasions while the issue was under discussion by the PDT.	See above cell for Corps Response
USFWS-19	U.S. Fish and Wildlife Service	Page 3-10, Section 3.6, Threatened and Endangered Species. This section should provide more detailed information on the existing status of listed species in the project area. The Service is assisting the Corps in the preparation of a Biological. Our draft FWCAR provides additional references for this section.	The Threatened and Endanagered species information in Ch. 3 has been updated. The Corps and WMD acknowledge information provided by Service staff.
USFWS-20	U.S. Fish and Wildlife Service	Page 3-13, Section 3.6.4, Florida Panther. Statements regarding the presence of this species appear to be conflicting in the text. This section should be revised to indicate that panther use of the project area has been verified.	The text of Ch. 3 has been so modified. Service and USGS biologists provided a map showing telemetry data for the entire region. While panther use of SGGE under its existing condition is not as extensive as panther use of adjoining, less disturbed public lands, there is still ample evidence from radio-collared animals that they regularly utilize and transit through the project lands.
USFWS-21	U.S. Fish and Wildlife Service	Page 3-17, Section 3.6.11, Essential Fish Habitat. This section should describe the components, authorization, and determination process for the Essential Fish Habitat designation, as many reviewers may not be familiar with this designation.	Please reference the Compliance Chaper for a discussion of the meaning of EFH. NOAA fisheries indicated its concurrence with the PIR/EIS determination of no adverse effects.
USFWS-22	U.S. Fish and Wildlife Service and Florida FWC	Page 3-18, Section 3.7.2, Soils. This section would benefit from a discussion of the seasonal oxidation process and effects of frequent fires under natural conditions on the thin layer of detritus that forms in shallow or short hydroperiod wetlands in sub-tropical Florida. These processes naturally oxidize organic deposits, leaving only staining or spodic layers in the soil horizon as evidence of hydrology. “Muck” layers are not typical of short-hydroperiod wetlands of recent geological age in areas of seasonal drawdown with frequent fire.	The existing analysis was deemed adequate by NRCS soils experts. It should also be noted that the primary author of the soils section is a former NRCS District Conservationist. Since no or minimal changes to existing soils are expected under the recommended plan, the absence of muck is not considered a topic worthy of extensive discussion.
USFWS-23	U.S. Fish and Wildlife Service and Florida FWC	Page 3-19, Section 3.9, Climate. This section appears to address changes in hydrology, not climate, and should be revised to address temperature, wind, and precipitation. The effects of climate on the existing drained habitat condition would include loss of sub-tropical plant species from fire and freeze, and potential loss of trees from high winds resulting from vulnerabilities due to soil oxidation or forest structure (thinning from fire and disease).	Service comments on the effects of lowered water table on microclimate are noted.

Comment Number	Organization / Agency	Comment	Response
USFWS-24	U.S. Fish and Wildlife Service and Florida FWC	Page 3-19, Section 3.10, Water Supply, Water Quality, Water Management. This section should include an analysis of recent and extensive changes in stormwater management, water use, and water quality associated with the issuance of nation-wide and individual Clean Water Act section 404 permits by the Corps and Environ-mental Resource Permits by the South Florida Water Management District (District) and the DEP. The Service provided information on recent significant projects to the District and the Corps during the PIR and hydrologic model development processes, and as cooperators with the EPA in the EIS for the Corps Regulatory Process in southwest Florida. Additional information on watershed alteration is available from the Lower West Coast Water Supply Plan, the South Lee County Watershed Plan, the Estero Bay Watershed Plan, the Big Cypress Basin Watershed Plan, and the Southwest Florida Feasibility Study.This section should be revised to include recent and significant hydrological changes to the upper watershed and areas downstream of the project.**See next two rows for continuation.**	Do not concur with this recommendation. The Corps recently finalized a Regulatory Environmental Impact Statement for Southwest Florida. The project under consideration is an environmental restoration project. It would be a digression from the primary purpose of the Picayune Strand Restoration study to re-evaluate the entire history of 404 permits in southwest florida, and it would not be in keeping with the CERP Restudy or other CERP reports prepared to date.
USFWS-24 Continuation		The project receives water from: 1) swale and canal discharges at low Levels of Service in a rapidly developing but low density NGGE residential area; and 2) dis-charges from significant agriculture areas to the north of Panther NWR and Faka-hatchee Strand. Changes to the Big Cypress Watershed that have resulted in diversion of water to the Imperial and Cocohatchee Watersheds from the Estero Bay Watershed and the Corkscrew Regional Ecosystem Watershed (CREW) areas should be detailed. Reference to watershed flow changes as detailed in the South Lee County Watershed Plan should be discussed with reference to this project and adjacent Fakahatchee Strand. The PIR should address recent changes in storm-water management associated with the canals adjacent to Bird Rookery Swamp, Immokalee Road, Cypress Canal, the four-laning of I-75, management measures at the Lucky Lake weir south of the Panther NWR, problems with water flow under U.S. 41 to the south of the project, agricultural areas north of Panther NWR that discharge through the Refuge to the project site, and influences of the	See above cell for Corps Response
USFWS-24 Conclusion		significantly diked agricultural area that occurs southwest of the project in the Belle Meade portion of Picayune Strand State Forest. We believe any discussion of existing and future hydrologic conditions that do not include an analysis of off-site areas where significant project features would be constructed, omits important information from the analysis. In particular, levee construction associated with the project condition at the agricultural area and Port of the Islands sub-division should affect the hydrology of these areas as discussed in the Pre-drainage, Existing, and Without Project Hydrology sections.	See above cell for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-25	U.S. Fish and Wildlife Service and Florida FWC	Page 3-20 and 3-27, Sections 3.10.1 and 3.12.2, Water Supply and Water Demand. These sections should indicate actual (as well as permitted) water use of the City of Naples well field and detail conditions which lead to reported residential well failure and canal drawdown in the vicinity of this well field under recent drought conditions. Limitations on future expansion of this well field, as discussed by the PDT, should be identified. The NGGE well field is mentioned on page 3-27. The report should identify the area that is supplied or influenced by this well field and if project water is affected by this well field. Water shortage areas and areas with salinity problems, as mentioned on page 3-27, should be identified and the project effect on these areas, if any, should be discussed in the text. This section should estimate existing and potential self-supply for the 101-square mile area of NGGE. This section should include a discussion of the permitted water use for agriculture north of Panther NWR and in the Belle Meade area and its influence, if any, on this project. **See nex**	Do not concur. The information present in this section on the City of Naples and other well fields in NGGE were based on best available information. The potential threats to the aquifer(s) due to operations of permitted users is outside of the authority for the scope of this study. Discussions of such topics as: future self-supply of the NGGE community; options for the City of Naples, and influence of agricultural activity on lands north of the Panther NWR are topics for the Southwest Florida Feasibility Study and will not be further pursued here.
USFWS-25 Conclusion		This information is necessary to evaluate the Savings Clause and Reservations determinations, and the Operations Management Plan. Understanding the effects of these water demands are particularly important for dry season water deliveries to the project and downstream estuaries. The water demands of the Port of the Islands community well field should be identified.	See above cell for Corps Response
USFWS-26	U.S. Fish and Wildlife Service	Page 3-21, Section 3.10.2, Water Quality. Rookery Bay National Estuarine Research Reserve collects continuous data in Blackwater and Pumpkin Bays, and should be recognized in the text.	Concur. Rookery bay data is mentioned in the Estuarine benefits section in the Environmental Appendix, and again in the Monitoring Plan.
USFWS-27	U.S. Fish and Wildlife Service	Page 3-24, Section 3.11, Estuarine Resources. The dates and a brief synopsis of the Marco Island and adjacent (Deltona Corporation) development should be expanded upon in this section due to the cumulative effects these very large projects would have on the project area's estuarine resources (in particular, manatees, seagrasses, and mangroves). This section should include a detailed discussion of the condition (location, size, depth) and history of construction of the Faka Union Canal below U.S. 41. There is some confusion as to whether this canal was permitted by the Corps. This canal severed estuarine creeks and the original Faka Union River upon construction. As a result, the effects associated with this canal include salinity changes in the marsh and mangrove systems on the adjacent Ter Thousand Islands NWR. This canal, its condition, and its fresh water transport, influence manatee distribution and behavior. This section would benefit by addition of a discussion o recreational and commercial fisheries resources in the area.	Do not concur. There is adequate discussion of the Marco Island development. This development began in the early 1960's and its effects are part of the existing condition. This is an issue peripheral to the project. Research to date indicates the Faka Union canal is of private construction. There are no Corps features in the project area. Again, adding these and other details will not add significantly to the main story of the report. Because benefits can not be quantified in the outer estuaries, and may not be highly significant in comparison to the benefits expected on project lands and upper (inner) estuaries, no amplification of the existing discussion has been made.

Comment Number	Organization / Agency	Comment	Response
USFWS-28	U.S. Fish and Wildlife Service	Page 3-28, Section 3.14, Hazardous, Toxic, and Radioactive Wastes (HTRW) Findings of the HTRW (Existing Condition) section are consistent with an Environmental Risk Assessment (ERA) completed on September 30, 2003, regarding soil contamination at SGGE. The Service identified several miscalculations, errors, and identified other unresolved issues in the ERA and submitted corrective recommendations to the District by letter dated March 23, 2004. The District and URS are currently in the process of addressing Service concerns regarding the ERA and the outcome of recommended corrections could change the results of the ERA. At this time, outstanding concerns and accompanying recommendations are as follows: (the full list of concerns can be found in the full copy of the USFWS letter, reproduced in Appendix of this PIR.)	Response: SFWMD will continue to work with Service staff to resolve discrepancies in the reports and develop the remediation plan. A cost estimate for remediation has been developed and is included in the overall project cost estimate as non-Federal costs (not cost-shared). Lands must be free of all contaminants prior to being conveyed to the Federal sponsor for construction.
USFWS-29	U.S. Fish and Wildlife Service and Florida FWC	Page 3-33, Section 3.16, Recreation. This section should identify the year that the Florida Division of Forestry (DOF) began management activities related to recreation in the SGGE portion of Picayune Strand State Forest, as well as those management activities listed in the Interim Management Plan Agreement between DOF, DEP, and DOI. This date is important as extensive recreational uses, particularly illegal OHV use, and hunting occurred prior to DOF management. ATV use is not currently under management by the DOF as it is a prohibited activity in most State forests. Hunting is currently being considered as a managed use in the forest. This section should reference DOI and DEP oversight of the mentioned Ten Year Management Plan consistent with previously adopted Interim Management Plans, protocol agreements, and Farm Bill 3. Types of recreational uses on the adjacent Fakahatchee Strand State Reserve should be outlined in this section to depict the full range of recreation in the project area, especially since the main access to the SGGE project from the southeast will be through Fakahatchee Strand.	Do not concur that previous or current recreational activities, especially unsanctioned or unpermitted activities, are relevant to the proposed project and management plan. The proposed Federal project, if authorized, will include safeguards for wildlife and threatened and endangered species, as part of the Recommendations and Assurances. The Corps of Engineers would not recommend, and Congress would not authorize, a Federal project that visualized or sanctioned continuation of illegal or unpermitted activities in lands acquired for restoration purposes.
USFWS-30	U.S. Fish and Wildlife Service and Florida FWC	Section 4, Future Without Project. Page 4-10, Section 4.6.4, Florida Panther. Although there are examples of panther/human encounters associated with the presence of prey in NGGE, there is no evidence that a partial percentage of this type of residential developmen would increase wild prey to the extent that panther/human encounters would increase. This discussion should be deleted.	Concur. Section has been removed.
USFWS-31	U.S. Fish and Wildlife Service and Florida FWC	Page 4-11, Section 4.6.7, Snail Kite. The “no action” phrase should be replaced with “without project”.	"No Action" is a NEPA term that is generally equivalent, for Corps planning documents, to the "future without project". It is understood that "no action" means no Federal project is built.

Comment Number	Organization / Agency	Comment	Response
USFWS-32	U.S. Fish and Wildlife Service	Page 4-11, Section 4.6.8, West Indian Manatee. The last sentence in this discussion addresses critical habitat and boat-related mortality concurrently. This is excerpted from the Service's draft FWCAR report in Appendix D and will be modified as follows: "Effects to critical habitat such as seagrasses would be difficult to quantify due to the lack of a monitoring program and an estuarine mixing model. Changes in manatee distribution or use of the marina basin as a warmwater refuge that might result from changes in stormwater management in the upper watershed may expose manatees to additional cold stress, or boat-related mortality or injury; depending on changes in manatee behavior or distribution."	New language has been incoroporated into Section 4.6.8.
USFWS-33	U.S. Fish and Wildlife Service and Florida FWC	Page 4-12, Section 4.6.9, Wood Stork This section should reference the potential for additional declines in wood stork productivity at Audubon's Corkscrew Sanctuary wood stork rookery. We are specifically interested in declines that may directly or indirectly result from additional development and associated wetland impacts.	Language has been added to reflect Service belief that future development might potentially further stress the Corkscrew swamp nesting population's reproductive success.
USFWS-34	U.S. Fish and Wildlife Service	Page 4-13, Section 4.9, Climate. The text should discuss trends in sea level change, particularly the rate of relative rise and the anticipated effects on storm (wind and surge) frequency and magnitude, saline intrusions, and plant and animal conservation. We recommend citing evidence that the northern encroachment of mangroves into the brackish marshes may, in part, be attributable to sea level rise.	Concur; CERP sea level rise CGM is cited.
USFWS-35	U.S. Fish and Wildlife Service and Florida FWC	Pages 4-13 to 4-15, Sections 4.10, 4.10.1, 4.10.2, and 4.10.3, Water Supply, Water Quality and Water Management. These sections should be modified to include potential effects of additional development in NGGE on the SGGE project.	Do not concur. Much of the drainage of NGGE moves toward the west.
USFWS-36	U.S. Fish and Wildlife Service and Florida FWC	Page 4.15, Section 4.11, Estuarine Resources. These sections should be modified to include potential effects of additional development in NGGE on the SGGE project. Further, we suggest explaining the assumption that the health of the Faka Union estuary would not continue to decline under current trends. The assumption seems counterintuitive to us.	Concur. Section 4.15 has been reworded to acknowledge that future development might adversely affect the estuaries, but it is outside the scope of the SGGE project to address the problem.
USFWS-37	U.S. Fish and Wildlife Service	Page 4-20, Section 4.18, General Environmental Setting for Other Lands. There are several agencies involved in managing the Ten Thousand Islands Region, including the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park. These agencies and their work should be identified.	These were added to the text.
USFWS-38	U.S. Fish and Wildlife Service	Section 5, Problems, Opportunities, and Objectives. This section should include the significant input of other State and Federal landholders and land managers with regard to project effects on their lands. This should also be included in Section 5.1, Public Concerns, as non-governmental stakeholders have also expressed these concerns.	Federal and State land holders added to the list of parties providing input.

Comment Number	Organization / Agency	Comment	Response
USFWS-39	U.S. Fish and Wildlife Service and Florida FWC	Page 5-1, Section 5.1, Public Concerns. The discussion of NGGE flooding and environmental projects should include data about the remaining wetlands in NGGE, including their extent and hydrology, and the history of the controversy and protection efforts surrounding these wetlands. This may be critical to the future of SGGE because, as NGGE develops and knowledge of today's conditions ebb from public consciousness, the public may erroneously come to believe that seasonal inundation of wetlands in NGGE is a flooding effect caused by the project. This misperception may lead to public pressure to increase drainage to SGGE and to change the Operational Management Plan in the future.	Paragraph inserted stating that wetlands exist and there are concerns that operations may increase drainage of the wetlands.
USFWS-40	U.S. Fish and Wildlife Service and Florida FWC	Page 5-2, Section 5.2, Problems and Opportunities. We suggest adding a couple of items to the discussion. First, the interception of freshwater that would normally travel as sheet-flow to the downstream brackish marshes and eventually to the bays has increased salinities, and facilitated the northward invasion of salt-tolerant species, with associated changes to wetland communities. Second, construction of the Faka Union canal has influenced freshwater wetlands by allowing salt water to intrude into those areas and disrupting tidal flow patterns west of the berm.	Both items inserted
USFWS-41	U.S. Fish and Wildlife Service	Page 5-3, Section 5.2, Problems and Opportunities. Table 5-1, as well as Table 3-2, on page 3-6 and Table 6-7 on page 6-70 indicate without project acreages of certain habitats that seem inconsistent with the expected increased project drainage under that condition. These tables should be reconciled or explanations provided in the text for their apparently inconsistent predictions. We recommend eliminating the word "critical" from the first sentence on page 5.4 with reference to panther habitat. The word "critical" has specific connotations relative to the Endangered Species Act when used as an adjective before "habitat."	A detailed analysis of the differences is in the Resource Assessment in Appendix D. Tables 5-1 and 6-7 are based on model output as if the vegetation had adjusted to the existing altered hydrology. Existing vegetation has not fully adjusted yet. Table 3-2 is NRCS field data. "Critical" was removed.
USFWS-42	U.S. Fish and Wildlife Service	Page 5-4, Section 5.3.1, Planning Goal. Chapter 9 of the "Yellow Book" gives the restoration and enhancement of wetlands on adjacent public lands equal consideration as a project purpose (see page 1-10). Because of extensive public lands interests, including two National Wildlife Refuges, a National Estuarine Research Reserve, and the Everglades National Park, this purpose should be emphasized in this section consistent with that directive.	Added to Section 5.3.1
USFWS-43	U.S. Fish and Wildlife Service	Page 5-5, Section 5.3.2, Planning Objectives. This section should specify that the multi-agency PDT formulated and developed consensus on the project objectives. The PDT would consider the development of these objectives to be one of the most significant products of the process.	Added to second paragraph of Section 5.3.2
USFWS-44	U.S. Fish and Wildlife Service	Page 5-8, Section 5.3.3, Planning Constraints. Regarding the statement "adversely affect" in the last sentence on the page should be replaced with "jeopardize the continued existence of," please see our comments under Page 6-7, Section 6.3.1, as follows for a discussion of flood maintenance constraints in NGGE.	Text changed from adverse to jeopardy, as suggested.

Comment Number	Organization / Agency	Comment	Response
USFWS-45	U.S. Fish and Wildlife Service	Section 6, Plan Formulation and Alternative Evaluation. We believe that there should be further consideration of how the cost to benefit ratios are constructed for other land management units. Specifically, the Ten Thousand Islands NWR, which is likely to be directly affected by the proposal, should be included in the analysis. Habitat Units should be estimated for the refuge using the South Florida Assessment Method. This methodology was used for Collier-Seminole State Park (which is surrounded on 3 sides by the refuge) and Fakahatchee Strand State Preserve (which shares a common boundary), both of which extend to the estuary. Inland Habitats (primarily north of US41) and Estuarine Habitats (nekton and oysters in the bays) have been analyzed and documented. However, a large area, between US41 and the bays, does not appear to be considered by either analysis. The affect of this project on this area should to be evaluated.	The MikeShe model does not quantify hydrology in tidal areas. The model analysis stops near U.S. 41. Thus the team could not use the model and the SFAM to predict habitat units for most of the Ten Thousand Islands NWR. SFAM was used only for the portion of Collier-Seminole State park that is located north of US 41, not the entire park. The oyster and nekton of the bays were analyzed with a different method that does not apply to the area between the bays and the inland areas.
USFWS-46	U.S. Fish and Wildlife Service and Florida FWC	Page 6-7, Section 6.3.1, First Iteration, Management Measures Considered, Pump Stations. The Service continues to have concerns about the applicability of the 100-year storm flood control standard for determining the pump size for this project. Application of this standard could result in drawdown of wetlands in NGGE, over-inundation of SGGE and other project resources, and discharges to downstream estuaries in perceived flood situations or in storms of 10, 25, or 50-year frequency. It would appear that designing a 100 year storm pump system to pump out canals that have less than a 10-year storm capacity in a flooding event which may render all infrastructures unusable, may not be cost effective or operationally tenable. This concern extends to flood insurance and vague references to a floodplain management plan in the PIR. We acknowledge concerns about perceived "takings" of private property, but suggest that language such as "baseline for floodplain management and the National Flood Insurance Program [NFIP]" be explained. The NFIP is not intended to foster development in flood hazard areas;	This was discussed at length with the USFWS in October 2003 and it was conveyed that this project was not a flood control project. However, impacts up to the 100 year would be looked at, especially since the "10-year storm capacity" cited by the USFWS could not be technically verified with respect to rainfall volume, spatial and temporal distribution, antecendent moisture distribution and other hydrologic parameters. As an assurance measure, rainfall publications and other technical information were updated as part of this study by the South Florida Water Management District (SFWMD) and provided to Hydrologic Engineers at SFWMD the Corps of Engineers Jacksonville District, USFWS and other Project Delivery Team members. That peer review provided and a consensus to use that revised rainfall documented in the Draft and Final Reports for rainfall volume, and spatial and temporal distribution and other hydrologic data. On 10 August 2004 a meeting was held with Hydrologists from the USFWS at Vero Beach to address the concerns of the Real Estate "Takings" Analysis. The USFWS was informed that analysis was completed by Attorneys i
USFWS-46 Conclusion		neither is it intended to define property rights. The NFIP and flood rate maps constitute aspects of a program that assign probabilities to flood events, subsidize flood insurance in certain areas if specified conditions are met, and limit liabilities to lenders. The relationships between the proposed action, a range of pump capacities, NGGE hydrology, flood insurance and other NFIP programs, and "floodplain management" should be comprehensively described.	See above cell for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-47	U.S. Fish and Wildlife Service and Florida FWC	Page 6-15, Section 6.3.3, Analysis Screening and Concerns, First Iteration. The PIR should provide information regarding estimates of real estate acquisition for NGGE as referenced in paragraph two on this page and in Table 6-18, 6-19, and 6-22 on page 6-103 for Alternative 6. Acquisition in portions of NGGE was considered during the alternative selection process included as a potential means to increase the area of hydrologic restoration in SGGE, reduce pump size, reduce engineered infrastructure, and protect wetland resources in existence under current condition in NGGE. There was considerable discussion and no agreement on the area potentially affected by flooding, the threshold at which flooding was acknowledged as impacting residents (increases in stage or duration), nor which models (MIKESHE or other) were used to assess this issue. The Service is of the opinion that the area of NGGE calculated for purchase in Alternative 6 may be overestimated. More precise information should be provided to help determine the actual potential cost of this project to insure that it is weighed against other alternatives accurately	The acres affected by alternatives was estimated using model runs and LIDAR elevation data. Traditional cross section survey data were used when available.
USFWS-48	U.S. Fish and Wildlife Service and Florida FWC	Page 6-52, Section 6.6.1, Hydrologic and Hydraulic Modeling. We caution that changes in models are not attributable to the PDT, although some PDT members, primarily project co-sponsors, did make model change decisions. This is important only in that this section implies more involvement or knowledge of model changes by the entire PDT than actually occurred.	The text of Section 6.6.1 has been revised. Concur that only the Corps of Engineers and the South Florida Water Management District actually made changes to the model. Many agencies and individuals were involved in interpreting the results.
USFWS-49	U.S. Fish and Wildlife Service	Pages 6-54 and 6-60, Section 6.6.3, Inland Habitat Changes. We recommend including the Ten Thousand Islands NWR, and the significant infestations of Brazilian pepper south of US 41 be included in the analysis. Further, the assertion that Brazilian pepper will not reinvade sites after hydrology has been restored should be supported with references.	The Ten Thousand Islands NWR is mostly out of the model domain (see comment #45 above) and we are unable to include it in the analysis.
USFWS-50	U.S. Fish and Wildlife Service	Pages 6-56 through 6-62, Section 6, South Florida Assessment Method. This section should describe how or if SFAM assesses inter-annual variability in water depths and their duration. For example, it would be interesting to know whether the SFAM indices reported in Table 6-4 represent a one-to-one spatial mapping, or, total acreage for the regions of interest. A more thorough description that explains how these indices are calculated should be provided.	The first full paragraph on page 6-62 states that the variables were defined and values assigned for the entire region or basin. It is not a model cell by model cel analysis.
USFWS-51	U.S. Fish and Wildlife Service	Page 6-62, Section 6.6.3, Inland Habitat Changes. Values for parameters should also be calculated for the Ten Thousand Islands NWR, since the values are not limited to areas that were hydrologically modified.	The alternatives do not include changes roads or canals, and we can not quantify hydrologic changes because it is located outside the model. The SFAM would likely show zero change.
USFWS-52	U.S. Fish and Wildlife Service	Page 6-63, Section 6.6.4, Estuarine Habitat Change. The assumption that Fakahatchee Bay has had minimal impacts from human activities is arguable. The explanation for the assumption should be improved. The SGGE canal system has likely intercepted some sheetflow that would normally flow into this bay, the construction of logging trams and US41 has altered to some degree the distribution of that sheet flow, and excessive freshwater flowing into Faka Union Bay extends to a varying degree into the western portion of Fakahatchee Bay. While Fakahatchee Bay may be relatively pristine compared to other bays affected by this project, we caution against carrying the comparison too far.	Concur. Fakahatchee Bay is less disturbed than the other bays although not free of human impacts. It is the best site available as a control / target / reference.

Comment Number	Organization / Agency	Comment	Response
USFWS-53	U.S. Fish and Wildlife Service	Page 6-70, Table 6.7 Water Depths and Major Plan Community Types. Data in Table 3-2 reports that the percent of Mesic Pine Flatwoods in 1995 was 2 percent. Yet, in Table 6-7, Mesic Pine Flatwoods represent 94 percent of the area. Please explain the large differences between the NCRC maps and the output from MIKESHE vegetation model.	See response to comment #41. The column for Existing in Table 6-7 is from model output and assumes that the vegetation has fully adjusted to the overdrained hydrology. Table 3-2 is from field measurements and represents vegetation communities that have not fully adjusted to the overdrained hydrology. The most important acreages for plan formulation, comparison of benefits, and cost effectiveness are the Without project, Alt 3D, Alt 6, and Alt 12, not Existing.
USFWS-54	U.S. Fish and Wildlife Service	Page 6-74, Section 6.7.2, Inland Performance Measures. It is not clear that Table 6-7 supports the conclusion that “the only areas that have not changed in water depth are areas that were and still are upland or coastal marsh communities.” There has consistently been an approximate 4' difference in water levels between the wet and dry season in the northern marshes of the Ten Thousand Islands NWR, with water levels being approximately 2' above ground during the wet season and 2' below ground during the peak of the dry season. This is inconsistent with the assumption that “coastal marshes are probably more strongly influenced by Gulf of Mexico water levels than flows through SGGE.” The table, the conclusion, or both should be modified for accuracy, precision, and consistency.	Table 6-7 contains very little, if any, acreage in the Ten Thousand Islands NWR, since most of this NWR is outside the model. The conclusions are based on the model predictions for the average wet season water depths. The conclusions did not take into account the dry season water depths. Depths of 2 foot above ground would be classified as marsh. These areas were located near US 41. The sentence will be revised to state the conclusion that the flows through SGGE did not affect the locations of marsh communities, based on the comparison of Pre-development and Future Without Project flows. We deleted the statement that something else is keeping the wet season water depths relatively constant.
USFWS-55	U.S. Fish and Wildlife Service	Page 6-83, Section 6.7.3, Inland Habitat Units. We recommend the authors review the numbers in Figure 6-11. The figure shows a 100 percent increase in Biota Habitat Units for Alternative 3D, with project, when it appears to be closer to 30 percent (40,000 to 52,000). Also, the figure shows a 100% decrease without project. This appears to be closer to a 15 percent decrease (40,000 to 35,000).	The horizontal and vertical axes are correct. The error is in the labels within the center of the chart. The labels have bee corrected to say "100% of HUs" rather than "100% increase". The chart shows 100% of the total gain - that the total estimated gain has occured, not a 100% chanage from existing.
USFWS-56	U.S. Fish and Wildlife Service	Page 6-85, Section 6.7.4, Estuarine Performance Measures. The derivation of the performance measure for nekton should be reiterated or referenced to previous sections of the document and the geographic location for the nekton flow performance measure should be included in the PIR. An analysis of the flow/salinity or stage/salinity relationship should be performed for the flow transects used, or, if conducted, the analysis should be reported.	Refer to Section 6.6.2, pages 6-52 to 6-54 of the draft PIR (and Sec 6.6.2 of the Final PIR) and the Benefit Analysis for Estuaries report in Appendix D for discussions of the relationship between flow and salinity for Faka Union. This empirical performance measure analysis for oyster and nekton was performed for the alternatives only for Faka Union Bay. Corresponding flow and salinity data are not available for the other bays.
USFWS-57	U.S. Fish and Wildlife Service	Page 6-93, Section 6.7.6, Generalized Alternative Comparison Table. The Evaluation Matrix for Study Area Lands Affected by the SGGE Project (Table 6-17) should include the Ten Thousand Islands NWR. This is especially important considering the number of important Environmental Quality variables that may be affected on the refuge.	A table for this area was not developed because the area is outside of the modeled area and we have no predictions for hydrologic changes.
USFWS-58	U.S. Fish and Wildlife Service and Florida FWC	Page 6-101, Section 6.8.3, Water Supply Benefits, Municipal and Industrial Water Supply, Agricultural Water Supply. This section states that a “...key design criterion and goal throughout the development of the SGGE system components has been that municipal and industrial water supply will remain the same or be increased with the SGGE plan...” The basis underlying this assumption, and related design criteria based on this assumption should be clearly identified.	The savings clause in Section 601(h)(5)(A) of WRDA 2000 requires that sources of water supply shall not be eliminated or transferred until a replacemen source is available. Section 373.1501 Florida Statute contains related language regarding assuring the quantity of water for existing legal users. These requirements are constraints on the alternatives. The sentence will be revised.

Comment Number	Organization / Agency	Comment	Response
USFWS-58-b	U.S. Fish and Wildlife Service	Page 6-101, Section 6.8.3, Water Supply Benefits, Municipal and Industrial Water Supply, Agricultural Water Supply. This section also states that groundwater levels may rise as a result of the project and yield more water for the ecosystem and potentially more water fo municipal and industrial use. It would be helpful if this section also identifies the volume of the additional yield that will be available for the natural system, and which areas are being considered for the benefits of this additional groundwater. Groundwater benefits to NGGE (outside project area) that might potentially occur should be balanced through the application of some of that additional water for the restoration of wetlands and other aquatic resources in NGGE. A water accounting system would help ensure that project water is not diverted for non-project uses.	Section 12, Assurances, addresses the volume of water for the ecosystem and whether additional water would be available. Surface aquifer (ground water) will increase in much of SGGE and will be unchanged in NGGE. M&I water generally comes from deeper aquifers.
USFWS-58-c	U.S. Fish and Wildlife Service	Page 6-101, Section 6.8.3, Water Supply Benefits, Municipal and Industrial Water Supply, Agricultural Water Supply. The Belle Meade agricultural area is an area of known saltwater intrusion which affects agricultural operations. Groundwater benefits may occur to alleviate this situation. Since the land use in this area may change (development may be intensified) under recent changes to the Collier County Comprehensive Plan, we recommend that all water be reserved for the natural system. Clearly and unequivocally reserving the waters for environmental restoration will ensure that potential water supply needs associated with intensifying land use do not decrease fish and wildlife benefits of the project.	Potential for benefit due to reduced saltwater intrusion was added to the text. Reservations and quantity of water is addressed in Section 12, Assurances.
USFWS-59	U.S. Fish and Wildlife Service and Florida FWC	Page 6-103, Section 6.8.6, Costs of Alternatives. See comment regarding computation of real estate costs for Alternative 6 on page 6-15 as portrayed in Table 6-18, 6-19, and 6-22.	Concerns about method to estimate real estate costs noted. Best available data was used in the analysis. Also see comment # USFWS-47. Real estate considerations are discussed at the end of Section 6.8.6, pages 6-105 to 6-110 of the draft PIR.
USFWS-60	U.S. Fish and Wildlife Service	Page 6-107, Section 6.8.6, Costs of Alternatives, Groundwater Impacts. The document should identify or delineate the portions of the Ten Thousand Islands region with a one-foot increase in groundwater levels.	The Ten Thousand Islands NWR is mostly out of the model domain (see comment #45 above) and we are unable to include it in the analysis.
USFWS-61	U.S. Fish and Wildlife Service	Page 6-116, Section 6.8.8, Cost Effectiveness and Incremental Cost Analysis. The Ten Thousand Islands NWR should be included in Table 6-22 (and Table 6-17), and subsequent comparisons.	This NWR is generallly outside of the model. Thus we have no estimated habitat units. See response to comment # USFWS-45.
USFWS-62	U.S. Fish and Wildlife Service	Page 6-136, Section 6.8.11, Risk and Uncertainty Analysis-Uncertainty of Project Benefits. We suggest clarifying whether the topography sensitivity analysis demonstrates that SFAM is reliable even if there is a lot of uncertainty in the topography, or, indicates that SFAM metrics are insensitive to changes in topography.	Suggestion noted and supplemental clarification was provide on Meeting 5 August 2004 with the USFWS at Vero Beach. It was understood by USFWS that on some portions of SFAM analysis were somewhat dependant on the topography.
USFWS-63	U.S. Fish and Wildlife Service	Section 7, RECOVER Evaluation. This section should include recommendations for additional analysis and requests for information that were contained in previous RECOVER reports.	Do not concur. The final RECOVER report reflects and incorporates previous comments. The final RECOVER report is included in Appendix. Recommendations are summarized in Section 7 of the PIR.
USFWS-64	U.S. Fish and Wildlife Service and Florida FWC	Section 8, Recommended Plan. Page 8-2, Section 8.2.2, Pump Stations. The Service believes that these pumps may represent an over-design based on a 100-year storm that may affect project area resources within and outside project boundaries. The Service recommends reducing the number of pumps or replacing them with a number of smaller capacity pumps as part of the design and construction phase of this project if it is indeed over-designed.	Optimization of the Pump Stations will be looked at in the Detailed Design Phase of the project. However, with repect to the 100 year storm and the assessment o impacts outside of the project boundaries this was addressed in comment #46 above.

Comment Number	Organization / Agency	Comment	Response
USFWS-65	U.S. Fish and Wildlife Service	Pages 8-2 and 8-3, Section 8.2.3, Levees. The effects of levees on listed species should be addressed. The levee around Port of the Islands and south of U.S. Highway 41 should be examined to determine effects on the adjacent Ten Thousand Islands NWR and potential benefits associated with blockage of sheetflow from refuge lands to the canal system. The Service believes that the levee proposed around the agricultural area in Belle Meade extends too far west, exceeds the limits of the project's effects, and would act to cut off surface water movements through this area. This levee was not previously reviewed by the PDT or the Service and deserves further scrutiny. Alternatives to the ring levee around private residential properties located in northeastern Belle Meade should be examined to minimize effects to wetlands. The levee construction around Port of the Islands south of US41 may restore ecological integrity by preventing tidally influenced salt water from intruding into adjacent fresh water marshes as is currently the case.	The levees were sited to minimize impacts to any wetlands or natural resources. If there are mitigation requirements for the siting of those levees they can be looked at during detailed design phase of this project.
USFWS-65 Conclusion		If feasible, breaks in the southern half of the existing berm on the west side of the Faka Union Canal should be considered as they may facilitate tidal water interchange to the area between the canal and the Wood River and divert some tidal waters from building up in the Port of the Islands basin.	See above cell for Corps Response
USFWS-66	U.S. Fish and Wildlife Service and Florida FWC	Page 8-3, Section 8.2.4, Roads. The road plan that was approved at various points in the planning process by various parties should be included in this document. The Service is concerned about the location of the paved portion of Miller Boulevard extending too far south with reference to its potential effects on surface water movement to Belle Meade and listed species. The majority of the road plan is acceptable. Proposed uses and types of road access will be reviewed in the DOF Ten Year Management Plan. The first paragraph of this section ends with the statement that remaining material from road destruction would be spread across the landscape. Disposal of this material could adversely affect adjacent habitats unless criteria are developed to protect sensitive areas. Please incorporate a more detailed description of road deconstruction as developed by members of the PDT and described in the Prairie Canal Early Start permit. After road degradation is completed adjacent to Prairie Canal, the Service may have additional recommendations based on an adaptive assessment process.	Text of Section 6.4.2 and 8.2.4 was expanded to acknowledge the multiagency input to the road plan. The text of 8.2.4 no longer statest that excess material would be spread across the landscape. The material will go into the canal to supplement the canal plugs. A copy of the road plan is shown on the plates in the engineering appendices.
USFWS-66 Conclusion		Pump access roads should be minimized where possible by placement along existing roads or canals.	See above cell for Corps Response
USFWS-67	U.S. Fish and Wildlife Service and Florida FWC	Page 8-4, Section 8.2.5, Culverts. There is no reference to the culverts under Stewart Boulevard. The text should explain whether the road is to be cut to grade, or culverted.	Culverts for Stewart were discussed in Section 8.2.4 Roads. The information was moved to Section 8.2.5 Culverts. CULVERTS ARE NOT IN MCACES AND NOT SIZED.

Comment Number	Organization / Agency	Comment	Response
USFWS-68	U.S. Fish and Wildlife Service	Page 8-4, Section 8.3, Operational Features. We remain concerned that issues discussed (or not) in this section could undermine all assumptions concerning ecosystem benefits and may affect listed species. Issues include the drawdown of wetlands in NGGE, overinundation of SGGE, dry season discharges of water beneficial to the downstream ecosystem, groundwater recharge of the NGGE canal system for use by wellfields, pump size, reporting procedures, and emergency water and fire management protocol. We recommend the text reference the draft Water Control Plan in Section VII of Appendix A, and incorporate the results of ongoing discussions. The Service provides additional comments with regard to this plan in Appendix A section of this document. However, the Service believes the proposed plan is a flood control plan, not a plan maximized for restoration. Additional model runs and discussion of this issue are forthcoming, but this issue was identified early in the planning process and has not been addressed to the Service's satisfaction.	Section 8.3 and the Operations Manual have been updated and refined to include adaptive management measures. This was done at the request of the USFWS and other agencies requests.
USFWS-69	U.S. Fish and Wildlife Service and Florida FWC	Page 8-6, Section 8.5, Adaptive Assessment and Monitoring. The Service is currently assisting in the development of a more detailed plan that will replace the plan in Appendix H of this document. The Service believes that this Plan is critical to achieving and documenting ecosystem benefits. Elements of this Plan are also necessary to minimize effects to federally listed species.	Concur. USFWS participation has been important to updating the Monitoring Plan.
USFWS-70	U.S. Fish and Wildlife Service	Page 8-11, Section 8.7.2, Cost Sharing of Adaptive Assessment and Monitoring. The document should specify the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park, rather than the less accurate term, Ten Thousand Islands area.	listed as requested.
USFWS-71	U.S. Fish and Wildlife Service and Florida FWC	Page 8-13, Section 8.8.3, Detailed Design Phase. The Service will continue to be integrally involved in the detailed design of this project. The detailed design phase should include remediation of contaminants, refinement of hydrologic models, water control plans, project phasing, and the adaptive assessment and monitoring process.	Concur. Completion of the archeological surveys now underway, in order to achieve full compliance with the NHPA, will also occur during detailed design.
USFWS-72	U.S. Fish and Wildlife Service and Florida FWC	Section 9, Environmental Effects. Page 9-4, Section 9.5, Fish and Wildlife Resources. The Service's Recommendation No. 2, as listed under this section is intended to establish: (1) baseline fish and wildlife surveys that would be repeated mid-construction and post-project as deemed appropriate; and (2) surveys to avoid impacts to fish and wildlife resources resulting from actual construction activities. The Adaptive Assessment and Monitoring Plan will address this first task; some pre-construction surveys will be required to minimize effects to listed species (consistent with the Prairie Canal Early Start Project). Our response to comments under Recommendation No. 6 is included in comments on Section 8.3 on page 8-4. Our response to comments under Recommendation No. 12 is included in comments on Section 11.18 on page 11-5. Our response to comments under Recommendation No. 13 is our PAL to the Corps, dated August 11, 2003, which addresses design storm and other model issues and assumptions.	Concur that pre-construction surveys will be required for species of concern. The monitoring plan included in Appendix H details the type, frequency and cost of all project-related surveys, including surveys and studies for post-construction adaptive assessment.

Comment Number	Organization / Agency	Comment	Response
USFWS-73	U.S. Fish and Wildlife Service	Page 9-15 and 9-16, Section 9.10, Hydrology. The text should be revised to reflect the intent of this project to restore hydrology, including hydroperiod and inter-annual variability, to SGGE. The second sentence of paragraph 3 indicates that coastal estuaries in the project vicinity presently receive, under most conditions, sufficient flows of fresh water. The Service does not agree with this statement and believes it conflicts with the project objectives to restore fresh water to estuaries that are blocked from upstream watersheds by the SGGE subdivision. Preliminary discussions with the District indicate that no additional water beyond ecosystem needs will be made available as a result of this project. Despite this, text within the PIR appears to be setting the stage for use of some unquantified portion of water in excess of natural system needs. The third paragraph on this page states that the state reservation rule "will be conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved."	The cited statement in the text was intended to mean that sufficient freshwater flows into the estuarine region taken as a whole. The timing and point of discharge, however, are inadquate. Text has been clarified. All of the flows from the Project area towards the south are the result of rainfall and deliveries under I-75 from the upper watershed. We are attempting to recharge the groundwater reservoir that was depleted when the canals were built. This should attenuate extreme peak flood flows and provide additional seepage toward the estuaries during the dry season, when they are needed most. Re-distribution of flows from the canals to overland sheet flow will spread the freswater out to the heads of all the estuarine bays in the region.
USFWS-73 Conclusion		The last sentence in this section on page 9-16 states that "this adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project." This again seems to inappropriately set the stage for configuring and operating a system that will generate some unknown portion of additional water for uses other than the natural system.	See above cell for Corps Response
USFWS-74	U.S. Fish and Wildlife Service	Page 9-17, Section 9.10.3, Water Management. This section allows for the changes in the Water Control and Operations Plan based on the water resource allocation for the natural system. This emphasizes the importance of Section 12 (Assurances) of this document and the Water Control Plan. The Service has significant concerns with regard to both these issues. See our Section 12 and Appendix A comments on these issues.	Noted.
USFWS-75	U.S. Fish and Wildlife Service and Florida FWC	Page 9-20, Section 9.12.3, Water Demand. Final figures for water demand do not currently contain accurate predictions for self-supply for the NGGE area. Without these predictions, water demands cannot be accurately assessed.	Do not concur. No information is currently available, but note that significant fraction of NGGE is within other drainage basins.
USFWS-76	U.S. Fish and Wildlife Service and Florida FWC	Page 9-25, Section 9.18, Environmental Effects on Adjacent Lands. Heavy equipment entering and leaving the construction areas should be decontaminated to avoid the transport of exotic and nuisance species to adjacent public lands.	Concur, if by "decontaminated " you mean "washed off to remove seeds, propagules, etc."
USFWS-77	U.S. Fish and Wildlife Service	Section 10 Public Involvement. Page 10-11, Section 10.7.1 U.S. Fish and Wildlife Service Provide references to all written correspondence from the Service, including the August 11, 2003, Planning Aid Letter (PAL).	The cited PAL has been added and noted .
USFWS-78	U.S. Fish and Wildlife Service	Section 11 Compliance with Federal Environmental Statutes. Page 11-1, Section 11.2, Endangered Species Act of 1973, As Amended. The last sentence in the first paragraph under this section should be revised from "completion of BA" to "completion of consultation under section 7 of the ESA." The last sentence on this page should be deleted. The project has not been fully coordinated under the ESA and the Service does not agree that at this stage of the planning, the Corps is in full compliance with ESA. We are continuing to work very cooperatively with the Corps to complete this consultation.	Concur. ESA compliance language has been changed. We continue to work with the Service. However, a draft Biological Assessment has been added to the final PIR/EIS and will be coordinated with the Service when Service staff indicate they are ready to receive it.

Comment Number	Organization / Agency	Comment	Response
USFWS-79	U.S. Fish and Wildlife Service	Page 11-2, Section 11.3, Fish and Wildlife Coordination Act of 1958, As Amended. This document should include references to and conclusions of all PAL's provided by the Service on this project, including our August 11, 2003, PAL. The FWCAR contained in Appendix D is a draft document that solicits comments from other State and Federal agencies for incorporation. The draft FWCAR was prepared, at the request of and in cooperation with the Corps, before many of the sections of this draft PIR were available for Service review. As evidenced by this correspondence, there are additional issues and conservation recommendations that will be incorporated into the Final FWCAR. Until this process in finalized, there should be acknowledgement that full compliance has not been achieved under the Fish and Wildlife Coordination Act.	Draft status of FWCAR included in the Draft PIR is noted. However, the Corps is in full compliance (for the considered phase of work) when it considers Service recommendations provided in the Draft CAR and incorporates the draft Report into the Draft PIR/EIS. A final CAR cannot be considered by the Corps, as noted, and we cannot incorporate it into our final document, until we receive it.
USFWS-80	U.S. Fish and Wildlife Service	Page 11-4, Section 11.12, Marine Mammal Protection Act of 1972, As Amended. The Service does not agree that the project is in full compliance with this Act, although all parties continue to work towards compliance. In particular, the Service has requested additional information on freshwater discharges to the manatee warmwater refugia within the Faka Union canal and Port of the Islands marina basin.	Coordination is ongoing between Service, USGS manatee experts, and Corps staff to incoporate the most recent manatee information into the report text. Manatee monitoring provisions have been included in the Monitoring and Assessment plan. The Corps and Water Management District believe that freshwater discharges under the recommended plan will be adequate to support continued manatee use of the Port of the Islands marina, but a commitment has been made to provide supplemental freshwater at the downstream Faka Union weir, should post-construction monitoring indicate this is desirable.
USFWS-81	U.S. Fish and Wildlife Service	Page 11-4, Section 11.13, Estuary Protection Act of 1968. The Service does not agree that the project is in full compliance with this Act, although all parties continue to work cooperatively to assure compliance.	Your doubts are noted. However, US EPA administers the Estuary Protection Act. It has indicated that the report and recommended plan are in compliance. The EPA "Lack of Objections" determination is included in the correspondence received on the draft.
USFWS-82	U.S. Fish and Wildlife Service	Page 11-5, Section 11.17 - E.O. 13089, Coral Reef Protection. The interpretation of this Executive Order generally differs from the description in this section. Although there are no documented coral reefs in the SGGE Study Area, coral reefs in other areas may be affected by this proposal and should be discussed and analyzed if warranted.	The meaning of the Coral Reef Executive Order is clarified in the text. The project is still in full compliance. There are no living coral reefs within many miles of the project area. This is an example of the overly-wide interpretations, descriptions and discussions that are not appropriate for a synoptic, analytical NEPA document.
USFWS-83	U.S. Fish and Wildlife Service	Page 11-5, Section 11.18 E.O. 13112, Invasive Species. The document does not identify the referenced "feasible/prudent measures to reduce invasive species infestations and minimize risk of introducing new invasive." The managing entity, DOF, does not currently have sufficient staff or funds to control exotic plants (in particular, Brazilian pepper) and some exotic animals on the project site. There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive species, especially in the short term, or whether more intensive management activities may be necessary on an initial or perpetual basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species. The Service believes that additional discussion and a separate Invasive Species Management and Monitoring Plan should be developed as part of this project.	Noted. Invasive control measures, including cleaning construction equipment prior to entry on the project would become part of project construction specifications. However, you are correct in stating that the project does not have a budget item for invasive exotic control. There is another CERP initiative directed at the problem created in the Everglades landscape, called "Melaleuca and other Exotic Plants." This project will characterize the problem and look at control methods. Although we agree that DOF would benefit from additional budget/staff for exotic control, that is not within the scope of the proposed project.

Comment Number	Organization / Agency	Comment	Response
USFWS-84	U.S. Fish and Wildlife Service	Page 11-5, Section 11.19, Federal Water Project Recreation Act. Until the DOF management plan is developed in its entirety and approved, it is difficult to determine compliance with this Act.	Compliance with the Federal Water Project Recreation Act is achieved by determining if any water-related recreational facilities would be adversely affected by the proposed project (such as existing boat ramps that would be removed). No such facilities have been identified on proposed Project lands; therefore, the project is in compliance.
USFWS-85	U.S. Fish and Wildlife Service	Page 11-7, Section 11.30, Water Resource Development Act of 2000, Section 601. The Service is of the opinion that until there is agreement on the identification of water reserved for the natural system, legal users, and "appropriate quantity, timing, and distribution of water for the natural system", this project cannot be determined to be in compliance with this Act. While Section 12 identifies a methodology for determining water reservations, the methodology is based on conceptual models, does not identify the exact quantity attributed to each legal user, and is unclear as to how timing and distribution of water needed by the system are being determined.	These determinations are provided by the Non-Federal sponsor. Your opinion is noted.
USFWS-86	U.S. Fish and Wildlife Service	Section 12, Project Assurances. General Comments. The SGGE project is primarily aimed at reducing over-drainage to restore wetlands in the project area. Through accomplishment of its purpose, the project will also improve the quantity, timing, and distribution of flows to the estuaries by reducing point source flows that currently damage the ecosystem. Since the project is hydrologically isolated from the regional system and designed to increase water levels within the project footprint, meeting the assurances required by WRDA should be relatively straightforward in that an analysis of overall regional water management changes is not required. We believe that the methods employed to identify water made available for restoration of the natural system are largely adequate, but somewhat incomplete. We suggest the following changes: · Fully document the methods used to perform evaluations (see specific comments below); · Insert key information into the assurances section -	Comment noted and your recommendations have been considered, as discussed with the USFWS on the Meetings of 5 and 10 August 2004 in Vero Beach. However, it is the responsibility of the Corps and the non-Federal sponsor to make these determinations.
USFWS-86 Continuation		o Evaluate Savings Clause compliance for fish and wildlife habitat areas that are outside the project footprint, but could be affected by the project (with the exception of the estuary at the downstream end of the Faka Union canal; please see comments on section 12.5.2 for specific areas that should be evaluated),	See row 98 for Corps Response
USFWS-86 Continuation		o Substantiate the claim that the WRDA 2000 Savings Clause for level of service for flood protection is provided (see section 12.1.2.1 [page 12-2]),	See row 98 for Corps Response
USFWS-86 Continuation		o Affirm that all of the water made available by this project is necessary for restoration of the natural system, and should be identified, dedicated, and managed for the natural system (in general, no water should be "excess" or available for other uses),	See row 98 for Corps Response
USFWS-86 Continuation		o Repeat the language found in Section 601 (h) (1) in WRDA 2000 regarding assurance of project benefits in Section 12.12 (although this language describes the purpose of CERP in Section 1.4.1, reiteration of this language in this part of the document remind reviewers and decision makers of the benefits of CERP),	See row 98 for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-86 Continuation		o Anticipate and reinforce Section 13 concepts by clearly stating in this section that (1) both the beneficial baseline water and the additional water produced or redirected from this project are needed to achieve the goals and objectives of CERP, as well as to ensure the benefits of the Plan for restoration and preservation of the natural system as required by WRDA 2000, and (2) both beneficial baseline water and additional project water should be reserved for natural resources by the State, and,	See row 98 for Corps Response
USFWS-86 Conclusion		o Provide a comprehensive discussion of the relationship between the pre-CERP baseline, the Savings Clause, and the level of service for flood protection, as set forth in the Programmatic Regulations, in Section 12.1.3.	See row 98 for Corps Response
USFWS-87	U.S. Fish and Wildlife Service	We also emphasize that the methods employed in the present PIR would require additional expansion for evaluation of future Comprehensive Everglades Restoration Plan (CERP) projects that have significant effects on regional water or that intentionally transfer existing sources through project modifications. We anticipate that this more complete and detailed set of procedures will be outlined in the forthcoming guidance memoranda on procedures for identifying water made available for restoration and for evaluating project effects on existing legal sources.	Comment noted.
USFWS-88	U.S. Fish and Wildlife Service	The assurances evaluation, model output graphics, and evaluations based on the graphics should be updated to reflect the final operational plan and to ensure consistency between project modeling and project assurances. The operational plan is the link between the water identified to be reserved for the natural system, based on the expected performance of the plan, and the actual deliveries for the natural system. Modeling to refine and optimize the operational plan commenced after completion of the draft PIR, so the currently available information may not be the best available.	Assurances Chapter has been updated and the operational plan will be further developed in the detailed design phase. That further development will also include additional modeling, which was discussed and agreed to with the USFWS on 10 August 2004 in Vero Beach. Additional data will be gathered to help construct the recommended plan.
USFWS-89	U.S. Fish and Wildlife Service	The organization of the assurances section is confusing in that the analysis of water being made available for restoration and other purposes is not clearly distinguished from the analysis of existing legal sources. Although there is a section entitled “Effects on Existing Legal Sources of Water,” there is no comparable section entitled, “Identification of Water Made Available for Restoration and Other Uses,” nor one entitled “Effects on Existing Level of Service for Flood Protection.” We suggest the following reorganization: a. Retain Section 12.2 “Principles for Identifying Water for the Natural System,” but move Section 12.2.3 “Description of Methods Used to Evaluate Project Effects on Existing Legal Sources” to current Section 12.5, b. Combine Section 12.3 and 12.4 and re-title as “Quantification of Water Made Available for the Natural System,” c. Add a section entitled “Effects on December, 2000, Level of Service for Flood Protection,”	Your comments have been considered in revision of Chapter 12.
USFWS-89 Conclusion		d. Reword Sections 12.5.2 and 12.5.3 to provide more concise statements as to whether there is a Savings Clause elimination or transfer of existing legal sources as to each of the potentially affected existing legal sources, and, e. Consolidate the statements about elimination or transfer that are spread between Sections 12.5.2 “Identification of Existing Legal Sources of Water,” and Section 12.5.3 “Elimination or Transfer of Existing Legal Sources” into a concise statement in Section 12.5.3.	See above cell for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-90	U.S. Fish and Wildlife Service	Lumping the entire project footprint may be too coarse of a spatial resolution to adequately capture restoration benefits across different landscape types, especially where sloughs are interspersed with shallower sheetflow wetlands and upland pine strands. Although an aggregate quantification of water provided to the SGGE area provides a description of the overall increase in available water, we believe that this should be supplemented with an analysis of indicator regions for different habitat types or monitoring locations that will be used to assess actual deliveries of water by the project.	No indicator regions have been established within the SGGE footprint; therefore, the model results in the final PIR will reflect an aggregate quantification of water provided to the SGGE area.
USFWS-91	U.S. Fish and Wildlife Service	It is important that the Savings Clause evaluations consider all existing legal sources that could be affected by a project. Graphics in Appendix A show that canal levels in NGGE are lower during the wet season than existing levels, yet the report states that there are no Savings Clause issues in this area. Graphics that demonstrate that the water available to the wetlands in NGGE and other areas has not been reduced should be included in the text. See our comments on Sections 3.10 (page 3-19), 5.2 (page 5-2), and 5.33 (pages 5-5 to 5-8).	Appendix A was revised. The analyses and design of the recommended plan were based on not adversely impacting the existing conditions. Comment 46 address some of the criteria, which also includes NEPA.
USFWS-92	U.S. Fish and Wildlife Service	Analysis of the project benefits and effects is hindered by inconsistent terminology, mislabeled graphics, the lack of graphics of supporting conclusions, missing locater maps, incomplete documentation of methods, and references to graphics outside section 12 that are missing exact figure numbers. We offer the following suggestions: a. Include a locater map that identifies the estuarine flow transect locations. b. Include documentation of the methods used to calculate the volume probability curves and estuary delivery graphics for all time periods: average annual, wet season, dry season, average year, dry year, and wet year, , (Subparts c through j of this comment continued as FWS-92-b, FWS-92-c, and FWS-92-d.)	part a: Concur; Figure A-32 of Appendix A of the final PIR shows the flow transects. The identification and quantification of water for the downstream estuaries are based on flows modeled along the southern project footprint boundary. part b: Concur. Documentation of how the probability curves and estuary graphics will be provided in final PIR.
USFWS-92-b	U.S. Fish and Wildlife Service	c. Identify the time step used to compare project stages to their natural system targets,	part c: The computational time steps used for different modules of the MIKE SHE-MIKE 11 modeling system are as follows: 1· Initial time step size: 0.5 hours, 2 · Maximum allowed time step size for unsaturated zone, overland flow, and for evapotranspiration computations: 4 hours, 3 - Maximum allowed saturated zone (below groundwater table) time step size: 8 hours, 4- · Mike 11 time step size: 3 minutes (long-term simulations), 5 minutes (3D refinement), 5 - The time step size can be different at different times depending on the convergence criteria in the model. But, the upper limit of the time step sizes will not exceed the aforementioned maximum allowed time step sizes. The output time steps are different compared to the computational time steps. These are also different in different modules. The output time step for overland and channel flow is 1 day while the output time step for groundwater flow is 7 days for long-term (1988 through 2000) simulations.

Comment Number	Organization / Agency	Comment	Response
USFWS-92-c	U.S. Fish and Wildlife Service	d. Include a narrative description and map illustration of the project footprint (model grid area) used to calculate volume probability curves, e. Include a description or definition of the natural system trace on the performance measure graphs, and clarify whether this is the same simulation referred to elsewhere in the document as the pre-drainage condition, the natural condition, and the natural systems model (NSM), f. Apply consistent terminology is used throughout the document, such as the use of "NSM" vs. "natural system" vs. "pre-drainage condition," or the use of "existing 2000 condition" vs. "existing 2003 condition" vs. "pre-CERP baseline," g. Summarize modeling results and conclusions, h. If warranted, reference any non-section 12 graphics that may relate to project assurances, i. Make the x-axis scales (time steps) on graphics 12-11, 12-12, 12-13, 12-19, 12-20, 12-21, 12-23, 12-24, 12-25, 12-27, 12-28 and 12-29 uniform, and	part d: Concur. The grid cell map with the project boundary will be provided. part e: The natural system model represents the pre-drainage condition. part f:: Concur. These terms will be clarified and used consistently in the final PIR. part g: Concur. A summary will be provided in final PIR. part h: concur. part i:The axis scales were selected such that the results of the simulated conditions could be easily discerned. Every attempt will be made to made the axis scales more uniform in the final graphics; however, a different axis scale may be required for some of the graphics in order to clearly show the results.
USFWS-92-d	U.S. Fish and Wildlife Service	j. Document the selection of the representative wet, dry and average years, and, justify the use of two different dry years to evaluate estuary deliveries (in the existing legal sources section, Figure 12-21 uses 2000 as the representative dry year; however, 1990 was used in the project effects section in Figure 12-13).	part j:Concur. The representative dry year will be 2000 in the final PIR. The selection of the representative wet, dry and average year hydrologic conditions was based on the statistical evaluation of the rainfall, surface and groundwater levels and stream flow data of the SGGE planning area for the period 1965 to 2000. However, continuous data for correlation of rainfall to water levels and stream flow was inadequate for the period prior to 1988. The data for the 1988-2000 period was found to be a representative cycle of drought, wet and average hydrologic conditions, with 1994, 1995 and 2000 representing the average, wet and dry years, respectively.
USFWS-93	U.S. Fish and Wildlife Service	Volume probability curves obscure timing and are difficult for some readers to relate to on-the-ground restoration benefits. If use of volume probability curves based on depth is the preferred method, we recommend that water quantities be expressed in terms of beneficial depth, a more relevant measure for biogeochemical understanding, to supplement volumetric values. We also recommend that the distribution of annual values for the 1988-2000 period be documented using a frequency-of-return graph.	The revised volume distribution graphics will be included in the final PIR, showing both volumes and depths. The period of hydrologic record used for the model simulations consists of only eleven years short-interval (daily or monthly) hydrologic parameters that were used for the development of the volume probability curves. In such situations, it is not appropriate to include annual return period on the graphics. The frequency of return is more appropriate for much larger periods of hydrologic record, such as the 36 year period of record used with the South Florida Water Management Model.
USFWS-94	U.S. Fish and Wildlife Service	Specific Comments (Section 12, Project Assurances). Pages 12-1 to 12-3, Section 12.1.2, Water Resources Development Act (WRDA 2000). The language found in Section 601 (h) (1) should be inserted prior to the discussion of Section 601 (h) (4) (A) of WRDA 2000. Section 601 (h) (1) states the following: The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized." The above quotation from WRDA 2000 includes paragraph 601(h)(4)(B) entitled the maintenance of flood protection, as well as paragraph 601(h)(4)(A) on existing legal sources.	Your suggestions are noted.

Comment Number	Organization / Agency	Comment	Response
USFWS-94 Conclusion		However, this section does not evaluate the WRDA 2000 Savings Clause for level of service for flood protection. This is an important oversight, and we suggest that a subsection of Section 12 be devoted to this topic.	See above cell for Corps Response
USFWS-95	U.S. Fish and Wildlife Service	Page 12-4, Section 12.1.3, Programmatic Regulations (33 CFR Part 385). We recommend that the following language be inserted in Section 12.1.3: The Programmatic Regulations provide that a pre-CERP baseline be developed to aid the Corps of Engineers and the District to implement the Savings Clause in determining if existing legal sources of water will be eliminated or transferred. The pre-CERP baseline is one of the tools to be utilized in this determination. The Programmatic Regulations also provide that each Project Implementation Report consider the operational conditions developed in the pre-CERP baseline to demonstrate that the levels of service of flood protection in existence on the date of enactment of WRDA 2000 and in accordance with applicable law will not be reduced by implementation of the project.	Concur; the language above will be inserted in the final PIR. However, since the pre-CERP baseline has not been established at the time of SGGE PIR development, the Savings Clause analysis was performed using model simulations reflecting 2000 conditions (i.e., 2000 land use and 2000 water supply demands). This will also be inserted in the text.
USFWS-96	U.S. Fish and Wildlife Service	We recommend removal of the phrase “Department of Interior” from the first sentence of paragraph two so that it is consistent with the Programmatic Regulations and reads “… water supply for fish and wildlife is to be identified by the Corps of Engineers and the South Florida Water Management District in consultation with several other Federal, State, Tribal, and local agencies.”	Concur. The phase “Department of Interior” will be removed.
USFWS-97	U.S. Fish and Wildlife Service	Pages 12-6 to 12-7, Section 12.2.1, Principles for Identifying Water for the Natural System-Background. The PIR should ensure that all water made available by a project and that contributes to identified ecosystem benefits, is quantified. This should include not only the main project area but also any natural areas where beneficial changes in quantity, timing or distribution of water have contributed to selection or justification of the project plan. We recommend that the final report include a summary of all natural areas for which hydrologic benefits have been quantified for the project, and that the water made available to these areas is identified in Section 12. The last paragraph states that the recommended plan effects were modeled using a hydrologic simulation model. We recommend that the PIR reference the hydrologic simulation model documentation.	Concur. Natural areas located outside the project footprint that hydrologically benefit from the project that will be identified in Section 12; this will include surface and ground water.
USFWS-98	U.S. Fish and Wildlife Service	Page 12-7, Section 12.2.2, Quantity, Timing, Distribution, and Water Quality. We recommend replacing the phrase “period of record” with “period of simulation” where appropriate to distinguish between the historical period of hydrologic record and the period of simulation of the hydrological models. Also, the report states that the entire range of historic climatic conditions is represented in the modeling: Since the hydrologic performance measures reflect preferred stages, depths, hydro-periods, etc. under a range of hydrologic conditions representative of historic conditions, a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of beneficial water deliveries available from project features though the entire range of historic climatic conditions. The text should clarify whether the period of simulation (1988 through 2000) is the largest historical period of record available, or, a subset representative of historical con-ditions experienced in the basin.	Concur. The period of simulation will be clarified. Distinction between “ period of record” and “period of simulation” will addressed and the appropriate term will be used in the text.

Comment Number	Organization / Agency	Comment	Response
USFWS-98		If the latter is the case, then documentation or supporting references should be included to show that the subset of years selected is representative of historical conditions.	See above cell for Corps Response
USFWS-99	U.S. Fish and Wildlife Service	Page 12-8, Section 12.2.3, Description of Method Used to Evaluate Project Effects on Existing Legal Sources. The first two sentences indicate that Table 12-1 lists "Existing legal sources" of water. However, the table lists the overall sources of water for the Faka Union Canal watershed, whereas the "existing legal sources" are defined operationally as the portion of these sources that is used as water supply by the specific Savings Clause beneficiaries that are listed later in Table 12-1 (page 12-8). This section is likely to foster a misinterpretation that all water entering the watershed is an "existing legal source." We recommend changing the words "existing legal source" and "legal source" in the first paragraph and in Table 12-1 to simply "source." "Existing legal sources" can then be defined in terms of the specific Savings Clause beneficiaries described in Section 12.5.2 and Table 12-3. In the last sentence of this section, we recommend replacing the word "existing" with "2000" so that the sentence reads "the hydrologic model simulates the pre-CERP baseline	Section 12.2.3 will be moved to Section 12.5 of the PIR, and this section, including tables, will be revised to clarify existing legal sources. In addition, clarification on the use of the 2000 condition will be made. However, it must be noted that the difference between the 2000 condition used in the PIR and the pre CERP baseline cannot be determined at this time since the pre-CERP baseline has been not been formally established. In addition, the use of the 2003 condition for the Florida State Statute s 373.1501 analyses be will clarified. The term "existing condition" used in conjunction with the 2000 and 2003 model simulations will be eliminated from the text and graphics to eliminate confusion.
USFWS-99		Additionally, clarification of the difference between the existing condition and the pre-CERP baseline is warranted throughout this section. The majority of the document defines the existing condition as 2003 conditions while page 12-8 describes the existing condition as the pre-CERP baseline or year 2000 conditions. It is not clear whether the model simulations for the pre-CERP baseline, and the with-project scenarios are identical (except for assumed project features). We suggest adding a clarifying statement, including, if necessary, a description of any differences. To facilitate the evaluation of SGGE project affects on water quantity and quality, SGGE project features should be the only difference between the model simulation inputs.	See above cell for Corps Response
USFWS-100	U.S. Fish and Wildlife Service	Page 12-9, Section 12.2.4, Regional Scale Effects. The report states that the primary regional-scale benefit of this project is to improve the timing and distribution of freshwater flows and reduce damaging point source flows to the downstream estuary. Yet, the graphics supplied in the draft PIR do not clearly demonstrate how timing and distribution are improved. The volume probability curves for estuary deliveries lump all flow categories together including open channel flow through Faka Union Canal and ground- and surface-water fluxes across all four transects. We suggest the PIR include graphics that distinguish between flows within each transect, and identify the portion of water delivered by each source within each transect. Bar charts could be used to easily identify flows by source for each transect if the bars were divided vertically by source and color coded.	We will include graphics showing both the surface and ground water effects, including fluxes across the modeled transects. No bar charts will be included in the final PIR.
USFWS-101	U.S. Fish and Wildlife Service	Page 12-9, Section 12.2.4.1, Estuary Deliveries. The second sentence in Section 12.2.4.1 states "water made available by the project and delivered by the sheetflow to the coastal estuaries within the identified estuarine targets is considered to be a beneficial delivery and is therefore identified for the natural system." While this is true, we recommend that the sentence be revised to include all sources of beneficial water delivered to the estuaries: structural flow from canals, groundwater flow, and sheet flow.	Concur. All sources of beneficial water for the estuary will be clearly stated in the PIR.

Comment Number	Organization / Agency	Comment	Response
USFWS-102	U.S. Fish and Wildlife Service	Pages 12-9 to 12-10, Section 12.2.5.1, Natural Areas. The last sentence in this paragraph should be revised to read "the quantity of water delivered to or retained within the project that results in wetland hydropatterns that fall within targets is considered beneficial water that is identified for the natural system." The expected level of ecological restoration is achieved through a combination of groundwater and surface water within the project footprint. We believe that project level benefits should include all beneficial water made available to the natural system, rather than just the volume of water held in surface water storage within the project footprint.	Concur. All sources of beneficial water for the natural areas will be identified in the PIR. The water budget information for the affected area will be provided in the final PIR.
USFWS-103	U.S. Fish and Wildlife Service	Pages 12-11 to 12-13, Section 12.3, Procedures for Quantification of Water for the Natural System. The PIR should describe how the volume probability curves are calculated for the natural areas and the estuaries at each of the different time periods: dry year, wet year, average year, dry season, wet season, and average annual. The description should identify the time steps used to calculate the averages, and identify the information used to generate the estuary delivery graphics, such as surface water, ground water, or other source. Since Conservation of Mass is the applicable scientific principle for identification of water quantities, the quantification of basin storage and all inflows and outflows is required. Typically, this is reported by a water budget which reports volumes for all significant components of the hydrologic system: structural flows, evapotranspiration, rainfall, groundwater flow, etc. The PIR should include water budgets for the project footprint depicting structural inflows and outflows, groundwater flow across the project boundaries, rainfall, and evapotranspiration.	Concur. A discussion of how the probability curves are calculated will be provided This will include identification of the time steps used to calculated the values. See earlier response in regards to the time step used to calculate the graphics. The water budget information for the affected area will be provided in the final PIR.
USFWS-104	U.S. Fish and Wildlife Service	Pages 12-10 to 12-13, Section 12.3, Procedures for Quantification ofWater for the Natural System. Section 12.3 should distinguish between beneficial baseline water to be protected and additional water produced or redirected by the project. It is unclear from the PIR whether all water delivered to the estuaries is additional water produced or redirected by the project and therefore water to be reserved by the State, or if a portion of this water is existing beneficial baseline water to be protected by the State. There also needs to be a similar discussion for natural areas as to the beneficial baseline water for natural areas and the additional water produced or redirected by the project.	Concur. The beneficial existing ("baseline water") and the incremental beneficial water produced by the project will be distinguished in the PIR for both the estuaries and the natural areas.
USFWS-105	U.S. Fish and Wildlife Service	Page 12-11, Section 12.3.1, Procedures for Quantification of Water for the Natural System. The second paragraph states "a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of water deliveries that are beneficial to the natural system from project features…" Volume probability curves based on depth neither represent all the water nor only the water delivered from project features. This method includes quantities from other sources, such as rainfall, and omits structural inflows from project features if these are stored as groundwater. We suggest rephrasing this statement as, "a probabilistic approach has been selected utilizing volume probability curves to depict the distribution of volumes of water that provide natural system benefits as a result of project features…"	Concur; the statement regarding the probabilistic approach will be modified.

Comment Number	Organization / Agency	Comment	Response
USFWS-106	U.S. Fish and Wildlife Service	Page 12-12 to 12-13, Section 12.3.2.1, Identification of Water to be Reserved. We suggest the second sentence be changed to reflect all time intervals used to describe project effects: annual average, wet season, dry season, wet year, dry year, and average year. We agree that the combination of the operational plan and the graphics depicting additional water made available by the project should comprise the water identified to be reserved for the natural system by the State of Florida. However, we feel that the volume probability curves based on depth do not capture all water being delivered by the project features for restoration and protection of fish and wildlife resources. We refer to our comments above on section 12.3.1 related to volume probability curves. We suggest the PIR include individual sections describing methods used to calculate wet year, dry year, and average year and provide the rationale for selecting the representative years.	Concur; the second sentence will be revised. Additionally, clarification and rationale of the wet year, dry year and average year will be addressed in the fina PIR.
USFWS-106 Conclusion		We also suggest that the documentation of the wet, dry and average season be expanded in the PIR, checking to ensure that the definitions for wet season and dry season are consistent with those used in other sections of the report.	See above cell for Corps Response
USFWS-107	U.S. Fish and Wildlife Service	Pages 12-11 to 12-13, Section 12.3.2, Beneficial Delivery Volume Probability Curves. Similar to our above comments for section 12.3, the text should include a description of how the volume probability curves were calculated. We also reiterate our general section request for documentation of the selected representative wet, dry and average years.	Concur; a description of how the probability distribution curves were calculated will be provided along with the documentation of representative years.
USFWS-108	U.S. Fish and Wildlife Service	Pages 12-13 to 12-23, Section 12.4, Project Results. The discussion in Section 12.4 only identifies additional beneficial water made available by the project. The beneficial baseline water should also be identified.	Both issues stated above will be addressed in final PIR. See response for Section 12.3.
USFWS-109	U.S. Fish and Wildlife Service	Pages 12-13 to 12-14, Section 12.4.1, Project Results, Background. Table 12-2 lists the targets and sources of beneficial water for each restoration area. We suggest groundwater flow and structural flow from Faka Union Canal be added to the list of sources for Faka Union bay and downstream coastal estuaries. We also suggest groundwater be added to the list of sources of beneficial water for the natural area restoration.	Concur. Table 12-2 will be revised to reflect the suggested modifications.
USFWS-110	U.S. Fish and Wildlife Service	Pages 12-14 to 12-15, Section 12.4.2.1, Project Footprint. We suggest that a map and text describing the project footprint be included in the PIR.	Concur; a description and map of the project footprint and map will be provided in the final PIR and referenced in this section. Additionally the main report and appendices shown the project footprint.
USFWS-111	U.S. Fish and Wildlife Service	Page 12-19, Section 12.4.3.1, Estuary Deliveries. The claimed benefit of reductions in point source flows from Faka Union is undermined by Figure 12-7, on page 12-19, which indicates that flows delivered by the canal are below target flows for 3-4 months (September through December) of the year. This should be clarified.	The purpose of including Figures 12-7, 12-8 and 12-9 was to demonstrate the significant reductions in point source discharges to the estuary from the Faka Union Canal (single transect) when compared to Figures 12-11, 12-12 and 12-13 (which show the improved estuarine deliveries across the entire southern transect of the project footprint). Figures 12-11 through 12-13 represent the recommended plan conditions and are used for the identification of water for the protection of fish and wildlife. These graphics show the estuarine restoration target is met or exceeded by the recommended plan for the average year, wet year and dry year conditions.

Comment Number	Organization / Agency	Comment	Response
USFWS-112	U.S. Fish and Wildlife Service	Page 12-24, Section 12.5.2, Identification of Existing Legal Sources of Water. It is central to the intent of the Savings Clause that it applies to all existing legal sources potentially affected by a project. It is probably of most importance to users of the existing legal sources that lie outside a project area and are not expected to benefit from it. Table 12-3 on Page 12-24 identifies the existing legal sources for water supply in the project study area. Local basin storage and runoff and the surficial aquifer are identified as the sources for fish and wildlife, agricultural, urban, and ENP. Yet, only a portion of ENP estuaries is affected, but a large portion of the Ten Thousand Islands NWR is affected. These sources were solely evaluated by analyzing changes in surface water and ground water storage within the project footprint. The analysis of existing legal sources in the project area should provide graphics and interpretive text demonstrating that existing legal sources for fish and wildlife within the basin, but outside the project footprint, have been protected.	Table 12-3 will be revised to appropriately reflect the Ten Thousand Islands NWR. Impacts to existing legal sources outside the project footprint will be included in the final PIR. Additionally, the project effects were evaluated holistically as shown in the model boundary graphic, without separately evaluating each of areas above. The boundary fluxes along the northern boundary (variable flow and head) are being processed from the model input and output. This level of regional detail is not appropriate for the Picayune Strand PIR . We suggest it is more suited to the Southwest Florida Feasibiltiy study.
USFWS-112 Conclusion		Specifically, we recommend evaluating model results for indicator regions within the following areas that were identified by agencies participating in the WRAC pre-CERP baseline issue team discussions: Corkscrew Swamp Sanctuary, Collier Seminole State Park, 10,000 Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Preserve, Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, and wetlands in NGGE. We also recommend evaluations for the Belle Meade portion of Picayune Strand State Forest, CREW, estuarine resources in Estero Bay, Henderson Creek, and the Gordon River. Additionally, water budgets for the project footprint and NGGE should be included in the PIR to summarize structural inflows and outflows, groundwater seepage, evapotranspiration, and rainfall. We also recommend including graphs of boundary fluxes along the northern and western boundaries of the model for the with- and without-project conditions, in order to demonstrate that the project will not have any effects outside the model domain.	See above cell for Corps Response
USFWS-113	U.S. Fish and Wildlife Service	Pages 12-27 to 12-30, Section 12.5.4, Identification of Project Effects on Existing Legal Sources of Water. Graphics 12-14 through 12-16 should include a trace for the natural system, or target. The target is necessary to illustrate that all of the water that the natural system is receiving is actually beneficial. The estuary graphics used to perform the existing legal source analysis evaluate the sum of all flows to the estuary. While it appears that the project passes the existing legal source test on that basis, Figure 12-7 indicates that delivery targets from Faka Union Bay may not be met at the end of the wet season and beginning of the dry season during an average year. Meeting the total flow requirements of the estuary may be acceptable for restoration, but deficiencies in any source of water should be documented and explained. We recommend that the estuarine evaluation team for the SGGE project be consulted on this issue. Effects on the West Indian manatee may also need to be addressed.	The water identified to be managed for the natural system is based on model simulations indicative of the 2003 conditions, not the 2000 condition; therefore, the restoration target was not included on graphics 12-14 through 12-16. For meeting total flow requirements to the estuary see response to USFWS comment 111. The representative dry year is 2000 in the final PIR.
USFWS-113 Conclusion		We suggest the PIR explain why 2000 was used as the representative dry year for analysis of estuary deliveries in the existing legal sources section while 1990 was used as the representative dry year for all other analyses in the document.	See above cell for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-114	U.S. Fish and Wildlife Service	Page 12-31, Section 12.6.1.3, Water Supply. This section states “one of the incidental project benefits of the recommended plan will be to improve the aquifer recharge in and adjacent to the study area; therefore, supplies of water to meet the demands of existing legal users are not expected to be adversely impacted by project implementation.” We recommend the PIR include graphics or references to graphics used to arrive at this conclusion.	Figures 12-22 through 12-24 in Section 12 of the final PIR demonstrate the aquifer recharge in and adjacent to the project area improves with the recommended plan; therefore, existing legal users are not expected to be adversely impacted by project implementation.
USFWS-115	U.S. Fish and Wildlife Service	Page 12-33, Section 12.6.1.5, Flood Protection. This section states “more detailed information including maps illustrating the comparison between existing and with project conditions can be found in Appendix A of this report.” We recommend the PIR include references to specific graphics that were used in the analysis or include them in the assurances section.	Do not concur, report is very large and it is not standard to duplicate figures for the main report, when those figures can be referenced.
USFWS-116	U.S. Fish and Wildlife Service	Page 12-37, Section 12.6.3.1, Water Supply Assurance. The text in this section could be misinterpreted. Increased volumes of water in surface water and groundwater storage within the project footprint are considered adequate assurances that water supply for existing legal users shall not be diminished through project implementation. However, this quantity of water should not be confused for excess water that is available for other uses such as water supply. The combination of increased groundwater and surface water levels within the project footprint are responsible for the restoration benefits expected and can not be made available to other users, such as water supply, without witnessing a reduction in restoration levels. We suggest the text be modified to clarify this distinction, including a discussion of what water may be made available for other uses, if any.	Quantities of water which are greater than what has been identified as beneficial for the protection of fish and wildlife (amounts that exceed the hydrologic restoration targets) are therefore, not identified to be reserved. Water made available by the project appears on model runs to be above restoration targets is not considered "available" for specific purposes. No determination has been made in the PIR as to the availability of this additional water for specific purposes.
USFWS-117	U.S. Fish and Wildlife Service	Page 12-42, Section 12.6.3.2, Flood Protection Assurance. This section states “detailed analysis for flood protection for the project area can be found in Appendix A.” We suggest the PIR include specific references to the graphics in Appendix A that were used to perform project assurance analyses and a narrative describing the conclusions that were drawn from them.	Do not concur, see reponse to comment 115.
USFWS-118	U.S. Fish and Wildlife Service and Florida FWC	Section 13, Recommendations (1) We strongly support recommendations that protect baseline water, as well as the reservation of additional project water for the natural system, by the State of Florida. Water made available by CERP projects over and above existing levels cannot be treated as “stand alone” contributions toward restoration because the benefits of “new” CERP water depend on the interaction between new and already-existing water in natural systems. Additionally, many natural areas within the CERP domain are not short of water but have too much, at least some of the time. The restoration of these areas depends on the protection of existing baseline water. We, therefore, strongly support the recommendation that the local sponsor act to protect both baseline and new project water for the natural system. (2) Recommendations contained in Section X of the draft FWCAR in Appendix D of this plan, and any other recommendations that will be incorporated in the final FWCAR, should be instituted as part of this project plan commitment.	Split out these recommendations individually. Our answers are: (1) Support noted; (2), FWCA regulations require us to consider, but not necessarily to adopt, all recommendations made by the Service in a DCAR or final CAR. This matrix shows we have concurred with and adopted many Service recommendations. Others are deferred for the detailed design phase, should the project be authorized; still others are considered by us to be impracticable. (3)The US Army Corps of Engineers intends to comply fully with the ESA and is not sure what is meant by "embrace" the Act. We have been and continue in close coordination with Service staff to assure adequate protection for and monitoring of, listed species that may be affected by the project. We expect project effects on endangered and threatened species to be beneficial; regarding (4) Adaptive management and monitoring plan has been revised in cooperation with the Service and may be found in Appendix H.

Comment Number	Organization / Agency	Comment	Response
USFWS-118 Continuation		(3) Due to the importance of this project to federally protected species, particularly the West Indian manatee, wood stork, and Florida panther, and the significant contribution of federal funds to project acquisition and development from the DOI and the Army Corps of Engineers, the Corps should embrace full compliance with the Endangered Species Act. In particular, Section 7(a) (1) directs federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the conservation of endangered and threatened species listed pursuant to section 4 of the Act. This portion of the Act sets forth actions beyond the standard of consulting with the Service to assure that agency actions are not likely to jeopardize the continued existence of any endangered or threatened species or its critical habitat. The Service is assisting the Corps in developing a plan that goes beyond avoidance of adverse effects to provide beneficial effects to listed species.	See above cell for Corps Response
USFWS-118 Conclusion		(4) Due to the complexity and resulting uncertainty associated with hydrologic modeling and the importance of development of an operations management plan that focuses on restoration benefits, the Corps should specifically commit to the continued development of an Adaptive Monitoring and Assessment Plan for this project. This plan is currently being developed and will be significantly modified beyond the plan included in this document.	
USFWS-119	U.S. Fish and Wildlife Service	Section 16, References. Page 16-1. Literature citations in this section appear to be missing from the draft FWCAR literature cited section.	We do not normally treat the CAR as a chapter of the PIR/EIS. We do not normally incorporate FWCAR references in the main report references.
USFWS-120	U.S. Fish and Wildlife Service	Appendices. Appendix A, Draft Hydrology and Hydraulics. General Comments. The documentation of the hydrologic modeling performed contains many editorial errors, omissions, and inconsistencies that make it difficult to evaluate. Many of the conclusions drawn within particular sections of the document are not supported by accompanying graphics of model results. Likewise, text descriptions of many graphics are missing. Legends on graphics are mislabeled or labeled with insufficient information to analyze them accurately. These problems are compounded by differences in aggregation levels and period of record, errors in scale bars, multiple measurement systems (feet vs. meters), multiple datum (NGVD29 vs. NAVD88), and contradictory text and figures. We offer the following specific recommendations for this text section:	Changes will be made to have a consistant datum and units of measure as well as to rectify any errors. Comment 1 response: Do not concur, Appendix A format has traditionally only high detailed recommended plan, however, at the request of PDT member, which include USFWS personnel the best 3 restoration alternatives were added to the Appendix. Comment 2 response. Concur figures were revised to clearly identify those features. Comment 3. response Do not concur, Operational plan was developed only for the recommended plan as per the CERP Programatic Regulations. Comment 4 Reponse. Do not concur boundary conditions at the northern and western boundarys are very far away from the proposed project area and not necessary for illustrating restoration or flood control modeling. However, boundary conditions are detailed in the Appendix A write up, as well as those files were given to the USFWS for their review. Comment 5 Response: Do not concur, this information is not necessary for the completion of this appendix.
USFWS-120 Continuation		1. It appears that several different modeling efforts were completed for different evaluation requirements. However, the report did not adequately document the various efforts or clearly indicate for each section which modeling effort was used. Clarification of the general modeling process undertaken for the project is necessary, including the process that was used to iteratively step through proposed changes to structural features and operational criteria.	See row 149 for Corps Response
USFWS-120 Continuation		2. Include a clearly labeled location map that identifies the well fields, chainages, monitoring locations in NGGE and SGGE, major roads, canals, and water control structures.	See Row 149 for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-120 Continuation		3. For each alternative evaluated, provide a table of operational criteria and a description of the alternative.	See Row 149 for Corps Response
USFWS-120 Continuation		4. Provide a graph of boundary fluxes along the northern and western boundaries of the model for the with- and without-project conditions to demonstrate that the project will not have any effects outside the model domain.	See Row 149 for Corps Response
USFWS-120 Conclusion		5. Include water budgets for watersheds in the model domain, NGGE and SGGE. This would help the reader to understand the sources and destinations of water in the project impact area.	See Row 149 for Corps Response
USFWS-120b	U.S. Fish and Wildlife Service	6. There appear to be more than one existing condition alternative used in the modeling. We believe a single existing condition alternative should be used. If it is necessary to have more than one existing condition, please provide adequate description for the differences and rationale for their use. 7. Provide a narrative summary of the modeling results including specific elements of the figures and maps from which conclusions are drawn. 8. When summarizing the spatial modeling results, provide maps depicting differences relative to a single alternative (i.e., Alt 3D relative to Existing Conditions). 9. Use consistent units and one vertical datum. 10. Label all graphics with the proper units and vertical datum. 11. Remove duplicate figures between the sections in the main body of the PIR and appendices or replace them with a reference to the page number where they can be found. 12. Correct scale bar errors on map figures. 13. Temporal aggregation levels should not be mixed. In particular, avoid mixing weekly hydrographs with daily hydrographs.	Comment 6 response: Do not concur model conditions are clearly stated in this appendix. The rationale for using was explained in the Appendix A write as well as in the 10 August 2004 meeting with the USFWS at Vero Beach. Comment 7 response: Do not concur Appendix A is fact based and any drawn H&H conclusions are noted in the H&H appendix. Comment 8 response: Do not concur, differences can be derived from maps provide. Comment 9 response: Concur. Comment 10 response : Concur. Comment 11 response: concur; however this comment directly contradicts comment USFWS 115 above. Comment 12: Comment noted well verify. Comment 13 response: Comment noted will verify. Comment 14 response: Concur, clarified in the Appendix A write up. Comment 15 repsonse: Comment noted will verify and correct as needed. Comment 16 response: Concur pages should be labeled, except for the figures and tables. Comment 17 response: Comment noted the Appendix A modeled wet, dry and average years. However, SFAM analysis was not performed by H&H PDT members therefore, was not documented in Appendix A.
USFWS-120b Conclusion		14. Analysis windows (e.g., dry season, wet season, dry year, or wet year) should be consistent throughout the analysis. 15. Correct contradictions between text descriptions and accompanying figures and conflicting text descriptions in different sections of the report. 16. Label pages in the appendix with page numbers. 17. Evaluate ecological restoration based on a period of simulation that includes a variety of meteorological conditions with inter- and intra- annual variability. The inclusion of these periods in the SFAM reduces the overall uncertainty in its application.	See row 155 for Corps Response
USFWS-121	U.S. Fish and Wildlife Service	Specific Comments (Appendices). Page A-15, Section IV.B, Topography. In this section, the vertical datum for the study is identified as the 1988 North American Vertical Datum (NAVD). It is not clear whether this is the same vertical datum that is used throughout the report, such as in the assurances evaluation and in the operational plan. It is distracting to convert between datums and units while reading the report. If multiple datums must be used, clearly identify the datum used on each graphic and provide a conversion chart.	Comment noted. One datum will be used see response to USFWS comment 120.

Comment Number	Organization / Agency	Comment	Response
USFWS-122	U.S. Fish and Wildlife Service	Page A-17, Section IV.C., Tributaries . We are concerned that the model does not adequately simulate surface water flow and the connection that exists between surface and ground waters. The second sentence on this page states that a field investigation of aquife impacts from the drainage canals in SGGE showed a drop in the water table of approximately 2 feet at a distance of 6,000 feet from the canal. This indicates that the surface water and ground water are very closely connected. However, the modeling output included in this report does not show the same degree of connection. Stages in the canals in NGGE are raised 2.3 feet during the dry season with minimal or no corresponding increases in groundwater stages (e.g., Figures A-89 through A-89B and Figures A-90 through A-90B).	Comment noted SFWMD, DHI and CESAJ-EN-H met with USFWS on 10 August 2004 in Vero Beach and it was apparent that there was no basis for this comment because there were not groundwater comparison plot presented to compare to the cited figures. However, SFWMD agreed to have DHI look at the groundwater result in this area.
USFWS-123	U.S. Fish and Wildlife Service	Page A-21, Section V.B.3., MIKESHE Evapotransporation Module (ET). Since evapotransporation constitutes a large portion of the water budget in south Florida, a description of how evaporation from the free water surface and soils is simulated in the model should be included. Also, include a description of the ranges of LAI and Kc and a reference to the data or available literature used to select their values. The inclusion of documentation for the ranges of Kc for given land uses, e.g. cypress, would allow reviewers to determine whether the variation is spatial or temporal.	Comment noted SFWMD, DHI and CESAJ-EN-H met with USFWS on 10 August 2004 in Vero Beach and explained the method of which ET was applied to the area and clarified the ranges and descriptions of the LAI and Kc parameters. The references for that data will not be included in Appendix A.
USFWS-124	U.S. Fish and Wildlife Service	Page A-22, Section V.B.D, Input Data and Model Setup. We are concerned that relative alternative-to-alternative comparisons may be complicated by parameters, such as floodplain topography and floodplain codes, that could change values between alternatives. Model-to-model comparisons should identify which model input parameters remain consistent between alternatives, and which ones change. When model input parameters change between alternatives, the change should be documented. We recommend using either a tabular or a graphical format, and inclusion of the documentation in the report.	Comment noted SFWMD, DHI and CESAJ-EN-H met with USFWS on 10 August 2004 in Vero Beach and demonstrated of how the flood plain codes were applied. However, that information will not be demonstrated for all the alternatives in the report in Appendix A.
USFWS-125	U.S. Fish and Wildlife Service	Page A-22, Section V.D.1., Meteorological Data. When the performance measure of the project is evaluated for only a small subset of years or meteorological conditions, it is critical to ensure that the years or conditions chosen are actually representative of the historic meteorological conditions. The text states that the 1988-2000 period of record represents the complete period of record for this area. If this is a subset of the available period of record, we recommend the PIR provide an analysis supporting the selection of 1988-2000 rainfall as a representative sample. We recommend the PIR provide data supporting the selection of the wet, dry, and average periods as represented by 1994, 1995 and 2000, respectively. Also an explanation of why these selected periods change throughout the analysis would be helpful. For example, in this section 2000 is defined as the average year, but in Section 12 it is the dry year. Once selected, we believe the representative years used to evaluate the project should not be changed.	Do not concur. The requested information was made available to all PDT members, which include USFWS personnel from the Vero Beach and Naples offices from DHI. DHI provide numerous reports and memos on the calibration and verification of the BCB model, which include discussions on the meteorological data and the supporting data. Reports date back all the way back to January of 2004 and earlier.

Comment Number	Organization / Agency	Comment	Response
USFWS-126	U.S. Fish and Wildlife Service	Pages A-23 and A-31, Section V.D.2. Land Use V.F. 1. Natural Systems Model (NSM). Since NSM is used as the target for restoration, it is critical to understand the assumptions used to develop it. Additional documentation of the methodology used to generate the pre-development (Natural) condition shown on Figure A-7 should be provided. The new material should identify the land use coverage used in the Natural System Model (NSM) simulation, too. Because the NSM is a critical part of the plan formulation process, complete descriptions of the NSM are important. For example, the documentation should: · Explain the relevance of descriptions for agriculture and other urban land uses, which appear in the legend of Figure A-7, · Compare the spatial fit of Figure A-7 with the NCRS categories depicted in Figure 3-1, · Explain how the period of record in MIKESHE relates to Figure A-7, · Identify the assumptions underlying canal removal inputs, and, · Describe how input parameters such as Manning's n, time constants, drainage depths, and detention storage were changed.	Do not concur. The requested information was made available to all PDT members, which include USFWS personnel from the Vero Beach and Naples offices from DHI on the NSM model. Biologist, Ecologists and other Environmental scientist conferred to generate this model input data set. Documentation on the selection of parameters were provided to the USFWS and other participating agencies by the SFWMD on the NSM model condtion. Changes were made to that model condition based on the peer review and input at that time. The current documentation in Appendix A was written to generally describe the condition not provide any in depth detailed description of that model condition. Additionally, meetings were held with the to USFWS on 5 and 10 August 2004 to clarify the assumptions for "canal removal inputs" and other model parameters. It was agreed that the current Appendix A writeup sufficiently describe the condition.
USFWS-127	U.S. Fish and Wildlife Service	Page A-24, Section V.D. 4, Topographic Data . A more complete description of the detention storage coefficient, including references and maps explaining how a spatial value was assigned to each alternative, should be provided. We suggest the text clarify how, if at all, its values were changed after calibration to simulate the alternatives.	Comment noted SFWMD, DHI and CESAJ-EN-H met with USFWS on 10 August 2004 in Vero Beach and demonstrated of how the detention storage coefficients were used. Those coefficient were not changed after calibratrion.
USFWS-128	U.S. Fish and Wildlife Service	Page A-25, Section D.4, Canal Network, Hydrological Data. We suggest selecting a local tidal stage boundary instead of what is currently proposed. Data from the Ten Thousand Islands NWR indicate that tidal influences do not extend much beyond the headwaters of the major bays. Thus, the southern boundary of the hydrologic model could be extended much farther south than it currently is. This would partially address the assessment's gap between inland and estuary areas.	Do not concur, the current tidal boundary conditon that is in the model was deemed adequated by the PDT peer review and Independent Technical Review. That tidal boundary conditon will not be changed at this point in time.
USFWS-129	U.S. Fish and Wildlife Service	Page A-25, Section V.D.4.a., Roughness Coefficients. To ensure model-to-model comparisons are true relative comparisons, Manning's n values for the overland flow module for each vegetation type should be provided. If these values change between alternatives, we recommend these changes be documented in the PIR.	Comment noted. This information was provided to the USFWS as part of the NSM Documentation mentioned in comment USFWS 126.
USFWS-130	U.S. Fish and Wildlife Service	Page A-27, Section V.D.8., Irrigation Data. It may not be appropriate to assume drip irrigation for all residential and agricultural irrigation in the entire model domain. This assumption would result in significantly reduced demands compared to conventional methods and could potentially result in the over-estimation of water available for environmental restoration. We believe that further explanation of the decision to assume drip irrigation values for all irrigation demands in the domain is warranted.	Comment noted SFWMD, DHI and CESAJ-EN-H met with USFWS on 10 August 2004 in Vero Beach and demonstrated of how the irrigation was modeled. It was noted that drip irregation was used over the domain as stated.
USFWS-131	U.S. Fish and Wildlife Service	Page A-27, Section V.D.9., Summary of Model Parameters. The missing, but requisite, determination that quantifies the significance of varied drainage depths and time constants during calibration should be included in the section. Without providing some measure of how changing these variables influences simulated flows and stages, the uncertainty in relative comparisons between alternatives can not be assessed.	Do not concur, there were not changes in the cited variables between alternatives.
USFWS-132	U.S. Fish and Wildlife Service	Page A-29, Section E.2, Initial Boundary Conditions. There may not have been tidal data available before 2000, but there is now, including data from Faka Union Bay. The newly available tidal data should be used in the modeling and the later stages of Alternative evaluation.	Do not concur, see response to USFWS comment 128

Comment Number	Organization / Agency	Comment	Response
USFWS-133	U.S. Fish and Wildlife Service	Page A-30, Section V.E.5., Calibration, Verification, and Validation. The text should be modified to explain why the model was calibrated and verified over the same time interval, 1995–1999. Typically, models are verified during a different time interval than that used for calibration to ensure that they adequately represent the physical system.	Concur, text will be modifed as discussed in the 10 August 2004 meeting with SFWMD, DHI and CESAJ-EN-H personnel.
USFWS-134	U.S. Fish and Wildlife Service	Page A-32, Section V.F.2., Existing Natural Systems Model. Two different simulations of the existing condition are used in this report. They appear to differ only by the simulation of FU-4. Please define each one and their intended purpose. Explain how the existence of and removal of the roads and ditches were modeled using the MIKESHE drainage component. Table A-1 does not include a specific reference to the drainage component. Describe what the drainage component is and how it was used to simulate the roads and ditches.	Comment noted, with respect to Natural Systems Model portion of comment see response to USFWS comment 126. Existing condtions with the New FU-4 and Old FU-4 conditions were explained tin the report and reiterated in the 10 August 2004 meeting with USFWS. This NSM in this report does not refer to the 2x2 (SFWMM) "NSM." The targets for restoration in this NSM were created based on known stage/durations for natural plant communities in the historic landscape.
USFWS-135	U.S. Fish and Wildlife Service	Pages A-33, 34, and 35, Section VF.4., Restored Conditions Alternative 3D. Figure A-40 does not accurately depict Alternative 6 as described. Figure A-40 indicates that structures Miller 2, FU-3, and Lucky Lake were removed whereas the text states that Miller 1, FU-2 and Merritt 1 should have been removed. This discrepancy should be clarified. If the correct version was used in the model for Alternative 6, explain why the stage for Alternative 6 in Figures A-89 through A-89B is higher that all of the other scenarios modeled. This is important since the results could be due to the leaky structure, or, more significantly, a datum shift that occurred in Alternative 6. A datum shift could affect the ranking of alternatives.Rationale should be included as to why Alternatives 3D, 6, and 12 were simulated for the period 1994-1999, but analysis windows for the graphics presented are only for the “average” year, 1994. To accurately describe the ecological restoration potential of the project, a range of conditions and seasons should be evaluated.We are concerned with the methods used to simulate the floodplains.	Comment Noted. Final report will be revised to eliminate discrepancy. Alternative 6 result show higher stages because that is the results of the model. Intuitively, one would expect higher stages and longer durations than the existing conditions because proposed project features for restoration and flood control. Additional information on the model runs have been provided to USFWS since Jan 2004 to the Vero Beach office, which include Alternative 6.
USFWS-135 Continuation		Please explain the conceptualization and rationale for using floodplains based on topography. Given documented stability problems associated with modeling of the canal plugs, we are concerned with our ability to accurately evaluate alternatives using model output. The third bullet on page A-34 states that adding the canal plugs caused model stability problems. Since the canal plugs are a critical part of the project design, it is extremely important that the modeling tool be capable of evaluating their effects. In fact, the geotechnical section of the report mentions the need for more modeling to simulate the flow around these plugs.The first bullet on Page A-35 that describes how east-west flow was established in the model is not entirely clear. Document the reasons and actual changes in the floodplain codes between alternatives or after calibration. If the floodplains were added to the model following calibration, a description should be included addressing how they affected the calibration of the model.	See Row 171 for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-135 Continuation		It is our understanding that the floodplain code is an input flag that allows surface water to flow over the bank from the floodplain in the MIKE11 network. The code should not enable surface water flows to enter a plugged canal that a floodplain traverses and travel a path independent of the physical constraints that exist. If floodplains were evident in the original topography, they should have been included in the existing conditions simulation rather than added later. Please explain how changing floodplain codes between alternatives might affect accurate "apple to apple" comparisons of alternatives. The explanation should allow reviewers to assess whether these changes between alternatives affect the relative ranking of alternatives, and ultimately, the selection and implementation of an alternative.The second bullet on Page A-35 states that Alternative 3D was simulated from 1994 through 1999 and for an average year. Yet, the time scales on the graphics in the document vary (e.g., 1993 through 1995, 1995, 1994, and 1988 through 2000).	See Row 171 for Corps Response
USFWS-135 Conclusion		We are assuming that different time scales were used in different modeling exercises to meet different requirements in this report. Provide a description of all modeling efforts that are included in this report and specify which was used for evaluation in each section.	See Row 171 for Corps Response
USFWS-136	U.S. Fish and Wildlife Service	Pages A-35, A-36, Section V.F. 4., Restored Conditions Alternatives 6 and 12. Please refer to comments on Page A-33-34 above. If these parameters were adjusted during or after calibration, documentation is necessary.	Comment noted see repsonse to USFWS comment 135.
USFWS-137	U.S. Fish and Wildlife Service	Page A-38, Section VI.A, Hydrology and Hydraulics Modeling for Flooding, Existing Condition. Please clarify the following statement: It is generally considered that depth of the overland flow is very small and the influence of the overland flow boundary will mainly be limited to adjacent cells.The northern and eastern boundaries of the model domain include Corkscrew Swamp Sanctuaries and Big Cypress National Preserve, which are areas where water depth and overland flow are significant components of the hydrologic cycle.	Comment noted, This comment was discussed with the USFWS on 10 August 2004 meeting with SFWMD, DHI and CESAJ-EN-H personnel. The overland portion of the MIKESHE model is affected by the stages in the adjacent cells in the 2D network.
USFWS-138	U.S. Fish and Wildlife Service	Page A-38, Section VI.G, Modeling Results for Restoration. Model results for some or all of the seven well sites on the Ten Thousand Islands NWR should be included, in addition to the 32 wells modeled in Figures A-47 through A-78.	Do not concur, well sites that were included in Appendix A were to support the main report and alternative 6, 12 and 3d and that was all that was requested by the PDT team members, which include personnel from USFWS, SFWMD, State of Florida FWC other agencies.
USFWS-139	U.S. Fish and Wildlife Service	Page A-39, Section VI.A., Hydrology and Hydraulics Modeling for Flooding, Existing Condition. The first paragraph on page A-39 states: …an accurate representation of the topography at the modeled grid level may not have been attained due to the 1500-foot by 1500-foot grid cell discretization…procurement of more detailed topographic data input is recommended to verify the final plan during the detailed design stage of the project. We concur that accurate topographic data are essential and should be incorporated when available. However, this may result in the need for recalibration of the model and could potentially change the predicted hydrological effects. If this is done, we recommend that project modeling be updated to confirm and recalculate the project benefits to ensure that existing legal sources have been protected, and update the calculation of water made available by the project and subject to state reservations.	Do not concur, project benefits will not be recalculated if the model is rerun in the Detailed Design Phase.

Comment Number	Organization / Agency	Comment	Response
USFWS-140	U.S. Fish and Wildlife Service	Page A-40, Section VI A. 1.b., Rainfall. We are concerned that the spatial distributions of rainfall for the 10-year, 25-year, and 100-year return periods for the BCB model depicted in Figures A-85 through A-87 are an over-estimation of extreme rainfall that is not observed in the historical record. Please explain how there could be uniform rainfall of the same return period at every station in the model domain at the same time. The assumption that the temporal distribution is the same for each station over the same 5 days seems incorrect because it implies that there is no forward movement of the storm towards and away from the project area. These factors contribute to an over-estimation of run-off because infiltration is exceeded simultaneously at all locations, resulting in significant over-estimation of necessary conveyance capacity. Please explain why the historical rainfall record is not sufficient for evaluating and assessing flood control objectives. During the 1988-2000 period, two tropical storms were recorded, a 1-in-10 and 1-in-25-year events.	Do not concur. Method for distributing rainfall over BCB model domain was based on the latest data, which was developed by the SFWMD and was based on historical data. As noted in USFWS comment 46, the USFWS hydrologist PDT members from the Vero Beach were provided the latest data since October 2003 and with their input this rainfall was developed into the best available data set. It should be noted that the only other available rainfall data is either not as recent, insufficient or does not exist.
USFWS-140 Conclusion		This period also included a wet season which has been described as one of the wettest on record. Please include graphics for the monitoring locations in NGGE and SGGE with the same analysis window (100-year storm) as the “Real Estate Takings Analysis” to assist in assessing potential impacts, such as excessive water depths and hydroperiods in NGGE and SGGE.	See above cell for Corps Response
USFWS-141	U.S. Fish and Wildlife Service	Page A-41, Section VI.A.1.c., Antecedent Moisture Conditions. Provide documentation on the selection of June 1993 through July 1995 as representative of average meteorological conditions. The section describing antecedent moisture conditions is not clear. Please explain why extremely wet conditions were used as an antecedent moisture condition. It seems like several different modeling efforts are described in the report with different periods of simulation and assumptions. Please also distinguish which simulations and evaluations used this antecedent moisture condition.	Do not concur, the wet antecedent moisture conditions utilized for the 10 year, 25 year and 100 year storm events were deemed resonable by hydrologists involved by the PDT member. This comment was dilberated again with the USFWS hydrologist in the 10 August 2004. It is unreasonable to assume that dry antecend moisture condition occur during the wet season in florida, which in this area is noted to have approximately 60 inches of annual rainfall. Additionally, the 10 year, 25 year and 100 year event are consider extreme and to consider the antecedent moisture conditions as normal would be unsubstantiated and unusual.
USFWS-142	U.S. Fish and Wildlife Service	Page A-42, Section VI.A.3., Calibration, Verification, and Validation. The documentation of the calibration results is inadequate; it does not provide the information reviewers need to determine if the model is accurately simulating physical conditions. The report states that 57 groundwater monitoring stations, 26 river/canal staff gauges and 5 flow gauges were used in model calibration. Calibration results for all stations should be referenced or included. Also, the report states that the model was verified and validated by comparing two tropical storm events. This model is being used to quantify restoration benefits during all meteorological conditions. Explain why verifying the model only for large storm events is adequate. Also provide a clearer description confirming whether the statistics in Tables A-11 and A-12 represent calibration and verification of the BCB for tropical storms Jerry and Harvey or for the 1995-1999 period of simulation.	Do not concur. Appendix A adequate substantiates calibration, verification and validation of the model. Additional, information can be gathered from the source of this information by DHI and SFWMD. PDT members from the USFWS were given this documentation, dated January 2004 and all of the subsequent information. Reader is provided all of the necessary information in the vicinity of the project area. Areas such as cork screw swamp and other areas within the 1200 mile domain are not necessary for the proposed project restoration area.
USFWS-143	U.S. Fish and Wildlife Service	Page A-45, Section VI.B.3., Project Features for Alternatives. Change the wording from “the primary features of environmental restoration are the pump stations and spreader channels” to “the primary features of environmental restoration are the canal plugs and removal of roads augmented by the pump stations and spreader channels.”	Concur, draft document will be changed for the final report.

Comment Number	Organization / Agency	Comment	Response
USFWS-144	U.S. Fish and Wildlife Service	Page A-50, Section VI.B.3.b.vi., Alternative 6, Removal of Existing Structures. Descriptions of Alternative 6 elsewhere in the document do not describe the removal of the Miller-2, FU-3, and Lucky Lake structures as indicated on page A-36. This particular description states that it would "remove existing Miller-1, FU-2, and Merritt-1 structures." The text should clarify which section contains the correct assumptions with respect to removed structures and verify that the modeling, analysis, and graphics presented in DPIR are consistent with the guidance from PDT during the plan formulation process. The operational criteria for the structures simulated in all alternatives should be provided. If the wrong structures were removed in the model, the ranking of alternatives needs to be reevaluated.	Concur, changes will be made as noted in USFWS comment 120 response to subset comment 15.
USFWS-145	U.S. Fish and Wildlife Service	Page A-55, Section VI.C.2.a., Alternative 6, With Project Condition. We recommend a description be provided showing which aspects of the figures noted support the conclusion that Alternative 6 will adversely affect the existing flood condition north of the project area. If possible, provide relative difference maps which include a "no difference classification" based on the accuracy and precision of the model.	Do not concur, see response to USFWS comment 135. Additionally, differences in stages between the existing condition and alternative 6 are shown the stage hydrographs in the Appendix A figures.
USFWS-146	U.S. Fish and Wildlife Service	Page A-55, Section VI C.2.a., Alternative 6, With Project Conditions. Figures A-89A and Figure A-90 show chainages located upstream of FU-3 and Miller-2, as well as I-75 in NGGE on the Faka Union and Miller canals, respectively. For both of these canals, a 2.0 ft increase is observed in the Alternative 6 canal stage over the existing. If Miller-2, FU-3 and Lucky Lake are simulated in Alternative 6, verification of the operational criteria for these structures should be provided. Additionally, the PIR should verify whether the weir crest elevation for Miller-2 and FU-3 structures is 6.2 ft NGVD29 and the open/close wet and dry season criteria are 6.7/6.2 and 7.2/6.45 (NGVD29), respectively. We recommend verification that the flood plain and drain codes simulated in Alternative 3D are the same as in the Alternative 6 simulation downstream of the structures. Discrepancies between alternatives or errors in modeled structures could potentially result in a different ranking of alternatives.	Do not concur. This comment was discussed at length with USFWS hydrologist in Vero Beach. Ranking of alternatives could not change because the model condtion 7.2 NAVD 88 in the dry season was uniform throughout all of the alternatives.
USFWS-147	U.S. Fish and Wildlife Service	Section VII, Draft Water Control Plan. General Comments. We recognize the difficulty associated with designing an operational plan from hydrologic models for the purpose of ecosystem restoration. However, the draft operational plan in this report is difficult to evaluate and does not appear to reflect operations developed for the purposes of environmental restoration. We offer the following recommendations to help improve the draft plan: · Consolidate all drafts into one official document (the Service has received updated plans); · Clarify which vertical datum was used an ensure accurate conversions were incorporated in the modeled input; · Use the selected vertical datum and measurement system consistently throughout the report; · Modify the operational criteria to create a gradual time/volume-step up and down that mimics the natural system fluctuations that occur between the wet and dry seasons;	Changes will be made to have a consistent datum and units of measurement, as noted in response to comment USFWS 120. As noted in meeting with USFWS 10 August 2004 in Vero Beach, draft operation manual (draft water control plan) will be modifed to provide adaptive management. The Design of the pump station intakes will be manufactured to meet the operation plan needs. A concensus between PDT team member and water mangers agree that pump station operation triggers will be set to stage gages along the canal not rainfall gages
USFWS-147 Continuation		· Design the minimum pump intake water at elevations that would prevent potential over-drainage of fish and wildlife habitats in NGGE and further upstream;	See Row 147 for Corps Response

Comment Number	Organization / Agency	Comment	Response
USFWS-47 Continuation		· Include a series of iterative field tests as part of the operational testing and monitoring phase;	See Row 147 for Corps Response
USFWS-47 Continuation		· Incorporate a restoration-based operations system, such as a rainfall driven operational system for NGGE and SGGE;	See Row 147 for Corps Response
USFWS-147 Continuation		· Provide a description of how monitoring locations for different habitat types will be used to assess operational success;	See Row 147 for Corps Response
USFWS-147 Continuation		· Describe how adaptive management will be incorporated;	See Row 147 for Corps Response
USFWS-147 Continuation		· Include documentation of the canal design optimums and the rationale for their selection;	See Row 147 for Corps Response
USFWS-147 Continuation		· Check the conditional logic statements to ensure that they allow the pumps to turn off;	See Row 147 for Corps Response
USFWS-147 Continuation		· Include a map depicting trigger locations noted in Tables A-18 through A-20; and,	See Row 147 for Corps Response
USFWS-147 Conclusion		· Provide documentation of the selected trigger locations.	See Row 147 for Corps Response
USFWS-148	U.S. Fish and Wildlife Service	Since the completion of the draft PIR, modeling has been initiated to refine and optimize the operational plan. It is imperative that the operational plan in the final draft be updated to reflect the results since the operational plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan, and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics should be updated in the final report to ensure consistency between project modeling and project assurances.	See response to USFWS comment 88
USFWS-149	U.S. Fish and Wildlife Service	Specific Comments (Section VII, Draft Water Control Plan) Page A-59, Section VII.A.1, Development of the Project Operations Manuals. The +/- 0.2 ft flexibility noted as necessary for the operational criteria shown in Tables A-18 through A-20 should be specified more clearly with respect to the frequency and duration of deviations. If this information can not be provided based on modeling or hydraulic analyses already completed, then the basis for the proposed deviation should be evaluated as an element of the field tests proposed during the Operational Testing and Monitoring Phase.	Do not concur, frequency of durations of deviations will not be specified. As discussed on 10 August 2004 meeting in Vero Beach it is unnecessary and unusual to provide this information in the operations plan.
USFWS-150	U.S. Fish and Wildlife Service	Page A-60, Section VII.A.4, Hurricane or Tropical Storm Regulations. Operational criteria associated with hurricanes, tropical storms, and droughts should be clearly documented in the Draft Operations Manual and included in the modeling. The documentation should include the sequence of steps returning back to normal operations.	Comment noted, as discussed on 10 August 2004 meeting in Vero Beach operational plan will be revised to clarify operations.
USFWS-151	U.S. Fish and Wildlife Service	Page A-63, Section VII.B.2.b, Alternative 3D Constraints-Storm Events. A large portion of the effective conveyance capacity of the SGGE canal system has been replaced by an overland flow path. This suggests that the tailwater conditions at FU-1 should no longer act as a constraint on pump capacity. Please clarify this apparent contradiction.	Concur, tailwater operations at FU-1 are not a constraint.

Comment Number	Organization / Agency	Comment	Response
USFWS-152	U.S. Fish and Wildlife Service	Page A-64, Section VII.B.3, Alternative 3D Overall Plan for Water Control. The draft PIR statement that waters routed from NGGE through the Miller, Faka Union and Merritt Canals will discharge at the southern extent of the Project through FU-1 concerns us. This appears to conflict with the goals and objectives of the project, which are to eliminate or reduce these point source flows. Further clarification is necessary regarding the statement that operations of the existing structure FU-1 and the newly constructed pump stations will be coordinated for flood control purposes. It is suggested that reference to FU-1 be removed or operational criteria for FU-1 supported by modeling or hydraulic analysis completed be added to Tables A-18 through A-20. We recommend the PIR provide a reference to the section that documents how the conveyance capacities of the Miller, Faka Union and Merrit Canals system were analyzed to determine the optimal canal elevation. We suggest the canal optimums be presented in tabular format for easy reference.	Concur, see response to USFWS comment 151
USFWS-153	U.S. Fish and Wildlife Service	Page A-65, Section VII.B.4, Alternative 3D-Standing Instruction to Operators. The language "optimum elevations in the plan shall be followed" and the supporting analysis should be referenced to the section of the PIR in which they are found.	Do not concur, supporting documentation has already been established with additional documentation being developed as noted in response to USFWS comment 88.
USFWS-154	U.S. Fish and Wildlife Service	Page A-65, Section VII.B.5, Alternative 3D-Pump Operations. The text and Tables A-18 through A-20 for the operations do not appear to match figures reported elsewhere in the appendix or in the Operation Schedule of Water Control Structures, dated January 2000. The "savings and takings" modeling results of Miller and Faka Union Canals for Alt 3D and Alt 12 have dry season stages of 7.2 ft NAVD88 or 8.5 ft NGVD29. The dry season criteria specified in Operation Schedule of Water Control Structures, dated January 2000, is 7.2 ft NGVD29. The 1.3-ft difference is a significant departure from the existing control for these reaches of the canals. If a vertical datum conversion error was made, the rankings of the alternatives might be incorrect. We recommend clarifying these points in the text.	Do not concur, see response to USFWS comment 146. As discussed on 10 August 2004 in Vero Beach with the USFWS modeling will be redone to lower the planned dry season optimum stages from 7.2 ft NAVD 88.
USFWS-155	U.S. Fish and Wildlife Service	Page A-66, Section VII.B.9, Alternative 3D-Fish and Wildlife. The meaning of the following should be explained: "… the SGGE Project construction will require below water table excavation for canal construction and improvement, which will improve fish habitat, especially during dry-out periods." The Service is not aware of any new canal construction or improvement that is included as part of Alternative 3D unless spreader channels or swales are considered new canals. Deep canals, channels, or ditches are not necessarily beneficial, because of the potential refugia they offer exotic fish, as well as larger piscivorous fish, which prey on more desirable forage fish during drawdown periods. Smaller forage fish are prey for wood storks and other wading birds.	Concur wording will be revised.
USFWS-156	U.S. Fish and Wildlife Service	Table A-1. In the row for the MIKESHE unsaturated zone module, we suggest replacement of the phrase "Richards equation/gravitational flow" with the correct governing equation used in this model. While it is true that the MIKESHE code has the capability of using the Richards equation, the most rigorous method of simulating flow in the unsaturated zone, it was not used for the Big Cypress Basin model, presumably because of computational time restraints.	Do not concur, equation is correct

Comment Number	Organization / Agency	Comment	Response
USFWS-157	U.S. Fish and Wildlife Service	Table A-11. Provide a narrative discussion of this MAE data in this table with regard to time shape, and bias between the simulated and observed data. Some of the errors in this table are rather high for Florida; one is almost five feet. This could indicate that calibration is not as good as it should be. Provide a map showing the locations in the table so that the spatial distribution of the errors can be determined. In particular, report on whether the errors are randomly distributed, or, alternately, whether certain areas of the model more accurate than others. Since other statistics, such as root mean square error, coefficient of correlation, and Nash-Sutcliffe Efficiency, are routinely available in MIKE post processing utilities, they should be included in the report.	Do not concur, as agreed in the 10 August 2004 meeting with USFWS additional documentation on the different errors are available in the DHI documentation for the MIKESHE model, for USFWS has the latest copies.
USFWS-158	U.S. Fish and Wildlife Service	Figure A-2. The figure should include the Ten Thousand Islands NWR boundary rather than just the Collier-Seminole State Park boundary.	Do not concur, Figure A-1 shows 10,000 Islands Refuge.
USFWS-159	U.S. Fish and Wildlife Service	Figure A-3. The figure indicates that mangrove occur immediately south of US41. The habitat in that area is primarily brackish marsh.	Comment noted, however, figure will remain as is.
USFWS-160	U.S. Fish and Wildlife Service	Figures A-14 through A-18. These maps show surfaces related to the various aquifers and confining units, but are difficult to understand without units. Label the graphs with the units of measurement and specify whether the numbers represent the absolute elevations for the top or the base of the presented unit.	Comment noted, as discussed with hydrogeologists at USFWS in Vero Beach on 10 August 2004, figures will be revised.
USFWS-161	U.S. Fish and Wildlife Service	Figures A-19 through A-23. The spatial distributions of the hydraulic conductivities data are shown in a peculiar bull's-eye pattern. The significance of this pattern should be explained. We could not determine whether they represent karst features or are an artifact of the interpolation method, for example. The text should also provide a reference to data that supports the range of values used and an explanation of why the conductivities are aligned linearly along the Merritt Canal.	Comment noted, as discussed with hydrogeologists at USFWS in Vero Beach on 10 August 2004, figures will be investigated and revised if necessary.
USFWS-162	U.S. Fish and Wildlife Service	Figures A-24 through A-33. We recommend the PIR include the MIKE11 canal network on all graphics of the input parameters. If MIKE11 is used to simulate floodplains including sloughs and strands, include those on the graphics and provide a description of instability problems if any exist.	Comment noted, as discussed with hydrologists at USFWS in Vero Beach on 10 August 2004, figures will be investigated and revised if necessary.
USFWS-163	U.S. Fish and Wildlife Service	Figure A-47. It appears that the existing and future without project traces are of weekly hydrographs while the proposed project scenario traces are of daily hydrographs. The PIR should provide an explanation describing why different temporally aggregated hydrographs are necessary.	Do not concur, met with hydrologist at the USFWS in Vero Beach on 10 August 2004, canal network is shown as a reference not as a MIKE 11 network. As agreed figures will stay as is and no instability documentation is necessary
USFWS-164	U.S. Fish and Wildlife Service	Figures A-89 through A-90S. These graphics are difficult to evaluate without reference to exact physical locations of the chainages, therefore, a location map that depicts the geographical locations of the chainages should be provided. The ground surface elevation on the graphs should also be included. A table of the structural operations as they exist in the model would be extremely useful for evaluating this section. Alternatively, the open and close criteria for the wet and dry season should be included on the graphics. Hydrographs for various chainages, or cross sections, should be selected that allow the reader to evaluate the open and close criteria or weir crest elevations at all of the structures.	Do not concur, met with hydrologist at the USFWS in Vero Beach on 10 August 2004, points are shown spatially in Appendix A.

Comment Number	Organization / Agency	Comment	Response
USFWS-165	U.S. Fish and Wildlife Service	Figures A-89 through A-122. Specify whether the datum NGVD29 or NAVD88 is used. It would improve document clarity if the same vertical datum were used throughout the report. Otherwise, the PIR should provide an explanation of why two vertical datums are necessary and provide a conversion chart. We recommend the modelers verify that conversion of operational criteria between datums to be included in the model is correct. Per the operation schedule in the Big Cypress Basin Operation Schedule of Water Control Structures, dated January 2000, the crest elevation of both FU-3 and Miller 2 is 6.2 feet NGVD29. Their wet season and dry season open/close elevations are 6.7 / 6.2 and 7.2 / 6.45, respectively. In figures A-89 through A-89B, the dry season criterion for Alternative 3D is near 7.2 feet NAVD88 or 8.5 feet NGVD29. The increased dry season operational stages at these locations appear to be a significant departure from those that were previously published. If datum conversion errors exist, the ranking of alternatives may not be correct.	Concur as noted in USFWS comment 120. One datum and one unit of measure will be provided. Do not concur with dry season comment, see reponse to USFWS comment 154.
USFWS-166	U.S. Fish and Wildlife Service	Appendix D, Resource Assessment. Inferences drawn from changes in plant communities between 1940 and 1995 should be conservative, and the appropriate caveats added to the text. Ground truthing of the 1995 Digital Orthophotographic Quarter Quadrangles (DOQQs) was not as thorough in the area south of US41 as it was within the SGGE. There was no ground truthing of the DOQQs east of the Faka Union Canal. Plant communities were inferred based upon soil type, as described in the 1998 Soil Survey of Collier County Area, Florida. Discrepancies between marsh and mangrove communities associated with the same soil type prompted staff of the Ten Thousand Islands NWR to delineate marsh occurring within the soil type associated with mangrove for the area west of the Faka Union Canal. This delineation was not conducted east of the Faka Union Canal, nor for the 1940 photography.	Concur that inferences should be conservative. Thank you for information on ground truthing in the TTI NWR.
USFWS-167	U.S. Fish and Wildlife Service	Page 3. Please explain whether the predicted plant communities were based on average hydrology simulated by MIKESHE for 1988-2000, or for 1994. We recommend the PIR include documentation of the steps required to generate the “pre-drainage” vegetation map and how MIKESHE was used.	1994
USFWS-168	U.S. Fish and Wildlife Service	Explain why the definition of the wet season was chosen as July 1 through October 1. We are particularly concerned that the definition in this section is different from other sections and the standard definition of wet season. This definition of the wet season omits the peak of the wet season.	As discussed in the meetings on 5 and 10 August 2004 this was selected based on the concensus of the PDT, which includes team members from the USFWS.
USFWS-169	U.S. Fish and Wildlife Service	Page 9, Freshwater Marsh. We believe that discussing the difficulty of reestablishing fresh water marshes from salt marshes is premature. The quality control and assurance processes, particularly ground truthing, associated with habitat identification using the 1995 DOQQs limits our ability to distinguish between freshwater and salt marsh community types. It is unknown whether or not freshwater marshes have been converted to salt marshes.	Concur. Language has been changed.
USFWS-170	U.S. Fish and Wildlife Service	Page 14, Hammocks. We urge caution on the inferences made concerning tropical hammocks. The data used to support the inferences have not been verified for accuracy. Discrepancies in the 1940 and 1995 data were noted, but not verified.	Objection noted.
USFWS-171	U.S. Fish and Wildlife Service	Page 16, Coastal Wetlands and Estuaries. Discrepancies in the available information should be incorporated into this discussion. Open water areas were not mapped accurately from the 1940 data. There are several large lakes, depicted in the 1954 Soil Survey maps that do not appear on the NRCS 1940 Vegetation Community map. The Little Wood River does not appear, either.	Comment noted.

Comment Number	Organization / Agency	Comment	Response
USFWS-172	U.S. Fish and Wildlife Service	Page 21. Provide a reference that supports the statement that average wet season water levels from July 1 through October 1 are considered to be closely related to hydroperiod. Additional analysis relating average water depth during the period from July 1 through October is necessary since the pattern of plant communities on the MIKESHE maps do not closely match those on NCRS maps.	See repsonse to USFWS comment 168.
USFWS-173	U.S. Fish and Wildlife Service	Page 23. The PIR should explain why the MIKESHE vegetation model converts the hydric flatwoods in the existing conditions land use shown in Figure A-3 to 90% mesic communities in the existing condition output. If this is an error, restoration benefits would need to be reevaluated.	Figure A-3 was approved by the ecosystem technical subteam and represents the consensus of knowledgeable field biologists. The model output suggests everything is drier because it is based on hydrology. Current hydrological conditions are drier than current vegetation would suggest. This probably means that without restoration more loss of hydric cover types might occur in the future. Also see reply to comment USFWS-41 and USFWS-53.
USFWS-174	U.S. Fish and Wildlife Service	Page 46. We recommend adding the Ten Thousand Islands NWR and Collier-Seminole State Park boundaries.	Do not concur, see response USFWS comment 45
USFWS-175	U.S. Fish and Wildlife Service	Appendix H, Draft Ecological and Water Quality Monitoring Plan. General Comments. The Service is coordinating with the District, Corps, DEP, DOF, USGS, Sirenia, FWC, The Conservancy of SW Florida, and Florida Gulf Coast University (FGCU) in a significant re-write and improvement of the referenced Monitoring Plan. The revised plan will be completed in time for insertion in the final PIR/EIS. In general, each element of this monitoring should specify targets, envelops, or thresholds as either flow or stage at known locations for the range of meteorological conditions to be experienced over the planning horizon. It would be desirable that these be qualified and quantified, and ready for use during the construction, testing, and monitoring of the operational phases noted in Appendix A. Additional maps of vegetation transects, well sites, and fish and wildlife sampling transects or sites are currently being developed and should be included in this appendix.	The final montiroing plan was received on August 9, 2004. It has been substituted for the earlier draft included in the DPIR.
USFWS-176	U.S. Fish and Wildlife Service	Specific Comments (Appendix H, Draft Ecological and Water Quality Monitoring Plan). Page H -1, Introduction. Please include a brief description of how the information learned will be used to improve performance measures used in the modeling, and potentially to enhance the model itself.	Your recommendation is noted. We do not wish to add more text to the plan at this stage. The purpose of the plan is not to improve the modeling, but to assure that real, on the ground restoration occurs. The Mike SHE model will undergo further development and refinement in the Southwest Florida Feasibility study. The bottom line is not better models, but a better ecosystem function.
USFWS-177	U.S. Fish and Wildlife Service	Page H-4, Section H.4.2., Hydrologic. Explain how the monitoring network shown in Figure H-1 can be used to determine whether or not a preferential flow path remains in the plugged canals. Explain in detail how collected information will be fed back into the operational plan. We recommend that rain gauges be co-located at any of the stage monitoring locations proposed; and that ground water/surface water (nested well clusters) data collection be correlated to improve our understanding of the ground water/surface water interaction.	Comment Noted
USFWS-178	U.S. Fish and Wildlife Service	Page H -5, Section H.4.2, Hydrologic. Restoration is defined as the pre-development condition of the uplands and wetlands. Please clarify whether this is a hydrological or an ecological target.	It is clearly both. However, the lack of historic data on groundwater hydrology and even details of surface hydrology,forced the team to look to historic vegetation patterns and infer hydrology from them. Because of this the ecological targets are more important than the modeled hydrological targets.
USFWS-179	U.S. Fish and Wildlife Service	Page H-12, Section H.4.5.1.A ,West Indian Manatee. The aerial distribution and strip-transect surveys were funded by the Ten Thousand Islands NWR, not the USGS Place-Based Studies.	Comment Noted

Comment Number	Organization / Agency	Comment	Response
USFWS-180	U.S. Fish and Wildlife Service	Page H-16, Table H-2. Additional State-Listed plants that occur in the Ten Thousand Islands NWR and Collier-Seminole State Park include barbed-wire cactus, satinleaf, butterfly orchid, wild cotton, shell mound prickly pear, inkberry, bay cedar, inflated wild pine, common wild pine, twisted air plant, and giant wild pine.	Comment Noted
USFWS-181	U.S. Fish and Wildlife Service	Page H-26, Figure H-5. Rookery Bay National Estuarine Research Reserve has a continuous in-situ monitoring site in Pumpkin Bay, which should be identified.	Comment Noted
USFWS-182	U.S. Fish and Wildlife Service and Florida FWC	Summary. The Service supports authorization of the SGGE Ecosystem Restoration Project to proceed to final PIR and detailed design. Although we find that the draft PIR/EIS provide a balanced and accurate description of the environmental impacts of the plan, the recommended changes contained herein are intended to allow for equal consideration of wildlife conservation with other features of the project, minimize incidental take of federally listed species, and to improve the public's understanding of the plan's anticipated ecological benefits.	All of the changes you recommend have been carefully considered, and where possible, adopted. Certain recommendations regarding modeling, detailed data requests and other model-related recommendations were not able to be implemented or were considered not vital for project design. We can commit to continue working and cooperating closely with the Service through detailed design and early project implementation, if the project is approved and authorized.
USFWS-183	U.S. Fish and Wildlife Service and Florida FWC	We find that the Service's recommendations have, in most cases, been incorporated in this project's planning. We call your attention, however, to our specific comments on Sections 12, Appendix A, and comments on Contaminants, exotic plant management, pump size, and the Adaptive Monitoring and Assessment Plan. As detailed design proceeds, we are committed to providing expert technical assistance on the protection of threatened and endangered species and the conservation of fish and wildlife and their habitats. We see a need for further planning and coordination for the following issues: 1. O&M plan/manual development; 2. Savings Clause and Reservations requirements; 3. Monitoring and Assessment Plan; 4. Exotic Species Management Plan; 5. Hydrologic modeling; 6. Alternative development and project design; 7. Remediation of contaminated areas; 8. Project effects on public lands; 9. Protection of federal trust species and other trust resources; and, 10. Watershed changes related to storm water management and development permit.	This is just a summary of the comments above, see responses above.
FWC-1	Florida Fish and Wildlife Conservation Commission	General Comments. The FWC staff finds that the draft PIR and EIS present an accurate description of the PDT's evaluation process and the benefits expected through implementation of the SGGE Ecosystem Restoration Project. The plan predicts that the tentatively selected alternative, Alternative 3D, will provide fish and wildlife resource benefits to the 86-square mile SGGE project site, adjacent public lands, and the 98 square miles of downstream coastal estuaries. It is expected that the restoration plan will restore 36,200 acres of wetlands, raise groundwater elevations in uplands, decrease the severity and frequency of wildfire, restore a hydrologic regime that supports subtropical plant species, assist in the recovery of listed species and migratory birds, and improve coastal fisheries.	Comment noted.

Comment Number	Organization / Agency	Comment	Response
FWC-2	Florida Fish and Wildlife Conservation Commission	The principal focus of our comments is on additional project design development that will: 1) de-emphasize engineered structure reliance, particularly the size of the pumps; 2) refine hydrological models; 3) develop an operations management plan that emphasizes operations for restoration over flood control; 4) finalize a modified Adaptive Assessment and Monitoring Plan; 5) develop an estuarine mixing model; 6) document extensive changes in the watershed that have resulted from explosive development and water management, and determine whether these changes have been considered; 7) remediate contaminated areas and address contaminants in areas outside of the project but affected by the project; 8) address all effects to adjacent public lands, and 9) expand the estuarine resource description and analysis.	We note your areas of concern. We have addressed many of these issues in our responses to FWS comments, especially issues 1, 2, 3, 4, 7 and 8. We do not intend to develop an estuarine model for this project (your issue #5), as it is not germane to the central area to be restored, would require acquisition of extensive bathymetry, and require linkage to a different hydrologic model. Regarding point (6) we will look, along with FWS, at watershed-level changes and trends, during the detailed design phase of the project, with a view to assuring that (a) upstream wetlands are not overdrained; and (b) asssure that all reasonably forseeable water demands upstream have been considered in the model. Regarding your #8, we have addressed reasonably forseeable effects o this project on adjacent public lands and have concluded, along with the Service NRCS, NOAA and others that effects are expected to be strongly beneficial.
FWC-3	Florida Fish and Wildlife Conservation Commission	Section 2, Pre-Drainage Conditions. Page 69, Section 2.3.1, Cypress Forest. This section does not address the wide variety of cypress forest found in the Big Cypress ecosystem, including more open prairie cypress and hat rack cypress systems. Restoration should produce a variety of natural cypress habitats, not just dense stands typical of strands.	The description of cypress forests in the text was primarily prepared by Dr. Michael Duever, an expert in southwest Florida ecosystems. It was not our intent to provide an exhaustive catalog of all types of cypress stands, nor do we believe that this level of detail is justified.
FWC-4	Florida Fish and Wildlife Conservation Commission	Page 71, Section 2.3.4, Pine Flatwoods. This section does discuss the difference in different pine flatwood types but does not clearly distinguish that hydric pine flatwoods are a desired natural wetland habitat common to the SGGE. Instead, hydric pine flatwoods are lumped into the “uplands” category. This should be distinguished along with the prevalence of epiphytes in hydric pine flatwoods.	Comment Noted
FWC-5	Florida Fish and Wildlife Conservation Commission	Page 74, Section 2.6, Threatened and Endangered Species. This section includes only some of the federally listed species affected by the proposed project. We recommend expansion of this section to include more technical information on the historic or pre-drainage status of listed species. Both state-listed species and federally-listed species affected by the proposed project, that we discussed and provided information on in the PDT process, should also be discussed including Florida panther (endangered - E), Everglades mink (E), West Indian manatee (E), wood stork (E), American crocodile (E), Atlantic green turtle (E), leatherback turtle (E), Atlantic ridley turtle (E), Florida black bear (threatened-T), Big Cypress (mangrove) fox squirrel (T), bald eagle (T(E)), Florida sandhill crane (T), southeastern American kestrel (T), least tern (T), piping plover (T), southeastern snowy plover (T), eastern indigo snake (T), Atlantic loggerhead turtle (T), red-cockaded woodpecker (species of special concern - SSC (E)), roseate spoonbill (SSC), little blue heron (SSC), reddish egret (SSC), snowy egret	Your comment is confusing. You have included in your list both Federally protected and State recognized species. We expect the effects of the project on the Federally listed species to be either insignificant or beneficial. Refer to the revised text and the draft Biological Assessment included in this report.

Comment Number	Organization / Agency	Comment	Response
FWC-5		(SSC), tricolored heron (SSC), limpkin (SSC), brown pelican (SSC), American oystercatcher (SSC), gopher tortoise (SSC), American alligator(SSC), gopher frog (SSC), rivulus (SSC), and Florida tree snail (SSC). The West Indian manatee is a native species with a pre-historic and historic record of occurrence in southwest Florida, rather than a recent arrival as implied by the context of the text in the PIR/EIS. The location of the largest wood stork colony in North American at Audubon's nearby Corkscrew Swamp Sanctuary should be documented in the text to provide context for later discussions of the importance of restoring the project's short-hydroperiod wetlands which are utilized as forage habitat by the wood stork. American crocodiles were historically found throughout the Ten Thousand Islands, and historic range extended as far as Tampa Bay on the west coast of Florida. We recommend that the Corps use the South Florida Multi-Species Recovery Plan (2001), biological opinions, individual listed species recovery plans, and available literature citations in these documents as information sources.	See Row 237 for Corps Response
FWC-5 Conclusion		The USFWS and we will assist in the compilation of this text.	See Row 237 for Corps Response
FWC-6	Florida Fish and Wildlife Conservation Commission	Page 78, Section 2.7, Geology and Soils. This section should be expanded to include specifics of the project area including hydric soils, the close connection of the surficial aquifer with surface water, and biogenic soils such as marl and mangrove peat that are hydrologically dependent. This information is available from PDT members, and also in Conceptual Models for CERP and the Southwest Florida Feasibility Study (SWFFS).	Do not concur. NRCS agreed with the conclusions and findings of the report. The vast bulk of the soils on project lands are thin, spodic soils.
FWC-7	Florida Fish and Wildlife Conservation Commission	Page 79, Section 2.9, Climate. This section should be expanded to show historical freeze, drought, flood, or hurricane occurrences which affected the project environment. This information is available from PDT members, including the Community Profile for the Hydric Slash Pine Flatwoods of Southwest Florida, and also in Conceptual Models for CERP and the Southwest Florida Feasibility Study (SWFFS).	Information provided by FWS comments has been incorporated.
FWC-8	Florida Fish and Wildlife Conservation Commission	Page 79, Section 2.10, Hydrology. This section should be expanded to show the vital importance of sheetflow, both surface and subsurface. The flat topography, sandy and/or marly soils, and the seasonal precipitation cycle are the principal influences of the pre-development SGGE hydrology. The flat topography, a result of Pleistocene geology, creates minimal gradients, resulting in slow runoff that occasionally creates very poorly defined first-order streams and typically results in sheetflow patterns. Water depths in natural hydric pine flatwoods vary throughout the seasonal hydrologic cycle. Extreme ranges are from 3 feet above ground surface to 5 feet below ground surface. Typical ranges are from 1 to 2 feet above ground surface at the height of the wet season to 3 feet below ground surface in the late dry season. For most of the year, hydric pine flatwoods have water within 1 foot above or below the ground surface. With the onset of the wet season, habitats of the historic SGGE are quickly saturated. As the rate of precipitation exceeds the rate of runoff, standing water appears in depressions in May-June.	Information has been incorporated into referenced section.

Comment Number	Organization / Agency	Comment	Response
FWC-8 Conclusioin		By July, historic SGGE habitats are uniformly wet. Deep water levels are attained by the late rainy season, in September/October. As the dry season begins in November, the pattern reverses with a shift to runoff exceeding precipitation. This results in the formation of isolated pools as sheetflow recedes below the ground surface. By March, only the depressional areas of SGGE habitats retain standing surface water. This information is available from PDT members and also in the South Florida Multi-species Recovery Plan, Conceptual Models for CERP, and the SWFFS. This section needs to be revised consistent with our comments for Section 3.10, Existing Condition Hydrology, and Section 3.10.3, Water Management, on pages 3-19 and 3-22, as well as our comments on documenting existing wetlands in NGGE under Section 3.3, Plant Communities, on Page 3-2.	See above cell for Corps Response
FWC-9	Florida Fish and Wildlife Conservation Commission	Page 82, Section 2.11, Estuarine Resources. This section should be significantly expanded to include a more detailed discussion of the historic presence of seagrass beds, sub-tidal oyster reefs, and calcareous bryozoan and vermetid reefs, as well as the historic location of high marsh/saltern (white zones) and the upper boundary of mangrove basin forests.	Do not concur. This project is not mainly about historic estuarine resources. Such a discussion is appropriate in the Fish and Wildlife Coordination Act and in the Environmental Resources appendix.
FWC-10	Florida Fish and Wildlife Conservation Commission	Page 89, Section 3.1, Introduction. This section describes the existing condition consistent with the Comprehensive Everglades Restoration Plan (CERP) as of the year 2000. In subsequent sections of the PIR/EIS, existing condition appears to be updated to 2003. The existing condition year should be clarified given the issuance of a significant number of permits that resulted in loss of fish and wildlife and water resources in the project watershed during that 3-year time span.	Text has been clarified. The 2000 condition is the required CERP project baseline.
FWC-11	Florida Fish and Wildlife Conservation Commission	Page 89, Section 3.2, General Environmental Setting. We recommend the following additions to this section with reference to Florida Panther and Ten Thousand Islands NWR's.Florida Panther NWR is located in three sub-basins of the Big Cypress Basin Watershed: Faka Union Canal Basin (extreme southwestern portion of the refuge), Fakahatchee Strand Basin (eastern portion of the refuge), and Okaloacoochee Slough Barron River Basin (minor area in southeastern portion of the refuge along S.R. 29). The hydrology of Panther NWR has been altered by drainage infrastructure of the surrounding landscape, including the SGGE project, and conveyance associated with agricultural operations located in the refuge watershed. Ten Thousand Islands NWR/National Estuarine Research Reserve is located directly south of the project. The more northern brackish water marshes of the NWR are starved for waters that are diverted by the SGGE canal system and point discharged down the adjacent Faka Union Canal into Faka Union Bay, affecting downstream estuaries.	Description added to the cited section of Chapter 3. Thank you.
FWC-11 Conclusion		The Faka Union Canal outside of the SGGE boundaries also operates to bring tidal flow and therefore higher salinities further inland than in adjacent estuaries.	See above cell for Corps Response
FWC-12	Florida Fish and Wildlife Conservation Commission	Page 98, Section 3.6, Threatened and Endangered Species. This section includes only some of the federally listed species affected by the proposed project. We recommend expansion of this section to include more technical information on the historic or pre-drainage status of listed species, per our comments on Section 2.6. This section should provide more detailed information on the existing status of listed species in the project area. The USFWS is assisting the Corps in the preparation of a Biological Assessment. We are coordinating in this assistance to provide additional references for this section.	There appears to be little readily available historic information on the status of the cited species in the Project area.

Comment Number	Organization / Agency	Comment	Response
FWC-13	Florida Fish and Wildlife Conservation Commission	Page 99, Section 3.6.1, American Crocodile. This section needs to be revised to indicate that American crocodiles are now documented as far north as northern Charlotte Harbor and that nesting has occurred on the west coast of Florida in the Ten Thousand Islands and north of Marco Island. This population is now increasing.	Information is incorporated in referenced section.
FWC-14	Florida Fish and Wildlife Conservation Commission	Page 101, Section 3.6.4, Florida Panther. This section needs to be revised to indicate that panther use of the SGGE project area has been verified. It should also reflect that panthers are currently using Belle Meade and NGGE. The core population also extends into Hendry and Lee counties through the Corkscrew Regional Ecosystem Watershed (CREW).	This information has been added. Maps of telemetered individuals clearly show panther use of the Project Area.
FWC-15	Florida Fish and Wildlife Conservation Commission	Page 107, Section 3.9, Climate. This section appears to address changes in hydrology, not climate, and should be revised to address temperature, wind, and precipitation. The effects of climate on the existing drained habitat condition would include loss of sub-tropical plant species from fire and freeze, and potential loss of trees from high winds resulting from vulnerabilities due to soil oxidation or forest structure (thinning from fire and disease).The climate of the SGGE is subtropical or tropical savanna. This results in alternating wet season flooding and severe dry season drought conditions. Mean annual precipitation in the SGGE is approximately 135 cm (53 inches). The dry season is from November to April and the wet season from June to September. Typically, between 18 to 23 percent of annua rainfall occurs in dry season and 60 to 72 percent of the rainfall occurs in wet season. Typically, the seasonal wetlands become saturated and attain standing water in the middle to late wet season.	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.
FWC-15 Continuation		It is interesting to note that the distribution of large, landscape-scale sheet flow wetlands in southern Collier and southern Lee counties correspond with areas of higher rainfall isoplethes of 60+ inches annually.Rainfall in the wet season follows a bimodal pattern, with the first peak in May or June and the second in September or October. It is of note that this pattern corresponds with peak flowering periods for the understory components of the freshwater wetland plant community.Thunderstorms are more frequent (over 100 annually) in the Fort Myers area than at any other location along the eastern Gulf coast. Seventy-five percent of the thunderstorms occur in the summer. The short duration, high intensity thundershowers are the result of cyclic land-sea breeze convection in a diurnal pattern peaking during late afternoon or early evening. Thunderstorm rainfall can be very local, resulting in differences of up to 5 inches per month between areas less than 5 miles apart in southwest Florida. Individual cloud volumes during thunderstorms in south Florida can range from 200 to 2,000 acre-feet.	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.

Comment Number	Organization / Agency	Comment	Response
FWC-15 Continuation		The wind patterns of south Florida are determined by interaction of prevailing easterly trade winds, local diurnal convective patterns in the summer, and continental cold fronts in the winter. Summer wind patterns are dominated by a daily wind shift that peaks at 12:00 to 2:00 P.M., with an onshore sea breeze during the day and an offshore land breeze at night. Winter dry season cold fronts occur approximately once a week. On a seasonal basis, the highest average wind speeds occur in late winter and early spring, and the lowest speeds occur in the summer. Localized strong winds of short duration are generated by summer thundershowers, extreme cold fronts, and tropical storms (Bradley 1972). On a typical day, wind speed is lowest at night, increasing through the day to the afternoon, and decreasing again in the evening.Temperature in southwest Florida is primarily controlled by latitude and maritime influences. The mean annual temperature is 74 degrees Fahrenheit, the average January temperature is 64 to 65 degrees Fahrenheit,	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.
FWC-15 Continuation		and the average August temperature is 82 degrees Fahrenheit. Southwest Florida is one of only two areas in the southeastern United States where air temperatures exceed 90 degrees Fahrenheit more than 120 days of the year. Typically, there is a 1-degree Fahrenheit difference between Charlotte County and Collier County. More inland areas display a greater daily range in temperature than coastal habitats.In winter, sharp drops in temperature occur following cold fronts containing cool, dry arctic air from Canada. Cooling begins after sunset and reaches the lowest temperatures at dawn. Temperature gradients of 14.9 to 5.9 degrees F can occur between coastal and inland areas a few miles apart. A similar gradient of 5.9 to 10.1 degrees F occurs between high, dry land (xeric pine flatwoods) and adjacent moist lowlands (hydric pine flatwoods). On calm, cold, clear nights frost may form in moist inland areas. A severe freeze occurs approximately once every 20 years.	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.
FWC-15 Continuation		The mean annual relative humidity averages approximately 75 percent with the highest (80-90 percent) in early morning and lowest (50-70 percent) in the afternoon. Seasonal differences are not great: mean relative humidity tends to be lowest in April (71 percent) and highest in summer and fall (80 percent).Evapotranspiration estimates for southwest Florida range from 30 to 48 inches per year. Evapotranspiration from the saturated soils of wetlands is an important control of sea breeze intensity and the formation of convective thunderstorms. Because evapotranspiration is a cooling phenomenon, land-to-water gradients are reduced, convective processes are reduced, and recently rained-upon areas receive less rainfall. The effect is a natural feedback mechanism that results in a more even spatial distribution of seasonal rainfall. This can also ameliorate the tendency towards formation of tornadoes over hot convective dry lands.South Florida is subject to more hurricanes than any other area of equal size in the United States. The area is subject to both Atlantic and Caribbean hurricanes.	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.

Comment Number	Organization / Agency	Comment	Response
FWC-15 Conclusion		Of the 38 hurricanes that passed over southwest Florida from 1901 to 1971, 30 occurred in August to October. Tropical storms strike once every 3 years in southern Collier County.The three primary climatic effects of hurricanes are high wind, storm surge, and heavy rain. Wind force increases by the square of the wind speed such that a 93 mph wind exerts four times as much force as a 47 mph wind. When hurricane winds attain 249 mph, as in the 1935 Labor Day hurricane, the effects on forested ecosystems, including tree fall, substrate disturbance, and propagule (cone) distribution, can be considerable.	We appreciate the climate synopsis. Some, but not all of the information, has been incorporated into the appropriate Section.
FWC-16	Florida Fish and Wildlife Conservation Commission	Page 111, Section 3.11, Estuarine Resources. This section should be significantly expanded to include descriptions of benthic communities (limestone rock outcroppings, bryozoan reefs, vermetid reefs, oyster beds, clam beds, pen shell-invertebrate complexes); algal mats; white mangrove invasion of oligohaline marsh sites; growth of mangroves at marsh and creek headwaters; detrital transport associated with loss of freshwater head; anoxic zones in, and transport of anoxic zones from Whitney, Pumpkin, and Wood Rivers; the significant effects of the Faka Union borrow berm in blocking lateral flows to the estuary, the role of sea level rise, and other issues.The dates and a brief synopsis of the Marco Island and adjacent (Deltona Corporation) development should be expanded upon in this section due to the cumulative effects these very large projects had on the project area's estuarine resources (in particular, high marsh, seagrasses, and mangroves).This section should include a detailed discussion of the condition (location, size, depth) and history of construction of the Faka Union Canal below U.S. 41.	Do not concur. The restoration project must focus on the lands to be benefitted most directly.The primary focus of the project is on lands in the area formerly known as Southern Golden Gate Estates; secondarily on the upper estuaries of the bays south of the project. Since the Coordination Act Report provides additional resource detail for DOI stewardship resources, we believe that is the appropriate place to provide details on the topics recommended in this paragraph. We do not want to discard or brush off the information as insignificant, but the level of detail in the main PIR report is already great; the report has been criticized as unwieldy, too long and too complex.
FWC-16		There is some confusion as to whether this canal was permitted by the Corps. This canal severed estuarine creeks and the original Faka Union River upon construction. As a result, the effects associated with this canal include salinity changes in the marsh and mangrove systems on the adjacent Ten Thousand Islands NWR. The condition of this canal and how it transports fresh water influence manatee distribution and behavior. This section would benefit by addition of a discussion of recreational and commercial fisheries resources in the area.	See the above row for Corps Response
FWC-17	Florida Fish and Wildlife Conservation Commission	Page 116, Section 3.14, Hazardous, Toxic, and Radioactive Wastes (HTRW). Findings of the HTRW (Existing Condition) section are consistent with an Environmental Risk Assessment (ERA) completed on September 30, 2003, regarding soil contamination at SGGE. The USFWS identified several miscalculations, errors, and identified other unresolved issues in the ERA and submitted corrective recommendations to the SFWMD by letter dated March 23, 2004. The SFWMD and URS are currently in the process of addressing USFWS concerns regarding the ERA, and the outcome of recommended corrections could change the results of the ERA.In striking contrast to the URS data provided in the ERA, sampling activities conducted by the DEP indicated large areas of high chlordane contamination within the SGGE Former Agricultural Area (FAW) and the adjacent Belle Meade property. Forty-two of 134 discreet samples collected by the DEP in these areas exhibited concentrations above the 100 ppb suggested clean-up criterion. The mean chlordane concentration for the entire area sampled by DEP was 222 ppb, compared with 5 ppb determined by URS.	We note that contaminant problems evidently only affect a "few hundred acres" of the more than 55,000 acres proposed for project implementation. SFWMD has committed to continue close coordination with FWS and DEP to clean up all contaminated lands. Lands must be certified free of contamination prior to being conveyed to the Federal Government for project construction, and it is the intent of the non-Federal sponsor to comply with this requirement.

Comment Number	Organization / Agency	Comment	Response
FWC-17 Continuation		This data must be given equal consideration with the URS data. The USFWS has recommended combining the DEP data with the URS data in all statistical calculations, in order to obtain an unbiased idea of the total areal extent and magnitude of chlordane contamination. All HQs for chlordane should be recalculated based on this combined dataset.Raising the water table in SGGE will rehydrate areas of the adjacent former agricultural lands to the west, attracting wading birds and other wildlife to those areas. Sampling conducted by the DEP in the adjacent Belle Meade area showed even higher levels of chlordane than those found on the SGGE property. The USFWS strongly recommends, and we concur, that the SGGE restoration project not be implemented until a plan has been developed to assess the extent of contamination and remediation processes that may be necessary on those (primarily public) lands west of SGGE that will be affected by this project.	See row 259 for Corps Response
FWC-17 Conclusion		The HTWR comments and recommendations apply to only a few hundred acres of the 55,000-acre project. Within this context, the vast majority of this site is entirely suitable for its proposed use in its present condition.	See row 259 for Corps Response
FWC-18	Florida Fish and Wildlife Conservation Commission	Page 320, Section 8.2.3, Levees. The effects of levees on listed species should be addressed. The levee around Port of the Islands and south of U.S. 41 should be examined to determine effects on the adjacent Ten Thousand Islands NWR, and potential benefits or adverse effects associated with blockage of sheetflow from refuge lands to the canal system. Ten Thousand Islands NWR believes that the standard design of a six-foot-high levee with a 15-foot-wide crown is an over-design, and recommends that the levee size be minimized to reduce impacts to adjacent wetlands and fish and wildlife habitat. The USFWS and FWC believe that the levee proposed around the agricultural area in Belle Meade extends too far west, exceeds the limits of the project's effects, and would act to cut off surface water movements through this area. This levee was not previously reviewed by the PDT or the FWC, and deserves further scrutiny. Alternatives to the ring levee around private residential properties located in northeastern Belle Meade should be examined to minimize effects to wetlands.	Levee heights are determined by modeled flood heights in existing developed areas and are required by the CERP requirements and Florida law.
FWC-19	Florida Fish and Wildlife Conservation Commission	Page 322, Section 8.3, Operational Features. This section does not reference the Draft Water Control Plan in Section VII of Appendix A. The USFWS provided additional comments with regard to this plan in Appendix A of this document. The proposed plan appears to be a flood control plan, not a plan optimized for hydrologic restoration. The PDT has communicated this issue to the Corps and the District. Additional model runs and discussion of this issue are forthcoming, but this issue was identified early in the planning process and has not been addressed to our satisfaction. This issue has the potential to affect all assumptions concerning ecosystem benefits and may negatively affect listed species. Issues include the drawdown of wetlands in NGGE, over-inundation of SGGE, fas pulse discharges of slugs of fresh water to the estuary, dry season discharges of water beneficial to the downstream ecosystem, groundwater recharge of the NGGE canal system for use by well fields, pump size, reporting procedures, and emergency water and fire management protocol.	The operational plan has been extensively revised since printing and coordination of the Draft PIR. Since all of the structures (pumps and levees) are required to avoid adverse increases in flooding potential, setting their operation requires a dual set of criteria: (1) operations to convey normal wet-season flows into the project area and (2) operations for high-stage events that would otherwise cause adverse stage increases in NGGE. The plan cannot be characterized as a flood control plan.

Comment Number	Organization / Agency	Comment	Response
FWC-20	Florida Fish and Wildlife Conservation Commission	Page 353, Section 9.10, Hydrology. The second sentence of paragraph 3 indicates that coastal estuaries in the project vicinity presently receive, under most conditions, sufficient flows of fresh water. We disagree with this statement and believe it conflicts with the project objectives to restore fresh water flows and volumes to estuaries that are blocked from upstream watersheds by the SGGE subdivision. Preliminary discussions with the SFWMD indicated that no additional water beyond ecosystem needs will be made available as a result of this project. Text within this PIR appears to be setting the stage for use of some unquantified portion of water in excess of natural system needs. The third paragraph on this page states that the state reservation rule "will be conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved."	Disagreement of FWC is noted. However, the sentence was meant to state that the primary estuarine problem at present is not interception of water previously flowing to the estuaries, but rather over-drainage and collection of all runoff and some groundwater into a sole canal, the Faka Union, and its discharge mainly to a single upper estuary. The proposed project would not add a source of "new" water. It is true that enough rainfall and upper watershed runoff arrive at the north side of the project area (albeit in canals) to provide the historic flow previously received in the estuaries.
FWC-20 Conclusion		The last sentence in this section on page 354 states that "this adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project." This again seems to set the stage for configuring and operating a system that will generate some unknown portion of additional water for uses other than the natural system. We believe that this is inappropriate, and that the SGGE is a restoration project not a water supply project.	See Row 264 for Corps Response
FWC-21	Florida Fish and Wildlife Conservation Commission	Page 354, Section 9.10.3, Water Management. This section allows for the changes in the Water Control and Operations Plan based on the water resource allocation for the natural system. This emphasizes the importance of Section 12, the Water Control Plan. FWC concurs with USFWS' significant concerns with regard to these issues.	Comment noted.
FWC-22	Florida Fish and Wildlife Conservation Commission	Page 355, Section 9.11 Estuarine Resources. This section should discuss the beneficial effects of the elimination of anoxic pulses from Whitney, Pumpkin, and Wood Rivers expected as a result of this project. The potential return of sub-tidal vs. inter-tidal oyster reefs to the project area should also be assessed. The extent of seagrass restoration and changes in mangrove forest coverage should also be expanded upon.	Since we cannot model these creeks, all we can state is that re-distribution of flow, and attenuation of freshwater pulses, should improve water quality conditions. Anoxic episodes are quite frequent in tidal creeks in Florida and elsewhere at the end of the dry season/beginning of the rainy season, if large surface freshwater inflows disrupt the salinity stratification, mixing anoxic, saline bottom water with surface waters. Later rainy season flows don't cause this effect, because the stratification has already been broken.
FWC-23	Florida Fish and Wildlife Conservation Commission	Appendix H, Draft Ecological and Water Quality Monitoring Plan. General Comments. The FWC is coordinating with the USFWS, SFWMD, Corps, DEP, DOF, USGS, Sirenia, The Conservancy of SW Florida, Florida Gulf Coast University, and National Wildlife Refuge staff in a significant re-write and improvement of the referenced Monitoring Plan that will be completed for insertion in the Final DPIR/EIS.In general, each element of this monitoring should specify targets, envelops, or thresholds as either flow or stage at known locations fo the range of meteorological conditions to be experienced over the planning horizon. It would be desirable that these be qualified and quantified, and ready for use during the construction, testing, and monitoring of the operational phases noted in Appendix A. Additional maps of vegetation transects, well sites, and fish and wildlife sampling transects or sites are currently being developed and should be included in this appendix.	The referenced revised monitoring plan was received on August 9, 2004 and has been inserted in the final PIR. We acknowledge the tremendous effort that this plan represents and the active cooperation of the many involved agencies, organizations and individuals.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
South Florida Ecological Services Office
1339 20th Street
Vero Beach, Florida 32960

September 22, 2004

Colonel Robert M. Carpenter
District Engineer
U.S. Army Corps of Engineers
701 San Marco Boulevard, Room 372
Jacksonville, Florida 32207-8175

Dear Colonel Carpenter:

The enclosed report is a final Fish and Wildlife Coordination Act (FWCA) report on the Picayune Strand Restoration Project (PSRP) for your review. This report is provided in accordance with the FWCA of 1958, as amended (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*) and the Endangered Species Act of 1973, as amended (87 Stat. 884; 16 U.S.C. 1531 *et seq.*).

The U.S. Fish and Wildlife Service (Service) and the Corps of Engineers (Corps) have enjoyed extensive cooperation over several years to plan this project. In the spirit of that cooperation, the Service is supporting the Corps' selection of Alternative 3D as the preferred alternative. Our comments on the Draft Project Implementation Report (PIR), our two previous draft FWCA reports, and the issues raised in this FWCA report indicate that our agencies must continue to cooperate to further refine the preferred alternative during detailed design. Additional information is needed, spanning the disciplines of engineering, hydrology, and biology to further refine this project as it moves forward to construction. Therefore, we will be providing an addendum to this final FWCA report at a later date as those refinements are made. Although an addendum will be provided, this report fulfills the requirements of section 2(b) of the FWCA, and constitutes the final report of the Secretary of the Interior.

The additional information that needs to be provided to the Service includes: 1) an accurate description of the anticipated hydrology and its effects on the surrounding public lands, the recovery of threatened and endangered species, wetland protection in the upper watershed, and how the operations for this project affect flooding, particularly in North Golden Gate Estates; 2) the geographic extent and temporal resolution used to evaluate project assurances; 3) a completed Project Operations Manual; 4) a completed Water Quality and Ecological Monitoring Plan; 5) completion of informal consultation with the Corps on endangered species; and 6) analyses of Off-Road Vehicle (ORV) use in the project area if this is under consideration.

We requested the concurrence of the Florida Fish and Wildlife Commission (FWC) and National Marine Fisheries Service (NOAA Fisheries) in response to our previous draft FWCA report. We have reviewed the FWC's comments to the State Clearinghouse on the draft PIR and found that

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the FWC shares many of the same concerns as the Service. However, we have not received any written concurrence to date with the findings of our draft FWCA report from either the FWC or NOAA Fisheries.

The Service stands ready to assist in resolving the issues presented here so that we can strongly support the restoration project for the Picayune Strand and adjacent habitats in southwest Florida. Should you have specific questions regarding the findings and recommendations in this revised draft report, please contact Kimberly Dryden, our lead biologist for this project, at 239-353-2873. The cooperation of your staff and the staff of the local sponsor, the Big Cypress Basin of the South Florida Water Management District, is greatly appreciated.

Sincerely yours,

James J. Slack
Field Supervisor
South Florida Ecological Services Office

Enclosure

cc:
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District, Big Cypress Basin, Naples, Florida (Clarence Tears)
District, Fort Myers, Naples Florida (Mike Duever)
District, Fort Myers, Florida (Janet Starnes)
District, West Palm Beach, Florida (Juan Diaz-Carreras)
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Picayune Strand Restoration Project

Final
Fish and Wildlife
Coordination Act Report

Submitted to:
Jacksonville District
U.S. Army Corps of Engineers
Jacksonville, Florida

Prepared by: Kim Dryden, Carl Couret, Todd Hopkins, Daryl Thomas, Freddie James, Callie McMunigal, Lorraine Heisler, Bob Frakes, Bob Pace, Jim Boggs, Jane Tutton, Margaret Wilson, Heather McSharry, Art Roybal, Steve Traxler, and Dottie Olszyk

Approved by: James J. Slack, Field Supervisor

U.S. Fish and Wildlife Service
South Florida Ecological Services Office
Vero Beach, Florida

September 2004

EXECUTIVE SUMMARY

In keeping with the multiple objectives (restoration of freshwater wetland and natural sheetflow conditions, enhancement of natural resource values on adjacent public lands, estuarine restoration, and protection of listed species and other fish and wildlife resources) of this restoration project, the Fish and Wildlife Service (Service) finds that the selected plan, Alternative 3D, would provide benefits to natural resources in the project area. The project would improve habitat conditions and foster the recovery of federally threatened and endangered species including the wood stork, Florida panther, red-cockaded woodpecker, snail kite, eastern indigo snake, American crocodile, and the West Indian manatee and its critical habitat. In addition to federally listed species, the project will assist in the conservation and recovery of species listed by the State of Florida, particularly wading birds (*e.g.*, snowy egret, little blue heron, tri-colored heron, roseate spoonbill, and white ibis), as well as the limpkin, Florida sandhill crane, Big Cypress fox squirrel, Florida black bear, and American alligator. However, we believe that this project could provide additional fish and wildlife resource benefits, provided the planning and managing agencies: 1) refine the recommended plan, Alternative 3D, in the detailed design stage to reduce dependence on engineered aspects of the plan; 2) develop and implement an Ecological and Water Quality Monitoring Plan consistent with ongoing coordination with the Service; and 3) develop and implement a Project Operating Manual that provides the maximum benefits for inland and coastal wetlands in the area affected by the project while ensuring that the existing level of flood protection to surrounding developed communities is not reduced.

The Service has developed recommendations regarding: 1) hydrological modeling; 2) estuarine resources; 3) monitoring of fish and wildlife resources; 4) monitoring and adaptive management planning; 5) threatened and endangered species; 6) exotic/invasive species; 7) contaminants; 8) alternative modifications; 9) on-site fish and wildlife management including recreational uses; 10) operation plan; and 11) other program coordination. Implementation of these recommendations would further enhance fish and wildlife diversity and abundance in the project area, while assuring that maximum ecological benefits are delivered to the complex of public lands that surround the project. These public lands include the Florida Panther National Wildlife Refuge, Belle Meade portion of the Picayune Strand State Forest, Fakahatchee Strand Preserve State Park, Collier Seminole State Park, Ten Thousand Islands National Wildlife Refuge, Rookery Bay National Estuarine Research Reserve, Cape Romano/Ten Thousand Islands Aquatic Preserve, and Everglades National Park.

Final Project Operating Manuals and monitoring plans are not currently completed for the Picayune Strand Restoration project. The Service is available to work with the Corps and South Florida Water Management District to develop comprehensive plans for operations and monitoring. As a result, a supplement to this Final Coordination Act Report will be supplied upon receipt and review of the comprehensive operations and monitoring plans for this project.

Our major recommendations include:

1. Conduct baseline, construction, and post-restoration surveys for federally and State-listed species including the West Indian manatee and its critical habitat, Florida panther, Florida black bear, wood stork, red-cockaded woodpecker, and state-listed wading birds;

2. Conduct construction and post-restoration surveys for fish and wildlife using methodologies established in existing baseline wildlife surveys;

3. Continue site management activities and develop the Ten-Year Picayune Strand Resource Management Plan consistent with site restoration and management objectives described in the Picayune Strand Restoration Project, Florida Forever program, Florida Division of Forestry management goals, and the Farm Bill and Interim Management Agreements with the Department of the Interior;

4. Implement the Ecological and Water Quality Monitoring Plan (Plan) (Appendix A of the Project Implementation Report/Environmental Impact Statement), integrating the results of fish and wildlife monitoring with design and operational plans to increase the long-term resource restoration benefits of the project. Modify the Plan to include Inland and Listed Species elements currently under development by the Service, South Florida Water Management District, Florida Division of Forestry, Florida Fish and Wildlife Conservation Commission, and the Conservancy of Southwest Florida;

5. Following multi-agency review and approval, implement a detailed Project Operating Manual that will benefit restoration of freshwater wetlands and downstream estuaries by restoring the quantity, quality, and timing of freshwater flows to the natural system, as well as protect and improve freshwater wetlands upstream of the project. In addition to ecosystem benefits, the project's operational rules must ensure that existing levels of flood protection for surrounding developed communities are not reduced;

6. Establish new water quality/quantity monitoring sites on the project and on adjacent public lands, such as the Ten Thousand Islands National Wildlife Refuge that would likely be affected by the project;

7. Monitor conditions in estuarine environments during project operation to validate hydrologic model predictions and provide a basis for improving the performance of the plan within the range of operational flexibility provided by the project design structures;

8. Ensure that existing baseline water quality data continue to be collected by government and local entities, such as Collier County, U.S. Geological Survey, Florida Department of Environmental Protection, the South Florida Water Management District, and the Southwest Florida Water Quality Consortium;

9. Develop an estuarine mixing model for the downstream estuaries of Faka Union, Fakahatchee, Pumpkin, and Blackwater Bays;

10. Draft an Exotic/Invasive Species Management Plan for the project and implement measures to control exotic plants during project construction and operation phases throughout the project area;

11. Identify and reach consensus on issues related to design storm calculations by development of a "white paper" by an interagency team;

12. Develop a specific Comprehensive Everglades Restoration Plan Guidance Memorandum on Flood Damage Assessment Procedures;

13. Evaluate hydrologic information for the thirteen year period of record simulated by the model to provide a full analysis of the project effects on the natural system. Develop assessment performance measures for dry season conditions, flood control, and water supply;

14. Remediate any contaminated portions of the project impact area where wildlife could be adversely affected by high levels of selenium, chlordane, or dieldrin as a result of project operation;

15. Modify detailed project design to reduce engineered structures, such as pumps and levees, to allow for more passive water management in the project area; and

16. Ensure that all recreation proposals by the site manager, Florida Division of Forestry, are consistent with the restoration objectives of this project which are primarily to restore natural resources to their natural condition and to prioritize protection of fish and wildlife resources, listed species, and downstream estuaries. All activities proposed by Florida Division of Forestry must be reviewed and approved by the Department of the Interior consistent with Farm Bill 3 and Interim Protocol Agreements, National Environmental Policy Act, Endangered Species Act, and various other State and Federal regulations.

ACKNOWLEDGEMENTS

The Service acknowledges the extensive contributions of the Interagency Technical Committee for the Southern Golden Gate Estates Watershed Planning Assistance Cooperative Study and the Project Delivery Team for the Southern Golden Gate Estates Hydrologic Restoration Project which were used in developing this report. Convened by the Big Cypress Basin Board of the District and the Natural Resource Conservation Service in January 1997, the Interagency Technical Committee consisted of a multi-agency, multi-disciplined group of biologists, foresters, hydrologists, soil scientists, land managers, educators, and private conservation interests who dedicated themselves to enhancing the project for fish and wildlife resources. Many of the original members of the Interagency Technical Committee are also members of the Project Delivery Team.

The Service would also like to acknowledge Dr. Michael J. Duever, senior ecologist with the District, and Ananta Nath, senior hydrologist with the Big Cypress Basin of the South Florida Water Management District. Their contribution to the project development, analysis, and design modification has been invaluable in the preparation of this report.

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ACRONYMS AND ABBREVIATIONS USED IN THE TEXT

AFB	Alternatives Formulation Briefing
ASR	Aquifer Storage Recovery
BA	Biological Assessment
BEBR	Bureau of Economic and Business Research
BO	Biological Opinion
BCBOPS	Big Cypress Operation Schedule of Water Control Structures
BCB	Big Cypress Basin
BCNP	Big Cypress National Preserve
BMP(s)	Best Management Practices
C&SF	Central and Southern Florida
CARL	Conservation and Recreational Lands Program
CCPCD	Collier County Pollution Control Department
CERP	Comprehensive Everglades Restoration Plan
Cf	Cypress Scamp
cfs	cubic feet per second
Corps	U.S. Army Corps of Engineers
Corkscrew	Audubon's Corkscrew Swamp Sanctuary
CR	County Road
CREW	Corkscrew Regional Ecosystem Watershed
CRP	Critical Restoration Projects
District	South Florida Water Management District
DEP	Florida Department of Environmental Regulation
DHI	Danish Hydraulic Institute
DNR	Florida Department of Natural Resources
DOF	Florida Division of Forestry
DOI	U.S. Department of the Interior
DOT	Florida Department of Transportation
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EMA #390	Technical Publication EMA #390
ENP	Everglades National Park
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ERA	Environmental Risk Assessment
ES	Ecological Services
ESA	Endangered Species Act
FANE	Former Agriculture Area Northeast
FASE	Former Agriculture Southeast
FAW	Former Agriculture West
FB	Farm Bill
FLUCCS	Florida Land Use and Cover Classification System
FMRI	Florida Marine Research Institute

FNAI	Florida Natural Areas Inventory
FWC	Florida Fish and Wildlife Conservation Commission
FWCA	Fish and Wildlife Coordination Act
GAC	Gulf American Corporation
GGE	Golden Gate Estates
GIS	Geographic Information System
GPS	Global Positioning System
ha	hectare (= 2.5 acres)
I-75	Interstate 75 (Alligator Alley)
IDW	Inverse Distance Weighting
ITR	Independent Technical Review
kg	kilograms
km	kilometers
lf	linear feet
LD	lethal dose
LIDAR	Light Detection and Ranging
LOAEL	lowest observed adverse effect level
LWCWSP	Lower West Coast Water Supply Plan
m	meters
m^2	square miles
mg	milligrams
MIKE-SHE	Integrated Hydrologic Simulation Model
MIKE 11	Canal network component of MIKE-SHE
MSL	mean sea level
MSRP	Multi-Species Recovery Plan
NAVD88	North American Vertical Datum 1988
NEPA	National Environmental Policy Act
NERR	National Estuarine Research Reserve
NGGE	North Golden Gate Estates
NGVD	National Geographic Vertical Datum 1929
NRCS	National Resource Conservation Service
NOAA Fisheries	National Marine Fisheries Service
NPS	U.S. National Park Service
NRCS	Natural Resources Conservation Service
NSM	Natural System Model
NWR	National Wildlife Refuge
OFW	Outstanding Florida Waters
O&M	Operations and Management
OPE	Other Project Element
ORV	Off-Road Vehicle
PAL	Planning Aid Letter
PAR	Planning Aide Report
PCT	Project Coordination Team
PDT	Project Delivery Team
PIR	Project Implementation Report

PLRG	Pollution Load Reduction Goal
PMP	Project Management Plan
PNWR	Panther National Wildlife Refuge
POI	Port of the Islands
PSRP	Picayune Strand Restoration Project
PSSF	Picayune Strand State Forest
ppb	parts per billion
ppt	parts per thousand
RECOVER	Restoration Coordination and Verification
RCW	Red-cockaded woodpecker
Restudy	Central & Southern Florida Project Comprehensive Review Study
SAV	Submerged Aquatic Vegetation
Service	Fish and Wildlife Service
SGGE	Southern Golden Gate Estates
SHCA	Strategic Habitat Conservation Areas
SPF	Standard Project Flood
SPS	Standard Project Storm
SR	State Road
SWFFS	Southwest Florida Feasibility Study
TMDL	Total Maximum Daily Load
TTI	Ten Thousand Islands
TTINWR	Ten Thousand Islands National Wildlife Refuge
UCL	Upper Confidence Limit
URS	URS Corporation
USDA	U.S. Department of Agriculture
USGS	U.S. Geological Survey
US 41	U.S. Highway 41
ug/l	microgram per liter
WRDA	Water Resources Development Act

I. IDENTIFICATION OF PURPOSE, SCOPE, AND AUTHORITY

A. Introduction

In the late 1950s, Gulf American Corporation (GAC) began purchasing an area of 173 square miles (111,053 acres) of Collier County, Florida for a vacation and retirement community, later marketed worldwide. The Golden Gate Estates (GGE) subdivision was approved in 1960, and included 183 miles of drainage canals with 25 water control structures and 813 miles of roads spaced at intervals of one-quarter mile. The area is characterized by nearly flat terrain with cypress wetlands, pine islands, wet and dry prairies, and several deeper wetland strands and sloughs including the adjacent Camp Keais and Fakahatchee Strands. Most of the land is inundated from at least July 1 to October 1 after the onset of the rainy season, and historically drained to downstream estuaries of the Gulf of Mexico through surface water movement in the form of shallow sheetflow. Two major canal systems, Golden Gate and Faka Union, were constructed in the early 1960s and between 1968 and 1971, respectively, to drain this area into Naples and Faka Union Bays (Corps 1980). Drainage channelized surface water runoff and altered each subbasins hydrologic response to rainfall. These canal systems are estimated to have increased drainage to 16 times that of historic conditions, lowered water tables by 2 to 4 feet, and reduced wetland hydroperiods by 2 to 4 months, resulting in increases in forest fires and annual runoff within the Big Cypress Basin (Gore 1988). The canals also circumvented drainage to downstream estuaries of the Blackwater, Pumpkin, Wood, and Little Wood Rivers. On December 16, 1966, the U.S. Army Corps of Engineers (Corps) issued a permit to dredge an entrance channel connecting the Faka Union Canal with the mouth of the Faka Union River. The construction of this canal generated a major point source freshwater discharge in Faka Union Bay which has significantly altered estuarine resources in portions of the Ten Thousand Islands (TTI).

Project History

In response to local environmental and other interests, the Collier County Board of County Commissioners, in 1975, designated the Golden Gate Estates Study Committee to address resource management and urban planning needs. In September of 1977, the State of Florida submitted a request for federal funding for the environmental restoration of Golden Gate Estates. Authorization of a Golden Gate Estates Feasibility Study was initiated by the Corps in 1978 to consider various alternatives to water resource problems resulting from the extensive Golden Gate Estates canal system. A Reconnaissance Report (Corps 1980) subsequently concluded that there was a federal interest in conducting a second phase study of Golden Gate Estates. In 1985, the project area was identified as a component of Florida's Save Our Everglades program. In 1986, the Corps released a Golden Gate Estates Feasibility Report (Corps 1986). Analysis of six alternative plans resulted in a determination that the project did not qualify for Federal implementation. The report did conclude that the plans that were evaluated, particularly Plan C, would be generally beneficial to environmental concerns. Plan C (FlowWay/ Conservation Area) included establishment of a Conservation Area on the western portion of the Picayune Strand Restoration Project (PSRP), and restoration of a flowway on the eastern portion of the project, using canal plugs.

The Southern Golden Gates Estates (SGGE) subdivision originally included 22,000 lots with more than 17,000 individual landowners scattered worldwide. By 1991, only 1,353 acres had been purchased by the State (Ramsey and Addison 1996). In 1990, the Florida Department of Environmental Protection (DEP) estimated it would take staff 10 to 20 years to acquire the PSRP project. In August of 1991, the Conservancy of Southwest Florida initiated a cooperative effort with DEP to expedite the process under a grant from the Harder Foundation. By May of 1993, the first round of acquisition offers had been sent to all 17,000 landowners. In February 1992, Governor Lawton Chiles issued a directive to the South Florida Water Management District (District) to "develop a conceptual hydrologic restoration plan for Southern Golden Gate Estates, using the Corps' Feasibility Report as a primary reference." In February 1996, the Big Cypress Basin (BCB) of the District completed the "Hydrologic Restoration of Southern Golden Gate Estates - Conceptual Plan" (Abbott and Nath 1996).

The Water Resources Development Act (WRDA) of 1996 (P.L. 104-303) authorized the Secretary of the Army, in cooperation with a non-Federal project sponsor and the South Florida Ecosystem Restoration Task Force, to provide a determination as to whether nominated Critical Restoration Projects (CRP) for the South Florida ecosystem would produce independent, immediate and substantial ecosystem restoration, preservation, and protection benefits. The PSRP Hydrologic Restoration Project was ranked seventh on the CRP list by the South Florida Ecosystem Restoration Working Group, after review by the Big Cypress Project Coordination Team (PCT), a regional subgroup formed under the direction of the Working Group.

In October 1996, the BCB of the District contracted a Cooperative Watershed Planning Assistance Study agreement with the U.S. Department of Agriculture's (USDA), Natural Resource Conservation Service (NRCS) to enhance the available database for soils, vegetation, topography, and a hydrological-ecological assessment of the Restoration Plan. The NRCS and the BCB convened an Interagency Technical Advisory Committee in January 1997. A Critical Project Letter Report was submitted by the Corps' Jacksonville Planning Division and approved by Corps Headquarters in March 1998.

In March 1999, it was determined that the total project cost of $144 million would exceed the $50 million Federal limit for Critical Projects since the project was 50/50 cost-shared. The Corps subsequently included the PSRP in the overall Comprehensive Everglades Restoration Plan (CERP) in order to provide alternative authorization and funding authority. A Project Management Plan (PMP) was approved in March 2001. In October 2001, the Interagency Technical Advisory Committee reorganized to become the Project Delivery Team (PDT) for the PSRP. The Corps, District, and the PDT began development of a Project Implementation Report (PIR) in 2002. In November 2002, the Corps prioritized the PSRP to prepare it for inclusion in a potential WRDA 2003. In February 2003, after preparation of a preliminary draft PIR, the Corps and District project management directed the PDT to develop additional alternatives to reduce project costs. An Alternatives Formulation Briefing (AFB) for the project was conducted on May 14, 2003. A Memorandum of Understanding between the State of Florida, District, and Collier County vacated county easements on approximately 279 miles of roadway within the restoration project in September 2003, providing for settlement of the last significant legal issue that would delay project implementation. Development of additional project alternatives narrowed the preferred alternative selection process to three alternatives in November 2003,

when the project was once again prioritized for inclusion into WRDA 2004. A draft PIR was provided for public review in April 2004. A public hearing conducted for National Environmental Protection Act (NEPA) compliance was conducted on June 17, 2004.

B. Purpose and Scope of the Project

The purpose of the PSRP, as proposed by the Corps and the District, is to restore altered hydrologic function to the 86-square mile (55,247 acres) PSRP (Figure 1). The proposed project is designed to re-establish historic flowways and reduce large, adverse point-source freshwater canal discharges by restoring natural overland sheetflow to the TTI estuarine system located downstream of the project area.

Chapter 9 of the Central and Southern Florida Project Comprehensive Review Study (Restudy) Integrated Feasibility Report and Programmatic Environmental Impact Statement (EIS) (known as the "Yellow Book") text reads as follows:

> "9.1.9.1 Southern Golden Gate Estates Restoration (OPE)
>
> This feature includes a combination of spreader channels, canal plugs, road removal and pump stations in the Western Basin and Big Cypress, Collier County, south of I-75 and north of U.S. 41 between the Belle Meade Area and the Fakahatchee Strand Preserve State Park.
>
> The purpose of this feature is to restore and enhance the wetlands in Golden Gate Estates and in adjacent public lands by reducing over-drainage. Implementation of the restoration plan would also improve the water quality of coastal estuaries by moderating the large salinity fluctuations caused by freshwater point discharge of the Faka Union Canal. The plan would also aid in protecting the City of Naples' eastern Golden Gate wellfield by improving groundwater recharge (page 9-26)."

The objectives of the PSRP as outlined in project planning documents are to:

- Re-establish historic flowways, sheetflow, and wetland hydroperiods;
- Reduce point-source discharges to improve the health of downstream estuaries;
- Maintain flood protection for developed areas north of the project;
- Improve aquifer recharge for water supply and to provide a saltwater intrusion barrier;
- Restore and enhance fish and wildlife resources, including listed species such as the Florida panther (*Puma [=Felis] concolor coryi*), Florida black bear (*Ursus americanus floridanus*), and wood stork (*Mycteria americana*);
- Protect rare habitat such as tropical hammocks and rare plant species including orchids and bromeliads' preserve upland habitat' control invasive exotic plants;
- Improve quality of stormwater runoff;
- Reduce or eliminate overdrainage of adjacent sensitive ecosystems;
- Provide resource-based recreational opportunities; and

- Provide contiguous conserved habitat for the greater Everglades ecosystem including the Florida Panther and TTI National Wildlife Refuges (NWR), Fakahatchee Strand Preserve State Park, Collier Seminole State Park, and the Belle Meade portion of PSSF.

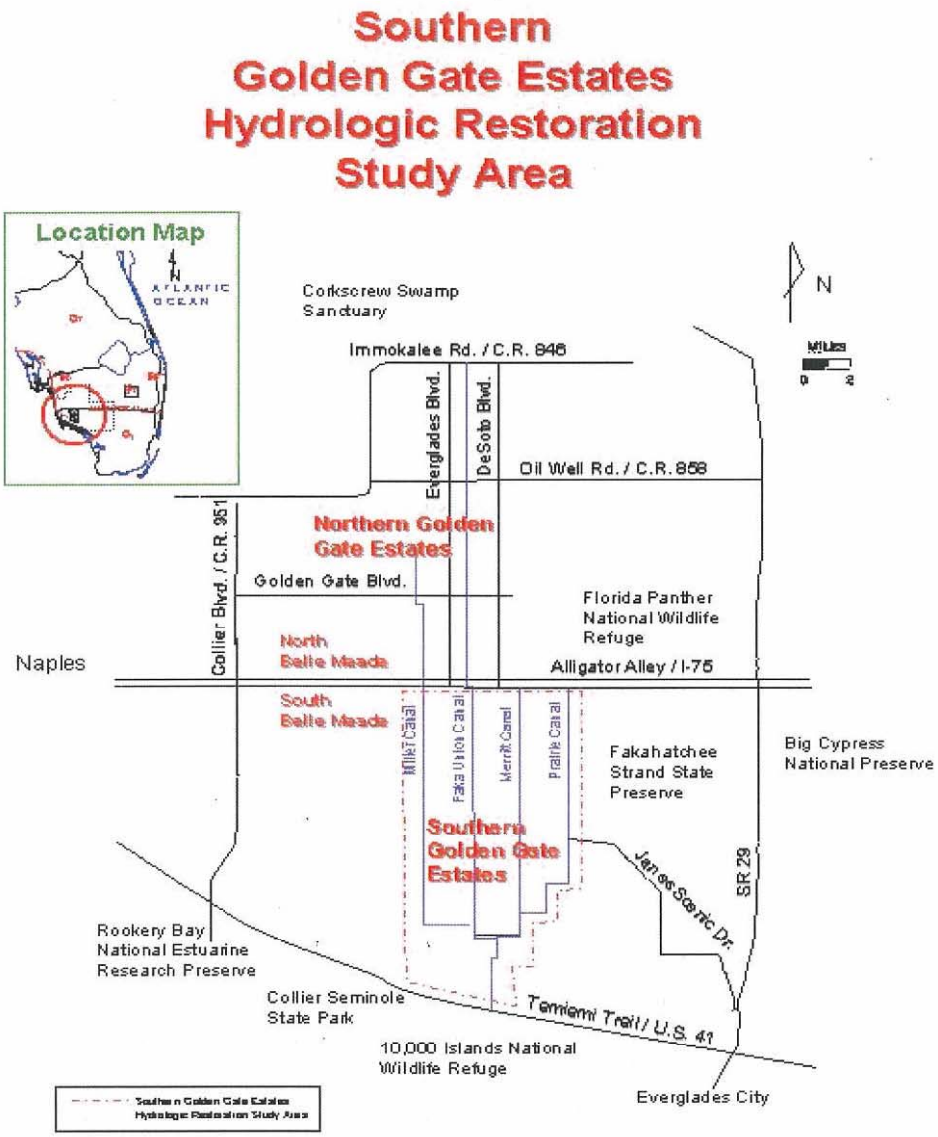

Figure 1. Location map of the study area

The implementation of the project is entirely contingent upon acquisition of lands. In April 1998, the Department of the Interior (DOI) and the DEP executed a grant agreement under the Farm Bill (FB) (Section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which gave DEP $25 million in Federal funds to acquire

approximately 20,250 acres in the PSRP. The FB3 grant agreement with DEP provides that conservation lands acquired under the agreement will be used and managed for conservation purposes within the scope and authorities of the FB and the Fish and Wildlife Coordination Act (FWCA). The framework agreement requires that all FB funds spent on land acquisition will be matched by non-Federal funds on a dollar-by-dollar basis. To date, over 99 percent of targeted lands have been purchased within the PSRP. Land acquisition negotiations within the PSRP are continuing under the direction of DEP with the remaining landowners.

C. Authority

Once finalized, this FWCA report will constitute the report of the Secretary of the Interior as required by section 2(b) of the FWCA (16 U.S.C. 661 *et seq.*), which establishes fish and wildlife conservation as a co-equal purpose or objective of federally funded or permitted water resource development projects. The FWCA allows for reports and recommendations from the Service and the State agency exercising administration over wildlife resources (in this case, the Florida Fish and Wildlife Conservation Commission [FWC]) to be integrated into Corps' reports seeking authorization for the Federal action. The FWCA also grants authority to the Corps to include fish and wildlife conservation measures within these projects.

The PSRP was authorized under the Restudy. The Restudy was authorized by section 309(l) of WRDA 1992 (P.L. 102-580). Generally, the objectives of the Restudy were to enhance ecological and economic values, as well as social well-being. More specifically, the goals and objectives of the Restudy were the following:

1. Increase the total spatial extent of natural areas including short hydroperiod wetlands;
2. Improve habitat and functional quality;
3. Improve native plant and animal species abundance and diversity;
4. Increase the availability of fresh water (agricultural, municipal, and industrial);
5. Reduce flood damage (agricultural and urban);
6. Provide recreational and navigational opportunities; and
7. Protect cultural and archeological resources and values.

The preliminary selected plan for the PSRP was approved by the Corps under the authority of section 528 of the WRDA 1996 as a Critical Project. Section 601 of the WRDA 2000 authorized the CERP, identified the PSRP as an "Other Project Element (OPE)," and required specific authorization of projects within the CERP, including a project description and a PIR.

II. PREVIOUS SERVICE INVOLVEMENT

A. General Coordination

The Service participated in both regional and ecosystem-wide evaluations and rankings of Critical Projects (authorized by WRDA 1996 [P.L. 104-303]) as members of the South Florida Ecosystem Restoration Working Group and the Big Cypress PCT. The PSRP was initially ranked seventh on the Critical Projects list. Service NWR and Ecological Services (ES) staff were members of the PSRP Interagency Technical Advisory Committee from January 1997 to

October 2001 and continued as members of the PDT for the PSRP project. The Service participated in all project public workshops and NEPA hearings, PDT meetings and working subgroup meetings, field site inspections, and conference calls between October 2001 and September 2004.

The Service submitted a Planning Aid Letter (PAL), dated October 27, 1999, in compliance with the Scope of Work for the PSRP and consistent with project planning under the Restudy. This letter outlined fish and wildlife resource concerns, including freshwater and estuarine impacts resulting from over-drained conditions in the PSRP area. The Service identified the need for updated vegetation and baseline fish and wildlife surveys, identified concerns regarding potential pollutants and listed species, and conducted a general analysis of the downstream effects of a tentatively preferred alternative (3C) on the TTI. The Service also recommended an adaptive management approach to project phasing, coordination with other State and Federal landowners and entities, a long-term project monitoring program, and the need to develop performance measures for the project.

On February 2, 2001, the Service provided detailed comments to the Corps on the Preliminary Draft PSRP PMP. These comments included flood control/wetlands protection in North Golden Gate Estates (NGGE), water supply issues related to the City of Naples wellfield in NGGE, the importance of providing a water regulation schedule, review by Restoration Coordination and Verification (RECOVER), the Draft PSSF Post Restoration Road Plan, the Biological Assessment (BA) for listed species on the site, and baseline fish and wildlife studies.

On January 9, 2002, the Service received a project description from the Corps for purposes of proceeding with the FWCA report.

On July 11, 2002, the Service attended a workshop to update the public on the status of the project. Issues identified by an estimated 100 attendees included property rights, perceived flooding concerns in NGGE, recreational access, and restoration benefits to wetlands and downstream estuaries.

On July 19, 2002, the Service provided a No Comment letter on the Corps Notice of Intent to Prepare an Integrated Draft PIR/EIS, noting the continued active participation of the Service in all project planning elements.

A Preliminary Draft PIR/EIS was developed by the PDT in January 2003 which identified the tentatively selected plan as 3D.

On January 17, 2003, the Service provided a PAL to the Corps which summarized the project status and recommended that: 1) restoration benefits be evaluated with respect to the pre-development condition, as well as the existing and 2050 without-project condition; 2) all major alternatives that were developed by the PDT, Corps, and District be evaluated; and 3) ecological and water quality performance measures or indicators, in addition to hydrological performance measures, be included in the project.
The Service attended the AFB for the project on May 14, 2003, in Jacksonville, Florida. Project managers and the PDT provided answers to the policy review comments reviewed at the AFB in

mid-July 2003. Several new alternatives were developed as a result of the AFB and most alternatives were re-modeled using an updated Integrated Hydrologic Simulation Model (MIKE SHE). A draft Phase I/II Contaminants Environmental Site Assessment Report was submitted to the District and the Service by URS Corporation in mid-August 2003.

In response to analysis of various hydrological model results, the Service submitted a PAL to the Corps on August 11, 2003, recommending consistent application of hydrological and meteorological data in developing Standard Project Flood and Standard Project Storm criteria using input data from regional rainfall models. The recommendations included development of a "white paper" on the subjects by an interagency peer group and a separate CERP guidance memorandum on flood damage assessment procedures.

Ecosystem benefits of various alternatives were re-evaluated in October and November 2003. Also in October 2003, the local project sponsor, the District, applied for a Corps Clean Water Act Section 404 permit and State Environmental Resource Permit (to fill a portion of the easternmost project canal, the Prairie Canal. The Service participated in the design, modification, and review of this "Early Start" project.

On October 1, 2003, the Service provided comments on the Phase I/II Environmental Site and Ecological Risk Assessment for a 600-acre portion of the project site and recommended further sampling in specific locations where high selenium was identified in earlier sampling efforts. Sampling results also indicated isolated areas had significant risk for sediment-dwelling organisms and fish due to toxaphene contamination.

On October 3, 2003, the Service assisted the District and DOF in providing a tour of the project for the State of Florida legislative aides. The purpose of this tour was to assess the remaining land condemnation proposals.

On October 16, 2003, various Service representatives attended the groundbreaking ceremony for the Prairie Canal Early Start project. On October 19, 2003, the Service provided comments on the Prairie Canal early start project under the FWCA and Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 *et seq.*) and recommended approval of that portion of the project upon finalization of fish and wildlife/protected species management plans and a resurvey (and remediation if necessary) of an area of the project for contaminants (selenium).

In December 2003, the Service began assisting the District and Corps in developing an Ecological and Water Quality Monitoring Plan proposal for the project. This proposal will be used to monitor inland and estuarine fish and wildlife resources including plant communities and invasive species, listed species, and water quality to monitor restoration benefits and provide direction for adaptive management decisions. Development of this plan continues.

On August 10, 2004, Service hydrologists met with the Corps, District, and the contractor, DHI, to discuss hydrological modeling issues, the project operations manual, and engineering and design features of the project that affect fish and wildlife resources. DHI provided new model results with reference to flood control/restoration objectives of water from NGGE and the Operational Manual, as well as changes in pump numbers and sizes. Other issues discussed

included documentation of model runs for Alternative 6, the removal of Lucky Lake weir and the replacement pump effects on Florida Panther NWR, pre-storm drawdown, the new F-U 4 weir in NGGE, wet and dry season water elevation correlation, topography, discrepancies in PIR graphics, land use assumptions, Stewart Boulevard's proposed culverts, the pre-development conditions vegetation map, the project road plan, weak groundwater and surface water response correlation in the hydrological model, errors in the operational criteria of simulated pumps, the effects of other projects in the watershed and their incorporation into the hydrological models, standard project flood rainfall calculations, the use of year 1994 as an average year in the model, and other model input parameters. There was agreement that significant modification, correction, or improvement of the issues discussed were goals to be pursued during continued project coordination and detailed design.

The Service assisted the Corps and District in responding to agency and public comment on the Draft PIR/EIS in August/September 2004 and continues development of the Ecological and Water Quality Monitoring Plan.

B. Site Inspections

The Service has participated in multiple site inspections of the PSRP area and adjacent affected State and Federal public lands over a six-year period with representatives of the District BCB, Corps, FWC, NRCS, DOF, DEP, and Collier County Natural Resources Division, as well as citizens and environmental groups. The majority of these site inspections were conducted for the purpose of developing and evaluating baseline data for the PSRP Interagency Technical Advisory Committee between January 1997 and October 2001, and as members of the PDT from October 2001 to the present. Initial site inspections included overall evaluation of project plan alternatives as discussed in Abbott and Nath (1996). Site inspections in 1997 and 1998 were primarily conducted to determine the recommended locations of 34 monitoring wells and associated baseline vegetation transects in representative habitats and appropriate geographic distributions. Site inspections from 1999 through the present were primarily conducted for purposes of evaluating potential alternatives to hydrological restoration; surveying the effects of exotic plant invasion, wildfire and freeze on ecosystem components; conducting fish and wildlife surveys; and coordinating Federal project interests with the Corps, District, DOF, DEP, and State legislative representatives. Site inspections with the District in the fall of 2003 and spring of 2004 were conducted to evaluate the planning and construction of the Prairie Canal Early Start portion of the project.

C. Endangered Species Act Consultation

The Service provided an October 27, 1999, PAL to the Corps that outlined project concerns including federally listed species. The Corps provided a BA, dated October 17, 2001, that requested initiation of consultation under the ESA on the West Indian manatee (*Trichechus manatus*), red-cockaded woodpecker (*Picoides borealis*), Florida panther, wood stork, Everglade snail kite (*Rostrhamus sociabilis plumbeus*), and eastern indigo snake (*Drymarchon corais couperi*). The Corps concluded that an earlier version of Alternative 3D would be "beneficial" to the wood stork and American crocodile (*Crocodylus accutus*); and "may affect, but was not likely to adversely affect" the Florida panther, eastern indigo snake, red-cockaded woodpecker, and West

Indian manatee. The Service did not respond to this determination since there were: 1) several immediate changes in the project development schedule; 2) details lacking in the identified selected plan; 3) new alternatives subsequently developmented; 4) pending results of several iterations of the hydrological model; and 5) changes in the hydrological model platform.

The Service completed consultation, in accordance with the ESA, with the Corps on the Prairie Canal Early Start portion of the PSRP in October 2003. The Service concurred with the Corps' determination that that the backfill of Prairie Canal on the eastern extent of the project "may affect, but is not likely to adversely affect" the Florida panther, wood stork, Everglade snail kite, West Indian manatee and its critical habitat, American crocodile, red-cockaded woodpecker, eastern indigo snake, and bald eagle (*Haliaeetus leucocephalus*). This concurrence was based on a project proposal developed by the applicant (District) which included pre-project wildlife surveys, construction protection plans for affected listed species, and post-restoration project monitoring and reporting.

On August 5, 2004, the Service met with the Corps to address comments on listed species consistent with the July 8 and July 13, 2004, PAL and DOI comments. The Service also requested additional information on the West Indian manatee including project effects on its warm water refugia and critical habitat. The Service and the U.S. Geological Survey (USGS) also provided the Corps with updated information on the status of the southwest Florida regional population of the manatee and USGS studies conducted in the project vicinity.

The Service has recently been advised of and is reviewing the effects of this project on two bald eagle nests located northwest of Port of the Islands (POI).

The Service has actively assisted the Corps in development of a modified BA for the PSRP. This extensive informal consultation process is intended to minimize the effects of the project on federally listed species. The Service believes that a detailed project alternative description, updated hydrological models, an Operations Manual that incorporates restoration components, and a completed Ecological and Water Quality Monitoring Plan that includes additional measures to minimize effects on listed species will be necessary to complete consultation.

III. DESCRIPTION OF PROJECT AREA

A. Project Location

The PSRP study area encompasses about 93-square miles (59,294 acres) of sensitive environmental landscape within the Big Cypress Watershed in Collier County, southwest Florida, between Interstate Highway 75 and U.S. Highway 41 (US 41) (Figure 1). The project is located northwest of Everglades National Park (ENP), southwest of the Florida Panther NWR, north of the TTI NWR and Rookery Bay National Estuarine Research Reserve (NERR), Cape Romano/TTI Aquatic Preserve, northeast of Collier Seminole State Park, west of the Fakahatchee Strand Preserve State Park, and east of the Belle Meade Conservation and Recreation Land (CARL) projects area (Figure 2). The PSRP area and the Belle Meade CARL areas constitute the PSSF which is managed by the DOF. The completion of this restoration

project in the midst of significant areas of State and Federal conservation lands will result in a total contiguous public land holding of approximately 2,602,144 acres in southwest Florida.

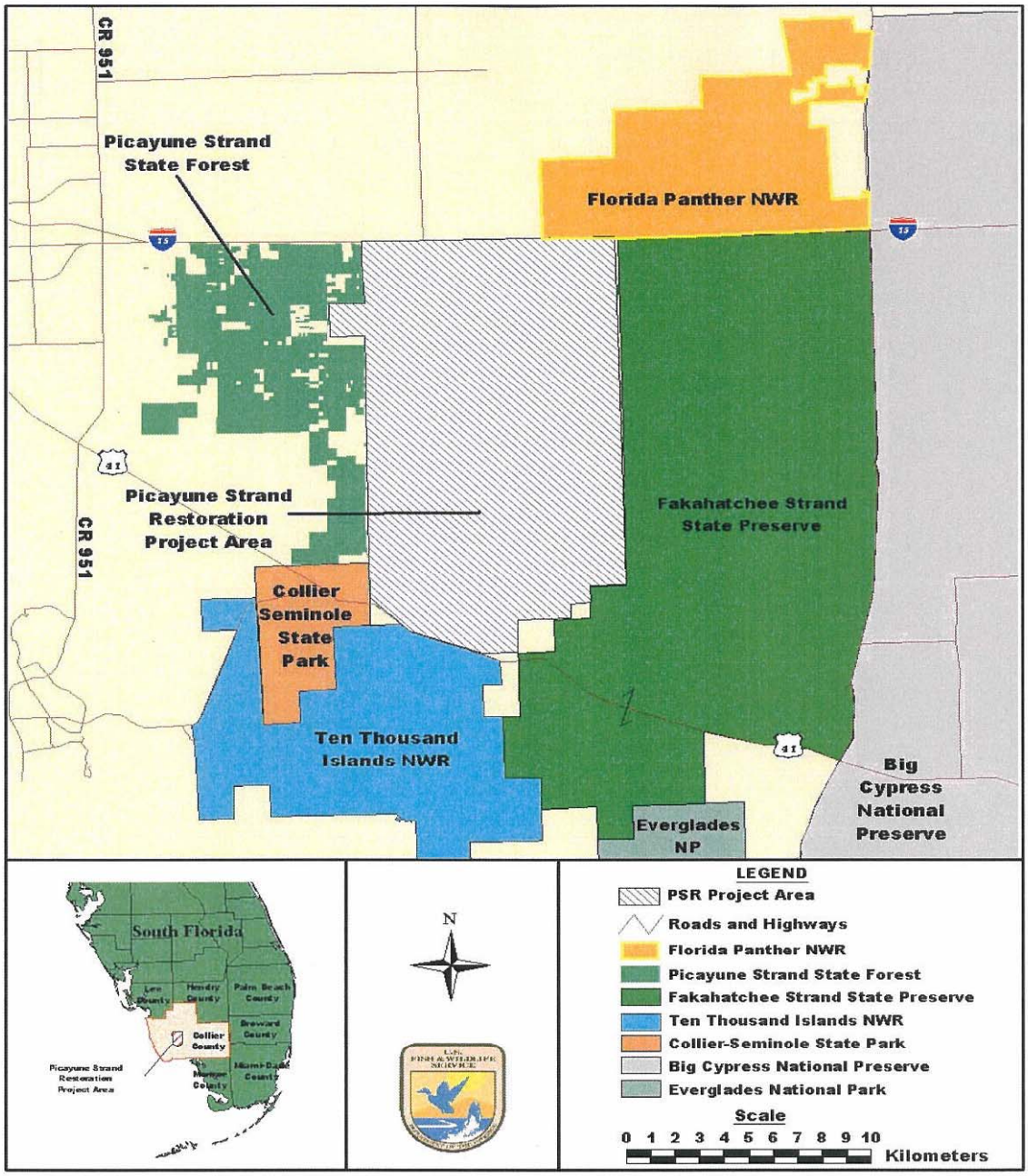

Figure 2. Location of PSRP in reference to adjacent public lands.

B. Study Area

1. Hydrology

The project is located in the Big Cypress Watershed, an estimated 2,800-square mile area within southwest Florida. This watershed includes all of Collier County, the southern portions of Lee and Hendry Counties, and smaller portions of Miami-Dade and Monroe Counties. Historic watershed boundaries in the immediate project area include portions of the Cochatchee, Belle Meade, and Camp Keais Basins. Note that the proper spelling for Keais is this, not what is on the figure (Figure 3).

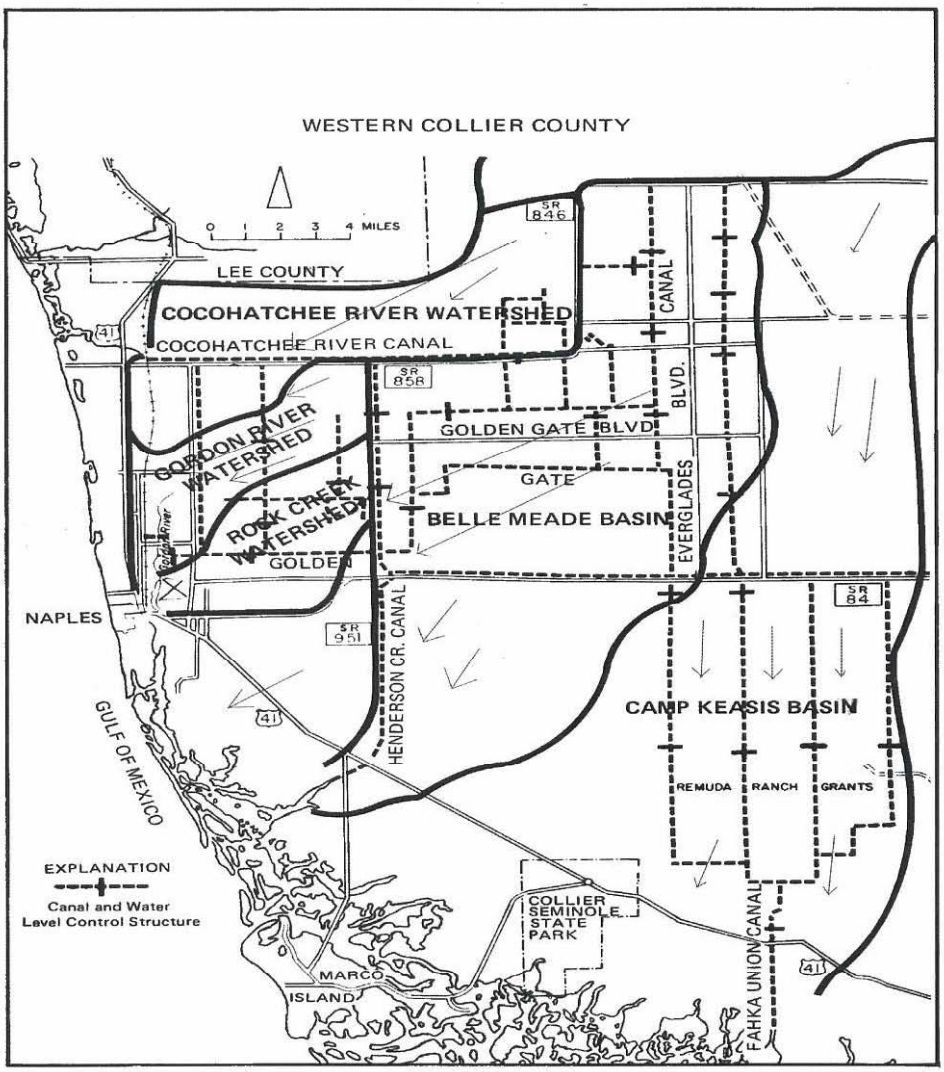

Figure 3. Historic surface flow patterns prior to the development of SGGE

The Faka Union Canal watershed, which includes the PSRP and part of NGGE, historically encompassed an area of about 234-square miles (Black et al. 1974). The Faka Union Canal system presently drains an area of about 189-square miles (200,000 acres), including approximately 70 miles of canals with 12 weir structures. The majority of the watershed has a grid-like system of roads spaced every quarter mile. Included in the Faka Union Canal system are portions of Corkscrew Swamp, which is 32 miles north of the canal network (Carter et al.

1973). The topography of the basin is characterized by low relief and poorly defined drainage patterns. Elevations range from 24 feet National Geographic Vertical Datum 1929 (NGVD) in the extreme north end with a gradual slope in the central and southern part to elevations of 2 feet NGVD near the outlet of the basin some 28 miles to the south. The basin's historic overland flow pattern is generally to the southwest. The existing Faka Union Canal watershed and its approximate surface drainage boundaries prior to the construction of the GGE canal system are illustrated in Figure 4.

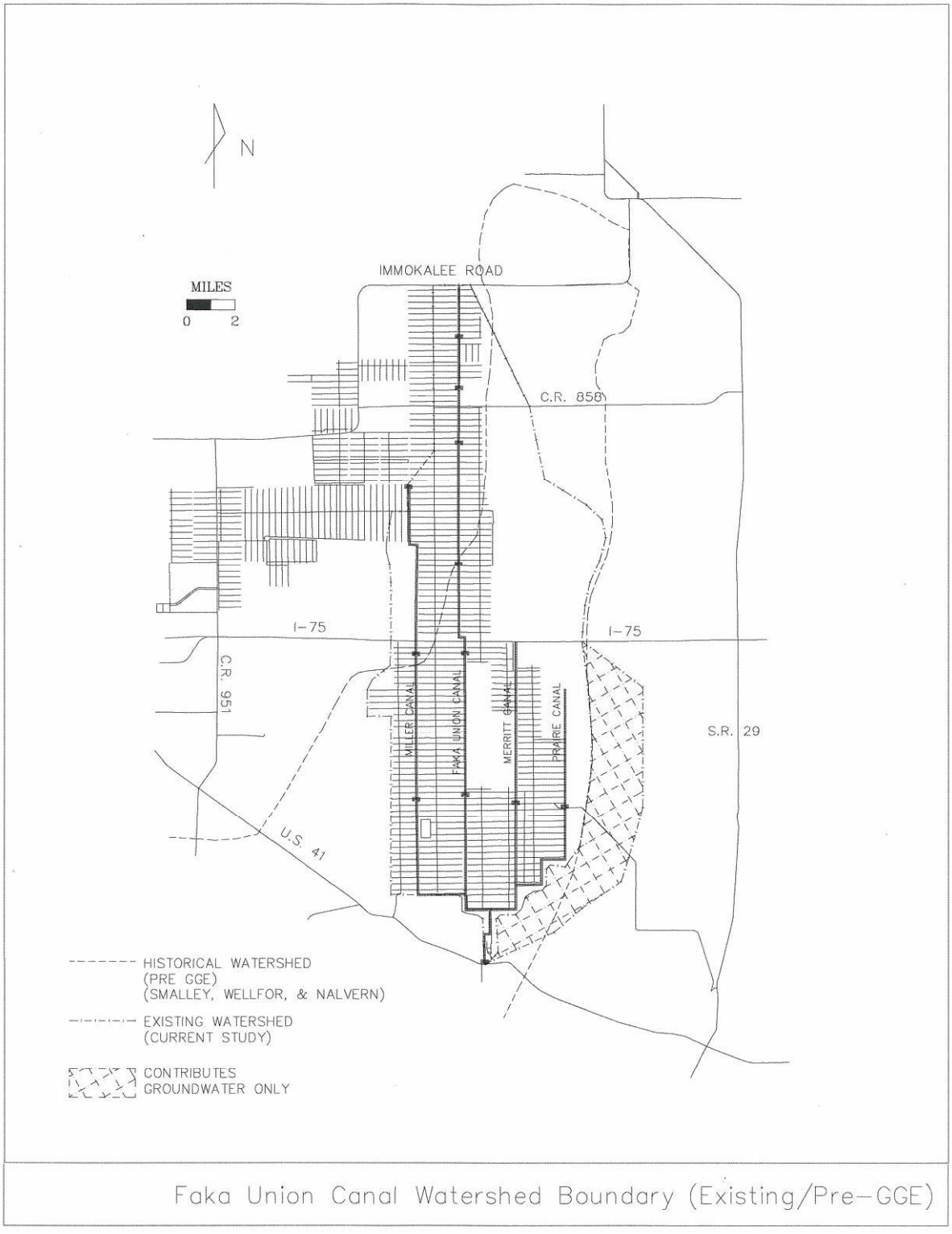

Figure 4. Faka Union Canal watershed boundary (Pre-GGE).

2. Geology and Soils

The PSRP area lies within the lower Coastal Lowlands topographic division, Big Cypress physiographic region, and has geomorphic features of the Southwestern Slope, Reticulated Coastal Swamps, and the TTI. Limestone and marine deposits underlying the area were formed during the Pleistocene epoch. The Southwest Slope is at an elevation below 25 feet above mean sea level (MSL). Most of this area has a thin mantel of sand, which generally becomes thicker to the north, overlying an eroded Tamiami Formation Limestone surface. The Reticulated Coastal Swamps border the Gulf Coast. These swamps are tidally influenced, complexly channeled mangrove swamps and coastal marshes. They are at an elevation of less than 5 feet above MSL. Thin deposits of organic material and marl overlie limestone and calcareous sandstone of the Tamiami Formation. The TTI are transitional between the quartz sand-dominated barrier island coastline to the north and the carbonate-dominated, quartz-deficient shoreline to the south. Sufficient quartz sand is present to form beaches on the Gulf side of the outermost islands, but not enough is present to allow the beaches to coalesce. The outer islands are often on a core composed of vermetid (gastropod) reef rock. The inner islands are generally composed of oyster reefs. Both types of islands are generally vegetated by mangrove swamps (USDA 1998).

Duever et al. (1986) classified four major soil groups (rock, sand, marl, and organics) in the Big Cypress National Preserve. These major soil groups are also found in the PSRP area. Soils throughout the project area vary in thickness over limestone. There is exposed limestone in the northeastern portion; the remainder of the area is shallow limestone. The surface thickness of the soils and depth to limestone is greatest in the lower elevations between US 41 and the platted portion of the project area. At the higher elevations in the project area where the thickness of the soil layer above the limestone is greater than 4 feet, soil-forming processes occur to form either stain layers or cause mineral movement within clay layers above the limestone. South of the four major canals that drain the PSRP, soils in the prairie areas have marl over sandy deposits on rock. The detailed map units from the modern soil survey seem to indirectly qualify that oxidation through drainage or fire activity has thinned the organic surface layers (District and NRCS 2001).

Most of the soils in the project area are characterized as poorly or very poorly drained, and historically were subject to intermittent or prolonged flooding. Because of the strong correlation between soil type and vegetation under unaltered conditions, observations of soil types in the PSRP area provide information about pre-development natural flowways and land cover. In the 1954 Collier County Soil Survey (Leighty et al. 1954), the deepest of these flowways and basins are identified as a generic map unit labeled as Cypress Swamp (Cf). The soil was not further classified for the map unit, as the purpose of the soil survey was to identify areas for agricultural pursuits, and areas mapped Cf were considered too wet for agriculture. However, the survey names several soils that are likely to be found within this map unit. Most of the unnamed soils have black or dark-gray mucky fine sand or peaty muck; in others, it is brown peat. According to the 1998 Collier County Soil Survey, areas mapped as Cf in the 1954 survey have soils that are predominately sandy or mucky fine sands. The modern soil surveys are more prone to identify soils within a map unit regardless of predicted use. The current PSRP area soil map units were also delineated in more detail due to larger mapping scales and greater detail within

the soil classification system used in the 1998 survey. Assessment of 1940 and 1953 aerial photography also verifies the plant communities within this map unit (District and NRCS 2001).

3. Land Use

A large portion of the Faka Union Canal watershed is part of the GGE development, zoned for single-family residential land use. Some previously farmed areas in the northern part of the watershed are now zoned for residential and commercial use. The residential zoning in the GGE is low density with a minimum lot size of 1.25 acres. Rapid growth in the project area over the past two years has resulted in an almost 20 percent increase in the number of individual homeowner estates being developed in the area directly north of the PSRP (CCPCD 2002). The remaining area is used for agriculture, predominately vegetable farming, except in areas of persistent flooding. The most populated areas of GGE are north of Alligator Alley (Interstate 75 [I-75]) and west of Everglades Boulevard in NGGE. Telephone and electric services are not available in most areas south of Alligator Alley and the area remains generally undeveloped. An exception is a small urban area, POI, located south of the PSRP adjacent to the northern portion of the main Faka Union Canal (District 2001).

4. Water Quality

The PSRP site has almost no residential development, but the infrastructure of roads, canals, and levees within the project area are defining features of existing ecological conditions. The water quality condition for the PSRP area is primarily affected by the historic and existing land use characteristics described above.

There are several monitoring efforts currently being conducted within the project impact area. The Collier County Pollution Control Department (CCPCD) monitors surface waters from at least eight sites that are classified as inflows or outflows to the PSRP area. The Southeast Environmental Research Center of Florida International University maintains an extensive monitoring network within the estuarine waters of the southwestern coast of Florida, including a site within the Faka Union Bay, located at the mouth of the canal. Rookery Bay NERR also collects continuous data from Faka Union and Fakahatchee Bays.

The construction of canals, levees, and roads within the Faka Union Basin have resulted in changes to the timing, quantity, and quality of surface waters within and around the project area. Groundwater flow and quality southward through the project area may also be influenced by these anthropogenic features. The physical and chemical conditions of surface waters in the Class III waters of the PSRP area generally meet State standards. The quality of groundwater is also within the DEP's drinking water standard for potable supply. The DEP's Year 2000 305 (b) Report indicates a "fair" condition for the Faka Union Canal (on a scale of good>fair>poor). The DEP findings also indicate no change in data trends from the canal monitoring site. The surface water data collected within and adjacent to the project area by CCPCD is used to develop water quality conditions on Collier County's web site. The DEP's Impaired Waters Rule Assessment determined the following conditions at locations within and adjacent to the project area:

- Faka Union Canal meets standards for dissolved oxygen, fecal coliform, and turbidity;
- Estuaries receiving flow from the Faka Union Basin meet standards for dissolved oxygen, chlorophyll, fecal coliform, and turbidity but are listed as impaired based on the concentrations of bacteria in shellfish; and
- Blackwater River meets standards for dissolved oxygen, chlorophyll, fecal coliform, and turbidity.

The TTI are designated as Outstanding Florida Waters (OFW) by the DEP. The OFW designation provides that the State cannot issue permits for direct discharges which would lower ambient water quality or for indirect discharges which would significantly degrade water quality. Permits for new dredge and fill projects must clearly be in the public interest. USGS and DEP are conducting significant ground/water and water quality studies within the PSRP boundaries and downstream estuaries. A Water Quality Monitoring Plan has been developed as part of this project (Appendix H in draft PIR/EIS).

5. Contaminants

In February and March 2000, the DEP conducted site investigations at the current and former agricultural fields on the western portion of the project site and further to the west in the Belle Meade area. These investigations included site visits, as well as the collection and laboratory analyses of soil samples for residual pesticides from the former cultivated areas. Results of the laboratory analysis exhibited elevated concentrations of organochlorine pesticides, specifically chlordane and to a lesser extent 4,4-DDE, 4,4-DDD, dieldrin, and endosulfan I.

In September 2000, DEP contracted (WRS Infrastructure & Environment) to perform a preliminary overview assessment of three tracts of land within the PSRP area. Identified in this study were "areas of high environmental concern" including areas of stressed vegetation, agricultural lands, or areas where greenhouses, shade houses, or nurseries were identified; areas of commercial land use; areas with large piles of discarded solid wastes; and areas with machinery storage and/or multiple abandoned vehicles. In November 2000, the District retained URS Corporation (URS) to complete a Phase I and II Environmental Site Assessment. A work plan for this study was presented to the Service for review and comment and was subsequently revised and approved. URS conducted a Phase I and II Environmental Site and Ecological Risk Assessment of the PSRP, resulting in a September 30, 2003, report. The report included sampling and assessment activities for the entire PSRP site and divides it into four areas: the Former Agriculture Area Northeast (FANE), Former Agriculture Southeast (FASE), Former Agriculture West (FAW), and the Interior area. The 1,450-acre FASE is located on the southeast boundary of the PSRP and was formerly utilized for tomato cultivation in the 1930s. The 750-acre FAW is located on the western project boundary and contains both cultivated and non-cultivated land last farmed in the early 1960s. The 600-acre FANE is located in the northeast project area and consists of three small farms of cultivated and non-cultivated land. One of the farms was a recently abandoned 23-acre grove/landscape nursery operation. In addition to the three former agricultural areas, 46 homesteads were identified within the 50,000-acre project Interior. Some of the homesteads include rudimentary landscape nursery/orchard operations, vegetable gardens, or hobby farms. Follow-up analyses of selenium soil concentrations and

desorption testing in the FASE were conducted by URS as a supplement to the Phase I and II Assessment and the results were provided in their July 9, 2004, report.

6. Ecology (adapted from Duever 2004)

Methods

There were two types of plant community maps used in the analysis of the PSRP. As part of a watershed study of the project area, the NRCS (District and NRCS 2001) developed detailed maps of the distribution of major plant community types in the PSRP area in 1940 and 1995 (Figure 5). The second set of maps was developed based on hydrology parameters calculated by the MIKE SHE model for pre-development, existing, 2050-without project, and various restoration alternatives (Figures 6, 7, and 8). Plant community distributions were predicted based on the hydrologic characteristics of each major community type and on model output of average water depths during the wet season (July 1 through October 1).

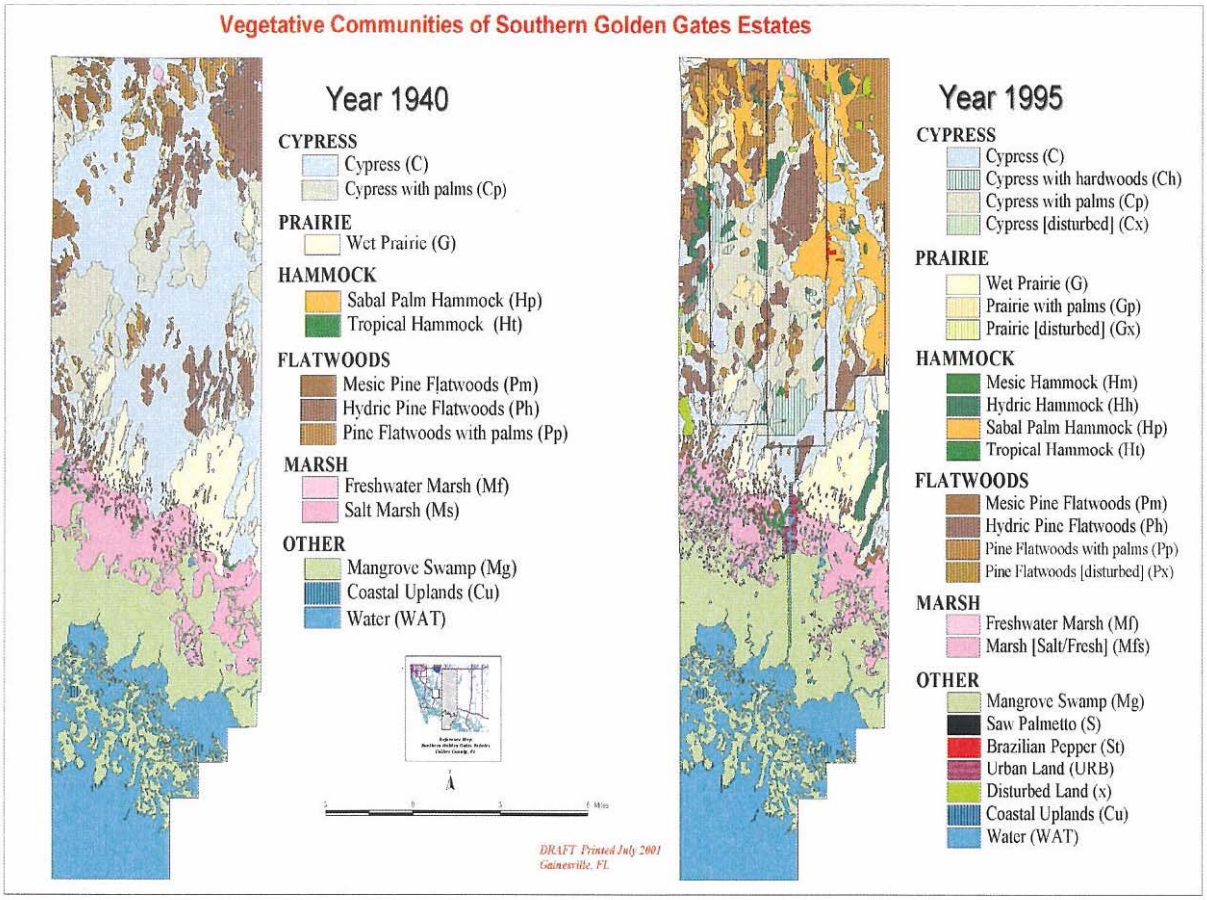

Figure 5. Vegetation maps of SGGE (PSRP) for 1940 and 1995 produced by the Natural Resources Conservation Service.

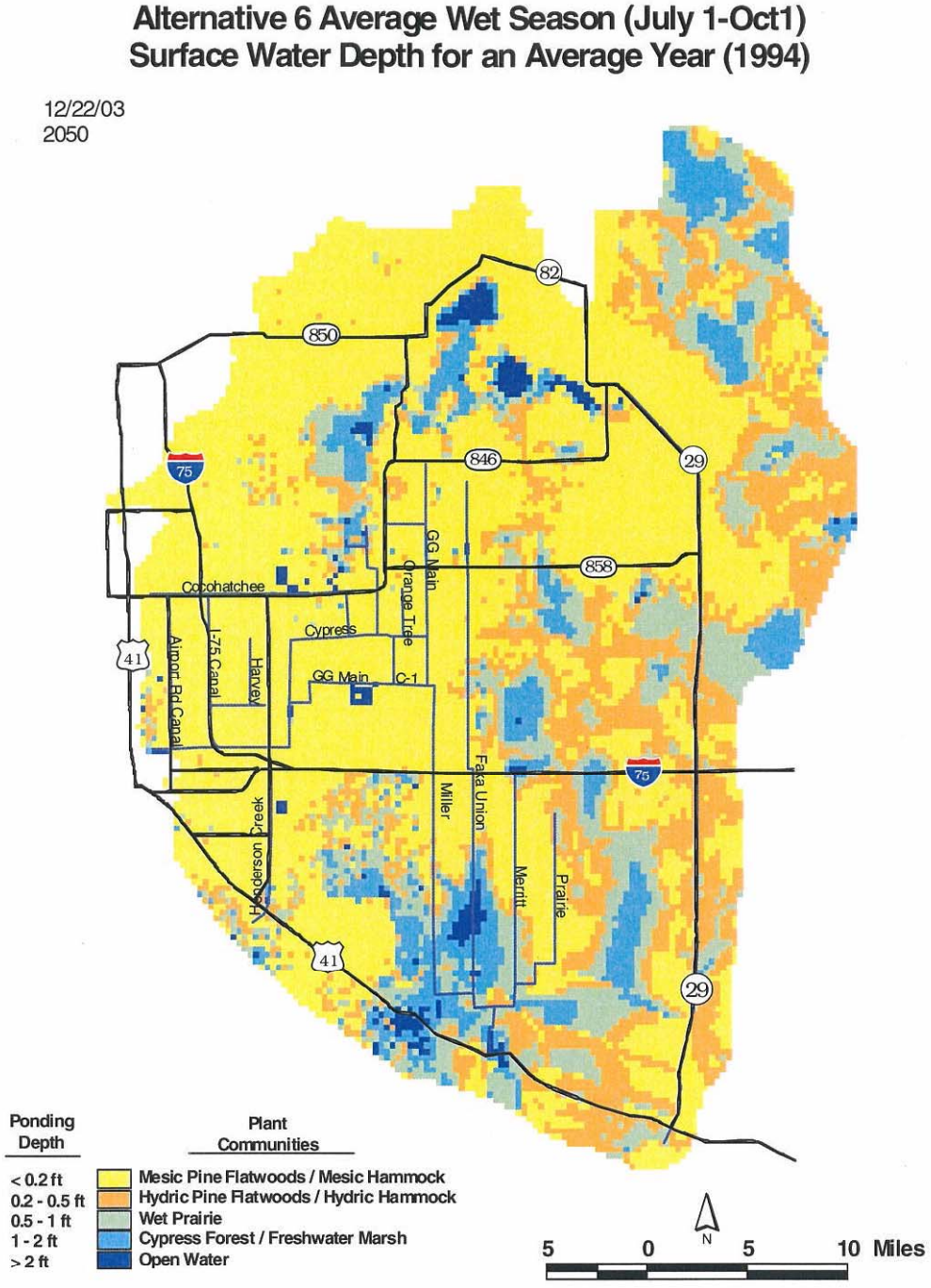

Figure 6. Alternative 6 average wet season water levels.

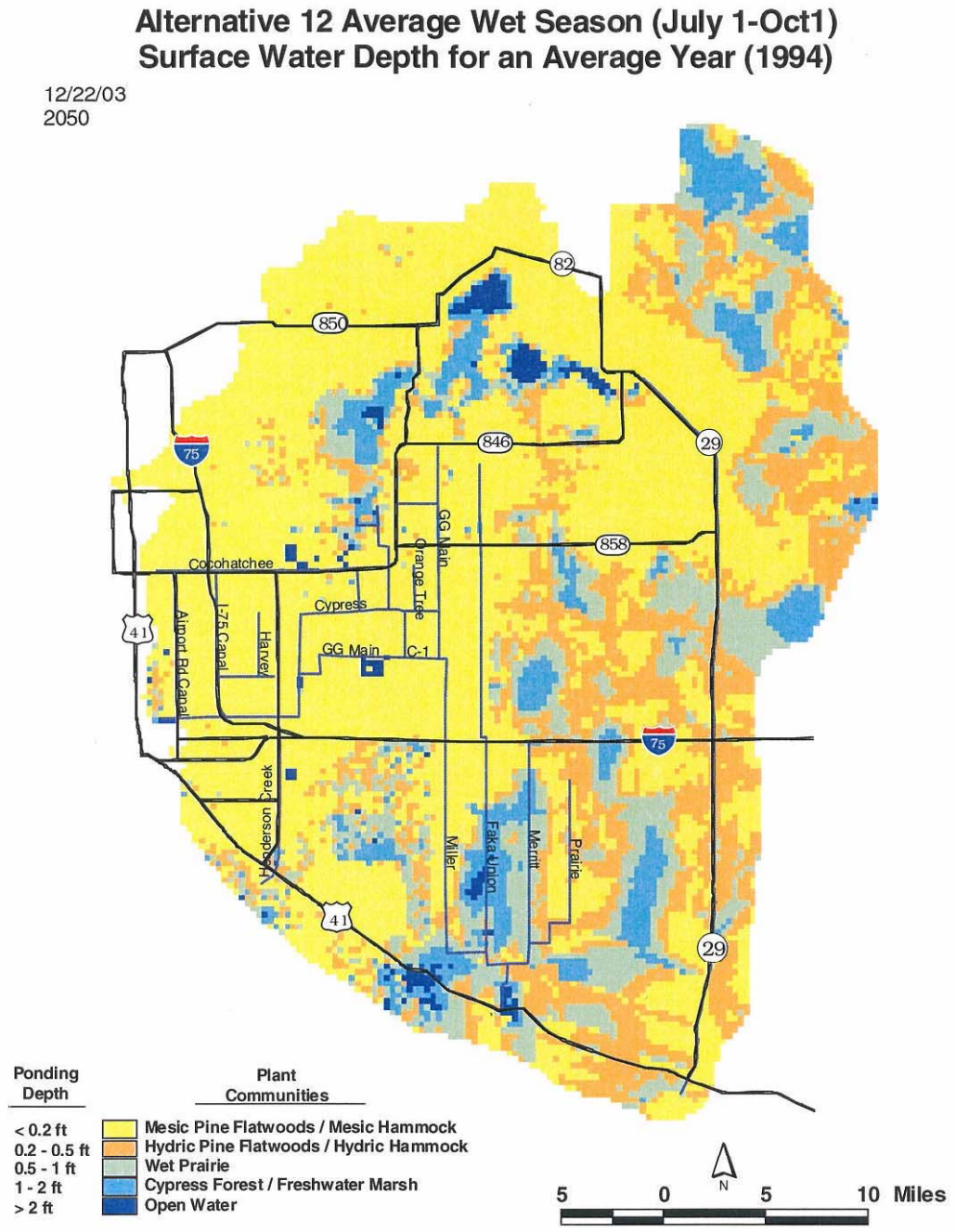

Figure 7. Alternative 12 average wet season water levels.

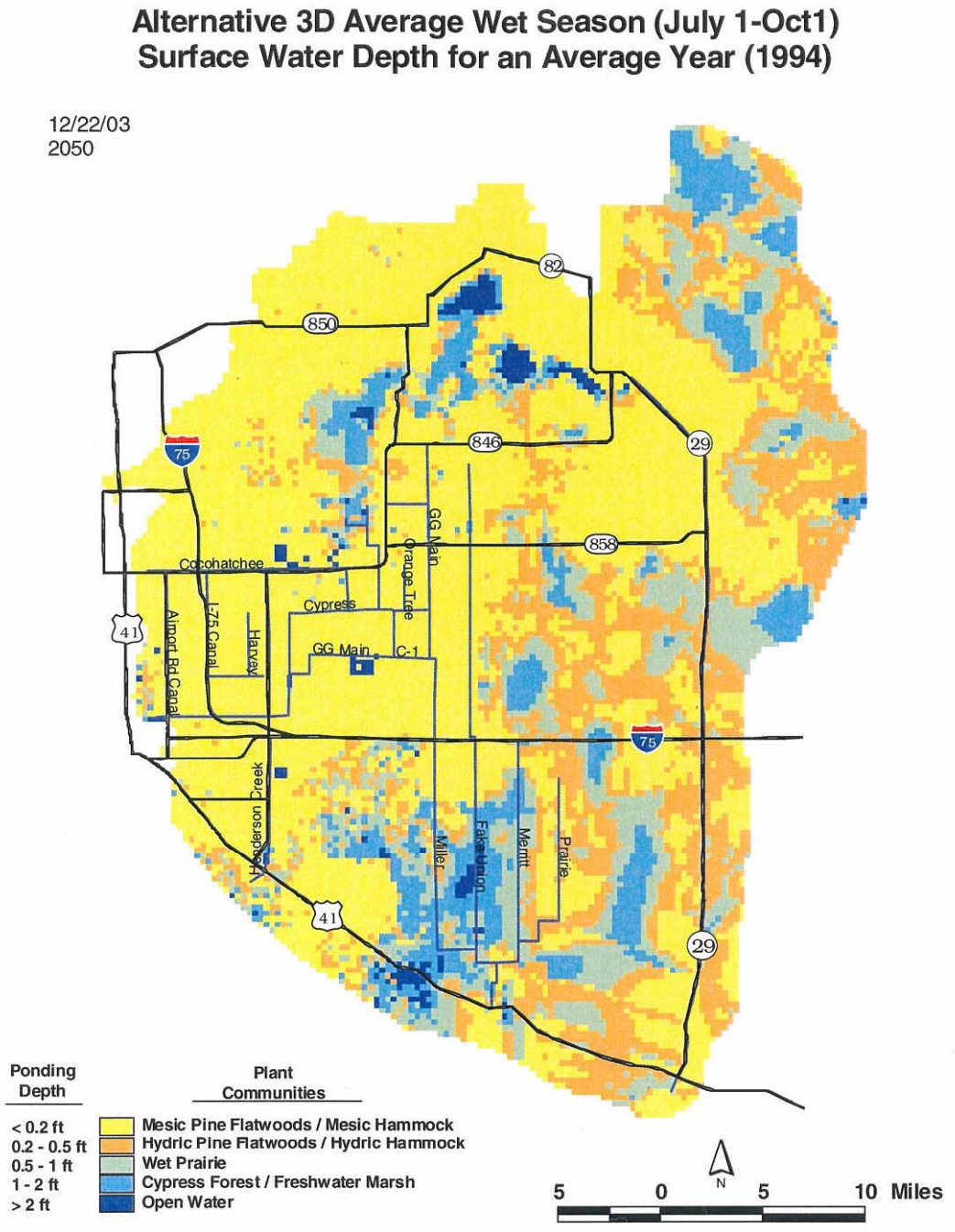

Figure 8. Alternative 3D average wet season water levels.

The MIKE SHE and NRCS maps have different boundaries, particularly along the coast. The MIKE SHE hydrology model is not designed to deal with tidal influences. The use of a constant

mean high tide boundary at its southern periphery is required by the model characteristics. The lack of data on topography and water circulation patterns would have greatly limited the usefulness of any model in this area. As a result, the model minimizes the amount of area influenced by tides by leaving out most the saline estuarine habitat located south of Tamiami Trail, which is included in the NRCS maps. In addition, the MIKE SHE model extends coverage to the west of the PSRP to try to minimize problems with model boundary conditions and to increase the accuracy of the model within the area of interest. This same boundary on the NRCS map, however, is somewhat closer to the Miller Canal. These differences are significant when comparing plant community acreages and percentages between pre-development, current, and restored conditions between the two sets of maps. The quarter-mile cell size of the model does not allow for development of plant community maps which include small features or features with a lot of edge, both of which can be more precisely shown on the NRCS map.

The NRCS plant community maps indicate where changes have occurred from pre-development to current condition. They also represent a valuable baseline with which to compare future change following restoration, particularly where a return to pre-development (natural) condition is the restoration target. However, while the NRCS maps provide good estimates of plant community acreages for natural and current conditions, they are not able to predict an estimate of restored condition acreages. The only acreage estimates for restoration conditions are those that can be calculated based on the hydrology model. Thus, since these two sets of maps cover somewhat different areas, the only accurate comparison of plant community acreages for the three conditions would be one based on the hydrology model.

The MIKE SHE model used in this study quantitatively estimates future conditions when certain system features are altered. The model does not represent real ecosystems. However, the value of the model is the ability to synthesize major features and processes operating within an ecosystem to evaluate specific manipulations more accurately than would otherwise be possible. The MIKE SHE model permits comparison of water levels, and by extension, major plant communities associated with pre-development, existing, and 2050-without-project conditions, as well as those conditions associated with each of the restoration alternatives. Modeled scenarios assume removal of virtually all the PSRP roads except the public access route along Everglades and Stewart Boulevards between Janes Scenic Drive and NGGE. PSRP plant communities are described using the Florida Land Use Cover and Forms Classification System (FLUCFCS) (DOT 1999). Hydrology and plant community relationships (Table 1) are based on Duever et al. (1975) and Duever (1984).

Table 1. Hydrologic regimes and other environmental factors that maintain the major plant community types. Relative abundance of these communities during natural and current conditions is indicated by the number of pluses from low abundance (+) to high abundance (++++). A zero (0) indicates the community is not present.

Average Wet Season Water Level (inches)	Hydroperiod (Month)	SGGE Non-Tidal Plant Communities	Non-Hydrologic Influences	Relative Abundance in SGGE	
				Natural	Current
≤-6	0	Tropical Hammock	No Fire	++	++
≤2	≤1	Mesic Pine Flatwoods	Fire	+++	+++
		Palmetto Prairie	>>>Fire	0	0
		Mesic Hammock	No Fire	0	++
		Brazilian Pepper	Exotic	0	++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
2 – 6	1 - 2	Hydric Pine Flatwoods	Fire	+++	+++
		Hydric Hammock	No Fire	0	+++
		Palms in Flatwoods	Soils	+++	+++
		Palms in Hammock	Soils	+	+++
6 – 12	2 - 6	Wet Prairie	Fire	+++	+++
12 – 24	6 - 10	Marsh	Fire	++	++
		Cypress Forest	< Fire	++++	++++
>24	>10	Open Water		0	0

a. Upland and Freshwater Habitats

The PSRP area was originally dominated by wetland communities, particularly cypress forest and, to a lesser extent, herbaceous wet prairies. Even those sites normally designated as uplands, particularly islands of mesic flatwoods, often had water at or above the ground surface for at least short periods during wetter portions of the year. After drainage, upland pines, palms, and hardwoods invaded many of the cypress forests. In addition, severe and frequent fires eliminated many of the pine and cypress trees, furthering the conversion of these lands to earlier shrubby successional stages of upland or shallow wetland plant communities. The character of the original PSRP has also changed as a result of the invasion of exotic plant species, particularly Brazilian pepper (*Schinus terebinthifolius*), into drained and disturbed sites.

Cypress Forest

Cypress forests (C) (FLUCFCS: 621 Cypress) in PSRP are dominated by stands of bald cypress (*Taxodium distichum*) and occasional hardwoods, such as red maple (*Acer rubrum*), pop ash (*Fraxinus caroliniana*), or pond apple (*Annona glabra*), where these hardwoods provide less than 30 percent canopy cover. Ground cover can be sparse to dense and emergent in standing water during normal wet season conditions. Epiphytic bromeliads and orchids are common in trees and ferns are common on palm trunks. Normal wet season water depths are relatively deep (12 to 24 inches) and hydroperiods are long (6 to 10 months) (Table 1). This community may occur on any type of soil, including sand, marl, rock, and organic. One variation of the cypress forest is cypress-with-palms (Cp), which were typical of shallow cypress communities in 1940 and drained cypress communities in the 1995 vegetation maps (Figure 5). Almost 40,000 acres of the lands within PSRP were cypress forest in 1940 (C, Cp) (Table 2), based on the NRCS vegetation map (Figure 5).

Following drainage of the PSRP area, the original cypress forest (C) has been reduced by about 20,000 acres based on the NRCS map (Table 2). Although there was little change in the acreage of the cypress-with-palms community (Cp), there were large shifts in the location of this plant community (Figure 5). It now occupies areas within the south-central project area that were largely cypress (C) in 1940. A larger portion of the original community (C, Cp) has been replaced by sabal palm hammock (Hp) or one of the pine flatwoods (P) communities.

A small portion of the cypress forest (C) at scattered locations throughout the original cypress communities has been converted to cypress-with-hardwoods (Ch) (FLUCFCS: 630 Wetland Forested Mixed), probably due to a lack of fire which has allowed succession to proceed (Table 2) (Figure 5). This community is dominated by bald cypress and a variety of hardwoods, such as red maple, pop ash, or pond apple, where these hardwoods provide more than 30 percent canopy cover. Epiphytic bromeliads are common in trees and ferns are common on palm trunks. Drier conditions could also have allowed hardwoods to invade the original cypress forests, but again only in the absence of fire.

Currently there are about 1,200 acres of the original cypress that are classified as disturbed (Table 2) (Figure 5). Disturbed cypress forest (Cx) is cypress forest habitat that has been significantly altered as evidenced by physically altered soils; large areas of charred, dead trees; dominance or partial dominance by ruderal species, such as saltbush (*Baccharis halimifolia*), wax myrtle (*Myrica cerifera*), muscadine grape (*Vitis munsoniana*), poison ivy (*Toxicodendron radicans*), or Brazilian pepper.

Table 2. Acreages and percentages of each SGGE plant community in 1940 and 1995.

Name	Veg. Symbol	1940 Acres	Percent (H)	1995 Acres	Percent (C)	Difference (1995-1940)	
Cypress	C	30583.1	30.5%	10567.1	10.5%	-20016.0	-19.9%
Cypress with hardwoods	Ch	0.0	0.0%	2845.7	2.8%	2845.7	2.8%
Cypress with palms	Cp	8758.1	8.7%	9025.6	9.0%	267.5	0.3%
Coastal Uplands	Cu	301.9	0.3%	301.9	0.3%	0.0	0.0%
Cypress (disturbed)	Cx	0.0	0.0%	1246.2	1.2%	1246.2	1.2%
Wet Prairie	G	7619.3	7.6%	7031.0	7.0%	-588.3	-0.6%
Prairie with palms	Gp	0.0	0.0%	2043.6	2.0%	2043.6	2.0%
Prairie (disturbed)	Gx	0.0	0.0%	161.8	0.2%	161.8	0.2%
Hydric Hammock	Hh	0.0	0.0%	2574.2	2.6%	2574.2	2.6%
Mesic Hammock	Hm	0.0	0.0%	139.8	0.1%	139.8	0.1%
Sabal Palm Hammock	Hp	55.8	0.1%	7286.4	7.3%	7230.7	7.2%
Tropical Hammock	Ht	264.9	0.3%	688.6	0.7%	423.7	0.4%
Freshwater Marsh	Mf	512.1	0.5%	94.7	0.1%	-417.5	-0.4%
Marsh (Salt/Fresh)	Mfs	8574.2	8.5%	6480.4	6.5%	-2093.8	-2.1%
Mangrove	Mg	16564.5	16.5%	18417.3	18.3%	1852.8	1.8%
Hydric Pine Flatwoods	Ph	7141.2	7.1%	5852.9	5.8%	-1288.3	-1.3%
Mesic Pine Flatwoods	Pm	2908.0	2.9%	1983.0	2.0%	-924.9	-0.9%
Pine Flatwoods with palms	Pp	2408.0	2.4%	6478.1	6.5%	4070.2	4.1%
Pine Flatwoods (disturbed)	Px	0.0	0.0%	48.2	0.0%	48.2	0.0%
Saw Palmetto	S	0.0	0.0%	6.2	0.0%	6.2	0.0%
Brazilian Pepper	St	0.0	0.0%	273.1	0.3%	273.1	0.3%
Urban Land	URB	0.0	0.0%	298.8	0.3%	298.8	0.3%
Water	WAT	14721.9	14.7%	15843.8	15.8%	1121.9	1.1%
Disturbed Land	x	0.0	0.0%	725.0	0.7%	725.0	0.7%
Total:		100412.9	100.0%	100413.5	100.0%		

Restoration of cypress communities to their original condition on sites where pre-development hydrology has been restored will likely take many decades. Since the original canopy cypress were probably about 100 to 200 years old, restoration will take longer where cypress have been eliminated or greatly reduced in numbers such as in the disturbed areas. Where most of the older cypress are still present, but have been invaded by palms or hardwoods, it should take less time, on the order of a few decades. The application of an appropriate fire regime (Duever 1984) and/or mechanical clearing would expedite the recovery of these latter sites. Certain areas are not expected to be restored to their natural condition, such as those located upstream of the pumps and spreader system, in the vicinity of portions of canals that will not be filled, and along canals with control structures that cannot be kept fully closed during flood events up to a 1-in-10-year frequency. They will likely remain in a drier condition that would support pine flatwoods and palm or hardwood hammock communities, although the vegetative composition of these communities would depend on the fire and exotic plant management programs. The

footprint of those areas where canals and roads have not been completely removed will not be restored.

Freshwater Marsh

Freshwater marsh communities (Mf) (FLUCFCS: 641 Freshwater Marshes) are low diversity herbaceous communities dominated by tall, dense stands of grasses and forbs. They have relatively long hydroperiods (6 to 10 months) and deep wet season water depths (12 to 24 inches) (Table 1). They are found primarily on organic soils. Fires are frequent and retard the invasion of woody vegetation. However, marshes may include an occasional bald cypress where these trees provide less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940 there were only a few small marshes in PSRP area (Table 2), with most of them located north of the salt marshes near the coast (Figure 5).

The conversion of sheetflow conditions to a point source discharge out of the Faka Union Canal would be expected to have converted most, if not all, of the freshwater marshes along the coast to salt marshes. However, the data cannot show if this has actually happened because the 1995 plant community classification combined salt and fresh marsh into a single class (Mfs) along the coast (Figure 5). Sea level rise may impede freshwater marsh reestablishment.

Wet Prairie

Wet prairies (G) (FLUCFCS: 643 Wet Prairies) are high diversity herbaceous communities dominated by short, open stands of grasses, sedges, and forbs. They have relatively short hydroperiods (2 to 6 months) and shallow wet season water depths (2 to 6 inches) (Table 1). They are found on mineral soils, including sand, marl, and rock. Fires are frequent and retard the invasion of woody vegetation. However, wet prairies can include an occasional slash pine (*Pinus elliottii*) or bald cypress, where these trees provide less than 30 percent cover. Epiphytes are uncommon due to the lack of trees. In 1940, wet prairies originally occupied about 7,600 acres (Table 2) and were most extensive just upstream of the brackish marshes along the coast, with smaller scattered areas in the northern and eastern portions of PSRP area (Figure 5).

Since the PSRP area has been drained, there has been only a small decrease in their acreage (Table 2) and a small change in the distribution of wet prairies (Figure 5). They are still most widespread just upstream of the coastal brackish marshes, with scattered smaller wet prairies further north, particularly along the eastern side of PSRP area. The lack of change between 1940 and 1995 in the larger, more downstream wet prairies is most likely due to their low elevation and proximity to the coast, which could have reduced the ability of the canals to drain these sites.

There is currently substantial acreage of wet prairie with palms (Gp) (Table 2) on sites that were cypress forest prior to drainage (Figure 5). These probably represent sites where sabal palm (*Sabal palmetto*) invaded following drainage, and subsequent fires eliminated the cypress. There are some small areas of disturbed wet prairie (Gx) that were cypress forest and are now at least partially dominated by ruderal species such as saltbush, wax myrtle, muscadine grape, poison ivy, or Brazilian pepper. Fires have probably eliminated the cypress and, with the drier conditions following drainage, early succession upland species are now invading these sites.

Since most of the wet prairie is still currently intact in the southern portion of the PSRP, restoration of this habitat to pre-development condition should be relatively expeditious, once the pre-development hydrology has been restored. Some small areas will not be restored, including those upstream of the pumps and spreader canals, where canals are not plugged, where canals and roads will not be completely removed, and where control structures are not kept closed during flood events up to a 1-in-10-year frequency. Otherwise the restored hydrology and an appropriate fire regime could be expected to revert most of the altered PSRP wet prairies to their original condition within a decade.

Pine Flatwoods

Most of the PSRP upland communities present in 1940, making up about 12,500 acres (Table 2), were islands of pine flatwoods (P) (FLUCFCS: 411 Pine Flatwoods) scattered throughout the area which decreased in both size and aerial coverage from north to south through the PSRP (Figure 5). Pine flatwoods have an open canopy dominated by slash pine. They typically have water slightly above (<6 inches) or below ground during the peak of the wet season, and have short hydroperiods (<2 months). They can occur on sand or rock substrates. Compared to hydric pine flatwoods (Ph) (FLUCFCS: 625 Hydric Pine Flatwoods), which have deeper wet season water depths (>6 inches) and a longer hydroperiod (>2 months), mesic pine flatwoods (Pm) are more elevated with shallower wet season water depths (<2 inches) and a shorter hydroperiod (<1 month). Mesic flatwoods are more likely to be dominated by dense saw palmetto (*Serenoa repens*), while hydric pine flatwoods are more likely to be dominated by a dense and diverse herbaceous ground cover of grasses, sedges, and forbs. Pine flatwoods with an abundance of sabal palms (Pp) in the subcanopy were also common, particularly in the northern portion of the PSRP. The open character of the canopy and shrub strata, and the dense groundcover, are maintained by intense and frequent fires. Epiphytes are not common due to the small number of trees and their limited branching, as well as the frequent fires.

There has been a moderate reduction in the acreage of mesic and hydric pine flatwoods (Table 2), although they generally have a very different distribution from where they occurred in 1940 (Figure 5). The one area where mesic pine flatwoods occurred in both 1940 and 1995 was along both sides of the boundary between fresh and saltwater communities near the coast. Hydric pine flatwoods have tended to expand into what were cypress communities in 1940.

There has been a substantial increase in the acreage of pine flatwoods that have been heavily invaded by sabal palms (Pp), which provide 30 percent or more shrub cover (Table 2). These palms are usually of similar size and appear to be even-aged. Dense palm stands occur on calcareous substrates in both natural uplands and uplands created by drainage (Figure 5). Otherwise, disturbed pine flatwoods (Px) are limited in extent, but can be identified by the presence of physically altered soils; large areas of charred, dead trees; and dominance or partial dominance by ruderal species such as saltbush, wax myrtle, muscadine grape, poison ivy, or Brazilian pepper.

A small area of dense shrubby saw palmetto (S) (FLUCFCS: 321, Palmetto Prairies) is present near the southwestern corner of the canal system (Table 2) (Figure 5). Slash pines may occur,

but are not common, and the ground cover is a sparse mix of mesic grasses and herbs. This community is essentially a mesic pine flatwoods where a high fire frequency has eliminated or prevented the invasion of pines.

Restoration of pine flatwoods communities to their original condition will likely take several decades, once pre-development hydrology has been restored. Since the canopy pine were probably about 50 to 100 years old, restoration will take longer where pines have been eliminated or greatly reduced in numbers. Where most of the older pines are still present, but have been invaded by palms or hardwoods, restoration should take less time. The application of an appropriate fire regime (Duever 1984) and/or mechanical clearing would expedite the recovery of these latter sites. Some areas will not be restored, including those upstream of the pumps and spreader canals, where canals are not plugged, where canals and roads will not be completely removed, and where control structures are not kept closed during flood events up to a 1-in-10-year frequency.

Hammocks

There was only a very small acreage of hammock in 1940 (Table 2), most likely because of frequent fires in areas dry enough to support these communities. These communities typically have water slightly above (<6 inches) or below ground during the peak of the wet season and short hydroperiods (<2 months). They can occur on sand or rock substrates. Those dominated by hardwoods are relatively intolerant of fire, while the sabal palm hammocks are not only tolerant but thrive with frequent, severe fires.

In 1940, there was a small area of sabal palm hammock (Hp) (FLUCFCS: 428, Cabbage Palm) near the northeast corner of the PSRP (Figure 5). This community type has an almost monospecific canopy of palms with few shrubs and little groundcover because of the dense canopy. Epiphytic ferns are common on sabal palm trunks.

Numerous small tropical hammocks (Ht) (FLUCFCS: 426, Tropical Hardwoods) were originally found scattered in the more upstream portions of the salt marshes along the coast (Figure 5), where proximity to the warm Gulf waters moderates freezing temperatures associated with winter cold fronts. These forested communities are dominated by a variety of hardwoods with tropical affinities, such as gumbo-limbo (*Bursera simaruba*), mastic *(Mastichodendron foetidissimum*), or strangler fig (*Ficus aurea*). Sabal palms and live oaks (*Quercus virginiana*) may be common, but are not dominant. Shrub density is moderate and includes small hardwoods such as myrsine (*Rapanea punctata*), wild coffee (*Psychotria nervosa*), or indigo berry (*Randia aculeata)*, and seedlings of the canopy species. Ground cover is usually sparse because of the dense canopy. Epiphytic ferns, bromeliads, and orchids are common on the hardwoods and palms.

Following drainage of PSRP, hammocks have expanded from a little over 400 acres in 1940 to over 10,000 acres in 1995 (Table 2). Drainage has created drier conditions suitable for hammock communities, although more frequent and intense fires would tend to limit them.
By 1995, the tropical hammocks may have more than doubled in acreage (Table 2) from their 1940 levels. However, this information should be considered as tentative as ground-truthing of

habitat has not occurred. Their distribution in the PSRP area is similar to what it was at that time; however, they are now also occupying numerous small islands in the coastal salt marshes that had previously supported mesic pine flatwoods (Figure 5). This would suggest a decrease in fire frequency in this area over the last 50 years, since sea level is more likely controlling water levels rather than changes associated with the PSRP canal system. However, it is possible that the less salt-tolerant pine have been replaced by more salt-tolerant tropical hardwoods, as a result of the reduction of freshwater flows following drainage of the PSRP.

Most of the new upland sites following drainage have a shallow depth to limestone. In addition, drier conditions have promoted the occurrence of frequent and severe fires. This combination of environmental conditions has created an ideal setting for the rapid expansion of the sabal palm hammock community from about 55 acres to almost 7,300 acres (Table 2). This expansion has occurred primarily in the northern and eastern portions of the PSRP area in cypress habitats, particularly those that tend to be closer to canals (Figure 5).

The lower elevation and wetter hydric hammock (Hh) (FLUCFCS: 433, Western Everglades Hardwoods) as well as the slightly higher elevated but still moist mesic hammock (Hm) were not present in 1940. In 1995, they occupied over 2,700 acres, although mesic hammock represented only 140 acres (Table 2). They are dominated by hardwoods such as red maple, sabal palm, live oak on drier sites, or laurel oak (*Q. laurifolia*) on wetter sites (Figure 5). Bald cypress occurs, but is not common. Shrub density is sparse to moderate and usually made up of small hardwoods including myrsine, wild coffee, indigo berry, or dahoon holly (*Ilex cassine*) and seedlings of the canopy species. Ground cover is variable, often dominated by ferns. Epiphytic bromeliads are common in trees and ferns are common on palm trunks. These two communities have primarily replaced cypress communities. The replacement by hydric hammock of a large area of cypress along the eastern boundary of the PSRP area to the south of Prairie Canal, which is probably less affected by drainage, suggests that lack of fire is also playing a role in this conversion.

Restoration of the PSRP area would be expected to substantially reduce the coverage of hammocks, once pre-development hydrology has been reestablished. A restored hydrology could be expected to eliminate or at least severely stress substantial areas of all of the hammock types, except the tropical hammocks where water levels have probably not been substantially altered. However, restoration is likely to require more than just fixing the hydrology. A combination of a restored fire regime and some amount of mechanical clearing will probably also be required to remove hardwoods or palms that have become established either on shallower wetlands or pine flatwoods.

Other Habitats

Several other community types with substantial acreages became established by 1995 that were not present in 1940. These include urban land, disturbed land, and Brazilian pepper (Table 2). The coverage of coastal uplands has not changed over this same time period.

Urban land is primarily the POI, a residential-resort-marina development complex. This land use is not included in the restoration effort (Figure 5).

Disturbed lands are primarily associated with agricultural activities (Figure 5). Soil disturbance associated with these activities will make it very difficult to restore natural communities on these lands over the short term. However, given a return to natural processes including hydrology and fire, these lands will likely recover over the long term. Mechanical treatment will be required to eliminate unnatural ground contours and established exotic or nuisance plant species.

Brazilian pepper (St) (FLUCFCS: 422, Brazilian Pepper) forms a nearly complete shrub layer, sometimes with other trees such as slash pine, bald cypress, or sabal palm forming a canopy. There is typically little ground cover in these very dense thickets and epiphytes seldom occur. In the PSRP area, this community is primarily a result of soil disturbance associated with canal and adjacent spoil pile construction (Figure 5). We anticipate that the biggest part of this problem will be addressed when spoil is returned to the canals and a more natural hydrology is restored.

b. Coastal Wetland and Estuarine Habitats

There has been a substantial decrease in acreage of salt marsh (Ms) (FLUCFCS: 642 Saltwater Marshes), as well as moderate increases in mangrove swamp (Mg) (FLUCFCS: 612 Mangrove Swamps) and open water (WAT) (FLUCFCS: 540 Bays and Estuaries) between 1940 and 1995 (Table 2). The general northward advance of mangroves into the salt marshes is likely due, at least partially, to the reduced freshwater flows from the PSRP area (Figure 5). However, other factors such as reduced fire frequency; as suggested by the conversion of pinelands in the same area to fire-intolerant hammock communities, and sea level rise could also be involved. Since the hydrology model does not include this area, it is not possible to determine the relative importance of these various influences using that tool. However, other methods should be considered in determining changes in the amount of freshwater that flows to the estuary. One approach to measuring changes in freshwater flows to the estuary is to compare flows along transects near the southern boundary of the PSRP hydrology model under modeled pre-development, current, and restored conditions.

The PSRP is located within the watershed of the TTI estuary which includes significant public landholdings, including Collier Seminole State Park (Blackwater Bay), Cape Romano/TTI Aquatic Preserve, Rookery Bay NERR, TTI NWR (Blackwater, Buttonwood, Pumpkin, Santina, Faka Union, and Fakahatchee Bays), Fakahatchee Strand Preserve State Park (Fakahatchee Bay), and the western edge of Everglades National Park (Fakahatchee Bay) (Figure 2). Faka Union Bay receives the majority of freshwater input from the PSRP area through the main Faka Union Canal. Other bays historically received freshwater inflows from the PSRP, but these discharges were disrupted or circumvented by the PSRP road and canal networks.

The TTI is a subtropical coastal ecosystem that includes important mangrove and marsh habitats, a rich diversity of native wildlife, and habitat for several notable threatened and endangered species. The estuarine system consists of innumerable small islands, tidal bars, and channels, which provide the following habitat types:
Salt Marsh

Saltwater marsh habitat is found landward or is interspersed on the upland side of mangrove fringing forest where it is periodically inundated at high spring tides and during storm surge. Salt marshes vary in structure and are commonly described as needle rush marshes dominated by *Juncus roemerianus*; salt flats or salterns dominated by saltgrass (*Distichlis spicata*), seashore dropseed (*Sporobolus virginicus*), sea purslane (*Sesuvium* spp.), glassworts (*Salicornia* spp.) sea lavender (*Limonium carolinianu*), sea blite (*Suaeda* spp.); and cordgrass marshes dominated by *Spartina patens* or *S. bakeri*. The borders or high areas in these saltmarshes often include groundsel tree or false-willow (*Baccharis augustifolia*), wax myrtle, marsh elders (*Iva* spp.), and Christmas berry (*Lycium carolinianum*).

Mangrove Forest

Mangrove forests dominate the intertidal zone in the TTI estuary. Most of the mangrove forest is second growth, probably ranging in age from 30 to 100 years of age as a result of destructive hurricanes in 1918 and 1960, which caused extensive deforestation along the southwest Florida coast (NOAA 1993). Three species of mangrove are the major components of the mangrove forest: the red mangrove (*Rhizophora mangle*); the black mangrove (*Avicennia germinans*); and the white mangrove (*Laguncularia racemosa*). Another species, the buttonwood (*Conocarpus erectus*), is classified as a "mangrove associate" and forms an important upland fringe in Florida's mangrove ecosystems (Tomlinson 1980, 1986). Red mangroves comprise the dominant vegetation on most of the islands, particularly on the fringe along the bays and tidal creeks. Black and white mangroves comprise mixed forests on island interiors and in the tidally flushed basins located more landward. Buttonwood is common on beach strands of outer islands and on natural and man-made levee ridges near mainland margins. Mangrove understory in some areas contains saltmarsh species, such as glasswort, saltwort (*Batis maritima*), sea purslane (*Sesuvium portulacastrum*), and sea ox-eye (*Borrichia frutescens*); as well as leather fern (*Acrostichum* spp.); spider lily (*Hymenocallis latifolia*); sea blite; marsh elder (*Iva frutescens*); and lianas, such as *Ipomoea tuba* and *Hippocratea volubilis* (Service 1982).

Submerged Vegetated Bottom

Seagrasses associated with open water area include Cuban shoal grass (*Halodule wrightii*), manatee grass (*Syringodium filiformis*), snook grass (*Halophila balonis*), and turtle grass (*Thalassia testudinum*). Various red macroalgae and green filamentous algae are associated with seagrass beds.

Submerged Non-vegetated Bottom

This habitat is comprised of marl or soft mud with occasional oyster bars and sandbars which are not stabilized by vegetation. When exposed at low tides, these areas are commonly called "tidal flats."

Coastal Strand

Coastal strand vegetation dominates high-energy coastal barrier islands that are exposed to moderate and high-energy wave action and sediment transport via littoral currents. Vegetation includes sea oats (*Uniola paniculata*), beach carpet (*Philoxerus vermicularis*), sea blite, and railroad vine.

Coastal Hammock

This habitat occurs within the scattered shell mounds of mangrove forest and marsh habitats. This assemblage is dominated by stoppers (*Eugenia axillaries*), gumbo-limbo, live oak, red bay (*Persea borbonia*), cabbage palm, nicker bean (*Caesalpinia crista*), and sea grape (*Cocoloba uvifera*).

Open Water

Numerous open water bays, including Blackwater, Pumpkin, Wood, Little Wood, Buttonwood, Faka Union, and Fakahatchee Bays, historically were or are the receiving waterbodies for the PSRP.

7. Fish and Wildlife Resources

a. Federally Listed and Candidate Species

Twelve federally listed threatened or endangered animal species and three candidate fish species are present or potentially present in the project area (Table 3). There are no federally listed plant species in the project area. Many of these species have been previously impacted by adverse effects on habitat due to wetland drainage, alteration of hydroperiod, wildfire, and water quality degradation. The PSRP has the potential to greatly benefit most, if not all, of these species. Those species not directly affected by the project include species that are rare in the project area or utilize estuarine habitat that is only indirectly affected by the restoration project.

Table 3. Federally listed threatened (T) or endangered (E) fish and wildlife species known or expected to occur within the PSRP area:

REPTILES		
American crocodile	*Crocodylus acutus*	E
Eastern indigo snake	*Drymarchon corais couperi*	T
Loggerhead sea turtle	*Caretta caretta*	T
Kemp's ridley sea turtle	*Lepidochelys kempi*	E
Atlantic green sea turtle	*Chelonia mydas mydas*	E
BIRDS		
Red-cockaded woodpecker	*Picoides borealis*	E
Wood stork	*Mycteria americana*	E
Everglade Snail kite	*Rostrhamus sociabilis plumbeus*	E
Bald eagle	*Haliaeetus leucocephalus*	T
MAMMALS		
Florida panther	*Puma concolor coryi*	E
West Indian manatee	*Trichechus manatus*	E

Fish species listed as endangered (E) or candidate (C) fish species regulated by the National Marine Fisheries Service (NOAA Fisheries) include:

Smalltooth Sawfish	*Pristis pectinata*	E
Goliath grouper	*Epinephelus itajara*	C
Mangrove rivulus	*Rivulus marmoratus*	C
Sand tiger shark	*Odontaspis taurus*	C

West Indian Manatee and Designated Critical Habitat

Published occurrences of manatees in Collier County date back to at least 1930 (Hartman 1974, Beeler and O'Shea 1985), although manatee remains in Indian middens demonstrate their presence in this area well before European colonization. Aerial surveys conducted in the mid-1970s through the early 1980s documented manatee distribution throughout the region, particularly in the Faka Union Canal (Beeler and O'Shea 1985). It is likely that manatees used the Faka Union River before the canal was dredged in the mid-1960s.

One hundred twenty-six watercraft-related manatee deaths out of 464 total deaths were documented from Collier County from October 1979 through August 2004. Documented deaths from January 1985 through March 2001 have been concentrated in Naples, Marco Island, and POI/Faka Union Canal, with substantial numbers also occurring near Cape Romano, and in Chokoloskee Bay, Barron River, and Tamiami Canal. Carcasses were also recovered in the

Blackwater River, Halfway Creek, Turner River, and Lopez River. As recently as May 20 and May 31, 2004, two watercraft-related manatee deaths occurred in Faka Union Canal downstream

of the PSRP.

The POI basin, located within the marina and residential canals of the upper Faka Union Canal just south of U.S. 41, is the second largest warm water refugia in southwest Florida (behind the Florida Power and Light powerplant within the Caloosahatchee River in Lee County). This basin has been documented to support as many as 300 manatees during periods of cold winter weather. The basin depth is probably the key feature responsible for creating a "passive" warm water refugium for this species (see comments below on manatee winter use patterns).

Cold dry season use of the warm water refugia marina basin at POI consists of bottom resting in the warmer waters of the marina basin which is 10-14 feet deep. Faka Union Canal, which provides access to the marina basin, is approximately 6 foot deep. Warmer water temperatures associated with the marina depth and the presence of saltwater on the basin bottom and a freshwater lens on the top of the basin; combine to attract manatees to the site. The volume, location, and flow of freshwater may affect marina basin temperature (temperature stratification). In most years, the marina basin receives limited rainfall in the winter when manatees are using the area for shelter from cold. Fresh water entering the marina basin over the Faka Union weir is probably colder than saltwater in the basin, but there are no data to verify this assumption, as there may be groundwater input into the Faka Union Canal north of the weir. Fresh water likely leaks around the weir when flow does not overtop it due to the porosity of the surrounding rock. Saltwater input to the marina basin is probably tidal but in the absence of a freshwater head, saltwater may also be entering the basin and canal through groundwater. Data are not available to support these assumptions. The POI marina basin is a targeted overwintering site for manatees. Manatees that use this site tend to use it exclusively.

After passage of cold fronts and depending on adjacent Gulf of Mexico and inland bay temperatures, manatees move to inshore bays which provide warm water refugia at night. At high tide during the daytime, manatees move to shallow inshore bays to absorb solar heat. During the wet season, manatees are distributed throughout the TTI and make fewer trips to the POI marina basin. Freshwater input into the marina basin during the spring dry season (April-May) may be an important factor in determining effects of the project on manatees.

The TTI NWR initiated studies on the potential effects of the PSRP project on manatees in August 1999. As part of their research contribution to the CERP, the Service's, TTI NWR and the USGS/Sirenia Project (USGS 2000) initiated additional studies in June 2000. The major objectives of the study were to determine distribution, movements, and habitat use by manatees associated with coastal waters and rivers, and to develop a population-level model to predict manatee response to changes in hydrology achieved by the PSRP as well as the overall CERP. Aerial distribution surveys have been conducted from August 1999 to February 2002 and March 2004 to the present using strip-transect aerial survey methods (Doyle, personal communication. August 30, 2004; and Lefebvre 2002). Radio tracking using satellite telemetry based on Argos and GPS systems have been conducted continuously since June 2000. In addition, preliminary spatial analysis of Argos and GPS data were conducted using GIS techniques to show potential changes in habitat use

patterns associated with changes in availability of fresh water. These data provide the basis for the first detailed analysis of manatee use patterns in the TTI/Everglades National Park area. Methods

and preliminary results of this study are provided below.

Strip-Transect Aerial Surveys. This approach has been used successfully to estimate manatee abundance in the Banana River, Florida (Miller *et al.* 1998). A total of 22 surveys were flown during warm months (June to October) of 2000, 2001, 2002, covering most of the TTI. Each survey consisted of 30 transects roughly 1 km apart, with a strip width of approximately 250 m. Estimated number of manatees ranged from 39 to 237 in the 167-km^2 study area.

Radio-tracking study. The radio-tracking study provides data critical for documenting the pre-restoration habitat use by manatees within the region affected by the PSRP. Two types of radio-tags were used for this study: Argos PTTs and GPS tags. The GPS tag acquires locations every 15 to 30 minutes and are more accurate than the Argos data (approx. 30 m vs. 150 m or more), but the battery life expectancy is shorter (8 weeks vs. 7 months). The Argos data provides region-wide, long-term coverage suitable for revealing general patterns of habitat use, while the GPS data shows fine details of travel pathways and time spent in specific areas. Through December 2003, Argos and GPS data were obtained for 25 and 10 manatees, respectively. A preliminary analysis of the Argos radio tracking data indicates that manatees in this region alter their movement patterns and habitat use in response to seasonal changes in temperature. During periods of intense cold, where gulf temperatures fall below 20 degrees C, telemetry locations occur in the Faka Union Canal, inland rivers, or inshore bays, suggesting that these areas provide important thermal refugia to manatees. In comparison, during the warm season, manatees are distributed across a much broader region, and the majority of the telemetry locations occur in offshore areas where seagrass beds are found. Aerial surveys of manatees conducted by the Service also confirm these distribution patterns (Doyle, personal communication, August 30, 2004).

A preliminary analysis of the GPS radio tracking data suggests some important habitat requirements for manatees in this region. GPS radio tracking data for ten manatees shows all animals making large movements (tens of kilometers) to and from seagrass beds in offshore areas and the Faka Union Canal or rivers that provide assess to freshwater. These animals show a pattern which may be typical for many manatees in this region, *i.e.*, multiple days of feeding on offshore seagrass beds followed by rapid, directed movement to a distant source of freshwater. Following a brief residence time at this freshwater site (often only a few hours), tracked individuals show a directed movement back to offshore areas. These large movements suggest that the availability of freshwater is an important determinant in manatee distribution and abundance in this region.

The striking difference in seasonal (cold season vs. warm season) use of the Faka Union Canal by radio-tagged manatees is undoubtedly related in large part to the warmer water temperatures in the Faka Union Canal during the winter. However, throughout the year all manatees tracked to date made frequent moves into the canal and rivers. The Faka Union Canal is heavily used all year, presumably because it is a reliable source of freshwater compared to surrounding rivers and

creeks. Depending upon the relative availability of freshwater in the canal vs. neighboring waterways after restoration, manatee use of the canal may be reduced during the wet and dry season (Lefebvre et al. 2003).

Manatee critical habitat was designated in 1976, although no specific primary or secondary constituent elements were included in the designation (50 CFR 17.95). The project area has features essential to the conservation of the manatee, including warm water refugia, reliable sources of fresh water, and foraging habitat (seagrass beds) adjacent to relatively deeper waters with little boat traffic.

Seagrasses are the predominant food used by manatee in coastal areas. Provancha and Hall (1991) reported a preference for manatee grass (*Syringodium filiforme*) and shoalgrass (*Halodule wrightii*) over the macroalga, *Caulerpa* spp., in the upper Banana River on the east coast of Florida. Inland bays of the TTI are generally characterized as "muddy" bays. Data from field studies conducted in the early 1970's (almost immediately after upstream canal and subdivision construction) indicate that approximately 52 percent of Fakahatchee Bay east of the PSRP project and 76 percent of Faka Union Bay directly downstream of the project have mud bottoms. In those bays most directly affected by the project, green filamentous algae constitute the major standing crop biomass during winter (dry season) months, with seagrasses and red-macro algae present in sparser amounts. During the wet season, seagrasses increase dramatically in the more pristine estuary of Fakahatchee Bay east of the project, while algae, particularly red macro-algae, continued to predominate in the impacted Faka Union Bay (Carter et al. 1973).

Red-Cockaded Woodpecker

The red-cockaded woodpecker (RCW) population in the lower Florida peninsula from Orlando south is limited to approximately 244 occupied clusters (DeLotelle and Guthrie 2000). In 1992, approximately 25 occupied, 10 undetermined, and 11 abandoned clusters occurred in the east Naples area including the Belle Meade tract of PSSF adjacent to the PSRP (Kim Dryden, Service, personal communication, 1999).

Although South Florida is not identified as a recovery population for red-cockaded woodpeckers, it does contain significant support populations. Statewide protection and restoration efforts focus on acquiring, managing, and restoring habitat surrounding these populations. Lands acquired in southwest Florida for RCW conservation should be contiguous with publicly-owned conservation lands that contain red-cockaded woodpecker clusters (Beever and Dryden 1992).

The Belle Meade tract of PSSF covers about 14,460 acres. In combination with the 59,294-acre PSRP, the project area provides an opportunity to support between 20 to 30 RCW clusters, assuming population expansion techniques and exotic plant species control are successful (DeLotelle and Guthrie 2000). The Belle Meade population of RCWs includes four occupied and 11 abandoned clusters located in mesic and hydric pine flatwoods. Approximately 40 RCW clusters are located 15 miles east of the PSRP in the Big Cypress National Preserve.

Pine stands, or pine-dominated pine/hardwood stands, with a low or sparse understory and ample old-growth pines, constitute primary RCW nesting and roosting habitat. In southwest Florida (Charlotte, Collier, and Lee Counties), hydric slash pine (*P. elliotii* var. *densa*) flatwoods provide the preferred nesting and foraging habitat for the RCW (Beever and Dryden 1992). This community has been maintained by fire and hydroperiod, and therefore does not have the dense

midstory more typical of xeric and mesic flatwoods in southwest Florida. Also, hydric pine flatwoods were not as accessible to historic forestry, agriculture, and land clearing practices as the xeric and mesic communities due to their wetland status.

Florida Panther

The Florida panther presently occupies most of the counties in Central and South Florida. The PSSF, Fakahatchee Strand Preserve State Park, Florida Panther NWR, Big Cypress National Preserve, Big Cypress Seminole Indian Reservation, and ranches located in southern Hendry County and northeastern Collier County provide a contiguous landscape that supports the only extant breeding puma population east of the Mississippi River. The survival and recovery of the Florida panther is dependent on protection and enhancement of this extant population, associated habitats, and prey resources. Panthers require adequate cover for resting and denning sites, prey, and a relative lack of disturbance in terms of road hazards and human activity.

Figures 10 and 11 depict Service telemetry data from radio-instrumented panthers over the last two decades. These data indicate that the Fakahatchee Strand Preserve State Park east of the PSRP, Florida Panther NWR northeast of the project, PSSF west of the PSRP area, and private lands northeast of the project are heavily used by panthers. Telemetry data for the PSRP indicate reduced occurrence, possibly consistent with degraded habitat and human disturbance associated with 279 miles of primary and secondary roadways (Land, personal communication, 2001). Two den sites are located in the PSRP area, one in the central portion of the project and one in the extreme northeastern corner of the property in proximity to Fakahatchee Strand Preserve State Park and the Florida Panther NWR (Service 2004).

The lack of frequent home range vacancies makes the likelihood of male panther recruitment into the population low (Maehr 1990). Females are readily recruited into the population as soon as they are capable of breeding (Maehr et al. 1991). Males appear to have more difficulty being recruited. The PSRP area is utilized primarily by sub-adult male panthers, which disperse through the site to the Belle Meade portion of PSSF from Fakahatchee Strand. Without large areas of suitable habitat to accommodate dispersal, young males have few opportunities for recruitment as residents. As a result, the panther's ability to increase and outbreed has been severely restricted. Successful male recruitment appears to depend on the death or home range shift of a resident adult male (Maehr et al. 1991).

White-tailed deer (*Odocoileus virginianus*) and wild hog (*Sus scrofa*) are important prey items for the Florida panther throughout South Florida (Maehr et al. 1990). Deer and hog density information is not available for the immediate project area. Deer densities may be affected by habitat quality and human disturbance. Deer densities on overdrained private lands being developed northwest of the project area averaged 1 deer/591 acres (Turrell & Associates, Incorporated 2001). Deer density in the BCNP's Corn Dance Unit east of the project was predicted to be 1 deer/165 to 1/250 acres. Predictions of deer density in Fakahatchee Strand were estimated to be higher than 1 deer/18.2 acres (McCown 1991). Deer densities in the Mullet Slough area of BCNP yielded an estimated density range of 1 deer/93 acres and 1 deer/250 acres. The Stairsteps unit of BCNP supports densities of 1 deer/190 to1/218 acres from track count estimates. Aerial surveys for the same units used after 1982 estimated deer densities at 1 deer/60

to 1/2643 acres. Harlow (1959) predicted deer density in wet prairie habitat in Florida to be 1 deer/115 acres. Panther prey density, especially deer, is an important factor in evaluating the panther habitat. The type of prey available to the panther affects the health and distribution of the panther, as well as its ability to breed and support young.

Because of their wide-ranging movements and extensive spatial requirements, panthers are particularly sensitive to habitat fragmentation (Harris 1985). Past land use activity, hydrologic alterations, road construction, invasion of exotic plants, and lack of fire management have affected the quality and quantity of panther habitat. The effects of invasion by exotic plants, such as melaleuca, on panther use of natural habitats are unknown.

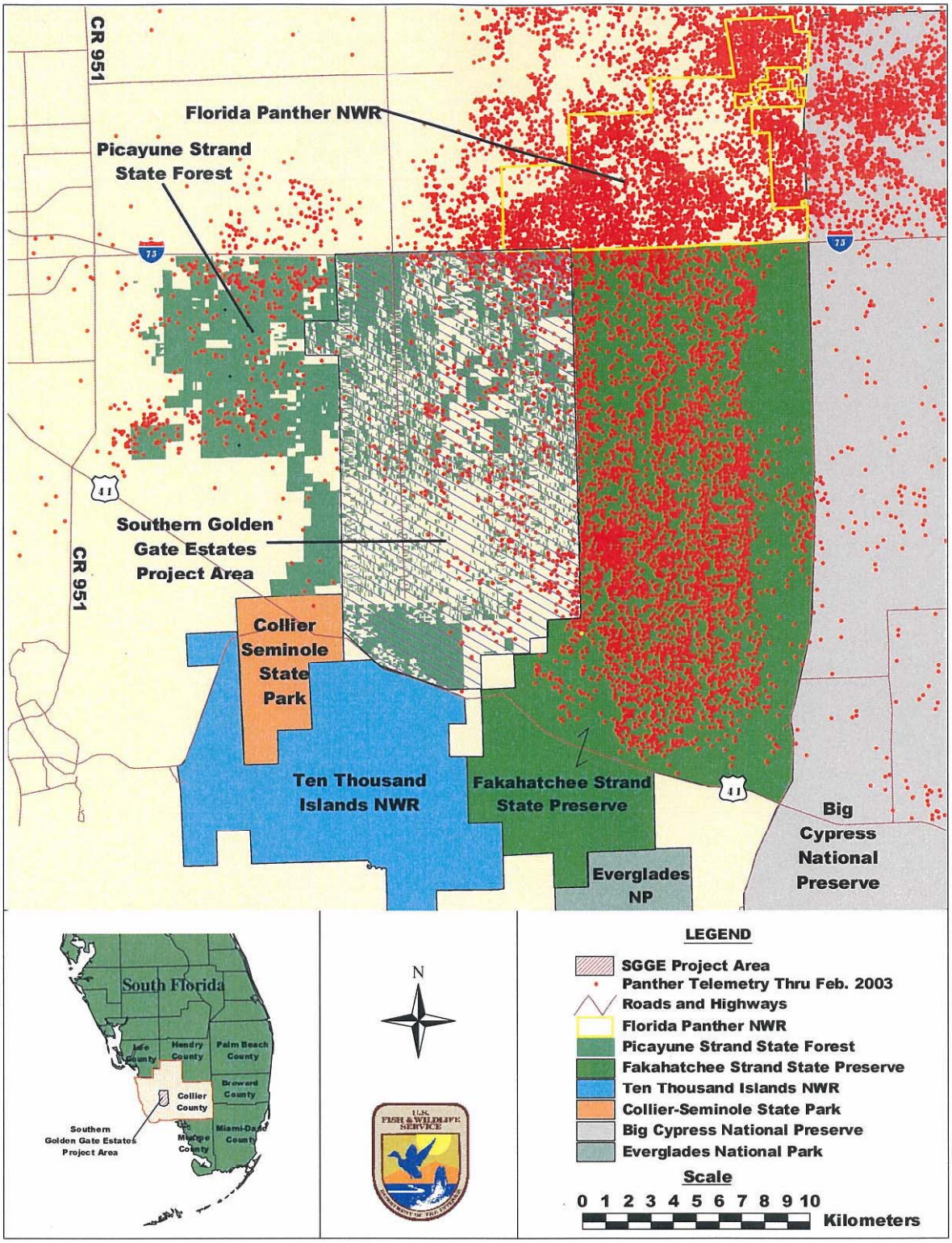

Figure 9. Panther telemetry information for the PSRP (Project).

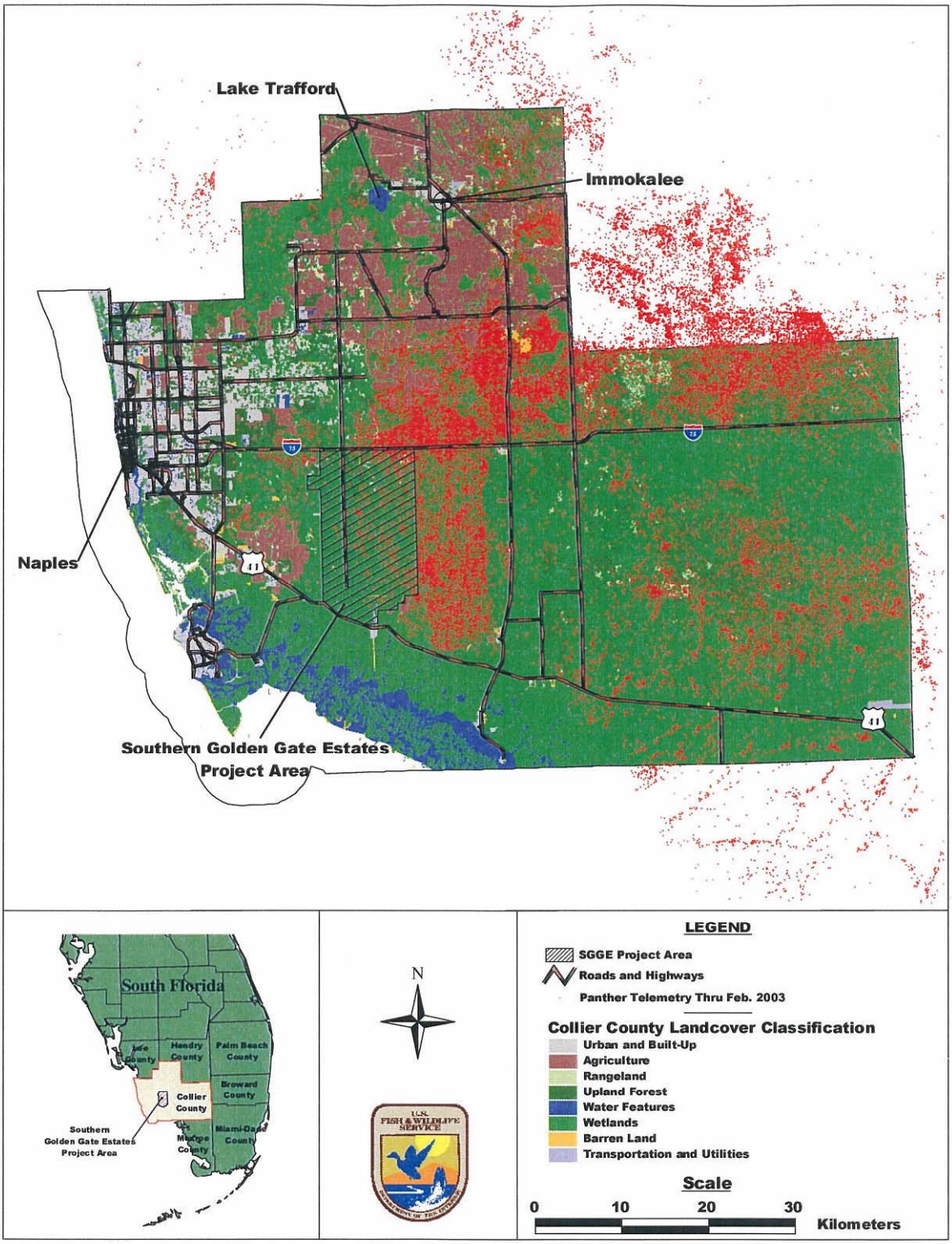

Figure 10. Panther telemetry information for the PSRP (Region).

Everglade Snail Kite and Designated Critical Habitat

The range of the endangered Everglade snail kite is restricted to habitats in South and Central Florida. Snail kites are nomadic in response to water depth, hydroperiod, food availability, and other habitat changes (Sykes 1978, 1983; Beissinger and Takekawa 1983; Bennetts et al. 1994). In dry years, the snail kite depends on water bodies which normally are suboptimal for feeding, such as canals, impoundments, or small marsh areas which are often remote from regularly used sites (Beissinger and Takekawa 1983, Bennetts et al. 1988, Takekawa and Beissinger 1989). These secondary or refugia habitats are vital to the continued survival of this species in Florida.

An adult Everglade snail kite was observed foraging along the Miller Canal on May 4, 2001, by Service and DOF staff (T. Doyle, personal communication, July 6, 2004). Snail kites have also been observed in the marshes of the TTI NWR as well as the agricultural area west of the project site. A snail kite was observed foraging in ditches adjacent to U.S. 41, approximately six miles southwest of the project site (Kim Dryden, Service, personal communication, June 15, 2002). Snail kites are present in wetlands within Lostman's and Okaloacoochee sloughs, Hinson Marsh, and the East Loop and Corn Dance units of BCNP east of the project site (Service 2000a).

The PSRP area does not include designated critical habitat for the Everglade snail kite.

Wood Stork

The wood stork is known to forage within suitable wetland habitats throughout the project area. Suitable wood stork foraging habitat consists of shallow wetlands with water depths of 2 to 15 inches. From January through June 2001, the Corps conducted monthly aerial wading bird surveys of the PSRP site and surrounding public and private lands. These surveys indicated that wading bird numbers were generally low during those months. Almost no surface water or wading birds were observed within the project area. The only water present in the PSRP was in canals with steep banks and deep water making these areas inaccessible to foraging wading birds. Drought conditions may have been a contributing factor to the low number of birds recorded. However, the excessive drainage by the PSRP canal network indicated that these conditions may not be that far removed from a normal dry season in the PSRP area. Twenty-seven wood storks were sighted during six survey flights (Nelson et al. 2001).

Three active wood stork nesting colonies are known to occur near the project area. Two of these colonies are located at Audubon's Corkscrew Swamp Sanctuary within the Corkscrew Regional Ecosystem Watershed (CREW), northeast of the project site. Audubon's Corkscrew Swamp Sanctuary (Corkscrew) is the largest historic wood stork colony in the United States. The third wood stork nesting colony is located east of the project site just north of the Fakahatchee Strand Preserve State Park. During the breeding season, feeding areas near the Corkscrew colony play an important role in chick survival and provide enhanced opportunities for newly fledged birds to learn effective feeding skills. Wetlands within 30 kilometers (km) of rookery sites have been described as core foraging areas for wood storks (Cox et al. 1994). However, they may forage as far as 75 km from rookery sites (Ogden, personal communication, August 1, 2000). Wood stork nest surveys have been conducted within these nesting colonies by the State of Florida. Data for the two colonies located in the CREW indicate that 1,722 nests were constructed in 2000 and

1,240 nests were reported in 2002. No wood stork nesting occurred in 2001. Additional data collected by the National Audubon Society indicate that 2,538 wood storks fledged during 2000 and 3,160 fledged during 2002. The most recent nesting data for the colony located north of the Fakahatchee Strand Preserve State Park indicate that 50 nests were observed during 1999 and 25 observed during 2000. No data are available for 2001 or 2002. Historic nesting data were unavailable for the nesting colony located north of the Fakahatchee Strand Preserve State Park; however, nesting and fledgling data have been collected within Corkscrew since 1958. On average over the last 44 years in Corkscrew, 1,654 nests have been initiated yearly, producing an average of 2,161 fledged young, or 1.3 young fledged per nest. However, the 44-year average is somewhat misleading. Before 1968, as many as 5,000 wood stork nests were annually initiated. Nesting activity peaked in 1961 when 6,000 nests produced a record 17,000 young fledged, or 2.8 fledged young per nest. The production of wood stork colonies varies considerably between years and locations, apparently in response to differences in food availability. Colonies that are limited by food resources may fledge an average of 0.5 to 1.0 young per active nest; whereas colonies that are not limited by food resources may fledge between 2.0 and 3.0 young per active nest (Ogden 1996). The 44-year average indicates that the two colonies at Corkscrew are generally limited by food resources. During the year 2002, these colonies were not limited by food resources. No data on nest productivity is available for the colony north of Fakahatchee Strand Preserve State Park. However, based on the overlapping core foraging areas, it is likely that these birds face many of the same foraging conditions as those nesting within Corkscrew.

The ability of wood storks to forage successfully affects their decision to nest at historic rookeries and determines whether nest failure or fledgling survival will occur. Survey data show that the Corkscrew colonies represent an average of 12 percent (510 out of 4,065 nests based on a four-year average) of the Florida population. On average, the South Florida sub-population represents 53 percent of the Florida population and 34 percent of the southeastern U.S. population. Storks nesting in the BCB, under pre-drainage conditions (1930s to 1940s), formed colonies between November and January (December in most years) regardless of annual rainfall and water level conditions (Ogden 1994 and 1998). In response to deteriorating habitat conditions in South Florida, wood storks in this region delayed the initiation of nesting until February or March, or about two months, in most years since the 1970s. This shift in the timing of nesting is believed to be responsible for the increased frequencies of nest failures and colony abandonment in this region over the last 20 years. Colonies that start after January in South Florida risk having young in the nests when May to June rains flood marshes and disperse forage fish. Historic data on colony locations identify the Everglades basin and Corkscrew colonies as the primary nesting locations for wood storks in South Florida (Ogden and Nesbitt 1979). In the late 1950s and early 1960s, the Corkscrew colonies accounted for 51 percent of the Florida population.

The primary factors affecting wood stork habitat within the project study area are the loss and alteration of wetlands due to development and agriculture. Secondary factors such as weather (freezes and hurricanes), parasites, disease, and chemical contamination may affect wood storks but there is insufficient information available to discuss the effects of these factors on this species.

Development pressures due to ongoing population growth in Collier and Lee County continue to threaten wetlands in the action area. Data from the U.S. Census Bureau indicate that from 1968 to 2000 the human populations of Collier, Hendry, and Lee Counties have increased by 94, 78, and 88 percent, respectively. The population of this three-county area was estimated at 731,675 during the 2000 census, and is expected to continue to grow with a concomitant increase in wetland filling for development.

Using a Geographic Information System (GIS) database, the Service estimates that the 30 km (18.6 mile) core foraging area around the Corkscrew wood stork colonies is about 695,593 acres and is comprised of 58 percent uplands and 42 percent wetlands. Twenty-one percent of the core foraging area wetlands are located on public lands; the majority (79 percent) is located on private lands. The northern portion of the PSRP area is located in the core foraging area of the Corkscrew sanctuary wood stork colony. However, the entire PSRP area is located within 75 km of the wood stork colony. Wetlands on public lands, except where degraded by historical drainage activities such as in the PSRP, are generally considered secure from direct alteration. However, management practices on private lands could indirectly influence surface water flow (and wetland protection/restoration) on adjacent public lands.

Wetland alteration on private lands, although regulated, is common in the project study area. The Service's GIS analysis of National Wetlands Inventory data indicates that the functions of 31,969 acres of wetlands, or 11 percent of the total wetlands in the core foraging area of the Corkscrew sanctuary nesting colonies, have been diminished by ditching and draining, excavation, and impoundment. Another 24,272 acres have been lost to development (eight percent of total wetlands). It is important to note that although many wetlands remain unaltered, changes in land use patterns around these wetlands have isolated them from larger systems and diminished their value as foraging and nesting habitats for wood storks.

Canals are common in the action area and significantly influence the hydrology of wetlands and other surface waters important to wood storks. Wang and Browder (1983) conducted a study in southwest Florida and found that the water table in the study area dropped about 1.5 to 2.0 feet after construction of canals. Another southwest Florida study found that the water table dropped approximately 2.0 feet, as far as 6,000 feet from the canal (Swayze and McPherson 1977). Black et al. (1974) estimated that, after construction of the canals, annual runoff from SGGE increased to about 17 inches.

Bald Eagle

Bald eagles are considered a water-dependent species typically found near estuaries, large lakes, reservoirs, major rivers, and some seacoast habitats (Service 1999). Their distribution is influenced by the availability of suitable nest and perch sites near large, open water bodies, typically with high amounts of water-to-land edge. The bald eagle is an opportunistic feeder, but in South Florida the bulk of its diet is fish. Bald eagle use varies in the PSRP area but is primarily confined to foraging activities. Bald eagle nests in Collier County are located within 10 miles of coastal estuaries, although most are located within two miles. . Bald eagles in Collier County typically nest in pine trees, but are also known to nest in cypress

The proximity of two bald eagle nests reported northwest of POI in Fakahatchee Strand and potentially in the southeastern portion of the project is under review. A bald eagle nest is located approximately five miles west of the project site in the Belle Meade tract of PSSF.

Eastern Indigo Snake

The eastern indigo snake is a large, black, non-venomous snake that is widely distributed throughout South Florida. Dramatic population declines have been caused by over-collecting for the domestic and international pet trade, as well as mortality caused by rattlesnake collectors who gassed gopher tortoise burrows to collect snakes. Because of its relatively large home range, this snake is especially vulnerable to habitat loss, degradation, and fragmentation (Lawler 1977, Moler 1985). Habitat loss and fragmentation by residential and commercial expansion are more significant threats to the eastern indigo snake in southwest Florida. Lawler (1977) noted that eastern indigo snake habitat has been destroyed by residential and commercial construction, agriculture, and timbering. Extensive tracts of wildland are the most important refuge for large numbers of eastern indigo snakes (Diemer and Speake 1981, Moler 1985). Additional human population growth will increase the risk of direct mortality of the eastern indigo snake from property owners, domestic animals, and highway mortality.

The eastern indigo snake is present within project boundaries and on adjacent private and public lands in the region. The PSRP area, along with NGGE, is known to be a popular collection site for amphibians and reptiles due to the accessibility associated with the 279-mile roadway grid (L. Jones, personnal communication, August 1, 1998). No specific survey data is available for the project area.

American Crocodile and Designated Critical Habitat

The current distribution of the American crocodile is limited to extreme South Florida, including coastal areas of Collier and Lee Counties. The distribution of crocodiles during the non-nesting season may vary considerably between years since adult crocodiles can disperse great distances (Kushlan and Mazzotti 1989). The majority of crocodiles are present in the vicinity of core nesting areas, located near Biscayne and Florida Bays (Kushlan and Mazzotti 1989). Crocodiles do nest in Southwest Florida, but successful crocodile reproduction has not been documented. However, several small groups and individual crocodiles have been documented from Sanibel Island and Pine Island, Lee County, south to the Fakahatchee River, Collier County. Crocodiles have been reported in Rookery Bay north of Marco Island and at the Eagle Creek Country Club just southwest of State Road (SR) 951 and U.S. 41. A crocodile was killed on U.S. 41 near the Faka Union Canal in 1997 (Lennie Jones, personnal communication, August 1, 1998). As many as eleven adult crocodiles have frequented manmade borrow pits at the Marco Airport site, approximately 9.5 miles west of the PSRP. These crocodiles have repeatedly nested unsuccessfully on an adjacent elevated berm called the "Road to Nowhere." Crocodiles have been reported in the Fakahatchee River southeast of the project site by National Park Service (NPS) and DEP staff in 2002 and 2003.

The PSRP area does not include designated critical habitat for the American crocodile.

Estuarine Fishes

One endangered and three candidate estuarine fish occur or may occur in estuaries downstream of the project. These fish species are the smalltooth sawfish, mangrove rivulus, Goliath grouper, and sand tiger shark which are under the jurisdiction of the NOAA Fisheries.

Sea Turtles

Three species of federally listed sea turtles have the potential to be affected by the project. They are the Atlantic loggerhead turtle (*Caretta caretta*), Atlantic green turtle (*Chelonia mydas*), and Atlantic ridley turtle (*Lepidochelys kempii*). Sea turtle nesting is not expected to be influenced by the project. Swimming sea turtle species are under the jurisdiction of the NOAA Fisheries.

b. State-Listed Species

The following fish, wildlife, and plant species (Tables 3 and 4) are State-listed as threatened (T), endangered (E), or species of special concern (SSC), and may occur or are known to occur in the study area.

Table 4. Species listed by the Florida Fish and Wildlife Conservation Commission as threatened (T), endangered (E), or of special concern (SSC), excluding those that are also federally listed.

Common Name	Species Name	Status
REPTILES		
American alligator	*Alligator mississippiensis*	SSC
Gopher tortoise	*Gopherus polyphemus*	SSC
AMPHIBIANS		
Gopher frog	*Rana capito*	SSC
BIRDS		
American oystercatcher	*Haematopus palliatus*	SSC
Black skimmer	*Rynchops niger*	SSC
Brown pelican	*Pelecanus occidentalis*	SSC
Burrowing owl	*Speotyto cunicularia*	SSC
Florida sandhill crane	*Grus canadensis pratensis*	T
Least tern	*Sterna antillarum*	T
Limpkin	*Aramus guarauna*	SSC
Little blue heron	*Egretta caerulea*	SSC
Peregrine falcon	*Falco peregrinus*	E
Reddish egret	*Egretta rufescens*	SSC
Roseate spoonbill	*Ajaia ajaja*	SSC
Snowy egret	*Egretta thula*	SSC

Southeastern snowy plover	*Charadrius alexandrinus tenuitrostris*	T
Tricolored heron	*Egretta tricolor*	SSC
White ibis	*Eudocimus albus*	SSC
White-crowned pigeon	*Columba leucocephala*	T
MAMMALS		
Big Cypress fox squirrel	*Sciurus niger avicennia*	T
Everglades mink	*Mustela vison evergladensis*	T
Florida black bear	*Ursus americanus floridanus*	T
MOLLUSCS		
Florida tree snail	*Liguus fasciatus*	SSC

Table 5. Plant species listed by the Florida Department of Agriculture and Consumer Services as threatened (T), endangered (E), or commercially exploited (C), excluding those that are also federally listed (Coile 2000).

Common Name	Species Name	Status
Giant leather fern	*Acrostichum danaeifolium*	C
Barbed-wire cactus	*Cereus pentogonus*	E
Satinleaf	*Chrysophyllum oliviforme*	T
Cowhorn(=cigar) orchid	*Cytopodium puncatatum*	E
Night-scent orchid	*Epidendrum nocturnum*	E
Beach creeper	*Ernodea littoralis*	T
Butterfly orchid	*Encyclia tampensis*	C
Wild cotton	*Gossypium hirsutum*	E
Simpson's ironwood; Simpson's stopper	*Myrcianthes fragrans (=Eugenia simpsonii)*	T
Giant sword fern	*Nephrolepis biserrata*	T
Hand adder's tongue fern	*Ophioglossum palmatum*	E
Shell mound prickly pear	*Opuntia stricta*	T
Florida royal palm	*Roystonea elata*	E
Inkberry	*Scaevola plumieri*	T
Bay cedar	*Suriana maritima*	E
Inflated (=reflexed) wild pine	*Tillandsia balbisiana*	T
Common (=stiff-leaved) wild pine	*Tillandsia fasciculata*	E
Twisted and banded air plant	*Tillandsia flexuosa*	E
Fuzzy-wuzzy (=hoary) air plant	*Tillandsia pruinosa*	E
Giant wild pine; Giant air plant	*Tillandsia utriculata*	E
Soft-leaved wild pine	*Tillandsia valenzuelana*	T
Spanish moss	*Tillandsia usneoides*	T
Sea lavender	*Tournefortia gnaphalodes*	E

c. Other Fish and Wildlife Resources

In 1994, the FWC (Cox et al. 1994) assessed Florida's wildlife habitat conservation system in order to provide recommendations to meet minimum conservation goals for declining wildlife species and rare plant and animal communities. The report (termed the GAPS report) described habitat areas in Florida that should be conserved if key components of the state's biological diversity were to be maintained. A GIS was used to assess land use, geographic data sets of fish and wildlife species, rare plants, and habitats to recommend lands (Strategic Habitat Conservation Areas [SHCA]) for additional protection. The SHCAs are lands needed to meet minimum conservation goals for 30 species of wildlife inadequately protected by conservation lands, rare habitats, bat maternity caves and winter roost caves, wetlands important to the breeding success of eight species of wading birds, and lands important to the long-term survival of 105 globally rare plant species. The project also identified Regional Biodiversity Hot Spots (RBHS) where large numbers of 52 selected species co-occur with areas that support rare plant and wildlife communities and coastal areas that support key components of biological diversity. The SHCAs encompass 4.82 million acres or approximately 13 percent of the land area in Florida. In 1994, 6.95 million acres were deemed to be in conservation status. Lands in conservation status in the vicinity of the PSRP total 2,546,944 acres (6.8 percent of the land area in Florida). The PSRP would contribute 55,294 acres to these conservation status lands.

The Southwest Florida Region was identified in the GAPS report as the most important region in Florida in terms of maintaining several wide-ranging species. Area 3 of the region (PSRP, the adjacent Belle Meade portion of the PSSF, and areas north of I-75, east of SR 951 and south of GGE [North Belle Meade]) contained SHCAs for the Florida panther, Florida black bear, and RCW. Other rare species in the area included the American swallow-tailed kite (*Elanoides forficatus*), bald eagle, hairy woodpecker (*Picoides villosus*), mottled duck (*Anas fulvigula*), eastern indigo snake, ghost orchid (*Dendrophylas lindenii*), cow-horned orchid (*Cyrtopodium puncatatum*), bird's nest spleenwort, cypress peperomia (*Peperomia glabella*), Fuch's bromeliad (*Guzmania monostachia*), banded wild pine (*Tillandsia flexulosa*), blunt-leaved peperomia (*Peperomia obtusifolia*), auricled spleenwort (*Asplenium auritum*), and narrow-leaved strap fern (*Campyloneurum angustifolium*).

In 1999, the Service finalized the South Florida Multi-Species Recovery Plan (MSRP). This plan is an ecosystem-based recovery plan to restore and maintain the biodiversity of native plants and animals, as well as the threatened and endangered species of South Florida. The plan identifies several ecological communities that are found in the PSRP area, including mesic temperate hammock, tropical hardwood hammock, forested wetlands (cypress forest), mesic and hydric flatwoods, freshwater marshes/wet prairies, mangroves, coastal salt marsh, and nearshore reefs.

Migratory Birds

Migratory birds are protected under the Migratory Bird Treaty Act (16 U.S.C. 703-712). The South Florida ecosystem is located along one of the primary migratory routes for bird species that breed in temperate North American and winter in the tropics of the Caribbean and South America. Many species of neotropical migrants have been recorded in the South Florida Ecosystem (Appendix D). In 1995, the Service prepared a list of migratory nongame birds of

management concern in the U.S. to stimulate a coordinated effort by Federal, State, and private agencies to develop and implement comprehensive and integrated approaches for management of these selected species (Service 1995). Forty-three of these species are found in the South Florida Ecosystem. Other migratory species like the tanagers (*Pirange* spp.), chimney swifts (*Chaeturaa pelagica*), tree swallows (*Iridoprocne bicolor*), nighthawks (*Chordeiles minor*), royal terns (*Sterna maxima*), and blue-winged teal (*Anas discors*) also have major migratory pathways through and to (as winter residents) South Florida. More than 129 bird species migrate to the South Florida Ecosystem to overwinter. Another 132 bird species breed in South Florida. Because the South Florida ecosystem is located near Cuba and the West Indies, it draws tropical species that rarely appear elsewhere in North America. Examples include the smooth-billed ani (*Crotophaga ani*), mangrove cuckoo (*Coccyzus minor*), Antillean nighthawk (*Chordeiles gundlachii*), white-crowned pigeon (*Columba leucocphala*), gray kingbird (*Tyrannus dominicensis*), short-tailed hawk (*Buteo brachyurus*), Everglade snail kite, and black-whiskered vireo (*Vireo altiloquus*). The South Florida Ecosystem has an endemic race of the yellow warbler (*Dendroica petechia*) and contains the majority of the nesting locations for the reddish egret (*Egretta rufescens*), roseate spoonbill (*Ajaia ajaja*), swallow-tailed kite, and short-tailed hawk in the U.S.

Southwest Florida has been identified as a core conservation area for the swallow-tailed kite (Meyer 1996). The swallow-tailed kite requires tall, accessible trees for nesting with open areas that provide sufficient small, easily subdued prey. Suitable habitat may be small stands or tree islands in prairie-like settings, low-density forests of uneven structure interrupted by open areas of shrub, swamp, or marsh vegetation, or denser forest, frequently interspersed with various sorts of openings (Meyer 1995). A large, pre-migratory roost (280 birds in 1988) of swallow-tailed kites has been documented 23 km away in Corkscrew, Collier County (Meyer and Collopy 1990), and surveys have identified the kite's preference for the PSRP area. The hydrologic restoration of the PSRP to its pre-drainage character, including an increase in cypress and hydric flatwoods, will provide increased nesting and foraging habitat for the swallow-tailed kite.

Fifteen species of herons, storks, and ibises nest in South Florida and are considered ecological indicators because of their wide foraging ranges, relatively narrow food requirements, and relatively specific habitat requirements. Their breeding success reflects the health of the wetland and coastal habitats of South Florida. Migratory songbirds, raptors, and wading birds utilize a variety of habitats within the PSRP and represent an important trust resource for the PSRP area. Both breeding bird and Christmas bird counts have been conducted in the PSRP area. The Audubon WatchList for the State of Florida (Muehter 1998) also includes several avian species known to inhabit the PSRP region (*i.e.,* American swallow-tailed kite, clapper rail [*Rallus longirostris*], and loggerhead shrike [*Lanius ludovicianus*]). State WatchLists promote the conservation of local bird populations and serve as an early warning system that focuses attention on at-risk bird species before they become endangered. The restoration actions proposed with this project should enhance natural habitat for migratory birds. The hydrologic restoration within the PSRP should also increase wading bird prey species such as amphibians, fish, and aquatic invertebrates.

Baseline Wildlife Surveys

Fish and wildlife surveys funded by the District and DOF were initiated in 2001. The surveys establish a baseline database that can be used to evaluate ecosystem responses to hydrologic restoration. Wildlife monitoring surveys conducted in the PSRP have documented many species of birds, mammals, reptiles, amphibians, fish, and insects which are summarized below.

The project area and adjacent habitat support a variety of songbirds, waterbirds, raptors, and wading birds. Notable wading birds include the limpkin (*Aramus guarauna*), great blue heron (*Ardea herodias*), little blue heron (*Egretta cearulea*), snowy egret (*E. thula*), great egret (*Ardea alba*), tricolored heron, white ibis (*Eudocimus albus*), and green heron (*Butorides virescens*).

Amphibians, such as the green tree frog (*Hyla cinerea*), squirrel tree frog (*H. squirella*), eastern narrowmouth toad (*Gastrophryne carolinensis*), pig frog (*Rana grylio*), and southern leopard frog (*R. utricularia*), utilize habitats within the project area that remain wet for most of the year. Other common herpetofauna include the American alligator (*Alligator mississippiensis*), Eastern diamondback rattlesnake (*Crotalus adamanteus*), yellow rat snake (*Elaphe obsoleta quadrivittata*), and red-bellied turtle (*Pseudemys nelsonii*).

Mammals, such as bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteus*), river otter (*Lutra canadensis*), and white-tailed deer (*Odocoileus virginianus*) also frequent the area.

Fish identified in project wetlands include eastern mosquitofish (*Gambusia holbrooki*), black acara (*Cichlasoma bimaculatum*), rainwater killifish (*Lucania parva*), bowfin (*Amia calva*), least killifish (*Heterandria formosa*), flagfish (*Jordanella floridae*), golden topminnow (*Fundulus confluentus*), largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), and sunfish (*Lepomis* spp.).

A complete list of fish species identified in the surveys is included in Appendix B.

Refugia Study

A study entitled "Enhancing the Recovery of Threatened and Endangered Species in the South Florida Ecosystem" is currently being conducted by The Conservancy of Southwest Florida, Environmental Science Division, for the Service. The study will determine the extent and importance of aquatic sites that function as "refugia" for organisms that inhabit the region with special attention to these sites in the survival and recovery of threatened and endangered species. Twenty sites were selected within the Fakahatchee and Picayune Strands (including PSRP) that are representative of either a permanent or semi-permanent aquatic habitat within the greater landscape that may serve as an aquatic reservoir or "oasis" for species in periods of dry-down or drought. These 20 sites represent both natural and artificial deepwater wetlands and ponds throughout the greater landscape that support obligate aquatic fauna (invertebrates, fishes, amphibians, and reptiles) and the predators that rely on them for survival (wading birds, migratory birds, reptiles, and larger mammals). Systematic study of the fauna that inhabit these systems at various times of the year is the primary focus of this project.

Appendicies B and C identify fish and wildlife collected as of June 2003.

Estuarine Resources

Introduction

Unlike most of South Florida, Collier County's estuarine areas remained virtually unaltered until the 1960s when severe pressure for residential and agricultural development occurred (DNR 1988). Development of Marco Island and construction of the GAC canal network, including the PSRP, were particularly devastating to adjacent estuarine areas.

Alterations in the timing and quantity of freshwater flowing into an estuary can have an impact on natural biodiversity by affecting food availability, predation pressure, and reproductive success and can directly cause chronic and acute stress (Serafy et al. 1997, Sklar and Browder 1998). Freshwater inflow can influence primary productivity, zooplankton biomass, and nekton abundance by influencing nutrient concentrations (Grange et al. 2000). Organic matter flowing into an estuary via freshwater inflow has been shown to contribute significantly to the food available for detritivores such as shrimp (Rivera et al. 2000). Several studies have documented that brackish water estuarine environments serve as refugia from predation for vulnerable fish and shellfish species (Rozas and Hackney 1984; Shirley et al. 1990).

Estuarine Fishes

Estuaries provide important habitat for the young of many fish species and their prey. The quantity and timing of freshwater inflows determine many characteristics of estuarine habitat by establishing salinity, other aspects of water chemistry, and the dynamics of currents and water exchange. Many commercial and recreational species caught outside of estuaries depend on estuaries during some part of their life cycle. Wetland drainage and other water management activities alter freshwater inflows to estuaries and affect the production of estuarine-dependent species (Browder et al. 1988, 1989). Biological studies have been conducted in Faka Union Bay and nearby bays to estimate the effect of canal discharges on estuarine organisms. Most information concerning the TTI's fish populations comes from trawl studies (Shirley 2002). Unfortunately, due to differences in methodology and locations, direct comparisons of results of these studies are problematic.

Yokel (1975) conducted a 1-year nighttime otter trawl sampling (July 1971 to July 1972) to compare animal abundances in similar habitats in Rookery Bay, near Marco Island, and in Fakahatchee Bay. In this study, 819 trawls collected 30,456 fish representing 59 species, with nearly 50 percent of the total catch coming from Fakahatchee Bay. The top five species collected were pinfish (*Lagodon rhomboides*), silver jenny (*Eucinostomus gula*), pigfish (*Orthopristis chrysoptera*), silver perch (*Bairdiella chrysoura*), and lane snapper (*Lutjanus synagris*).

Carter et al. (1973) combined the results of seines, surface trawls, and otter trawls to compare fish populations in Faka Union Bay and Fakahatchee Bay. The top six species in order of abundance were anchovy (*Anchoa* spp., primarily *mitchilli*), yellowfin menhaden (*Brevoortia*

smithi), scaled sardine (*Harengula pensacolae*), pinfish, silver perch, and silver jenny. Fakahatchee Bay had both higher diversity and higher abundance than Faka Union Bay. During their study, Carter et al. (1973) collected 273,270 fish representing 96 species.

Colby et al. (1985) conducted surface and bottom trawls in Faka Union Bay, as well as four bays to the east and four bays to the west (August 1982 to August 1983). These researchers related species composition, size, relative abundance, and food consumed to salinity, sediments, and aquatic vegetation. The top six species collected in this study were anchovy, spotfin mojarra, silver jenny, black-cheeked tonguefish (*Symphurus plagiusa*), lined sole (*Achirus lineatus*), and sand seatrout (*Cynoscion arenarius*). Anchovy, menhaden, silversides (family Atherinidae), and needle fish (family Belonidae) were predominately collected with surface trawls while pinfish, pigfish, sand seatrout, and silver perch were more common in otter trawls. This study found fish number and biomass, and the numbers of certain macroinvertebrates to be substantially less in Faka Union Bay than in the other sampling locations. Bighead searobin (*Prionotus tribulus*), tidewater silversides (*Menidia beryllina*), Gulf toadfish (*Opsanus beta*), and mullet (*Mugil* spp.) were collected in all eight other locations, yet never in Faka Union Bay. Fish abundance declined at the onset of the rainy season to a greater extent in Faka Union Bay, where numbers were reduced by 83 percent, as opposed to 70 percent in the bays to the east and 50 percent in the bays to the west. Spotfin mojarra were relatively more abundant in Faka Union Bay than in the other sampling locations.

Browder et al. (1986) used surface and otter trawls to collect fish and macroinvertebrates during monthly sampling from July 1982 to June 1984. Stations were sampled in Pumpkin Bay, Dismal Pass, Fakahatchee Bay, Fakahatchee Pass, Faka Union Bay, and Faka Union Pass. Surface and bottom trawl data were combined. A total of 85,561 fish representing 71 species were collected. The 882 otter trawl collections contained 18,252 fish representing 71 species. The six most abundant species were the same as those reported by Carter et al. (1973), bay anchovy (*A. mitchilli*), yellowfin menhaden, scaled sardine, pinfish, silver perch and silver jenny. Variation in the ranking of bays by relative abundance varied among species and seasons, but the most common pattern was that Pumpkin Bay had significantly higher abundance than one or both of the other two bays. Fewest significant differences among bays occurred during the winter, when Faka Union had a significantly greater abundance of bay anchovies and silver jennies. Fakahatchee and Pumpkin Bay had higher species diversity than Faka Union Bay, but fish abundance was seldom greater in Fakahatchee Bay than in Faka Union Bay.

The work of Carter et al. (1973), Browder et al. (1986), and Colby et al. (1985) suggested that the abundance, biomass, and diversity of fish and macroinvertebrates are lower in Faka Union Bay than in other parts of the TTI not receiving a point-source discharge. The analyses of Browder and Wang (1988) suggested that reduction in optimal-salinity habitat was one possible mechanism for lowered abundance.

The canal system may have affected the area of optimum-salinity habitat in nearby bays by diverting freshwater to Faka Union Bay that otherwise would have entered these other systems as surface or groundwater. Browder et al. (1989) noted a reverse salinity gradient into Pumpkin Bay (a neighboring bay to the west) during part of the year, probably due to the large amount of fresh water exiting the TTI through Faka Union Bay.

Since 1999, the Rookery Bay NERR staff has conducted otter trawl sampling in Fakahatchee Bay, Faka Union Bay, and Pumpkin Bay. Sampling of Henderson Creek began in 2000. During this time, 264 hauls have collected 32,236 fish representing 57 species, a much higher catch per unit effort, yet a slightly lower diversity compared to previous studies (O'Donnell, unpublished data). Dominant taxa in trawl collections from the three bays in 1999 and 2000 were mojarra/jennies (*Eucinostomus* spp.), black-cheeked tonguefish, pinfish, inshore lizardfish (*Synodus foetens*), bighead searobin, southern puffer (*Sphoeroides nephelus*), anchovies, and lined sole. Year, season, and location influenced relative abundance of fish species. In 1999, the six top taxa were ranked the same in all three bays, except that bay anchovies substituted in Faka Union Bay for searobins in the other two bays 1999. In 2000, anchovies appeared as one of the top six dominants in all three bays; however, the order differed (fifth in Fakahatchee Bay, fourth in Faka Union Bay, and second in Pumpkin Bay).

Loss of seagrass habitat may have contributed to the decline in fish abundance in both Faka Union Bay and Fakahatchee Bay. Carter et al. (1973) found pinfish and silver perch in greatest abundances in the seagrass beds (described as dense stands of turtle grass [*Thalassia testudinum*] and shoal weed) within Fakahatchee Bay. They also collected proportionally more snook, red drum, seatrout, snapper, and pink shrimp from Fakahatchee Bay than from Faka Union Bay. Yokel (1975) reported the greatest fish abundances from trawls over sites with grass beds in Rookery Bay, Fakahatchee Bay, and near Marco Island. Specifically, the greatest abundances of pinfish, pigfish, and pink shrimp were at trawling stations in shoal grass habitats. The greatest abundances of silver perch, silver jenny, and lane snapper were in a trawl station adjacent to a mangrove fringe habitat within a sparse seagrass bed. Weinstein et al. (1977) found significantly more pinfish and pigfish, more pink shrimp, and higher fish diversity in seagrass habitat. In Rookery Bay, Sheridan (1992) found significantly more pink shrimp in seagrass habitat than in nearby mangrove habitat or open water. Seagrass beds provide ideal nursery habitat, including food and shelter, for many sport and commercial species. Not all species are positively related to seagrass; spotfin mojarra were collected most often by Yokel (1975) in Henderson Creek, where the bottom habitat was described as fine sand with no vegetation.

Colby et al. (1985) suggested that direct effects of altered salinity or reduced availability of suitable bottom habitat were not enough to explain the lower fish abundance in Faka Union Bay. They proposed that variation in the availability of benthic prey may also have influenced the observed pattern of fish distribution.

Ichthyoplankton

Icthyoplankton and other zooplankters have been compared to evaluate the biological effects of Faka Union Canal discharges. Collins and Finucane (1984) collected fewer zooplankton, fish eggs, and fish larvae from Faka Union Pass than from Fakahatchee Pass. Browder et al. (1986) found higher concentrations of clingfishes and blennies in Fakahatchee Pass than in Pumpkin Pass, but no significant differences between Fakahatchee Pass and Faka Union Pass. Browder et al. (1988) found that the concentration of fish larvae in bayward transport was nearly twice as great in Fakahatchee Pass as in Faka Union Pass but was low overall in Pumpkin Pass relative to Fakahatchee Pass. Reverse salinity gradients may depress the bayward migration of

ichthyoplankton especially to Pumpkin Bay. The reverse salinity gradients caused by the outpouring of water to Gullivan Bay through the Faka Union Canal and Pass may be weaker in Fakahatchee Pass than in Pumpkin Pass because Fakahatchee Bay is directly connected to Faka Union Bay and receives low-salinity water through that connection. Flood tide transport through Faka Union Pass as a function of freshwater discharge has not been studied. Eight dominant taxa were examined in the Browder et al. (1986) study and 19 dominant taxa were examined in the Browder et al. (1988) study.

Curiously, ichthyoplankton concentrations in Faka Union Pass are lower than those in the other passes throughout the year, not just during periods of high discharges. Four of the 19 dominant ichthyoplankton taxa reach peak concentrations in the season of peak discharges, September and October. These studies demonstrated the negative effects of excessive canal discharges associated with the Faka Union Canal on larval fish recruitment. In addition, the ichthyoplankton studies provide information on the time of the year when there is the greatest need for appropriate nursery conditions in Faka Union and nearby bays.

Oyster Reefs

Oyster reef development is critical to estuarine ecology and to the geomorphologic structure of the region (Parkinson 1989, Savarese et al. 2002). The mangrove islands that differentiate the inner and outer bays and passages are based upon oyster reefs (Parkinson 1989, Savarese et al. 2002). The oyster, *Crassostrea virginica*, is the principal suspension feeder within these estuarine waters; oyster reefs are the principal agents of benthic-pelagic coupling. Oysters remove the carbon fixed in the water column by phytoplankton and transfer that carbon to the benthos. This filter feeding action improves water quality and clarity to support benthic primary production. Oyster reefs are essential fish habitat and provide substrate for many species, including prized game fish such as red drum, and can be used to monitor management and restoration practices (Savarese and Volety 2001).

A recent study examined the impact of water management practices on oyster physiology and ecology (Savarese and Volety 2001). Three estuaries were considered: 1) Faka Union, the estuary most impacted by present-day water management and the one to be most carefully monitored during and after PSRP restoration; 2) Henderson Creek, outside the influence of PSRP management but also an estuary scheduled for restoration; and 3) Blackwater River, the least hydrologically altered estuary west of Faka Union Bay. A characterization of Fakahatchee Bay's oyster reefs began in summer 2003 (Savarese et al. 2003). A number of measures were quantified in the original study, including: 1) oyster growth and recruitment; 2) oyster living density and productivity; 3) geographic distribution and aerial density of oyster reefs; and 4) incidence of the oyster disease DERMO (caused by the protozoan parasite *Perkinsus marinus*). Comparisons were made between estuaries and among spatially homologous locations along the down- to up-stream estuarine axis (Savarese and Volety 2001).

Comparisons of oyster physiology and ecology among the three systems demonstrated that the impacts of freshwater inundation from channelization and drainage of the wetlands within the PSRP have adversely affected oysters and the development of oyster reefs. The difference is best exemplified by the location and aerial coverage of reefs. Of the three estuaries studied, Faka

Union has the lowest area of reef occurrence (24,300 square miles [m^2]; 1.0 percent coverage) compared to 35,400 m^2 (1.7 percent) in Blackwater and 47,700 m^2 (1.6 percent) in Henderson. The region of maximum oyster growth, recruitment, living density, and reef development has shifted downstream along the estuarine axis in Faka Union Bay relative to the other, less severely affected, estuaries. The area of densest reef coverage in the Faka Union system is now located in the lower estuary where the accommodation for reef growth is most limited. There is more intertidal area for reef development upstream in and around the inner bay, which historically had the best water quality for reef development (Savarese and Volety 2001).

Other Macroinvertebrates

The six dominant macroinvertebrates in the Browder et al. (1986) trawl study were grass shrimp (primarily *Palaemonetes intermedius*), pink shrimp (*Farfantepenaeus duorarum*), mud crab (*Neopanope texana*), hermit crab (*Pagurus bonairensis*), arrow shrimp (*Tozeuma carolinense*), and blue crab (*Callinectes sapidus*), which made up 51, 20, 11, 9, 5, and 2 percent of the macroinvertebrate catch, respectively, and 98 percent of the macroinvertebrate catch collectively. Pink shrimp and blue crab are commercial species. Pink shrimp abundance was extremely high in Pumpkin Bay compared to Fakahatchee or Faka Union Bay. Grass shrimp, arrow shrimp, hermit crabs, and mud crabs were more abundant in the passes than in the bays. These taxa also were important components of the macroinvertebrate abundance in Faka Union and Fakahatchee Bays in the early 1970s (Carter et al. 1973). Browder et al. (1988) found significant relationships between relative abundance and monthly average area (spatial extent) of salinity habitat within Faka Union Bay, for several dominant fish species, as well as pink shrimp and blue crabs.

Pink shrimp is an important commercial species in South Florida. The TTI area contains nursery grounds for shrimp recruited to fishing grounds near Sanibel Island (Costello and Allen 1966). Laboratory experiments with juvenile pink shrimp from Florida Bay indicate a low tolerance to salinity extremes, especially low salinity (Browder et al. 2002). The relationship of survival and growth to temperature and salinity is encapsulated in a simulation model (Browder et al. 2002).

The blue crab was one of the more abundant macroinvertebrate species in Faka Union and Fakahatchee Bays in the early 1970s (Carter et al. 1973, Evink 1975), and Faka Union, Fakahatchee, and Pumpkin Bays in the early 1980s (Browder et al. 1986). Besides its commercial importance, this species is a major prey item for large fish, wading birds, and sea turtles (Van Heukelem 1991). It is an opportunistic omnivore (Darnell 1959). This species is dependent on estuaries during several life stages. Browder et al. (1986) found significantly higher blue crab abundances in Pumpkin Bay than in Faka Union Bay. Blue crab abundance varied seasonally, being highest in winter and spring and lowest in summer and fall. Abundance was significantly higher in Pumpkin Bay in summer and fall and Fakahatchee Pass in winter.

Blue crabs have different salinity requirements or preferences at different life stages (Pattillo et al. 1997). Juveniles prefer seagrass habitat, but also use salt marsh habitat, and have been found in greatest numbers in the low to intermediate salinities (2-21 parts per thousand [ppt]) characteristic of upper and middle estuaries. Adult males spend most of their time in low salinity water (< 10 ppt). Females move from higher to lower salinities as they approach their terminal

mote in order to mate. Females with eggs are usually found at 23-33 ppt. Spawning usually occurs from 2 to 9 months following mating. In North Carolina, spawning usually occurs in the spring by females that mated during August to September of the previous year. Two spawning peaks typically occur in the Gulf of Mexico, one in late spring and the other in late summer or early fall. The optimum salinity for hatching is 23-28 ppt (observed, 10.2-32.6 ppt). Larvae are usually found at > 20 ppt. Optimal salinities of 16-43 ppt were reported for survival and 1 1.5-35.5 ppt for development. The best strategy to promote high blue crab density may be to maintain a broad salinity gradient and provide the natural timing of flow in relation to rainfall. The species is very sensitive to pesticides and heavy metals, especially during early life stages.

Shirley et al. (1997) studied the recruitment dynamics of crabs on oyster reef habitats in Henderson Creek and Blackwater River (May 1996 to April 1997) relative to salinity fluctuations. Recruitment of juvenile porcellanid (stenohaline) and xanthid (euryhaline) crabs to both estuaries was similar, peaking in the early wet season. In contrast, significantly fewer adult stenohaline crabs were found in Henderson Creek than in Blackwater River. Site-specific differences in salinity fluctuations were also observed. This study concluded that the altered freshwater inflow into Henderson Creek adversely affected stenohaline crab populations. The Rookery Bay NERR staff continues to monitor crab populations on oyster reefs within Henderson Creek and Blackwater River and has expanded this study to include Fakahatchee Bay and Faka Union Bay. These data indicate that altered freshwater inflow is reflected in the relative abundance of stenohaline and euryhaline oyster reef crab populations (Shirley 2002).

The two crab groups include species such as *Eurypanopeus depressus* (euryhaline) and *Petrolisthes armatus* (stenohaline) known to be important items in the diet of fish and birds. Once they recruit to a reef, these species must remain on the reef and tolerate conditions at that location in order to survive. Once recruited to a reef, they cannot move to another area to escape unfavorable conditions. The extreme salinity fluctuations that occur in Faka Union Bay as a result of the canal system may limit the abundance of both of these species. The relative abundance of the two species at a site can provide an index of recent prevailing conditions (*i.e.*, low and fluctuating or high and relatively stable) (Shirley 2002).

Essential Fish Habitat

The Rookery Bay NERR area is identified as Essential Fish Habitat (EFH) under the 1996 amendments to the Magnuson-Stevens Fisheries Conservation and Management Act. This requires the National Marine Fisheries Service (NMFS), regional fishery management councils, and other Federal agencies to identify and protect important marine and anadromous fish habitat to support the maintenance of sustainable fisheries. Essential to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. Federal action agencies which fund, permit, or carry out activities that may adversely impact EFH are required to consult with the NMFS regarding the potential effects of their actions on EFH. EFH consultations are incorporated into existing interagency procedures under the NEPA, ESA, Clean Water Act, and FWCA whenever possible. EFH is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Fishery management plans and managed species for the Gulf of Mexico include Shrimp, Red Drum, Reef Fish, Stone Crab, Spiny Lobster, Coral and Coral Reef and Coastal Migratory Pelagic Fisheries Management Plans.

Estuarine areas identified under the Gulf of Mexico Fisheries Management Plan include estuarine emergent wetlands, mangrove wetlands, seagrass, algal flats, and mud, as well as sand, shell, and rock substrates and the estuarine water column. Marine areas include the water column, vegetated and non-vegetated bottoms, and live bottoms in nearshore areas.

IV. FISH AND WILDLIFE RESOURCE CONCERNS

A. Introduction

The intent of this section is to define fish and wildlife resource values in terms of the issues and areas of concern generated by the proposed project. This analysis is supported by several regional plans including the MSRP (Service 1999). The MSRP is an ecosystem-based recovery plan to restore and maintain the biodiversity of native plants and animals, as well as the threatened and endangered species of South Florida. The major fish and wildlife resource concerns for the proposed project are: 1) expansion and protection of the contiguous South Florida ecosystem; 2) synergistic effects of other restoration projects; 3) protection of national interest lands; 4) effects of rapid human population expansion in the general project area; 5) restoration of pre-development (natural) hydrology; 6) invasive species control; 7) restoration of natural habitat distribution and continuity; 8) management and elimination of point source discharges of freshwater into downstream estuaries; 9) protection of threatened and endangered species; 10) improved water quality; 11) reduced contaminants; 12) improved operational plans; 13) fish and wildlife resource management consistent with restoration plans; 14) improved road plan; 15) appropriate location and design of levees; 16) water demands (assurances); 17) soil conservation; 18) development and implementation of monitoring plans; 19) assessment of project performance measures; 20) alternatives development; and 21) protection and improvement of existing wetlands in NGGE and other effected parts of the watershed in private ownership.

B. Resource Concerns

1. Expansion and Protection of the Contiguous South Florida Ecosystem

The regional ecosystem restoration component of this project is overwhelmingly apparent: The restoration of existing resources and prevention of development-related impacts to contiguous public land holdings that would total 2,602,144 acres when the PSRP and adjacent public lands are considered. The importance of this uninterrupted landscape to management and recovery of wide-ranging species, including listed species such as the Florida panther and wood stork, cannot be overstated. The Service expects this restoration project to result in direct benefits to

55,247 acres of fish and wildlife resources and could extend beneficial effects to more than 19,000 acres of downstream estuaries. These estuaries, which include the TTI NWR, Cape Romano/TTI Aquatic Preserve, and Rookery Bay NERR, as well as the northwest portion of the estuaries of ENP, contain the largest mangrove ecosystem in the United States. Additionally, four surrounding public land holdings under the management of the DOF, the DEP, and the Service will be protected and enhanced by the completion of this project. Project components were designed by, and will be consistent with, multi-agency resource objectives and are sensitive

to rare species and habitat components found nowhere else in the world offering unique educational and recreational access opportunities to the public.

2. Synergistic Effects of Other Restoration Projects

Tamiami Trail Culverts

A portion of the Tamiami Trail Culverts Critical Restoration Project is located south of the PSRP and is an essential element in restoring sheetflow conditions from the project to the downstream estuaries. The total project will involve installation of 54 culverts along Tamiami Trail (U.S. 41), construction of 21 new Tamiami Canal plugs, and modification of eight existing canal plugs. The existing bridges along the Tamiami Trail are too few in number and inadequately spaced to allow adequate sheetflow to the south. The Tamiami Canal, on the north side of the Tamiami Trail, intercepts sheetflow and diverts these waters to the existing bridges. Plugs and/or driveways across the Tamiami Canal also restrict and divert flows. Typically, the existing bridges provide more than historic flow at bridge locations, while areas to the south between the bridges receive no surface water flow. The western portion of the Tamiami Trail, south of the PSRP, impedes the north-south flow of surface water from wet prairies and cypress strands north of the Trail to saltwater wetlands (brackish and salt marshes, mangroves, and open bays) south of the Trail. These alterations of freshwater flow have resulted in saltwater encroachment further north than under historic conditions, which have altered plant communities and ecosystem functions. Restoration of this flow should restore wetlands to a more natural condition.

Southwest Florida Feasibility Study

The WRDA of 1992 authorized the C&SF Restudy to reexamine the C&SF Project to determine the feasibility of structural or operational modifications to the project. These modifications were deemed to be essential to the restoration of the Everglades and the South Florida ecosystem. The July 1999 report to Congress recommended initiation of the Southwest Florida Feasibility Study (SWFFS) to better define problems and opportunities to restore this ecosystem. The PSRP is located in a 4,300-square mile (2,705,587-acre) study area. Regional fish and wildlife resource concerns that were identified by the Service in the initial Planning Aid Report (PAR) for the project and are pertinent to the PSRP include:

Loss of Seasonal Wetlands. Amphibian, reptile, macroinvertebrate, and forage fish populations associated with seasonal or short-hydroperiod wetlands form the basis of one of the study area's most distinctive and important food webs, one that is critical to wading birds. Seasonal wetlands are dependent on sheetflow conditions for hydrology and recolonization of many fauna, and require a consistent water table to maintain shallow surface inundation. During the dry season, the water level drops until surface water is isolated only in small depressions, concentrating food for wading birds and other species. Due to their size and isolated nature, short-hydroperiod wetlands are targeted for development by urban and agricultural interests in the study area.

Loss of Pine Flatwoods. Although not a rare habitat historically, pine flatwoods were reduced to about 50 percent of their historic extent by 1970 (Birnhak and Crowder 1974) as a result of urban and agricultural development. Wade et al. (1980) reported that, in 1980, pine flatwoods occupied more area in South Florida than any other kind of plant community except the

Everglades marsh. By 1989, Kautz (1993) indicated that pine flatwoods had dropped to fifth in areal extent in Florida, behind grasslands, cypress swamp, dry prairies, and freshwater marsh. For the first time, urban areas occupied more acreage in South Florida than pine flatwoods.

Decline in Wading Bird Numbers. Wading bird populations in South Florida have undergone declines far greater than the declines of their nesting habitats. According to current estimates, breeding populations of wading birds in South Florida have declined by more than 90 percent as their habitats have been reduced by 50 percent (Ogden 1994). Of the 15 species that breed in South Florida, the wood stork, great egret (*Casmerodius albus*), snowy egret, tricolored heron, and white ibis had declined by an estimated 75 to 80 percent between the 1930s and the late 1970s (Ogden 1994). The total number of wading birds nesting in the Big Cypress and Everglades basins has declined by more than 95 percent from peak estimates of nesting birds in the 1930s. Impacts of altered hydropatterns include: 1) reduced number of birds attempting to nest; 2) relocated colonies; 3) altered timing of nesting; and 4) fewer years of successful nesting.

Resource Management Conflicts on Public Lands. Demands placed on public resources for water management, such as flood control and water supply, have created or have increasing potential to create resource management conflicts on public land. These conflicts can include: 1) drainage of wetlands from surface water wellfields or canals/lakes for water supply or irrigation; 2) increased water depth and flood duration in wetlands and upland habitats for water storage purposes; 3) altered water flows to downstream estuaries driven by management decisions during flood and drought events; and 4) use of public lands for water storage or water quality treatment areas. Impacts associated with these uses include loss of wetlands and wetland function, particularly early dry season drawdown; vegetative and biological community changes; point-source discharges to estuaries; zero flow conditions to estuaries; exotic plant and animal infestation; and poor water quality which adversely impacts fish and wildlife resources.

Monitoring and Adaptive Assessment. The CERP identified the need for developing an adaptive assessment strategy for measuring the success of this large restoration project. Monitoring for the SWFFS and the PSRP will likely be integrated within the system-wide adaptive assessment process, which is now being developed by the Adaptive Assessment Team, part of the RECOVER process. An adaptive assessment and management strategy is critical to the success of restoration projects where conceptual hydrological modeling is the primary tool for project design and engineering.

Project Implementation and Phasing Schedule. Timing of proposed project components can be important, particularly for: 1) restoration components that may improve conditions in recruitment areas for estuarine fishes and invertebrates; and 2) projects where partial implementation of water management design has not been modeled independently of the entire project. An implementation schedule can incorporate flexibility that allows for the integration of modified or additional water quality and/or ecological restoration targets in detailed design, construction, and future operation of project components.

Additional Water Storage in Watershed Basin. A regional issues paper prepared for the SWFFS identified the need for more storage in the upper watershed of this basin to preserve existing wetlands, attenuate flooding, and preserve groundwater resources in the NGGE. A major issue

affecting project design and cost is maintenance of flood control in both residential and agricultural areas north of the PSRP site. The human population in the 101-square mile NGGE north of PSRP has increased from 24,076 in 1990 to 41,637 in 2000 (73 percent increase), and is projected to reach 90,762 by 2020 (46 percent increase from 2000). The Faka Union Canal drains the eastern (area of most rapid growth) portion of NGGE into the PSRP (CCPCD 2002).

3. Protection of National Interest Lands

Chapter 9 of the "Yellow Book" gives the restoration and enhancement of wetlands on adjacent public lands equal consideration as a project purpose. Because adjacent lands include two NWRs, Rookery Bay NERR, ENP, two State parks, and a portion of a State forest, the importance of this project purpose cannot be over-emphasized.

There is a strong connection between freshwater outflows from the Southwest Florida coast, Florida Bay, and the upper Keys (Lee et al. 2002). Therefore, benefits or adverse effects of water management related to this project should be considered with regard to their potential for restoration of the larger marine ecosystem, including a National Marine Sanctuary.

The 26,400-acre Florida Panther NWR is located in Collier County and is part of a large watershed that originates in the CREW area and Okaloacoochee Slough systems to the north which flow downstream to Fakahatchee Strand and the PSRP to the TTI system. The refuge is primarily pine and cypress forest and hardwood hammock, and is managed to create optimum habitat conditions for the Florida panther, protect rare plant species, and provide suitable habitat for other federally listed or rare species such as the wood stork, Big Cypress fox squirrel, and Everglades mink. Florida Panther NWR concerns include the cumulative effects of continued habitat loss and fragmentation on South Florida's panther population, hydrological restoration on NWR lands, encroachment of land uses that conflict with NWR management, and exotic plant management. The hydrology of the Florida Panther NWR has been altered by: 1) drainage infrastructure of the surrounding landscape, including the PSRP; and 2) conveyance associated with agricultural operations located in the refuge watershed. Drainage infrastructure directly adjacent to the Florida Panther NWR includes the I-75 canals on the southern boundary and the SR 29 (Barron River) canal on the eastern boundary. The canals adjacent to I-75 are discontinuous; plugs were purposely located within the canals in order to reduce drainage. However, these canals have equalizing culverts near ground level that allow some east-west flow during high water levels. Similarly north-south flow to Merritt Canal in the PSRP occurs over canal plugs during high water periods. Lucky Lake weir was constructed in Merritt Canal to reduce some of this drainage. The Barron River (SR 29) canal also has weirs that retain water during the dry season and this canal is a source of water for Everglades City. Although weirs and plugs block or retain water, canals still act as localized drainage features, which drain the southern end of the Florida Panther NWR during dry season drawdowns. Agricultural operations in the watershed north of the refuge act to retain or detain water during the dry season by virtue of internal drainage features (ditches, canals, reservoirs, and detention areas). During the late wet to early dry season, and occasionally during the winter dry season, the refuge receives an excess of water from agricultural pump-out operations designed to dry out and manage farm fields for production. However, vegetative succession (cabbage palm and exotic plant invasion) on the NWR indicates an overall historic drawdown of wetlands on refuge lands, especially on

the eastern side of the refuge. NWR planning and management goals include land acquisition, conservation easement, and other private landowner agreements that would help recover the Florida panther.

The 35,000-acre TTI NWR is located directly south of the PSRP in Collier County and was created to protect important mangrove and marsh habitats, native wildlife, and the endangered species of the area including the American crocodile, West Indian manatee, three sea turtle species, shorebirds, and other estuarine species. The TTI NWR does not receive water that historically was conveyed to a number of estuaries in the NWR from the PSRP and the upstream watershed. This water is shunted to upstream canal systems in the PSRP and point-discharged to Faka Union Bay at the Faka Union Canal outlet. The Faka Union Canal parallels the eastern refuge boundary and acts to funnel saltwater significantly further inland than pre-development condition. Project canals therefore both starve the upper refuge from freshwater input and extend saltwater further inland through a tidal bore in the lower Faka Union Canal. This allows the invasion of saltwater tolerant vegetation farther into the upper refuge. The downstream estuaries of the refuge are doubly impacted by alternating salinity conditions from point source freshwater discharges during the wet season and high salinity from tidal bores in the Faka Union Canal during the dry season. TTI NWR concerns include: 1) freshwater inflows that affect water quantity and quality in the estuary, particularly through Bad Luck Prairie and Faka Union Canal from the PSRP; 2) exotic plant and animal invasion; 3) effects on manatee critical habitat; 4) the effect of construction of project infrastructure on NWR lands, particularly the levee on the west side of Faka Union Canal; and 5) completion and implementation of a detailed monitoring plan that will assess the effects of the project on the NWR and allow for adaptive management.. The NWR will receive immediate water quantity and quality changes as a result of the completion of the PSRP and the Tamiami Trails Culvert projects. However, baseline information on water quality and quantity; salt and freshwater marsh and mangrove communities, and tidal influences has either not been collected or not been incorporated into the project hydrologic analysis.

BCNP covers 716,000 acres and is located primarily in south and southeast Collier County, adjoining the northwest section of ENP. Although BCNP is not directly adjacent to the PSRP, it is adjoined by Fakahatchee Strand Preserve State Park which is adjacent to the project. The hydrology of the BCNP's cypress and pine forests is critical to the freshwater supply of ENP. The BCNP is managed for native ecosystems, rare plant species, and listed species including the panther, wood stork, and RCW. The BCNP's management concerns are primarily with water quantity and quality which affect surface hydrology, exotic plant and animal invasion, incompatible adjacent land use, recovery of listed species, and protection of other fish and wildlife resources.

The 1,506,500-acre ENP is the largest remaining subtropical wilderness in the nation and has been designated a Biosphere Reserve, World Heritage Site, and Wetland of International Importance. Only two other sites in the world have been placed on all three lists (Service 1998). The park is managed for a vast array of fish and wildlife species, rare tropical orchids and other plants, and other species associated with the park's mangrove estuaries. The ENP's concerns include quality and quantity of freshwater inflows, exotic plant and animal management, and incompatible adjacent land uses.

4. Human Population Expansion

Current statistics demonstrate that Collier County, including the PSRP study area, is characterized by a much greater population growth rate than the rest of the State and the nation as a whole. Collier County's 2000 census showed a human population of 251,377. The population of this county had an enormous 65.3 percent increase from 1990 to 2000, and the estimated change between 2000 and 2001 was 5.7 percent. The population of Florida and the United States increased by 23.5 percent and 13.1 percent, respectively, during the same period. The State of Florida added over three million residents from 1990 to 2000, the third largest increase in the nation.

Population in Collier County is projected to more than triple from 2000 to 2050. Due to this anticipated population growth, the county is expected to have one of the largest populations in the Lower West Coast. Table 6 summarizes existing and projected population in the study area based on the 2000 U.S. Census. The future estimates are based on Collier County's April 1, 2001, published population projections to the year 2030. The Bureau of Economic and Business Research at the University of Florida (BEBR) medium estimates ("high" and "low" estimates are also shown) for growth trends evident from 2020 to 2030 were utilized to extend Collier County's population projection out to 2050. Table 6 displays the population rates of growth for each decade from 2000 to 2050. Table 7 indicates the population growth rate of the study area is expected to exceed that of the State from 2000 to 2050.

Table 6. Study Area population estimates, 2000-2050

Population (1,000's)						
	Year					
	2000	2010	2020	2030	2040	2050
Collier	251.3	372.3	479.3	583.2	709.1	862.1
Share of Florida Total	1.6%	2.0%	2.2%	2.4%	2.6%	2.9%
Florida Total	15,982.4	18,866.7	21,792.6	24,528.6	27,118.7	29,714.5

Table 7. Study Area population rates of growth 2000-2050

Average (% Per year) Population Growth					
	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050
Collier	4.8%	2.9%	2.2%	2.2%	2.2%
Florida Total	1.8%	1.55%	1.26%	1.06%	0.96%

Table 8. Study Area population growth 2000-2050

	% Change 2000-2050
Collier	**243.1%**
Florida	**85.9%**

An analysis of recent and extensive changes in stormwater management, water supply, water demand, and water quality associated with the issuance of nationwide and individual 404 permits by the Corps, and Environmental Resource Permits by the District and DEP, is essential to determine the effects of adjacent urban and agricultural development on project design, costs, and benefits. Information on recent significant projects impacting water management in the PSRP watershed were provided by the Service to the District and the Corps during development of the Draft and Final PIRs. Changes to the Big Cypress Watershed that have resulted in diversion of water to the Imperial and Cocohatchee Watersheds from the Estero Bay Watershed and the CREW areas need to be included in project design. Watershed flow changes, as detailed in the South Lee County Watershed Plan, need to be discussed with reference to the PSRP and adjacent Fakahatchee Strand, as this plan appears to direct additional waters southward to the project area. Changes in stormwater management associated with canals adjacent to Bird Rookery Swamp, Immokalee Road, Cypress Canal, and the four-laning of I-75; management measures to replace or improve the Lucky Lake weir south of the Florida Panther NWR; problems with water flow under U.S. 41 to the south of the project; the effects of agricultural areas north of Florida Panther NWR; and the effects of those significant agricultural areas located southwest of the project that are proposed to be blocked by a levee system should be included in project design and analysis. Additional information and text are available from the Lower West Coast Water Supply Plan (being updated), South Lee County Watershed Plan, Estero Bay Watershed Plan, Big Cypress Watershed Plan, SFFS, and EIS for the Corps Regulatory Process in Southwest Florida.

In keeping with the spirit and intent of the Corps Water Resources Policies and Authorities for Civil Works Project, EP 1165-2-1, July 30, 1999, the "principal focus in ecosystem restoration will be on those ecological resources and processes that are directly associated with, or are directly dependent upon, the hydrologic regime of the ecosystem(s) and/or watershed(s) in which they are found." The Service is concerned that significant changes to the Big Cypress Watershed and major planning proposals that have received agency approval have not been fully integrated into this project modeling and design.

5. Restoration of Natural Hydrology

National Wildlife Refuge Lands

This project will have direct effects on the two adjacent NWRs located immediately upstream and downstream of the project. The Service is concerned that model input may have assumed too much surface waterflow from Okaloacoochee Slough and Hinson Marsh (through the Okaloacoochee Slough/Barron River Basin and under SR 29 (Barron River). This flow is non-existent or limited for much of the year. An over-estimate of this flow may lead to an over-estimate of the existing condition hydrology on the NWRs. Current hydrological model output appears to predict limited effects of the PSRP on Florida Panther NWR based on this assumption. This assumption is not supported by observations of vegetative succession to a more disturbed (drier) condition as evidenced by cabbage palm invasion of the refuge. Pump and spreader swale systems on Merritt Canal are proposed to replace Lucky Lake weir, which was placed in Merritt Canal in part to eliminate drainage on Florida Panther NWR. Based on hydrologic modeling concerns and potential errors in operating elevations, it is not clear whether the pump/spreader swale system will approximate the effects of the weir. The Service has also requested that additional water be seasonally detained on the NWR to ameliorate some of the overdrainage concerns.

The Service is also concerned about the effects of the project on the TTI NWR. The design of the east-west portion of the "T" canal above Bad Luck Prairie does not appear to be sufficient to transport natural flow, although this may be addressed in the detailed design stage. Water levels on the NWR are of particular concern, because hydrology will determine whether portions of the refuge remain as saltwater wetlands or convert to the historic condition of freshwater wetlands. Levee construction on the adjacent Faka Union Canal below U.S. 41 could also affect interior drainage/inundation of NWR wetlands. The levee could block some effects of the tidal bore that brings saltwater further inland than the natural condition.

Weed Control

Aquatic weed infestation reduced the hydraulic performance of the PSRP canals after canal completion until 1990, when the District began an aggressive weed control program (Abbott and Nath 1996). This weed control program occurred in concert with maintenance activities and changes in canal weir management to increase drainage in the PSRP from 1990 to the present. These actions resulted in increased runoff volume and rate. The reinfestation of weeds in canals that remain after project construction will slow water transport and/or contribute to

decomposition and sedimentation processes that should, over an extended period, fill the remaining canal sections.

Saltwater Intrusion

The Service is concerned with the effects of saltwater intrusion on the PSRP site and adjacent public lands. Inland movement of seawater along tidal reaches of streams and canals can intrude into the shallow aquifer when reductions in freshwater levels occur. In 1968, the Collier County Commission established a "salt barrier line" beyond which uncontrolled drainage canals could not be excavated unless water control structures were established at the line to prevent further inland penetration of seawater. This line is currently located at U.S. 41. Evidence of saltwater intrusion is demonstrated in the composition of plant communities located north of U.S. 41 in the Bad Luck Prairie portion of the PSRP, in plant community changes (mangrove encroachment) in the TTI NWR, and along the Faka Union Canal near POI.

Freeze

The effect of climate buffering is lost when surface water levels are lowered. Standing water buffers severe changes in local temperatures by giving off heat on cold nights and absorbing heat on hot days (Corps 1980). Every few years, temperature conditions in southwest Florida approach or fall below freezing. When these conditions occur, subtropical vegetation, including orchids and bromeliads as well as gumbo-limbo, stoppers, and coco-plum, can be damaged or killed. Evidence of freeze damage that may be exacerbated by a reduction in hydrology on the site is the periodic freeze damage to mangroves and the exotic Brazilian pepper.

Hydrological Model Issues

During PIR/EIS review, the Service highlighted a number of technical issues capable of introducing uncertainty in plan formulation, calculation of benefits, analysis of Real Estate takings, and analysis of project assurances. Our concerns were expressed informally through project meetings and correspondence with technical representatives, formally in several PALs, and most recently in a NEPA comment letter, dated July 13, 2004 (Appendix A). A meeting was held on August 10, 2004, to attempt to resolve some of these issues. We are concerned that the issues described in Appendix E do not allow us to perform valid comparisons between alternatives or evaluate the true effects of the project on fish and wildlife resources. We offer the following recommendations which would allow the Service to adequately evaluate project benefits and impacts on fish and wildlife resource values:

6. Exotic and Invasive Species Control

South Florida's subtropical climate provides an excellent growth environment for the rapid spread of exotic plants that can cause extensive alterations to an area's natural ecosystems. Environmental changes caused by extensive hydroperiod alterations in the project area have been an important factor in exotic plant invasion. Exotic plant species are associated with drained or disruptive fire and hydrologic regimes. Exotic plant invasion can result in partial or total displacement of native plants, loss of wildlife habitat, and the degradation of public use areas.

Non-indigenous plant or animal species that persist in the project area may harm or displace native species and alter ecosystem functions. Brazilian pepper and Melaleuca are among the most prolific invasive species, although other introduced plant and animal species may locally or regionally imperil fish and wildlife resources. Increased nutrient loads may lead to the proliferation of nuisance species such as cattails (*Typha* spp.) or primrose willow (*Ludwigia peruviana*).

Brazilian pepper does not become established in deeper wetland communities and rarely grows on sites inundated longer than 3 to 6 months (LaRosa et al. 1992). Results of experiments conducted by the Sanibel-Captiva Conservation Foundation on Sanibel Island, Florida (1990-1991), and the effects of a substantial rainfall in 1995 suggest that Brazilian pepper can be stressed or killed by flooding. Successful invasion appears to be a function of seed access to an area, germination of introduced seeds, and seedling survival (Ewel et al. 1982). The long-term goal of the PSRP is to return the hydrology of the area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return the PSRP to its pre-drainage character, including the plant communities and wildlife that it supported at that time. It will be important to continually monitor for the presence of exotic/invasive plant species and implement control measures while their populations are still small. Initial observations of the Prairie Canal Early Start Project indicate that invasion of Brazilian pepper seedlings on substrates that have been disturbed by restoration activities and fire (in the presence of seed source) will be a primary concern.

It should be noted that the ability of the selected plan to reduce exotic vegetation is based on the assumption that an Exotic/Invasive Species Management Plan will be implemented as part of the recommended plan. This management plan should have three components: 1) construction practices that reduce the spread of the exotic plants; 2) initial aggressive treatment and management of substrates that are bared by restoration activities; and 3) extensive site management activities by the land manager. Without such a plan, exotic vegetation would re-infest the project area and the existing condition would persist.

Non-indigenous amphibian, reptile, and mammal populations which may be present in the project area can change complex ecosystem relationships and/or reduce the food supply for native predators (DEP 1994). Feral hogs in the PSRP area degrade wildlife habitat, compete directly with native wildlife for food, and act as a reservoir for diseases communicable to man and domestic animals. Feral hog habitat includes the flatwoods, freshwater marshes, ponds, sloughs, and cabbage palm hammock plant communities. In general, most low and medium hog populations occur where habitat quality is limited. The detrimental effects of wild hogs are multi-faceted and result from their movements, habitat utilization, and food habits. Their rooting disrupts vegetative communities and successional patterns, as well as altering nutrient cycling. Therefore, they can have both direct and indirect effects on some fauna either through predation or alteration of the forest floor habitat (Tate 1983). It is hypothesized that the wild hog is a fairly significant competitor for food with a number of other wildlife species such as deer, turkey, squirrels, and even waterfowl (Thompson 1977). Trapping, sport hunting, and agricultural depredation control measures have been implemented to suppress populations in some areas of Florida where feral hogs are having detrimental effects.

Florida has 16 species of native bromeliads, many of which are restricted to the southern portion of the State. However, a non-indigenous weevil (*Metamasius callizona*) is destroying populations of six native bromeliad species, *Catopsis berteroniana*, *C. floribunda*, *C. nutans*, *Guzmania monostachia*, *Tillandsia pruinosa*, and *T. flexuosa* at an increased rate. Florida populations of *Tillandsia utriculata*, which was common and widespread, have been so devastated that this species and *T. fasciculata* have been placed on the Florida list of endangered species, and *T. paucifolia* will soon join their ranks (Frank and Thomas 1996). In an attempt to control the weevil, a specialized biological control agent is being evaluated.

Non-native Invasive Fish Species

Early fish sampling reports from the 1960s in the Water Conservation Areas (WCAs) indicated a relative absence of non-native fish. Dineen (1965a) reported the presence of a single pirate perch (*Aphredoderus sayanus*) in WCA- 2. Dineen (1965b) also reported that an exotic cichlid (identified as *Aequidens portalegrensis* but presumed to actually be the black acara, *Cichlasoma bimaculatum*) had become established in the North New River Canal, which is among the earliest reports of its occurrence in Florida. In his report, Dineen indicated that where the acara occurred, it was second in numbers only to the shellcracker (*Lepomis microlophus*). He did not report occurrence of this species in any other canals in 1965. In 1982, Shafland and Pestrak reported that 15 non-native fishes were established in Florida, and many other species had been documented within Florida waters by this time (USGS 2003). In 1996, 75 exotic species had been collected in Florida, 23 were reproducing, and 18 were reported as "established" (Shafland 1996). There are now 32 species of non-native fish known to be reproducing within freshwater systems in Florida, and 22 of these are considered to be established (Shafland 2001, P. Shafland, FWC, personal communication 2003). Some reports indicate that over 120 non-native fish species have been documented in Florida waters (Benson et al. 2001, USGS 2003), though information is lacking on the current status of most of these. Many species have not been recorded within Florida waters in several years.

All of these reports indicate that introduction, establishment, and dispersal of non-native fish species have continued to increase over time. There are no indications that the number of new species introduced to Florida will decline or cease.

In addition to an increasing number of exotic species, the distributions of many non-native fish that have become established also continue to expand. The brown hoplo, or armored catfish (*Hoplosternum littorale*), which was previously reported to occur from the St. Johns River south to Lake Trafford in Collier County (USGS 2003), has recently been observed within wet prairies of the Rocky Glades of the ENP in the extreme southern part of Florida (Kline and Perry 2003). In all, Kline and Perry (2003) have documented three new occurrences of exotic species within ENP (jaguar Guapote - *Cichlasoma managuense*, jewel cichlid - *Hemichromis* sp., and armored catfish) since the publication of the *Inventory of Fishes of Everglades National Park* (Loftus 2000). Shafland and Pestrak (1982) and others recognize that exotic fish can easily disperse through the numerous unobstructed waterways of Florida. Shafland and Pestrak (1982) report that "unless limited by some other environmental factors, these fishes will eventually extend their ranges throughout Florida."

Increasing abundance and biomass of exotic species are probably also occurring. Recent reports indicate exotic fish populations within the WCAs are well established and occur both within canals and the adjacent marsh (Fury et al. 1995, 1998). The biomass of exotic species within canals has exceeded 200 kg/2.5 acres (Fury et al. 1995). Sampling within marshes of ENP has indicated variable abundance of exotic species, but some samples have included as much as 40 to 60 percent exotic species (Kline and Perry 2003). Volin et al. (2003) report that exotic species composed from 10 to 12 percent of the fish in native wet prairie and cypress habitats within one year, and exotic fish may be proportionally more abundant in larger size classes. Gill net samples of fish too large to be captured in minnow traps yielded over 20 percent exotic species. Volin et al. (2003) also report that over 60 percent of the fish sampled at a canal outflow culvert were exotics. Kobza et al. (in press) found that, in karst wetlands of ENP, most native taxa were unlikely to survive during marsh dry-downs in the deep refuges that contained predatory non-native taxa.

The Service recognizes non-native fish species, as well as non-native plants and other exotic animals, as a potentially severe obstacle to achieving restoration. The Service has participated in numerous discussions with personnel from other agencies, researchers, and the public about this issue, and continues to consider it an urgent problem. However, it remains difficult to assess the threat from non-native fish and measure ecological impacts due to variability in occurrence, density, and biomass within different habitats and geographic areas over time (Trexler et al. 2000).

Canals, canal sections, or deeper ditches that remain on the PSRP site will provide permanent habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could disperse predatory fish to isolated wetlands where increased predation on small fishes could reduce the forage base for wading birds and wood storks.

The following exotic fish species were collected in the PSRP area: walking catfish (*Clarias batrachus*), pike killifish (*Belonesox belizanus maxillosus*), oscar (*Astronotus ocellatus*), black acara (*Cichlasoma bimaculatum*), Mayan cichlid (*Cichlasoma urophthalamus*), spotted tilapia (*Tilapia mariae*), *and* blue tilapia (*Oreochromis aureus*). Both walking catfish and pike killifish are considered predators on native aquatic animals, are highly drought-tolerant, and use solution holes as refuges. The Mayan cichlid is a predator on native aquatic animals and competes for nest sites with native sunfishes. All nonindigenous fish species collected thus far in the PSRP area have the potential for ecosystem damage via predation, local nesting competition, habitat disturbance, and/or spread of exotic parasites (D. Ceilley, personal communication 2004). Preliminary indications are that most of the exotic fish will be confined to disturbed canal remnants after project completion. However, because of the potential current and future threat resulting from non-native fishes and the broad policy-level support for action against invasive species, project monitoring plans should identify non-native fishes and the extent to which these fishes invade adjacent restored habitats to determine if control measures are necessary.

Federal agencies have been provided a mandate to address invasive exotic species under Executive Order (E.O.) 13112: Invasive Species. Under this E.O., Federal agencies are directed

to identify appropriate control practices and means to reduce the spread of exotic species, and use relevant programs and authorities to prevent, control, monitor, and research invasive species. It further directs Federal agencies not to fund projects that are likely to promote the introduction or spread of exotic species.

The PIR does not identify referenced "feasible/prudent measures to reduce invasive species infestations and minimize risk of introducing new invasives." The managing entity, DOF, does not currently have sufficient staff or funds to control exotic plants and some exotic animals on the project site. There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive species, especially in the short term, or whether more intensive management activities may be necessary on a short or long-term basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species.

7. Restoration of Natural Habitat Distribution Continuity

Differences in the location of habitat derived from the NRCS pre-development and existing condition maps and model output maps are significant. Additional explanation is needed in order to estimate the model's accuracy in predicting the distribution of plant communities under pre-development, existing, and future with and without-the-project conditions. The primary goals of the PSRP are to restore short and long-hydroperiod wetlands to historic proportions by inducing sheetflow conditions, and to reduce point source discharges of freshwater to restore downstream estuaries. Table 1 indicates anticipated habitat changes based on hydroperiods associated with the major existing wetland communities in southwest Florida. Only major plant communities are identified in Table 1, although 24 different plant communities and land use categories have been mapped for purposes of identifying the impacts of drainage on the landscape between pre-development (1940s) and 1995. The major effects of the drainage associated with the existing canal and water management infrastructure within the project are the loss of cypress forest and herbaceous wet prairies. Historically, small areas of pine flatwoods normally designated as uplands were located in narrow strands in elevated areas of the project and in the northwest project corner. Hydric flatwoods, which often have water at or above the ground surface for at least short periods during wetter portions of the year, were the majority of the remaining flatwoods. Due to the variable nature of shallow wetland hydroperiods and site topography over time, many on-site plant communities historically contained elements of both uplands and wetlands which were periodically affected by fire, freeze, drought, flood, and hurricane events. After drainage, upland pines, cabbage palms, and hardwoods invaded many of the cypress forests. Severe and frequent fires eliminated many of the pine and cypress trees, furthering the conversion of these lands to earlier successional shrubby states of upland or shallow wetland plant communities. Exotic plant species, particularly Brazilian pepper, have changed the character of many habitats, especially adjacent to the site's extensive canal and roadway network. Because the site is significantly affected by drainage features upstream of the project, primarily NGGE, the project goals were developed with acknowledgment that habitat restoration would include a balance of project management features to restore as much of the site as possible to pre-drainage character. There was also consideration of upland restoration and protection, acknowledgment of interim and post-restoration management, and post-restoration operational features related to the effects of the project on fish and wildlife and listed species concerns.

Table 9 indicates that the model results based on the selected alternative will result in significantly more mesic flatwoods (9,194 acres) and less hydric flatwoods (827 acres) and wet prairie (4,700 acres) than pre-drainage conditions. These plant communities would replace significant acreage (2,427 acres) of pre-drainage cypress forest and some freshwater marsh. While Alternative 3D might appear to fall short of restoring cypress forests on the project site to pre-drainage conditions, the following should be considered when assessing the project restoration benefits: 1) pre-development cypress communities (based on analysis of soils maps) often included mixed canopies of pines, palms and hardwoods, especially in short-hydroperiod cypress forests as opposed to deeper cypress stands, and therefore there may be an over-estimate of the original extent of cypress forest; 2) project design considerations purposely included protection of upland plant communities in the northern and northwest project boundaries to minimize downstream project effects to listed species such as the Florida panther and RCW, and rare plant communities such as tropical hammocks; and 3) significant restoration in the quality and function of 12,809 acres of cypress forest from the existing condition is anticipated under Alternative 3D.

Although exact figures are not available based on the lack of an estuarine model and ground-truthing for plant communities, changes in estuarine communities between 1940 and 1995 indicate that the reduction of freshwater flows to the estuary may have increased the extent of mangroves south of the project boundary by approximately 1,853 acres and decreased brackish marshes by 2,094 acres. These estimates should be considered to be very tentative based on the limited data.

Table 8. Acreage, percent, and difference of major PSRP plant communities: 1940 = Pre-development target, 1995 = Existing, and Alternative 3D = Projected with implementation of Alternative 3D.

Plant Communities	Natural (Acres)	Existing (Acres)	Alt. 3D (Acres)	Difference Natural to Existing (Acres)	Difference Natural to 3D (Acres)	Difference Existing to 3D (Acres)
Mesic	9,194	55,058	18,388	45,864	9,194	-36,670
Hydric	11,260	2,273	10,433	-8,987	-827	8,160
Wet Pr / Sc Cyp	19,420	878	14,720	-18,542	-4,700	13,842
Cyp / Marsh	16,166	930	13,739	-15,236	-2,427	12,809
Open Water	3,254	155	2,014	-3,099	-1,240	1,859
Total	59,294	59,294	59,294			

Plant Communities	Natural (% Total)	Existing (% Total)	Alt. 3D (% Total)	Difference Natural to Existing (% Change)	Difference Natural to 3D (% Change)	Difference Existing to 3D (% Change)
Mesic	16	93	31	599	200	33
Hydric	19	4	18	20	93	459
Wet Pr / Sc Cyp	33	1	25	5	76	1,677
Cyp / Marsh	27	2	23	6	85	1,477
Open Water	5	0	3	5	62	1,300
Total	100	100	100			

Land Use and Habitat Types

Table 8 provides a list of the major land use, habitat types (1995 FLUCFCS codes), habitat acreage, and percentage of total habitat acres in the project area for pre-development and 1995 (existing) conditions. Table 8 also indicates the anticipated changes in land use and major habitat types that will occur under Alternative 3D post-restoration.

8. Management and Elimination of Point Source Discharges of Freshwater into Downstream Estuaries

The PSRP is located within the watershed of the TTI estuary. Faka Union Bay receives the majority of freshwater input from the PSRP through the main Faka Union Canal which collects flows from four project canals to the north. The canal system drains about 200,000 acres, receiving direct drainage from as far upstream as Corkscrew Swamp, 32 miles to the north. Faka Union Canal discharge records from a gauging station located upstream from the main outfall weir are available since 1969. These records indicate that average discharges for the period of

record were 115 cfs during the dry season (November through May) and 460 cfs during the wet season (June through October), with an extreme discharge of 3,200 cfs occurring right after the canals were built (Abbott and Nath 1996).

Bays adjacent to the TTI historically received freshwater input from the PSRP wetlands but flows were disrupted or circumvented by road development and the Faka Union Canal network. Alterations in timing and quantity of freshwater flows into an estuary can impact natural biodiversity of the estuary by affecting food availability, predation pressure, and reproductive success, as well as directly causing chronic and acute stress. Freshwater inflow can influence primary productivity, zooplankton biomass, and nekton abundance by influencing nutrient concentrations. Flow alterations have resulted in large fluctuations in salinity and water quality, which in turn impact critical estuarine biota. Salinity is a major ecological variable that controls important aspects of the estuarine community structure and food web (Myers and Ewel 1990). Salinity data collected at 30-minute intervals over three years within Faka Union and Fakahatchee Bays (Reference Site for the area) indicate alterations of the salinity pattern and fluctuation (Rookery Bay NERR, unpublished data). The average salinity for Faka Union Bay has been measured consistently lower in comparison to Fakahatchee Bay.

Riverine mangrove wetlands occur in floodplains near the mouth of freshwater systems and may be composed of all mangrove species. These wetlands receive nutrients from freshwater flow and are most sensitive to variations in this flow, as well as variations in water quality. Decreasing riverine runoff through channelization of adjacent drainages reduces inputs of nutrients and sediments to these forests and reduces water ventilation of mangrove roots (Lugo 1976).

Point source discharges, like Faka Union main canal, may increase sediment and turbidity in the water column resulting in limited light penetration and reduced seagrass and algal growth. Seagrasses provide food and habitat for many estuarine species, and low algal productivity can reduce the productivity of aquatic invertebrates, an important food source of many fish. Siltation is known to have deleterious effects on epiphytic organisms that are found on mangrove prop roots. High turbidity levels affect fish feeding and growth because the ability of fish to find and capture food is impaired at higher turbidity levels. In addition, gill function in some fish may be impaired after prolonged exposure to high turbidity levels. Sediments can also be contaminated with potentially toxic concentrations of metals, herbicides, and pesticides. Unnatural sediment deposition can limit the quality of the benthic communities (*e.g.*, seagrasses and oyster bars) by abrasion, habitat loss, and reduction of dissolved oxygen concentrations. These limitations, in combination with "freshwater shock," negatively affect the overall ecological health of the estuary.

Sediment loads can also increase oxygen demand. When turbidity is largely due to organic material, dissolved oxygen depletion may occur. Organics contain excess nutrients that encourage microbial breakdown, a process that requires valuable dissolved oxygen. The concentration of dissolved oxygen in the estuary is crucial to fish production, and fish kills often result from extensive or extended oxygen depletion.

Restoration of freshwater wetland and pre-development sheetflow conditions in the PSRP will reduce point discharges and improve the health of downstream estuaries. Restoration could result in a more natural salinity regime that, in turn, would increase the productivity of seagrasses, oysters, fish, and other estuarine-dependent species. However, freshwater flow to the estuaries may be altered in a way that is not beneficial. A carefully engineered design combined with year-round management and adaptive assessments of these flows is critical to project success. Designs that do not depend on structural components will better approximate the natural system and prevent management decisions that may be driven by flood control issues. Careful management to prevent point source discharges during most of the year or even over several years can be neutralized by one incorrect management decision at a critical time.

Conversely, a reduction in flow resulting from too much water being held in the watershed (more likely during the dry season) can create lower salinities that would be harmful if prolonged (1 week or more). Water held in canal systems in NGGE for purposes of water supply can actually damage downstream estuaries. Poor timing and gradual versus rapid releases of freshwater flow into the estuary can affect reproductive and migration cycles of estuarine species. Detailed estuarine mixing models to predict the effects of the project plan and any operational plan for water management are not available. Therefore, developments of a conservative Operational Manual that favor estuarine protection strategies are critical. These plans should include adaptive management strategies based on the impacts of water management practices on the downstream estuary as indicated by project monitoring plans. An estuarine mixing model should be developed and utilized to examine the relationship between Faka Union Canal outflows and Faka Union Bay and adjacent bay salinity isohalines under various operational alternatives, and should be designed to accommodate changes in overland flows.

As stated previously, there is a strong connection between freshwater outflows from the southwest Florida coast, Florida Bay, and the upper Keys (Lee et al. 2002). Therefore, benefits or adverse effects of water management related to this project should be considered with regard to their potential for restoration of the larger marine ecosystem, including the Florida Keys National Marine Sanctuary.

Protection of Threatened and Endangered Species

Differences in the location and acreages of habitat derived from the NRCS pre-development and existing condition maps and model output maps are significant. An additional explanation is needed to estimate the model's accuracy in predicting the distribution of plant communities under pre-development, existing, and future with and without the project. This information is particularly important to assess the effect of the project on listed species and their critical habitats under the ESA.

In addition, the effects of levees, berms, and other project infrastructure must be evaluated at the detailed design stage to determine if additional project impacts on listed species will result.

West Indian Manatee

The projected reduction of average freshwater flows in the Faka Union Canal during the dry season (November-May) is likely to influence manatee use of the canal and their distribution throughout the region. Project alternatives will reduce wet season freshwater discharges in the Faka Union Canal as well, which should restore watershed connections to the adjacent Blackwater, Pumpkin, and to a lesser degree Fakahatchee Bay estuaries. Restoration of the watershed may contribute to additional manatee use of these natural freshwater sources as opposed to the existing freshwater point-source discharges from Faka Union Bay. However, USGS biologists hypothesize that during cold periods (water temperature < 20°C), manatees will continue to aggregate in the POI basin south of the PSRP, in part because of thermal buffering provided by the deeper water, as well as to drink freshwater seeping through the weir at the head of the canal. During warmer periods (water temperature >20°C), manatee use of the canal may depend on the availability of freshwater at the canal versus at nearby rivers. Use of the canal may decrease significantly, particularly if adjacent rivers are receiving greater freshwater input than the canal and are closer to feeding areas. The effects of the project on manatees should be considered for three seasons: spring (dry season), summer/fall (wet season) and winter (cold dry season). USGS is currently in the fourth year of monitoring manatees in the TTI and will complete a second year of monitoring this winter which will focus on manatee behavior during the cold dry season. USGS is also monitoring manatees in Whitewater Bay. The Service began monitoring manatees in 1999 using aerial surveys; this work continues.

Because use of the Faka Union Canal brings manatees into proximity with boats, it is possible that boat-related deaths and injuries in this region will be reduced (two manatees that died as a result of watercraft-related injuries were recovered in the canal in May of 2004) if manatees become less reliant on the canal as their major source of fresh water and do not seek areas of higher boat traffic. A change in manatee use of the Faka Union Canal during periods of cold stress could also change exposure to boat traffic, but this effect is less likely provided the thermal buffering in the canal is not changed due to restoration. However the presence of idle speed zones in the Faka Union canal vs. limited or non-existent speed zones in manatee habitat outside of the canal is a factor in the continuing analysis of project effects on the manatee.

It has been the Service's position that monitoring of the effects of the project on manatee behavior is necessary to determine the project effects and monitor potential incidental take of the manatee population. Initial baseline studies of manatee movements in the TTI area have been conducted by the Service, FWC, and USGS. Monitoring and funding of this year's dry season manatee movements and additional monitoring during construction and post-construction are necessary to assess restoration benefits and minimize effects on the manatee population. Funding for this monitoring should be included in the project monitoring plan unless funding is available from other agencies or programs.

Because there is currently no estuarine model for the project that can quantify changes in flow to individual downstream estuaries, an evaluation of proposed alternatives is based on estimating changes in point source discharges in relation to existing conditions. The preferred plan will result in changes in surface water discharge rates and timing from the Faka Union Canal to downstream estuaries as well as overland flow to adjacent estuaries from river receiving

additional overland flow from the restored watershed. Information on the volume, rate, and timing of freshwater releases through this system will need to be quantified to better define the anticipated effects of the project on manatees and manatee critical habitat. Information on the Faka Union basin water temperature and salinity will be necessary to determine the effect of the project on the warm water refugia at the site.

Red-Cockaded Woodpecker

The project site is not currently documented as RCW habitat, although active clusters are located in the adjacent Belle Meade portion of PSSF (two miles west of the PSRP) and in BCNP (37 miles east of the project). Habitat evaluations based on the hydrological model indicate that a significant acreage of flatwoods will be replaced by cypress and other wetland communities as a result of the restoration. Although flatwoods will be lost, it is the intent of the restoration to improve the quality of the remaining pine flatwoods and potentially restore a forest that can support additional RCW clusters. It is also the intent of the restoration to protect pine strands that under natural condition were located on slightly elevated ridges that ran parallel to the southwesterly wetland flow patterns on the site. The geographic location of flatwoods communities on the post-restoration site will also be important in enhancing regional RCW populations. Forest restoration would contribute to adjacent public lands management of this endangered species, and possibly contribute to regional recovery of the RCW population in southwest Florida by increasing the number of RCW clusters/foraging habitat and providing a forested "bridge" of habitat for RCWs to disperse over a wider landscape.

Florida Panther

It is expected that the project will increase the panther's ability to feed, breed, and shelter as a result of hydrologic restoration of both wetlands and uplands on the project site. To restore panther habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to the natural condition. Since small changes in water elevation (*e.g.*, six inches) and/or hydroperiod (*e.g.*, one month) can completely alter plant communities in southwest Florida, it is critical that: 1) predicted water elevations/hydroperiods be as accurate as possible; 2) adaptive management seek to monitor restoration effects on vegetation; 3) panther prey be evaluated in an adaptive management program; and 4) water management of the site be strictly conducted and monitored. A major feature of the restoration is the removal of the majority of the 279 miles of road grid. This is important to the panther because it would reduce vehicle-related mortality, decrease human disturbance to panthers and panther prey, reduce exotic plant invasion which tends to be more severe near disturbed roadsides, and result in thousands of acres of restored habitat. Since the project will be managed as a State forest by the DOF, it is also important that the road plan be reviewed with regard to potential effects on the panther from loss of habitat and recreational uses, including hunting and off-road vehicle (ORV) use.

Wood Stork

It is critical that natural hydroperiods be established in post-restoration wetlands to support surface water connections (sheetflow) between wetlands to allow fish dispersal and establish dry-

season or drought-resistant refugia, increase the extent and quality of wetlands, decrease competition between forage fish species, reduce predation on forage fishes, and reduce unwanted exotic fish species that compete with forage fishes.

Canals that remain on the site will provide permanent habitat for predatory species of native and exotic fish. Predatory fish prey upon smaller fish species that provide an important forage base for wood storks. Wet season rainfall could allow predatory fish access to isolated wetlands and increase predation of small fishes on the site, reducing the small fish forage base used by wading birds, including wood storks.

Since minor changes in water elevations and hydroperiods can completely alter plant communities in southwest Florida, it is critical that: 1) predicted water elevations/hydroperiods be as accurate as possible; 2) adaptive management seek to monitor restoration effects on vegetation; and 3) water management of the site be strictly conducted and monitored. Operational plans for project infrastructure are critical in determining the effects of the project on wood storks. During wet years, water management practices could prevent the formation of shallow pools that concentrate wood stork forage fishes. During dry years, water management practices could over drain the freshwater sloughs, reduce freshwater flows into the downstream estuaries, and reduce wetland productivity of wood storks forage fishes. Variable water management practices could increase or decrease frequencies of wood stork nest failure in area rookeries.

Eastern Indigo Snake

It is expected that the project will increase the eastern indigo snake's ability to feed, breed, and shelter, as a result of hydrological restoration of both wetlands and uplands on the project site. To restore indigo habitat, it is important to be able to predict, design, and construct a project that will restore habitats as close as possible to natural conditions. It is also critical that the majority of the 279 miles of road grid be removed and that post-project site habitat management occurs.

9. Improved Water Quality

Implementation of the restoration plan will improve the water quality of coastal estuaries. This would occur by moderating the large salinity fluctuations caused by freshwater point-source discharges through the Faka Union Canal and distributing these discharges via overland sheetflow to the downstream estuaries.

Increasing development pressure north of the project area raises concerns over the elevation of nutrient loads and fecal coliform concentrations in the surface waters of the project area. This and other nutrients derived from vegetation killed as a result of restoration efforts could potentially encourage the growth of nuisance plant species. It would be important to monitor the PSRP for nuisance species (*e.g.*, cattails and primrose willow) and provide control measures before they spread and dominate an area. If phosphorus levels become sufficiently high as NGGE develops, it may become necessary to treat canal inflows to protect the character of the PSRP's natural plant communities.

The NGGE may be contributing nutrient concentrations that can cause algal blooms under certain environmental and seasonal conditions. Data from monitoring sites located at the inflows of the project area along the Faka Union and Merritt Canals indicate mean phosphorus concentrations of 15 parts per billion (ppb). The estuarine sampling site located at the outfall of the Faka Union Canal weir averaged 20 ppb. An outlying concentration of 150 ppb was also obtained at the estuarine site. While there have been no indications that these concentrations have caused algal blooms within the study area (chlorophyll is used as an indicator of nutrient enrichment, and no violations for chlorophyll were found at the Faka Union site going into the estuary or in monthly data collected within the estuaries), the downstream estuarine systems are classified as extremely oligotrophic. Impairment of water quality from sustained high levels of nutrients would be a concern.

Another potential impact to the water quality of receiving waters after sheetflow is re-established would be the presence of extensive off-road vehicle trails in the southwestern portion of the project area. Flow across these denuded areas could increase sedimentation effects on the marsh vegetation and elevate turbidity levels in the creeks to the south.

The Service recognizes that several of the primary goals of this project provide excellent opportunities for water quality improvements. Science-based performance measures should be employed in order to insure benefits to water quality. Water quality performance measures for the PSRP should focus on specific restoration targets for estuaries. Achieving restoration targets in the downstream estuaries will also indicate success in achieving water quality objectives for the freshwater components of the project area. Protocols for waterflow through the Faka Union Canal should enable flows to closely mimic the salinity regime occurring in Fakahatchee Bay. The Fakahatchee estuarine area is mainly influenced by Fakahatchee Strand which closely mirrors an unaltered Everglades system and would simulate the natural freshwater to saltwater interface relationship that once occurred throughout the TTI area.

The Service is concerned about the quality of the water that will be received by TTI NWR from Faka Union Canal and through Bad Luck Prairie. These concerns include contaminants and nutrients, such as phosphorus. The project water quality monitoring plan should include the TTI NWR.

Reduced Contaminants

The Service believes that the District and URS are adequately assessing potential ecological risks on the PSRP property. The Phase I and II Environmental Site and ERA is well-designed, was coordinated early and throughout the plan development process with the Service, is comprehensive in scope, and represents the state-of-the art in ecological risk assessment.

The Service previously identified several miscalculations, errors, and other problems with the k_{oc} and k_{ow} values for dieldrin and chlordane presented in the District's ERA completed on September 30, 2003. These errors could lead to a significant underestimation of risk to fish and wildlife resources. In a letter to the District dated March 23, 2004, the Service recommended either repeating the laboratory studies and recalculating the k_{oc} and k_{ow}, or using

the literature values for these parameters in the ERA. In subsequent discussions, the District verbally agreed to use the literature values of these parameters in risk calculations for this property, rather than repeating the laboratory studies.

Based on the literature values of the k_{oc} and k_{ow}, the Service calculated cleanup goals of 100 ppb and 6 ppb for chlordane and dieldrin, respectively. All soil locations with measured concentrations above these levels would require delineation and some type of remediation. The District verbally concurred with these cleanup goals.

Potential Ecotoxicity of Selenium

Establishing a threshold toxicity screening level for selenium is very difficult because toxicity to aquatic invertebrates, birds, and mammals (including humans) occurs at approximately twice the amount required for nutritional needs (Lemly 1997). Research initiated since selenium induced poisoning of fish and wildlife at Kesterson NWR was observed (early to mid-1980s) has generated an extensive database regarding the physiological effects of waterborne and dietary exposure. Much of this work has attempted to correlate selenium concentrations in sediment and water to adverse effects to receptor species, ranging from teratogenesis and failed reproduction to mortality (DOI 1998).

Recent research indicates several pathways exist, which influence toxicity by cycling selenium throughout the aquatic food web as it readily mobilizes between and among sediments, water, and the biota (Lemly 1997, DOI 1998). Two of the most important pathways used to cycle selenium between water and the biota are: 1) uptake by rooted plants, and 2) uptake by bottom-dwelling invertebrates. These two scenarios increase the potential for the exposure of invertebrates and fish through the dietary route from highly contaminated plant material/detritus, even in aquatic systems demonstrating low selenium concentrations in the water (Lemly and Smith 1987). This effective mode of mobilization contributes to the bioaccumulation of selenium in fish from 100 to 30,000 times that of the water, depending upon the species and type of tissue sampled. Biomagnification of selenium usually ranges from two to six times between primary producers (algae and macrophytes) and the lower consumers such as zooplankton, invertebrates, and fish (Lemly 1997). Lemly (1997) reported that fish could eat contaminated plankton or benthic invertebrates demonstrating accumulated selenium concentrations four times that of their food, (*i.e.*, phytoplankton, periphyton), which in turn could contain 500 times the selenium concentration found in the water.

Lemly (1997) summarized the findings of several documented studies (Belews Lake, North Carolina, and Kesterson NWR, California), indicating that concentrations as low as 5 micrograms/liter (µg/l) in water presented a moderate to high risk to invertebrates, fish and birds. This is comparable to the lowest observed adverse effect level (LOAEL) range of 1 to 3 ug/l for bioaccumulation in fish and birds reported by the DOI (1998), derived from information collected across the western United States.

Risks from selenium in sediments do not appear to be as clearly correlated among research efforts summarized by Lemly (1997) or DOI (1998). Lemly (1997) reported that selenium concentrations ranging from 3.0 to 4.0 milligrams per kilogram (mg/kg) in sediments presented a

moderate risk to fish and aquatic birds from dietary accumulation from benthic invertebrates to fish and birds. The DOI (1998) reported that the maximum No observed adverse effect level (NOAEL) response boundary for birds nesting at shallow terminal ponds is 0.4 mg/kg and the minimum total response EC_{100} was 1.0 mg/kg. The EC_{10} (adverse affects observed for 10 percent of the exposed population) for selenium exposure to fish and birds utilizing a variety of freshwater aquatic systems was 2.5 mg/kg and the EC_{100} was greater than 4.0 mg/kg. The DOI report indicated that normal background selenium should range from 0.2 to 2.0 mg/kg. These risk interpretations demonstrate a high degree of variability between and among aquatic systems (shallow terminal ponds and other various freshwater systems) and geography (west verses east United States).

Potential Ecotoxicity of the Organic Contaminate of Potential Environment Concerns

Chlordane is an organochlorine insecticide and a member of the cyclodiene-type family of compounds (Chambers 1994). Effects attributed to chlordane exposure include blood dyscrasia, hepatotoxicity, neurotoxicity, immunotoxicity and cancer. Possible mechanisms of toxicity relevant to all target organs include the ability of chlordane and its metabolites to bind irreversibly to cellular macromolecules, inducing cell death or disrupting normal cell function. In addition, chlordane may increase tissue production of superoxide, which can accelerate lipid peroxidation, disrupting the function of cellular and subcellular membranes. Chlordane also induces its own metabolism to toxic intermediates, which may exacerbate its hepatotoxicity. This may involve suppression of hepatic mitochondrial energy metabolism.

Chlordane, banned in 1988, has been applied extensively to control pestiferous soil invertebrates, usually at rates between 0.6 and 2.24 kg/hectare (ha). Within this range sensitive, non-target species, especially earthworms, were adversely affected.

Nominal water concentrations between 0.2 and 3.0 µg/l were harmful to various species of fish and aquatic invertebrates. Effects included a reduction in survival, immobilization, impaired reproduction, histopathology, and elevated chlordane accumulations. Cis-chlordane, when compared with trans-chlordane, was more toxic, preferentially stored, and concentrated to a greater degree. In aquatic organisms, cis-chlordane photoisomers were frequently more toxic than the parent form. Oxychlordane was not a major metabolite in aquatic fauna.

Sensitive bird species had reduced survival after consumption of diets as low as 1.5 mg chlordane per kg of ration, or after a single oral dose as low as 14.1 mg/kg body weight (BW); accumulations were documented in tissues following consumption of diets containing 0.1 to 0.3 mg of chlordane per kg of feed. Oxychlordane was the most persistent metabolite in avian brain tissue.

There is concern regarding the continued widespread use of chlordane because of its ability to cause liver cancer in domestic mice. Other adverse effects in mammals, such as elevated tissue residues and growth inhibition, were frequently associated with diets containing between 0.76 and 5.0 mg of chlordane per kg of feed. Metabolism of technical chlordane by mammals results primarily in oxychlordane, a metabolite that is about 20 times more toxic than the parent compound and the most persistent metabolite stored in adipose tissues. Chlordane interactions

with other agricultural chemicals produced significant biological effects in warm-blooded organisms, indicating a need for additional research on this subject.

Chlordane, like many of the insecticides, is not overly toxic in vascular plants. This is presumably due to the lack of nervous system structures normally associated with its effects.

Chlordane has been used extensively to control grubs, ants, snails, and other invertebrates in soil. Chlordane was applied to wheat crops in India at 0.6 kg/ha to control an infestation by two species of termites (*Odontotermes obesus* and *Microtermes obesi*). This chlordane application rate was effective and increased grain yield, but an application rate of 0.4 kg/ha and lower was not effective (Eisler 1990). Fly and beetle larvae in soil were killed by an application of chlordane at 1.12 to 2.24 kg/ha, which also caused reductions in populations of various species of non-target soil invertebrates. Significant reductions in earthworm populations were recorded following application of 2.2 kg/ha (Eisler 1990). The most significant chronic effect in invertebrates exposed to chlordane is survival. The lowest reported chronic values for fish and invertebrates ranged from 1.09 (non-daphnid invertebrates) to 1.6 µg/l (fish) (Suter and Tsao 1996). Eisler (1990) reports immobilization, impaired reproduction, and histopathology recorded in fish and planarians between 0.8 and 3.0 µg/l. This suggests that the most significant chronic effects in fish are on survival and reproduction.

No specific information was identified on direct effects of chlordane in amphibians and reptiles. However, it is believed they may also be sensitive to chlordane.

The most sensitive birds tested against technical chlordane were California quail (*Callipepla californica*), with an acute oral Lethal Dose $(LD)_{50}$ of 14.1 mg/kg BW; ring-necked pheasant (*Phasianus colchicus*), with an acute oral LD_{50} of 24 to 72 mg/kg BW; and European starlings (*Sturnus vulgaris*) fed diets containing 1.5 mg/kg ration for 57 days or 6.25 mg/kg for 24 days. No truly chronic dietary studies of chlordane were located at the time of this writing for birds. A 40-day oral LD_{50} was reported at 5.47 mg/kg-BW per day as was a LOAEL on survival of red-winged blackbirds at 10.7 mg/kg-BW per day for an 84-day exposure. Based on such limited information, the most significant effect cannot be established. However, given the mammalian response, it is believed to be on survival. Results of chronic feeding studies in mice (which appear to be the most sensitive of mammals tested) showed that doses ranging from 3.9 to 6.5 mg/kg-BW per day were effective in reducing survival over 80-week and 18-month exposure periods, respectively. Survival appears to be the most significant chronic effect associated with chlordane in mammals.

Dieldrin

Dieldrin is a member of the cyclodiene class of organochlorine pesticides and is very similar in structure to aldrin. Aldrin rapidly breaks down to dieldrin in the field. Like other organochlorines, it is very persistent in the environment and tends to bioaccumulate and biomagnify in the food chain. Dieldrin is very toxic to birds. In experimental studies, as little as 1 µg/g in the diet has been shown to be lethal. In one of the most vivid examples of dieldrin toxicity, there was a virtual elimination of most species of terrestrial mammals when dieldrin was applied in Illinois to control the Japanese beetle. In experimental studies, dieldrin has

induced adverse reproductive effects in birds, but evidence from the field has indicated that this pesticide is unimportant in eggshell thinning. From 1964 to 1977, dieldrin was identified as the cause of death in 28 bald eagles out of 444 examined. Dieldrin, in concert with DDT, was probably responsible for the dramatic declines of the Eurasian sparrowhawk, merlin, and peregrine falcon in Europe and the eastern United States in the 1960s and early 1970s.

Roadbeds

Four asphalt core samples were collected throughout the PSRP site to determine if the use of removed asphalt road beds for fill would increase risk to fish and wildlife resources. Asphalt core samples indicated that the substrate was relatively inert. However, the Service believes that asphalt roadbed should be used as a last resort, only after all gravel roadbeds have been removed. Asphalt can be recycled and that option should be explored. If sufficient amounts of fill are not available on-site to complete restoration, the District should investigate other sources of fill outside the project impact area prior to using asphalt.

Former Agricultural Northeast (FANE) (*Resampling Results*)

The additional sampling for the FANE did not detect selenium at any level of concern. While it is difficult to explain the initial high levels of selenium detected in this area, two resampling efforts have failed to confirm the original selenium results. Therefore, the Service is of the opinion that widespread high selenium levels in this area are unlikely. Rehydration and restoration of this area (Prairie Canal) should not present a risk to fish and wildlife resources.

Former Agriculture Southeast (FASE) (*ERA results)*

Desorption studies conducted on bulk sediment produced a selenium concentration of 15 ppb in pore water. It is not known what selenium levels might result in surface water in the FASE, but it will be something less than 15 ppb. Levels above 2-3 ppb are considered to represent a risk to avian species.

The results of the ERA for the FASE indicate that selenium in grids 25 and 29 pose minimal risk to small mammals. The ERA also concludes that there is no risk to birds from selenium. The Service does not agree that this lack of effects to avian species has been demonstrated with a high degree of confidence, since in the original composite sampling exceeded 3 parts per million (ppm) selenium, a level known to have had adverse reproductive effects on birds in other parts of the country.

Former Agriculture West (FAW) (*ERA Results*)

Exposure to dieldrin- and chlordane-contaminated soils from the FAW caused significant mortality and growth reduction in test organisms. Ten-day sediment toxicity assays for the FAW indicated that neither survival nor growth was affected in *Hyalella azteca* for Grid 16 soils, but growth of this species was affected by the Grid 1 sample. Both the survival and growth of *Chironomus tentans*, however, was significantly affected by exposure to both grids of concern compared to controls. Soils from Grid 1 produced 99 percent mortality in *C. tentans*.

The 28-day bioaccumulation test for the FAW using bulk samples from two showed significantly elevated levels of alpha- and gamma-chlordane in *Lumbriculus variegates*. One grid bulk sample also showed elevated levels of dieldrin in *L. variegates*.

The results of ERA modeling suggest that total chlordane found in this area poses a significant risk to sediment-dwelling organisms in four grids of the FAW. Dieldrin levels found in one grid of the FAW pose a significant risk to sediment-dwelling organisms as well. These modeling results are supported by the sediment toxicity tests discussed above.

The District verbally concurred with literature based cleanup goals of 100 ppb and 6 ppb for chlordane and dieldrin, respectively, and is currently conducting further sampling and analysis to delineate areas within the FAW requiring cleanup.

In contrast to the URS data provided in the ERA, sampling activities conducted by the DEP indicated large areas of high chlordane contamination within the PSRP FAW and the adjacent Belle Meade property. Forty-two of the 135 discreet samples collected by the DEP in these areas exhibited concentrations above the 100 ppb suggested clean-up criterion. The mean chlordane concentration for the entire area sampled by DEP was 222 ppb, compared with 5 ppb determined by URS. Similarly, the DEP 95 percent upper confidence limit (UCL) was 343 ppb compared with 8 ppb from URS data. Since there is no reason that we are aware of to question the validity of the DEP data, this data must be given equal consideration with the URS data. The Service recommends combining the DEP data with the URS data in all statistical calculations in order to obtain an unbiased idea of the total areal extent and magnitude of chlordane contamination. All hazard quotients (HQs) for chlordane should be recalculated based on this combined dataset.

Interior (*ERA Results*)

URS determined that the sampling results for the Interior Area did not warrant further consideration or risk assessment activities. After reviewing the information presented, the Service is in agreement with this conclusion.

Lands West of PSRP

When evaluating impacts to Federal trust resources from a project, the Service must consider all impacts, even if they occur outside the project boundary. Raising the water table in PSRP will rehydrate areas of the adjacent former agricultural lands to the west, attracting wading birds and other trust resources to those areas. Sampling conducted by the DEP in the adjacent Belle Meade area showed even higher levels of chlordane than those found on the PSRP property. In our March 23, 2004, letter, the Service recommended that a sampling plan be developed to assess the extent of contamination and remediation that may be necessary on those (primarily public) lands west of PSRP that will be affected by this project. The District completed this assessment and on August 17, 2004, submitted a draft document to the Service for review.

10. Improved Operational Plans

The draft Operational Plan in this report is difficult to evaluate and does not appear to reflect operations developed for the purposes of environmental restoration. We are providing recommendations in section 10.G that address our concerns with the current plan.

Since the completion of the draft PIR/EIS, additional modeling was initiated to refine and optimize the operational plan. It is imperative that the operational plan be updated to reflect the results since the operational plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics should be updated to ensure consistency between project modeling and project assurances.

11. Fish and Wildlife Resource Management

The DOF has prepared a draft Environmental Assessment (EA) (DOF 2003) and is preparing a Ten-Year Resource Management Plan for the PSRP that will detail management activities to complement the hydrologic restoration of the PSRP project. The CARL project proposal sets forth the purpose for land acquisition of the project site as follows:

- Preservation of habitat critical to or providing significant protection for endangered species;

- Restoration of an altered ecosystem to correct environmental damage that has occurred over the past 40 years, including:
    - Restoration of natural patterns of waterflow into the Fakahatchee Strand.
    - Restoration of productive wetlands systems,
    - Reduction of water losses – increased amount of freshwater entering the aquifer.
    - Improvement of productivity (natural systems ad functions) in the bays and estuaries, and
    - Furtherance of the objectives of the Big Cypress Area of Critical State Concern (Chapter 28-25 F.A.C., Chapter 380 F.S.); and

- For use as a State preserve or wildlife management area;

Consistent with these purposes, DOF has developed the following objectives to manage the site:

- Restore, maintain and protect all native ecosystems; including, the health and diversity of native biological communities (flora and fauna) associated with these natural areas;

- Ensure the long-term viability of populations and native species considered rare, endangered, threatened, or of special concern;

- Restore, maintain and protect hydrologic functions related to the quality and quantity of water resources and the health of associated wetland and aquatic natural communities;

- Protect and preserve known archeological and historical resources;

- Restore and maintain forest health and productivity by practicing sustainable forest management utilizing sound silvicultural techniques to create an old growth forest that yields multiple ecological benefits;

- Provide research, education and interpretive opportunities related to natural resource and ecosystem management;

- Provide for compatible public access, integrating human use through a program of resource-based forest recreation, not emphasizing any particular use over the others, or over the restoration, maintenance and protection of native ecosystems; and

- Provide necessary resources in order to accomplish all identified goals and objectives.

The draft Preferred Alternative B of the EA is Multiple Use Management which includes exotic control management, prescribed burning, wildfire control, forest product sales, and dispersed recreation such as camping, hunting, fishing, hiking, horseback riding, and mountain biking. The details of the onsite management plan and their effects on listed species and fish and wildlife resources will be reviewed by the DOI consistent with the Interim Use Agreement, the FWCA, and ESA. Issues that will affect resources include: 1) road access for private property and ORV use; 2) the type, location, frequency, and effects of ORV use, 3) forest productivity and harvest; 4) the extent and type of hunting; 5) the extent and type of passive recreational uses; 6) prescribed and wildfire management; 7) listed species management; and 8) exotic/invasive plant and animal control.

Extensive recreational uses, particularly illegal ORV use and hunting, occurred prior to DOF management, but are now either prohibited (*e.g.*, ORVs) or managed (hunting consistent with FWC's Wildlife Management Area designation). These uses affect restoration of fish and wildlife resources on PSRP and adjacent State and Federal lands. Proposed recreational uses must be consistent with restoration objectives and applicable State and Federal laws, and will be reviewed as such by the DOI.

12. Improved Road Plans

In August 2000, the PSRP PDT approved a plan that specifies the disposition of PSRP project roadways after restoration and included road location, type of use, and grade (elevation). A modified road plan, dated March 2003 was developed by DOF, the Corps, and the District and was included in a 2003 memorandum of understanding (MOU) between Collier County, the District, and DEP. Issues that have not been resolved with regard to this plan include: 1) extension of Miller Boulevard as a primary road further south and its effects on hydrologic restoration and listed species; 2) the amount, type, and management of proposed public access/use on project roadways as specified in the MOU and its implementation through the DOF management plan; 3) design of hydrological restoration across east-west roadways; 4) project infrastructure roadway location and effects, especially pump access roadway improvements to Berson Boulevard or existing canal berms north of the pump station locations;

5) multiple-use issues as proposed in a future resource management plan; and 6) elevation of roadways remaining in the project.

Appropriate Size and Location of Levees

Flood protection levees that will protect private or public property from flooding that may result from project construction and operation will have an effect on fish and wildlife resources and listed species. The exact scope and location of these levees will be determined in the detailed design and construction phase. These berms have the potential to: 1) reduce restoration benefits on both the project site and adjacent public lands; 2) impact fish and wildlife resources both on and off the project site; 3) conflict with previously agreed to mitigation areas or project purposes on adjacent property where Service consultation under the FWCA and ESA has occurred; 4) increase project costs at the expense of restoration; and 5) introduce exotic plants. The Service will seek to eliminate or minimize levee designs which decrease restoration benefits or adversely affect listed species. These include the extensive levees around the agricultural areas located west and southwest of the project area, levees that are constructed to access pump stations, and levees on TTI NWR adjacent to Faka Union Canal.

13. Water Demands

The City of Naples and Collier County each withdraw about 20-25 million gallons of water every day from the Faka Union Canal Watershed. During a recent drought event, water withdrawals attributed to the City of Naples wellfield contributed to a significant lowering of Faka Union Canal in NGGE. This groundwater drawdown was cited as the cause of some residential well failures in the adjacent NGGE. A primary goal of the PSRP is to restore groundwater levels within the upper watershed. Water supply needs in the upper watershed during the dry season should be specifically analyzed with respect to the effects on water made available to the PSRP during the dry season. If an operational and water management plan is established to contribute to dry season flows to the estuary, then watershed demands for the same water that exceed the current demand must be assessed. If more water is held in the upper Faka Union Canal system to alleviate drawdown concerns from water demands, then the effects of that management action should be considered in the operational plan for this project.

14. Soil Conservation

Many wetland soil types in South Florida are geologically young and subject to rapid oxidation during the dry season. As wetlands are drained, organic soils that support wetland vegetation are destroyed by fire, oxidation, shrinkage and/or compaction. The process responsible for formation of these soils cannot take place during a shortened hydroperiod. Loss or degeneration of soils may be particularly destructive in deeper wetlands such as cypress sloughs, and may hinder recovery of these habitats even when hydrology is restored. Soil subsidence can make forests more susceptible to wind-throw during storms or hurricanes.

15. Implementation of Monitoring Plans

The Service has assisted in the preparation of an Ecological and Water Quality Project Monitoring Plan (Appendix H of the Draft PIR/EIS) and associated budget. This plan would provide for baseline, construction, and post-restoration monitoring of water quality, ground and surface waters, vegetation, wading birds, aquatic fauna, small mammals, oyster health and ecology, oyster reef fish populations, nekton, mangrove/salt marsh vegetation boundary, and federally and State-listed species. A significant portion of the plan has not been completed consistent with PDT working group efforts. It is absolutely essential that this plan be completed and funded for the Service to support this project.

16. Assessment of Project Performance Measures

The Service is of the opinion that the estuary performance measures are very qualitative and that a predictive tool would greatly help the quantification of benefits in the estuary. At a minimum, GIS analysis of estuarine habitats combined with best professional judgment is needed. Additional agency personnel may need to be brought into this group and consideration should be given to using other models, such as the Wang/Browder Faka Union model.

There is a lack of project-level performance measures corresponding to dry season conditions and extreme water levels for this project that are addressed in RECOVER's system-wide performance measures. In addition, the (Regional Evaluation Team [RET] of RECOVER) concluded that three of the PSRP alternatives (Alternatives 3D, 6 and 12) will meet or exceed only two of the three performance expectations outlined in the CERP. Additional information is necessary to evaluate the third performance expectation dealing with groundwater recharge.

17. Alternatives Development

The PIR should provide information regarding estimates of Real Estate acquisition for NGGE as referenced for Alternative 6. Acquisition in portions of NGGE was considered during the alternative selection process as a potential means to increase the area of hydrologic restoration in PSRP, reduce pump size, reduce engineered infrastructure, and protect wetland resources in existence under current conditions in NGGE. There was considerable discussion and no agreement on the area potentially affected by flooding, the threshold (increases in stage or duration) at which flooding was acknowledged as impacting residents, nor which models (MIKE-SHE or other) were used to assess this issue. The Service is of the opinion that the area of NGGE calculated for purchase in Alternative 6 may be overestimated. More precise information should be provided to help determine the actual potential cost of this alternative to insure that it is fairly and accurately weighed against other project alternatives. Elements of Alternative 6 could be applied to the selected alternative to reduce the costs of engineered infrastructure and associated maintenance.

18. Protection of Wetlands in NGGE

Extensive wetland communities still persist in the eastern portion of NGGE (the headwaters of the Picayune Strand which is the project namesake), in portions of the Belle Meade part of the

PSSF, and in the vicinity of private agricultural holdings southwest of the project site. The presence of these wetlands contributes to the perception of "flooding" in these rapidly developing areas. Cost of the project attributed to meeting the "takings" test and the Savings Clause are associated with the extent and cost of mitigating for developable land in NGGE and other areas affected by the project. Wetlands in NGGE have also been considered or excluded from consideration under various Corps' nationwide and general permits specific to that area and were singled out for consideration by the "EIS on Improving the Regulatory Process in Southwest Florida, Lee and Collier Counties, Florida" (Corps 2002). There is an extensive history of controversy over jurisdiction, location, protection, and mitigation for wetlands in NGGE involving the Corps' 404 permitting program. The cost to the public of the loss of what was originally estimated to include 79,000 acres of wetlands for the entire GGE subdivision in a 1980s study (Conservancy 1986) was between $5,475,000 and $6,740,000 in 1985 dollars. The intent of E.O. 11990, May 24, 1977, Protection of Wetlands, is for Federal agencies to take a leadership role in "minimizing the destruction, loss or degradation of wetlands." To fulfill this intent, it is necessary to characterize the wetlands in the affected NGGE area and other areas affected by the project. The effect of the project in maintaining or improving the condition of these wetlands is essential to determining if benefits attributed to the project are actual, and to reduce estimated and future costs associated with public perceptions that the restoration project may be responsible for increased flooding in developing areas.

Groundwater resources in NGGE and surrounding areas may also be affected by the project. The existing and potential self-supply for the 101 square-mile area of NGGE, as well as the effects of permitted water supply demands of the City of Naples wellfield in NGGE, should be included in project analysis on water supply and demand within the project area watershed.

19. Assurances (Savings and Water Identified for the Natural System)

The Service provided comments on Section 12 of the draft PIR/EIS, project assurances, in a letter dated July 13, 2004. On August 24, 2004, we received draft responses from the District. A response from the Corps has not been received to date nor is a new version of Section 12 available for review. Additionally, we continue to have unresolved concerns with the modeling used to simulate the project and evaluate project assurances. We are therefore unable to determine whether the Corps' findings are adequately presented and substantiated. This section provides a summary of our existing concerns and outlines some of the modeling issues addressed in Section IV (b) (5) as they pertain to project assurances. Readers should also refer back to the July 13, 2004, letter for detailed comments (Appendix A).

The PSRP restoration project is primarily aimed at rehydrating over-drained wetlands in the project area. Through accomplishment of the project's purpose, improvements in the quantity, timing, and distribution of flows to the estuaries should be achieved by reducing damaging point source flows that currently exist. Since the project is hydrologically isolated from the regional system and designed to increase water levels within the project footprint, meeting the assurances required by WRDA is relatively straightforward in that an analysis of overall regional water management changes is not required. It is important to the Service that the benefits of the plan are achieved for the natural system. We believe that the methods employed to identify water to

be dedicated and managed for the natural system, including water made available by the project, are incomplete and will be providing detailed comments in section 10.M.

In our original comments we recommended that the estuarine team be consulted on the spatial and temporal scale chosen to evaluate the existing legal sources for the downstream estuary. Graphics indicate that total flows may be met on an average annual basis but not on a spatially distributed seasonal basis. Therefore, we reiterate this recommendation. The temporal and spatial scales for the evaluation of existing legal sources for fish and wildlife should be consistent with the opinion of the scientific and technical teams responsible for selecting performance measure targets and performing evaluations of fish and wildlife resources.

Our original comments failed to communicate that we found technical errors in the x-axis scale bars for the following graphics: 12-11, 12-12, 12-13, 12-19, 12-20, 12-21, 12-23, 12-24, 12-25, 12-27, 12-28, and 12-29. Time intervals on the x-axis of these graphics represent varying lengths of time from 1 month to several months.

Additionally, several modeling issues were identified in an interagency meeting held on August 10, 2004. At this meeting, Service staff raised various concerns about the accuracy of the modeling performed. Some concerns that could not be resolved during the meeting have potential effects on project assurances. They need to be resolved before the Service can conclude whether the project assurances have been met.

Modelers representing the sponsoring agencies acknowledged errors of 0.5 to 1.3 feet in the operational on/off criteria for at least three pumps that transmit water from NGGE to SGGE. We are concerned that these errors mask the true benefits or impacts of the project, potentially over- or under- estimating project benefits.

We believe that the model significantly underestimates the exchange of water between the canal and the aquifer. As a result, we are concerned that benefits or impacts to fish and wildlife resources are not being accurately predicted by the model.

We are concerned that the model does not accurately represent the volume and distribution of flows to the downstream estuary. The flows calculated by the model are tightly linked to the use of unrealistic canal extensions from SGGE to the coast and questionable assumptions for various input parameters such as flood plain cross sections, flood codes, and other aquifer parameters.

Currently the draft Project Operating Manual is based on a model that contains operational errors. To ensure consistency between the project modeling, Project Operating Manual and the project assurances, the assurances section should be updated to reflect the final operational plan after errors are corrected. The Project Operating Manual is the link between the water identified to be reserved for the natural system, based on the expected performance of the plan, and the actual deliveries for the natural system.

We wish to emphasize that the methods employed in the present PIR would require additional expansion for evaluation of future CERP projects that have significant effects on regional water or that intentionally transfer existing sources through project modifications. We anticipate that

this more complete and detailed set of procedures will be outlined in the forthcoming guidance memoranda on procedures for identifying water made available for restoration and for evaluating project effects on existing legal sources.

V. EVALUATION METHODOLOGY

A. Hydrologic-Hydraulic Assessment

The District took the lead in compiling the hydrologic data and evaluating the effects and performance of the Selected Plan on fish and wildlife habitat within the PSRP. The Corps took the lead in evaluating other project constraints, such as flood control and Real Estate "takings" analyses. The District was responsible for analysis needed to satisfy the Savings Clause. Modeling of the complex surface and groundwater flow patterns of the watershed incorporated into the PIR was accomplished through the application MIKE-SHE, an integrated mathematical modeling system, by DHI (Refsgaard and Storm 1995).

The MIKE-SHE modeling system is an integrated and distributed, physically-based, finite-difference mathematical model. The MIKE-SHE modeling system comprises a number of modules, which may be combined to describe flow within the entire land-based part of the hydrological cycle. The modules which have been applied in the PSRP modeling studies include overland flow, unsaturated and saturated, evapotranspiration, and the module for simulating rivers and channels. The issues raised earlier in the Hydrologic Model Issues section of this report cast uncertainty about canal/aquifer interactions and overland flow that occurs in the BCB. The uncertainty, however, has not been quantified to aid the Service in determining whether the model is weighted evenly among assessments of various water management scenarios for flood control, wetland restoration, and water supply in the BCB watershed.

B. Modeling Domain and Scenarios

While the Service generally supports the currently described Alternative 3D for the PSRP, we find that significant additional analyses are needed prior to and during detailed design. The most important analysis is the identification of appropriately sized pumps and their operational criteria. The Service recommends that the detailed design for the project commit to conducting incremental modeling before completion of the project to identify the interim operations that will achieve optimum benefits to the natural system. These would include operational criteria associated with pre-storm drawdowns for tropical storms and hurricanes, as well as drought contingency plans. Additionally, there are a number of other issues with respect to the modeling completed to date that need clarification to ensure that the plan formulation process was not biased toward any alternative or weighted by the constraints of other project purposes. Chief among these concerns is whether or not the MIKE-SHE model is able to accurately represent project features and simulate the hydrology of the study area without relying heavily on the MIKE 11 flood plain topography and flood codes. If our concerns regarding differences in floodplains and codes between alternatives are found to be accurate, a less structurally-dependent alternative, possibly using a combination of features from Alternatives 3D and 6, may be feasible and cost-effective.

VI. FISH AND WILDLIFE RESOURCES WITHOUT THE PROJECT

The Service has adopted, with some modification, the Future Without Project Condition analysis as contained in the draft PIR/EIS for the PSRP, as follows. Analysis of listed species under the "without project" condition has been modified from the PIR text.
This section describes the most likely status of year 2060 conditions on fish and wildlife resources in the PSRP area if no Federal action is taken to restore the site. For the PSRP, the date for the "future without" project conditions is administratively fixed at the year 2060. The 2060 base year and the accompanying 50-year period of analysis were chosen for a variety of reasons. It was recognized that there was a need to be able to tie the results from this study back to the analysis that is being done for the overall benefits of the CERP, which uses 2060 as the future base year. Since this project is not likely to be constructed until 2010, a 50-year period of analysis was needed.

The PSRP PDT determined that the PSRP area would likely have 60 percent of the land area owned by the State and 40 percent in private ownership without the authorization of the Federal project. The 40 percent private ownership would be expected by 2060 to develop in a low-density residential pattern involving about 8,000 built-out parcels. Distribution of State-owned versus privately-held parcels would be in a "checkerboard" configuration reflecting the historic acquisition pattern in the area (Figure 12). The decision to use the 60/40 split was based on an analysis of the history of land acquisition by the DEP from 1985 through 1997. Acquisition of lands in PSRP by DEP began in 1985 when the State approved a plan to purchase land in the PSRP area using CARL funds under the State's "Save Our Everglades" program. The CARL program required land to be purchased from willing sellers for not more than the appraised fair market value. If the private landowner was unwilling to sell to DEP, then DEP could not condemn the land without express approval from the Trustees of the State of Florida. Acquisition of PSRP was an incredible undertaking because it involved approximately 19,995 parcels spread across 59,294 acres. From 1985 through December 1997, DEP had acquired approximately 17,183 acres from 8,543 landowners.

At the end of 1997, the PSRP was selected as a CRP by the Corps. The PSRP had also been ranked as number four on June 4, 1996, by the South Florida Ecosystem Restoration Working Group as a priority project for receipt of DOI funds. Without approval of the PSRP as a CRP and DEP's receipt of Federal FB funds, land acquisition by DEP from the end of 1997 through 2050 would have continued only from willing sellers and at a pace so that by 2060 only an estimated 60 percent of the area would have been in public ownership. Without Federal participation, it is questionable whether the State would have been able to acquire land at anywhere near the current rate.

Collier County has one of the highest population growth rates in the nation. It could therefore be predicted that by 2060 the vast majority of the private lots would have homes constructed on them. A 60 percent State forest/40 percent private land ownership pattern would effectively prevent restoration of historic sheetflow over the project area. Restoration would not be possible given private landowner needs of flood damage protection and road access.

Water Supply

Under the "without project" conditions, the surficial aquifers would continue to recede as 8,000 private wells would be developed on private parcels covering 40 percent of the project area. Overdrainage caused by an improved canal system and an increase in impervious surface from development would further reduce recharge to the freshwater aquifer. By the year 2060, lack of recharge in combination with sea level rise and private well withdrawal could cause an undetermined level of contamination of aquifers from saline water intrusion. Analysis to determine the probable regional extent of saline intrusion in 2060 would take separate funding, years of work, and is outside the scope of this project.

Water Quality

Under "without project" conditions, water quality in the PSRP area would continue to be degraded as over-drainage of the Faka Union Canal system basin intensifies. Runoff from the increased development in the Faka Union Canal basin would be expected to contain pollutants from roads and other impervious surfaces. The dramatic increase in septic systems to service the residential development in NGGE and SGGE may pose water quality problems.

Roads

The "checkerboard" pattern of the public/private parcels would require that most of the 279 miles of existing roads be cleared of exotics, repaired, upgraded for safety, and maintained on a regular schedule. The 279-mile system of raised roads would eliminate any possibility of waterflow across the project area and would present impediments to the environmental management of the State land. Because of this continued easy access for motor vehicles, the existing reality of illegal dumping, poaching, careless use of ORVs, and the irresponsible use of firearms would most likely persist and worsen on State-owned lands. Most of the existing 279 miles of road would continue to exist and possibly even be expanded in the "without project" alternative. As subdivision build-out occurs, noise from general traffic, construction, and other vehicles would be expected to increase. Safety lighting, which is totally absent from the current project condition, would likely be added to road corridors.

Water Management

Under "without project" conditions in the PSRP area, the management of surface and groundwater resources for drainage, flood control, protection of water supply, and water quality would continue to be regulated, operated, and maintained by the BCB unit of District. It is likely that several large rainfall events would occur prior to 2060 which would flood the residential properties in PSRP, as well as portions of the NGGE watershed. Such an event would cause political pressure to expand flood protection for the protection of life and property of the 8,000 residences in PSRP. An "improved"
48 miles of canal system would further overdrain public lands and send even more freshwater to a point source discharge into Faka Union Bay. The capture of all surface waterflow by this canal system would eliminate the historic flow of freshwater to other estuaries in the TTI Region.

Fish and Wildlife Habitat Management

Management functions on the 60 percent State forestland, such as law enforcement, wildlife management, invasive and exotic species control, prescribed burns, forest products harvest, and ORV regulation, would be gravely hampered by the public-private ownership pattern. Law enforcement on State lands prohibiting public intrusion or damage would be nearly impossible due to the difficulty and high cost of surveying and legally posting 1 to 5-acre lots. Without proper posting of State land boundaries, it would be difficult to get a conviction if a reasonably prudent person were unable to tell if they were on State or private land. Educational and research opportunities for fish and wildlife resources would also be limited by the ownership pattern.

Recreation Resources

Under the "without project" conditions, the resulting "checkerboard" ownership pattern would limit both the availability and quality of the recreation uses compatible with resource protection on public land. Trails for horseback riding, hiking, off-road bicycling, wildlife viewing and nature study would be difficult to establish with the unconsolidated ownership pattern and the extensive road system. Provisions for hunting and camping opportunities would be challenging and probably result in conflicts between public land users and residents. Uncontrolled use of firearms would continue to be a major public safety concern. However, since the Faka Union Canal system would remain in place under "without project" conditions, there would be opportunities for fishing and some in-canal boating.

Contaminant Issues

Under the "without project" condition, the project area parcels owned by the State would require remediation of contaminated sites only if they posed an immediate hazard. Since the "without project" condition scenario maintains and most likely expands the 279-mile road system, it would be expected that the illegal dumping of trash and hazardous substances on public lands would continue, creating a continual maintenance problem.

Plant Communities

With 2060 "without project" conditions, hydroperiods within the PSRP would not sustain wetland vegetation. The landscape would continue to succeed to poor quality upland habitats dominated by invasive cabbage palms and exotic species such as Brazilian pepper. Increased numbers of cabbage palms would result in ladder fuel to reach the crowns of the native pines, reducing this habitat to a few remnant stands. Mesic community types would include exotic, invasive and weedy species, such as Brazilian pepper, citrus, cabbage palm, dog fennel, and caesarweed. Melaleuca and cogon grass would spread into the few remaining wet areas, as continued wildfires damage the native cypress stands. Herbicide treatment of exotic plants would need to be repeated in perpetuity, due to reinfestation of the treated areas caused by wildfire, as well as wildlife and human vectors. The few remaining epiphytic orchids and bromeliads would disappear because of illegal collecting, wildfires, low humidity, and an increased freeze frequency caused by a lack of standing water.

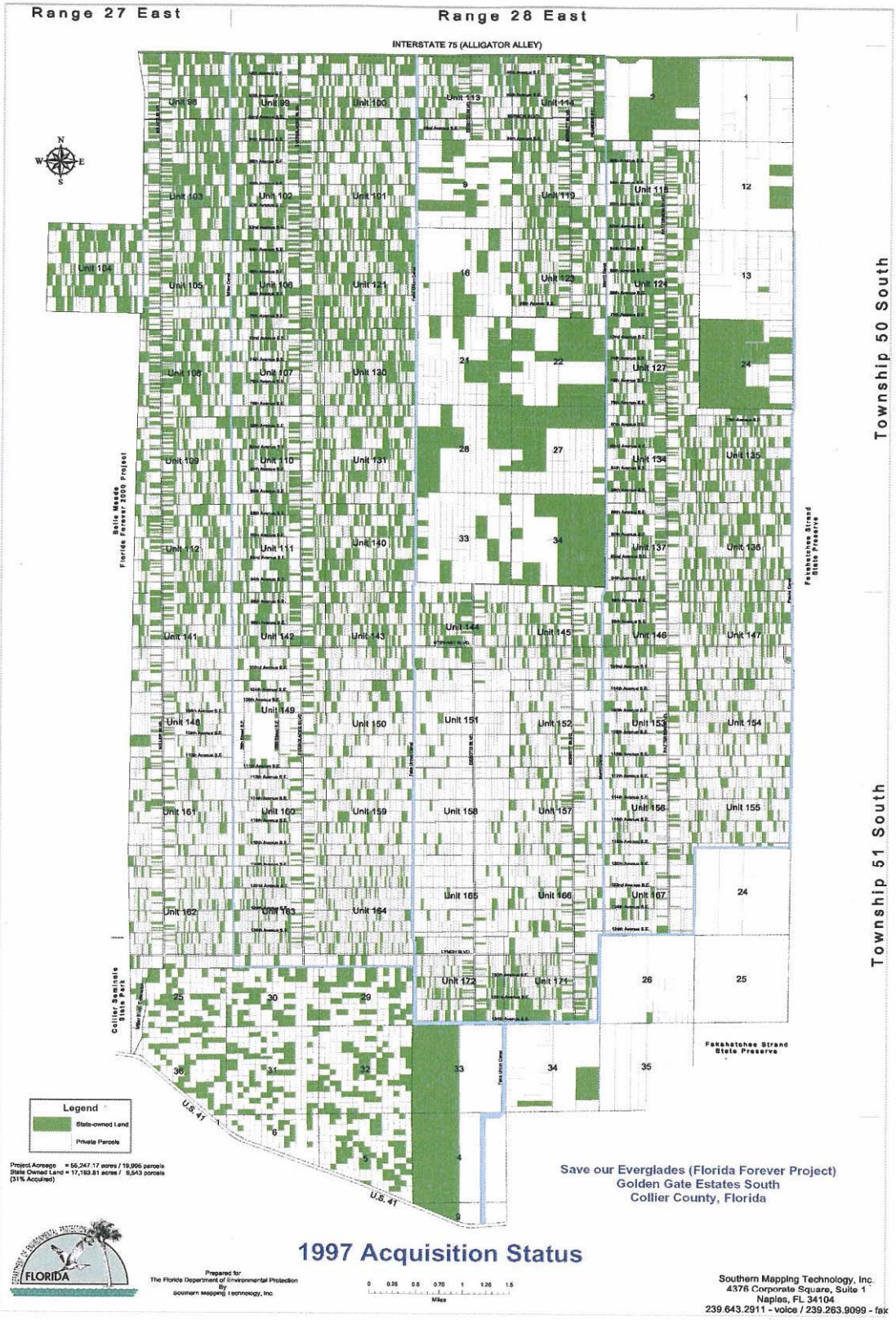

Figure 12. PSRP 1997 ownership map 1

Fire

The 60/40 ownership patterns in the 2060 base year would result in extremely dry conditions as a result of increases in both impervious surfaces and over-drainage for flood protection. The DOF would continue to prescribe burns in order to reduce fuels for potential wildfires and to restore fire-dependent communities and wildlife habitat. The window of opportunity for conducting safe prescribed burns would be greatly reduced by the quick drainage of soil moisture and the groundwater table in canal systems. Prescribed burning on private land could be accomplished through the Hawkins bill; however, greater numbers of private residences and general fear/nuisance of fire would increase the difficulty of accomplishing large acreage burns. Private residences would need to be protected during prescribed burns, which would make the burns logistically challenging. With the window of opportunity so dramatically shortened, conducting many small burns near residences would require large budgets and numbers of trained personnel and equipment for a short period of time. The number of uncontrolled fires caused by man would increase as the number of people using the area increases. During some future drought cycle, devastating wildfires would likely occur. Besides threatening public health and safety, these wildfires would severely damage organic soils and continue to reduce native pine and cypress overstory. Even with prescribed burns, pine and cypress in PSRP have, and will continue to have, a higher mortality than in undrained areas due to a lower water table and the high number of sabal palms. Although the sabal palm is a native species, it is fire-tolerant; seeds well in bare substrate, and becomes virtually a monotypic stand covering the landscape. Under the very dry "without project" conditions, sabal palms would act as a ladder fuel into the pine and cypress canopy. They would encroach into all vegetation types, further increasing future wildfire intensities and mortality of the other native species. Palm fronds increase the frequency and range of spot ignition during a wildfire. Wildfire also encourages other invasive and exotic vegetation to spread, particularly Brazilian pepper, Melaleuca, and cogon grass.

Fish and Wildlife Resources

Under 2060 "without project" conditions, the 60/40-percent ownership pattern would lead to overdrainage through the maintenance or improvement of project canals, resulting in a loss of habitat diversity. Continued hydrologic degradation would eliminate most wet prairie, marsh, and cypress communities, the edges of which provide forage habitat during drydown for deer, raccoons, and hogs. Mesic and hydric flatwood habitats would dry out further and be taken over by invasive and exotic plants that would reduce wildlife habitat quality. Succession from wetlands to uplands would eliminate those species that require ponded conditions for survival and breeding, such as fish, amphibians, and some reptiles.

Habitats that could support fish and wildlife species would be severely reduced and fragmented by the "checkerboard" residential build-out under the "without project" condition. Some residents on the 8,000 private parcels may allow their dogs and cats to run free, which would be difficult to control and have a negative effect on wildlife, especially squirrels, birds, and small mammals. This condition is currently evidenced by NGGE. Continued succession of the ecosystem to poor quality uplands would increase the population of exotic animal species harmful to fish and wildlife. Drained conditions would favor exotic species such as fire ants which impact ground-nesting birds, other insects, and any wildlife that remains stationary long

enough to be attacked. Nuisance wildlife encounters, especially with bears and raccoons, would increase as people encroach into natural habitat. This situation would be exacerbated by the presence of adjacent public lands that are managed specifically for the conservation of these species. Construction of electric and telephone lines would be hazardous to wading birds and waterfowl. An improved 279-mile road system would see an ever-increasing number of vehicles and wildlife road mortalities, affecting such species as the Big Cypress fox squirrel, native reptiles and amphibians, and migratory and breeding birds. The road system would facilitate human access. Increased human presence would result in disturbances to foraging wading birds, breeding birds, mid-sized carnivores such as gray fox and bobcat, deer, bear, and other native wildlife.

Threatened and Endangered Species

Lack of consolidated State ownership and the additional drainage of PSRP would make it difficult to manage or recover of federally and State-listed species. Wide-ranging species, such as the Florida panther and Florida black bear, would be affected to the greatest extent. The location of a development of moderate density but of such magnitude (93 square miles) in the center of a large complex of State and federally owned public lands would have adverse effects on listed species management and recovery on those lands. Effects would include: 1) increased cost of fire and exotic species management; 2) increased nuisance animal complaints resulting in relocation of listed wildlife away from recovery management units; 3) increased incidence of illegal hunting of prey species or poaching of plant resources; 4) increased human disturbance; 5) increased road mortality; and 6) increased risk of contaminants or pollutants.

Bald Eagle

Overdrainage of the project area under "without project" conditions would result in continued loss of wetland habitat that would be available for bald eagle foraging activities. Wildfire caused by overdrainage would continue to eliminate pine and cypress canopy that could be used for bald eagle roosting, perching, and potential nest sites. Residential development would reduce available habitat and increase human disturbance to foraging and nesting eagles. Overall habitat use and potential nesting by bald eagles would decline under the "without project" condition.

Eastern Indigo Snake

Because of its relatively large home range, this snake is vulnerable to habitat loss, degradation, and fragmentation. The "without project" conditions include a 40 percent residential build-out, no hydrologic restoration of habitats that support indigo snake prey, improved roads, increased likelihood of human/snake encounters, and illegal collecting. The indigo snake population would decline under the "without project" condition.

Florida Panther

The "without project" condition would result in direct loss of 40 percent of the project habitat, fragmentation of most of the State-owned habitat remaining in the project area, loss of habitat diversity, increased human presence, further reduction of the prey base, and additional traffic on

project roads. These conditions would be expected to reduce panther use of the site to intermittent levels associated with accessing adjacent public lands, a pattern already indicated by panther telemetry on the site and adjacent lands. Development of the area in the center of lands managed specifically for the Florida panther, particularly the Florida Panther NWR and Fakahatchee Strand Preserve State Park, would adversely affect use of these public lands by the panther. Increased traffic associated with project roadways would increase the potential for vehicle mortality, which could not be offset due to the development pattern. A reduction in habitat and increased human disturbance could change or eliminate any use of the site by breeding females. A "without project" condition could be expected to reduce the panther population on the project site, as well as adjacent public lands specifically managed for panther recovery.

Red-Cockaded Woodpecker

The "without project" condition would lead to the further loss of mesic and hydric pine flatwood habitats due primarily to wildfire conditions, exotic plant invasion, development of pinelands on the 40 percent buildout area, and the difficulty of managing for pinelands over time using fire ecology. A reduction in pinelands would result in increased competition for forage and nesting habitat with other woodpeckers, particularly the red-bellied woodpecker (*Melanerpes carolinus*). Both potential RCW nesting and foraging habitat would be reduced, affecting adjacent public lands such as the Belle Meade portion of the PSSF management, and essentially precluding efforts to expand management for this species to the PSRP.

Everglade Snail Kite and Wood Stork

In dry years, the Everglade snail kite depends on water bodies such as canals, impoundments, or small marsh areas, remote from regularly used sites; which normally are suboptimal feeding habitats (Beissinger and Takekawa 1983). Snail kites have been documented near the Miller Boulevard project canal, and use canals and drainage ditches, as well as natural wetlands southwest and east of the project site. These secondary or refuge habitats are vital to the continued survival of this species in Florida during drought events, although current use of the project site appears to be minimal. Snail kites could potentially use project canal systems on an infrequent basis in the future; although development, continued wetland loss, increased water management for project infrastructure and human presence may further reduce such use.

Wood stork foraging habitat would be virtually eliminated by continued overdrainage, additional site development, water management for flood control, and lack of wetland restoration on the project site. This condition currently exists in NGGE. Since project site wetlands are located proximate to the wood stork rookery at Corkscrew, and the loss of regional wetlands to development is the primary reason for reduction of rookery productivity, the "without project" condition would be expected to reduce rookery productivity at and other nearby rookeries even further.

West Indian Manatee and Designated Critical Habitat

Freshwater point source discharges to the Faka Union Bay would continue and probably increase due to development and water management practices under the "without project" condition. Rapid salinity changes and potential increases in nutrients and contaminants associated with a developing watershed would further impact Faka Union Bay and downstream estuaries. Adjacent bays and estuaries would continue to receive less water from the watershed than under natural conditions. Impacts to the West Indian manatee under the "without project" condition would include: 1) potential changes in temperature and freshwater input conditions that support manatee use of the warm water refugia within the POI marina basin in the Faka Union Canal, 2) displacement of manatees further down the estuary during the wet season in response to increased point source discharges, 3) new or additional loss of manatee critical habitat (seagrass) in downstream estuaries associated with effects of increased freshwater point discharges, and associated nutrients and pollutants, and 4) changes in manatee distribution or use of the marina basin as a warm water refugia , exposing manatees to different levels of boat-related injury or mortality.

Smalltooth Sawfish and American Crocodile

Freshwater point source discharges to the Faka Union Bay would continue and probably increase due to development and water management practices under the "without project" condition. Rapid salinity changes and potential increases in nutrients and contaminants associated with a developing watershed would further impact Faka Union Bay and downstream estuaries. Adjacent bays and estuaries would continue to receive less water from the watershed than under natural conditions. Although the direct effects of these estuarine alterations on the smalltooth sawfish and American crocodile are not known, a reduction in the amount and quality of estuarine habitat would be expected to further reduce the populations of these species.

Endangered Plants

Although no federally endangered plants are documented on the project site, State-listed plants, particularly orchids and bromeliads, are documented on the site. Increased drainage, wildfires, susceptibility to freeze due to overdrainage, infrastructure construction, and illegal collecting expected under the "without project" condition could continue to reduce or even eliminate some State-listed plant species from the project site.

Downstream Estuaries

Escalation of development in NGGE and the 40 percent residential build-out of PSRP would increase freshwater flows through the project canals to Faka Union Bay. The continued point source discharges would further change the unnatural timing and distribution of salinity in the Faka Union estuary. These substantial variations in salinity would continue to shock the estuarine macrobenthic communities, further reducing their long-term viability. Other nearby estuaries and bays would continue to receive less water than provided by the natural pre-drainage watershed.

VII. DESCRIPTION OF SELECTED PLAN AND OTHER ALTERNATIVES

General

As a result of several studies of the GGE area, the Governor of Florida requested in 1992 that the District develop a conceptual hydrologic plan for the PSRP to enhance the environmental value and water resources of the region. Five alternatives were initially developed (District 1996) and evaluated through model simulations to determine their ability to meet project objectives. Alternatives 1, 2, 3A, 3B, and 3C ranged from partial/incremental restoration to the full-scale construction of spreader canals, swale and road removal, placement of canal blocks, and pump stations. During a second iteration of alternative review in 2001, Alternative 3D (3C without most roads) was developed to increase restoration benefits associated with road removal. Following an initial evaluation of the high cost associated with construction of Alternative 3D, 16 additional alternatives were developed with various combinations of component features. Alternative 4 looked at the effects of various bridge sizes at I-75. Alternative 6 was a no-pump alternative. Alternative 7 relocated spreader channels and canal blocks substantially southward. Alternative 8 allowed two canals to be open during storms and Alternative 9 left one canal open during storms to maintain the existing flood protection for NGGE. Alternative 10 replaced fixed weir structures with adjustable Obermeyer weirs. Alternatives 11 to 16 included various combinations of open and plugged canals, fixed weirs, and Obermeyer weirs. In Alternative 17, only Prairie Canal would be plugged. Alternative 18 included only land acquisition and no construction. Alternative 19 included 3 plugged canals, 2 pump stations, connector canals, and widening of Faka Union Canal.

Alternative Footprint Features

Project alternatives considered the following design features.

1. Spreader Canals and Berms

The purpose of a spreader canal is twofold. First, it must receive southbound flow from the existing canal and redirect this flow in an east-west direction. Secondly, it must redistribute the flow in a broad shallow front across the land surface, usually by overtopping its downstream bank and discharging onto the land surface. If only the first purpose was important, a canal cross-section similar to the current PSRP canals could be used. However, the backwater effects of raising the water surface elevation in the spreader canal high enough to allow overtopping and discharging onto the land surface may compromise flood protection for the upstream portions of the north-south canals. In order to maintain flood protection north of I-75, two water levels must be maintained and separated in the canal; with the downstream or south end at the necessary higher level (*i.e.*, slightly above ground) and the upstream or north end at the lower level. The proposed spreader is a relatively shallow canal. Figure 13 shows a typical cross-section. The water surface elevation is "stepped up" by pumping into the spreader canal and the water then flows by gravity onto the land surface by overtopping the spreader banks. The bed of the spreader canal is sloped to allow the water to reach the remote ends of the spreader canal. Water is prevented from backing up to the north by a berm and the natural topography of the area. A

ditch collects seepage flows and returns them to the spreader canal. Spreader canal and berm systems would have to be designed and operated with pump stations.

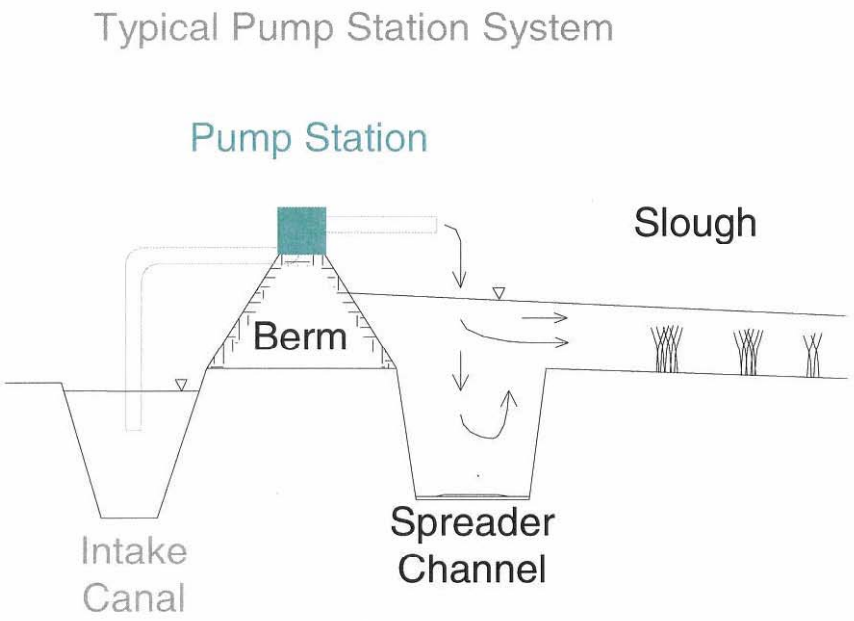

Figure 13. Typical spreader canal.

2. Pump Stations

The pump stations are an integral part of the spreader canal system and are necessary to move lower elevation waters from the canals entering PSRP from the north to the southern side of the spreader berm where water elevations would be higher. The size of the pump stations are based on two criteria: 1) average monthly wet season flows that enter PSRP through the Miller, Faka Union, and Merritt Canals; and 2) estimated flow through the canals during a 100-year storm event.

Pump stations would be constructed and operated in association with spreader canals and berms. The pump stations would operate to provide flows for restoration during much of the year. During storms, the pump stations would be operated to ensure that there are no adverse impacts to the existing level of flood protection for NGGE as of December 2000). The pump stations would be operated so that they would maintain existing levels of service but not operated to increase levels of flood protection.

3. Road Demolition

The roads in PSRP are elevated a few inches to a foot above the adjacent ground level and most have side ditches. There are also ridges of rock (spoil ridges) that are located parallel to some of

the roads. These roads, roadside ditches, and spoil ridges intercept water that would otherwise flow across the surface of the ground. Ditches parallel to the roads also intercept ground water. Road demolition is defined as reducing the elevation of the roads to match adjacent ground level, discontinuing maintenance, and allowing vegetation to grow on the former roads. Material would be pushed aside and leveled, or used for canal plugs. East-west roads and roads crossing major flow ways were initially considered top priority for removal; however, restoration of natural sheetflow conditions requires extensive and uniform removal of roadways. Roads and spoil ridges also provide disturbed upland habitat for exotic species such as Brazilian pepper. All asphalt material removed from the paved roads would be disposed of in a manner consistent with all applicable rules and regulations, and in accordance with DEP and EPA guidance. At present, asphalt would be stock-piled for use in post-restoration road maintenance by DOF.

4. Canal Plugs/Swale Blocks

The canals in PSRP are principally responsible for the overall degradation of the hydrology and ecology of the area due to their ability to intercept both surface water and shallow groundwater. Canal plugs would eliminate channelized flow and a gradual north-south slope design would provide stability when overtopping occurs during the wet periods. The Corps will consider the placement of additional plugs in the swales (ditches) adjacent to some roads during detailed design, however, the Service believes this design feature would adversely affect restored sheetflow conditions. Various numbers and locations for canal plugs were considered based on estimates of available fill.

5. Canal Backfill

The canals would be filled to adjacent ground levels. Material from the existing berms and roads would be used for the fill. This approach would be more effective than canal plugs in eliminating channelized flow and interception of ground water, but it is anticipated that sufficient fill will not be available to fully backfill all canals based on the Prairie Canal "early start" project.

5. Elimination of Canal Maintenance South of the Spreader Channels and Removal of Existing Weir Structures

Elimination of the ongoing aquatic weed control activities for canal maintenance in the major canals would restrict the conveyance capacity of the remnant canals and reduce channelized flow over time. Since the canals south of I-75 would not convey water, existing weir structures would become obsolete. Five internal weirs would remain unaffected. The concrete and sheet piles of these structures may be left intact if they pose no environmental problem, however, the steel walkways and gates could be salvaged.

6. Gated Culverts

The purpose of the culverts would be to divert some of the existing canal flow to the spreader canal.

7. Exotic Plant Removal

Berms and portions of roads that are degraded will have Brazilian pepper removed as part of their restoration. The remaining roads will require treatment with herbicides to control Brazilian pepper; however, some of these roads will need to be mechanically cleared down the middle before access for herbicide application can be achieved.

8. Culverts Under US 41

Culverts to allow sheetflow of water from the restored PSRP to downstream estuaries would be constructed between County 92 and SR 29. The location and dimension of culverts are part of the Tamiami Trails Culverts Restoration Project and will be constructed prior to the PSRP restoration.

9. Acquire Real Estate Interest

An appropriate Real Estate interest, such as flowage easement, conservation easement, or fee title, would be purchased. A Real Estate fee interest ensures that the project could be built, operated, and maintained for ecosystem benefits. Flowage or conservation easement interest would allow project waterflow to flow across private lands consistent with restoration benefits.

10. Reservoir

A reservoir could be constructed to hold stormwaterflow from heavy storm events and to prevent a large amount of freshwater from being quickly discharged directly into the estuary following rain events. Pumps would divert water into the reservoir which would release these waters gradually into existing canals. These canal waters would then flow to the proposed spreader system or be used for some other water need. Due to the porosity of the aquifer in the project area, reservoirs may require liners in order to be effective, significantly increasing construction and maintenance costs.

11. Aquifer Storage and Recovery (ASR)

ASR is a method of storing surface water by pumping it through a well into an aquifer. In order to recover this water, it is pumped back to the surface using the same well. The ASR method can be used during times when water is readily available, such as during the wet season, in anticipation of times when water would be needed, such as during the dry season.

In order to be an effective water storage method, water must be impounded in large quantities for a period of time at the surface, such as in a reservoir. Prior to being pumped into the aquifer for storage, the water is typically treated. After treatment, the water is pumped into the aquifer at a rate of about 5 million gallons per day.

In order for ASR to be considered useful and pertinent for application in the ecological restoration of PSRP, large flows which currently pass through the canals right after heavy rain events must be diverted, made to slowly flow overland through the wetlands, and ultimately

discharged into the estuary over a longer period of time. The ASR strategy and method of operation do not appear to function in the way required for the restoration of PSRP.

12. Adjustable Weirs

Adjustable weirs would be constructed in the canals. The Obermeyer Spillway Gate system is being considered. It is a patented bottom-hinged steel spillway gate panel, lifted and supported on the downstream side by an inflatable air bladder (Figure 14). By controlling the pressure in the bladder, the gate panel's position can be adjusted within the system control range of full inflation to full deflation. The system can be remotely controlled and includes an air compressor, receiver tank, and various control valves for inflating/deflating the air bladder. All automatic systems include provisions for local manual control. Obermeyer gates are custom designed to conform to the canal cross-section with a minimum profile when in the lowered position. These structures would be held in the upright (closed) position most of the year, so that they would retain water within the canal. They would be opened during large storms to maintain existing flood control conditions in NGGE. Detailed design and cost considerations may modify weir design toward more standard adjustable weir designs used by the District.

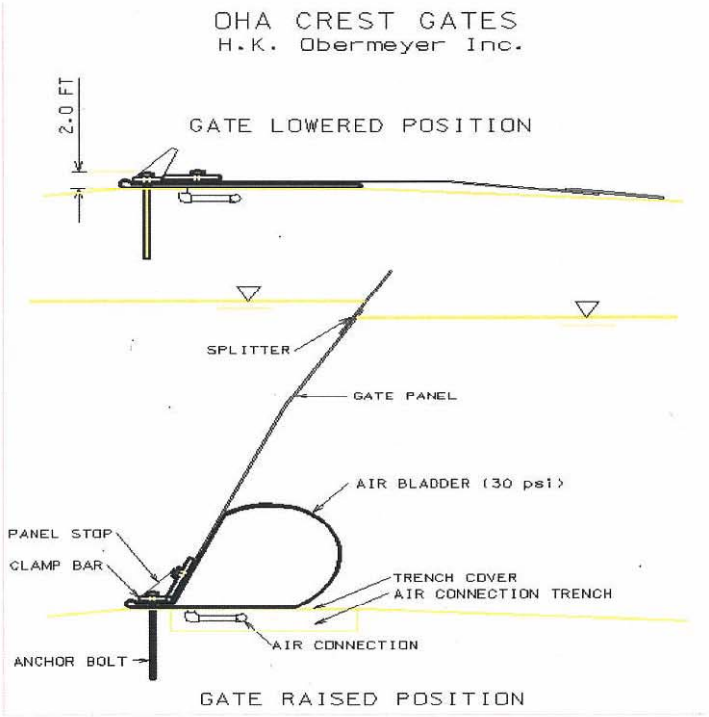

Figure 14. Obermeyer Pneumatically Operated Gate System

13. Berms Along Canals

These berms would be earthen walls constructed parallel to the canals. The berms may serve to prevent sheetflow from returning to the canals; however, groundwater seepage into canals would continue. No plan is available to estimate the size and location of potential berms. "Other

measures to initially retrieve water from canals to establish sheetflow" are not defined in the plan.

14. Lining of Canals

Placing a low permeability liner within the canals or sections of the canals would reduce ground water infiltration into the canal.

15. Levee Near the Belle Meade Agricultural Area

This levee would prevent the increased water level and duration that are desired for most of PSRP and eastern Belle Meade portion of PSSF from adversely impacting the Belle Meade agricultural area located southwest of the project. The plan indicates that the existing agricultural berms would not be sufficient to prevent flooding from several of the PSRP alternatives. However, design and costs associated with building two levees, as opposed to securing one existing levee, have not been determined. The location of the levee extends around the perimeter of the entire agricultural production area and may exceed the project impact area.

16. Modify I-75 Bridges

Water in the Miller, Faka Union, and Merritt Canals flows from NGGE under bridges at I-75 and into the PSRP. Initial modeling suggested that the bridges might be small enough to restrict flows during storm events when canal discharges are largest. Increasing the width of these bridges would remove backwater effects and allow the water in NGGE to leave faster than under existing conditions. This may counteract the effects of other management measures which may cause flood waters in NGGE to be higher or remain longer than under the existing condition.

17. Widen Canals

One or more canals would be widened in order to convey floodwaters faster during storm events. If a canal is plugged and no pump station and spreader are constructed, then an adjacent canal would have to be widened to accept the additional floodwater. A connector canal would also have to be constructed.

18. Connector Canal

This would be a generally east-west canal or channel between the existing canals. It would function as a conduit for stormwater to move from one canal to another. Construction of this measure would normally require widening of the receiving canal.

19. Levee Surrounding Port of the Islands

This levee would protect the POI development from adverse flooding, both during the normal wet season and during storm events. POI is located at the southern end of PSRP, where the Faka Union Canal crosses under U.S. 41. This levee will also reduce surface waterflow into the lower

end of the Faka Union Canal. Construction of the lower portion of this levee may require construction within the TTI NWR boundary.

20. Culvert Under Everglades Boulevard Near I-75

One or more major culverts under the ramps leading to the Everglades Boulevard bridge over I-75 would allow water in the (I-75 borrow canals) to flow in an east-west direction. This may reduce the likelihood of flooding in NGGE along any of the canals by giving stormwater within a specific canal an alternative discharge location for continuing down the canal.

21. Levee near Private Lands in Northeast Belle Meade

A levee would be constructed around a 600-acre neighborhood of private homes which is located west of the intersection 52nd Avenue and Miller Boulevard in northeast Belle Meade. This levee would protect the neighborhood from elevated surface water during average wet season conditions and storm events. An interior drainage system would also be constructed.

Table 9 illustrates how each management measure or project feature considered during alternative development would affect the planning objectives for the PRSP.

Table 9. PSRP Objectives/Measures Matrix. This table illustrates the planning objectives that are addressed by each of the management measures (components).

PSRP Objectives / PSRP MEASURES	Flow to Estuary	Sheet Flow in PSRP	Plant Communities	Aquifer Recharge	Listed Species	Fish and Wildlife	Ecological Connectivity	Recreation	Fire
Spreader Channel	✓	✓	✓	✓					
Pump Stations	✓	✓	✓	✓		✓			
Reservoir				✓				✓	
ASR				✓					
Road Demolition	✓	✓	✓	✓	✓	✓	✓	✓	✓
Canal Plugs	✓	✓	✓	✓		✓	✓		
Fill Canals	✓	✓	✓	✓		✓	✓		
Eliminate Canal Maintenance	✓	✓	✓	✓		✓			
Gated Culverts	✓								
Exotic Plant Removal			✓		✓	✓			
Adjustable Weirs	✓	✓	✓	✓					✓
Lining Canals		✓	✓	✓					
Culverts Under U.S. Highway 41	✓		✓			✓			
Berms along Canals	✓	✓	✓	✓					
Berm at Belle Meade Ag area	✓	✓							
I-75 Bridges		✓							

PSRP Objectives / PSRP MEASURES	Flow to Estuary	Sheet Flow in PSRP	Plant Communities	Aquifer Recharge	Listed Species	Fish and Wildlife	Ecological Connectivity	Recreation	Fire
Widen Canals									
Connector Canal									
Berm at POI	✓	✓							
Culvert under Everglades Blvd		✓							

Alternatives Considered in the Final Planning Stages

During the planning process, a number of alternatives dropped out because of high cost, limited restoration potential, and/or flooding constraints. Only three alternatives were considered in the final planning stages, which are described below.

Alternative 6 – No Pumps Plan

This alternative was designed as a low-cost, low-technology alternative (Figure 15). Initial evaluations of earlier alternatives disclosed that blocking canals in PSRP near I-75 tended to increase stages and duration of high water for some distance into NGGE during storm events. By moving the whole construction area southward, the area of induced flooding in NGGE would also be moved southward. By installing canal blocks only in the southern half of PSRP, it was expected that the backwater induced flooding would be contained within the northern half of the PSRP and not extend north of I-75 into NGGE.

Plugs would be placed in the Miller, Faka Union, and Merritt Canals starting just south of 100th Avenue (Stewart Boulevard). There would be no spreader channels or pump stations. Prairie Canal would be plugged along its entire length. A total of 46 canal plugs would be constructed. Approximately 227 miles of roads would be demolished. Canal maintenance south of the plugs would be eliminated. Culverts would be constructed under US 41. Protective earthen levees would be constructed to prevent flooding in three areas: (1) POI; (2) residential neighborhood in northwest Belle Meade; and (3) Belle Meade agricultural area.

Alternative 6

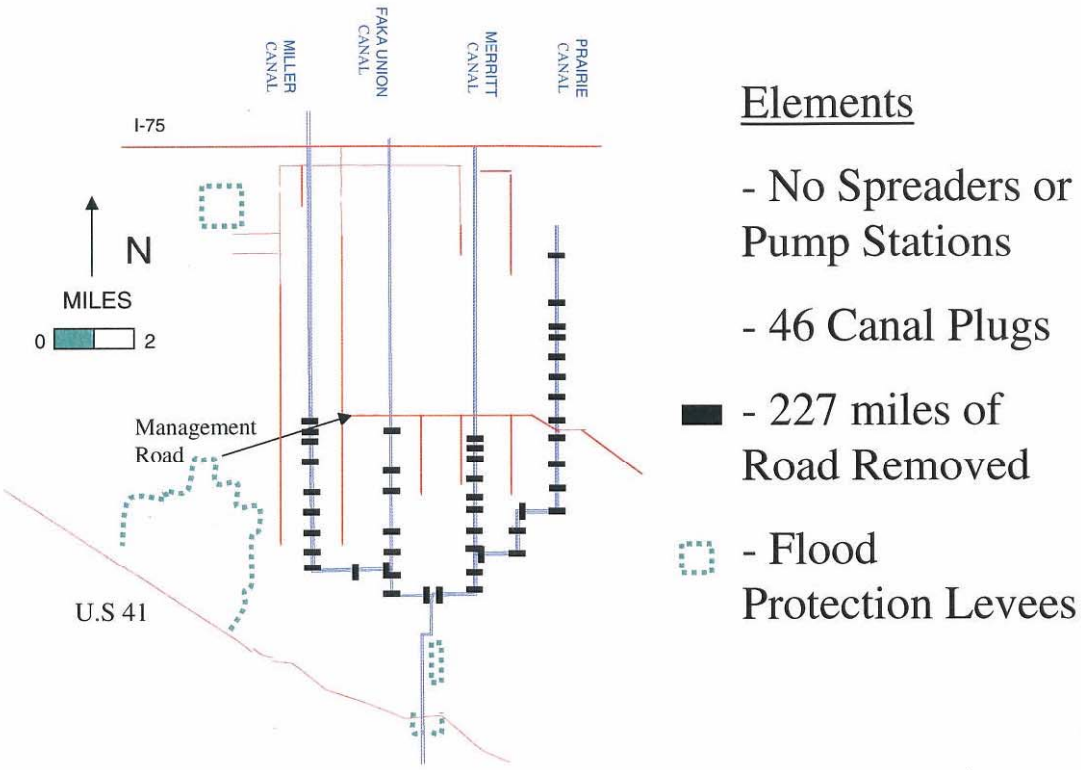

Figure 15. Alternative 6.

Alternative 12

Alternative 12 is a combination of Alternative 3D and Alternative 9 (Figure 16). It would permanently plug Faka Union, Merritt, and Prairie Canals. Pump stations and spreaders would be constructed in the Faka Union (2000 cfs), Merritt (800 cfs), and Miller Canals (100 cfs). Two Obermeyer weirs would be constructed in the south flowing section of Miller Canal. One adjustable Obermeyer weir would be constructed in the east-west section of Miller Canal. Culverts would be constructed under US 41. Levees would be constructed around POI, the northeast Belle Meade residential area, and the Belle Meade agricultural area.

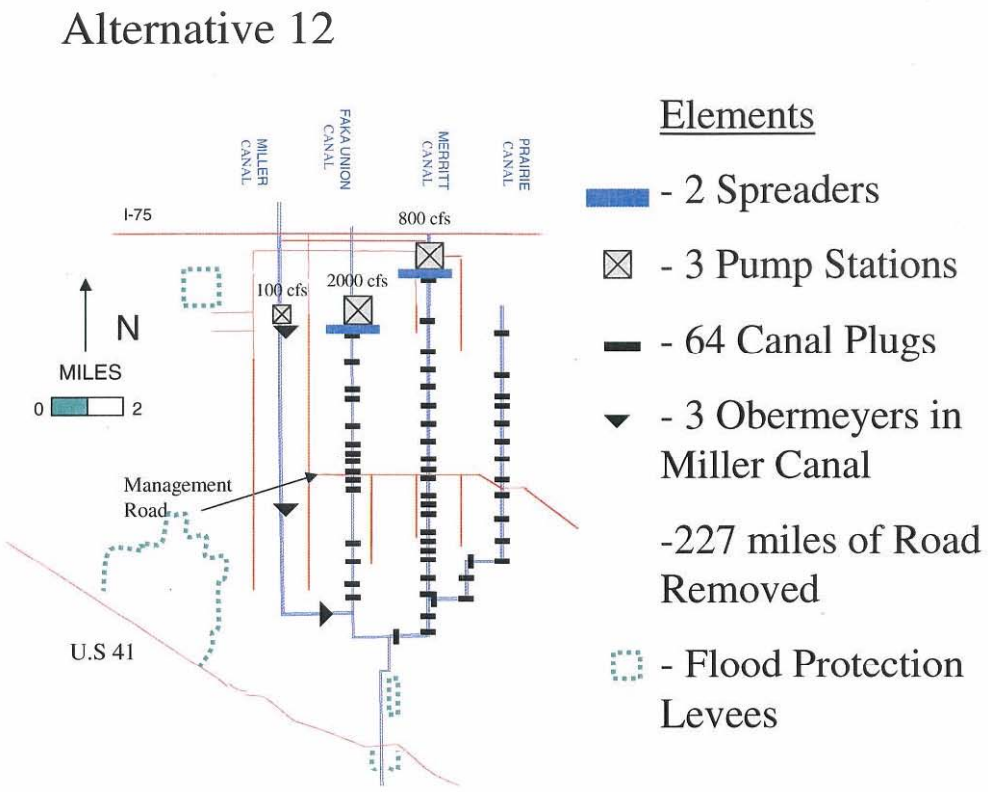

Figure 16. Alternative 12

Alternative 3D – Recommended Plan

The recommended plan or Preferred Alternative, Alternative 3D, has been modified slightly from the alternative reviewed under the Draft CAR (Figure 17). The total cost of the project is $380,923,000 which includes associated land costs of about $197,212,000. Monitoring costs are estimated at 1,894,000. The average annual operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) costs are estimated at $2,129,000.

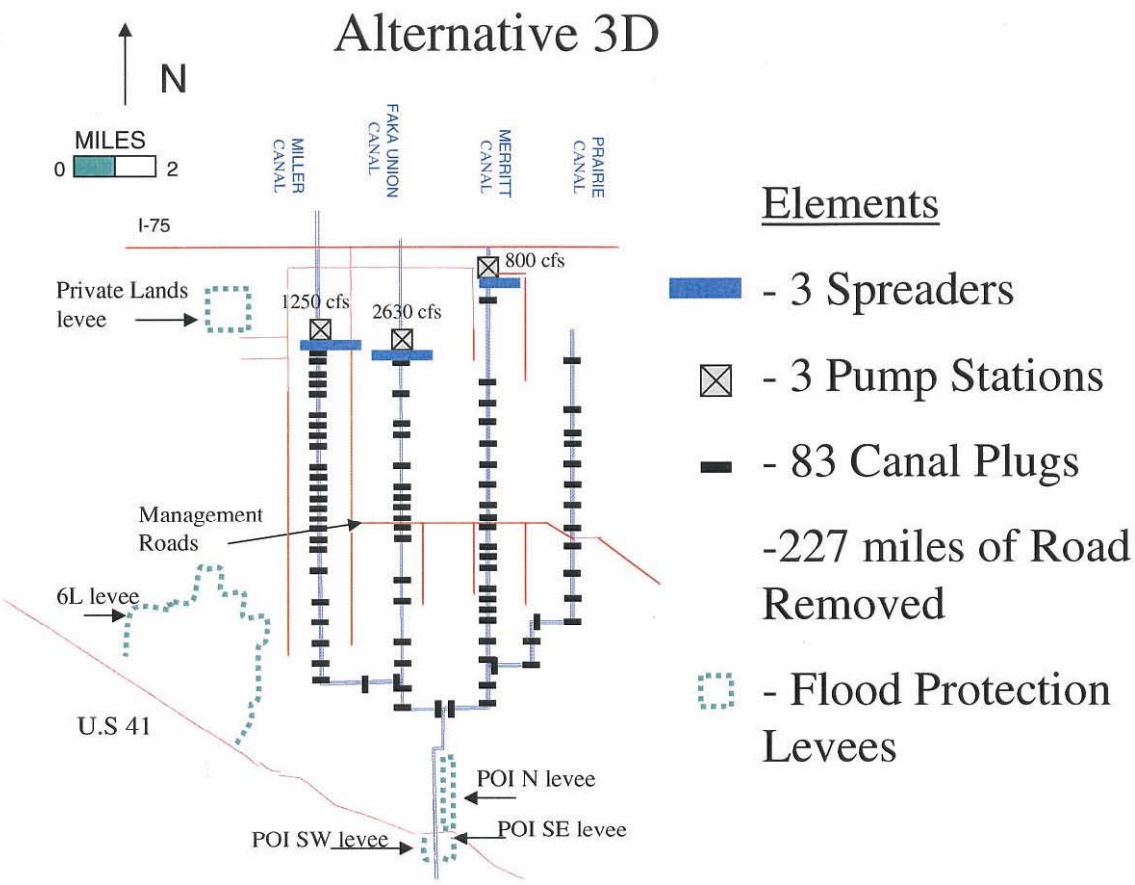

Figure 17. Alternative 3D

Canal Plugs

Eighty-three canal plugs would be placed in the four canals. The approximate locations of the plugs are shown in Figure 17. The source material for the canal plugs and swale blocks would be the spoil from the original canal and swale excavations, and the demolition and degrading of the roads.

Three spreader canals will be constructed that run in an east-west direction across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The spreader canals will be located immediately downstream of the proposed pump stations. The pumps have been designed to have discharge pipe free fall into the spreader canals, which will act as a plunge pool for energy dissipation and to aerate the water. The discharge waters will then be conveyed overland to the downstream project area. The length of the spreader canals were optimized for restoration pumping rates. For the Miller, Faka Union, and Merritt pump stations, the spreader canal lengths will be approximately 4500 feet, 7000 feet, and 1400 feet, respectively. They will serve to distribute the flows along the overland areas to emulate the historic sheet flow of the area.

Pump Stations

Pump stations would be constructed on the Miller, Faka Union, and Merritt Canals (Figure 17). The Miller Pump Station would be constructed on the Miller Canal near 64th Avenue SE. The Miller Pump Station would have two 100 cfs pumps and three 350 cfs pumps, for a total capacity of 1,250 cfs at 5 bays. The Faka Union Pump station would be constructed on the Faka Union Canal near 66th Avenue SE. The Faka Union Pump Station would have two 125 cfs pumps, two 250 cfs pumps, and four 470 cfs pumps, for a total capacity of 2,630 cfs at 8 bays. The Merritt Pump station would be constructed on the Merritt Canal near 54th Avenue SE. The Merritt Pump Station would have two 80 cfs pumps and three 213 cfs pumps, for a total capacity of 800 cfs at 5 bays. The pumps would be utilized to maintain flow through the project area during flood events and to help distribute water for restoration. A small 100 cfs pump station will be required for interior drainage of the Private Lands levee system.

Levees

Five levees would be constructed that would protect existing development from elevated water levels. The locations of each levee are shown in Figure 17. A ring levee would be built in the southern end of the SGGE to protect the POI Waterfront RV Resort and other structures from being flooded by the higher water and sheet flow from the north and northeast. The levee would be on the eastern side of the Faka Union Canal, south of the "T" (the intersection where the four SGGE canals join to form one canal), and north of U.S. 41. The levee would be about 3 miles in length. The typical levee section will be 15 feet wide, 9 feet high, and have 1:3 side slopes. The resultant amount of fill would be approximately 224,000 cy. The source material for the levee would be from the spoil from the original canal and swale excavations and road demolition work. A second levee would protect the POI development southeast of the intersection of the Faka Union Canal and US 41 (Figure 17). The levee would be about 0.8 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. A third levee would be constructed to protect the POI development southwest of the intersection of the Faka Union Canal and US 41 (Figure 17). The levee would be about 0.36 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. The agricultural area in southern Belle Meade is surrounded by a levee or berm to assist the farm operators with managing water levels on their properties. A new, improved perimeter levee (6L levee in Figure 17) would be constructed to ensure that the higher water levels expected from the recommended plan will not flood the agricultural area. The levee would be about 17 miles long. The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes. A ring levee would be constructed around the set of private residential properties located in northeastern Belle Meade, adjacent to the northwest corner of SGGE (Figure 17). The typical levee section would be 12 feet wide, 6 feet high, and have 1:3 side slopes.

Roads

About 227 of the 279 miles of roads existing in SGGE would be degraded to existing grade to allow for sheetflow. About 219 miles of these roads were constructed of crushed limestone and 60 miles are paved with asphalt. The road material would be removed with standard earth-moving equipment. Asphalt would be removed off-site and disposed of according to State

regulations. Trees and other vegetation growing along and in the roads would be left in place as much as practicable. Demolished roads would generally become impassable by vehicles. Some of the material would be used for construction of the canal plugs and flood protection levees. Any remaining material would be placed in the canals to supplement the canal plugs.

About 52 miles of existing road would remain in SGGE. Stewart Boulevard would remain between Jane's Scenic Parkway and Everglades Boulevard. Everglades Boulevard would remain between Stewart Boulevard and I-75. Berson Boulevard west of the Merritt Canal would remain. These roads would be modified with a mix of low water crossings and with culverts to allow water to flow under or over them. Portions of the north-south Miller, DeSoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but would remain available for use during the dry season.

Up to 4 miles of new, unpaved roads would be constructed from Berson Boulevard southward to the sites of the three proposed pump stations. The design and exact location of these roads is not available. The "PSSF Post Restoration Road Plan, Final Draft" (March 2003) describes road location, maintenance, and management post-restoration. "Primary Roads" which include Berson Boulevard, the northwestern portion of Miller Boulevard, Everglades Boulevard, and Stewart Boulevard to the existing Jane's Scenic Drive in Fakahatchee Strand Preserve, will be open to the public year round and will require alteration to accommodate sheetflow restoration. "Secondary Roads" will be gated roads that will be maintained at ambient grade, utilizing low water crossings, geoweb, or other methods to stabilize the roadbed. The main purpose of these roads will be for management access. "Service Roads" are described as unstabilized dirt trails, used seasonally for management purposes. Some other gated roads or banks of canals will be maintained for prescribed burn or exotic plant control management. Additionally, "Temporary Roads" are anticipated to be maintained or constructed consistent with individual projects, followed by restoration and permanent closure. An agreement between the Board of Trustees of the Internal Improvement Trust Fund, the District, and Collier County, Florida, vacates county road easements within the PSRP. This agreement references the Road Plan and sets forth conditions under which the parties agreed to the vacation. This agreement is not part of the Federal project. Aspects of the plan, if proposed through the DOF Resource Management Plan, will be reviewed by the DOI. The exact location of the 52 miles of roads that are proposed to remain in the PSRP and the consistency of this plan with the referenced March 2003 plan cannot be determined by the Service based on the Recommended Plan.

Culverts

New culverts would be constructed under U.S. 41. The culverts would supplement the bridges and culverts that exist today. The culverts are identified as 42A, 46A, 51A, 51B, 51C, 55A, 62A, 66A, and 66B in the Letter Report and Environmental Assessment for the Tamiami Trail Culverts Critical Project. Culverts would be constructed under Everglades Boulevard immediately south of I-75 to connect the drainage / borrow canals adjacent to the southern side of I-75. Culverts and low water crossings would be constructed in Stewart Boulevard and other roads that would remain within PSRP. The number, size, and specific location of these culverts will be determined during the detailed design phase. Culverts would be required for interior

drainage of the leveed areas. They would convey runoff off- site to reduce the amount of interior flooding that could occur during storms.

Operational Features

The Recommend Plan indicates that the Project Operating Manuals would be prepared and provided to the District prior to final turnover of the project. As the project proceeds, interim operations and maintenance, and interim operating manuals for operation of the pumps and the spreader canals will be provided to District for each completed project feature. Upon completion of the project construction and an operational testing and monitoring phase, a set of final manuals will be assembled and provided to the District. The District would operate the pump stations.

The non-runoff phase of operation is characteristic of the dry period (mid October to April) across the PSRP landscape and is maintained by gravity flow. Many of the roads that obstruct the historic flow ways will be degraded to natural ground level. As waterflow in the canals encounters the canal plugs, it will form a series of pools. The plan indicates that the operation of the pump stations during this period will be necessary if gravity flow is not adequate to maintain the optimum canal stages.

The plan indicates that the flood control phase of operation is characteristic of periods of high discharges during the wet season (May to mid October), particularly during runoff events, and during severe tropical storms in order to remove excess runoff or regain canal storage. Continuous pump station operations during the wet season are anticipated.

Land Acquisition

The total estimated land requirement is about 84,056 acres. There are 55,247 acres in the Southern Golden Gate Estates CARL Area, which will be required in fee title. A perpetual flowage easement will be required over about 9,021 acres in the PSSF Area, which may be hydrologically impacted in the average wet season with an increase in the depth of waters from the Project on average from 0.5 to over 2.0 feet. Fee title will be the required estate over 334 acres required for construction of the five levees.

Adaptive Assessment and Monitoring

The intent of the PSRP Water Quality and Ecological Monitoring Plan is to determine if the anticipated hydrologic, vegetative, wildlife, and estuarine benefits of the project are being achieved and to support the adaptive management process over the 50-year life of the project. The plan proposes to monitor ecosystem responses to the changes in hydroperiod depth and duration, and changes in flows to the estuaries resulting from implementation of recommended Alternative 3D. The current estimate for the average annual monitoring and adaptive assessment activities described in Section 8.4 and Appendix H of the Draft PIR/EIS is $887,000 (Table 8). Much of the monitoring is "front-loaded", with the most intensive monitoring scheduled for the early years of the project, when the most rapid ecosystem change is expected to occur.

Site Management Features

The DOF will manage the PSRP land as a unit of the PSSF. DOF is preparing a Ten-year Resource Management Plan for the restoration project.

VIII. POTENTIAL EFFECTS OF THE PROJECT

The primary purpose of this project is to restore a more natural hydrology to an area where surface water sheet flow has been intercepted by 279 miles of roads and captured in 48 miles of canals. Alternative 3D includes construction of at least 83 earthen canal plugs, and the demolition of 227 miles of roads. Three spreader canals will be constructed in an east-west direction, across Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. Three pump stations would be constructed and sized so that the existing Level of Service for flood protection in NGGE would not be reduced. In order to maintain the existing level of flood control, two 100 cfs and three 350 cfs pump stations would convey 1,250 cubic feet per second (cfs) on the Miller Canal. The Faka Union pump station would have two 125 cfs pumps, two 250 cfs pumps, and four 470 cfs pumps for a total of 2,630 cfs. The Merritt pump station would have two 80 cfs pumps and three 213 cfs pumps for a total of 800 cfs. This is an increase of 880 cfs over the proposal reviewed by the Service in the Draft PIR. This increase is associated with modeling of a new weir structure in NGGE at FU-4 which can store additional water.

A. General Fish and Wildlife Effects

The 55,247-acre PSRP is extremely important for the south Florida ecosystem and its restoration will connect surrounding State and Federal conservation areas into a contiguous block of land (Figure 2) of approximately 2.5 million acres. Currently the PSRP canal system has a hydrologic influence over much of the surrounding State and Federal lands. Florida Panther NWR, TTI NWR, and Fakahatchee Strand Preserve State Park have been impacted by overdrainage, therefore all should benefit from hydrologic restoration on PSRP. The Belle Meade tract of the PSSF should also benefit from the restoration of the major flowway from the southwest portion of PSRP. The restored project would support wide-ranging species such as the endangered wood stork and Florida panther; the State-threatened black bear, and numerous species of State-listed wading birds. Completion of the PSRP is central to the management and improvement of resource values of these existing conservation areas. In addition to reestablishing an extensive regional landscape for wildlife, the restoration area will provide infiltration areas to benefit groundwater resources and reduce salt-water intrusion.

Pine flatwood, tropical hammock, and hardwood hammock plant communities are disappearing from the South Florida landscape. Because these communities contain relatively dry uplands, they are the first habitats to be developed. As part of the recommended alternative, about 17,720 acres of the northwest corner of the project were intentionally reserved for preservation of these upland communities. Reestablishing a more natural ground water table cycle should allow DOF to manage this area as a higher quality upland habitat.

The long-term goal of the recommended alternative is to return the hydrology of the area downstream of the pumps and spreader canals to a condition comparable to that which existed prior to drainage. This alternative would also have a beneficial ground water effect on the upland habitats that are upstream of the pumps. The combination of a restored hydrology, a more natural fire regime, and an appropriate exotic vegetation control program can be expected to reestablish the pre-drainage character of the PSRP plant communities. This would mean that plant communities that have developed under the existing hydrologic and fire regimes, but were not present prior to drainage, would be replaced during the decades following restoration by communities more similar to those present prior to drainage. In addition, extant plant and animal communities that also existed in the PSRP prior to construction of the canal system, but have become established in new areas as a result of drainage, would likely return to their original distribution.

The significantly reduced duration of flooded conditions in PSRP has likely had dramatic impacts on tropical vegetation due to the loss of freeze protection from the moderating influence of standing water when winter cold fronts pass through the area. These effects include the elimination of tropical hammocks from the ecosystem and the loss of orchids and epiphytes from the majority of the entire site, either due to freeze intolerance or fire associated with overdrainage. Restoration of the natural hydrology by implementing the recommended alternative would reestablish conditions where many of these tropical communities could reestablish.

Under the recommended alternative, prescribed burns would be less intense, resulting in lower tree mortality due to the restored water table. The window for performing prescribed burns would be greatly extended due to longer hydroperiods, resulting in more acres burned per year. There would be increased opportunity for doing more growing-season burns, which will mimic the natural fire regime of southwest Florida.

Reduction in access due to removal of most roads should reduce the incidence of human-caused wildfires. Roads are not only barriers to sheetflow, but also act as a barrier to the natural spread of prescribed fire. Road removal would allow a more efficient and beneficial prescribed fire regime.

The presence and health of wildlife populations are a function of the habitats available to support them. Given the dramatic changes in hydrologic and fire regimes in the PSRP over the past thirty years, the current wildlife populations have undoubtedly changed from those present prior to development. Implementing the recommended alternative would return the landscape to a more natural hydrology, which has obvious implications for wetland- dependent wildlife species. Amphibians, otters, wading birds, forage fish and aquatic invertebrates would likely see a resurgence of their populations.

Under the recommended alternative, approximately 100 percent of the PSRP landscape would be in public ownership and managed as a natural area. The existing infrastructure of roads and canals would be mostly eliminated. Limited motor vehicle access would reduce illegal dumping, poaching, and the irresponsible use of firearms.

B. Specific Effects of Project Construction

1. Existing Vegetation/Habitat

Construction activities proposed under the recommended alternative that may result in the removal of native vegetation, including some ecologically valuable habitat include: the removal and grading of selected roads, ditches, and berms; the construction of canal plugs, spreader canals, pump stations, and earthen berms around private property.

The recommended plan design features will have the following specific effects:

- a.. Pump Stations, Spreader Channels and Berms. The length of the three spreader canals associated with Alternative 3D is 12,900 feet (0.81 miles). If the width of construction associated with this feature is 60 feet (no scaled cross-section was available for review), impacts to 17.77 acres of habitat are associated with the spreader swale.. No cross-sections are available for an intake canal or berm associated with this spreader canal. However, estimating a 60-foot intake canal and 50–foot berm for a distance of 12,900 feet, total habitat impacts associated with this feature could be 32.58 acres. The majority of this impact would be to pine flatwoods and cabbage palm forest. It is estimated that approximately four miles of new roadway construction may be associated with construction of access to the spreader canal, berm, and pump station features. Pump stations will be constructed on berms in association with the spreader and berm design as described above. Only minor habitat impacts are expected.

- Road Demolition. Roads in PSRP are elevated a few inches to a foot above the adjacent ground and they intercept water that would otherwise flow across the ground surface. Roads provide disturbed habitat which serves as introduction sites for exotic plant species like Brazilian pepper. Ditches located parallel to the roads intercept surface and groundwater and limit historic flow patterns. Road demolition is defined as reducing the elevation of the road to match the adjacent land surface. Material would be pushed aside and leveled. Excess fill would be pushed into project canals to serve as plugs. A 150-foot clearing limit is estimated for paved and unpaved roadway demolition or degradation. Of this150 feet, approximately 20 feet may be paved or filled road surface, 30 feet is roadside swales, and approximately 60 feet is spoil berm or rocks.

The estimated maximum impacts to habitat associated with degradation of roads for a maximum of 70 feet (150 feet minus road and spoil berm) for 253.7 miles of roadway is 8.48 acres per mile of roadway or 1,926 acres. About 30 feet is typically degraded herbaceous wetlands (3.64 acres per mile of roadway or 825.5 acres). Approximately 40 feet is typically pine, cabbage palm, or exotic vegetation that invaded areas adjacent to roadways after drainage (4.85 acres per mile of roadway or 1,100 acres). These areas are expected to be restored to pre-development vegetation condition.

The Service is concerned about the location of the paved portion of Miller Boulevard extending too far south with reference to its potential effects on surface water movement to Belle Meade and listed species.

- Canal Plugs/Canal Backfill/Swale Blocks. There are 48 miles of canals in the PSRP with a typical width of 100 feet. Canal depth varies, submerged aquatic vegetation coverage varies, and the location and size of the canal plugs is very preliminary. There is limited information available to estimate habitat impacts to aquatic species within the canals. Assuming the entire canal system is considered to have some habitat value, there is potential for 5,280,000 cubic feet (195,555 cubic yards) of aquatic habitat impact if the canal system is filled. This does not include littoral shelves because this type of habitat is lacking in most of the canal system due to the vertical canal banks. At present there is no information available on the location of or size of swale blocks that may be constructed in some roadside ditches.

Alternative 3D, although conceptually indicating the location and number of canal backfill and plugs, appears to limit plugs in the east-west portion of the "T" canal north of Bad Luck Prairie, U.S. 41, and the TTI NWR. If the "T" canal is not backfilled to the maximum extent, anticipated benefits to downstream freshwater wetlands and estuaries may be reduced. Although it is anticipated that during wet season conditions the canal would have limited effect, the canal would still act as a major drainage feature during the dry season.

- Existing Weir structures. Five internal weirs would remain unaffected, although concreted and sheetpile sections of these structures could be left intact if they created no environmental problems. Lucky Lake weir in Merritt Canal would be removed and replaced by a pump and spreader swale system. See comments in the Operations effects with regard to this weir removal.

- Berms along Canals. These berms would be earthen walls constructed parallel to canals to prevent sheetflow from returning to the canal where necessary. No plan is available to estimate the size and location of potential berms and the construction of these features may be deemed unnecessary. Where there are existing berms along the canals, no additional impact to habitat is anticipated.

- Levees. Levee construction associated with POI development flood protection is estimated to impact 7.15 acres. About 0.5 acres of this impact may occur within the TTI NWR.

- Culverts. The selected plan does not reference the culverting of Stewart Boulevard which acts as an east-west barrier to sheetflow across the project. The design (elevation, capacity, etc.) and location of these culverts will affect surface waterflow across the site.

2. Exotic Vegetation

Exotic Plant Removal. Exotic plant species, such as Melaleuca and especially Brazilian pepper, are common in the project area. Brazilian pepper and other exotics will be removed from berms and portions of roads that are degraded. Removal will include mechanical and herbicide applications. The exact acreage of exotic plant removal along roads is unavailable but is

predicted to be up to about 2,752 acres based on removal of a 100-foot swath of exotic plants along 253.7 miles of roadway.

Exposed soils associated with construction activities create the potential for introduction and propagation of exotic and nuisance plant species. This propagation has already been observed in some portions of the Prairie Canal backfill project (Duever, pers. comm., January. 28, 2004). Complete invasion of restored areas by exotic plants would limit restoration benefits by more than 4,709.12 acres (approximate footprint of disturbance associated with canal and road removal). This scenario is unlikely where weedy or invasive natives will likely compete with exotic vegetation, but indicates the importance of monitoring and management efforts.

3. Fish and Wildlife Disturbance

Noise, fumes, light and human presence associated with mobilization of equipment and temporary construction activities may disturb roosting or foraging wading and waterbirds as well as breeding birds. However, these activities appeared to have minimal impact on wildlife foraging in canal remnants as they became habituated to the relatively small level of construction traffic and human presence associated with the Prairie Canal Early Start project. Phasing will confine construction activities and access routes, and staging areas will likely be designated. Construction activities will result in the loss of some native fishes, particularly sunfish and tarpon. Amphibians and reptiles may experience temporary increases in mortality associated with construction access on roadways during the wet season or the onset of dredge and fill activities after the wet season.

4. Fish and Wildlife Benefits

Wading birds will forage in drawdown areas during and immediately after construction. Wading birds, particularly long-legged waders such as great blue herons and great egrets, wood storks, and small alligators were observed to forage heavily on insect, fish, amphibian, and reptiles that were trapped in or colonized canal remnants isolated by backfilling activities in the Prairie Canal Early Start portion of the PSRP in dry season conditions. Similar conditions would occur throughout the project site.

5. Existing Contaminants and Disposal/Use of Soils

It is anticipated that all contaminated areas identified on the site will be remediated consistent with coordination with the District. There is a possibility that isolated areas may be activated by project construction. Asphalt from degraded roadways will be stockpiled consistent with State and Federal regulations and used for road maintenance by the DOF.

6. Fire Management

Canal fill and plugs will temporarily increase the access points to Fakahatchee Strand State Reserve, potentially increasing the potential for illegal access, and illegal activities such as arson. Canals function as fire breaks which would be partially eliminated by canal backfill activities.

7. Other Resource Management

Elimination of ongoing aquatic weed control activities for canal maintenance in major canals would restrict the conveyance capacity of the remnant canals and help reduce channelized flow. Since the canals south of I-75 would cease to act like canals, existing weir structures would become obsolete.

C. Specific Effects of Project Operation

1. Upland/Freshwater Wetland Habitats

Pumps

Pump stations would be constructed and operated in association with spreader channels and berms. The pump stations would operate to provide flows for restoration during much of the year. During storms, the pump stations would be operated to ensure that there are no adverse impacts to the existing levels of flood protection for NGGE.

The operation of high-volume pumps to move water from NGGE represents a potential threat to fish and other aquatic resources. Pumps can cause direct loss of fish, amphibians, invertebrates, and other aquatic life through impingement and entrainment. This project calls for the installation of three large pumps that connect to canals and discharge to a downstream spreader swale system. It is anticipated from observations of similar systems in southwest Florida that an unspecified area of habitat located downstream of the spreader swale system will likely be altered to a different habitat type (most likely from upland to some type of wetland) or remain in a disturbed condition due to fluctuation in water levels associated with pump operations. The significance of this impacted area on fish and wildlife, including listed species, is presently undetermined.

Exotic/Invasive Vegetation

We anticipate that the restoration of hydrology would reduce the coverage/density of exotic and nuisance plant species after an extended time period as a result of a more natural hydroperiod regime. The effect of rehydration on mature stands of Brazilian pepper, the principle exotic plant invader, will likely be minimal in the short-term as this species can withstand some inundation. This is evidenced by Brazilian pepper invasion of many agricultural retention/detention areas which may experience extended inundation or pulsed stormwater management in the project vicinity. Rehydration is more likely to result in benefits over the project life in concert with aggressive exotic plant management. If the project hydrologic models are determined to have a high margin of error and the water management structures and operational plans are based on flawed predictions, then there is a potential for a reduction or elimination of project benefits because continued hydrological disturbance will contribute to the maintenance of conditions that favor exotic and invasive species, especially seed germination. Dry season operations may be particularly important as they may create bare substrates or favor germination.

Fire Management

Restored hydrology should contribute to improved fire management on the entire project site, but especially south of the spreader swale and pump operations area. Groundwater conditions will improve fire management north of this area, but to a lesser extent. If the project hydrologic models were determined to have a high margin of error, and the water management structures and operational plan are based on flawed predictions, there is a potential for a reduction or elimination of project benefits. Project habitat restoration benefits would be reduced by lack of restoration of pre-development hydroperiods that continue to favor wildfire conditions

Adjacent Public Lands

Restored hydrology should contribute to the maintenance or improvement of dry season conditions on Florida Panther NWR north of the project if the Lucky Lake weir function is approximated by the pump and spreader swale system on Merritt Canal. Restored hydrology on TTI NWR should contribute to the southward movement of salt-tolerant habitat on the refuge consistent with pre-development conditions. If the project hydrologic models were determined to have a high margin of error and if project operations were conducted consistent with flood control and not restoration objectives, there is a potential for continued overdrainage or increased flooding of adjacent public lands. Current model runs predict limited effects on water levels on the Florida Panther NWR. The refuge would benefit from additional water at specific times of the year to mitigate for drainage effects of adjacent and upstream development. An excess of water on TTI NWR, the southwest portion of PSSF, Collier Seminole State Park, and Fakahatchee Strand Preserve State Park could actually result in alteration of habitats that would impact uplands, relocate brackish and saltwater interfaces further south than the natural condition, or cause disturbed conditions that contribute to invasive or exotic plant proliferation.

2. Estuarine Restoration

General Benefits

Estuarine resources will be positively affected by the restoration of a more natural waterflow regime. The sheetflow disrupted by the PSRP canal system has grossly altered water quality in an 83-square mile area within the TTI (a rectangular area roughly defined by U.S.41 to the north, the outer island coastal margin in the south, Blackwater Bay in the west, and Fakahatchee Bay in the east). When this area is added to the region within PSRP, the total area that would benefit from the restoration is significantly increased.

The freshwater input to four major estuarine systems (from west to east: Blackwater River, Pumpkin Bay, Faka-Union Bay, and Fakahatchee Bay) and the smaller intervening estuaries, has been severely altered by the project canal system. Faka Union Bay, the estuary immediately downstream of the canal system, experiences freshwater inundation during the rainy season. This inundation significantly reduces salinity along with other co-varying physical quality parameters. Sheetflow to the estuaries west of Faka Union has been substantially reduced and this has artificially increased salinity during the rainy season. The impacts to water quality in Fakahatchee Bay, east of Faka Union Bay, are not as clear because this system has not been

monitored as extensively. We suspect, however, that this system has also experienced freshwater reduction. All engineering alternatives should improve freshwater delivery to these estuaries, with the recommended alternative providing the maximum habitat restoration benefit. Determination of estuarine benefits is hampered by the lack of detailed information on flows directly into each bay or estuary. Modeling output for this project only provides flows crossing the Tamiami Trail which lies 3-5 miles from the bays to the southwest. Nevertheless this alternative is expected to restore the pre-alteration seasonal timing and discharge of sheet flow to the central TTI, and to reduce point-source fresh water surges into Faka Union Bay and restore more natural pre-development flows to Palm Bay, Blackwater Bay, Buttonwood Bay, Pumpkin Bay, and Fakahatchee Bay. The NMFS website lists the TTI Estuary as EFH for adult and juvenile brown shrimp *(Penaeus aztecus)*, gray snapper *(Lutjanus griseus)*, gulf stone crab *(Menippe adina)*, pink shrimp *(Penaeus duorarum)*, red drum *(Sciaenops ocellatus)*, Spanish mackerel *(Scomberomorus maculates)*, spiny lobster *(Panulirus argus)*, stone crab *(Menippe mercenaria)*, and white shrimp *(Penaeus setiferus)*. Restoration of sheetflow will benefit EFH for all estuarine fauna.

Although estuarine ecosystems are designed to withstand seasonal variation in salinity, the pulsing or inundation by freshwater or, alternatively, the elimination of variability because of the reduction of freshwater input are harmful to the health of the system. All estuarine habitats, including aquatic vegetation beds, oyster reefs, soft-bottom embayments, sand or mud shoals, fringing mangrove forests, and the open water nekton depend upon fresh and marine water mixing. Brackish water conditions provide nutrient and dissolved oxygen enrichment which promotes productivity. These conditions also provide refugia from predators and an ideal setting for reproduction and juvenile growth and development. Ultimately, the health of the entire estuarine system is predicted to improve.

National Interest Lands

Successful restoration should restore benefits to estuaries in the TTI NWR, Rookery Bay NERR, and ENP. If the project hydrologic models were determined to have a high margin of error, there is a potential for this project to impact National Interest Lands as indicated above.

Recreation

*Recreational Fisheries.*_The shallow estuaries of the TTI are excellent fishing grounds for recreational and commercial fisheries. Sixteen species of commercially harvested fish and shellfish reside in the estuarine system or depend upon estuaries for some part of their life cycle (USFWS 2002). Restoration of timing and quantity of sheetflow to the bays and estuaries is expected to increase the spatial extent of seagrass beds, and restore oyster habitat, both of which provide important habitats for recreational fin and shellfish. Nine species of sharks have been captured in the TTI and several of these shark species rely heavily on the shallow bays as nurseries (P. O'Donnell. DEP, personal communication). The intensity of recreational angling has not been studied in this area since it was characterized in the early 1970s (Kinch and O'Hara), but recorders conducting monthly waterbird surveys for the past decade have noted a significant increase in the number of boats utilizing the backwater areas. Restoration has the

potential to benefit commercial and recreational fisheries, and create an increased demand for access to the backwater areas by fishermen.

*Wildlife-Related Recreation (Ecotourism).*_Outdoor recreation and ecotourism is a significant attraction to residents and tourists on the lower west coast of Florida. It is not possible at this time to anticipate precisely how expenditures and consumer surplus associated with PSRP-related recreation would change with the recommended plan. However, ecotourism appears to be on the increase in southwest Florida as public landholdings, population, and seasonal visitors increase. Recent educational and management efforts by PSSF, Collier Seminole State Park, Fakahatchee Strand Preserve State Park, Rookery Bay NERR, and the TTI NWR are promoting environmentally friendly recreational activities. The PSRP will benefit wildlife-related recreation in the region. Wetland restoration in PSRP should result in habitat improvement, and increases in diversity and abundance of mammals, birds, reptiles, amphibians, fish, invertebrates, and plants. An impending Ten-Year Resource Management Plan for the PSRP and PSSF provides for passive recreational activities consistent with restoration, including horseback riding, hiking, camping, fishing, off-road bicycling, hang-gliding, some types of hunting, wildlife viewing, and nature study.

Land Management

The land acquisition element of the project has allowed for the consolidation of 59,294 acres of habitat for management together with the 15,000 acres of the adjacent Belle Meade tract of the PSSF. In concert with other State and Federal lands, public landholdings in this area are more or less contiguous, with the exception of roadways and some outparcels, and total 2,602,144 acres. This contiguous ownership fosters improved management activities both on the project and adjacent public lands, including: 1) prescribed and wildlife management; 2) exotic/invasive species management; 3) law enforcement; 4) fish and wildlife habitat management; 5) recreational access; and 6) listed species management and recovery, especially for wide-ranging species such as the Florida panther, Florida black bear, West Indian manatee and wood stork.

D. Summary of Consultation Under the Endangered Species Act

Coordination with Corps and District

The Service provided an October 27, 1999, PAL that outlined project concerns including federally listed species. The Corps provided a BA, dated October 17, 2001, that requested initiation of consultation under the ESA on the West Indian manatee, RCW, Florida panther, wood stork, snail kite, and eastern indigo snake. The Corps concluded that an earlier version of Alternative 3D would be "beneficial" to the wood stork and American crocodile; and "may affect, but is not likely to adversely affect" the Florida panther, eastern indigo snake, red-cockaded woodpecker, and West Indian manatee. The Service did not respond to this initial determination for the following reasons: 1) several immediate changes in the project development schedule; 2) the lack of details provided with the identified selected plan; 3) subsequent development of new alternatives; 4) pending results of several iterations of the hydrological model; and 5) a change in the hydrological model platform. However, the Service has actively assisted the Corps in development of a modified Biological Assessment for the PSRP since 2001, as significant project alternative development has occurred.

The Service is requesting some additional information on the West Indian manatee consistent with the best available scientific information that emphasizes the importance of the warm water refugia at the POI marina basin and indicates that the southwest Florida population of the manatee is in decline. Additional information/measures to minimize the effect of the project on the Florida panther may be requested as the current status of this species becomes subject to additional protection and recovery strategies as the result of recent litigation. Two bald eagle nests that are located northeast of the POI area are being reviewed in order to determine if the project will affect bald eagle nest activities. This extensive informal consultation process is intended to minimize the effects of the project on federally listed species. The Service believes that additional coordination and hydrologic model refinement in the detailed design stage of the recommended plan in conjunction with completion of the Ecology and Water Quality Monitoring Plan and Operations Plan will be necessary to complete consultation.

The Service did complete ESA consultation with the Corps on the Prairie Canal Early Start portion of the PSRP in October 2003. The Service concurred with the Corp's determination that that the backfill of Prairie Canal on the eastern extent of the project "may affect, but is not likely to adversely affect" the Florida panther, wood stork, Everglade snail kite, West Indian manatee and its critical habitat, American crocodile, red-cockaded woodpecker, eastern indigo snake, and bald eagle. This concurrence was based on a project proposal developed by the applicant, the District, which included pre-project wildlife surveys, construction protection plans for affected listed species, and post-restoration project monitoring and reporting. Following is a summary of the effects on federally-listed species:

IX EVALUATION OF THE PROJECT

Relationship to the Comprehensive Plan for the C&SF Project (adapted from the Draft Regional Evaluation Report, January 2004)

According to the RET's draft report on the PSRP, dated January 26, 2004, RECOVER evaluators are concerned with flood control operations regarding wading bird populations. In Section 8.3 (Operational Features) of the PIR, the following statement is made regarding operations of Alternative 3D: "During this period potential storm events will initiate a canal drawdown in order to provide adequate canal storage for flood protection. If the drawdown were to occur during the dry season this could have a negative impact on wading birds and other wildlife species."

One of the primary missions of RECOVER is to work with the PDTs to evaluate (through predictive modeling) and maximize the contribution made by each project to the system-wide performance of CERP. With this mission RECOVER prepared a Regional Evaluation of the final three proposed project alternatives for the PSRP The purpose of this regional evaluation is to: (1) inform the PDT of the compatibility of proposed project alternatives with regional CERP restoration goals and performance expectations; (2) identify improvements for project performance that would improve its regional performance; and (3) provide decision-makers required information regarding regional performance expectations of the PSRP.

This evaluation compares the three project alternatives to performance expectations of the Comprehensive Plan (Alternative D13R) by contrasting the alternatives to the 2060 future "without project" condition and against restoration targets. It should be noted that this regional evaluation is unusual for RECOVER because the evaluation was conducted out of sequence, i.e., the evaluation was conducted after selection of a recommended plan; therefore, the regional evaluation was not taken into consideration when selecting the recommended plan. This altered sequence was due to an expedited schedule for project completion. Also, the regional evaluation conducted for this report was performed without benefit of regional modeling results since the PSRP is hydrologically isolated and cannot be simulated by the regional landscape models. Consequently, this evaluation is based on the best professional judgment of an interagency team of RECOVER evaluators using a local project hydrologic model (MIKE-SHE).

Consistency with Objectives of the Comprehensive Plan

The planning objectives developed for the PSRP are consistent with the objectives of the Comprehensive Plan. The planning objectives developed for the PSRP were developed using both the broad CERP goals and objectives and the more defined regional and site-specific restoration objectives of hydrologic restoration.

Consistency with Performance Measures of the Comprehensive Plan

There is general compatibility between the project-level performance measures developed for the PSRP and the system-wide performance measures of the Comprehensive Plan. However, the lack of performance measures corresponding to the issues of dry season conditions and extreme water levels addressed by RECOVER's system-wide performance measures is one noteworthy inconsistency.

Project Performance – Comparison to the Comprehensive Plan and Future Without Conditions

Based on information provided by the PDT, RECOVER has concluded that the three PSRP alternatives (Alternatives 3D, 6 and 12) will meet or exceed two of the three performance expectations outlined in the Comprehensive Plan. The two performance expectations that will be met include hydrologic restoration and water quality improvements to coastal estuaries. Insufficient information was provided to evaluate the third performance expectation dealing with groundwater recharge. Alternative 3D outperforms Alternatives 6 and 12 in achieving performance expectations. The combination of a restored hydrologic regime, a restored fire regime, and an appropriate exotic vegetation control program can be expected to return most of the PSRP to its pre-development character, including the plant communities and wildlife that it previously supported. However, it should be recognized that the full benefits of the restoration process would take many decades (40-50 years) to be recognized, which is also the project life of this project.

If none of the PSRP alternatives are implemented, conditions will continue to decline. By 2060, upland conditions would dominate virtually the entire project site and no wetlands larger than 25 acres would exist, with the exception of coastal marshes. The continuity of natural habitats between government preserved land resources would be lost. Without restoration of sheetflow

and the elimination of point source discharges to Faka Union Bay, continued water quality degradation caused by salinity fluctuations would result in further loss of species diversity. Forage fish populations would continue to decline and recreational fishing would also suffer. Oyster reefs would be eliminated.

System-Wide Performance Expectations

From a regional perspective RECOVER has concluded that the three PSRP alternatives would support the restoration of the three essential characteristics of the south Florida ecosystem prior to development.

Pre-development Ecosystem Characteristic	**PSRP Project Regional Benefit**
A hydrologic regime that featured dynamic water storage capabilities and sheetflow to coastal estuaries	Increases the storage of surface water in wetlands and allow the volume and timing of freshwater follows to the estuaries to occur in a more natural manner
A large spatial scale	Continuity of natural habitat would be expanded by combing the PSRP restored lands with surrounding natural areas; all managed by the same natural resource agency
Heterogeneity of natural habitats	Improves the ecological health and habitat characteristics of three estuaries by reducing salinity fluctuations from a single point source discharge

X. RECOMMENDATIONS/CONSERVATION MEASURES

A. Federally Listed Species

West Indian Manatee

1. Fund further development of model and model output for a spatially-explicit, individual-based model for manatees to better understand how changes in hydrology associated with restoration of PSRP and the Everglades may affect the distribution and abundance of manatees. Initial construction of the individual-based model already has been accomplished through funding from the USGS' Place-Based Studies on the Comprehensive Everglades Restoration Plan. Four key GIS layers are used by the model. A detailed bathymetric layer will restrict the simulated movements of manatees to appropriate water depths. Preliminary analysis of the radio tracking data shows that most locations are in water depths of 12 feet or less. Salinity layers showing the location of freshwater ($\leq$ 5 ppt) will be used to identify areas where manatees periodically return to drink freshwater, providing a link between the manatee model and hydrology information. Aerial survey data, radio tracking data and field mapping are being used to identify feeding behavior and key foraging areas containing high quality submerged aquatic vegetation. The fourth layer will identify sites that serve as winter thermal refugia.

2. Continue comprehensive aerial survey and radio telemetry studies in the warm water refugia at POI marina, Faka Union canal, and the region to provide data for the spatially-explicit model and to document the distribution and status of the manatee population during project construction and post restoration for the 50-year project life. The details of these surveys must be included in the Ecological and Water Quality Monitoring Plan.

3. Conduct construction activities consistent with the Standard Manatee Construction Protection Guidelines if in-water activities (currently not anticipated) are needed in Faka Union Canal south of Faka Union Weir No. 1.

4. Conduct baseline and post-project (5-year intervals for 20 years) seagrass surveys in affected bays of the Ten Thousand Islands.

5. Analyze available boat traffic information from the Service (Doyle, personal communication, August 31, 2004, FWC unpublished information) in the Faka Union basin/canal system and in adjacent bay systems that could be affected by restoration efforts. This analysis will use available information to determine the potential for boat-related mortality associated with potential changes in manatee use patterns and freshwater discharges associated with restoration efforts.

6. Provide and assess the following information on warm water refugia conditions at POI marina basin and Faka Union Canal:

   a. POI marina depth and configuration.
   b. Faka Union canal depth and configuration pre and post-project construction from the Faka Union weir to the "T" canal (which will be plugged) north of the weir, and from the marina basin to Faka Union Bay.
   c. Faka Union Bay bathymetry if available through other sources.
   d. Three-season stratified temperature and salinity measurements by depth and location within POI marina.
   e. Three-season pre and post-project freshwater inflow data.
   f. Assessment (estimate) of freshwater leakage around the existing weir.
   g. Three-season assessment (model) of groundwater, pre and post-project input, to the project canal system and marina basin.
   e. Tidal information for Faka Union Bay and canal if available through other sources.
   f. Engineered evaluation of whether a reduction of freshwater and an increase of saltwater to the marina basin would change basin temperature or result in mixing that would eliminate freshwater lens currently available to manatees.
   g. Three-season temperature assessment of water flowing over Faka Union weir.
   h. Amount of and effects of the permitted and potential increases in freshwater well withdrawals at POI on surface or groundwater potentially utilized by manatees.
   i. Status of septic system at POI and an evaluation of the potential, if any effect on manatees in the adjacent canal and marina basin.
   j. Effect of pulse releases or other Water Control Plan procedures on manatees.
   k. Effects of identified contaminant remediation areas on manatees.

7. Provide for contingencies to supply freshwater across the Faka Union weir to the marina basin in the event that they became necessary were also discussed. These include:

    a. Pipe construction to supply fresh water over weir to marina basin.
    b. Agreement to maintain leaky weir condition.
    c. Groundwater pumping.
    d. Agreement for "Minimum Flow" level for manatees in marina basin.
    e. Construction of a new raised weir to store and control fresh water releases to the marina basin.

Florida Panther

1. Conduct 1-year pre-project baseline (year 2004 is strongly recommended due to onset of managed hunt by FWC) and post-project (5-year intervals for 50 years) prey density studies using aerial transects consistent with FWC-recommended methodology or available infra-red detection technology (The Service recommends contracting directly with FWC).

2. Assess and characterize pre-project panther telemetry in the project area including Fakahatchee Strand Preserve State Park, BCP, the Belle Meade portion of PSSF, and Florida Panther NWR. Assess and characterize post-project panther telemetry, including abundance and distribution of panthers over landscape, changes in habitat utilization if any, numbers of breeding females, and changes in population age distribution. Post-project assessments should be conducted every 3 years. The Service recommends contracting directly with FWC for data compilation and review.

3. Coordinate with FWC to determine if panther denning activities are occurring in potential project construction areas. If denning is occurring during construction phases, obtain recommendations for construction buffers from FWC if determined to be necessary.

4. Assess project road plan and proposed road access/use plans on the Florida panther.

5. Assess project phasing plan effects on the Florida panther. Prohibit construction access through Fakahatchee Strand Preserve State Park and designate minimal access construction route to each project phase. Post panther warning signs consistent with Service recommendations along construction routes.

6. Develop panther information for pre-construction project briefing.

7. Assess recreational use or management plan effects on the Florida panther if adopted as part of the Federal project.

8. Assess plant community succession from habitat monitoring plan for effects on panther and panther prey.

9. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

10. Monitor and document Division of Forestry fire regimes to assess their effects on plant communities.

Wood Stork/Everglade Snail Kite/Eastern Indigo Snake

1. Monitor the hydrological effects of the project design by: (1) conducting a baseline vegetation transect study prior to construction consistent with the 1999 NRCS vegetation sampling methodology; (2) resampling with the 1999 NRCS vegetation sampling methodology at 1, 3, and 5 years following project construction, and then every 5 years for the 50-year project life; (3) sampling one or more permanently marked 50-m transects at each of the new District well sites prior to construction within representative plant communities consistent with Main et al. (2000); (4) adding one 50-m transect to each NRCS vegetation sampling plot prior to construction, consistent with Main et al. (2000); and (5) resampling 50-m plots consistent with Main et al. (2000) at 1, 3, and 5 years following project construction, and then every five years for the 50-year project life.

2. Monitor the water quality effects of the project consistent with the Water Quality portion of the Water Quality and Ecological Monitoring Plan (Appendix H as modified in the Final PSRP PIR).

3. Monitor the surface water and groundwater effects of the project consistent with the Water Quality portion of the Water Quality and Ecological Monitoring Plan (Appendix H as modified in the Final PSRP PIR).

4. Conduct a detailed assessment of operations plan effects on project wetlands consistent with a Project Operations Manual approved by the Service. Modify the operations plan in an adaptive management process that will include reporting, assessment, and recommendations based on the evaluation of the operations plan's consistency with restoration objectives.

5. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

6. Monitor and document Division of Forestry fire regimes to assess their effects on plant communities.

Eastern Indigo Snake

1. Adopt the Standard Eastern Indigo Snake Protection Measures as part of the project.

2. Provide for dissemination of information on the eastern indigo snake to contractors and construction staff at a pre-construction briefing.

Wood Stork

1. Monitor the yearly productivity of stork nesting colonies within 30 km of the project site. The Service recommends using existing information sources at FWC and Audubon's Corkscrew Swamp Sanctuary.

2. Conduct a baseline wading bird survey consistent with Nelson et al. (2001) as modified. Because the 2001 survey was conducted during the dry season of a drought year, a new baseline survey is recommended. However, at a minimum, a wet season baseline survey (July 1 through January 30) should be conducted prior to construction. Resampling should occur on a yearly basis during project construction, one year after restoration, and then at five-year intervals for the 50-year project life.

3. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

4. Monitor and document Division of Forestry fire regimes to assess their effects on plant communities.

Red-Cockaded Woodpecker

1. Conduct/assess baseline population surveys of RCWs within Belle Meade, PSRP, Fakahatchee, and Big Cypress Preserve.

2. Conduct/assess post-project baseline population surveys of RCWs in Belle Meade, PSRP, Fakahatchee, and Big Cypress Preserve at five-year intervals beginning five years after project completion and continue monitoring/assessment on five-year intervals for the 50-year project life.

3. Monitor and document DOF fire regimes to assess their effects on plant communities.

4. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

Bald Eagle

1. Determine if bald eagle nests recently identified near POI and in Fakahatchee Strand Preserve State Park will be impacted by the project.

American Crocodile

1. Based on the best available information from Rookery Bay NERR, TTI NWR, ENP, and IFAS (Mazzotti, unpublished data), assess pre- and post-project crocodile nesting or sighting information to determine if changes in hydrology have contributed to additional habitat protection or use.

B. State Listed Species

1. Monitor State-listed species, including State-listed wading birds, as recommended above and the State-threatened Florida black bear.

2. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

3. Monitor and document DOF fire regimes to assess their effects on plant communities.

C. Wetlands

1. Canal backfill should be prioritized over "plugs" where sufficient fill is available. Plugs or backfill should be placed strategically near flowways to maximize site wetland restoration.

2. Monitor wetland plant and exotic/invasive plant communities consistent with H as modified in the Final PSRP PIR (Ecology and Water Quality Management Plan).

D. Fish and Wildlife Resource Management on Project and Adjacent Lands

The PSRP and adjacent Belle Meade portion of the PSSF are managed by the DOF under the PSSF. The management of the State forest should be consistent with the following CARL acquisition goals (DOF 2001):

1. Preserve habitat critical or provide significant protection for endangered species.

2. Restore an altered ecosystem to correct environmental damage that has occurred over the past 40 years, including a) restoration of the natural patterns of waterflow into the Fakahatchee Strand Preserve, b) restoration of productive wetland systems, c) reduction of frequency and severity of wildfires, d) reduction of water losses and increases in the amount of freshwater entering the aquifer, and e) improvement in productivity of downstream bays and estuaries.

Further the objectives of the Big Cypress Area of Critical State Concern (Chapter 28-25 FAC and Chapter 380, FS). Use as a State preserve or wildlife management area.

Additionally, the goals of the Division of Forestry in managing Florida's State forests are as follows:

1. Restore, maintain, and protect all native ecosystems, including the health and diversity of native biological communities (flora and fauna) associated with these natural areas.

2. Ensure the long-term viability of populations and native species considered rare, endangered, threatened, or of special concern.

3. Restore, maintain, and protect hydrologic functions related to the quality and quantity of water resources, and the health of associated wetland and aquatic natural communities.

4. Protect and preserve known archeological and historical resources.

5. Restore and maintain forest health and productivity by practicing sustainable forest management utilizing sound silvicultural techniques to create an old growth forest that yields multiple ecological benefits.

6. Provide research, education and interpretive opportunities related to natural resource and ecosystem management.

7. Provide for compatible public access, integrating human use through a program of resource-based forest recreation.

8. Provide necessary funding resources in order to accomplish all identified goals and objectives.

E. Adaptive Assessment

1. The Service recommends that a detailed Adaptive Assessment protocol be developed for the project. The protocol should identify performance measures consistent with project objectives, a monitoring plan, a time table for review of the data generated as part of the Water Quality and Ecological Monitoring Plan and Project Operations Manual, parties responsible for review, actions that will be taken when performance measures are not met, and management and administrative remedies for failure to meet performance measures consistent with project objectives.

2. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

F. Water Quality and Ecological Monitoring Plan

1. Complete Inland Aquatic Fauna Section of the Water Quality and Ecological Monitoring Plan (as modified in Appendix H of the Final PSRP PIR).

2. A modified Water Quality and Ecological Monitoring Plan (Appendix H of the Final PSRP PIR) must be funded and implemented as part of the project proposal.

3. Coordinate Federal project with Ten-Year PSSF Resource Management Plan, when approved.

4. Monitor and document DOF fire regimes to assess their effects on plant communities.

G. Operational Plan

Ecosystem restoration should be the primary purpose of the operational plan, with flood control maintenance as a constraint. Project Operations Manuals should be modified as more detailed hydrologic information becomes available during project implementation. The operational plan should include the regulation schedules, operating criteria, and additional provisions as may be required to collect, analyze, and disseminate basic data. Detailed operating instructions to ensure that the project meets the restoration goals and targets should also be included in the form of a draft, interim, preliminary, and final operational plan. The Corps and the District should coordinate with the Service to ensure that the ecological objectives of the restoration project are met using real-time operational criteria and rules. The water resource allocation for the natural system as described in the PIR should be utilized and described in both documents as the project progresses. An adaptive assessment team should meet when operations begin, during interim construction operations, and after construction to review the operational plan in concert with the information obtained from the Water Quality and Ecological Monitoring Plan to assure that restoration benefits are being met and that operations are optimized for restoration. We offer the following comments for inclusion in a revised operations manual:

- modify the operational criteria to create a gradual time/volume-step up and down that mimics the natural system fluctuations which occur between the wet and dry seasons;
- design the minimum pump intake water at elevations that would prevent potential over-drainage of fish and wildlife habitats in NGGE and further upstream;
- include a series of iterative field tests as part of the operational testing and monitoring phase;
- incorporate a restoration-based operations system, such as a rainfall driven operational system for NGGE and PSRP;
- provide a description of how monitoring locations for different habitat types will be used to assess operational success;
- describe how adaptive management will be incorporated;
- include documentation of the canal design optimums and the rationale for their selection;
- include a map depicting trigger locations; and
- provide documentation for the basis of selecting these trigger locations

In addition, the operations manual and operational plans should be coordinated with Federal project with Ten-Year PSSF Resource Management Plan, when approved. The Service will have additional recommendations after an updated operational plan is made available for review

H. Monitoring Wells

1. Continue collection of existing baseline well data from available sources.

2. Establish new monitoring wells in NGGE prior to construction at locations that will provide information on surface and groundwater elevations and adjacent wetland vegetation to ensure that NGGE wetlands are not adversely affected by project operations. Coordinate/calibrate all available well/water level monitoring data in vicinity with PSRP. Calibrate existing well data with new well installation to ensure that historic data is not precluded. Existing data includes:

   a. Wells, staff gauges, and flow monitors for the Tamiami Trail Culverts and Plugs Critical Project.

   b. Wells in the Belle Meade tract of PSSF.

   c. Wells, staff gauges, and flow monitors in TTI and Florida Panther NWRs.

   d. Wells and staff gauges in Fakahatchee Strand Preserve State Park.

   e. BCB surface and groundwater wells.

   f. BCB flow and stage measures in main conveyance canals and weir structures.

I. Fish and Wildlife Resources

1. Develop an estuarine mixing model for the TTI estuary.

2. Continue timber cruise surveys by Division of Forestry.

3. Monitor and report on plant collection (indigenous tribes) effects on PSRP.

4. Map species and distribution of sea grasses in Faka-Union, Fakahatchee, Pumpkin, and Blackwater estuaries before and after restoration.

5. Map aerial coverage and degree of fragmentation of salt marsh and mangrove habitats on TTI NWR and Fakahatchee Strand Preserve State Park to establish post-restoration changes in salt and freshwater ecotones.

6. Establish new baseline fish and wildlife (Inland Aquatic Fauna) and vegetative monitoring sites in TTI and Fakahatchee Strand Preserve State Park in cooperation with the Service and DEP, consistent with baseline surveys in PSRP. Monitor during construction and at post-construction intervals as indicated below.

7. Monitor Estuaries consistent with the Estuarine portion of Appendix H of the Final PSRP PIR (Water Quality and Ecological Monitoring Plan)

8. Monitor Inland Aquatic Fauna (fish, amphibians, macroinvertebrates) on PSRP, consistent with Ceilley et al. (2003), Ceilley (2003), Ceilley and Cox (1995), and USFWS Cooperative Agreement # 1448-40181-G-047 (Refugia Study) as modified by the PDT working group completing the Water Quality and Ecological Monitoring Plan.

9. Monitor and document DOF's prescribed fire regimes to assess their effects on plant communities.

10. Coordinate Federal project with the Ten-Year PSSF Resource Management Plan, when approved.

11. Document extreme weather events (hurricanes, tropical storms, high winds, excessive rainfall events, droughts, and freezes) to determine their effects on fish and wildlife resources.

J. Exotic Plants and Animals

1. Develop an Invasive/Exotic Plant and Animal Management Plan in coordination with the DOF.

2. Target Category I and II non-native plant species for control as identified on the Exotic Pest Plant Council's annually updated list of Florida's Most Invasive Species. Category I species include non-native plants that invade and disrupt Florida native plant communities. Category II plants have the potential to invade and disrupt natural succession processes. Both Category I and II exotics are considered invasive and a threat to the function and ecological stability of Florida's natural communities.

3. Include measures to control exotic plants during project construction and operation phases throughout the project area.

K. Hydrological Modeling

1. A "white paper" should be drafted by an interagency team to identify issues related to design storm calculations. The paper should be reviewed by the Corps and provided to the District with a request for peer review that would focus on reviewing hydrological and meteorological data.

2. A separate CERP Guidance Memorandum (CGM) on Flood Damage Assessment Procedures should be developed to provide specific guidance on the accepted use and consistent application of data for developing the SPS/SPF for all CERP projects.

3. Updated topography should be used in future detailed design modeling.

4. Hydrologic information on dry and extreme wet season conditions should be evaluated to provide a full analysis of the effects of these conditions on the natural system.

5. Performance measures for the dry season should be developed.

6. Performance measures for flood control should be developed.

7. Upstream weir management at FU-4, Cypress Canal, Corkscrew Canal, and Cocohatchee Canal should be detailed as part of the operational plan.

8. Use model output representing responses to a range of meteorological conditions such as 1988-2000, the period simulated for project assurances, to evaluate effects to fish and wildlife resources.

9. Perform a QA/QC of the operational criteria in the model for Alternative 3D, 6, 12, and the existing conditions simulation. Correct all errors found in the operational criteria in the model, affirm that the ranking of alternatives did not change, recalculate benefits, revise the project operating manual, and revise project assurances as necessary.

10. Re-evaluate the need for a total capacity of 4,650 cfs in the project. Our analysis indicates that a maximum of about 2,850 cfs would be adequate to maintain the existing conveyance in NGGE.

11. Demonstrate that the project does not change flows entering the watershed by providing transect flows for the northern boundary of the project.

12. Perform a QA/QC of elevations in the MIKE-SHE topography to ensure data from various sources were seamed together correctly. Also, perform a QA/QC of the consistency between the MIKE 11 cross section elevations and the MIKE-SHE topography. These elevations should be consistent with each other. If necessary, rerun the model for all affected alternatives (3D, 6, 12, and the existing conditions simulation). If the differences in elevations are determined to be correct, demonstrate that the inconsistencies between elevations in MIKE 11 and MIKE-SHE did not affect the calculation of benefits by restricting the conveyance of water between the MIKE-SHE and MIKE 11 or affect the ranking of alternatives.

13. Perform a QA/QC of the model input data sets describing the various aquifer parameters, flood codes and flood plains. At the meeting on August 10, 2004, the District agreed to document any changes between alternatives. We also request that the technical experts demonstrate that changes in these parameters between alternatives do not affect the ranking of alternatives or calculation of project benefits by pre-determining flow and stage in the model.

14. Provide a rationale for modeling non-existent extensions of the Merrit, Miller, and Faka Union Canals from SGGE to the coast. Demonstrate that they adequately model flows to the downstream estuary and do not predetermine the spatial extent or distribution of flows.

15. Demonstrate that the model adequately simulates the interaction between surface water and ground water to ensure that the model is accurately predicting project benefits and impacts.

16. Document how the partial plugging of the canals was simulated in the model including a rationale with respect to stability problems in the model.

17. Document the error introduced by the assumptions in the application of the 10-, 25-, 50- and 100-year storms and an estimate of the increase in pump capacity over the existing levels. It is possible that the application of the rainfall volumes in the design storms increase pump capacity in the project by 140 to 160 percent over what is necessary to maintain the existing level of service.

L. Contaminants.

1. Four asphalt core samples were collected throughout the PSRP site to determine if the use of removed asphalt road beds for fill would increase risk to fish and wildlife resources. The Service believes that asphalt roadbed should be used as a last resort, only after all gravel roadbeds have been removed. Asphalt can be recycled and that option should be explored. We understand that sufficient amounts of fill may not be available on-site to complete restoration, however, the District should investigate other sources of fill prior to using asphalt.

2. The additional sampling and analysis performed by URS for grid 22 of the FANE portion of the property did not detect selenium at any level of concern. Therefore, the Service is of the opinion that rehydration and restoration of this area (Prairie Canal) should not present a risk to fish and wildlife resources.

3. The Interior areas were extensively sampled in accordance with established protocol. No significant areas of concern or point sources were identified. URS did note large areas of solid waste and recommended that the waste be removed prior to hydrologic restoration. URS also recommended pre-demolition asbestos surveys for homesteads in the Interior area. The Service supports these recommendations.

4. High selenium levels were found in the FASE, particularly in Grids 25 and 29 and sediment sample SED-6. The conclusion states that selenium levels found in grids 25 and 29 of the FASE could pose risk to small mammals. The Service believes that the highest of these levels may also pose a risk to trust resources (*i.e.*, wading birds, waterfowl) that may utilize these restored wetlands. The 95 percent UCL for selenium in Grid 29, using all of the data for that grid, was 3.19 ppm. A similar value for Grid 25 was 2.29 ppm. These levels are at or above a concentration known to have produced reproductive failure in birds. The Service had recommended that the highest levels of selenium in these grids be delineated and remediated. Consequently, URS was contracted to conduct additional analyses of selenium in the FASE which were provided in a report, dated July 14, 2004. Although a thorough and exhaustive investigation of selenium contamination in the FASE was performed, the resampling did not result in the

desired delineation of the contaminated zone which is critical in determining the intensity and extent of contamination and a strategy for corrective actions (if necessary). Although initial follow-up discrete sampling (April 17, 2003) did provide useful data in substantiating the general presence of selenium contamination within grids 25 and 29 (first indicated by relatively high levels of contamination in the initial composite samples), data generated from subsequent sampling (March 9 and May 1, 2004) were inadequate to effectively delineate the extent of the contaminated zone.

5. The selenium data presented for the FASE highlight an ongoing dilemma regarding the adequacy of follow-up sampling associated with south Florida Environmental Site Assessments related to CERP. There is no doubt that URS and the District took diligent and painstaking efforts, and used a sound scientific methodology to confirm previous composite and discrete data collected from grids 25 and 29 and to delineate the intensity and extent of selenium contamination at the FASE. However, the large number of follow-up samples exhibiting very low selenium levels at locations previously established as zones of high concentration makes it difficult to objectively interpret these data in a systematic and comprehensive manner.

6. A review of the existing hydrologic modeling data and vegetation maps for the SGGE suggests that the FASE portion of this property will not experience much of a change from the existing condition with the project. The hydrologic restoration for this area will be limited to moderating the existing hydropattern, such that the depth and duration of existing wetlands would increase and the vegetative community would change. Proposed restoration in the FASE are passive and there are no current plans to construct and operate water conveyances, stormwater treatment areas (STAs), or reservoirs on any part of this previously farmed land. Therefore, this project would not likely change the existing selenium transport and fate mechanisms in the FASE nor exacerbate bioaccumulation and toxicity to local flora and fauna. We expect selenium contamination in the FASE would likely remain consistent with existing conditions and have a low probability of additional loading over time. It is not anticipated that proposed hydrologic restoration at the FASE would create an attractive nuisance by concentrating selenium. Therefore, the Service does not believe that the level of selenium exposure to trust resources (including federally listed threatened and endangered species) in the FASE would likely increase over that of the existing condition as a result of this wetland restoration project as proposed.

7. According to URS, approximately 50 acres of chlordane-impacted soil is present in the FAW. These soils are located in grids 1, 13, 16, 21, 27, and 30. An additional 6.7 acres of dieldrin-impacted soil was delineated in grid 1 of the FAW. The Service recommends that the areas be remediated or capped with clean fill to form upland areas, thereby preventing liberation of chlordane or dieldrin into restored areas of the PSRP.

8. High levels of selenium were measured in eight grids (Grids 23-30) during composite sampling of Area 64W in the FAW. One of these, Grid 30, contained an extremely high selenium level (6 ppm). Yet, these eight grids received no followup sampling for selenium to confirm and delineate the extent of the contamination. Before inundating

these grids, particularly Grid 30, it will be necessary to return to the FAW and complete additional selenium sampling. If some of these concentrations prove to be accurate, remediation of some or all of these grids may be necessary before restoring hydrology which will attract trust resources to the area.

M. Assurances

1. We strongly support recommendations that protect beneficial baseline water, as well as the reservation of water made available for the natural system, by the State of Florida. Water made available by CERP projects over and above existing levels cannot be treated as "stand alone" contributions toward restoration because the benefits of "new" CERP water depend on the interaction between new and already-existing water in natural systems. Additionally, many natural areas within the CERP domain are not short of water but have too much, at least some of the time. The restoration of these areas depends on the protection of existing beneficial baseline water. We, therefore, strongly support the recommendation that the local sponsor act to protect both beneficial baseline and water made available for the natural system.

2. Recommendations contained in Section X. of the Draft Fish and Wildlife Coordination Report in Appendix D of this plan, as amended, should be instituted as part of this project plan commitment.

3. Due to the importance of this project to federally protected species, particularly the West Indian manatee, wood stork, and Florida panther, and the significant contribution of Federal funds to project acquisition and development from the DOI and the Corps, the Corps should embrace full compliance with the Endangered Species Act. In particular, Section 7(a) (1) directs Federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the *conservation* of endangered and threatened species listed pursuant to section 4 of the Act. This portion of the act sets forth actions beyond the standard of consulting with the Service to assure that agency actions are not likely to jeopardize the continued existence of any endangered or threatened species or its critical habitat. The Service is assisting the Corps in developing a plan that goes beyond avoidance of adverse effects to provide beneficial effects to listed species.

4. Due to the complexity and resulting uncertainly associated with hydrologic modeling, particularly in light of the recently acknowledged operational errors and inconsistent application of input parameters, and the importance of development of an operations management plan that focuses on restoration benefits, the Corps should specifically commit to the continued development of an Adaptive Monitoring and Assessment Plan for this project. This plan is currently being developed and will be significantly modified beyond the plan included in this document.

5. Evaluate Savings Clause compliance for fish and wildlife habitat areas that are <u>outside</u> the project footprint, but could be affected by the project, in addition to the estuary at the downstream end of the Faka Union Canal;

6. Substantiate the claim that the WRDA 2000 Savings Clause level of service for flood protection is provided;

7. Ensure that all water made available by the project that contributes to identifying ecosystem benefits is quantified. This should include not only the main project area but also any natural areas where beneficial changes in quantity, timing or distribution of water have contributed to selection or justification of the project plan;

8. Affirm that all of the water made available by this project is necessary for restoration of the natural system, and should be identified, dedicated, and managed for the natural system;

9. Acknowledge that water to be dedicated and managed for the natural system includes the beneficial portions of baseline water and additional project water from various sources. The expected level of ecological restoration is achieved through a combination of groundwater and surface water within the project footprint. We believe that project level benefits should include all beneficial water made available to the natural system, rather than just the volume of water held in surface water storage within the project footprint;

10. Repeat the language found in Section 601 (h) (1) in WRDA 2000 regarding assurance of project benefits in Section 12.12 (although this language describes the purpose of CERP in Section 1.4.1, reiteration of this language in this part of the document reminds reviewers and decision makers of the benefits of CERP);

11. Anticipate and reinforce Section 13 concepts by clearly stating in this section that 1) both the baseline water and the additional water produced or redirected from this project are needed to achieve the goals and objectives of CERP, as well as to ensure the benefits of the Plan for restoration and preservation of the natural system as required by WRDA 2000, and 2) this baseline water should be protected consistent with Federal and State law and the project water made available should be reserved by the State;

12. Provide a comprehensive discussion of the relationship between the pre-CERP baseline, the Savings Clause, and the level of service for flood protection, as set forth in the Programmatic Regulations, in Section 12.1.3;

13. Distinguish between beneficial baseline water to be protected and additional water produced or redirected by the project that will be identified for reservation by the State;

14. Fully document the methods and graphics used to perform the assurances evaluations. Include graphics that substantiate the benefits of the project such as the claim that the project improves the timing and distribution of freshwater flows to the downstream estuary; and

15. Ensure restoration benefits across different landscape types are adequately evaluated. We recommend supplementing existing evaluations with an analysis of indicator regions for

different habitat types or monitoring locations that will be used to assess actual deliveries of water by the project.

X SUMMARY OF FINDINGS AND SERVICE POSITION

The Corps and District have assessed 22 alternatives during the development of the PSRP. Most of these potential alternatives were eliminated because of high costs, limited restoration potential, especially to downstream estuaries, and/or flooding constraints in the NGGE. Three alternatives (Alternatives 3D, 6 and 12) were carried forward by the Corps/District and are being considered in the final planning stages of this project. Alternative 3D is the recommended plan because it would provide the greatest potential for wetland restoration in the PSRP site and restoration of natural water deliveries to the downstream coastal habitats in the TTI area. Its features include: (1) plugs on four canals; (2) road removal (227 miles); (3) three spreader channels and pump stations; (4) culverts under US 41; and (5) flood protection levees around POI, the northeastern portion of the Belle Meade Area, and the Belle Meade agricultural area. . Alternative 6 was designed as the low-technology alternative (no spreader channels and pumps, or associated operation/maintenance requirements). Its features include: (1) canal plugs along Prairie Canal's entire length, but limited to the southern half of the 3 remaining canals to the west; (2) road removal (227 miles); (3) culverts under US 41; and (4) flood protection levees as noted above. . Because of a concern for plug-induced backwater flooding that might extend north of I-75 into the NGGE, canal plugs were sited on the southern half of the 3 canals that extend into the NGGE. As a consequence, wetland restoration would be limited primarily to the southern portion of the project site and downstream coastal habitats in the TTI area. Alternative 12 is a modification of Alternative 3D. Its features include: (1) canal plugs along 3 canals and 3 adjustable weirs on the fourth canal (Miller Canal); (2) two spreader canals and pump stations on Faka Union and Merritt Canals; (3) road removal (227 miles); (4) culverts under US 41; and (5) a flood protection levees as noted above. Because this alternative would keep Miller Canal open and allow its freshwater pulses to continue to enter Faka Union Bay and limit sheetflow restoration to Bad Luck Prairie and the TTI NWR, wetland restoration on the project site and in the downstream estuaries would not achieve the levels anticipated for Alternatives 3D and 6.

The Service generally supports Alternative 3D as the recommended plan because it would provide greater wetland restoration benefits to the PSRP site, Faka Union estuary, and adjacent coastal bays, according to hydrologic modeling results provided by the Corps/District and our evaluations. However, this support is qualified and dependent upon improvement and refinement of hydrological model input and output, the development of an Operational Plan that prioritizes restoration over flood control, completion of an Ecological and Water Quality Monitoring Plan, an Exotic/Invasive Species Management Plan, and ESA consultation. If these significant project issues are not addressed in the Detailed Design and Construction phase of this project, the Service would have to re-evaluate its position on this alternative.

High levels of selenium, chlordane and dieldrin were found on several locations in the project area which could pose a risk to small mammals, birds, and invertebrates. The Service recommends that follow-up sampling for selenium be conducted on 8 grids (Grids 23-30) in

Area 64W in the FAW. Depending on the results of this re-sampling effort, remediation or capping may be required. As a result of the conflicting data collected during the follow-up selenium sampling conducted in the FASE where previous samples found selenium in high concentrations (Grids 25 and 29), we recommend that, in addition to desorption testing, the District attempt to collect more information regarding toxicity and bioaccumulation where selenium is detected above 1.0 mg/kg in future assessments to begin developing selenium toxicity and bioaccumulation reference data that relates to Florida. The Service also recommends that biological monitoring of invertebrates, fish, and birds be implemented at the FASE, consistent with similar monitoring associated with other CERP projects and operations.

In addition, the Service recommends that remediation or capping be conducted in areas where high concentrations of chlordane (Grids 1, 13, 16, 21, 27 and 30) and dieldrin (Grid 1) have been reported in the FAW.

The Service has recommended several corrections and changes in methods that may have a significant impact on the risks HQs presented in the District's ERA for this property. These include (a) combining and giving equal weight to URS and FDEP data, (b) correcting mathematical errors involved in the calculation of k_{oc} and k_{ow} values for chlordane and dieldrin, (c) repeating the desorption/bioaccumulation studies needed to determine these values, and/or (d) using literature values of physical parameters (k_{oc} and k_{ow}) for chlordane and dieldrin. The District has agreed to, and begun to implement, many of these changes. Because any of these changes will cause changes in the estimated risks, it will be necessary to recalculate all HQs for chlordane and dieldrin. All tables and associated text in the ERA, where HQs for these contaminants are presented or discussed, will require revision. Once revisions have been completed, a revised ERA should be issued to replace the original.

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APPENDIX A. The Department of Interior's NEPA Comments, dated July 13, 2004, on the Draft PIR/EIS for PSRP.

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

July 13, 2004

Brad Foster PD-PF
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Foster,

Thank you for the opportunity to review and provide comments on the Draft Integrated Project Implementation Report (PIR) and the Environmental Impact Statement (EIS) for the Southern Golden Gate Estates (SGGE) Ecosystem Restoration Component of the Comprehensive Everglades Restoration Plan (CERP). The Department of the Interior recognizes the complexity of the task undertaken in this draft document and appreciates the effort the Jacksonville District has made in the development of this important CERP component.

The Department continues to strongly support the restoration of the SGGE project area. The SGGE project is an excellent opportunity to restore the area's cypress, pinelands, wet prairies, and the pre-drainage hydrology and ecology, and to eliminate damaging point source discharge of fresh water from Faka Union Canal. The close proximity of the project area to other protected lands also provides a valuable opportunity to link natural habitats and to improve conditions in areas downstream of the project, including the Ten Thousand Islands area.

The SGGE project plan has been developed and reviewed by a multi-disciplined team that includes federal, state, and local government biologists, hydrologists, planners, and engineers. However, we recognize that the PIR review process also provides an opportunity for PIR refinement as well as design development and improvement. Consistent with this continuing effort, the Department recommends that the following recommendations, consistent with WRDA 2000's overarching objective of the Comprehensive Plan, be incorporated prior to the PIR being finalized, approved and proceeding to detailed design. We offer four general recommendations for improvements to the final PIR and one comment regarding needed refinements to the modeling that will be used in the final design document.

We would also like to offer the enclosed specific comments on the Draft Integrated Project Implementation Report and the Environmental Impact Statement for the Southern Golden Gate Estates as provided by the Fish and Wildlife Service to be addressed in the final PIR. These comments provide recommendations related to the description and development of the project as presented in the draft PIR and EIS and further detail our overarching comments listed below. Extensive technical comments are also attached in order to ensure that the PIR meets the intent of the Plan. As referenced in the attachment, the comments also underscore the need for continuing collaboration to ensure full compliance with applicable Federal laws.

Furthermore, we recognize that significant work is underway to develop the six-guidance memoranda that will memorialize State and Federal policy with respect to PIR's. Our comments assume that the approaches employed in this PIR for alternative evaluation, operational manuals, and project assurances will be consistent with the ongoing efforts to develop these guidance memoranda. In addition to ensuring this consistency, we trust that any inconsistent approaches in the PIR, approved prior to the final release of the guidance memoranda, will not be considered as a precedent for future PIR's.

Recommendations to be Included in Final PIR

1. **Project Operating Manual Development**

As required by the Programmatic Regulations (Section 385.26 (a)(3)(xvi)), a draft Project Operating Manual, where appropriate, must be included in the PIR before it is finalized. The current draft PIR makes references to a Project Operating Manual that is currently being developed but is not included in the draft PIR. We request that the draft Project Operating Manual currently under development be provided for review and commend prior to its inclusion in the final PIR.

2. **Finalize a Modified Adaptive Assessment and Monitoring Plan**

It is our understanding that the Adaptive Assessment and Monitoring Plan in the draft PIR is intended to be replaced by a more comprehensive monitoring plan that is currently under development. We fully support the multi-agency effort for this new monitoring plan and believe it is critical to achieving and documenting ecosystem benefits. The comprehensive Adaptive Assessment and Monitoring Plan will also assure protection and increased benefits to adjacent lands, including two National Wildlife Refuges and Everglades National Park; as well as State of Florida forests, parks, and reserves. Accordingly, we recommend that the Adaptive Assessment and Monitoring Plan in the draft PIR will be replaced in the final PIR by the more comprehensive monitoring plan that is currently under development.

3. **Control and management of invasive species**

The Corps of Engineers has recognized invasive exotic species as a serious and fundamental threat to South Florida Ecosystem Restoration and to CERP implementation. (See Information Paper, dated 21 May 2002, entitled "Proposed Plan for Fiscal Year (FY) 03 Exotic and Invasive Species Management and Control" and via the inclusion of "environmental protection" as a primary mission of the Corps in WRDA 1999). The Corps has provided $5.8 million as part of CERP for two invasive species projects. 1) The CERP Project Management Plan; Melaleuca Eradication and Other Exotic Plants, April 2004 and 2) the preparation of a reconnaissance-type "special report that would further identify the overall problem with exotic and invasive species and provide a recommendation regarding further Federal involvement"... for South Florida Ecosystem Restoration. Because of the serious problem with invasive exotic species, particularly Brazilian pepper in the SGGE, the PIR should reference and use the two CERP invasive species plans and recognize the Corps' expanded involvement in invasive species management through CERP.

In addition to any references to the control and management of invasive species contained in the SGGE PIR, the Department expects the Final Land Management Plan referenced below to include land management actions to deal with invasive exotic species. The Final Land Management Plan should specifically consider potential effects of invasive exotic species on

threatened and endangered species and manage the threatened and endangered species in a manner sufficient to ensure restoration and facilitate recovery.

4. **Assurances and Natural Resource Protection**
We applaud the language contained in the assurances section of the PIR and believe that this section begins to set forth an important framework to achieve project benefits anticipated by WRDA 2000. However, we recommend that this section be expanded and redrafted to include natural resource protections and benefits, and baseline water measurements that are currently being negotiated for inclusion in the Guidance Memoranda. Furthermore, we recommend that hydrologic improvements that benefit fish and wildlife outside the project footprint be documented. Further, we believe an evaluation of existing and future flood protection benefits is required to satisfy the WRDA 2000 Savings Clause, as is an evaluation of hydrologic conditions that support fish and wildlife. Finally, if it is determined that there is no water available in excess of the amount needed for restoration, we recommend that this conclusion be stated in the report. This will clarify how much water is available for other water related needs.

5. **Modeling Refinements**
Hydrological models have been developed to support project alternative selection and project benefit analysis. The models are used as tools to reasonably approximate the effects of the project plan design on fish and wildlife resources. However, the Department still has concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and design storm applications. We recommend that the models be further refined to more accurately predict project effects on upstream and downstream lands. The models should also characterize the wetland loss and increased stormwater runoff resulting from existing agriculture and rapid urban development of the project watershed.

As federal funds were utilized to acquire project lands for restoration activities, the final land use will be set forth by the State of Florida in the Final Land Management Plan as required by the funding agreement. The United States Fish and Wildlife Service looks forward to receiving the Final Management Plan for review and approval.

Thank you for your consideration of these comments. We look forward to continued collaboration with the Corps, the State of Florida and all stakeholders to achieve the best possible result as these important CERP projects move forward.

Sincerely,

Terrence C. Salt
Director of Everglades Restoration Initiatives

Cc: COL Carpenter
Ernie Barnett
Henry Dean
Jay Slack
Dan Kimball
Carol Clark
Willy Taylor

ATTACHMENT (Fish and Wildlife Service comments)

Southern Golden Gate Estates (SGGE) is an 86-square-mile (55,247 acres) portion of a 173-square-mile (111,053 acres) Golden Gate Estates subdivision purchased and constructed from the late 1950s to the 1970s as a vacation and retirement community in Collier County, Florida. Golden Gate Estates Subdivision infrastructure included 183 miles of drainage canals, 25 water control structures, and 813 miles of roads. The SGGE project includes 19,992 platted parcels, 279 miles of roads, 251 culverts, 10 bridges, 48 miles of drainage canals, and 8 weirs. Surface water runoff is captured by massive canals in an area that was historically characterized by sheetflow conditions across nearly flat terrain inundated by subtropical rains. Watershed habitat alterations included conversion of wetland habitat to uplands, exotic plant species invasion, and loss of plant diversity due to severity and frequency of wildfire and susceptibility to freeze damage. Cypress-dominated wetlands were replaced with mesic flatwoods and fire-tolerant cabbage palm (*Sabal palmetto*). Point-source discharges to the downstream estuary of Faka Union Bay eliminated or severely impacted oyster (*Crassostrea virginica*) and seagrass beds and altered fish population structure. Reduced freshwater flows into adjacent estuaries have resulted in the dominance or movement of salt-tolerant plants and animals into more inland areas, and creation of hypersaline conditions in some receiving waters.

During the development of the PIR for this project, 22 alternative plans were evaluated based on the following objectives:

- re-establish historic flow-ways, sheetflow and wetland hydroperiods;
- reduce point discharges to improve the health of downstream estuaries;
- maintain flood protection for developed areas north of the project;
- improve aquifer recharge for water supply and to provide a saltwater intrusion barrier;
- restore and enhance fish and wildlife resources including State and federally listed species such as the Florida panther (*Puma concolor coryi*), Florida black bear (*Ursus americanus floridanus*), and wood stork (*Mycteria americana*);
- protect rare habitat such as tropical hammocks and plant species including orchids and bromeliads;
- preserve upland habitat;
- control invasive exotic plants;
- improve water quality of stormwater runoff;
- reduce or eliminate overdrainage of adjacent sensitive ecosystems, primarily in public ownership;
- provide resource-based recreational opportunities; and
- provide contiguous habitat conservation for the greater Everglades ecosystem.

The tentatively recommended project plan, Alternative 3D, will include at least 83 canal plugs to be placed in the four major project canals: Miller, Faka Union, Merritt, and Prairie. The source material for the canal plugs will be the spoil from the original canal and swale excavations, as well as that spoil obtained from the demolition and degrading of project roads. 260 of the 279 miles of roads would be graded to lower their elevations to the same level as the surrounding ground, and 227 miles of these degraded roads would be abandoned and allowed to revegetate.

The remaining paved roads would connect Janes Scenic Drive in Fakahatchee Strand to Stewart and Everglades Boulevards and North Golden Gate Estates (NGGE), and provide access to a small number of property owners in the Belle Meade portion of Picayune Strand State Forest to the west. Pump stations will be constructed on three of the four project canals and three spreader channels will be constructed immediately downstream of the proposed pump stations to distribute water overland to emulate historic sheetflow. The northwest portion of the project site will not be restored to sheetflow conditions to protect upland habitat important to listed species and accommodate flood control maintenance in NGGE. Five levees would be constructed to protect existing development at Port of the Islands, a major agricultural area west of the project, and private residential areas northwest of the project site from elevated water levels. The cost of the construction and real estate for the tentatively recommended plan is estimated to be $362,612,000. Annual operation and maintenance is estimated to cost $2,129,000. Annual monitoring is estimated to cost $700,000.

A substantial feature of this project restoration effort is the completion of a land acquisition program that has been ongoing since State efforts to acquire the project site began in 1985. The SGGE subdivision originally included 22,000 lots with more than 17,000 individual landowners scattered worldwide. In April 1998, the Department of the Interior (DOI) and the Department of Environment Protection (DEP) executed a grant agreement under the Farm Bill (FB) (Section 390 of the Federal Agriculture Improvement and Reform Act of 1996, Public Law 104-127), which ultimately resulted in approximately $38 million in Federal funds for land acquisition. Land acquisition efforts are now over 99 percent complete, with only two parcel negotiations outstanding.

General Comments

The Fish and Wildlife Service (Service) finds that the draft PIR/EIS present a balanced description of the Interagency Technical Committee and Project Delivery Team's (PDT's) evaluation process, and the benefits expected through implementation of the SGGE Ecosystem Restoration Project. The Service expects the tentatively selected alternative, Alternative 3D, will provide fish and wildlife resource benefits to the 86-square mile SGGE project site, adjacent public lands, and the 98-square miles of downstream coastal estuaries. It is expected that the restoration plan will restore 36,200 acres of wetlands, raise groundwater elevations in uplands, decrease the severity and frequency of wildfire, restore a hydrologic regime that supports subtropical plant species, assist in the recovery of listed species and migratory birds, and improve coastal fisheries.

We appreciate the complexity of the hydrological models that support project alternative selection and project benefit analysis. We recognize these models as tools for reasonable approximation of project plan design effects on fish and wildlife resources. However, the Service has significant concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and application of design storm.

Our consistent participation in project development and analysis as members of the PDT since 1997 reinforces our belief that all reasonable, cost-effective alternatives have been considered. However, we are also cognizant of the limitations posed by extensive assessment requirements under severe time constraints. This project alternative development and assessment is only the initial step in developing a final design that integrates construction infrastructure with operations management and adaptive monitoring and assessment.

The principal focus of our comments is additional project design development that will: (1) de-emphasize engineered structure reliance, particularly the size of the pumps; (2) refine hydrological models; (3) develop an operations management plan that emphasizes operations for restoration over flood control; (4) finalize a modified Adaptive Assessment and Monitoring plan; (5) provide a complete analysis to ensure compliance with the Savings Clause and to identify water made available by the project to be reserved under Florida law; (6) develop an estuarine mixing model; (7) document extensive changes in the watershed that have resulted from explosive development and water management, and determine whether these changes have been considered; (8) remediate contaminated areas and address contaminants in areas outside of the project but affected by the project; and (9) address all effects to adjacent public lands. We have not included editorial comments except in those cases where we believed the reader's understanding would be significantly improved.

Appendix D includes the draft Fish and Wildlife Coordination Act Report (FWCAR) for the tentatively selected plan. This report was prepared in January 2004 at the request of the Corps in order to meet accelerated deadlines for preparation of the draft PIR/EIS for the project. Due to subsequent project report preparation delays, substantial portions (including the Operation Management Plan, Section 12-Assurances, and some hydrologic model information) of the draft PIR/EIS were not available for Service review at the time of the draft FWCAR preparation. The draft FWCAR will be modified and re-submitted to the Corps prior to the final PIR/EIS and subsequent to these comments under the National Environmental Policy Act.

Throughout the text there are frequent references to the actions or decisions of the PDT. While the PDT did assess the majority of the project, it should be noted that specific hydrologic modeling and analysis, flood analysis, Level of Service considerations, some alternatives development, development of the operations management plan, and cost considerations were not products of the PDT process, but were the result of decisions made by one or both of the project sponsors. The document should be edited to reflect these considerations so that government agency comments on the PIR do not appear to conflict with perceived actions of government agency representatives who were PDT members.

Specific Comments

Summary

Page vii

The Ten Thousand Islands National Wildlife Refuge (NWR) should be included in the calculation of hydrology habitat units and biotic habitat units. See comments in Section 6 for more details.

Section 1, Study Purpose and Need

Figures 1-1, 1-2, 1-3, and 1-5 should be reconciled to indicate: 1) overlap of Picayune Strand State Forest with the South Belle Meade Area; and 2) overlap of Ten Thousand Islands Estuary with the Ten Thousand Islands National Wildlife Refuge/Aquatic Preserve/and National Estuarine Research Reserve. Text descriptions of the Planning, Project, and Study Areas are not well reconciled with the map and map keys. The Project Area Description in Section 1.4.4 and Figure 1-5 describes affected areas but does not include portions of Fakahatchee Strand south of the SGGE Conservation and Recreational Lands (CARL) boundary. Since this area is affected by the project, this area should have been modeled and included in the project effects. Figure 1-4 should be improved to more accurately represent the boundaries for the various land management units.

Page 2-7, Section 2.5, Fish and Wildlife Resources

The Service recommends this section be expanded. The fish and wildlife resources of the project area reflect the distinctive biogeography of the region and should be further described in this PIR/EIS in order to demonstrate both the uniqueness and vulnerability of project resources. The SGGE project is unique in its location in a subtropical climate subject to intense seasonal rainfall and occasional catastrophic events like hurricanes. Plant communities have been established in recent geological times in frequently flooded nutrient-poor coral, marl, and sand substrates. The project's location on the South Florida peninsula subjects the flora and fauna to natural invasion and migration of plants and animals from the West Indies and has elements of flora and fauna that have evolved after isolation from populations in western states during post glacial periods. The project area is also located within and upstream of the largest mangrove swamp in North America.

Section 2.3, Plant Communities

There are several inconsistencies which should be resolved in this section, including:

- Page 2-1: There is a different definition of the Project Area here than on page 1-14.
- Page 2-3: Saltmarsh is listed as a dominant ecological community, but freshwater marsh is so-listed on page 1-13. The marsh south of US41 is accurately described as brackish marsh.
- Table 2-1: does not identify Coastal Wetlands and Estuaries, which are discussed later in

Section 2.3.6.

Page 2-8, Section 2.6, Threatened and Endangered Species

The Service recommends expansion of this section to include more technical information on the historic or pre-drainage status of listed species. In particular, the status of the West Indian manatee should be revised to describe it as a native species rather than a recent arrival as implied by the context of the text in the PIR/EIS. The location of the largest wood stork colony in North America at Audubon's nearby Corkscrew Swamp Sanctuary should be documented in the text to provide context for later discussions of the importance of restoring the project's short-hydroperiod wetlands which are utilized as forage habitat by the wood stork. The Service recommends that the Corps use of the South Florida Multi-Species Recovery Plan, biological opinions, individual listed species recovery plans, and available literature citations in these documents as information sources. The Service will assist in the compilation of this text.

Page 2-11, Section 2.6.9, Endangered Plants

This section should be revised to show the status of those endangered plants that are expected to occur in the project area based on known habitat, distribution, and ecology of the SGGE pre-development landscape.

Page 2-11, Section 2.6.10, Essential Fish Habitat

This section should be revised to indicate what elements of Essential Fish Habitat potentially existed in a pre-drainage condition based on available studies and historic descriptions of Gulf of Mexico fisheries. Text from Section 2.11 (Estuarine Resources) should be incorporated and cross-referenced.

Page 2-13, Section 2.9, Climate

This section should be expanded to show historical freeze, drought, flood, or hurricane occurrences which affected the project environment.

Page 2-13, Section 2.10, Hydrology

This section should be revised consistent with our comments for Section 3.10, Existing Condition Hydrology, and Section 3.10.3, Water Management, on pages 3-19 and 3-22,

as well as our comments on documenting existing wetlands in NGGE under Section 3.3, Plant Communities, on Page 3-2.

Page 3-1, Section 3, Existing Conditions

Page 3-1, Section 3.1, Introduction

This section describes the existing condition consistent with the Comprehensive Everglades Restoration Plan (CERP) as of the year 2000. In subsequent sections of the PIR/EIS, existing condition appears to be updated to 2003. The existing condition year should be consistent across all analyses and descriptions. We recommend 2003 or more recently, given the issuance of a significant number of permits that resulted in loss of fish and wildlife and water resources in the project watershed between 2000 and now. See our comments on page 12-8, Section 12.2.3.

Page 3-1, Section 3.2. General Environmental Setting

This section should be clarified. The notation "north of the Ten Thousand Islands NWR" should be replace the appropriate text in "...marine preserves and refuges that constitute the Ten Thousand Islands Region...". Also, there are 6 major embayments as shown in Figure 3-2. Thus, Palm Bay and Buttonwood Bay should be added to the list and Blackwater River should be changed to Blackwater Bay.

Page 3-2, Section 3.3. Plant Communities

This section and Table 3.2 should include actual, as well as percentages of acreages of plant community changes in 1940 vs. 1995. Year 1995 plant communities and plant community acreage and percentage of habitat predicted by hydrologic models for year 2000 should be included in Table 3.2 so that model predictions for expected habitat versus actual habitat analysis can be prepared to determine model prediction accuracy.

This section should also contain information on exotic plant species, including their ecology and distribution in the project area.

The Service strongly recommends, and has recommended throughout the project development process, that this document include a discussion of the existing wetlands in NGGE. This is extremely important for three reasons: (1) there is an extensive history of controversy over jurisdiction, location, protection, and mitigation for wetlands in NGGE involving the Corp's Clean Water Act section 404 permitting program; (2) as development increases in NGGE, there will be continued misconception that seasonally-inundated wetlands are actually flooded uplands; and (3) given a false perception that these NGGE areas are flooded as opposed to naturally occurring wetlands, there will be public perception that the SGGE project is responsible. Public pressure to change the Operations Management Plan to accommodate flood control in NGGE would likely affect project benefits for fish and wildlife resources. In our comments on Section 5, Problems, Opportunities, and Objectives, we reiterate this recommendation. It should be noted that this information (Collier County vegetation mapping and hydric soils) has been provided to the Corps on at least two separate occasions while the issue was under discussion by the PDT.

Page 3-10, Section 3.6. Threatened and Endangered Species

This section should provide more detailed information on the existing status of listed species in the project area. The Service is assisting the Corps in the preparation of a Biological. Our draft FWCAR provides additional references for this section.

Page 3-13, Section 3.6.4, Florida Panther

Statements regarding the presence of this species appear to be conflicting in the text. This section should be revised to indicate that panther use of the project area has been verified.

Page 3-17, Section 3.6.11, Essential Fish Habitat

This section should describe the components, authorization, and determination process for the Essential Fish Habitat designation, as many reviewers may not be familiar with this designation.

Page 3-18, Section 3.7.2, Soils

This section would benefit from a discussion of the seasonal oxidation process and effects of frequent fires under natural conditions on the thin layer of detritus that forms in shallow or short hydroperiod wetlands in sub-tropical Florida. These processes naturally oxidize organic deposits, leaving only staining or spodic layers in the soil horizon as evidence of hydrology. "Muck" layers are not typical of short-hydroperiod wetlands of recent geological age in areas of seasonal drawdown with frequent fire.

Page 3-19, Section 3.9, Climate

This section appears to address changes in hydrology, not climate, and should be revised to address temperature, wind, and precipitation. The effects of climate on the existing drained habitat condition would include loss of sub-tropical plant species from fire and freeze, and potential loss of trees from high winds resulting from vulnerabilities due to soil oxidation or forest structure (thinning from fire and disease).

Page 3-19, Section 3.10, Water Supply, Water Quality, Water Management

This section should include an analysis of recent and extensive changes in stormwater management, water use, and water quality associated with the issuance of nationwide and individual Clean Water Act section 404 permits by the Corps and Environmental Resource Permits by the South Florida Water Management District (District) and the DEP. The Service provided information on recent significant projects to the District and the Corps during the PIR and hydrologic model development processes, and as cooperators with the EPA in the EIS for the Corps Regulatory Process in southwest Florida. Additional information on watershed alteration is available from the Lower West Coast Water Supply Plan, the South Lee County Watershed Plan, the Estero Bay Watershed Plan, the Big Cypress Basin Watershed Plan, and the Southwest Florida Feasibility Study.

This section should be revised to include recent and significant hydrological changes to the upper watershed and areas downstream of the project. The project receives water from: 1) swale and canal discharges at low Levels of Service in a rapidly developing but low density NGGE residential area; and 2) discharges from significant agriculture areas to the north of Panther NWR and Fakahatchee Strand. Changes to the Big Cypress Watershed that have resulted in diversion of water to the Imperial and Cocohatchee Watersheds from the Estero Bay Watershed and the Corkscrew Regional Ecosystem Watershed (CREW) areas should be detailed. Reference to watershed flow changes as detailed in the South Lee County Watershed Plan should be discussed with reference to this project and adjacent Fakahatchee Strand. The PIR should address recent changes in stormwater management associated with the canals adjacent to Bird Rookery Swamp, Immokalee Road, Cypress Canal, the four-laning of I-75, management measures at the Lucky Lake weir south of the Panther NWR, problems with water flow under U.S. 41 to the south of the project, agricultural areas north of Panther NWR that discharge through the Refuge to the project site, and influences of the significantly diked agricultural area that occurs southwest of the project in the Belle Meade portion of Picayune Strand State Forest.

We believe any discussion of existing and future hydrologic conditions that do not include an analysis of off-site areas where significant project features would be constructed, omits important information from the analysis. In particular, levee construction associated with the project condition at the agricultural area and Port of the Islands sub-division should affect the hydrology of these areas as discussed in the Pre-drainage, Existing, and Without Project Hydrology sections.

Page 3-20 and 3-27. Sections 3.10.1 and 3.12.2. Water Supply and Water Demand

These sections should indicate actual (as well as permitted) water use of the City of Naples well field and detail conditions which lead to reported residential well failure and canal drawdown in the vicinity of this well field under recent drought conditions. Limitations on future expansion of this well field, as discussed by the PDT, should be identified. The NGGE well field is mentioned on page 3-27. The report should identify the area that is supplied or influenced by this well field and if project water is affected by this well field. Water shortage areas and areas with salinity problems, as mentioned on page 3-27, should be identified and the project effect on these areas, if any, should be discussed in the text.

This section should estimate existing and potential self-supply for the 101-square mile area of NGGE. This section should include a discussion of the permitted water use for agriculture north of Panther NWR and in the Belle Meade area and its influence, if any, on this project. This information is necessary to evaluate the Savings Clause and Reservations determinations, and the Operations Management Plan. Understanding the effects of these water demands are particularly important for dry season water deliveries to the project and downstream estuaries. The water demands of the Port of the Islands community well field should be identified.

Page 3-21. Section 3.10.2. Water Quality

Rookery Bay National Estuarine Research Reserve collects continuous data in Blackwater and Pumpkin Bays, and should be recognized in the text.

Page 3-24, Section 3.11, Estuarine Resources

The dates and a brief synopsis of the Marco Island and adjacent (Deltona Corporation) development should be expanded upon in this section due to the cumulative effects these very large projects would have on the project area's estuarine resources (in particular, manatees, seagrasses, and mangroves).

This section should include a detailed discussion of the condition (location, size, depth) and history of construction of the Faka Union Canal below U.S. 41. There is some confusion as to whether this canal was permitted by the Corps. This canal severed estuarine creeks and the original Faka Union River upon construction. As a result, the effects associated with this canal include salinity changes in the marsh and mangrove systems on the adjacent Ten Thousand Islands NWR. This canal, its condition, and its fresh water transport, influence manatee distribution and behavior.

This section would benefit by addition of a discussion of recreational and commercial fisheries resources in the area.

Page 3-28, Section 3.14, Hazardous, Toxic, and Radioactive Wastes (HTRW)

Findings of the HTRW (Existing Condition) section are consistent with an Environmental Risk Assessment (ERA) completed on September 30, 2003, regarding soil contamination at SGGE. The Service identified several miscalculations, errors, and identified other unresolved issues in the ERA and submitted corrective recommendations to the District by letter dated March 23, 2004. The District and URS are currently in the process of addressing Service concerns regarding the ERA and the outcome of recommended corrections could change the results of the ERA. At this time, outstanding concerns and accompanying recommendations are as follows:

- The ERA calculates site-specific organic carbon partition coefficients (k_{oc}) and octanol-water partition coefficients (k_{ow}) values for dieldrin. The k_{oc} value calculated is much higher than literature values, while the k_{ow} is much lower. The document suggests "weathering" as a possible explanation. The Service feels that it is unlikely that weathering alone can explain both an increase in one value and a decrease in the other. The k_{ow} is a physical constant for dieldrin and should not change due to weathering. Additional explanation is needed to justify the use of these values in the ERA. Table 18 of the ERA contains major errors which result in the incorrect calculation of the site-specific k_{oc} and k_{ow} for chlordane. As a result, all HQs for chlordane reported in this ERA are incorrect and need to be recalculated. Total chlordane should equal the sum of the alpha chlordane and the gamma chlordane isomers. In the desorption portion of this Table 18, total chlordane is incorrectly given the same value as alpha chlordane, ignoring

the gamma chlordane isomer. Similarly, in the bioaccumulation portion of Table 18, lipid concentrations are based only on alpha chlordane instead of total chlordane as they should be. Correction of these errors may result in significant changes in the HQs for all species presented in this document.

- Even after correcting the mathematical errors discussed above, the site-specific k_{oc} for chlordane, as calculated in this report, is approximately 15 times greater than the values reported in the published scientific literature. If accurate, this means that chlordane in this soil would be released much more slowly than expected, resulting in greatly reduced risk to wildlife receptors. The Service encourages obtaining and using site-specific data where possible. Given the large discrepancies with literature values, and the fact that a number of non-detects were obtained in the desorption study, the Service recommends repeating the desorption studies for chlordane to confirm the initial result. Material for the repeat study could be obtained during follow-up sampling activities.

- If the original site-specific k_{oc} result cannot be confirmed, the Service recommends a cleanup criterion of 100 ppb (ug/kg) for chlordane. While still well above the State's Probable Effect Concentration (PEC) of 18 ppb, this level should represent insignificant risks to Federal trust resources. All soil locations with measured concentrations above this level would require delineation and some type of remediation. It should be recognized that soils containing between 18 and 100 ppb of chlordane may still result in some impairment of the benthic community in localized areas of the Former Agriculture Area-West (FAW).

- If the original site-specific k_{oc} for chlordane is confirmed by the repeat study, the cleanup criterion for protection of piscivorous birds could be as high as 1.5 ppm (mg/kg). This would mean that only a few isolated locations would require remediation for protection of Federal trust resources. None of the District sampling results exceeded 1.5 ppm chlordane, while only four DEP samples (Brandt-Williams and Shirley 2000) exceeded this level. However, the Service does not endorse leaving up to 1.5 ppm chlordane in place in the soil, because this would almost certainly result in severe impacts to the prospective benthic community in the FAW.

- Similar to the situation for chlordane, the site-specific k_{oc} value for dieldrin obtained in this ERA falls far outside the range of k_{oc} values reported in the literature for a variety of soil types. In addition, the site-specific k_{ow} reported in this assessment is substantially lower than the literature values. If accurate, this means that dieldrin in this soil would be released to water much more slowly, and taken up by organisms less readily, than would be predicted by literature values. The result of using these site-specific values could be to underestimate risk to wildlife receptors by more than 100-fold. The Service does not feel that discrepancies of this magnitude can be accounted for by weathering alone. One possible explanation is that the desorption and bioaccumulation studies for dieldrin had not yet reached steady state at the termination of the studies. The Service is uncomfortable with the use of these values and recommends that literature values for the

k_{oc} and k_{ow} be used instead. Based on the literature values, the Service recommends a clean-up criterion for dieldrin of 6 ppb. This level was exceeded in only one grid (Grid 1 of the FAW).

- In striking contrast to the URS data provided in the ERA, sampling activities conducted by the DEP indicated large areas of high chlordane contamination within the SGGE FAW and the adjacent Belle Meade property. 42 of 134 discreet samples collected by the DEP in these areas exhibited concentrations above the 100 ppb suggested clean-up criterion. The mean chlordane concentration for the entire area sampled by DEP was 222 ppb, compared with 5 ppb determined by URS. Similarly, the DEP 95 percent UCL was 343 ppb compared with 8 ppb from URS data. Since there is no reason that we are aware of to question the validity of the DEP data, this data must be given equal consideration with the URS data. The Service recommends combining the DEP data with the URS data in all statistical calculations, in order to obtain an unbiased idea of the total areal extent and magnitude of chlordane contamination. All HQs for chlordane should be recalculated based on this combined dataset.

- When evaluating impacts to Federal trust resources from a project, the Service must consider all impacts, even if they occur outside the project boundary. Raising the water table in SGGE will rehydrate areas of the adjacent former agricultural lands to the west, attracting wading birds and other trust resources to those areas. Sampling conducted by the DEP in the adjacent Belle Meade area showed even higher levels of chlordane than those found on the SGGE property. The Service strongly recommends that the SGGE restoration project not be implemented until a plan has been developed to assess the extent of contamination and remediation processes that may be necessary on those (primarily public) lands west of SGGE that will be affected by this project.

- The Service has recommended several corrections and changes in methods that may have a significant impact on the outcome of this ERA, including: (a) combining URS and DEP data, (b) correcting mathematical errors involved in the chlordane k_{oc} and k_{ow}, (c) repeating the desorption/bioaccumulation studies needed to determine these values, and/or (d) using literature values of physical parameters (k_{oc} and k_{ow}) for chlordane and dieldrin. Because any of these changes will cause changes in the estimated risks, it will be necessary to recalculate all HQs for chlordane, dieldrin, and selenium. All tables and associated text, where HQs for these contaminants are presented or discussed, will require revision.

The above comments and recommendations apply to only a few hundred acres of this 55,000-acre property. Within this context, the vast majority of this site is entirely suitable for its proposed use in its present condition.

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Page 3-33, Section 3.16, Recreation

This section should identify the year that the Florida Division of Forestry (DOF) began

management activities related to recreation in the SGGE portion of Picayune Strand State Forest, as well as those management activities listed in the Interim Management Plan Agreement between DOF, DEP, and DOI. This date is important as extensive recreational uses, particularly illegal OHV use, and hunting occurred prior to DOF management. ATV use is not currently under management by the DOF as it is a prohibited activity in most State forests. Hunting is currently being considered as a managed use in the forest. This section should reference DOI and DEP oversight of the mentioned Ten Year Management Plan consistent with previously adopted Interim Management Plans, protocol agreements, and Farm Bill 3. Types of recreational uses on the adjacent Fakahatchee Strand State Reserve should be outlined in this section to depict the full range of recreation in the project area, especially since the main access to the SGGE project from the southeast will be through Fakahatchee Strand.

Section 4, Future Without Project

Page 4-10, Section 4.6.4. Florida Panther

Although there are examples of panther/human encounters associated with the presence of prey in NGGE, there is no evidence that a partial percentage of this type of residential development would increase wild prey to the extent that panther/human encounters would increase. This discussion should be deleted.

Page 4-11, Section 4.6.7. Snail Kite

The "no action" phrase should be replaced with "without project".

Page 4-11, Section 4.6.8. West Indian Manatee

The last sentence in this discussion addresses critical habitat and boat-related mortality concurrently. This is excerpted from the Service's draft FWCAR report in Appendix D and will be modified as follows: "Effects to critical habitat such as seagrasses would be difficult to quantify due to the lack of a monitoring program and an estuarine mixing model. Changes in manatee distribution or use of the marina basin as a warmwater refuge that might result from changes in stormwater management in the upper watershed may expose manatees to additional cold stress, or boat-related mortality or injury; depending on changes in manatee behavior or distribution."

Page 4-12, Section 4.6.9. Wood Stork

This section should reference the potential for additional declines in wood stork productivity at Audubon's Corkscrew Sanctuary wood stork rookery. We are specifically interested in declines that may directly or indirectly result from additional development and associated wetland impacts.

Page 4-13, Section 4.9. Climate

The text should discuss trends in sea level change, particularly the rate of relative rise and the anticipated effects on storm (wind and surge) frequency and magnitude, saline intrusions, and plant and animal conservation. We recommend citing evidence that the northern encroachment of mangroves into the brackish marshes may, in part, be attributable to sea level rise.

Pages 4-13 to 4-15, Sections 4.10, 4.10.1, 4.10.2, and 4.10.3, Water Supply, Water Quality, and Water Management

These sections should be modified to include potential effects of additional development in NGGE on the SGGE project.

Page 4.15, Section 4.11, Estuarine Resources

These sections should be modified to include potential effects of additional development in NGGE on the SGGE project. Further, we suggest explaining the assumption that the health of the Faka Union estuary would not continue to decline under current trends. The assumption seems counterintuitive to us.

Page 4-20, Section 4.18, General Environmental Setting for Other Lands

There are several agencies involved in managing the Ten Thousand Islands Region, including the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park. These agencies and their work should be identified.

Section 5, Problems, Opportunities, and Objectives

This section should include the significant input of other State and Federal landholders and land managers with regard to project effects on their lands. This should also be included in Section 5.1, Public Concerns, as non-governmental stakeholders have also expressed these concerns.

Page 5-1, Section 5.1, Public Concerns

The discussion of NGGE flooding and environmental projects should include data about the remaining wetlands in NGGE, including their extent and hydrology, and the history of the controversy and protection efforts surrounding these wetlands. This may be critical to the future of SGGE because, as NGGE develops and knowledge of today's conditions ebb from public consciousness, the public may erroneously come to believe that seasonal inundation of wetlands in NGGE is a flooding effect caused by the project. This misperception may lead to public pressure to increase drainage to SGGE and to change the Operational Management Plan in the future.

Page 5-2, Section 5.2, Problems and Opportunities

We suggest adding a couple of items to the discussion. First, the interception of freshwater that

would normally travel as sheet-flow to the downstream brackish marshes and eventually to the bays has increased salinities, and facilitated the northward invasion of salt-tolerant species, with associated changes to wetland communities. Second, construction of the Faka Union canal has influenced freshwater wetlands by allowing salt water to intrude into those areas and disrupting tidal flow patterns west of the berm.

Page 5-3, Section 5.2. Problems and Opportunities

Table 5-1, as well as Table 3-2, on page 3-6 and Table 6-7 on page 6-70 indicate without project acreages of certain habitats that seem inconsistent with the expected increased project drainage under that condition. These tables should be reconciled or explanations provided in the text for their apparently inconsistent predictions.

We recommend eliminating the word "critical" from the first sentence on page 5.4 with reference to panther habitat. The word "critical" has specific connotations relative to the Endangered Species Act when used as an adjective before "habitat."

Page 5-4, Section 5.3.1. Planning Goal

Chapter 9 of the "Yellow Book" gives the restoration and enhancement of *wetlands on adjacent public lands* equal consideration as a project purpose (see page 1-10). Because of extensive public lands interests, including two National Wildlife Refuges, a National Estuarine Research Reserve, and the Everglades National Park, this purpose should be emphasized in this section consistent with that directive.

Page 5-5, Section 5.3.2. Planning Objectives

This section should specify that the multi-agency PDT formulated and developed consensus on the project objectives. The PDT would consider the development of these objectives to be one of the most significant products of the process.

Page 5-8, Section 5.3.3. Planning Constraints

Regarding the statement "adversely affect" in the last sentence on the page should be replaced with "jeopardize the continued existence of," please see our comments under Page 6-7, Section 6.3.1, as follows for a discussion of flood maintenance constraints in NGGE.

Section 6, Plan Formulation and Alternative Evaluation

We believe that there should be further consideration of how the cost to benefit ratios are constructed for other land management units. Specifically, the Ten Thousand Islands NWR, which is likely to be directly affected by the proposal, should be included in the analysis.

Habitat Units should be estimated for the refuge using the South Florida Assessment Method.

This methodology was used for Collier-Seminole State Park (which is surrounded on 3 sides by the refuge) and Fakahatchee Strand State Preserve (which shares a common boundary), both of which extend to the estuary.

Inland Habitats (primarily north of US41) and Estuarine Habitats (nekton and oysters in the bays) have been analyzed and documented. However, a large area, between US41 and the bays, does not appear to be considered by either analysis. The affect of this project on this area should to be evaluated.

Page 6-7, Section 6.3.1, First Iteration, Management Measures Considered, Pump Stations

The Service continues to have concerns about the applicability of the 100-year storm flood control standard for determining the pump size for this project. Application of this standard could result in drawdown of wetlands in NGGE, over-inundation of SGGE and other project resources, and discharges to downstream estuaries in perceived flood situations or in storms of 10, 25, or 50-year frequency. It would appear that designing a 100-year storm pump system to pump out canals that have less than a 10-year storm capacity in a flooding event which may render all infrastructures unusable, may not be cost effective or operationally tenable.

This concern extends to flood insurance and vague references to a floodplain-management plan in the PIR. We acknowledge concerns about perceived "takings" of private property, but suggest that language such as "baseline for floodplain management and the National Flood Insurance Program [NFIP]" be explained. The NFIP is not intended to foster development in flood hazard areas; neither is it intended to define property rights. The NFIP and flood rate maps constitute aspects of a program that assign probabilities to flood events, subsidize flood insurance in certain areas if specified conditions are met, and limit liabilities to lenders. The relationships between the proposed action, a range of pump capacities, NGGE hydrology, flood insurance and other NFIP programs, and "floodplain management" should be comprehensively described.

Page 6-15, Section 6.3.3, Analysis Screening and Concerns, First Iteration

The PIR should provide information regarding estimates of real estate acquisition for NGGE as referenced in paragraph two on this page and in Table 6-18, 6-19, and 6-22 on page 6-103 for Alternative 6. Acquisition in portions of NGGE was considered during the alternative selection process included as a potential means to increase the area of hydrologic restoration in SGGE, reduce pump size, reduce engineered infrastructure, and protect wetland resources in existence under current condition in NGGE. There was considerable discussion and no agreement on the area potentially affected by flooding, the threshold at which flooding was acknowledged as impacting residents (increases in stage or duration), nor which models (MIKESHE or other) were used to assess this issue. The Service is of the opinion that the area of NGGE calculated for purchase in Alternative 6 may be overestimated. More precise information should be provided to help determine the actual potential cost of this project to insure that it is weighed against other alternatives accurately.

Page 6-52, Section 6.6.1, Hydrologic and Hydraulic Modeling

We caution that changes in models are not attributable to the PDT, although some PDT members, primarily project co-sponsors, did make model change decisions. This is important only in that this section implies more involvement or knowledge of model changes by the entire PDT than actually occurred.

Pages 6-54 and 6-60, Section 6.6.3, Inland Habitat Changes

We recommend including the Ten Thousand Islands NWR, and the significant infestations of Brazilian pepper south of US 41 be included in the analysis. Further, the assertion that Brazilian pepper will not reinvade sites after hydrology has been restored should be supported with references.

Pages 6-56 through 6-62, Section 6, South Florida Assessment Method

This section should describe how or if SFAM assesses inter-annual variability in water depths and their duration. For example, it would be interesting to know whether the SFAM indices reported in Table 6-4 represent a one-to-one spatial mapping, or, total acreage for the regions of interest. A more thorough description that explains how these indices are calculated should be provided.

Page 6-62, Section 6.6.3, Inland Habitat Changes

Values for parameters should also be calculated for the Ten Thousand Islands NWR, since the values are not limited to areas that were hydrologically modified.

Page 6-63, Section 6.6.4, Estuarine Habitat Change

The assumption that Fakahatchee Bay has had minimal impacts from human activities is arguable. The explanation for the assumption should be improved. The SGGE canal system has likely intercepted some sheetflow that would normally flow into this bay, the construction of logging trams and US41 has altered to some degree the distribution of that sheet flow, and excessive freshwater flowing into Faka Union Bay extends to a varying degree into the western portion of Fakahatchee Bay. While Fakahatchee Bay may be relatively pristine compared to other bays affected by this project, we caution against carrying the comparison too far.

Page 6-70, Table 6.7 Water Depths and Major Plan Community Types

Data in Table 3-2 reports that the percent of Mesic Pine Flatwoods in 1995 was 2 percent. Yet, in Table 6-7, Mesic Pine Flatwoods represent 94 percent of the area. Please explain the large differences between the NCRC maps and the output from MIKESHE vegetation model.

Page 6-74, Section 6.7.2, Inland Performance Measures

It is not clear that Table 6-7 supports the conclusion that "the only areas that have not changed in water depth are areas that were and still are upland or coastal marsh communities." There has consistently been an approximate 4' difference in water levels between the wet and dry season in the northern marshes of the Ten Thousand Islands NWR, with water levels being approximately 2' above ground during the wet season and 2' below ground during the peak of the dry season. This is inconsistent with the assumption that "coastal marshes are probably more strongly influenced by Gulf of Mexico water levels than flows through SGGE." The table, the conclusion, or both should be modified for accuracy, precision, and consistency.

Page 6-83, Section 6.7.3, Inland Habitat Units

We recommend the authors review the numbers in Figure 6-11. The figure shows a 100 percent increase in Biota Habitat Units for Alternative 3D, with project, when it appears to be closer to 30 percent (40,000 to 52,000). Also, the figure shows a 100% decrease without project. This appears to be closer to a 15 percent decrease (40,000 to 35,000).

Page 6-85, Section 6.7.4, Estuarine Performance Measures

The derivation of the performance measure for nekton should be reiterated or referenced to previous sections of the document and the geographic location for the nekton flow performance measure should be included in the PIR. An analysis of the flow/salinity or stage/salinity relationship should be performed for the flow transects used, or, if conducted, the analysis should be reported.

Page 6-93, Section 6.7.6, Generalized Alternative Comparison Table

The Evaluation Matrix for Study Area Lands Affected by the SGGE Project (Table 6-17) should include the Ten Thousand Islands NWR. This is especially important considering the number of important Environmental Quality variables that may be affected on the refuge.

Page 6-101, Section 6.8.3, Water Supply Benefits, Municipal and Industrial Water Supply, Agricultural Water Supply

This section states that a "...key design criterion and goal throughout the development of the SGGE system components has been that municipal and industrial water supply will remain the same or be increased with the SGGE plan..." The basis underlying this assumption, and related design criteria based on this assumption should be clearly identified.

This section also states that groundwater levels may rise as a result of the project and yield more water for the ecosystem and potentially more water for municipal and industrial use. It would be helpful if this section also identifies the volume of the additional yield that will be available for the natural system, and which areas are being considered for the benefits of this additional

groundwater. Groundwater benefits to NGGE (outside project area) that might potentially occur should be balanced through the application of some of that additional water for the restoration of wetlands and other aquatic resources in NGGE. A water accounting system would help ensure that project water is not diverted for non-project uses.

The Belle Meade agricultural area is an area of known saltwater intrusion which affects agricultural operations. Groundwater benefits may occur to alleviate this situation. Since the land use in this area may change (development may be intensified) under recent changes to the Collier County Comprehensive Plan, we recommend that all water be reserved for the natural system. Clearly and unequivocally reserving the waters for environmental restoration will ensure that potential water supply needs associated with intensifying land use do not decrease fish and wildlife benefits of the project.

Page 6-103, Section 6.8.6. Costs of Alternatives

See comment regarding computation of real estate costs for Alternative 6 on page 6-15 as portrayed in Table 6-18, 6-19, and 6-22.

Page 6-107, Section 6.8.6, Costs of Alternatives, Groundwater Impacts

The document should identify or delineate the portions of the Ten Thousand Islands region with a one-foot increase in groundwater levels.

Page 6-116, Section 6.8.8. Cost Effectiveness and Incremental Cost Analysis

The Ten Thousand Islands NWR should be included in Table 6-22 (and Table 6-17), and subsequent comparisons.

Page 6-136, Section 6.8.11, Risk and Uncertainty Analysis-Uncertainty of Project Benefits

We suggest clarifying whether the topography sensitivity analysis demonstrates that SFAM is reliable even if there is a lot of uncertainty in the topography, or, indicates that SFAM metrics are insensitive to changes in topography.

Section 7, RECOVER Evaluation

This section should include recommendations for additional analysis and requests for information that were contained in previous RECOVER reports.

Section 8, Recommended Plan

Page 8-2, Section 8.2.2, Pump Stations

The Service believes that these pumps may represent an over-design based on a 100-year storm that may affect project area resources within and outside project boundaries. The Service recommends reducing the number of pumps or replacing them with a number of smaller capacity pumps as part of the design and construction phase of this project if it is indeed over-designed.

Pages 8-2 and 8-3, Section 8.2.3, Levees

The effects of levees on listed species should be addressed. The levee around Port of the Islands and south of U.S. Highway 41 should be examined to determine effects on the adjacent Ten Thousand Islands NWR and potential benefits associated with blockage of sheetflow from refuge lands to the canal system. The Service believes that the levee proposed around the agricultural area in Belle Meade extends too far west, exceeds the limits of the project's effects, and would act to cut off surface water movements through this area. This levee was not previously reviewed by the PDT or the Service and deserves further scrutiny. Alternatives to the ring levee around private residential properties located in northeastern Belle Meade should be examined to minimize effects to wetlands.

The levee construction around Port of the Islands south of US41 may restore ecological integrity by preventing tidally influenced salt water from intruding into adjacent fresh water marshes as is currently the case. If feasible, breaks in the southern half of the existing berm on the west side of the Faka Union Canal should be considered as they may facilitate tidal water interchange to the area between the canal and the Wood River and divert some tidal waters from building up in the Port of the Islands basin.

Page 8-3, Section 8.2.4, Roads

The road plan that was approved at various points in the planning process by various parties should be included in this document. The Service is concerned about the location of the paved portion of Miller Boulevard extending too far south with reference to its potential effects on surface water movement to Belle Meade and listed species. The majority of the road plan is acceptable. Proposed uses and types of road access will be reviewed in the DOF Ten Year Management Plan. The first paragraph of this section ends with the statement that remaining material from road destruction would be spread across the landscape. Disposal of this material could adversely affect adjacent habitats unless criteria are developed to protect sensitive areas. Please incorporate a more detailed description of road deconstruction as developed by members of the PDT and described in the Prairie Canal Early Start permit. After road degradation is completed adjacent to Prairie Canal, the Service may have additional recommendations based on an adaptive assessment process.

Pump access roads should be minimized where possible by placement along existing roads or canals.

Page 8-4, Section 8.2.5, Culverts

There is no reference to the culverts under Stewart Boulevard. The text should explain whether the road is to be cut to grade, or culverted.

Page 8-4, Section 8.3, Operational Features

We remain concerned that issues discussed (or not) in this section could undermine all assumptions concerning ecosystem benefits and may affect listed species. Issues include the drawdown of wetlands in NGGE, overinundation of SGGE, dry season discharges of water beneficial to the downstream ecosystem, groundwater recharge of the NGGE canal system for use by wellfields, pump size, reporting procedures, and emergency water and fire management protocol. We recommend the text reference the draft Water Control Plan in Section VII of Appendix A, and incorporate the results of ongoing discussions.

The Service provides additional comments with regard to this plan in Appendix A section of this document. However, the Service believes the proposed plan is a flood control plan, not a plan maximized for restoration. Additional model runs and discussion of this issue are forthcoming, but this issue was identified early in the planning process and has not been addressed to the Service's satisfaction.

Page 8-6, Section 8.5, Adaptive Assessment and Monitoring

The Service is currently assisting in the development of a more detailed plan that will replace the plan in Appendix H of this document. The Service believes that this Plan is critical to achieving and documenting ecosystem benefits. Elements of this Plan are also necessary to minimize effects to federally listed species.

Page 8-11, Section 8.7.2, Cost Sharing of Adaptive Assessment and Monitoring

The document should specify the Ten Thousand Islands NWR, Rookery Bay National Estuarine Research Reserve, and Everglades National Park, rather than the less accurate term, Ten Thousand Islands area.

Page 8-13, Section 8.8.3, Detailed Design Phase

The Service will continue to be integrally involved in the detailed design of this project. The detailed design phase should include remediation of contaminants, refinement of hydrologic models, water control plans, project phasing, and the adaptive assessment and monitoring process.

Section 9, Environmental Effects

Page 9-4, Section 9.5, Fish and Wildlife Resources

The Service's Recommendation No. 2, as listed under this section is intended to establish: (1)

baseline fish and wildlife surveys that would be repeated mid-construction and post-project as deemed appropriate; and (2) surveys to avoid impacts to fish and wildlife resources resulting from actual construction activities. The Adaptive Assessment and Monitoring Plan will address this first task; some pre-construction surveys will be required to minimize effects to listed species (consistent with the Prairie Canal Early Start Project). Our response to comments under Recommendation No. 6 is included in comments on Section 8.3 on page 8-4. Our response to comments under Recommendation No. 12 is included in comments on Section 11.18 on page 11-5. Our response to comments under Recommendation No. 13 is our PAL to the Corps, dated August 11, 2003, which addresses design storm and other model issues and assumptions.

Page 9-15 and 9-16, Section 9.10, Hydrology

The text should be revised to reflect the intent of this project to restore hydrology, including hydroperiod and inter-annual variability, to SGGE. The second sentence of paragraph 3 indicates that coastal estuaries in the project vicinity presently receive, under most conditions, sufficient flows of fresh water. The Service does not agree with this statement and believes it conflicts with the project objectives to restore fresh water to estuaries that are blocked from upstream watersheds by the SGGE subdivision.

Preliminary discussions with the District indicate that no additional water beyond ecosystem needs will be made available as a result of this project. Despite this, text within the PIR appears to be setting the stage for use of some unquantified portion of water in excess of natural system needs. The third paragraph on this page states that the state reservation rule "will be conditioned to reflect that all of the reserved water may not be delivered to the natural system until the facility is constructed, operated, tested, and a final operating manual is approved." The last sentence in this section on page 9-16 states that "this adaptive assessment and management process provides an opportunity to revise the amount of water reserved for the natural system as appropriate and provides flexibility to account for changes in implementation strategies during the life of the project." This again seems to inappropriately set the stage for configuring and operating a system that will generate some unknown portion of additional water for uses other than the natural system.

Page 9-17, Section 9.10.3, Water Management

This section allows for the changes in the Water Control and Operations Plan based on the water resource allocation for the natural system. This emphasizes the importance of Section 12 (Assurances) of this document and the Water Control Plan. The Service has significant concerns with regard to both these issues. See our Section 12 and Appendix A comments on these issues.

Page 9-20, Section 9.12.3, Water Demand

Final figures for water demand do not currently contain accurate predictions for self-supply for the NGGE area. Without these predictions, water demands cannot be accurately assessed.

Page 9-25. Section 9.18. Environmental Effects on Adjacent Lands

Heavy equipment entering and leaving the construction areas should be decontaminated to avoid the transport of exotic and nuisance species to adjacent public lands.

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Section 10 Public Involvement

Page 10-11. Section 10.7.1 U.S. Fish and Wildlife Service

Provide references to all written correspondence from the Service, including the August 11, 2003, Planning Aid Letter (PAL).

Section 11 Compliance with Federal Environmental Statutes

Page 11-1. Section 11.2. Endangered Species Act of 1973. As Amended

The last sentence in the first paragraph under this section should be revised from "completion of BA" to "completion of consultation under section 7 of the ESA."

The last sentence on this page should be deleted. The project has not been fully coordinated under the ESA and the Service does not agree that at this stage of the planning, the Corps is in full compliance with ESA. We are continuing to work very cooperatively with the Corps to complete this consultation.

Page 11-2. Section 11.3. Fish and Wildlife Coordination Act of 1958. As Amended

This document should include references to and conclusions of all PAL's provided by the Service on this project, including our August 11, 2003, PAL. The FWCAR contained in Appendix D is a draft document that solicits comments from other State and Federal agencies for incorporation. The draft FWCAR was prepared, at the request of and in cooperation with the Corps, before many of the sections of this draft PIR were available for Service review. As evidenced by this correspondence, there are additional issues and conservation recommendations that will be incorporated into the Final FWCAR. Until this process in finalized, there should be acknowledgement that full compliance has not been achieved under the Fish and Wildlife Coordination Act.

Page 11-4. Section 11.12. Marine Mammal Protection Act of 1972. As Amended

The Service does not agree that the project is in full compliance with this Act, although all parties continue to work towards compliance. In particular, the Service has requested additional information on freshwater discharges to the manatee warmwater refugia within the Faka Union canal and Port of the Islands marina basin.

Page 11-4. Section 11.13. Estuary Protection Act of 1968

The Service does not agree that the project is in full compliance with this Act, although all parties continue to work cooperatively to assure compliance.

Page 11-5, Section 11.17 - E.O. 13089, Coral Reef Protection

The interpretation of this Executive Order generally differs from the description in this section. Although there are no documented coral reefs in the SGGE Study Area, coral reefs in other areas may be affected by this proposal and should be discussed and analyzed if warranted.

Page 11-5, Section 11.18 E.O. 13112, Invasive Species

The document does not identify the referenced "feasible/prudent measures to reduce invasive species infestations and minimize risk of introducing new invasive." The managing entity, DOF, does not currently have sufficient staff or funds to control exotic plants (in particular, Brazilian pepper) and some exotic animals on the project site. There is a significant question as to whether rehydration will act as the primary control mechanism for some invasive species, especially in the short term, or whether more intensive management activities may be necessary on an initial or perpetual basis. Additionally, management/control activities, or a lack thereof, may affect federally listed species. The Service believes that additional discussion and a separate Invasive Species Management and Monitoring Plan should be developed as part of this project.

Page 11-5, Section 11.19, Federal Water Project Recreation Act

Until the DOF management plan is developed in its entirety and approved, it is difficult to determine compliance with this Act.

Page 11-7, Section 11.30, Water Resource Development Act of 2000, Section 601

The Service is of the opinion that until there is agreement on the identification of water reserved for the natural system, legal users, and "appropriate quantity, timing, and distribution of water for the natural system", this project cannot be determined to be in compliance with this Act. While Section 12 identifies a methodology for determining water reservations, the methodology is based on conceptual models, does not identify the exact quantity attributed to each legal user, and is unclear as to how timing and distribution of water needed by the system are being determined.

Section 12, Project Assurances

General Comments

The SGGE project is primarily aimed at reducing over-drainage to restore wetlands in the project area. Through accomplishment of its purpose, the project will also improve the quantity, timing, and distribution of flows to the estuaries by reducing point source flows that currently damage the ecosystem. Since the project is hydrologically isolated from the regional system and designed

to increase water levels within the project footprint, meeting the assurances required by WRDA should be relatively straightforward in that an analysis of overall regional water management changes is not required. We believe that the methods employed to identify water made available for restoration of the natural system are largely adequate, but somewhat incomplete. We suggest the following changes:

- Fully document the methods used to perform evaluations (see specific comments below);

- Insert key information into the assurances section -
    - Evaluate Savings Clause compliance for fish and wildlife habitat areas that are outside the project footprint, but could be affected by the project (with the exception of the estuary at the downstream end of the Faka Union canal; please see comments on section 12.5.2 for specific areas that should be evaluated),
    - Substantiate the claim that the WRDA 2000 Savings Clause for level of service for flood protection is provided (see section 12.1.2.1 [page 12-2]),
    - Affirm that all of the water made available by this project is necessary for restoration of the natural system, and should be identified, dedicated, and managed for the natural system (in general, no water should be "excess" or available for other uses),
    - Repeat the language found in Section 601 (h) (1) in WRDA 2000 regarding assurance of project benefits in Section 12.12 (although this language describes the purpose of CERP in Section 1.4.1, reiteration of this language in this part of the document remind reviewers and decision makers of the benefits of CERP),
    - Anticipate and reinforce Section 13 concepts by clearly stating in this section that (1) both the beneficial baseline water and the additional water produced or redirected from this project are needed to achieve the goals and objectives of CERP, as well as to ensure the benefits of the Plan for restoration and preservation of the natural system as required by WRDA 2000, and (2) both beneficial baseline water and additional project water should be reserved for natural resources by the State, and,
    - Provide a comprehensive discussion of the relationship between the pre-CERP baseline, the Savings Clause, and the level of service for flood protection, as set forth in the Programmatic Regulations, in Section 12.1.3.

We also emphasize that the methods employed in the present PIR would require additional expansion for evaluation of future Comprehensive Everglades Restoration Plan (CERP) projects that have significant effects on regional water or that intentionally transfer existing sources through project modifications. We anticipate that this more complete and detailed set of procedures will be outlined in the forthcoming guidance memoranda on procedures for identifying water made available for restoration and for evaluating project effects on existing legal sources.

The assurances evaluation, model output graphics, and evaluations based on the graphics should be updated to reflect the final operational plan and to ensure consistency between project

modeling and project assurances. The operational plan is the link between the water identified to be reserved for the natural system, based on the expected performance of the plan, and the actual deliveries for the natural system. Modeling to refine and optimize the operational plan commenced after completion of the draft PIR, so the currently available information may not be the best available.

The organization of the assurances section is confusing in that the analysis of water being made available for restoration and other purposes is not clearly distinguished from the analysis of existing legal sources. Although there is a section entitled "Effects on Existing Legal Sources of Water," there is no comparable section entitled, "Identification of Water Made Available for Restoration and Other Uses," nor one entitled "Effects on Existing Level of Service for Flood Protection." We suggest the following reorganization:

a. Retain Section 12.2 "Principles for Identifying Water for the Natural System," but move Section 12.2.3 "Description of Methods Used to Evaluate Project Effects on Existing Legal Sources" to current Section 12.5,
b. Combine Section 12.3 and 12.4 and re-title as "Quantification of Water Made Available for the Natural System,"
c. Add a section entitled "Effects on December, 2000, Level of Service for Flood Protection,"
d. Reword Sections 12.5.2 and 12.5.3 to provide more concise statements as to whether there is a Savings Clause elimination or transfer of existing legal sources as to each of the potentially affected existing legal sources, and,
e. Consolidate the statements about elimination or transfer that are spread between Sections 12.5.2 "Identification of Existing Legal Sources of Water," and Section 12.5.3 "Elimination or Transfer of Existing Legal Sources" into a concise statement in Section 12.5.3.

Lumping the entire project footprint may be too coarse of a spatial resolution to adequately capture restoration benefits across different landscape types, especially where sloughs are interspersed with shallower sheetflow wetlands and upland pine strands. Although an aggregate quantification of water provided to the SGGE area provides a description of the overall increase in available water, we believe that this should be supplemented with an analysis of indicator regions for different habitat types or monitoring locations that will be used to assess actual deliveries of water by the project.

It is important that the Savings Clause evaluations consider all existing legal sources that could be affected by a project. Graphics in Appendix A show that canal levels in NGGE are lower during the wet season than existing levels, yet the report states that there are no Savings Clause issues in this area. Graphics that demonstrate that the water available to the wetlands in NGGE and other areas has not been reduced should be included in the text. See our comments on Sections 3.10 (page 3-19), 5.2 (page 5-2), and 5.33 (pages 5-5 to 5-8).

Analysis of the project benefits and effects is hindered by inconsistent terminology, mislabeled

graphics, the lack of graphics of supporting conclusions, missing locater maps, incomplete documentation of methods, and references to graphics outside section 12 that are missing exact figure numbers. We offer the following suggestions:

a. Include a locater map that identifies the estuarine flow transect locations.
b. Include documentation of the methods used to calculate the volume probability curves and estuary delivery graphics for all time periods: average annual, wet season, dry season, average year, dry year, and wet year,
c. Identify the time step used to compare project stages to their natural system targets,
d. Include a narrative description and map illustration of the project footprint (model grid area) used to calculate volume probability curves,
e. Include a description or definition of the natural system trace on the performance measure graphs, and clarify whether this is the same simulation referred to elsewhere in the document as the pre-drainage condition, the natural condition, and the natural systems model (NSM),
f. Apply consistent terminology is used throughout the document, such as the use of "NSM" vs. "natural system" vs. "pre-drainage condition," or the use of "existing 2000 condition" vs. "existing 2003 condition" vs. "pre-CERP baseline,"
g. Summarize modeling results and conclusions,
h. If warranted, reference any non-section 12 graphics that may relate to project assurances,
i. Make the x-axis scales (time steps) on graphics 12-11, 12-12, 12-13, 12-19, 12-20, 12-21, 12-23, 12-24, 12-25, 12-27, 12-28 and 12-29 uniform, and
j. Document the selection of the representative wet, dry and average years, and, justify the use of two different dry years to evaluate estuary deliveries (in the existing legal sources section, Figure 12-21 uses 2000 as the representative dry year; however, 1990 was used in the project effects section in Figure 12-13).

Volume probability curves obscure timing and are difficult for some readers to relate to on-the-ground restoration benefits. If use of volume probability curves based on depth is the preferred method, we recommend that water quantities be expressed in terms of beneficial depth, a more relevant measure for biogeochemical understanding, to supplement volumetric values. We also recommend that the distribution of annual values for the 1988-2000 period be documented using a frequency-of-return graph.

Specific Comments (Section 12, Project Assurances)
Pages 12-1 to 12-3, Section 12.1.2, Water Resources Development Act (WRDA 2000)

The language found in Section 601 (h) (1) should be inserted prior to the discussion of Section 601 (h) (4) (A) of WRDA 2000. Section 601 (h) (1) states the following:

> *The overarching objective of the Plan is the restoration, preservation, and protection of the South Florida Ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure*

the protection of water quality in, the reduction of the loss of fresh water from, the improvement of the environment of the South Florida Ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized."

The above quotation from WRDA 2000 includes paragraph 601(h)(4)(B) entitled the maintenance of flood protection, as well as paragraph 601(h)(4)(A) on existing legal sources. However, this section does not evaluate the WRDA 2000 Savings Clause for level of service for flood protection. This is an important oversight, and we suggest that a subsection of Section 12 be devoted to this topic.

Page 12-4, Section 12.1.3, Programmatic Regulations (33 CFR Part 385)

We recommend that the following language be inserted in Section 12.1.3:

The Programmatic Regulations provide that a pre-CERP baseline be developed to aid the Corps of Engineers and the District to implement the Savings Clause in determining if existing legal sources of water will be eliminated or transferred. The pre-CERP baseline is one of the tools to be utilized in this determination. The Programmatic Regulations also provide that each Project Implementation Report consider the operational conditions developed in the pre-CERP baseline to demonstrate that the levels of service of flood protection in existence on the date of enactment of WRDA 2000 and in accordance with applicable law will not be reduced by implementation of the project.

We recommend removal of the phrase "Department of Interior" from the first sentence of paragraph two so that it is consistent with the Programmatic Regulations and reads "... water supply for fish and wildlife is to be identified by the Corps of Engineers and the South Florida Water Management District in consultation with several other Federal, State, Tribal, and local agencies."

Pages 12-6 to 12-7, Section 12.2.1, Principles for Identifying Water for the Natural System-Background

The PIR should ensure that all water made available by a project and that contributes to identified ecosystem benefits, is quantified. This should include not only the main project area but also any natural areas where beneficial changes in quantity, timing or distribution of water have contributed to selection or justification of the project plan. We recommend that the final report include a summary of all natural areas for which hydrologic benefits have been quantified for the project, and that the water made available to these areas is identified in Section 12.

The last paragraph states that the recommended plan effects were modeled using a hydrologic simulation model. We recommend that the PIR reference the hydrologic simulation model documentation.

Page 12-7, Section 12.2.2, Quantity, Timing, Distribution, and Water Quality

We recommend replacing the phrase "period of record" with "period of simulation" where appropriate to distinguish between the historical period of hydrologic record and the period of simulation of the hydrological models. Also, the report states that the entire range of historic climatic conditions is represented in the modeling:

> *Since the hydrologic performance measures reflect preferred stages, depths, hydroperiods, etc. under a range of hydrologic conditions representative of historic conditions, a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of beneficial water deliveries available from project features though the entire range of historic climatic conditions.*

The text should clarify whether the period of simulation (1988 through 2000) is the largest historical period of record available, or, a subset representative of historical conditions experienced in the basin. If the latter is the case, then documentation or supporting references should be included to show that the subset of years selected is representative of historical conditions.

Page 12-8, Section 12.2.3, Description of Method Used to Evaluate Project Effects on Existing Legal Sources

The first two sentences indicate that Table 12-1 lists "Existing legal sources" of water. However, the table lists the overall sources of water for the Faka Union Canal watershed, whereas the "existing legal sources" are defined operationally as the portion of these sources that is used as water supply by the specific Savings Clause beneficiaries that are listed later in Table 12-1 (page 12-8). This section is likely to foster a misinterpretation that all water entering the watershed is an "existing legal source." We recommend changing the words "existing legal source" and "legal source" in the first paragraph and in Table 12-1 to simply "source." "Existing legal sources" can then be defined in terms of the specific Savings Clause beneficiaries described in Section 12.5.2 and Table 12-3. In the last sentence of this section, we recommend replacing the word "existing" with "2000" so that the sentence reads "the hydrologic model simulates the pre-CERP baseline (2000) conditions ...." Additionally, clarification of the difference between the existing condition and the pre-CERP baseline is warranted throughout this section. The majority of the document defines the existing condition as 2003 conditions while page 12-8 describes the existing condition as the pre-CERP baseline or year 2000 conditions.

It is not clear whether the model simulations for the pre-CERP baseline, and the with-project scenarios are identical (except for assumed project features). We suggest adding a clarifying statement, including, if necessary, a description of any differences. To facilitate the evaluation of SGGE project affects on water quantity and quality, SGGE project features should be the only difference between the model simulation inputs.

Page 12-9, Section 12.2.4, Regional Scale Effects

The report states that the primary regional-scale benefit of this project is to improve the timing and distribution of freshwater flows and reduce damaging point source flows to the downstream estuary. Yet, the graphics supplied in the draft PIR do not clearly demonstrate how timing and distribution are improved. The volume probability curves for estuary deliveries lump all flow categories together including open channel flow through Faka Union Canal and ground- and surface- water fluxes across all four transects. We suggest the PIR include graphics that distinguish between flows within each transect, and identify the portion of water delivered by each source within each transect. Bar charts could be used to easily identify flows by source for each transect if the bars were divided vertically by source and color coded.

Page 12-9, Section 12.2.4.1, Estuary Deliveries

The second sentence in Section 12.2.4.1 states "water made available by the project and delivered by the sheetflow to the coastal estuaries within the identified estuarine targets is considered to be a beneficial delivery and is therefore identified for the natural system."

While this is true, we recommend that the sentence be revised to include all sources of beneficial water delivered to the estuaries: structural flow from canals, groundwater flow, and sheet flow.

Pages 12-9 to 12-10, Section 12.2.5.1, Natural Areas

The last sentence in this paragraph should be revised to read "the quantity of water delivered to or retained within the project that results in wetland hydropatterns that fall within targets is considered beneficial water that is identified for the natural system." The expected level of ecological restoration is achieved through a combination of groundwater and surface water within the project footprint. We believe that project level benefits should include all beneficial water made available to the natural system, rather than just the volume of water held in surface water storage within the project footprint.

Pages 12-11 to 12-13, Section 12.3, Procedures for Quantification of Water for the Natural System

The PIR should describe how the volume probability curves are calculated for the natural areas and the estuaries at each of the different time periods: dry year, wet year, average year, dry season, wet season, and average annual. The description should identify the time steps used to calculate the averages, and identify the information used to generate the estuary delivery graphics, such as surface water, ground water, or other source.

Since Conservation of Mass is the applicable scientific principle for identification of water quantities, the quantification of basin storage and all inflows and outflows is required. Typically, this is reported by a water budget which reports volumes for all significant components of the hydrologic system: structural flows, evapotranspiration, rainfall, groundwater flow, etc. The PIR

should include water budgets for the project footprint depicting structural inflows and outflows, groundwater flow across the project boundaries, rainfall, and evapotranspiration.

Pages 12-10 to 12-13, Section 12.3, Procedures for Quantification ofWater for the Natural System

Section 12.3 should distinguish between beneficial baseline water to be protected and additional water produced or redirected by the project. It is unclear from the PIR whether all water delivered to the estuaries is additional water produced or redirected by the project and therefore water to be reserved by the State, or if a portion of this water is existing beneficial baseline water to be protected by the State. There also needs to be a similar discussion for natural areas as to the beneficial baseline water for natural areas and the additional water produced or redirected by the project.

Page 12-11, Section 12.3.1, Procedures for Quantification of Water for the Natural System

The second paragraph states "a probabilistic approach has been selected utilizing volume probability curves to depict the continuum of volumes of water deliveries that are beneficial to the natural system from project features..." Volume probability curves based on depth neither represent all the water nor only the water delivered from project features. This method includes quantities from other sources, such as rainfall, and omits structural inflows from project features if these are stored as groundwater. We suggest rephrasing this statement as, "a probabilistic approach has been selected utilizing volume probability curves to depict the distribution of volumes of water that provide natural system benefits as a result of project features..."

Page 12-12 to 12-13, Section 12.3.2.1, Identification of Water to be Reserved

We suggest the second sentence be changed to reflect all time intervals used to describe project effects: annual average, wet season, dry season, wet year, dry year, and average year.

We agree that the combination of the operational plan and the graphics depicting additional water made available by the project should comprise the water identified to be reserved for the natural system by the State of Florida. However, we feel that the volume probability curves based on depth do not capture all water being delivered by the project features for restoration and protection of fish and wildlife resources. We refer to our comments above on section 12.3.1 related to volume probability curves.

We suggest the PIR include individual sections describing methods used to calculate wet year, dry year, and average year and provide the rationale for selecting the representative years. We also suggest that the documentation of the wet, dry and average season be expanded in the PIR, checking to ensure that the definitions for wet season and dry season are consistent with those used in other sections of the report.

Pages 12-11 to 12-13, Section 12.3.2, Beneficial Delivery Volume Probability Curves

Similar to our above comments for section 12.3, the text should include a description of how the volume probability curves were calculated. We also reiterate our general section request for documentation of the selected representative wet, dry and average years.

Pages 12-13 to 12-23, Section 12.4, Project Results

The discussion in Section 12.4 only identifies additional beneficial water made available by the project. The beneficial baseline water should also be identified.

Pages 12-13 to 12-14, Section 12.4.1, Project Results, Background

Table 12-2 lists the targets and sources of beneficial water for each restoration area. We suggest groundwater flow and structural flow from Faka Union Canal be added to the list of sources for Faka Union bay and downstream coastal estuaries. We also suggest groundwater be added to the list of sources of beneficial water for the natural area restoration.

Pages 12-14 to 12-15, Section 12.4.2.1, Project Footprint

We suggest that a map and text describing the project footprint be included in the PIR.

Page 12-19, Section 12.4.3.1, Estuary Deliveries

The claimed benefit of reductions in point source flows from Faka Union is undermined by Figure 12-7, on page 12-19, which indicates that flows delivered by the canal are below target flows for 3-4 months (September through December) of the year. This should be clarified.

Page 12-24, Section 12.5.2, Identification of Existing Legal Sources of Water

It is central to the intent of the Savings Clause that it applies to all existing legal sources potentially affected by a project. It is probably of most importance to users of the existing legal sources that lie outside a project area and are not expected to benefit from it. Table 12-3 on Page 12-24 identifies the existing legal sources for water supply in the project study area. Local basin storage and runoff and the surficial aquifer are identified as the sources for fish and wildlife, agricultural, urban, and ENP. Yet, only a portion of ENP estuaries is affected, but a large portion of the Ten Thousand Islands NWR is affected. These sources were solely evaluated by analyzing changes in surface water and ground water storage within the project footprint.

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The analysis of existing legal sources in the project area should provide graphics and interpretive text demonstrating that existing legal sources for fish and wildlife within the basin, but outside the project footprint, have been protected. Specifically, we recommend evaluating model results for indicator regions within the following areas that were identified by agencies participating in the WRAC pre-CERP baseline issue team discussions: Corkscrew Swamp Sanctuary, Collier Seminole State Park, 10,000 Islands National Wildlife Refuge, Rookery Bay National Estuarine

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Research Preserve, Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, and wetlands in NGGE.

We also recommend evaluations for the Belle Meade portion of Picayune Strand State Forest, CREW, estuarine resources in Estero Bay, Henderson Creek, and the Gordon River. Additionally, water budgets for the project footprint and NGGE should be included in the PIR to summarize structural inflows and outflows, groundwater seepage, evapotranspiration, and rainfall. We also recommend including graphs of boundary fluxes along the northern and

western boundaries of the model for the with- and without-project conditions, in order to demonstrate that the project will not have any effects outside the model domain.

Pages 12-27 to 12-30, Section 12.5.4, Identification of Project Effects on Existing Legal Sources of Water

Graphics 12-14 through 12-16 should include a trace for the natural system, or target. The target is necessary to illustrate that all of the water that the natural system is receiving is actually beneficial.

The estuary graphics used to perform the existing legal source analysis evaluate the sum of all flows to the estuary. While it appears that the project passes the existing legal source test on that basis, Figure 12-7 indicates that delivery targets from Faka Union Bay may not be met at the end of the wet season and beginning of the dry season during an average year. Meeting the total flow requirements of the estuary may be acceptable for restoration, but deficiencies in any source of water should be documented and explained. We recommend that the estuarine evaluation team for the SGGE project be consulted on this issue. Effects on the West Indian manatee may also need to be addressed.

We suggest the PIR explain why 2000 was used as the representative dry year for analysis of estuary deliveries in the existing legal sources section while 1990 was used as the representative dry year for all other analyses in the document.

Page 12-31, Section 12.6.1.3, Water Supply

This section states "one of the incidental project benefits of the recommended plan will be to improve the aquifer recharge in and adjacent to the study area; therefore, supplies of water to meet the demands of existing legal users are not expected to be adversely impacted by project implementation." We recommend the PIR include graphics or references to graphics used to arrive at this conclusion.

Page 12-33, Section 12.6.1.5, Flood Protection

This section states "more detailed information including maps illustrating the comparison between existing and with project conditions can be found in Appendix A of this report." We

recommend the PIR include references to specific graphics that were used in the analysis or include them in the assurances section.

Page 12-37, Section 12.6.3.1, Water Supply Assurance

The text in this section could be misinterpreted. Increased volumes of water in surface water and groundwater storage within the project footprint are considered adequate assurances that water supply for existing legal users shall not be diminished through project implementation. However, this quantity of water should not be confused for excess water that is available for other uses such as water supply. The combination of increased groundwater and surface water levels within the project footprint are responsible for the restoration benefits expected and can not be made available to other users, such as water supply, without witnessing a reduction in restoration levels. We suggest the text be modified to clarify this distinction, including a discussion of what water may be made available for other uses, if any.

Page 12-42, Section 12.6.3.2, Flood Protection Assurance

This section states "detailed analysis for flood protection for the project area can be found in Appendix A." We suggest the PIR include specific references to the graphics in Appendix A that were used to perform project assurance analyses and a narrative describing the conclusions that were drawn from them.

Section 13, Recommendations

(1) We strongly support recommendations that protect baseline water, as well as the reservation of additional project water for the natural system, by the State of Florida. Water made available by CERP projects over and above existing levels cannot be treated as "stand alone" contributions toward restoration because the benefits of "new" CERP water depend on the interaction between new and already-existing water in natural systems. Additionally, many natural areas within the CERP domain are not short of water but have too much, at least some of the time. The restoration of these areas depends on the protection of existing baseline water. We, therefore, strongly support the recommendation that the local sponsor act to protect both baseline and new project water for the natural system.

(2) Recommendations contained in Section X of the draft FWCAR in Appendix D of this plan, and any other recommendations that will be incorporated in the final FWCAR, should be instituted as part of this project plan commitment.

(3) Due to the importance of this project to federally protected species, particularly the West Indian manatee, wood stork, and Florida panther, and the significant contribution of federal funds to project acquisition and development from the DOI and the Army Corps of Engineers, the Corps should embrace full compliance with the Endangered Species Act. In particular, Section 7(a) (1) directs federal agencies to utilize their authorities in furtherance of the purposes of the Act by carrying out programs for the *conservation* of endangered and threatened species listed

pursuant to section 4 of the Act. This portion of the Act sets forth actions beyond the standard of consulting with the Service to assure that agency actions are not likely to jeopardize the continued existence of any endangered or threatened species or its critical habitat. The Service is assisting the Corps in developing a plan that goes beyond avoidance of adverse effects to provide beneficial effects to listed species.

(4) Due to the complexity and resulting uncertainty associated with hydrologic modeling and the importance of development of an operations management plan that focuses on restoration benefits, the Corps should specifically commit to the continued development of an Adaptive Monitoring and Assessment Plan for this project. This plan is currently being developed and will be significantly modified beyond the plan included in this document.

Section 16, References

Page 16-1

Literature citations in this section appear to be missing from the draft FWCAR literature cited section.

Appendices

Appendix A, Draft Hydrology and Hydraulics

General Comments

The documentation of the hydrologic modeling performed contains many editorial errors, omissions, and inconsistencies that make it difficult to evaluate. Many of the conclusions drawn within particular sections of the document are not supported by accompanying graphics of model results. Likewise, text descriptions of many graphics are missing. Legends on graphics are mislabeled or labeled with insufficient information to analyze them accurately. These problems are compounded by differences in aggregation levels and period of record, errors in scale bars, multiple measurement systems (feet vs. meters), multiple datum (NGVD29 vs. NAVD88), and contradictory text and figures. We offer the following specific recommendations for this text section:

1. It appears that several different modeling efforts were completed for different evaluation requirements. However, the report did not adequately document the various efforts or clearly indicate for each section which modeling effort was used. Clarification of the general modeling process undertaken for the project is necessary, including the process that was used to iteratively step through proposed changes to structural features and operational criteria.

2. Include a clearly labeled location map that identifies the well fields, chainages,

monitoring locations in NGGE and SGGE, major roads, canals, and water control structures.

3. For each alternative evaluated, provide a table of operational criteria and a description of the alternative.

4. Provide a graph of boundary fluxes along the northern and western boundaries of the model for the with- and without-project conditions to demonstrate that the project will not have any effects outside the model domain.

5. Include water budgets for watersheds in the model domain, NGGE and SGGE. This would help the reader to understand the sources and destinations of water in the project impact area.

6. There appear to be more than one existing condition alternative used in the modeling. We believe a single existing condition alternative should be used. If it is necessary to have more than one existing condition, please provide adequate description for the differences and rationale for their use.

7. Provide a narrative summary of the modeling results including specific elements of the figures and maps from which conclusions are drawn.

8. When summarizing the spatial modeling results, provide maps depicting differences relative to a single alternative (*i.e.*, Alt 3D relative to Existing Conditions).

9. Use consistent units and one vertical datum.

10. Label all graphics with the proper units and vertical datum.

11. Remove duplicate figures between the sections in the main body of the PIR and appendices or replace them with a reference to the page number where they can be found.

12. Correct scale bar errors on map figures.

13. Temporal aggregation levels should not be mixed. In particular, avoid mixing weekly hydrographs with daily hydrographs.

14. Analysis windows (*e.g.*, dry season, wet season, dry year, or wet year) should be consistent throughout the analysis.

15. Correct contradictions between text descriptions and accompanying figures and conflicting text descriptions in different sections of the report.

16. Label pages in the appendix with page numbers.

17. Evaluate ecological restoration based on a period of simulation that includes a variety of meteorological conditions with inter- and intra- annual variability. The inclusion of these periods in the SFAM reduces the overall uncertainty in its application.

Specific Comments (Appendices)

Page A-15, Section IV.B, Topography

In this section, the vertical datum for the study is identified as the 1988 North American Vertical Datum (NAVD). It is not clear whether this is the same vertical datum that is used throughout the report, such as in the assurances evaluation and in the operational plan. It is distracting to convert between datums and units while reading the report. If multiple datums must be used, clearly identify the datum used on each graphic and provide a conversion chart.

Page A-17, Section IV.C., Tributaries

We are concerned that the model does not adequately simulate surface water flow and the connection that exists between surface and ground waters. The second sentence on this page states that a field investigation of aquifer impacts from the drainage canals in SGGE showed a drop in the water table of approximately 2 feet at a distance of 6,000 feet from the canal. This indicates that the surface water and ground water are very closely connected. However, the modeling output included in this report does not show the same degree of connection. Stages in the canals in NGGE are raised 2.3 feet during the dry season with minimal or no corresponding increases in groundwater stages (*e.g.*, Figures A-89 through A-89B and Figures A-90 through A-90B).

Page A-21, Section V.B.3., MIKESHE Evapotransporation Module (ET)

Since evapotransporation constitutes a large portion of the water budget in south Florida, a description of how evaporation from the free water surface and soils is simulated in the model should be included. Also, include a description of the ranges of LAI and K_c and a reference to the data or available literature used to select their values. The inclusion of documentation for the ranges of K_c for given land uses, *e.g.* cypress, would allow reviewers to determine whether the variation is spatial or temporal.

Page A-22, Section V.B.D, Input Data and Model Setup

We are concerned that relative alternative-to-alternative comparisons may be complicated by parameters, such as floodplain topography and floodplain codes, that could change values between alternatives. Model-to-model comparisons should identify which model input parameters remain consistent between alternatives, and which ones change. When model input parameters change between alternatives, the change should be documented. We recommend using either a tabular or a graphical format, and inclusion of the documentation in the report.

Page A-22, Section V.D.1., Meteorological Data

When the performance measure of the project is evaluated for only a small subset of years or meteorological conditions, it is critical to ensure that the years or conditions chosen are actually representative of the historic meteorological conditions. The text states that the 1988-2000 period of record represents the complete period of record for this area. If this is a subset of the available period of record, we recommend the PIR provide an analysis supporting the selection of 1988-2000 rainfall as a representative sample.

We recommend the PIR provide data supporting the selection of the wet, dry, and average periods as represented by 1994, 1995 and 2000, respectively. Also an explanation of why these selected periods change throughout the analysis would be helpful. For example, in this section 2000 is defined as the average year, but in Section 12 it is the dry year. Once selected, we believe the representative years used to evaluate the project should not be changed.

Pages A-23 and A-31, Section V.D.2. Land Use V.F. 1. Natural Systems Model (NSM)

Since NSM is used as the target for restoration, it is critical to understand the assumptions used to develop it. Additional documentation of the methodology used to generate the pre-development (Natural) condition shown on Figure A-7 should be provided. The new material should identify the land use coverage used in the Natural System Model (NSM) simulation, too. Because the NSM is a critical part of the plan formulation process, complete descriptions of the NSM are important. For example, the documentation should:

- Explain the relevance of descriptions for agriculture and other urban land uses, which appear in the legend of Figure A-7,
- Compare the spatial fit of Figure A-7 with the NCRS categories depicted in Figure 3-1,
- Explain how the period of record in MIKESHE relates to Figure A-7,
- Identify the assumptions underlying canal removal inputs, and,
- Describe how input parameters such as Manning's n, time constants, drainage depths, and detention storage were changed.

Page A-24, Section V.D. 4, Topographic Data

A more complete description of the detention storage coefficient, including references and maps explaining how a spatial value was assigned to each alternative, should be provided. We suggest the text clarify how, if at all, its values were changed after calibration to simulate the alternatives.

Page A-25, Section D.4, Canal Network, Hydrological Data

We suggest selecting a local tidal stage boundary instead of what is currently proposed. Data from the Ten Thousand Islands NWR indicate that tidal influences do not extend much beyond the headwaters of the major bays. Thus, the southern boundary of the hydrologic model could be extended much farther south than it currently is. This would partially address the assessment's gap between inland and estuary areas.

Page A-25, Section V.D.4.a., Roughness Coefficients

To ensure model-to-model comparisons are true relative comparisons, Manning's n values for the overland flow module for each vegetation type should be provided. If these values change between alternatives, we recommend these changes be documented in the PIR.

Page A-27, Section V.D.8., Irrigation Data

It may not be appropriate to assume drip irrigation for all residential and agricultural irrigation in the entire model domain. This assumption would result in significantly reduced demands compared to conventional methods and could potentially result in the over-estimation of water available for environmental restoration. We believe that further explanation of the decision to assume drip irrigation values for all irrigation demands in the domain is warranted.

Page A-27, Section V.D.9., Summary of Model Parameters

The missing, but requisite, determination that quantifies the significance of varied drainage depths and time constants during calibration should be included in the section. Without providing some measure of how changing these variables influences simulated flows and stages, the uncertainty in relative comparisons between alternatives can not be assessed.

Page A-29, Section E.2, Initial Boundary Conditions

There may not have been tidal data available before 2000, but there is now, including data from Faka Union Bay. The newly available tidal data should be used in the modeling and the later stages of Alternative evaluation

Page A-30, Section V.E.5., Calibration, Verification, and Validation

The text should be modified to explain why the model was calibrated and verified over the same time interval, 1995–1999. Typically, models are verified during a different time interval than that used for calibration to ensure that they adequately represent the physical system.

Page A-32, Section V.F.2., Existing Natural Systems Model

Two different simulations of the existing condition are used in this report. They appear to differ only by the simulation of FU-4. Please define each one and their intended purpose.

Explain how the existence of and removal of the roads and ditches were modeled using the MIKESHE drainage component. Table A-1 does not include a specific reference to the drainage component. Describe what the drainage component is and how it was used to simulate the roads and ditches.

Pages A-33, 34, and 35, Section VF.4., Restored Conditions Alternative 3D

Figure A-40 does not accurately depict Alternative 6 as described. Figure A-40 indicates that structures Miller 2, FU-3, and Lucky Lake were removed whereas the text states that Miller 1, FU-2 and Merritt 1 should have been removed. This discrepancy should be clarified. If the correct version was used in the model for Alternative 6; explain why the stage for Alternative 6 in Figures A-89 through A-89B is higher that all of the other scenarios modeled. This is important since the results could be due to the leaky structure, or, more significantly, a datum shift that occurred in Alternative 6. A datum shift could affect the ranking of alternatives.

Rationale should be included as to why Alternatives 3D, 6, and 12 were simulated for the period 1994-1999, but analysis windows for the graphics presented are only for the "average" year, 1994. To accurately describe the ecological restoration potential of the project, a range of conditions and seasons should be evaluated.

We are concerned with the methods used to simulate the floodplains. Please explain the conceptualization and rationale for using floodplains based on topography. Given documented stability problems associated with modeling of the canal plugs, we are concerned with our ability to accurately evaluate alternatives using model output. The third bullet on page A-34 states that adding the canal plugs caused model stability problems. Since the canal plugs are a critical part of the project design, it is extremely important that the modeling tool be capable of evaluating their effects. In fact, the geotechnical section of the report mentions the need for more modeling to simulate the flow around these plugs.

The first bullet on Page A-35 that describes how east-west flow was established in the model is not entirely clear. Document the reasons and actual changes in the floodplain codes between alternatives or after calibration. If the floodplains were added to the model following calibration, a description should be included addressing how they affected the calibration of the model. It is our understanding that the floodplain code is an input flag that allows surface water to flow over the bank from the floodplain in the MIKE11 network. The code should not enable surface water flows to enter a plugged canal that a floodplain traverses and travel a path independent of the physical constraints that exist. If floodplains were evident in the original topography, they should have been included in the existing conditions simulation rather than added later. Please explain how changing floodplain codes between alternatives might affect accurate "apple to apple" comparisons of alternatives. The explanation should allow reviewers to assess whether these changes between alternatives affect the relative ranking of alternatives, and ultimately, the selection and implementation of an alternative.

The second bullet on Page A-35 states that Alternative 3D was simulated from 1994 through

1999 and for an average year. Yet, the time scales on the graphics in the document vary (*e.g.*, 1993 through 1995, 1995, 1994, and 1988 through 2000). We are assuming that different time scales were used in different modeling exercises to meet different requirements in this report. Provide a description of all modeling efforts that are included in this report and specify which was used for evaluation in each section.

Pages A-35, A-36, Section V.F. 4., Restored Conditions Alternatives 6 and 12

Please refer to comments on Page A-33-34 above. If these parameters were adjusted during or after calibration, documentation is necessary.

Page A-38, Section VI.A. Hydrology and Hydraulics Modeling for Flooding, Existing Condition

Please clarify the following statement:

> *It is generally considered that depth of the overland flow is very small and the influence of the overland flow boundary will mainly be limited to adjacent cells.*

The northern and eastern boundaries of the model domain include Corkscrew Swamp Sanctuaries and Big Cypress National Preserve, which are areas where water depth and overland flow are significant components of the hydrologic cycle.

Page A-38, Section VI.G. Modeling Results for Restoration

Model results for some or all of the seven well sites on the Ten Thousand Islands NWR should be included, in addition to the 32 wells modeled in Figures A-47 through A-78.

Page A-39, Section VI.A., Hydrology and Hydraulics Modeling for Flooding, Existing Condition

The first paragraph on page A-39 states:

> *...an accurate representation of the topography at the modeled grid level may not have been attained due to the 1500-foot by 1500-foot grid cell discretization...procurement of more detailed topographic data input is recommended to verify the final plan during the detailed design stage of the project.*

We concur that accurate topographic data are essential and should be incorporated when available. However, this may result in the need for recalibration of the model and could potentially change the predicted hydrological effects. If this is done, we recommend that project modeling be updated to confirm and recalculate the project benefits to ensure that existing legal sources have been protected, and update the calculation of water made available by the project and subject to state reservations.

Page A-40, Section VI A. 1.b., Rainfall

We are concerned that the spatial distributions of rainfall for the 10-year, 25-year, and 100-year return periods for the BCB model depicted in Figures A-85 through A-87 are an over-estimation of extreme rainfall that is not observed in the historical record. Please explain how there could be uniform rainfall of the same return period at every station in the model domain at the same time. The assumption that the temporal distribution is the same for each station over the same 5 days seems incorrect because it implies that there is no forward movement of the storm towards and away from the project area. These factors contribute to an over-estimation of run-off because infiltration is exceeded simultaneously at all locations, resulting in significant over-estimation of necessary conveyance capacity. Please explain why the historical rainfall record is not sufficient for evaluating and assessing flood control objectives. During the 1988-2000 period, two tropical storms were recorded, a 1-in-10 and 1-in-25-year events. This period also included a wet season which has been described as one of the wettest on record. Please include graphics for the monitoring locations in NGGE and SGGE with the same analysis window (100-year storm) as the "Real Estate Takings Analysis" to assist in assessing potential impacts, such as excessive water depths and hydroperiods in NGGE and SGGE.

Page A-41, Section VI.A.1.c., Antecedent Moisture Conditions

Provide documentation on the selection of June 1993 through July 1995 as representative of average meteorological conditions.

The section describing antecedent moisture conditions is not clear. Please explain why extremely wet conditions were used as an antecedent moisture condition. It seems like several different modeling efforts are described in the report with different periods of simulation and assumptions. Please also distinguish which simulations and evaluations used this antecedent moisture condition.

Page A-42, Section VI.A.3., Calibration, Verification, and Validation

The documentation of the calibration results is inadequate; it does not provide the information reviewers need to determine if the model is accurately simulating physical conditions. The report states that 57 groundwater monitoring stations, 26 river/canal staff gauges and 5 flow gauges were used in model calibration. Calibration results for all stations should be referenced or included. Also, the report states that the model was verified and validated by comparing two tropical storm events. This model is being used to quantify restoration benefits during all meteorological conditions. Explain why verifying the model only for large storm events is adequate. Also provide a clearer description confirming whether the statistics in Tables A-11 and A-12 represent calibration and verification of the BCB for tropical storms Jerry and Harvey or for the 1995-1999 period of simulation.

Page A-45, Section VI.B.3., Project Features for Alternatives

Change the wording from "the primary features of environmental restoration are the pump stations and spreader channels" to "the primary features of environmental restoration are the canal plugs and removal of roads augmented by the pump stations and spreader channels."

Page A-50, Section VI.B.3.b.vi., Alternative 6, Removal of Existing Structures

Descriptions of Alternative 6 elsewhere in the document do not describe the removal of the Miller-2, FU-3, and Lucky Lake structures as indicated on page A-36. This particular description states that it would "remove existing Miller-1, FU-2, and Merritt-1 structures." The text should clarify which section contains the correct assumptions with respect to removed structures and verify that the modeling, analysis, and graphics presented in DPIR are consistent with the guidance from PDT during the plan formulation process. The operational criteria for the structures simulated in all alternatives should be provided. If the wrong structures were removed in the model, the ranking of alternatives needs to be reevaluated.

Page A-55, Section VI.C.2.a., Alternative 6, With Project Condition

We recommend a description be provided showing which aspects of the figures noted support the conclusion that Alternative 6 will adversely affect the existing flood condition north of the project area. If possible, provide relative difference maps which include a "no difference classification" based on the accuracy and precision of the model.

Page A-55, Section VI C.2.a., Alternative 6, With Project Conditions

Figures A-89A and Figure A-90 show chainages located upstream of FU-3 and Miller-2, as well as I-75 in NGGE on the Faka Union and Miller canals, respectively. For both of these canals, a 2.0 ft. increase is observed in the Alternative 6 canal stage over the existing. If Miller-2, FU-3 and Lucky Lake are simulated in Alternative 6, verification of the operational criteria for these structures should be provided. Additionally, the PIR should verify whether the weir crest elevation for Miller-2 and FU-3 structures is 6.2 ft NGVD29 and the open/close wet and dry season criteria are 6.7/6.2 and 7.2/6.45 (NGVD29), respectively. We recommend verification that the flood plain and drain codes simulated in Alternative 3D are the same as in the Alternative 6 simulation downstream of the structures. Discrepancies between alternatives or errors in modeled structures could potentially result in a different ranking of alternatives.

Section VII, Draft Water Control Plan

General Comments

We recognize the difficulty associated with designing an operational plan from hydrologic models for the purpose of ecosystem restoration. However, the draft operational plan in this report is difficult to evaluate and does not appear to reflect operations developed for the purposes of environmental restoration. We offer the following recommendations to help improve the draft

plan:

- Consolidate all drafts into one official document (the Service has received updated plans);
- Clarify which vertical datum was used an ensure accurate conversions were incorporated in the modeled input;
- Use the selected vertical datum and measurement system consistently throughout the report;
- Modify the operational criteria to create a gradual time/volume-step up and down that mimics the natural system fluctuations that occur between the wet and dry seasons;
- Design the minimum pump intake water at elevations that would prevent potential over-drainage of fish and wildlife habitats in NGGE and further upstream;
- Include a series of iterative field tests as part of the operational testing and monitoring phase;
- Incorporate a restoration-based operations system, such as a rainfall driven operational system for NGGE and SGGE;
- Provide a description of how monitoring locations for different habitat types will be used to assess operational success;
- Describe how adaptive management will be incorporated;
- Include documentation of the canal design optimums and the rationale for their selection;
- Check the conditional logic statements to ensure that they allow the pumps to turn off;
- Include a map depicting trigger locations noted in Tables A-18 through A-20; and,
- Provide documentation of the selected trigger locations.

Since the completion of the draft PIR, modeling has been initiated to refine and optimize the operational plan. It is imperative that the operational plan in the final draft be updated to reflect the results since the operational plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan, and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics should be updated in the final report to ensure consistency between project modeling and project assurances.

Specific Comments (Section VII, Draft Water Control Plan)
Page A-59, Section VII.A.1, Development of the Project Operations Manuals

The +/- 0.2 ft flexibility noted as necessary for the operational criteria shown in Tables A-18 through A-20 should be specified more clearly with respect to the frequency and duration of deviations. If this information can not be provided based on modeling or hydraulic analyses already completed, then the basis for the proposed deviation should be evaluated as an element of the field tests proposed during the Operational Testing and Monitoring Phase.

Page A-60, Section VII.A.4, Hurricane or Tropical Storm Regulations

Operational criteria associated with hurricanes, tropical storms, and droughts should be clearly

documented in the Draft Operations Manual and included in the modeling. The documentation should include the sequence of steps returning back to normal operations.

Page A-63, Section VII.B.2.b. Alternative 3D Constraints-Storm Events

A large portion of the effective conveyance capacity of the SGGE canal system has been replaced by an overland flow path. This suggests that the tailwater conditions at FU-1 should no longer act as a constraint on pump capacity. Please clarify this apparent contradiction.

Page A-64, Section VII.B.3. Alternative 3D Overall Plan for Water Control

The draft PIR statement that waters routed from NGGE through the Miller, Faka Union and Merritt Canals will discharge at the southern extent of the Project through FU-1 concerns us. This appears to conflict with the goals and objectives of the project, which are to eliminate or reduce these point source flows. Further clarification is necessary regarding the statement that operations of the existing structure FU-1 and the newly constructed pump stations will be coordinated for flood control purposes. It is suggested that reference to FU-1 be removed or operational criteria for FU-1 supported by modeling or hydraulic analysis completed be added to Tables A-18 through A-20.

We recommend the PIR provide a reference to the section that documents how the conveyance capacities of the Miller, Faka Union and Merritt Canals system were analyzed to determine the optimal canal elevation. We suggest the canal optimums be presented in tabular format for easy reference.

Page A-65, Section VII.B.4. Alternative 3D-Standing Instruction to Operators

The language "optimum elevations in the plan shall be followed" and the supporting analysis should be referenced to the section of the PIR in which they are found.

Page A-65, Section VII.B.5. Alternative 3D-Pump Operations

The text and Tables A-18 through A-20 for the operations do not appear to match figures reported elsewhere in the appendix or in the Operation Schedule of Water Control Structures, dated January 2000. The "savings and takings" modeling results of Miller and Faka Union Canals for Alt 3D and Alt 12 have dry season stages of 7.2 ft NAVD88 or 8.5 ft NGVD29. The dry season criteria specified in Operation Schedule of Water Control Structures, dated January 2000, is 7.2 ft NGVD29. The 1.3-ft difference is a significant departure from the existing control for these reaches of the canals. If a vertical datum conversion error was made, the rankings of the alternatives might be incorrect. We recommend clarifying these points in the text.

Page A-66, Section VII.B.9. Alternative 3D-Fish and Wildlife

The meaning of the following should be explained: "... the SGGE Project construction will require below water table excavation for canal construction and improvement, which will

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improve fish habitat, especially during dry-out periods." The Service is not aware of any new canal construction or improvement that is included as part of Alternative 3D unless spreader channels or swales are considered new canals. Deep canals, channels, or ditches are not necessarily beneficial, because of the potential refugia they offer exotic fish, as well as larger piscivorous fish, which prey on more desirable forage fish during drawdown periods. Smaller forage fish are prey for wood storks and other wading birds.

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Table A-1

In the row for the MIKESHE unsaturated zone module, we suggest replacement of the phrase "Richards equation/gravitational flow" with the correct governing equation used in this model. While it is true that the MIKESHE code has the capability of using the Richards equation, the most rigorous method of simulating flow in the unsaturated zone, it was not used for the Big Cypress Basin model, presumably because of computational time restraints.

Table A-11

Provide a narrative discussion of this MAE data in this table with regard to time, shape, and bias between the simulated and observed data. Some of the errors in this table are rather high for Florida; one is almost five feet. This could indicate that calibration is not as good as it should be. Provide a map showing the locations in the table so that the spatial distribution of the errors can be determined. In particular, report on whether the errors are randomly distributed, or, alternately, whether certain areas of the model more accurate than others. Since other statistics, such as root mean square error, coefficient of correlation, and Nash-Sutcliffe Efficiency, are routinely available in MIKE post processing utilities, they should be included in the report.

Figure A-2

The figure should include the Ten Thousand Islands NWR boundary rather than just the Collier-Seminole State Park boundary.

Figure A-3

The figure indicates that mangrove occur immediately south of US41. The habitat in that area is primarily brackish marsh.

Figures A-14 through A-18

These maps show surfaces related to the various aquifers and confining units, but are difficult to understand without units. Label the graphs with the units of measurement and specify whether the numbers represent the absolute elevations for the top or the base of the presented unit.

Figures A-19 through A-23

The spatial distributions of the hydraulic conductivities data are shown in a peculiar bull's-eye pattern. The significance of this pattern should be explained. We could not determine whether they represent karst features or are an artifact of the interpolation method, for example. The text should also provide a reference to data that supports the range of values used and an explanation of why the conductivities are aligned linearly along the Merritt Canal.

Figures A-24 through A-33

We recommend the PIR include the MIKE11 canal network on all graphics of the input parameters. If MIKE11 is used to simulate floodplains including sloughs and strands, include those on the graphics and provide a description of instability problems if any exist.

Figure A-47

It appears that the existing and future without project traces are of weekly hydrographs while the proposed project scenario traces are of daily hydrographs. The PIR should provide an explanation describing why different temporally aggregated hydrographs are necessary.

Figures A-89 through A-90S

These graphics are difficult to evaluate without reference to exact physical locations of the chainages, therefore, a location map that depicts the geographical locations of the chainages should be provided. The ground surface elevation on the graphs should also be included. A table of the structural operations as they exist in the model would be extremely useful for evaluating this section. Alternatively, the open and close criteria for the wet and dry season should be included on the graphics. Hydrographs for various chainages, or cross sections, should be selected that allow the reader to evaluate the open and close criteria or weir crest elevations at all of the structures.

Figures A-89 through A-122

Specify whether the datum NGVD29 or NAVD88 is used. It would improve document clarity if the same vertical datum were used throughout the report. Otherwise, the PIR should provide an explanation of why two vertical datums are necessary and provide a conversion chart. We recommend the modelers verify that conversion of operational criteria between datums to be included in the model is correct. Per the operation schedule in the Big Cypress Basin Operation Schedule of Water Control Structures, dated January 2000, the crest elevation of both FU-3 and Miller 2 is 6.2 feet NGVD29. Their wet season and dry season open/close elevations are 6.7 / 6.2 and 7.2 / 6.45, respectively. In figures A-89 through A-89B, the dry season criterion for Alternative 3D is near 7.2 feet NAVD88 or 8.5 feet NGVD29. The increased dry season operational stages at these locations appear to be a significant departure from those that were

previously published. If datum conversion errors exist, the ranking of alternatives may not be correct.

Appendix D, Resource Assessment

Inferences drawn from changes in plant communities between 1940 and 1995 should be conservative, and the appropriate caveats added to the text. Ground truthing of the 1995 Digital Orthophotographic Quarter Quadrangles (DOQQs) was not as thorough in the area south of US41 as it was within the SGGE. There was no ground truthing of the DOQQs east of the Faka Union Canal. Plant communities were inferred based upon soil type, as described in the 1998 Soil Survey of Collier County Area, Florida. Discrepancies between marsh and mangrove communities associated with the same soil type prompted staff of the Ten Thousand Islands NWR to delineate marsh occurring within the soil type associated with mangrove for the area west of the Faka Union Canal. This delineation was not conducted east of the Faka Union Canal, nor for the 1940 photography.

Page 3

Please explain whether the predicted plant communities were based on average hydrology simulated by MIKESHE for 1988-2000, or for 1994. We recommend the PIR include documentation of the steps required to generate the "pre-drainage" vegetation map and how MIKESHE was used.

Explain why the definition of the wet season was chosen as July 1 through October 1. We are particularly concerned that the definition in this section is different from other sections and the standard definition of wet season. This definition of the wet season omits the peak of the wet season.

Page 9, Freshwater Marsh

We believe that discussing the difficulty of reestablishing fresh water marshes from salt marshes is premature. The quality control and assurance processes, particularly ground truthing, associated with habitat identification using the 1995 DOQQs limits our ability to distinguish between freshwater and salt marsh community types. It is unknown whether or not freshwater marshes have been converted to salt marshes.

Page 14, Hammocks

We urge caution on the inferences made concerning tropical hammocks. The data used to support the inferences have not been verified for accuracy. Discrepancies in the 1940 and 1995 data were noted, but not verified.

Page 16, Coastal Wetlands and Estuaries

Discrepancies in the available information should be incorporated into this discussion. Open water areas were not mapped accurately from the 1940 data. There are several large lakes, depicted in the 1954 Soil Survey maps that do not appear on the NRCS 1940 Vegetation Community map. The Little Wood River does not appear, either.

Page 21

Provide a reference that supports the statement that average wet season water levels from July 1 through October 1 are considered to be closely related to hydroperiod. Additional analysis relating average water depth during the period from July 1 through October is necessary since the pattern of plant communities on the MIKESHE maps do not closely match those on NCRS maps.

Page 23

The PIR should explain why the MIKESHE vegetation model converts the hydric flatwoods in the existing conditions land use shown in Figure A-3 to 90% mesic communities in the existing condition output. If this is an error, restoration benefits would need to be reevaluated.

Page 46

We recommend adding the Ten Thousand Islands NWR and Collier-Seminole State Park boundaries.

Appendix H, Draft Ecological and Water Quality Monitoring Plan

General Comments

The Service is coordinating with the District, Corps, DEP, DOF, USGS, Sirenia, FWC, The Conservancy of SW Florida, and Florida Gulf Coast University (FGCU) in a significant re-write and improvement of the referenced Monitoring Plan. The revised plan will be completed in time for insertion in the final PIR/EIS.

In general, each element of this monitoring should specify targets, envelops, or thresholds as either flow or stage at known locations for the range of meteorological conditions to be experienced over the planning horizon. It would be desirable that these be qualified and quantified, and ready for use during the construction, testing, and monitoring of the operational phases noted in Appendix A.

Additional maps of vegetation transects, well sites, and fish and wildlife sampling transects or sites are currently being developed and should be included in this appendix.

Specific Comments (Appendix H, Draft Ecological and Water Quality Monitoring Plan)
Page H -1, Introduction

Please include a brief description of how the information learned will be used to improve performance measures used in the modeling, and potentially to enhance the model itself.

Page H-4, Section H.4.2., Hydrologic

Explain how the monitoring network shown in Figure H-1 can be used to determine whether or not a preferential flow path remains in the plugged canals. Explain in detail how collected information will be fed back into the operational plan.

We recommend that rain gauges be co-located at any of the stage monitoring locations proposed; and that ground water/surface water (nested well clusters) data collection be correlated to improve our understanding of the ground water/surface water interaction.

Page H -5, Section H.4.2, Hydrologic

Restoration is defined as the pre-development condition of the uplands and wetlands. Please clarify whether this is a hydrological or an ecological target.

Page H-12, Section H.4.5.1.A ,West Indian Manatee

The aerial distribution and strip-transect surveys were funded by the Ten Thousand Islands NWR, not the USGS Place-Based Studies.

Page H-16, Table H-2

Additional State-Listed plants that occur in the Ten Thousand Islands NWR and Collier-Seminole State Park include barbed-wire cactus, satinleaf, butterfly orchid, wild cotton, shell mound prickly pear, inkberry, bay cedar, inflated wild pine, common wild pine, twisted air plant, and giant wild pine.

Page H-26, Figure H-5

Rookery Bay National Estuarine Research Reserve has a continuous *in-situ* monitoring site in Pumpkin Bay, which should be identified.

Summary

The Service supports authorization of the SGGE Ecosystem Restoration Project to proceed to final PIR and detailed design. Although we find that the draft PIR/EIS provide a balanced and accurate description of the environmental impacts of the plan, the recommended changes contained herein are intended to allow for equal consideration of wildlife conservation with other features of the project, minimize incidental take of federally listed species, and to improve the public's understanding of the plan's anticipated ecological benefits.

We find that the Service's recommendations have, in most cases, been incorporated in this project's planning. We call your attention, however, to our specific comments on Sections 12, Appendix A, and comments on Contaminants, exotic plant management, pump size, and the Adaptive Monitoring and Assessment Plan. As detailed design proceeds, we are committed to providing expert technical assistance on the protection of threatened and endangered species and the conservation of fish and wildlife and their habitats. We see a need for further planning and coordination for the following issues:

1. O&M plan/manual development;
2. Savings Clause and Reservations requirements;
3. Monitoring and Assessment Plan;
4. Exotic Species Management Plan;
5. Hydrologic modeling;
6. Alternative development and project design;
7. Remediation of contaminated areas;
8. Project effects on public lands;
9. Protection of federal trust species and other trust resources; and,
10. Watershed changes related to storm water management and development permit.

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APPENDIX B. Refugia Project: Fish Collections (Conservancy of Southwest Florida)

THE CONSERVANCY
Of Southwest Florida

Refugia Project : Fish Collections (June 2003)

Family	Scientific Name	Common Name
Ictaluridae		
Bullhead Catfish	*Ameiurus nebulosus*	Brown Bullhead Catfish
Clariidae		
Labyrinth Catfish	*Clarias batrachus*	Walking Catfish*
Cyprinodontidae		
Pupfishes	*Jordanella floridae*	Flagfish
Fundulidae		
Topminnows/Killifishes	*Fundulus chrysotus*	Golden Topminnow
	Fundulus confluentus	Marsh Killifish
	Fundulus seminolis	Seminole Killifish
	Lucania goodei	Bluefin Killifish
	Lucania parva	Rainwater Killifish
Poeciliidae		
Live Bearers	*Belonesox belizanus maxillosus*	Pike Killifish*
	Gambusia holbrooki	Mosquito Fish
	Heterandria formosa	Least Killifish
	Poecilia latipinna	Sailfin Molly
Centrarchidae		
Sunfishes/ Bass	*Enneacanthus gloriosus*	Bluespotted sunfish
	Lepomis gulosus	Warmouth
	Lepomis macrochirus	Bluegill
	Lepomis marginatus	Dollar Sunfish
	Lepomis microlophus	Redear Sunfish
	Lepomis punctatus	Spotted Sunfish
	Micropterus salmoides	Largemouth Bass

Elasomatidae Pygmy Sunfishes	*Elassoma evergladei*	Everglades Pygmy Sunfish
Atherinidae Silversides	*Labidesthes sicculus*	Brook Silverside
Etheostoma Darters	*Etheostoma fusiforme*	Swamp Darter
Catostomidae Suckers	*Erimyzon sucetta*	Lake Chubsucker
Cyprinidae Minnows	*Notemigonus crysoleucas* *Cyprinus carpio*	Golden Shiner Common Carp
Cichlidae Cichlids	*Astronotus ocellatus* *Cichlasoma bimaculatum* *Cichlasoma urophthalamus* *Tilapia mariae* *Oreochromis aureus*	Oscar* Black Acara* Mayan Cichlid* Spotted Tilapia* Blue Tilapia*
Lepisosteidae Gar	*Lepisosteus platyrhincus*	Florida Gar
Centropomidae Snook	Centropomis undecimalis	Common Snook
Elopidae	*Megalops atlanticus*	Tarpon

APPENDIX C. Refugia Project: Wildlife Species List (Conservancy of Southwest Florida)

THE CONSERVANCY
Of Southwest Florida

Refugia Project: Wildlife Species List (June 2003)

SCIENTIFIC NAME	COMMON NAME
REPTILES/AMPHIBIANS:	
Acris gryllus ssp	Cricket frog
Agkistrodon piscivorus	Cotton mouth
Alligator mississippiensis	American alligator
Amphiuma means	Two-toed amphiuma
Anolis carolinensis	Green anole
Anolis sagrei sagrei	Brown anole
Bufo quercicus	Oak toad
Bufo terrestris	Southern toad
Coluber constrictor	Black racer
Crotalus adamanteus	Eastern diamondback rattlesnake
Deirochelys reticularia	Chicken turtle
Diadophis punctatus punctatus	Southern ringneck snake
Elaphe guttata	Corn snake
Elaphe obsoleta quadrivittata	Yellow rat snake
Eleutherodactylus planirostris	Greenhouse frog
Eumeces inexpectatus	Southeastern five-lined skink
Farancia abacura abacura	Eastern mud snake
Gastrophryne carolinensis	Eastern Narrowmouth toad
Hemidactylus turcicus	Mediterranean gecko
Hyla cinerea	Green treefrog
Hyla femoralis	Pine woods treefrog
Hyla squirella	Squirrel treefrog
Kinosternon bauri	Striped mud turtle
Limnaoedus ocularis	Little grass frog
Micrurus fulvius	Eastern coral snake
Nerodia fasciata pictiventris	Florida water snake
Notophthalmus viridescens piaropicola	Peninsula Newt
Ophisaurus ventralis	Eastern glass lizard
Osteopilus septentrionalis	Cuban treefrog
Pseudacris nigrita verrucosa	Florida chorus frog
Pseudemys floridana	Florida cooter
Pseudemys floridana peninsularis	Peninsula cooter
Pseudemys nelsoni	Florida red-bellied turtle
Rana grylio	Pig frog
Rana sphenocephala	Southern leopard frog
Sistrurus miliarius barbouri	Dusky pigmy rattlesnake
Storeria dekayi victa	Florida brown snake
Thamnophis sauritus sauritus	Eastern ribbon snake
Trionyx ferox	Softshell turtle

BIRDS:

Accipiter cooperii	Cooper's hawk
Agelaius phoeniceus	Red-winged blackbird
Anas discors	Blue-winged teal
Anhinga anhinga	Anhinga
Aramus guarauna	Limpkin
Ardea herodias	Great blue heron
Botaurus lentiginosus	American Bittern
Bombycilla cedrorum	Cedar waxwing
Buteo lineatus	Red-shouldered hawk
Butorides striatus	Green heron
Cardinalis cardinalis	Northern cardinal
Casmerodius albus	Great egret
Cathartes aura	Turkey vulture
Ceryle alcyon	Belted kingfisher
Charadrius vociferus	Killdeer
Chordeiles minor	Common nighthawk
Colaptes auratus	Yellow-shafted flicker
Colinus virginiacus	Northern bobwhite
Columbina passerina	Common ground dove
Coragyps atratus	Black vulture
Corvus brachyrhynchos	American crow
Cyanocitta cristata	Blue jay
Dryocopus pileatus	Pileated woodpecker
Dumetella carolinensis	Gray catbird
Egretta caerulea	Little blue heron
Egretta rufrescens	Reddish egret
Egretta thula	Snowy egret
Egretta tricolor	Tricolored heron
Elanoides forficatus	Swallow-tailed kite
Eudocimus albus	White ibis
Falco sparverius	American kestrel
Fulica americana	American coot
Gallinago gallinago	Common Snipe
Gallinula chloropus	Common moorhen
Haliaeetus leucocephalus	Bald eagle
Ixobrychus exilis	Least bittern
Melanerpes carolinus	Red-bellied woodpecker
Melanerpes erythrocephalus	Red-headed woodpecker
Meleagris gallopavo	Wild turkey
Mimus polyglottos	Northern mockingbird
Mycteria amaricana	Wood stork
Myiarchus crinitus	Great Crested Flycatcher
Pandion haliaetus	Osprey
Phalacrococorax auritus	Double-crested cormorant
Picoides pubescens	Downy woodpecker
Picoides villosus	Hairy woodpecker
Pipilo erythrophthalmus	Eastern Towhee
Polioptila caerulea	Blue-gray Gnatcatcher
Porphyrula martinica	Purple gallinule
Quiscalus quiscula	Common grackle
Seiurus motacilla	Louisiana Waterthrush
Strix varia	Barred owl

Thyothorus ludovicianus	Carolina wren
Vireo griseus	White-eyed vireo
Zenaida macroura	Mourning dove

MAMMALS:

Blarina carolinensis	Short-tailed shrew
Dasypus novemcinctus	Armadillo
Lutra canadensis	River otter
Lynx rufus	Bobcat
Odocoileus virginianus	White-tailed deer
Procyon lotor	Raccoon
Sciurus carolinensis	Gray squirrel
Spilogale putorius	Eastern spotted skunk
Sus scrofa	Feral pig
Sylvilagus palustris	Marsh rabbit
Urocyon cinereoargenteus	Gray fox
Ursus americanus	Black bear
Felis concolor	Florida Panther
Didelphis marsupialis	Opossum
Mustela vison evergladensis	*Everglades Mink*

APPENDIX D. Migratory Bird List

Appendix D: Migratory Birds in South Florida.

Pelecanus occidentalis, Brown Pelican
Gavia stellata, Red-throated loon
Gavia immer, Common loon
Gavia pacifica, Pacific loon
Phalacrocorax carbo, Great Cormorant
Tachybaptus, Least Grebe
Podilymbus podiceps, Pied-billed Grebe
Podiceps auritus, Horned Grebe
Podiceps nigricollis, Eared Grebe
Fregata magnificens, Magnificent Frigatebird
Calonectris diomedea, Cory's Shearwater
Botaurus lentiginosus, American Bittern
Puffinus gravis, Greater Shearwater
Ixobrychus exilis, Least Bittern
Puffinus griseus, Sooty Shearwater
Ardea herodias, Great Blue Heron
Puffinus puffinus, Manx Shearwater
Casmerodius albus, Great Egret
Puffinus lherminieri, Audubon's Shearwater
Egretta thula, Snowy Egret
Egretta tricolor, Tricolored Heron
Oceanites oceanicus, Wilson's Storm-Petrel
Bubulcus ibis, Cattle Egret
Oceanodroma leucorhoa, Leach's Storm-Petrel
Butorides striatus, Green-backed Heron
Oceanodroma castro, Band-rumped Storm-Petrel
Nycticorax nycticorax, Black-crowned Night Heron
Phaethon lepturus, White-tailed Tropicbird
Eudocimus ruber, Scarlet Ibis
Phaethon aethereus, Red-tailed Tropicbird
Plegadis falcinellus, Glossy Ibis
Ajaia ajaja, Roseate Spoonbill
Sula dactylatra, Masked Booby
Sula leucogosster, Brown Booby
Sula sula, Red-footed Booby
Mycteria americana, Wood Stork
Sula bassanus, Northern Gannet
Pelecanus erythrorhynchos, American White Pelican
Phalacrocorax auritus, Double-crested Cormorant
Anhinga anhinga, Anhinga
Egretta caerulea, Little Blue Heron
Egretta rufescens, Reddish Egret
Nycticorax violaceus, Yellow-crowned Night Heron
Eudocimus albus, White Ibis
Plegadis chihi, White-faced Ibis
Elanoides forficatus, American Swallow-tailed Kite
Phoenicopterus ruber, Greater Flamingo
Rhostrhamus sociabilis, Snail Kite
Haliaeetus leucocephalus, Bald Eagle
Accipiter striatus, Sharp-shinned Hawk
Dendrocygna bicolor, Fulvous Whistling-Duck
Buteo lineatus, Red-shouldered Hawk

Dendrocygna autumnalis, Black-bellied Whistling-Duck
Buteo platypterus, Broad-winged Hawk
Buteo brachyurus, Short-tailed Hawk
Anser albifrons, Greater White-fronted Goose
Buteo swainsoni, Swainson's Hawk
Chen caerulescens, Snow Goose
Buteo jamaicensis, Red-tailed Hawk
Branta bernicla, Brant
Branta canadensis, Canada Goose
Aix sponsa, Wood Duck
Anas crecca, Green-winged Teal
Polyborus plancus, Crested Caracara
Anas rubripes, American Black Duck
Falco sparverius, American Kestrel
Anas fulvigula, Mottled Duck
Falco columbarius, Merlin
Anas platyrhynchos, Mallard
Falco peregrinus, Peregrine Falcon
Anas bahamensis, White-cheeked Pintail
Anas acuta, Northern Pintail
Anas discors, Blue-winged Teal
Anas cyanoptera, Cinnamon Teal
Anas clypeata, Northern Shoveler
Anas strepera, gadwall
Coturnicops noveboracensis, Yellow Rail
Anas penelope, Eurasian Wigeon
Laterallus jamaicensis, Black Rail
Anas americana, Redhead
Rallus longirostris, Clapper Rail
Aythya collaris, Ring-necked Duck
Rallus elegans, King Rail
Aythya marila, Greater Scaup
Rallus limicola, Virginia Rail
Aythya affinis, Lesser Scaup
Porzana caarolina, Sora
Somateria spectabilis, King Elder
Porphyrula martinica, Purple Gallinule
Histrionicus histrionicus, Harlequin Duck
Gallinula chloropus, Common Moorhen
Clangula hyemalis, Oldsquaw
Fulica americana, American Coot
Melanitta fusca, White-winged Scoter
Bucephala clangula, Common Goldeneye
Bucephala albeola, Bufflehead
Lophodytes cucullatus, Hooded Merganser
Aramus guarauna, Limpkin
Mergus merganser, Common Merganser
Mergus serrator, Red-breasted Merganser
Oxyura jamaicensis, Rudy Duck
Oxyura dominica, Masked Duck
Grus canadensis, Sandhill Crane
Coragyps atratus, Black Vulture
Pluvialis squatarola, Black-bellied Plover
Cathartes aura, Turkey Vulture
Pluvialis dominica, Lesser Golden-Plover

Charadrius wilsonia, Wilson's Plover
Pandion haliaetus, Osprey
Elanus caeruleus, Black-shouldered Kite
Ictinia mississippiensis, Mississippi Kite
Circus cyaneus, Northern Harrier
Accipiter cooperii, Cooper's Hawk
Charadrius alexandrinus, Snowy Plover
Charadrius semipalmatus, Semipalmated Plover
Stercorarius pomarinus, Pomarine Jaeger
Charadrius melodus, Piping Plover
Stercorarius parasiticus, Parasitic Jaeger
Charadrius vociferus, Killdeer
Stercorarius longicaudus, Long-tailed Jaeger
Charadrius montanus, Mountain Plover
Larus atricilla, Laughing Gull
Larus minutus, Little Gull
Haematopus palliatus, American Oystercatcher
Larus philadelphia, Bonaparte's Gull
Larus argentatus, Herring Gull
Himantopus mexicanus, Black-necked Stilt
Larus fuscus, Lesser Black-backed Gull
Recurvirostra americana, American Avocet
Larus hyperboreus, Glaucous Gull
Rissa tridactyla, Black-legged Kittiwake
Tringa melanoleuca, Greater Yellowlegs
Sterna nilotica, Gull-billed Tern
Tringa flavipes, Lesser Yellowlegs
Sterna caspia, Caspian Tern
Tringa solitaria, Solitary Sandpiper
Sterna maxima, Royal Tern
Catoptrophorus semipalmatus, Willet
Sterna sandvicensis, Sandwich Tern
Actitus macularia, Spotted Sandpiper
Sterna dougallii, Roseate Tern
Bartramia longicauda, Upland Sandpiper
Sterna hirundo, Common Tern
Numenius phaeopus, Whimbrel
Sterna paradisaea, Arctic Tern
Numenius americanus, Long-billed Curlew
Sterna fosteri, Forster's Tern
Limosa limosa, Black-tailed Godwit
Sterna antillarum, Least Tern
Limosa haemastica, Hudsonian Godwit
Sterna anaethetus, Bridled Tern
Limosa fedoa, Marbled Godwit
Sterna fuscata, Sooty Tern
Arenaria interpres, Ruddy Turnstone
Chlidonias niger, Black Tern
Aphriza virgata, Surfbird
Anous stolidus, Brown Noddy
Calidris canutus, Red Knot
Rynchops niger, Black Skimmer
Calidris alba, Sanderling
Calidris pusilla, Semipalmated Sandpiper
Calidris mauri, Western Sandpiper

Calidris minutilla, Least Sandpiper
Alle alle, Dovekie
Calidris fuscicollis, White-rumped Sandpiper
Alca torda, Razorbill
Calidris bairdii, Baird's Sandpiper
Calidris melanotos, Pectoral Sandpiper
Calidris acuminata, Sharp-tailed Sandpiper
Calidris maritima, Purple Sandpiper
Calidris alpina, Dunlin
Calidris ferruginea, Curlew Sandpiper
Columba squamosa, Scaly-naped Pigeon
Calidris himantopus, Stilt Sandpiper
Columba leucocephala, White-crowned Pigeon
Tryngites subruficollis, Buff-breasted Sandpiper
Columba fasciaata, Band-tailed Pigeon
Philomachus pugnax, Ruff
Zenaida asiatica, White-winged Dove
Limnodromus griseus, Short-billed Dowitcher
Zenaida aurita, Zenaida Dove
Gallinago gallinago, Common Snipe
Zenaida macroura, Mourning Dove
Scolopax minor, American Woodcock
Columbina passerina, Common Ground-Dove
Phalaropus tricolor, Wilson's Phalarope
Geotrygon chrysia, Key West Quail-Dove
Phalaropus lobatus, Red-necked Phalarope
Geotrygon montana, Ruddy Quail-Dove
Phalaropus fulicaria, Red Phalarope
Larus pipixcan, Franklin's Gull
Larus ridibundus, Common Black-headed Gull
Larus delawarensis, Ring-billed Gull
Larus thayeri, Thayer's Gull
Larus marinus, Great Black-backed Gull
Xema sabini, Sabine's Gull
Coccyzus erythropthalmus, Black-billed Cuckoo
Ceryle alcyon, Belted Kingfisher
Coccyzus americanus, Yellow-billed Cuckoo
Coccyzus minor, Mangrove Cuckoo
Crotophaga ani, Smooth-billed Ani
Crotophaga sulcirostris, Groove-billed Ani
Melanerpes erythrocephalus, Red-headed Woodpecker
Sphyrapicus varius, Yellow-bellied Sapsucker
Tyto alba, Common Barn-Owl
Picoides villosus, Hairy woodpecker
Colaptes auratus, Northern Flicker
Otus asio, Eastern Screech-Owl
Campephilus principalis, Ivory-billed Woodpecker
Bubo virginianus, Great Horned Owl
Athene cunicularia, Burrowing Owl
Strix varia, Barred Owl
Asio otus, Long-eared Owl
Asio flammeus, Short-eared Owl
Aegolius acadicus, Northern Saw-whet Owl
Contopus borealis, Olive-sided flycatcher
Empidonax flaviventris, Yellow-bellied Flycatcher

Empidonax alnorum, Alder Flycatcher
Chordeiles acutipennis, Lesser Nighthawk
Empidonax minimus, Least Flycatcher
Chordeiles minor, Common Nighthawk
Sayornis nigricans, Black Phoebe
Chordeiles gundlacchii, Antillean Nighthawk
Sayornis phoebe, Eastern Phoebe
Caprimulgus carolinensis, Chuck-will's-widow
Sayornis saya, Say's Phoebe
Caprimulgus vociferus, Whip-poor-will
Pyrocephalus rubinus, Vermilion Flycatcher
Myiarchus crinitus, Great Crested Flycatcher
Tyrannus vociferans, Cassin's Kingbird
Chaetura pelagica, Chimney Swift
Tyrannus tyrannus, Eastern Kingbird
Tachornis phoenicobia, Antillean Palm Swift
Tyrannus dominicensis, Gray Kingbird
Tyrannus forficatus, Scissor-tailed Flycatcher
Amazilia yucatenensis, Buff-bellied Hummingbird
Calliphlox evelynae, Bahama Woodstar
Archilochus colubris, Ruby-throated Hummingbird
Archilochus alexandri, Black-chinned
Eremophila alpestris, Horned Lark Hummingbird
Selasphorus rufus, Rufous Hummingbird
Melanerpes carolinus, Red-bellied Woodpecker
Picoides pubescens, Downy Woodpecker
Picoides borealis, Red-cockaded Woodpecker
Dryocopus pileatus, Pileated Woodpecker
Contopus virens, Eastern Wood-Pewee
Empidonax virescens, Acadian Flycatcher
Empidonax traillii, Willow Flycatcher
Myiarchus cinerascens, Ash-throated Flycatcher
Myiarchus tyrannulus, Brown-crested Flycatcher
Tyrannus verticalis, Western Kingbird
Tyrannus caudifasciatus, Loggerhead Kingbird
Tyrannus savana, Fork-tailed Flycatcher
Progne subis, Purple Martin
Catharus minimus, Gray-cheeked Thrush
Tachycineta bicolor, Tree Swallow
Catharus usstulantus, Swainson's Thrush
Tachycineta cyaneoviridis, Bahama Swallow
Catharus guttatus, Hermit Thrush
Stelgidopteryx serripennis, N. Rough-winged Swallow
Hylocichla mustelina, Wood Thrush
Swallow *Turdus migratorius,* American Robin
Riparia riparia, Bank Swallow
Ixoreus naevius, Varied Thrush
Hirundo pyrrhonota, Cliff Swallow
Hirundo fulva, Cave Swallow
Hirundo rustica, Barn Swallow
Mimus gundlachii, Behamian Mockingbird
Cyanocitta cristata, Blue Jay
Toxostoma rufum, Brown Thrasher
Aphelocoma coerulescens, Florida Scrub Jay
Corvus brachyrhynchos, American Crow

Corvus ossifragus, Fish Crow
Parus carolinensis, Carolina Chickadee
Parus bicolor, Tufted Titmouse
Bombycilla cedrorum, Cedar Waxwing
Sitta canadensis, Red-breasted Nuthatch
Lanius ludovicianus, Loggerhead Shrike
Sitta pusilla, Brown-headed Nuthatch
Certhia americana, Brown creeper
Vireo bellii, Bell's Vireo
Vireo flavifrons, Yellow-throated Vireo
Thryothorus ludovicianus, Carolina Wren
Vireo philadelphicus, Philadelphia Vireo
Troglodytes aedon, House Wren
Vireo olivaceus, Red-eyed Vireo
Troglodytes troglodytes, Winter Wren
Vireo altiloquus, Black-whiskered Vireo
Cistothorus platensis, Sedge Wren
Vireo crassirostris, Thick-billed Vireo
Cistothorus palustris, Marsh Wren
Regulus satrapa, Golden-crowned Kinglet
Vermivora pinus, Blue-winged Warbler
Regulus calendula, Ruby-crowned Kinglet
Vermivora chrysoptera, Golden-winged Warbler
Polioptila caerulea, Blue-gray Gnatcatcher
Vermivora peregrina, Tennessee Warbler
Vermivora ruficapilla, Nashville Warbler
Oenanthe oenanthe, Northern Wheatear
Dendroica coronata, Yellow-rumped Warbler
Sialis sialis, Eastern Bluebird
Dendroica petechia, Yellow Warbler
Catharus fuscescens, Veery
Dendroica pensylvanica, Chestnut-sided Warbler
Dumetella carolinensis, Gray Catbird
Mimus polyglottos, Northern Mockingbird
Anthus spragueii, Sprague's Pipit
Vireo griseus, White-eyed Vireo
Vireo solitarius, Solitary Vireo
Vireo gilvus, Warbling Vireo
Vermivora bachmanii, Bachman's Warbler
Vermivora celata, Orange-crowned Warbler
Parula americana, Northern Parula
Dendroica magnolia, Magnolia Warbler
Guiraca caerulea, Blue Grosbeak
Dendroica tigrina, Cape May Warbler
Passerina amoena, Lazuli Bunting
Dendroica caerulescens, Black-throated
Passerina cyanea, Indigo Bunting BlueWarbler
Passerina ciris, Painted Bunting
Dendroica townsendi, Townsend's Warbler
Spiza americana, Dickcissel
Dendroica virens, Black-throated Green Warbler
Dendroica fusca, Blackburnian Warbler
Dendroica dominica, Yellow-throated Warbler
Dendrioca pinus, Pine Warbler
Pipilo erythrophthalmus, Rufous-sided Towhee

Dendroica kirtlandii, Kirtland's Warbler
Tiaris bicolor, Black-faced Grassquit
Dendroica discolor, Prairie Warbler
Aimophila aestivalis, Bachman's Sparrow
Dendroica palmarum, Palm Warbler
Spizella passerina, Chipping Sparrow
Dendroica castanea, Bay-breasted Warbler
Spizella pallida, Clay-colored Sparrow
Dendroica striata, Blackpoll Warbler
Spizella pusilla, Field Sparrow
Dendroica cerulea, Cerulean Warbler
Pooecetes gramineus, Vesper Sparrow
Mniotilta varia, Black-and-White Warbler
Chondestes grammacus, Lark Sparrow
Setophaga ruticilla, American Redstart
Calamospiza melanocorys, Lark Bunting
Protonotaria citrea, Prothonotary Warbler
Passerculus sandwichensis, Savannah Sparrow
Helmitheros vermivorus, Worm-eating Warbler
Ammodramus savannarum, Grasshopper Sparrow
Limnothlypis swainsonii, Swainson's Warbler
Ammodramus henslowii, Henslow's Sparrow
Seiurus noveboracensis, Northern Waterthrush
Ammodramus leconteii, Le Conte's Sparrow
Seiurus motacilla, Louisiana Waterthrush
Ammodramus caudacutus, Sharp-tailed Sparrow
Oporornis formosus, Kentucky Warbler
Ammodramus maritimus, Seaside Sparrow
Oporornis agilis, Connecticut Warbler
Melospiza melodia, Song Sparrow
Oporornis philadelphia, Mourning Warbler
Melospiza lincolnii, Lincoln's Sparrow
Geothlypis trichas, Common Yellowthroat
Melospiza georgiana, Swamp Sparrow
Wilsonia citrina, Hooded Warbler
Zonotrichia albicollis, White-throated Sparrow
Wilsonia pusilla, Wilson's Warbler
Zonotrichia leucophrys, White-crowned Sparrow
Wilsonia canadensis, Canada Warbler
Zonotrichia querula, Harris' Sparrow
Icteria virens, Yellow-breasted Chat
Junco hyemalis, Dark-eyed Junco
Spindalis zena, Stripe-headed Tanager
Piranga rubra, Summer Tanager
Dolichonyx oryzivorus, Bobolink
Piranga olivacea, Scarlet Tanager
Agelaius phoeniceus, Red-winged Blackbird
Piranga ludoviciana, Western Tanager
Sturnella magna, Eastern Meadowlark
Xanthocephalus xanthocephalus, Yellow-headed Blackbird
Spindalis zena, Stripe-headed Tanager
Euphagus cyanocephalus, Brewer's Blackbird
Piranga rubra, Summer Tanager
Quiscalus major, Boat-tailed Grackle
Piranga olivacea, Scarlet Tanager

Qiscalus quiscula, Common Grackle
Piranga ludoviciana, Western Tanager
Molothrus bonariensis, Shiny Cowbird
Molothrus ater, Brown-headed Cowbird
Cardinalis cardinals, Northern Cardinal
Icterus galbula, Northern Oriole
Pheucticus ludovicianus, Rose-breasted Grosbeak
Pheucticus melanocephalus, Black-headed Grosbeak
Calcarius lapponicus, Lapland Longspur
Sturnella neglecta, Western Meadowlark
Euphagus crolinus, Rusty Blackbird
Molothrus aeneus, Bronzed Cowbird
Icterus spurius, Orchard Oriole
Carpodacus purpureus, Purple Finch
Carduelis pinus, Pine Siskin
Carduelis tristis, American Goldfinch

Appendix E. Restoration of Natural Hydrology: Technical Report on PSRP Hydrologic Model Issues

Review of the hydrologic modeling presented in the draft PIR/EIS highlighted a number of issues integral to the plan formulation process and ultimate selection of Alternative 3D that warrant further clarification or discussion in the PIR/EIS. These concerns were provided to the Corps and District through a Department comment letter, dated July 13, 2004, and Service PAL dated July 8, 2004. The Service has not received a formal written response to date. Since the draft PIR, the project sponsors have performed new modeling to optimize the operational plan of the selected alternative. The Service did not participate in these optimization runs or receive the input, output or performance measures from the final optimized run in time to be incorporated in this report. Therefore our review is based on the information contained in the draft PIR and corresponding modeling input and output received on June 30, 2004.

On August 10, 2004, technical representatives from the Service, the District and the Corps met to discuss and resolve outstanding modeling issues. This section of the FWCA contains the Service's technical review of the unresolved issues focusing on differences in model input parameters between alternatives, *i.e.,* flood codes, flood plain cross-sections, structural features and the operational criteria. It also includes a review of other important model input parameters such as Manning's *M*, various aquifer parameters, the complex and dynamic interaction between the surface and ground water and the model's sensitivity to changes in the input parameters between alternatives. Schedule constraints limited exploration of landuse and vegetation with respect to evapotranspiration and their potential to bias one alternative over another during the plan formulation process.

We understand that the link between our comments on the modeling and our role in the project may not be clear. However, it is important to realize that the resolution of these issues is necessary because the Service uses output from the model to evaluate project benefits or impacts to fish and wildlife resources. We are concerned that the issues below do not allow us to perform apple to apple comparisions between alternatives or evaluate the true effects of the project on fish and wildlife resources. We look forward to continuing to work with the Corps to resolve these issues and ensure that the project meets its ecosystem restoration goals.

a. Input Parameters

i. Meteorological Data

When the performance of a project is evaluated for a small subset of years or meteorological conditions, it is critical to ensure that the years or periods chosen are representative of the range of meteorological conditions historically experienced. The PIR/EIS should include data and analyses supporting the selection of the simulation period as well as the selection of the wet, dry, and average periods, 1994, 1995 and 2000, respectively, as representative. Only one year, 1994, was used in the DPIR/EIS to evaluate ecological benefits of the project. The intra- and inter-annual variability of rainfall and its effects on hydrology over the longer record available (1988 to 2000) remains unanalyzed. Further complicating matters, review of meteorlogical data indicates that 1994 was not an average year based on total annual rainfall. The data shown in Figure 1 indicates that 1993 through1995 rainfall patterns are significantly wetter than the average long term record. Since benefits are only calculated for a wet year (1994), the Service is

concerned that the benefits are overestimated. Benefits actually observed in dry and average years could be significantly lower than those predicted in the PIR/EIS. In order to understand benefits likely to occur under a range of expected conditions, we recommend using the 1988 to 2000 period that was modeled for assurances to quantify ecological benefits.

Another important factor when selecting representative rainfall periods, is that they, with the model and performance measures used, form the hydrologic basis of the project's design to meet ecological goals as constrained by the other project purposes. For example, the DPIR/EIS average wet season water depth and duration hydrologic performance measures developed for different plant communities were derived from rainfall from a variety of periods, *e.g.*, 1973 to 1977 and 1984. Comparisons of rainfall from these shorter periods, where mean water depth and duration were determined for each plant community, should be checked against the longer period of rainfall available. The rainfall from the periods used to develop the performance measures needs to be compared to the 1993-1995 period. Without these comparisons, it is difficult to understand whether the benefits observed in the selected plan are due to increased rainfall or the features and operations proposed. The environmental benefits predicted are potentially a result of the above average rainfall patterns that will not be achieved during other meteorological conditions.

ii. Design Storm

On August 11, 2003, the Service provided a PAL to the Corps that expressed concerns that the method used to generate spatial rainfall values for the Standard Project Flood (SPF) and Standard Project Storm (SPS) overestimated rainfall within the basins. We are concerned that the methodology used to generate the temporal and spatial distribution of all design storms over estimates run-off volumes and corresponding peak discharges. Since the project is required to remove more water to meet existing flood control requirements, increased run-off results in reduced environmental restoration benefits. Increased capacity used expressly for flood protection is undesirable because storage is not available to attenuate associated pulse releases. By significantly increasing run-off volumes and over designing the structural capacity and canal conveyance to remove the inflated volumes of water over-drainage of the isolated wetlends in NGGE is possible. Consequently, the assessment model may tend to underpredict the frequency and duration of water level declines of both surface and ground waters. The combination of these factors could prevent the project from fully achieving restoration objectives because the predicted volumes of water will ultimately not be available for ecosystem needs.

The PIR/EIS needs a more thorough explanation of the assumption that uniform rainfall is applied at the same return period over the entire model domain simultaneously. The assumption that the temporal distribution is the same for each station over the same 5-day period seems incorrect. It implies that there is no forward movement of the storm towards and away from the project area. There is little correlation of daily rainfall between adjacent stations. Increasing the interval of accumulation to a 5-day total rainfall only marginally increases the correlation. Small-scale temporal variability is well documented in the literature and obvious in the data. To observe a correlation between adjacent stations it would be necessary to increase the interval for

accumulating rainfall to greater than one month. These factors contribute to an over-estimation of run-off because infiltration is exceeded simultaneously at all locations.

To understand the potential effects of this method on fish and wildlife resources, we used an Inverse Distance Weighted geostatistical method to estimate 5-day rainfall for tropical storms Jerry and Harvey and the data used in Frequency Analysis of Daily Rainfall Maxima for Central and South Florida, Technical Publication #390 (Pathak, 2001) (EMA#390) to calculate the 5-day 25-year maximum annual rainfall. Figure 2 shows the rainfall isohyetals for tropical storms Jerry (August 23-25, 1995) and data used in EMA#390 to calculate the 5-day 25-year maximum annual rainfall. The rainfall isohyetals shown for TS Jerry represent the maximum total 5-day rainfall surrounding the dates noted in the DPIR/EIS. The steep gradients between the contours observed for TS Jerry highlight the spatial variability inherent in southwest Florida rainfall as opposed to a uniform distribution assumed in the DPIR/EIS modeling of design storms. TS Jerry isohytels also show the spatial variability expected with extreme meteorological events of this type. Additionally, if one were to examine the temporal distribution of these events there would be considerable differences observed in the assumed versus the actual.

The DPIR/EIS stated that a "frequency analysis performed determined those events to be approximately 10+ year event for Tropical Storm Jerry (1995) and a 25 year event for Tropical Storm Harvey (1999)." Rainfall volumes were calculated for the area shown in Figure 2. From this information it appears that the return frequency of the tropical storms may be reversed with Jerry actually representing the 25-year event. For these events, the difference in the rainfall volumes between the actual and the design storms were 6 and 11 percent. It is important to note that the increases observed are in addition to those that result when rainfall from discrete locations is applied to landscape scales at time increments less than a month or a season.

Comparison of an observed 5-day 100-year maximum annual rainfall with one based on the EMA#390 assumptions was not possible to calculate. Based on the analysis of the 10- and 25-year comparisons, it is evident that as the return period increases the over-estimation of run-off volume also increases. A prudent estimate of the overestimation between observed and hypothetical for the 5-day 100-year annual maximum rainfall could easily be between 15 and 25 percent. The ecological significance of embedding such a design criteria on an ecosystem restoration project is exemplified by the C&SF Project S-9 pump station or the S-12 structures. Because no specific hydrologic performance measures were used to assess the implications of the application of the design storms, either with respect to their magnitude or frequency of occurrence evaluating the long-term effects of their associated operations on wetlands being restored and the potential affects on fish and wildlife remains unanalyzed.

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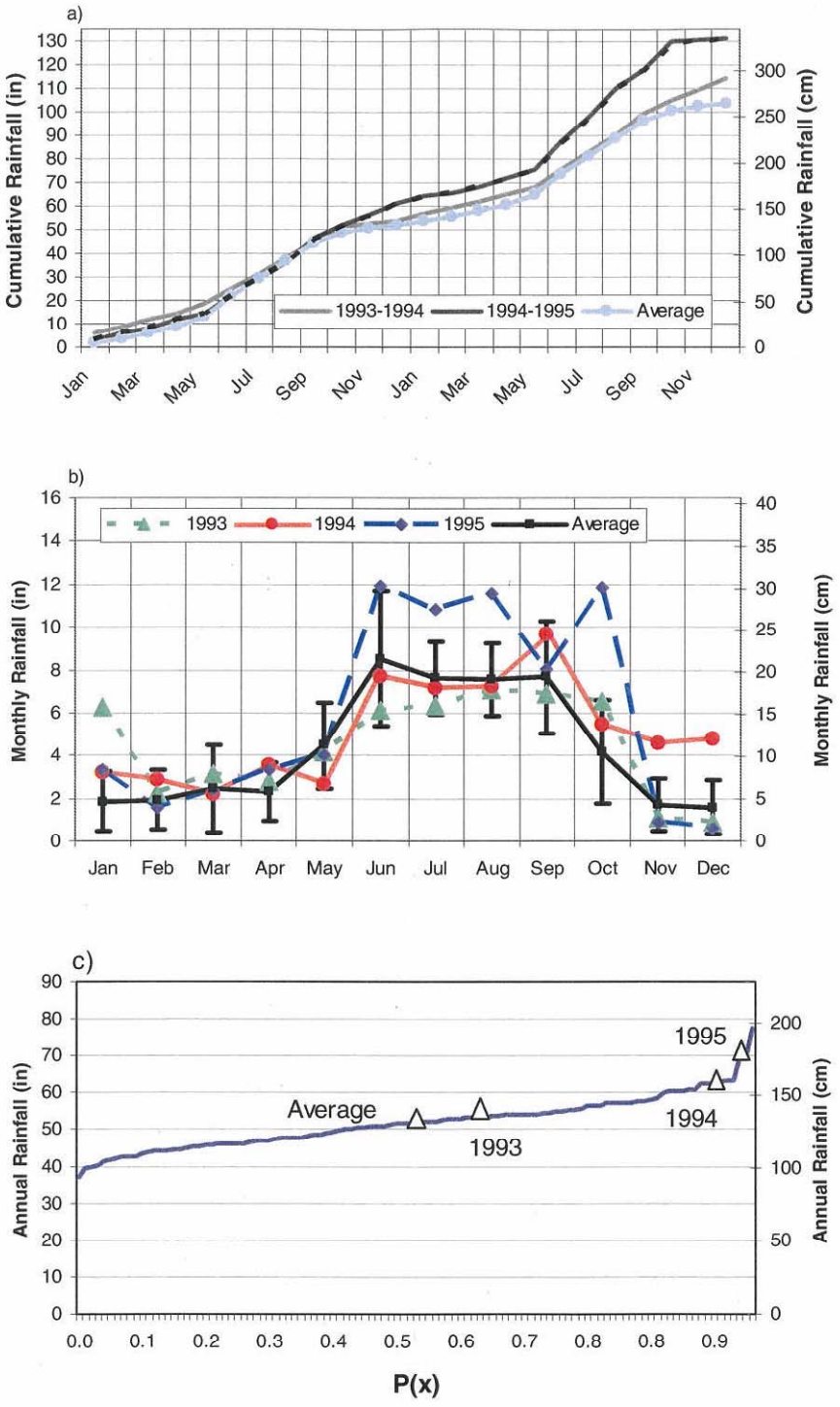


Figure 1 Accumulated annual (a), monthly (b) and frequency of annual (c) NCDC rainfall for Region 5 for the analysis windows in the DPIR/EIS (Everglades and SW Florida)

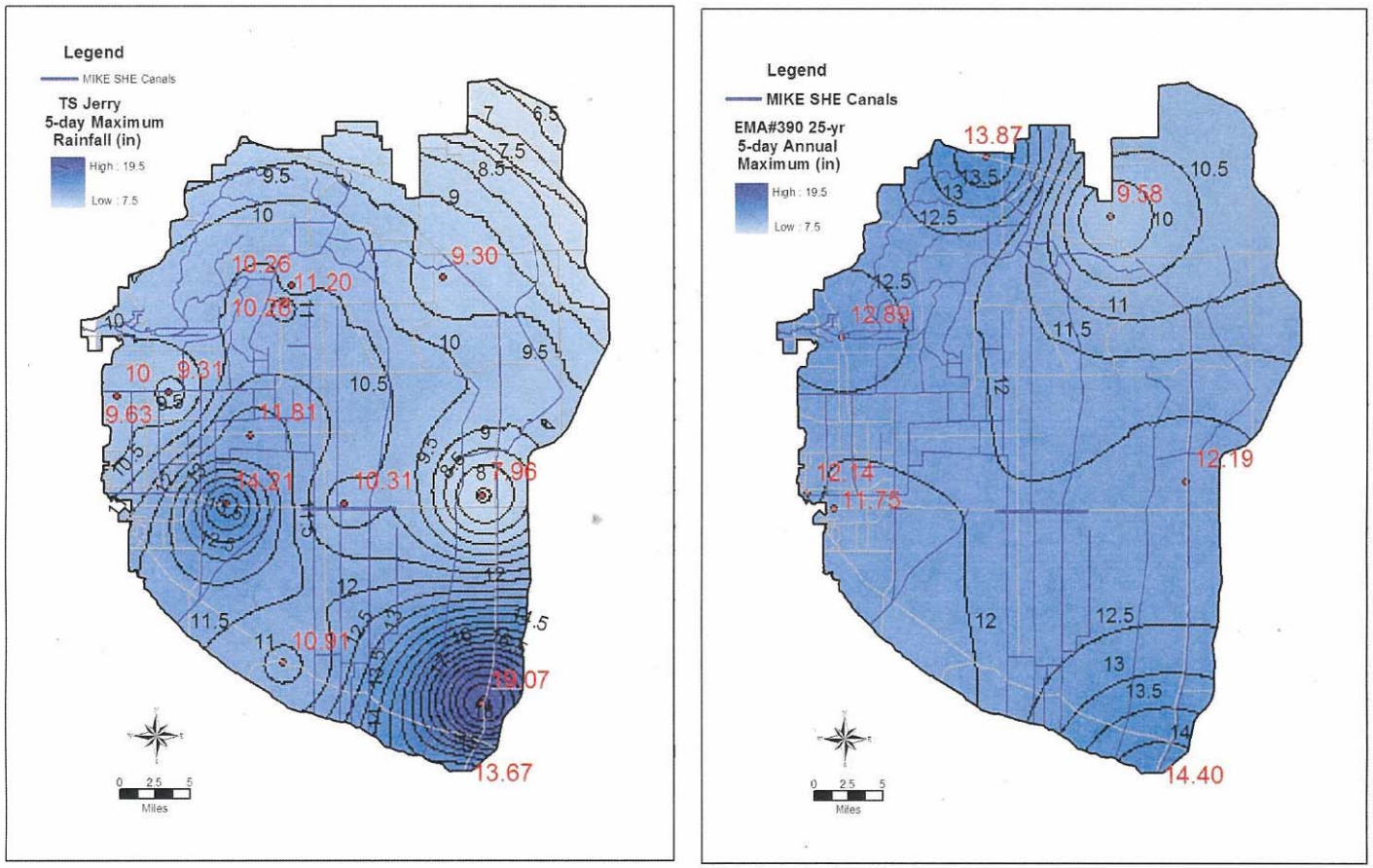


Figure 2 The 5-day total rainfall recorded for tropical storms Jerry (left) and the 25-year 5-day annual maximum EMA#390 data(right). Both were generated from data available through the District's hydrologic database and EMA#390. Station metadata is available upon request.

iii. Topography

Topographic data from a variety of sources were integrated into the MIKE SHE and MIKE 11 models. These data included recently aquired LIDAR data where available. Figure 3 shows the topography input data set used in the MIKE SHE model. From this figure, it appears that the LIDAR data represents the west half of the model domain. Most of this data set is lacking smoothing of any kind. The east half of the model consists of the original DEM data. Because of the sharp discontinuities observed in the data in Figure 3, some discussion is warranted on the meshing of the different sources, QA/QC of the data set, and their significance to interpretation of model results presented.

We are concerned that the cross sections in MIKE 11 do not match the topography used in MIKE SHE. Documentation on the consistency between these two data sets is necessary. Figure 4 shows a flood plain cross section from MIKE 11in SGGE relative to the topography used in MIKE SHE at the same location. Based on these inconsistencies, the topography and flood plain topography should be reevaluated. Six inches of elevation difference in the project area can result in significant changes in hydroperiods and resulting vegetation. Therefore every effort should be made to ensure that the synthesis of elevations from different sources input into the model does not increase or decrease ponding unrealistically. For example, the MIKE 11 network notes more than one source of topographic data for delineation of flood plains including 2002, Alt3D, Alt6, Alt12 DEM, DEM_2000, DEM_scen, DEM-RAS, HEC-2, HEC-RAS-UNET, NewDEM, SWMM, dummy, Dummy, Unet and UNET-RAS. Ensuring consistency of these different sources with those used in the general topography is critical because of the MIKE SHE/MIKE 11 coupling. The limited number of calibration and verification points in the SGGE domain makes it difficult to assess whether systematic bias or uncertainty is being introduced as a result of these different sources of data or other deficiencies in the available input data.

While the results of the sensitivity analysis included in the DPIR/EIS were informative, it is unclear whether the relationship between the MIKE 11 and the MIKE SHE topographic elevations were maintained with the plus and minus one foot increase to the general MIKE SHE topography. Quantification of the change observed in the flood control performance measures and presentation of the calibration and verification statistics with the topography changed is warranted. Contrary to the conclusions reached in DPIR/EIS regarding the topographic sensitivity analysis, the lack of additional information in support of it could lead to conflicting conclusions. If topography in SGGE is increased or decreased uniformly, model results change little. If little or no difference is observed in the flood control performance measures and the calibration and verification statistics, that would suggest more of a model problem than one attributed to insensitivity of the performance measures.

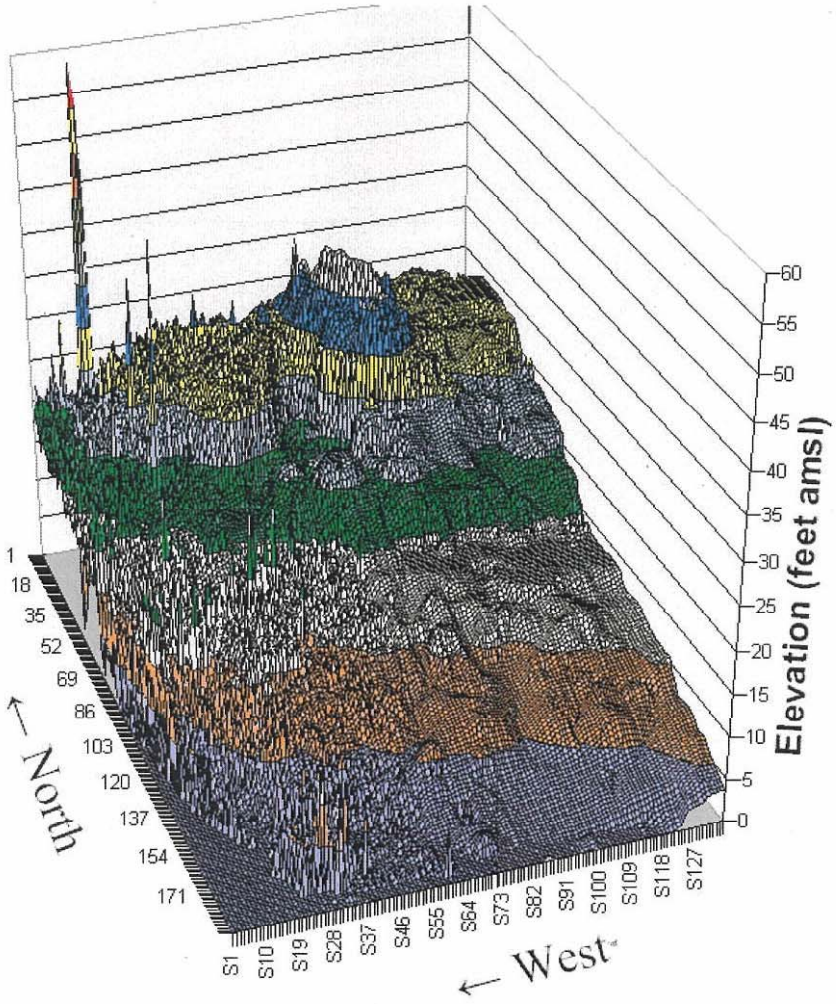


Figure 3 Regional topography generated from MIKE SHE model input (ft NAVD88).

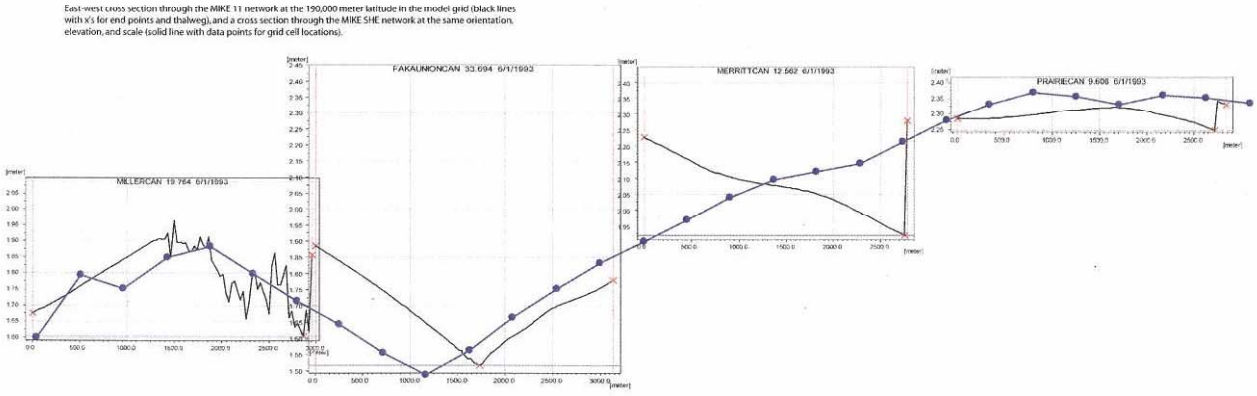


Figure 4 MIKE 11 cross section geometry (solid black) relative to MIKE SHE topography (solid blue with filled circles).

iv. Land Use and Vegetation

There is a significant difference in SGGE vegetation classifications between the input in the MIKE SHE model and the NRCS 1995 vegetation classifications. Figure 5 shows the actual NRCS 1995 vegetation classifications and the vegetation classifications used as MIKE SHE. Table 1 contains percentages for each vegetation classification for both the NRCS 1995 map and MIKE SHE input. The NRCS vegetation classifications were grouped according to water depth and duration criteria presented in the DPIR/EIS. MIKE SHE vegetation classes are dominated by hydric flatwoods where the NRCS vlasses are dominated by cypress, marshes and mesic flatwoods. A more thorough description is necessary to explain these diffences including some explanation of how the uniform vegetation community in MIKE SHE affectsManning's *M* and ET (shown in Figure 5).

Table 1 Percentage of vegetation classifications for the 2000 MIKE SHE model land use input and the 1995 NCRS within a generalized boundary representing the SGGE.

Name	Depth Class	Percentage MIKE SHE	Percentage 1995 NCRS
Mesic Flatwoods	<0.2	0.2	30.5
Hydric Flatwoods	0.2-0.5	60.3	15.1
Wet Prairie	0.5-1.0	11.7	12.2
Cypress/Marsh	1.0-2.0	15.9	40.5

v. Aquifer Parameters

The Service is concerned that the values used to represent various aquifer parameters in the model may result in unrealized benefits or unpredicted impacts to the ecosystem. Clearly, subsurface information is sparse as compared with some surface information; such as canal geometry and control structure operations. Using geostatisical methods to interpolate between sparse data can lead to spurious results. For example, there is a "bullseye" pattern and strong north south linearity within the SGGE project area in the hydraulic conductivity maps in the DPIR/EIS. These areas are apparently places where real data have been obtained, and the vast areas where such data are unknown have been maintained at originally estimated values. Better use of the available data, and better interpolation and smoothing schemes should be employed. Occassionally, boundary conditions are applied as "forcing factors" in order to make conductivity are suspicious and often as in this case used to improve calibration and verification statistics. However, without sensitivity analysis it is difficult to assess the degree that these discontinuities prevent water from ponding too deeply or conversely facilate increased ponding.

A 3-dimensional surface of the hydraulic conductivity data for the Lower Tamiami aquifer is shown on the ride side of Figure 6. The surface shows Southern Golden Gate Estates, about 300 km^2 in size, as a sharply bounded area with horizontal hydraulic conductivity an order of magnitude higher than the surrounding areas. A similar trend is observed in vertical hydraulic conductivity for an area just to the north in North Golden Gate Estates. This area, about 75 km^2 in size, contains vertical conductivity values that are about 30 times greater than their surroundings. Explanation for these discontinuities and their significance in affecting surface and subsurface hydrology in both NGGE and SGGE should be included in the PIR/EIS.

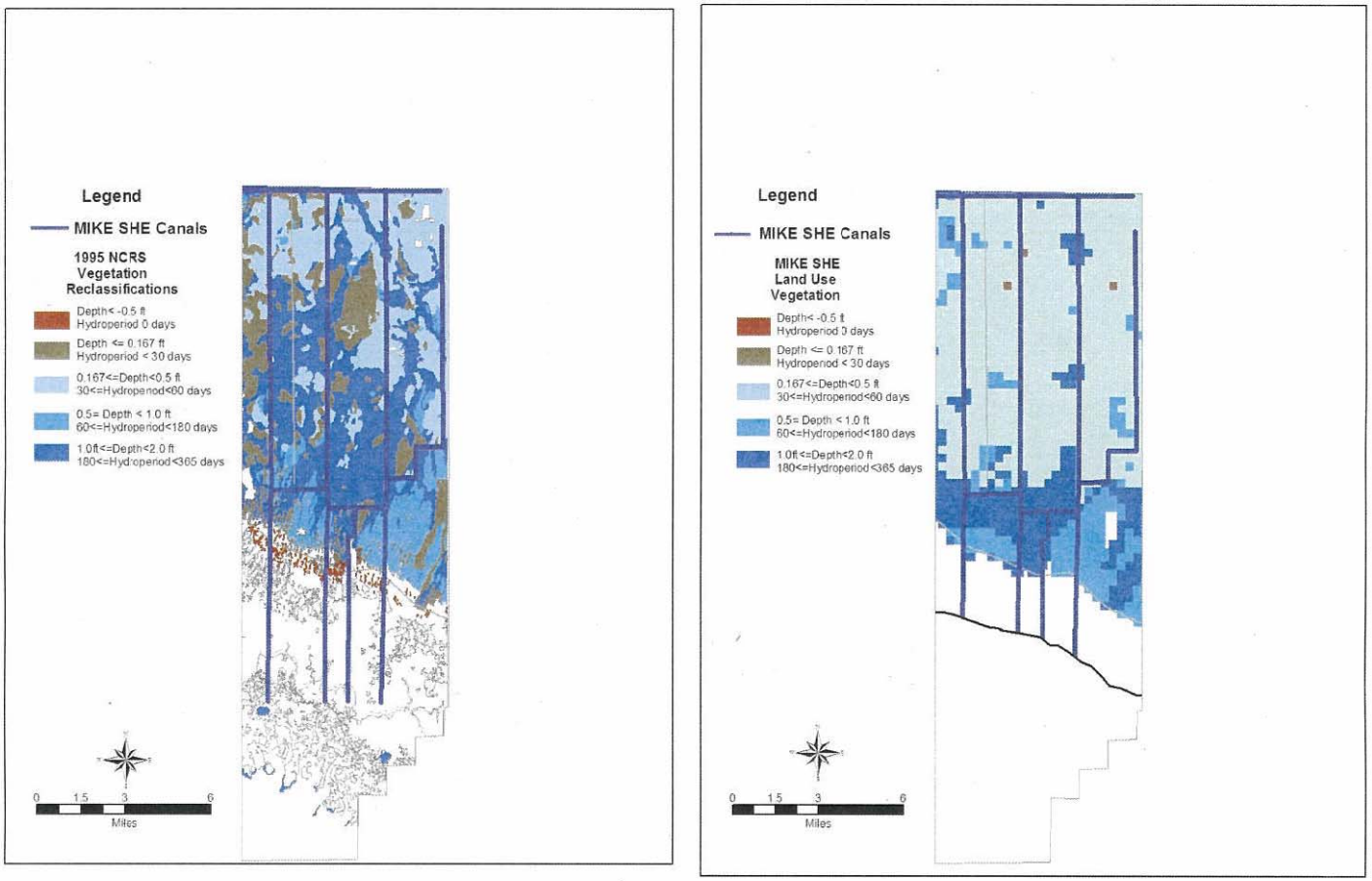
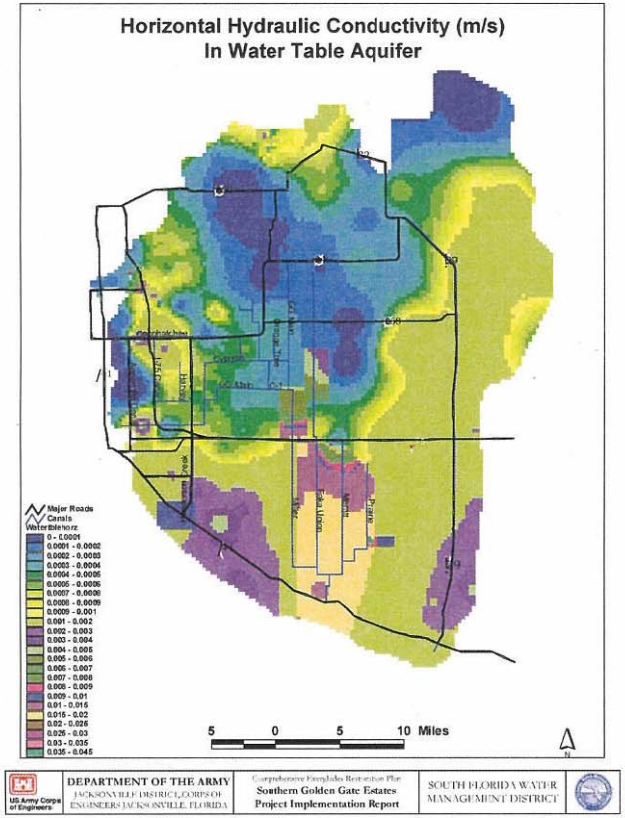


Figure 5. 1995 NRCS (left) and 2000 MIKE SHE model input vegetation classifications (right)



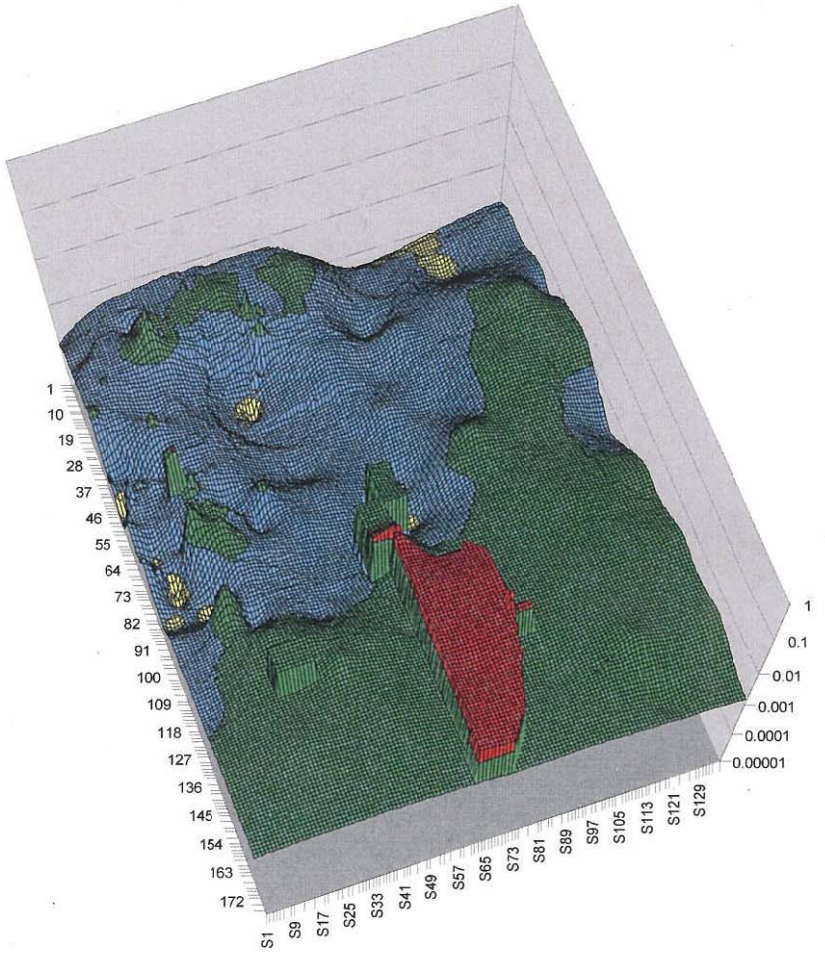


Figure A-19

a) b)

Figure 6. Horizontal Hydraulic Condiuctivity for Lower Tamiami Aquifer MIKE SHE input (m/s).

vi. Surface Water

We are concerned that the use of MIKE 11 and its associated flood plain topography, cross sections, and codes don't adequately simulate physical processes of the wetlands, marshes, sloughs and strands prevalent throughout the study area. The conceptualization of the features in the hydrologic model is an important consideration to the Service in the assessment of the proposed alternatives. Documentation should explain why this is warranted, including adequate descriptions of instability problems if they exist and the steps necessary to minimize or eliminate their occurence. For example, an explanation of the extension of the Miller, Faka Union and Merrit canals to the coast should also be included. What is the significance of these features to the the Tamiami Trail culvert project and surface water flows to the estuaries? These features give the impression that the spatial distribution of flows has been pre-determined.

MIKE 11 Canal Network – Cross Sections

The MIKE SHE documentation emphasizes "that the flood mapping and hydrodynamic flooding during the simulation requires a good consistency between the MIKE 11 cross-sections and the ground surface elevations of the corresponding MIKE SHE flood grid points." However, Figures 7a and 7b show that the elevations in the MIKE 11 network do not match up with one another, nor do water levels necessarily remain consistent between adjancent chainages. Figure 7a shows an east-west cross section composite in SGGE, about 15 km (9.32 miles) north of Port of the Islands. A vertical difference of up to 0.25 m (0.82 ft.) between cross section elevations and differing water levels of up to 0.2 m (0.7 ft.) is observed. Figure 7b shows an east-west cross section consisting of overlapping sections of the Miller and Faka Union Canal extensions, about 4 km (2.5 miles) north of Port of the Islands. In this case the elevation difference between the land and the water is 0.14 m (0.46 ft.) and 0.04 m (0.13 ft.) respectively. As the model is physically based, it seems a greater effort should have been made to ensure consistency between the elevations in MIKE 11 and MIKE SHE. Water must rise considerably higher than it should in reality to overflow the channels and be transferred to the overland flow module. Figure 7 indicates that barriers to flow exist in the digital elevation model but not in the MIKE 11 network.

While it is important to extend the number of comparisions of the cross-sections, the three we reviewed provide enough evidence of potential problems to warrant further review and explanation. These potential errors are critical due to the role MIKE 11 plays in the movement of surface water in the canal network and wetlands throughout the study area and due to the the interchange of water between the MIKE 11 network and the "Overland Flow" module.

Calculating overland flow in a flood plain using a 1-D equation opposed through a marsh with a 2-D equation seems a less than ideal conceptualization of these physical processes. Consider the following description exerpted from MIKE SHE documentation with respect to the calculation of the exchange of flows between the two.

> *In terms of the water balance, the surface water in the inundated areas belongs to the MIKE 11 water balance. In other words, if there is ponded water on the surface when*

the grid node floods, the existing ponded water is added to the MIKE 11 water flow in the river. Subsequently, as long as the element is flooded, any exchange to or from the surface water is managed through MIKE 11. If the element reverts back [sic] *to the non-flooded state, then any ponded water is again accounted for in the the overland flow component.*

These statements need to be clarified of how an area in a non-flooded (*i.e.*, not ponded) state, may have an overland flow component. A cursory examination of the difference between the cross-section geometry for Alternative 3D and 6 suggest that there were instances when overbank flows, *i.e.*, stages greater than 0.61 m (2 ft.), occured but were constrained by the cross-section geometry. Figures 8 and 9 depict the cross-section geometry of the Faka Union canal at the same latitude for Alternatives 3D and 6. Figure 10 shows stage duration curves for Alternative 6. If the cross-section geometry for the flood plain and flood codes used in Alternative 3D was applied in Alternative 6, greater inundation of wetlands adjacent to the canal could be possible. Based on the data shown in Figure 10, Alternative 6 over bank flows may have been possible for up to 40 percent of the simulation period. This could translate into previously unaccounted environmental benefits.

MIKE 11 Flood Codes

Confidence in the selection of Alternative 3D is dependent on confidence in the alternative-to-alternative comparisons during plan formulation. However, these comparisons may be complicated by differences in input parameters between alternatives, such as flood plain topography and flood codes.

Our analysis indicates that the flood plain codes change between alternatives. Figure 11 shows the flood codes for Alternative 3D and Alternative 6. It is our understanding that the flood code is an input flag that allows surface water to flow over the bank to the flood plain from the MIKE 11 network. It is not clear how the code enables surface water to exit the MIKE 11 network and transfer to MIKE SHE overland flow and back again. Because of the uncertainty surrounding the input parameters, it is prudent to ensure that consistency between alternatives is maintained. Documentation should address why changes in the flood code network are deemed necessary for the different alternatives. Unless a rationale is provided stating otherwise, it appears that the flood plains and codes in Alternative 3D should be acceptable for all alternatives.

Modelers at the August 10, 2004, meeting could not confirm or explain these differences between the flood code layouts. However, they agreed to look into the issue and provide documentation of any changes between alternatives. This documentation should include how the differences shown in Figure 11 affect canal/aquifer interactions and the implications to alternative-to-alternative comparisons. Additionally, a more thorough discussion should be provided regarding the conceptualization and rationale for using flood plains and flood codes in determining flooding or inundation boundaries of adjacent wetlands when flood codes are flagged. Explanation of how these codes constrain the extent of flooding or inundation is necessary for understanding how they potentially affect the interpretation of model results. If it

does act as a constraint for flooding, what steps were taken during the plan formulation process to prevent

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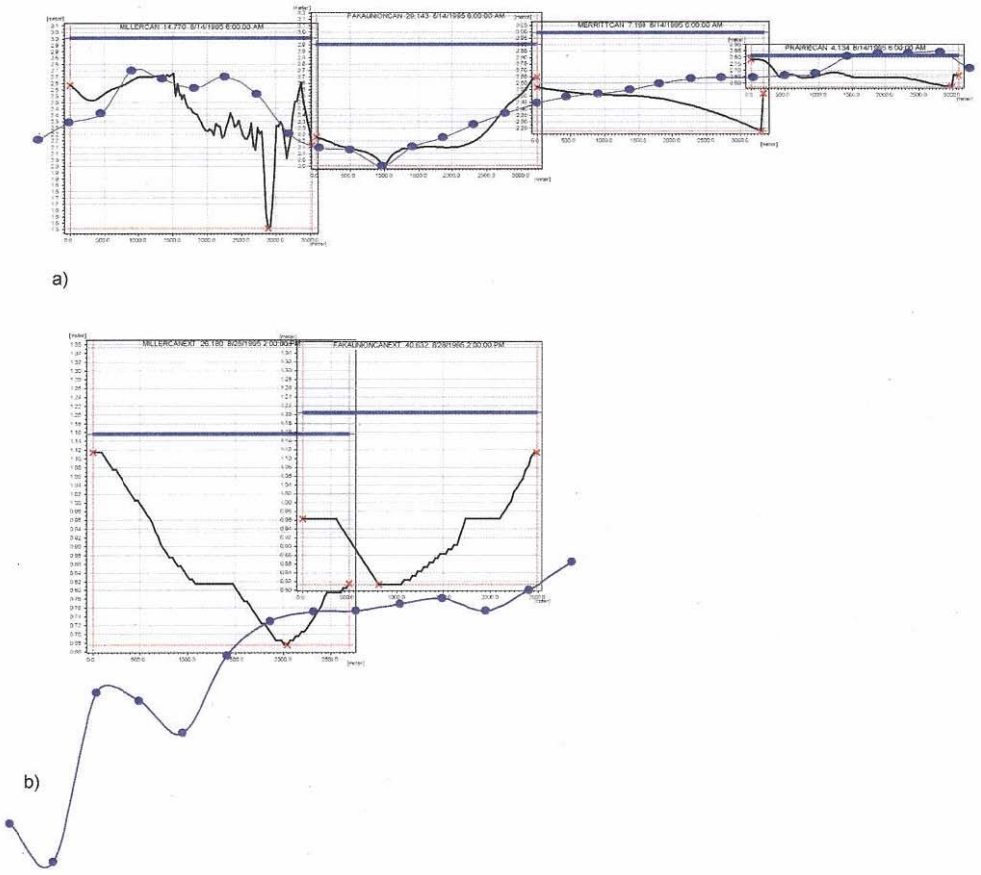

Figure 7. Cross section composites (to scale) for the Miller, Faka Union and Merritt Canals in SGGE 15 km and 4 km north of Port of the Islands, respectively a) and b). Overlaps in the cross sections relate to relative positions in MIKE SHE.

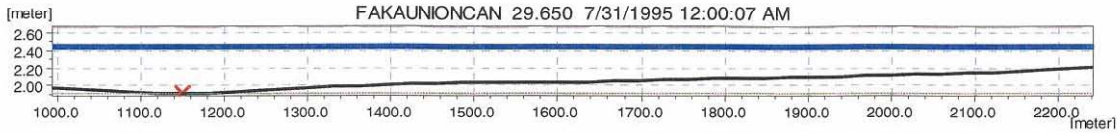

Figure 8. Cross section geometry for a flood plain of the Faka Union canal, Alternative 3D.



Figure 9. Cross-section geometry for the same flood plain as Figure 8 from Alternative 6.

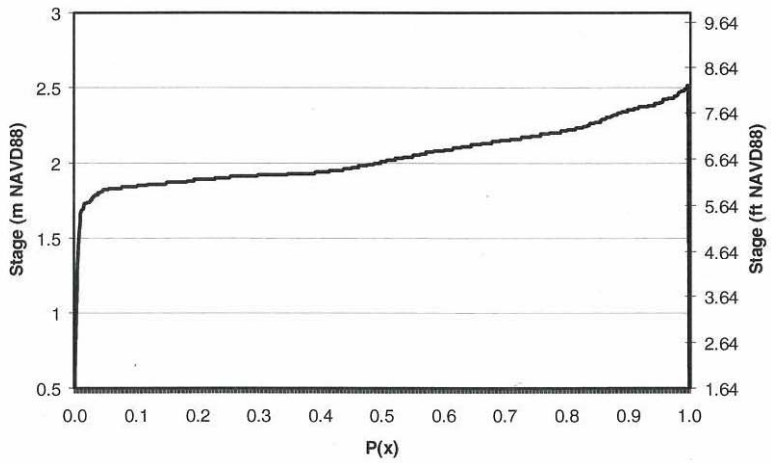

Figure 10. Stage duration curve for Alternative 6 for the cross-section shown in Figure 9.

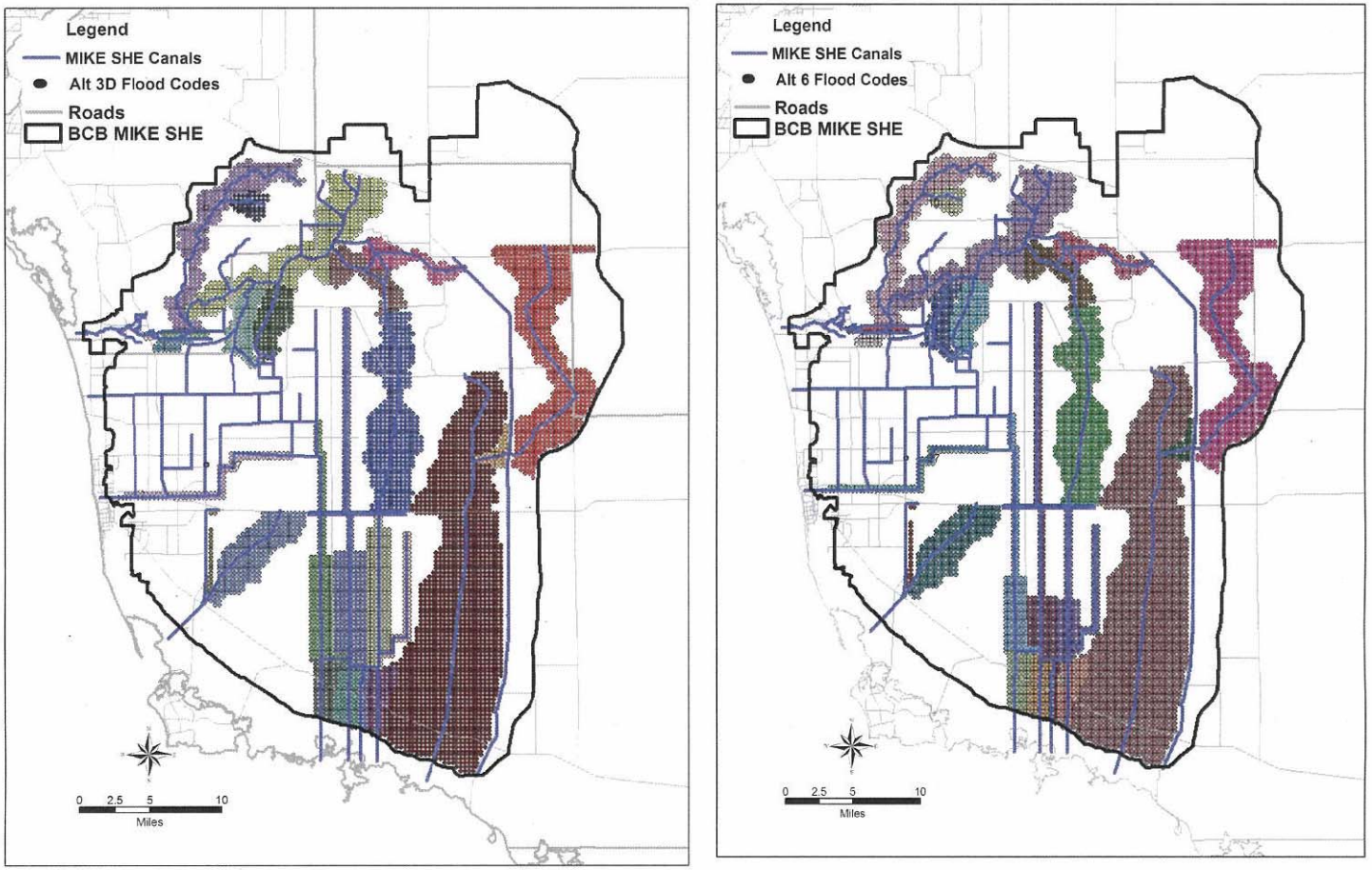

Figure 11 MIKE SHE flood codes for Alternative 3D (left) and 6 (right).

bias between the different alternatives? Finally, the documentation should describe the source data used to generate the flood plains and flood plain codes. If flood plains were evident in the original topography, they should be in the existing conditions simulation. If the flood plains were added to the model following calibration, a description should be included addressing how, if at all, they affect the calibration of the model.

Effects of Canal Extensions

We are concerned with the way overland flow from SGGE to the downstream estuaries was simulated in the model. It appears that the Miller, Faka Union, and Merritt canals were extended from SGGE to the coast. This extension seems spurious and contrived as a mechanism to transport overland flow south through the culverts (otherwise the culverts exist in a vacuum and would not be able to function). Figure 12 shows the high resolution aerial photographs of the marshes between the bottom of the Miller and Faka Union Canals to U.S. 41 at the approximate location of the extension canals in the model. Clearly the north-south flow-ways these extensions represent do not exist, nor will they be constructed. The white arrows represent an interpretation of the natural drainage from northeast to the southwest associated with the existing topography. How will the conceptualization of surface flows in the model differ from those that are likely to exist post-project? If the ground surface elevations in question have not been significantly disturbed, water should flow from northeast to southwest consistent with the digital elevation model. As seen in the circle on the left side of Figure 13, the cross sections for these extensions consist of a broad swale. It is hard to believe that these exist unless they were created by the undisciplined passage of heavy equipment during SGGE canal construction or other ORV. No evidence for these types of activities is apparent on the aerial photograph or on the ground (refer to Figure 12).

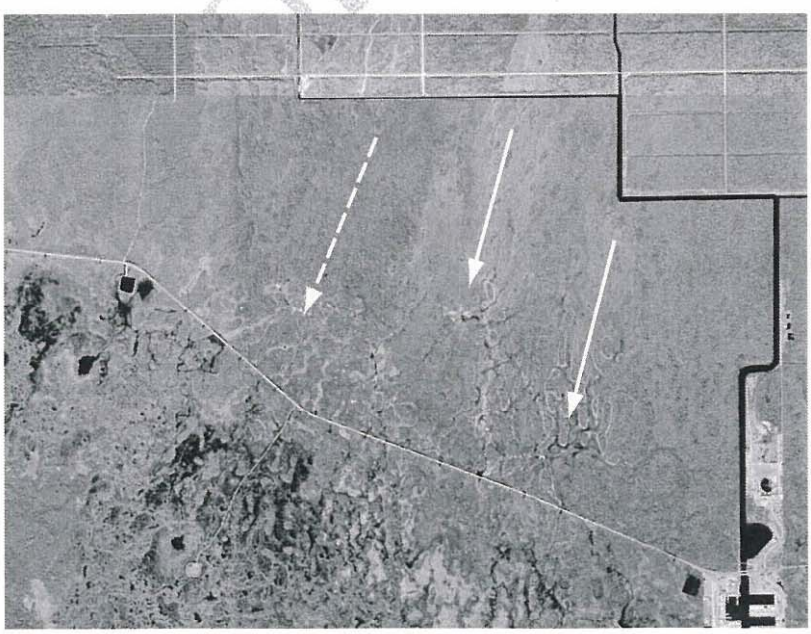

Figure 12 High resolution aerial photographs of the marshes between the bottom of the Miller and Faka Union Canals to U.S. 41 in the approximate locations of the extension canals simulated in MIKE SHE

To evaluate the validity of the canal extensions, the Service analyzed the flows calculated by the model. Flows for Alternative 3D were generated for the three extension canals at the culverts at U.S. 41 and FU-1. The left side of Figure 13 shows the MIKE 11 network for the SGGE and the extensions of the Miller, Faka Union and Merrit canals for Alternative 3D. Flows at FU-1 and the culverts at the extention canals are shown in Figure 14. These flows were generated from the MIKE 11 result file. MIKE 11 surface water flows through FU-1 and the Miller, Faka Union and Merritt culverts for September 1994 match reasonably well with flows for these locations reported in the DPIR/EIS (see Figures A-42, A-44 through A-46 in Appendix A). Next MIKE SHE overland flows in the y-direction (the REV results file) were generated for the Miller flow section shown on the right side of Figure 13. Since the model assumes a northern orientation of flow, the negative values shown in Figure 15 represent southward overland flows. The September 1994 overland flows do not match either the MIKE 11 Miller canal extension or the values reported in Figures A-44 in Appendix A of the DPIR/EIS. As noted earlier, the MIKE 11 module dominates the movement of surface water in this area. This conceptualization may contribute to differences between simulated and actual upstream hydrology potentially resulting in impacts and unrealized benefits by the project. Further discussion should be provided in the PIR/EIS explaining the inclusion of the extensions and the implications to meeting both the upland hydrologic restoration targets and the downstream estuarine salinity envelopes. The conceptualization and simulation of these features has significant implications to the volume, timing and distribution of flows that will occur as a result of the project.

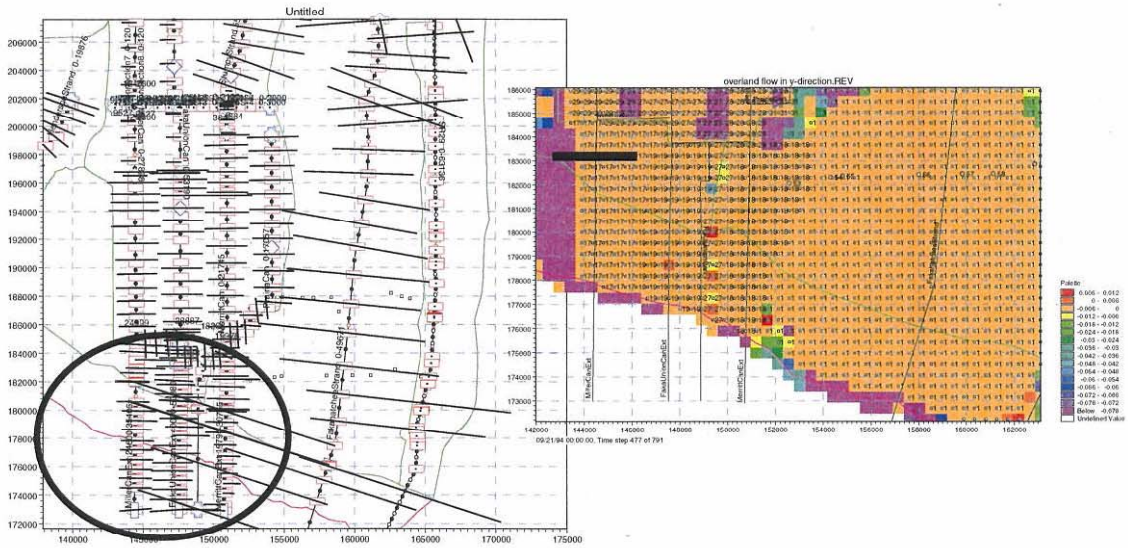

Figure 13 Alternative 3D MIKE 11 canal network and cross-sections (left) and flood codes for the Miller, Faka Union and Merrit extension (right).

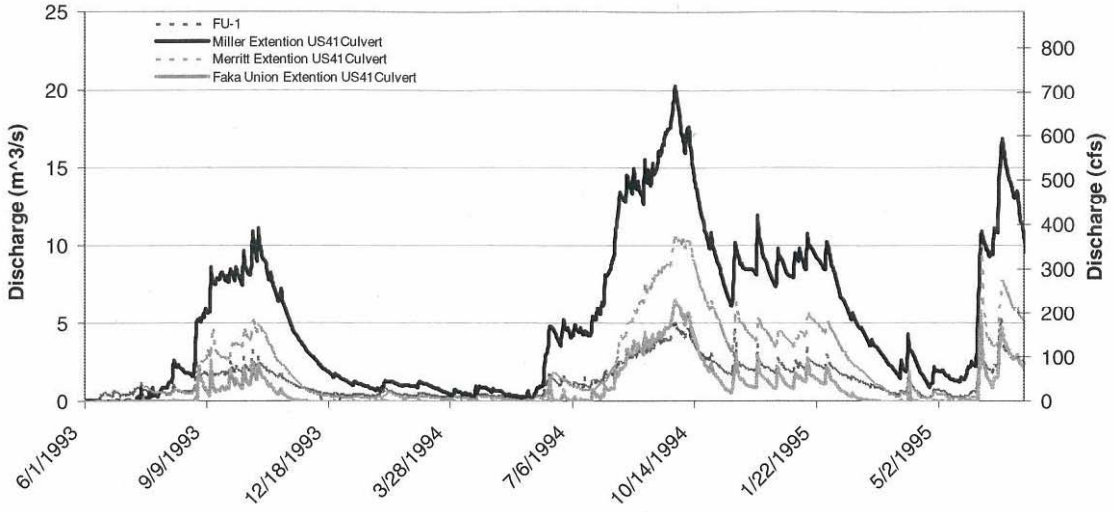

Figure 14 MIKE 11 flows through Miller, Faka Union and Merrit canal extensions and the FU-1 weir on the Faka Union Canal for Alternative 3D.

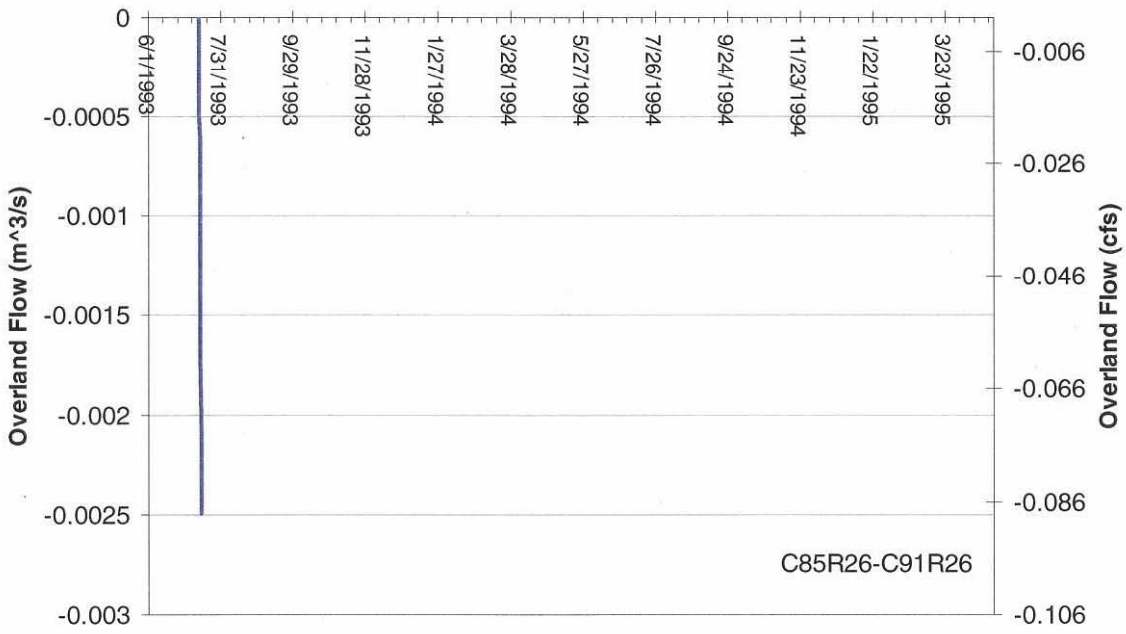

Figure 15 Miller flowway flows generated from the overland flow in the y-direction of the MIKE SHE results file for Alternative 3D.

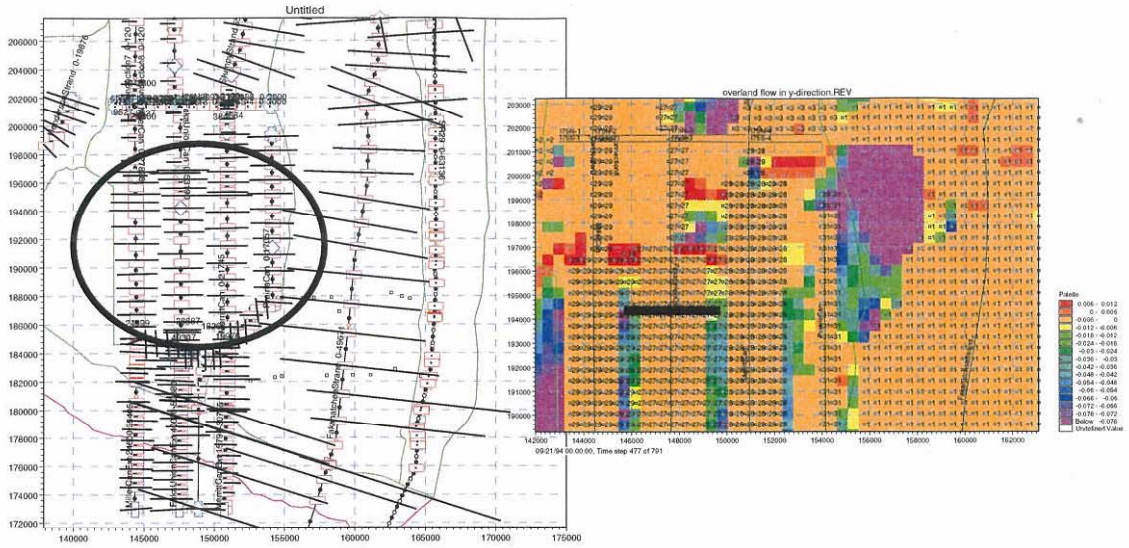

Figure 16 Alternative 3D MIKE 11 canal network and cross-sections (left) and flood codes for the Miller, Faka Union and Prairie Canals (right).

Effects of Backfilled Canals

Concerns noted for the conceptualization and simulation of the extension canals apply to the backfilled portions of the SGGE canal network. Figure 16 shows the MIKE 11 network for the SGGE of the Miller, Faka Union and Merrit canals for Alternative 3D. Figure 17 shows MIKE 11 flows immediately upstream, downstream and again further downstream from the Faka Union pump station for Alternative 3D. With the exception of variability due to the continual on and off cycling of the pumps the two downstream flow hydrographs (lower two) are nearly identical in terms of volume and timing. Figure 18 shows overland flow in the y-direction for the flow section shown on the right side of Figure 16. Although there is very little similarity between the MIKE 11 and MIKE SHE flows depicted, the smoothing evident in the bottom hydrograph of Figure 17 is an indication that there is some exchange between the two modules. Again, as previously indicated further discussion should be provided in the PIR/EIS explaining these differences and their significance to benefits assessed during the plan formulation. Additionally since flood codes and cross sections change between alternatives, documentation and explanation of how they affect the level of benefits observed should be included.

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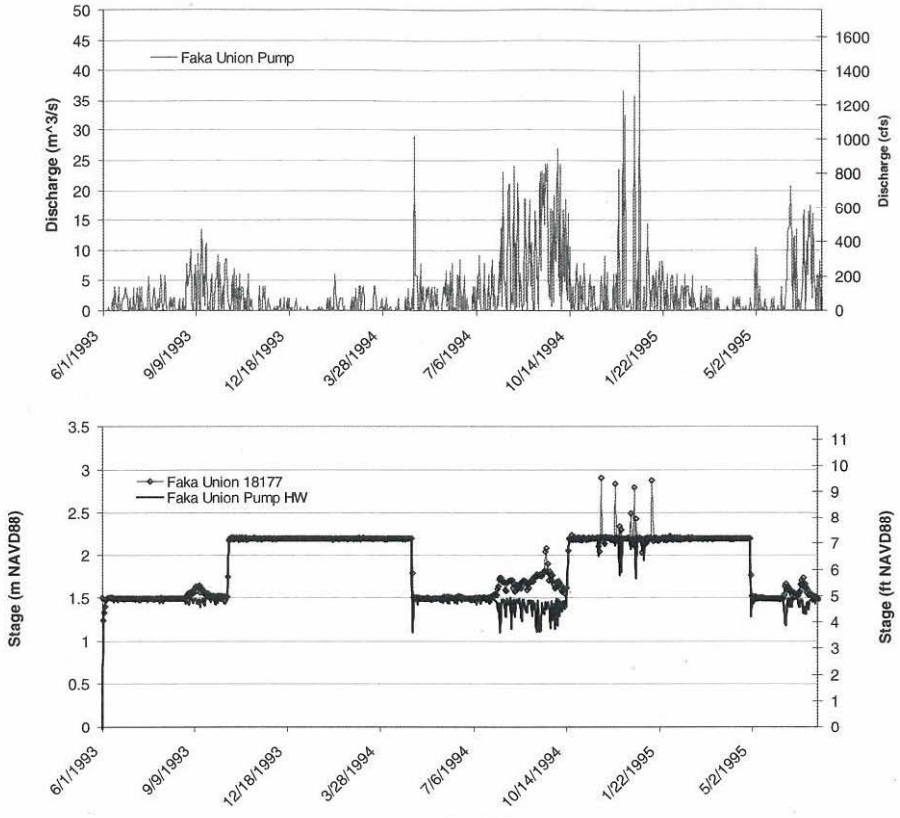

Figure 17 Faka Union Canal MIKE 11 flow (top) and stage (bottom) hydrographs for chainages upstream and downstream of the proposed Alternative 3D pump station.

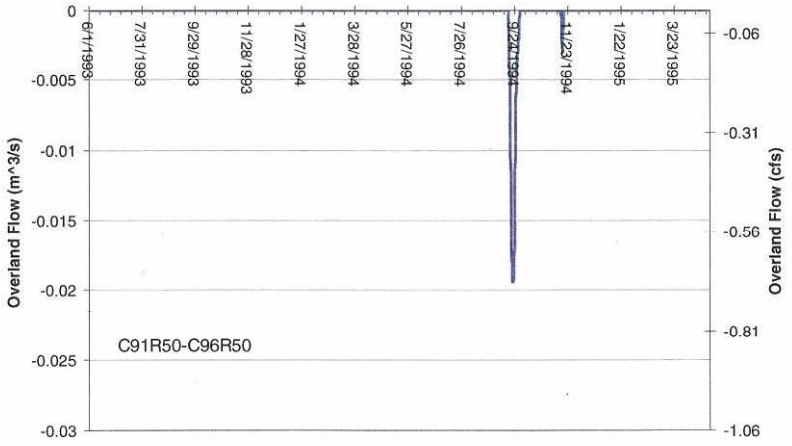

Figure 18 Faka Union flowway flows generated from the overland flow in the y-direction MIKE SHE results file for Alternative 3D.

vii. Groundwater – Surfacewater Interaction

The Service is concerned that the plan formulation process for this project depends heavily on a hydrologic model that appears to inadequately simulate the hydraulic connection that exists between surface water and ground water. The DPIR/EIS states that a field investigation of aquifer impacts from the drainage canals in SGGE showed a drop in the water table of approximately 0.61 m (2 feet) at a distance of 1.8 km (6,000 ft.) from the canal. District staff presented field data at the August 10, 2004 meeting showing that groundwater levels respond to changes in canals approximately 3.2 to 4.8 km (2-3 miles) away, depending on the season. This indicates that the surface water and ground water are very closely connected. Yet, the modeling results do not show this degree of connection. For example, stages in the Faka Union and Miller canals in the lower portion of NGGE are raised 0.7 m (2.3 ft.) for the entire dry season with minimal or no corresponding increases in groundwater stage in the adjacent aquifer. An increase of this magnitude and duration in canal stage would certainly be expected to have implications to flood control, water supply and environmental aspects of the project. Hydrologic metrics that demonstrate the model's ability to simulate the canal aquifer interactions are required. If the MIKE SHE model does not show the same degree of connection as known to exist in reality, then justification or rationale for its use must be explained in the PIR/EIS.

It is difficult to understand the connection between MIKE 11 and MIKE SHE, especially with regards to the flood codes. Does MIKE 11 transfer water to MIKE SHE at its 3 minute time step, or at MIKE SHE's hours-long interval? If at the longer interval, what happens to the MIKE 11 water as it is building up before the transfer? To assist in our own understanding of the MIKE SHE and MIKE 11 coupling, the Service attempted to examine the relationship between flows in the MIKE 11 network and flows across a horizontal transect at the same latitude. Groundwater and surface water levels were examined for a series of cells in NGGE. Water levels across a transect perpendicular to Faka Union Canal at the cross-section shown in Figure 19 (Figures A-89A in the DPIR/EIS) were inspected. Chainage 18177 is located between FU-3 and FU-4 in NGGE on the Faka Union. In Figure 19 note the approximate 0.61 m (2.0 ft.) increase in stage observed between Alternative 3D, 6 and 12 dry season canal stage and the existing conditions. Approximately the same increase, 0.61 m (2.0 ft.), is observed between Alternative 6 wet season stage and Alternative 3D, 12 and the existing conditions. Wet season stages simulated in this reach of the canal for existing conditions exceed Alternative 3D and 12 by approximately 0.3 m (1.0 ft.). Similar differences, *i.e.*, increased stages between the alternatives for both wet and dry season, are observed in the Miller Canal at the same latitude.

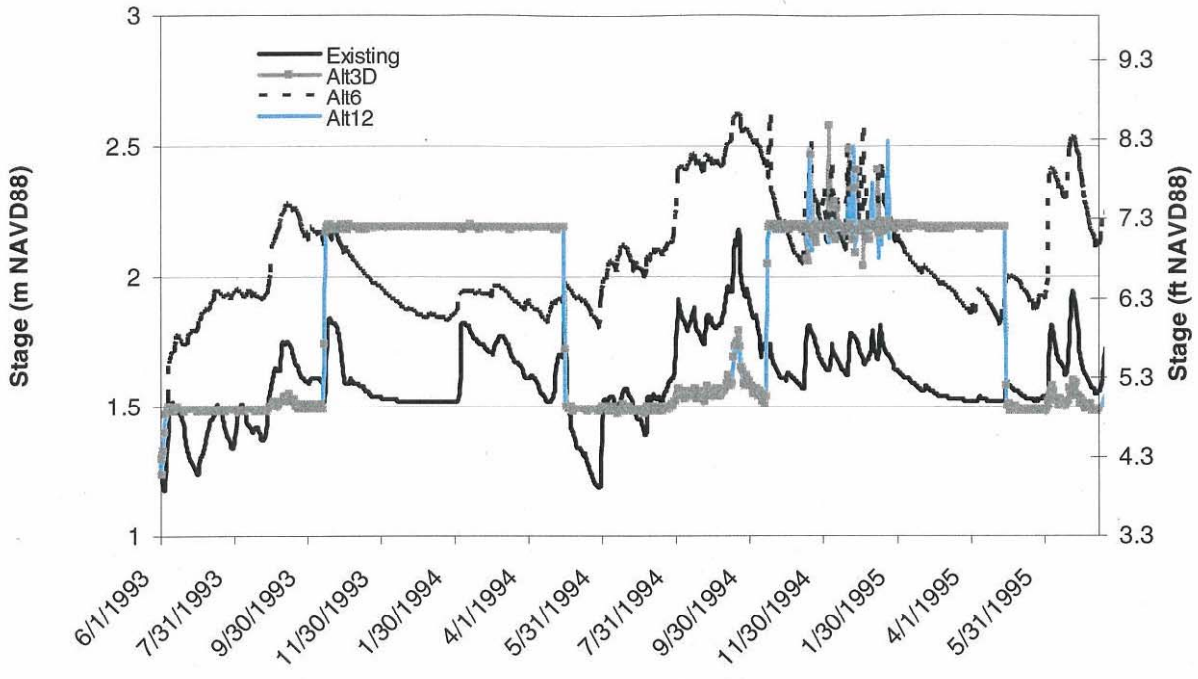

Figure 19 Faka Union Canal stage hydrographs at a location upstream from I-75.

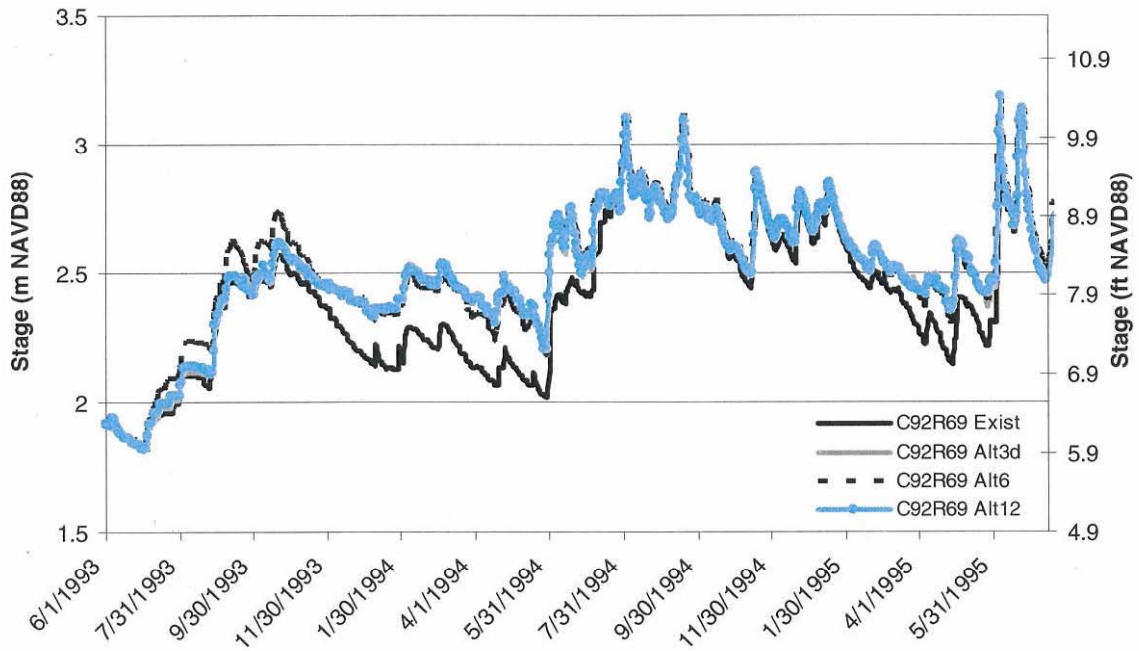

Figure 20 NGGE4 located approximately 1 mile west of Faka Union Canal between FU-3 and FU-4.

A set of stage hydrographs provided by the District were examined for general trends and characteristics that would be consistent with the hydrographs shown in Figure 19. Figure 20

shows the stage hydrographs for a monitoring location labeled NGGE 4, located approximately one mile west and east of the Miller and Faka Union Canals, respectively. This station best exemplifies the coupling concerns. There is very little difference observed between the alternatives, including important characteristics of the hydrograph such as the onset of the wet season, peak water levels and recession rates. The most obvious differences are observed during the dry season. Yet given the large differences in the Figure 19 stage hydrographs observed between Alternative 3D, 6 and 12 with the existing condition, the change in storage has little or no affect on the subsequent wet season stages. The rapid change from wet to dry season operations, approximately a 0.61 m (2.0 ft.) increase in stage has little affect on the dry season stages observed at NGGE 4 and not until much later in the dry season. A lag of this duration is unexpected given the properties of the aquifer.

To determine whether differences increase moving toward the canal, groundwater head at cells along a horizontal transect perpendicular to Faka Union Canal in the general vicinity of NGGE 4 were examined. The first cell was approximately the same distance from the canal as NGGE. Groundwater levels were generated using the head elevation in saturated zone *rev* file for the existing condition and alternatives 3D and 6. Figure 21 shows the location of this transect and approximate location of NGGE. Figure 22 shows Alternative 3D stage hydrographs for the five cells. A couple of observations are worth noting regarding Figure 22. The first is the relative insensitivity of C95R69, C94R69 and C93R69 to fluctuations of 0.4 m (1.3 ft.) in the adjacent cell. Secondly, the stage hydrographs are relatively insensitive to the differences of approximately 0.61 m (2.0 ft.) during the dry season noted in Figure 20. It appears that only cells to the east of Faka Union Canal, cells C92R69, C93R69 and C94C69, respond to the increased dry season stage uniformily by about 0.2 m (0.65 ft.) but not until later in the dry season.

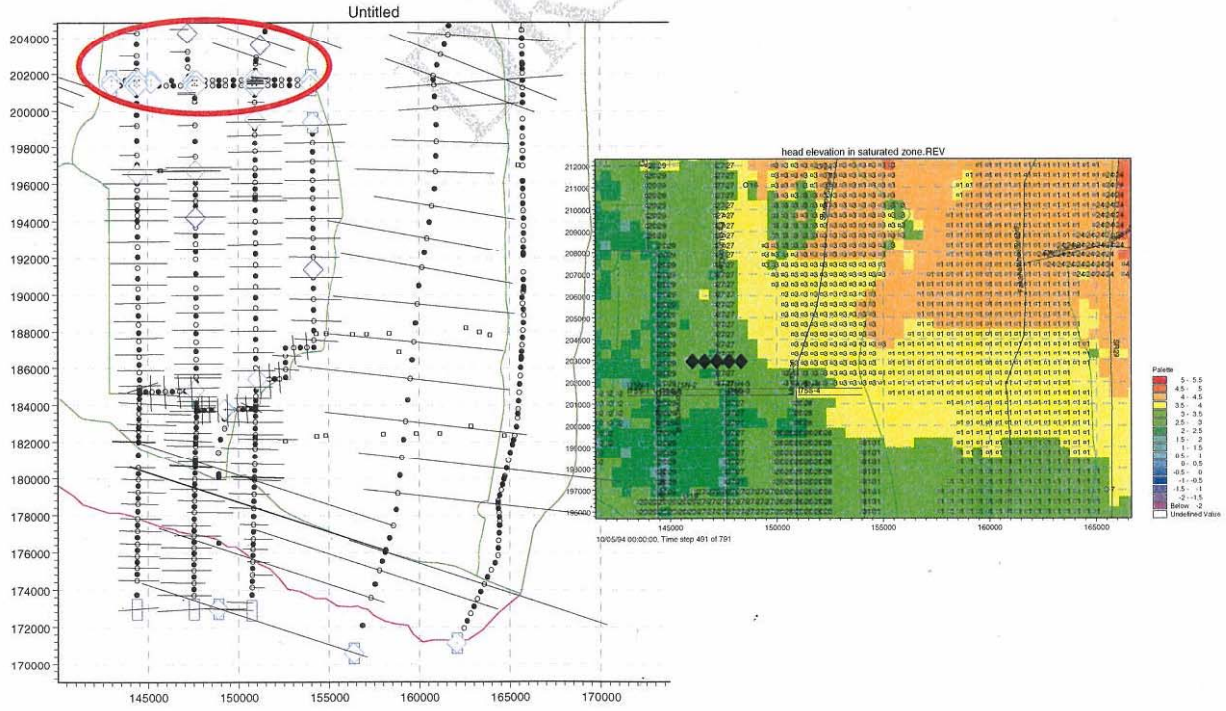

Figure 21 General location for cell transects aligned perpendicular to the Faka Union Canal.

Figures 23 and 24 show the stage hydrographs for the same five cells shown in Figure 22 for the existing conditions scenario and Alternative 6, respectively. The same observations regarding insensitivity of adjacent cells noted in Figure 22 are evident. Likewise, the relative insensitivity of C95R69, C94R69, and C93R69 to fluctuations of 0.4 m (1.3 ft.) in the adjacent cell can be observed in the hydrographs. Finally, the relative insensitivity observed in the stage hydrographs to differences of approximately 0.61 m (2.0 ft.) at the onset and during the dry season noted in Figure 23 is also observed. Time constraints limited examination of additional transects but if similar head differences in adjacent cells are found, interpretation of calibration and verification statistics is questionable.

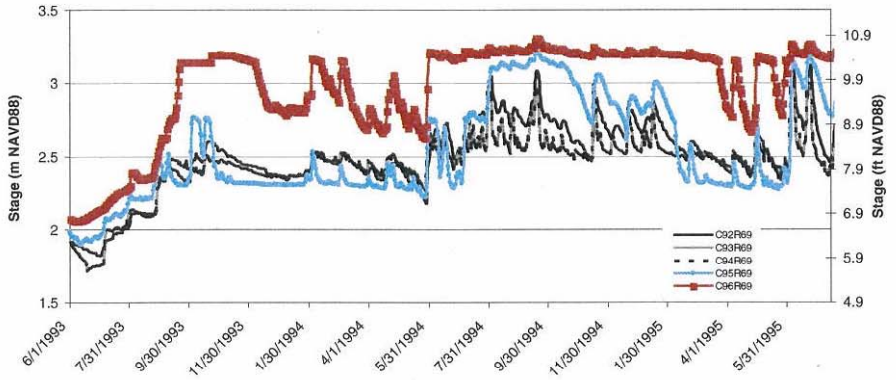

Figure 22 Stage hydrograph (meters) for Alternative 3D along a transect of cells aligned perpendicular to the Faka Union Canal.

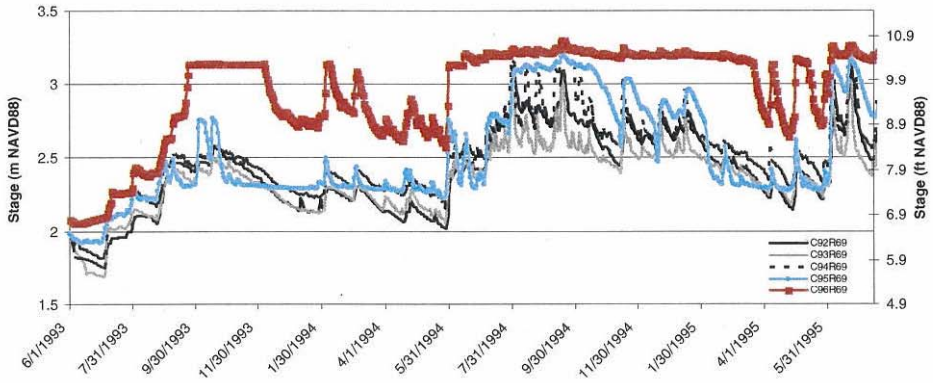

Figure 23 Stage hydrograph (meters) for the existing conditions scenario along a transect of cells aligned perpendicular to the Faka Union Canal.

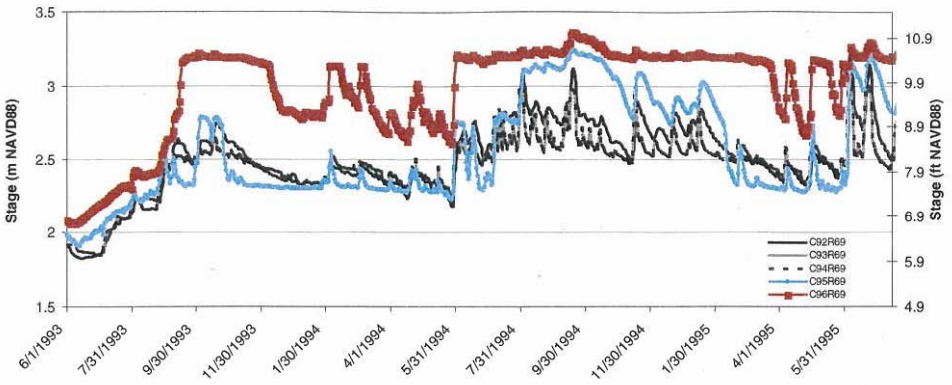

Figure 24 Stage hydrograph (meters) for Alternative 6 along a transect of cells aligned perpendicular to the Faka Union Canal.

viii. Canal Plugs

Examination of the MIKE 11 canal flood plain cross section geometry for the alternatives included in the DPIR/EIS indicates that complete removal of canals were simulated, not a partial plugging. Since the canal plugs are a critical part of the project design, it is extremely important that the modeling tool is capable of evaluating their effects. In fact, the geotechnical section of the report mentions the need for more modeling to simulation the flow around these plugs. Given documented stability problems associated with modeling of the canal plugs, we are concerned withour ability to accurately evaluate alternatives using model output.

ix. Manning's *M* in MIKE 11 and MIKE SHE

To ensure relative model-to-model comparisons are accurate, Manning's *M (1/n)* values for each vegetation type are required for the MIKE 11 network and the overland flow module. Because quantitative estimates of Manning's *M* are limited for southwest Florida, their application is both science and art. Careful attention to its assignment during the calibration and verification are required. If Manning's *M* values in MIKE SHE or MIKE 11 change between alternatives, the differences should be documented and explained with respect to the plan formulation process.

Table 2 shows Mannings *M* for bed resistance for selected MIKE 11 canal reaches simulated in the existing conditions and Alternative 3D. Since assignment of Manning's *M* values at intermediate chainages is calculated linearily, some qualification of how this interpolation is justified and "accurate" is desireable. Additionally, variation of Manning's *M* longitudally in the manner suggested in the documentation for the software is not consistent with our normal understanding of variation in the coefficient. Change in resistance is typically a function of depth, *i.e.*, resistance decreases with increasing depth, not distance downstream. Furthermore, changing cross-sectional areas associated with flood plains and canal geometries as simulated in the different alternatives would affect depths and velocities. While the overall branch lengths are not changing the number of segments would change between alternatives. Therefore, some check of how the linear assignment of Manning's *M* changes linearly in the MIKE 11 module

between the alternatives and the potential implications to alternative-to-alternative comparisons is warranted.

Further complicating the issue of Manning's *M* in the MIKE 11 module is the flood plain resistance parameter. Since it is not activated, the flood plain resistance is calculated from the cross-sectional data which without exception was found to be set to a value of 1 for every branch in the MIKE 11 network. The combination of these factors with the application of the "Uniform Section" applied appears to result in a bed resistance coefficient independent of the three variables most directly affecting Manning's *M*, depth, vegetation type or land use and velocity. The additional MIKE 11 parameters for Alternative 3D are shown in Table 3. Since the flood code option is used and the "Bed Topography" code is set to "Use Grid Data" there is a question of whether or not the cross-sectional geometries of the flood plains are required in the MIKE 11 network. Finally, the column labeled "Flood Area" in Table 3 allows for an option that automatically calculates the area of inundation or flooding. Documentation for MIKE SHE indicates that this method is suitable for simple, nearly straight channels which exist throughout the majority of the project area. Therefore, why wasn't this input option used?

Manning's *M (1/n)* for land use and vegetation simulated in the MIKE SHE overland module are shown in Table 4. Also shown in Table 4 are Manning's *M* values at detention depth and plus 0.5 ft used in the South Florida Water Management Model (SFWMM). Multiple values in column 2 indicate that more than one value of Manning's *M* exist for the same vegetation type in the MIKE SHE input. The first value in column 2 represents the majority value followed by less frequently used values. The number of occurrences for multiple values of Mannings *M* is typically less then 10 occurrences. Some explanation should be provided in the PIR/EIS of how a Manning's *M* value of 2 is appropriate for a land use of urban low density and wetland cypress prairie. One would expect significantly different values of Manning's *M*, similar to those input in the SFWMM for these categories.

Studies of flow velocities in the Everglades are frequently 0.03 ft/s (1 cm/s) or less, and the results show that Manning's *n* coefficient for Everglades marsh depends on both the flow depth and the flow velocity as well as on the characteristics of the vegetation (Lee and Carter, 1999). Figure 25 shows the potential range of of Manning's *M* for various vegetation classifications simulated in the SFWMM for depths between 0.001 and 1 ft. Based on the information presented in Table 4 and Figure 25 little or no correlation between the MIKE SHE Manning's *M*, land use and vegetation types simulated is observed. Likewise there is little similarity between the input values used in MIKE SHE and those used in the SFWMM. The SFWMM is a widely used regional hydrologic model that has been used for many water resource projects in south Florida. The Manning's *M* values used would be expected to to be consistent with the literature within an acceptable range of variability. Figure 26 further reinforces the Services concern about this input parameter. Figure 26 shows the distribution of Mannings *M* input for MIKE SHE. The heavy reliance on a single value of 2 (78 percent) does not seem consistent with our expectation of the variability for the range of land uses and vegetations simulated. Explanation of the differences noted should be provided in the PIR/EIS including the sensitivity of the model to this input parameter. In addition these discussions should include explanation of whether the lack of variability in Mannings *M* results in a greater likelihood for over or under estimating

benefits and impacts to the natural system in SGGE relative to the project constraints associated with NGGE.

Table 2 Bed resistance for selected MIKE 11 canal reach simulated in the existing conditions and alternative 3D.

Branch Name	Chainage	Existing Conditions	Alternative 3D
FakaUnionCan	0.000000	28.6	28.6
FakaUnionCan	53190.000000	28.6	28.6
MillerCan	0.000000	28.6	28.6
MillerCan	27828.000000	28.6	2.00
MerrittCan	0.000000	28.6	28.6
MerrittCan	21745.000000	28.6	2.00
PrairieCan	0.000000	28.6	2.00
PrairieCan	17057.000000	28.6	2.00

Table 3 MIKE 11 runoff and groundwater input parameter links for Existing Conditions and Alternative 3D.

Branch Name	US Chainage	DS Chainage	Exchange type	Leakage Coef	Flood Area	Flood Code	Bed Topography	Bed Leakage
FakaUnionCan	0	21600	Reduced (a)	0.0001	Manual	27	Use Grid Data	Use River data
FakaUnionCan	21600	53190	Reduced (a)	1E-005	Manual	27	Use Grid Data	Use River data
PrairieCan	0	17057	Reduced (a)	0.0001	Manual	31	Use Grid Data	Use River data
MerrittCan	0	21745	Reduced (a)	0.0001	Manual	28	Use Grid Data	Use River data
MillerCan	0	9448.8	Reduced (a)	0.0001	Manual	29	Use Grid Data	Use River data
MillerCan	9448.8	27828	Reduced (a)	0.0001	Manual	29	Use Grid Data	Use River data

Table 4 Manning's *M* values used in the MIKE SHE and South Florida Water Management Model (SFWMM) input.

Land Use / Vegetation	MIKE SHE Manning's *M*	SFWMM 1/*n* @Detention Depth	SFWMM 1/*n* @Detention Depth+0.5 ft
Urban low density	2	5.000	5.000
Urban high density	2,0.296	4.444	4.444
Agriculture citrus	2	0.148	0.587
Wetland marsh	1.118,0.296,2	0.153	0.608
Wetland sawgrass plains		0.142	0.562
Wetland wet prairie	0.668,0.296,2	0.110	0.435
Rangeland shrubland (scrub and shrub)	2	4.444	4.444
Agriculture row (or truck) crops	2,0.296	4.444	4.444
Agriculture sugar cane	2,0.296	4.444	4.444
Agriculture irrigated pasture		0.106	0.487
Wetland stormwater treatment area and above-ground reservoir		12.500	12.500
Forest wetlands	2,0.296	0.993	4.286
Forest mangroves	2,0.296	0.172	0.706
Forest melaleuca		0.485	1.928
Wetland cattail		0.154	0.613
Forest uplands	0.296,1.176,2	1.176	1.176

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Wetland modified ridge & slough		0.155	0.636
Wetland marl prairie		0.301	1.194
Wetland mixed cattail / sawgrass		0.154	0.613
Water open water (deep excavated reservoirs)	0,2	0	0
Wetland modified ridge & sawgrass-invaded slough		0.234	0.931
Wetland cypress prairie (hydrologically similar to wet prairie)	2,0.296	0.110	0.435

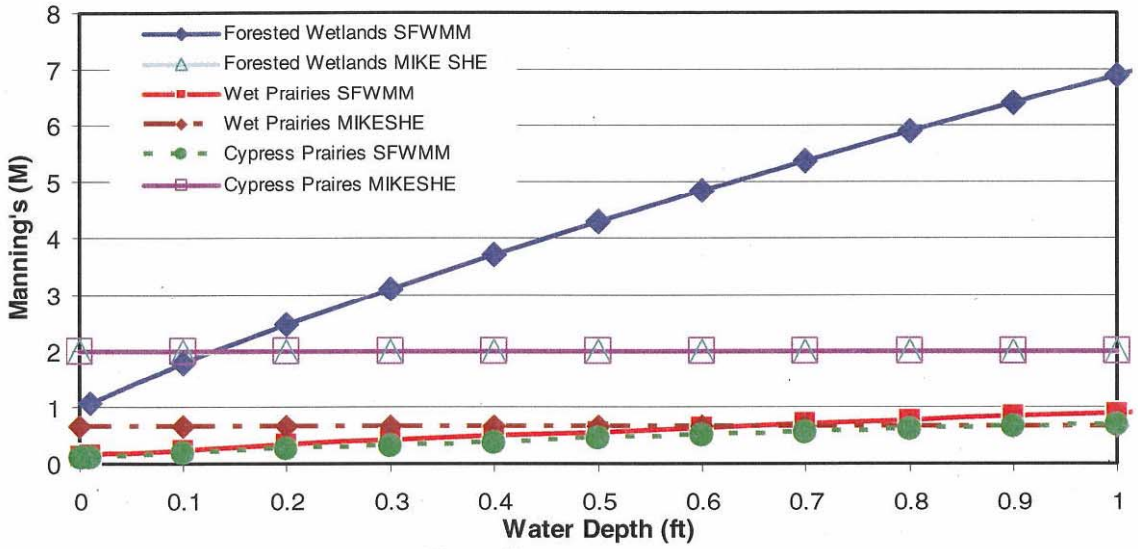

Figure 25 The potential range of Manning's *M* for different vegetation classifications simulated in the SFWMM and MIKE SHE for depths between 0.001 and 1 ft.

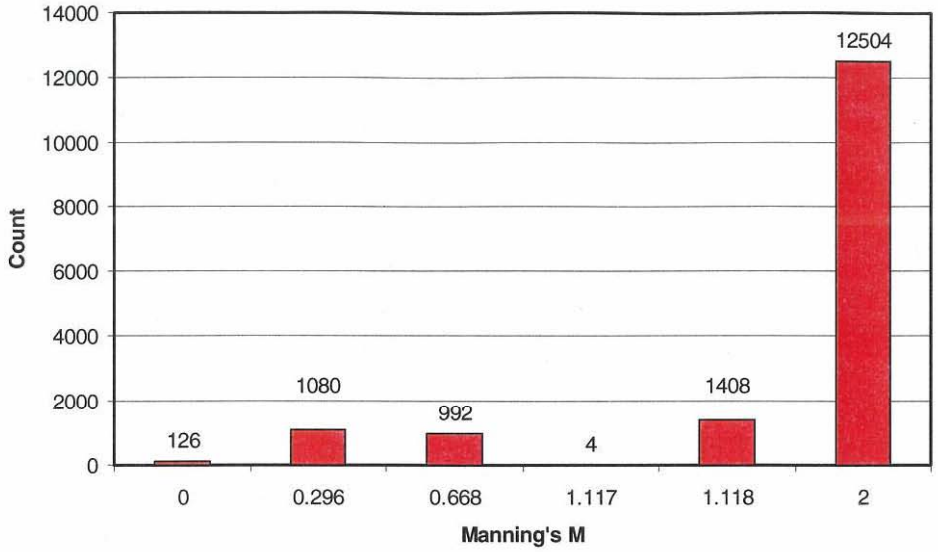

Figure 26 The distribution of Manning's *M* used as input for MIKE SHE.

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x. Operational and Structural Input Parameters

Control of Structures

To discuss operational criteria, a conceptual understanding of the MIKE SHE and MIKE 11 operational control of water management structures is necessary. This is a complex undertaking because of the large number of variables involved including branch, chainage, ID, gate type, number and width of gates, sill level, initial value, head loss factors and the control definitions. While all are important, this discussion is limited to the control definitions and strategy for each structure, the open / close or on / off operational criteria, and how they are enabled through MIKE 11. The control strategy is built upon a sequence of logical "if" statements each of which must evaluate to true for an action to be executed. The logical operators are built on a control type at a specified location and target type at either the same or another location. Control targets can consist of water levels discharge, velocity, temporal, difference in head or gate level. An example for the Alternative 3D Faka Union pumps is shown in Tables 6 and 7.

Table 6 Operational criteria for Faka Union Canal from MIKE 11.

Priority	Pump ID	Logical Operator (LO)	Branch LO	Chainage LO	ID LO	Sign	Use TS-value	Value	Time Series File	TS Code
	1	TS-Scalar		0		>	no	0.500	TimeSeries ContGate.dfs0	Code
1	1	H	Faka Union Can	23113		>=	no	1.490		
2	1	H	Faka Union Can	23113		>=	no	2.19	TimeSeries ContGate.dfs0	Code
3	1	H		0		<	no	0.00		

	2	TS-Scalar		0		>	no	0.500	TimeSeries ContGate.dfs0	Code
1	2	H	Faka Union Can	23113		>=	no	1.490		
	2	Q_Struc	Faka Union Can	27600	FU-pump1	>	no	3.54		
	2	H	Faka Union Can	23113		>=	no	2.19	TimeSeries ContGate.dfs0	Code
2										
	2	Q_Struc	Faka Union Canal	27600	FU-Pump1	>	no	3.54		
3	2	H		0		<	no	0.00		
		TS-Scalar		0		>	no	0.500	TimeSeries ContGate.dfs0	Code
1	3	H	Faka Union Can	23113		>=	no	1.490		
		Q_Struc	Faka Union Can	27600	FU-Pump2	>	no	3.54		
		H	Faka Union Can	23113		>=	no	2.19	TimeSeries ContGate.dfs0	Code
2	3									
		Q_Struc	Faka Union Canal	27600	FU-Pump2	>	no	3.54		
3	3	H		0		<	No	0.00		

We are concerned with the conceptualization of the pumps replacing Miller-2, FU-3 and the Lucky Lake weir. Chainage 27600, representing the approximate location of the Faka Union pumps, is simulated as a combination of a broad crested weir and pumps. The control stragegy input file shown in Table 7 indicates that the pump capacity of FU-3 is 2,600 cfs (74 m^3/s). Why is there a need for a broad crested weir, called FU-Berm, with a 7,041 ft. (2,146 m) cross section, a capacity of 210,000 cfs (5,950 m^3/s) and a crest elevation of 4.01 m? Additionally, shouldn't the total capacity of the Faka Union pumps be 2000 cfs (57 m^3/s) not 2,600 cfs (74 m^3/s)? Since it is unlikely that stage at chainage 27590 would exceed 4.0 m why is the weir capacity needed?

Similar concerns could be expressed for the Miller and Merritt Canal pump and weir configurations. The simulated capacity of the Miller pumps is close to those documented in the DPIR/EIS, 1,090 cfs (31 m^3/s) as compared to the published value of 1,000 cfs (28 m^3/s). However, the pump capacity for Merritt Canal appears to be more than double the 800 cfs (23 m^3/s) published in the DPIR/EIS. The control strategy input file indicates that Merritt pump capacity is 1,500 cfs (42 m^3/s).

Table 7 Control and target values for the Faka Union pump station replacing FU-3.

	Priority 1		Priority 2		Priority 3	
	Control Value Elevation (m)	Target Value Pump Capacity(m^3/s)	Control Value Elev. (m)	Target Value Pump Capacity(m^3/s)	Control Value Eleva. (m)	Target Value Pump Capacity(m^3/s)
FU	-100	0	-100	0	-84.95055	0
P	0.877824	0	1.578864	0	84.95055	0
U	0.92964	3.53960625	1.63068	3.53960625		

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M	0.941832	3.53960625	1.642872	3.53960625		
P 1	99.9999999996	3.53960625	100	3.53960625		
FU	-100	0	-100	0	-84.95055	0
P	0.877824	0	1.578864	0	84.95055	0
U	0.981456	7.0792125	1.679448	7.0792125		
M	1.002792	7.0792125	1.703832	7.0792125		
P	100	7.0792125	100	7.0792125		
2						
FU	-100	0	-100	0	-84.95055	0
P	0.877824	0	1.578864	0	84.95055	0
U	1.030224	14.158425	1.731264	14.158425		
M	1.566672	14.158425	2.267712	14.158425		
P	100	14.158425	100	14.158425		
3						

Figure 27 shows the translation of the MIKE 11 input, Tables 6 and 7 as headwater stage hydrographs, discharge of the pumps structures , and stage hydrographs at a cross-section (23113) some distance upstream of the pumps for Alternative 3D in the Faka Union Canal. Chainage 23113 is located at the intersection of I-75 and the Faka Union Canal. The wet and dry season criteria are 1.49 m (4.9 ft.) and 2.19 m (7.2 ft.) NAVD88, respectively. It is difficult to determine if the flashy discharge rates are due to on the on / off cycling of the pumps from zero to 700 cfs (20 m^3/s) or if it the result of the storing frequency of the MIKE 11. If the later is true, explanation and correction of the operational criteria in the PIR/EIS is warranted. Also it is difficult to distinguish pumping rates at the various control elevations specified in Table 7.

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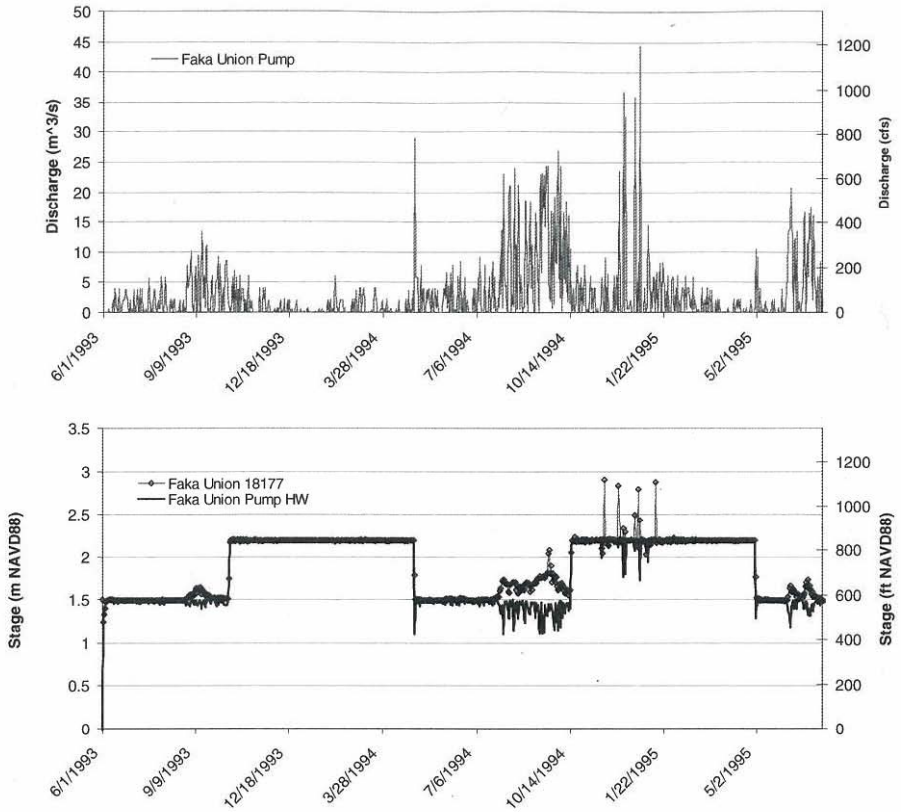

Figure 27 Discharge for the Faka Union pump (top) and headwater stage hydrographs for theFaka Union pump and at a cross-section (18177) (bottom).

Consistency with Existing Water Control Manuals

	Dry Season			Wet Season		
Canal / Structure Name	**BCBOPS** (open / close)	**Model**	**Draft Ops Manual** (optimum)	**BCBOPS** (open / close)	**Model**	**Draft Ops Manual** (optimum)
Miller Canal	5.9/5.1	7.2	7.2	5.4/4.9	4.9	4.9
Faka Union Canal	5.9/5.1	7.2	7.2	5.4/4.9	4.9	4.9
Merritt Canal	8.5/8.0	7.2	8.0	5.7/5.2	4.9	5.2

Table 8 Operational criteria in feet NAVD 88 as published in the BCBOPS, simulated by the MIKE SHE network file , and included with the draft operations manual.

Table 8 summarizes the operational criteria of the pumps on Miller Canal, Faka Union Canal and Merritt Canal. There are apparent differences in the operational criteria in the model and those published in the Big Cypress Operation Schedule of Water Control Structures, Ladd 2000 (BCBOPS). In the wet season, canal levels in the model are maintained 0.15 and 0.24 m (0.5 to

0.8 ft) lower than published values. In the dry season two of the canals in the model are maintained 0.4 m (1.3 ft.) higher and one is maintained 0.4 m (1.3 ft.) lower than published values. It is possible that these changes are intentional operational changes that are part of the project design. However, at the meeting on August 10, 2004 modelers confirmed that they were instead errors in the conversion between NAVD88 and NGVD. These errors need to be fixed immediately to accurately calculate project benefits.

There are also apparent differences between the operational criteria for the Merrit Canal pump station between the model and the draft operational manual. It is imperative that the operating manual for the project capture the correct operational criteria. We recommend that the model and the project operating manual go through a comprehensive QA/QC to ensure operations were translated correctly into the model and from the model to the operations manual. The project operating manual then needs to be revised to incorporate the corrected operations for the error noted above for wet and dry season criteria at the three pumps. Finally, operational manuals usually specify on / off or open / close criteria for structures. The SGGE draft project operating manual only lists one elevation. Is this elevation used as both an on and an off criteria? Can water managers achieve operations like that?

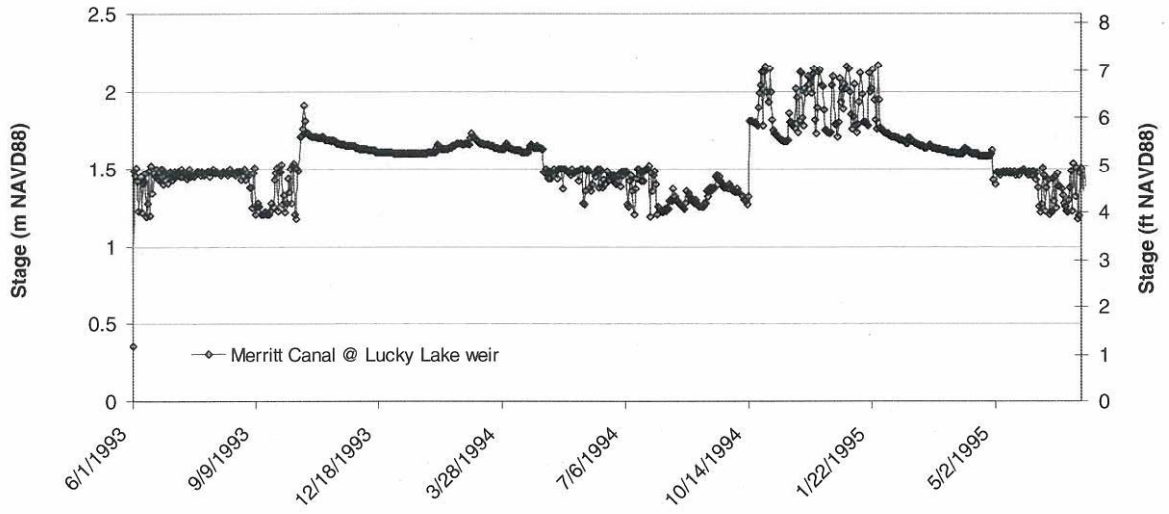

Figure 28 Headwater stage, in NAVD88 for the Merritt pump station.

b. Output Analysis: Quantity, Timing, and Distribution

The Service is concerned that the project is unnecessarily increasing NGGE discharge capacity above historical levels. The increase in discharge from 860 cfs for Alternative 3C in the yellow book to 3800 cfs in Alternative 3D in the DPIR/EIS to 4650 cfs following recent optimization runs needs closer examination. The Service compared MIKE 11 discharges from the existing condition simulation and the Alternative 3D simulation with actual FU-1 discharges. The relative flow distribution from NGGE through the Miller-2, Faka Union-3 and the Lucky Lake weir were estimated from model output by calculating the sum of the discharges at these structures and expressing it as a percentage of total FU-1 discharge. The model simulation

period used for these calculations was August 1, 1993 through August 1, 1995. Duration curves in Figure 29 show the percentage of daily NGGE outflow as a percentage of FU-1. Figure 30 shows a frequency analysis of the 1-day annual maximum discharge for FU-1 (1971-1999).

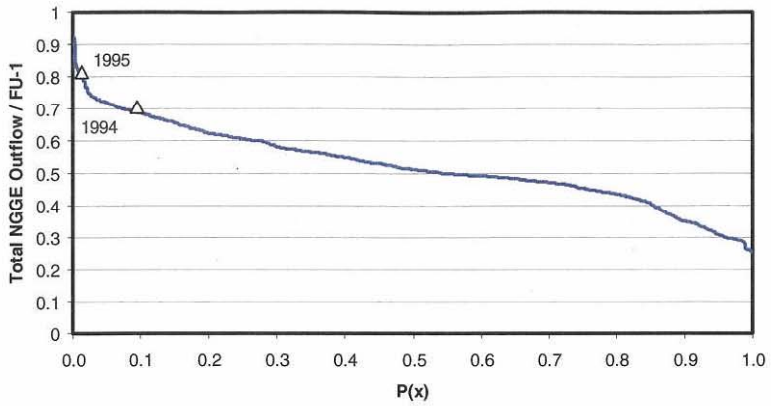

Figure 29 Percentage of daily NGGE outflow as a percentage of FU-1 duration curve simulated in MIKE 11 existing conditions scenario.

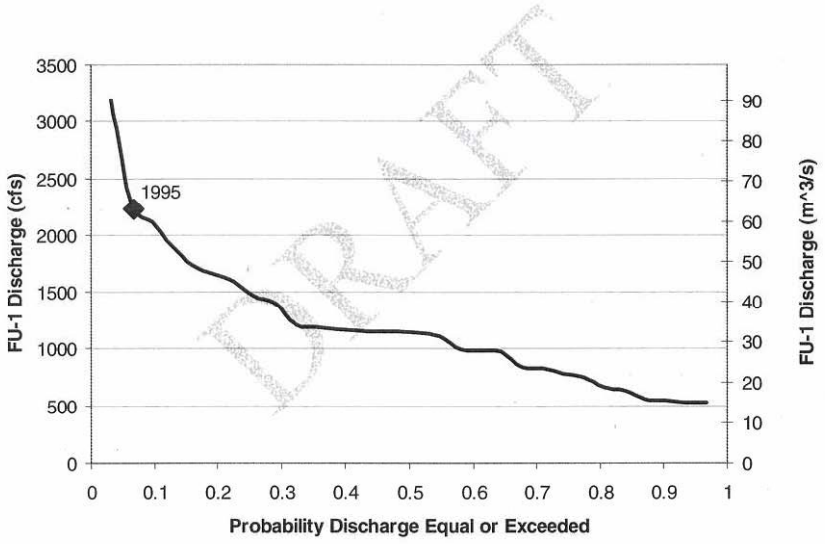

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Figure 30 Frequency analysis of the 1-day annual maximum discharge for FU-1 (1971-1999).

Based on ratios calculated from model output in Figure 27, the Service estimated capacity requirements for Alternative 3D pump stations during a wet year, 1995. First the ratio of total NGGE outflows to FU-1 discharge was estimated from Figure 29 and 30 for 1995. During this year, total flows out of NGGE comprise 80 percent of the total FU-1 discharge. There is only approximately a 0.05 probability that the flow ratio in 1995 will be equaled or exceeded. Using Figure 29, 80 was chosen as the maximum ratio of NGGE outflows to FU-1 discharge to account for the errors associated with MIKE SHE and input parameters, *i.e.*, rainfall. Using the 80 percent ratio also accounts for the uncertainty in simulated flows, *i.e.*, over-estimation preventing other project purposes from overly constraining the ecosystem restoration objectives of the project. Next the ratio for 1995 was compared to observed FU-1 discharge to calculate the total outflow from NGGE and the portion from each canal.

FU-1 daily peak discharges in 1995 were 2,245 cfs (64 m^3/s), resulting in NGGE outflows of 1,796 cfs (51 m^3/s). Recall from the simplified rainfall analysis present earlier that 1995 was at the extreme wet end of the available 1895-2000 rainfall record. In comparison, the largest recorded daily FU-1 discharge was 3,190 cfs (90 m^3/s) in 1971. The NGGE outflows using the 80 percent FU-1 flow with this this discharge is 2,552 cfs (72 m^3/s). Given this analysis, the Service questions the need for 4650 cfs capacity from NGGE. Our analysis showed that 1,796 cfs was adequate to restore flows. Using the 1995 discharges for determining an adequate capacity for NGGE in the SGGE ecosystem restoration project makes sense for a couple of reasons. First, since 1971 significant capacity has been added to the drainage network through the structural features and canals of the Cocohatchee, Belle Meade, Gordon, and Rock Creek Watershed. Therefore, the original contributing basin during this period was probably much larger than today. Additionally, one would expect that the rating curve for FU-1 in 1995 is much tighter than in the earlier part of the record providing greater confidence in the discharge data from the later period. Lastly, the 1995 FU-1 daily discharge was determined through a simple plotting position method of having approximately a 0.05 probability of being equaled or exceeded.

We recognize that one ratio doesn't meet all needs for the range of meterological conditions that will be experienced. Therefore, we also performed the same analysis for a range of conditions. The distribution of pump capacities was calculated from the individual percentages of Miller-2, Faka Union-3 and Lucky Lake to FU-1 using the model data. Average pump capacities were calculated for ratios in the 75-85 percent range in Figure 29 for January 1, 1993 through August 1, 1995. Before averaging, the obvious outliers in the distribution were removed. Table 10 shows the distribution of flows from applying the methodology described including the outliers, the maximum discharges observed in the averages and the outliers, and the distribution of capacities proposed in Alternative 3D. Based on this information it appears that a total capacity of 2,721 cfs (77 m^3/s) would be adequate to maintain existing NGGE project objectives. This is significantly less than the 4650 cfs (132 m^3/s) recommended by project sponsors following optimization runs. We are concerned that restoration benefits will be reduced by the extra pump capacity, particularly when benefits projects may be overestimated due to the use of the antecedent wet year (1995) to calculate them.

Table 10 Tabularized distribution of outflows from NGGE for the Miller, Faka Union and Merritt Canals.

	Miller-2	FU-3	Lucky Lake
Average 1993-Aug. 1,1995	230	318	630
Average 75th to 85th Percentiles	202	284	1305
Outliers 75th to 85th Percentiles	702	166	848
Outliers 75th to 85th Percentiles	574	634	558
Outliers 75th to 85th Percentiles	625	714	469
Maximum Discharge	702	714	1305
Alternative 3D	1000	2000	800

We are also concerned that the distribution of total flows proposed in Alternative 3D is different than those observed through our analysis using the model and actual discharge data. Figure 29 shows the differences in flow distributions calculated from FU-1 observed data and model

discharge data with the Alternative 3D pump capacity distribution. Some discussion in the PIR/EIS is warranted for the basis of assuming a different distribution then observed in Table 10 and Figure 31, particularly with respect to ecosystem restoration objectives.

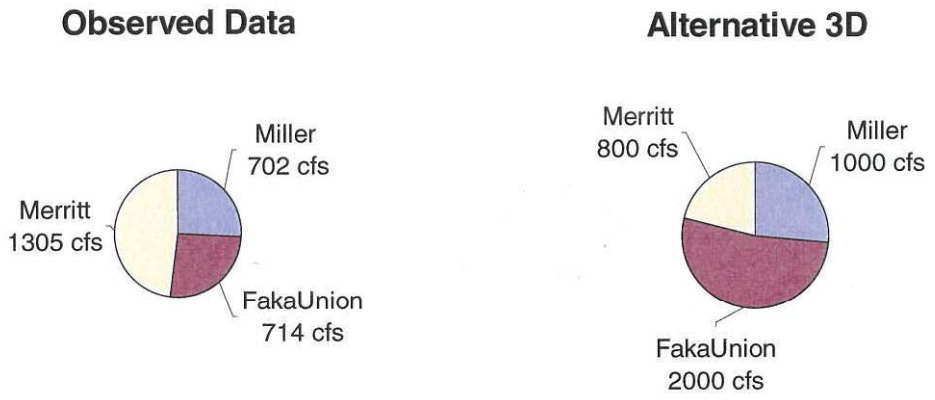

Figure 31 Flow distribution for the Miller, Faka Union and Merritt Canals calculated from observed field data versus Alternative 3D.

c. Draft Project Operating Manual

The Sevice recognizes the difficulty associated with designing an operational plan based on information from hydrologic models for the purpose of ecosystem restoration. However, the draft project operating manual in the draft PIR is difficult to evaluate and does not appear to reflect operations developed for the purposes of environmental restoration. Furthermore, through our review we have discovered inconsistencies with the operations of pump stations in Alternative 3D that could affect the performance of the plan. We offer the following recommendations to help improve the operating plan:

- perform a QA/QC of all operational criteria in the model;
- modify the operational criteria to create a gradual time/volume-step up and down that mimics the natural system fluctuations that occur between the wet and dry seasons;
- reexamine the on criteria elevations for the pumps in the context of minimum pump intake elevations;
- design the minimum pump intake water at elevations that would prevent potential over-drainage of fish and wildlife habitats in SGGE and NGGE including further upstream in the watershed;
- include a series of iterative field tests as part of the operational testing and monitoring phase;
- incorporate a restoration-based operations system, such as a rainfall driven operational system for NGGE and SGGE;
- provide a description of how monitoring locations for different habitat types will be used to assess operational success;
- describe how adaptive management will be incorporated;
- include documentation of the canal design optimums and the rationale for their selection; and

- check the conditional logic statements to ensure that they allow the pumps to turn off;

Since the completion of the DPIR/EIS, modeling has been initiated to refine and optimize the operational plan. However during the August 10, 2004 meeting, technical representatives acknowledged that were errors in the operational criteria for the Miller, Faka Union and Merritt pump stations. These errors need to be corrected. Additionally, operations for all other alternatives including the existing conditions scenario need to be checked for consistency with published BCBOPS values or project purposes. Unless incorporated for the purpose of meeting specific project goals, differences in model operations and BCBOPS operations indicate errors.

It is imperative that the operational plan in the PIR/EIS be updated to reflect the results of the new optimization runs and corrected errors since the operational plan is the link between the water identified to be reserved for the natural system based on the expected performance of the plan and the actual deliveries for the natural system. Additionally, model output graphics and evaluations based on the graphics should be updated in the final report to ensure consistency between project modeling and environmental benefits including project assurances.

The information provided in the DPIR/EIS, modeling, supporting analyses and narrative descriptions is not sufficient to assess the potential impacts or benefits associated with the project. From what information is provided, the Service believes the proposed operational plan is a flood control plan rather than one maximized for restoration. The Service has communicated this issue to the Corps and the District. We look forward to working with the sponsors on the operational plan in detailed design to ensure that it meets the restoration goals expected. The operations have the potential to affect all assumptions concerning ecosystem benefits and may affect listed species. Issues include the drawdown of wetlands in NGGE, overinundation of SGGE, dry season discharges of water beneficial to the downstream ecosystem, groundwater recharge of the NGGE canal system for use by wellfields, pump size, reporting procedures, and emergency water and fire management protocol.

i. Pre-Storm Drawdown for Tropical Storms and Hurricanes

The completed modeling, the operational plan and other supporting analyses and narrative descriptions provided in the DPIR/EIS are not sufficient to assess the potential impacts or benefits associated with the pre-storm drawdowns. Given the lag observed in Figure 20 and Figure 22 through 24 it would be reasonable to expect that any proposed pre-storm drawdown could not be implemented effectively without introducing significant risk of impact to other project objectives, *i.e.* water supply and environmental.

ii. Drought Contingency Plan

The completed modeling, the operational plan and other supporting analyses and narrative descriptions provided in the DPIR/EIS are not sufficient to assess the potential impacts or benefits associated with a drought contingency plan. Given the lack of increase in stages due to the more than a 0.61 m (2.0 ft.) increase in canal stage observed in Figures 19, 20, and 22 through 24, it would be unreasonable to expect that any proposed drought contingency plan

could not be implemented effectively without introducing significant risk of impact to other project objectives, *i.e.,* flood control.

d. Plan Formulation

i. Determination of Level of Service

The SGGE project has been an on going effort for many years. The evolution of an alternative that balances the needs of upstream constituencies, *i.e.,* flood control for NGGE and one that achieve the ecosystem restoration objectives of SGGE are very clearly documented in the DPIR/EIS. The NEPA and PAL comments noted concerns of the Service on the lack of a clear reference for the modeling of design storms as the basis for the determination of an increased risk of flooding, not most large storms as indicated in DPIR/EIS.

> *Once the Corps of Engineers' and South Florida Water Management District's hydraulic and hydrologic models were operating, it became clear that the alternatives from the 1996 report, including the Yellow Book plan, would generate increased flooding in large areas north of I-75 during most large storm events relative to conditions in existence in December 2000 when the Comprehensive Plan was adopted by Congress. These initial alternatives would not be consistent with existing law and policy regarding increased flooding.*

This language appears contradictory to information presented elsewhere in the DPIR/EIS that indicates that the "level of service", *i.e.,* flood protection associated with the existing features of the NGGE and SGGE canal network are not capable of handling a 10-year storm.

During the PDT plan formulation process, as well as in the DPIR/EIS determination of impacts associated with increased risk or actual flooding were not provided to allowing meaningful interpretation of the results. Little information was presented to the PDT during the process that allowed them to understand how "level of service" impacts were quantified. Because the plan formulation process did not include development of alternatives simultaneously assessing the ecosystem benefits and flooding impacts until the final round of three alternatives, it ultimately weighed as constraints of the project over the ecological objectives of the project. Clearer, explanation in the PIR/EIS of why this increased "level of service", *i.e.* 1-*in*-100 year flood protection is required. More importantly, what are the implications to SGGE if through the monitoring and adaptive management program it is determined that modification of operations will erode this new "level of service" by the Alternative 3D are required.

ii. Flood Control Analysis

Flood control analysis including the models, input assumptions and methodology used to determine what "maintenance of existing flood control" would require the SGGE project design to perform remain unclear. Initial use of both the MIKE-SHE and HEC-RAS models for flood control analysis produced different results. The project sponsors alternated use of both models in determining flood control requirements, switching back to HEC-RAS less than 1 month before preparation of the draft PIR. The methodology and model output for the current flood control analysis is not yet available for review. No description of flood control performance measures is provided in the PIR. Because of these factors it is difficult to understand how the needed pump

capacity proposed for Alternative 3D is warranted given limitations of the existing canal network.

iii. Alternative Design Issues: Canal Backfill vs. Plugs

The Service is concerned that project canals that remain open as part of any project design were not modeled and could continue to have significant or local drainage effects on site wetlands. Altered infiltration of rainfall and seepage from canals is the principal means of recharge to the Water Table Aquifer. Less runoff is available for groundwater recharge of the shallow, underlying Water Table Aquifer, which results in lower groundwater levels. The water table is estimated to have been lowered from one to two feet after construction of the canals. One field investigation showed groundwater impacts extended 6,000 ft. from a SGGE canal (Wang 1978; Swayze and McPherson 1977). Another study indicated that the Faka Union Canal lowered groundwater levels as much as 4 ft. below pre-construction levels (USGS 1977). Drainage by the Faka Union Canal system has caused a downward slope in water levels westward from the Fakahatchee Strand State Preserve to the eastern canal in SGGE (Corps 1980). The center of the Preserve is only 3.5 miles from the project's east canal (Prairie Canal). The Service is of the opinion that canal backfill, as opposed to intermittent plugging, will restore additional wetlands. The Service is aware of the limits of available fill adjacent to some canals. Modeling the complete backfilling of canals opposed to intermittent plugging, highlights these concerns. In addition to the location of available fill, site elevation and locations of major sloughs should be factors in determining the location and extent of canal backfill.

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APPENDIX E

SOCIO-ECONOMICS

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E.1 SOCIO-ECONOMICS

E.1.1 Introduction

The Southern Golden Gate Estates (SGGE) recommended plan is an important piece of the South Florida ecosystem improvement efforts that together make up the overall Comprehensive Everglades Restoration Plan (CERP). This part of the SGGE report is concerned with the socio-economic issues of plan implementation. The primary effects of the SGGE project are the costs of implementation, and the ecosystem restoration and improvement effects. The net national project cost (NED cost) represents the largest monetarily expressed impact of plan implementation. Project costs have regional impact dimensions as well, as expenditures on the project can cause changes in local and regional earnings, sales, and employment, due to the ripple effect of project spending throughout the regional economy. The most significant beneficial effect of the project is the ecosystem improvement expected to result from the plan. This major benefit is not expressed in monetary terms, in accordance with policy. A cost effective/incremental cost analysis is utilized to determine the alternative that provides the greatest desired benefits at the lowest possible cost. Besides these two major effects of costs and ecosystem improvement, the many components that together embody CERP also have some effects on navigation, recreation, fishing, and water supply (agricultural, and urban). The SGGE plan's impacts in these areas are expected to be minor.

E.1.2 Purpose of this Investigation

This investigation assesses the economic effects of the alternative ecosystem restoration plans formulated in the feasibility phase of the Southern Golden Gates Estates Hydrologic Restoration Project. The economic evaluation of the alternative restoration plans includes five principal elements:

Socio-economic Profile of the Study Area: This profile includes population and economic forecasts for the region, as well as projections of future water demand.

Anticipated Effects of Alternative Plans on the National Economic Development (NED) Account: Alternative plans could result in positive or negative effects on net national economic efficiency due to project-induced impacts on the following economic activities in south Florida:

- Agricultural water supply,
- Municipal and industrial (M&I) water supply,
- Flooding potential,
- Recreation, and
- Commercial and recreational fishing

Evaluation of Project Costs: Project costs include all expenditures required to implement the alternative plans. The Federal government and the State of Florida will share these costs. Project costs include those for initial construction; lands; relocations; rights of way; rehabilitation, replacement, and repair; and operations and maintenance (O&M) (including the costs of post-construction monitoring and adaptive management).

Regional Economic Development (RED) Effects: The potential RED effects of the alternative plans include changes in income, employment, or economic output of the region.

Other Social Effects (OSE): The potential social effects of the alternative restoration plans include effects on minority, elderly, and disadvantaged groups, population displacement, and effects on community cohesion.

The economic analysis for the Southern Golden Gate Estates study was conducted consistent with Federal statutes and Corps policy. Procedures for estimating NED and RED effects are specified in the Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies (U.S. Water Resources Council, 10 May 1983), Engineering Regulation (ER) 1105-2-100 (22 April 2000), and other Corps guidance.

E.1.3 Study Area

The Southern Golden Gate Estates study encompasses an area of approximately 94 square miles (60,160 acres) located in southwestern Collier County between Interstate 75 and U.S. Highway 41 (see Figure 1). It is located southwest of the Florida Panther National Wildlife Refuge, north of the Ten Thousand Islands Estuary, east of the Belle Meade State Conservation and Recreation Lands Project Area, west of the Fakahatchee Strand State Preserve, and encompasses the Picayune Strand State Forest. SGGE's central location among all of these nature preserves and wildlife areas reflects its importance to the ecological connectivity of the entire region. The condition of SGGE affects the immediate project area and also the significant regional ecological resources.

The Faka Union Watershed that includes the SGGE and part of the Northern Golden Gate Estates (NGGE) encompasses approximately 189 square miles through a network of 70 miles of four primary canals namely, the Miller, Faka Union, Merritt and Prairie Canals.

E.1.4 Alternative Restoration Plans

The alternative restoration plans have been formulated in the feasibility phase of the SGGE study. Each alternative consists of a suite of structural and operational changes to the existing canal system, as well as improving habitat for the Florida Panther.

E.1.5 Methodology

A number of factors were considered prior to developing the methodologies used to evaluate the economic effects of the alternative restoration plans. These factors include: available analytical tools, economic theory, Federal policy, obtainable data, and time and budgetary constraints. These factors are discussed below.

E.1.5.1 Without-Plan And With-Plan Conditions

Proper definition of the without and with-plan conditions are critical to the planning process. The without-plan condition is the most likely condition expected to exist in the future in the absence of a proposed project. The future without plan condition (2050) is the benchmark against which alternative future with-plans are evaluated. National and regional socio-economic parameters considered include income, employment, population, and other aggregate projections such as land use trends, water supply, and water demand. Comparisons of conditions with the implementation of alternative plans to future without-plan conditions were performed to identify the beneficial and adverse effects of the proposed plans. Depending on the alternative and the type of economic impact, changes resulting from implementation of a restoration plan may be desirable or undesirable when compared to the future without-plan condition. For example, alternatives that include modifications to the current system to provide additional water storage areas may result in fewer economic losses associated with agricultural (irrigation) water shortages. This would be a desirable ancillary benefit of restoration.

E.1.5.2 Sources And Causes Of Economic Effects

The potential economic impacts of the alternative restoration plans are secondary consequences of the environmental enhancements and hydrologic changes that are expected to result from the proposed structural and operational modifications to the Southern Golden Gate Estates. These projected impacts are contingent upon the successful implementation and operation of restoration plans and subsequent outputs. Therefore, subject to the uncertainties inherent in those ecosystem restoration activities. Due to the challenges inherent in quantifying NER benefits, quantifying the resulting NED benefits is also a

challenge. Nonetheless there are methods for evaluating the economic efficiencies of alternative restoration plans.

E.1.5.3 Methodology For Conducting Economic Analysis

Consistent with U.S. Army Corps of Engineers Guidance, a benefit-cost analysis is not required for national ecosystem restoration plans. For ecosystem restoration projects, a plan that reasonably maximizes ecosystem restoration benefits compared to costs, consistent with the Federal objective shall be selected. An incremental analysis approach was used to examine increments of plans or project features to determine their incremental costs and benefits in a progressive manner until incremental benefits no longer exceed incremental costs The methodologies used to conduct economic analysis studies for the SGGE Study were based on a combination of factors, including: economic theory, Corps of Engineers' ecosystem restoration and economic evaluation policies, and the characteristics of methodologies used by economists to value ecosystem benefits. For the SGGE study, the alternative restoration plans were compared using information in monetary and non-monetary units. The economic analysis of the SGGE alternative restoration plans include: (1) the NED costs (in monetary terms), (2) the anticipated environmental benefits resulting from restoration measures (in non-monetary terms), (3) the NED benefits and impacts attributable to the following: agricultural water supply, municipal and industrial water supply, commercial navigation, recreation, and commercial fishing (in monetary and non-monetary terms) and (4) the positive and adverse regional economic effects (RED) resulting from project implementation.

This section of the report address items (1), (3), and (4) above. Theoretically, the economic basis for making policy decisions about whether to invest public funds in ecosystem restoration in SGGE is the same as for any other government-spending program. The monetary and non-monetary costs and benefits of any proposed government project should be compared in order to determine whether the expenditure is justified and to select the plan, which maximizes the net benefits to society for the investment of public funds. The costs of ecosystem restoration projects include: initial construction costs; major rehabilitation and repair costs; operations and maintenance (O&M) costs; post construction monitoring costs; and adverse NED effects. Typically, these costs can be expressed in monetary (i.e., dollar) terms.

The principal challenge of ecosystem restoration economics is estimating the value of restoration benefits. The primary purpose (and therefore the primary benefits) of each alternative plan is ecosystem restoration. The benefits of ecosystem restoration are usually expressed by ecologists in non-monetary units, such as acres of specific habitat created or enhanced, indices of biological productivity associated with habitat improvement, or increased abundance

and/or diversity of particular species of plants or animals. For decision-making purposes, it would be desirable to express ecosystem restoration benefits in monetary terms, in order to compare them with project costs. Expressing the costs and benefits of alternatives in a common, monetary metric would facilitate selection of the best restoration plan for a given site. However, calculating the monetary value of environmental amenities is both difficult and controversial. Environmental amenities are public goods that are generally not exchanged in the marketplace. For marketable commodities (i.e., items that people buy and sell), the demand, and prices paid, for these goods can be used as "proxies" for determining their value to consumers. In the absence of data on consumers' expenditures for environmental amenities, resource economists have attempted to develop techniques that can be used to estimate their value using indirect indicators of consumers' "willingness to pay" for ecosystem restoration. For goods and services that are not purchased in the marketplace, non-market valuation approaches must be used to infer their value to the public. There are direct and indirect use values for these goods and services. Use values refer to the value consumers obtain from using a good that is related to an environmental amenity. For example, recreational fishermen obtain direct use value from the freshwater fisheries. The fishermen also obtain indirect use values from the ecosystem, since it provides ecological functions that contribute to the productivity of the fisheries. Use values can be either consumptive or non-consumptive. Consumptive use values refer to the cases for which the good is consumed by the user and is no longer available to others, such as waterfowl hunting. Non-consumptive use values refer to the value obtained by a user in cases for which the good remains to be used by others in the future, such as catch-and-release fishing or bird watching. It is reasonable to expect that the alternative restoration plans will generate additional use values to the public. Non-market activities that would benefit from restoration plans include recreational fishing, subsistence activities, and a variety of eco-tourism related activities (e.g., bird watching, hiking, canoeing, etc.).

Non-use values include the values the public obtains from simply knowing that the good or resource is available, even if they have not used it previously. Individuals may value a good simply from knowing it exists (existence value) or because the may want to have the opportunity to use it at some future time (option value). Again, it is reasonable to expect that the alternative restoration plans will generate additional non-use values to the public. The tremendous interest in and support for ecosystem restoration, not just in south Florida but throughout the country (and the world), is an indication that a broad segment of society values the ecosystem, even though most have never experienced the area first hand.

Theoretically, it should be possible to determine the value of restoring the SGGE ecosystem by asking people what they would be willing to pay for different levels

and types of restoration projects, or by observing what they spend on ancillary costs (e.g., travel, subsistence, equipment, etc.) when they engage in these non-market experiences. Economists have developed a variety of techniques to estimate society's willingness to pay for these types of non-marketable environmental amenities. These economic valuation techniques include market-based, surrogate market, and non-market methodologies (see Freeman, 1993). Market-based approaches estimate the value of environmental resources using information generated in the marketplace. These approaches include changes in factors of production, valuation of complimentary goods and services, defensive expenditures, and market valuation of the next best alternative. Surrogate-market techniques estimate value based on preferences revealed in surrogate markets. These techniques include the travel cost method and hedonic valuation. The contingent valuation method (CVM) is the most widely accepted non-market valuation methodology. CVM is perceived as the most effective technique to determine society's willingness to pay for environmental protection and/or restoration and is the only technique able to estimate non-use (i.e., option and existence) values. This method is based on carefully designed surveys that solicit respondent's willingness to pay for a specific environmental resource in a given condition. The survey is intended to reveal both users' and non-users' willingness to pay for the resource.

Unfortunately, these surrogate-market techniques, including CVM, have significant shortcomings that lead to concerns about their reliability and validity. They are especially problematic in cases for which respondents are unfamiliar with the environmental amenity, when the issue is controversial, or where it generates strong reactions, based on ethical, rather than economic motivations. Most importantly for the SGGE effort, the reliability and validity of these techniques are especially questionable in situations in which the actual changes that would result from the restoration efforts are difficult to precisely describe or visualize. Finally, stated preference methods, such as CVM, can be expensive to implement, especially when multiple alternatives are being evaluated.

As specified in Corps of Engineers ecosystem restoration policy (EC 1105-2-210: Ecosystem Restoration in the Civil Works Program), ecosystem restoration projects are not subject to traditional benefit-cost analyses. An ecosystem restoration proposal must still be justified by comparing the monetary and non-monetary costs and benefits of restoring degraded ecosystems. Corps ecosystem restoration evaluation procedures focus on the non-monetary benefits of restoration, comparing these benefits to monetary costs using cost effectiveness and incremental cost analysis procedures.

E.1.6 Prior Studies

This study relied on the use of prior studies and other secondary information to the extent possible. These studies are contained in the reference list presented at the end of this Appendix. The SFWMD has previously conducted a wide variety of studies that directly or indirectly support this investigation. Interviews with SFWMD staff and review of SFWMD reports have contributed greatly to this investigation.

E.1.7 Organization of Report

The sections that follow evaluate the economic impacts of the alternative restoration plans. Section 2 develops a socio-economic profile for the region, and Section 3 contains the water demand forecasts for the region. These sections develop the basis for critical physical and socio-economic effects of the future conditions, with-plan and without-plan. These effects were instrumental in the assessment of potential NED effects of the alternative restoration plans in subsequent sections, including agricultural water supply, M&I water supply, flooding, commercial navigation, recreation, and commercial and recreational fishing. The costs of the alternative plans are presented in Section 10. The regional economic effects and other social effects of the alternative plans are explored in Sections 11 and 12, respectively. Finally, Section 13 presents a summary of the economic effects of the alternative plans and conclusions.

E.2 POPULATION AND ECONOMY

E.2.1 Overview

This section of the appendix includes a description of the local economy and demographics of the study area. This descriptive information provides insight into the study area's socio-economic characteristics, and provides part of the basis for different facets of the economic impact evaluation work in the rest of this appendix.

The people who live in the study area, and the economic activity, in which they are engaged, comprise important components of the area's total environment. In addition to the direct use of this data for the water use projections and other social effects mentioned above, they represent the socio-economic environment for the other impact topics of flooding, water use shortages, fishing, recreation, and navigation.

Any course of action forthcoming from this study will have effects throughout an economic system as well as the natural ecosystem(s), the health and sustenance of which are the impetus for this investigation. The economic system is connected with the natural ecosystem and in general is ultimately dependent upon it for survival. This connection is especially strong in the study area. Adverse changes in the health and condition of the natural system can cause severe negative impacts on the economic system, particularly in the study area for this feasibility study. Conversely, in this study area, beneficial changes to the natural system are expected to have a strong positive effect on the economic system. It is significant, therefore, to describe and understand the general economic and social environment within which such changes could take place. Although the main focus of economic impact evaluation efforts undertaken for this study has been to describe the economic impacts and benefits of alternatives being considered for implementation, describing the broader context for these evaluation efforts is also necessary and important.

E.2.2 Study Area

This study focused on the SGGE study area of the Lower West Coast region of south Florida, located in Collier County. In terms of land use, the study area is mostly vacant lots with existing roadways and canals. The majority of the urban areas are located outside the study area in the Northern Golden Gate Estates.

E.2.2.1 General

Socioeconomic and demographic data for the study area indicate higher than average income compared to the rest of the State and Nation, and much greater economic and population growth than for the rest of the Nation. Additional characteristics of the study area include a strong service sector, fishing, tourism, and recreation. Florida's economy is generally characterized by strong wholesale and retail trade, government and service sectors. Florida's warm weather and extensive coastline attract vacationers and other visitors and helps to make the State a significant retirement destination for people from all over the country. This is especially true for Collier County, accounting for substantially higher growth rate than the rest of Florida and the nation. Agricultural production and fisheries, which are important sectors of the State's economy, are significant to portions of the Collier County. Easily developed land, accessible water supply, abundant natural resources, and the aesthetic beauty of the region are the fundamental building blocks of the local economy. Relative to the national economy, the manufacturing sector has played less of a role in Florida, including the study area. However, high technology manufacturing has begun to emerge as a significant sector in the State over the last decade.

E.2.2.2 Population

Current statistics demonstrate that Collier County, including the SGGE Study Area, is characterized by a much greater population growth rate than the rest of the State and the Nation as a whole. Collier County had a 2000 census population of 251,377 persons. The population of this county had an enormous increase of 65.3 percent from 1990 to 2000, and the estimate percentage change between 2000 and 2001 was 5.7 percent. The population of Florida and the United States increased 23.5 percent and 13.1 percent respectfully during the same period. The state of Florida added over three million persons from 1990 to 2000, ranking third in the nation in numerical change.

Population in Collier County is expected to more than triple from 2000 to 2060. Due to this anticipated population growth, the county is expected to have one of the largest populations in the Lower West Coast. The dense urban area of southwestern Florida has contributed to development pressure and population increases in Collier County.

Table 1 summarizes existing and projected population in the SGGE Study Area. The 2000 figures are from the U.S. Census. The future estimates are based on Collier County's April 1, 2001 publication of population projection to the year 2030. The Bureau of Economic and Business Research at the University of Florida (BEBR) medium estimates ("high" and "low" estimates are also shown) growth trends evident between 2020-2030 were utilized to extend Collier County's population projection out to 2050. Collier Counties build out was project at approximately 800,000 persons. These population projections were calculated for the South West Florida Feasibility Study. Table 2 displays the population rates of growth for each decade from 2000 to 2060. Table 3 indicates the population growth rate of the study area is expected to exceed that of the State from 2000-2060.

Table 1 Study Area Population Estimates, 2000-2060

Population (1,000's)							
	Year						
	2000	2010	2020	2030	2040	2050	2060
Collier	251.3	383.7	529	689.3	740.9	792.6	800
Share of Florida Total	1.60%	2.00%	2.20%	2.40%	2.60%	2.90%	N/A
Florida Total	15,982.40	18,866.70	21,792.60	24,528.60	27,118.70	29,714.50	N/A

Table 2 Study Area Population Rates of Growth, 2000-2060

Average (% Per year) Population Growth						
	2000-2010	2010-2020	2020-2030	2030-2040	2040-2050	**2050-2060**
Collier	5.3%	3.8%	3.0%	>1%	>1%	>1%
Florida Total	1.8%	1.55%	1.26%	1.06%	0.96%	N/A

Table 3 Study Area Population Growth, 2000-2050

	% Change 2000-2050*
Collier	215%
Florida	85.9%

* Note: Florida population projections are only published until 2050

The Collier County and BEBR projections, which both contribute to the above projection estimates, are based on different methodologies and assumptions, and as a result, differ in projected growth. In general, the BEBR projections tend to reflect slightly lower growth than the County's projections. In the past, the County's projections have been closer to actual growth, and consequently have been used for planning purposes in Collier County. The Corps of Engineers water resource planning studies in Florida have typically used BEBR and Bureau of Economic Analysis (BEA) projections. This represents a slight departure from the standard agency practice of using BEA and BEBR projections for most feasibility studies and investigations. This deviation from BEA and BEBR projections insures that this study will have been done using a set of projections consistent with the Regional Water Supply Plan, the Southwest Florida Feasibility Study, and the state of Florida.

Florida is the fourth most populated state in the nation, with an estimate of nearly 16 million total residents in 2000. Its past is marked by rapid post World War II growth, which accelerated Florida's share of the U.S. population from just under 2% in 1950 to just over 5% in 1990. This trend is expected to continue, although at a more modest rate, so that about 8% of the U.S. population will be in Florida by 2050. The resulting state population is expected to grow another 85% by 2050, reaching nearly 30 million people by then. Table 4 outlines the ethnic/racial distribution of the study area population using information from the 2000 Census. The study area has a much smaller percentage of black population, but a larger percentage of persons of Hispanic/Latino origin than the rest of State. The 2000 census shows the study area with 4.5% percent black and 19.6 percent Hispanic/Latino while Florida's statewide percentages were 14.6 and 16.8 percent, respectively.

Table 4 2000 Census Racial/Ethnic Population Distribution

Racial/Ethnic Population	Collier County	Florida
White persons, percent, 2000	86.1%	78.0%
Black or African American persons, percent, 2000	4.5%	14.6%
American Indian and Alaska Native persons, percent, 2000	0.3%	0.3%
Asian persons, percent, 2000	0.6%	1.7%
Native Hawaiian and Other Pacific Islander, percent, 2000	0.1%	0.1%
Persons reporting some other race, percent, 2000	6.2%	3.0%
Persons reporting two or more races, percent, 2000	2.2%	2.4%
Persons of Hispanic or Latino origin, percent, 2000	19.6%	16.8%

The Table 5 outlines the 2000 population over the age of 65. There are significantly more people in the over age 65 category in Florida than in the rest of the nation (17.6% vs. 12.4%). This trend is magnified in the Collier County, which substantially exceeds the Florida percentage. The relatively high percentage of the population over age 65 is attributable in part to the desirable climate, aesthetic beauty, and outstanding recreational opportunities of the region, all of which are attributes of the Southern Golden Gate Estates ecosystem. An economic result of the combination of a relatively older population coupled with relative affluence is a well-developed wholesale and retail trade based economy, together with a robust personal and professional services sector.

Table 5 Study Area Population Over Age 65

Population Age	Collier County	Florida
Population under 5 years old, 2000	13,441	945,823
Persons under 5 years old, percent, 2000	5.3%	5.9%
Population 65 years old and over, 2000	61,513	2,807,597
Persons 65 years old and over, percent, 2000	24.5%	17.6%
Persons under 18 years old, 2000	49,941	3,646,340
Persons under 18 years old, percent, 2000	19.9%	22.8%

E.2.2.3 Economy

The study area had a 2000 per capita personal income 46% above that for the State as a whole. Florida's per capital personal income is a little higher (less than 1% higher) than the Nation's. The percentage of households in the study area that fall below the poverty threshold is considerably less than that of the State and Nation as indicated in Table 6. Tables 7 and 8 display employment and income statistics.

Table 6 Percent of Households Below Poverty Threshold

Percent below poverty	Collier County	Florida
Persons below poverty, 1999	25,449	1,952,629
Persons below poverty, percent, 1999	10.3%	12.5%

Table 7 Study Area Employment

Employment Statistics	Collier County	Florida
Civilian labor force, 1999	93,644	7,366,498
Unemployment, 1999	3,530	284,168
Full-time and part-time employment by place of work, 1997	118,730	8,032,538
Full-time and part-time employment, net change 1990 to 1997	26,063	1,245,739
Employment in government, 1997	9,170	1,048,270
Private nonfarm establishments, 1999	8,198	424,089
Change in private nonfarm establishments, 1990 to 1999	2,285	62,759
Private nonfarm establishments, percent change 1990-1999	38.6%	17.4%
Private nonfarm estabs with less than 20 employees, 1999	7,406	374,051
Total number of firms, 1997	25,818	1,301,921
Minority-owned firms, 1997	2,583	286,885
Minority-owned firms, percent of total, 1997	10.0%	22.0%
Women-owned firms, 1997	6,035	337,811
Women-owned firms, percent of total, 1997	23.4%	25.9%

Table 8 Study Area Real Per Capita Income

	Employment Statistics	Collier County	Florida
?	Personal income, 1997 ($1000)	6,968,962	363,979,647
?	Personal income per capita, 1997	36,210	24,799

E.3 MUNICIPAL & INDUSTRIAL WATER DEMAND

E.3.1 Overview

In order to analyze the impacts on water supply, the water demand must be estimated and forecasted. The basis for the municipal and industrial (M&I) water demand projections used in this study is a water demand forecast prepared under contract for the Jacksonville District, Corps of Engineers, by Gulf Engineers & Consultants, Inc., Baton Rouge, Louisiana (GEC).

IWR-MAIN Water Demand Analysis Software Version 6.1 is the model that estimates current and future water demand for this study. The IWR-MAIN Software was initially developed for the Office of Water Resources for the U.S. Department of the Interior in 1969. The system has been improved in subsequent versions and has been selected by the Institute for Water Resources (IWR) of the U.S. Army Corps of Engineers as a proven method of water demand forecasting. The IWR-MAIN Water Demand Forecasting model requires demographic, housing, and business statistics and water use data aggregated by user classifications and seasonal variations for distinct geographical areas. The relevant geographical area for this study is Collier County.

E.3.2 Collier County Water Demand

Water demand projections were based on two different sets of demographic projections developed by state and local agencies. The University of Florida, Bureau of Economic and Business Research (BEBR) developed the first set of projections. BEBR data is only projected through the year of 2030. The second set of demographic projections was obtained from Collier County. The BEBR employment projections and growth rates were used in conjunction with the county prepared population projections to develop the third set of water use projections.

Under all alternatives the water demands will increase due to an increase in population. Water demand calculations are being conducted for 2000-2050 by Gulf Engineers in conjunction with the Southwest Florida Feasibility Study. The results of these projections are in draft form, but the final figures are not expected to significantly change. Preliminary water demand projections estimate Collier County's most likely population scenario, conservation–adjusted water use in 2050 at 295.3 MGD. Due to the exceptionally small rate of growth projected between 2050 and 2060, it not expected that 2060's water demands will be any higher than in 2050, after taking into account conservation measures.

Collier County is expected to be using 60% of the total water demanded in the Lower West Coast.

With the implementation of the recommend plan, the groundwater levels will increase leading to increased supplies of water and decreased salinity levels in private wells in the NGGE. With more persons drawing water and less water available, the increased level of groundwater may provide incidental water supply benefits. The amount of additional water supplied is unknown, so an attempt to quantify the NED benefits has not been conducted.

The SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, requiring rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

The restricted water use scenario is included because the SFWMD requires the development of water conservation plans as a prerequisite for water utilities to obtain a water use permit. With the implementation of conservation plans, water demand should change. Most conservation plans incorporate passive water conservation measures that include increasing block rate structures, the required use of ultra-low flow water fixtures on new or renovated construction, restrictions on lawn watering, requiring rain sensors on automatic sprinkler systems, a leak detection program, and public education concerning water conservation measures.

E.3.3 Impacts of Selected Alternatives

A key design criterion and goal throughout the development of the SGGE system components has been that Municipal & Industrial water supply will remain the same or be increased with the SGGE plan implemented as compared to without the SGGE plan in place. No reduction in the amount of water available to municipal and industrial properties will be caused by implementation of the SGGE plan. It possible that the groundwater level may slightly rise as a result of the selected alternatives, in turning yielding more water for the ecosystem and potentially more water available for Municipal and Industrial usage. The level of water that would be made available to M&I usage is believed to be minimal, causing little if any benefits.

E.3.4 Agricultural Water Supply

The agricultural land present in the SGGE surrounding is located primarily in the Belle Meade Agricultural Area and consists of row crops. Groundwater is the main source of water used for agricultural irrigation in the SGGE study area. The four drainage canals in the SGGE study area are not used as a source for water irrigation. An extensive effort has been undertaken to ensure that the there would be no adverse effect of the restoration project on agricultural water supply. This was one of the constraints of the project, and surface and groundwater modeling have both demonstrated that there will be no reduction in water to the agricultural lands in any of the alternatives that were to be evaluated.

It is also quite possible that the groundwater levels will rise in the agricultural areas of Belle Meade, which in turn may prove to provide incidental benefits. With the groundwater levels rising, it may be possible for agricultural irrigation to continue operating longer than they currently can during periods of drought. This increase in groundwater levels would in effect be a measurable, albeit minimal benefit.

E.3.5 Flood Control Impacts of Selected Alternatives

The purpose of this section is to attempt to identify the beneficial and adverse flood impacts that might occur with each proposed project alternative. Some of this work has already been accomplished in the formulation of the alternatives. In areas where flood hazards were identified or confirmed in this study, full consideration has been given to improving areas and mitigating impacts by incorporating design changes.

A key design criterion and goal throughout the development of the SGGE system components has been that flooding of developed areas will remain the same or improved with the SGGE plan implemented as compared to without the SGGE plan in place. No flooding of residential or commercial properties will be caused by implementation of the SGGE plan.

Flood damages to urban development include structural damages to buildings, as well as damages to personal property and associated lawns, pavement, shrubs, and streets. Flooding has been evident in certain low laying areas in North Golden Gate Estates. Depth of flooding is the determining factor for damages to structures and their contents. Duration of flooding is the determining factor for damages to lawns, pavements, shrubs, and streets. Flood damages to agricultural development are primarily related to flood duration. Losses to vegetable and fruit crops are very much dependent upon the duration

of flooding in root zones. Properly calibrated topographic and stage-hydrograph information is required to compute depths of flooding to structures and duration of flooding to agriculture. More detailed information, including maps illustrating the comparison between existing conditions and with project conditions, can be found in Appendix A of this report and the Project Assurances section (Section 12).

E.4 COMMERCIAL NAVIGATION

E.4.1 Overview

Commercial navigation in the study area is nonexistent due to the four canals limited size, limited length, and inaccessibility to any other bodies of water. The canals all eventually flow to the Port of the Islands in the Fakaunion Canal, which is separated from the four canals by a weir. This weir, and other weirs throughout the SGGE canal system, prohibits commercial navigation.

E.5 RECREATION

E.5.1 Overview

This section examines the potential effects of the SGGE Recommended Plan on outdoor recreation in the study area. Outdoor recreation in Florida includes many different activities. A common way of differentiating outdoor recreation activities is to classify them based as "user-oriented" or "resource-based" activities. User-oriented activities, such as individual and team sports, are not dependent on any natural resource setting and can be located, space permitting, on any open site. These facilities are provided for the convenience of the user. For example, a basketball court can be added to a playground. Resource-based activities, such as hunting and fishing, depend on the existence and quality of supporting natural or historical resources. The economic value of resource-based recreation is determined by the users' willingness to pay for a recreation occasion. The willingness of current and potential users to pay for resource-based recreation of specific quantity and quality constitutes the demand for that type of recreation. The interaction of demand with the quantity and quality of recreation resources available determines the recreation use or "participation" levels for that resource-based activity. When the quantity or quality of recreation resources is modified by a project, such as the alternative restoration plans, the change in value of resource-based recreation is based on the difference in the willingness of users to pay under the with- and without-project conditions.

The SGGE ecosystem provides a unique and extensive natural resource-based recreational resource. The restoration of the SGGE ecosystem could potentially have important impacts on the value of outdoor recreation in the study area. The hydrologic changes associated with the SGGE's alternative restoration plans have been designed to improve the structure and function of the ecosystems. These improvements can be expected to provide resource based recreational opportunities compatible with the protection the natural systems. Many tourists and residents recreate in the natural areas of the study area. If the alternative restoration plans improve the ecology of the study area, the quality of the study area related recreation and/or the number of people who participate in study area related recreation could increase as well. Consequently, the value of outdoor recreation in the study area could also substantially increase.

However, precisely estimating the future value of SGGE- related recreation in the study area is problematic, and anticipating the incremental changes in value associated with SGGE restoration is even more challenging. There are four principal uncertainties that challenge forecasting the future quantity and quality of outdoor recreation under with- and without project conditions. Perhaps the most important uncertainty concerns the timing and character of the ecological changes that are expected to result from the alternative restoration plans. At this time the outcomes of the restoration actions cannot be predicted. Consequently, secondary effects, such as associated changes in recreation patterns and the resulting effect on industries supporting recreation (e.g., marine industry) cannot be accurately quantified.

Another uncertainty regarding the value future value of recreation is the marketing of tourism and study area related recreation. If the restored ecosystem is used to market tourism and recreation in the study area, the value of recreation could change dramatically relative to the without-project future conditions.

A third uncertainty is the degree to which recreational facilities and recreational access would be developed as part of a restoration plan. Recreation facilities and access, such as visitor centers, scenic overlooks, nature trails, and roads, can greatly affect participation levels.

Finally, there are a variety of economic factors at the national level that can influence tourist and resident recreation demand. These factors include the health of the national economy, levels of disposable income, and the availability and costs of competing recreation opportunities. As described in the 2000 Florida Statewide Comprehensive Outdoor Recreation Plan (SCORP)(Draft): "The states 1996 tourist population (44.7 million) is expected to increase to 57 million visitors, a 25% increase, by 2005. However, Florida tourism and its economic implications are sensitive to national economic and energy policies.

The dynamic nature of the industry causes uncertainty in tourism forecasting, making it difficult to accurately project visitation levels for more than one or two years at a time" (Florida Department of Environmental Protection, 2000). As evidence of the challenges of tourism and recreation forecasting, the Florida Tourism and Industry Marketing Corporation limits its tourism forecasts to three years, and the most recent SCORP (2000) used a ten-year forecast horizon (to the year 2010).

E.5.1.1 Recreation Resources

The SCORP is the best source of information on recreation demand and supply at the state and regional scales. It divides the state into 11 planning regions, each with clusters of counties. As indicated in Table 9, Region IX is the planning region that encompasses the study area.

Table 9 Counties Within SCORP Planning Regions Potentially Affected by Alternative Restoration Plans

Region	Counties
Region XI	Charlotte
	Collier
	Lee
	Sarasota
	Glades
	Hendry

Source: Florida Department of Environmental Protection, 2000.

The SCORP organizes outdoor recreation in Florida into 47 categories that encompass a variety of recreation activities including team sports (e.g., basketball and baseball), individual sports (e.g., golf and tennis), hunting, fishing, swimming, and boating. Table 10 presents descriptive information on the recreation facilities in SCORP Regions IX for 21 recreation categories relating to SGGE. These resource-based categories were selected as those that could potentially be affected by the hydrologic changes or ecological changes associated with the alternative restoration plans. This table also includes percentages of the statewide totals for the recreation categories.

Table 10 Regional Outdoor Receration Facilities, Region IX, 1998

Resource / Facility	Region IX	% of State Total	State Total
Outdoor Recreation Areas	1,107	8%	13,097
Outdoor Recreation Acres			
Land Acres	997,733	11%	9,077,004
Water Acres	59,584	3%	1,773,900
Hunting Acres			
Land Acres	453,163	7%	6,046,955
Water Acres	414	0%	121,761
Camping			
RV / Trailer Camp Sites	20,838	15%	138,576
Tent Camp Sites	453	4%	10,214
Trails			
Hiking Trails (miles)	313	8%	3,904
Horseback Riding Trails (miles)	25	2%	1443
Bike Trails (miles)	199	21%	963
Nature Trails (miles)	93	9%	1043
Freshwater Catwalks	196	26%	748
Boating			
Canoe Trails (miles)	169	7%	2,587
Freshwater Boat Ramp Lanes	95	5%	1,973
Freshwater Marinas	19	4%	511
Freshwater Slips / Moorings	944	8%	11,758

Source: Florida Department of Environmental Protection. 2000

E.5.1.2 Recreation Demand

Profiles of existing and future recreation demand in the study area can be developed by drawing on a variety of information at the national, state, regional, and local levels. The discussions begin with the results of two national surveys on outdoor recreation. These illustrate the participation and expenditures of participants in outdoor recreation activities that could potentially be affected though SGGE restoration.

E.5.1.3 National Recreation Trends

National trends in recreation may help to identify potential or expected changes in the demand for Florida recreation as the result of ecosystem restoration. Two recent national surveys of outdoor recreation have particular relevance for this investigation.

E.5.1.4 National Survey Of Recreation And The Environment

The Outdoor Recreation Coalition of America conducted a National Survey of Recreation and the Environment in 1994 and 1995. Approximately 17,000 Americans were interviewed in a random sample telephone survey, providing information regarding their participation in 62 recreational activities organized into 13 broad categories.

Table 11 presents 1994-1995 participation rates for 26 of the 62 surveyed recreational activities. The activities in this table were selected as those that potentially could be affected by the alternative restoration plans. Of the selected activities, the three most popular groups of activities were outdoor viewing, fitness activities, and outdoor social activities that had participation rates of 76.2 percent, 68.3 percent and 67.8 percent, respectively. Walking was identified as the most popular activity with approximately 134 million participating (66.7 percent of the population). Approximately 124 million recreationists (62.1 percent) enjoy visiting a beach or other waterside and gathering outdoors with family. Sightseeing also had a high level of participation (56.6 percent). Other very popular activities include hiking and backpacking, fishing, boating and camping.

The Outdoor Recreation Coalition conducted a similar national survey of recreation and the environment in 1983-1994. Table 12 compares the results of the two surveys. The categories are somewhat different than in Table 11 due to differences in the surveys.

Table 11 Participation Rates for Selected Recreational Activities by U.S. Population 16 Years of Older, 1994-1995

	Participants (millions)	Percent of U.S. Population
Fitness	136.9	68.3%
Walking	133.7	66.7%
Viewing / Studying	152.6	76.2%
Nature Centers	93.1	46.5%
Visitor Centers	69.4	34.6%
Bird Watching	54.1	27.0%
Wildlife Viewing	62.6	31.3%
Fish Viewing	27.4	13.7%
Other Wildlife Viewing	27.5	13.7%
Sightseeing	113.4	56.6%
Visiting Beach / Waterside	124.4	62.1%
Water-based Nature Study	55.4	27.7%
Camping	52.8	26.4%
Developed Area	41.5	20.7%
Primitive Area	28	14.0%
Hunting	18.6	9.3%
Big Game	14.2	7.1%
Small Game	13	6.5%
Migratory Bird	4.3	2.1%
Fishing	57.8	28.9%
Freshwater	48.8	24.4%
Saltwater	19	9.5%
Warmwater	40.8	20.4%
Anadromous	9.1	4.5%
Catch and release	15.5	7.7%
Boating	58.1	29.0%
Canoeing	14.1	7.0%
Kayaking	2.6	1.3%
Rowing	8.4	4.2%
Outdoor Adventure	73.6	36.7%
Hiking	47.8	23.9%
Off-Road Vehicle Driving	27.9	13.9%
Horseback Riding	14.3	7.1%

Source: Outdoor Recreation Coalition of America, 1997.

Table 12 Trends in U.S. Recreation Participation, 1983-1994

Recreational Activity	1983-1984 (millions)	1994-1995 (millions)	% Change
U.S. POPULATION	**234,868 (January '84)**	**261,575 (January '95)**	**11.4%**
Fitness			
Walking	93.6	133.7	42.8%
Viewing Studying			
Bird watching	21.2	54.1	155.2%
Sightseeing	81.3	113.4	39.5%
Camping (overall)	42.4	52.8	24.5%
Camping, developed	30	41.5	38.3%
Camping, primitive	17.7	28	58.2%
Hunting	21.2	18.6	-12.3%
Fishing	60.1	57.8	-3.8%
Boating	49.5	58.1	17.4%
Swimming			
Pool Swimming	76	88.5	16.4%
River/lake/ocean Swimming	56.5	78.1	38.2%
Outdoor Adventure			
Hiking	24.7	47.8	93.5%
Backpacking	8.8	15.2	72.7%
Off-Road Driving	19.4	27.9	43.8%
Horseback Riding	15.9	14.3	-10.1%

Source: Outdoor Recreation Coalition of America, 1997.

This table contains numbers of participants, not participation rates. As indicated in this table, there has been an increase in the number of participants for almost all activities. The 11.4% increase in U.S. population during this period explains some of the change in number of participants. However, some activities are clearly undergoing an increase in participation rates. For example, birdwatching has the largest increase (155 percent) in number of participants from 1984 to 1995. Hiking and backpacking also experienced large increases in participation, 93.5 and 72.7 percent respectively. Walking activity increased 42 percent from 94 million to 134 million participants. Also, since 1984 there has been an increasing interest in specialized outdoor adventure activities such as orienteering, mountain climbing, rock climbing, caving, and special types of wildlife viewing.

In general, the variety of recreational interests in the U.S. appears to be increasing along with recreational participation rates. As future recreation needs and interests develop, it is important to recognize that participation in specific types of recreational activities is often linked to demographic factors such as age and income. For example, participation in activities requiring

vigorous exercise is considerably higher for young people than for senior citizens. However, the elderly population has increasing recreation participation because of the growing awareness of the importance of physical fitness. Participation in most activities is low for those with family incomes below $25,000 per year. Interestingly, participation is also low for those with family incomes greater than $100,000 per year. Most outdoor recreational activities appear to be enjoyed largely by the middle class, those with family incomes between $25,000 and $75,000 per year.

E.5.1.5 National Survey Of Fishing, Hunting, And Wildlife-Associated Recreation

The U.S. Fish and Wildlife Service conducted the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation in 1996. As part of this survey, 22,578 anglers and hunters and 11,759 wildlife watchers were interviewed. The purpose of the survey was to gather information regarding participation and expenditures for wildlife-related activities, including fishing, hunting, and wildlife watching. National participation and expenditure data for sportsmen and wildlife watchers are presented in Table 13. The survey revealed that 77 million Americans aged 16 or older (40 percent of the adult population) enjoyed some form of wildlife-related recreation in 1996 with total expenditures exceeding $101 billion.

Table 13 Total U.S. Wildlife-Watching Participation, 1996

Category	Participants	Expenditures
Residential	60.8 million	
Nonresidential	23.7 million	
Total*	62.9 million	$29 billion

Source: U.S. Fish and Wildlife Service, 1996.

Wildlife watching activities primarily included observing, photographing and feeding wildlife for two types of participants: residential and nonresidential. The residential category included those activities that occurred within one mile of the residents' homes, while the nonresidential group included those who took trips or outings for the primary purpose of observing, photographing, or feeding wildlife. Based on the National Survey of Fishing, Hunting, and Wildlife-Associated Recreation, in 1996 over 62.9 million people in the U.S. participated in wildlife watching. This figure is consistent with the 1995 participation of 62.6 million wildlife watchers reported in the National Survey of Recreation and the Environment.

The sum of residential and nonresidential subcategories does not equal the total due to an overlap in participation.

Table 14 presents residential and nonresidential participation in various wildlife-watching activities. Among all wildlife-watching participants, 97 percent (60.8 million) watched wildlife within 1 mile of their home (residential). The most popular residential activities included feeding and observing wildlife, 54.1 and 44.1 million participants, respectively. Approximately 23.7 million people (38 percent of all wildlife-watchers) spent 314 million days in 1996 taking trips for the primary purpose of enjoying wildlife. Of all nonresidential wildlife watchers, 68 percent participated only within their home state, 13 percent traveled only to other states and 19 percent took wildlife watching trips in both their state of residence as well as in other states. Survey results indicated that wildlife-watching trips were evenly distributed among male and female participants. The types of sites visited by nonresidential wildlife watchers included woodlands (77 percent), lakes or streamside (69 percent), open field (63 percent), brush covered (59 percent), wetland marsh or swamp (44 percent), manmade area (39 percent) and oceanside (27 percent). Of the 23.7 million nonresidential participants, 22.9 million enjoyed observing wildlife. Observing birds and land mammals was favored by 75 percent of wildlife observers.

Table 14 U.S. Wildlife-Watching Activity, 1996

Category	Participants (millions)	Average Days / Year (millions)	Average Days / Participant
Total Wildlife Watching*	62.9 (100%)		
Residential*	60.8 (97% of total)		
Observed Wildlife	44.1		
Photographed Wildlife	16.0		
Fed Wildlife	54.1		
Maintained Plantings/Natural Areas	13.4		
Visited Public Areas	11.0		
Nonresidential*	23.7 (38% of total)	314	13.2
Observed Wildlife	22.9	279	12.2
Photographed Wildlife	12.0	79	6.6
Fed Wildlife	10.0	90	9.0

Source: U.S. Fish and Wildlife Service, 1996.
* The sum of subcategories may not equal the category total due to an overlap in participation.

Table 15 presents a profile of wildlife observed by nonresidential participants by type. Waterfowl and songbirds were among the most popular species watched.

Table 15 U.S. NonResidential Wildlife-Watching by Species, 1996

Category	Participants (millions)	% of Total
Nonresidential	23.7	
Birds	17.7	75%
Waterfowl	14.3	
Songbirds	12.9	
Birds of Prey	10.6	
Other Shorebirds	9.5	
Other Birds	6.5	
Land Mammals	17.7	75%
Fish	8.4	35%
Marine Mammals	3.5	15%
Other	11.5	49%

Source: U.S. Fish and Wildlife Service, 1996.

The National Survey of Fishing, Hunting, and Wildlife-Associated Recreation also contains state-level information on recreation participation and expenditures. In 1996, approximately 3,642,000 of Florida's 11,239,000 residents (32 percent) participated in wildlife-related recreation with the following distribution: 2,840,000 wildlife watching (25 percent of the state population) and 1,988,000 hunting/fishing (18 percent of the state's population). According to the survey, 79 percent of the time spent wildlife watching by Florida residents is spent within the State of Florida.

As indicated in Table 16, there were an estimated 1,846,000 participants in wildlife-watching activities in Florida in 1996. Approximately 1,050,000 (57 percent) of these participants were Florida residents and the remainder (796,000 or 43 percent) was from outside the state. Together, the in-state and out-of-state participants spent a total of 14,658,000 days watching wildlife in Florida.

Table 16 Participants in Wildlife-Related Recreation in Florida, 1996

Participant	Residents	% of Total	Non-residents	% of Total	Total
Anglers	1,878,000	(66%)	986,000	(34%)	2,864,000
Hunters	170,000	(92%)	14,000	(8%)	184,000
Wildlife Watchers	1,050,000	(57%)	796,000	(43%)	1,846,000

Source: U.S. Fish and Wildlife Service, 1996.

Table 17 presents estimated expenditures associated with wildlife watching in Florida during 1996. As indicated in this table, in-state and out-of-state participants spent over $1.6 billion in 1996 on wildlife watching. This includes trip-related expenditures and equipment expenditures. Wildlife watching equipment includes binoculars, film, bird food, and special clothing. Auxiliary equipment expenditures accounted for items such as tents and backpacking equipment. Other expenditures include magazines and books, membership dues and contributions, land leasing and ownership, and plantings.

Table 17 Florida Wildlife-Watching Expenditures, 1996

Expenditure Category	Total Expenditures (millions)	% of Total
TOTAL EXPENDITURES	$ 1,677.2	100%
Trip-Related Expenditures	$ 754.7	45%
Food and Lodging	$ 439.7	26%
Transportation	$ 189.4	11%
Other Trip Costs	$ 125.6	7%
Total Equipment Expenditures	$ 767.6	46%
Wildlife-Watching Equipment	$ 286.9	17%
Auxiliary Equipment	$ 65.4	4%
Other Expenditures	$ 154.8	9%

Source: U.S. Fish and Wildlife Service, 1996.

E.5.1.6 State Recreation Trends

The Florida SCORP supplements the results of the two national recreation surveys described above with estimates of current and future recreation demand at the state and regional scales. Recreation demands were developed for the SCORP through surveys of residents and tourists. The Division of Recreation and Parks conducts periodic surveys of resident and tourist participation in recreation activities to estimate outdoor recreation in Florida. The Division did not have funds to conduct a new participation survey for the latest SCORP so the recreation participation information was derived from the 1992-1993 surveys conducted by the University of Florida, Department of Recreation, Parks, and Tourism. Participation in outdoor recreation activities is expressed in terms of user-occasions, which occur each time an individual participates in a single outdoor recreation activity. The number of user-occasions was calculated for each planning region as well as the entire state by type of activity. Demand was estimated for 1997, 2000, 2005 and 2010 by applying the per capita participation rates to population projections.

Table 18 presents 1992 statewide resident and tourist demand in Florida for selected outdoor recreation activities. The activities were chosen based on their potential for being affected by the alternative restoration plans. As indicated in this table, over 45 million residents and tourists participated in these activities

in 1992. Hiking, recreational vehicle (RV) camping, and nature study were popular with residents and tourists. With the exception of RV camping, participation by residents outnumbered tourist participation.

Table 18 Demand for Selected Recreation Activities in Florida User-Occasions (Thousands), 1992

Activity	Resident	Tourist	Resident & Tourist	% of Total
Hunting	1,656	34	1,690	4%
RV Camping	2,992	5,659	8,651	19%
Tent Camping	1,260	825	2,086	5%
Hiking	5,220	3,668	8,887	20%
Horseback Riding	3,155	491	3,647	8%
Nature Study	4,645	2,215	6,859	15%
Canoeing	846	555	1,401	3%
Total	27,235	18,271	45,506	100%

Source: Florida Department of Environmental Protection, 1994.

Table 19 presents participation rates for the same set of recreation activities during 1985 and 1992. In general, residents have higher participation rates than tourists, and participation rates for both groups have declined from 1985 to 1992.

Table 19 Participation Rates for Selected Recreation Activities, 1985, 1992

	% of Residents Participating		% of Tourists Participating	
Activity	1985	1992	1985	1992
Hunting	11%	2%	0%	0%
RV / Trailer Camping	8%	3%	4%	5%
Tent Camping	10%	3%	1%	1%
Hiking	10%	6%	3%	3%
Horseback Riding	8%	3%	0%	0%
Nature Study	17%	5%	4%	3%
Canoeing	10%	3%	1%	1%

Source: Florida Department of Environmental Protection, 1994.

Table 20 present 1997 and projected 2000 demands for the selected recreation activities in SCORP Planning Region IX. This table includes user-occasions as well as facility/resource needs. As part of the without-project conditions, all of the regions are expected to have significant increases in demands for the selected recreation activities with a commensurate need to increase development of the regions' recreation resources and facilities.

Table 20 Demand and Facility Needs (1997 and 2000), Selected Recreation Activities, Southwest Region (SCORP Region IX)

Activity	Units	Demand (user-occasions)		Resources / Facility Needs	
		1997	2000	1997	2000
Hunting	Acres	108,131	115,776	0	0
RV / Trailer Camping	Camp Sites	1,501,703	1,706,273	0	0
Tent Camping	Camp Sites	456,225	513,387	112	183
Hiking	Linear Miles	1,299,375	1,464,722	223	291
Horseback Riding	Linear Miles	141,087	156,045	0	0
Nature Study	Linear Miles	2,146,713	2,365,741	11	22
Canoeing	Feet	N/A	137,916*	0	0

Source: Florida Department of Environmental Protection, 2000.
*Florida Department of Environmental Protection, 1994.

E.5.1.7 State Tourism Trends

As described in the SCORP, 49 million domestic and international visitors to Florida per year comprise a significant portion of the overall demand for outdoor recreation resources in Florida. Their participation in resource-based recreation and their relatively high incomes (compared to resident recreationists) make tourists a significant component of SGGE-related recreation in the study area. The Comprehensive Review Study detailed the importance of tourism on the recreation in Florida.

E.5.1.8 Potential Changes In Value Of Recreation

In order to estimate the effects of restoration on the value of SGGE-related recreation, the value of a project's recreation resources should be measured in terms of willingness to pay as specified in Corps guidance (ER 1105-2-100). The best estimates of recreation resource value come from survey-based studies using primary data collected from users and potential users of the recreation resource. For this investigation, the time and budget did not permit the primary data collection required of survey-based methodologies. However, the results of a previous study (Waddington et al., 1994), which estimated the value of non-consumptive recreation in Florida, give a perspective on the value of SGGE-related recreation resources. Expenditure data on SGGE-related recreation is also presented to give as complete a picture of the recreation impact of SGGE restoration, as existing information would allow.

To estimate the incremental changes in recreation value associated with each of the alternative restoration plans would require an understanding of how a plan's effects on the quantity and quality of recreation resources would modify the demand for that resource. This would require extensive survey-based data

collection, as indicated above. Even though the data collection and analysis needed to adequately estimate the recreation effects of the alternative restoration plans are beyond the scope of this report, an analysis of existing data can provide insight to the potential magnitude of the effects of restoration action. This perspective on the economic value of SGGE-related recreation is presented in terms of recreation expenditures and willingness to pay for non-consumptive recreation.

The estimation of expenditures on SGGE-related recreation can be conducted at the regional scale. As indicated in Table 21, the SCORP can be used to estimate expenditures on wildlife-watching recreation in the study area at the regional scale. The SCORP estimated year 2000 user-occasions for five selected recreation categories used in the SCORP: recreational vehicle camping, tent camping, hiking, horseback riding, nature study, and canoeing (Table 20). Expenditures per user occasion $40 (in $2001)) are based on the national estimate of expenditures per trip for wildlife watching from the National Survey of Fishing, Hunting, and Wildlife Associated Recreation. Based on this expenditure per user occasion, the year 2000 total expenditures for wildlife watching in Region IX would be approximately $258 million.

Table 21 Estimated Expenditures: South Florida Wildlife-Watching, Year 2000 (Estimated)

SCORP Region	User Occasions*	Expenditures/User-Occasion**	Total Expenditures
Region IX	6,459,860	$40	$258,394,400

* From Florida DEP, 2000. (sum of user occasions from Table 20.)
** From U.S. Fish and Wildlife Service, 1997.

Expenditures represent the minimum value of the recreation resources, since participants are willing to pay more than they actually expend. Waddington et al. (1994) conducted CVM studies to estimate the willingness to pay of recreationists beyond the willingness revealed in their expenditures. Economists refer to this additional willingness to pay as consumer surplus. For outdoor recreation in Florida, Waddington et al. (1994) estimated the consumer surplus at $50 (in $2001) per user occasion. This estimate of consumer surplus can be applied to SGGE-related recreation at the regional scale in a manner similar to the expenditure estimates above. Tables 22 present the regional estimates of non-consumptive recreation. The year 2000 regional estimate is $322 million.

Table 22 Estimated Consumer Surplus: South Florida Wildlife-Watching by SCORP Region IX, Year 2000 (Estimated)

SCORP Region	User Occasions*	Consumer Surplus / User Occasion**	Total Consumer Surplus
Region IX	6,459,860	$50	$322,993,000

* From Florida DEP, 2000.
* *From Waddington et al., 1994.

The preceding tables present estimates of the expenditures and consumer surplus for SGGE-related recreation. The estimates contained in the tables provide insight to the value of the SGGE-related recreation resources, but they should not be interpreted as estimates of that value. As described above, this would require survey-based primary research. The regional estimates of the expenditures and consumer surplus of SGGE-related wildlife watching are based on secondary sources of information.

In sum, the SGGE ecosystems can support a significant amount of outdoor recreation in the Lower West Coast of Florida. A significant portion of the expenditures comes from tourists. It is not possible at this time to anticipate precisely how expenditures and consumer surplus associated with SGGE-related recreation would change if restoration occurred. However, based on the recent adverse effects related to environmental damaging of the ecosystem, it can be concluded that improving the environmental quality of the SGGE ecosystem will substantially support and sustain local recreation-based businesses. Given the potential levels of expenditures and consumer surplus in the future, a small percentage increase in the quantity or quality of SGGE-related recreation could represent an increase in recreation value.

The State of Florida has planned recreation activities to be implemented upon restoration of the SGGE ecosystem. The uses presently considered compatible with resource protection and passive recreation include: horseback riding, hiking, camping, fishing, off road bicycling, hang gliding, some types of hunting, wildlife viewing and nature study. All the uses are consistent with the five-year management plan and use best management practices (BMPs) to protect the natural resources.

E.5.2 Recreational and Commercial Fishing

Fishing in the Southern Golden Gate Estates area is relatively minimal recreationally, and non-existent commercially. The existing canals in the SGGE area do not provide opportunities for commercial fishing. Due to the non-continuous navigability and the lack of a marina to get into the canals,

recreational fishing is limited. SGGE presently provides non-controlled access to undeveloped land around the canals, preventing the current use rates calculations for recreational fishing. Shore fishing, as well as canoes and small trolling boats are used in the canals for recreational purposes. According to the Picayune Strand State Forest five-year outdoor recreation plan, all canals are currently open to fishing, and will continue to be open after the restoration. The boat ramps that are currently in existence will remain open, so the impact on recreational fishing will be minimal. It can be noted that recreational fishing benefits will not cause a negative impact on the local economy, but the additional benefits will in all likelihood, be too minimal to measurably impact the economy.

E.6 COSTS

Data for initial construction/implementation, land acquisition, monitoring, and periodically recurring costs for OMRR&R (operation, maintenance, repair, replacement, and rehabilitation), have been developed through engineering design and cost estimation, and real estate appraisal efforts. Details of that data development are explained and discussed elsewhere in this report. The main issues requiring economic evaluation attention include equivalent time basis calculations, price levels, and timing of project spending.

Costs represent the difference between conditions without any plan (the "base condition", or "without-project condition") and with a plan or alternative. For purposes of this report and analysis, NED costs (National Economic Development Costs, as defined by Federal and Corps of Engineers policy), are expressed in 2003 price levels, and are based generally on costs estimated to be incurred over a 50 year period of analysis. Costs of a plan represent the value of goods and services required to implement and operate/maintain the plan. Table 23 displays the costs associated with the alternatives. The costs presented in Table 23 are total initial costs of construction and real estate. The O&M cost are annual estimates for fully implemented components.

Table 23 Summary of Costs of Alternatives (dollars)

	ALT 3D	ALT 6	ALT 12
Construction cost	112,204,200	51,576,700	110,751,600
Lands	250,408,000	686,832,000	240,537,000
Total Initial cost	362,612,200	738,408,700	351,288,600
Annual Monitoring	700,000	700,000	700,000
Annual Operation and Maintenance	2,129,000	175,000	1,498,000

Construction cost includes pre-construction, engineering and design (PED) and supervision and administration (S&A)

The timing of a plan's costs is important. Construction and other initial implementation for component costs cannot simply be added to periodically recurring costs for project operation, maintenance, and monitoring. Also, construction costs incurred in a given year of the project can't simply be added to construction costs incurred in other years if meaningful and direct comparisons of the costs of the different components are to be made. A common practice of equating sums of money across time with their equivalent at an earlier single point in time is the process known as discounting. Through this mathematical process, which involves the use of an interest rate (or discount rate) officially prescribed by Federal policy for use in water resource planning analysis (currently set at 5.625% per year), the cost time stream for the alternative plans were mathematically translated into a equivalent time basis value.

There is some admitted uncertainty as to how any of the plans, if approved and adopted, would be implemented. It is recognized that any of the plans would likely be implemented over a considerable period of time, little by little. For purposes of this evaluation, construction and land costs are assumed to be incurred on an equal monthly basis during the implementation of the alternative plans as defined in the Table 24.

Engineering Regulation (ER) 1105-2-100 requires that interest during construction (IDC) be computed which represents the opportunity cost of capital incurred during the construction period. Interest was computed for construction and PED costs from the middle of the month in which the expenditures were incurred until the first of the month following the estimated construction completion date presented in Table 24. All alternatives have the same real estate IDC amounts, due to the same land being needed for construction and the same certification dates, this would amount to a linear increase in costs for all alternatives which would have no influence on the incremental analysis. For the Recommended Plan Section (Section 8), interest during construction was computed for real estate from the date the lands are expected to be certified for the project. For the SGGE lands, there are two certification dates. The first on the lands that are need for construction, the second will be for the remaining lands, which will be certified when construction is completed and benefits begin.

The cost of a project is the investment incurred up to the beginning of the period of analysis. The investment cost at that time is the sum of construction and other initial cost such as real estate and PED cost plus interest during construction. Table 25 summarizes the total investment cost and total annual equivalent costs of each alternative plan.

Table 24 Construction Schedule and Costs

TASK	COST	Estimated Start		Estimated Finish
Southern Golden Gate Estates			15-Mar-03	15-Mar-09
Alternative 3D				
RE Acquisition	$250,408,000			
PED	$1,467,625	(Early Work)	15-Mar-03	15-Oct-03
	$6,603,675		15-Mar-05	16-Mar-06
S&A	$1,630,625	(Early Work)	15-Oct-03	15-Mar-05
	$7,338,175		15-Mar-06	15-Mar-09
Construction	$16,306,847	(Early Work)	15-Oct-03	15-Mar-05
	$78,857,353		15-Mar-06	15-Mar-09
Alternative 6				
RE Acquisition	$686,832,000			
PED	$1,467,625	(Early Work)	15-Mar-03	15-Oct-03
	$2,018,675		15-Mar-05	16-Mar-06
S&A	$1,630,625	(Early Work)	15-Oct-03	15-Mar-05
	$2,243,175		15-Mar-06	15-Mar-09
Construction	$16,306,847	(Early Work)	15-Oct-03	15-Mar-05
	$27,909,853		15-Mar-06	15-Mar-09
Alternative 12				
RE Acquisition	$240,537,000			
PED	$1,467,625	(Early Work)	15-Mar-03	15-Oct-03
	$6,494,875		15-Mar-05	16-Mar-06
S&A	$1,630,625	(Early Work)	15-Oct-03	15-Mar-05
	$7,215,675		15-Mar-06	15-Mar-09
Construction	$16,306,847	(Early Work)	15-Oct-03	15-Mar-05
	$77,635,953		15-Mar-06	15-Mar-09

(Note: Prairie Canal Construction early work is a component of alternatives 3D, 6 and 12. Adding the costs of this component to Alternatives 3d, 6 and 12 will give total construction costs for the various alternatives).

Table 25 Summary of Costs of Alternative Plans

	Alternative 3D*	Alternative 6	Alternative 12
Construction Cost	$95,164,200	$44,216,700	$93,942,800
Preconstruct Engineerng & Design	$8,071,300	$3,486,300	$7,962,500
Construction Management	$8,968,800	$3,873,800	$8,846,300
Interest During Construction*	$20,824,951	$11,866,023	$20,610,430
Lands	$250,408,000	$686,832,000	$240,537,000
Total Project Investment	$383,437,251	$750,274,823	$371,899,030
Interest and Amortization	$23,063,143	$41,311,856	$22,369,137
Operation and Maintenance	$2,129,000	$175,000	$1,498,000
Monitoring	$700,000	$700,000	$700,000
Total Annual Equivalent Costs	$25,892,143	$42,186,856	$24,567,137

- IDC for real estate was not included in the plan selection screening. All alternatives have the same real estate IDC amounts, due to the same land being needed for construction and the same certification dates.
- Alternative 3D costs were updated as part of the detailed design of the recommended plan, and were not included in the plan selection process, but are included in the Recommended Plan (SECTION 8) of the main report.

Note: Columns may not add due to rounding.

E.7 COST EFFECTIVENESS AND INCREMENTAL COST ANALYSES

Cost effectiveness and incremental cost analyses (CE/ICA) reveal information about good financial investments given the dollar costs and non-dollar outputs ("benefits") of alternative investment choices. The analyses are conducted in a series of steps that progressively identify alternatives that meet specified criteria and screen-out those that do not. Corps Engineer Regulation 1105-2-100 requires cost effectiveness and incremental cost analyses to support recommendations for ecosystem restoration.

Cost effectiveness analysis begins with a comparison of the costs and outputs of alternative plans to identify the least cost plan for every possible level of output considered. The resulting least cost alternative plans are then compared to identify those that would produce greater levels of output at the same cost, or at a lesser cost, as other alternative plans. Alternative plans identified through this comparison are the cost effective alternative plans. Next, the cost effective

alternative plans are compared to identify the most economically efficient alternative plans, that is, the "Best Buy" alternative plans that would produce the "biggest bang for the buck." Finally, the additional costs for the additional amounts of output ("incremental cost") produced by the Best Buy alternative plans are calculated. The results of all the calculations and comparisons of costs and outputs provide a basis for addressing the decision question "Is it worth it?," i.e., are the additional outputs worth the costs incurred to achieve them?

In practice, Corps ecosystem restoration studies typically measure the ecosystem benefits of alternative plans in terms of physical dimensions (number of acres of wetlands, for example), or population counts (number of wading birds, for example), or various habitat-based scores ("habitat units" based on the U.S. Fish & Wildlife Service's *Habitat Evaluation Procedures*, or "HEP", for example). Although for the Southern Golden Gate Estates project many performance measures were evaluated to ascertain how well each of the alternative plans performed on various criteria indicative of ecosystem restoration in the estuary and inland, habitat units were selected by the PDT as the metric that best integrated information regarding the quality and quantity of improved habitat for various representative species and/ or communities within the estuarine and inland ecosystems.

Sometimes it is difficult to summarize the results of CE/ICA when the analyses are performed separately on habitat units for distinct species or communities. This phenomenon often occurs simply because different management measures or alternative plans "do" different things, provide different types of output, and provide benefits to different biological communities. This is the case for the SGGE features and alternatives, in which certain features or alternatives provide greater benefits to the uplands habitats in the watershed, while other alternatives provide greater benefits for the estuary habitats. Therefore, in addition to the four separate types of habitat units quantified (oysters, hydrology, nekton and biota) CE/ICA was also performed on two additional metrics. An estuary habitat unit was calculated as the combined habitat units for the two species of communities inhabiting the estuary (oysters and nekton). Both of the two communities occupies two separate zones of spatial extent within the estuarine aquatic ecosystem (or at least were delineated as separate areas for the purposes of habitat unit estimation), so it is appropriate to add them together (since there is no spatial overlap) to get a better indication of total estuary output. Likewise, an inland habitat unit was calculated as the combined habitat units for the two indicators of inland (biota and hydrology).

In many cases if may be desirable to estimate benefits to both the estuary and inland added together, but in the case of SGGE, it was determined that simply examining the combined estuary and combined inland habitat units separately provided substantial data for determining the alternative that is the most

economically efficient. This will be demonstrated in the various following charts and graphs. In summary, CE/ICA was performed using the following 6 metrics to represent various ecosystem outputs of the SGGE alternatives:

- Oyster habitat units
- Nekton habitat units
- Biotic habitat units
- Hydrology habitat units
- Combined uplands habitat units
- Combined estuary habitat units

Cost effectiveness and incremental cost analyses were conducted for each of the SGGE alternative plans. The analyses compared the alternative plans' average annual costs against the appropriate average annual habitat unit estimates. The average annual outputs were calculated as the difference between with-plan and without-plan conditions over the period of analysis (through year 2060). The without-plan habitat units, with alternatives habitat units and lift calculations are provided in Table 26.

Although the alternatives for the SGGE study were formulated using the CERP system-wide approach, the total cost of CERP is not included in this cost effectiveness and incremental cost analyses. The cost of the balance of the CERP features, those not included in the SGGE alternatives, is the same for all the SGGE alternatives. As such, including it in this analysis does not bring any additional insight or differentiation between alternatives. For this analysis, the difference between the alternatives can be shown through a display of the outputs and costs of each SGGE alternative without the cost of the "other CERP" features.

All of the environmental outputs were calculated on an average annual basis to account for the fact that several years may be required for full attainment of the functional capacities to be realized. The following figures represent the expected future with and without project habitat units, which were used to calculate the average annual benefits for each ecosystem output.

Table 26 Costs and Outputs Used in Cost Effectiveness and Incremental Cost Analyses (Values for Alternatives are Differences Between "Without" Plan and "With" Plan on an Average Annual Basis)

	Average Annual Habitat Units Without Project	Average Annual Habitat Units Alternative 3d	Alternative 3D Average Annual Lift/Benefit (Difference between with and without)	Average Annual Habitat Units Alternative 6	Alternative 6 Average Annual Lift/Benefit (Difference between with and without)	Average Annual Habitat Units Alternative 12	Alternative 12 Average Annual Lift/Benefit (Difference between with and without)
Average Annual Cost			**$25,892,143**		**$42,186,856**		**$24,567,137**
SGGE	35,692	47,531	11,839	46,090	10,397	46,450	10,758
Fakahatchee	72,357	75,210	2,853	75,210	2,853	75,210	2,853
Panther	18,993	19,058	65	19,058	65	19,058	65
Belle Meade	21,564	22322	757	21,774	209	21,591	27
Collier Seminole	3,656	3,863	207	3,863	207	3,811	154
Total Biota	**152,262**	**167,984**	**15,721**	**165,995**	**13,731**	**166,120**	**13,857**
SGGE	20,753	49,807	29,054	45,063	24,310	44,471	23,718
Fakahatchee	69,740	72,145	2,405	72,947	3,207	72,145	2,405
Panther	21,704	21,953	249	21,953	249	21,953	249
Belle Meade	24,951	27,055	2,104	26,454	1,503	25,551	600
Collier Seminole	3,645	3,948	303	3,948	303	3,862	217
Total Hydrology	**140,793**	**174,908**	**34,115**	**170,365**	**29,572**	**167,982**	**27,189**
Total Nekton	**34.65**	**539.9**	**505.25**	**559.54**	**524.89**	**499.91**	**465.26**
Total Oyster	**0.6**	**7.88**	**7.28**	**8.16**	**7.56**	**7.31**	**6.71**

Note: Values assume system benefits (ecosystem outputs that would accrue to the SGGE study area if rest of CERP is constructed).

Figure 1 Oyster Habitat With and Without Time-Series For Alternative 3D

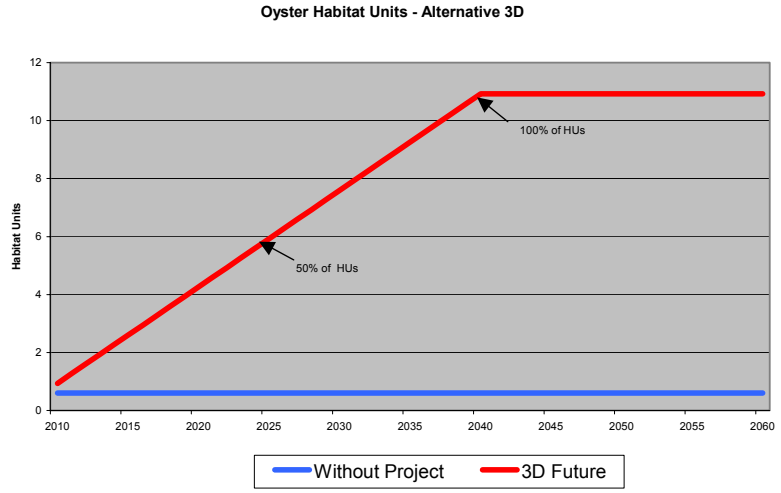


Figure 2 Oyster Habitat With and Without Time-Series for Alternative 6

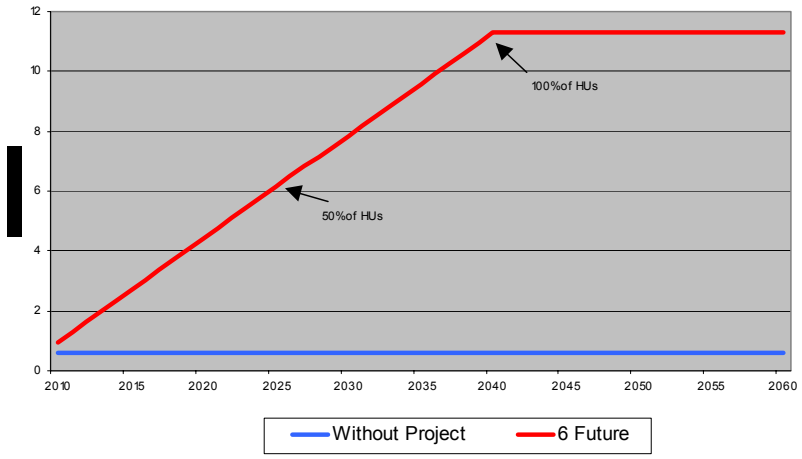


Figure 3 Oyster Habitat With and Without Time-Series for Alternative 12

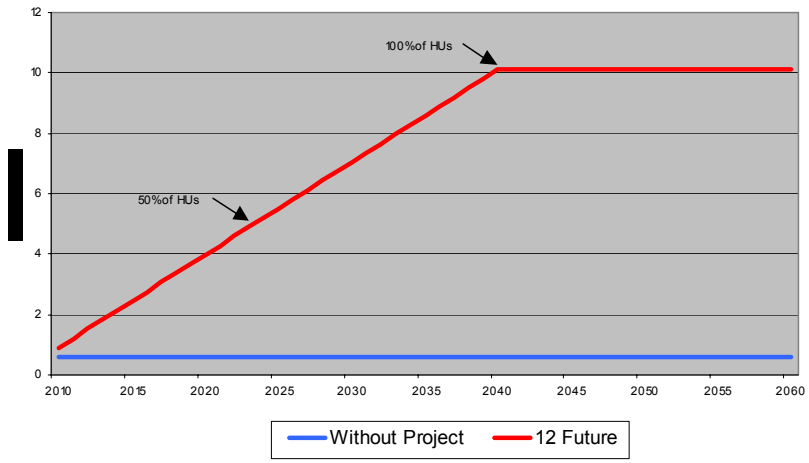


Figure 4 Nekton Habitat Time Series Graph With and Without Project Conditions for Alternative 3D

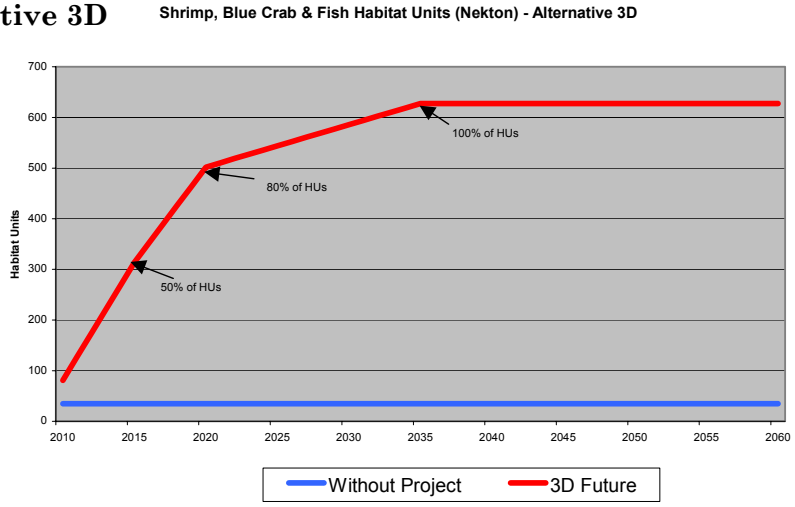


Figure 5 Nekton Habitat Time Series Graph With and Without Project Conditions for Alternative 6

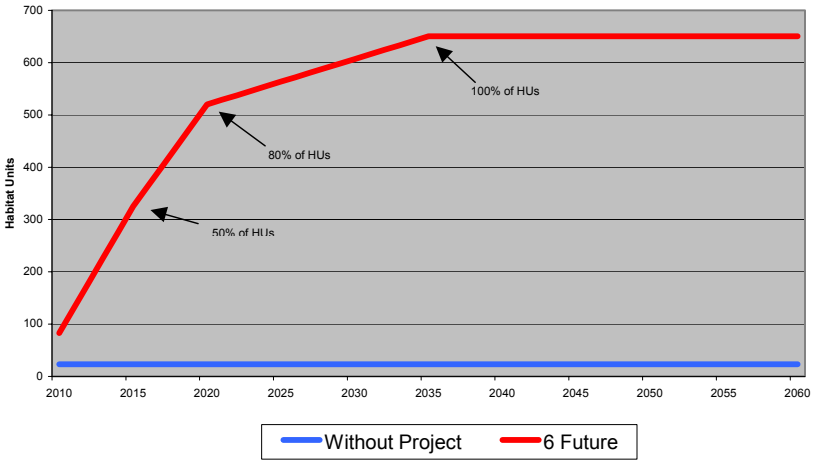


Figure 6 Nekton Habitat Time Series Graph With and Without Project Conditions for Alternative 12

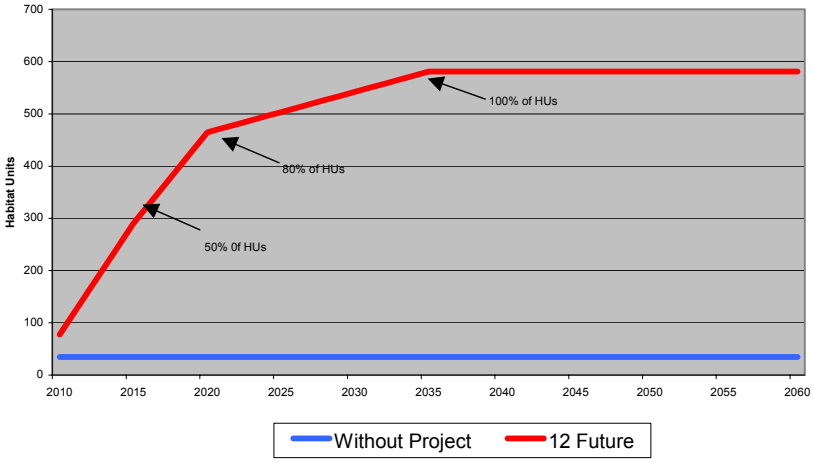


Figure 7 Biota Habitat Time Series Graph With and Without Project Conditions for Alternative 3D

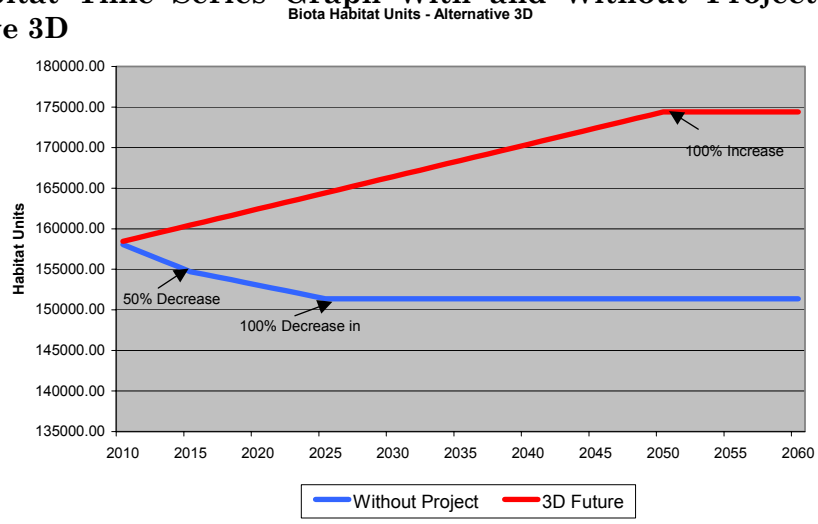


Figure 8 Biota Habitat Time Series Graph With and Without Project Conditions for Alternative 6

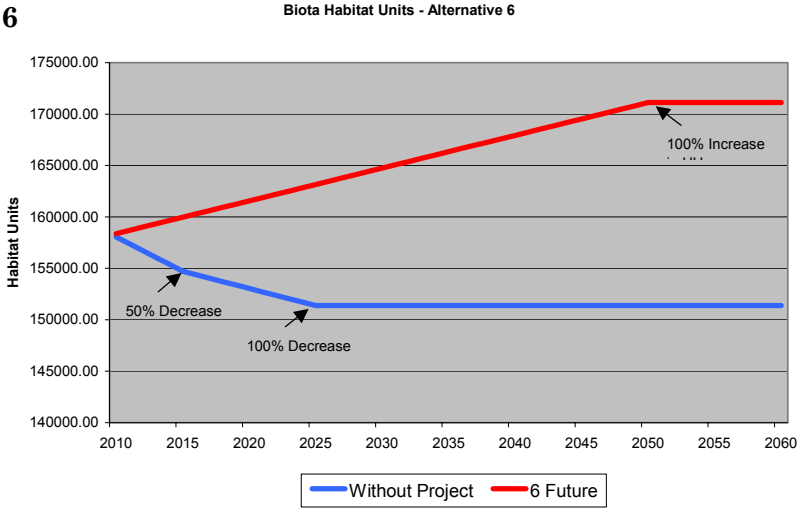


Figure 9 Biota Habitat Time Series Graph With and Without Project Conditions for Alternative 12

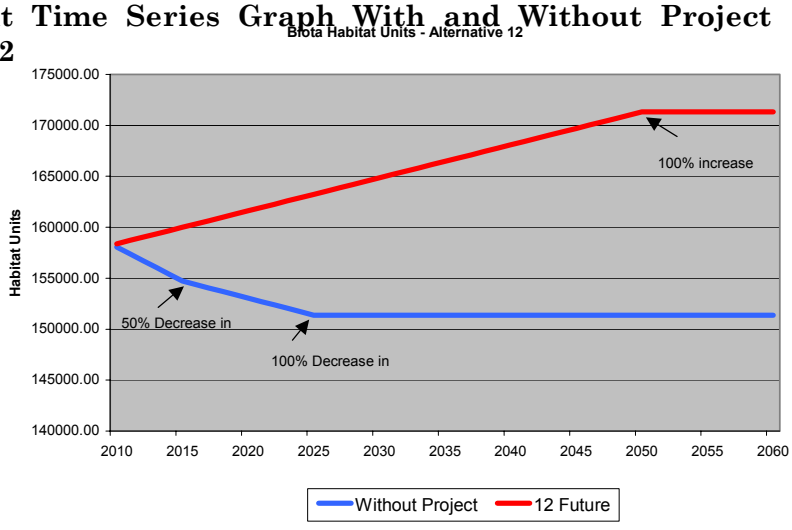


Figure 10 Hydrology Habitat Time Series Graph With and Without Project Conditions for Alternative 3D

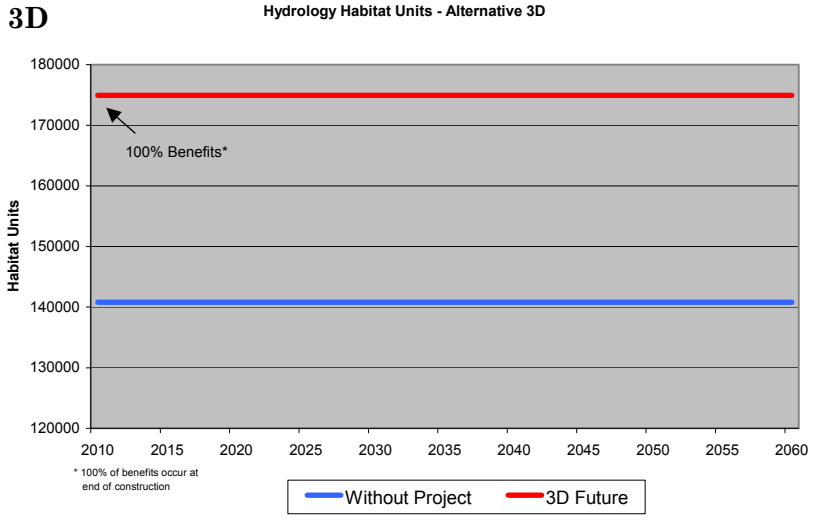


Figure 11 Hydrology Habitat Time Series Graph With and Without Project Conditions for Alternative 6

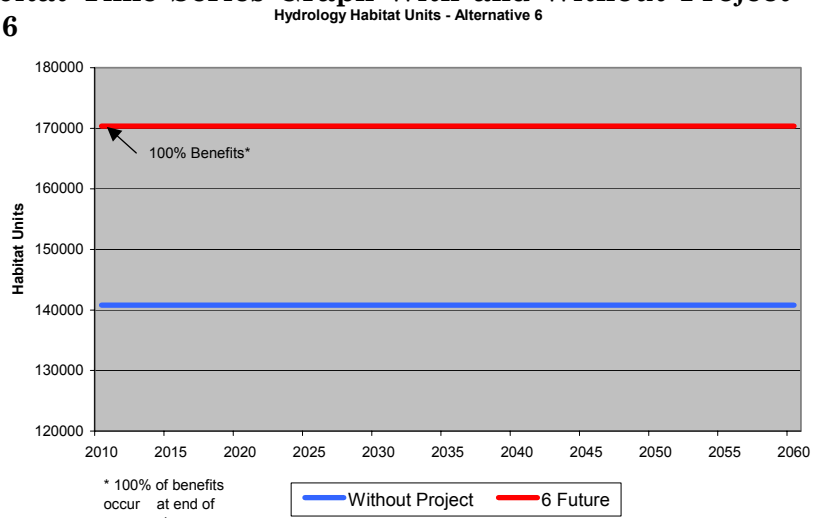
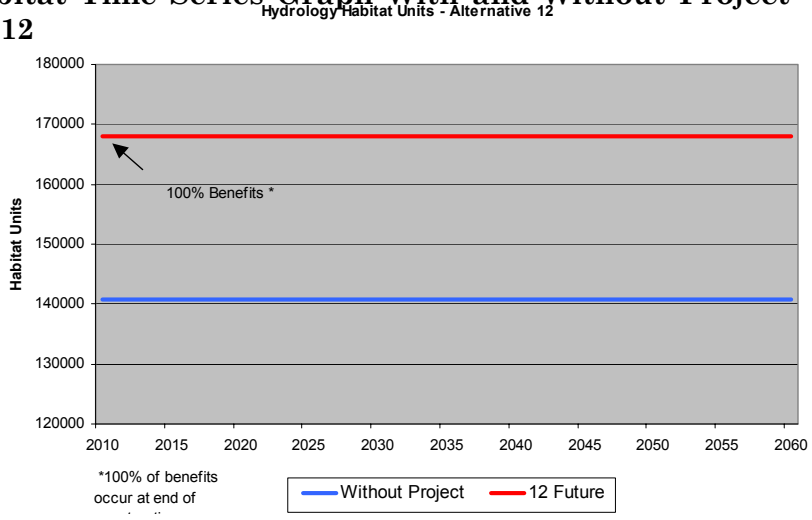


Figure 12 Hydrology Habitat Time Series Graph With and Without Project Conditions for Alternative 12



E.7.1 Cost Effectiveness Analysis

The following sections present the results of cost effectiveness analysis for the SGGE alternative plans for respective output indicators, grouped by estuary outputs and watershed outputs. All the alternative plans are arrayed by increasing output to clearly show plans that provide the same output for less cost or more output for the same or less cost (i.e., the cost effective plans). .

E.7.1.1 Cost Effectiveness Analysis – Estuary Outputs

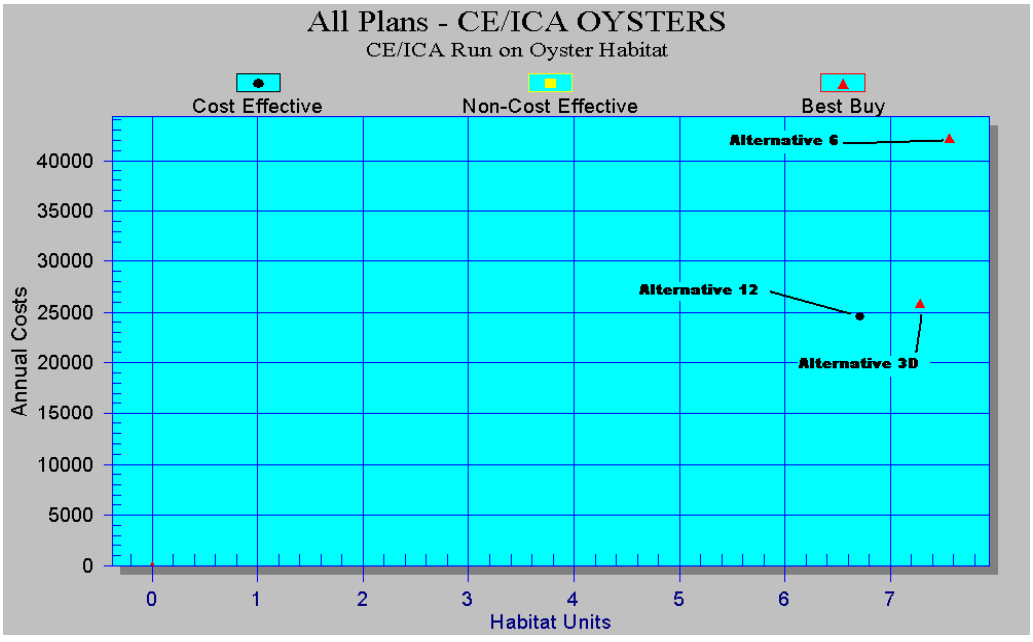
E.7.1.1.1 Cost Effectiveness Analysis – Oyster Habitat Units

Table 27 and Figure 13 show that Alternatives 3d, 6 and 12 are all cost effective in the production of oyster habitat. Alternative 6 provides a greater habitat lift than Alternative 3D, but Alternative 3D ($3,556,000/HU) has a much lower average cost per output then Alternative 6 ($5,580,000/HU).

Table 27 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Oyster Habitat Units

	Average Annual Cost ($1,000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Oyster Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	6.71	3,661	YES
Alternative 3D	25,892	7.28	3,556	YES
Alternative 6	42,187	7.56	5,580	YES

Figure 13 SGGE Alternative Plans - CE/ICA Run On Oyster Habitat



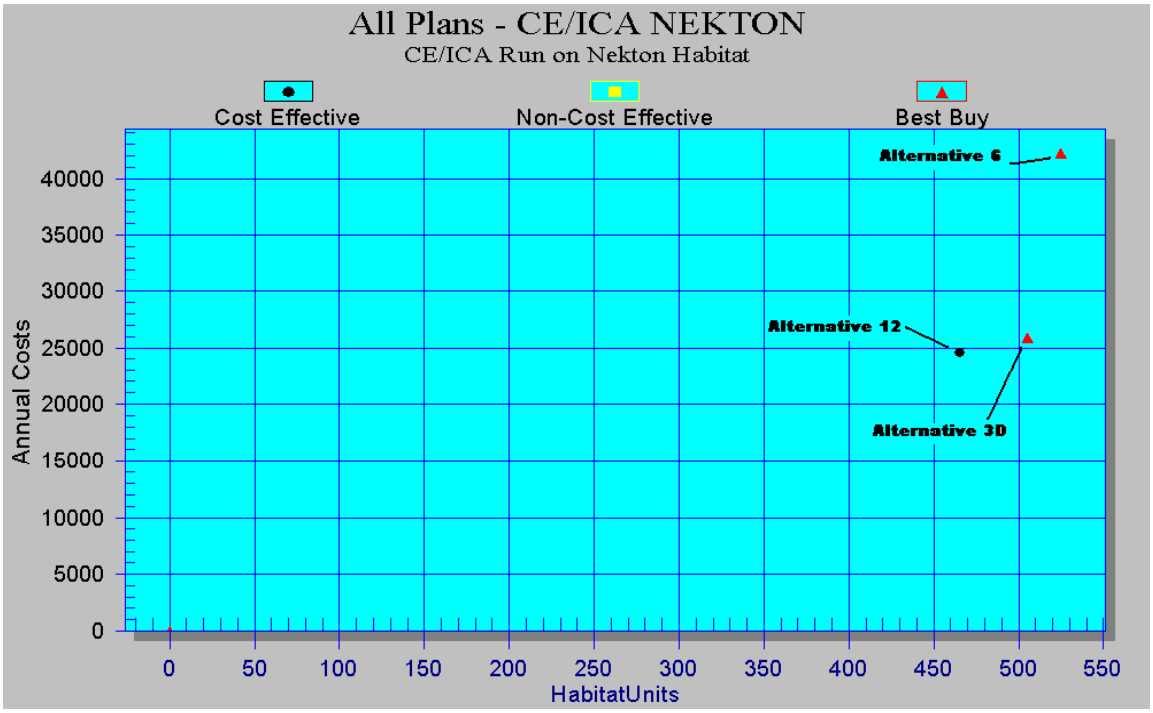
E.7.1.1.2 Cost Effectiveness Analysis – Nekton Habitat Units

Table 28 and Figure 14 show that Alternative 3D, 6 and 12 are cost effective in the production of neckton habitat. Alternative 3D provides a substantial amount of nekton habitat at a per unit cost of ($51,240/HU). Alternative 6 ($80,300/HU) provides only 4% more benefits at a greater than 50% increase in cost per habitat unit. Alternative 6's higher costs stem from higher land cost due to additional land purchases required north of SGGE.

Table 28 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Nekton Habitat Units

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Nekton Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	465.26	52.8	YES
Alternative 3D	25,892	505.25	51.24	YES
Alternative 6	42,187	524.89	80.38	YES

Figure 14 SGGE Alternative Plans - CE/ICA Run On Nekton Habitat



E.7.1.1.3 Cost Effectiveness Analysis – Combined Estuary Habitat Units

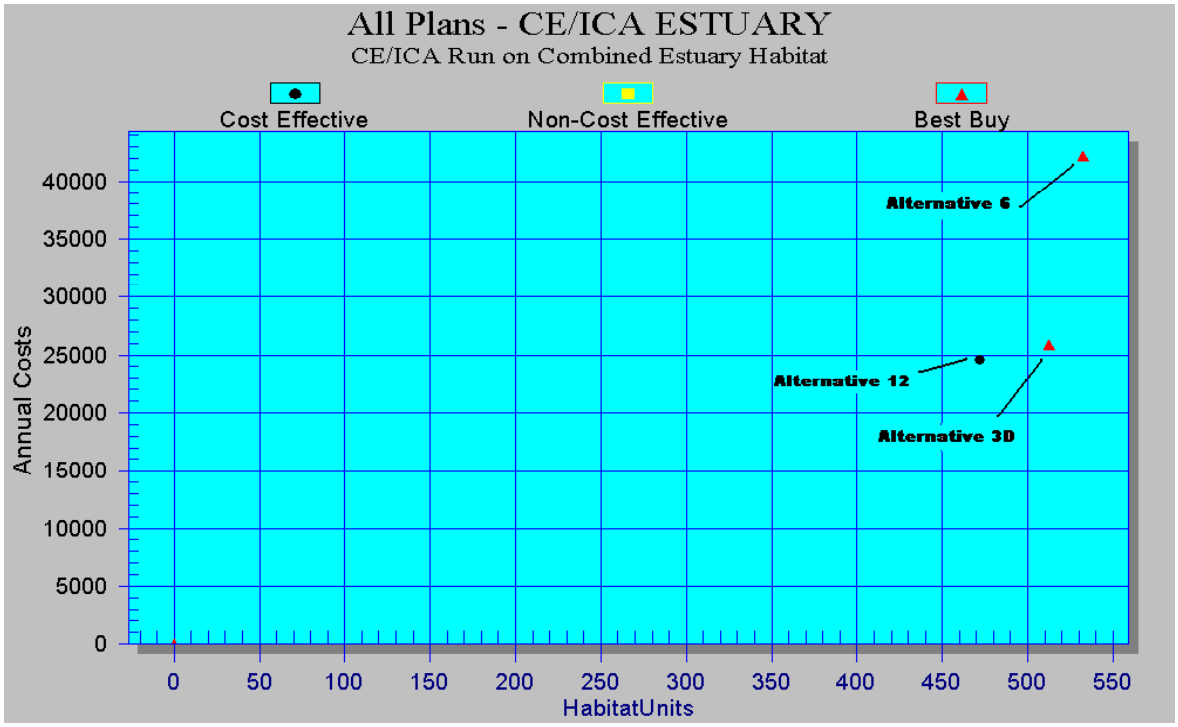
A combined estuary habitat unit was calculated as the combined habitat units for the two species or communities inhabiting the estuary (oysters and nekton). These indicators are combinable due to their relationships and distinct separable spatial extent in the estuary.

Table 29 and Figure 15 show that Alternative 3D, 6 and 12 are cost effective in the production of estuary habitat. Alternative 3D provides a 512.54 habitat units at a per unit cost of ($52,060/HU). Alternative 6 ($79,240/HU) provides only 4% more benefits at more than a 50% increase in cost per habitat unit. Alternative 6's higher costs stem from higher land cost.

Table 29 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Total Estuary Habitat Units

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Total Estuary Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	471.97	52.06	YES
Alternative 3D	25,892	512.54	50.52	YES
Alternative 6	42,187	532.45	79.24	YES

Figure 15 SGGE Alternative Plans - CE/ICA Run On Total Estuary Habitat



E.7.1.2 Cost Effectiveness Analysis – Inland Outputs

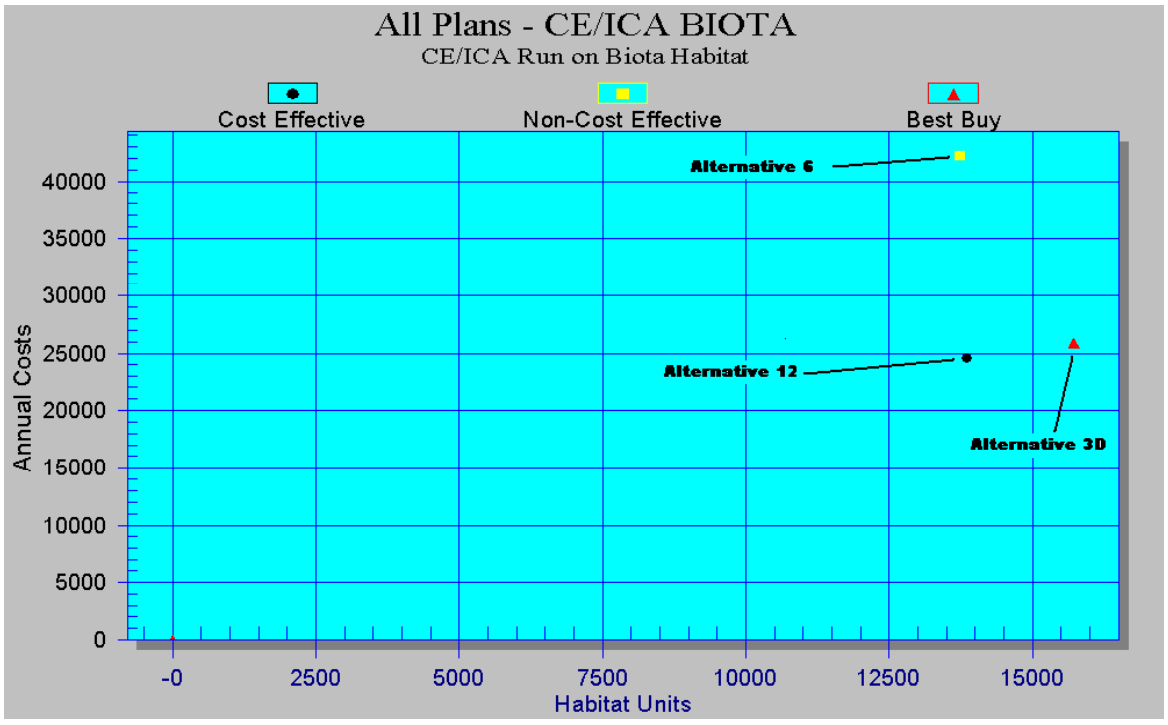
E.7.1.2.1 Cost Effectiveness Analysis – Biota

Table 30 and Figure 16 show that Alternatives 3D and 12 are the only cost effective plans in producing Biota output. Alternative 6 ($3,073/HU) provides almost 2,000 fewer HU's at an average cost that is almost twice as high as Alternative 3D ($1,650/HU). Alternative 6 provides the least amount of lift at the greatest cost. Alternative 12 produces less output than Alternative 3D and at a lower cost.

Table 30 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Biota Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Biota Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 6	42,187	13,731	3.073	
Alternative 12	24,567	13,857	1.773	YES
Alternative 3D	25,892	15,721	1.65	YES

Figure 16 SGGE Alternative Plans - CE/ICA Run On Biota Habitat



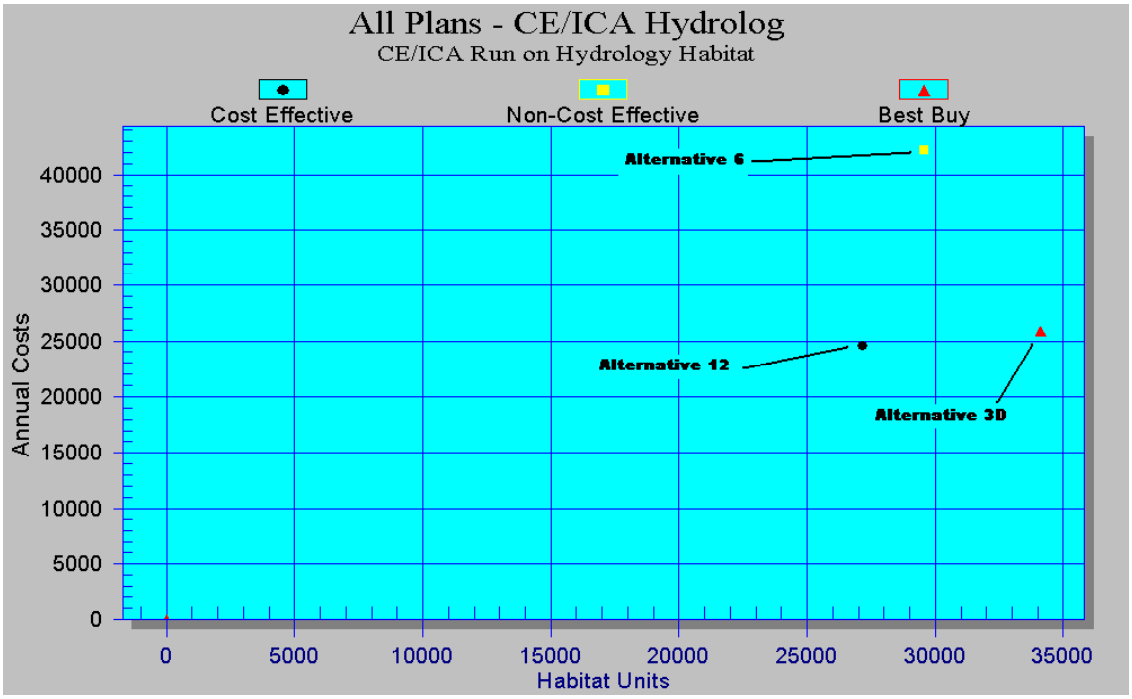
E.7.1.2.2 Cost Effectiveness Analysis – Hydrology

Table 31 and Figure 17 show that Alternatives 3D and 12 are the only cost effective plans in producing Hydrology output. Alternative 6 ($1,794/HU) provides almost 5,000 less HU's at an average cost that is almost twice as high as Alternative 3D ($968/HU). Alternative 12 produces less output than Alternative 3D and at a lower cost, meeting the definition of cost effective.

Table 31 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Hydrology Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Hydrology Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,567	27,189	0.904	YES
Alternative 6	42,187	29,572	1.427	
Alternative 3D	25,892	34,114	0.76	YES

Figure 17 SGGE Alternative Plans - CE/ICA Run On Hydrology Habitat



E.7.1.2.3 Cost Effectiveness Analysis – Combined Inland Habitat Units

An inland habitat unit was calculated as the combined habitat units for the two communities inhabiting the watershed (biota and hydrology). The hydrology and biota habitat were calculating using the same acreage, therefore requiring a

weighted average to determine the total inland habitat units. The team of scientists calculating the habitat units for SGGE determined that both hydrology and biota were of equal importance, meriting both plans be assigned an equal weight of one. In order to obtain the total inland habitat units, the habitat units created from hydrology were added to the habitat units created from biota and averaged.

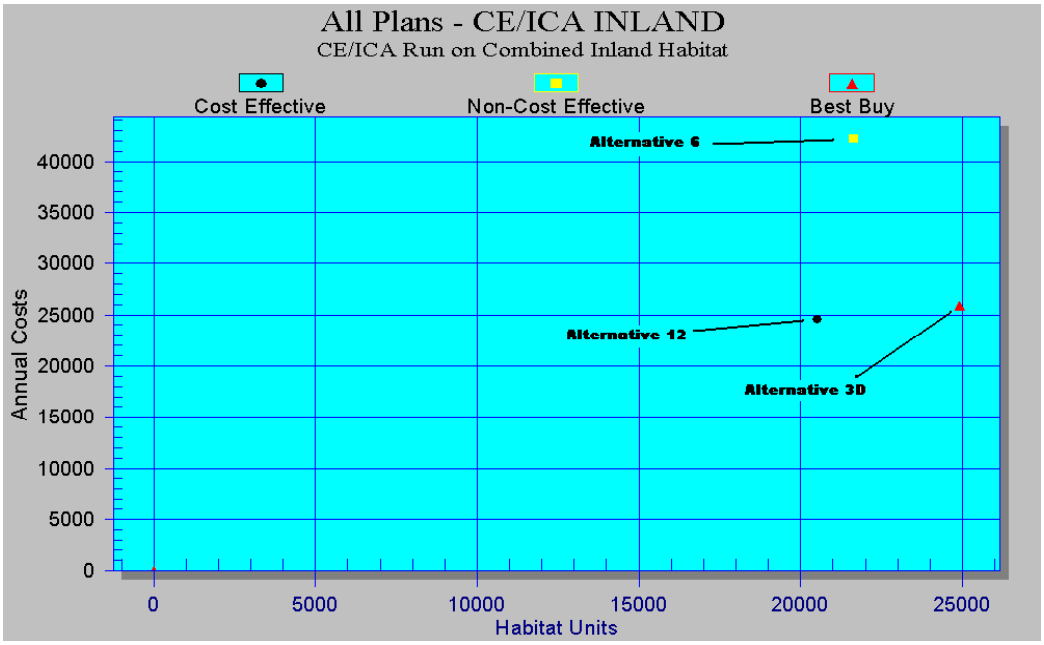
Weighted Inland Total Average = ((Hydrology HU's) + (Biota HU's)) / 2

Table 32 and Figure 18 show that Alternatives 3D and 12 are the only cost effective plans in producing combined inland output. Alternative 6 ($1,949/HU) provides more than 3,000 less HU's at an average cost per unit of output that is almost two times greater than Alternative 3D ($1,039/HU). Both Alternatives 12 and 6 produce less output than Alternative 3D. Alternative 12 produces less output and costs less than Alternative 3D, making it a cost effective plan.

Table 32 Results of Cost Effectiveness Analysis: All Plans and Cost Effective Plans Arrayed by Increasing Output for Each Output Category - Inland Habitat Combined

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Cost Effective?
Plans	**Combined Inland Habitat Units (HU)**			
Without Plan	$0	0	N/A	
Alternative 12	24,5	20,523	1	YES
Alternative 6	42,187	21,651	1.949	
Alternative 3D	25,892	24,917	1.039	YES

Figure 18 SGGE Alternative Plans - CE/ICA Run On Combined Inland Habitat



E.7.2 Incremental Cost Analysis

Tables 33 through 38 and Figures 19 through 24 present the results of incremental cost analysis for the SGGE alternative plans for respective output indicators. All the cost effective plans are arrayed by increasing output to clearly show changes in cost (i.e., increments of cost) and changes in output (i.e., increments of output) of each cost effective alternative plan compared to the Without Plan condition. The plan with the lowest incremental costs per unit of output of all plans is the first Best Buy plan. After the first Best Buy plan is identified, all larger cost effective plans are compared to the first Best Buy plan in terms of increases in (increments of) cost and increases in (increments of) output. The alternative plan with the lowest incremental cost per unit of output (for all cost effective plans larger than the first Best Buy plan) is the second Best Buy plan. There are no more than two Best Buy plans for any output indicator for the SGGE alternatives.

E.7.2.1 Incremental Cost Analysis – Estuary Outputs

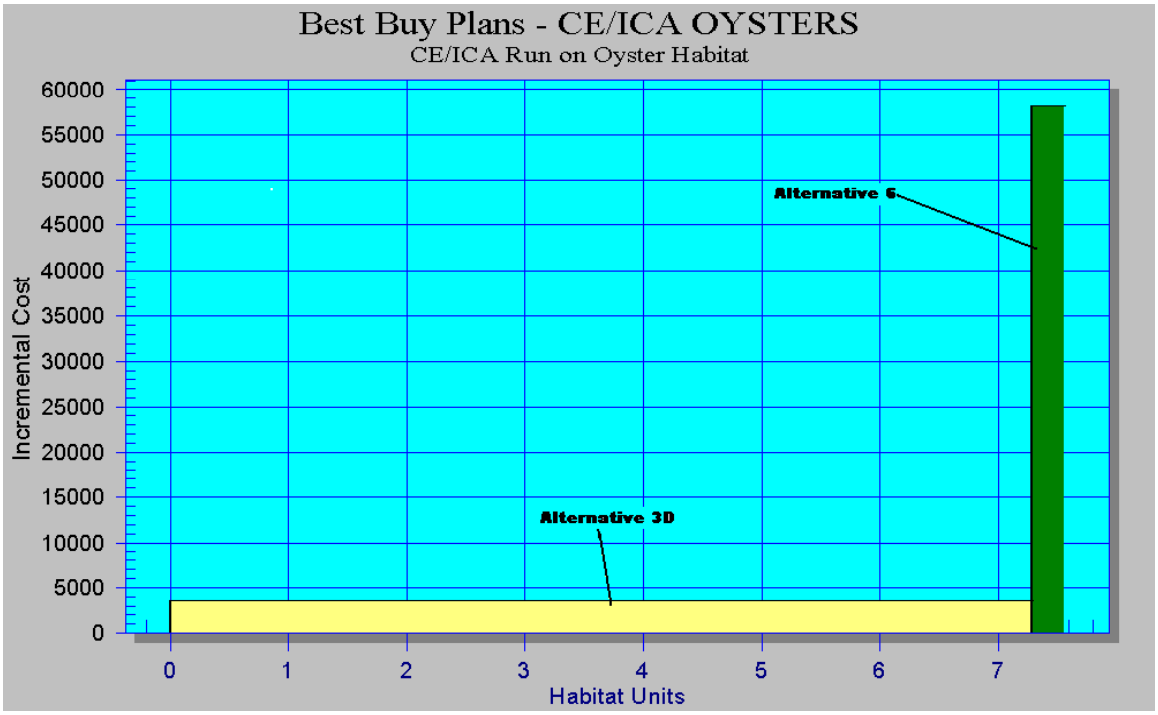
E.7.2.1.1 Incremental Cost Analysis – Oyster Habitat Units

Table 33 and Figure 19 show that there is two Best Buy plans for oyster habitat, Alternative 3D and Alternative 6. Looking at the box graph an obvious spike occurs between Alternatives 3D and 6. This spike reflects that Alternative 6 only produces .28 more habitat units at an average annual costs that is over $15,000,000 more than Alternative 3D. Alternative 3D produces 96% of the oyster benefits that Alternative 6 does, yet Alternative 6 cost greater than 60% more than Alternative 3D.

Table 33 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Oyster Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Oyster Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	7.28	3,556	25,892	7.28	3,556	1st Best Buy
Alternative 6	42,187	7.56	5,580	16,295	.28	58,202	2nd Best Buy

Figure 19 Best Buy Plans for Oyster Habitat



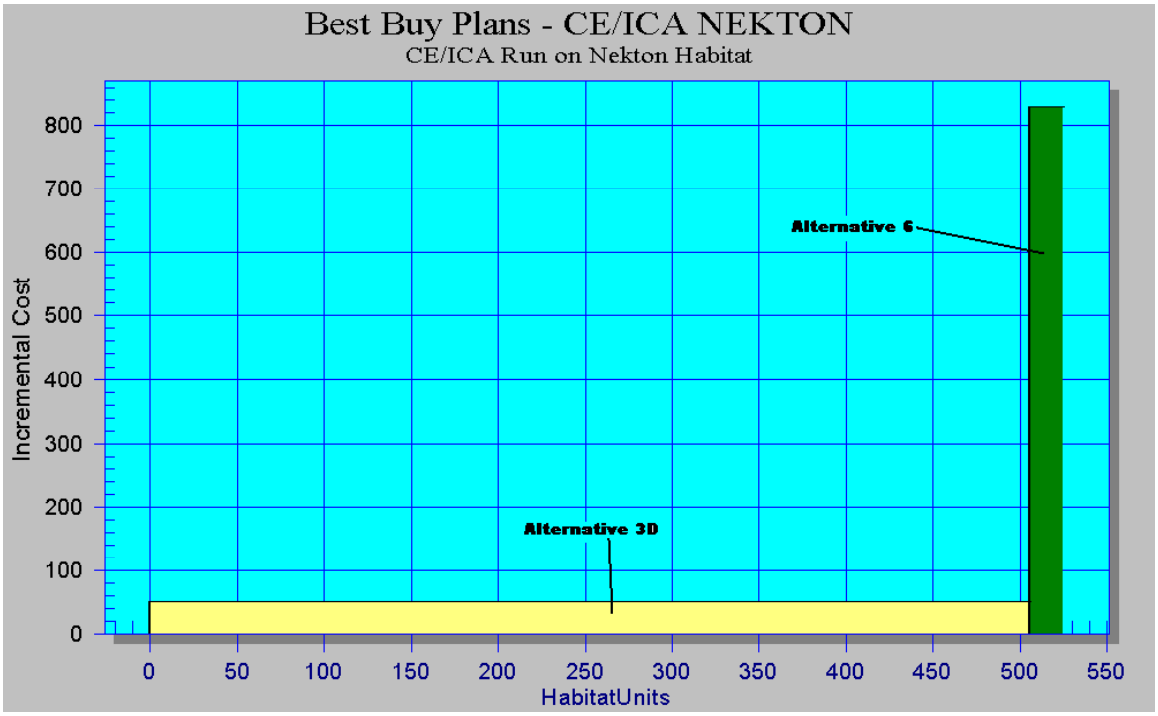
E.7.2.1.2 Incremental Cost Analysis – Nekton Habitat Units

Table 34 and Figure 20 show that there are two best buy plans for nekton habitat, Alternatives 3D and 6. Alternative 3D has the lowest incremental costs per unit of nekton output of any of the alternatives ($51,250 per HU). This stands to reason, as this alternative does not include the real estate costs for the area north of Southern Golden Gate Estates. The next best alternative in terms of nekton habitat is Alternative 6. It provides an increment of 19.64 additional HU's over Alt 3D (at a high incremental cost of $829,770 per unit of nekton habitat), and has a higher average costs ($80,380 per HU). Alternative 6 has an incremental cost per unit of output that is over 16 times greater than Alternative 3D's.

Table 34 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Nekton Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Nekton Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	505.25	51.25	25,892	505.25	51.25	1st Best Buy
Alternative 6	42,187	524.89	80.38	16,295	19.64	829.77	2nd Best Buy

Figure 20 Best Buy Plans for Nekton Habitat



E.7.2.1.3 Incremental Cost Analysis – Combined Estuary Habitat Units

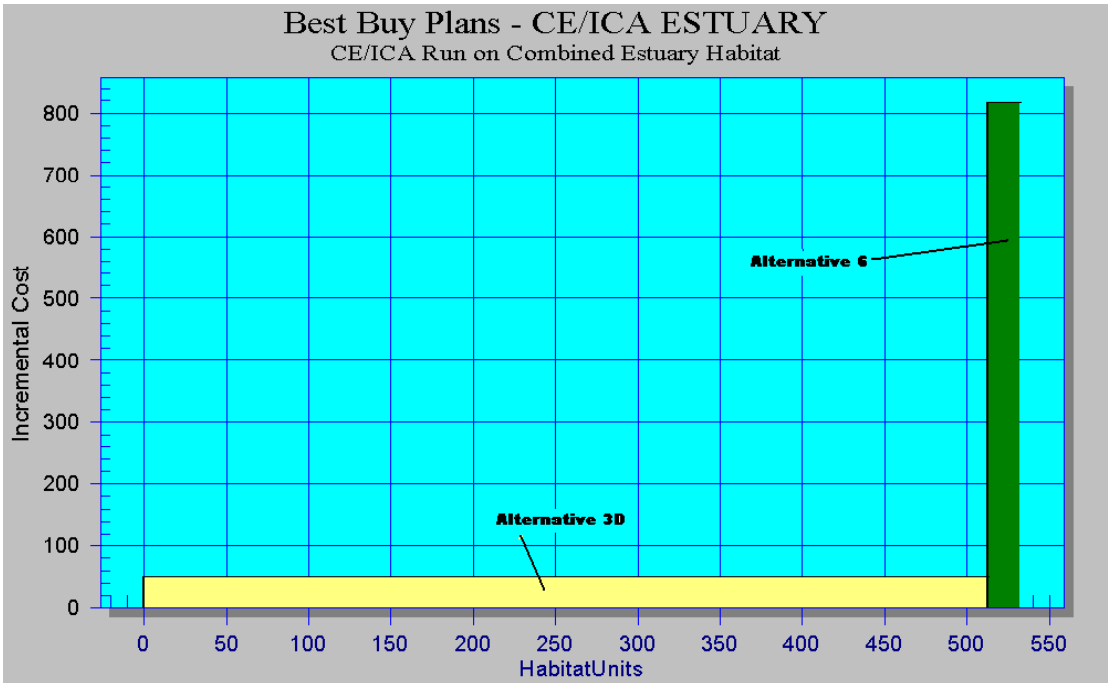
Table 35 and Figure 21 show that there are two best buy plans for combined estuarine habitat, Alternatives 3D and 6. As with both the nekton and oyster best buy box graphs, the same spike can be seen when going from Alternative 3D to Alternative 6. Alternative 3D has the lowest incremental costs per unit of combined estuarine output of any of the alternatives ($50,520/HU). This stands

to reason, as this alternative does not include the real estate costs for the area north of Southern Golden Gate Estates, and can be ascertained that since Alternative 3D had the lowest incremental costs per unit of estuarine outputs separately it would also when combined. The next best alternative in terms of combined estuarine habitat is Alternative 6. It provides an increment of 19.91 additional HU's over Alt 3D (at a high incremental cost of $818,110/habitat unit), and has a higher average costs ($79,240 per HU). Alternative 6 does provide the most total estuarine habitat units (532.45), but it is important to note that it is producing fewer than 4% more estuarine benefits at a cost that is more than 60% greater than Alternative 3D.

Table 35 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Total Estuary Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy
Combined Estuary Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	25,892	512.54	50.52	25,892	512.54	50.52	1st Best Buy
Alternative 6	42,187	532.45	79.24	16,295	19.91	818.11	2nd Best Buy

Figure 21 Best Buy Plans for Combined Estuary Habitat



E.7.2.2 Incremental Cost Analysis – Inland Outputs

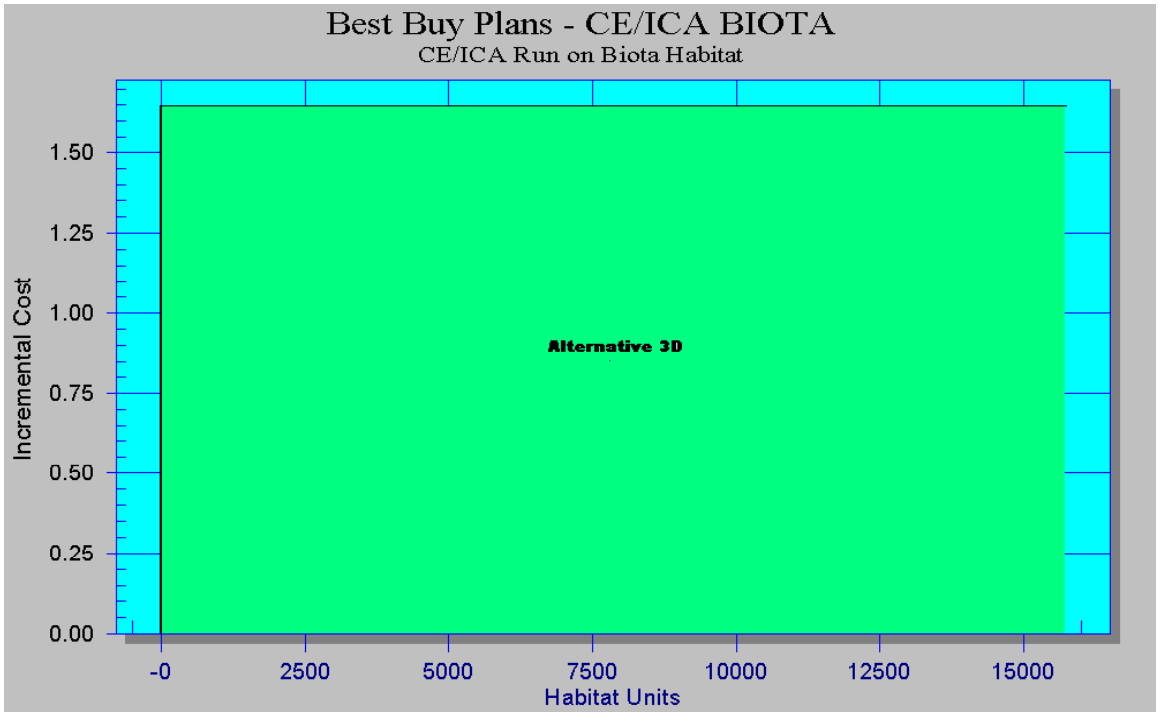
E.7.2.2.1 Incremental Cost Analysis – Biota Habitat Units

Table 36 and Figure 22 show that there is one Best Buy plan for biota habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

Table 36 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Biota Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Biota Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	$25,892	15,721	1.65	25,892	15,721	1.65	Only Best Buy

Figure 22 Best Buy Plans for Biota Habitat



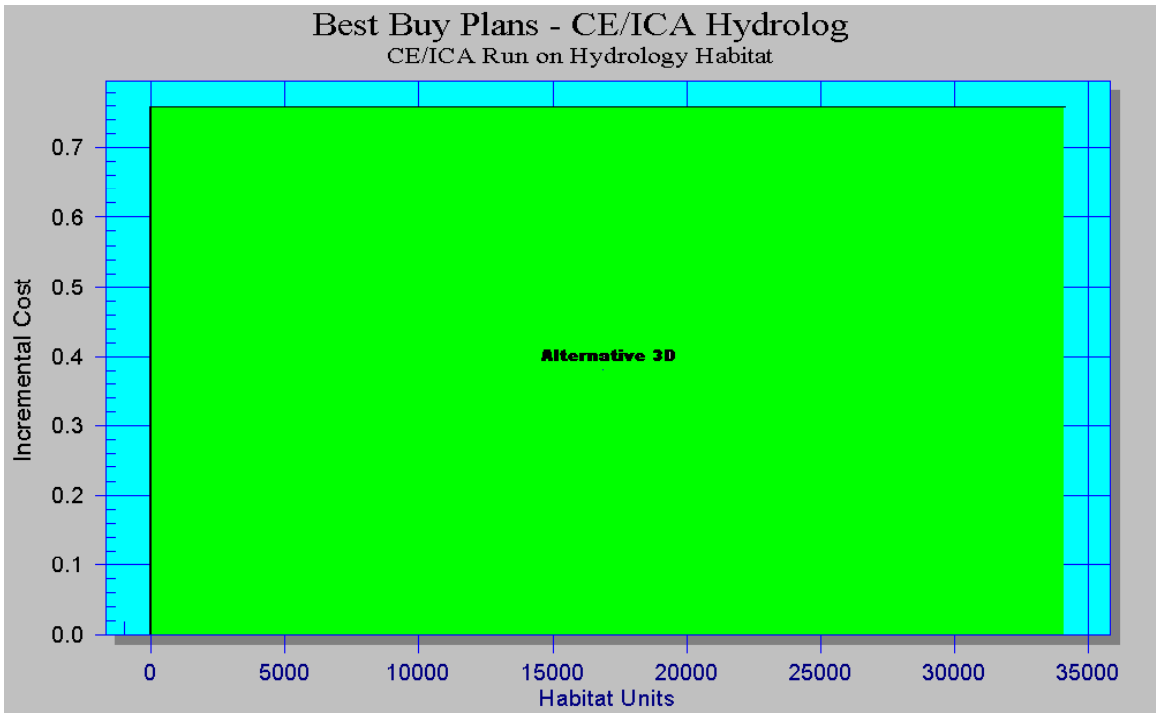
E.7.2.2.2 Incremental Cost Analysis – Hydrology Habitat Units

Table 37 and Figure 23 show that there is one Best Buy plan for hydrology habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

Table 37 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Hydrology Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Hydrology Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	$25,892	34,114	0.759	25,892	34,114	0.759	Only Best Buy

Figure 23 Best Buy Plans for Hydrology Habitat



E.7.2.2.3 Incremental Cost Analysis – Combined Inland Habitat Units

Table 38 and Figure 24 show that there is one Best Buy plan for combined inland habitat, Alternative 3D. Alternative 6 was not a cost effective plan due to the high real estate costs, eliminating it from consideration for a "best buy" plan. Alternative 12 was a cost effective plan with less habitat units created, but since the average cost per habitat unit was greater than Alternative 3D, it was not considered a best buy.

Table 38 Results of Incremental Cost Analysis: Cost Effective and Best Buy Plans Arrayed by Increasing Output for Combined Inland Habitat

	Average Annual Cost ($1000)	Output	Average Cost Per Output ($1,000)	Incremental Average Annual Cost ($1,000)	Incremental Output	Incremental Cost Per Output ($1,000)	Best Buy?
Combined Inland Habitat Units (HU)							
Without Plan	$0	0	N/A	N/A	N/A	N/A	
Alternative 3D	$25,892	24,917	1.039	25,892	24,917	1.039	Only Best Buy

Figure 24 Best Buy Plans for Combined Inland Restoration

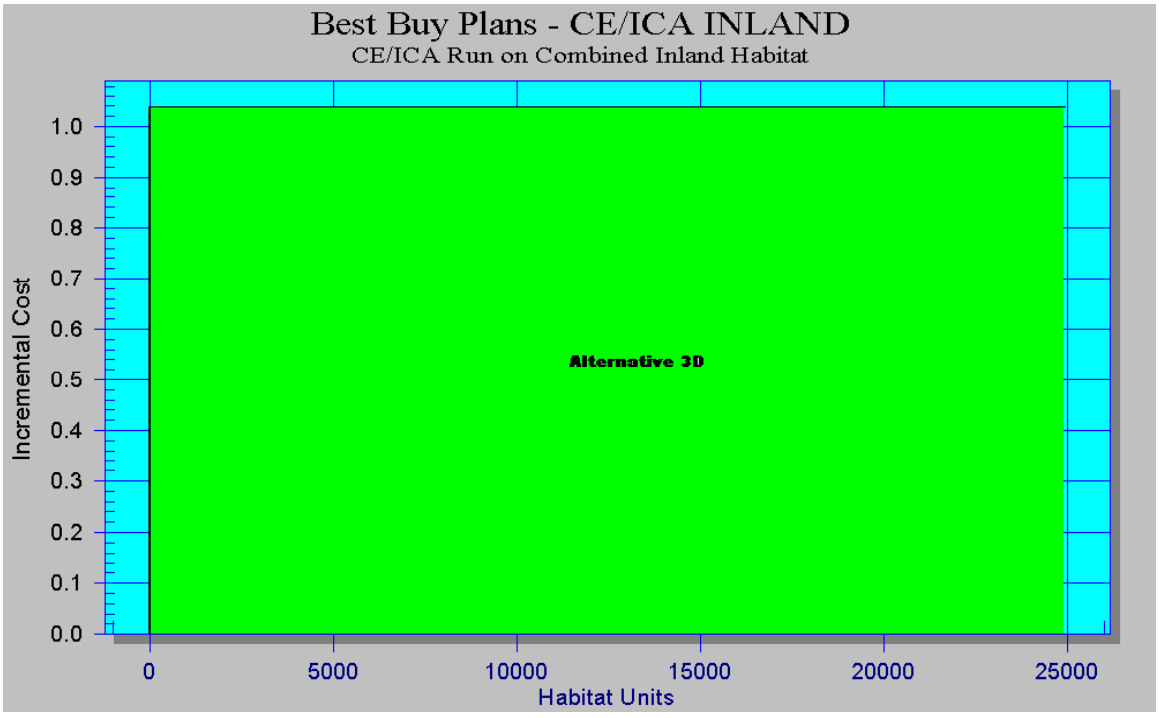


Table 39 below summarizes the results of cost effectiveness and incremental cost analyses for all the ecosystem outputs and metrics used in the analyses. As can be noted from the table below, Alternative 3D is the only alternative that is both cost effective and a best buy for all habitat categories. Alternative 6 costs almost 300 million dollars more than Alternative 3D, while only providing 4% more estuarine benefits. Conversely, Alternative 6 has a 70% increase in total cost over Alternative 3D, and actually provides 15% less inland benefits.

Table 39 Results of Cost Effectiveness and Incremental Cost Analyses

Variable	Alt 3D	Alt 6	Alt 12
Oyster Habitat	Cost Effective Best Buy	Cost Effective Best Buy	Cost Effective
Nekton Habitat	Cost Effective Best Buy	Cost Effective Best Buy	Cost Effective
Total Estuary Habitat	Cost Effective Best Buy	Cost Effective Best Buy	Cost Effective
Biota Habitat	Cost Effective Best Buy		Cost Effective
Hydrology Habitat	Cost Effective Best Buy		Cost Effective
Total Inland Habitat	Cost Effective Best Buy		Cost Effective

These figures assisted in answering the question of "Is it Worth It?" Looking at inland habitat units, is it worth paying more for Alternative 6 to obtain less benefits? This answer to this question is a resounding no. Examining estuarine habitat units, is it worth paying 70% more for less than a 4% increase in benefits. Once again, the answer is no, the small increase in benefits do not warrant the enormous extra expense. This substantial increase in price, relatively large decrease in inland habitat units and minor increase in estuarine habitat units leads to the logical conclusion of screening Alternative 6 from further consideration.

E.8 REGIONAL ECONOMIC IMPACTS

E.8.1 Introduction

The purpose of this section is to evaluate and quantify the economic consequences of the Southern Golden Gate Estates plan implementation. The SGGE implementation impacts on the regional (Charlotte, Collier, Glades, Hendry and Lee) economy are expected to result from expenditures on construction and real estate.

The study region of the impact analysis is defined in the following section. Five types of economic impacts are defined and quantified in the section on impact categories. The general methodology used in the evaluation of regional impacts with simple numerical examples drawn from South Florida is explained in the method of regional impact analysis section. The results of the computations are presented in the final section.

E.8.2 Defining The Study Area

The Southern Golden Gates Estates study area is contained within Collier County. The national and state statistical systems that provide the data for the regional economic analysis make it impractical to isolate the economic activities of parts of counties, and the RIMS II1 multipliers available for our use are limited to specific regions in Florida. The regional economic impact multipliers of the SGGE plan are included in the Southwest Region of RIMS II. The Southwest Region provides multiplier data that corresponds to Charlotte, Collier, Glades, Hendry and Lee Counties.

The magnitude of the economic impacts on the local region may be evaluated in relation to their causes. These cover a range of anticipated effects. First are the impacts due to the actual construction costs of all the components of each alternative. Second are the impacts due to the costs of the land purchases required by the components for each alternative. Two additional categories of costs will occur on an annual basis once the project begins: the cost of monitoring the project and the cost associated with operating and maintaining the components of each alternative. Each of these categories is discussed in the next section.

1 Regional Input-Output Modeling System (RIMS II), an input-output regional economic model developed by the U.S. Bureau of Economic Analysis. See Section F.11.4.1 for further analysis.

E.8.3 The Impact Categories

The two categories of impacts that will be considered are: (a) impacts due to construction activities and impacts due to operations, maintenance and monitoring costs.

E.8.3.1 Construction

Construction costs, the most significant of the impact categories, were derived by summing up the costs of all the plan features for each alternative. These were estimated by summing the detailed line items of each feature. These aggregate costs were categorized as new conservation and development facilities for RIMS II analysis.

E.8.3.2 Operation And Maintenance (O & M)

O&M costs were estimated for each alternative plan. These estimates were aggregated and the total average annual O&M costs are represented in Table F-30. These costs were treated as "conservation and development facilities-O&M" for RIMS II analysis.

E.8.3.3 Total Project Costs And Annual Project Costs

Total construction and real estate costs for each alternative plan are summarized in Table 40, lines 1 and 2. Annual monitoring and O & M costs for the alternative plans are summarized in Table 40 lines 4 and 5.

Table 40 Summary of Total Project Costs and Annual Costs

	ALT 3D	ALT 6	ALT 12
Construction cost	112,204,200	51,576,700	110,751,600
Lands	250,408,000	686,832,000	240,537,000
Total Initial cost	362,612,200	738,408,700	351,288,600
Annual Monitoring	700,000	700,000	700,000
Annual Operation and Maintenance	2,129,000	175,000	1,498,000

*Alternative 3D costs were updated as part of the detailed design of the recommended plan, and were not included in the plan selection process, but are included in the Recommended Plan (SECTION 8) of the main report.

E.8.4 The Method Of Regional Impact Analysis

E.8.4.1 The Regional Input-Output Structure

The regional impacts analyzed in this report have been estimated using information from the U.S. Department of Commerce's Regional Input-Output Modeling System, (RIMS II). RIMS final demand multipliers provide a way to estimate the consequences of economic activity stimulated by project implementation. Final demand multipliers can be thought of as a way to calculate the economic impact dollars spent by one industry on all industries in a given economy. For example, one dollar spent in one industry will generate financial activity for another industry within a community; that is, to purchase food, clothing, housing or other goods, or to pay taxes.

The types of economic impacts that a new project can have on output (sales), earnings, and employment in a region are known as "direct," "indirect," and "induced." The first round of expenditures for the project causes direct impacts. The indirect impacts count the inputs that are purchased as a result of the first round expenditures. Indirect effects will vary in significance depending on the complexity of production in the study area and the degree to which local producers supply required materials. Induced impacts are the cumulative economic effects that result from the spending of the workers' earnings. These three impacts combine to form the final demand impacts of a project in the study area.

The three RIMS final demand multipliers are as follows, where COSTS are the Project Costs as seen on Table 23:

OUTPUT MULTIPLIERS: measure the dollars of total output generated in a defined geographic economy for each dollar of product produced or delivered by a given industry

Total Output = Total Operating Expenses (COSTS) x Output Multiplier

EARNINGS MULTIPLIERS: measure the earnings/purchasing power that an industry generates, through its payroll and the multiplier effects, to households employed in all local economies.

Aggregate Housed Income = Total Operating Expenses (COSTS) x Earnings Multiplier

EMPLOYMENT MULTIPLIERS: measure the number of part-time and full-time (-full time equivalent (FTE)'S) jobs generated within a given industry needed to deliver $1million of products or services to the final demand market within a geographic area.

FTE Jobs Supported = (Total Operating Expenses (COSTS)/1,000,000 x Employment Multiplier

In assessing the impacts presented in this report, the limits of the RIMS methodology should be recognized. The data used to develop the RIMS II multipliers were based on 1992 regional economic data. These data may not capture the variances in today's economy, but should provide a reasonable impact estimate. Proper use of the RIMS II 1992 multipliers requires that total cost estimates first be price-adjusted to 1992 price level using a CORPS published construction index (Civil Works Construction Cost Index System (CWCCIS) 31 Mar 2001). The effects of the costs at the 1992 level were then calculated, using the 1992 RIMS II multipliers. These impacts were then price-adjusted to 2004 figures by utilizing the appropriate CPI index published by the Bureau of Labor Statistics.

Keeping these limitations in mind, it is important to recognize that RIMS multipliers are based on a formal and widely accepted national analysis of economic activity. The RIMS analysis continues to provide a consistent method to quantify the economic impact of construction projects at the regional level.

The RIMS II multipliers and CPI data used in this evaluation are described below.

1992 RIMS II Multipliers:
Southwest Region (Charlotte, Collier, Glades, Hendry and Lee Counties)

Industry - ("Conservation and development facilities – New")
Output – 1.6817
Earning – 0.6759
Employment – 30.3

Industry - ("Conservation and development facilities – O&M
Output – 1.6037
Earning – 0.7274
Employment –32.0

Construction Index:

1992	- 422.05
2004	- 538.94

CPI Index:

1992	- 140.3
2003	- 184

E.8.5 Regional Economic Impacts

E.8.5.1 Overall Impacts: Output (Sales), Jobs, And Earnings

The impact of all the categories of expenditure on gross output (sales), jobs, and earnings were computed for each alternative. The impacts represent the effects resulting from construction spending during project implementation and will occur during the construction period, expected to last 4 years beginning in 2006.

At first glance the figures from the following table look like enormous impacts resulting from the construction spending required to implement the various project components. When placed in the context of Collier County, however, these effects generally represent a very small percentage of the total economic activity taking place in this region.

Table 41 Overall Regional Economic Impacts of the Southern Golden Gate Estates Alternatives

Alternative	Project Component	Impacts			Project Costs ($)
		Output ($1,000's)	Earnings ($1,000's)	Employment (FTE)	
ALT 3D	Construction	194,110	78,016	2,662	112,204,200
	O & M (Annual)	3512	1593	53	2,129,000
ALT 6	Construction	89,226	35,861	1,224	51,576,700
	O & M (Annual)	388	131	4	175,000
ALT 12	Construction	191,597	77,006	2,628	110,751,600
	O & M (Annual)	2471	1121	38	1,498,000

Sample Calculations (for above tabulation of "Overall Regional Economic Impacts of SGGE Construction") for the alternative plans are delineated below:

Output Regional Impact
= (Component Cost) x (1992 Construction Price Index Adjustment Factor) x (RIMS II 1992 Output Multiplier for Study Area) x (CPI Output Price Level Adjustment Factor)
=$112,204,200 x (422.05/538.94) x 1.6817 x (184.3/140.3)
=$194,110 ($1,000's of dollars)

Earnings Regional Impact
= (Component Cost) x (1992 Construction Price Index Adjustment Factor) x (RIMSII 1992 Earnings Multiplier for Study Area) x (CPI Output Price Level Adjustment Factor)
= $112,204,200 x (422.05/538.94) x .6759 x (184.3/140.3)
= $78,016 ($1,000's of dollars)

Employment Regional Impact:
= (Component Cost)/$1,000,0000 x (1992 Construction Price Index Adjustment Factor) x (RIMSII 1992 Employment Multiplier for Study Area)
= $112,204,200 /$1,000,000 x (422.05/538.94) x 30.3
= 2,662

It is important to remember that the construction not a one-year injection into the regional economy, but will be broken up over a number of years. The effects of the annual spending on the regional economy will prove even less significant than viewing the expenditures in total. Since the impacts are likely to occur in varying magnitude over time, the summary effects given in Table 28 represent the upper limit if all these impacts were to occur simultaneously. In reality, the impacts of the construction last only as long as those activities are carried out. The impacts represent the effects resulting from construction expenditures during project implementation that is expected to last four years beginning in 2006. The impacts of the monitoring and operation-maintenance costs begin at a relatively low level at the time the project is initiated, rise to a maximum, and then continue at a constant level once the project is completed.

These effects are noteworthy, to be sure, but the relative impact on the regional economy is quite small, mirroring the estimate regional impact of the overall CERP project estimated in the Comprehensive Review Study.

Table 42 contains the labor employment and earnings of each county represented by the various projects. The gross state product (GSP) for Florida is presented for a comparison to the output (sales) created by the construction projects.

Table 42 Regional Totals

Region	Earnings (2000)2 (thousands of dollars)	Employment (2002)3	Output (1999)4
Charlotte	$3,511,055	54,703	
Collier	$10,197,520	114,551	
Glades	$166,163	3,395	
Hendry	$736,082	13,168	
Lee	$11,833,582	189,490	
Southwest Total	$26,444,402	375,307	
Florida			$442,895,000,000

When comparing the impacts of construction, as shown in Table 43, to the actual total figures for the counties and state, it is important to recognize that the latest earnings data available were from 2000 census data. These figures have increased since 2000, but are considered sufficient for this analysis. It should be noted that these calculated comparison percentages will appear larger than the actual representative percentages based on up to date earnings and output data, meaning the impact will not be as great. The comparison percentages of the total regional economy to construction impacts involved in the various projects are represented in the following table. The total output (sales) for the counties and the Southwest Region is not available at this time. The total output for the state of Florida will be used for this generalization. The impacts are compared to the figures of the respective region.

Table 43 Construction Impacts vs Actual Demographic Figures

Alternative		Employment	Earnings ($1,000s)	Output ($1,000s)
ALT 3D	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	2,662 375,307 0.71	$78,016 $26,444,402 0.30	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$194,110 $442,895,000 0.04
ALT 6	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	1,224 375,307 0.33	$35,861 $26,444,402 0.14	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$89,226 $442,895,000 0.02
ALT 12	Annual Impact to the Southwest Region Published Current Amount Percent of Regional Economy	2,628 375,307 0.70	$77,006 $26,444,402 0.29	
	Florida Regional Effect Published Current Amount Percent of Regional Economy			$191,597 $442,895,000 0.04

2 Bureau of Economic Analysis, Regional Accounts Data, Local Area Personal Income, 1999
3 State of Florida, Local Area unemployment Statistics by County, January 2001
4 Bureau of Economic Analysis, US Department of Commerce, June 2001.

E.9 OTHER SOCIAL EFFECTS

E.9.1 Overview

The Other Social Effects (OSE) account considers the effects of alternative plans in areas that are not already contained in the NED and RED accounts. The categories of effects contained within the OSE account include:

- Urban and community impacts,
- Life, health, and safety factors,
- Displacement,
- Long-term productivity, and
- Energy requirements and energy conservation.

The SGGE alternative restoration plans could result in beneficial and adverse OSE within the study area. As is evident throughout this appendix, a variety of positive and adverse NED impacts on water supply (agricultural and urban), flood damage reduction and recreation are expected to result from SGGE restoration. Similarly, the alternative restoration plans could have positive or adverse OSE impacts on the study area associated with (1) plan implementation, including land acquisition, project construction, and operations and maintenance (O&M) activities, and (2) operation of the modified C&SF system. As in the case of the NED effects, the OSE account is concerned with the net effects of the alternative plans (i.e., the differences between the with- and without-project future conditions).

Some of the potential OSE impacts would occur primarily at the regional scale, and others would have more localized effects. At both scales, there may be some individuals and communities that are positively affected by SGGE restoration, some that are adversely affected, and many that are not affected at all. Relative to the size of the regional or local economies, the OSE effects may be minimal. However, if these effects occur predominantly within a limited geographic area, or affect a relatively small or vulnerable population, then the impacts can be disproportionately large. Therefore, the purposes of OSE analysis include not only determining the total magnitude of potential impacts, but also identifying the population (and its characteristics) which would be affected by any proposed action.

Some of the categories of effects typically included in the OSE account do not pertain to the alternative restoration plans. For example, the alternative plans are not expected to affect energy use or energy conservation in the study area.

As will be noted, other categories of potential OSE impacts have been addressed previously in this appendix.

E.9.2 Potential Urban And Community Impacts

An urban and community impact is the principal category of potential OSE impacts associated with the alternative restoration plans. This category of impacts includes effects on income distribution, employment distribution, population distribution and composition, and quality of community life. Some urban and community impacts have previously been addressed in this appendix. For example, regional income effects and fiscal impacts were discussed in the Regional Economic Development analysis. In addition, the impacts of agricultural water supply and municipal and industrial water supply were discussed in detail in earlier sections. The OSE assessment of urban and community impacts considers both the potential for exposure to the effects of the alternative restoration plans and the degree of vulnerability to potential impacts. Exposure refers to whether an individual or community is subject to the other social effects of the alternative plans. Vulnerability refers to the ability of that individual or community to respond or adjust to those effects.

Potential urban and community impacts of the alternative restoration plans could result from: land acquisition and potential relocation of populations for project construction features and construction activity associated with plan implementation. In general, construction activity is considered to have positive impacts. At the local scale, construction and O&M activities associated with the alternative restoration plans can have positive effects to local residents and communities by providing jobs, increasing local wages, increasing local sales, increasing tax revenues and generally benefiting the local economy.

There are a variety of social and economic factors that are important determinants of an individual's or community's ability to cope with adversity. One of the most important economic factors in the ability of individuals and groups to respond is the number of employment alternatives available locally. The ability to find another job depends on the education and training of the work force as well as the needs of local economic concerns, such as other farms, agricultural-related services, or some other local business. The socio-economic makeup of the community is also an important consideration of the ability of individuals and the community at large to cope with the adverse effects of large-scale agricultural land conversion. Some groups in society are recognized as having less opportunity to respond to adversity. These groups include ethnic and racial minorities, the elderly, and the poor. Table 44 presents a socio-economic vulnerability profile for each of the study area counties. This profile contains information that indicates the ability of the county population to respond to social and economic adversity. It is important to recognize that the

county scale may not accurately reflect the ability of any given community or groups within a community to accommodate potential changes associated with the alternative restoration plans.

Table 44 contains the racial/ethnic mix of each of the study area counties, as well as population over 65 years of age, 1990 unemployment, per capita income, and the expected changes in employment and income from 1990 to 2010.

Table 44 Socio-Economic Vulnerability Profile

County	White	Black	American Indian	Hispanic*	Other	Population Over 65	Unemployment Rate (1990)	1997 Per Capita Income**	Percent of Population Below Poverty Level
Collier	86.1%	4.5%	0.3%	19.6%	6.2%	24.5%	4.0%***	$24,799	12.5%

Source: Fedstats.gov
*Hispanic can be any race.
**(% relative to state average)
*** Naples Metropolitan Area

Although the restoration of the SGGE ecosystem is a unique undertaking, there have been other projects and programs with similar goals and socio-economic contexts. One study conducted by the U.S. Department of the Interior assessed the national and regional economic impacts of not allowing timber harvests in certain old-growth forests in Oregon in order to protect the Northern Spotted Owl. One aspect of this study investigated the re-employment of timber workers who had been displaced by the cessation of local logging activities. Surveys of displaced loggers suggested that they found that 57% of displaced workers reported post-displacement wages equal to or above their previous wages. According to the Bureau of Labor Statistics, 92% of displaced workers find new jobs within one year, and the remaining 8% find jobs within two years.

E.10 ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires the Federal Government to achieve environmental justice by identifying and addressing high, adverse and disproportionate effects of its activities on minority and low-income populations. It requires the analysis of information such as the race, national origin, and income level for areas expected to be impacted by environmental actions. It also requires Federal agencies to identify the need to ensure the protection of populations relying on subsistence consumption of fish and wildlife, through analysis of information on such consumption patterns, and the communication of associated risks to the public.

The SGGE project will provide benefits to quality of life by improving the natural environment we live in. The SGGE projects feature of wetland restorations and improved water discharge, which by design, are in locations remote from urban populations such that negative impacts are eliminated for all communities. The SGGE is a congressionally approved project funded with Federal and State dollars to make improvements to hydrology for man and the environment.

The SGGE does not present any environmental impacts that are high, adverse and disproportionate to low income, minority or Tribal populations. Through the public participation process of the outreach and NEPA scoping no high and adverse impacts became known. There was sufficient public input to feel confident that scoping was successful and that the breadth of the potential impacts were communicated and understood by the public. Therefore with no high and adverse impacts there is nothing that would require a disproportionate impact analysis. Thus this NEPA process has found no evidence of high, adverse and disproportionate impacts.

Project sites are located based upon hydrologic characteristics, land availability and interconnection to existing canals and structures to optimize operations. Furthermore, in the consideration of the project site, urban areas are avoided to eliminate the negative impacts typically associated with site location of large projects. Through "willing seller agreements" a variety of land rights have been or will be acquired that allow the use of land for the resulting improvements to the human quality of life and the intended environmental benefits intended by the SGGE.

These environmental benefits provide quality of life improvements to all people and primarily to people in the communities within the SGGE study area. Existing canals will be operationally and physically changed to allow water to sheet flow similar to historical conditions and will help eliminate peak

detrimental storm water runoff and add other beneficial water related purposes. By the nature of design, this operating procedure will maintain if not improve flood control. This will improve the quality of human life by providing increased wildlife activity; a special bonus for those who appreciate seeing increases in fish and bird populations. This logically translates to the increased benefits in enjoyment, aesthetics, and economics for sport fishing.

Most lands acquired for SGGE projects will not cause a significant amount of persons to relocate. The vast majority of the land was unimproved and did not require physically relocating persons. The results of the outreach scope, that was directed at property owners as well as residents, was such that many owners did not even know where their property was. Census data only applies to residents and thus has limited value in fully portraying the demographics of those effected.

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APPENDIX F

REAL ESTATE PLAN

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U.S. Army Corps of Engineers

REAL ESTATE PLAN
Appendix "F"

For

Central & Southern Florida Project, Comprehensive Everglades Restoration Plan, Picayune Strand Hydrologic Restoration Project

Prepared by:

Department of the Army
Jacksonville District
Corps of Engineers

Real Estate Division

September 2004

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REAL ESTATE PLAN

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F.1 STATEMENT OF PURPOSE OF THE REAL ESTATE PLAN (REP)

The purpose of this Real Estate Plan (REP) is to present the overall real estate requirements, costs, acquisition schedules, and other real estate requirements necessary for the Central and Southern Florida, Comprehensive Everglades Restoration Plan, Picayune Strand Hydrologic Restoration Project. This Real Estate Plan is tentative in nature and both the final real property acquisition lines and estimates of value are subject to change after approval of the decision document to which this Plan is appended.

F.2 PROJECT AUTHORIZATION

Along with the C&SF Restudy, the Picayune Strand Hydrologic Restoration PIR is authorized by *Section 309(l)* of the *Water Resources Development Act of 1992* (Public Law 102-580) which states:

> *"(1) CENTRAL AND SOUTHERN FLORIDA. -- The Chief of Engineers shall review the report of the Chief of Engineers on central and southern Florida, published as House Document 643; 80th Congress, 2nd Session, and other pertinent reports, with a view to determining whether modifications to the existing project are advisable at the present time due to significantly changed physical, biological, demographic, or economic conditions, with particular reference to modifying the project or its operation for improving the quality of the environment, improving protection of the aquifer, and improving the integrity, capability, and conservation of urban water supplies affected by the project or its operation."*

This study is also authorized by two resolutions of the Committee on Transportation and Infrastructure, United States House of Representatives, dated September 24, 1992. The first resolution states:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, Eightieth Congress, Second Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply and other purposes."*

The second resolution states:

> *"Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and Harbors, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, Eightieth Congress, Second Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of environmental quality, water supply and other purposes for Florida Bay, including a comprehensive, coordinated ecosystem study with hydrodynamic modeling of Florida Bay and its connections to the Everglades, the Gulf of Mexico, and the Florida Keys Coral Reef ecosystem."*

The *Water Resources Development Act of 1996* was enacted on October 12, 1996. *Section 528* of the Act (Public Law 104-303) entitled "Everglades and South Florida Ecosystem Restoration" authorizes a number of ecosystem restoration activities and also provides specific direction and guidance for the CERP.

> *(b) RESTORATION ACTIVITIES-*
> *(1) COMPREHENSIVE PLAN-*
> *(A) DEVELOPMENT-*
> *(i) PURPOSE- The Secretary shall develop, as expeditiously as practicable, a proposed Comprehensive Plan for the purpose of restoring, preserving, and protecting the South Florida ecosystem. The Comprehensive Plan shall provide for the protection of water quality in, and the reduction of the loss of fresh water from, the Everglades. The Comprehensive Plan shall include such features as are necessary to provide for the water-related needs of the region, including flood control, the enhancement of water supplies, and other objectives served by the Central and Southern Florida Project.*
> *(ii) CONSIDERATIONS- The Comprehensive Plan shall—*
> *(I) Be developed by the Secretary in cooperation with the non-Federal project sponsor and in consultation with the Task Force; and*
> *(II) Consider the conceptual framework specified in the report titled "Conceptual Plan for the Central and Southern Florida Project Restudy," published by the Commission and approved by the Governor.*
> *(B) SUBMISSION- Not later than July 1, 1999, the Secretary shall—*
> *(i) Complete the feasibility phase of the Central and Southern Florida Project comprehensive review study as authorized by section 309(l) of the Water Resources Development Act of 1992 (106 Statue.*

4844), and by two resolutions of the Committee on Public Works and Transportation of the House of Representatives, dated September 24, 1992; and

(ii) Submit to Congress the plan developed under subparagraph (A)(i) consisting of a feasibility report and a programmatic environmental impact statement covering the proposed Federal action set forth in the plan.

(C) ADDITIONAL STUDIES AND ANALYSES- Notwithstanding the completion of the feasibility report under subparagraph (B), the Secretary shall continue to conduct such studies and analyses as are necessary, consistent with subparagraph (A)(i).

A design agreement to perform project engineering and design (PED) activities including adaptive assessment and monitoring in support of CERP was executed on May 12, 2000 between the U.S. Army Corps of Engineers (Corps) and South Florida Water Management District (SFWMD). This agreement provides for the SFWMD to receive in-kind credit for design work. A Master Program Management Plan (MPMP) for the CERP was executed on August 24, 2000, outlining the protocols and procedures by which project management plans for all projects included in the agreement would be completed. This document conforms to the guidance provided within the MPMP.

In *Section 601* of the *Water Resources Development Act of 2000* (PL 106-541), Congress approved the Central and Southern Florida (C&SF) Project Comprehensive Review Study Integrated Feasibility Report and Programmatic Environmental Impact Statement (known as the "Yellow Book"), which describes and outlines the Comprehensive Everglades Restoration Plan (CERP):

(b) Comprehensive Everglades Restoration Plan –

(1) Approval -

(A) IN GENERAL. —Except as modified by this section, the Plan is approved as a framework for modifications and operational changes to the Central and Southern Florida Project that are needed to restore, preserve, and protect the South Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The Plan shall be implemented to ensure the protection of water quality in, the reduction of the loss of fresh water from, and the improvement of the environment of the South Florida ecosystem and to achieve and maintain the benefits to the natural system and human environment described in the Plan, and required pursuant to this section, for as long as the project is authorized.

Finally, WRDA 2000 requires that a PIR:

> *(4) PROJECT-SPECIFIC ASSURANCES-*
> *(A) PROJECT IMPLEMENTATION REPORTS-*
> *(i) IN GENERAL- The Secretary and the non-Federal sponsor shall develop project implementation reports in accordance with section 10.3.1 of the Plan.*
> *(ii) COORDINATION- In developing a project implementation report, the Secretary and the non-Federal sponsor shall coordinate with appropriate Federal, State, tribal, and local governments.*
> *(iii) REQUIREMENTS- A project implementation report shall--*
> *(I) be consistent with the Plan and the programmatic regulations promulgated under paragraph (3);*
> *(II) describe how each of the requirements stated in paragraph (3)(B) is satisfied;*
> *(III) comply with the National Environmental Policy Act of 1969 (42 U.S.C. 4321 et seq.);*
> *(IV) identify the appropriate quantity, timing, and distribution of water dedicated and managed for the natural system;*
> *(V) identify the amount of water to be reserved or allocated for the natural system necessary to implement, under State law, subclauses (IV) and (VI);*
> *(VI) comply with applicable water quality standards and applicable water quality permitting requirements under subsection (b)(2)(A)(ii);*
> *(VII) be based on the best available science; and*
> *(VIII) include an analysis concerning the cost-effectiveness and engineering feasibility of the project.*

F.3 PICAYUNE STRAND HYDROLOGIC RESTORATION (formerly known as SOUTHERN GOLDEN GATE ESTATES PROJECT) AS DESCRIBED IN THE OTHER PROJECT ELEMENTS OF THE CENTRAL AND SOUTHERN FLORIDA PROJECT COMPREHENSIVE REVIEW STUDY DATED APRIL 1999

In the Central & Southern Florida Project, Comprehensive Review Study (Yellow Book), Southern Golden Gate Estates Hydrologic Restoration Project (now known as Picayune Strand Hydrologic Restoration Project) was discussed in the Section 9.1.9.1 as part of the Recommended Comprehensive Restoration

Plan, in Appendix A6, section A6.3.4.2, and on page F-78 of the Real Estate Appendix (Appendix F). The description in Section 9.1.9.1 provides as follows:

> "*9.1.9.1 Southern Golden Gate Estates Restoration (OPE)*
>
> *This feature includes a combination of spreader channels, canal plugs, road removal and pump stations in the Western Basin and Big Cypress, Collier County, south of I-75 and north of U.S. 41 between the Belle Meade Area and the Fakahatchee Strand State Preserve.*
>
> *The purpose of this feature is to restore and enhance the wetlands in Golden Gate Estates and in adjacent public lands by reducing over-drainage. Implementation of the restoration plan would also improve the water quality of coastal estuaries by moderating the large salinity fluctuations caused by freshwater point discharge of the Faka Union Canal. The plan would also aid in protecting the City of Naples' eastern Golden Gate well field by improving groundwater recharge.*" (Yellow Book, page 9-26)

At the time the Yellow Book went to publication in March 1999, the exact description of what the Southern Golden Gate Estates Project would entail and the exact acreage required for the SGGE component had not been determined. The Florida Department of Environmental Protection (FDEP) had received $25 million from the Department of Interior (DOI) to acquire 20,250 acres of land. FDEP had already acquired over 17,000 acres in Southern Golden Gate Estates CARL Area. It was assumed that $50 million ($25 million Federal/$25 million non-Federal) would cover all lands required for the SGGE Project; therefore the cost included in the Appendix had a real estate cost of zero (0).

F.4 PROJECT LOCATION AND DESCRIPTION

The Southern Golden Gate Estates Conservation and Recreation Lands Area (SGGE CARL Area) encompasses approximately 55,247 acres of land in Collier County, Florida. It is located about 12 to 15 miles in an easterly direction from downtown Naples. Access to the project area is from Interstate 75 at County Road 951, from County Road 951 onto Golden Gate Boulevard then onto Everglades Boulevard to Miller Boulevard. The SGGE CARL Area is located in all of Township 50 South and all of Township 51 South except Section 36; and in Township 52 South, in Sections 4, 5, and 6; Ranges 27 and 28 East, Collier County, Florida. It is bounded to the north by Interstate 75, to the northeast by the Florida Panther National Wildlife Refuge, to the east by the Fakahatchee Strand State Preserve, to the south by U.S. Highway 41 and Ten Thousand Islands National Wildlife Refuge and Aquatic Preserve, and to the west by



Collier Seminole State Park and Belle Meade State Conservation and Recreation Land (Carl) Project (Figure 1).

The Belle Meade State Conservation and Recreation Land (Carl) Project is comprised of 27,200 acres of which approximately 17,670 acres are state owned and is located west of the SGGE CARL Area.

Before development, the Project Area was characterized by seasonal flooding several months of the year, and broad slow moving sheet flow sustained wetland vegetation and rejuvenated freshwater aquifers. The development of the SGGE CARL Area included a network of roads that intercepts the natural flow ways, and four major drainage/flood control canals which drain the landscape, resulting in the reduction of aquifer storage, increased freshwater shock load discharges to the estuary, invasion of upland vegetation and increased frequency of forest fires.

The objectives for the Picayune Strand Hydrologic Restoration Project include reestablishing natural freshwater flows to the estuary, restoring pre-drainage hydro patterns, including sheet flow and flow ways, reestablishing natural plant distribution and composition, increasing surface aquifer recharge, increasing fish and wildlife resources, restoring habitat for listed species, restoring ecological connectivity and providing contiguous habitat protection to adjacent public lands, providing resource based recreational opportunities compatible with the protection of the natural systems, and restoring the natural fire regime.

F.5 RECOMMENDED PLAN –ALTERNATIVE 3D

ROADS– The recommended plan includes the removal and demolition of approximately 227 miles of the 279 miles of the existing roads. The roads would be ripped-up with heavy equipment. The demolished roads would then generally be impassable by vehicles. Some of the material would be used for construction of the canal plugs and levees. The remaining material would be spread across the landscape so that it would be flat. The asphalt material removed from the roads would be placed in a storage area within the SGGE CARL Area for future road maintenance purposes.

Approximately 52 miles of existing roads would remain in the SGGE CARL Area. Stewart Boulevard would remain to connect Janes Scenic Parkway and Everglades Boulevard. Everglades Boulevard would remain to provide access between Stewart Boulevard and Interstate 75 to the residences and businesses in the area known as Belle Meade. Benson Boulevard west of the Merritt Canal would remain. These roads would be modified with low water crossings to allow water to flow over them and with culverts to allow water to flow under them.



They would also serve for operations and maintenance of the Project. Portions of the north-south Miller, Desoto, Merritt, and Patterson Boulevards would be degraded to adjacent ground elevations, but remain available for use during the dry season.

Approximately 4 miles of new, unpaved roads would be constructed from Benson Boulevard southward to the sites of the three proposed pump stations.

EXISTING STRUCTURES-The Miller-2, FU-3 and Lucky Lake weir structures will be removed. These existing structures are fixed concrete weirs. The Lucky Lake weir has steel plated sluice gates mounted to the crest, which will require additional demolition work.

PUMP STATIONS-There will be 3 pump stations constructed on the existing canals, one on the Miller Canal, one on the Faka Union Canal and one on the Merritt Canal. The Miller Pump Station will be constructed on the Miller Canal near 64th Avenue SE. The Miller Pump Station (1,250 cfs total) will have 4-125 cfs pumps and 2-375 cfs pumps, for a total of 6 bays. The Faka Union Pump Station (2,630 cfs total) will be constructed on the Faka Union Canal near 66th Avenue SE. The Faka Union Pump Station will have 2-125 cfs pumps, 2-250 cfs pump and 4-470 cfs pumps, for a total of 8 bays. The Merritt Pump Station will be constructed on the Merritt Canal near 54th Avenue SE. The Merritt Pump Station (800 cfs total) will have 2-80 cfs pumps and 3-213 cfs pumps, for a total of 5 bays. The capacities of those pump stations were designed to not adversely impact the existing levels of flood protection up to the 100-year 5-day synthetic storm. These pump stations have been optimized to meet the environmental restoration demands of the Project area. A fourth small 100 cfs pump station will be required for interior drainage to the private lands levee system, PL Levee, at the northwest corner of the project. A 6 acre-foot detention basin will be required for sump and drainage collection requirements.

SPREADER CANALS-Three spreader channels will be constructed and will run in an east-west direction, across the Miller Canal at 64th Avenue, the Faka Union Canal at 66th Avenue, and the Merritt Canal at 54th Avenue. The spreader canals will be located immediately downstream of the proposed pump stations. The pumps have been designed to have discharge pipe free fall into the spreader channels, which will act as a plunge pool for energy dissipation and to aerate the water. The discharge waters will then be conveyed overland to the downstream project area. The spreader canals lengths were optimized for restoration pumping rates. For the Miller, Faka Union and Merritt pump stations the spreader canal lengths will be approximately 4500 feet, 7000 feet and 1400 feet, respectively. They will serve to distribute the flows along the overland areas to emulate the historic sheet flow of the area.

CANAL PLUGS-There will be 83 canal plugs installed in the four canals. The source material for the canal plugs and swale blocks will be from the material dredged from the original canals and swale excavations and the demolition and degradation of the roads. There should be sufficient material available for the canal plugs work.

CULVERTS-Culvert structures are required to provide interior drainage to the protected lands. The 6L Ranch levee has a series of existing culverts through US 41 that allows for the existing drainage to be conveyed downstream and away from the site. However, 6 - 72 inch corrugated metal pipe culverts and 2 - 48 inch culverts with flap gate controls will be require to convey flow on the north side of US 41 (Tamiami Trail) through the 6L Levee. The PL Levee will require 2 - 36 inch corrugated metal pipe culverts with flap gate controls. The 41 N Levee will require 3 - 72 inch culverts with flap gate control at the outfall at the Faka Union Canal and another uncontrolled 3 - 72 inch culvert structure at the entrance into the protected area from US 41. The two levee systems south, 41 W Levee and 41 E Levee, of US 41 adjacent to the Faka Union canal will have a hardened concrete outfall apron to protect against head cutting from the interior drainage ditch discharges. An additional culvert structure will be required on the southern abutment to connect the east and west borrow canals at I-75. This structure will have 3 - 72 inch corrugated metal pipe with no control. This structure is part of the restoration effort to allow water to flow between the Faka Union Canal and the Miller Canal.

TAMIAMI TRAIL CULVERTS-New culverts will be constructed under U.S. Highway 41. The culverts will supplement the bridges and culverts that exist today. The culverts are identified as 42A, 46A, 51A, 51B, 51C, 55A and 62A in the Letter Report and Environmental Assessment for the Tamiami Trail Culverts Critical Project.

LEVEES-There will be five project levee segments, which will be constructed around residential and agricultural areas. Four of the levees are adjacent to US Highway 41.

The first levee system, 6L Levee, will be near the 6L Ranch in Belle Meade. This site was selected due to the existing levee system in place. However, site investigations to the area determined that the existing levee system would be difficult to rehabilitate. Therefore a new levee system will be constructed adjacent to the restored lands and a seepage collection system will be incorporated between the proposed levee and the existing levee. This levee will protect the lands to the west of that levee from the 100-year flooding due to the proposed project.

The second levee system, PL Levee, will protect the private lands on the boundary with Belle Meade at the northwest corner of the project. The levee system will encircle those private lands to protect the area from the 100-year flooding do to the project. A seepage collection system will be part of the levee system. To construct this levee will require a temporary access across other FDEP owned lands in Southern Belle Meade.

The third levee system, 41 N Levee, will be built to protect the private lands on the southern end of the project area, which is just northeast of the FU-1 structure. This area will be encompassed by the proposed levee to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of the levee system.

The fourth and fifth levee systems, 41 W Levee and 41 E Levee, will be built to protect the private lands on the western and eastern banks of the Faka Union Canal just south of US 41 at the Port of the Islands at the southern end of the project area. Those areas will be protected on the backsides with levees to protect against 100-year flooding due to the proposed project. A seepage collection system will be part of these levee systems.

Four of the levees will have heights of 6 feet above grade and a top width of 15 feet. The fifth levee adjacent to US Highway 41 at the Faka Union Canal will have a height of 9 feet above grade and a top width of 15 feet.

The proposed material to build these levees is the material from the degradation of the existing roads. After the canal plugs are constructed, the quantity of material remaining from these roads appears, from the available data, to be close to the quantity required for construction of the levees.

F.6 EXISTING FEDERAL PROJECTS

No existing Federal projects lie fully or partially within the lands required for construction, operation, maintenance, repair, replacement and rehabilitation of the Project. Ten Thousand Islands National Wildlife Refuge and Aquatic Preserve are Federally owned lands, located directly south of the SGGE Project Area and south of US Highway 41. The Tamiami Trail Culvert Critical Restoration Project is partially located within the Picayune Strand Project. Seven of the 54 culverts approved for this critical project will be constructed for the Picayune Strand Project.

F.7 FEDERALLY OWNED LANDS

Ten Thousand Islands National Wildlife Refuge and Aquatic Preserve are Federally owned lands, located directly south of the SGGE Project Area and south of US Highway 41. The Ten Thousand Islands National Wildlife Refuge and Aquatic Preserve is comprised of 35,000 acres. Approximately 8,000 acres are mangrove forest. Approximately 16,000 acres are marine water and the remaining approximately 11,000 acres are freshwater marshland or other habitat. This area is managed by the U.S. Fish and Wildlife Service (USFWS). The USFWS has agreed in principle to allow the additional water and to negotiate and execute an agreement or provide a letter for consent to the non-Federal Sponsor for such additional waters.

F.8 NON-FEDERAL SPONSOR OWNED LANDS

The State of Florida through the Florida Department of Environmental Protection (FDEP) has acquired fee title to approximately 53,643 acres of the total 55,247 acres in the SGGE CARL Area and is in the process of acquiring the remaining 1,604 acres. In addition, the State of Florida owns most of the surrounding Fakahatchee Strand State Preserve, comprised of approximately 80,300 acres of which approximately 61,400 acres are owned by the State. The remaining 18,900 acres are in private ownership. The Collier Seminole State Park, also owned by the State, is comprised of 6,430 acres. The Belle Meade State Conservation and Recreation Land (Carl) Project is comprised of 27,200 acres of which approximately 17,670 acres are state owned. In the Sections or portions of Sections required for the Project, FDEP has acquired and owns fee to approximately 66 percent of the 8,868 acres.

F.9 FEDERAL AGRICULTURE IMPROVEMENT AND REFORM ACT OF 1996 (FARM BILL)

The State of Florida through the FDEP has been acquiring lands since 1985 from willing sellers for The Save Our Everglades Florida Forever Project, Southern Golden Gate Estates, Collier County, Florida. The acquisition of lands within SGGE CARL Area was funded by the State's Conservation and Recreation Lands (CARL) program. By the end of December 1997, FDEP had acquired approximately 17,000 acres of the total of 55,247 acres contained within the project area or roughly 31 percent of the project lands.

On April 4, 1996, Congress enacted the Federal Agriculture Improvement and Reform Act of 1996 (Public Law 104-127, 110 Stat. 1022). Section 390 of the Federal Agriculture Improvement and Reform Act of 1996 provided:



SEC. 390. EVERGLADES ECOSYSTEM RESTORATION.

(a) IN GENERAL.--On July 1, 1996, out of any funds in the Treasury not otherwise appropriated, the Secretary of the Treasury shall provide $200,000,000 to the Secretary of the Interior to carry out this section.

(b) ENTITLEMENT.--The Secretary of the Interior (referred to in this section as the "Secretary")--

(1) shall be entitled to receive the funds made available under subsection (a);

(2) shall accept the funds; and

(3) shall use the funds to--

(A) conduct restoration activities in the Everglades ecosystem in South Florida, which shall include the acquisition of real property and interests in real property located within the Everglades ecosystem; and

(B) fund resource protection and resource maintenance activities in the Everglades ecosystem.

In June of 1996, the SGGE CARL Area was listed as the fourth priority for receipt of the Federal Farm Bill funds authorized pursuant to the Federal Agriculture Improvement and Reform Act of 1996. The estimated total cost of the first three priority projects for Federal Farm Bill funds totaled over $490,000,000. In June 1996, it was not determined which of the land acquisition projects would receive Federal funds.

On October 3, 1996, a Framework Agreement was signed between the United States Department of Interior (DOI), the United States Department of the Army, the State of Florida, Department of Environmental Protection (FDEP) and the South Florida Water Management District. The Framework Agreement was written to provide a framework for the Secretary of Interior to provide Section 390 funds to the other parties for Everglades ecosystem restoration for both the acquisition of real property or the construction of features that were intended to become part of existing or future Corps of Engineers projects. The Agreement provided that except as otherwise provided by law or agreed to by the Secretary of Interior, all Section 390 funds expended would be matched by non-Federal funds on a dollar-for-dollar basis. The Agreement also provides: "Section 390 funds disbursed for the acquisition of real property or the construction of features shall count as Federal funds for cost sharing purposes for Army projects. Funds provided by the non-Federal parties to match Federal funds provided under Section 390 will be treated as non-Federal funds for cost-sharing purposes for Army projects. The value of real estate acquired pursuant to this Article shall be the acquisition cost of such real property for credit purposes under applicable cost-sharing principles."

In April 1998, DOI and FDEP executed a Federal Grant in which DOI provided $25,000,000 to FDEP for the acquisition of 20,250 acres, more-or-less. In December 1999, an amendment was signed to add an additional $13,000,000 making the total Federal funding received by FDEP $38,000,000. FDEP was not required to provide non-Federal matching funds for receipt of the $38,000,000. Since the signing of the Framework and Grant Agreements, land acquisition was accelerated by the State of Florida through FDEP.

FDEP has acquired 17,549.87 acres in the SGGE CARL Area with Farm Bill funds. All lands acquired with Section 390 funds required for the Project will be credited toward the Federal share of Project costs. The remaining 37,697.13 acres has been or will be acquired with State funds.

F.10 UNIFORM RELOCATION ASSISTANCE ACT, PL 91-646

The information provided by FDEP indicated that there were originally 47 owners or tenants that qualified as displacees for the Uniform Relocation Assistance Benefits, Public Law (PL) 91-646, as amended. The 47 displacees consisted of 41 single residence owners and 6 apartment tenants. There remains 1 single residence owner to be relocated. It is anticipated that due to limited availability of comparable replacement housing and rapidly rising real estate values in the area last resort housing may be required. The Grant Agreement between DOI and FDEP stipulated that FDEP must comply with applicable laws, regulations, policies, guidelines, and requirements governing Federal grants and land acquisition. In Belle Meade CARL lands, there are approximately 3 owners that may require relocation benefit payments, estimated relocation payments for the 3 owners is a total of $500,000.

F.11 NAVIGATIONAL SERVITUDE AND OTHER LANDS

The navigation servitude is not applicable to the Picayune Strand Project.

F.12 ACCESS TO PROJECT AREA

Ingress and egress will be via Federal, State, municipal, county roads, and roads available to the non-Federal Sponsor for Project purposes. To construct the PL Levee a temporary access easement will be required across other FDEP owned lands in Southern Belle Meade.

F.13 BORROW AND DISPOSAL SITES

The borrow material or excavated material from the SGGE CARL Area will be utilized for construction of the 83 canal plugs and for construction of the five levees. No borrow or disposal sites outside the Project boundary should be required.

F.14 TEMPORARY WORK AREAS

Lands within the SGGE CARL Area will be used for temporary work areas, as required.

F.15 INDUCED FLOODING

On December 11, 2000 the Water Resources Development Act of 2000 (WRDA 2000) was signed into law by the President of the United States (Public Law No. 106-541, of the 106th Congress). Section 601(h)(5) contains a Savings Clause that provides protection for existing legal sources of water that will be eliminated or transferred due to project implementation and no significant and adverse reduction in the level of service for flood protection that was in existence on the date of enactment and in accordance with applicable law. The Programmatic Regulations for the Everglades (33 CFR §§ 385.5 and 385.35-37) require a programmatic guidance memorandum on existing legal sources of water, and a determination of the pre-CERP baseline conditions and direction about what constitutes "levels of service for flood protection … in accordance with applicable law" existing on date of enactment of WRDA 2000. These formal processes will involve extensive coordination with federal, State and local agencies, the South Florida Water Management District, Tribes, stakeholders in CERP, and the public. Both of these processes also require concurrence by the Secretary of Interior and the Governor of the State of Florida. The guidance memorandum, the pre-CERP baseline, and direction about what constitutes "levels of service for flood protection" are still being developed. As discussed in Section 6, Plan Formulation, potential Savings Clause impacts were one of the considerations analyzed when evaluating each alternative plan.

The goal of the project is to restore the hydrology of SGGE CARL Area. Restoring the hydrology will restore wildlife and vegetative communities, including habitat for protected species (Florida Panther and others), and the downstream estuary conditions to a more historic, less degraded state. The purposes of the project include increasing habitat areas for threatened and endangered species such as the Florida panther, increasing sheet flow throughout the project area, restoration of a more natural hydroperiod



throughout the study area, water quality improvement and management for a more natural fire regime. For the results of the hydrologic modeling, see figures A119 through A158 in ***Appendix A***. In the SGGE CARL Area approximately 90% of the 55,247 acres are hydrologically impacted in the average wet season with increases in water depth from 0.5 to over 2.0 feet.

In the Belle Meade State Conservation and Recreation Land (CARL) Project Area, approximately 8,868 acres will be hydrologically impacted in the average wet season with an increase in the depth of waters from the Project on average from 0.5 to over 1.0 foot. Due to increases in the depth and duration, a perpetual flowage easement will have to be acquired over approximately 8,868 acres. See Engineering Appendix, Appendix A for the Stage Hydrographs.

F.16 REAL ESTATE INTEREST REQUIRED FOR PROJECT

SOUTHERN GOLDEN GATE ESTATES CARL AREA

The recommended estate for the SGGE CARL Area is fee based on the following analysis. This analysis to determine the minimum real estate interests required for the Picayune Strand Hydrologic Restoration Project is completed in accordance with the draft CECW-P/CERE memorandum SUBJECT: Determining Land Requirements and Real Estate Interests on Ecosystem Restoration Projects. The draft guidance requires an analysis to determine the real estate interests required for the project utilizing the following:

a. Identify all construction features and determine the minimum interest required to support construction and operation, maintenance, repair, and replacement (OMR&R). Construction includes such items as dredging, digging or filling canals, altering contours, depositing materials and erecting structures.
b. Evaluate any affirmative rights the Government must secure over benefited lands to meet the defined restoration objectives. These are in areas where ecosystem functions and processes are being restored or lands that are required as a buffer to protect the restored lands. Examples of such activities include the right to plant or remove vegetation, erect signs, or conduct periodic prescribed burns.
c. Evaluate any restrictions on the existing landowner's use of benefited lands that are necessary to meet specifically defined restoration objectives for the project. Examples include limiting grazing or placing prohibitions on plowing, alteration of contours, placement of structures for human habitation, and use of pesticides or fertilizers.
d. Determine whether a Takings Analysis is appropriate in instances where there will be an increase in flooding over or other hydrologic alteration to

private lands that may have risen to the level of a taking of property. This is particularly significant where the impacted lands are not otherwise needed for construction or OMR&R of the project or where only a minimal interest is needed. A Takings Analysis is not required in all cases, such as those in which fee or a significant interest is already justified for construction or OMR&R.

e. When any of the above analyses indicate that less than a fee interest is required for the project, sound real estate practices traditionally dictate that fee acquisition is typically appropriate when the cost of easements are estimated at 75% of fee or higher. Ultimately, the decision of fee or easement needs to be fully supported, taking all factors into consideration.

The SGGE CARL Area is comprised of 55,247 acres located in Collier County, Florida. Alternative 3D, the recommended plan, consists of the construction of 3 pump stations, 3 spreader canals and 83 canal plugs. It also requires the removal and demolition of 227 miles of road and construction of 52 miles of road to provide access to the Project Area and to adjacent areas.

Pursuant to the Framework Agreement, all Section 390 funds (Farm Bill funds) spent by FDEP for lands with the Project will be credited toward the Federal share of Project costs. The 17,549.87 acres acquired with Federal Farm Bill funds will be required in fee.

Construction features in the SGGE CARL Area for which fee title would be minimum estate required include: (a) the areas covered by the three pump stations; (b) the areas covered by the eighty three canal plugs located within the canals in the SGGE CARL Area; (c) the area covered by the 227 miles of road to be removed and demolished. (These roads were owned by Collier County and have been abandoned for the project construction); (d) the area covered by 52 miles of roads to be constructed; and (e) the areas covered by the three spreader canals. Fee would be required over approximately 23,200 acres of the 55,247 acres within Southern Golden Gate Estates.

The minimum real estate interest for the remainder of the approximately 32,047 acres in the SGGE CARL Area, including lands north of the pump station and south of I-75, was defined after determining the affirmative rights required by the Government to meet the defined restoration objectives and the determination of the restrictions and prohibitions on the use of the lands by the current owners were determined and by determining what hydrological impact the Project was having on these lands. The constraints, prohibitions and restrictions on private use include, but are not limited to, the following:

a) A prohibition of livestock is required. The negative effects of allowing cattle, horses, or other livestock on the natural areas will result in continued



grazing on desirable upland and wetland plants and the production of manure which can degrade surface and ground water quality on site and off site. Restrictions would allow landowners to use low-density livestock on a temporary basis to control exotic species. Only temporary fencing would be allowed. Assistance from a grazing professional would be required to determine for each parcel the timing and number of livestock. The small size of each parcel would require very short-term use probably measured in terms of days in order to not devastate the native vegetation. Providing road or trail access to each of the grazed parcels would in itself be very detrimental to the ecosystem. Wetlands created by the project would have to be fenced off to exclude livestock. Permanent fencing like roads reduces ecosystem values. No public agency could take on the management of this number of separate grazing plans. Cattle could still impact upland habitats if they had access and potential expected habitat units may be not realized over existing conditions.

b) A prohibition of all agricultural activity is required. High intensity farming activities, such as row or field crops, sod, citrus, ornamental plants, etc are inconsistent with wetland or upland restoration and would be prohibited. These types of land cover provide poor wildlife habitat. The unrestricted use of pesticides and fertilizers can negatively affect Habitat Units both on site and off site and would therefore be prohibited. Some low intensity type lumbering or other forestry related activities might be appropriate to promote vegetative restoration. Planting and eventual thinning of native pine seedlings and saplings could enhance the restoration of historic pine flatwoods. Activities such as removal and even commercial sale for landscaping of invasive species such as the cabbage palm might be incorporated into a restoration plan without significantly altering upland habitat units gained. However managing programs for logging or farming with easements on privately held estates would be daunting for any land management agency.

c) A prohibition of new construction activity is required. The Habitat Units were calculated assuming that the infrastructure of the subdivision would be removed leaving behind only those structures necessary for the requirements of the managing agency and to provide for acceptable public recreational use. Providing access to any of the parcels would require the maintenance of some portion of the 279 miles of roads. The elimination of the road system, easy vehicle access, and human presence on both the wetlands and uplands provide the most important ecosystem benefits with which the Habitat Units were calculated. The maintenance of existing structures and the construction of new structures (homes, buildings, roads, parking lots, and utilities) on any of the parcels would cause a significant reduction of the calculated Habitat Units. By allowing homes or other buildings to remain or to be constructed within SGGE CARL Area, access to the sites would have to be maintained. Removal of 227

miles of the total of 279 of existing roads is imperative to restoration under the tentatively recommended plan.

d) A prohibition on the extraction of minerals or water, or the application of municipal sludge on site. These are generally inconsistent with restoration activities planned for the natural areas. The extraction of minerals or water, are generally inconsistent with the restoration activities planned for the SGGE. Habitat Units were calculated assuming that no further mineral, surface, or ground water extraction would occur. If build out on easement parcels occurred, the need for fill material and well water would contribute to as much as a 100% loss of Habitat Units in affected wetlands and a 50% loss in potential Habitat Units in affected uplands. The managing agency might be able to allow restricted groundwater withdrawals for surrounding communities without affecting the calculated Habitat Units.

e) Some restriction of public and private access would be required. Some activities like hiking and fishing would be allowed with the assumption that they would only have minimal impacts on calculated habitat units. Intensive unfettered public access is likely to have detrimental effects on the ecosystem. Habitat units were calculated on the assumption that 227 of the 279 miles of public roadway would be removed and much of the remaining 52 would be restricted. Only 18 miles of road would be maintained as all season gravel access. The remaining secondary roads would be restricted seasonally to motorized vehicles. Off road vehicle use would be prohibited. Easements on the private land would need to account for this restricted public access.

There is a requirement for land management activities for restoration under the tentatively recommended plan. These types of activities are necessary for full restoration of the SGGE CARL Area as envisioned. If the activities were not conducted then there would be a loss of potential habitat units that would have been gained. These activities include contaminant remediation, fire management, and exotic species control.

After consideration of all the affirmative rights required by the government and the restrictions on the landowner(s) use of the properties, it was determined that the conservation easement would generally be the minimum real estate interest required over the remaining lands within SGGE CARL Area. However, for Alternative 3D, approximately 90% of the remaining 32,047 acres are hydrologically impacted by the construction of the project in the average wet season. Construction of the Project causes an increase in depth of water on the lands ranging from 0.5 feet to over 2.0 feet. To provide for both the increases in hydrological impacts in this acreage and to maintain these areas as wetlands, fee is the recommended estate.



The total estimated fee cost of lands within the SGGE CARL Area is $128,707,026 utilizing FDEP's actual acquisition costs for 53,463 acres acquired and the estimated land costs for the 1,604 acres remaining to be acquired.

BELLE MEADE STATE CONSERVATION AND RECREATION LAND (CARL) AREA

A perpetual flowage easement will be required over 8,868 acres in the Belle Meade CARL Area due to increased inundation caused by construction of the Picayune Strand Hyrdologic Restoration Project. The roads are much more primitive than in SGGE CARL Area and the access is through SGGE CARL Area. The State of Florida's Belle Meade State Conservation and Recreation Land (Carl) Project is comprised of the 27,200 acres of which approximately 17,670 acres are currently state owned. The only improvements are a number of dwellings and weekend cabins in the area. Wet conditions prohibit nearly all access. Only about one mile of eastern portion of Southern Belle Meade adjoining the SGGE CARL Area is improved with some type of primitive traversable road system. There is no public service or utilities in this area. Improvements are on generators, septic tanks and wells. There is a very limited amount of electrical service in Southern Belle Meade. Further development of electrical service is very expensive and requires demand of which there is none. There are no water and sewer services to any of the subject properties. Wells and septic systems are the norm. Most of Southern Belle Meade is inundated with water. There can be no permanent structures in most of the area. All subject lands are zoned "A" Agricultural, by Collier County and also are subject to subject to an Agricultural/Rural designation of the Comprehensive Land Use Plan. This zoning regulation is intended to create an area of predominantly agricultural usage with very low-density housing based on a maximum density of one unit per forty acres. It is estimated that the highest and best use of land in the Southern Belle Meade in its present condition, is limited residential or recreation use with limited agricultural uses. In the after scenario there will be hydrologic impacts, (with the margin of error identified as + or – 0.5 feet of water). The perpetual flowage easement is estimated to cover lands located in all or portions of Sections 15, 16, 17, 20, 21, 22, 23, 26, 27, 28, 29, 34, and 35, Township 50 South, Range 27 East and portions of Sections 2, 3, 10, 11, 14, 15, 22, and 23, Township 51 South, Range 26 East. Although it is presently difficult to access these ownerships during the wet season, any additional water could impact the dryer properties by 90% due to increased flooding and access impacts on developability. It is currently estimated that 10% of Southern Belle Meade is in this category. The estimated value of these lands is $4,389,660 with 3 improvements having an estimated value of $50,000. It is estimated that 90% of the lands in Belle Meade are wet and that the additional water flow from the project would have minimal impact, or about 10% diminution in value. The estimated value of these lands is $2,394,360 with no improvements. During the



Planning, Engineering and Design phase of the Project, additional information on access, septic systems and first floor elevations will be developed in this area and will be compared to the projected hydrologic impacts. Additionally, the Florida Department of Environmental Protection (FDEP) has acquired fee title to all or portions of these Sections of land required for the Project. As additional information is obtained which may reduce areas impacted and therefore reduce lands required for the Project, the lands owned by FDEP and impacted by the Project will be identified. FDEP and SFWMD will provide a perpetual flowage easement over the FDEP owned lands and will be credited for the value of the easement required on these FDEP lands based on the percentage of the actual fee acquisition cost of the lands.

Additionally, a levee easement will be required on approximately 397 acres in Belle Meade and around the Port of Islands for construction of the levees. Total estimated value is $2,183,500.

F.17 MINERAL AND TIMBER ACTIVITIES

Preliminary assessment indicates that there are no known present or anticipated mineral or subsurface mineral extraction activities within the vicinity of the proposed SGGE CARL Area that may affect construction, operation, or maintenance of the Project. There are currently no timber harvesting activities. Since the basis for the construction of the Project is to restore the ecosystem within the SGGE Project Area, such activities will be restricted.

F.18 NON-FEDERAL AUTHORITY TO PARTICIPATE IN THE PROJECT

The SFWMD was created by virtue of Florida Statutes, Chapter 373, Section .069 to further the State policy of flood damage prevention, preserve natural resources of the State including fish and wildlife and to assist in maintaining the navigability of rivers and harbors. (There are other enumerated purposes but they are not directly applicable to this Project.) The SFWMD is specifically empowered to

> *Cooperate with the United States in the manner provided by Congress for flood control, reclamation, conservation, and allied purposes in protecting the inhabitants, the land, and other property within the district from the effects of a surplus or a deficiency of water when the same may be beneficial to the public health, welfare, safety, and utility. (Section 373.103)*

To carry out the above purposes, the SFWMD is empowered to

> *...hold, control, and acquire by donation, lease, or purchase, or to condemn any land, public or private, needed for rights-of-way or other purposes, and may remove any building or other obstruction necessary for the construction, maintenance, and operation of the works; and to hold and have full control over the works and rights-of-way of the district.*

The term *works of the district* is defined by Section 373.019 to be

> *...those projects and works, including, but not limited to, structures, impoundments, wells, and other water courses, together with the appurtenant facilities and accompanying lands, which have been officially adopted by the governing board of the district as works of the district.*

Section 373.139 specifically empowers the SFWMD

> *...to acquire fee title to real property and easements therein by purchase, gift, devise, lease, eminent domain, or otherwise for flood control, water storage, water management, and preservation of wetlands, streams and lakes, except that eminent domain powers which may be used only for acquiring real property for flood control and water storage.*

and

> *FLORIDA STATUTES*
> *TITLE XXVIII. NATURAL RESOURCES; CONSERVATION, RECLAMATION, AND USE*
> *CHAPTER 373. WATER RESOURCES*
> *PART I. STATE WATER RESOURCE PLAN*
>
> *373.1501. South Florida Water Management District as local sponsor*
> *(1) As used in this section and s. 373.026(8), the term:*
> *(b) "Department" means the Department of Environmental Protection.*
> *(c) "District" means the South Florida Water Management District.*
> *(f) "Project" means the Central and Southern Florida Project.*
> *(g) "Project Component" means any structural or operational change, resulting from the restudy, to the Central and Southern Florida Project as it existed and was operated as of January 1, 1999.*
> *(h) "Restudy" means the Comprehensive Review Study of the Central and Southern Florida Project, for which federal participation was authorized by the federal Water Resources Development Acts of 1992 and 1996 together with related Congressional resolutions and for which participation by the South Florida Water Management District is*

authorized by this section. The term includes all actions undertaken pursuant to the aforementioned authorizations which will result in recommendations for modifications or additions to the Central and Southern Florida Project.

(2) The Legislature finds that the restudy is important for restoring the Everglades ecosystem and sustaining the environment, economy, and social well- being of South Florida. It is the intent of the Legislature to facilitate and support the restudy through a process concurrent with Federal Government review and Congressional authorization. Nothing in this section is intended in any way to limit federal agencies or Congress in the exercise of their duties and responsibilities. It is further the intent of the Legislature that all project components be implemented through the appropriate processes of this chapter and be consistent with the balanced policies and purposes of this chapter, specifically s. 373.016.

(4) The district is authorized to act as local sponsor of the project for those project features within the district as provided in this subsection and subject to the oversight of the department as further provided in s. 373.026. The district may:

(a) Act as local sponsor for all project features previously authorized by Congress;

(b) Continue data gathering, analysis, research, and design of project components, participate in preconstruction engineering and design documents for project components, and further refine the Comprehensive Plan of the restudy as a guide and framework for identifying other project components;

(c) Construct pilot projects that will assist in determining the feasibility of technology included in the Comprehensive Plan of the restudy; and

(d) Act as local sponsor for project components.

(5) In its role as local sponsor for the project, the district shall comply with its responsibilities under this chapter and implement project components through appropriate provisions of this chapter. In the development of project components, the district shall:

(a) Analyze and evaluate all needs to be met in a comprehensive manner and consider all applicable water resource issues, including water supply, water quality, flood protection, threatened and endangered species, and other natural system and habitat needs;

(b) Determine with reasonable certainty that all project components are feasible based upon standard engineering practices and technologies and are the most efficient and cost-effective of feasible alternatives or combination of alternatives, consistent with restudy purposes, implementation of project components, and operation of the project;

(c) Determine with reasonable certainty that all project components are consistent with applicable law and regulations, and can be permitted



and operated as proposed. For purposes of such determination:

1. The district shall convene a preapplication conference with all state and federal agencies with applicable regulatory jurisdiction;

2. State agencies with applicable regulatory jurisdiction shall participate in the preapplication conference and provide information necessary for the district's determination; and

3. The district shall request that federal agencies with applicable regulatory jurisdiction participate in the preapplication conference and provide information necessary for the district's determination;

(d) Consistent with this chapter, the purposes for the restudy provided in the Water Resources Development Act of 1996, and other applicable federal law, provide reasonable assurances that the quantity of water available to existing legal users shall not be diminished by implementation of project components so as to adversely impact existing legal users, that existing levels of service for flood protection will not be diminished outside the geographic area of the project component, and that water management practices will continue to adapt to meet the needs of the restored natural environment.

(e) Ensure that implementation of project components is coordinated with existing utilities and public infrastructure and that impacts to and relocation of existing utility or public infrastructure are minimized.

(6) The department and the district shall expeditiously pursue implementation of project modifications previously authorized by Congress or the Legislature, including the Everglades Construction Project. Project components should complement and should not delay project modifications previously authorized.

(7) Notwithstanding any provision of this section, nothing herein shall be construed to modify or supplant the authority of the district or the department to prevent harm to the water resources as provided in this chapter.

(8) Final agency action with regard to any project component subject to s. 373.026(8)(b) shall be taken by the department. Actions taken by the district pursuant to subsection (5) shall not be considered final agency action. Any petition for formal proceedings filed pursuant to ss. 120.569 and 120.57 shall require a hearing under the summary hearing provisions of s. 120.574, which shall be mandatory. The final hearing under this section shall be held within 30 days after receipt of the petition by the Division of Administrative Hearings.

F.19 PROPOSED ESTATES

F.19.1 STANDARD ESTATES - FEE

The fee simple title to (the land described in Schedule A) /(Tracts Nos. ____, ____ and ___), subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

FLOOD DAMAGE REDUCTION LEVEE EASEMENT
A perpetual and assignable right and easement in (the land described in Schedule A) (Tracts Nos.____, ____ and ____) to construct, maintain, repair, operate, patrol and replace a flood damage reduction levee, including all appurtenances thereto; reserving, however, to the owners, their heirs and assigns, all such rights and privileges in the land as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

TEMPORARY WORK AREA EASEMENT
A temporary easement and right-of-way in, on, over and across (the land described in Schedule A) (Tracts Nos. ___ and ___), for a period not to exceed _____ years, beginning with date possession of the land is granted to the Local Sponsor, for use by the United States, its representatives, agents, and contractors as a (borrow area) (work area), including the right to (borrow and/or deposit fill, spoil and waste material thereon) (move, store and remove equipment and supplies), and erect and remove temporary structures on the land and to perform any other work necessary and incident to the construction of the Central and Southern Florida, Southern Golden Gate Estates Hydrologic Restoration Project, together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions, and any other vegetation, structures, or obstacles within the limits of the right-of-way; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used without interfering with or abridging the rights and easement hereby acquired; subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

FLOWAGE EASEMENT (Permanent Flooding)
The perpetual right, power, privilege and easement permanently to overflow, flood and submerge (the land described in Schedule A) (Tracts Nos. ____, ____ and ____), (and to maintain mosquito control) in connection with the operation maintenance of the Southern Golden Gate Estates Hydrologic Restoration Project, as authorized by the Act of Congress approved _____, and the continuing right to clear and remove any brush, debris and natural obstructions which, in the opinion of the representative of the **SOUTH FLORIDA WATER**

MANAGEMENT DISTRICT in charge of the project, may be detrimental to the project, together with all right, title and interest in and to the timber, structures and improvements situate on the land; provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the **SOUTH FLORIDA WATER MANAGEMENT DISTRICT** in charge of the project, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution.

FLOWAGE EASEMENT (Occasional Flooding)

The perpetual right, power, privilege and easement occasionally to overflow, flood and submerge (the land described in Schedule A) (Tract No. ____) and to maintain mosquito control in connection with the operation and maintenance of the Picayune Strand Project as authorized by-the Act of Congress approved _____, together with all right, title and interest in and to the structure; and improvements now situate on the land, except fencing (and also excepting _____ (here identify those structures not designed for human habitation which the **SOUTH FLORIDA WATER MANAGEMENT DISTRICT** determines may remain on the land)) or provided that no structures for human habitation shall be constructed or maintained on the land, that no other structures shall be constructed or maintained on the land except as may be approved in writing by the representative of the **SOUTH FLORIDA WATER MANAGEMENT DISTRICT** in charge of the project, and that no excavation shall be conducted and no landfill placed on the land without such approval as to the location and method of excavation and/or placement of landfill; the above estate is taken subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowners, their heirs and assigns, all such rights and privileges as may be used and enjoyed without interfering with the use of the project for the purposes authorized by Congress or abridging the rights and easement hereby acquired; provided further that any use of the land shall be subject to Federal and State laws with respect to pollution.

TEMPORARY ACCESS ROAD EASEMENT

A temporary and assignable easement and right-of-way in, on, over, and across (the land described in Schedule A) for a period not to exceed _____, for the location, construction, operation, maintenance, alteration, replacement and use of

(an) access road(s) and appurtenances thereto; together with the right to trim, cut, fell and remove therefrom all trees, underbrush, obstructions and other vegetation, structures, or obstacles within the limits of the right-of-way; (reserving however, to the owners, their heirs and assigns, the right to cross over or under the right-of-way as access to their adjoining land at the locations indicated in Schedule B); subject, however, to existing easements for public roads and highways, public utilities, railroads and pipelines.

F.20 ZONING ORDINANCES

Preliminary investigation indicates that no enactments of zoning ordinances are proposed in lieu of, or to facilitate, acquisition in connection with the Project. The eastern portion of the BELLE MEADE Area is designated under the future land use maps of Collier County as being in an area identified as Agricultural/Rural Designation and have been also designated under the Ordinance as Sending Lands for the Transfer of Development Rights (TDR) program. The primary purpose of the TDR process within the Rural Fringe Mixed Use District is to establish an equitable method of protecting and conserving the most valuable environmental lands, including large connected wetland systems and significant areas of habitat for listed species, while allowing property owners of such lands to recoup lost value and development potential through an economically viable process of transferring such rights to other more suitable lands. Sending Lands are those lands that have the highest degree of environmental value and sensitivity and generally include significant wetlands, uplands, and habitat for listed species. Private Property owners of lands designated as Sending Lands may transfer density to Receiving Lands within the Rural Fringe Mixed Use District, and to lands within the Urban Designated Area subject to limitations set forth in the Density Rating System. Permitted uses are limited to the following:

a) Agricultural uses consistent with Chapter 823.14(6) Florida Statutes (Florida Right to Farm Act).

b) Detached single-family dwelling units, including mobile homes where the Mobile Home Zoning Overlay exists, at a maximum density of one dwelling unit per 40 acres or one dwelling unit per lot or parcel of less than 40 acres, which existed on or before June 22, 1999. For the purpose of this provision, a lot or parcel which is deemed to have been in existence on or before June 22, 1999 is 1) a lot or parcel which is part of a subdivision recorded in the public records of Collier County, Florida; or 2) a lot or parcel which has limited fixed boundaries, described by metes and bounds or other specific legal description, the description of which has been recorded in the public records of Collier County Florida on or before June 22, 1999; or 3) a lot or parcel which has limited fixed boundaries, for which an agreement for deed was executed prior to June 22, 1999.



c) Habitat preservation and conservation uses.

d) Passive parks and other passive recreational uses.

e) Sporting and Recreational camps, within which the lodging component shall not exceed 1 unit per 5 gross acres.

f) Essential Services necessary to serve permitted uses identified in Section 5.a) through 5.e) such as the following: private wells and septic tanks; utility lines, except sewer lines; sewer lines and lift stations, only if located within non-NRPA Sending Lands, and only if located within already cleared portions of existing rights-of-way or easements, and if necessary to serve the Rural Transition Water and Sewer District; and, water pumping stations necessary to serve the Rural Transition Water and Sewer District.

g) Essential Services necessary to ensure public safety.

h) Oil extraction and related processing. Where practicable, directional-drilling techniques and/or previously cleared or disturbed areas shall be utilized to minimize impacts to native habitats.

F.21 ACQUISITION SCHEDULES

It is anticipated that FDEP will complete the acquisition of the lands in the SGGE CARL Area in advance of the dates required for construction and operation. Acquisition of lands within BELLE MEADE STATE CONSERVATION AND RECREATION LAND (CARL) PROJECT will be completed prior to completion of construction of the Picayune Strand Hydrologic Restoration Project.

F.22 FACILITY, UTILITY RELOCATIONS

Preliminary investigation indicates that the only utility companies that provide services in the SGGE CARL Area are Florida Power & Light Company (power) and Sprint (telephone). Due to the development patterns in the SGGE CARL Area, service is limited primarily to the northwest portion of SGGE CARL Area. Most of their facilities are located within the rights of way of the local road network in SGGE CARL Area. No major utility corridors or easements traverse the SGGE CARL Area. Some of the local distribution lines are used to provide service to areas east of SGGE CARL Area. Time Warner, the cable provider in the NGGE area, does not provide any service south of Interstate 75. The roads within the SGGE CARL Area were owned and maintained by Collier County, Florida

The State of Florida, through the Board of Trustees of the Internal Improvement Trust Fund and the SFWMD executed an Agreement with Collier County, Florida in September 2003. The Agreement provides that Collier County would

adopt a resolution vacating and releasing its interest in all certain roadways with the SGGE CARL Area and would release, terminate or disclaim any interest in the rights of way of portions of Janes Scenic Drive and Miller Boulevard. In exchange for Collier County vacating, releasing, terminating or disclaiming its interests in these roads, the State and SFWMD agreed to the following: (1) SFWMD would dedicate annually $1 million to the operation, maintenance and repair of secondary canal system in Collier County for a period of 20 years; (2) SFWMD would convey at no cost to the County 640 contiguous acres of unimproved land for recreational purposes; (3) the State and SFWMD will maintain the roadways in the SGGE CARL Area in manners prescribed in the Agreement; (4) the State and SFWMD will provide access to Sprint and Florida Power & Light from roadways designated as "primary, all weather roads" to all telephone and electric facilities located within the rights of way and if requested would provide a replacement easement to Sprint and Florida Power & Light; and (5) the general public will be given access for recreational use on the lands within the SGGE CARL Area. FDEP and SFWMD have agreed in writing that they will not receive any credit for the expenditure of funds related to the terms, provisions, and conditions set forth in this Agreement.

The SFWMD has executed an agreement with the State of Florida Department of Transportation (FDOT) for the construction of the Tamiami Trail Culvert Critical Restoration Project. This agreement allows SFWMD to construct the culverts within the FDOT right of way of U.S. Highway 41. After completion, maintenance of the roadway culverts and roadway facilities become the responsibility of FDOT. FDOT is participating in the project by providing $10,698,614 for design, construction engineering, and construction costs. FDOT has granted SFWMD a permit to complete the work within the right of way.

F.23 HAZARDOUS TOXIC OR RADIOLOGICAL WASTE (HTRW)

The SFWMD contracted with URS Corporation for Hazardous, Toxic, and Radioactive Waste (HTRW) Phase I, II, & III assessments on the SGGE project site and immediate surrounding area. The contract was completed on September 30, 2003 by delivery of the report entitled *Phase I/II Environmental Site & Ecological Risk Assessment*. An executive summary, including instructions for accessing a copy of the entire three (3) volume report, can be located in Appendix D. The URS report delineates the project area into 4 zones. High levels of selenium, chlordane and dieldrin were found on several locations in the SGGE CARL Area. The following is a brief overview of the potential HTRW remediation solutions within each zone.

(1) Interior Area The URS report identified no significant HTRW impacts that would inhibit the proposed restoration activities within this zone. It



recommended that the homesteads in the Interior Area be surveyed for potential asbestos containing materials, the potable wells abandoned, and the septic systems decommissioned.

(2) Former Agricultural Area – Southeast (FASE) Soil sampling in this zone identified selenium above the USFWS interim guideline concentration. The results of the URS ERA indicate that levels of selenium in soils found within these two areas may pose a minimal risk potential for small ground foraging mammals however it is unlikely that the contamination will affect any ESA trustee species. Based on the results of the selenium desorption tests, the statistical review, and groundwater analytical results, it was recommended in the Phase III ERA that no additional assessments or corrective activities be conducted in the FASE. This zone within SGGE should be acceptable for the District's proposed future use of the property. It is important to note that the USFWS has not completed their review of this section of the property. At sites where selenium has been found in high concentrations in the FASE (Grids 25 and 29), it is recommended that remediation or capping actions be conducted.

(3) Former Agricultural Area _ Northeast (FANE) Soil sampling within the FANE identified toxaphene areas above the Sediment Quality Assessment Guideline (SQAG). Based on the results of the ERA, soils impacted with selenium in the FANE may pose a minimal risk potential for certain small ground foraging mammals, however it is unlikely that these selenium concentrations will affect the USFWS trustee species. According to the URS Phase III report the FANE is acceptable for the District proposed future use pending USFWS final review and concurrence.

(4) Former Agricultural Area – West (FAW) Soil sampling within the FAW indicated that organochlorine pesticides chlordane and dieldrin were detected above the SQAG. Therefore the URS report recommends that the District Project manager and project design team (PDT) consider implementing a final design to minimize the ecological risk associated with inundating the contaminated areas. Design modifications consistent with minimizing this ecological risk may include shifting the southwestern project boundary to exclude the impacted area, site grading, and changing the depth/time interval of flooding by manipulating pump operations. In the event that these design modifications are not reasonable alternatives, one or more of the following five corrective actions may be required to minimize the potential risks to ecological receptors. Prior to conducting any corrective actions chlordane and dieldrin impacted soils will need to be further delineated**.** The USFWS recommends that follow-up sampling for selenium be conducted on 8 grids (Grids 23-30) in Area 64W in the FAW. Depending on the results of this re-sampling effort, remediation or capping may be required. The USFWS also recommends that remediation or capping be conducted in areas where high concentrations of



chlordane (Grids 1, 13, 16, 21, 27 and 30) and dieldrin (Grid 1) have been reported in the FAW.

F.24 PROJECT SUPPORT

There are two remaining landowners in the SGGE Project area that have not entered into a contract for acquisition or been acquired by eminent domain by the State of Florida: one is a private individual and the other is the Miccosukee Tribe of Indians of Florida.

The private landowner owns a quarter of a section of property in the north end of SGGE. His homestead is on the property, and he is permitted by Collier County to operate an aquaculture farm. Currently the landowner is in the process of excavating ponds. The excavated material, generally limerock, is being sold as material to be used in the construction of roads.

The Miccosukee Tribe of Indians of Florida owns a section and a quarter in the south end of the Project site. The Tribe has been presented with numerous offers by the State of Florida to acquire the land in question. All offers to date have been rejected. The State of Florida has filed a condemnation action to acquire the land.

F.25 CREDITING FOR INCIDENTAL COSTS AND REVIEW AND RETENTION OF CREDIT DOCUMENTATION

Jacksonville District proposes the following streamlined method for crediting for incidental costs and review and retention of credit documentations for those lands required for the Project in the SGGE CARL Area.

FDEP ADMINISTRATIVE COSTS FOR LAND ACQUISITION IN SGGE CARL AREA. Pursuant to WRDA 2000, regardless of the date of acquisition, the non-Federal Sponsor is entitled to Credit for "..the value of lands or interests in lands and incidental costs for land acquired by a non-Federal sponsor in accordance with a project implementation report for any project included in the Plan and authorized by Congress shall be (i) included in the total cost of the project; and (ii) credited toward the non-Federal share of the cost of the project." The Jacksonville District, SFWMD and FDEP are recommending that FDEP and SFWMD be credited an amount not to exceed $29,158,914 for the administrative/incidental costs associated with the acquisition of the 19,992 parcels in the SGGE CARL Area. This amount would include, but not be limited to, the following past, present and future administrative/incidental costs: (1) all FDEP's salaries, other personnel services, and contract labor; (2)(a) all FDEP's



Contractor expenses, including all American Government Services task assignments or contracts, (2)(b) all First Title & Abstract task assignments or contracts past, present and future, and (2)(c) all PBS&J Contract Services; (3) all costs associated with the services of State of Florida Attorney; (4) all costs associated with the services of the State of Florida Office of General Counsel; (5) all costs associated with contract appraisals and review of appraisal; (6) all costs associated with environmental site observations; (7) all costs associated with closings, title commitments, title insurance, recording fees, and documentary stamps; (8) all costs associated with surveys or legal descriptions; (9) all the following costs associated with relocation assistance payments, including moving costs, tenant relocation benefits, business relocation benefits, closing costs for replacement housing, and administrative settlement fees; (10) all attorneys fees; and (11) all costs of eminent domain, except land and improvement costs.

Prior to execution of the Project Cooperation Agreement, a review of FDEP's administrative/incidental costs associated with the administrative/incidental costs associated with the acquisition of the 19,992 parcels in the SGGE CARL Area by a party approved by the Deputy Assistant Secretary of the Army (Civil Works). The party conducting the review will submit a report to the Deputy Assistant Secretary of the Army (Civil Works) for approval. FDEP will be required to provide necessary supporting documents for the review report, including any credit claimed for P.L. 91-646 relocation housing payments.

CERTIFICATION OF LANDS FOR THE 19,992 PARCELS IN SGGE CARL AREA. Normally for Land Certifications, the non-Federal Sponsor provides a Land Certification signed by the non-Federal Sponsor and an Attorney's Opinion of Title for the parcels being certified together with either legal descriptions of the parcels or a map of the parcels attached to both the Land Certification and Attorney's Opinion. The Corps will be provided two Certifications for lands required for the Project in the SGGE CARL Area signed by both SFWMD and FDEP. The first certification will contain all lands required for construction in SGGE CARL Area (the 55,247 acres), the second will contain all remaining lands in SGGE CARL Area (55,247 acres). For each Certification, a map will be attached which will show all the parcels in the SGGE CARL Area being certified. Those parcels will be color coded versus the rest of the SGGE CARL Area that will not be color-coded. The Certification will state that fee title is the estate being provided in this certification for these lands in the SGGE CARL Area. No Attorney's Opinion of Title will be provided by either FDEP or SFWMD for these lands in the SGGE CARL Area. This will reduce SFWMD and Jacksonville District's administrative costs associated with the crediting of FDEP's administrative/incidental costs.

CREDIT FOR SGGE CARL AREA LANDS. Normally to receive credit for the value of lands required for the Project, FDEP and SFWMD would have to submit



appraisals to the Corps for review and approval prior to a final determination of credit. For FDEP to provide copies of all the appraisals on the 19,992 parcels within SGGE and for the Corps to review and approve all the material would be a tremendous undertaking. The time (estimate of 10 man-years) and costs for the Corps and Sponsor would be unrealistically high and would not be in the best interest of either party. The Jacksonville District, FDEP and SFWMD are proposing that FDEP receive credit for its actual land and improvement acquisition costs for the 36,092.55 acres in the SGGE CARL Area acquired as of May 31, 2004 in an amount not to exceed $75,394,333. The actual acquisition costs for the lands in the SGGE CARL Area acquired as of May 31, 2004 will be the subject of a review of by a party approved by the Deputy Assistant Secretary of the Army (Civil Works) conducted prior to execution of the Project Cooperation Agreement. The party conducting the review will submit a report to the Deputy Assistant Secretary of the Army (Civil Works) for approval. FDEP will be required to provide necessary supporting documents for the review report. FDEP has acquired 17,549.87 acres in the SGGE CARL Area with Farm Bill funds. The remaining acreage will be acquired with State funds.

The proposed streamlined credit and certification process for the lands in the SGGE CARL Area provides opportunities for expediting the crediting and certification process and reducing administrative costs associated with the review of crediting packages. Such opportunities will allow for an expedited reimbursement for credit to the SFWMD and reduce costs expended in duplication of documents, transportation delivery fees, and storage. It will also reduce the person-hours required to assemble the documents for each tract, reduce person-hours and personnel required to perform the review, and obviate the need for maintenance of such records by the Corps, FDEP and the SFWMD.

CREDIT AND CERTIFICATION OF LANDS NOT AQUIRED IN THE SGGE CARL AREA AS OF MAY 31, 2004 AND FOR LANDS OUTSIDE THE SGGE CARL AREA. Normal crediting and certification procedures will be followed for lands in the SGGE CARL Area not acquired as of May 31, 2004 and for land required for the Project not within the SGGE CARL Area, except that in the Southern Belle Meade CARL Area, FDEP and SFWMD will provide a perpetual flowage easement over the FDEP owned lands and will be credited for the value of the easement required on these FDEP lands based on the percentage of the actual fee acquisition cost of the lands.

The proposals above are reduced as follows:

a. For any lands or acreage within the former Southern Golden Gate Estates Subdivision comprised of 55,247 acres acquired by the Non-Federal Sponsor or the Florida Department of Environmental Protection prior to May 31, 2004, the creditable value shall be a sum not to exceed

$75,394,333, subject to a Peer Review Report by a party designated by the Deputy Assistant Secretary of the Army (Civil Works) and approval of the Peer Review Report by the Deputy Assistant Secretary of the Army (Civil Works) and subject to a determination that the lands are required for the Project.

b. For lands, easements and rights-of-way within the former Southern Golden Gate Estates Subdivision comprised of 55,247 acres acquired by the Non-Federal Sponsor or the Florida Department of Environmental Protection after May 31, 2004, the creditable value shall be the actual acquisition cost of such real property interests at the time the interests are acquired, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable.

c. Subject to a Peer Review Report by a party designated by the Deputy Assistant Secretary of the Army (Civil Works) and approval of the Peer Review Report by the Deputy Assistant Secretary of the Army (Civil Works), the incidental/administrative costs incurred by the Florida Department of Environmental Protection for the acquisition of all lands, easements, and rights-of-way within the former Southern Golden Gate Estates Subdivision shall not exceed the sum of $29,158,914.

d. If the lands, easements and rights-of-way which lie outside the boundaries of the former Southern Golden Gate Estates Subdivision were acquired prior to execution of the Project Cooperation Agreement, the creditable value shall be their purchase price, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable, together with their reasonable and necessary incidental costs of acquisition.

e. The value of lands, easements, or rights-of-way required for the Project which lie outside the boundaries of the former Southern Golden Gate Estates Subdivision acquired by the Non-Federal Sponsor after the effective date of the Project Cooperation Agreement executed for this Project shall be the actual acquisition cost of such real property interests at the time the interests are acquired, subject to a determination that the lands are required for the Project and that the costs are reasonable, allowable and allocable, together with their reasonable and necessary incidental costs of acquisition.

F.26 BASELINE COST ESTIMATES

Cost estimates are based on the actual FDEP acquisition costs and appraisals provided by FDEP, and relied upon for data and conclusions regarding values. The total 55,247 acres that consist of about 19,992 parcels are being acquired by FDEP. This total cost captures actual and estimated costs from 1984 to the current period. Improved properties that existed within the study area consisted of pole buildings, mobile homes, and single-family residences. The highest and best uses for the lands are recreation or rural residential uses. The below table provides a summary of Real Estate costs as follows:

TABLE F - 1 BASELINE COST ESTIMATE

PROJECT: **Southern Golden Gate Estates Hydrologic Restoration**
DATE: 12 August 2004

LANDS AND DAMAGES:

ESTATE	PARCELS	ACRES	COST-LAND AND IMPROVEMENTS	
FEE - Farm Bill Direct Acquisition	2883	17181.63	$29,795,440.18	
FEE - Farm Bill condemnation	82	368.24	$1,517,253.00	
FEE - Farm Bill Remaining	0	0.00	$0.00	
FEE - State of Florida Acquired-CARL	5210	14911.39	$14,169,590.00	
FEE - State of Florida Acquired-CARL Tax sales	1676	2716.43	$1,078,660.31	
FEE - State of Florida Condemnation-CARL	0	0.00	$84,119.30	
FEE - State of Florida Acquired-P2000	3790	12057.34	$25,191,965.57	
FEE - State of Florida Condemnation-P2000	528	1930.91	$13,180,639.69	
FEE - State of Florida Acquired-Florida Forever	244	676.73	$5,050,672.77	
FEE - State of Florida Condemnation-Florida Forever	1210	3784.25	$16,619,235.34	
FEE-State of Florida donations	7	15.50	$19,450.00	
TOTAL ACQUIRED	**15630**	**53642.42**	**$106,707,026.16**	
FEE - State of Florida Remaining	300	1604.58	$22,000,000.00	
	15930	55247.00	$128,707,026.16	
TAMIAMI TRAIL CULVERTS	1	20.00	$40,000	
PFE DOERR	2	153.00	$413,100	
FEE BERMS	10	397.00	$2,183,500	
PFE BELLE MEADE	150	8868.00	$6,834,020	
TEMPORARY EASEMENT	10	5.20	$6,500	
			$9,477,120	
SUBTOTAL				
SGGE	15930	55247.00	$128,707,026.16	
OUTSIDE	173	9443.20	$9,477,120	
SEVERANCE:	0	0.00	$0	
SUBTOTAL		0.00	$0	$138,184,146

MINERALS		$0
TOTAL LANDS AND DAMAGES (RD)		**$138,184,146**
ACQ/ADMIN		
FED FUTURE		$1,868,500
NON-FED PRIOR		$29,158,914
NON FED FUTURE		$2,600,000
NON FED PRIOR FEDERAL FUNDS		$3,761,290
PL 91-646 PRIOR STATE		$891,325
PL 91-646 FUTURE STATE		$500,000
PL 91-646 PRIOR FEDERAL		$3,010,982
TOTAL REAL ESTATE COST EXCLUDING CONTINGENCY		**$179,975,157**
PRIOR FEDERAL PAYMENTS		$38,084,965
FDEP ACTUAL ACQUISITION COSTS		$75,394,333
FDEP PRIOR ADMINISTRATIVE COSTS		$29,158,914
SUBTOTAL FOR CONTINGENCY MINUS FEDERAL PAYMENTS & ACTUAL COSTS		$37,336,946
REAL ESTATE CONTINGENCY (35%)		$13,067,931
	$193,043,088	
TOTAL ESTIMATED RE COSTS (RD)		**$193,043,100**
FUTURE LAND	$31,477,120	
PRIOR FEDERAL PAYMENTS	$38,084,965	
FDEP ACTUAL COST	$75,394,333	

F.27 PROJECT MAPS

Map labeled as Figure F-1 is the Picayune Strand Planning Area Map and shows the general location of the Project. Map labeled Figure 2 is the SGGE Study Area map and shows the location of SGGE CARL Area and the other State and Private lands surrounding the SGGE CARL Area. Map labeled Figure F-3 and entitled " Save Our Everglades (Golden Gate Estates South), Collier County, Florida, Ownership Map" shows the Townships, Ranges, Sections, landmarks and roads, and other information for the SGGE CARL Area. Figure 4 shows the Townships, Ranges, Sections, and other information for the FDEP Belle Meade Area. Figure 5 shows the location of the Project Features.

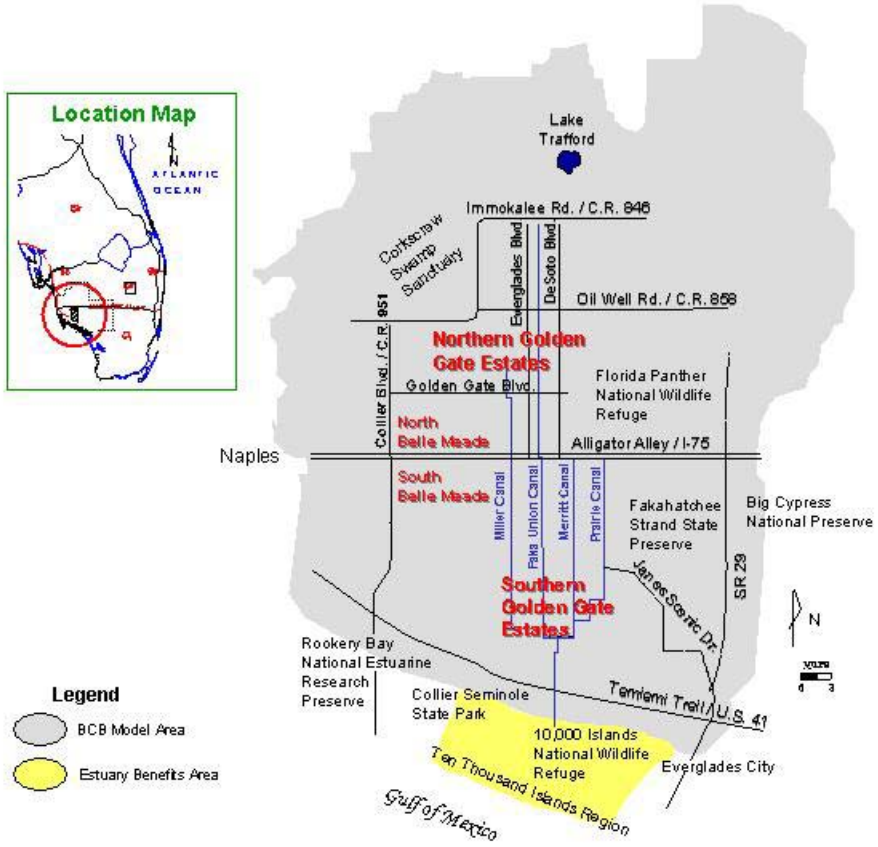

FIGURE F - 1 PICAYUNE STRAND PLANNING AREA

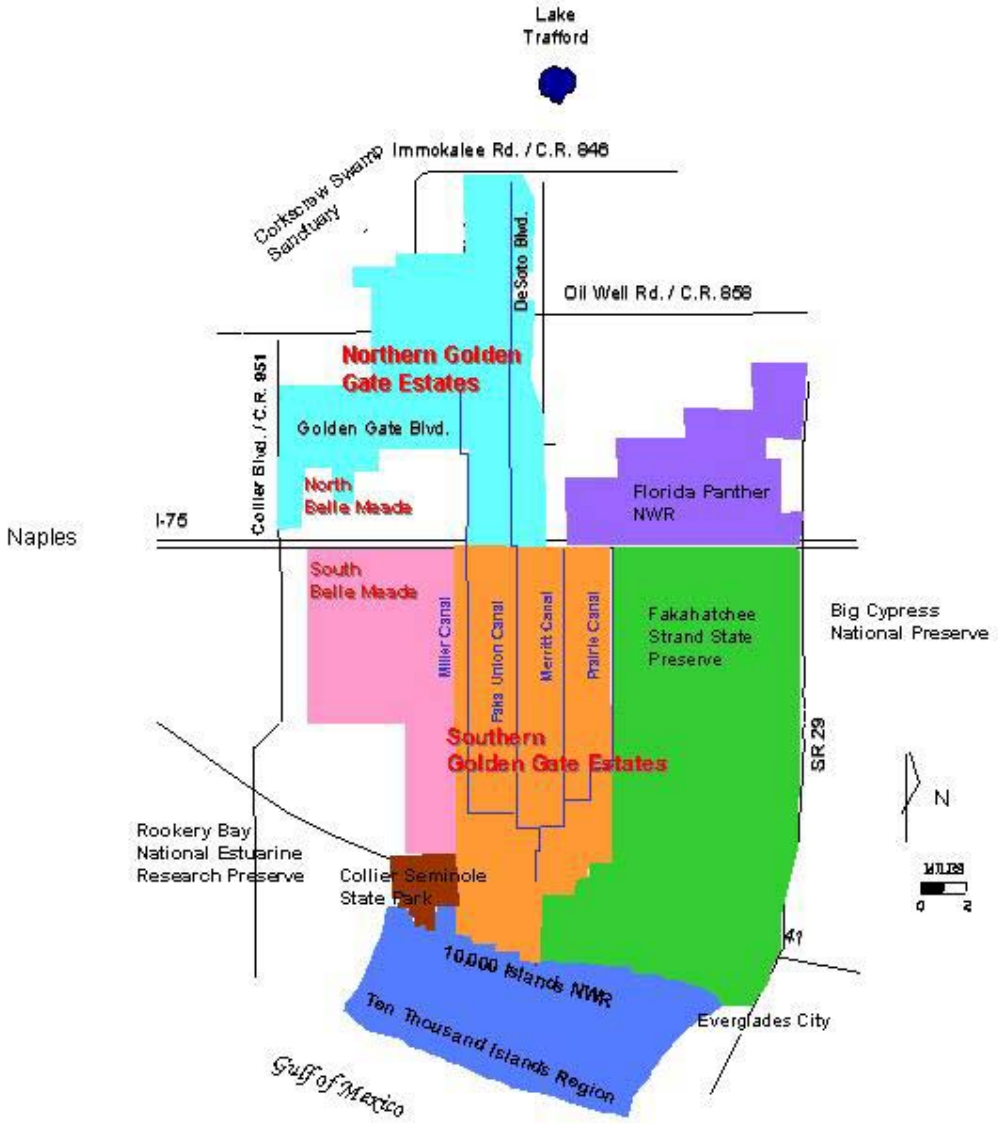

FIGURE F - 2 PICAYUNE STRAND STUDY AREA



FIGURE F - 3 SOUTHERN GOLDEN GATE ESTATES CARL (FDEP)

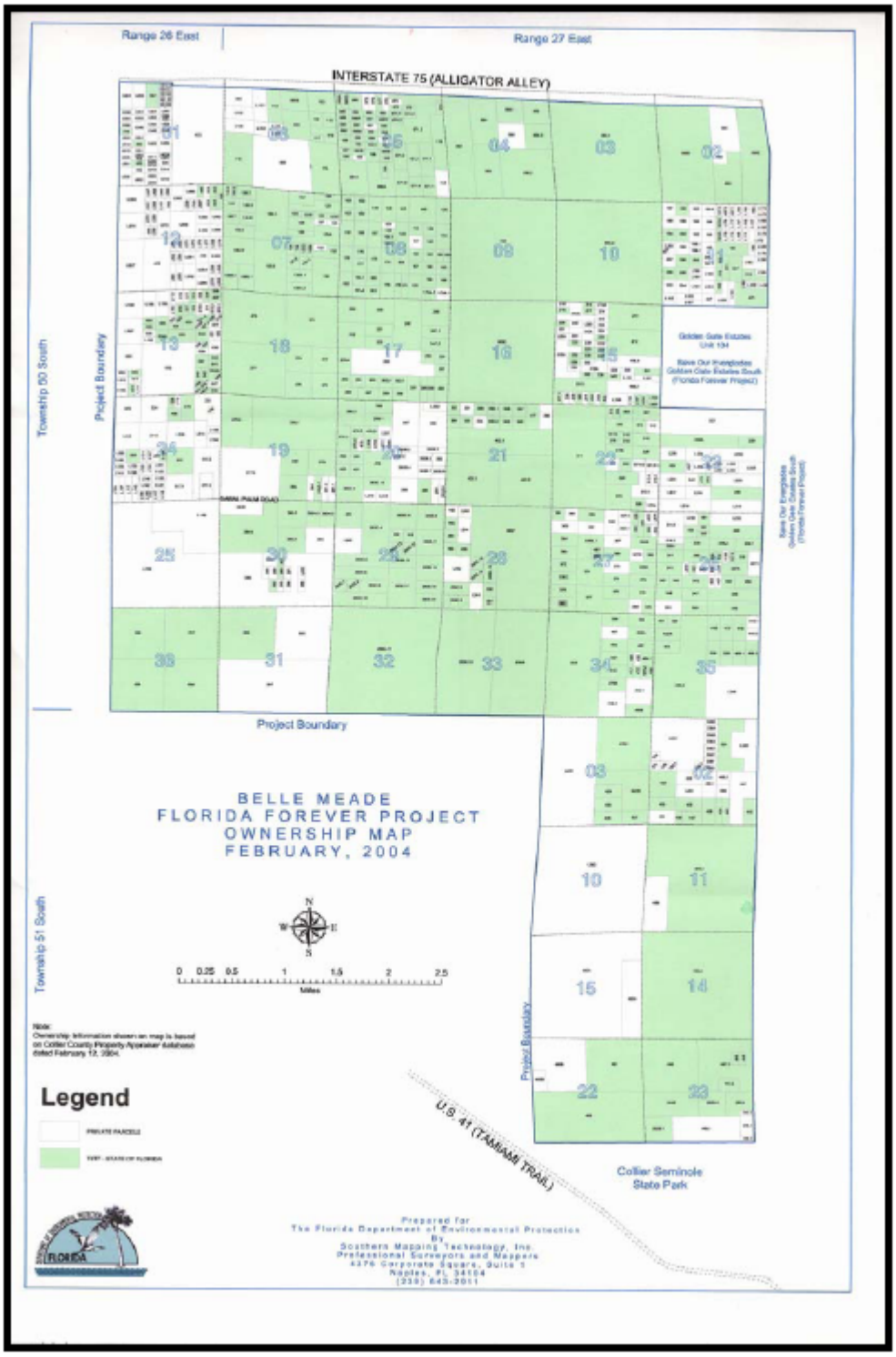

FIGURE F - 4 BELLE MEADE AREA

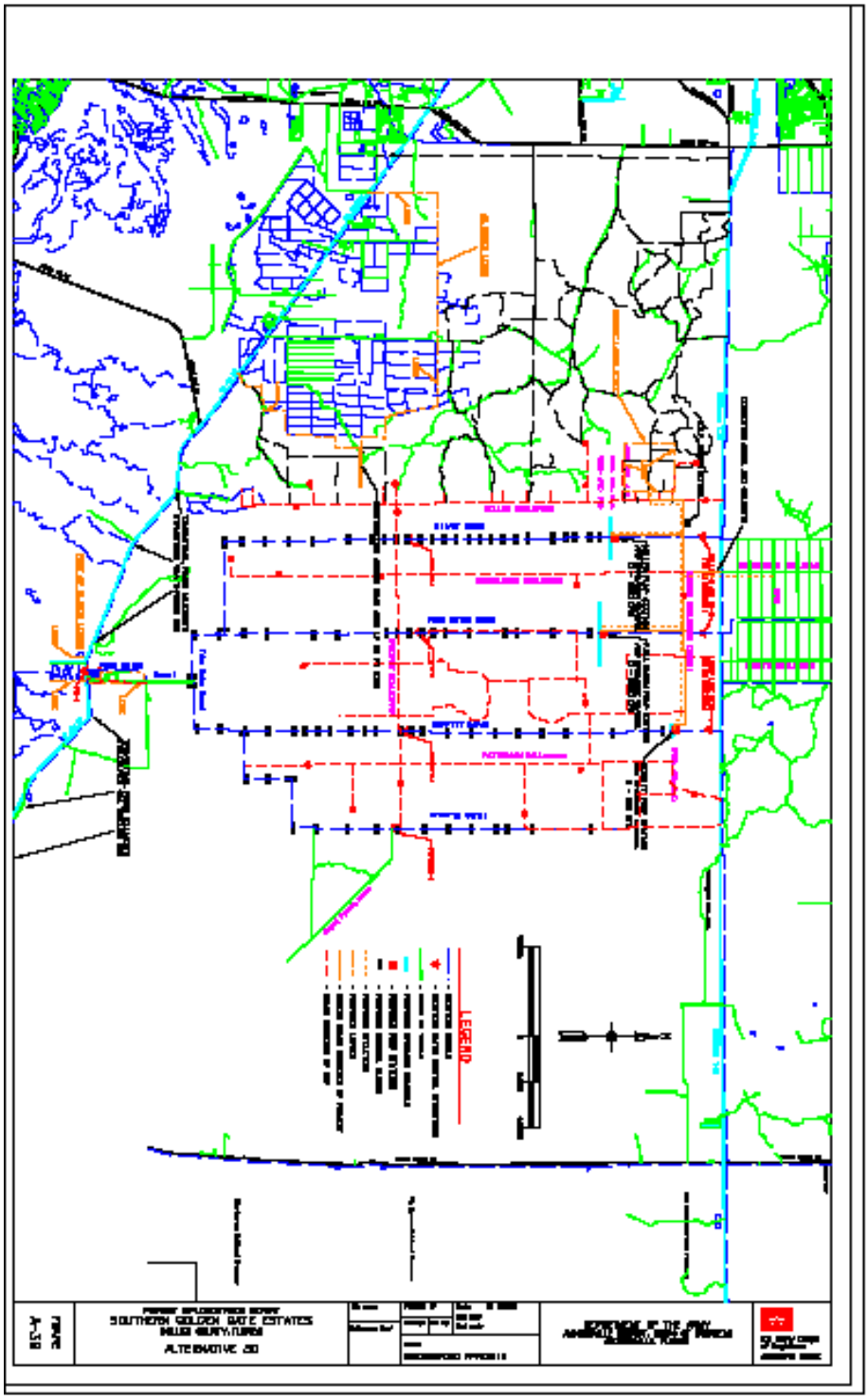

FIGURE F - 5 MAP SHOWING PROJECT FEATURES IS SGGE AND BELLE MEADE

TABLE F - 2 MCASES COST ESTIMATE

ESTIMATED PROJECT REAL ESTATE COSTS
PROJECT: **Southern Golden Gate Estates Hydrologic Restoration**
DATE: 13 August 2004

01	LANDS AND DAMAGES	
01AA	PROJECT PLANNING	$60,000
01B--	ACQUISITIONS	
01B20	BY LOCAL SPONSOR (LS) PRIOR	$29,158,914
	BY LOCAL SPONSOR FUTURE	$692,000
	BY LOCAL SPONSOR (LS) PRIOR FED	$3,761,290
	BY LS CREDITING	$20,000
01B40	REVIEW OF LS	$632,000
01C--	CONDEMNATIONS	
01C20	BY LOCAL SPONSOR FUTURE	$1,260,000
01C40	REVIEW OF LS	$252,000
01E--	APPRAISALS	
01E30	BY LOCAL SPONSOR FUTURE	$519,000
01E50	REVIEW OF LS	$849,000
01F--	PL 91-646 ASSISTANCE	
01F20	BY LOCAL SPONSOR FUTURE	$84,000
01F40	REVIEW OF LS	$55,500
01G--	TEMPORARY PERMITS/LICENCES/RIGHTS-OF-ENTRY	
01G20	BY LS	$20,000
01G40	REVIEW OF LS	$10,000
01G60	DAMAGE CLAIMS	$5,000
01M00	PROJECTED RELATED ASMINISTRATION	
	REAL ESTATE REVIEW OF PCA	$10,000
01R--	REAL ESTATE PAYMENTS	
01R1	LAND PAYMENTS	
01R1B	BY LS FUTURE	$31,477,120
	BY LS ACTUAL	$75,394,333
	BY LS FEDERAL FUNDS	$31,312,693



01R2	PL 91-646 ASSISTANCE PAYMENTS		
01R2B	BY LS FUTURE	$500,000	
	BY LS PRIOR	$891,325	
	BY LS FEDERAL FUNDS	$3,010,982	
TOTAL REAL ESTATE COST EXCLUDING CONTINGENCY			**$179,975,157**
PRIOR FEDERAL PAYMENTS			$38,084,965
FDEP ACTUAL ACQUISITION COSTS			$75,394,333
FDEP PRIOR ADMINISTRATIVE COSTS			$29,158,914
SUBTOTAL FOR CONTINGENCY MINUS FEDERAL PAYMENTS & ACTUAL COSTS & LS PRIOR ADMINISTRATIVE COSTS			$37,336,945
REAL ESTATE CONTINGENCY (35%)			$13,067,931
		$193,043,088	
TOTAL PROJECT REAL ESTATE COST (RD)			**$193,043,100**

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APPENDIX G

CORRESPONDENCE, COMMENTS, AND RESPONSES

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Introduction to Appendix G: Comments and Responses

Appendix G of the Picayune Strand Final PIR/EIS consists of the subsections listed in the following table. The first subsection provides a brief overview of the major comments. The second section contains the full copies of every comment letter and email received. The third section contains a table that presents each comment received, the source of the comment, and the Corps of Engineers' and SFWMD's response to the comment. The fourth section contains a summary of the questions and comments received during the public workshop held in Naples, Florida, on June 17, 2004. The fifth section contains the official transcript of the public workshop. This workshop occurred during the public comment period for the Draft PIR, which was open from May 14, 2004, to July 13, 2004.

Note that the Copies of Letters Received section contains comments received from the Florida Fish and Wildlife Commission (FWC). Responses to the FWC comments are not contained in the Appendix G "Table of Comments and Responses" section. Rather, the responses to FWC comments are grouped with the responses to U.S. Fish and Wildlife Service comments, since many of the comments are the same. Responses to both of these agency's comments are contained in a table within Appendix D: Environmental.

Appendix G Subsection	**Number of Pages**
Overview of Comments	2
Copies of Letters Received	130
Table of Responses to Letters	34
Summary of Workshop Comments	1
Transcript of Public Workshop, Jun 17, 2004	140

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Summary of Comments Received on the Draft PIR

The Jacksonville District, U.S. Army Corps of Engineers, received comments through 24 letters, 34 emails, and 1 phone call. Comments are very briefly noted below.

The U.S. Environmental Protection Agency (EPA) supports the specific objectives of this proposal. A rating of Lack of Objectives was assigned. EPA recommends developing an interagency SGGE Operations Team. EPA offers comments to guide the final plan design and implementation, including cost savings, pre-CERP baseline, and permits.

The U.S. Department of Interior (DOI) has recommendations of various points of improvement for the PIR: Project Operating Manual Development, Finalize a Modified Adaptive Assessment and Monitoring Plan, Control and Management of Invasive Species, Assurances and Natural Resource Protection, and Modeling Refinements.

The State Historic Preservation Officer (SHPO) states that historic resource concerns have been adequately addressed with cultural resource assessment surveys being conducted to determine if significant resources are present.

The Florida Department of Transportation (FDOT) offers comments entailing Notice of Conditional Consistency, State Highway System Concerns (I-75, SR 29, and U.S. 41), U.S. 41 Culverts, Project Access Roads, Conclusions; Cost Effectiveness and Incremental Cost Analyses, Section 9.18.1 (Cumulative Effects) Error, Compliance with State Laws, Section 13 (Recommendations), and Summary Comment.

The Southwest Florida Regional Planning Commission finds the document Regionally Significant and Consistent with adopted goals, objectives, and policies of the Strategic Regional Policy Plan.

Property Rights Action Committee is opposed to the project.

Henderson Franklin Attorneys at Law believes the Plan will have a detrimental effect on 6L's farm property. They list issues and areas of concern.

Brigham Moore, on behalf of Helen Nobel and Vince Duerr, are concerned about flooding in their properties.

The 15,000 Coalition, Inc. had a problem with the meetings and notification methods and were worried about effects to property.

The Collier County Audubon Society is convinced of the benefits of this project. They also offer concerns and comments for better implementation.

The Florida Wildlife Federation has statements they would like to be included in the final document. They are worried that impacts on listed species have not been fully assessed.

The Conservancy of Southwest Florida supports Alternative 3D as the recommended plan.

The Miccosukee Tribe of Indians strenuously objects to the PIR/EIS. They stress violations of WRDA 2000, NEPA, APA, ESA, Programmatic Regulations, National Historic Preservation Act of 1966, and others laws and statutes.

Many letters and emails were received that include comments on support of the project, support of Alternative 3D, hurricane/emergency evacuation route, additional data collection and modeling needed, cost estimates needed, fear of over-drainage and excess flooding, comment period requested to be extended, concerns of what will happen if project does not work, inadequate public meeting in Naples, FL on June 17, 2004, no notice of public meeting, not able to or not enough time to read report, opposed to the project, further review and modification of document needed, ATV riding area needed to be replaced, people's private land should not be taken away (especially Jesse Hardy's), project costs too much, concerns of U.S. 41, and not receiving a copy of the document.

Comment Letters and Emails Received

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

James C. Duck, Chief
Planning Division
U.S. Army Corps of Engineers
Jacksonville District
P.O. Box 4970
Jacksonville, FL 32232-0019

SUBJECT: Draft Integrated Project Implementation Report and Environmental Impact Statement for the Ecosystem Restoration of "Southern Golden Gate Estates" [SGGE], Collier County, FL; CEQ No. 040224; ERP No. COE-E36183-FL, (dated April, 2004)

Dear Mr. Duck:

Pursuant to its responsibilities under Section 102(2)(C) of the National Environmental Policy Act (NEPA) and Section 309 of the Clean Air Act, the U.S. Environmental Protection Agency (EPA) has reviewed the above U.S. Army Corps of Engineers (COE) Draft Environmental Impact Statement (DEIS) and Draft Project Implementation Report. The subject document evaluates the environmental ramifications attendant to employing various structural/non-structural measures to reestablish the pre-drainage hydrology and ecology on this 55,247-acre subdivision of the overall residential development. Specifically, the recommended alternative [3A] will entail construction of a series of pump stations and spreader channels to slow water flowing through the four existing drainage canals [Miller, Faka, Union, and Merritt]. The pump stations [and their operation] are an important element of the proposal since the water must move in an uninterrupted fashion southward to preclude induced flooding within North Golden Gates Estates [NGGE]. On the other hand, operation of these pumps must be carefully staged to lessen the probability that any enhanced flood protection will result in further inappropriate land use in NGGE..

In order to realize these interrelated management goals, the Jacksonville District should establish an interagency SGGE Operations team. Its membership would include state/federal agency representatives as well as local interests. It would focus on operational procedures that determine pumping requirements in relation to canal stages and existing/forecast weather conditions. Experience suggests that these operating procedures would need to be revised frequently after the initial construction is completed and then periodically after a critical mass of information becomes available to reach reasoned, longer-term decisions. Given that this is a proposal of almost regional

proportions, some fundamental changes in watershed hydrology can be expected. For example, the five developed areas, e.g., northern Belle Meade, within the project's effects area will receive greater incremental flood elevations [for a given rainfall episode] which will require protection by a ring levee and culvert system. Water diverted via the spreader channels from the main channels would be distributed across the intervening landscape both to the east and west. There is the anticipation that these hydrological changes will enhance wetland communities within SGGE confines and improve the timing/volume of fresh water to the downstream estuaries of the Ten Thousand Islands region. Further, most of the roads and adjacent ditches within the SGGE would be degraded [to their original elevations] and plugged, respectively. Excess non-asphaltic material from the roadways will be used to plug the main drainage canals. The positive impacts of these measures [compared to without project conditions] should be regionally significant, viz., ecological restoration of 55,000 acres to include over 36,000 acres of wetland communities, improved hydrology both within and external to the immediate project effects area, restoration of the historical connections between/among various federal/state preserves, etc.

EPA strongly supports the specific objectives of this proposal as well as the related environmental goals of the even more Comprehensive Everglades Restoration Project. Given their complexity and interrelated nature, realizing the desired environmental consequences will be a long and adaptive process. Long-term monitoring to determine just how successful this proposal is in achieving its projected environmental deliverables will be another responsibility of the SGGE Operational Team. Given the importance of this proposal, we intend to participate actively with our state/federal stakeholders in this regard.

EPA determined that the consequences attendant to this proposal have been appropriately characterized/evaluated; therefore, a rating of "LO" (*Lack of Objections*) was assigned. We appreciate the opportunity to evaluate this action and should you have questions regarding our comments, Mr. Eric Hughes (904/232-2464/ Eric.H.Hughes@saj02.usace.army.mil)of our South Florida Office or Dr. Gerald Miller (404-562-9626/Miller.Gerald@epa.gov) will serve as initial points of contact.

Sincerely,

Heinz J. Mueller, Chief
NEPA Program Office
Office of Policy and Management

United States Department of the Interior

OFFICE OF THE SECRETARY
Washington, D.C. 20240

July 13, 2004

Brad Foster PD-PF
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville, Florida 32232-0019

Dear Mr. Foster,

Thank you for the opportunity to review and provide comments on the Draft Integrated Project Implementation Report (PIR) and the Environmental Impact Statement (EIS) for the Southern Golden Gate Estates (SGGE) Ecosystem Restoration Component of the Comprehensive Everglades Restoration Plan (CERP). The Department of the Interior recognizes the complexity of the task undertaken in this draft document and appreciates the effort the Jacksonville District has made in the development of this important CERP component.

The Department continues to strongly support the restoration of the SGGE project area. The SGGE project is an excellent opportunity to restore the area's cypress, pinelands, wet prairies, and the pre-drainage hydrology and ecology, and to eliminate damaging point source discharge of fresh water from Faka Union Canal. The close proximity of the project area to other protected lands also provides a valuable opportunity to link natural habitats and to improve conditions in areas downstream of the project, including the Ten Thousand Islands area.

The SGGE project plan has been developed and reviewed by a multi-disciplined team that includes federal, state, and local government biologists, hydrologists, planners, and engineers. However, we recognize that the PIR review process also provides an opportunity for PIR refinement as well as design development and improvement. Consistent with this continuing effort, the Department recommends that the following recommendations, consistent with WRDA 2000's overarching objective of the Comprehensive Plan, be incorporated prior to the PIR being finalized, approved and proceeding to detailed design. We offer four general recommendations for improvements to the final PIR and one comment regarding needed refinements to the modeling that will be used in the final design document.

We would also like to offer the enclosed specific comments on the Draft Integrated Project Implementation Report and the Environmental Impact Statement for the Southern Golden Gate Estates as provided by the Fish and Wildlife Service to be addressed in the final PIR. These comments provide recommendations related to the description and development of the project as presented in the draft PIR and EIS and further detail our overarching comments listed below. Extensive technical comments are also attached in order to ensure that the PIR meets the intent of the Plan. As referenced in the attachment, the comments also underscore the need for continuing collaboration to ensure full compliance with applicable Federal laws.

Furthermore, we recognize that significant work is underway to develop the six-guidance memoranda that will memorialize State and Federal policy with respect to PIR's. Our comments assume that the approaches employed in this PIR for alternative evaluation, operational manuals, and project assurances will be consistent with the ongoing efforts to develop these guidance memoranda. In addition to ensuring this consistency, we trust that any inconsistent approaches in the PIR, approved prior to the final release of the guidance memoranda, will not be considered as a precedent for future PIR's.

Recommendations to be Included in Final PIR

1. **Project Operating Manual Development**

As required by the Programmatic Regulations (Section 385.26 (a)(3)(xvi)), a draft Project Operating Manual, where appropriate, must be included in the PIR before it is finalized. The current draft PIR makes references to a Project Operating Manual that is currently being developed but is not included in the draft PIR. We request that the draft Project Operating Manual currently under development be provided for review and commend prior to its inclusion in the final PIR.

2. **Finalize a Modified Adaptive Assessment and Monitoring Plan**

It is our understanding that the Adaptive Assessment and Monitoring Plan in the draft PIR is intended to be replaced by a more comprehensive monitoring plan that is currently under development. We fully support the multi-agency effort for this new monitoring plan and believe it is critical to achieving and documenting ecosystem benefits. The comprehensive Adaptive Assessment and Monitoring Plan will also assure protection and increased benefits to adjacent lands, including two National Wildlife Refuges and Everglades National Park; as well as State of Florida forests, parks, and reserves. Accordingly, we recommend that the Adaptive Assessment and Monitoring Plan in the draft PIR will be replaced in the final PIR by the more comprehensive monitoring plan that is currently under development.

3. **Control and management of invasive species**

The Corps of Engineers has recognized invasive exotic species as a serious and fundamental threat to South Florida Ecosystem Restoration and to CERP implementation. (See Information Paper, dated 21 May 2002, entitled "Proposed Plan for Fiscal Year (FY) 03 Exotic and Invasive Species Management and Control" and via the inclusion of "environmental protection" as a primary mission of the Corps in WRDA 1999). The Corps has provided $5.8 million as part of CERP for two invasive species projects. 1) The CERP Project Management Plan; Melaleuca Eradication and Other Exotic Plants, April 2004 and 2) the preparation of a reconnaissance-type "special report that would further identify the overall problem with exotic and invasive species and provide a recommendation regarding further Federal involvement"... for South Florida Ecosystem Restoration. Because of the serious problem with invasive exotic species, particularly Brazilian pepper in the SGGE, the PIR should reference and use the two CERP invasive species plans and recognize the Corps' expanded involvement in invasive species management through CERP.

In addition to any references to the control and management of invasive species contained in the SGGE PIR, the Department expects the Final Land Management Plan referenced below to include land management actions to deal with invasive exotic species. The Final Land Management Plan should specifically consider potential effects of invasive exotic species on

threatened and endangered species and manage the threatened and endangered species in a manner sufficient to ensure restoration and facilitate recovery.

4. **Assurances and Natural Resource Protection**
We applaud the language contained in the assurances section of the PIR and believe that this section begins to set forth an important framework to achieve project benefits anticipated by WRDA 2000. However, we recommend that this section be expanded and redrafted to include natural resource protections and benefits, and baseline water measurements that are currently being negotiated for inclusion in the Guidance Memoranda. Furthermore, we recommend that hydrologic improvements that benefit fish and wildlife outside the project footprint be documented. Further, we believe an evaluation of existing and future flood protection benefits is required to satisfy the WRDA 2000 Savings Clause, as is an evaluation of hydrologic conditions that support fish and wildlife. Finally, if it is determined that there is no water available in excess of the amount needed for restoration, we recommend that this conclusion be stated in the report. This will clarify how much water is available for other water related needs.

5. Modeling Refinements
Hydrological models have been developed to support project alternative selection and project benefit analysis. The models are used as tools to reasonably approximate the effects of the project plan design on fish and wildlife resources. However, the Department still has concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and design storm applications. We recommend that the models be further refined to more accurately predict project effects on upstream and downstream lands. The models should also characterize the wetland loss and increased stormwater runoff resulting from existing agriculture and rapid urban development of the project watershed.

As federal funds were utilized to acquire project lands for restoration activities, the final land use will be set forth by the State of Florida in the Final Land Management Plan as required by the funding agreement. The United States Fish and Wildlife Service looks forward to receiving the Final Management Plan for review and approval.

Thank you for your consideration of these comments. We look forward to continued collaboration with the Corps, the State of Florida and all stakeholders to achieve the best possible result as these important CERP projects move forward.

Sincerely,

Terrence C. Salt
Director of Everglades Restoration Initiatives

Cc: COL Carpenter
Ernie Barnett
Henry Dean
Jay Slack
Dan Kimball
Carol Clark
Willy Taylor

From: NMFS HCDPC [NMFS.HCDPC@noaa.gov]
Sent: Tuesday, June 22, 2004 1:04 PM
To: Southern Golden Gate Estates
Cc: Joan Browder; Sramek Mark
Subject: Southern Golden Gate Estates

The National Marine Fisheries Service (NOAA Fisheries) has reviewed the Southern Golden
Gate Estates (SGGE) Hydrologic Restoration Project Draft Integrated Implementation Report and Environmental Impact Statement, dated April 2004. The SGGE project is a component of the Comprehensive Everglades Restoration Project, and would reestablish historical water flow characteristics within the study area, and restore and enhance fish and wildlife habitats within the Ten Thousand Islands watershed, Collier County, Florida.

Based upon our review of the document, and our participation in the June 17, 2004, Public Workshop in Naples, Florida, we find that the description of fishery resources and habitats which occur within the project area and the assessment of potential adverse impacts associated with the proposed activities are adequate. We anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore, do not object to the proposed restoration activities.

Pursuant to essential fish habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act, no further coordination is necessary unless the project
design is further modified, and your agency determines that implementation of those revisions could result in adverse impacts to EFH and dependent fishery resources. We appreciate the opportunity to provide you with our comments. If you have any questions, please feel free to contact Mr. Mark Sramek at the letterhead address above, or by calling (727) 570-5311.

From: Dione Carroll [DioneC@miccosukeetribe.com]
Sent: Friday, June 25, 2004 3:40 PM
To: Sggecomments
Subject: Dear Mr. Kremer;

Dear Mr. Kremer;

Attached please find the Objections by the Miccosukee Tribe of Indians to the Draft Integrated Project Implementation Report and Environmental Impact Statement on the Federal Southern Golden Gate Estates Project. A signed copy with all attachments has been forwarded to you via U.S. Mail.
If you have any questions, please do not hesitate to contact me at 305-223-8380 ext. 2226. Thank you for your kind attention to this matter.

Dione Carroll, Esq.
General Counsel
Dionè C. Carroll
General Counsel, In House
Phone: 305-223-8380 x 2226
Fax: 305-223-1011
Miccosukee Tribe of Indians of Florida
P.O. Box 440021, Tamiami Station
Miami, Florida 33144

June 25, 2004

Via Federal Express

Colonel Robert M. Carpenter
U.S. Army Corps of Engineers
701 San Marco Blvd., Room 372
Jacksonville, Florida 32207-8175

Re: Objections by the Miccosukee Tribe of Indians to the Draft Integrated Project Implementation Report and Environmental Impact Statement on the Federal Southern Golden Gate Estates Project

Dear Colonel Carpenter:

I. INTRODUCTION

The Miccosukee Tribe of Indians strenuously objects to the Army Corps of Engineers ("Corps") Draft Integrated Project Implementation Report and Environmental Impact Statement ("PIR/EIS") for the Southern Golden Gate Estates Ecosystem Restoration. The Tribe contends that the PIR/EIS and events leading up to the PIR/EIS violate at least the Water Resources Development Act of 2000 ("WRDA 2000") and WRDA predecessor statutes, the National Environmental Policy Act (NEPA) and implementing regulations, the Administrative Procedures Act ("APA"), the Endangered Species Act ("ESA") and implementing regulations, the December 2003 Programmatic Regulations, the National Historic Preservation Act of 1966, Executive Order 12898 on Environmental Justice, Chapter 373, Florida Statutes and the Corps' trust responsibility to the Tribe. The Corps' Draft PIR/EIS is premature, incomplete, inaccurate and inadequate as it purports to only tentatively select Alternative 3D, does discuss in any meaningful way that the Tribe has hundreds of acres of lands in the project area,[1] and does not reflect the fact that the Corps' state and local partners (the

[1]Page 4-4 of the PIR/EIS contains a map of the project area which fails to identify Tribal lands. The map should be revised to indicate the Tribe's lands.

South Florida Water Management District ("SFWMD") and the Department of Environmental Protection ("DEP")) have been condemning land and have already constructed components of the Project, even plowing in canals, as part of implementing a federal project without having completed the environmental reviews required under NEPA, the ESA, the Programmatic Regulations and Chapter 373, Florida Statues. It even goes so far to suggest the project is being performed only with land which is purchased, when clearly land is being condemned as well, see PIR/EIS page 3-2, and showing favorites by allowing that selected lands are receiving flood protection, while others are taken.

The Draft PIR/EIS also violates WRDA 2000 by asking Congress to authorize giving and crediting the state partner with federal funds even though they have begun illegally implementing a federal project prior to complying with WRDA 2000 and conducting the reviews required by NEPA, the ESA, the Corps own rules, including the Programmatic Regulations, and Chapter 373, Florida Statues. The fact that the state has moved forward on the project before the reviews required by law are completed must be thoroughly discussed in the PIR/EIS, which is required to be a full disclosure document.

The scant reference by FWS in its Coordination Act Report attached as an exhibit to the document and passing references in the PIR/EIS are not the type of detailed description of the state's pre-EIS "early start" of the project that is required to be included in an EIS and which should now be included in a Supplemental EIS ("SEIS"). It is clear to the Tribe that the reason 3D is the tentatively selected alternative is to allow the state to continue to condemn land it thinks it needs and construct the project willy nilly, so that the Corps can merely rubber stamp a plan that is already a done deal. The Tribe contends that the Corps must issue an SEIS once it identifies a selected alternative that is not tentative, so that a detailed alternative can go through the NEPA process.

The Tribe further anticipates violation of the Clean Water Act of 1972. In addition to the federal requirements, Sections 373.470(3)(c), 373.026(8)(b), and 373.1501(5), Florida Statutes, require specific reports and analysis. Those requirements are not completed, and so, the PIR/EIS enables a violation of state law as well as federal law.

A. SGGE PIR/EIS VIOLATES THE INDIAN TRUST DOCTRINE

The Army Corps of Engineers owes the Miccosukee Tribe of Indians a sacred trust obligation and fiduciary duty to protect Tribal lands, resources, and assets pursuant to the federal Indian Trust Doctrine developed over hundreds of years of jurisprudence. The Corps' failure to stop the state, the Corps' local partner, from unfairly and unnecessarily attempting to seize the Tribe's lands prior to the PIR/EIS process being completed adversely affects lands that are vital to the culture and way of life of the Tribe, and which the Corps has a solemn responsibility to protect. Moreover, the Department of the Interior, which furnished funds for land acquisition, is required explicitly under WRDA 2000 to abide by its trust responsibility during CERP

implementation. The PIR/EIS sadly barely acknowledges that the Tribe has lands in the project area when it discusses *consulting* with the Tribe in Section 3.15 on Cultural Resources. Section 5.15 on Cultural Resources contains no mention of the Tribe.

The Draft PIR/EIS systematically refers to tribal consultations as if the Tribe were consulted to the level of stakeholder participation or in satisfaction of trust obligations. It is the Tribe's position that their concerns have been ignored by the federal Government. Inches of paper correspondence to the Department of the Interior and other federal agencies about the problem of Indian land in the area has gone unanswered. See Attached correspondence. Saying you have consulted the Tribe does not make it so. Even section 5.1, Public Concerns, fails utterly to recognize the concerns raised by the Miccosukee tribe. The Tribe urges you to do something about a situation which has achieved and exceeded crisis levels.

B. THE SGGE PIR/EIS VIOLATES WRDA

Congress, which sought to prevent the exact type of NEPA abuse happening here, required that any CERP Project must first be subject to an EIS prior to authorization and construction. As stated at page iv of the PIR/EIS, *"WRDA 2000 requires completion of the Project Implementation Report prior to implementation of the CERP Project."* No final PIR exists and yet portions of the SGGE project are being conducted and land is being purchased and forcibly taken without the required PIR or other NEPA analysis having been finalized.

As stated at Section 12.1.2 of the PIR/EIS, Section 601(h)(4)(a) requires that the PIR comply with the National Environmental Policy Act. WRDA 2000 also includes a savings clause, section 601(h)(5)(B), that requires that implementation of the plan will not reduce levels of service for flood protection that were in existence on the date of enactment of WRDA 2000 and in accordance with applicable law. The concept of re-flooding conflicts with this savings clause which preserves flood protection.

Despite the PIR/EIS requirements, the Corps has facilitated its state partner fast tracking implementation of the project, including condemning for land acquisition, prior to the EIS being completed, and complying with the savings clause, as required by WRDA 2000. Table 12-3 appears inaccurate because it fails to recognized the Tribe uses at least water for natural purposes (local basin storage and runoff) for its land in SGGE. The land still belongs to the Tribe and must not be treated as taken. Even worse, at Section 13, the Corps actually recommends that Congress credit its state partner for its dismal failure to comply with WRDA 2000 and other federal laws.

In addition to the Corps' existing trust responsibility to Indian Tribes, which is universally recognized (though often not honored) and an aspect of the long recognized duty of the federal government to American Indian Tribes, WRDA 2000 places a specific coordination requirement on the Corps which has not been satisfied. WRDA indicates as follows: "(4) PROJECT-SPECIFIC ASSURANCES- (A) PROJECT IMPLEMENTATION REPORTS- . . . (ii) COORDINATION- In developing a project implementation report, the Secretary and the

non-Federal sponsor shall coordinate with appropriate Federal, State, tribal and local governments." The Corps has ignored this provision entirely. The Tribe has received no meaningful coordination. It has been treated with less dignity than the public at large. Instead of conducting coordination, the state Department of Environmental Protection has gone forward to try to take the Tribe's land impacted by the project, and questions posed by the Tribe to the Corps and the local sponsor regarding the project have gone unanswered. The Tribe's fundamental issues, previously raised to the Corps, go even now unaddressed and ignored by the Draft PIR/EIS. The general abuse and neglect the Tribe has received cannot be construed as "coordination."

C. SGGE PIR/EIS PROCESS VIOLATES NEPA

As a review of the fundamentally flawed PIR/EIS demonstrates, the Corps is not taking the objective hard look required by NEPA, because they have prejudiced the process by allowing the state to acquire land, and even begin implementing components of the project, while admitting their selected alternative, and the land acquisition for it, is tentative and subject to change and that the NEPA process is not complete. Indeed, the SFWMD announced the fact that it was *beginning construction of the Southern Golden Gate Estates restoration project* in its 2003-2004 Budget in the Brief report. To paraphrase the Judge in another NEPA case, after its state partner has already committed millions of dollars for construction and land acquisition for which they expect credit from the federal government, how can the Corps now be trusted to take the clear eyed hard look required by NEPA, or is this PIR/EIS merely a classic Wonderland case of first-the-verdict, then the trial?

Furthermore, to go forward with construction, permits had to be obtained from the Army Corps of Engineers. In issuing those permits the Corps has unlawfully segmented the project for NEPA purposes.

Incredibly, this project is estimated to cost $362 million. Approximately 38 million dollars of the purchase in the South Block is planned to be funded or refunded to DEP by Interior, and yet, DEP has been purchasing and condemning land in the area for years. In so doing, the project has been segmented and furthered without performing the appropriate NEPA analysis. In the process, Miccosukee lands are directly under attack. The Corps is exalting form over substance and cooperating with DEP, the Department of the Interior and others to violate and illegally avoid environmental statutes.

In April 1998, the Department of the Interior and DEP executed a Federal Grant in which Interior provided $25,000,000 to DEP for the acquisition of 20,250 acres, more-or-less. In December 1999, an amendment was signed to add an additional $13,000,000 making the total Federal funding received by DEP $38,000,000. DEP was not required to provide non-federal matching funds for receipt of the $38,000,000. Since the signing of the Agreements, land acquisition in the SGGE area was accelerated by the State of Florida through DEP, including an attempt to quick take Miccosukee tribal land. All of this has been conducted in a manner which violates the legal requirement not to segment projects involving major federal action impacting

the human environment and the legal requirement to perform appropriate environmental analysis prior to beginning projects.

The Corps' own regulations prohibit actions during the NEPA process that will limit the choice of reasonable alternatives or prejudice the ultimate decision on the project. See, 33 C.F.R. 230.22 (adopting 40 C.F.R. 1506.1). The fact that the Corps allowed the SFWMD to acquire land, and even begin constructing portions of the project, before completing the EIS violates NEPA and its implementing regulations. It also violates WRDA 2000, which requires that an EIS be conducted first. To add insult to injury, the Corps used an advisory group to screen and select the alternatives. Aside from the fact that this has implications under the Sunshine law and/or Federal Advisory Committee Act ("FACA"), it is clear that the Corps used selected groups to make all their decisions first and then invited the public in afterwards. Finally, the PIR/EIS fails to analyze reasonable alternatives to condemnation and taking of land.

No specific alternative is analyzed that would allow the Miccosukee Tribe to continue to own and conduct native cultural practices on its lands in SGGE. Nor is there a specific analysis of whether the Miccosukee parcels are necessary. The failure to analyze this reasonable alternative is contrary to both NEPA and the Corps' trust responsibility to the Tribe.

D. SGGE PIR/EIS VIOLATES THE APA

The condemnation and acquisition of land, and construction of portions of the project prior to completing the NEPA and ESA process is contrary to current rules and regulations of the Corps and is either in violation of, or constitutes an amendment to, these rules and regulations. This amendment of rules and regulations violates the APA because the Corps has never complied with the required rulemaking procedures, including notice and the opportunity to be heard, pursuant to APA. The PIR/EIS does not state that the Corps plans to comply with the rulemaking requirements of the APA. Moreover, the document appears to suggest that the final water control plan will come after the EIS process, which is contrary to Corps' rules on water projects. And, the Corps has failed to conduct the complete analysis required by the Programmatic Regulations for CERP projects.

E. SGGE PIR/EIS VIOLATES THE ESA

While purporting to be necessary for endangered species, the PIR/EIS violates the Endangered Species Act ("ESA"), 16 U.S.C. 1531 et seq. by failing to adequately analyze the impacts on endangered species in the project area prior to the state partner commencing implementation of the project. The ESA requires that a Biological Assessment ("BA") be prepared as part of the interagency consultation process to analyze whether proposed actions are likely to jeopardize the continued existence of endangered species. According to page 9-8, the Corps received such an assessment but failed to implement the alternatives analyzed. The Corps states that the FWS will need a more detailed alternative to be able to conduct its assessment. In other words, no final

BA is complete.

The Corps states that no construction of the tentatively recommended alternative 3D will take place prior to completion of the BA, concurrence of FWS, and full compliance with the Endangered Species Act. The Tribe disagrees with the Corps view at section 11.2 that it is proper for the FWS and the Corps to coordinate a full-fledged Biological Assessment of the Project for endangered species between the Draft PIR/EIS and Final PIR/EIS. This is not sufficient to comply with NEPA. Such an assessment, and the design documentation which it will be based should be included in the Draft PIR/EIS. Failure to have done so, requires the Corps to release an SEIS with the information for the public to review. The SEIS should also explain how the Corps can allow its state partner to move ahead with plowing in canals, and other parameters that will be part of the federally authorized project prior to complying with the ESA.

For instance, the Draft FWS Coordination Act Report dated February 2004, page 105 of the Appendix, states that the Service completed ESA consultation with the Corps on the "Prairie Canal Early Start" portion of the SGGE Restoration Project. This is an improper segmentation of the Project under both NEPA and the ESA and fails to look at cumulative impacts of the project prior to construction, as required by law. More important, it shows that the Corps was aware that the SFWMD was constructing portions of the project prior to completing the NEPA process, and even participating in the construction by seeking consultation with FWS to enable the project to proceed.

F. DECEMBER 2003 PROGRAMMATIC REGULATIONS

Your process fails to meet the requirements of the December 2003 Final Programmatic Regulations for the Comprehensive Everglades Restoration Plan (CERP). The SGGE Project Implementation Report does not follow the three-step formulation and evaluation process described in the Programmatic Regulations. You purport to do this because SGGE is geographically and hydrologically separated from the other components of CERP. Given the extraordinary inter-connectivity of the Everglades ecosystem it is not plausible to dispense with the process developed in the Programmatic Regulations for the instant PIR.

G. PIR/EIS VIOLATES THE 5TH AMENDMENT AND DUE PROCESS

The predetermined selection and commencement of construction of portions of Alternative 3D prior to complying with federal law has resulted in premature and unnecessary attempts to take the Tribe's lands and violates the Tribe's constitutionally protected rights, including interference with life, liberty and property rights without due process of law.

H. ENVIRONMENTAL INJUSTICE

The PIR/EIS fails to acknowledge in the section on environmental justice, that

the Miccosukee Tribe has significant lands and practices its culture in the project area and that it will be disproportionately impacted by the project should the state continue to attempt to take its lands for no reason. The Tribe, whose members lived in this area long before non-Indians arrived and maintains these lands in conservation to practice its culture, would be adversely and disproportionately impacted by the taking of its lands for no good reason. This environmental injustice being perpetrated on the first residents of this area should be discussed in the PIR/EIS. Furthermore, the Tribe's access to important other lands used in its cultural practices is likely to be severely curtailed. This represents a dramatic impact to Tribal cultural practices, and the Corps needs to take measures to guarantee continued access for the Tribe.

Section 9.15 - Cultural Resources, fails to recognize the important cultural resources these lands represent to the Miccosukee Tribe. The Tribe needs lands in the area to practice its important cultural activities, including gathering of herbs for Tribal medicines and materials necessary for construction of native dwellings. It also contains important archaeological sites. Any human remains found in the SGGE area must be addressed in an extremely sensitive manner according to Miccosukee custom. There appears to be no culturally sensitive plan to address this problem either.

In short the Draft PIR/EIS fails to recognize the high, adverse and disproportionate impacts to the Miccosukee Tribal population represented by this project and its condemnation of Tribal lands component. The Tribe, pursuant to the special trust responsibility the federal government has to the Tribe, is supposed to receive special consideration of its special needs. No such consideration has been given, and this violates federal law.

It is also important to note that Northern Golden Gate Estates, a residential community, is not being required to clean up their discharges before dumping their polluted water into Southern Golden Gate Estates. In fact, Northern Golden Gate Estates will get larger pumps under this plan, see PIR/EIS page 6-16, so that they may obtain an even greater level of flood protection at the expense of Tribal lands in Southern Golden Gate Estates. In order to achieve justice, the Tribe should be consulted about the possibility of giving its land special treatment in order to meet the Tribe's environmental and cultural needs. Along with this consideration, it must be noted that page 3-20 admits "[r]echarge from the canal influences the yield of the well field. Protection of the long-term sustained yield of this well field is one of the city's primary issues related to hydrologic restoration of the SGGE Project Area." In short, it appears the project is motivated by protecting urban water supply and flood protection at the expense of Tribal interests.

I. THE TRIBE'S CULTURAL RESOURCES

The Corps of Engineers has failed in its Congressionally mandated responsibility to the Miccosukee Tribe to provide government-to-government consultation on the impacts of the proposed project to archaeological sites. The Tribe received a single letter on this Project from the Corps of Engineers. This is not government-to-government consultation. A face-to-face

meeting is necessary in order to build trust with the Miccosukee Tribe and for the Corps to explain the Project and its anticipated impacts on the known archaeological resources. Further archaeological surveys are required. These surveys must be completed to the Tribe's satisfaction before the Project is approved and incorporated in this PIR/EIS. After this initial consultation, the Tribe will then take into consideration the impacts of the Project and develop a response. Please be aware that the Miccosukee Tribe is not the only tribe with historical ties to this area. There are other federally-recognized tribes that must also be included in this consultation. Consultation is necessary because federal funds are being used in the project. The Miccosukee Tribe insists that this consultation take place immediately with its Native American Graves Protection and Repatriation Act and Section 106 Representatives before this Project proceeds any further.

The Miccosukee Tribe further has objections to the anticipated desecration of American Indian archaeological and possible burial sites, including one found on lands owned by the Tribe. No adequate consultation has occurred with respect to this matter. No adequate methodology for addressing the Tribe's concerns has been prepared. Instead, DEP has gone forward to try to take Tribal lands without regard to its cultural concerns. As your EIS recognizes, in the past "the United States relentlessly pursued a policy of Indian removal in Florida, relocating them to territories west of the Mississippi under the guise of the Indian Removal Act of 1830 and the Seminole Wars." In this, a new millennium, evidence supports that a new age of removal is afoot. In spite of decades of evidence that the Tribe is a superior custodian of the land, adopting the most stringent water quality standards to protect its reservation lands, the government is cooperating to force the Tribe off its land, in violation of existing laws.

Existing Conditions - 3.15 Cultural Resources, recognizes the existence of many archaeological sites and says the Corps won't start construction until coordination with the State Historic Preservation Officer ("SHPO"). But, that simply is not true. Construction has already started. Furthermore, no mention is made of the Miccosukee Tribe land in the area or the archaeological site thereon. The PIR/EIS even admits the Prairie Canal Early Start Project, part of the SGGE project started without some testing being completed with respect to already identified archaeological sites. To the extent the project may impact any historical sites, especially those which may involve human remains, the Tribe objects. Clearly further measures need to be taken to address these issues in the SGGE project area.

There is little doubt that the removal of roads and canals will limit Tribal access to historically available lands used in the Tribe's cultural activities in Picayune Strand. Continued access is of the utmost importance to the Tribe. It is further certain the project will interfere with the Tribe's ability to protect verified archaeological sites. This represents disproportionate damage to the Tribe, and the Corps needs to incorporate ways for the project to allow continued access for the Tribe and a continuing ability to protect cultural features.

J. WATER QUALITY AND QUANTITY

No adequate consideration of water quality concerns has been made. Rehydrating with

dirty water is not a viable alternative. In such an instance, the restoration becomes, instead, the pollution of natural areas, jeopardizing the continuation of the habitats of threatened, endangered and species of special concern. Until the quality of the water entering the SGGE has been addressed, the project should not continue to go forward. Reflooding, for instance, of farmlands for hydrologic restoration could lead to the mobilization of pollutants including but not limited to pesticides and organochlorine pesticides, chlordane and dieldrin, and organic pollutants such as phosphorus.

Furthermore, the Tribe still has profound concerns that the planned additions of water to the area will damage or destroy the existing habitat, potentially impacting threatened or endangered species or species of special concern. The Tribe is not comfortable that adequate modeling has been performed, and the conclusions you are making in the PIR/EIS are tentative at best.

II. CONCLUSION

The Army Corps of Engineers is violating WRDA 2000, NEPA, the ESA, the APA, the Indian Trust Doctrine, the 5th Amendment to the U.S. Constitution and Chapter 373, Florida Statutes, by allowing its state partner to acquire lands and begin implementing a federal project, which the Corps will later rubber stamp and provide federal funding for and will predetermine the process and make these laws a sham in the name of Everglades restoration. The Corps' legally insufficient PIR/EIS is a premature and inadequate assessment of a project for which they only have a tentative alternative, and does not comply with NEPA's mandate that an EIS be a full disclosure document. It is clear from the tentative and incomplete nature of the document that the plan for Southern Golden Gate Estates will evolve as the state continues its illegal activities and the Corps will merely rubber stamp, and provide federal funds for, a preordained project that was decided outside the NEPA process. It has become clear to the Tribe that rather than comply with NEPA and the ESA prior to taking action, the Corps has learned to shield its failure to comply with environmental laws by clothing their non-compliance in the mantle of Everglades restoration. This was not what Congress intended in WRDA 2000 and this is not what either Congress, or the public, intended when it passed these hard won environmental laws.

Environmental laws should be followed. The failure to do so will result in hastily devised and harmful plans which violate people's rights and ignore laws designed to protect the environment. The Corps' legally insufficient PIR/EIS, and its turning a blind eye toward the state's and regional actions on a federal project prior to complying with NEPA and the ESA, will not advance the goals of environmental restoration.

Sincerely yours,

Dionè C. Carroll, Esq.

General Counsel

Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Colleen M. Castille
Secretary

June 25, 2004

Mr. Bradley A. Foster
Planning Division, Jacksonville District
U. S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Department of the Army, Jacksonville District Corps of Engineers and South Florida Water Management District – Comprehensive Everglades Restoration Plan – Southern Golden Gates Estates Ecosystem Restoration – Draft Integrated Project Implementation Report and Environmental Impact Statement – April 2004 – Collier County, Florida.
SAI # FL200405106211C

Dear Mr. Foster:

The Florida State Clearinghouse is awaiting additional comments from our reviewing agencies on the above-referenced project. We are therefore requesting an additional fifteen (15) days for completion of the consistency review in accordance with 15 CFR 930.41(b).

We will make every effort to conclude the review and forward the consistency determination to you on or before July 2, 2004.

Thank you for your assistance and cooperation. If you have any questions or require additional information, please contact Ms. Lauren P. Milligan at (850) 245-2170.

Sincerely,

Sally B. Mann

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm

Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Colleen M. Castille
Secretary

OFFICE OF INTERGOVERNMENTAL PROGRAMS

FAX TRANSMITTAL FORM

TO: Mr. Brad Foster DATE: July 9, 2004

OFFICE: USACE – PD LOCATION: Jacksonville, FL

FAX #: (904) 232-3442 NUMBER OF PAGES: 3
(including cover sheet)

RE: Department of the Army, Jacksonville District Corps of Engineers and South Florida Water Management District – Comprehensive Everglades Restoration Plan – Southern Golden Gates Estates Ecosystem Restoration – Draft Integrated Project Implementation Report and Environmental Impact Statement – April 2004 – Collier County, Florida.
SAI # FL200405106211C

State Clearinghouse Extension Request Letter # 2

FROM: Lauren P. Milligan LOCATION: Douglas Bldg, Mail Station 47

FAX #: (850) 245-2190 PHONE #: (850) 245-2170

Department of Environmental Protection

Jeb Bush
Governor

Marjory Stoneman Douglas Building
3900 Commonwealth Boulevard
Tallahassee, Florida 32399-3000

Colleen M. Castille
Secretary

July 9, 2004

Mr. Bradley A. Foster
Planning Division, Jacksonville District
U. S. Army Corps of Engineers
Post Office Box 4970
Jacksonville, Florida 32232-0019

RE: Department of the Army, Jacksonville District Corps of Engineers and South Florida Water Management District – Comprehensive Everglades Restoration Plan – Southern Golden Gates Estates Ecosystem Restoration – Draft Integrated Project Implementation Report and Environmental Impact Statement – April 2004 – Collier County, Florida.
SAI # FL200405106211C

Dear Mr. Foster:

The Florida State Clearinghouse is awaiting additional comments from our reviewing agencies and resolution of the Florida Department of Transportation's potential "conditional concurrence" with the federal proposal, pursuant to Section 15 CFR 930.4. We are therefore requesting an additional fifteen (15) days for completion of the consistency review in accordance with Section 15 CFR 930.41(b).

We will make every effort to conclude the review and forward the consistency determination to you on or before July 23, 2004.

Thank you for your assistance and cooperation. If you have any questions or require additional information, please contact Ms. Lauren P. Milligan at (850) 245-2170.

Sincerely,

Sally B. Mann, Director
Office of Intergovernmental Programs

SBM/lm

Enclosure: Section 15 CFR 930.4

Florida State Clearinghouse

[Code of Federal Regulations]
[Title 15, Volume 3]
[Revised as of January 1, 2004]
From the U.S. Government Printing Office via GPO Access
[**CITE: 15CFR930.4**]

[Page 240-241]

TITLE 15--COMMERCE AND FOREIGN TRADE

CHAPTER IX--NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, DEPARTMENT OF COMMERCE

PART 930_FEDERAL CONSISTENCY WITH APPROVED COASTAL MANAGEMENT PROGRAMS--Table of Contents

Subpart A_General Information

Sec. 930.**4** Conditional concurrences

(a) Federal agencies, applicants, persons and applicant agencies should cooperate with State agencies to develop conditions that, if agreed to during the State agency's consistency review period and included in a Federal agency's final decision under subpart C or in a Federal agency's approval under subparts D, E, F or I of this part, would allow the State agency to concur with the federal action. If instead a State agency issues a conditional concurrence:

(1) The State agency shall include in its concurrence letter the conditions which must be satisfied, an explanation of why the conditions are necessary to ensure consistency with specific enforceable policies of the management program, and an identification of the specific enforceable policies. The State agency's concurrence letter shall also inform the parties that if the requirements of paragraphs (a)(1) through (3) of the section are not met, then all parties shall treat the State agency's conditional concurrence letter as an objection pursuant to the applicable subpart and notify, pursuant to Sec. 930.63(e), applicants, persons and applicant agencies of the opportunity to appeal the State agency's objection to the Secretary of Commerce within 30 days after receipt of the State agency's conditional concurrence/objection or 30 days after receiving notice from the Federal agency that the application will not be approved as amended by the State agency's conditions; and

(2) The Federal agency (for subpart C), applicant (for subparts D and I), person (for subpart E) or applicant agency (for subpart F) shall modify the applicable plan, project proposal, or application to the Federal agency pursuant to the State agency's conditions. The Federal agency, applicant, person or applicant agency shall immediately notify the State agency if the State agency's conditions are not acceptable; and

(3) The Federal agency (for subparts D, E, F and I) shall approve the amended application (with the State agency's conditions). The Federal agency shall immediately notify the State agency and applicant or applicant agency if the Federal agency will not approve the application as amended by the State agency's conditions.

[[Page 241]]

(b) If the requirements of paragraphs (a)(1) through (3) of this section are not met, then all parties shall treat the State agency's conditional concurrence as an objection pursuant to the applicable subpart.

Foster, Bradley A SAJ

From: Milligan, Lauren [Lauren.Milligan@dep.state.fl.us]
Sent: Friday, June 25, 2004 2:36 PM
To: Brad Foster (E-mail)
Cc: Lawson, Daniel
Subject: FW: Southern Golden Gates Estates DPIR - State Comments



ICAR6211-04-Signoff.pdf

Hi Brad:

RE: U.S. Army Corps of Engineers and South Florida Water Management District - Comprehensive Everglades Restoration Plan - Southern Golden Gates Estates Ecosystem Restoration - Draft Integrated Project Implementation Report and Environmental Impact Statement - April 2004 - Collier County, Florida.
SAI # FL200405106211C

Please see the attached .pdf file comments from the Florida Department of Transportation. Hopefully, we'll get our State Clearinghouse consistency letter out on Monday. Please let us know if you have any questions or concerns. Thank you!

Lauren P. Milligan, Environmental Consultant
Florida State Clearinghouse
Florida Department of Environmental Protection
3900 Commonwealth Blvd, Mail Station 47
Tallahassee, Florida 32399-3000
ph. 850/245-2170
fax 850/245-2190

-----Original Message-----
From: larry.slayback@dot.state.fl.us
[mailto:larry.slayback@dot.state.fl.us]
Sent: Thursday, June 24, 2004 7:15 PM
To: Milligan, Lauren
Cc: sandra.whitmire@dot.state.fl.us; charlotte.hand@dot.state.fl.us
Subject: District One Comments ICAR #6211C (ACOE So. Golden Gate)

(See attached file: ICAR6211-04-Signoff.pdf)

Larry G. Slayback
District One (SWAO), MS 1-98
SC 741-4300 / (239) 461-4300
Email: larry.slayback@dot.state.fl.us

Florida Department of Transportation

JEB BUSH
GOVERNOR

JOSE ABREU
SECRETARY

June 24, 2004

Ms. Lauren Milligan, Coordinator
Florida State Clearinghouse
Florida Department of Environmental Protection
3900 Commonwealth Boulevard, MS 47
Tallahassee, Florida 32399-3000

RE: ICAR REVIEW (SAI# FL200405106211C)
NOTICE: CONDITIONAL CONSISTENCY – SOUTH GOLDEN GATE PLAN

Dear Ms. Milligan:

District One, Florida Department of Transportation, has reviewed the above-referenced Intergovernmental Coordination and Review (ICAR) document, and offers the following comments:

1. **Notice of Conditional Consistency:** The *Draft Integrated Project Implementation Report and Environmental Impact Statement* for the Southern Golden Gate Estates Ecosystem Restoration Project, produced by the U. S. Army Corps of Engineers, is devoid of any analyses or narrative discussions relative to the project's potential impacts to the State Highway System. The documents refer to Chapters 334 and 339, Florida Statutes, and state that there will be "...no adverse impacts to the public transportation system"; however, the draft documents do not provide any relevant impact analyses, discussion of findings, or justifications to support the statement, nor specific documented assurances to that effect. The safety and welfare of the motoring public are of paramount importance to the Department's mission and statutory charge. To ensure such responsibilities are met, District One deems the documents ***"Conditional Consistency"***, *subject to the Corps' addressing of potential impacts and issues pertinent to the State Highway System, as well as the provision of assurances and/or remedial modifications to the project's design, if necessary, to the satisfaction of the District One Drainage Engineer*. These stipulations will need to be satisfactorily addressed in order to preclude a district finding of "***Inconsistent***" when the *final* versions of the above documents are submitted for final State Clearinghouse review.

2. **State Highway System Concerns:** Because the intent of the project is to restore natural hydro patterns and flow ways, thereby restoring sheet flow to the Southern Golden Gate Estates project area, there will be significant changes in hydraulics and hydrology, including significant increases in groundwater tables. As a result of these proposed changes, District One requests

that the following issues and potential impacts, at a minimum, be adequately addressed within the aforementioned report and EIS, as well as discussed with Eddie Joyner, PE, District Drainage Engineer, at our District One Headquarters in Bartow, at (239) 519-2497.

- **Interstate 75:** With the selected Alternative 3D plan there will be installed a connector culvert under Everglades Boulevard to tie together the drainage canals along I-75. There also will be installed just south of I-75 spreader channels, three large pump stations, and canal plugs. While the report states that the models show no impact to Northern Golden Gate Estates north of I-75, there does not appear to be any discussion as to whether there could be drainage impacts to the I-75 mainline or I-75/SR 29 interchange during storm events as a result of the above installations. I-75 is critical to regional hurricane evacuation and its drainage system must not be impeded in any way to avoid over-topping. Also, with the slowing and redistribution of head waters just south of I-75, what will be the impact on ground water levels near I-75 and will there be any corresponding threat to the structural integrity of the roadbed at the sub-base level? Please assess and discuss findings to the above, as well as any remedial actions.

- **State Road 29:** With the installation of as many as twelve canal plugs in Prairie Canal alone, which is the eastern-most of the canals, there obviously will be a commensurate rise in both surface waters and ground water tables throughout the area. Increased ground water elevations could impact the structural integrity of SR 29 to the east. Department standards call for the separation of water table elevations and sub-base of state roadways by two feet during any given 24-hour period. Will the increase in surface waters contribute to the overtopping of SR 29 during storm events? If so, at which event levels?

- **US 41 (Tamiami Trail):** With the south/southwest sheet flows, increased distribution of surface waters over the entire project area, and substantially increased ground water levels, what will be the impacts to Tamiami Trail? What will be the threat level for over-topping and bride/culvert scouring during significant storm events, including tropical storms? While Tamiami Trail is not a regional emergency evacuation route, it nevertheless is one of only two east-west arteries connecting southeast Florida to the southwest. Also, the threat of ground water levels endangering the sub-base of state roadways would seem to be greatest in the southern part of the project area, especially Tamiami Trail. Please provide analysis, findings, and any mitigation if necessary.

3. **US 41 (Tamiami Trail) Culverts:** The narrative's discussion of the installation of culverts under Tamiami Trail is unclear whether there is implied a need for *additional* culverts for the segment of US 41 bordering the project area, or if the Critical Culvert program's culverts, which are currently being installed, are adequate. Please clarify the narrative.

4. **Project Access Roads:** The documents state that approximately eleven (11) miles of new, permanent access roads will need to be constructed within and possibly into the project area. The Applicant is advised that direct access to and from I-75 is prohibited, and that any access connections to either Tamiami Trail or SR 29 will require a review of plans and access (driveway) permits, pursuant to Department Rules 14-96 and 14-97, FAC. The Applicant will need to contact Mitch Riley, Collier County Permits Manager, Agent for District One, at (239) 659-5767 for guidance in initiating the review and permitting process, once access locations and technical information are available by the Applicant for submittal and review.

5. **Conclusions; Cost Effectiveness and Incremental Cost Analyses:** After appropriate analyses of impacts to the State Highway System, and conclusions are drawn, the documents should reflect the findings, any mitigation measures, and/or modifications to the report and EIS, especially Section 6.8 (Evaluation of Alternative Plans), particularly the "Cost Effectiveness, Incremental Cost Analysis, and Conclusions" subsections; Section 8 (Recommended Plan); Section 9 (Environmental Effects), especially the "Infrastructure and Environmental Effects on Adjacent Lands" subsections; Section 12 (Assurances and State Laws); and Section 13 (Recommendations). Ensure summary of all impacts to FDOT rights-of-way is included.

6. **Section 9.18.1 (Cumulative Effects) Error:** The document states that the Tamiami Trail Critical Culvert Project, which involves the installation of new culverts under US 41 and associated resurfacing, "...may potentially increase overall vehicle use, which, in turn, may pose long-term consequences to endangered Florida panthers in the form of increased automobile-animal interactions." This is erroneous. Aside from typical growth in background traffic, it is the increasing development of National Park Service kiosks and visitor centers catering to the public that is expected to attract/generate additional traffic to US 41, as well as the designating of Tamiami Trail a "National Scenic Byway"; not the resurfacing of an existing roadway in sore need of repair. In fact, design plans for the resurfacing of Tamiami Trail will not include paved shoulders, at the request of the NPS. Please correct the narrative statement in Section 9.18.1.

7. **Compliance with State Laws:** The documents made reference to Chapters 334 (Transportation Administration) and 339 (Transportation Finance & Planning), Florida Statutes; however, the Applicant needs to also review the following additional statutes: 335 (State Highway System), and 338 (Intrastate Highway System and Toll Facilities), FS, for consistency and compliance.

8. **Section 13 (Recommendations):** The narrative on Page 13-6 recommends that non-federal sponsors be credited for construction activities completed in advance of execution of a "Project Cooperation Agreement" with the Corps of Engineers, including the installation of culverts under US 41, subject to such provision being enacted into law by the Congress. Please clarify whether this means FDOT would be able to recoup all costs associated with its transfer of funds to the SFWMD for the installation of the Tamiami Trail Critical Culverts Project, including consequential resurfacing as a result of the construction? The clarification may be relayed to either Michael Rippe, Director of the FDOT Southwest Area Office in Fort Myers, at (239) 461-4300, or Larry Slayback at the same number.

9. **Summary Comment:** Be assured of District One's cooperation, support, and commitment to the *Southern Golden Gate Estates Ecosystem Restoration Project* as soon as our concerns and any potential impacts to the State Highway System are addressed, assurances of compliance are given, and/or impacts are satisfactorily remediated.

If District One may be of further service, or should you have any questions, please contact Larry Slayback, District One ICAR Coordinator, at Suncom 741-4300 or (239) 461-4300.

Sincerely,

Larry G. Slayback
District ICAR Coordinator

LGS/ls

cc: Email Distribution

Memorandum

TO: Dan Lawson, Florida State Clearinghouse

THROUGH: Greg Knecht, Administrator
Water Quality Standards & Special Projects Program

FROM: John Outland, Gordon Romeis

DATE: June 22, 2004

SUBJECT: Department of the Army, Jacksonville District Corps of Engineers and South Florida Water Management District, Comprehensive Everglades Restoration Plan—Southern Golden Gate Estates Ecosystem Restoration, Draft Integrated Project Implementation Report and Environmental Impact Statement, Collier County, Florida, April 2004

SAI#: FL04-6211C

The Department of Environmental Protection supports the tentatively recommended plan (Alt. 3D) for Southern Golden Gate Estates as presented in the Draft Project Implementation Report (PIR) and Draft EIS, dated April 2004. Department staff have actively participated in the development of the recommended plan and associated PIR as members of the Project Delivery Team. As such, we feel that the project as currently proposed is consistent with the water quality and ecosystem restoration objectives as outlined in the Comprehensive Everglades Restoration Plan (CERP). However, as mutually agreed between the Department and the South Florida Water Management District, the review and comments provided below do not constitute the State's formal review of CERP project components as required by state law under §373.1501, Florida Statues (F.S.) and §373.026, F.S.

Background

Southern Golden Gates Estates (SGGE) was placed on Florida's Conservation and Recreation Land acquisition program in 1985. It was recognized then that the area's wetlands had suffered from over drainage. We support the joint effort by the Corps of Engineers, South Florida Water Management District, and the State of Florida to implement this Comprehensive Everglades Restoration Plan component. The project will provide benefits to SGGE and to surrounding federal and state public trust lands.

The recommended plan will result in the restoration of ecological values of the SGGE project area and improve the adjacent Ten Thousand Island estuary. This restoration project will restore the pre-drainage hydropattern by redistributing water flows over the SGGE landscape recovering the pre-development habitat types in the SGGE project area and restore beneficial flows to the

estuary. This will be achieved through pump stations, spreader canals, canal plugs, road removal, culverts and flood protection levees.

The recommended plan should achieve the following major restoration goals: Over 55,000 acres in SGGE will be ecologically restored, 36,200 acres increase in wetland vegetation communities restored, an increase if 7.3 habitat units of oyster reef in three adjacent estuaries, an increase of over 500 habitat units for open water fish in three estuaries, an increase if of over 5,000 habitat units and 3,800 biotic units in the lands adjacent to SGGE -- Fakahatchee Strand State Preserve, Florida Panther National Wildlife Refuge, Belle Meade CARL, and Collier-Seminole State Park.

Comments

The following comments are offered to guide the final plan design and implementation.

1) We suggest that the recommended plan be further evaluated in the final design to determine if cost savings can be accomplished by eliminating or downsizing of the proposed pump stations without sacrificing flood management in NGGE.

2) The Pre-CERP baseline water for fish and wildlife resources has not been established at this time. It is anticipated that the Pre-CERP baseline water will not be reserved prior to execution of CERP restoration project PCAs but will be reserved before construction is started as an item of local cooperation for the SGGE restoration project.

   We raise this concern because a Pre-CERP reservation is characterized as a reservation of the water currently available and beneficial to the natural system **prior** to implementation of a CERP project and specifically is **not** a requirement of WRDA or the Programmatic Regulations. This Pre-CERP reservation is in addition to the reservation of water made available by the Project for the natural system, which is to be adopted prior to execution of the Project Cooperation Agreement pursuant to Section 601(h) of WRDA 2000.

   The State's position has been that although we do not agree the pre-CERP reservation is required by WRDA, we agree that in order to provide confidence that the pre-CERP baseline water remains available for the natural system, we propose that the following language on Page 13-5 of Section 13 be revised in the final PIR as an item of local cooperation:

   "The Non-Federal Sponsor shall maintain an appropriate quantity, quality, timing, and distribution of water to ensure the restoration and preservation of the natural system for so long as the Project remains authorized. This water shall be consistent with the restoration goals of the Comprehensive Plan and meet all applicable water quality standards. The Non-Federal Sponsor shall:
   1) Ensure, through appropriate and legally enforceable means under Florida law, that the beneficial base water as identified in the Project Implementation Report (PIR) will be available for the natural system at the time the Project becomes operational and will remain available for so long as the Project remains authorized. This beneficial base water and the Project water identified in Section 12 of the PIR in combination are

necessary to achieve the restoration goals and objectives for the Southern Golden Gate Estates Project in the approved Comprehensive Plan.
2) Prior to the execution of the Project Cooperation Agreement, reserve the additional water that will be made available by implementation of this Project and that is necessary for the restoration and preservation of the natural system pursuant to Section 601(h)(4)(B)(ii) of the Water Resources Development Act of 2000.
3) After the Project Cooperation Agreement is signed, make such adjustments to any reservation of water for this Project adopted pursuant to subparagraph 2 above, that later information, science, or analyses shows is necessary for the restoration and preservation of the natural system.
4) Provide the Government with written certification that the requirements of subparagraphs 1 and 2 of this section have been fulfilled.
5) For so long as the Project remains authorized, notify the Secretary of the Army should any change be made in the reservation of water or other legally enforceable means of protecting water and consult with the Government. The Government may verify that the changed reservation adopted pursuant to subparagraph 2 continues to ensure that the appropriate quantity, quality, timing, and distribution of water is dedicated and managed for the restoration and preservation of the natural system. Any change to a reservation of water for this Project identified pursuant to subparagraph 2 shall require an amendment to the Project Cooperation Agreement.

Permits
Upon completion of detailed design, this project will require a Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit pursuant to Chapter 373.1502, F.S. The project may require a NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities in accordance with Rule 62-621.300(4), Florida Administrative Code (F.A.C.). Other department permits may be required during the construction phase of this project, as applicable.

We look forward to continuing our relationship with the U.S. Army Corps of Engineers and the South Florida Water Management District as we move forward with implementing the Comprehensive Everglades Restoration Plan. If you have any questions regarding these comments, please feel free to contact John Outland at 850-245-2087.

cc: John Outland (email)
Gordon Romeis (email)
Karen Bickford (email)
Mark Latch (email)
Stacey Feken (email)

Project Information	
Project:	FL200405106211C
Comments Due:	June 09, 2004
Letter Due:	July 25, 2004
Description:	DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS AND SOUTH FLORIDA WATER MANAGEMENT DISTRICT - COMPREHENSIVE EVERGLADES RESTORATION PLAN - SOUTHERN GOLDEN GATES ESTATES ECOSYSTEM RESTORATION - DRAFT INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT - APRIL 2004 - COLLIER COUNTY, FLORIDA.
Keywords:	ACOE/SFWMD - DIPIR, EIS - SOUTHERN GOLDEN GATES ESTATES ECOSYSTEM RESTORATION
CFDA #:	99.997

Agency Comments:
COMMUNITY AFFAIRS - FLORIDA DEPARTMENT OF COMMUNITY AFFAIRS
Released Without Comment
ENVIRONMENTAL PROTECTION - FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION
DEP supports the tentatively recommended plan for ecosystem restoration of Southern Golden Gate Estates (SGGE) as presented in the Draft Project Implementation Report and Draft EIS, dated April 2004. It is recommended that the plan be further evaluated in the final design to determine if cost savings can be accomplished by eliminating or downsizing the proposed pump stations without sacrificing flood management in SGGE. Although DEP does not agree that the pre-CERP reservation of water is required by the Water Reservation Development Act, it is agreed that the pre-CERP baseline water should remain available for the natural system. DEP recommends language to be included in the final PIR for local cooperation. Please see the enclosed memorandum from DEP that discusses water reservation concerns and recommends specific language for use in the final PIR.
STATE - FLORIDA DEPARTMENT OF STATE
No comment/Consistent
ENVIRONMENTAL POLICY UNIT - OFFICE OF POLICY AND BUDGET, ENVIRONMENTAL POLICY UNIT
SW FLORIDA RPC - SOUTHWEST FLORIDA REGIONAL PLANNING COUNCIL
The project has been found Regionally Significant and Consistent with the adopted goals, objectives, and policies of the Strategic Regional Policy Plan.
COLLIER - COLLIER COUNTY
No Comment
AGRICULTURE - FLORIDA DEPARTMENT OF AGRICULTURE AND CONSUMER SERVICES
As lead managing agency of the Picayune Strand State Forest, we look forward to continued cooperation with the Army Corps of Engineers on the Southern Golden Gates Estates Ecosystem Restoration and request that all restoration efforts be coordinated with the Florida Division of Forestry.
TRANSPORTATION - FLORIDA DEPARTMENT OF TRANSPORTATION
Comments to be sent under separate cover. Larry Slayback, District ICAR Coordinator (239) 461-4300
FISH and WILDLIFE COMMISSION - FLORIDA FISH AND WILDLIFE CONSERVATION COMMISSION
22-PAGE LETTER BY BRIAN BARNETT DATED 7/8/04.

COUNTY: COLLIER
SAI - CORPS-SFWMD
2004-4311
HR: 2004-4314

DATE: 5/10/2004
COMMENTS DUE DATE: 6/9/2004
CLEARANCE DUE DATE: 6/25/2004
SAI#: FL200405106211C

MESSAGE:

STATE AGENCIES	WATER MNGMNT. DISTRICTS	OPB POLICY UNIT	RPCS & LOC GOVS
AGRICULTURE		ENVIRONMENTAL POLICY UNIT	
COMMUNITY AFFAIRS			
ENVIRONMENTAL PROTECTION			
FISH and WILDLIFE COMMISSION			
X STATE			
TRANSPORTATION			

The attached document requires a Coastal Zone Management Act/Florida Coastal Management Program consistency evaluation and is categorized as one of the following:

- _ Federal Assistance to State or Local Government (15 CFR 930, Subpart F). Agencies are required to evaluate the consistency of the activity.
- X Direct Federal Activity (15 CFR 930, Subpart C). Federal Agencies are required to furnish a consistency determination for the State's concurrence or objection.
- _ Outer Continental Shelf Exploration, Development or Production Activities (15 CFR 930, Subpart E). Operators are required to provide a consistency certification for state concurrence/objection.
- _ Federal Licensing or Permitting Activity (15 CFR 930, Subpart D). Such projects will only be evaluated for consistency when there is not an analogous state license or permit.

Project Description:

DEPARTMENT OF THE ARMY, JACKSONVILLE DISTRICT CORPS OF ENGINEERS AND SOUTH FLORIDA WATER MANAGEMENT DISTRICT - COMPREHENSIVE EVERGLADES RESTORATION PLAN - SOUTHERN GOLDEN GATES ESTATES ECOSYSTEM RESTORATION - DRAFT INTEGRATED PROJECT IMPLEMENTATION REPORT AND ENVIRONMENTAL IMPACT STATEMENT - APRIL 2004 - COLLIER COUNTY, FLORIDA.

To: Florida State Clearinghouse

AGENCY CONTACT AND COORDINATOR (SCH)
3900 COMMONWEALTH BOULEVARD MS-47
TALLAHASSEE, FLORIDA 32399-3000
TELEPHONE: (850) 245-2161
FAX: (850) 245-2190

EO. 12372/NEPA

- ☑ No Comment
- ☐ Comment Attached
- ☐ Not Applicable

Federal Consistency

- ☑ No Comment/Consistent
- ☐ Consistent/Comments Attached
- ☐ Inconsistent/Comments Attached
- ☐ Not Applicable

From:

Division/Bureau: Historical Resources
Reviewer: Susan M. Harp Laura A. Kammerer, Supervisor
Date: 5/27/04 5-27-2004

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2004 JUN 13 PM 1:32
FLORIDA STATE CLEARINGHOUSE

FLORIDA DEPARTMENT OF STATE
Glenda E. Hood
Secretary of State
DIVISION OF HISTORICAL RESOURCES

May 14, 2004

U.S. Army Corps of Engineers
Brad Foster PD-PF
P. O. Box 4970
Jacksonville, Florida 32232-0019

Re: *Southern Golden Gates Estates Hydrologic Restoration Project Draft Integrated Project Implementation Report and Environmental Impact Statement*
Collier County, Florida
DHR Project File No. 2004-4314

Dear Mr. Foster:

Our office received and reviewed the above referenced report in accordance with the agency's responsibilities under Section 267.061 Florida Statutes, Section 106 of the *National Historic Preservation Act of 1966*, as amended and *36 CFR Part 800: Protection of Historic Properties*. The State Historic Preservation Officer is to advise Federal agencies as they identify historic properties (listed or eligible for listing, in the *National Register of Historic Places*), assess effects upon them, and considers alternatives to avoid or minimize adverse effects.

Our review of this document indicates that historic resources concerns have been adequately addressed with the condition that cultural resource assessment surveys will be conducted to determine if significant resources are present. We look forward to reviewing and commenting on the resultant reports.

If you have any questions concerning our comments, please do not hesitate to contact Susan Harp at (850) 245-6333. Thank you for your interest in protecting Florida's historic resources.

Sincerely,

Laura A. Kammerer, Supervisor

for Frederick Gaske, Director, and
State Historic Preservation Officer

500 S. Bronough Street • Tallahassee, FL 32399-0250 • http://www.flheritage.com

☐ **Director's Office** (850) 245-6300 • FAX: 245-6435
☐ **Archaeological Research** (850) 245-6444 • FAX: 245-6436
☑ **Historic Preservation** (850) 245-6333 • FAX: 245-6437
☐ **Historical Museums** (850) 245-6400 • FAX: 245-6433
☐ **Palm Beach Regional Office** (561) 279-1475 • FAX: 279-1476
☐ **St. Augustine Regional Office** (904) 825-5045 • FAX: 825-5044
☐ **Tampa Regional Office** (813) 272-3843 • FAX: 272-2340

Southwest Florida Regional Planning Council

4980 Bayline Drive, 4th Floor, N. Ft. Myers, FL 33917-3909 (239) 656-7720

P.O. Box 3455, N. Ft. Myers, FL 33918-3455 SUNCOM 749-7720

FAX (239) 656-7724

June 14, 2004

James C. Duck
Dept of the Army Jacksonville Corps of Engineers
PO Box 4970
Jacksonville, FL 32232

RE: IC&R Project #2004-045
State Clearinghouse #FL200405106211C

Comprehensive Everglades Restoration Plan -- Southern Golden Gate Estates Ecosystem Restoration - Draft Integrated Project Implementation Report and EIS

Dear Mr. Duck :

The staff of the Southwest Florida Regional Planning Council reviews various proposals, Notifications of Intent, Preapplications, permit applications, and Environmental Impact Statements for compliance with regional goals, objectives, and policies, as determined by the Strategic Regional Policy Plan. The staff reviews such items in accordance with the Florida Intergovernmental Coordination and Review Process (Chapter 29I-5, F.A.C.), and adopted regional clearinghouse procedures.

These designations determine Council staff procedure in regards to the reviewed project. The four designations are:

Less Than Regionally Significant and Consistent no further review of the project can be expected from Council.

Less Than Regionally Significant and Inconsistent Council does not find the project of regional importance, but will note certain concerns as part of its continued monitoring for cumulative impact within the noted goal area.

Regionally Significant and Consistent project is of regional importance, and appears to be consistent with Regional goals, objectives, and policies.

Printed on Recycled Paper

Regionally Significant and Inconsistent project is of regional importance and does not appear to be consistent with Regional goals, objectives, and policies. Council will oppose the project as submitted, but is willing to participate in any efforts to modify the project to mitigate the concerns.

The above referenced document has been reviewed by this office, based on the information contained in the document, and on local knowledge, has been found **Regionally Significant and Consistent** with adopted goals, objectives, and policies of the Strategic Regional Policy Plan.

Should you or any other party request this finding to be reconsidered, please contact Nichole L. Gwinnett, IC&R Coordinator, with this request, or any questions concerning staff review of this item. This recommendation will be discussed at the next scheduled Council meeting. Should Council action differ from the staff recommendation, you will be notified.

Sincerely,

SOUTHWEST FLORIDA REGIONAL PLANNING COUNCIL

David Y. Burr
Executive Director

DYB/NLG

cc: Sally B. Mann, Florida State Clearinghouse Director

John Kremer

South Florida Regional Planning Council

May 27, 2004

Mr. James C. Duck, Chief, Planning Division
Department of the Army
Jacksonville District Corps of Engineers
P.O. Box 4970
Jacksonville, FL 32232-0019

RE: SFRPC #04-0524, Request for comments on the Draft Integrated Project Implementation Report and Draft Environmental Impact Statement (DEIS) for the Southern Golden Gate Estates Ecosystem Restoration, U.S. Army Corps of Engineers, Collier and Monroe Counties.

Dear Mr. Duck:

We have reviewed the above-referenced DEIS and have the following comments:

- Council staff believes the objectives and preferred alternative of the Southern Golden Gate Estates Ecosystem Restoration to be generally consistent with the goals and policies of the *Strategic Regional Policy Plan for South Florida* (SRPP). The restoration project will contribute to a more livable and sustainable South Florida. The Project Implementation Report is particularly consistent with the following goals and policies of the *SRPP*:

Strategic Regional Goal

3.2 Develop a more efficient and sustainable allocation of the water resources of the region.

Regional Policies

3.2.6 When reviewing proposed projects and through the implementation of the SRPP, discourage water management and proposed development projects that alter the natural wet and dry cycles of Natural Resources of Regional Significance or suitable adjacent buffer areas or cause functional disruption of wetlands or aquifer recharge areas.

Strategic Regional Goal

3.4 Improve the protection of upland habitat areas and maximize the interrelationships between the wetland and upland components of the natural system.

Regional Policies

3.4.1 Require the utilization of vegetation and wildlife surveys in project review which include the identification of listed species habitat quantity and quality.

3.4.2 Utilize the results of the vegetation, wildlife and listed species habitat surveys in the reduction of project related impacts to identified wildlife populations or communities. The results of the surveys will be utilized to ensure that the proposed project is compatible with identified or otherwise documented on-site viable populations or communities by retaining those populations or communities on-site.

3440 Hollywood Boulevard, Suite 140, Hollywood, Florida 33021
Broward (954) 985-4416, State (800) 985-4416
SunCom 473-4416, FAX (954) 985-4417, Sun Com FAX 473-4417
email: sfadmin@sfrpc.com, website: www.sfrpc.com

3.4.4 Require the use of ecological studies and site and species specific surveys in projects that may impact natural habitat areas to ensure that rare and state and federally listed plants and wildlife are identified with respect to temporal and spatial distribution.

3.4.5 Identify and protect the habitats of rare and state and federally listed species. For those rare and threatened species that have been scientifically demonstrated by past or site specific studies to be relocated successfully, without resulting in harm to the relocated or receiving populations, and where *in-situ* preservation is neither possible nor desirable from an ecological perspective, identify suitable receptor sites, guaranteed to be preserved and managed in perpetuity for the protection of the relocated species that will be utilized for the relocation of such rare or listed plants and animals made necessary by unavoidable project impacts. Consistent use of the site by endangered species, or documented endangered species habitat on-site shall be preserved on-site.

3.4.7 Natural system corridors shall include upland as well as wetland habitat areas to facilitate the re-establishment of regional system ecological values and functions.

3.4.8 Remove invasive exotics from all Natural Resources of Regional Significance and associated buffer areas. Require the continued regular and periodic maintenance of areas that have had invasive exotics removed.

3.4.9 Required maintenance shall insure that re-establishment of the invasive exotic does not occur.

3.4.11 Local governments shall be encouraged to remove invasive exotics from government property

Strategic Regional Goal

3.9 Restore and protect the ecological values and functions of the Everglades System.

Regional Policies

3.9.3 Support the establishment and management of buffer areas between development and the Everglades system.

3.9.4 Restore natural volume, timing, quality and distribution of water to the Everglades, Florida Bay, Biscayne Bay, other eastern estuaries, and the Atlantic Ocean by:

a) supporting structural and operational modifications to the Central and Southern Flood Control Project and recommended by the US Army Corps of Engineers C&SF Feasibility Study;
b) supporting implementation of East Coast Buffer Plan; and
c) supporting a water supply plan that meets the needs of the natural system.

Thank you for the opportunity to comment. If you require further information, please contact me.

Sincerely,

John E. Hulsey, AICP
Senior Planner

JEH/kal

COLLIER COUNTY AUDUBON SOCIETY

660 Ninth Street, North, Suite 32A
Naples, FL 34102

July 6, 2004

U.S. Army Corps of Engineers
Brad Foster PD-PF
P.O. Box 4970
Jacksonville, FL 32232-0019
Via email: SGGEComments@saj02.usace.army.mil

RE: Southern Golden Gate Estates (SGGE) CERP Restoration Plan, Draft PIR/EIS

Dear Mr. Foster:

Collier County Audubon Society has received and reviewed a copy of the draft SGGE Restoration Plan PIR/EIS, attended numerous project update meetings, and met with water management district staff, including Janet Starnes, regarding this recommended CERP project. We find the overall tentatively recommended plan to be very supportable and we urge its final drafting to be expeditiously forwarded to Congress for funding and implementation to commence.

Collier Audubon Society is convinced of the benefits of this project, which include: improvement and protection for private and public water supply wells in North Golden Gate Estates (NGGE), 83% restoration of the natural ecological systems as compared with pre-development models, habitat enhancement for 80-100,000 acres in the region, including 55,000 acres of the project itself, restoring the proper freshwater discharges to the estuaries of the Ten Thousand Islands portion of the Everglades, which will dramatically improve sport and commercial fisheries, and improving the ecological connectivity among the important adjacent public preserves, refuges and parks.

On the specific tenets of this plan, Collier Audubon offers a few concerns and comments to help assure the best implementation of this plan:

1. We support alternative 3D because of its maximum restoration benefits. However, we are concerned about the use of large pumps to achieve this. The risk and potential is there for using those pumps to OVER drain the NGGE, especially during storm events. We ask that written assurances be made regarding not increasing the drainage of NGGE in the Plan and its implementing documents. All current references to this issue only address UNDER-drainage of NGGE. Also, it is not clear what the definitions are of “emergency conditions” or “prior approval” in Appendix A Water Controls when referring to deviations from normal operations of

those pumps. One such deviation could be over-drainage during regular storms or just a wet summer, so specific criteria and definitions are needed in writing for any such deviations to avoid normal rain events prompting cries of "emergency". Likewise, "prior approval" is too vague. The Corps and District should not increase the feasibility of people building houses in the wettest areas of NGGE with this project.

2. Our understanding is that the Florida Division of Forestry, the ultimate land manager for the Picayune Strand State Forest, intends to allow mudding and other destructive traffic by ORV/ATV driving public in the part of the SGGE restoration area. Collier Audubon Society believes this to be an incompatible land use for a restoration area and would like to see the Corps and District exert some measure of control or stipulate what uses are NOT compatible with this finished project. The "traditional" off-road vehicle uses in the SGGE have been trespassing and *illegal* and should not be viewed as anything vested. Along with the District, Collier Audubon is working on finding alternative sites for such activities.

3. We have heard individual demands for hurricane evacuation routes through this area, but are puzzled by any serious consideration of this. These wetlands are among the last places we should be routing traffic escaping a storm.

4. It was not clear from the scale of the maps, but we urge this project's diked areas conform to Collier County's Natural Resource Protection Area boundaries in South Belle Meade around the 6-L's agricultural area. Please do not include NRPA acreage within the dikes.

While the above comments contain some constructive criticisms, they are intended to improve what we are confident is a very necessary, effective and feasible recommended CERP project for restoration of the Picayune Strand State Forest. Collier County Audubon Society will continue to lend its support.

Sincerely,

Bradley Cornell
Environmental Policy Analyst
239-643-7822
millercornell@mindspring.com

CONSERVANCY
Of Southwest Florida
1450 Merrihue Drive•Naples, FL 34102
239.403.4213•Fax 239.262.0672
www.conservancy.org

July 13, 2004

Brad Foster PD-PF
U.S. Army Corps of Engineers
P.O. Box 4970
Jacksonville FL 32232-0019

RE: Southern Golden Gate Estates Draft Integrated Project Implementation Report and Environmental Impact Statement (DPIR)

Dear Mr. Foster:

The Conservancy of Southwest Florida supports Alternative 3-D as the recommended plan for hydrologic restoration of Southern Golden Gate Estates. We believe that this alternative will allow for restoration of the currently over-drained areas in Southern Golden Gate, while providing sufficient protection for residents to the north against flooding beyond current levels. We ask that Alternative 3-D be forwarded to Congress for approval within the Water Resources Development Act (WRDA) 2004 budget and that hydrologic restoration commence as soon as possible. As one of the first restoration projects with the Comprehensive Everglades Restoration Plan, we believe Southern Golden Gate Estates will prove to be a restoration success story, restoring sheetflow, historic vegetative communities and wildlife habitat. However, time is of the essence and delay on this project would be detrimental. Therefore, we ask that the DPIR move forward in the process of approval and funding.

Collier County is one of the fastest growing areas in the country. Collier County also contains many areas of sensitive environmental habitat. With growth increasing and moving farther out into our rural areas, serious environmental impacts arise. We are losing hundreds of acres of wetlands each year. According to Alternative 3-D, restoration of Southern Golden Gate Estates will result in the addition of 36,200 acres of wetland vegetative communities. This will mean additional habitat for wetland dependent plant and animal species, increased water recharge and the elimination of large freshwater inputs that currently create negative impacts in the estuaries of the Ten Thousand Islands Region.

One concern that the Conservancy has about Alternative 3-D is that this project not be used to dewater Northern Golden Gate Estates. The pumps that are put in place within the Southern Estates should not be used to provide additional flood control beyond current levels of protection for Northern Golden Gate Estates. We support WRDA 2000 requirements that the level of service of flood protection be maintained, but over-drainage in this area would lead to the same serious environmental problems that have occurred in SGGE and would threaten groundwater recharge and protection against fires within the North Estates.

Collier County is fortunate to have a large mosaic of lands in public ownership. Southern Golden Gate Estates is almost entirely surrounded by public lands that are important for both their habitat and hydrologic values. It is the missing piece of the puzzle with the Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, Ten Thousand Islands National Wildlife Refuge, Collier-Seminole State Park and Belle Meade surrounding its boarders. Please move forward with Alternative 3-D, in order to begin restoration through WRDA 2004.

If you have any questions about the Conservancy's position of Southern Golden Gate Estates or Alternative 3-D, please contact me at (239) 403-3222.

Sincerely,

Gary Davis
Director, Environmental Policy

From: Nancy Payton [fwfnaples@earthlink.net]
Sent: Tuesday, July 13, 2004 4:10 PM
To: Sggecomments
Cc: Ernie Barnett; Laura Hartt; Franklin Adams; Manley Fuller; Malia Hale; Wes Woolf; Jim Beever; Kim Dryden; John Outland; Janet Starnes
Subject: FWF/NWF Comments on SGGE - embedded & attached

U.S. Army Corps of Engineers
Jacksonville District
ATTN: Brad Foster, PD-PF
P.O. Box 4970
Jacksonville, FL 32232-0019

RE: Comments on Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project Draft Integrated Project Implementation Report (DPIR) & Environmental Impact Statement (DEIS)
Dear Dr. Foster:

On May 14, 2004, the Jacksonville District of the U.S. Army Corps of Engineers (Corps) issued the Draft Integrated Project Implementation Report and Environmental Impact Statement (DPIR/DEIS) for the Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project. The DPIR/DEIS identifies Alternative 3D as the recommended restoration plan for SGGE. We are writing on behalf of the Florida Wildlife Federation and the National Wildlife Federation (Federations) to voice our general support for the restoration plan. However, we have a few remaining concerns.

The Federations have repeatedly received verbal assurances over the years that there will be no "straws" pulling water from or pushing water into SGGE, but these assurances were not acknowledged in the draft document.

In the final Integrated Project Implementation Report and Environmental Impact Statement, the Federations request that the following be unequivocally stated.

1.. The SGGE Ecosystem Restoration project will not dewater Northern Golden Gate Estates, North Belle Meade, and other neighboring lands. This project is not a flood or stormwater control project. It is not and will not function as a reservoir.

2.. All water flowing into and falling on SGGE will be for nature only. Page 9-15 of the DPIR/DEIS states that water in SGGE may be "made available for other uses." The other uses are not specified, but they will likely change SGGE from a restoration effort to a water supply project. Making SGGE water "available for other uses" is contrary to the restoration effort. Such references should be stricken from the final document or the final document should explicitly state that there are no other uses.
Furthermore, the Federations have concerns that the impacts of the restoration project on listed species have not been fully assessed and disclosed. According to page 9-8 of the DPIR/DEIS, the U.S. Fish & Wildlife Service (FWS) will need a "more detailed project

alternative including additional measures to minimize effects on listed species" before completing its informal consultation. The DPIR/DEIS also states that the Corps will update its Biological Assessment (BA) for inclusion in the final PIR/EIS. DPIR/DEIS at 9-8. Although the DPIR/DEIS acknowledges no construction will occur prior to completion of the BA, absence of a final BA in the DPIR/DEIS makes assessment of the impacts of the recommended project alternative on listed species tenuous.

Prior to issuing the final PIR/EIS, we encourage the Corps to release a supplemental EIS containing the final BA, thereby demonstrating that it has taken the requisite "hard look" at the project alternative's impacts on listed species while allowing the public to comment accordingly.

In spite of these shortcomings, on behalf of the Federations, we also would like to reiterate the positive aspects of the recommended alternative for the public record. Most importantly, Alternative 3D will provide habitat for several federally listed endangered species including the Florida panther. Id. at 3-1. Alternative 3D would restore the SGGE Project Area by plugging 42 miles of the canals and removing 227 miles of the roads. Id. at i. Alternative 3D will connect surrounding state and federal nature preserves and wildlife areas to form a contiguous block of land and create an area large enough "to provide viable habitat for wide ranging species such as the endangered Florida panther and the state listed black bear." Id. at 9-1.

Currently, the "ongoing lack of consolidated state ownership and continued drainage of the project area make it difficult to stabilize, much less recover, listed species found in the project area." Id. at 4-9. This is particularly true for the Florida panther. In the absence of restoration, panther use of the SGGE Project Area will continue to decline. Id. Panthers would lose at least 40% of their habitat in the project area to residential "build-out." Draft Fish and Wildlife Coordination Act Report, DPIR/DEIS, App. D at 83. For that matter, ongoing fragmentation of state lands, further loss of habitat diversity and panther prey, and intensification of traffic and human presence in the project area would further degrade any panther habitat remaining in the project area. Id.

In the absence of restoration, other listed species also will continue to decline because of increased human presence, easy vehicular access, limited refuge areas, and less suitable habitat. DPIR/DEIS at 4-9. For example, continued drainage of the SGGE Project Area will eliminate wetland habitat for bald eagles and snail kites. Id. at 4-9, 4-11. Without hydrological restoration, already low populations of wading birds may disappear. Id. at 4-9. Unconsolidated lands will have a "very devastating effect" on eastern indigo snake populations, which are particularly vulnerable to habitat loss, degradation, and fragmentation. Id. at 4-10. Further loss of pine flatwood habitat will limit the expansion of the red-cockaded woodpecker into the SGGE Project Area and contribute to the species' ongoing decline. Id. Continued increases in salinity and freshwater point source discharges into estuaries are likely to adversely affect American crocodile and West Indian manatee populations. Id. at 4-9, 4-11.

Implementation of Alternative 3D provides a unique opportunity for Everglades ecosystem restoration and endangered species recovery. The Federations thank all who have worked and continue to work on this very important Everglades ecological restoration project.

Sincerely,

Nancy Anne Payton
Southwest Florida Field Representative
Florida Wildlife Federation
2590 Golden Gate Parkway, Suite 105
Naples, Florida 34105

Wesley Woolf
Director, Southeastern Natural Resource Center
National Wildlife Federation
1330 West Peachtree Street, Suite 475
Atlanta, Georgia 30309

From: tyagoston@netzero.com
Sent: Thursday, July 08, 2004 8:15 AM
To: Sggecomments
Cc: bellhall@aol.com; tyagoston@netzero.net; tyagoston@cs.com
Subject: I need a written copy,Mr Brad Foster

To Mr Brad Foster
I would appreciate a written coppyt of the"Comprahencive Restoration Plan for Southern Golden Gate Estates- Draft for
Thanks
Ty Agoston
President
Taxwatch of Collier County
360 10th Ave NW
Naples FL 34120

From: Trisha Akers [lazeeakers@msn.com]
Sent: Friday, June 18, 2004 8:25 AM
To: Sggecomments
Subject: Everglades Restoration Project

Since I was unable to attend the meeting in Naples on June 17th, I would like to voice my opinion through this email.

I understand that this project, if all goes correctly, will help the sheetflow in southern Florida, but there is alot more going on. Those who oppose shutting down the Picayune are not teenagers or 20 year olds who want to go out and play in the woods, drink and injure themselves, or others, there are alot of families, such as myself, who take their children out and camp, ride 4-wheelers and enjoy the area. I have lived in Naples for 31 years and used the area all my life. I have to say there are alot more of us than there are of the rowdy ones. To totally take away an area in which we and countless others have gone to for 30 plus years is devestating.

There will also be an impact on the recreational industry in this area. People spend alot of money on their off-road vehicles. My family, for example, has close to $30,000 worth of 4-wheelers. One for each member of the family, and spares for friends to ride. Will we be compensated for the investment we have in these bikes? No, of course not. What about the ATV shops in town, not the corporate shops, but the little man, he has to feed his family. With no business he can't do that. Will he be compensated? No..... It's just not right....

We have heard about a 1,000 acre area where people will be able to ride, but is that enough? In my opinion, no. Only because you put that many people in such a small area, there's bound to be people getting hurt, and not to mention the fact that there is a high-end residential development being built to the west of it that will not put up with that kind of activity at all hours of the night. SO there must be another alternative, keep a few thousand acrea area in the existing Picayune riding area and satisfy all.

Like I said earlier, there is alot more at stake here than the "Agencies" realize. Please think about the total impacts before making the "final" decision.

Thank you for giving us the opportunity to let our voices be heard.

Sincerely,
Tha Akers Family
Naples, Florida
660 Ninth Street, North, Suite 32A
Naples, FL 34102

From: Debbie Bartlett [dbartlett@cadc.cc]
Sent: Wednesday, July 07, 2004 2:56 PM
To: Sggecomments
Subject: Jesse Hardy Land

To whom it may concern, My name is Debbie Bartlett and I live in Arkansas on the Ouachita river at Bartlett Landing. We have just fourteen acres we where offered one million for our property. They where needing a place to put a marina on the Ouachita river. We refused there offer. Our place is very special to use and it is not for sale. I guess the moral to this story is to fight for your land Jesse Hardy. Our prayers are with you.

Debbie Bartlett

Henderson|Franklin
ATTORNEYS AT LAW

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Post Office Box 280 • Fort Myers, FL 33902
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Bonita Springs • Sanibel

Reply to
Charles J. Basinait
Direct Dial Number 239.337.8433
E-Mail: charles.basinait@henlaw.com

June 28, 2004

REVISED LETTER

VIA FACSIMILE AND U.S. MAIL

Army Corps of Engineers
Mr. Brad Foster PD-PF
P.O. Box 4970
Jacksonville, FL 32232-0019

Re: Public comment by an affected land owner with regard to the Southern Golden Gate Estates (SGGE) Ecosystem Restoration Plan (Plan) for Collier County, Florida.

Dear Mr. Foster:

Please be advised that this law firm represents the interests of WFA Land Co., Inc., FFD Land Co., Inc. and TGL, Inc. (hereinafter referred to as the "Owners"), the owners of more than 5,000 acres that will be affected by the proposed SGGE Ecosystem Restoration Plan for Collier County, Florida. The Owners operate a large scale farming operation more commonly known as 6L's Farm that lies adjacent to the SGGE Plan area and will be surrounded on three sides by the proposed Plan. We were made aware of the extent of the Plan and the existence of the Plan documents at a meeting we requested with the Army Corps of Engineers (ACOE) and the South Florida Water Management District (SFWMD) held at the 6L's farm office in Collier County on Wednesday, June 16th, 2004.

Based on the information presented at that meeting and the subsequent review of available documents, it is our opinion that the Plan as proposed will have a significant detrimental impact on our property and will negatively affect our ability to use the land for the cultivation of row crops, namely vegetables. This land is critical to the overall operation of 6L's Farms which is a major supplier of vegetables worldwide. Damage to this land will carry with it a substantial financial impact on our business.

Since being made aware of the proposed Plan, we have engaged professionals in a variety of areas to review the Plan and assist us in its evaluation. The purpose of this letter is to state our objections and concerns to date with regard to the proposed Plan.

As our full review of the Plan progresses and as questions we pose are answered, our positions with regard to certain aspects of the Plan may change. My goal is to establish a baseline of concerns that through mutual consideration will result in the elimination of any negative effects on our property and thus permitting you to proceed with your restoration Plan. Listed below are issues and areas of concern we have at this time:

1. The Plan as proposed will impact the groundwater levels for 6L's Farms. 6L's utilizes a complex system of dikes, ditches and pumps to ensure that the groundwater and surface water levels are maintained for optimal growth of our crops. Either increasing or decreasing the groundwater level surrounding the farm will have a significant adverse impact on our ability to grow crops successfully.

2. Based on our initial review of the Plan, there is insufficient modeling of the affect on groundwater and thus the impact on 6L's farm as a result of the build out of the SGGE project.

3. In order to accurately model the impact to 6L's a logging of the sub-strata should be done. What additional soil data do you Plan to collect in the development of the Plan?

4. We were told by Michelle Wolfe, Assistant District Counsel for the ACOE that the baseline date for determining the affects of this project on property owners is December 11, 2000. What conditions, including, but not limited to, control elevations for affected properties are documented as of December 11, 2000? This is not clear in your report. In addition, please provide copies of any and all documentation regarding these baseline conditions.

5. It was indicated at the meeting on June 16th that a levee is Planned around other 6L's property for the purpose of keeping increased groundwater levels in the SGGE from flooding our property. Of great concern to us is the issue of seepage under any proposed levee system, which does not appear to be addressed in your Plan. The soil in the area is extremely uniform and porous and as such will quickly transfer any increase in the water table across expanses of land through the sub-strata. What design work has been done with regard to the creation of an interceptor or seepage facility that will address the proposed peak flows in the SGGE and permit 6L's to continue its operation unaffected by this Plan?

6. 6L's pumps water from its fields at the peak rainy season which is also the peak season for flows of your proposed Plan. How can you assure us that our control elevation for discharge and therefore our entire farming operation will not be negatively affected by the proposed Plan?

7. Any modeling must sufficiently address the outfall to and eventually from the US 41 canal to be able to handle the existing flows plus the potential increased flows at peak stages from your project. The existing structures at times already fail to meet the current needs and are poorly maintained.

8. Should a seepage or interceptor Plan be developed to address the water table conditions for 6L's, a suitable sized buffer will be required between the structure and 6L's property line to address peak infiltration periods.

9. I understand that construction will commence in 2007. Baseline data should therefore be measured from the date just prior to construction, not December 11, 2000. Please provide me with copies of any property owner notifications with regard to the December 11, 2000 date, and the basis for using this date as opposed to the 2007 construction date.

10. Modeling of the SGGE and the affect on the 6L's property should utilize the same duration and frequency. For example, it the SGGE Plan utilizes a 100-year event for modeling then the impacts to the 6L's property should be modeled at the 100-year level also.

11. At our meeting on June 16th with representatives of the ACOE and SFWMD, no mention was made of the current comment period ending on June 28th. One of our consultants fortunately read it in the local newspaper that was reporting on a meeting the Corps had with citizens of the North Golden Gate Estates. Will there be additional comment periods as the Plan is altered and ultimately finalized, and how will notifications take place?

As you can see from the issues raised in this letter, the Owners are extremely concerned with the status of this Plan and the apparent lack of data with regard to the impact to surrounding lands, particularly our farming operation as well as that of Deseret Farms to our North and the Sunnygrove homeowners in Section 16. Absent additional data and design elements to protect 6L's farm from any potential negative impacts of this Plan, we are left no choice but to object to the Plan as currently drafted and demand changes to address our concerns.

I formally request that specific notification with regard to any and all amendments, changes and public comment periods in the future be addressed to myself as well as:

Peter Dessak
Vice President
West Florida Agro, Ltd.
P.O. Box 3088
Immokalee, FL 34143-3088
Tel: 239-657-4221
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Jamie Williams
Assistant Director
Farm Op, Inc.
11900 Six L's Farm Road
Naples, Florida 34114
Tel: 239-774-6936
Fax: 239-774-4587
jamiew@sixls.com

Thank you for your kind attention to this matter.

Very truly yours,



Charles J. Basinait

CJB/jma

cc: Peter Dessak
Jamie Williams
David Wilkison
Tim Hancock
(All copied via Facsimile)

BRIGHAM MOORE LLP
EMINENT DOMAIN & PROPERTY RIGHTS LAWYERS

Toby Prince Brigham
S. William Moore
Andrew H. Schuster
Robert C. Byrne
Mark A. Tobin
Amy Brigham Boulris
Andrew Prince Brigham
Laura N. Camp
Juan M. Muñiz

Jackson H. Bowman IV
Patrick T. DiPietro
Gregory S. Rix
D. Mark Natirboff
Francisco J. Pines
Manny K. Papalas
C. William Curtis III
Jennifer Aycock

June 25, 2004

U.S. Army Corps of Engineers
Brad Foster PD-PF
P.O. Box 4970
Jacksonville, Florida 32232-0019

Re: **Southern Golden Gate Estates Hydrologic Restoration Project**

Dear Mr. Foster:

This letter is intended as public comment to the Draft PIR/EIS. Our Firm represents Bernie and Helen Nobel and Vince Duerr. These fine people own property immediately adjacent to the west of the above-referenced project (in line with about 124th and 126th Avenues). While their properties are located outside of the project boundaries, based on comments made at the Public Hearing held on June 17, 2004 in Naples, as well as information contained within the Draft PIR/EIS, our clients have reasons for concern. The factual bases for their concerns will be explained below. The legal bases that indicate our clients are due remedies are the private property protections contained in our United States and Florida Constitutions, as well as the law set forth in Florida Statutes and cases.

Miller Boulevard is the road used to access the Nobel and Duerr properties. The road is asphalt paved and above grade, and it provides unimpeded, primary access during wet and dry seasons. The South Florida Water Management District proposes to make this road "Secondary - Dry Season at Grade." The proposal to degrade Miller Boulevard will deprive the Nobels and Mr. Duerr substantial access to their properties. Proof of this is found in the comments made by Ms. Starnes at the June 17, 2004 Public Hearing concerning the proposed Miller Boulevard degradation, and the results of modeling shown in Appendix "A" to the Draft PIR/EIS.

The Nobels and Mr. Duerr have concern about their properties flooding for several reasons. As with access, Ms. Starnes' comments and the modeling results reflect that the restoration project will cause their properties to flood. Additionally, a six-foot levee is proposed for property located west of the Nobel and Duerr properties "to prevent the increased water levels and durations that are desired for most of SGGE and eastern Belle Meade from adversely impacting the Belle Meade agricultural area." This goal is also stated in Sections Six and Eight of the Draft PIR/EIS: "One team objective was to protect the lands located within the 6L levee;" and "a perimeter levee will be constructed to ensure that the higher water levels expected from the recommended plan will not flood the agricultural area."

This "area" is located about a mile west of the Nobel and Duerr properties. It seems obvious that if flooding is anticipated a mile to the west, then flooding should be anticipated directly adjacent to the project.

In Section 12 of the Draft PIR/EIS, it indicates that "SFWMD is providing reasonable assurances that existing levels of service for flood protection will not be diminished outside the geographic area of the project." This does not appear to be accurate given the information provided in the Draft PIR/EIS. As no **specific** discussion about the project impacts to the Nobel and Duerr properties is contained in the Draft PIR/EIS, please provide the details that support the assurances provided by SFWMD as they apply to the Nobel and Duerr properties.

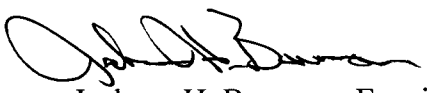
The Nobels and Mr. Duerr do not want to have their access diminished or to be flooded. Appendix "C" indicates that approximately $5,602,000 has been allocated to levee construction in the recommended alternative. Has an estimate been prepared of the cost to build a levee around the Nobel and Duerr properties? If so, please provide the details of the study, and the basis for not including the levee as part of the recommended alternative. If a cost estimate has not been prepared, please indicate why.

Ms. Starnes indicated at the public hearing that since access would be diminished and flooding would occur, purchase offers would be made to the Nobels and Mr. Duerr under the "willing seller" program. The Nobels and Mr. Duerr want to be on equal footing with the government agencies. That means they want the protections provided in our constitutions to be followed. They do not want to engage in "take-it, or leave-it," one-sided negotiations, which typify the "willing seller" program.

Ms. Starnes' acknowledgment of diminished access and flooding seems to be inconsistent with the "reasonable assurance" requirement specified in § 373.1501(5)(d) of the Florida Statutes. Please indicate how her acknowledgment is consistent with the statutory requirement. Also, please indicate **all** of the reasons why the District's power of eminent domain will not be used to acquire the Nobel and Duerr properties.

We appreciate your willingness to address these comments. If anyone at any responsible agency has any questions, please call me.

Sincerely,



Jackson H. Bowman, Esquire

cc: Bernie Nobel
Vince Duerr

From: Stephen Broadhead [SBROADHEAD@elmore.rr.com]
Sent: Monday, June 28, 2004 11:36 AM
To: Sggecomments
Cc: Mcmillen, Rick I
Subject: Fw: Golden Gates Estates Property Project

Good morning,

I have an interest in a 40 acre parcel located @ 1800 72nd Ave SE Naples Fla. I have a copy of The New York Times dated June 13, 2004 with a story about a Mr. Hardy and a buyout problem. Do you know or have a contact person that may know if my property is included in this Southern Golden Gates Estates Project? I have a local atty on 5th Ave in Naples but live out of state..any help will be greatly appreciated...my # in case needed is 334-285-4296

Thank you,
Vicki Broadhead

From: 10K Islands [10000islands@earthlink.net]
Sent: Monday, June 28, 2004 8:22 AM
To: Sggecomments
Cc: poigatorgirl@earthlink.net
Subject: Picayune Strand Restoration Plan

Gentlemen,

As a full time resident of "Port of the Islands", I would like to voice my concerns about the above subject project. I feel the benefits of this plan do not justify the potential harm that that the many uncertainties may cause. In particular, concerns for the following issues cannot be alleviated.

- The plan promises that we would have the same amount of water (drinking/irrigation) as we have now. We are still a growing community. What is being done to insure we will have an adequate water supply (drinking and irrigation)?
- Our canal is already difficult to navigate during low tide. What impact will this have to our water level in the canal? What impact will it have to the Manatees?
- What will be done to insure that this plan does not increase the disease carrying mosquito population? All those dammed up canals nearby will surely add to the problem.
- Will the levees be visible from our homes? Will our views of the mangroves be destroyed?

Thank you for you consideration of these matters.

Best regards,

Dave Claise
President, Sunset Cay Villas XI
266 Newport Dr #307
Naples, FL 34114

To: USACoE
Brad Foster/Col. Carpenter)
Po Box 4970
Jacksonville, FL. 32232-0019

From: Frank F. Denninger
461 E 4th ST.
Hialeah, Fl. 33013

Date: 7-1-04

Re: Request Comment period be extended beyond 7-13-04 due to recently discovered anomalies of an extremely serious nature regarding Maps within SCCE Draft PIR and Appendix.

Dear Mr. Foster,

Having been in receipt of and reviewing the above referenced documents for over a week I have hit a snag that I believe creates an intellectual anomaly impossible to overcome. The anomaly is that certain maps intregally related to large portions of text contained in the documents are either identical but with different titles or the different but with

but with the same title.

Reviewing this complicated project necessitates being able to precisely relate map features to a myriad of text information that specifies areas specified by Draft Map titles. The lack of rock solid linkage between Map titles and text of these documents; Absolutely no intellectual foundation can be derived upon which sound comments could be based upon.

This untenable condition must be remedied immediately, corrected maps be produced using 100% consistent titles and supplied to myself and all others the PIR and Appendix have been sent to for review or other purposes.

I would appreciate an expeditious response to me directly as to how the USACOE intends to deal with this serious anomaly.

The problem maps are located as follows: In the Draft PIR pgs 1-3, 1-11, 1-12 and 1-15. In the Appendix. FNCAR pgs 9 and 10

I feel that 1-2 weeks more time should be sufficient past everyones receipt date of the corrected maps so as

to verify myown and everyone elses basis for comments.

Thanks Sincerely,

Frank F Dennings
461 E 40 ST
Hialeah, Fl. 33013
ph/fax 305 836 9261

ps. possibly the E.A regarding the Tamiami Trail Culvert Project recently incorporated into this SCCOE project should be sent to all recipients of the SCCOE data so that they be made fully aware of all aspects involved. Not me, I have it.

Thanks Again.

Sent: Friday, June 11, 2004 3:33 PM
To: Sggecomments
Subject: Comments about SGGE Integrated PIR / EIS
Comments are at http://jessehardy.org/ and http://jessehardy.org/everglades.htm

From: Ted Guy [guywe@gate.net]
Sent: Monday, June 28, 2004 4:42 PM
To: Sggecomments
Subject: Wildlands Florida project comments

The public owns those lands, not just the environmentalists, and it wrong to exclude the public from their own land.

/s/ William E. Guy, Jr.
643 SW Fuge Rd.
Stuart, FL 34997

From: Tim Hancock [talonmanagement@earthlink.net]
Sent: Monday, June 28, 2004 1:32 PM
To: Sggecomments
Subject: Request for Fax Number

Please provide me with a fax number that comments regarding the SGGE Restoration Plan can be sent to. Since today is the deadline for comments, your prompt attention to this request will be greatly appreciated. Thank you.

Tim Hancock
President
Talon Management, Inc.
3898 Tamiami Trail North, Suite 202
Naples, FL 34103
Phone: 239-262-6197
Fax: 239-262-6198

From: auditu@sccu.com
Sent: Tuesday, July 06, 2004 9:15 AM
To: Sggecomments
Subject: Jesse

Hi,
We are former neighbors of Jesse's. My name is Trudie and my brothers are Ricky and Joe Johnston. Jesse rented from my parents for about 10 years. We just saw his story. Please ask Jesse to contact us. We are there for him and would like to talk with him.

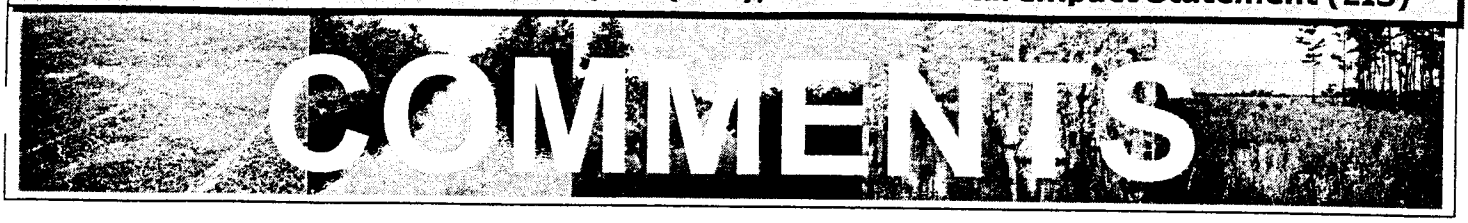
My cell phone is 321-223-1871, home 321-951-3601, work toll free 1-800-447-7228. Please let me know that you have received this. Thank you very much.

Trudie Infantini
Internal Audit Manager
Space Coast Credit Union
P. O. Box 419001
Melbourne, FL 32941
321-752-2222 Ext- 9750

From: Jeanne [jeeeny@the-beach.net]
Sent: Tuesday, July 06, 2004 8:01 AM
To: Sggecomments
Subject: Jessie Hardy

Stop tormenting this man. One person is not going to hurt water restoration attempts. let him be

Southern Golden Gate Estates (Picayune Strand) Hydrologic Restoration
Draft Project Implementation Report (PIR)/Environmental Impact Statement (EIS)



Thank you for attending this evening's Public Workshop. We value your contribution. If you would like to provide additional comments on this evening's presentation and discussion, please provide comments below and return to us prior to the end of the public comment period on June 28, 2004.

COMMENTS: *(May be continued on reverse)* I AM VERY CONCERNED THAT THIS MEETING WAS ANOTHER WHITEWASH TO SATISFY THE REQUIREMENTS OF A PUBLIC MEETING SO IT CAN BE STATED A MEETING WAS HELD (WITHOUT SERIOUSLY CONSIDERING THE PUBLIC INPUT.)

YOUR PROCESS IS FLAWED IN REGARDS TO DOING A RECREATION PLAN AFTER RESTORATION. IF FILL MATERIAL IS NOT SET ASIDE DURING REMOVAL OF ROADS, IT WILL NOT BE PURCHASED & TRUCKED IN LATER (THEN THE EXCUSE WILL BE IT'S TO EXPENSIVE!) IF PLANS AREN'T MADE AHEAD OF TIME FOR BOAT RAMPS, PARKING PADS FOR VEHICLES & TRAILERS, HIKING PATHS, ORV ACCESS POINTS, ETC., THEY WON'T BE BUILT. THIS IS WHAT MANY MEMBERS OF THE PUBLIC THAT HAVE ENJOYED THIS AREA EXPECT TO HAPPEN. THIS PROJECT IS APPEARING TO BE ANOTHER ACTION OF THE GOVERNMENT TO LIE TO THE PUBLIC TO GET WHAT A FEW ENVIRONMENTALISTS WANT. (KEEP THE PUBLIC OFF PUBLIC LANDS INSTEAD OF ENFORCING REGULATIONS)

(OVER)

NAME AND ADDRESS: *(Optional)*
WAYNE JENKINS
2500 JENKINS WAY
NAPLES, FL. 34119

Please mail comments to:
U.S. Army Corps of Engineers
Brad Foster PD-PF
P.O. Box 4970
Jacksonville, Florida 32232-0019
or
E-mail to:
SGGEComments@saj02.usace.army.mil

WHAT SAFEGUARDS HAVE YOU BUILT IN YOUR RESTORATION PLAN IF WHAT YOU BELIEVE WILL WORK DOES NOT?? AN EXAMPLE WOULD BE CULVERTS UNDER THE CANAL PLUGS OR WEIRS THAT COULD BE OPENED IN AN EMERGENCY. SHOULD THE PUBLIC TRUST YOU AND WAIT FOR THE PLUGS TO BE DUG OUT WHILE THEIR HOMES ARE FLOODED??

I'm SURE THE FINAL ANSWER WILL BE "THEY SHOULD NOT HAVE BUILT IN WETLANDS!!"

WE NEED SOME MEETINGS ON THE WEST COAST TO ANSWER CONCERNS RAISED AT THIS MEETING.

SINCERELY,

Wayne Jenkins

From: George R Johns [papijohnswgup@juno.com]
Sent: Thursday, July 08, 2004 3:58 PM
To: Sggecomments
Subject: Re. Jesse Hardy

`Itr seems to me that the problem we are facing with the restoration of the natural flow of the River of Grass should have been thought out some fifty years ago. In my opinion, yuou will never restore the natural flow unless you remoce every obstacle that has contributed to the situation we are now faced with. That means removing Alligator Alley in its entirety. I have reservations about the State footing half or any part of the restoration as I don't think it was our idea in the first. We are paying enough taxes as it is now. We must commend Mr. Jesse Hardy for being the, "Rugh out" type of man he is and for braving the various elements of his home place. It is NOT fair to sell someone a piece of land, and then come back years later to condem and run him off his property. There should be more justice than that in this country. Isn't that the way they do it in some countries?? Sincerely, George R Johns, Hialeah, Fl.

From: Gladys3055@aol.com
Sent: Tuesday, July 06, 2004 3:55 PM
To: Sggecomments
Subject: Wishing you good luck on holding onto your life's dream
Enjoyed reading of your prosperity and hate to see your dream taken away from you. You have worked too hard all your life to have to give in to this advancement ,seems like they should be able to work around you. Best wishes and best of luck. guess you will need it. I will be following as to what progesses. Love Gladys Johnston

From: Tjoyce67@aol.com
Sent: Tuesday, July 13, 2004 4:33 PM
To: Sggecomments
Subject: South Golden Gate Estates Restoration Project
Dear Mr. Brad Foster,

I was told recently by a friend of mine that today was the last day to make comments on the South Golden Gate Restoration Project. I am totally against this project for several different reasons.

First of all I believe the cost of this project is too great. I believe these funds could go to a project of much greater need, such as our educational system. Secondly, I am not totally convinced of the environmental impact that this restoration project. This land has been this way since 1960, what is going to happen to the habitat that is currently there.

I believe that the comment period must be extended and further discussion must take place.

Thank you for your consideration,

Thomas P Joyce
6811 SW 6th Street
Pembroke Pines, Florida 33023
tjoyce67@aol.com

Comments for the Integrated Draft Project Implementation Report and Environmental Impact Statement for Southern Golden Gate Estate (Picayune Strand) Restoration

From: Cindy Kemp Vice President Property Rights Action Committee

I am opposed to this project being implemented and furthermore, in good faith, this project should not proceed without creditable provable science. Where is the underlying documentation? Property Rights Action Committee, (PRAC) is compiling lists of inaccurate or unproven information from the PIR It is a rush on destruction to spend taxpayer money on a project that is not back up by accurate facts. We need the science and documentation to make intelligent comments. Some people have not even received the hard copy edition of the PIR. A local ex-city councilman has not received his Braille copy and many people did not even receive notices for the PIR or public meeting. The Army Corps and cooperating agencies, are not operating on a level playing field, when you have spent years reviewing the plan and only allow the public a very short period of time to review.
The public meeting was inadequate as the facility was not appropriate and people were too uncomfortable to remain and the room size could not contain the crowd.

Tamiami Culvert Project is being incorporated into the plan yet there is no information about this in the PIR. There is no EIS on the culver project and safety issues are a problem. Why and where is the underlying documentation?

It appears that the Data Quality Act is not being upheld and this is a problem

The issue of berms around Jesse Harry's property is not evaluated in the PIR, yet we have discovered gross misrepresentations of projected costs.

PRAC is seeking adequate time to review and gather the underlying documentation to compare with opposing expert opinion. There needs to be documentation concerning the water level rising in NGGE and Belle Mead as this is a major concern affecting thousand of people safety and investments. Where is the documentation concerning mosquitoes impact on health? Where is the underlying documentation for safety? We need to see evacuation routes for people in Marco Island and NGGE who are land-locked in case of fires or storms or other threatening situations, as I had to call the fire department yesterday afternoon to put out a brush fire only hundreds of feet from my property?

This is our taxpayer funds and we need to have the documentation to justify the project. Presently that proof is missing and needs to be corrected. These questions and concerns need to be address and I trust you will understand our intent is for the well being of the public.

Sincerely,
Cindy Kemp kgwestside@yahoo.com

From: Cindy Kemp [kgwestside@yahoo.com]
Sent: Tuesday, July 13, 2004 8:50 PM
To: Sggecomments
Subject: Comments- SGGE

Comments for the Integrated Draft Project Implementation Report and Environmental Impact Statement for Southern Golden Gate Estate (Picayune Strand) Restoration

From: Cindy Kemp Vice President Property Rights Action Committee

We are opposed to this project being implemented and furthermore, in good faith, this project should not proceed without creditable provable science. Where is the underlying documentation? Property Rights Action Committee, (PRAC) is compiling lists of inaccurate or unproven information from the PIR. It is a rush on destruction to spend taxpayer money on a project that is not back up by accurate facts. We need the science and documentation to make intelligent comments. Some people have not even received the hard copy edition of the PIR. A local ex-city councilman has not received his Braille copy and many people did not even receive notices for the PIR or public meeting. The Army Corps and cooperating agencies, are not operating on a level playing field, when you have spent years reviewing the plan and only allow the public a very short period of time to review.

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need to be addressed and I trust you will understand our intent is for the well being of the public.

Sincerely,
Cindy Kemp kgwestside@yahoo.com

THE 15,000 COALITION, INC
(A FLORIDA NOT FOR PROFIT ORGANIZATION)
THE COLLIER CENTER BUILDING
1061 COLLIER CENTER WAY
NAPLES, FLORIDA 34110
(239) 593-1000

June 26, 2004

VIA FACSIMILE 904-232-2201 and E-mail rick.i.mcmillen@usace.army.mil

Mr. Rick McMillen, P.E.
Project Manager
U.S. Army Corps of Engineers
PO Box 4970
Jacksonville, Fl 32232-0019

Re: Request for 45-day extension of time to evaluate the Picayune Strand Hydrologic Restoration—Southern Golden Gate Project

Dear Mr. McMillen:

This letter is written in behalf of more than 3,256 members of The 15,000 Coalition, Inc. The Coalition, as you know, is made up of seriously affected property owners with lands immediately adjacent to the captioned Project on the North side of Interstate 75. Our Coalition property owners encompass approximately 22,000 acres in the area known as North Belle Meade together with North Golden Gate Estates.

A team headed by Mr. Brad Foster of your office held a meeting on June 17, 2004 in Naples at the Best Western Naples Plaza Hotel at 6:30 p.m. where there was an attempt to explain the captioned project to more than 235 people whose lives and constitutional rights are impacted by the proposed Project.

The purpose of this letter is to request no less than a 45-day extension of time so that all of the members of the Coalition and others may study and evaluate your Proposals.

Please be informed, the subject meeting your team attempted in Naples on June 17, 2004 was not well prepared and the room was grossly inadequate in size. The air conditioning system was not of sufficient size to accommodate the people in attendance and some property owners became ill and had to leave the meeting. The building presented a health hazard and safety hazard. The sound system was not effective. The seating was about half of what was needed and as a result, about 50% of those attending were unable to see, hear or understand what your group was attempting to explain.

The 15,000 Coalition members would also like for the record to be abundantly clear, nearly all of affected property owners did not receive any form of written notice of the subject meeting and therefore nearly all were unable to attend. We insist that in the future, NO MEETING be held unless and until each member of the 15,000 Coalition (all 3,256 of which own lands that are affected by your Project) is properly notified in writing of such meeting. We ask that no less than 30-days notice be provided in writing, to every one of our members in the future.

It was suggested at the June 17, 2004 meeting that the proposed Alternative 3-D Project will depend upon a number of very large and expensive mechanical pumps in order to protect our property owners lands and homes from flooding. If the pumps should fail, perhaps the residents in Naples, Florida under certain storm conditions would also be flooded. No information was available or provided to any of us attending the June 17, 2004 meeting regarding the use of any hydrologic models to demonstrate what would occur, and what properties (even those located in downtown Naples) would be flooded if the pumps failed to function during a 100-year storm. This information was not available at the meeting and the members of The 15,000 Coalition, Inc. will not be able to evaluate your proposal, or make comment, without the ability to view the ACOE's modeling information as well as alternatives.

As a further point of information, when this office learned on May 24, 2004 that you had a CD containing information about the proposed project, we emailed, called and wrote to obtain a CD of the Project. We were informed by your office on May 25, 2004 that the CD was not available and on back order. We received our copy of the CD the day before your meeting on June 17, 2004 and this was not sufficient time to study your plan.

Due to the complexity of the design and information, each of our members should have the opportunity to attend and to evaluate about Alternative 3-D. The members of The 15,000 Coalition formally request that no less than two (2) additional NEPA meetings be conducted (making a total of at least three).

The members of The 15,000 Coalition further ask that, in the future all such meetings be published no less than 30-days prior in the Naples Daily News. Most importantly, The 15,000 Coalition, Inc., asks that by direct mail to each property owner in North Belle Meade and North Golden Gate Estate (essentially The 15,000 Coalition membership) receive written notice of any planned meeting concerning Southern Golden Gate Estates Hydrologic Restoration Project.

Thank you for your cooperation,

Sincerely,

Don E. Lester, Executive Director
The 15,000 Coalition, Inc.

cc:		Fax:		E-Mail:
	Senator James Inhofe		202-224-4721 Attn: A. Hogan	
	Eric Staats, Naples Daily News		239-263-4824	emstaats@naplesnews.com
	James Mattson, Esq.		305-451-9593	mattson@bellsouth.net
	Richard E. Bonner, P.E. ACOE		904-232-2200	richard.e.bonner@sajo2.usace.army.mail
	Brad Foster PD-PF ACOE		904-232-3442	bradley.a.foster.@sajo2.usace.army.mail
	Representative Porter Goss		239-774-7262	porter.goss@mail.house.gov
	Representative Mario Diaz-Balart		239-348-3569	stephen.hart@mail.house.gov
	Representative J.Dudley Goodlette		239-417-6207	goodlette.dudley@myflhouse.com
	Senator Burt Saunders		888-263-7893	saunders.burt.web@flsenate.gov
	Chairman Richard Pombo		202-226-0861	
	Anata Nath, P.E.		239-597-4987	anath@sfwmd.gov
	Janet Starnes, AICP		239-338-2936	istarne@swfmd.gov

From: Betty Faye Lewis [bettyf@magnolia-net.com]
Sent: Monday, July 05, 2004 1:08 AM
To: Sggecomments
Subject: Mr. Hardy's Fight

Mr. Hardy,
I just finished reading an article in our local paper about the government trying to take your land!!! First,
Let me say HANG IN THERE!!!!!! I know from personal experience what you are going through, only mine was a much smaller situation. Mine was not the Federal government; but the County. I had 11 acres of land, on which I had spent almost all my life. My parents had cleared, built the house I grew up in; and
it wasn't anything fancy; but it was OUR HOME!!! They condemned everything I had, put me $60,000 in debt, when we owed NO ONE!!!! Sadly, we gave in and had to rebuild about 600 ft. from where we were; but sir, it wouldn't have been worth my Father and Mother'sor My life, if they had bodyly thrown us off!! I must say that is exactly what would have happened, as my Father had already told the sheriff that if he came to serve the eviction papers he' d better leave his gun at home, as there was no place on earth he'd rather die than on the front doorsteps of our home!!!!
So Mr. Hardy, don't let them bulldoze you, as they did us!!!!! I admire you!!! They can fool some folks; but you know as well as I, someone is going to make a KILLING, IF YOU GIVE IN!!!!! Sincerely, Betty Faye Lewis

BILL LHOTA
4750 18 AV S.E.
NAPLES FL
34117
(239) 455-1423
07-13-04

MR BRAD FOSTER
US ARMY CORP OF ENGINEERS
JACKSONVILLE, FLA.

RE: CERP

DEAR MR FOSTER:

I AM WRITING TO REQUEST A 6 MONTH EXTENSION OF THE PUBLIC COMMENT PERIOD FOR THE FOLLOWING REASONS.

1. THE DOCUMENTS WERE PROMISED IN FEBRUARY AND NOT MADE AVAILABLE UNTIL MAY.
2. THE DOCUMENTS ARE LENGTHY AND COMPLEX AND MORE TIME IS NEEDED TO REVIEW THEM ADEQUATLY.
3. THE DOCUMENTS CONTAIN CONFLICTING DATA AS REGARDS THE LEVEE CONSTRUCTION.
4. THERE ARE UNANSWERED QUESTIONS CONCERNING THE EFFECTS OF THE PROJECT ON THE WATER TABLE IN N.G.G.E.
5. SUPPORTING DOCUMENTATION HAS NOT BEEN FORTHCOMING.
6. THE DOCUMENTS REFER TO THE USE OF CONTAMINATED MATERIAL.

THEREFORE IN THE ABSENCE OF THE EXTENSION REQUESTED AND IN THE ABSENSE OF SUFFICIENT INFORMATION, I AM OPPOSED TO THIS PROJECT.

SINCERELY Bill Lhota 7-13-04

From: Vanessa Malstrom [poigatorgirl@earthlink.net]
Sent: Sunday, June 27, 2004 8:42 PM
To: Sggecomments
Subject: picayune strand

I attended the public workshop June 17th at the Naples Best Western. After reviewing the information presented, SGGE draft and reviewing numerous documents on the subject, of the Everglades Restoration Project, it is my feeling that the alternative 3D should not be implemented. I am a resident of Port of the Islands. My concerns are as follows:

POI is a resort, fishing and boating community. With the current plan there is a great deal of uncertainty concerning water for consumption, irrigation, and water flow of the canal. POI is still a growing community. Will we have enough water in the future? Our canal at present is difficult to navigate at low tide. If we have less water in our canal it would inhibit the recreational use of the canal. Also, with less water the endangered Manatees and other forms of aquatic life would not be able to sustain life. I am very concerned about the use of burms as flood protection. The POI is a beautiful community and unsightly burms would effect our property values as well as the environment. I am also concerned about disease carrying mosquitoes which would flourish as a result dammed up canals. The access to public land would be inhibited. The cost is astronomical, currently estimated at $400 Million dollars. For these reasons, and many more, I am strongly against this Everglades Restoration Project because of the uncertainty of a negative impact to the environment, animals, fish, vegetation, and humans.

SGGE comments

Never have I seen such an effort to exclude the public from a project. Your idea of public input is having closed meetings with environmental groups. Although I have signed up on numerous occasions to be on your mailing list in the past two years I have received a total of two e-mails on project delivery meetings both of which were cancelled. You have had 2 public meetings on this project, not one public concern ;has been addressed. From flooding, to recreation no answers. Your original project manager Major Chaput, could not even give an explanation of a one hundred year flood(check the August 2002 meeting transcript). This months public meeting was a complete sham. No one was notified, the only way I found out is from the Ft. Myers newspaper. A small room overloaded with people, violating fire code rules for occupancy. Many people could not even get access and were turned away, even more couldn't park and left before even getting to the building. Once again I repeat, your idea of public input only applies to paid enviro's. Attempts to get another meeting have been answered with a quick **NO.**

Even more disturbing is the fact Collier County engineers questioned SFWMD , that raising water table levels in Northern Golden Gate could lead to ground water contamination due to septics being unable to properly "perk". (I have a copy of that email). Once again the public be dammed, no response, the project is far more important than the residents drinking water or potential for diseases in the wet season

But the most disturbing is the fact that the Corp has issued permits for SFWMD, your partner in this to begin this project in spite of the fact this project is still in draft form.. Mr. Duke claimed it " wasn't exactly a violation of the law". That's just what the public needs to hear from project managers.

The fix:

Take a deep breath and address everyone's concerns. Truly involve the public, and show us a benefit. A short wait will be much easier than years of public outrage and litigation.

Brian McMahon
360 22nd Ave NW
Naples, Fl 34120

Dreadnot@ATT.net
239-353-0110

From: Sari McMahon [wonderology@att.net]
Sent: Tuesday, July 13, 2004 3:44 PM
To: Sggecomments
Subject: SGGE/CERP Draft PIR/EIS

Mr. Foster,

I have several concerns regarding this project, including but not limited to contamination by illeagal dumping and septic systems being enveloped by higher water tables, access to the area by emergency services and the overall costs (which seem to rise weekly).

I have been reading the PIR/EIS and find a lack of supporting documentation to prove the science. I fear an environmental disaster of such a scale as to pale the disasters that resulted from simular porjects in Ocklawaha Chain of Lakes.

For these reasons I am opposed to this project.

Thabk you
Sari McMahon

From: Vulcanmars@aol.com
Sent: Tuesday, July 13, 2004 10:02 PM
To: Sggecomments
Subject: SGGE

Hello.
I would like it to be noted that I an against the SGGE Everglades restoration plan. In the short time the states has had control of the area it has already gone to hell. Jane Scenic Drive is overgrown with vegetation and road is in very poor condonation.
There has been very poor explanations of what will happen to the sheet flow once it gets to US41. Is the water going to run over the road? Or are we constructing more culverts to aid the "natural" water flow. Will the wildlife that has adapted for the last 30 years learn to swim overnight?
There also appears to be a serious missed calculation on Sheet 8-3, paragraph 1 on plans for levees. Using USACE cross-section specs for the levee it would require 39 square yards. Of cross-section times 44,299 yards long for the 25.17 miles of levees resulting in a fill requirement of 1,727,661 cubic yards plus the 30 percent compaction factor which results in 2,240,000 cubic yards of fill not the 224,000 as stated in the Draft.
Is this true? How much more is this going to cost tax payers? Are these the same engineers that calculated the size of the pumping stations for flood control?
It would seem that this restoration is being shoved down our throat just because a president signed a document he new nothing about several years ago.
Thank you.
Mario Menendez
3830 24 Ave SE
Naples, FL 34117

Urgent Notice:
Comments on SGGE Restoration Project

Brad Foster,

SGGEComments@sajo2.usace.army.mil
FAX 1-904-232-3976

Post-it® Fax Note 7671	Date 7-13-04	# of pages ▶ 2
To Brad Foster	From Mogelvangs	
Co./Dept. PDPF	Co. Chris & Sandra	
Phone #	Phone # 239 643 0566	
Fax # 904 232 3976	Fax # 239 643 6803	

Dear Mr.Foster,

Today, we realize full well, is the deadline for the comment period for the South Golden Gate Estates Restoration Project, and we fully realize that if our input as to what is quite obviously wrong with the assumptions on which the plan is based, and therefore many features of the plan itself, is ever to be heard officially, that we must NOW OR NEVER ask, PLEASE, that THE PUBLIC COMMENT PERIOD ON THE SOUTHERN GOLDEN GATE HYDROLOGIC RESTORATION PROJECT BE EXTENDED.

We are opposed to the institution of the project, as described in the PIR draft, at this particular juncture, first of all, because the time for comment, on a 750 page document, that was only released quite recent to the proposed conclusion of THE PUBLIC COMMENT PERIOD is simply insufficient for citizens who have work, and family, and health, and possible other responsibilities such as charity, and public service.

We therefore formally ask that THE PUBLIC COMMENT PERIOD on THE SOUTHERN GOLDEN GATE HYDROLOGIC RESTORATION PROJECT as contained in the PIR draft be extended, at least another ninty (90) days, and hopefully, and formally request, another six (6) months.

Since the document contains many ASSUMPTIONS or POSTULATES, or possibly even INTENTIONAL UNTRUTHS, that are scientifically unsupportable, it is almost certain that if the project is initiated at this point as described in the cited document, that the inevitable harm to the environment as well as to individuals and their families will result in official action against the responsible agencies and individuals promulgating the project.

We do not want the U.S. Army Corps of Engineers to assume that we support the project as currently proposed, and again ask and petition that the comment period be extended, hopefully six (6) months.

We are opposed to the project as currently proposed as it will, as now proposed, and without further analysis, input, and refinement, result in flooding of some occupied areas, and contamination of ground water, and interruption of sanitation in other inhabited areas, thereby

unnecessarily compromising public safety. Furthermore, the plan as now constructed does not allow sufficient traditional access by our fellow citizens to the renewable natural recreational resources of the geographic area of the project.

To give you some understanding of the basis for concern, one of the petitioning parties, Leonard Paul Christian Mogelvang, Bachelor of Science in Biology, University of Florida; Doctor of Medicine, University of Florida, when a student at the University of Florida worked in the Department of Biology as Field Assistant to Dr. Albert Laessle in ecological botanical field research over the entire state of Florida from Fort Moultrie, Alabama to Saint Simon's Island, Georgia to Key West, Florida, and has given expert ecological testimony in legal proceedings in Court in the State of Florida.

It is very clear that the PIR draft of the South Golden Gate Estates Restoration Project as it now exists is in need of further review and modification, with better material scientific documentation, and more complete evaluation of costs, with more efficient and public safety enhancing documentation.

Therefore, additional time as well as more flexible public meeting times and facility resources for public input are hereby requested in order to be able to obtain needed underlying documentation for the project, and thereby sustained active broad-based consensual public support.

Signed, this 13th day of July, 2004 AD

Leonard Paul Christian Mogelvang, B.S., M.D.
Leonard Paul Christian Mogelvang, B.S., M.D.

Sandra Joy Gillespie Mogelvang
Sandra Joy Gillespie Mogelvang, B.S., Educ.

L. P. Christian Mogelvang II
Leonard Paul Christian Mogelvang II

Southern Golden Gate Estates (Picayune Strand) Hydrologic Restoration
Draft Project Implementation Report (PIR)/Environmental Impact Statement (EIS)

COMMENTS



Thank you for attending this evening's Public Workshop. We value your contribution. If you would like to provide additional comments on this evening's presentation and discussion, please provide comments below and return to us prior to the end of the public comment period on June 28, 2004.

Brad Foster PDPF
USACE
re SGGE, & Picayune Strand.

June 17, 2004

COMMENTS: *(May be continued on reverse)*

Only dry season for at grade violates original gov't promise to continue traditional uses.

Swamp buggying is traditional

Hunting, camping & fishing in non specified areas is traditional

Live up to the U.S. Government promise when "Everglades Restoration" was first started & don't take Jesse Hardy's land

AME AND ADDRESS: *(Optional)*

J C Magelwaag M.D.

Please mail comments to:
U.S. Army Corps of Engineers
Brad Foster PD-PF
P.O. Box 4970
Jacksonville, Florida 32232-0019
or
E-mail to:
SGGEComments@saj02.usace.army.mil

Why should 6 L's huge property be protected & not Jesse Hardy's relatively homestead.?

I am qualified to assert that your assumptions regarding his property are invalid.

Just have him sign a release and leave him alone

Christian Mogelvang, M.D.

ATT'N: SFWMD & US Army Corp of Engineers

Subj': Everglades Restoration Project

(Public Meeting, @ Best Western, I-75 & Pine Ridge,

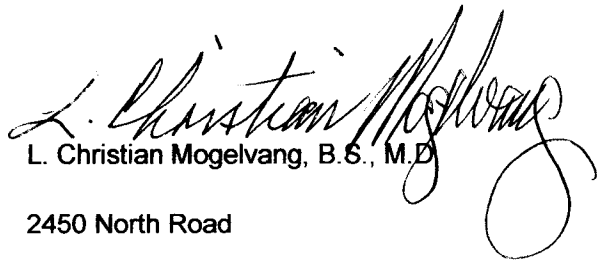
Naples, Fla. June 17,2004AD)

I am a graduate Biologist, Univ. of Fla., 1962, Field Assistant to Dr. Albert Laessle, of Univ. of Fla. in ecological research of Florida plant communities, 1960-1962, and have given expert ecological testimony in official proceedings regarding the natural environment in the Southwest Florida area.

The 700+ page official Plan document, which I have, since last month, tried to review and correlate with personally gathered observations, is far too much material to properly evaluate and cogently respond to within this time period.

In the time I have had to review only a small part of the Plan document, I can already recognize areas of significant invalid assumptions and assertions. Therefore, I, and I am sure, others will require at least another 4-6 months to be able to review, correlate with known environmental data, and accurately and cogently respond, although I can already see some definite areas in which "Statements of Fact"?; No, ---"Theories"?; No, --- "Postulates"?; No, ---"Misguided Propaganda"? Yes!---------- is included.

Therefore I am necessarily and officially, and in the interest of long-term public accord, demanding that I, and I am categorically sure, other, more personally and materially affected parties be given a required extension for the Public Comment Period, of at least another 6 (six) months before finalizing or proceeding any further with the "Everglades Restoration Project" .



L. Christian Mogelvang, B.S., M.D

2450 North Road

Mail To: Box 3316

Naples, Fla. 34106

Telephone: 239 643 0566

Cellular: 239 450 9820

Pager: 239 890 0850

MessageFrom: Beverly K. Mott [bev@goidt.com]
Sent: Friday, July 09, 2004 3:22 PM
To: Sggecomments
Cc: governor@state.us.fl.gov
Subject: Jesse Hardy

Government run amok. This homesteaded property being forcibly taken from it's owner is unconscionable and frightening.
Once government begins to overstep it's bounds in such a manner, it is a sure sign of a decaying society that nearly always leads down the long slope to revolution.

Please rethink this proposition.

Sincerely,
Beverly K. Mott
4205 Palma Sola Blvd.
Bradenton, FL 34209

From: SuDaNym@aol.com
Sent: Sunday, June 20, 2004 4:12 PM
To: Sggecomments
Subject: SGGE Draft

Question/Comment regarding the SGGE Draft:

You are aware that the location of the Plan has been used for decades for target practice, paramilitary training, ORV's, and dumping of toxic substances. Indeed, people were encouraged to use the area for some of these purposes. There has been no trash pickup service provided for the area.

The litter, including everything from shotgun shells to ATV parts to appliances and entire vehicles, continues to accumulate. (Pictures are available upon request) It was my understanding that the main object of the Everglades Restoration Plan was to restore the Everglades, which first and foremost should mean removal of the various things that have contaminated it over the decades.

Although Phase One of the Project has started, there seems to have been no effort to clean up the years of accumulation and no effort to prevent further damage to the environment in the area. The current materials that litter the area have had a detrimental impact on the area already, and that detrimental impact will increase exponentially once mixed with water, or buried in the bottom of the canals only to later contaminate the aquifers.

There are some things that are just not safe to sweep under the rug.

Regards,
Sue Murphy

Search Engines 411 Inc.
6017 Pine Ridge Rd. #251
Naples, FL 34119-3956
(239) 455-6128
(239) 269-1867 cell
http://www.searchengines411.com

From: SuDaNym@aol.com
Sent: Monday, June 21, 2004 5:35 PM
To: Sggecomments
Subject: Comments - copy of email previously sent to Jeb Bush

Governor Bush,

This is concerning Item 3 on the Agenda for the Board of Trustees of the Internal Improvement Trust Fund for the Cabinet Meeting of May 25th.

As a resident of Golden Gate Estates and a local business owner I submit the following analysis in support of the decision to allow Mr. Hardy's existing homestead to remain in the project area.

At the last Cabinet Meeting you instructed staff to seek creative alternatives that would allow Mr. Hardy's existing homestead to remain within the project area.

The staff did this. They obtained estimates for two alternatives, one which would allow Mr. Hardy's existing homestead (160 acres) to remain within the project area (Alternative One), and one which would not allow Mr. Hardy's existing homestead (160 acres) to remain with the project area (Alternative Two).

Clearly Alternative Two would require waiver of the eminent domain laws that require the landowner to provide prior written approval of the 'taking.' Below the requirements, as stated in the Meeting Agenda, is in bold text, with my comments in normal text.

Eminent domain may be used to acquire any of the property on the Florida Forever "A" group project priority list if: (1) the state has made at least two bona fida offers to purchase the land through negotiation and and impasse between the state and the land owner has been reached;

Although there have been offers to purchase the land made, it seems that only one of them was made through negotiation, as required by the law. This is a moot point however, inasmuch as the other elements cannot be applied in Mr. Hardy's case.

...and (2) the land is of special importance to the state because (a) it involves an endangered or natural resource and is in imminent danger of being developed.

Although it has been stated that Mr. Hardy's land is of special importance to the state, Mr. Hardy's property is not in imminent danger of being developed and as part of the negotiations he could be asked to sign an agreement that he would not develop it. Looking at the photographs of his property on his website jessehardy.com it is quite clear that in the 30 years he has owned the property, there has been negligible "development." These pictures were taken in 2003 and 2004, and we will be happy to supply more photographs upon request.

...(b) it is of unique value to the state and failure to acquire the property would constitute an irreparable loss to the state;

Considering the amount of money planned for this entire restoration project, the difference between the expense of Alternative One and Alternative Two could not possibly cause irreparable loss to the state.

or (c) the failure to acquire the property would seriously impair the state's ability to manage or protect other state-owned lands.

Clearly if Alternative One would violate this element of the law then SWFMD would not have wasted time and money obtaining an evaluation of Alternative One.

These facts clearly indicate to any reasonable person that there is insufficient justification to waive the requirement to have the property owner's written approval prior to eminent domain in the case of Jesse Hardy. Given Alternative One and Alternative Two as set forth in the Agenda, Alternative One is clearly the only choice.

I believe that you are a reasonable person. Thank you for taking the time to consider this.

Respectfully,

Sue Murphy
CEO

Search Engines 411 Inc.
6017 Pine Ridge Rd. #251
Naples, FL 34119-3956
(239) 455-6128
(239) 269-1867 cell

From: SuDaNym@aol.com
Sent: Friday, June 18, 2004 8:59 AM
To: Sggecomments
Subject: SGGE Hydrological Project Comment

Prior to the April 13th FL Cabinet Meeting, Mr. Hardy made an official request to be provided a reasonable accommodation to his disability that would allow him to participate in the meeting. He was unable to attend the meeting due to his disability.

We were told in advance, by the Governor's office that he would receive that accommodation in the form of being called on the phone, on a special land line that we set up at my home, from the Cabinet Meeting. That never happened. It is my understanding that he was not provided with the reasonable accommodation for his disabilty that he is entitled to in accordance with the requirements of the ADA (Americans with Disabilities Act). Despite that, that Cabinet Meeting and the rest of the process has proceeded without his participation.

I am not an attorney, but it seems that Jesse's right to 'equal access' to participate in the process that involves the taking of his land for a Federal and State Project have been violated, and I would think that before proceeding further with the Project, that should be rectified.

Thank you.

Sue Murphy

Search Engines 411 Inc.
6017 Pine Ridge Rd. #251
Naples, FL 34119-3956
(239) 455-6128
(239) 269-1867 cell
http://www.searchengines411.com

We are Totally against The Flooding of Southern Golden Gate Estates and The Belle Meade.

Reason Deliberate Killing of Animals Due to 27" of water 9 months of the year as stated. Also, the potential Killing of people By not providing the evucating Rout of Miller Blvd. extension and Miller Blvd. To Provide a Rout from Marco Island, Goodland, Fiddlers Creek, Cypress Windings, and all of the people in and along Tamiami Trail or 41.

Al Perkins

Belle Meade Groups

Previous Spokes person for
Citizens for Constional Property Rights

From: Perry, Daryl [dperry@mdc.edu]
Sent: Tuesday, July 06, 2004 10:34 AM
To: Sggecomments
Subject: Jesse James Hardy

Importance: High

Shame on You!

Leave Mr. Hardy and his land alone. It seems to me, people have the right to choose and decide where they will live and the type of environment they want for themselves and family. It Mr. Hardy purchased this land and invested monetarily and with sweat equity, it seems right, that he deserves to be left alone. Doesn't our U.S. Constitution guarantee this premise?

DP
A Concerned Taxpaying Citizen
Miami, Dade County, Florida
United States of America

-----Original Message-----
From: Walter Pine <Pine_w@bellsouth.net>
To: Rick McMillan <Rick.I.Mcmillen@saj02.usace.army.mil>
CC: Cindy Kemp <kgwestside@yahoo.com>
Sent: Wed Jul 14 00:18:11 2004
Subject: Fwd: Mail System Error - Returned Mail

Mr. McMillan,

My comments were bounced back. The mail server was not found. Please let me know what happened. All other emails sent out at that time went through.

Walter Pine

Begin forwarded message:
From: Mail Administrator <Postmaster@mail.bellsouth.net>
Date: July 13, 2004 11:57:35 PM EDT
To: Pine_w@bellsouth.net
Subject: Mail System Error - Returned Mail
Reply-To: Mail Administrator <Postmaster@mail.bellsouth.net>
.net 007: This e-mail message was undeliverable due to the
following reason:
.net 013: The destination mail server was not found.
Note: This error message indicates there could be a problem in the
transmission path to the destination mail system.
Solution:
Check the e-mail address for correct spelling and resend.
Host sajo2.usace.army.mil not found
The following recipients did not receive this message:
<SGGEComments@sajo2.usace.army.mil>
Reporting-MTA: dns; imf25aec.mail.bellsouth.net
Arrival-Date: Tue, 13 Jul 2004 23:57:34 -0400
Received-From-MTA: dns; [208.61.152.163]
Final-Recipient: RFC822; <SGGEComments@sajo2.usace.army.mil>
Action: failed
Status: 5.1.2
Remote-MTA: dns; sajo2.usace.army.mil

From: Walter Pine <Pine_w@bellsouth.net>
Date: July 13, 2004 11:57:32 PM EDT
To: SGGEComments@sajo2.usace.army.mil
Subject: Comments

Center for Civil Rights Advocacy
P.O. Box 5395
Titusville, Fl 32783

July 13, 2004

Army Corp of Engineers
Prudential Building
701 San Marco Blvd.
Jacksonville, FL 32207

Re: Comments for the Integrated Draft Project Implementation Report and Environmental Impact Statement for Southern Golden Gate Estate (Picayune Strand) Restoration and REQUEST FOR EXTENSION OF PUBLIC COMMENT PERIOD

The Center requests a 6 month extension of the public comment period and fulfillment of all public records requests by ACE and its partners in this project. The Center has been unable to obtain the underlying documentation for our public comments. Requests to state and federal agencies have yet to be answered. There are many internal inconsistencies and contradictions in the document. We are very concerned about the quantity and magnitude of the discrepancies. Because the quantity and magnitude of the discrepancies give credence to incompetence and possible fraud in the preparation of the PIR, this project and related projects the Center can not give specific comments that would enable the concealment of these misrepresentations and errors. We request the appointment of an independent review authority for the receipt of comments and review for possible misconduct and incompetence.

The Center will enter the following general comments.

1. The public jointly held by the Army Corp of Engineers and the Army Corps of Engineers meeting/workshop of 17 June 2004 held at the Best Western in Naples was held in building that was not compliant with the Vocational Rehabilitation Act and the Americans with Disabilities Act.

a. The air-conditioning for the room did not work and necessitated many people leaving the meeting.

b. More people arrived than the room allowed to attend.

c. There was inadequate signage for the meeting.

d. Assisted listening devices were not available during to the meeting to members of the public with hearing impairments.

2. The distribution of the PIR was not accompanied by nor contained the adequate instructions for making public comments.

3. The sixty day public comment period was not sufficient to review and study the PIR, obtain underlying public records, contradictory expert opinions, and formulate comments for submission.

4. No braille copies of the PIR were provided to the Center or sight impaired members of the public.

5. Mr. Duke, upon request refused/failed to inform the public of the process to apply for an extension to the public comment period at the June 17 2004 workshop.

6. The Center has not received documents (including copies of the PIR and braille copies) requested by the Center at the June 8 2004 meeting with the SFWMD and Corp of Engineers, Janet Starnes, Regional Project Manager, Southern District Restoration Department, SFWMD and Rick McMillan, Senior Project Manager, ACE.

7. The Army Corp of Engineers has failed to meet the standards established by the Data Quality Act and Executive Order 12360.

8. According to Lauren Milligan, Florida Department of Environmental Protection, Office of Intergovernmental Coordination State has received an extension of the comment period to 25 July while the public has not received the same extension.

The Center intends to submit a more detailed document and comments to the appropriate authority upon discovering who and where the appropriate authority is.

Walter D. Pine, Executive Director
Center for Civil Rights Advocacy
P.O. Box 5395
Titusville, Fl 32783-5395

Email: pine_w@bellsouth.net
Ph. 321-264-2959
Fax 321-383-1158

This message and any attachments are solely for the use of intended recipient or recipients. They may contain privileged and/or confidential information. If you are not the intended recipient, you are hereby notified that you received this email in error, and that any review, dissemination, distribution or copying of this email and any attachment is strictly prohibited. If you receive this email in error please contact the sender and delete the message and any attachments associated therewith from your computer. If the message is addresses to you the message is intended to obtain your response. Please respond accordingly. Your cooperation in this matter is appreciated.

From: stLeoCathCh@comcast.net
Sent: Friday, July 09, 2004 3:27 PM
To: Sggecomments
Subject: saving the only natural public land left in collier county.

To Whom It May Concern:

Please don't take away our ATV area just, because there are some ignorant riders out there, or just because you can.

Flooding the south blocks will only put more of nature in harm's way (and in people's back yards). Where do you think the animals will go if they are standing in water...they'll seek the closest dry land they can find...Golden Gate Estates!

If you want to fix the real problem, you have to go back to where the problem started in the beginning...the sugarcane fields around Lake Okeechobee. Have the sugarcan farmers pay for the problems they've created, not the residents of Golden Gate!

Sincerely,
Rebecca Purcell
210 - 16th St SE
Naples, Fl. 34117

From: Julie Smithson [propertyrights@earthlink.net]
Sent: Wednesday, June 23, 2004 1:35 PM
To: Foster, Bradley A
Cc: Sggecomments
Subject: RE: Public Comments on SGGE

Brad,

I did get the zero confused with the letter "O"; sorry! At any rate, fifteen more days is still not enough to thoroughly digest and intelligently comment on such a voluminous plan, so I am officially requesting a much longer extension of the public comment period. My original public comment from last Thursday is reiterated here: ninety (90) days extension of the public comment period is hereby requested.

Julie

----- Original Message -----
From: Foster, Bradley A SAJ
To: propertyrights@earthlink.net
Sent: 6/23/2004 8:31:15 AM
Subject: RE: Public Comments on SGGE

Julie:
Regarding your comment emailed last Thursday, I did not receive it in the SGGEcomments@saj02.usace.army.mil address. Note that the character after "saj" is the number zero and not a letter. Other persons have successfully submitted comments, so I am confident that the email address works. Can you resend?

As a result of the comments received during the public workshop on Thursday, June 17, the public review period has been extended by 15 days. The review period is now a total of 60 days long. The new closing date is July 13, 2004.

Thank you for your continued interest in this project.

Brad
-----Original Message-----
From: Julie Smithson [mailto:propertyrights@earthlink.net]
Sent: Tuesday, June 22, 2004 5:18 PM
To: Foster, Bradley A
Subject: Re: Public Comments on SGGE

Brad:

I sent a public comment by email last Thursday, requesting that the public comment period be extended by ninety (90) days due to the sheer volume of information requiring

review. To date, I've received no email reply. I have no way of knowing if my request was received!

Julie

From: Julie Smithson [propertyrights@earthlink.net]
Sent: Friday, July 09, 2004 8:08 PM
To: Sggecomments; Duke, Dennis R; Bond, Carrie L; Conner, Susan L; Moore, Brooks W; Duck, James C; Mcmillen, Rick I; Robbins, Erica A; Mckoy, Peter B; Cintron, Barbara B
Cc: Foster, Bradley A; FL - Amos, Leo; FL - Bracken, William; FL - Brevard Insider, Ed Clark; FL - Bush, Governor Jeb; Liz Lackovich; Truman Scarborough; Ron Pritchard; Sue Carlson; Jackie Colon; Duwayne Lundgren; FL - Doudney, Doug; FL - Ellis, Steve; FL - Figley, Jared; FL - Fortin, Madeleine; FL - Hunter, Zada Albury; FL - Jacobson, Jan Michael; FL - JESSE HARDY'S WEBSITE! Meaux, Nanette; FL - Kawaja, Peter; FL - Kemp, Cindy and Mark; FL - LAWYER Lilley, Floy; FL - Locke, Vera; FL - McClelland, Martin S.; FL - McGill, Captain Tom & Joan; FL - Montalto, Karol; FL - Pine, Walter; FL - Russell, Dave; FL - RADIO Beck, Glenn; FL - Stump, Mary and Wilbur
Subject: Comment period CAN be extended: just look at this and then tell me otherwise

SGGE Project implementers and others that have emailed to tell me that you don't have authority to extend the public comment deadline past its current -- and hopelessly inadequate, not to mention failure to provide enough time for public comment -- deadline. Yeah, sure, you've been just soooo kind and extended it for thirty days, but THAT IS NOT ENOUGH. Read what I've pasted below and then get your heads in a huddle and come up with a LONGER COMMENT PERIOD. Chop, chop, now!

All right, let's roll out the excuses why you can't extend the comment period for another six months, to allow intelligent minds to peruse that mountain of paper that you demanded 'public comment' in just a few short weeks.

If this can be done, you can set public comment deadline for your "Wildlands Project" under another name, at least until 31 December 2004. This is not a big deal and you know it, each and every one of you. Think of it as your 'job security'...

Julie Kay Smithson

NOTE:

USFWS ANNOUNCES DEADLINE EXTENSION FOR BULL TROUT REVIEW

http://www.cbbulletin.com/Free/19920.aspx

USFWS ANNOUNCES DEADLINE EXTENSION FOR BULL TROUT REVIEW
Posted on Friday, July 09, 2004 (PST)

The U.S. Fish and Wildlife Service announced that it is extending the deadline for comments on its 5-year review of bull trout, which are protected as threatened under the federal Endangered Species Act.

The 5-year review will assess the best available information on how bull trout have fared since they were listed for protection across their range in the lower 48 states in 1999. This will include analyses of population data and threats to the species.

The deadline, originally set for July 1, 2004, is being extended to January 3, 2005, to allow additional time for people to submit new information that has become available since the 1999 listing.

"The purpose of a 5-year review is to ensure that the classification of a species as threatened or endangered is accurate," said Dave Allen, the USFWS' Pacific Region director.

The USFWS received multiple written requests to extend the comment deadline. Among those were requests by the states of Idaho, Montana and Washington, which have been active participants in bull trout recovery planning and implementation. The three states are undertaking a range-wide review of bull trout and plan to submit their information as part of the 5-year review.

According to the federal agency, the review will consider the best scientific and commercial data that have become available since the current listing determination, such as species biology; habitat conditions; threat status and trends; and other new information, data, or corrections including, but not limited to, taxonomic or nomenclatural changes, identification of erroneous information contained in the list, and improved analytical methods. Information submitted should be supported by documentation such as maps, bibliographic references, methods used to gather and analyze the data, and/or copies of any pertinent publications, reports or letters by knowledgeable sources.

If the USFWS finds that a change in the species' classification is warranted, the agency may separately propose to reclassify or de-list bull trout. If the agency does propose a change, it would go through a separate formal rule-making process, including public review and comment, as defined in section 4(a) of the ESA. No change in classification would occur until the completion of that process.

In January 2002, the federal agency and the Alliance for the Wild Rockies and Friends of the Wild Swan reached a court settlement establishing a schedule for the proposal of critical habitat for bull trout. The two environmental groups sued the Service for not designating critical habitat after listing bull trout in 1999 as threatened throughout its range in the lower 48 states. At the time, the Service had been unable to complete critical habitat determinations because of budget constraints.

Pending completion of the 5-year review, the Service is temporarily suspending work on the draft Recovery Plans for the Columbia River, Klamath River, and St. Mary-Belly River distinct population segments (DPS) of bull trout, which were released in November

2002. The draft Recovery Plans for the Jarbidge and Coastal-Puget Sound population segments were released this week. After the public comment period has closed for these latter two chapters, further work on them will also be suspended pending completion of the 5-year review.

Separately, bull trout critical habitat work is continuing on a revised schedule. An agreement with plaintiffs calls for a final designation of critical habitat for the Columbia and Klamath River population segments to be completed by September 2004. On June 25, 2004, the Service proposed critical habitat for the Jarbidge, St. Mary-Belly, and Coastal-Puget Sound population segments of bull trout and will accept public comment on that proposal until August 25, 2004. Final critical habitat for these population segments will be designated in June 2005.

From: Julie Smithson [propertyrights@earthlink.net]
Sent: Monday, June 28, 2004 3:24 PM
To: Sggecomments; Cintron, Barbara B SAJ; Moore, Brooks W SAJ; Duke, Dennis R SAJ; Duck, James C SAJ; McMillen, Rick I SAJ; Foster, Bradley A SAJ
Cc: Bond, Carrie L SAJ; Robbins, Erica A SAJ; McKoy, Peter B SAJ
Subject: RE: Public Comments on SGGE

Barbara Cintron:

I will expect immediate notification when the public comment period is extended or the "plan" is scrapped, or whatever other avenue should be pursued.

Just as the "plan" originated from a template above you in the chain of command, as per your comment: "Determination of a longer extension would have to come from decisionmakers above us in the chain of command", I expect all such things to also originate there.

I expect further communication to either address me without a prefix or with the one I use, which is "Miss."

Julie Kay Smithson

----- Original Message -----
From: Cintron, Barbara B SAJ
To: Moore, Brooks W SAJ;Duke, Dennis R SAJ;Duck, James C SAJ;McMillen, Rick I SAJ;Foster, Bradley A SAJ;propertyrights@earthlink.net
Cc: Bond, Carrie L SAJ; Robbins, Erica A SAJ; McKoy, Peter B SAJ
Sent: 6/28/2004 2:57:19 PM
Subject: FW: FW: Public Comments on SGGE

Dear Ms. Smithson:

A determination was made, immediately after close of the public meeting held on Thursday, June 17th, to grant a one-time, 15 day extension of the comment period on the Draft PIR/EIS. At this time I have not received authorization for further extensions of the official comment period.

Therefore, unless a new extension is granted, the final day for sending comments on the DPIR/DEIS is July 13.

If a decision is made to further extend the comment period, I will try to let you know immediately.

Please note that 15 days is a normal duration for an extension on a Draft EIS, according to our NEPA regulatory guidelines. Determination of a longer extension would have to come from decisionmakers above us in the chain of command.

Please keep in contact with us. I will let you know if anything changes.

Thanks,

Barbara Cintron

-----Original Message-----
From: Conner, Susan L SAJ
Sent: Monday, June 28, 2004 2:22 PM
To: Foster, Bradley A SAJ
Cc: Cintron, Barbara B SAJ
Subject: FW: FW: Public Comments on SGGE

-----Original Message-----
From: Julie Smithson [mailto:propertyrights@earthlink.net]
Sent: Monday, June 28, 2004 2:14 PM
To: Conner, Susan L SAJ; Sggecomments
Cc: FL - Russell, Dave; FL - Stump, Mary and Wilbur; FL - STUDENT Price, Lync; FL - Ward, Gerald M.; FL - U.S. Rep. Rick Keller; FL - Senate Pres. Johnnie Byrd; FL - RADIO Beck, Glenn; FL - Pine, Walter; FL - Montalto, Karol; FL - Hunter, Zada Albury; FL - Jacobson, Jan Michael; FL - Kawaja, Peter; FL - Kemp, Cindy and Mark; FL - LAWYER Lilley, Floy; FL - Locke, Vera; FL - McClelland, Martin S.; FL - McGill, Captain Tom & Joan; FL - Doudney, Doug; FL - Ellis, Steve; FL - Figley, Jared; FL - Fortin, Madeleine; Liz Lackovich; Truman Scarborough; Ron Pritchard; Sue Carlson; Jackie Colon; Duwayne Lundgren; FL - Brevard Insider, Ed Clark; FL - Amos, Leo; FL - Bracken, William; FL House Ralph Arza; FL HouseThad Altman; FL House Bob Allen; FL House Kevin Ambler; FL House Tom Anderson; FL House Bruce Antone; FL House Frank Attkisson; Terri - Cannon, Anna L.
Subject: RE: FW: Public Comments on SGGE

Susan:

"At this time ... " is insufficient for comprehensive comments to be made on what you must agree is a huge amount of paperwork and maps, charts, etc., to read through and seek to make sense of.

I reiterate that I strongly urge the extension by another ninety (90) days, or failing in that, that the entire project be withdrawn due to the lead agency's refusal to consider that the vast majority of the public cannot possibly comment intelligently on something that appears to take ten times more paperwork than needed to describe. It seems to me that implementing The Wildlands Project for the south half of Florida is something that a LOT more of the public should know about and learn about, since it appears to be all about removing public access -- and the public itself -- from this huge area. Sure, it's to be done 'incrementally,' but the long-term plan remains the same. Did I mention that this includes the NATURAL RESOURCES that would leave the private landowners?

I expect you to include this entire email -- including all headers -- as part of my public comments, noting that I am indeed disgusted at the continuing disregard for property rights being exhibited by any federal agency with a hand in this, lead or otherwise.

I also hope that those 'cc'ed in this email will submit THEIR public comments regarding this 700+ page "plan" to: SGGEcomments@saj02.usace.army.mil

Julie Kay Smithson
213 Thorn Locust Lane
London, Ohio 43140-8844

----- Original Message -----
From: Conner, Susan L SAJ
To: propertyrights@earthlink.net
Sent: 6/28/2004 1:32:20 PM
Subject: FW: Public Comments on SGGE

Julie-

We have extended the original public comment period by 15 days, so the new close of comments is 13 July, 2004. At this time we do not foresee any further extensions. We appreciate your interest in the project and hope that you will be able to comment on the project in this timeframe.

Please let me know if I can be of further assistance.

Sincerely,
Susan Conner

Susan L. Conner
US Army Corps of Engineers
Environmental Branch, Planning Division
701 San Marco Blvd.
P.O. Box 4970
Jacksonville, FL 32232
904-232-1782
susan.l.conner@usace.army.mil

-----Original Message-----
From: Julie Smithson [mailto:propertyrights@earthlink.net]
Sent: Wednesday, June 23, 2004 1:35 PM
To: Foster, Bradley A
Cc: Sggecomments
Subject: RE: Public Comments on SGGE

Brad,

I did get the zero confused with the letter "O"; sorry! At any rate, fifteen more days is still not enough to thoroughly digest and intelligently comment on such a voluminous plan, so I am officially requesting a much longer extension of the public comment period. My original public comment from last Thursday is reiterated here: ninety (90) days extension of the public comment period is hereby requested.

Julie

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From: Foster, Bradley A SAJ
To: propertyrights@earthlink.net
Sent: 6/23/2004 8:31:15 AM
Subject: RE: Public Comments on SGGE

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Regarding your comment emailed last Thursday, I did not receive it in the SGGEcomments@saj02.usace.army.mil address. Note that the character after "saj" is the number zero and not a letter. Other persons have successfully submitted comments, so I am confident that the email address works. Can you resend?

As a result of the comments received during the public workshop on Thursday, June 17, the public review period has been extended by 15 days. The review period is now a total of 60 days long. The new closing date is July 13, 2004.

Thank you for your continued interest in this project.

Brad

-----Original Message-----
From: Julie Smithson [mailto:propertyrights@earthlink.net]
Sent: Tuesday, June 22, 2004 5:18 PM
To: Foster, Bradley A
Subject: Re: Public Comments on SGGE

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Julie

From: Julie Smithson [propertyrights@earthlink.net]
Sent: Tuesday, July 13, 2004 2:25 PM
Cc: kgwestside@yahoo.com; westump@earthlink.net; gladesguru@aol.com
Subject: Deadline TODAY: July 13, 2004 My Official Public Comments: SGGE Restoration Project

My Official Public Comments on the SGGE (Southern Golden Gate Estates) "Restoration Project"

July 13, 2004

To:
sggecomments@saj02.usace.army.mil
carrie.L.bond@saj02.usace.army.mil;
barbara.b.cintron@saj02.usace.army.mil; susan.L.conner@saj02.usace.army.mil;
dennis.r.duke@saj02.usace.army.mil;
james.c.duck@saj02.usace.army.mil; amanda.d.ellison@saj02.usace.army.mil;
bradley.a.foster@saj02.usace.army.mil; peter.b.mckoy@saj02.usace.army.mil;
rick.i.mcmillen@saj02.usace.army.mil; brooks.w.moore@saj02.usace.army.mil;
erica.a.robbins@saj02.usace.army.mil

Jacksonville U.S. Army Corps of Engineers
Bradley A. Foster, PD-PF
701 San Marco Boulevard
Jacksonville, Florida 32207

and many others.

From and by: Julie Kay Smithson
213 Thorn Locust Lane
London, Ohio 43140

I expect this entire email, including all headers, to be made a part of the public record on this "Restoration Project". I also expect to be mailed a copy -- PROMPTLY -- of each and every current and future "Plan" that is in ANY WAY related to this land/resource/freedom theft.

Recommended reading for all that are concerned about this "Plan":

http://www.propertyrightsresearch.org/wildlndsprjctfrms.htm
http://www.propertyrightsresearch.org/articles/statement_from_governor_jeb
The Wildlands Project Press Page http://www.wildlandsproject.org/roomtoroam/press/
http://www.propertyrightsresearch.org/florcnts.htm
http://www.propertyrightsresearch.org/interior_department_praises_ever.htm
http://www.twp.org (The Wildlands Project "Official Site")
http://www.twp.org/action/cebadillas/index.html ("Cebadillas")
http://www.twp.org/action/maine/index.html ("Maine Wildlands Network")
http://www.twp.org/action/siwn/index.html ("Sky Islands Wildlands Network")
http://www.twp.org/action/ytoy/index.html ("Yellowstone to Yukon")
http://www.twp.org/site_contents/index.html
http://www.twp.org/vision/index.html ("Vision")
http://www.tws.org The Wilderness Society

www.propertyrightsresearch.org/all_in_the_name_of_environmental.htm

Each of you employed with taxpayer dollars knows that this is nothing more than a puzzle piece of The Wildlands Project in Florida, and each of you also knows that the intent is to depopulate from one-third to one-half of Florida, which conveniently recoups all natural resources and property from those that have worked hard for it and honorably and legally OWN it.

There is NO NEED to "protect" any wildlife by flooding, retaking, or otherwise stealing (please, no need to waste the phrase "willing sellers" on me) this vast amount of real estate. You are laconic about the costs, since you intend to keep drawing (leeching) from the taxpayer cash cow 'from here to eternity'. Human safety is not a factor in this "Plan" -- because you don't CARE about the safety or well-being of Jesse James Hardy, Tommy and Tara Hilton and others. You don't even care enough to follow the letter of the law, as mandated by the National Environmental Protection Act of 1969 (NEPA) and hold formal public hearings, at which you MUST record the attendees and you MUST answer their questions, rather than the "informal" "process" with which you seek to ILLEGALLY STEAL everything, including the public's LEGAL RIGHT to be HEARD, ANSWERED and RECORDED. I am told that you also FAIL to in any way provide this "Plan" to the blind in a Braille version. That is a slap in the fact to those that are not sighted.

In many cases your coercive tactics have paid off for you, and you've acquired -- through one means or another -- quite a lot of land and its resources. Displacing people seems to be something you 'feed on' and derive energy/pleasure from.

Worship of flora and fauna to the exclusion of humans -- and in your own documents calling for the "restoration" to "pre-European" and "pre-Columbian" settlement times -- is Deep Ecology. It is a religion, practiced ostensibly to elevate said flora and fauna to a false idol position and one from which the sacrifice of people is considered all right.

Those of you that are in any way connected to this massive waste of paper and ink that you've dubbed the "SGGE Restoration Project" know full well that no one can intelligently comment on this Medusa in a one- or two-month "public comment period". It certainly took all of you a lot longer than that to come up with this land and resource theft "Plan".

To that end, rather than comment on the specifics of your 700+ page "Plan", I shall reiterate what I have twice commented publicly already -- and what you are EXPECTED to ALSO include in the public record on this "Plan":

Either SCRAP this entire land theft "Plan" (my PREFERRED ALTERNATIVE, in your vernacular) or reduce it to a puny shadow of its current state: no more than ten percent of its current volume and intent.

Landowner and homeowner and business owner Jesse James Hardy, of Naples, is part of your target for the removal of all people from your "Plan". LEAVE HIM ALONE!

More plainly stated:

LEAVE JESSE HARDY ALONE!

This man and his family are NOT doing anything detrimental to ANY flora or fauna, "endangered" or otherwise. He -- and many of us, including yours truly -- knows just how all-encompassing the tentacles of this "Plan" actually are, and he has NO INTENTION of letting any of you take his home or his property.

What part of GO AWAY don't you understand?

Yes, I'm keenly aware of Governor Bush's intent to rewild the southern third/half of Florida -- all except the FLAGLER developments, that is.

The FLAGLER Developments are "allowed" to stay, because The FLAGLER Developments are to be the milkers of the cash cow that this huge area of stolen land/homes/resources is planned to become.

On May 23, 2003, Governor Bush made the following public:
Statement from Governor Jeb Bush Regarding Everglades Restoration
May 23, 2003
By Florida Governor Jeb Bush
jeb.bush@myflorida.com

The Everglades is an important Florida treasure and its restoration has been my highest environmental priority.

In recent weeks there has been much written and said that does not convey the facts behind recent legislation and it's potential impact on our current federal partnership.

I hope the following will help clarify the policy, motivations and impact. Please do not hesitate to get back to me with any feedback or additional questions.

On Tuesday, May 20, 2003, I signed into law a much-discussed bill that will further our efforts to restore the Everglades.

Restoring the River of Grass involves both water flow and water quality. It also requires cooperation.

The 1992 court-ordered settlement agreement and the Comprehensive Everglades Restoration Plan are central to our state-federal partnership to clean up this national treasure.

The law I signed Tuesday strengthens the other crucial part of our efforts -- the 1994 Everglades Forever Act, which established Florida's commitment to restoring water quality.

Under the Everglades Forever Act, all parties involved determined that cleaning up the Everglades meant reaching a 10 parts per billion (ppb) phosphorous standard in the water because the unique nature of the Everglades is that it can only tolerate very small amounts of phosphorus.

To put that into perspective, 10 ppb is equal to 10 grains of sand in a bucket of a billion grains.

Today, 90% of the 2.4 million acres of land and water that make up the Everglades are at or below this 10 ppb standard.

By the December 2006 deadline, 95% of the Everglades 2.4 million, will be at or below 10 ppb standard.

While the Everglades Forever Act of 1994 told us to clean up the water in the Everglades by 2006, it didn't tell us how.

The Act told us to reduce phosphorus by 2006, but didn't tell us by how much. Instead, it required the Department of Environmental Protection (DEP) and the South Florida Water Management District (SFWMD) to figure out and implement a plan by December 2003 that will achieve our goal.

The bill I signed into law Tuesday answers these open questions and extends our commitment.

We worked hard over the past several weeks to ensure that the bill that passed through the legislature had the stringent standards to continue our success, and it does.

It allows DEP to adopt a strict 10 ppb standard, and the SFWMD to implement a Long-term Plan to accomplish the goal.

It also adds another $450 million to pay for the effort, without raising taxes or increasing federal funding.

The reality is that the new law actually defines the state's responsibilities more clearly, and acknowledges the fact that -- while a plan will be in place for reaching a 10 ppb standard across the entire Everglades by 2006 -- five percent of the water will not be at 10 ppb, but will achieve the "net improvement" standard set in place in 1994.

Decades of buildup of run off from Lake Okeechobee has embedded phosphorous in the Everglades sediment, and that will take longer than the original deadline of 2006 to dilute.

I remain fully committed to restoring the water quality of the Everglades at the earliest possible date, and to protecting the valuable partnership of state and federal government required to complete the restoration of this national treasure.

This is a complicated issue, and there has been much misinformation about the legislation I signed Tuesday and the state's efforts to restore the Everglades.

I hope the following helps clarify the facts on this important issue. Again, I invite you to contact me at jeb.bush@myflorida.com with any feedback or further questions. Thank you.

Everglades: Myths vs. Facts

MYTH: Proposed amendments to the Everglades Forever Act undermine the federal settlement agreement.

FACT: Florida is meeting the obligations of the Settlement Agreement and will continue to do so. The Settlement Agreement applies to federal waters, which are Everglades National Park and the Loxahatchee Wildlife Refuge. It does not apply to state waters. The State of Florida is responsible for restoring water quality for the entire Everglades Protection area, and we are currently ahead of schedule in this regard.

MYTH: The Everglades is completely polluted.

FACT: Water in 90 percent of the Everglades is clean, meaning [that] it's already at 10 ppb.

Since 1994, Florida has cut average concentrations of phosphorous entering the Everglades Protection Area from 170 ppb to numbers as low as 20 ppb.

Today, water in 90 percent of the Everglades has phosphorus levels of no more than 10 ppb, and all federal waters within the marsh currently have less than 10 ppb.

We reached this standard last year -- four years ahead of schedule.

By December 31, 2006, 95 percent of the entire Everglades also will meet this goal.

The remaining five percent will sporadically have phosphorus levels higher than the goal until the phosphorus buildup in the sediment can be cleansed through "green" technology.

But the remaining five percent will meet the requirement that "net improvement" be achieved, as set forth in the 1994 Everglades Forever Act.

MYTH: Florida has done nothing to clean up the Everglades.

FACT: Hundreds of millions of dollars have been invested in the construction of 44,000 acres of man-made marshes that filter pollution from water entering the Everglades. These treatment marshes, along with improved farming practices, cut phosphorus by 60 percent over the last decade. By 2006, optimization of these "green" technologies will further reduce phosphorus levels.

Keep in mind that Florida has the sole responsibility for restoring water quality, and we have demonstrated our commitment by investing $650 million to clean up pollution in the Everglades. The legislation signed by Governor Bush today guarantees another $451 million to get the job done -- without federal funding or raising taxes.

The state-federal partnership deals with water quantity, and in this Florida too has demonstrated its commitment. Since 2000, we have provided an additional $711 million, including $200 million in this tough budget year, to fund our share of the state-federal plan to implement the Comprehensive Everglades Restoration Plan.

MYTH: Proposed amendments to the Everglades Forever Act change or weaken the compliance deadline.

FACT: The compliance deadline remains the same, December 31, 2006. The deadline requires that we meet the 10 ppb standard or show continued net improvement. The legislation signed today and the proposed amendments require a plan, an enforceable schedule, and the money to get the job done.

Today, water in 90 percent of the Everglades has phosphorus levels of no more than 10 ppb, and by December 31, 2006, 95 percent of the entire Everglades will meet this goal. The remaining five percent will sporadically have phosphorus levels higher than the goal. This is the result of more than 30 years of phosphorus flowing freely into the Everglades from Lake Okeechobee that became imbedded in the sediment of the marsh.

Scientifically it is impossible to bring this small amount of land to the 10 ppb level, but we will continue to reduce the levels by cleansing the water through "green" technology. This five percent will meet the requirement that "net improvement" be achieved, as set forth in the 1994 Everglades Forever Act. The bill Governor Bush signed today provides a clear path for continuing to lower the phosphorus levels in these areas.

MYTH: We are weakening water quality standards.

FACT: We are not weakening water quality standards and the Department of Environmental Protection proposed a science-based Phosphorus Water Quality Standard of 10 parts per billion (ppb). The Department is committed to adopting that stringent standard.

MYTH: There is something Florida can do today or in the near future that will make the entire Everglades attain the 10 ppb by the statutory deadline.

FACT: Florida is currently implementing the most environmentally sound, technically feasible technologies to attain the 10 ppb in the entire Everglades. But, a natural phenomenon known as "soil reflux," which is caused when phosphorus embedded in the soil from years of pollution is released into the water, will cause phosphorus levels to exceed 10 ppb for years, perhaps even decades. The State is exploring ways to accelerate this natural process.

MYTH: The Florida Legislature is establishing the water quality standard.

FACT: The 1994 Everglades Forever Act requires the Department of Environmental Protection to adopt a water quality standard by December 31, 2003. The Department is on schedule to adopt a rule by the statutory deadline.

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If you would like to change your subscription or unsubscribe, please go to:
http://www.myflorida.com/myflorida/subscribe.html

http://www.propertyrightsresearch.org/articles/statement_from_governor_jeb_bush.htm

This is a "pet project" -- which includes REMOVING ALL PEOPLE AND THEIR PROPERTY RIGHTS -- from which Florida's Governor apparently does not intend to be dissuaded. Read on:

Everglades restoration plan gets official start

(Note: While Terri Schiavo spent yesterday with no food and no water, Florida Governor Bush was 'officially' beginning The Wildlands Project in Florida. By whatever 'politically correct' name it is called at the moment, this is part of TWP -- which has been ongoing unofficially, for years, and only in the last week has 'gone public.' FL state senator Burt Saunders apparently has it on good authority that, no matter what the voters want, "There will be no problem in terms of funding [Everglades restoration] as far as the state Legislature is concerned." Still resisting eminent domain are the Miccosukee tribe of Indians and 67-year-old disabled veteran Jesse Hardy, who lives on 160 acres with his adopted 7-year-old son, Tommy. Gov. Bush 'doesn't like to' pursue eminent domain, but seems to think that Jesse Hardy will be pleased with being 'well-compensated' -- never mind that this is Jesse's home, that he lives on Naomi Street, a street he named after his mother, and that he's lived there almost as long as Governor Bush has been alive. This is the depopulation of a massive area of Florida by humans and private property, whether said humans/private property owners want it or not. Notice that the 'holdout' property owner is painted as being money-hungry and opportunistic, but that in the end, he still must move. See 'Additional recommended reading' below article for a letter from Governor Bush from earlier this year. It is not a 'nice' read. This 'restoration plan' reminds me of other illicit things that have come 'out of the closet' in recent decades of decay and decadence, disarray and dismal delving ever deeper into the decline of American freedom.)

October 17, 2003

By Eric Staats
emstaats@naplesnews.com
Naples Daily News
Naples, Florida
http://naplesnews.com

To submit a Letter to the Editor: letters@naplesnews.com

Gov. Jeb Bush donned a hard hat and grabbed a shovel Thursday at the edge of a canal in rural Collier County to break ground on the first construction project of the $8.4 billion Everglades restoration plan.

The project will tear out roads and fill in canals to restore natural water flows across 55,000 acres in Southern Golden Gate Estates, where developers once dreamed of building the world's largest subdivision between U.S. 41 East and Interstate 75.

Thursday's ceremonial start of work seemed as much about shoring up federal support for the larger Everglades restoration plan as it was about moving dirt.

Some in Congress expressed skepticism about the state's commitment to restoration after Bush signed a bill earlier this year that delays the deadline for sugar companies to clean up polluted runoff into the Everglades from sugar cane fields south of Lake Okeechobee.

"We're committed to the future of the Everglades, to honoring our commitments and promises, to protecting the natural treasures of our state," Bush said.

"You know what, actions speak louder than words, actions speak louder than words and results outlast rhetoric," he said. "Today's actions and today's results are proof positive of Florida's commitment to restoring the River of Grass and the power of working together."

State Sen. Burt Saunders, R-Naples, among those sharing the dais with Bush, added his own assurances for good measure.

"There will be no problem in terms of funding (Everglades restoration) as far as the state Legislature is concerned," Saunders said.

So far, the state's money is the only money going toward the Southern Golden Gate Estates restoration project, which is estimated to cost $50 million.

The South Florida Water Management District is moving forward alone on a so-called "early start" in Southern Golden Gate Estates.

A team of state and federal engineers and scientists still is mired in the details of the rest of the restoration. The plan is to ask Congress to authorize the project next year.

"We've accelerated this in anticipation of the federal government catching up," Bush said.

The "early start" phase will fill in seven miles of the Prairie Canal on the eastern edge of Southern Golden Gate and tear out 25 miles of roads. Work could be done by October 2005.

"I hope we might see more of this kind of progress in the future," said Florida Department of Environmental Protection Secretary David Struhs, who also wielded his own shovel.

During the ceremony, South Florida Water Management District Director Henry Dean credited Struhs with getting "personally involved" in pushing the early start six months ago. He called Struhs "the straw that stirred the drink."

Southern Golden Gate Estates restoration has been in the talking stages since the 1980s, and getting to Thursday's groundbreaking has been a fight all the way.

Almost 4,000 landowners in Southern Golden Gate Estates filed lawsuits in 1988 and 1992, claiming the state wasn't offering fair prices for their land and was violating their rights to use it.

A 1997 settlement required new appraisals and set the stage for a massive wave of successful eminent domain claims in Collier Circuit Court.

In 1997, the state owned 17,180 acres in the restoration area. Now, less than 2,000 acres remain in private hands. The state has bought 13,000 parcels since 1997, according to state figures.

The buyout, comprising 19,000 parcels, has cost $110 million, about $38 million of which came from the federal government.

Complaints persist to this day about the state's use of eminent domain in Southern Golden Gate Estates and about landowners getting raw deals from the government.

On Tuesday, though, Bush and the Cabinet approved an $880,000 deal with holdout property owner George Miller. Miller bought his 20-acre parcel in 1988 for $6,000.

Still holding out are the Miccosukee tribe of Indians and 67-year-old disabled veteran Jesse Hardy, who lives on 160 acres with his adopted 7-year-old son, Tommy.

Bush said Thursday that it looked as if negotiations with Hardy would not succeed and that the state would have to pursue eminent domain against him, something Bush said he doesn't like to do. He said Hardy would be "well-compensated."

As for the Miccosukees, negotiations are continuing, Struhs said Thursday.

Even Collier County was threatened with eminent domain when county commissioners refused to hand over miles of roads in the restoration area. Commissioners approved a roads deal last month.

Under the deal, the county gave up the roads in exchange for $1 million a year for up to 20 years for maintenance of the county's drainage system and a pledge that the state will find 640 acres for an ATV park for angry riders pushed out by the restoration.

Commissioner Frank Halas was the only county commissioner to attend the ceremony, which drew about 250 people, many of them employees of state and federal agencies connected to the restoration.

Many of them rode to the event in chartered buses through Fakahatchee Strand State Preserve. Bush arrived by helicopter, landing on a patch of pavement at the end of Stewart Boulevard.

The Water Enhancement and Restoration Council, a public-private group spearheaded by the region's largest developers, footed most of the bill for the event -- including a catered lunch of barbecue sandwiches, cole slaw, green beans and swamp cabbage -- contributing $5,000, said South Florida Water Management District spokesman Kurt Harclerode.

Restoration advocate Nancy Payton said the groundbreaking was worth celebrating after years of talking about it.

"I had hoped it would happen in my lifetime, but I didn't think it would happen so soon," said Payton, field representative for the Florida Wildlife Federation.

http://naplesnews.com/03/10/naples/e39080a.htm

Photos and map that accompany article:

Map:
Everglades Restoration Groundbreaking Source: Everglades Restoration Plan. Kori Rumore/Staff
http://naplesnews.com/03/10/graphics/17breakmap-sm.JPG

Full-size map:
Everglades Restoration Groundbreaking Source: Everglades Restoration Plan. Kori Rumore/Staff
http://naplesnews.com/03/10/graphics/17breakmap.JPG

Florida Gov. Jeb Bush answers questions from reporters after a groundbreaking ceremony for Everglades restoration at the intersection of Janes Scenic Drive and Prairie

Canal in the Southern Golden Gate Estates area of Collier County on Thursday. At left is David Struhs, secretary of the Florida Department of Environmental Protection. David Ahntholz/Staff http://naplesnews.com/03/10/graphics/17break2.JPG

Mike Barry, from left, of the Florida Division of Forestry; Win Everham, a professor of environmental studies at Florida Gulf Coast University; and Melinda Schuman, a biologist with The Conservancy of Southwest Florida stand on a walkway over the Prairie Canal near Janes Scenic Drive on Thursday after a groundbreaking ceremony to mark the beginning of construction work on the $8 billion Everglades restoration project. Prairie Canal is the first canal to be filled in an effort to slow freshwater drainage as part of the restoration project in Southern Golden Gates Estates. David Ahntholz/Staff http://naplesnews.com/03/10/graphics/17break.JPG

Additional recommended reading:

http://www.propertyrightsresearch.org/wildlndsprjctfrms.htm
http://www.propertyrightsresearch.org/articles/statement_from_governor_jeb
The Wildlands Project Press Page http://www.wildlandsproject.org/roomtoroam/press/
http://www.propertyrightsresearch.org/florcnts.htm
http://www.propertyrightsresearch.org/interior_department_praises_ever.htm
http://www.twp.org (The Wildlands Project "Official Site")
http://www.twp.org/action/cebadillas/index.html ("Cebadillas")
http://www.twp.org/action/maine/index.html ("Maine Wildlands Network")
http://www.twp.org/action/siwn/index.html ("Sky Islands Wildlands Network")
http://www.twp.org/action/ytoy/index.html ("Yellowstone to Yukon")
http://www.twp.org/site_contents/index.html
http://www.twp.org/vision/index.html ("Vision")
http://www.tws.org The Wilderness Society
www.propertyrightsresearch.org/all_in_the_name_of_environmental.htm
www.propertyrightsresearch.org/wildlands_project_comes_to_hidal8.htm
http://www.propertyrightsresearch.org/articles5/everglades_restoration_plan_gets1.htm

Now, the third one's the "charm" (retch):
Fight for Everglades land enters 6th round

(Note: This article is definitely sympathetic to The Wildlands Project and as such, does the facts surrounding Jesse Hardy and his home, no favors. Rather, it makes him appear unreasonable and/or mercenary, neither of which is true. So the reader may better understand the "highest environmental priority", Gov. Bush's letter to Floridians from June 23, 2003, immediately follows this article.)

April 30, 2004
By Paul Flemming, The News-Press Tallahassee Bureau
The News-Press
Fort Myers, Florida
http://www.news-press.com

To submit a Letter to the Editor: mailbag@news-press.com

For the fifth time, a final decision was delayed Thursday on the fate of Jesse Hardy's 160 acres in the Golden Gates Estates South subdivision.

Governor Jeb Bush's Cabinet deferred until its May 11 meeting a request by the Department of Environmental Protection to begin eminent domain proceedings against Hardy.

Hardy's land is the "hole in the donut" of 55,247 acres that is part of the second phase of the state's Everglades restoration effort.

The 68-year-old Hardy doesn't want to sell or swap.

He's turned down offers of $4.5 million for his property, and a proposal to give him 160 acres in St. Lucie County as a trade.

DEP officials did not have requested engineering studies completed Thursday.

Bush and state Treasurer Tom Gallagher asked the agency to provide options at the Cabinet's April 13 meeting. Bush had directed state negotiators at that meeting to pursue the possibility of Hardy staying on his property.

Hardy and DEP officials are scheduled to meet next week to review plans that would avoid flooding and allow access to his Collier County land. In preliminary estimates earlier this month, DEP said building a dike to protect Hardy's land from flooding would cost $5.8 million to build and $100,000 a year to maintain.

Policy established in the Florida Forever land-acquisition program requires Cabinet approval to pursue eminent domain forfeiture against unwilling sellers of homestead property.

DEP officials have said that offering Hardy anything other than a purchase of his property would call into question the 1,862 parcels purchased from other Golden Gate Estates South landowners.

There were other Florida Forever purchases approved by the Cabinet Thursday:

About 30 acres in Brevard County were approved for purchase around Turkey Creek as part of the ongoing coastal scrub ecosystem project. The state will pay half of the $440,000 purchase price to owner National Heritage Foundation.

Brevard County [taxpayers] will pay the other half.

More than 7,000 acres have already been purchased in the 56,689-acre project.

DEP characterized the land as "one of the most endangered natural communities in North America." It's identified as important manatee habitat, as well as home to migrating songbirds.

Also approved was an agreement with the Northwest Florida Water Management District and the Conservation Fund regarding 7,800 acres surrounding the lower Perdido River. In the deal, the state agreed to pay for half of the acquisitions of land owned by International Paper in the buffer project on offers negotiated by the Conservation Fund.

As part of the agreement, the water district will purchase a 10-acre recreation site within the project boundaries to be managed by Escambia County.

http://www.news-press.com/news/local_state/040430hardy.html

Statement from Governor Jeb Bush Regarding Everglades Restoration

May 23, 2003

By Florida Governor Jeb Bush
jeb.bush@myflorida.com

The Everglades is an important Florida treasure and its restoration has been my highest environmental priority.

In recent weeks there has been much written and said that does not convey the facts behind recent legislation and its potential impact on our current federal partnership.

I hope the following will help clarify the policy, motivations and impact. Please do not hesitate to get back to me with any feedback or additional questions.

On Tuesday, May 20, 2003, I signed into law a much-discussed bill that will further our efforts to restore the Everglades.

Restoring the River of Grass involves both water flow and water quality. It also requires cooperation.

The 1992 court-ordered settlement agreement and the Comprehensive Everglades Restoration Plan are central to our state-federal partnership to clean up this national treasure.

The law I signed Tuesday strengthens the other crucial part of our efforts -- the 1994 Everglades Forever Act, which established Florida's commitment to restoring water quality.

Under the Everglades Forever Act, all parties involved determined that cleaning up the Everglades meant reaching a 10 parts per billion (ppb) phosphorous standard in the water because the unique nature of the Everglades is that it can only tolerate very small amounts of phosphorus.

To put that into perspective, 10 ppb is equal to 10 grains of sand in a bucket of a billion grains.

Today, 90% of the 2.4 million acres of land and water that make up the Everglades are at or below this 10 ppb standard.

By the December 2006 deadline, 95% of the Everglades 2.4 million, will be at or below 10 ppb standard.

While the Everglades Forever Act of 1994 told us to clean up the water in the Everglades by 2006, it didn't tell us how.

The Act told us to reduce phosphorus by 2006, but didn't tell us by how much. Instead, it required the Department of Environmental Protection (DEP) and the South Florida Water Management District (SFWMD) to figure out and implement a plan by December 2003 that will achieve our goal.

The bill I signed into law Tuesday answers these open questions and extends our commitment.

We worked hard over the past several weeks to ensure that the bill that passed through the legislature had the stringent standards to continue our success, and it does.

It allows DEP to adopt a strict 10 ppb standard, and the SFWMD to implement a Long-term Plan to accomplish the goal.

It also adds another $450 million to pay for the effort, without raising taxes or increasing federal funding.

The reality is that the new law actually defines the state's responsibilities more clearly, and acknowledges the fact that -- while a plan will be in place for reaching a 10 ppb standard across the entire Everglades by 2006 -- five percent of the water will not be at 10 ppb, but will achieve the "net improvement" standard set in place in 1994.

Decades of buildup of run off from Lake Okeechobee has embedded phosphorous in the Everglades sediment, and that will take longer than the original deadline of 2006 to dilute.

I remain fully committed to restoring the water quality of the Everglades at the earliest possible date, and to protecting the valuable partnership of state and federal government required to complete the restoration of this national treasure.

This is a complicated issue, and there has been much misinformation about the legislation I signed Tuesday and the state's efforts to restore the Everglades.

I hope the following helps clarify the facts on this important issue. Again, I invite you to contact me at jeb.bush@myflorida.com with any feedback or further questions. Thank you.

Everglades: Myths vs. Facts

MYTH: Proposed amendments to the Everglades Forever Act undermine the federal settlement agreement.

FACT: Florida is meeting the obligations of the Settlement Agreement and will continue to do so. The Settlement Agreement applies to federal waters, which are Everglades National Park and the Loxahatchee Wildlife Refuge. It does not apply to state waters. The State of Florida is responsible for restoring water quality for the entire Everglades Protection area, and we are currently ahead of schedule in this regard.

MYTH: The Everglades is completely polluted.

FACT: Water in 90 percent of the Everglades is clean, meaning [that] it's already at 10 ppb.

Since 1994, Florida has cut average concentrations of phosphorous entering the Everglades Protection Area from 170 ppb to numbers as low as 20 ppb.

Today, water in 90 percent of the Everglades has phosphorus levels of no more than 10 ppb, and all federal waters within the marsh currently have less than 10 ppb.

We reached this standard last year -- four years ahead of schedule.

By December 31, 2006, 95 percent of the entire Everglades also will meet this goal.

The remaining five percent will sporadically have phosphorus levels higher than the goal until the phosphorus buildup in the sediment can be cleansed through "green" technology.

But the remaining five percent will meet the requirement that "net improvement" be achieved, as set forth in the 1994 Everglades Forever Act.

MYTH: Florida has done nothing to clean up the Everglades.

FACT: Hundreds of millions of dollars have been invested in the construction of 44,000 acres of man-made marshes that filter pollution from water entering the Everglades. These treatment marshes, along with improved farming practices, cut phosphorus by 60

percent over the last decade. By 2006, optimization of these "green" technologies will further reduce phosphorus levels.

Keep in mind that Florida has the sole responsibility for restoring water quality, and we have demonstrated our commitment by investing $650 million [taxpayer dollars] to clean up pollution in the Everglades. The legislation signed by Governor Bush today guarantees another $451 million [taxpayer dollars] to get the job done -- without federal funding or raising taxes.

The state-federal partnership deals with water quantity, and in this Florida too has demonstrated its commitment. Since 2000, we have provided an additional $711 million, including $200 million in this tough budget year, to fund our share of the state-federal plan to implement the Comprehensive Everglades Restoration Plan.

MYTH: Proposed amendments to the Everglades Forever Act change or weaken the compliance deadline.

FACT: The compliance deadline remains the same, December 31, 2006. The deadline requires that we meet the 10 ppb standard or show continued net improvement. The legislation signed today and the proposed amendments require a plan, an enforceable schedule, and the money to get the job done.

Today, water in 90 percent of the Everglades has phosphorus levels of no more than 10 ppb, and by December 31, 2006, 95 percent of the entire Everglades will meet this goal. The remaining five percent will sporadically have phosphorus levels higher than the goal. This is the result of more than 30 years of phosphorus flowing freely into the Everglades from Lake Okeechobee that became imbedded in the sediment of the marsh.

Scientifically it is impossible to bring this small amount of land to the 10 ppb level, but we will continue to reduce the levels by cleansing the water through "green" technology. This five percent will meet the requirement that "net improvement" be achieved, as set forth in the 1994 Everglades Forever Act. The bill Governor Bush signed today provides a clear path for continuing to lower the phosphorus levels in these areas.

MYTH: We are weakening water quality standards.

FACT: We are not weakening water quality standards and the Department of Environmental Protection proposed a science-based Phosphorus Water Quality Standard of 10 parts per billion (ppb). The Department is committed to adopting that stringent standard.

MYTH: There is something Florida can do today or in the near future that will make the entire Everglades attain the 10 ppb by the statutory deadline.

FACT: Florida is currently implementing the most environmentally sound, technically feasible technologies to attain the 10 ppb in the entire Everglades. But, a natural

phenomenon known as "soil reflux," which is caused when phosphorus embedded in the soil from years of pollution is released into the water, will cause phosphorus levels to exceed 10 ppb for years, perhaps even decades. The State is exploring ways to accelerate this natural process.

MYTH: The Florida Legislature is establishing the water quality standard.

FACT: The 1994 Everglades Forever Act requires the Department of Environmental Protection to adopt a water quality standard by December 31, 2003. The Department is on schedule to adopt a rule by the statutory deadline.

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http://www.myflorida.com/myflorida/subscribe.html
http://www.propertyrightsresearch.org/articles/statement_from_governor_jeb_bush.htm
http://www.propertyrightsresearch.org/2004/articles5/fight_for_everglades_land_enters.htm

This completes my THIRD Official Public Comment on the SGGE "Restoration Project", with my Strong Suggestion, once again, to SCRAP this THEFT "Plan" if you FAIL to extend its public comment period, hold the REQUIRED Formal Public Hearings AND reduce its scope by AT LEAST NINETY PERCENT.

Julie Kay Smithson
propertyrights@earthlink.net

6-20-04

Dear Sirs -

Thank you for sending that volumous report to me. It answered alot of questions that i had about what is going to happen, when the plan for restoration is implemented. I am writing this late to you. I hope that you get it on time.

The best news that i got from the report, was what you are going to do, to prevent flooding in North Belle Meade, which is where i live. You are going to put in levees and that will help alot.

I now think that it is good thing to restore the flow and return it back to what is was. Also to get rid of the exotic plants. They choke out other plants and use alot of water.

Thank you,

Gregory U. Szansky

From: Mary Stump [westump@earthlink.net]
Sent: Friday, June 18, 2004 2:07 PM
To: Sggecomments
Subject: It's a Property Rights thing

Peasants' Press
June 18, 2004
By Mary F. Stump
Continuing Saga of Jesse Hardy

Remember Jesse who lives in south Golden Gate Estates in Naples, Fl.? Our veteran friend gave 14 years of service and became a navy seal. Involved in maneuvers, he jumped from a chopper at 60 feet breaking his back in two places. He got involved in real estate and in 1976 bought 160 high and dry acres in Collier County, south of I-75 in the area that runs east and west from Naples to Ft. Lauderdale. Jesse has proper permitting for an aquaculture farm, and is planning for future campers to visit with their families for outdoor fun. One lake is finished and stocked while the other is under construction. The limestone fill is sold to the county for raising road beds. Yet, everybody looses.

Why?

Years ago, much of this area had been sectioned off, roads were built and lots were sold. Now, the Everglades Restoration is taking place. The intent is to clean water by natural filtration before it flows to the Gulf, eliminating the original canals and roads put in place by the Corp of Engineers and to return 55,000 acres to its "natural" condition. The state has acquired 19,000 parcels of land. Part of the plan includes 3 massive pumping stations for moving water. This requires canals and roads for access to the pumps for maintenance. Why destroy those in place to build new? Will flooding land that is 10 to 14 feet above sea level put more of Florida under water than anticipated?

They call this a "work in progress" and are willing to change course if they see it isn't working, and there are no guaranteed results in achieving their desired outcome. With a handful of engineers, an assortment of plans and 45 environmental groups bellying up to the taxpayer bar, insuring their jobs well into the future, it's easy to recognize another fleecing of America.

The blue prints for this 8.5 billion dollar program was incomplete when the project began. Reintroduction of wild animals, potential flooding and 100% participation for federal funding are their justifications for removing Jesse. He and the Miccosukee Indians living on their 800 acres, remain.

The latest contract is 4.5 million dollar buyout for Jesse's land, but his land is not for sale. There is no other comparable 160 acres for trade. Men of character and honor such as Pat Tillman and Jesse Hardy know money is not always the answer.

This fight is for all Americans who are loosing their possessions, cattle, land and building rights, through the idea of wetlands, reserves, preserves and the endangered "fill in the blank," often imposed by extortionist methods by the unelected.

With expected over runs this project will make Boston's Big Dig look like a sand pail project.

Write to your politicians. Tell them you are not interested. If water is needed for future population and growth, have them look at our borders.

Do unto others as you would have them do unto you

From: Mary Stump [westump@earthlink.net]
Sent: Monday, June 28, 2004 2:57 PM
To: Sggecomments
Subject: South golden Gate

To whom it may concern,
Please send me a review of these 700 pages in short form and exactly what it means.
thank you.
Mary F. Stump
Do unto others as you would have them do unto you

From: Maureen Sullivan-Hartung [classifieds@goldengategazette.com]
Sent: Tuesday, July 13, 2004 10:04 AM
To: Sggecomments
Cc: sullivanhartung@worldnet.att.net
Subject: Comment on Everglades Restoration Project

Brad Foster:

Good morning. Maureen Sullivan-Hartung here from the Gazette newspaper, voicing my personal concerns (as a resident myself) against the proposed SGGE restoration project. My biggest concern at this time pertains to the soil contaminates that could end up in the fill and then be flooded throughout the system creating havoc on fish and foul with drastic results. I would just like to see some actual studies proving that this issue has indeed been addressed thoroughly. (I have requested a copy of the draft in the written form, since it differs from the CD provided the evening of the public hearing in June but have yet to receive it.)

Tried to talk personally with Colonel Carpenter yesterday; however Susan said he was out of the office traveling, so I left my message (concern) with her. She then graciously forwarded me onto Rick McMillen's extension where I left a message on his machine to return my call.

Many thanks for "hearing" me out.

Maureen Sullivan-Hartung

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From: Mimi Wolok [mwolok@peganet.com]
Sent: Wednesday, June 23, 2004 3:49 PM
To: Sggecomments
Subject: SGGE Comment

I am a resident of Collier County, and I live at 1112 Trail Terrace Drive, Naples, FL 34103.
I fully support the proposed PIR for South Golden Gate Estates, as proposed.
Even if it is beyond the scope of this process, I also support continued full access of off-road vehicles for owners of property within the Picayune, especially the Fakahatchee Strand State Preserve.

Thank you.

Mimi S. Wolok

Comment Number	Organization / Agency	Comment	Response
EPA-1	Heinz J. Mueller, Chief, NEPA Program Office, Office of Policy and Management, EPA Region 4, Atlanta Federal Register, 61 Forsyth Street, Atlanta, GA 30303-8960	The pump stations and their operation are an important element of the proposal since the water must move in an interrupted fashion southward to preclude induced flooding within NGGE. On the other hand, operation of these pumps must be carefully staged to lessen the probability that any enhanced flood protection will result in further inappropriate land use in NGGE. In order to realize these interrelated management goals, the Jacksonville District should establish an interagency SGGE Operations team. Its membership would include state/federal agency representatives as well as local interests. It would focus on operational procedures that determine pumping requirements in relation to canal stages and existing/forecast weather conditions. . .	A Draft Operating Manual is included in this Report. It will be refined in cooperation with the non-Federal Sponsor and coordinated with concerned agencies during the detailed engineering phase of the project, after the project is authorized. In accordance with the requirements of WRDA 2000 and the CERP Programmatic Regulations, this plan is included in the present report. The Operating Manual will be coordinated with other government agencies and before the project is turned over to the SFWMD the operations plan will be presented to the public.
EPA-2	Heinz J. Mueller, Chief, NEPA Program Office, Office of Policy and Management, EPA Region 4, Atlanta Federal Register, 61 Forsyth Street, Atlanta, GA 30303-8960	Given that this is a proposal of almost regional proportions, some fundamental changes in watershed hydrology can be expected. . . There is anticipation that these hydrological changes will enhance wetland communities within SGGE confines and improve the timing/volume of fresh water to the downstream estuaries of the Ten Thousand Islands region. . . The positive impacts of these measures should be regionally significant. . .	Noted
EPA-3	Heinz J. Mueller, Chief, NEPA Program Office, Office of Policy and Management, EPA Region 4, Atlanta Federal Register, 61 Forsyth Street, Atlanta, GA 30303-8960	EPA strongly supports the specific objectives of this proposal as well as the related environmental goals of the even more CERP. . . Long-term monitoring to determine just how successful this proposal is in achieving its projected environmental deliverables will be another responsibility of the SGGE Operational Team. Given the importance of this proposal, we intend to participate actively with our state/federal stakeholders in this regard.	EPA support is acknowledged. We welcome continued coordination with EPA. The monitoring plan has been revised and updated. Please refer to Appendix H.
EPA-4	Heinz J. Mueller, Chief, NEPA Program Office, Office of Policy and Management, EPA Region 4, Atlanta Federal Register, 61 Forsyth Street, Atlanta, GA 30303-8960	EPA determined that the consequences attendant to the proposal have been appropriately characterized/evaluated; therefore, a rating of "LO" (Lack of Objectives) was assigned.	Thank you. We look forward to continue cooperation during development of detailed designs, if the project is approved.
DOI-1	Terrence C. Salt, Director of Everglades Restoration Initiatives, United States Department of the Interior	Project Operating Manual Development. As required by the Programmatic Regulations, a draft Project Operating Manual, where appropriate, must be included in the PIR before it is finalized. We request that the draft Project Operating Manual currently under development be provided for review and comment prior to its inclusion in the final PIR.	Concur. This report contains a draft Operating Manual. Please refer to Appendix A.

Comment Number	Organization / Agency	Comment	Response
DOI-2	Terrence C. Salt, Director of Everglades Restoration Initiatives, United States Department of the Interior	Finalize a Modified Adaptive Assessment and Monitoring Plan. We recommend that the Adaptive Assessment and Monitoring Plan in the draft PIR will be replaced in the final PIR by the more comprehensive monitoring plan that is currently under development.	Concur. The Draft Monitoring and Assessment plan is included in Appendix H. It has been revised and expanded by the Ecosystem sub-team, with significant assistance and contribution from Department of the Interior staff.
DOI-3	Terrence C. Salt, Director of Everglades Restoration Initiatives, United States Department of the Interior	Control and Management of Invasive Species. Because of the serious problem with invasive exotic species, particularly Brazilian pepper in the SGGE, the PIR should reference and use the two CERP invasive species plans and recognize the Corps' expanded involvement in invasive species management through CERP. The Final Land Management Plan should specifically consider potential effects of invasive exotic species on threatened and endangered species and manage the threatened and endangered species in a manner sufficient to ensure restoration and facilitate recovery.	In the discussion of existing conditions, as well as the effects of the recommended plan, there is some discussion of invasive and exotic species. The CERP program recognizes the problem of invasive exotic species. Brazilian pepper and Melaleuca are invasive exotics found on project lands. Additionally, the native but invasive cabbage palm is noted as a problem species, which has been able to expand its cover in the project area due to overdraining and hot fires. However, the primary purpose of the proposed plan is to re-hydrate areas that are currently overdrained. While the monitoring plan includes periodic plant cover characterization of SGGE sample sites, no funds are currently earmarked in the project for exotic plant species control.
DOI-4	Terrence C. Salt, Director of Everglades Restoration Initiatives, United States Department of the Interior	Assurances and Natural Resources Protection. We recommend that the assurances section be expanded and redrafted to include natural resources protections and benefits and baseline water measurements that are currently being negotiated for inclusion in the Guidance Memoranda. We recommend that hydrologic improvement that benefit fish and wildlife outside the project footprint be documented. We believe an evaluation of existing and future flood protection benefits is required to satisfy the WRDA 2000 Savings Clause, as is an evaluation of hydrologic conditions that support fish and wildlife. If it is determined that there is no water available in excess of the amount needed for restoration, we recommend that this conclusion be stated in the report.	There is a qualitative discussion of ecosystem benefits expected outside the project footprint. The model domain does not extend to tidally influenced lands, however; and without detailed bathymetry Corps modeling experts have stated that we cannot apply existing tidal models. The Southwest Florida Feasibility Study is grappling with this problem at a regional level, and may be a more appropriate medium for its resolution. With regard to flooding, we do not measure flood mitigation on restoration projects - we must only identify that there are no adverse impacts on existing flood stages and durations on adjacent lands. Water made available by the project which appears on model runs to be above restoration targets is not considered "available" for specific purposes. No determination has been made in the PIR as the availability of this additional water for specific purposes.

Comment Number	Organization / Agency	Comment	Response
DOI-5	Terrence C. Salt, Director of Everglades Restoration Initiatives, United States Department of the Interior	Modeling Refinements. The Department still has concerns with regard to model input, calibration and validation, and model assumptions, including aquifer parameters, period of simulation, operational criteria, and design storm applications. We recommend that the models be further refined to more accurately predict project effects on upstream and downstream lands. The models should also characterize the wetland loss and increased stormwater runoff resulting from existing agriculture and rapid urban development of the project watershed.	We will provide the Service with model outputs as available, and will continue to dialog on modeling issues. However, the selection of the model for this project was done some time ago, and data and outputs are what they are. The Corps and the South Florida Water Management District have many years of experience working with hydrologic and flood models. Although we recognize Service concerns, we cannot allow them to override the judgment and expertise of our own staff. We believe that the current set of model runs are sufficiently accurate to predict ecosystem benefits and flood stages and durations. We commit to continue working in an open environment with free exchange of data, technical considerations and outputs. Further refinement of the design would occur if the project is approved during the next detailed engineering phase. There is potential for further exploring model refinements during that phase.
NMFS-1	NMFS HCDPC, Mr. Mark Sramek, 3500 Delwood Beach Road, Panama City, Florida 32408	Based upon our review of the document, and our participation in the June 17, 2004, Public Workshop in Naples, Florida, we find that the description of fishery resources and habitats which occur within the project area and the assessment of potential adverse impacts associated with the proposed activities are **adequate.** We anticipate that any adverse effects that might occur on marine and anadromous fishery resources would be minimal and, therefore, do not object to the proposed restoration activities. Pursuant to essential fish habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act, no further coordination is necessary unless the project design is further modified, and your agency determines that implementation of those revisions could result in adverse impacts to EFH and dependent fishery resources.	Statement of concurrence with the EFH determination, required under the Magnuson-Stevens Fishery Management and Conservation Act, noted. Thank you for your response. We intend to continue monitoring estuarine resources, if the project is approved, under the Monitoring Plan.
Miccosukee-1	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The Miccosukee Tribe of Indians strenuously objects to the Army Corps of Engineers (“Corps”) Draft Integrated Project Implementation Report and Environmental Impact Statement (“PIR/EIS”) for the Southern Golden Gate Estates Ecosystem Restoration. The Tribe contends that the PIR/EIS and events leading up to the PIR/EIS violate at least the Water Resources Development Act of 2000 (“WRDA 2000") ..., the National Environmental Policy Act (NEPA) ... the Administrative Procedures Act (“APA”), the Endangered Species Act (“ESA”) ..., the December 2003 Programmatic Regulations, the National Historic Preservation Act of 1966, Executive Order 12898 on Environmental Justice, Chapter 373, Florida Statutes and the Corps' trust responsibility to the Tribe. ... does discuss in any meaningful way that the Tribe has hundreds of acres of lands in the project area, and does not reflect the fact that the South Florida Water Management District (“SFWMD”) and the Department of Environmental Protection (“DEP”)) have been condemning land and have already constructed components of the Project, ...	These topics are addressed separately in the following comments and responses.

Comment Number	Organization / Agency	Comment	Response
Miccosukee-2	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The Army Corps of Engineers owes the Miccosukee Tribe of Indians a sacred trust obligation and fiduciary duty to protect Tribal lands, resources, and assets pursuant to the federal Indian Trust Doctrine developed over hundreds of years of jurisprudence. The Corps' failure to stop the State from attempting to acquire the Tribe's land prior to completing the PIR/EIS adversely affects lands vital to the culture and way of life of the tribe, ... Consultation with the Tribe has been inadequate.	On June 29, 2004, a letter was sent to Tribal Chairman Billy Cypress requesting government - to - government consultation on the Draft PIR so that the Tribe and the U.S. Army Corps of Engineers (Corps) could collaboratively work to develop resolutions to the Tribe's concerns with the project at this pre-decisional stage. Final agency action will not occur until a Record of Decision on the project is published in the Federal Register.
Miccosukee-3	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The District and the Corps are not following the requirements of WRDA 2000 by failing to complete a Project Implementation Report before land is purchased and construction begins. … Coordination with American Indian Tribes has been inadequate.	WRDA 2000 requires that the PIR be completed before Congress can authorize a project. The final PIR will contain complete NEPA documentation and Saving Clause Analysis pursuant to WRDA 2000. Land acquisition and construction actions undertaken by the State in advance of the Final PIR for this project has been undertaken independently by the State under state law. As mentioned in an earlier reponse, the Corps has requested government - to - government consultation with the Miccosukee Tribe of Indians.
Miccosukee-4	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The requirements of NEPA are not being followed as part of the PIR process because the State is moving forward with construction. … DEP has been purchasing land in the area for years. ….	There is no Federal restoration project at this time. There is only a Federal study. The final Programmatic EIS for CERP discussed th preliminary proposal for Southern Golden Gate Estates. The draft PIR and draft EIS was produced and coordinated in accordance with NEPA and WRDA 2000. The State has started construcction using state funds. The Corps made it clear to the State that there was no guarantee of credit or that the proposed project would be approved by the Corps' headquarters or authorized by Congress. Actions of the State taken by State agencies without Federal participation, do not invalidate the Federal NEPA process.
Miccosukee-5	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The Administrative Procedure Act (APA) non-compliance … acquisition of land and coxnstrtuction of part of the project prior to completing NEPA and ESA compliance is a violation or amendment of the APA. … the document appears to suggest that the final water contro plan will come after the EIS process, which is counter to Corp's rules on water projects.	The District is following all appropriate and applicable Federal regulations in developing the PIR for this project. According to the December 2003 Final Programmatic Regulations, the Project Operating Manual will be developed with the Tribe and other interests. The Final Operating Manual is to be completed after the operational testing and monitoring phase of the project. Consultation with the Tribe will continue between development of the draft and final operating manuals.
Miccosukee-6	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The SGGE PIR/EIS violates the Endangered Species Act. … a final Biological Assessment (BA) is required … lack of a BA means that the PIR/EIS does not comply with NEPA.	The NEPA process and the ESA compliance process are seaprate legal actions. It is not unusual for formal completion of full compliance with ESA to take longer than the NEPA process. The final PIR contains our assessment of impacts as well as the position of the US Fish and Wildlife Service.
Miccosukee-7	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The PIR fails to meet the requirements of the December 2003 Final Programmatic Regulations. ... The PIR does not follow the 3-step formulation and evaluation process.	The Final Programmatic Regulations provide for the development of a special Guidance Memorandum addressing appropriate formulation procedures for CERP projects. This Guidance Memorandum has not been completed. Until then, the Programmatic Regulations provide that the Army use whatever methods are deemed appropriate and consistent with applicable laws and policies.

Comment Number	Organization / Agency	Comment	Response
Miccosukee-8	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	Concern that the the Tribe's 5th Amendment and Due Process rights are not being protected.	Please refer to responses to comments Miccosukee-2 and Miccosukee-4. The SFWMD and the Corps are complying with all applicable laws and regulations, and will continue to give the Tribe opportunity for input into the Project.
Miccosukee-9	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	The Tribe has significant lands and practices its culture in the project area. The tribe would be adversely impacted by the taking of its lands. The land is an important cultural resource to the Tribe. There are archeological resources in the area. ... The residents of NGGE will provide greater level of flood protection at the expense of Tribal lands in SGGE.	The Corps is undertaking cultural resources surveys in the project area. The surveys are being performed in accordance with Federal and State laws. The Corps has coordinated with the Tribe's cultural resources respresentative, Mr. Steve Terry. The Tribe is encouraged to comment on the ongoing survey and planned surveys, survey stragies, and results. Continued access to the land will be addressed during government - to - government consultation discussions. Flood protection and urban water supply are not objectives of this project. The pump stations will be operated to maintain existing drainage for NGGE, not increase drainage.
Miccosukee-10	Miccosukee Tribe of Indians of Florida, P.O. Box 440021, Tamiami Station, Miami, Florida 33144	No adequate consideration of water quality concerns has been made. Rehydrating with dirty water is not a viable alternative.	The water quality monitoring plan in Appendix H of the PIR details comprehensive considerations for waer quality. This plan was developed with considerable input and cooperation from Federal, state, and local agencies. Water quality at the proposed surface water inflow locations (pump stations) will be monitored. It is important to note that the majority of source water for rehydration of the project area is from retaining natural rainfall events onto the project area, not from increased artificial surface water inputs.
FDACS	Florida Department of Agriculture and Consumer Services, Division of Forestry	As the lead managing agency of the Picayune Strand State Forest, the Florida Department of Agriculture and Consumer Services looks forward to continued cooperation with the Corps of Engineers on SGGE Ecosystem Restoration and requests that all restoration efforts be coordinated with the Florida Division of Forestry.	Noted. Representatives of the DOF have made significant contributions to the monitoring and assessment plan as members of the ecosystem sub-group. We expect to continue cooperating with DOF in development of the management plan for the Forest.
FDEP-1	John Outland, Florida Department of Environmental Protection,	The Florida Department of Environmental Protection supports the tentatively recommended plan (Alt. 3D) for Southern Golden Gate Estates as presented in the Draft PIR and EIS, dated April 2004. … the review and comments provided below do not constitute the State's formal review of CERP project components as required by state law under 373.1501, Florida Statutes (F.S.) and 373.026, F.S.	Noted. The Corps and SFWMD welcome DEP support and anticipate continued close coordination, if the project is approved, during the Federal detailed design phase.
FDEP-2	John Outland, Florida Department of Environmental Protection,	We suggest that the recommended plan be further evaluated in the final design to determine if cost savings can be accomplished by eliminating or downsizing of the proposed pump stations without sacrificing flood management in NGGE.	Pumps have been sized not to have an adverse impact in the adjacent lands. Further optimatization of the pump station will be performed in the detailed design phase of this project. All design details, including size, number and placement of pump stations, will be re-visited. If appropriate, some re-runs of the model may be utilized to optimize these features. FDEP will be kept informed of design details that will be developed during the detailed design phase of the project.

Comment Number	Organization / Agency	Comment	Response
FDEP-3	John Outland, Florida Department of Environmental Protection,	The Pre-CERP baseline water for fish and wilflife resources has not been established at this time. It is anticipated that the Pre-CERP baseline water will not be reserved prior to execution of CERP restoration project PCAs but will be reserved before construction is started as an item of local cooperation for the SGGE restoration project. We raise this concern because a Pre-CERP reservation is characterized as a reservation of the water currently available and beneficial to the natural system prior to implementation of a CERP project and specifically is **not** a requirement of WRDA or the Programmatic Regulations. This Pre-CERP reservation is in addition to the reservation of water made available by the Project for the natural system, which is to be adopted prior to execution of the Project Cooperation Agreement pursuant to Section 6-1(h) of WRDA 2000. **Please see next row for the conclusion of remarks**	We do not see this as a problem for the Picayune Strand Restoration Project, for there is no Federal multi-purpose project in place south of I-75 in the region, nor do there appear to be significant existing rights to water other than those associated with the natural system. The water to be provided for the ecosystem is the water that now arrives via rainfall, groundwater seepage and channeled drainage from higher ground north of I-75; in other words, the natural inflow to the project area. Additionally, the future use of the area as a State Forest is for conservation, propagation of wildlife, compatible recreation and forest management. Re-hydration of the groundwater aquifer and the surface wetlands is expected to benefit groundwater levels in adjoining lands, especially Fakahatchee Strand State Forest. The recommended alternative, Alt. 3D, is just "big" enough to provide adequate water to restore the natural ecosystem; due to the cost of project structures and operations, the system is not designed, nor will it be operated, to provide "surplus" water.
FDEP-3	John Outland **Conclusion**	The state's position has been that although we do not agree the pre-CERP reservation is required by WRDA, we agree that in order to provide confidence that the pre-CERP baseline water remains available for the natural system, we propose that the following language on Page 13-5 of Section 13 be revised in the final PIR as an item of local cooperation: (see the text in the original letter)	
FDEP-4	John Outland, Florida Department of Environmental Protection,	Permits. Upon completion of detailed design, this project will require a Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit pursuant to Chapter 373.1502, F.S. The project may require a NPDES Generic Permit for Stormwater Discharge from Large and Small Construction Activities in accordance with Rule 62-621.300(4), Florida Administrative Code (F.A.C.). Other department permits may be required during the construction phase of this project, as applicable.	Permits will be applied for at the appropriate time.
FDEP-5	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Notice of Conditional CZM Consistency. The Draft Integrated PIR/EIS for the SGGE project is devoid of any analyses or narrative discussions relative to the project's potential impacts to the State Highway System. . . The safety and welfare of the motoring public are of paramount importance to the Department's mission and statutory charge. To ensure such responsibilities are met, District One deems the documents "Conditional Consistency". . .	(Same as comment FDOT-1) We expect no adverse impacts on state highway systems. The purpose of the project is to change the *manner* of conveyance of water from the north to the south part of the project area. The project area will receive water from rainfall and drainage of areas north of I-75, as before. No additional water will flow through the project area, in comparison to existing conditions. The project will substitute overland flow and groundwater movement for channeled flow. We note that Tamiami Trail pre-dates the construction of the South Golden Gate Estates channels. Additionally, the improved culverts described in the "Tamiami Trail Culverts" CERP Critical Project have been incorporated into design for this project, providing the needed conveyance under the trail.

Comment Number	Organization / Agency	Comment	Response
FDEP-6	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	State Highway System Concerns. Because the intent of the project is to restore natural hydro patterns and flow ways, thereby restoring sheet flow to the SGGE project area, there will be significant changes in hydraulics and hydrology, including significant increases in ground-water tables. As a result of these proposed changes, District One requests that the following issues and potential impacts, at a mini-mum, be adequately addressed within the report and EIS, as well as discussed with Eddie Joyner, PE, District Drainage Engineer, at our District One Headquarters in Bartow, at (239) 519-2497. . .1) Interstate 75. There appears to be no discussion as to whether there could be drainage impacts to the I-75 mainline or I-75/SR 29 interchange during storm events. . . 2) State Road 29. . . . Will the increase in sur face waters contribute to the overtopping of SR 29 during storm events? If so, at which event levels? 3) US 41 (Tamiami Trail). **Please see next row for conclusion.**	Same as comment FDOT-2. I-75 will not be affected by project elements. SR-29 is likewise not expected to be affected. The Corps and Water Management District invite continued coordination with FDOT and we will utilize the contacts provided in your letter. In response to your questions about Tamiami Trail, please refer to the response to the previous comment: the "Tamiami Trail Culverts" design from the Critical Project has been incorporated into the Picayune Strand Restoration project. These culverts will provide additional conveyance under the Trail during high water events. We have held several meetings with the Florida Department of Transportation to obtain detailed surveys and geotechnical information for the indicated roads.
FDEP-6	Lauren Milligan **Conclusion**	...what will be the impacts to Tamiami Trail? What will be the threat level for over-topping and bride/culvert scouring during significant storm events, including tropical storms? . . . Please provide analysis, findings, and any mitigation if necessary.	
FDEP-7	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Blvd, MS 47, Tallahassee, FL 23299-3000	US 41 (Tamiami Trail) Culverts. The narrative's discussion of the installation of culverts under Tamiami Trail is unclear whether there is implied a need for additional culverts for the segment of US 41 bordering the project area, or if the Critical Culvert program's culverts, which are currently being installed, are adequate. Please clarify the narrative.	Same as comment FDOT-3. The Tamiami Trail Culverts critical project design was based on presumed complete elimination of the channels and sheet flow over the entire project area. Alt 3D provides some additional storage (above this design) because portions of the channels will be left open, but blocked. The new culverts are expected to provide adequate conveyance.
FDEP-8	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Project Access Roads. Direct access to and from I-75 is prohibited and any access connections to either Tamiami Trail or SR 29 will require a review of plans and access (driveway) permits, pursuant to Department Rules 14-96 and 14-97, FAC.	Same as comment FDOT-4. No direct access to I-75 or SR 29 is currently proposed. Connection to Tamiami Trail may be needed. FDOT will be consulted druing development of detailed plans.

Comment Number	Organization / Agency	Comment	Response
FDEP-9	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Conclusions; Cost Effectiveness and Incremental Cost Analyses. After appropriate analyses of impacts to the State Highway System, and conclusions are drawn, the documents should reflect the findings, any mitigation measures, and/or modifications to the report and EIS, especially. . . Ensure summary of all impacts to FDOT rights-of-way is included.	Same as comment FDOT-5. A statement regarding effects on State Highways has been added to the report. Please refer to Chapter 9, "Environmental Effects."
FDEP-10	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Section 9.18.1 (Cumulative Effects) Error. . . . Aside from typical growth in background traffic, it is the increasing development of National Park Service kiosks and visitor centers catering to the public that is expected to attract/generate additional traffic to US 41, as well as the designating of Tamiami Trail a "National Scenic Byway"; not the resurfacing of an existing roadway in sore need of repair. In fact, design plans for the resurfacing of Tamiami Trail will not include paved shoulders, at the request of the NPS. Please correct the narrative statement in Section 9.18.1.	Same as comment FDOT-6. Correction will be made as indicated.
FDEP-11	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Compliance with State Laws. The documents made reference to Chapters 334 (Transportation Administration) and 339 (Transportation Finance & Planning), Florida Statutes; however, the Applicant needs to also review the following additional statutes: 335 (State Highway System), and 338 (Intrastate Highway System and Toll Facilities), FS, for consistency and compliance.	Same as comment FDOT-7. Noted. Revised CZM consistency statement includes compliance with these additional Sections.
FDEP-12	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection, 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Section 13 (Recommendations). The narrative on Page 13-6 recommends that non-federal sponsors be credited for construction activities completed in advance of execution of a "Project Cooperation Agreement" with the COE. . . Please clarify whether this means FDOT would be able to recoup all costs associated with its transfer of funds to the SFWMD for the installation of the Tamiami Trail Culverts Project, including consequential resurfacing as a result of the construction? The clarification may be relayed to either Michael Rippe. . . or Larry Slayback.	Same as comment FDOT-8. The non-Federal sponsor will be credited for the non-Federal funds for this work, but will not receive credit for Federal funds it may use for the work. Credit will be given for the culverts themselves and necessary road repairs associated with the culverts. The sponsor's entire Culverts Project may not be eligible for credit. This will be further evaluated during the preparation of the Project Cooperation Agreement.

Comment Number	Organization / Agency	Comment	Response
FDEP-13	Lauren Milligan, Coordinator, Florida State Clearinghouse, FDEP (Florida Department of Environmental Protection), 3900 Commonwealth Boulevard, MS 47, Tallahassee, FL 23299-3000	Summary Comment. Be assured of District One's cooperation, support, and commitment to the SGGE Restoration Project as soon as our concerns and any potential impacts to the State Highway System are addressed, assurances of compliance are given, and/or impacts are satisfactorily remediated.	Same as comment FDOT-9. FDOT's support of the project, subject to resolution of concerns expressed, is noted and appreciated. We will continue coordination to resolve all outstanding issues.
FDEP-14	Sally B. Mann, DEP, Marjory Stoneman Douglas Building, 3900 Commonwealth Boulevard, Tallahassee, FL 32399-3000	The Florida State Clearinghouse is awaiting additional comments from our reviewing agencies on the project. We are therefore requesting an additional fifteen (15) days for completion of the consistency review in accordance with 15 CFR 930.41(b). We will make every effort to conclude the review and forward the consistency determination to you on or before July 2, 2004.	Noted
FDOT-1	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Notice of Conditional Consistency. The Draft Integrated PIR/EIS for the SGGE project is devoid of any analyses or narrative discussions relative to the project's potential impacts to the State Highway System. . . The safety and welfare of the motoring public are of paramount importance to the Department's mission and statutory charge. To ensure such responsibilities are met, District One deems the documents "Conditional Consistency". . .	We expect no impacts on state highway systems. Reference comment/response in FDEP Clearinghouse comment FDEP-5, above.
FDOT-2	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	State Highway System Concerns. Because the intent of the project is to restore natural hydro patterns and flow ways, thereby restoring sheet flow to the SGGE project area, there will be significant changes in hydraulics and hydrology, including significant increases in groundwater tables. As a result of these proposed changes, District One requests that the following issues and potential impacts, at a minimum, be adequately addressed within the report and EIS, as well as discussed with Eddie Joyner, PE, District Drainage Engineer, at our District One Headquarters in Bartow, at (239) 519-2497. . .1) Interstate 75. There appears to be no discussion as to whether there could be drainage impacts to the I-75 mainline or I-75/SR 29 interchange during storm events. . . 2) State Road 29. . . . Will the increase in surface waters contribute to the overtopping of SR 29 during storm events? If so, at which event levels? 3) US 41 (Tamiami Trail). ...what will be the impacts to Tamiami Trail? **Please see next row for conclusion**	Pending EN-HH response, no adverse effect on the cited highways is expected. See response to comment FDEP-6
FDOT-2	Larry G. Slayback, **Conclusion**	What will be the threat level for over-topping and bride/culvert scouring during significant storm events, including tropical storms? . . . Please provide analysis, findings, and any mitigation if necessary.	

Comment Number	Organization / Agency	Comment	Response
FDOT-3	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	US 41 (Tamiami Trail) Culverts. The narrative's discussion of the installation of culverts under Tamiami Trail is unclear whether there is implied a need for additional culverts for the segment of US 41 bordering the project area, or if the Critical Culvert program's culverts, which are currently being installed, are adequate. Please clarify the narrative.	Narrative will be clarified. The Critical Project's culverts are now part of the Picayune Strand restoration project, and are expected to convey all flows. See response to FDEP-7
FDOT-4	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Project Access Roads. Direct access to and from I-75 is prohibited and any access connections to either Tamiami Trail or SR 29 will require a review of plans and access (driveway) permits, pursuant to Department Rules 14-96 and 14-97, FAC.	Concur. No direct access to I-75 or S.R. 29 has been proposed. Connection to Tamiami Trail may be needed. FDOT will be consulted during development of detailed plans. Also see Clearinghouse comment FDEP-8.
FDOT-5	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Conclusions; Cost Effectiveness and Incremental Cost Analyses. After appropriate analyses of impacts to the State Highway System, and conclusions are drawn, the documents should reflect the findings, any mitigation measures, and/or modifications to the report and EIS, especially. . . Ensure summary of all impacts to FDOT rights-of-way is included.	Calculations will be reviewed if additional costs are incurred due to impacts to FDOT right-of-way. PD-PF
FDOT-6	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Section 9.18.1 (Cumulative Effects) Error. . . . Aside from typical growth in background traffic, it is the increasing development of National Park Service kiosks and visitor centers catering to the public that is expected to attract/generate additional traffic to US 41, as well as the designating of Tamiami Trail a "National Scenic Byway"; not the resurfacing of an existing roadway in sore need of repair. In fact, design plans for the resurfacing of Tamiami Trail will not include paved shoulders, at the request of the NPS. Please correct the narrative statement in Section 9.18.1.	Concur. Text will be revised. Also see response to FDEP-10
FDOT-7	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Compliance with State Laws. The documents made reference to Chapters 334 (Transportation Administration) and 339 (Transportation Finance & Planning), Florida Statutes; however, the Applicant needs to also review the following additional statutes: 335 (State Highway System), and 338 (Intrastate Highway System and Toll Facilities), FS, for consistency and compliance.	These Chapters will be reviewed. Also see response to FDEP-11

Comment Number	Organization / Agency	Comment	Response
FDOT-8	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Section 13 (Recommendations). The narrative on Page 13-6 recommends that non-federal sponsors be credited for construction activities completed in advance of execution of a "Project Cooperation Agreement" with the COE. . . Please clarify whether this means FDOT would be able to recoup all costs associated with its transfer of funds to the SFWMD for the installation of the Tamiami Trail Culverts Project, including consequential resurfacing as a result of the construction? The clarification may be relayed to either Michael Rippe. . . or Larry Slayback.	The non-Federal sponsor will be credited for the non-Federal funds for this work, but will not receive credit for Federal funds it may use for the work. Credit will be given for the culverts themselves and necessary road repairs associated with the culverts. The sponsor's entire Culverts Project may not be eligible for credit. This will be further evaluated during the preparation of the Project Cooperation Agreement. Also see response to FDEP-12
FDOT-9	Larry G. Slayback, District ICAR Coordinator, District One Southwest Area Office, Florida Department of Transportation, P.O. Box 1030, Fort Myers, FL 33902-1030	Summary Comment. Be assured of District One's cooperation, support, and commitment to the SGGE Restoration Project as soon as our concerns and any potential impacts to the State Highway System are addressed, assurances of compliance are given, and/or impacts are satisfactorily remediated.	FDOT's support of the project, subject to resolution of concerns expressed, is noted and appreciated. We will continue coordination to resolve all outstanding issues.
SHPO-1	Frederick Gaske, SHPO, Florida Department of State, 500 S. Bronough Street, Tallahassee, FL 32399-0250	Historic resource concerns have been adequately addressed with the condition that cultural resource assessment surveys will be conducted to determine if significant resources are present. We look forward to reviewing and commenting on the resultant reports.	Cultural resource surveys are now underway. Results will be coordinated with the State Historic Preservation Officer as they become available.
SWFRPC-1	Southwest Florida Regional Planning Council, 4980 Bayline Drive, 4th Floor, N. Ft. Myers, FL 33917-3909; State Clearinghouse	Document has been found Regionally Significant and Consistent with adopted goals, objectives, and policies of the Strategic Regional Policy Plan	Noted. We anticipate continued coordination with the Regional Planning Council if the project is approved for detailed design and construction.
SFRPC-1	South Florida Regional Planning Council, 3440 Hollywood Boulevard, Suite 140, Hollywood, FL 33021	The objectives and preferred alternative of the Southern Golden Gate Estates Ecosystem Restoration have been found to be generally consistent with the goals and policies of the Strategic Regional Policy Plan for South Florida (SRPP)	Noted

Comment Number	Organization / Agency	Comment	Response
Audubon-1	Bradley Cornell, Environmental Policy Analyst, Collier County Audubon Society, 660 Ninth Street, North, Suite 32A, Naples, FL 34102	Collier County Audubon Society has received and reviewed a copy of the draft SGGE Restoration Plan PIR/EIS, attended numerous project update meetings, and met with water management district staff, including Janet Starnes, regarding this recommended CERP project. We find the overall tentatively recommended plan to be very supportable and we urge its final drafting to be expeditiously forwarded to Congress for funding and implementation to commence.	Audubon's support is appreciated.
Audubon-2	Bradley Cornell, Environmental Policy Analyst, Collier County Audubon Society, 660 Ninth Street, North, Suite 32A, Naples, FL 34102	We support alternative 3D because of its maximum restoration benefits. However, we are concerned about the use of large pumps to achieve this. The risk and potential is there for using those pumps to OVER drain the NGGE, especially during storm events. We ask that written assurances be made regarding not increasing the drainage of NGGE in the Plan and its implementing documents. All current references to this issue only address UNDER-drainage of NGGE. Also, it is not clear what the definitions are of “emergency conditions” or “prior approval” in Appendix A Water Controls when referring to deviations from normal operations of those pumps. One such deviation could be over-drainage during regular storms or just a wet summer, so specific criteria and definitions are needed in writing for any such deviations to avoid normal rain events prompting cries of “emergency”. Likewise, “prior approval” is too vague. The Corps and District should not increase the feasibility of people building houses in the wettest areas of NGGE with this project.	Operations are addressed in the Draft Operations Manual which is part of Appendix A. This appendix addresses and defines emergency operations, pre-storm drawdowns and other specifics.
Audubon-3	Bradley Cornell, Environmental Policy Analyst, Collier County Audubon Society, 660 Ninth Street, North, Suite 32A, Naples, FL 34102	Our understanding is that the Florida Division of Forestry, the ultimate land manager for the Picayune Strand State Forest, intends to allow mudding and other destructive traffic by ORV/ATV driving public in the part of the SGGE restoration area. Collier Audubon Society believes this to be an incompatible land use for a restoration area and would like to see the Corps and District exert some measure of control or stipulate what uses are NOT compatible with this finished project. The “traditional” off-road vehicle uses in the SGGE have been trespassing and illegal and should not be viewed as anything vested. Along with the District, Collier Audubon is working on finding alternative sites for such activities.	Noted. The Real Estate appendix (App F) includes a discussion of uses compatible and incompatible with ecosystem restoration and endangered species habitat. We note that the project area is known habitat for the Florida Panther and other endangered species. Land use must be compatible with ecosystem recovery, endangered species conservation and recovery and wetland restoration to be eligible for Federal cost-share.
Audubon-4	Bradley Cornell, Environmental Policy Analyst, Collier County Audubon Society, 660 Ninth Street, North, Suite 32A, Naples, FL 34102	We have heard individual demands for hurricane evacuation routes through this area, but are puzzled by any serious consideration of this. These wetlands are among the last places we should be routing traffic escaping a storm.	Noted. In general hurricanes and tropical storms bring flooding rains, as experienced with this year's passage of Hurricane Frances. During such periods a sizable fraction of lands in the project area would be under water and unsuitable for use as an evacuation route, even along roads not destined for down-grading and removal of pavement.

Comment Number	Organization / Agency	Comment	Response
Audubon-5	Bradley Cornell, Environmental Policy Analyst, Collier County Audubon Society, 660 Ninth Street, North, Suite 32A, Naples, FL 34102	It was not clear from the scale of the maps, but we urge this project's diked areas conform to Collier County's Natural Resource Protection Area boundaries in South Belle Meade around the 6-L's agricultural area. Please do not include NRPA acreage within the dikes.	There will be an unavoidable but minimal loss of NRPA acreage due to the project.
Conservancy of SW FL-1	Gary Davis, Director, Environmental Policy, Conservancy of Southwest Florida, 1450 Merrihue Drive, Naples, FL, 34102	The Conservancy of Southwest Florida supports Alternative 3D as the recommended plan for hydrologic restoration of Southern Golden Gate Estates.	Your support is appreciated.
Conservancy of SW FL-2	Gary Davis, Director, Environmental Policy, Conservancy of Southwest Florida, 1450 Merrihue Drive, Naples, FL, 34102	One concern is that Alternative 3D not be used to dewater Northern Golden Gate Estates. The pumps should not be used to provide additional flood control beyond current levels of protection for NGGE. …. Over-drainage of NGGE would lead to the same serious environmental problems that have occurred in SGGE and would threaten groundwater recharge and protection against fires within the North Estates.	Noted. The entire project development Team and cooperators tried to find a non-mechanical solution that would still provide no increase in flood stages or durations in Northern Golden Gate Estates. However, every alternative tried was not successful. We appreciate the Conservancy's concern with over-drainage of NGGE, but the mere presence of pumps is not the same thing as permission to use them capriciously. The operating plan will determine pump on/off triggers, emergency operation parameters, required coordination and provide operational flexibility and redundancy to avoid increasing adverse flooding events while still maintaining existing wetlands north of I-75.
FWF-1	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	The Federations have repeatedly received verbal assurances over the years that there will be no "straws" pulling water from or pushing water into SGGE, but these assurances were not acknowledged in the draft document. In the final Integrated Project Implementation Report and Environmental Impact Statement, the Federations request that the following be unequivocally stated. 1) The SGGE Ecosystem Restoration project will not dewater Northern Golden Gate Estates, North Belle Meade, and other neighboring lands. This project is not a flood or stormwater control project. It is not and will not function as a reservoir. 2) All water flowing into and falling on SGGE will be for nature only. Page 9-15 of the DPIR/DEIS states that water in SGGE may be "made available for other uses." The other uses are not specified, but they will likely change SGGE from a restoration effort to a water supply project. Making SGGE water "available for other uses" is contrary to the restoration effort. Such references should be stricken from the final document or the final document should explicitly state that there are no other uses.	Assurance language has been revised in Final PIR/EIS to clarify intent. All of the water is considered necessary for restoration.

Comment Number	Organization / Agency	Comment	Response
FWF-2	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	Furthermore, the Federations have concerns that the impacts of the restoration project on listed species have not been fully assessed and disclosed. According to page 9-8 of the DPIR/DEIS, the U.S. Fish & Wildlife Service (FWS) will need a "more detailed project alternative including additional measures to minimize effects on listed species" before completing its informal consultation. The DPIR/DEIS also states that the Corps will update its Biological Assessment (BA) for inclusion in the final PIR/EIS. DPIR/DEIS at 9-8. Although the DPIR/DEIS acknowledges no construction will occur prior to completion of the BA, absence of a final BA in the DPIR/DEIS makes assessment of the impacts of the recommended project alternative on listed species tenuous.	Noted. The Final PIR/EIS will contain further details and a final BA.
FWF-3	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	Prior to issuing the final PIR/EIS, we encourage the Corps to release a supplemental EIS containing the final BA, thereby demonstrating that it has taken the requisite "hard look" at the project alternative's impacts on listed species while allowing the public to comment accordingly.	No supplement is necessary. The final BA will be included in the Final EIS.
FWF-4	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	In spite of these shortcomings, on behalf of the Federations, we also would like to reiterate the positive aspects of the recommended alternative for the public record. Most importantly, Alternative 3D will provide habitat for several federally listed endangered species including the Florida panther. Id. at 3-1. Alternative 3D would restore the SGGE Project Area by plugging 42 miles of the canals and removing 227 miles of the roads. Id. at i. Alternative 3D will connect surrounding state and federal nature preserves and wildlife areas to form a contiguous block of land and create an area large enough "to provide viable habitat for wide ranging species such as the endangered Florida panther and the state listed black bear." Id. at 9-1.	Thank you for your support.
FWF-5	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	Currently, the "ongoing lack of consolidated state ownership and continued drainage of the project area make it difficult to stabilize, much less recover, listed species found in the project area." Id. at 4-9. This is particularly true for the Florida panther. In the absence of restoration, panther use of the SGGE Project Area will continue to decline. Id. Panthers would lose at least 40% of their habitat in the project area to residential "build-out." Draft Fish and Wildlife Coordination Act Report, DPIR/DEIS, App. D at 83. For that matter, ongoing fragmentation of state lands, further loss of habitat diversity and panther prey, and intensification of traffic and human presence in the project area would further degrade any panther habitat remaining in the project area. Id.	Noted

Comment Number	Organization / Agency	Comment	Response
FWF-6	Nancy Anne Payton, Southwest Florida Field Representative, Florida Wildlife Federation, 2590 Golden Gate Parkway, Suite 105, Naples, Florida 34105	In the absence of restoration, other listed species also will continue to decline because of increased human presence, easy vehicular access, limited refuge areas, and less suitable habitat. DPIR/DEIS at 4-9. For example, continued drainage of the SGGE Project Area will eliminate wetland habitat for bald eagles and snail kites. Id. at 4-9, 4-11. Without hydrological restoration, already low populations of wading birds may disappear. Id. at 4-9. Unconsolidated lands will have a "very devastating effect" on eastern indigo snake populations, which are particularly vulnerable to habitat loss, degradation, and fragmentation. Id. at 4-10. Further loss of pine flatwood habitat will limit the expansion of the red-cockaded woodpecker into the SGGE Project Area and contribute to the species' ongoing decline. Id. Continued increases in salinity and freshwater point source discharges into estuaries are likely to adversely affect American crocodile and West Indian manatee populations. Id. at 4-9, 4-11.	Noted
Akers-1	Trisha Akers, lazeeakers@msn.com, Naples, Florida	I understand that this project, if all goes correctly, will help the sheetflow in southern Florida, but there is a lot more going on. Those who oppose shutting down the Picayune are not teenagers or 20 year olds who want to go out and play in the woods, drink and injure themselves, or others, there are a lot of families, such as myself, who take their children out and camp, ride 4-wheelers and enjoy the area. I have lived in Naples for 31 years and used the area all my life. I have to say there are a lot more of us than there are of the rowdy ones. To totally take away an area in which we and countless others have gone to for 30 plus years is devastating.	Noted - However, there are no current legal provisions for "4-wheeler" (ORV) use in SGGE. The Corps and Water Management District are not proposing "taking away" the land. It will still be a State forest, and it is likely that many low impact uses may continue. By focusing on restoring the historic landscape, the project should provide a higher quality natural experience. Reduction of disturbance will favor wildlife, birds and native plants over fires, invasive weeds, traffic and noise. For the future we predicted up to 40% development of the Project area, into both residential and commercial properties. That would not have fostered the kind of outdoor recreational experience you appear to enjoy.
Akers-2	Trisha Akers, lazeeakers@msn.com, Naples, Florida	There will also be an impact on the recreational industry in this area. People spend a lot of money on their off-road vehicles. My family, for example, has close to $30,000 worth of 4-wheelers. One for each member of the family, and spares for friends to ride. Will we be compensated for the investment we have in these bikes? No, of course not. What about the ATV shops in town, not the corporate shops, but the little man, he has to feed his family. With no business he can't do that. Will he be compensated? No..... It's just not right....	Noted - However, there are no current legal provisions under current conditions for ORV use in SGGE.

Comment Number	Organization / Agency	Comment	Response
Akers-3	Trisha Akers, lazeeakers@msn.com, Naples, Florida	We have heard about a 1,000 acre area where people will be able to ride, but is that enough? In my opinion, no. Only because you put that many people in such a small area, there's bound to be people getting hurt, and not to mention the fact that there is a high-end residential development being built to the west of it that will not put up with that kind of activity at all hours of the night. SO there must be another alternative, keep a few thousand acre area in the existing Picayune riding area and satisfy all.Like I said earlier, there is a lot more at stake here than the "Agencies" realize. Please think about the total impacts before making the "final" decision.	Noted - However, there are no current legal provisions under current conditions for ORV use in SGGE.
Basinalt-1	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	The Plan as proposed will impact the groundwater levels for 6L's Farms. 6L's utilizes a complex system of dikes, ditches and pumps to ensure that the groundwater and surface water levels are maintained for optimal growth of our crops. Either increasing or decreasing the groundwater level surrounding the farm will have a significant adverse impact on our ability to grow crops successfully.	The recommended plan includes protection levees around 6Ls farms. The draft PIR proposed to use the existind 6L's levee as part of this project. However, the 6L's ranch requested that the project does not affect their property. Therefore, it is proposed to build an entire new levee system with a seepage ditch between the new levee and the existing 6L levee systems. Detailed design of that system will be performed in the detail design phase of this project.
Basinalt-2	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	Based on our initial review of the Plan, there is insufficient modeling of the affect on groundwater and thus the impact on 6L's farm as a result of the build out of the SGGE project.	See response to Basinalt-1
Basinalt-3	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	In order to accurately model the impact to 6L's a logging of the sub-strata should be done. What additional soil data do you Plan to collect in the development of the Plan?	Additional core boring will be performed along the 6L's levee alignment corridor.
Basinalt-4	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	We were told by Michelle Wolfe, Assistant District Counsel for the ACOE that the baseline data for determining the affects of this project on property owners is December 11, 2000. What conditions, including, but not limited to, control elevations for affected properties are documented as of December 11, 2000? This is not clear in your report. In addition, please provide copies of any and all documentation regarding these baseline conditions.	Additional data include topography, zoning and permitting requirements, building codes, the Collier County Growth Management Plan, and all other relevant public records
Basinalt-5	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	It was indicated at the meeting on June 16th that a levee is Planned around other 6L's property for the purpose of keeping increased groundwater levels in the SGGE from flooding our property. Of great concern to us is the issue of seepage under any proposed levee system, which does not appear to be addressed in your Plan. The soil in the area is extremely uniform and porous and as such will quickly transfer any increase in the water table across expanses of land through the sub-strata. What design work has been done with regard to the creation of an interceptor or seepage facility that will address the proposed peak flows in the SGGE and permit 6L's to continue its operation unaffected by this Plan?	Comment noted. See response to Basinalt-1.

Comment Number	Organization / Agency	Comment	Response
Basinalt-6	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	6L's pumps water from its fields at the peak rainy season which is also the peak season for flows of your proposed Plan. How can you assure us that our control elevation for discharge and therefore our entire farming operation will not be negatively affected by the proposed Plan?	Pumping will need to pump into the seepage canal system on the exterior side of the existing 6L levee.
Basinalt-7	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	Any modeling must sufficiently address the outfall to and eventually from the US 41 canal to be able to handle the existing flows plus the potential increased flows at peak states from your project. The existing structures at times already fail to meet the current needs and are poorly maintained.	Concur. If the project is approved these issues will be addressed in the detailed design phase. However we note that routine maintenance of existing drainage works outside of the project are not addressed in this report. The Corps and SFWMD will be working closely with FDOT during design to ensure that the correct profile information on US 41 is used in the design modeling to ensure that public safety is not compromised. Any necessary road improvements caused by lack of maintenance will be segregated from project costs and negotiated separately with FDOT.
Basinalt-8	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	Should a seepage or interceptor Plan be developed to address the water table conditions for 6L's, a suitable sized buffer will be required between the structure and 6L's property line to address peak infiltration periods.	Comment noted, see response to comment Basinalt-1.
Basinalt-9	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	I understand the construction will commence in 2007. Baseline data should therefore be measured from the date just prior to construction, not December 11, 2000. Please provide me with copies of any property owner notifications with regard to the December 11, 2000 date, and the basis for using this date as opposed to the 2007 construction date.	Concur with need for data just prior to construction. December 11, 2000 data is needed to meet the requirements of the Water Resources Act of 2000.
Basinalt-10	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	Modeling of the SGGE and the affect on the 6L's property should utilize the same duration and frequency. For example, if the SGGE Plan utilizes a 100-year event for modeling then the impacts to the 6L's property should be modeled at the 100-year level also.	Modeling is done to avoid adversely impacting existing conditions. The proposed levee modeling indicated no adverse effects. The design wil be further refined based on new survey data. However we were informed that your existing permits include only a 25-year storm event.
Basinalt-11	Charles J. Basinalt, Henderson Franklin Attorneys at Law, P.O. Box 280, Fort Myers, FL 33902	At our meeting on June 16th with representatives of the ACOE and SFWMD, no mention was made of the current comment period ending on June 28th. One of our consultants fortunately read it in the local newspaper that was reporting on a meeting the Corps had with citizens of the North Golden Gate Estates. Will there be additional comment periods as the Plan is altered and ultimately finalized, and how will notifications take place?	Yes. When the Final EIS is noticed there will be an additional public comment period. Because you submitted comments on the Draft PIR/EIS, you will receive a copy of the final report and are on our mailing list for future notifications regarding this project.
Black-1	Lindsey Black 2312 Elizabeth Court Naples, FL 34112	By telephone, she stated that she is opposed to the Southern Golden Gate Estates restoration project.	Noted.

Comment Number	Organization / Agency	Comment	Response
Bowman-1	Jackson H. Bowman, Brigham Moore, 1780 102nd Avenue North, Suite 100, St. Petersburg, FL 33716	Bernie and Helen Nobel and Vince Duerr have concern about their properties flooding due to this project. A six-foot levee is proposed for property located west of the Nobel and Duerr properties. It seems obvious that if flooding is anticipated a mile to the west, then flooding should be anticipated directly adjacent to the project.	Despite attempts attempts to avoid taking these properties, it is impossible to achieve the goals of the project without flooding these lands. To allow then to remain we would need to build a levee, raise the road for access, and place culverts under the road to avoid cutting off the sheet flow. Such a fix would add several million dollars to the cost of the project and invite negetaive comments due to declining benefits from those agencies and organizaions that are supporting the restoation project.
Bowman-2	Jackson H. Bowman, Brigham Moore, 1780 102nd Avenue North, Suite 100, St. Petersburg, FL 33716	In Section 12 of the Draft PIR/EIS, it indicates that "SFWMD is providing reasonable assurances that existing levels of service for flood protection will not be diminished outside the geographic area of the project." This does not appear to be accurate given the information provided in the Draft PIR/EIS. As no specific discussion about the project impacts to the Nobel and Duerr properties is contained in the Draft PIR/EIS, please provide the details that support the assurances provided by SFWMD as they apply to the Nobel and Duerr properties.	See response to Bowman-1
Bowman-3	Jackson H. Bowman, Brigham Moore, 1780 102nd Avenue North, Suite 100, St. Petersburg, FL 33716	The Nobels and Mr. Duerr do not want to have their access diminished or to be flooded. Appendix "C" indicates that approximately $5,602,000 has been allocated to levee construction in the recommended alternative. Has an estimate been prepared of the cost to build a levee around the Nobel and Duerr properties? If so, please provide the details of the study, and the basis for not including the levee as part of the recommended alternative. If a cost estimate has not been prepared, please indicate why.	See response to Bowman-1
Bowman-4	Jackson H. Bowman, Brigham Moore, 1780 102nd Avenue North, Suite 100, St. Petersburg, FL 33716	Ms. Starnes indicated at the public hearing that since access would be diminished and flooding would occur, purchase offers would be made to the Nobels and Mr. Duerr under the "willing seller" program. The Nobels and Mr. Duerr want to be on equal footing with the government agencies. That means they want the protections provided in our constitutions to be followed. They do not want to engage in "take-it, or leave-it," one-sided negotiations, which typify the "willing seller" program.	Noted.
Bowman-5	Jackson H. Bowman, Brigham Moore, 1780 102nd Avenue North, Suite 100, St. Petersburg, FL 33716	Ms. Starnes' acknowledgement of diminished access and flooding seems to be inconsistent with the "reasonable assurance" requirement specified in 373.1501(5)(d) of the Florida Statutes. Please indicate how her acknowledgement is consistent with the statutory requirement. Also, please indicate all of the reasons why the District's power of eminent domain will not be used to acquire the Nobel and Duerr properties.	The area is designated a willing seller area and SFWMD has not been provided authority for eminent domain.

Comment Number	Organization / Agency	Comment	Response
Claise-1	Dave Claise, President, Sunset Cay Villas XI, 266 Newport Dr #307, Naples, FL 34114	As a full time resident of “Port of the Islands”, I would like to voice my concerns about the above subject project. I feel the benefits of this plan do not justify the potential harm that that the many uncertainties may cause. In particular, concerns for the following issues cannot be alleviated. The plan promises that we would have the same amount of water (drinking/irrigation) as we have now. We are still a growing community. What is being done to insure we will have an adequate water supply (drinking and irrigation)? Our canal is already difficult to navigate during low tide. What impact will this have to our water level in the canal? What impact will it have to the Manatees? What will be done to insure that this plan does not increase the disease carrying mosquito population? All those dammed up canals nearby will surely add to the problem. Will the levees be visible from our homes? Will our views of the mangroves be destroyed?	The SGGE project will provide protection to Port of the Islands wells. It will incidentally provide additional recharge to water supply wells. The proposed project will protect those properties from overland flow. Ancillatory benefit may be achieve with the additional recharge to the surficial aquifer by the hydrologic restoration on the exterior adjacent Picayune Strand Project Lands. This project will not affect the navigation downstream of the FU-1 weir. That area is tidally influenced and the navigation draft is directly dependant on the tidal conditions in that area. This project will not have impact on the Manatees and Mosquito populations. The levees will be visible from some homes. Destruction of mangroves will be minimized if impacted.
Denniger-1	Frank F. Denniger, 461 E 40 St., Hialeah, FL 33013	Request comment period be extended beyond 13 July 2004 due to recently discovered anomalies of an extremely serious feature regarding maps within SGGE draft PIR and Appendix	The July 13 date was a 15-day extension of the original public comment period. No additional comment period was awarded. No further information regarding the "anomalies" cited in this letter was received.
Guy-1	William E. Guy, Jr., 643 SW Fuge Rd., Stuart, FL 34997	The public owns those lands, not just the environmentalists, and it wrong to exclude the public from their own land.	The DOF is responsible for the management plans for these public areas. Generally, there are not plans to "exclude the public" from the Project lands. A management plan under development for Picayune Strand will determine points of access and compatible as well as incompatible uses. Regulation of public access is not the same as exclusion. Clearly the State must be able to manage the lands for restoration. We note that there is a good, paved access road to adjacent Fakahatchee Strand State Forest.
Infantini-1	Trudie Infantini, Internal Audit Manager, Space Coast Credit Union, P. O. Box 419001, Melbourne, FL 32941	We are former neighbors of Jesse's. My name is Trudie and my brothers are Ricky and Joe Johnston. Jesse rented from my parents for about 10 years. We just saw his story. Please ask Jesse to contact us. We are there for him and would like to talk with him. My cell phone is 321-223-1871, home 321-951-3601, work toll free 1-800-447-7228. Please let me know that you have received this. Thank you very much.	No response necessary.
Jeanne-1	Jeanne, jeeeny@the-beach.net	Stop tormenting this man. One person is not going to hurt water restoration attempts. let him be (Evidently references Mr. Hardy).	No response necessary.

Comment Number	Organization / Agency	Comment	Response
Jenkins-1	Wayne Jenkins, 2500 Jenkins Way, Naples, FL 34117	I am very concerned that this meeting was another whitewash to satisfy the requirements of a public meeting so it can be stated a meeting was held. Your process is flawed in regards to doing a recreation plan after restoration. If you fill material, it will not be purchased and trucked in later. If plans aren't made ahead of time for boat ramps, parking pads for vehicles and trailers, hiking paths, ORV access points, etc., they won't be built.	We note that the State Department of Agriculture, Division of Forestry, has a management plan for Picayune Strand State Forest. At present, ORV access is not addressed in this management plan. With blockage of most canals, the need for a boat ramp is likewise not visualized. The existing management plan will doubtless undergo updating and revision as the project area is restored, if the Federal project is approved. However, it should be noted that the Federal project is an ecosystem restoration project, not a recreation project. Recreation proposed for restored lands must be compatible with rehydration of the lands and ecosystem restoration targets.
Jenkins-2	Wayne Jenkins, 2500 Jenkins Way, Naples, FL 34117	What safeguards have you built in your restoration plan if what you believe will work does not? An example would be culverts under the canal plugs or weirs that could be opened in an emergency. Should the public trust you and wait for the plugs to be dug out while their homes are flooded? We need some meetings on the West Coast to answer concerns raised at this meeting.	The Corps and SFWMD have many decades of experience providing flood mitigation works in South Florida. In the past, the main problem has been not inadequate flood protection, but projects that worked too well, causing drying of the ecosystem. There is sufficient redundancy built into the proposed pump systems. Emergency back up systems are provided on all of the pump station structures. Upon completion of the project an Operations, Maintenance, Repair and Replacement (OMR&R) Manual will be given to the SFWMD to maintain all of the existing structures, levee and other features impletemented as part of the recommend plan. Subsequent to that, periodic inspections of those facilities will be performed to insure that all of the proposed features are maintained within accordance to the OMR&R manual. The proposed structures and pumps can be operated to provide adequate drainage from NGGE to avoid increased flooding over existing conditions. However, this project does not have as an additional purpose providing NEW, higher levels of flood protection in the NGGE area.
Johns-1	George R Johns, papijohnswgup@juno.com, Hialeah, FL	It seems to me that the problem we are facing with the restoration of the natural flow of the River of Grass should have been thought out some fifty years ago. In my opinion, you will never restore the natural flow unless you remove every obstacle that has contributed to the situation we are now faced with. That means removing Alligator Alley in its entirety. I have reservations about the State footing half or any part of the restoration as I don't think it was our idea in the first. We are paying enough taxes as it is now. We must commend Mr. Jesse Hardy for being the, "Rough out" type of man he is and for braving the various elements of his home place. It is NOT fair to sell someone a piece of land, and then come back years later to condemn and run him off his property. There should be more justice than that in this country. Isn't that the way they do it in some countries??	Noted. However, you are incorrect about the origin of the SGGE restoration concept. It was indeed developed first by a conservation commission consisting of State and Non-governmental organizations in southwest Florida, then presented to the Federal Government. For a brief history of previous studies and restoration plans, please read the Fish and Wildlife Draft Coordination Act Report, which is reproduced in Appendix D.

Comment Number	Organization / Agency	Comment	Response
Johnston-1	Gladys Johnston, Gladys3055@aol.com	[letter to Jesse Hardy] Enjoyed reading of your prosperity and hate to see your dream taken away from you. You have worked too hard all your life to have to give in to this advancement ,seems like they should be able to work around you. Best wishes and best of luck. guess you will need it. I will be following as to what progresses.	No response necessary.
Joyce-1	Thomas P Joyce 6811 SW 6th Street Pembroke Pines, Florida 33023	I am totally against this project for several different reasons. First of all I believe the cost of this project is too great. I believe these funds could go to a project of much greater need, such as our educational system. Secondly, I am not totally convinced of the environmental impact that this restoration project. This land has been this way since 1960, what is going to happen to the habitat that is currently there. I believe that the comment period must be extended and further discussion must take place.	This is a proposed project, not yet authorized. The comment period was extended to July 13. Ultimately, in order to proceed, the project must be approved at the highest levels of the Water Management District and the U.S. army Chief of Engineers, the Assistant Secretary of the Army for Civil Works, and authorized by Congress.
Kemp-1	Cindy Kemp, Vice President, Property Rights Action Committee	I am opposed to this project being implemented and furthermore, this project should not proceed without creditable provable science. Where is the underlying documentation?	The PIR/EIS and its appendices provide the analysis completed to justify the project.
Kemp-2	Cindy Kemp, Vice President, Property Rights Action Committee	Tamiami Culvert Project is being incorporated into the plan yet there is no information about this in the PIR. There is no EIS on the culvert project and safety issues are a problem. Why and where is the underlying documentation?	An EA was completed for Tamiami Trail Culverts several years ago under the Critical Projects Program. The Tamiami Trail Culverts in this part of the Trail were sized to provide conveyance of waters flowing to the Trail from the (then proposed) South Golden Gate Estates project. Although this portion of the project was already approved and permitted by FDEP, funds were not available to construct it under the Critical Projects Program. It has been added to the Picayune Strand Restoration project for consideration as part of the cost-shared Federal project.
Kemp-3	Cindy Kemp, Vice President, Property Rights Action Committee	It appears that the Data Quality Act is not being upheld and this is a problem.	The Federal Data Quality Act was not intended to be used to challenge NEPA analyses. Data generated during the evaluations and modeling conducted for the Project Implementation Report phase include: monitoring station and meteorological data collected by the South Florida Water Management District; peer reviewed hydrologic models with extensive prior use in the U.S. and Europe; biological data and projections that have been reviewed by scientists from several Federal and State agencies with a high degree of consensus (note comments and responses above from USEPA, FWS, Audubon, Southwest Florida Conservancy, FDEP and others). Even in areas of disagreement over details, there is substantial governmental and non-governmental support for the recommended alternative.
Kemp-4	Cindy Kemp, Vice President, Property Rights Action Committee	The issue of berms around Jesse Hardy's property is not evaluated in the PIR, yet we have discovered gross misrepresentations of projected costs.	This property is not proposed for levee protection.

Comment Number	Organization / Agency	Comment	Response
Kemp-5	Cindy Kemp, Vice President, Property Rights Action Committee	There needs to be documentation concerning the water level rising in NGGE and Belle Meade as this is a major concern affecting thousands of people's safety and investments. Where is the documentation concerning mosquitoes' impact on health? Where is the underlying documentation for safety? We need to see evacuation routes for people in Marco Island and NGGE who are land-locked in case of fires or storms or other threatening situations?	Water level information is contained in the H & H Appendix. Interstate 75 is a designated evacuation route. Since most of the project area would be flooded during the wet season, and would be expected to flood during tropical storm passage, it does not make sense to designate an evacuation route inside it. There is currently no designated evacuation route within the project footprint. All relevant safety and health issues have been addressed.
Lester-1	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	The purpose of this letter is to request no less than a 45-day extension of time so that all of the members of the Coalition and others may study and evaluate your Proposals.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period extension was awarded.
Lester-2	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	Please be informed, the subject meeting your team attempted in Naples on June 17, 2004 was not well prepared and the room was grossly inadequate in size. The air conditioning system was not of sufficient size to accommodate the people in attendance and some property owners became ill and had to leave the meeting. The building presented a health hazard and safety hazard. The sound system was not effective. The seating was about half of what was needed and as a result, about 50% of those attending were unable to see, hear, or understand what your group was attempting to explain.	State health and safety experts who checked the meeting place found no health or safety hazards at this meeting. Although the meeting was crowded, the crowd was within the capacity of the facility. We are sorry you were uncomfortable but that does not invalidate the meeting.
Lester-3	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	The 15,000 Coalition members would also like for the record to be abundantly clear, nearly all of affected property owners did not receive any form of written notice of the subject meeting and therefore nearly all were unable to attend. We insist that in the future, NO MEETING be held unless and until each member of the 15,000 Coalition (all 3,256 of which own lands that are affected by your Project) is properly notified in writing of such meeting. We ask that no less than 30-days notice be provided in writing, to every one of our members in the future.	If we are provided the mailing addresses for these 3256 residents and we will be glad to mail a notice of availability when the Final PIR/EIS is published.
Lester-4	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	It was suggested at the June 17, 2004 meeting that the proposed Alternative 3-D Project will depend upon a number of very large and expensive mechanical pumps in order to protect our property owners lands and homes from flooding. No information was available or provided to any of us attending the meeting regarding the use of any hydrologic models to demonstrate what would occur, and what properties would be flooded if the pumps failed to function during a 100-year storm. The members of the Coalition will not be able to evaluate your proposal, or make comment, without the ability to view the ACOE's modeling information as well as alternatives.	Information on the hydrologic models used and the modeled outputs for all alternatives was provided in the Draft PIR/EIS and shown in detail in its Hydrology-Hydraulics appendix, Appendix A.

Comment Number	Organization / Agency	Comment	Response
Lester-5	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	As a further point of information, when this office learned on May 24, 2004 that you had a CD containing information about the proposed project, we emailed, called, and wrote to obtain a CD of the Project. We were informed by your office on May 25, 2004 that the CD was not available and on back order. We received your copy of the CD the day before your meeting on June 17, 2004 and this was not sufficient time to study your plan.	Neither USACE nor SFWMD has a record of your request. However, ample public copies were available in Collier County public libraries and on the internet.
Lester-6	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	Due to the complexity of the design and information, each of our members should have the opportunity to attend and to evaluate about Alternative 3-D. The members of the Coalition formally request that no less than two (2) additional NEPA meetings be conducted (making a total of at least three).	Since the final report will recommend the same plan as that evaluated in the Draft PIR/EIS, we do not anticipate another public meeting after its release at this time. We will mail you a copy of the final report when it is approved for release.
Lester-7	Don E. Lester, The 15,000 Coalition, Inc., The Collier Center Building, 1061 Collier Center Way, Naples, FL 34110	The members of the Coalition further ask that in the future all such meetings be published no less than 30 days prior in the Naples Daily News. Most importantly, the Coalition asks that by direct mail to each property owner in North Belle Meade and North Golden Gate Estate (essentially the Coalition membership) receive written notice of any planned meeting concerning SGGE Hydrologic Restoration Project.	No additional public meetings are planned at this time. You will be notified by letter when the Final PIR/Final EIS is available, and you will receive a copy.
Lewis-1	Betty Faye Lewis, bettyf@magnolia-net.com	[letter to Jesse Hardy] . . .Mr. Hardy, don't let them bulldoze you, as they did us!!!!! I admire you!!! They can fool some folks; but you know as well as I, someone is going to make a KILLING, IF YOU GIVE IN!!!!!	No response necessary
Lhota-1	Bill Lhota, 4750 18 Av SE, Naples, FL 34117	Requests a 6 month extension of the public comment period and is opposed to the project.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period was awarded. Your opposition to the project is noted. There will be a review period after publication of the Final PIR.
Malstrom-1	Vanessa Malstrom, poigatorgirl@earthlink.net	I attended the public workshop June 17th at the Naples Best Western. After reviewing the information presented, SGGE draft and reviewing numerous documents on the subject, of the Everglades Restoration Project, it is my feeling that the alternative 3D should not be implemented. I am a resident of Port of the Islands. My concerns are as follows: POI is a resort, fishing and boating community. With the current plan there is a great deal of uncertainty concerning water for consumption, irrigation, and water flow of the canal. POI is still a growing community. Will we have enough water in the future? Our canal at present is difficult to navigate at low tide. If we have less water in our canal it would inhibit the recreational use of the canal. Also, with less water the endangered Manatees and other forms of aquatic life would not be able to sustain life.	The SGGE project will provide protection to Port of the Islands wells. It will incidentally provide additional recharge to water supply wells by raising ground water levels in the region. No aspect of the restoration project will affect channel depth. That area is tidally influenced and the navigation draft is directly dependant on the tidal conditions in that area. The artificially dredged channel is expected to require maintenance from time to time, but that is responsibility of the community. This project will not have impact on the Manatee population.
Malstrom-2	Vanessa Malstrom, poigatorgirl@earthlink.net	I am very concerned about the use of burms as flood protection. The POI is a beautiful community and unsightly burms would effect our property values as well as the environment.	Noted. A berm is a low levee and not likely to be highly visible from the marina.

Comment Number	Organization / Agency	Comment	Response
Malstrom-3	Vanessa Malstrom, poigatorgirl@earthlink.net	I am also concerned about disease carrying mosquitoes which would flourish as a result dammed up canals. The access to public land would be inhibited.	Noted. Since Port of the Islands is largely surrounded by mangrove and brackish marshes, mosquitoes are already abundant. No changes from existing conditions are expected as a result of the proposed project.
Malstrom-4	Vanessa Malstrom, poigatorgirl@earthlink.net	The cost is astronomical, currently estimated at $400 Million dollars. For these reasons, and many more, I am strongly against this Everglades Restoration Project because of the uncertainty of a negative impact to the environment, animals, fish, vegetation, and humans.	Noted
McMahonB-1	Brian McMahon, 360 22nd Ave NW, Naples, Fl 34120	Never have I seen such an effort to exclude the public from a project. Your idea of public input is having closed meetings with environ-mental groups. Although I have signed up on numerous occasions to be on your mailing list in the past two years I have received a total of two e-mails on project delivery meetings both of which were cancelled. You have had 2 public meetings on this project, not one public concern ;has been addressed. From flooding, to recreation no answers. Your original project manager Major Chaput, could not even give an explanation of a one hundred year flood(check the August 2002 meeting transcript). This months public meeting was a complete sham. No one was notified, the only way I found out is from the Ft. Myers newspaper. A small room overloaded with people, violating fire code rules for occupancy. Many people could not even get access and were turned away, even more couldn't park and left before even getting to the building. Once again I repeat, your idea of public input only applies to paid enviro's. Attempts to get another meeting have been answered with a quick NO.	As you stated, the meeting was indeed noticed in the local newspapers, as well as on radio stations. No building codes were violated, and the meeting conditions were inspected and approved by local safety officials. This project is not yet approved. Please review and consider the final PIR/EIS and express your opinions to the Corps, to the Water Management District, and to your local Congressional representatives. You will receive a copy of the final Report by mail, most probably some time in October, 2004.
McMahonB-2	Brian McMahon, 360 22nd Ave NW, Naples, Fl 34120	Even more disturbing is the fact Collier County engineers questioned SFWMD , that raising water table levels in Northern Golden Gate could lead to ground water contamination due to septics being unable to properly "perk". (I have a copy of that email). Once again the public be dammed, no response, the project is far more important than the residents drinking water or potential for diseases in the wet season	This project was designed to maintain *existing* levels of water in NGGE, not to increase or decrease them. If septic tanks are not operating properly under existing conditions, that is not related to the proposed project. We are aware of this issue. The proposed project is neither a drainage nor a buy-out program for NGGE. Please study the operating manual in this report.
McMahonB-3	Brian McMahon, 360 22nd Ave NW, Naples, Fl 34120	But the most disturbing is the fact that the Corp has issued permits for SFWMD, your partner in this to begin this project in spite of the fact this project is still in draft form.. Mr. Duke claimed it " wasn't exactly a violation of the law". That's just what the public needs to hear from project managers.	The State has proceeded at 100% non-federal expense to implement a partial restoration project on the Prairie Canal part of the Project area. In order to do this the State applied for and received a Corps Permit. It is understood perfectly that the SFWMD will not be reimbursed for its expenditures on this Prairie Canal project unless this portion of the proposed restoration is part of the final recommended plan proposed by the Corps for Congressional authorization, and ultimately authorized by Congress. The ongoing State construction is not illegal because it is a 100% state funded project at this time, and it has Federal permits to be built.
McMahonB-4	Brian McMahon, 360 22nd Ave NW, Naples, Fl 34120	Take a deep breath and address everyone's concerns. Truly involve the public, and show us a benefit. A short wait will be much easier than years of public outrage and litigation.	No response necessary

Comment Number	Organization / Agency	Comment	Response
McMahonS-1	Sara McMahon, wonderology@att.net	I have several concerns regarding this project, including but not limited to contamination by illeagal dumping and septic systems being enveloped by higher water tables, access to the area by emergency services and the overall costs (which seem to rise weekly). I have been reading the PIR/EIS and find a lack of supporting documentation to prove the science. I fear an environmental disaster of such a scale as to pale the disasters that resulted from simular projects in Ocklawaha Chain of Lakes. For these reasons I am opposed to this project.	No housing or septic systems would remain in the project area.
Menendez-1	Mario Menendez 3830 24 Ave SE Naples, FL 34117	I would like it to be noted that I am against the SGGE Everglades restoration plan. In the short time the states has had control of the area it has already gone to hell. Jane Scenic Drive is overgrown with vegetation and road is in very poor condition. There has been very poor explanations of what will happen to the sheet flow once it gets to US41. Is the water going to run over the road? Or are we constructing more culverts to aid the "natural" water flow. Will the wildlife that has adapted for the last 30 years learn to swim overnight?	Noted - The PIR/EIS provides the analysis completed to justify the project. New culverts will be constructed through Tamiami Trail to increase conveyance above that which is provided by the existing culverts. Wildlife habitat values of project lands are expected to improve compared to existing conditions. Analysis to support this conclusion is provided in the PIR/EIS.
Menendez-2	Mario Menendez 3830 24 Ave SE Naples, FL 34117	There also appears to be a serious missed calculation on Sheet 8-3, paragraph 1 on plans for levees. Using USACE cross-section specs for the levee it would require 39 square yards. Of cross-section times 44,299 yards long for the 25.17 miles of levees resulting in a fill requirement of 1,727,661 cubic yards plus the 30 percent compaction factor which results in 2,240,000 cubic yards of fill not the 224,000 as stated in the Draft. Is this true? How much more is this going to cost tax payers? Are these the same engineers that calculated the size of the pumping stations for flood control? It would seem that this restoration is being shoved down our throat just because a president signed a document he new nothing about several years ago.	On page 8-3 of the Draft PIR, 224,000 cubic yards was correct for the levee to surround POI Waterfront RV resort. The paragraph provides the volume for this one levee only, not for all five of the levees. There was a typographical error in this paragraph - the width of the levee should have been 15 feet rather than 12 feet. Appendix C, plate C-4, has 15 feet. The dimensions for all of the levees is contained in Appendix C of the final PIR.
Mogelvang-1	L. Christian Mogelvang, B.S., M.D., Box 3316, Naples, FL 34106	Recognized areas of significant invalid assumptions and assertions within the Plan document. Will need at least another 4-6 months to be able to review, correlate with known environmental data, and accurately and cogently respond.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period extension was awarded. There will be a review period after publication of the Final PIR.
Mogelvang-2	L. Christian Mogelvang, B.S., M.D., Box 3316, Naples, FL 34106	Please extend the public comment period at least another 90 days and hopefully another 6 months. We are opposed to the institution of the project, as described in the PIR draft. The public comment period is simply insufficient.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period was awarded. There will be a review period after publication of the Final PIR.
Mogelvang-3	L. Christian Mogelvang, B.S., M.D., Box 3316, Naples, FL 34106	It is very clear that the PIR draft of the SGGE project as it now exists is in need of further review and modification, with better material scientific documentation and more complete evaluation of costs, with more efficient and public safety enhancing documentation.	There will be continue analysis of the recommended plan during the Detailed Design phase of the project.

Comment Number	Organization / Agency	Comment	Response
Mott-1	Beverly K. Mott, 4205 Palma Sola Blvd., Bradenton, FL 34209	Government run amok. This homesteaded property being forcibly taken from it's owner is unconscionable and frightening. Once government begins to overstep it's bounds in such a manner, it is a sure sign of a decaying society that nearly always leads down the long slope to revolution. Please rethink this proposition.	Noted
Murphy-1	Sue Murphy, Search Engines 411 Inc., 6017 Pine Ridge Rd. #251, Naples, FL 34119-3956	Prior to the April 13th FL Cabinet Meeting, Mr. Hardy made an official request to be provided a reasonable accommodation to his disability that would allow him to participate in the meeting. He was unable to attend the meeting due to his disability. We were told in advance, by the Governor's office that he would receive that accommodation in the form of being called on the phone, on a special land line that we set up at my home, from the Cabinet Meeting. That never happened. It is my understanding that he was not provided with the reasonable accommodation for his disabilty that he is entitled to in accordance with the requirements of the ADA (Americans with Disabilities Act). Despite that, that Cabinet Meeting and the rest of the process has proceeded without his participation. I am not an attorney, but it seems that Jesse's right to 'equal access' to participate in the process that involves the taking of his land for a Federal and State Project have been violated, and I would think that before proceeding further with the Project, that should be rectified.	Noted. (comment regarding the April 13, 2004, cabinet meeting)
Murphy-2	Sue Murphy, Search Engines 411 Inc., 6017 Pine Ridge Rd. #251, Naples, FL 34119-3956	Although Phase One of the Project has started, there seems to have been no effort to clean up the years of accumulation and no effort to prevent further damage to the environment in the area. The current materials that litter the area have had a detrimental impact on the area already, and that detrimental impact will increase exponentially once mixed with water, or buried in the bottom of the canals only to later contaminate the aquifers.	Noted.
Murphy-3	Sue Murphy, CEO, Search Engines 411 Inc., 6017 Pine Ridge Rd. #251, Naples, FL 34119-3956	This is concerning Item 3 on the Agenda for the Board of Trustees of the Internal Improvement Trust Fund for the Cabinet Meeting of May 25th. As a resident of Golden Gate Estates and a local business owner I submit the following analysis in support of the decision to allow Mr. Hardy's existing homestead to remain in the project area. At the last Cabinet Meeting you instructed staff to seek creative alternatives that would allow Mr. Hardy's existing homestead to remain within the project area. The staff did this. They obtained estimates for two alternatives, one which would allow Mr. Hardy's existing homestead (160 acres) to remain within the project area (Alternative One), and one which would not allow Mr. Hardy's existing homestead (160 acres) to remain with the project area (Alternative Two). . . . . .**Please see next row for conclusion.**	No response necessary (copy of letter to Gov. Bush).

Comment Number	Organization / Agency	Comment	Response
Murphy-3	Sue Murphy **Conclustion**	Considering the amount of money planned for this entire restoration project, the difference between the expense of Alternative One and Alternative Two could not possibly cause irreparable loss to the state. These facts clearly indicate to any reasonable person that there is insufficient justification to waive the requirement to have the property owner's written approval prior to eminent domain in the case of Jessee Hardy. Given Alternative One and Alternative Two as set forth in the Agenda, Alternative One is clearly the only choice	
Perkins-1	Al Perkins, Belle Meade Groups	We are totally against the flooding of SGGE and the Belle Meade. Reasons are the deliberate killing of animals due to 27 inches of water 9 months of the year as stated and the potential killing of people by not providing the evacuation route of Miller Blvd., etc.	Noted; but please see our previous responses to the suitability of Miller Boulevard as an evacuation route for hurricanes. It would likely be under one to a few feet of water during passage of a wet tropical storm or hurricane. Animals utilizing the area, including deer, bear, panther, and others, are highly adaptable and utilize the highest ground during the wet season. We do not anticipate adverse effects on the wildlife habitat values of the area as a consequence of re-hydration.
Perry-1	Daryl Perry, dperry@mdc.edu, A Concerned Taxpaying Citizen, Miami, Dade County, Florida, United States of America	Leave Mr. Hardy and his land alone. It seems to me, people have the right to choose and decide where they will live and the type of environment they want for themselves and family. It Mr. Hardy purchased this land and invested monetarily and with sweat equity, it seems right, that he deserves to be left alone. Doesn't our U.S. Constitution guarantee this premise?	Your concerns are noted.
Pine-1	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The Center requests a 6 month extension of the public comment period and fulfillment of all public records requests by ACE and its partners in this project.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period was awarded.
Pine-2	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The public meeting/workshop of 17 June 2004 held at the Best Western in Naples was held in a building that was not compliant with the Vocational Rehabilitation Act and the Americans with Disabilities Act.	Do not concur.
Pine-3	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The distribution of the PIR was not accompanied by nor contained the adequate instructions for making public comments.	The Abstract Page of the PIR identified the proper point of contact for comments on the report. This report was available in Collier County Public libraries and available on the Everglades Restoration web site. This comment is not valid.

Comment Number	Organization / Agency	Comment	Response
Pine-4	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The 60 day public comment period was not sufficient to review and study the PIR, obtain underlying public records, conradictory expert opinions, and formulate comments for submission.	The NEPA review period for a draft EIS is customarily 45 days. We extended this period an additional 15 days to provide extra time for citizens who felt they could not provide comments in the 45 day period. An entity's inability to read and comment within the provided time is not considered, under NEPA, sufficient reason to extend the comment period.
Pine-5	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	No Braille copies of the PIR were provided to the Center or sight-impaired members of the public.	That is correct. However, there are now public domain (free) programs available to users of personal computers that translate written words into voice. Many large libraries have such programs on their computers, and the PIR/EIS have been continuously available over the Internet since the week prior to publication of the Notice of Availability in the Federal Register (May 14, 2004). The lack of a printed Braille copy should not be an impediment.
Pine-6	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	Mr. Duke, upon request, refused/failed to inform the public of the process to apply for an extension to the public comment period at the June 17, 2000 workshop.	Mr. Duke verbally granted a request for an extension of 7 days during the cited public meeting. Subsequently the Corps lengthened the extension to 15 days. For the record, such a request for an extension should be sent to the District Engineer, Jacksonville District, US Army Corps of Engineers, PO Box 4970, Jacksonville Florida 32232. Requests may be written or delivered via email.
Pine-7	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The Center has not received documents requested by the Center at the June 8, 2004 meeting with the SFWMD and COE, etc.	You will receive a complete copy of the revised PIR/EIS. The Draft PIR/EIS is available on the Evergladesplan.org website.
Pine-8	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	The COE has failed to meet the standards established by the Data Quality Act and Executive Order 12360.	We believe we have met the requirements of the cited act.
Pine-9	Walter D. Pine, Executive Director, Center for Civil Rights Advocacy, P.O. Box 5395, Titusville, FL 32783-5395	According to Lauren Milligan, FDEP, Office of Intergovernmental Coordination, State has received an extension of the comment period to 25 July while the public has not received the same extension.	The State Clearinghouse reviews the document for consistency with the State coastal Management Program under the Federal Coastal Zone Management Act. This Act. as amended, provides for a review period of 60 days (minimum) of any Federal document by the State Point of Contact for Federal programs. Although this state review runs concurrently with the NEPA review they are not the same; the NEPA process may continue while the CZM review is pending. However, we note that the Clearinghouse did determine that the project is currently in compliance with the CZMA at this phase of its development. Reference Comment FDEP-5 (Mann, June 24 letter)

Comment Number	Organization / Agency	Comment	Response
Purcell-1	Rebecca Purcell, 210 - 16th St SE, Naples, Fl. 34117	Please don't take away our ATV area just, because there are some ignorant riders out there, or just because you can. Flooding the south blocks will only put more of nature in harm's way (and in people's back yards). Where do you think the animals will go if they are standing in water...they'll seek the closest dry land they can find...Golden Gate Estates! If you want to fix the real problem, you have to go back to where the problem started in the beginning...the sugarcane fields around Lake Okeechobee. Have the sugarcane farmers pay for the problems they've created, not the residents of Golden Gate!	Noted - However, there are no current legal provisions for ORV use in SGGE. Published studies of ATV impacts, conducted in National Forests, show the strong adverse impact of uncontrolled and unlimited ORV use on wildlife habitat use and behavior. One of the purposes of this restoration project is to restore wetland hydrology and wildlife habitat in the Picayune Strand area. Providing safe and undisturbed habitat for wildlife is necessary to achieve endangered species and habitat restoration targets. This purpose is not compatible with unrestricted and widespread ATV use in the habitat. By the way, there is no strong connection between sugarcane farming in the Everglades Agricultural Area and overdrainage problems in the "south blocks" project area. Drainage was caused by construction of privately financed canals in the 1950s and 1960s.
Smithson-1	Julie Kay Smithson, 213 Thorn Locust Lane, London, Ohio 43140-8844	At any rate, fifteen more days is still not enough to thoroughly digest and intelligently comment on such a voluminous plan, so I am officially requesting a much longer extension of the public comment period. My original public comment from last Thursday is reiterated here: ninety (90) days extension of the public comment period is hereby requested.	The July 13 date was a 15-day extension of the original public comment period. No additional comment period was awarded.
Smithson-2	Julie Kay Smithson, 213 Thorn Locust Lane, London, Ohio 43140-8844	"At this time ... " is insufficient for comprehensive comments to be made on what you must agree is a huge amount of paperwork and maps, charts, etc., to read through and seek to make sense of. I reiterate that I strongly urge the extension by another ninety (90) days, or failing in that, that the entire project be withdrawn due to the lead agency's refusal to consider that the vast majority of the public cannot possibly comment intelligently on something that appears to take ten times more paperwork than needed to describe. It seems to me that implementing The Wildlands Project for the south half of Florida is something that a LOT more of the public should know about and learn about, since it appears to be all about removing public access -- and the public itself -- from this huge area. Sure, it's to be done 'incrementally,' but the long-term plan remains the same. Did I mention that this includes the NATURAL RESOURCES that would leave the private landowners? **Please see next row for conclusion.**	All public comments on a draft PIR/EIS are reproduced in full in the final report. See pages following these comment/response summaries.
Smithson-2	Julie Kay Smithson **Conclusion**	I expect you to include this entire email -- including all headers -- as part of my public comments, noting that I am indeed disgusted at the continuing disregard for property rights being exhibited by any federal agency with a hand in this, lead or otherwise.	

Comment Number	Organization / Agency	Comment	Response
Smithson-3	Julie Kay Smithson, 213 Thorn Locust Lane, London, Ohio 43140-8844	I will expect immediate notification when the public comment period is extended or the "plan" is scrapped, or whatever other avenue should be pursued. Just as the "plan" originated from a template above you in the chain of command, as per your comment: "Determination of a longer extension would have to come from decisionmakers above us in the chain of command", I expect all such things to also originate there. I expect further communication to either address me without a prefix or with the one I use, which is "Miss."	The decision to extend a public comment period is that of the District Engineer, according to our regulations and common practice.
Smithson-4	Julie Kay Smithson, 213 Thorn Locust Lane, London, Ohio 43140-8844	SGGE Project implementers and others that have emailed to tell me that you don't have authority to extend the public comment deadline past its current -- and hopelessly inadequate, not to mention failure to provide enough time for public comment -- deadline. Yeah, sure, you've been just soooo kind and extended it for thirty days, but THAT IS NOT ENOUGH. Read what I've pasted below and then get your heads in a huddle and come up with a LONGER COMMENT PERIOD. If this can be done, you can set public comment deadline for your "Wildlands Project" under another name, at least until 31 December 2004.	No response necessary. The comment period closed as stated on July 13.
Smithson-5	Julie Kay Smithson, 213 Thorn Locust Lane, London, Ohio 43140-8844	There is NO NEED to "protect" any wildlife by flooding, retaking, or otherwise stealing (please, no need to waste the phrase "willing sellers" on me) this vast amount of real estate. You are laconic about the costs, since you intend to keep drawing (leeching) from the taxpayer cash cow 'from here to eternity'. Human safety is not a factor in this "Plan" -- because you don't CARE about the safety or well-being of Jesse James Hardy, Tommy and Tara Hilton and others. You don't even care enough to follow the letter of the law, as mandated by the National Environmental Protection Act of 1969 (NEPA) and hold formal public hearings, at which you MUST record the attendees and you MUST answer their questions, rather than the "informal" "process" with which you seek to ILLEGALLY STEAL everything, including the public's LEGAL RIGHT to be HEARD, ANSWERED and RECORDED. I am told that you also FAIL to in any way provide this "Plan" to the blind in a Braille version. That is a slap in the fact to those that are not sighted.	Full explanation of cost estimate is included in the PIR. NEPA and its regulations do not require public hearings. They allow for such hearings, under the Federal Administrative Procedures Act, when in the judgment of the District Commander they may be warranted. One of the criteria for public hearings would be substantial controversy or disagreement among public agencies over the proposed action. Such fundamental disagreement has not occurred in the case of the present report.

Comment Number	Organization / Agency	Comment	Response
Stump-1	Mary F. Stump, westump@earthlink.net	. . .Years ago, much of this area had been sectioned off, roads were built and lots were sold. Now, the Everglades Restoration is taking place. The intent is to clean water by natural filtration before it flows to the Gulf, eliminating the original canals and roads put in place by the Corp of Engineers and to return 55,000 acres to its "natural" condition. The state has acquired 19,000 parcels of land. Part of the plan includes 3 massive pumping stations for moving water. This requires canals and roads for access to the pumps for maintenance. Why destroy those in place to build new? Will flooding land that is 10 to 14 feet above sea level put more of Florida under water than anticipated?. . . The blue prints for this 8.5 billion dollar program was incomplete when the project began. Reintroduction of wild animals, potential flooding and 100% participation for federal funding are their justifications for removing Jesse. . .Write to your politicians. Tell them you are not interested. If water is needed for future population and growth, have them look at our borders.	Gulf America Corporation built these roads and canals in the 1960s. None of the existing canals or roads were built by the Army Corps of Engineers. Refer to the introductory chapter in the Fish and Wildlife Coordination Act Report for a brief history of development in the SGGE area, as well as early efforts to restore the lands. It is clear that the initiative to restore began as a "grass roots" NGO-State effort, with additional early studies by the Corps. However, to date the US Army Corps of Engineers has not built any structures in the study area. As much as possible, existing roads will be used for access to the proposed pump stations.
Stump-2	Mary F. Stump, westump@earthlink.net	Please send me a review of these 700 pages in short form and exactly what it means. thank you.	Please see the Executive Summary included in the front of the full report for a short review and summary of the project.
Sullivan-Hartung-1	Maureen Sullivan-Hartung Tuff Publications 11725 Collier Blvd. Suite C Naples, FL 34116	My biggest concern at this time pertains to the soil contaminates that could end up in the fill and then be flooded throughout the system creating havoc on fish and foul with drastic results. I would just like to see some actual studies proving that this issue has indeed been addressed thoroughly. (I have requested a copy of the draft in the written form, since it differs from the CD provided the evening of the public hearing in June but have yet to receive it.)	Please refer to the HTRW (Hazardous and toxic waste) section in the PIR/EIS. A detailed, in-depth survey was conducted over the entire property after preliminary surveys indicated sites and contaminants of concern. Remediation of contaminants is a State responsibility, and a plan to immobilize or remove all significant contamination has been developed. The State must certify the lands as free of contaminants before the Federal Government will accept them for project purposes. The non-federal sponsor has developed a cost estimate for remaining remediation, which is included (non-Federal costs) in the Cost Estimate appendix to this report.
Wolok-1	Mimi Wolok, 1112 Trail Terrace Drive, Naples, FL 34103	I am a resident of Collier County, and I live at 1112 Trail Terrace Drive, Naples, FL 34103. I fully support the proposed PIR for South Golden Gate Estates, as proposed. Even if it is beyond the scope of this process, I also support continued full access of off-road vehicles for owners of property within the Picayune, especially the Fakahatchee Strand State Preserve.	Noted. Thank you for your expression of support.

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Summary of Picayune Strand Restoration Public Workshop
Held on June 17, 2004, in Naples, FL

The workshop started with introductions and a discussion of logistics for the meeting. Second was a presentation of the proposed project. Following this was a period of questions and answers. The final section of the workshop was a period of public comments.

The following list summarizes the major questions and comments that were presented during the workshop.

- Support for the project
- Support for alternative 3D
- Hurricane/emergency evacuation routes
- Access for emergency vehicles
- Additional data collection and modeling needed
- High price of cost estimates/project
- Fears of over-drainage and excess flooding
- Requests for the comment period to be extended
- Inability to read report or insufficient time to read it
- Concerns of what will happen if project doesn't work
- Opposition to project
- Further review and modification of document needed
- Concerns of taking away ATV riding area
- Concerns of taking away people's private land (especially Jesse Hardy's)
- Concerns of the requirements and restrictions that may be in the Forestry department's unfinished management plan
- Questions about the transfer of roads from the County to the State, and the requirement to identify 640 acres for off road vehicles
- Concerns about U.S. 41
- Miccosukee land
- Inadequate notice or no notice of the June 17, 2004 public meeting
- Report was not published in Braille
- Impacts to horse trails in Belle Meade
- Impacts to water supply for Port of the Islands

Responses to Questions and Comments

Appendix G does not contain a separate section specifically for responses to each of the questions and comments raised during the workshop. Many of the questions were addressed during the workshop itself, and both the question and response are contained in the transcript. The issues from the workshop are the same as some of the issues contained in the written comments that were submitted during the public comment period on the draft report. Please see the Comment-Response matrix that follows the written comments received for responses to the issues raised during the public workshop.

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UNITED STATES ARMY CORPS OF ENGINEERS

and

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

RE: SOUTHERN GOLDEN GATE ESTATES
HYDROLOGIC RESTORATION PROJECT

Transcript of proceedings had at the public hearings conducted by the United States Army Corps of Engineers and the South Florida Water Management District, at the Best Western Naples Plaza, 6400 Dudly Drive, Naples, Florida, on June 17, 2004, commencing at 7:00 p.m.

PRESENT:

Dennis Duke, USACE, Project Manager
Rick McMillen, Project Manager, USACE
Janet Starnes, SFWMD
Ananta Nath, SFWMD
Brice McKay, USACE
Rhonda Haag, SFWMD

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MR. DUKE: Welcome this evening. Appreciate all of you coming out.

UNIDENTIFIED SPEAKER: Those of you who would prefer to hear this translated simultaneously into Spanish, we do have equipment over here on this table. I'll be over there to hand it out if you would be kind enough to come over before we get started right now and get the equipment.

MR. DUKE: Okay. No takers on Spanish. Okay. Well, I was born in Georgia, so if you can't understand me, we'll have to find somebody and translate on that.

Apologize for that.

Welcome this evening. Again, I appreciate you all taking your time to come out and help us with this very important project we've got going here.

My name is Dennis Duke. I'm the program manager for the Army Corps of Engineers for South Florida restoration. I'm headquartered out of West Palm Beach. I also have an office in Jacksonville, and which neither office of which I spend very much time in because I'm normally on the road, which I have been to Washington and

Miami today.

Appreciate you coming out again and taking the time to be with us.

Again, the purposes of this meeting tonight is to go over the plan that we put together for what we call the Southern Golden Gate Estates Restoration or Picayune Strand Restoration Project, so we have developed a project implementation report which is out for public review at this point in time. What we would like to do is walk you through some of the highlights of that report and recommended plan, tentatively selected plan, at this point in time; and after the presentation we would like to get your comments and feedback in two forms.

One is verbally for those of you who choose to speak, and I understand we have perhaps as many as a hundred plus cards for people indicating they wish to speak. So tonight we will be here as long as you need us to be here. Obviously, you -- well, you may wear out before we do even though -- we'll see. Depends on how much you get out of us. But, anyhow, we will take the public comments. If you have a long statement, we'll ask that you submit it in

written form. Anything you would like to submit in written form, we will take that back as well. The rest of those comments, the verbal statements, will go on. We'd like to ask you to limit your comments at that point in time to perhaps two minutes apiece. We'll learn more about that as we start that process.

We have a lot of people from the Corps of Engineers and the South Florida Water Management District. Again, this is a partnership project being done between the federal government and the state government with the U.S. Army Corps of Engineers as the lead agency. I don't wear a uniform. I'm a civilian employee even though I work for the U.S. Army Corps of Engineers.

With us tonight from the Corps side we have Mr. Rick McMillen here in the corner. He'll be doing a lot of the talking about the details here. He's our project manager. And he came up to me earlier tonight and said what did you get me into. And we have Miss Erica Robbins, who's an outreach specialist here in the back; and Brad Foster. Did I see Brad? Where is Brad? Okay, he's out? Okay, no problem.

Ananta Nath from the South Florida Water

Management District; Janet Starnes, who is the project manager for the South Florida Water Management District; and I'm going to murder this last name. Bridget -- how about we do that?

UNIDENTIFIED SPEAKER: (Inaudible).

MR. DUKE: Okay. And Barb Kirby. And I know saw several others in here, Rhonda, Carolyn Williams from the water management district in terms of their outreach program.

Do I have cards here for elected officials? Do we have any elected officials tonight?

Okay. This person up here is our court reporter, okay. Obviously, in my role, I deal with them a lot, unfortunately, in either depositions or that kind of thing; but the purpose of this tonight is so we can have an accurate transcription of this meeting. It's not to be held against you, it's just so we can accurately capture what is being said tonight, any comments you have, discussions and that kind of thing. This will become part of our public record of this meeting. So that's what this fellow here is doing, transcribing everything for us.

We had no takers that I saw on the Spanish.

We do have cards that we request people fill out, attendance cards for tonight's meeting. This is so we can keep a record. If you indicate you want to speak or submit a written document, that kind of thing, we'll have that available to us in the future. If you need a card and did not fill out a card indicating you want to speak or that you're even here, if you'd hold up your hands, we can get you a card or see one of the ladies in the back over here, okay?

As I said -- okay. Well, this is one of the first meetings I have been to where nobody held up a hand wanting cards. That's good.

I do a lot of these after 30 years in the Corps.

Okay. Rick McMillen, who's our project manager, and Janet Starnes will be providing you the details I mentioned before, so without further ado, what we would like to do is go through these presentations. Then we'll take some questions and get into the comments; but in order to allow everyone to hear, because some of your questions that you may have as they go through this may be answered during the presentation, so if you can just make a mental

note or jot it down if you have a question about this, let them get through their little presentation and then ask your questions about that afterward, I would very much appreciate it.

Okay? With that, thank you.

Rick.

MR. McMILLEN: Hello. Can everybody hear me on this mike? I want to make sure I have got it turned on.

UNIDENTIFIED SPEAKER: Just barely.

MR. McMILLEN: Just barely? Do I need to get it this close?

Okay. Can you hear me now?

All right. The presentation, we're going to -- as Dennis mentioned to you, my name is Rick McMillen. I'm the project manager with the Corps. I'm headquartered out of Jacksonville.

Okay. We're here to talk about Southern Golden Gate Estates, Picayune Strand.

Let me grab my channel switcher here.

All right. As Dennis mentioned to you, we're doing all of this recording and everything because we're trying to get to authorization of the project. That's the next process. That's why we're going through this comment period right

now.

The project is a component of the Comprehensive Everglades Restoration Project, which this happens to be a component, as I mentioned to you, and requires Congressional authorization.

The area map, the area we're talking about, is this area right in here. If you notice the public lands, the panther refuge to the north, the Fakahatchee Strand on the east side, the Big Cypress Basin, and to the south we have the Thousand Islands Wildlife Refuge, Collier County Seminole Park. Right in the middle of it is our project area, the area map.

The hydrological restoration area is what we're concerned about today. That's the area highlighted in yellow. Some of you call it the South Blocks. Hydrologic restoration, that's basically meaning that's the area we're trying to restore back to its original or historic predrainage condition, hydrologic meaning water, so we're trying to put more water back into it.

Some of you know the history of this project. A developer in the 1960's come in and constructed 279 miles of roads and 48 miles of

canals. That resulted in overdrainage of the Southern Golden Gates area, which in turn resulted in extreme flows of fresh water to the estuary to the south. It also resulted in drier conditions inland, causing the expansion of basic plant species such as the Brazilian peppers, the loss of most of our cypress forest; and as the plant species changed, it also changed the quality of the animal habitat in the area.

This picture right here depicts what the historic major and minor flows or the sloughs in the area. This is what we're trying to get back to, okay.

We considered twenty plus alternatives as we tried to come up with a design for restoring the Southern Golden Gates area. We whittled them down through our engineering process down to three that warranted additional engineering analysis; and as I go through the presentation, you will see that I refer to them as Alternatives 6, 12 and 3-D. Also as part of that evaluation we did consider not doing anything, which is a no action alternative, what would happen if we just didn't do a thing.

The decision criteria. When we started

evaluating these criterias, we applied three selection criterias. Those are our objectives or goals that we were trying to make.

First one was no point source discharge to the estuary. As you saw, the canals that were built drained it and they caused the one point discharge to the south that impacted the estuaries to the south.

In order to restore it, we set a criteria for ourselves that we were going to restore greater than 50 percent of the area back to its historic conditions or predrainage conditions.

And the other was we were not going to increase the flooding in Northern Golden Gate Estates.

Those were the criterias as we went through and evaluated these alternatives and come up with our solution.

Alternative 6, this is the one that's a passive system, as we would like to refer to it, because it doesn't include any pumps. We eliminated this alternative because we could not control the water flows and it backed up into Northern Golden Gate estates, violating one of our criterias. Kick it out, doesn't work for us.

Alternative 12, it's got some structures, we're blocking up some canals; but we leave this one canal here open. That still drained the area too fast and resulted in a point discharge to the estuaries to the south. It violated a criteria. Therefore, we didn't use it.

Brings us to the recommended plan, Alternative 3-D. It includes pumps on each of the major canals up here. We're plugging pumps. The areas that you see in red, those are the roads that we're going to be leaving, the primary records for access and maintenance. You will also see some other roads in there that will be taken down to grade dry season, meaning they are only usable during the dry seasons.

This is our plan that we've come up with because it meets all the three criterias that we set for ourselves.

The benefits of this alternative, this recommended plan. As I mentioned, it restores the fresh water flows to the estuaries, not in a single point discharge but over a much broader area. It enhances and restores the upland and wetland habitats in the area. It restores the predrainage flow to historic sheet flow, overland

flow pattern; and it restores and enhances the habitat for endangered and protected species such as the panthers and the wood storks and it increases the groundwater levels in the area.

Another benefit to the project is that it's the missing piece to the puzzle. If you look at the public lands all the way around it here, this is the missing piece. It helps restore the ecological connectivity or the water, if you will, to the other adjacent public lands. It enhances those public lands in essence.

The cost of the recommended. This is a kicker. $383 million.

If you look at how we break it down, the majority of that is in the land cost, the cost to acquire the land, the easements, the rights-of-way in order to restore the Southern Golden Gates area. Okay?

The schedule. This is where we're at right now.

As you know, most of you know, we're out for a public comment period that started May 14th and lasts 45 days. We need your comments so we can address those comments in the project information report. Okay. Once that comment period is over

with, then we look at those comments, address them and revise the report, send them up to our South Atlantic division office in Atlanta for a division engineer to send out a public notice. Once he sends that out or signs that, then it goes through another 30-day comment period, so you get another review of it. Once that 30-day review period -- an we expect that to occur sometime in the September time frame, then we revise that report one more time per those comments and we send it to the Chief of Engineers to get a report from him and then Congress authorizes it. That's where we're at. Okay?

As I mentioned to you, we need your comments. As Dennis mentioned, if you have got a lengthy written comment, please put it on a card so we can address it. Get your written comments in to us. It started on May 14th. The comment period ends on the 28th. You can send them two ways. You can send it down on an e-mail that you see up there or you can put them in writing to the U.S. Army Corps of Engineers, attention of Mr. Brad Foster. Okay?

Give you some time to write that down if you need to.

I'm being told that this information is available on a little orange sheet back here that's been provided or that you have access to, so we'll just move on from there. Make sure you stop and get one if you haven't already.

That ends that part of the presentation. I'm sorry about -- it's just a quick overview. It's hot in here and I apologize for that, but we'll get through the questions and answers just as fast as we can, so bear with us as we set that part of the public workshop up. Hold on. And thank you, folks.

MR. DUKE: Okay. All right, questions about this that we can get before we have a comment period? Yes, sir.

MR. McMAHON: You have already begun this project prior to the public hearings or anything else. My understanding of CERP was that it was a mandate that they finish the Mod Waters project before beginning anything else. How is it that you have gotten around that law?

MR. DUKE: Two items there. One, the South Florida Water Management District has launched an initiative on the Prairie Canal, adding some plugs there. They have moved that in advance to

the completion of this project implementation report. They applied for and obtained permits from both the Corps of Engineers under our Section 404 --

MR. McMAHON: 404 dredge and fill permit.

MR. DUKE: Right.

MR. McMAHON: In essence you have started construction without any public hearings being held on this project, in violation of CERP, which says Mod Waters has to be finished first.

MR. DUKE: The second part of that is it's not exactly in violation of the law. It says that Mod Waters --

MR. McMAHON: What's exactly? You said not exactly.

MR. DUKE: Excuse me. There's certain components that are specified in the law that says Congress will not or cannot -- or construction funds cannot be appropriated before Mod Waters is completed for these components. This is not one of those components that are listed, okay, so this is -- what I mean by not exactly, this is not one of those components that that requirement is applied.

Again, that early work is done by the South

Florida Water Management District. It is evaluated as an alternative in this plan in the report to see whether or not its compatible were the recommended plan that will eventually come out of this report and determine whether or not the South Florida Water Management District receives credit for that work as a part of this project.

UNIDENTIFIED SPEAKER: That was Brian McMahon who just made that question.

MR. DUKE: Any other questions? Yes.

MS. WHITBECK: I'm Peggy Whitbeck. I live in Northern Belle Meade and I noticed on your criteria you did not list Northern Belle Meade as not being impacted at all in the flooding. Is that true? Will the water table change in Northern Belle Meade?

MS. STARNES: The North Belle Meade area, if you're speaking to the area that's just to the -- I'm sorry.

The North Belle Meade area, if you're speaking to the area that's to the northwest corner of the South Blocks. If you're looking at the map, it's kind of in the northwest corner. If you're looking from 41 up, if you look at the

maps over there, there's an area -- oh, you're talking north of 75. I'm sorry. I apologize. I'm thinking South Belle Meade; you're saying North Belle Meade. I apologize. There will be no flooding impacts in North Belle Meade.

MS. MALSTREU: Hi. I'm Vanessa Malstreu from Port of the Islands, and I have a number of concerns.

One of them is that the Port of the Islands is a resort fishing and boating community. It is difficult in low tide to navigate the canal. How will this impact the use of our canal and our lifestyle? Will there be more or less water in our canal?

Also, the Port of the Islands is a growing community. What are you doing to insure the current and future water needs will be met?

Also, there are going to be berms that are going to be built, like dikes. Are they going to be visible or hidden from sight?

MS. STARNES: Your first question dealt with the water levels or elevations in the canal especially during low flows or during low tide. We do not anticipate based on all the analysis that we've done that there will be any real

change in terms of the low flows or the dry season flows in that canal. During the high flows that you get during wet season now, those will not exist the way they do today. The high season or wet season flows will be lower. But as a whole the low flows or the dry season, what we call the dry season flows, will be pretty much the same as they are today, so as long as you don't have difficulty during dry season now, you will not have difficulty with dry season in the future.

That was the first question. She had three parts to it.

The second question had to do with the water supply in the Port of the Isles area. In terms of the water supply in the Port of the Isles area, the Port of the Isles wellfield is actually south of the Southern Golden Gate Estates project area. We do anticipate that there will be additional surface water in that wellfield area. In addition, the actual water table aquifer will also be higher. But those are actually deeper wells, so we don't anticipate that we'll be having any direct impact on those wells.

In terms of future supplies, your future

supplies, you will have to come in for a consumptive use permit with the South Florida Water Management District the same as you would today. That will not change at all. We don't anticipate creating new water, so there will be no additional water in the future as a result of this project except for the natural system; but there will be no negative impact upon existing legal users.

Your third question had to deal with the berms. We feel that it's critical to actually berm off the Port of the Isles area because of the surface water flows that we are recreating. If the Port of the Isles development was not there -- that area used to be a flooded area where there was overland flow that's considerably deeper than there would be today were that area not there, were that development not there, so that's why we felt that in order to maintain the integrity of that area that it was -- the most reasonable approach was to actually berm that area off to prevent any future flooding of that area as a result of the project.

And we have already contacted and are going to -- it's our intention to work with the

community improvement district to design and develop those berms so that they are acceptable to the community.

MR. DUKE: Yes, sir. Do you have a question?

MR. AGOSTAN: I think I can speak loud enough.

MR. DUKE: We would like to get it on the record, please, sir.

MR. AGOSTAN: All right. Having come from a centrally planned economy -- my name is Ty Agostan.

And going back to the first statement, having come from a centrally planned economy, I have a very deep distrust in a centrally planned activity like this one. I would like to know just exactly what your track records are, being that at this point in time you cannot financially rape some 19,000 families, acquiring this land.

Now I see the sequence of your priorities and the last item on that sequence was flooding Northern Golden Gate Estates. I'm just curious whether that was a subconscious slip.

MR. DUKE: Good question. No, that was not a subconscious slip. It was not intentional.

That's just the listing there that we have. Actually, that is an absolute requirement, that we do not induce or create additional flooding impacts, either Northern Gate Estates area or in the areas to the west, occupied areas or developed areas to the west. It's a requirement of the law that put CERP or the comprehensive plan into place, the Water Resource Development Act of 2000. We have to meet those tests.

MR. AGOSTAN: What kind of credentials do you have to make a statement like that?

MR. DUKE: Personally, the people that do this are registered professional engineers with the Corps of Engineers and South Florida Water Management District.

Yes, sir. I'm sorry.

MR. SHEER: My name is Don Sheer (Phonetic spelling), and I live west of the area which you're showing on your maps. I live in what's known as Section 16. We're in the middle of Six L Farms property.

The ownership or the management of Six L Farms has been visited by representatives of your group in the last couple of days a couple of times regarding possible flooding of Sector 10 of

Six L Farms and possible fixes for that, kind of on a casual basis kind of letting them know that you're not sure of what the effect will actually be on their property.

I live very close to that and that concerns me, so that's basically my question.

MS. STARNES: Much like the Port of the Isles, we recognize the agricultural area and those people that live in that agricultural area known as Six L's Farm. There's also a Section 16, which is primarily residential, and Desiree Farms. We recognized that again that was an area that needed to be protected, so it is currently our plan and within our -- and what we will be doing as we move forward with the design, we will actually be designing a flood control kind of berm that will protect that area. As the South Blocks floods, it will flood into South Belle Meade; and we were anticipating that if we did not improve the existing berms that were there that we had the potential to flood that area, so our solution to that, what we felt was the most technically sound and reasonable solution, was to berm that area off.

MS. ST. JOHN: I'm Debbie St. John.

I use the Belle Meade horse trails along with several other people.

So are you saying that you're going to build berms around Belle Meade?

MS. STARNES: No, ma'am, that's not what I said. The berm itself will be literally adjacent to the Six L-Desiree Farm, the agricultural area. There's an existing berm there now that is actually built and maintained by the agricultural entities that farm that area. We will actually be putting a new berm in probably immediately adjacent to that berm to protect that area. Belle Meade itself will not be bermed off. It will be open just as it is today.

The area that will be bermed off is in the northwest corner. Just outside of the South Blocks, there's a residential community there. There's a strong likelihood as we move into design that we will determine that there's a need for a berm in that area to protect those residences, so it is currently -- we have costed and designed for a berm in that area to protect those residences.

MR. RANKIN: I'm Doug Rankin. I'm past president of the Golden Gate Estates Area Civic

Association. I'm currently vice president of the 5th District Association.

I have several concerns here.

Several years ago they came to us with this plan and showed these pumps; and I understand under normal conditions this system will probably operate to protect the Northern Golden Gate Estates, where I happen to live. My concern is, having been a lifelong respondent in the State of Florida and having seen so many engineers come to Florida and think they knew what they were doing and not -- and my family's been here since 1925 -- I'm concerned that this may work in normal situations; but there seems to be no alternative to get the water out of this system other than by using these pumps. And my question is: How do these pumps work in 150-mile-an-hour winds, under water, with no power, and their diesel engine is under water; and then what happens in that scenario to the Northern Golden Gate Estates, who when they are all done, half of which is going to depend on this drainage?

My next concern is also emergency management related and it has to do with an agreement Collier County reached with the State about when

this -- when Collier County gave up the roads. Currently we have several square miles, in fact probably eight or ten square miles off of Desoto and Everglades south of Golden Gate Boulevard and currently only have one way out, to come up off Golden Gate Boulevard. We've had numerous fires that have been in that area burning south. And basically, being sealed off in that area, there is no way out except a little break-through gate that most of their automobiles cannot use, especially in inclement weather, how are those people are going to get out of there in the event of an emergency? That's the reason I assume that you've still kept the road to Janes Scenic as an all-weather road. I don't know how -- because I go down Janes Scenic all the time -- how the rest of Janes Scenic is going to meet that emergency egress requirement.

I don't know if you all have considered putting an exchange in at Everglades. The reason that wasn't put in before is the State was concerned about having more development in the Southern Estates. That's obviously no longer a concern. It would make a great little entrance into your grand little fiefdom here and it would

also allow people in that area to get out in the event of an emergency.

I don't have go statistics right now, but I imagine there's probably a thousand people living in the area I speak of that could easily be cut off in that area and burn to death or flooded to death in a number of scenarios that only have one way out, and I don't know that Janes Scenic is a reasonable alternative.

The other thing I'm a little concerned about is use and also the recent reports I have seen of garbage because I don't think anybody really has the personnel to patrol this area and what I have seen recently in newspapers, garbage has started piling up everywhere because there really is no -- you're all doing stuff out there, but there's nobody really watching the store and garbage is starting to pile up. And this is one of the things I have always been concerned about. We restore natural lands, we do this; and if you don't watch them, they turn into garbage heaps is what they do around here. And I'm very concerned about those items also.

Thank you.

UNIDENTIFIED SPEAKER: No answers?

MR. DUKE: We're working on it.

A couple of answers here on the questions. There were a lot of questions here.

The one on the pump design, the pumps would -- you're right about the diesel-powered pumps. That's what we use throughout our South Florida system. We have them in use -- they have them in place over in Miami all along the southeastern coast that we use, and that's the -- we have electric with diesel backup. Basically, these are -- we create basically storm shelters for our crews when we have a hurricane coming. These provide structures that will withstand that so we can put crews out there to man those. We locate them solely so they will be operating -- operable during those adverse conditions, above the water -- expected flood water elevations.

MR. RANKIN: My question was -- I don't know if you saw Turkey Point Fossil after Andrew. They had a concrete stack over there that was -- the concrete in it was like this thick, from there to there, not the whole stack, just the side of it; and this thing was about -- oh, what, 50 feet high. By the time they were done with it, you could stick -- Andrew was done with it,

you could stick Volkswagens through it.

My concern is you have another alternative there that leaves one of the canals open; and, obviously, that doesn't meet your criteria because it drains too fast. My question is: Since there are all sorts of scenarios where these pumps will fail -- and I have lived through Donna, where it took out things in Bradenton there. 1926 storm, 1928 storm that killed tens of thousands of people back in the old days. And we're overdue for one of those, by the way.

Why didn't you just take that other plan and instead of putting in the permanent blocks just put in blocks that you could throw open the gates on? Those don't require diesel fuel or electricity to run and in that adverse condition they could drain and in normal conditions they could be closed and nobody would care and it wouldn't take you that long to open them in an emergency.

I just have a real problem because Golden Gates Estates area -- we're the second fastest growing community in the nation and Golden Gate Estates is where everybody is coming now because it's the only place left. It's not even

affordable anymore. You're going to be talking -- I have got what, 30,000 people out there already? You're talking fifty, sixty, seventy, eighty, ninety thousand pretty quick; and that's a lot of people to put at risk if three pumps fail.

And why wasn't there -- and this was raised. I remember there was a water management guy here. He was at the Golden Gate Civic -- he was at the Golden Gate City Auditorium seven, eight years ago when these questions were raised and they still don't seem to be addressed.

MR. DUKE: Well, first, there are three pump station locations. There's a series of pumps at each location that are designed to handle different quantities of flow.

One of the alternatives you will see in there does examine the different -- leaving the canal open with different gates, and I think you'll go through the analysis and see that. I'm not going to run through the comparison here.

Again, look at that, give us your comments; and you have a lot of excellent comments. If you would, provide those in writing.

Janet, I don't know if you want to address

the road access.

MS. STARNES: The evacuation route issue?

When we actually -- the water management district and the Florida Department of Environmental Protection, when they signed the agreement with Collier County, which was -- basically released the roads to the ownership of the Florida Department of Environmental Protection, one of the provisions in that agreement is that the water management district will work with Collier County to identify a process by which they can get access to utilization of the -- there's a gate right at Everglades Boulevard and I-75, where we could improve that so that it can be used for an emergency evacuation route.

And I have actually been in contact with and Collier County has been in contact with me over the last couple of weeks because that issue has come up again at the local level; and we are working towards that goal, so we feel that with access to I-75 for evacuation and leaving Janes Scenic open, with an early determ -- were there a need to evacuate, we have extremely good emergency professionals here in South Florida,

fortunately, and in Collier County; and with their good judgment and their professional judgment, they'll make the determination as to the appropriate time to evacuate and because of the location being rather remote, they would make that evacuation determination much earlier than they may in a less remote area anyway, so we feel that we can work with the county and actually resolve that issue.

Were there any other -- did you have --

MR. RANKIN: The other one was the garbage that we've recently seen building up down there and the use -- I know a lot of people here are concerned that this is going to end up like several other pieces of this puzzle, promises of public access but really no effective public access and use.

MS. STARNES: In terms of garbage or misuse of the property in that respect, actually, we have built into the project over the next 20 years -- actually over the next 50 years operations and maintenance money; and whether that will be through agreement with the Division of Forestry or -- you know, the mechanics of that certainly have not been worked out and I'm not

going to sit here and say that they have been worked out, but we do recognize that as a problem and that is an issue that we have actually factored into the operations and maintenance of the entire project area, not just the pumps.

You know, typically you just figure operations and maintenance for your pump. We have actually gone a step beyond that.

In terms of recreational access, yes, there will be recreational access to the South Blocks. What that recreational access will specifically be I can't speak to today. That is actually being developed through the Division of Forestry's management plan. That management plan is currently being redrafted. It is my understanding it will be released at the end of summer, August or so.

The Division of Forestry is actually under contract with the Florida Department of Environmental Protection to manage the South Blocks, and that will not change in the future due to restoration.

MR. DUKE: Sir.

DR. MOGELVANG: My name is Christian Mogelvang, M.D. I'm Naples' first plastic

surgeon, but I'm not anymore.

I am a graduate biologist, University of Florida; and I understand that there are -- that -- what the broad plan is here, what people are trying to do. I do understand it. I'm a graduate biologist, as I said, from the University of Florida, field assistant to Dr. Albert Leslie, studying Florida ecology during my college years from Fort Moultrie to Brunswick to Key West. I think I covered it pretty well. And I have given expert ecological testimony in official proceedings regarding the natural environment in this area.

I have been looking at the pond and the surroundings out there and I could write a book about that.

Anyway, one thing that I would like to say is this gentleman's concern that he just voiced here can be answered very easily by the fact that that's why they are causing you to build new houses in North Golden Gate on four to six feet of fill. The only -- the idea of only -- and I understand this is not your direct responsibility, but only dry season access to the at grade areas violates the original government

promise when they started the Everglades restoration to allow continued traditional uses. Swamp buggying is a traditional use and I'm ecologically qualified to say that the claims that have been made about ecological damage there have been -- they are not valid. Hunting, camping and fishing in nonspecified areas is traditional.

And I say U.S. Government, live up to your promise when Everglades restoration first started.

I have some other comments here that are written comments which I will turn in, and I thank you for the opportunity to express my opinions.

UNIDENTIFIED SPEAKER: Are you answering questions or taking comments?

MR. DUKE: Answering questions. Please restrict your -- and good -- thank you -- please restrict your -- to this question period and not make comments. We'll take that later.

MR. MACKEY: Yes. My name is Bob Mackey, and I don't understand how you can have a public review process if you are unable to say what the public access criteria will be. If this public

review process ends before you tell us what kind of access we'll have, how can we possibly have any comment on it?

MS. STARNES: I can actually answer that question. Because the Department of Interior has assisted in purchasing the South Blocks, there's actually $38 million worth of federal dollars that have assisted in acquiring the properties in the South Blocks. Any change in that management plan will require a public review just like this plan. It will have to go through public workshop, it will have to go through full public review just the same as our project implementation report; and that process is scheduled to begin in August.

MR. MACKEY: But construction is going to begin before -- may begin before this -- all this information comes to us.

MS. STARNES: Construction of the big project will not begin before August, I assure you.

MR. MACKEY: Well, big, little, it's going to start before you tell us how we can get out there.

MR. DUKE: I have another question over

here.

MR. GLENN: How are you all doing tonight? My name is Bob Glenn.

I'm a fairly simple kind of guy; and with all the educated Army Corps of Engineers guys here, there's one question, one little statement that's bothered me since the beginning of this. I have tried to follow along pretty well; and, like I said, as simple as I am, I understand sheet flow. We opened up the Kissimmee river -- I believe that's what it's called up in that area, the north area; and that created a sheet flow and that sheet flow is what we're trying to do here. We're trying to make it flow, just continue the flow. And I remember back eight, nine years ago when this all started, they said that our buggies and four-wheelers created ruts and that disturbed the sheet flow, the natural sheet flow.

Well, they put this thing in called I-75 that kind of goes against the way that sheet flow goes. Like I said, I'm pretty simple; but that seems kind of contradictory to what we're doing.

And then on the side of I-75 we dug like a 30-foot canal that kind of holds water, but

that's okay, so maybe I'm wrong. Like I said, I'm pretty simple. If it was such a big concern, maybe we could have elevated I-75 and let the water flow.

But not that the Army Corps of Engineers ever makes any mistakes. We know how well those panther crossings work. You know, those panthers are going through those crossings left and right. We know how well that worked.

What I really don't understand is we're putting berms and stuff up, but yet we're going back to natural restoration of this land. Well, there were no natural berms here. We all know it was pretty flat out there. And I just don't understand if we're so concerned about bringing it back to natural, why don't we bulldoze I-75 and let it all flow like it should?

MR. DUKE: Other than bulldozing I-75, I'm not sure I saw a question there.

And just for -- the Kissimmee River restoration is -- that's ongoing at this time is we had basically dug a channel, changed a 100-mile-long river to a 52-mile-long canal. We're in the process of backfilling 22 miles of that canal to basically put the sheet flow back.

Yes, there are some issues. The Corps of Engineers did not design even though we did permit the construction of I-75 and it did include those panther crossings as a requirement of coordination with the Fish and Wildlife Service, so --

MR. GLENN: But it didn't work, and then -- so what's to say -- and the lady from Southwest, the water management district, she pointed out for the poor people that live over by Port of the Islands and stuff, we're going to wall you in. Not that we have ever made a mistake; and like the gentleman said, Janes Scenic Drive, I have been there on rainy days when it's a foot deep under water. When those people are trying to leave and those pumps break down, there's no place to go. The sheet flow goes that way.

I just don't understand why we're only doing something so little. This Picayune Strand is little compared to everything else. If we're going to do it, why half-ass it? Why don't we just do the whole thing? Let's bulldoze it all and then let it all flow because everybody will flow, you will flood out the Indians and then we'll have the Indians all mad.

MR. DUKE: Do you have a question, sir? We really need to get on to the comment period here.

MR. LESTER: My name is Don Lester. I'm executive director of the 15,000 Coalition, which is a group of landowners north of I-75 that's affected by this; and I have just kind of a bookkeeping question I would like to understand.

Is this an official NEPA meeting?

MR. DUKE: Yes.

MR. LESTER: Is this the first NEPA meeting?

MR. DUKE: No. There was a scoping meeting done when this project was started. And this project has been ongoing for many years. There was basically a feasibility report that was started back in the nineteen eighties.

MR. LESTER: Several of us were present at a previous meeting with the Corps of Engineers held in Collier County and I asked the question at least 25 times and I heard an equal amount of yeses and an equal of nos, it's not. Janet Starnes was there. Janet, you remember. I asked the question. You remember that they declared it was not an official NEPA meeting at that time. Then they said it was and they said it wasn't.

And it didn't turn out so well in the first

meeting; and if this is the second meeting, when is the third?

MR. DUKE: Right now we do not have plans for a third meeting.

MR. LESTER: Well, are you required to have a plan for a third or is this one of those things that you said -- I'm going to quote you. You said it's not exactly illegal. Is that kind of like a little bit pregnant?

You're required to have three meetings. I want a straight answer in front of all these people and the reporters. Is this number one? Because if it's number one, tell us. If it's number two, then you have got to go back and clean up that you said it wasn't last time. Let's get it straight. We want three meetings, three meetings; and if you're not going to do it, that's the first objection we're going to make.

MR. DUKE: Brad, can you answer that?

UNIDENTIFIED SPEAKER: Get the lawyers in here.

MR. LESTER: Ladies and gentlemen, we're entitled to three full recognized meetings. The last meeting that we had, they sent it -- sent us to the wrong address. We didn't have

notification. We're not going to stand for this.

MR. FOSTER: I'm Brad Foster with the Corps of Engineers; and the way we have understood it, the way we read the rules, is that there's a requirement for a meeting after we release the draft report. That is this meeting tonight.

UNIDENTIFIED SPEAKER: Speak into the mike, please.

MR. FOSTER: Our reading of the regulations is that there is a requirement for a meeting after the release of the draft report. That is this meeting tonight. There are also requirements for gathering information before the report is produced, earlier efforts. It doesn't say meeting, it says gathering information. A meeting is one way to gather the information.

MR. LESTER: Sir, Colonel Bonner of your office assured us that we would never have another scenario like we had in Naples and he assured us in a public meeting and he gave us that we didn't have a meeting and it was starting over and that we would have our three meetings; and we want our three meetings and if you're telling us that this is it and this is all we're going to have, we automatically right away are

dissatisfied because this hasn't been a meeting and this isn't -- this isn't number two. We don't know what it is and you sure didn't know last time what it was.

MR. DUKE: Brice, you want to address that?

MR. McKAY: CEQ, the Council on Environmental Quality that regulates the workshops and all that --

UNIDENTIFIED SPEAKER: Who are you?

MR. McCOY: I'm Brice McCoy with the Corps of Engineers.

CEQ, which regulates the NEPA and gives us the guidelines on that, states that we should have workshops, okay. It does not give a quantitative number for that. It does say at the end that we would do it for the draft report.

The NEPA scoping meeting is actually a NEPA process, a whole NEPA period. We get information in by various ways. Workshops is one of those meetings. Yes, that meeting you did go to was part of the NEPA process, the part of the scoping process, where we gathered that information in.

I don't know where the three that you're coming from, they are not in any laws that I've read, they're not in the CEQ's guidelines, so

we'll gladly check into that and look into that for you if you want to provide us where that is in the federal regs.

MR. LESTER: Absolutely. You're required -- Colonel Bonner has already explained that you're required to have three. We want the three and we would like to have the dates of them.

Is that correct, group?

UNIDENTIFIED SPEAKERS: Yeah.

MR. LESTER: We would like to have that. You know how to get hold of me. Brice, you know who I am. Please give us our three meetings.

And what is this deal you have a meeting tonight and the comment section is over on the 28th of this month? That's not very long. You're not giving us much time. We have some comments, we want to make them; but you're not giving us much time.

We want our three meetings.

MR. McKAY: Again, I don't know where the three come from, but we're here to listen --

MR. LESTER: This might be one, but we want two more.

MR. DUKE: Yes, sir; and, by the way, just for the record, Richard Bonner is our deputy

district engineer for project management. Colonel Robert M. Carpenter is our district commander engineer.

Yes, sir. Is there a question?

DR. MOGELVANG: Yes.

MR. DUKE: Okay.

DR. MOGELVANG: I just wanted to ask you one more question.

Why should --

UNIDENTIFIED SPEAKER: Your name?

DR. MOGELVANG: Christian Mogelvang.

Why should Six-L's huge property be protected and not Jesse Hardy's relatively small homestead? Don't take Jesse Hardy's land, please.

MR. DUKE: Janet, do you want to answer that regarding the Six L and the flood protection plan?

MS. STARNES: I had someone talking in my ear and I didn't hear the question.

MR. DUKE: The question is Jesse Hardy's land, Jesse Hardy being in the center of the --

MS. STARNES: The primary difference between the Six L's property and the Southern Golden Gate Estates proper study area or the South Blocks

area is Mr. Hardy's property is actually located right in the middle of the project area. His property is actually on -- the southern edge of his property is actually where we have currently planned to locate our pump station on FakaUnion Canal. By virtue of that pump station being there, that in and of itself will cause some backwater effect onto his property; and that's one of the key reasons that it's critical that his property be actually acquired rather than just an easement be provided.

MR. PINE: My name is Walter Pine, from the Center for Civil Rights Advocacy.

The first question I want to ask is when you gave the rules for holding these meetings and they asked about not having enough comment, why didn't you tell the citizens they could apply to the Corps of Engineers to have the comment period extended? That's the first question.

Second question. On the ingress and egress, the access issues, where are the scientific facts that tell that the people aren't going to have a problem? The Department of -- both Florida Department of Transportation and the Federal Department of Transportation have well-developed

investigative and -- forgive me. They have well-developed processes for determining whether there will be a problem. Why is there no traffic studies available?

Third question has to do with science. You're supposed to be able to show that there's a reasonable connection between the activity, what you're doing, and that it will accomplish a reasonable governmental goal. I asked for the science at a meeting about two and a half weeks ago. To date I have received nothing, all right, in regard to Jesse Hardy's property or any other issue. Where is the science that shows that anything that you say or give your opinion on will actually occur?

The opinions of the engineers are just that, opinions. You are required to have a scientific basis for your decisions and to justify your acts. I would like copies of all the reports, the studies and the science behind which you're basing your decisions.

My final question is this. Why is it you haven't explained to these people, first of all, they are entitled to an investigation of this process through their local legislators as a

Congressional investigation, they're entitled to an investigation through the ombudsman's office, they can file civil rights complaints to the Department of Justice, all free of costs? Why have you not told them that you -- the Corps of Engineers also has an IAG for which if they feel that they're being wronged they can apply through and ask for an investigation by your inspector general? Why have all the checks and balances not been laid out before the community so that they can challenge both with you and with the appropriate authorities the decisions that you have made correctly or incorrectly?

That's my last question.

MR. McMILLEN: Okay. You will have to bear with me as we try and work through all your questions.

With regards to asking for an extension on the comment period, I remember having a meeting with you two weeks ago and we asked you, because this is a formal process, the extension has to come to us in writing; and we have not yet received that in writing to my knowledge.

MR. PINE: That wasn't my question.

UNIDENTIFIED SPEAKER: Excuse me. We are

collecting a petition with signatures for people that want to have this comment period extended. Meet us out in the hall if you didn't sign the petition, but there will be a petition.

MR. PINE: That wasn't my question. My question was why you did not inform the citizens that that was their option. That was my question. Why this group of individuals, after it being brought to their attention that people felt that this was not sufficient time, did not inform them of their rights?

THE CHAIRMAN: Basically, this should have been in the letter that went out with the posting on this thing. You are entitled to request an extension. We do have that in writing. If you're collecting a petition, please get that to us. That will be your -- constitute your formal request in writing to us to request the extension.

MR. PINE: What letter?

MR. DUKE: The letter that was posted out on our web site and sent out to various agencies for the distribution of the report? How did you find out about this?

UNIDENTIFIED SPEAKER: It wasn't sent out to

the public, the people that really matter.

MR. DUKE: Thirty-five hundred letters sent out, okay?

UNIDENTIFIED SPEAKERS: (Inaudible.)

MR. PINE: Excuse me. If I might ask, once again, this --

UNIDENTIFIED SPEAKERS: (Inaudible.)

MR. PINE: Excuse me. I seem to be missing -- I seem to be misunderstanding here. I didn't ask if you sent out a letter. I asked why you didn't tell them now when they raised the issue of the short notice of their rights, why didn't you tell them today?

MR. DUKE: I thought you just did. I can tell them again; but basically, yes, you can request an extension for the comment period.

UNIDENTIFIED SPEAKER: Are you going to grant it? We're going to request it. Are you going to grant it?

MR. DUKE: I need to meet with those that are -- when you collect the petition, bring it up, and we'll see the basis of your -- I'm not going to arbitrarily grant it --

UNIDENTIFIED SPEAKER: How many want an extension? Let's tell him how many want an

extension.

UNIDENTIFIED SPEAKERS: (Inaudible.)

UNIDENTIFIED SPEAKER: Are you getting the picture?

MR. DUKE: It doesn't matter how many say. I need to understand the reasons and rationale for the request.

MR. PINE: Excuse me.

MR. DUKE: It can be one person or it can be a thousand people. I need to have that in writing and I need to understand the basis of that request.

MR. PINE: Are you the person that would grant the extension?

MR. DUKE: I am not. Colonel Carpenter is.

MR. PINE: All right. The people have the right to know the point, the person that will make the decision, his address and the appropriate place.

You still haven't answered the question. Tell the people who they have to apply to, what they have to include in the response so they can appropriately utilize the system. You have not fulfilled their rights yet.

MR. DUKE: I'm sorry. Okay. I will suggest

you get the -- okay. We're going to have to move on to the comment period, since that's what I'm getting a lot of.

MR. PINE: So you're refusing to answer why you will not inform the citizens of what their lights are?

MR. DUKE: I'm not saying that.

MR. PINE: Then do so. Then answer the question.

MR. DUKE: What would you like for me to answer? I told you you just informed them. I just said if you want to make a request --

MR. PINE: Who is the person that makes the decision?

MR. DUKE: The person was --

MR. PINE: Please respond.

MR. DUKE: The announcement is on this yellow copy as well. The person that makes the decision on the extension will be Colonel Carpenter. He will do so on my recommendation and the recommendations of other staff. Therefore, if you want to make it, I will stay here until I receive that and hear your concerns.

MR. PINE: What does the letter need to contain?

MR. DUKE: What you're asking for -- why are you asking for an extension, and it can be as simple as you do not have time because of extenuating circumstances to review the document in its entirety and request an extension for a certain period of time.

MR. PINE: Does it need the full name and address of the requester?

MR. DUKE: Yes.

UNIDENTIFIED SPEAKER: It's not on this yellow paper.

MR. DUKE: The address is on the paper. It's the same address. It's the address for written comments. It's the address here that's noted for Brad Foster. If you address it to Colonel Robert M. Carpenter -- actually, Brad Foster is the staff person that handles this and collects the information and produces that report to the colonel for his consideration.

But, again, I will be advising the colonel. I have already talked to him before this public meeting because I understood that there would be concerns, briefed him on concerns, request for an extension tonight; and I've already talked to him about that and he's waiting to hear from me after

this meeting, so I need to hear from you.

UNIDENTIFIED SPEAKER: If we give them to you tonight, can they go to him?

MR. DUKE: Yes.

Yes, ma'am. You've been patient.

MS. CONDELLO: My name is Virginia Condello and -- my name is Virginia Condello and it was briefly alluded to before that the Belle Meade horse trails would not be bermed, but you didn't say what effect the opening the canals and the drainage situation would have on the access to those horse trails and, you know, will they be flooded more of the season; and also as far as the property, the private property that is in the Belle Meade area off of Beck Boulevard and Benfield, that area you were talking about before, you said that maybe you would have to look into berming some of these residential areas. Would those residential areas be bermed after they have been flooded and damage has been done or when will you decide to protect those private properties that remain?

MS. STARNES: In terms of the berm, our current design and plan includes a berm. It is our current anticipation that we will -- the

modeling that we have done and the technical analysis that we have done currently indicates that there is a high probability that there will be an increase in surface water elevation in that area, so we currently have planned for and designed in, and it's a very preliminary design, a berm around that area.

As we move into detailed design, we will actually make a determination as to the size of the berm, for lack of a better way to say it; and there may be some areas farther to the west that will not actually need the berm because we don't anticipate the water flowing back north, so the -- if you look at the schematics for the berm, it shows just a square box for the berm and we don't anticipate the need for a full square box.

I didn't clearly state that earlier. That's what I'm referring to, so that's your first question on the berm.

MS. CONDELLO: It doesn't say -- nowhere can you find out where this berm is planned for exactly.

MS. STARNES: We have not exactly located it yet, so you are correct in that statement.

MS. STARNES: The second --

MS. CONDELLO: Might be on private property in that area.

MS. STARNES: No, ma'am, it will not be on private property.

The second question had to deal with the horse trails. I'm not familiar with it, having never been on that horse trail. Is that the one where the trail head is right there by the Division of Forestry office?

MS. CONDELLO: Yes. Well, the public access is on Miller Boulevard; but there's another one on the west side over at Newman Drive and off Benfield and Beck, at M&H Horse Stables.

MS. STARNES: My anticipation, and I'm -- I haven't looked at the actual model map; but my anticipation is that trail would be open just as it is today; that during wet season -- I suspect it's wet during wet season now.

MS. CONDELLO: Yes.

MS. STARNES: So during wet season it would still be wet. I would anticipate that you would have a slightly longer period at the end of wet season where it would be wet.

MS. CONDELLO: So You don't anticipate that

it's going to be wet all year round or inaccessible all year round?

MS. STARNES: No, absolutely not.

MR. DUKE: Yes, sir.

MR. LHOTA: My name is Bill Lohta and I'm president of the Property Rights Action Committee and I have a question.

I have read through the documents; and as I understand it, Northern Golden Gate Estates is going to be protected from flooding.

MS. STARNES: Correct.

MR. LOHTA: What isn't clear to me is whether or not there's going to be any increased risk of flooding, and if not, then why does FEMA want to be included in the flood plan?

MR. DUKE: Part of the plans and the rationale for the large pump stations are to protect that area from flooding, maintain existing levels of service. This doesn't mean that you're going to be improved above what you are now, but existing levels of service for flood protection will be maintained for the northern area.

The FEMA maps, they are mapping everything that's being developed or has been developed and

that may be subject potentially to flooding; and that's existing flood conditions. It has nothing to do with this project.

Yes, sir.

UNIDENTIFIED SPEAKER: I'm just saying go to the comments.

MR. DUKE: Yes, let's do that.

Jeff Cox. Jeff Cox?

MR. COX: I'll pass. A lot of people want to talk.

MR. DUKE: Do you have something you want to say? Either a comment or a question -- I mean do you have a questions?

MS. NOBLES: Yeah, I have a question. You guys realize that --

UNIDENTIFIED SPEAKER: Name?

MS. NOBLES: My name is Ashley Nobles. I live out in North Golden Gate Estates.

Do you guys realize that that's where all of us play that you're trying to flood and do you think flooding is going to stop us from going out there? Every year it floods. Every year it floods, and we still go out there. Do you think that adding a little more water is going to stop us? We'll just build our buggies taller, get a

bigger lift kit. Do you think that's going to stop us?

MR. DUKE: I didn't say it was.

MS. NOBLES: But you're telling us that our four-wheelers and our buggies and trucks are what is causing all the damage.

MR. DUKE: I don't believe I said that.

MS. NOBLES: Well, not in this initial meeting, but you guys have said it before.

MR. DUKE: That has been a concern for any area that we're trying to restore to more natural conditions.

MS. NOBLES: I don't know. I see it flood every year. Last year there was like what, a foot and a half of water on the roads? I don't know how you guys are going to try and stop us by flooding this. You put a big gate up and --

UNIDENTIFIED SPEAKER: My truck's going to be the first one through it.

MS. NOBLES: Well, everything's just going to run it over.

MR. DUKE: That's part of the land management plan that's being developed.

Yes, sir.

MR. HAYLOCK: My name is Rick Haylock and I

have some land in there and a house and initially we were told that there was going to be a 640-acre park that was going to be given to the people so they would be compensated for all of these roads that are going to be taken out so that they can't go in there. Now, so far we haven't seen anything; and that's one of my questions is, you know, when will we know when this will be given to the public that they can have access to somewhere they can take their buggies and their vehicles and whatever.

Now, the other question I have is okay, so we build our houses up four, six feet to protect against floods; but, you know, our yards, we have landscaping, we have shrubbery, we have concrete walls and everything and if for some reason your calculations go wrong and you flood all our yards and destroy all our landscaping, is there any plans to compensate us in any way for this kind of damage?

MS. STARNES: Okay, the first question has to do with the 640 acres, better known as the section of land that was committed to Collier County as a part of the agreement where Collier County released the roads in Southern Golden Gate

Estates. That's a commitment that was made by the South Florida Water Management District. We have two years to provide that section of land. One year is just about up. And I'll be perfectly honest. We are having difficulty in identifying a full section of land that -- with a willing seller, so we are obviously going to have to work a little harder over the next 12 months to accomplish that goal. The commitment is there and it will be provided. That I can absolutely commit to.

As far as in the event our calculations were in error, and we have a strong confidence in them, but in the event they were and that can clearly be demonstrated, absolutely, you would be provided compensation for any damage that could be shown to be a result, direct result of our project.

MR. HAYLOCK: For the 640, how much do you plan to spend to get -- to acquire those acres?

MS. STARNES: We did not set a limit on the cost of those, that acreage.

MR. HAYLOCK: Has any money been set aside for the purchase of that?

MS. STARNES: Yes, there was; and now I'm

trying to remember what the amount -- there's money set aside in the fiscal year 2005 budget in the event we cannot find a piece and close on it in 2004; and if my memory serves me correctly, I believe we set aside $2 million. But I don't know -- don't quote me on that. I really need to go back and look at the budget.

MR. HAYLOCK: Because for the Southern Belle Glades -- I mean my cousin, she gave up her land because she thought it was for the public good and they only gave her two thousand for 15 acres; and I'm sure that you're not going to find that kind of price.

MS. STARNES: You're correct.

MR. DUKE: Thank you, sir.

Jackson Bowman.

Yes, ma'am.

MS. HUMPHRIES: My name is Pat Humphries and I would like to know what is going to happen if this project doesn't work. What if it's a failure?

MR. DUKE: In terms of?

MR. HUMPHRIES: It doesn't restore, the water just sits there like a big mud puddle, it doesn't accomplish anything that you set out to

do. What are you going to do with the land then?

MR. DUKE: Basically, we have a high confidence in the fact when we backfill the canals or plus the canals that the water levels will come -- restore to probably not their exact condition as they were before but largely to what they should have historically been.

We have what we've called as part of the comprehensive restoration plan program that was specially authorized by Congress for this called adaptive assessment monitoring, so we have an extensive monitoring plan that we'll go through; and if we determine that the results that we're seeing or the impacts that we're seeing are not what was intended, we will come back and make adjustments to the plan to achieve those originally intended results.

I'm sorry. There was a Jackson -- I'm sorry, sir.

UNIDENTIFIED SPEAKER: Right here, sir.

MS. HAYLOCK: I have a question. My name is Mildred Mercado Haylock. My name is on there; and my question is: If this doesn't work, which I don't see it working, also if we're going to flood everything, what are you going to do about

all the mosquitoes? There's enough mosquitoes in the area right now? Are we going to be eaten? Are we going to get malaria or whatever it is you get from mosquitoes? What's going to happen to the mosquitoes? Are you going to spray so that then all the animals can die? Because I have a lot of animals on my property, my own and others that come from the wilderness, so I don't like the spraying, but I don't like the mosquitoes either. But what happens when everything is flooded and there's a lot more mosquitoes than there is now? What are you going to do with those?

MR. DUKE: That will be part of the land management program that's developed for this area. Again, that is under way, Janet, already with the land management program to address those impacts associated with both the land use as well as the management, removal of trash and control of exotics, invasive and nuisance species that would tend to occupy those areas. So there will be a control plan that's developed for that.

Yes, sir.

MR. BOWMAN: My name is Jackson Bowman. I'm a lawyer with Brigham Moore and I'm here on

behalf of Bernie and Helen Noble and Vince Dewer (Phonetic spelling). And they own the property -- I think the water management district people know, I don't know if the Corps folks do -- they own the property that's at the extreme end of Miller Boulevard just west of 124th and 126th.

And what I want to know is: Is the grade going to change on Miller Boulevard? That's one question.

The second question is what the impact of the project is on their properties, the modeled impact. It looks to me on the selected alternative if the levee goes around their properties -- that's what it looks like -- and if the levee goes around their properties, how will they access their properties?

MS. STARNES: Is that all?

MR. BOWMAN: Finally, how will they access their properties if the flooding increases?

MS. STARNES: I did speak with Mr. Noble last week because he was not going to be able to attend this meeting.

The Noble/Dewer properties are adjacent properties that are immediately north along the

northern boundary of the Collier Seminole State Park.

We actually investigated berming their properties off much like we are the residential areas up in the northwest corner. Mr. Noble and Mr. Dewer's properties are not actually residential properties. They are not homesteaded properties.

Based on our assessment of -- because they are not a part of the Six L's berm. There's actually enough distance between the Noble and Dewer properties and the existing Six L's properties that it's not feasible to berm them off as a part of this, what we call the Six L's berm; and so we had looked into and investigated the possibility of berming those properties off.

Due to the access issues, and Mr. Dewar actually has an established mandated mitigation site on his property that we would actually have to keep wet, we determined that it was not economically feasible or reasonable to berm those properties off; and in my conversation with Mr. Noble last week, I informed him of that.

The current modeling does indicate that we would actually be flooding his properties

significantly.

And as to the access, they currently access down Miller Boulevard, which is above grade, from -- I don't remember the exact road down, but there's a point on Miller Boulevard where that road will actually go to at grade, so during wet season their access is also directly impacted by this plan.

Due to that fact, we have actually in speaking with Mr. Noble last week, and I have not had an opportunity to contact Mr. Dewar, we will be moving forward with surveying those properties and getting appraisals on them and preparing a proposal for acquisition of those properties.

MR. BOWMAN: Do you plan on condemning the properties?

MS. STARNES: No, sir. At this point in time those properties are not within the area that is legally -- the Florida Department of Environmental Protection has authority to do condemnation. That is a willing seller area.

MR. BOWMAN: But do you acknowledge that they are going to have increased periods of flooding?

MS. STARNES: Yes, I do acknowledge that.

MR. BOWMAN: Thank you very much.

I don't need comments.

MR. DUKE: Okay, yes.

MR. HAZEL: My name is Jeremy Hazel; and, you know, I know some of these people out here and we all have four-wheelers and swamp buggies and take our trucks out there. Where do you expect us to go once you flood it? Do you want us to go on the sides of the roads and have four-wheelers crossing the roads when you're trying to drive down them every day?

UNIDENTIFIED SPEAKER: In their back yard, man, that's where we're going.

MR. HAZEL: Where do you expect us to go?

MR. DUKE: I'm not sure we've made a decision to close it yet.

MR. HAZEL: Well, even if you do, where do you expect all of us to go?

UNIDENTIFIED SPEAKER: Let them go out there and get stuck.

MR. HAZEL: Yeah. Let us go out there and have fun. It keeps us out of town, it keeps us out of trouble.

MR. DUKE: Okay. Thank you.

Is that a question, sir?

UNIDENTIFIED SPEAKER: Just a comment. Same lines. You know, you talk about those 640 acres.

UNIDENTIFIED SPEAKER: We need your name, please.

MR. MENENDEZ: Mario Menendez. I live in the Estates. I have three properties and I'm close to 75.

I am concerned about the flooding; but I also use this area, my family uses it as recreation. We have four-wheelers; we like going out there, playing in the mud.

You're looking for property somewhere else. Why? You have got all that wasteland there. Open it up, charge $4 a head like they do in the state parks. That way you can hire more people to patrol it, put garbage bins out there so people can throw their garbage in it, let people use the property. It's taxpayer dollars. Why can't we use it?

We have to go -- if you have a four-wheeler, it's getting to be you have to go five hours to Ocala to ride your four-wheeler, five hours to Ocala National Forest to ride the four-wheeler.

MR. DUKE: Actually, as part of this we're

trying to show that that was our -- talk about that being addressed under -- through the land management process. We would like to note also that the water management district, Corps of Engineers, along with a host of agencies, have been working on a land management practice recreational use through what's called the Water Resource Advisory Committee to the governing board. As a result of that committee that was addressing concerns with both access, not only four-wheeler, offroad vehicles, hunting, fishing, bike riding, horseback riding, et cetera, have adopted a series of policies with principles for land use management; and that's what we're working with now to come back to you with a proposed land use plan for this area, so we'll be coming with that; and I don't have a time line for that.

MR. MENENDEZ: The land is there. Take advantage of it. You can always move the pumps. If they move the pumps down three, four, five miles south, would it make a difference?

MR. DUKE: Yes.

MR. MENENDEZ: You're still going to have to go over the Tamiami Canal. How? That Tamiami

Canal, where does the water go? That sheet flow -- the same way this gentleman was talking about 75, once you get south of 75 and, you know, the buggies make the ruts and mess up the water flow. Really? Where does the water cross over the Tamiami Trail. It can't. It goes down the canal, pumped out by the pumps, down to Miami.

MR. DUKE: Part of this plan is to provide additional sets of culverts under Tamiami Trail to improve flow across the Trail.

Getting back, Jan Jacobson.

MR. JACOBSON: Good evening, ladies and gentlemen. I am Jan Jacobson. I'm director of the Everglades Institute.

I have spent unfortunately the last few days out in the Glades dealing with one of your other cooperative agency problems, particularly the panther, so I'm -- having had two hours of sleep for the last several days.

I was particularly curious about the fact that we have brought to the agency's attention ever since the joint meeting at Homestead, Florida, right after Hurricane Andrew, which I believe Colonel Soll (Phonetic spelling) attended. We pointed out at that point that the

fundamental premise -- several of the premises were faulty. We never received any comment on that and it's been quite a number of years, so I don't really hold a whole lot of hope I'm going too hear a response now. I will get a formal copy of that sent to everyone.

But my primary concern was I noticed that the questions raised by my colleague, Mr. Pine, really weren't answered; and I hope the record here would indicate what those questions were. But was there a reason they weren't answered? The first one got a partial answer, but the other three weren't.

MR. DUKE: I would be happy to try and answer the rest of them.

MR. JACOBSON: In that case I would like to yield the remainder of my time to him if he's able to make it back in because of the heat.

MR. DUKE: Okay.

MR. JACOBSON: Thank you.

MR. DUKE: Sure thing.

Deb St. John or Debbie St. John? Leah Lemaster. Jody Flores. Pat Humphries.

MS. HUMPHRIES: My name is Pat Humphries. I'm on the board of the directors for the Golden

Gate Estates Civic Association; and the Golden Gate Estates Civic Association supports the restoration concept but does not support this project. We are against the eminent domain process for Mr. Hardy, the lack of a guarantee of public access to the land and the inability to sink wells for drinking water for Collier County. We therefore do not support this project as it stands.

And this comment generates a question. In the event that Mr. Hardy has to vacate his land, what are you going to do with the excavation site? Are you going to mine it for fill, are you going to fill in the ponds or are you going to leave it as is?

MR. DUKE: You want to answer that, Janet?

Basically, the intent is to restore the area. We'll be removing as it says in the plan some 227 odd miles of roads, filling in canals, cross-drainage, et cetera. This would be one of those areas that that would be also done to restore it back.

MS. HUMPHRIES: You're not going to use that area? You're not going to --

MR. DUKE: Mine it, no.

MS. HUMPHRIES: -- mine it, you're going to fill in the ponds, the existing ponds?

MS. STARNES: I don't know that we've determined that we would actually fill in the existing pond due to the fact that that is just going to require even more fill from somewhere else to do that.

One thing that we have looked at and are considering doing is we're only going to plug the canal, so there'll be little ponds kind of all over there and over time they'll naturally fill in.

One thing we are considering doing with the site that's already been mined is actually changing the slope so that by changing the slope, you'll actually make it a much shallower mine and you will actually open it up so that it's more like a lake, a much shallower -- because it's 28, 25 feet deep now. We would actually -- by pushing in the sides, you can actually make it considerably shallower and much more appropriate for aquatic kind of habitat.

MS. HUMPHRIES: So you would not mine it, you would just make the ponds --

MS. STARNES: We will not mine it.

MS. HUMPHRIES: Just make the ponds shallower?

MS. STARNES: That's our current thought.

UNIDENTIFIED SPEAKER: Not going to build golf courses?

MR. DUKE: No.

Mr. Andrew Lissiardi.

MR. LISSIARDI: I'll pass.

MR. DUKE: Thank you, sir.

Christian Mogelvang.

DR. MOGELVANG: I've had my say.

MR. DUKE: Oh, sorry. Okay, sir. Thank you.

Nancy Payton.

MS. PAYTON: Good evening. Nancy Payton, representing the Florida Wildlife Federation.

I'm here to support on behalf of the federation the Alternative 3-D and to express appreciation to all the agencies and individuals who worked very hard to develop this plan; and there was significant public input and many opportunities for the public and interested folks to participate, and again we appreciate that.

We do have two comments. We will be submitting written comments with National

Wildlife Federation; but I do have two comments that I would like to have on the record that are concerns that we brought up at every forum that has addressed Southern Golden Gate Estates restoration. And that is that, of course, we understand the need to maintain flood control levels and -- flood control and not to increase flooding in Northern Golden Gate Estates; but we're concerned about dewatering and just the opposite and we want assurances that the pumps will not be used to dewater Northern Golden Gate Estates or other areas, surrounding areas.

And that's implied, I think, in the document we're reviewing now; but if you could be more explicit, we would have a higher level of comfort with the plan.

And also we would appreciate if it was very clear in the plan that there will be no straws into Southern Golden Gate Estates. As this process has evolved, it has been a restoration process and we have been told for many years that what flows into Southern Golden Gate Estates now or falls on Southern Golden Gate Estates is nature's and won't be drained off for residential or agricultural purposes; and so we would like

those assurances again and also that Southern Golden Gate Estates in the future won't be looked at as a wasteland, as I heard one gentlemen refer to it, as an area that we can use for flood control and abandon the restoration efforts that we've paid a lot of money.

And I notice that the cost of Southern Golden Gate Estates restoration has gone up $20 million since the report was published and today it was $20 million higher, so I think it's very important that we move as quickly as possible to get our money's worth.

Thank you very much.

UNIDENTIFIED SPEAKER: We'll come ride in your back yard. How about that?

MR. DUKE: Next will be Kernie Kelsey (Phonetic spelling) and Keny Sheehan.

MR. SHEEHAN: All right. By shutting this down, where do you expect me to ride?

Keny Sheehan.

All right. By shutting this down, where do you want me to ride? On the golf courses in Naples? I mean look how many golf courses there are. You guys want to shut down one spot that I go? For what? Just so like shut me out? All

right, there's tons of people that use that.

The one lady said, yeah, that one road that connects into Miller. Yeah, you guys don't even know the land. I mean you guys want to shut something down that you guys don't have no clue about who rides it or what.

That's pretty much it. That's all I want to say.

MR. DUKE: Okay, thank you.

Karol Montalto.

MS. MONTALTO: Just like it's spelled, Montalto.

MR. DUKE: My name is Karol Montalto, M-O-N-T-A-L-T-O; and I have written down a few notes because there's just so much to cover here.

These are a few of the statements that I keep hearing repeated.

We ask questions about things and we get assurances that you have a high confidence and we say are you going to do this and you say we won't. Well, you won't, but what agency will? Okay. And we hear not at this point, it isn't in the plans. Well, all the land that was bought in the Southern Golden Gate Estates at the time that it was bought, it was planned to have people live

there, so now that plan has been changed, so what confidence can we have that what you're telling us today won't be changed again?

And you're talking about public access. Recently I read an article in the Golden Gate Gazette and it was about ATVers, which I'm not one, but I respect their right to do it because I think it's good, clean fun -- but not clean, but fun, but -- and the article -- if you will bear with me one second. I forgot to pick it up. I just want to read it verbatim.

The article talks about closing down public land; and I understand from some of the fellows that this is a normal procedure, they do that and as a government official they have a right to do that. That's all well and good. But the time period that they are doing this bothers me. They are doing it for a 60-day period, which just happens to coincide with summer vacation, when the kids are out of school and looking for a place to play. And I know my kids. They are up at 5:00 in the morning. They go to high school. By the time they are done with sports and homework, they may be asleep by 10:30; and that doesn't include any extra time. So summer

vacation is a very important time for them.

But in this article the bottom part says, "Officials say RV use in this preserve is minimal at this time of the year and the closure will inconvenience very few people and will benefit the resources."

That seems to be a common thread with everything that's out here. We're the bad guys. Yeah, it's Big Cypress, which I don't have an opinion on that part of it. It's the principle of the thing. It's the disrespect for these people's rights and the fact that they are not even taking into consideration the time period that they are using and the way that they write it. It just -- it reminds me of a meeting that we had gone to at one point where one of the ladies representing one group or another got up and said well, you people, you know, you bought the land out there, it's going to flood, you should have expected that. Well, that's not what we expected. We bought it to live there.

And as far as the input, Nancy had mentioned that there were a lot of meetings and there was a lot of chances for public input. Well, were those meetings noticed -- notified to people with

a letter like was notified to all of us about today's meeting? Nobody over here even heard of the letter. I didn't get a letter. I would think that it would be a personal thing. And I have been to a lot of meetings, put my name on a list to get notified about things that are coming up; and I haven't got notified about stuff like that in the mail where it would be sure to get to me.

But I don't know. I just feel like we're being treated like a group of children and the answer that we keep getting is okay, all right, write it down and we'll review it; or we're here to help you, this is the best thing, we have a high confidence. But I don't see any real concrete answers to this and it really scares me for the future of my property that is out there because I live just north of the area and I don't flood and it kind of bothers me the terminology that there won't be any increased flooding in Northern Golden Gate Estates and I think I would like it better if it were written that it wouldn't cause flooding.

That's all.

MR. DUKE: Okay. Thank you.

Yes, sir. You have a questions?

MR. KENNEDY: My name is Sean Kennedy and I didn't sign up to actually speak at all today because I really didn't think I was going to hear as much B.S. as I have, so I'm going to say this before I leave; and I think everybody in here is --

MR. DUKE: Is this a question, sir?

MR. KENNEDY: No. This is a comment. We're in a comment section at the moment.

MR. DUKE: Did you fill out a card? I'm going by the list as they were turned in.

UNIDENTIFIED SPEAKER: Let him speak.

MR. KENNEDY: You want to shut me up just like you want to shut up the rest of Naples.

MR. DUKE: No. I want to be courteous to the people that filled out a card.

UNIDENTIFIED SPEAKER: We don't care.

MR. KENNEDY: I'm just trying to get to the point right here.

MR. DUKE: You wish to donate your time?

UNIDENTIFIED SPEAKER: We don't care. Let him speak.

MR. KENNEDY: Nobody here really cares. We will stay here until three o'clock in the morning

if need be.

UNIDENTIFIED SPEAKER: Why are you in control? Why are you in control?

MR. DUKE: Please sit down, sir.

UNIDENTIFIED SPEAKER: Why have you got so much power that you decide who gets to speak? Why do we got to bow and pay homage to you?

MR. DUKE: You don't. I'm just doing down the cards.

UNIDENTIFIED SPEAKER: Let the man speak.

MR. DUKE: Your call.

MR. KENNEDY: My final comment before I leave, you have said on numerous occasions that you have not made some decisions on other areas of concern that are affected by this project. Well, if you haven't made the decision, then why are you here today? Why don't you go out, figure out what you're going to do, what is going to be affected overall by this whole project, figure out what it's going to be, where these people are going to be able to ride their buggies, what exactly is going to be flooded, how exactly these people are going to get out of their properties if by any chance we do have a flood, once you figure that out, then come back here.

MR. DUKE: Mr. Ty Agostan, Agostan, Ty Agostan.

MR. AGOSTAN: You should probably pull a number of names so they could queue.

Good evening. My name is Ty Agostan, and essentially I don't trust you. Apparently you have a lot of company. You claim expertise, you don't provide proof.

To be honest with you, I'm from New York City; and I remember the days when Florida advertised come on down. There were 19,000 families in those southern blocks that you people hustled. There was a small Cuban guy who was sitting next to me at a County Commission meeting. He had tears coming out of his eyes. He was saying I paid $10,000 for my five acres. They offered me eight hundred. Now, I understand that's reasonably common.

Now, beginning back to my objections, you know, there was an entrance and exit on Route 75, which I understand is a federal project; and while you claim expertise, you have to shut that exit down. Is that an indicator of your expertise? I mean apparently the start off of this plan was wrong to begin with, so what type

of a degree of certainty you have?

The lady sits there, very flippantly talking about well, we do this and we do that, but doesn't put it in writing. You have no idea whether she is committed or does she have the authority to be committed because, as I understand, and I have limited knowledge in the area, only the Governor of the State has eminent domain powers. Now, the Governor does authorize various departments to use that eminent domain; but as far as I know, only he has it. And this Mr. Hardy issue apparently proved that they essentially passed on eminent domain.

So what I would like to know that you are sitting here kind of dragging this thing on until people get tired, they have to go to work, I don't, so it doesn't make a whole lot of difference; but you're losing your people and you're kind of very casual here, willing to lose them, because you really don't want to listen to them.

UNIDENTIFIED SPEAKER: And we can vote.

MR. AGOSTAN: You don't get a vote here, my friend. These are the guys who's going to talk to the Congress and their recommendation will go.

And I am not exactly sure -- my name was on the Army Corps of Engineers mailing list. I never got any notification of this. I was on their e-mail list. I never got an e-mail. So you guys, if I took this very seriously, would be hustling me. Besides me, how many other people are you hustling?

So again I just want to express my distrust at your current process, and it's not very open and not very trustworthy.

Thanks.

MR. DUKE: I need to take an administrative break here to take care of some administrative deals with our recorder. Ten minutes, we'll resume.

(Whereupon, a brief recess was taken.)

MR. DUKE: If everybody could grab a seat and let's get started back. I know it's hot and I know it's late. Unfortunately, this is the largest facility we could find in the area. I appreciate your indulgence and patience getting through this tonight.

A question was asked during the break as we settle down about what do we do with these comments.

UNIDENTIFIED SPEAKER: Can we take a seat? Let's take our seats, please.

MR. DUKE: Mr. Fred Tarrant. Yes, sir.

MR. TARRANT: Okay. I want to thank you for allowing me to speak out of turn. I appreciate that.

For the record, my name is Fred Tarrant. I live at 175 3rd Street South and I'm proud to be here speaking for the Taxpayer Action Group of Collier County.

It's generally thought that the American Indians were a pretty primitive, simple people; and in many respects they were. But it's a documented fact that they had enough brains that they did not defecate where they drink. They didn't do that. Very few animals do that. But the Department of Environmental Protection and other agencies in the state have already issued permits to Collier County to install a wastewater ASR well that would allow the pumping of treated sewer water, which contains toilet water, you can imagine whatever you can flush down the toilet, into an ASR well for partial recovery; and they are doing this right -- naturally right next to a beautiful residential neighborhood, Carlton

Lakes.

But it's amazing to me how money drives all of these issues. When you really get behind it and you look at it, it's all about money. It's not about protecting the environment. It's all about money. It's all about keeping the giant juggernaut, development juggernaut, rolling.

The last point I wanted to make -- and the Taxpayer Action Group is taking a very active interest in this potential contamination of our natural underground water supply and the degradation of people's property because of this; but the last thing I wanted to point out -- and more to the people who are here this evening attending. Really, folks, you came here tonight to address the subjects. Most respectfully, I would suggest that you are basically jousting with windmills and in the end I don't believe, with all due respect to the gentlemen that are here and ladies and gentlemen, in the end I do not believe that your recommendations and suggestions that you make here tonight will have any more effect on the end result than a mosquito on the posterior of an elephant.

Having said that, I will also suggest to you

folks who are here tonight that you are here tonight because your five servants who have forgotten the fact that they are your servants -- I'm referring to your five Collier County Commissioners, who receive about $65,000 a year in benefits -- these County Commissioners have thrown you people to the lions. That's why you are here tonight jousting with the Corps of Engineers and the water management people and the DEP people. If your Collier County Commissioners really cared about you and your property rights, they would be here in force tonight; but more importantly, they would have been in force, they would have been there for you in force long before you got to this stage.

Now you may say oh, I like my County Commissioner; oh, he's a great guy; I'm going to help him get reelected. Well, you go right ahead and help him get reelected; but you just ask yourself: Why are you here tonight? You're here tonight because the Collier County Commissioners threw you to the lions and you don't realize how much power the Collier County Commissioners have.

They have a legal staff of about ten or 12 lawyers. They have an annual budget that's

approaching $1 billion. They have all kinds of power and influence. But those five County Commissioners, my friends, sat there a year ago and voted for transfer of development rights that stripped away your rights to do as you would like to do with your own property that you pay taxes on. And those County Commissioners had -- there were 38 speakers there in the Commission chamber and they were pleading with the Commissioners not to do that, not to do that; but they did it because it was politically expedient for them to do that. That was the Republican thing to do. That was the Jeb Bush thing to do. That was the Republican Executive Board thing to do; and the thinking about how they are going to get reelected and where is their campaign money going to come from. Eighty or 85 percent of it comes from the development community, comes from the land use lawyers.

You have been had, my friends. The County Commissioners are the ones that you need to drum out of office and get people that listen to you. They have thrown you to the lions.

Thank you.

MR. DUKE: Thank you, sir.

Mr. Richard Gatti.

MR. GATTI: Fred's a good friend of mine and I can say this. He's a tough act to follow.

My name is Richard Gatti. I live at 104 Newport Key, Port of the Islands, Naples, Florida, 34114. I'm president of the Port of the Islands Community Development District; and for those of you who may not know, that's a quasi-government agency set up to handle the infrastructure at Port of the Islands.

I don't want -- I have a written statement, but I don't want to make any issues tonight. The only thing I want to share with you is at the port we're concerned with three issues. One is the location of the berm; secondly, we're concerned with preservation of our irrigation source; third, we're concerned with access to our wellfield. One of the areas in question is going to be flooded, that's the access to our wellfield.

The only thing I'm looking for tonight is to establish as part of the record the commitment from Mr. McMillen and Janet to work with us to a reasonable solution on all three of these issues.

Thank you.

MR. DUKE: Thank you, sir.

Miss Susan Murphy.

MS. MURPHY: Hi. My name is Susan Murphy, M-U-R-P-H-Y; and I just have a couple quick things to say.

In Real Estate Plan Appendix F to the plan you have very little information in there on what you're going to be doing with Jesse Hardy.

I spoke with Jesse earlier today and at 4:30 he said to me, and this is a quote, "I haven't signed nothing, I haven't agreed to nothing, nothing is settled. The Governor would have to put eminent domain on me and he hasn't done it." That's a quote.

Now, I would like somebody to elaborate on that. Thank you.

MS. STARNES: Dennis, do you want me to handle that?

MR. DUKE: I'm not sure.

Yes, please. This is a state action.

MS. STARNES: The acquisition of Mr. Hardy's property will be by the Florida Department of Environmental Protection. They are the agency that is acquiring all of the properties in the South Blocks. The Governor and the cabinet voted

I believe it was last month or the previous month -- I can't remember --

UNIDENTIFIED SPEAKER: May 25th.

MS. STARNES: -- May 25th -- to go forward with condemnation, eminent domain, in the event that an agreement is not reached by August 31st, 2004. If an agreement is not reached with Mr. Hardy, between Mr. Hardy and the Florida Department of Environmental Protection in terms of acquiring his property, then the State of Florida will file for condemnation in a court of law.

MS. MURPHY: Can I ask the question: What efforts are you making right now for -- to settle this?

MS. STARNES: I do not represent the Florida Department of Environmental Protection.

UNIDENTIFIED SPEAKER: What efforts are being made?

MS. STARNES: And I'm going to be perfectly honest. I have not checked with the folks that do -- are heading up that acquisition. Judy Warrick is the individual that is actually overseeing the acquisitions. Her name and contact information is actually on that

information sheet; and I do not know if they have had any meetings since the action by the Governor and Cabinet.

Negotiations for acquisition of property is actually considered excluded from public review. It's actually considered confidential, so Judy can't share that information with me, so I don't ask.

MS. MURPHY: But you will be putting this information in your --

MS. STARNES: There will be no reference to Mr. Hardy's property or the status of his acquisition in the real estate plan because it's no different than any of the other acquisitions in terms of the real estate analysis, which is that our actions were going to cause a take, we were going to legally impact his properties to the point that we did not feel that they were usable, so therefore we were going to have a take, so we have determined that an acquisition is needed. So just as we've identified all of the acquisition information in general in the real estate appendix, it would be within that general information. It won't be specifically referred to, no, unless I'm mistaken.

Is Michelle still here?

Then I accurately stated the way we will handle it in the appendix.

MS. MURPHY: Now, the time frame that we're talking about, all the comments to this have to be in by June 28th; is that right.

MS. STARNES: Yes.

MS. MURPHY: Okay, but the -- whatever is going to happen with Jesse may not happen until August 31st; is that right?

MS. STARNES: The acquisition of that property, the actual condemnation may not occur until after August 31st if they do not come to settlement prior to that. If they come to settlement prior to that, we will be notified of what that agreement is in terms of total dollars so that we can adjust our costs. That is the only thing it affects is the cost assessment.

And we have got a current estimate already in there, so we aren't anticipating having to do a major adjustment.

MR. DUKE: Seldon Easterly. Diane Carroll.

MS. CARROLL: Good evening. My name is Diona Carroll. I'm the general counsel for the Miccosubee tribe.

MR. DUKE: Sorry, Diona.

MS. CARROLL: That's all right.

MR. DUKE: Comes from reading the cards.

MS. CARROLL: It always draws a smile when I stand up for one reason or another.

The Miccosukee tribe of Indians of Florida are the most assertive, strongest, long lasting of all advocates for the Everglades. They have been advocates for decades for restoration and protection. They are the only people that live in the Everglades.

The tribe owns over 800 acres of land in the Southern Golden Gate Estate area. That land is used for low intensity purposes, for cultural harvesting, for herbs and for palm fronds and other components necessary to build chickees. This use is in danger and we have been working for a long time to have this land taken into trust by the federal government and now at the end of the process we're being studiously ignored.

We're studiously ignored in the EIS and in fact there are grave inaccuracies about what's going on.

In the section of the EIS relating to

cultural resources, they fail to even recognize the tribe owns land in the area and that on that property are archeological sites. We have done archeological surveys and we're simply not -- we're not getting a lot of help.

In the beginning DEP started the process to try and purchase the land. The tribe was compelled not to sell the land to DEP. This is because federal law prohibits the land through the Indian Nonintercourse Act from being transferred. 25 USC Section 177 says we can't sell it.

We also have the cultural requirements that, as you might guess Indian, tribes have been moved and moved and moved and moved and the Miccosukee right along with them, again and again and again, always wherever -- the Indian tribes get put where people don't want them, stick them out in the swamp. When it becomes inconvenient to have them there, they get moved again.

In any event, the result has been that the Department of Environmental Protection has instituted a taking proceeding. This is completely inappropriate and it doesn't take into account the tribe's sovereignty rights. This

taking procedure is in the face of the fact that the tribe has offered to transfer the land to the federal government to be used in conservation purposes in the current purposes that the land are used for.

So I suppose the first thing I would say to you is we need to do something about this. There is a better way. It's ridiculous for this to end up in multiple court cases. It's already in two. It's likely to end up in more.

My second -- we'll be giving detailed comments on a lot of other issues.

We also have -- you know, as I said, we're very significantly committed to appropriate restoration and we have some profound concerns about the restoration which is planned to occur in the area. For instance, we have concerns about the water quality in the area. We want to see this land healthy and we're concerned that it's not going to be under the design plan.

It also appears that the cart is in front of the horse. DEP has -- is buying and condemning significant land before you finish your environmental analysis. NEPA, the Everglades -- excuse me -- the Endangered Species Act and the

APA and WRDA we believe are violated by the process as it occurs right now.

What is happening is that the decision is being implemented prior to the decision being made and analyzed. We will detail this further in the future, but I hope that you will take more serious the consideration of the trust responsibility to Indian tribes.

We don't feel we have been properly consulted. I actually sent some of my people out to try and further consultation. We posed a lot of questions, we never got any kind of response; and we feel like that trust responsibility to the tribe is not being honored.

Thank you.

MR. DUKE: Thank you, Diona.

Gary Davis. Doug Rankin.

MR. RANKIN: Yes, sir.

My name is Doug Rankin. I live in the Northern Golden Gate Estates.

I previously identified organizations I'm affiliated with.

The first thing I want to raise to this meeting tonight is that I believe that in order for this to be a proper meeting to meet your

requirements, it has to be a lawful meeting. The room in which we are engaged in this meeting I have given to understand has a fire code limitation of 100 people. Until about 8:40, and it is now 9:11, this meeting started before seven o'clock, this room I understand had in excess of 300 people in it and thus was in violation of local fire codes and should not have been had.

Also I understand from numerous people who were outside, more than 150 people were turned away or had left because they simply had no place for them to enter the room and no place for them to be in the hallway.

This is clearly -- a room was clearly chosen inappropriately for the anticipated turnout of this meeting. The area you are affecting is larger than most counties and larger than at least one state. To require a room that this hotel management informs me they were assured by a member of the Corps -- and who was the member of the Corps that assured the hotel that it would be less than a hundred people in here? Who was that?

MR. DUKE: It wasn't identified.

MR. RANKIN: Okay. Well, the hotel

management informed me earlier that they were assured there would be less than a hundred people here. That is obviously an unrealistic expectation for an area -- this county has 330,000 people in it. You are affecting an area in the 5th District that includes approximately forty or fifty thousand people minimum. To have -- to use -- to engage a room that has a maximum capability of 100 people is clearly illegal, inappropriate and unreasonable.

I know earlier hotel management was threatening to call the North Naples Fire District to have this meeting shut down because of these difficulties.

The next situation I want to raise is the items that I raised before. I have not heard a good explanation of emergency prevention of flooding in the Northern Estates under the kind of conditions that are well can be expected in this area. This was raised years ago at the meeting that took place in Golden Gate City and appears to still not to have been adequately addressed.

Also, I have heard nothing so far this evening either about the emergency egress; and I

helped write that agreement with the county, so I'm familiar with what it says. And that -- I don't see this filling this at all.

Janes Scenic is often impassable. That gate situation is clearly impassable most of the time and especially by the vehicles mostly driven by people who live in that area, and you're talking an area of three or four thousand people.

The other matter I want to bring up that was -- and I'm afraid I'm going to have to disagree with Nancy Payton earlier. We are approaching or will be approaching when this community reaches build out a water crisis. Currently the City of Naples, Collier County and Golden Gate Estates all get their water from the same place, underneath Golden Gate Estates. I believe that Nancy Payton as well is not well placed and that this plan needs to include the withdrawal of potable water from this area eventually. The withdrawal of the potable water here is minuscule compared to the amount of water that's going to be flooded into this land and will protect the environment of other areas of this land.

I can understand many of the people that are

now gone's attitude regarding this situation. As far as the State, they were told over a long period of time there would never be eminent domain and then there was eminent domain. For years our County Commission found much -- I'm afraid I'm going to have to disagree with my friend Fred -- the County Commission was pretty powerless in this situation. They tried for years to force the State either to do this or not do this while they slowly squeezed people out of their land and finally were successful somewhat in that and protecting those people's rights.

And as far as the Army Corps, you're telling me we have professional engineers here that are assuring this. I remember a few years ago, no offense intended, situations involving the Ohio and Mississippi River where a large number of people in the Army Corps justified to Congress under oath economic feasibility studies on numerous projects up and down those and other basins that were later found to be unfounded.

And I was raised by the code that I believe is at West Point, although I never attended that; and I found in my life that trust is a very hard thing to get, a very easy thing to lose and a

very hard thing to get the second time.

And I understand some of what I'm hearing. Also, I am very much concerned and I have not had a chance, even though I'm an attorney, to review this plan with sufficient clarity to find out if you can continue to do what I have heard.

I have attended multiple meetings over this over a period of years; and each time I have attended this meeting I have heard from forestry, which is a lot of what these people here were concerned about, about use of this area, oh, we're just a few months away from coming up with that plan. Now it seems the plan is going to come up after all these comment periods are over, even the September one; and then it's going to be dropped on these people after all the ability to comment on this part of it.

You cannot build a house, finalize how you're going to build the house and then later on decide how you're going to use it. That makes no sense to me at all; and, like I said, I haven't had a chance to see if it's legal or not, but be that as it may, there is clearly some difficulties here and I'm thoroughly concerned about the impact this is going to have on

neighboring areas.

Like I said, I've spent my entire life -- the other thing I'm very concerned about, this entire Everglades restoration.

A lot of people have forgotten why all these plumbing systems were put in. My parents lived -- my grandparents lived in Bradenton years ago; and after -- right after World War II, there was not a hurricane, there was just a series of thunderstorms and most of the west coast was under water, anywhere from two to six feet, for a period of weeks. That is what caused a lot of the systems that are now being taken out or modified to be put in. I know there's nobody around left that was here back then, and I hope to God that you all have had a chance to look back at why these systems were put in in the first place. I will tell you that happened at a time when there were twenty or thirty thousand people in each of these counties that now hold hundreds and hundreds of thousands of people.

I am also real concerned about these dikes protecting people. There was the 1926 storm that cut across the center of this state, killed everybody that lived inland of Fort Myers at the

time. Then there's the 1928 storm that was the end of the last great Florida land boom. It went into Tampa and left Miami. On its way through that course, it broke the then existing dikes on Lake Okeechobee, which were a lot more substantial than what you're building, and killed everybody who lived below that lake.

I am very concerned that this thing looks real good on paper, although I understand from talking with people in the audience the gentleman's property who was mentioned earlier that is now almost being invited to sue for inverse condemnation was assured until a few months ago that he wouldn't be flooded. If we have that kind of drastic, 180-degree turns in this alleged planning, I have some real concerns.

And I also understand the other gentleman that was up here, "Show me the science." And Dr. Dean O'Dell, he gets on there, everybody wants to do these little folk remedies. Show me the science that it works.

If the people that are more educated in science than I am, and I do have somewhat of a background but not much, can't answer that question or haven't been answered that question,

I wonder if there is an answer or is just we think it's going to work.

Now, those of us who live on seven acres out in the estates and have all these nice little animals running around their houses as I do, and my other house is up on top of a mountain on several acres, and who has all these animals running around there are not anti-environmentalists. We like the environment. We understand that this process needs to happen.

But I think people need to know what the heck they are doing before they do it.

Thank you.

MR. DUKE: Thank you.

Vanessa Malstrew. Bill Lohta.

UNIDENTIFIED SPEAKER: He left.

MR. DUKE: V. Condello.

He already passed. Okay.

Bob Glenn. Sari McMahon, mahan.

MS. McMAHON: McMahon.

MR. DUKE: McMahon. Okay.

MS. McMAHON: My name is Sari McMahon, S-A-R-I, M-C, capital M-A-H-O-N; and I'm here tonight to speak to you as a private citizen and not as a representative of any of the groups to

which I belong. And what I'd like to talk about is in the Everglades restoration, what I'm not hearing is about the soil samples and quality assurance that the ground is safe.

Back in 1996, St. John's River Water Management District was involved in a restoration project around Lake Griffin. After spending $12.6 million purchasing muck farms to reclaim them as part of the lake that they used to be part of, alligators began to die and there was a significant reduction in the number of eggs they laid and then only four percent of them were hatching. Soft shell turtles and certain species of fish and birds were also effected. Many of them are now sterile.

In '99 another project reclaiming 4,000 acres of muck farms around Lake Apopka resulted in more wildlife deaths. This 103.5 million dollar project, St. John's District was responsible for flooding the farm land to recreate a marsh on the north shore of the lake, which attracted tens of thousands of birds. More than a thousand of these migratory birds died. Hundreds of them were our rarest and most fragile species; and, again, the survivors were left

sterile and have other reproductive problems.

They bought this land, knowing that it had high levels of pesticides, most of which had been bands in the seventies or eighties, not because they were harmful to humans but because of the problems that they caused in wildlife. Even though toxicologists determined that the farms would pose a hazard not only to the fish in the lakes but to the birds that ate them and on up the food chain, the district, St. John's River Water Management District, went ahead and did this project, conducting only 355 soil samples, or one for every 37 acres.

Both of these projects were environmental disasters, killing a lot of wildlife and having long lasting reproductive problems that are ongoing to this day.

In the meantime, the species included in -- that were killed were bald eagles, wood storks and other endangered species, including the American white pelican and other large fish-eating species of birds.

One of the reasons they gave for not conducting the appropriate and proper soil samples was the expense. I personally don't

understand how we cannot afford to do the soil samples.

The streets east of Naples is what Golden Gate Estates was called many years ago. I grew up in Florida. I'm a lifetime resident. I can trace my roots in Florida back to almost the Civil War; and even back in the seventies, growing up in Fort Myers as a teenager, everybody knew that the empty streets east of Naples was the place to dump anything you wanted to get rid of. God only knows what's been dumped out there.

The pollution around these two lakes in Central Florida, both of these lakes, Lake Apopka and Lake Griffin that I was speaking about, are in Lake County, Florida, just north of Orlando; and they knew what they were getting into with these properties. They knew there had been farm lands there, they knew there were pesticides there; and still they had environmental disaster.

Here we're going into an area where we don't know what's been put out there over the last 45 years; and in the meantime I say that we need a plan that provides data to determine which areas are safe to reflood, those that would require additional remediation before doing so and those

where alternate plans need to be developed because the ground contamination would not -- would make it unsafe to reflood.

In the meantime, there are no state or federal rules that govern how to clean up a site that will eventually be flooded; but the St. John's District did face charges for the damages that they did, which they were able to work out with the State so that they actually were not charged with criminal offenses, but they could have been, but they faced civil fines as well.

I would hate to see us go out there and flood all of this land and then find that it was full of very toxic things and end up destroying the very thing we seek to preserve. There's only one Everglades in all the world. There's thousands and tens of thousands of lakes on the face of this earth, but there's only one Everglades; and if we ruin it, we'll never get it back.

Thank you.

MR. DUKE: Thank you.

Brian McMahon.

MR. McMAHON: I'm amazed at the dollar figure that's up there. It was $362 million when

you sent me the books two weeks ago. Tonight it's 382 million. What happened in two weeks that cost $20 million? $20 million in two weeks.

The original cost when they talked about this project two years ago was seven to nine million dollars for the restoration and $85 million in property acquisition. You guys are $182 million over budget and you haven't even started.

You understand how much money this is? Break it down. $6,500 an acre. For $6,500 an acre, this place should look like Jungle Larry's when you're done. $6,500 an acre and it doesn't benefit the residents of Collier County in any way. People are going to lose their recreational rights. We have no plan for $6,500 an acre of how they are going too recreate. We can't use the water out of it. Why in the world would you expect the taxpayers to come up and pay $382 million for this?

It just baffles me that you actually sit there and think that this money comes from Washington and Tallahassee and it doesn't come from the taxpayers. It's like some kind of free manna from heaven.

I pay taxes. It comes out of my check every week. Every time I buy a can of dog food, they take six cents. And you're going to go out and spend this kind of money on this project that doesn't do a thing for us?

I can't even begin to justify how you can sit there and look at me and tell me it's three hundred -- $6,500 an acre. $6,500 an acre. I could hire landscaper in this town for that kind of money to make this beautiful.

For this money the best thing we get out of this is wood stork habitat. That's the best thing you guys offer in a thousand page book. No reference to what this is going to do for the people of Collier County because it does absolutely nothing.

You know, last week I watched Ronald Reagan stand at the Berlin Wall and he said, "Mr. Gorbachev, tear down this wall." In one sentence he broke down the cold war, and it was over a few weeks -- a few years later. In one sentence, explained the cold war in terms that people could understand.

The only thing that I can say regarding this project is, "Mr. Bush, you have got to be

kidding."

I'm done.

MR. DUKE: Thank you, sir.

Mario Fernandez.

UNIDENTIFIED SPEAKER: He left.

MR. DUKE: Mario Menendez. Don Lester. Mark Shremek (Phonetic spelling). Don Peterson.

MR. PETERSON: Good evening. My name is Don Peterson. I'm the fire chief of Golden Gate Fire Control and Rescue District.

Our position is not adversarial with all the government entities here, but I do need to once again bring some questions to the floor and to the attention of everyone that we were there the night the -- or the day that became the night wherein the agreement was struck for the turnover of the property. During that meeting we had raised the issues about the emergency access and it was talked about briefly that Everglades Boulevard and I-75 -- I don't know if you're aware, and it was mentioned just in the last two weeks I think it was, some contact was made. PB Farradine is under contract with the State, doing the interstate improvements currently from Sarasota to the Broward County line or includes,

I guess, some of the Broward County line. We've talked with them in those meetings. They are doing enhancements, median crossovers, signage and different things; and we had brought to their attention the possibility of getting that gate resolved with the project that they are doing for emergency access.

We had discussed with the Division of Forestry and County Commissioners at the time that that -- the existing gate was inadequate for usage for full emergency access. It was basically to handle brush fires. We could get through it, and that's it. We do need enhancement of that. We would ask to move it from the northwest corner to the southwest corner. There are safety issues, concerns on the northwest corner. We've asked to -- the southwest, the traffic goes eastbound. It can be enhanced very easily.

The question we had raised and we have raised several times in smaller meetings and we continue to raise the issue -- and I have to admit I have not completely got through the 700-page document, it's been a challenge, but we did try to scan for the key words of emergency

service protection. The only thing we find in there addresses wild land fires, which the Division of Forestry takes care of.

There also needs to be addressed somehow the medical side of it, whether that's anywhere from people bleeding to the heart attacks. It is a recreational area and until you get it completely taken care of, people are going to recreate down there somehow and one of the only primary responders to that area -- it is a budget impact to us and we continue to ask to be in that process somehow of how that's going to be addressed.

Talking about the berms that we have raised the concern before. The folks that are in the area west of Miller, basically from 52nd down to about 68th, in the unblocked section there, we had asked questions before, was that berm going to cut these people off and if it was, how were they going to get access in there. The reason I mention it and the question here is that I attended several meetings with Vince Dewar and Bernie Noble and Helen, his wife; and I was in those meetings where they were assured -- and they've spent thousands of dollars of their own

money and they were assured they were not going to be flooded out. It's very disheartening to hear tonight they are going to be flooded out, that the model has finally shown that.

My concern as an emergency service provider, are those folks in that unblocked section going to be flooded out; and if that potential is there, we need some plan to be able to get in there and to facilitate whatever those folks need. Currently it's a problem during the rainy season and it's only going to get worse with the backup of water.

I think one of the things that would help everybody immensely -- again, we've asked the question because it does directly impact us -- the 650 acres for recreation. At the time that was brought into the deal, there was not an area identified. From an emergency service planning aspect, the sooner that area could be identified, potentially that would not become our responsibility anymore. Some other agency would need to be made aware of this. However, a lot of the anxiety would disappear, I think, if you could put that on the top of the pile. I understand if you don't have a willing property

seller, that's a problem; but people need an area to recreate; and as we find on the emergency services side, they are going to do it one way or the other and as a result we get stuck in the middle because they get hurt when they do that, whether it's on the regular roads they shouldn't be, wherever. And I don't mean to be cheerleading for anybody here. However, we have to pick up the pieces, so to speak; and the sooner that recreation area can be identified, a lot of the anxiety could disappear because they know they're going to be able to recreate.

Time's got to be given to us to be able to give the protection for those people that are going to be in there, whether you want them in there or not; and, again, we want to be included in the loop.

It was mentioned forestry's plan was put off again. We've -- we know Hank very well, we work with him very well. Again, it's not adversarial; however, as a provider we need to get some answers as soon as possible because until you get it completely locked in, people are going to be down there. They are going to be expecting us to go down there and find them.

Thank you.

MR. DUKE: Thank you, sir.

Cindy Kemp.

MS. KEMP: Hi. My name is Cindy Kemp and I'm with the Property Rights Action Committee; and we are taking petitions to have this public comment period extended.

We received our packet in the mail mid-May. There's not enough time to read through it, decipher all the different things and then gather the information that we need to gather, so if anybody has not signed the petition, please step over and do that and we'll make copies and then we will submit them to you.

I feel that we are the taxpayers in this room. I'm sorry all the people left, but they are hot and tired; and we're the ones that are funding this project. My husband and I, we just bought a car. We spent over two months researching it. We need the time. If this is how we're going to be spending our money to do this project, we need the time to research it to get the data. Okay? So we will be expecting an extension.

Furthermore, one of the reasons we do need

the science behind this is a lot of the validity of what is truly happening needs to be justified. This so-called sheet flow that is supposed to be taking everything back to a more natural way, if that's truly the case, why isn't the Fakahatchee Strand included in this when there's the logging trams that run through there that stop that sheet flow? That's -- kind of puts a little doubt on what is the purpose here.

This is why we want the data. We want to trace back and see where this is going; and I would urge everyone to think that this is not a done deal, that you are all the people who can say yes or no to this and these people here are our people that work for us and they want to hear from us. So it's up to us to give them the comments.

That's it.

MR. DUKE: Thank you.

That's a very valid point. The decision will be made by your representatives in Congress and the State on this project, so that -- you know, we take your comments here and consider them and include them in this document; and as we complete the final document with whatever

recommendations that go forward, your opportunity there is through your legislative representatives.

Mark Gerstel.

MR. GERSTEL: I'm Mark Gerstel from Golden Gate Estates; and as Cindy was saying and Doug Rankin and Brian McMahon, there were a lot of good points brought up at this meeting and from the younger group also. I don't think you're really ready to start this program. You have got -- from all the information I have heard today, there's a lot of flaws and I'm sure you agree there's a lot of flaws and that's why you're having these meetings, to get the public information and comments.

But the thing that really comes out to me -- I'm Cindy's husband, and we again spent a lot of money on a car and we researched it over and over and over again.

You're spending how much money for this project?

MR. DUKE: Three hundred eighty-two million up on the slide.

MR. GERSTEL: $382 million? Isn't there something else we can use this money for instead

of for this Southern Golden Gate Estates project?

Thank you.

MR. DUKE: Thank you.

Wayne Jenkins.

MR. JENKINS: Good evening. My name is Wayne Jenkins, president of the Collier Sportsman and Conservation Club.

I think it's already been kind of pointed out that there seems to me like we have got the cart before the horse with some of these plans; but one point I would like to ask, and I'm not setting you up, I would like to know: Southern Golden Gates is a part of CERP?

MR. DUKE: Yes.

MR. JENKINS: Under CERP isn't there a provision there for no net loss of recreation?

MR. DUKE: No. There's two provisions in there. One is what is called a savings and assurances clause, one addresses flood protection; and that's why we cannot adversely impact existing levels of service for flood protection that existed in the time of enactment, which was December 11 of 2000. The other is we can also not adversely impact existing legal sources of water for water supply purposes, which

gets to some of the questions here about will this have an adverse impact on our water supply. No, it can't. We have to show that -- prove that we can't. But there's not a similar provision in recreation.

MR. JENKINS: But you do have a recreational committee as part of CERP?

MR. DUKE: Yes, we do.

MR. JENKINS: Thank you.

I guess I'm going to speak to you mainly on fill tonight; and, as I said to start with, it seems like we're a little ahead of ourself.

We've already started taking out Prairie Canal or plugging it. We don't have a recreational plan in place. And one of the big concerns that I have, there's a lot of different forms of recreation. The 650 acres that Chief Peterson spoke of, that was a place for an ATV to get them off of the Prairie. There are other legitimate forms of recreation that goes with the ability to use an offroad vehicle. We have one heck of a battle right now with Division of Forestry and who maintains this land. We're fighting to -- according to their philosophy, they can't allow offroad vehicles.

This is a large area. There are other forms of recreation that have potential in addition to mudding. I think the kids need a place to go mudding; but there are also sight-seeing, camping, hunting opportunities, fishing opportunities. And I just -- I'm afraid my concern is once we go and strip these roads out, start building these berms, then we come along with a recreational plan -- I'll tell you right now if there's not fill left there for a pad where somebody can off-load a buggy or fishing boat or whatever, we're not going to get it; and I think this is something that's being sadly neglected already.

With the road system out there, the -- even if it's the at grade roads that are left in there, there should be some room for some designated trails in the vast amount of acreage.

And I guess the other thing that kind of struck me odd tonight, I'm sitting here listening that we're going to berm all the way around Port of the Islands, berm the northwest area of Belle Meade, we're going to berm around Six L Farms; but we can't berm around 160 acres for Jesse Hardy, and that's sad.

And I will close with that. I thank you for the opportunity to address you.

MR. DUKE: Thank you, sir.

Rich Haylock.

MR. HAYLOCK: One thing I notice is that they keep referring to all the computer models that they have done. Now, the initial ones came out and they came out to be incorrect, so they had to redo those and bring in more massive pumps. Now, we haven't seen anything here presented on the computer models of how the flooding is going to be and we haven't been given any information prior; and I know when Hurricane Andrew hit, all the computer models that insurance and even Corps of Engineers had were basically thrown out the window because they just -- nothing fit the size of that hurricane and the damage that it did.

Now, if we get some type of hurricane coming in this area, you know, how can we be assured that you have any computer models that are going to be able to calculate the kind of flood and damage that will occur with a hurricane of that force? Do you have anything that you have for the current model that you can give to the people

so they can take a look to see what the calculations are?

MR. DUKE: Yes, sir. We can provide you the output, the model that was used, the calculations and determinations about size of the pumps.

MR. HAYLOCK: Is that something that you have on a web site or something?

MR. DUKE: Yes, sir. Just as was pointed out, it's summarized and the tendencies -- that's a very voluminous -- if you want to go into the details, runs, outputs, we have the information on the web site; and if you would like, we can have someone show you how you can access that.

Thank you, sir. Wes Vachon.

MR. VACHON: How are you doing?

The plans to fill in the canals -- I don't know if you realize what is south of the canals. That would be 41. And let's say that, you know, we fill in the canals, right, no problem, the ground's unsettled, we get a hurricane, it's going to wash 41 off the map. I don't know if you guys understand that. That's like common sense that, you know, the water flows south towards the equator, you know. That's really common sense, I mean. If you fill in the canals,

it's just going to wash it away in the threat of a hurricane; and that's Mother Nature for you.

MR. DUKE: Thank you.

Walter Pine.

MR. PINE: My name is Walter Pine. My first comment is that you did not respond to all my questions; secondly, that you didn't adequately respond to the one that you began to respond to. Okay? Public comment is of little use if we can't get answers to the questions, where we can get intelligent responses.

The other issues that I would like to bring to your attention is we had disabled people in this audience. There was no assisted listening devices available, no Braille available, no notice on your paperwork to tell people where to resort to for those access issues. That's a basic requirement of equal access. That puts this meeting in question.

The fact that the size of the meeting was so drastically underestimated is also another issue.

As a result, I have requested that you hold another meeting, preferably within a few weeks or whatever time is necessary for the public notice under federal regulations. I know for the State

it only requires seven days.

The temperature that was in here at the time made it difficult for me to remain in here. I am a disabled vet. I am very high function; however, the failure to provide a meeting room that had adequate air conditioning, adequate facilities made it impossible for me to remain in here for the entire meeting, so even for me -- and many people left here because of discomfort and problems.

And, however, that's an error, breakdown in equipment or what, I don't know.

I have been told that you estimated that this meeting would be a hundred people, but you set up for 180. That's how many chairs are out. It seems that perhaps the comment about 180 is a little bit disingenuous because if you only believed a hundred would be here, why did you set up for 180? So obviously you were aware that this meeting was going to be significantly larger than a hundred people.

In regards to the documents that we're dealing with, they contain many internal inconsistencies. I am not going to critique your document so that you can make it stronger and

more legally palatable, I will not help you correct it; but I will expose the untruths in it. All right.

It's your duty to do it within the limits of the law and as required by the standards with which you must comply. It is also -- nowhere in that document does it explain to us where we may discover these standards. The process by which we get our substantive rights, due process rights, is not explained in there. There is no notice in there of people's rights or where to resort should they need additional information. There is no determining authority in there.

Now, these are basic things.

There is no -- on none of the charts is there a margin of error. One gentleman made a comment about the modeling. I see nothing in there that validates or makes the modeling valid or reliable. Modeling is a scientific method. Validity tells you how correct it is, reliability tells you how likely it is you're able to repeat the study; and together they give you another number called confidence rating, which allows you to be able to draw extrapolations to know if what you do in the future is going to be correct.

Now, gentlemen, I worked for the Department of State; I worked for the Department of Defense. I also know what these requirements are. I was a COR, contract office representative. I know what it takes to legally spend federal money. I also know that you haven't met those standards. All right. It's that simple.

Now, in regards to the pre-existing canals and facilities that were already on these properties, they were built for a reason, justifiable cause, governmental purposes, proper studies, all the things were properly done. The need for those facilities has already been established. When you change those canals and such, you must incorporate into the new structures those needs. You cannot just ignore the idea that a storm is going to flood somebody's property or that a hundred-year storm doesn't occur but every hundred years. Additionally, you can't ignore that when a storm comes to an area, it tends on occasion to push trees into your canals. That tends to make problems with your pumps.

You know, everything you have said here, you have come up with plausible comments and

plausible responses about some of the equipment; but, gentlemen, they have to work. If they don't work and you spend the money, you have failed to meet your duty and are personally liable. That's the way it works when you spend the state and federal money.

You have not provided adequate facilities for meetings, you have not provided requested public documents, you have not provided adequate time for study of those documents; and I would defy any of you to give a complete and thorough response to the documents we received a few weeks ago. If you ever got somebody that can do it, that's a very extraordinary individual.

Now, these meetings and these notices and these comments are supposed to be reasonable. That's typically the term that is used.

You choose a comment period that is reasonable to the volume of material that you put out. That is in fact a requirement. Failure to do so means you've failed in your responsibilities.

Notice is also a requirement. Now, there are a number of different requirements for both the state and the federal agencies. You are here

in a joint meeting. Since it is a joint meeting here in the State of Florida, Government in the Sunshine and Public Records Act of the State of Florida does apply.

While we are required to request that information, those documents and records through the Florida agency, you are also required to make sure that the Florida agency has them. That includes the scientific studies, that includes the underlying documentation, that includes minutes of previous meetings, that includes the tapes of previous meetings.

Now, I would like to see at some point where all this stuff exists. I have asked and to this point have not been responded to.

Now, there's a little thing called bad faith. That's synonymous with the word "fraud". If you act knowingly in violation of the law and spend federal money without proper justification -- I suggest you call the last head of the Department of Civil Rights for the U.S. Department of Interior, Fish and Wildlife Service. I believe he works in Montana now, okay?

Our whole point is truth in accountability.

That means proper science, proper studies, proper decisions within the limits and rights of the individuals.

I have seen very little consideration of the rights of individuals. There is an apparent disregard for the safety of the public, callous disregard, if I might add, because I see no evidence that you have studied to insure that in catastrophic events the facilities and changes that you are making would adequately provide for the safety of the public. In not doing so, you put the lives at risk and you not only create a liability for the government, you do so for yourselves, both as a supervisor and as an engineer or whatever.

I don't know what your degrees are, I don't know what -- I know what one of your positions is; but I will know, I will find out and I'm sure many in the audience -- I'll be glad to share it with everybody. I'll be glad to explain to them everything I know.

The point is is there's nobody here that is against a good and valid project, there is nobody here that is against saving of the natural resources; but everybody here is against the loss

of their personal liberties, the loss of their constitutional rights and the failures to properly inform them of the information that justifies your actions. The documentation that you have doesn't do that.

Now I will make a last comment. In your personal behaviors here today you have failed in protecting the rights of the people you serve. Ladies and gentlemen, you are public servants. In serving the public your first duty is to protect the Constitution. You have not done so. All right.

Your second duty is to obey the law. I believe there's some questions there as well, so there's really no reason to worry about all the regulations you keep quoting because it doesn't work regulation first, it works Constitution first. It works law second. The regulation comes after that.

I would appreciate that you give us the substantive information and regulations and rules that you have quoted here today. We are entitled to that. Where you claim that you are only required to give one meeting, I request the policies and procedures and laws that say that,

not the opinion. If you wish to give me opinions, please cite the laws and I'll be glad to take it to the Florida Bar and ask them if you are allowed to give a legal opinion. I doubt it. If you're a lawyer, you have that right; if not, get a lawyer.

Now, in regards to the interpretation of those laws, I would recommend in the future that you do as I advise everybody else and that's seek legal counsel and have legal counsel properly respond.

That is the sum of my comments in regards to this process simply because I cannot make an intelligible response to the substantive information in your documents because you have not allowed me to. You have created a situation whereby the average citizen could not reasonably be expected to respond to the issues contained in the document you provided for this meeting.

Thank you.

MR. DUKE: Thank you, sir.

Ms. Lyndsey Black.

MS. BLACK: I'm not going to stand up here and like babble about scientific stuff to you guys because I don't know anything about it; but

I'm pretty confident that you guys were all young once and you all had somewhere that you went to let loose because you worked or did whatever. I go to school full time, I work full time; and I have one day a week that I can go do what I want to do. And I don't know -- it sounds to me like none of you guys live in Naples. Don't know where you live, honestly don't care; but it's an expensive city to live in and, you know, I would rather go spend an entire day, maybe put ten bucks of gas in somebody's vehicle, in their ATV, than spend like 30 bucks to go sit for two hours and watch some stupid movie when I can be outside enjoying the weather I moved down here for with my friends having a good time, not hurting anybody or anything, and be in that place where I like to be, where I'm sure all you guys liked to be when you were young.

I mean I don't know about sheet flow and I don't know about this or that; but I know that when I'm out in that place that you want to flood and take away from everyone that was over there, that I see wildlife out there, I see plenty of birds, I see plenty of plants that I don't see here in the city where they have built plenty of

gated developments and taken away all of the natural sheet flow and whatever from those areas.

You know, I mean no one goes out there but us. I mean I don't know if any of you guys have actually taken the time to go out there and research the areas or spend some actual time and appreciate the areas that you want to take away from all of us that go out every weekend and do appreciate, but there's an entire group of us and a bunch of people that couldn't make it because they are working or they're in summer school and they're studying, trying to better themselves.

And, you know, we're not asking for much. We're just asking for you guys to take a little consideration and think back to when you were young and you had that one place that you liked to go to pass the time and not spend all the money you worked so hard for; and like, I mean, when you're my age, money isn't everything; and from all I have been hearing, because I sat through your entire meeting, and all I keep hearing is well, this is going to cost this and this is going to cost this. Well, why don't you guys just take ten seconds to open your eyes and look at what you're actually doing to a whole

bunch of people and not just people that appreciate it for its recreational like qualities, but all the people that live out there and are freaking out because they could wake up one morning and not be able to leave their homes because their vehicles will suck up too much water because their front lawns are flooded and then they have to pay to get their engines fixed.

Rather than look at the money, just take a second to think of all the people in the cities where you guys don't live; but, you know, I mean, put yourselves in our shoes. Not just the kids that go out there to have a good time, but the residents of the areas that you're essentially going to completely screw up.

I mean it's an expensive city. It's expensive to live places where you don't have to worry about this kind of crap and the people that may not be able to afford those places -- like my family can't afford to live in Port Royal; but in Port Royal they never have to worry about anybody coming and flooding their front lawns. Like just take a second to just think back to when you were 19, 20, 18, whatever, and think about what you liked to do and then consider what it's like to

have somebody just basically come over and be like oh, we're just going to take that because of the sheet flow that we built a highway through. Just take a second to do that.

MR. DUKE: Thank you.

That's all the comment cards I have. Someone else care to make comment?

Yes, ma'am.

MS. WHITBECK: I'm Peggy Whitbeck.

I would just like to make a suggestion that if you have your future meetings or when you have your future meetings that if you would let the associations know in the area, you can get that through Jim Coletta (Phonetic spelling). He has an advisory meeting for all the associations.

I happen to be the treasurer and secretary of the Northern Belle Meade Association, what's called the Frangipani Agricultural Community Civic Association; and we would then let all our neighbors and our members know and we could get the word out a little better and maybe you wouldn't have so many hotheaded people saying we didn't know about this, we found out about it at the last minute.

Okay?

MR. DUKE: Thank you.

And also if you have an idea for more accommodating facilities, we'd be happy to hear about it.

UNIDENTIFIED SPEAKER: About the auditorium?

MR. DUKE: Please.

Anyone else?

Okay. Well, again, after this meeting is over, I would like to see you if I could a minute about your petition that you're collecting.

And with that, I believe if that's it, that concludes our meeting.

Thank you all for coming. We'll take your comments.

If the extension is granted to the comment period, you will be notified or receive notice in the paper about that; and that should be out shortly after we get the documentation and consider it.

Thank you. Have a good evening.

STATE OF FLORIDA)
COUNTY OF LEE)

I, John F. Martina, Jr., Notary Public and Contract Court Reporter for the Circuit Court of the 20th Judicial Circuit of the State of Florida, do hereby certify that I was authorized to and did stenographically report the foregoing proceedings and that the typewritten transcript, consisting of pages numbered 1 through 139, inclusive, is a true record.

IN WITNESS WHEREOF, I have hereunto set my hand this day of June, 2004.

John F. Martina, Jr., Notary Public, State of Florida at Large.

APPENDIX H

ECOLOGICAL AND WATER QUALITY MONITORING PLAN

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APPENDIX H
ECOLOGICAL AND WATER QUALITY MONITORING PLAN FOR THE SOUTHERN GOLDEN GATE ESTATES HYDROLOGIC RESTORATION PROJECT

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APPENDIX H

ECOLOGICAL AND WATER QUALITY MONITORING PLAN FOR THE SOUTHERN GOLDEN GATE ESTATES HYDROLOGIC RESTORATION PROJECT

H.1 INTRODUCTION

The intent of this SGGE Ecological and Water Quality Monitoring Plan is to determine if the anticipated hydrologic, vegetative, wildlife, and estuarine benefits of the project are being achieved and to support the adaptive management process over the 50-year life of the project. The plan proposes to monitor ecosystem responses to changes in water depth and duration and changes in flows to the estuaries resulting from implementation of tentatively recommended alternative 3D. Desired ecosystem responses to these changes in hydrology are listed in the following primary objectives for the project as developed by the Project Delivery Team (PDT).

1. Reestablish natural freshwater flows to estuary
2. Restore natural hydropatterns, including sheet flow and flow ways
3. Reestablish natural plant distribution and composition
4. Increase surface aquifer recharge
5. Restore habitat for listed species
6. Increase fish and wildlife resources
7. Restore ecological connectivity and provide contiguous habitat protection to adjacent public lands
8. *Provide resource based recreational opportunities compatible with the protection of the natural systems
9. Restore natural fire regime

*Objective 8 will not be discussed further in this monitoring plan. The Florida Division of Forestry (DOF) as the land management agency will be expected to consult with the SFAM team agencies on appropriate recreational opportunities to assure they are compatible with the ecosystem restoration intent of the project.

Water quality benefits have not been defined as an objective of this restoration project, however the project still needs to meet the DEP requirement of "do not cause or contribute" to any non-HTRW contaminant loading. The water quality monitoring portion of this plan is designed to assure that the requirements are being achieved.

RECOVER and the CERP Project Delivery Teams (PDT) recognize that the effects from implementing the CERP projects must be monitored at both system-wide and local scales. Responsibility for the design and implementation of system-wide monitoring is in the hands of RECOVER, while the design and implementation of monitoring to determine local effects and project performance is the responsibility of the individual CERP PDT. To implement the system-wide program, RECOVER has developed the CERP Monitoring and Assessment Plan (MAP; RECOVER 2004a) and an associated OA/QC document (i.e., Quality Assurance Systems Requirements; RECOVER 2004b). The MAP and the individual project monitoring plans must be closely coordinated to ensure that measures and targets selected by the project teams are consistent with system-wide measures and that duplication of effort is avoided. RECOVER is also developing a guidance memorandum for standardizing assessment activities. The SGGE monitoring plan will implement those procedures when finalized.

The SGGE Ecological and Water Quality Monitoring Plan will utilize the protocols and results of the MAP whenever possible. However, since the MAP is focused primarily on regional changes occurring in the eastern portion of south Florida, it is at this time uncertain how much monitoring assistance will be provided to the SGGE project.

Cost estimates for proposed monitoring are provided at the end of the appendix. If in the process of restoring and monitoring the SGGE Study area, the PDT believes that activities should be modified, then the costs would also be modified.

H.2 PROJECT DESCRIPTION

As suggested in Sections 02 Pre-drainage Conditions, 03 Existing Conditions, and 04 Future Without Project Conditions of this PIR, infrastructure development within the SGGE Project Area has caused significant environmental problems.

By capturing most of the drainage from the Study Area, the Faka Union Canal system has eliminated sheet flow, drained the wetlands, and lowered the surficial water table within the Study area. The total area and quality of wetland vegetation communities have declined, the abundance of native fish and wildlife populations and habitat have declined, publicly owned adjacent lands have become drier, the recharge rate of the surficial aquifer has been reduced, and non-native species have become much more abundant. The heavily drained conditions have made the SGGE Project Area more prone to larger and more intense wildfires then under pre-drainage conditions. These fires are accelerating the change in vegetation communities from cypress swamps and

wet prairies to mesic communities dominated by fire tolerant species such as cabbage palm and exotics such as Brazilian pepper.

The 279-mile road network, of which 60 miles are paved, affects the groundwater infiltration rate, enhances runoff, and acts as blocks to the natural sheetflow. The roads are laid out on a quarter mile grid that provides easy human access for the indiscriminate use of all types of vehicles, poaching (animals and vegetation), vandalism, and the illegal dumping of solid waste. Infrastructure development for the SGGE subdivision has resulted in the fragmentation of a block of contiguous publicly owned natural lands suitable for wide ranging wildlife such as the Florida panther as well as other threatened and endangered species. The SGGE Project Area is critical for ecological connectivity across these public lands.

The altered hydrology of the SGGE Study Area has also caused problems in the estuaries south of SGGE. The rapid run-off rate from the watershed through the Faka Union Canal System results in extreme variation of discharge to Faka Union Bay. Discharges are much higher than natural during the wet season and during storms. Discharges are much lower than normal during the dry season since over-drainage reduces surficial aquifer recharge. In addition, with the interception of the natural pre-drainage flow ways by the roads and canals, other estuaries south of U.S. 41 are no longer receiving the fresh water input required to maintain their salinity equilibrium. Oyster beds and submerged aquatic vegetation (SAV) provide important habitat for numerous organisms and are indicators of a healthy estuary. Efforts of the SGGE project focus on establishing inflow regimes that will provide appropriate salinity ranges to re-establish and maintain these and other key organisms in the estuaries of the Ten Thousand Islands Region fed by the flowways emanating from SGGE.

H.3 PROJECT BENEFITS BREAKDOWN

H.3.1 South Florida Assessment Methodology (SFAM)

After considering a variety of possible wetland assessment tools to evaluate natural pre-development, existing, and future-without-project conditions in SGGE as well as those conditions that would result from the various restoration alternatives, a team of agency biologists decided to develop a modified U.S. Army Corps of Engineers' Hydrogeomorphic (HGM) approach, which the team named the South Florida Assessment Methodology (SFAM). The team involved in the SGGE inland benefits assessment using SFAM included representatives from the U.S. Army Corps of Engineers, South Florida Water Management District, Florida Fish and Wildlife Conservation Commission, and U.S. Fish and Wildlife Service. It is anticipated that post construction a similar team will meet with

the land managers on a yearly basis to review the following monitoring data, apply the SFAM to determine if project benefits are being achieved, and devise ways to adapt management activities to better meet project objectives.

H.3.2 Hydrologic

Hydrologic benefits are directly related to above objectives 2 (restore natural hydropatterns, including sheet flow and flow ways) and 4 (increase surface aquifer recharge). Increases in water levels will be the clearest and most rapid response to the proposed restoration in SGGE. This return to a more natural pre-drainage hydrology will be the driving force in the restoration of the vegetation, wildlife habitat, and estuaries. Thus the monitoring of the pump operations and the consequent hydrologic changes on the Project Area are very important.

During 2003, the South Florida Water Management District (SFWMD) began continuous real-time monitoring of 24 newly installed wells that are located throughout SGGE (Figure H-1). These wells will provide pre-restoration baseline as well as post-restoration data to document changes in surface and surficial aquifer water levels and hydroperiods. Elevations of the wells are in the process of being surveyed, and once this is completed, the water level data for the wells will be available real time in the SFWMD DBHYDRO database.

A number of criteria were established for selection of the 24 water level monitoring sites. The first was good spatial coverage of SGGE. Four east-west bands were identified, with each beginning in Fakahatchee and extending west into Belle Meade. The objective was to have wells located across the project area and into adjacent lands that were being hydrologically affected, but to a lesser extent, by the SGGE canal system. Given the constraints on access, particularly post-restoration, wells were established in the four bands in Belle Meade but in only one band in Fakahatchee. The four bands also allow the evaluation of north-south trends in hydrology in relation to the planned restoration. At the time the wells were installed, there was still significant uncertainty about the design of the project, and therefore what portions of SGGE would actually be restored. So the bands were established using the following criteria to be able to evaluate the two major types of alternatives under consideration. The northern band was located upstream of all of the restoration alternatives to assess likely changes in groundwater levels in areas where surface water was not expected to occur for extended periods following restoration. The next band to the south was located just downstream of the pumps and spreader canals in Alternative 3D. This area was likely to have somewhat higher than pre-development water levels at times during the wet season because of likely piling up of water moved

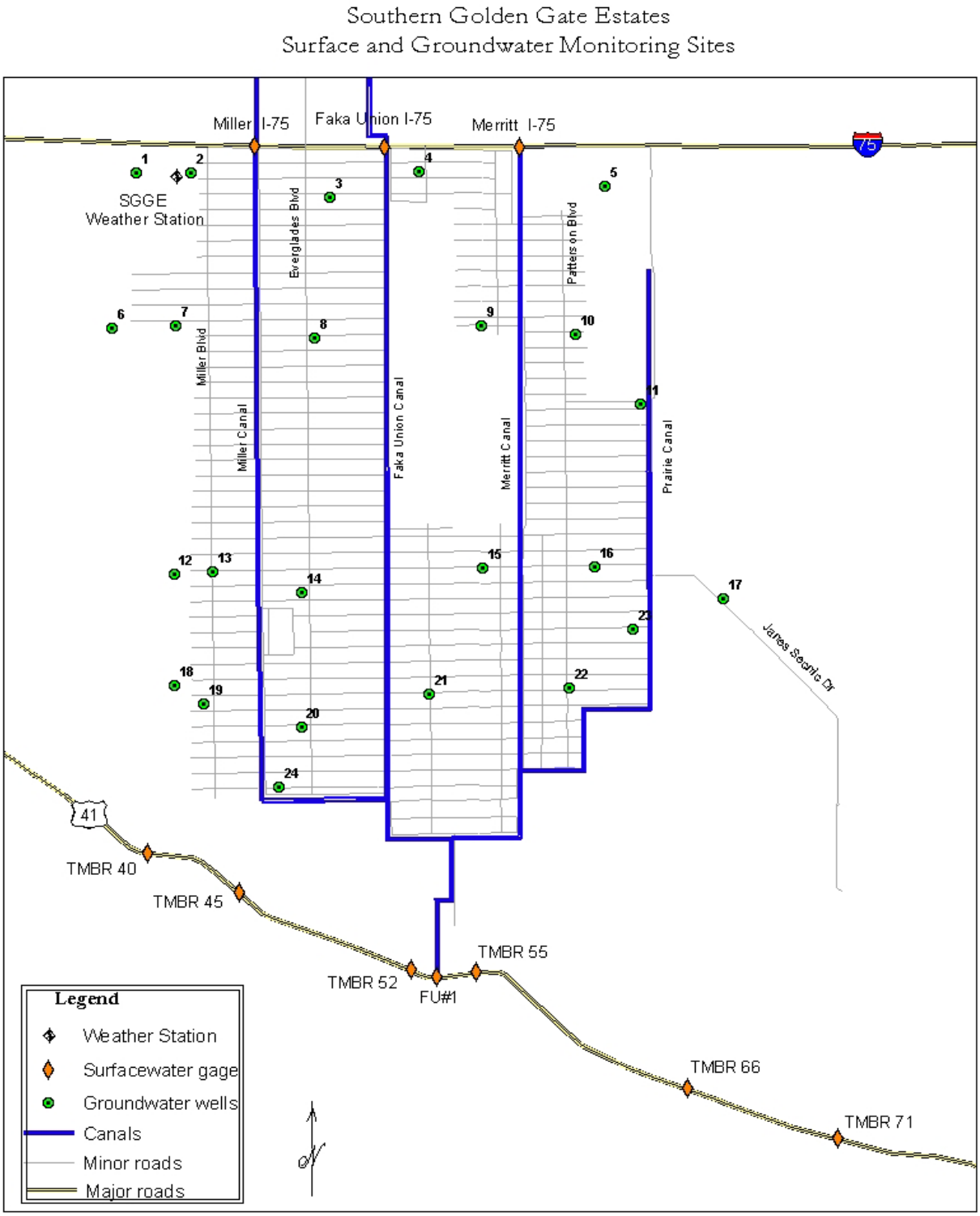

Figure H-1 Existing Southern Golden Gate Estates monitoring wells, staff gauges, and weather station

through the pumps. In Alternative 6, groundwater levels would increase in this area, but again surface water was unlikely to be present for long in this band. The next band was located downstream of the top of the filled canals in Alternative 6, where there could be significant piling up of water, at least in the vicinity of the canals, as water moving south in the unfilled portions of the canals encounters the filled canals. In Alternative 3D, this area should have a fairly natural hydrology as the water has had time to spread out across the landscape. The southernmost band of wells are located in an area where fairly natural water levels should occur in both Alternatives 3D and 6.

The wells were not distributed in a rigorous spatial grid, and a number of the wells do not fit neatly into the four bands described above because of other considerations. In addition to providing spatial information on pre- and post-restoration hydrology, the wells were distributed so as to be able to assess whether a suitable hydrology was being restored to the major types of plant communities that will be present following restoration. Potential well monitoring sites were evaluated in terms of their current communities and the original communities that were estimated to have occupied these sites. Since there is information on hydroperiods and wet and dry season water levels that produce and maintain each of the major plant community types, this allows the estimation of what hydropatterns ought to be found in the vicinity of each monitoring site post-restoration. These predicted hydropatterns represent the targets for each well site. Also, when compatible with the overall design described above, the new wells were located at the Natural Resources Conservation Service (NRCS) monitoring sites, where baseline hydrologic, vegetation, and wildlife data have been collected for several years.

In addition to the 24 new wells, three additional continuous recording wells will be installed in the brackish marshes south of Tamiami Trail. Two will be located west of the Faka Union Canal and one to the east of the canal to document water level and salinity changes following SGGE restoration.

There are also 30 very shallow wells on the SGGE Project Area that were installed as part of the NRCS SGGE Watershed Planning Assistance Cooperative Study. They have been monitored approximately monthly since 1998. For those wells that have not been disturbed, we have almost a full year's overlap of these data with that from our recently installed automated wells. This will allow us to develop correlations between the two sets of wells to extend the baseline period of record for the automated wells. Some of the older wells may be incorporated into the construction and post-construction well monitoring grid as appropriate.

Staff at Fakahatchee Strand State Preserve have been collecting monthly water level measurements since 1987 from 25 wells along two transects that extend

across the Preserve. These data have clearly demonstrated the degree of drawdown and its spatial extent into Fakahatchee from the SGGE canal system (Figure H-2). In the absence of the SGGE canals, these profiles would be essentially flat or at most have a shallow gradient towards SGGE because of the south-southwest direction of water flow in the area. The slopes beyond 5 miles are associated with the Barron River Canal along SR 29. The wells will continue to be monitored following SGGE restoration, when the downward slopes along the first 1 - 3 miles of the profiles should disappear.

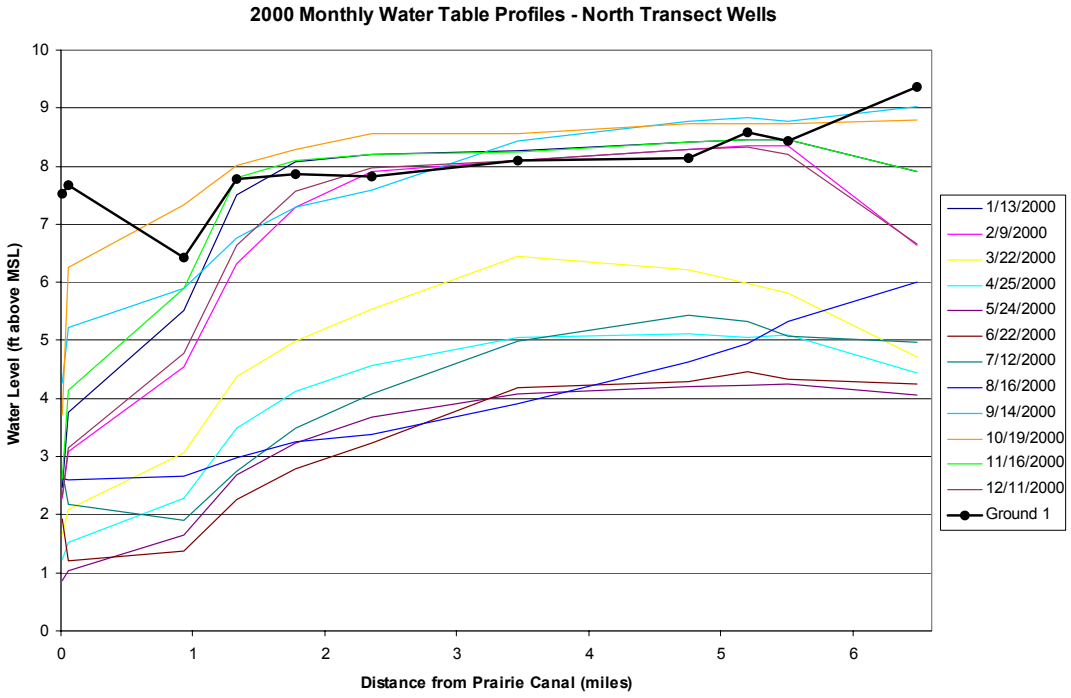

Figure H-2 Monthly water table and ground surface profiles in 2000 across Fakahatchee Strand from Prairie Canal in Southern Golden Gate Estates on the left to the Barron River Canal along S. R. 29 on the right

Each year pre-project, during construction, and for the 50-year life post-project, the well data will be analyzed to determine water level stage and duration. These results will be used to assess the effects of pump operations on the inland and estuarine plant and animal communities. This will allow identification of needed modifications of pump operations to further improve restoration benefits. For inland SGGE, hydrologic restoration is defined as a return to pre-development hydropatterns appropriate for the pre-development plant communities. Hydrologic restoration in the estuaries is based on comparable salinity distributions in the restored estuaries to that simultaneously present in Fakahatchee Bay, which is considered a natural reference site.

The District has installed a continuous real-time weather station in the northwest corner of SGGE, which became operational in September 2002 (Figure H-1). Parameters being monitored include precipitation, temperature, wind speed and direction, and solar radiation for calculated evaporation. These data will soon be available on the SFWMD DBHYDRO database.

Timing of Hydrologic Restoration

Restoration of SGGE will primarily involve filling canals to restore more natural water levels and hydroperiods, and, in combination with road removal, overland flows through most of SGGE and into the downstream estuaries. Hydrologic restoration should be virtually complete by the end of the first wet season following completion of construction. Mobile organisms, whose presence and health depends primarily on hydrology, should begin to appear during this first wet season, although it may take one to several years for their populations to reestablish their pre-drainage numbers and distribution depending on their reproductive and dispersal characteristics. I expect that this pattern would also apply to estuarine organisms that are strongly influenced by salinity.

Thus, it seems reasonable to expect a rapid recovery of organisms affected primarily by hydrology and salinity. This would suggest the need for an intensive but relatively short-term monitoring effort, where we would expect to approach our restoration targets within about five years of the completion of construction and to reach them within ten years, at which time monitoring for most or all of these parameters would be terminated.

H.3.3 Plant Communities

Plant community benefits are directly related to above objectives 3 (reestablish natural plant distribution and composition) and 9 (restore natural fire regimes). Control, reduction, or elimination of exotic plant species is also paramount in producing predicted benefits of restoring native vegetation. Water levels along with hydroperiods will be the best predictor of long-term biotic responses to SGGE restoration.

H.3.3.1 Patterns of Plant Community Recovery

For vegetation and organisms associated with the restoration of vegetative structure, recovery can be expected to take much longer than for recovery of hydropatterns, the actual time being dependent on reproductive, dispersal, and developmental characteristics of the various species. Where major components of the plant communities have been lost, recovery rates following restoration can be expected to be slow initially, but to then increase over time as these

components recolonize and begin to reproduce onsite. Some plant communities can take decades or centuries to reach their full structural development, and organisms dependent on these structural characteristics may not appear for many years following restoration.

The most dramatic initial changes in vegetation will be the mortality of upland and some wetland vegetation as discussed above in the water quality section. When this occurs, early successional native plant species will likely dominate these sites for at least a few years, before later successional species arrive and begin to establish the more mature plant communities.

Another dramatic but more localized change will be the conversion of some existing wetlands, which have lost substantial depths of organic soil, to open water communities because of the deeper water and longer hydroperiods. Current sites that would be most likely to become open water would be willow ponds and possibly some of the remaining cypress forests, where some cypress may survive, but only as relatively open forests. Accumulation of organic soils that are sufficient to reduce hydroperiods to a range suitable for the reestablishment of emergent vegetative communities on these sites will take centuries.

Since the wet prairies seem to have been the least impacted by drainage, they will likely recover very rapidly. The main changes would involve reducing the density of woody shrubs and trees, including palms and Brazilian pepper, which have invaded them. It is uncertain whether the restored water depths and durations will be sufficient to eliminate the woody vegetation in this relatively shallow water community, and chemical or mechanical treatment may be required in some areas. However, once the woody vegetation is eliminated, reinvasion could be controlled with prescribed fire.

A restored hydrology and a more natural fire regime would help to restore the pine communities over time by elimination of hardwoods that have invaded them. However, it is likely that an initial chemical and mechanical control effort will be required over a decade or more to reduce the palms to a more natural abundance and to bring Brazilian pepper down to the point where it requires only a low level long term maintenance effort. Where the pines have been lost to severe fires, it will take many decades for them to slowly reinvade and then grow into a mature forest. However, the most important component of the pineland is its diverse ground cover, and, hopefully, soil disturbance has not been so extensive in the SGGE pinelands to have eliminated it over large areas. Where it still exists, it should recover rapidly following the reestablishment of more natural hydrologic and fire regimes, and the elimination of the dense palm and Brazilian pepper canopy. Where soil disturbance has been extensive, only intensive restoration efforts are likely to restore the ground cover in less than many centuries and possibly a millennium.

Hardwood communities originally were uncommon in SGGE. Their current distribution is most likely a result of logging swamp forests, where they were present as a subcanopy component, and their fortuitous occurrence in portions of SGGE that have not yet burned since the area was drained.

A restored hydrology and a more natural fire regime would set the stage for the restoration of the cypress and dwarf cypress communities. There currently is not a consensus as to whether existing populations of sabal palm and Brazilian pepper would be eliminated in the more deeply flooded areas by merely reestablishing overland flow in SGGE. However, it is generally agreed that they will not be eliminated in the more shallowly inundated cypress forests and that an initial chemical and mechanical control effort will be required over a decade or more to reduce the palms to a more natural abundance and to bring Brazilian pepper down to the point where it requires only a low level long term maintenance effort. However, once these two species have been eliminated, reinvasion could be controlled with prescribed fire. Where the cypress trees have been lost to severe fires, it will take many decades and possibly a few centuries for them to reinvade and grow into a mature forest.

The remaining swamp forests will probably change primarily in terms of the loss of upland components that will be drowned by the restored water levels, which should happen over only a few years following the completion of construction. Swamp forests, where the cypress trees have been eliminated by fire, will likely take several centuries to reestablish their pre-drainage structure and composition.

Available information, based primarily on aerial photography, indicates that mangroves have moved inland and replaced much of the coastal marshes between the early 1940s and mid-1990s. It is uncertain how much of this change is due to reductions in freshwater flows from the drained SGGE, as opposed to sea level rise or reductions in fire frequency. Thus, it is difficult to estimate how much change to expect in the location of the boundary between these two communities subsequent to hydrologic restoration in SGGE. As monitoring data becomes available, the CERP adaptive assessment process should provide a basis for needed modifications of the management of these areas.

Another consideration in terms of vegetative change following restoration is the creation of more favorable conditions for some exotic plant species, particularly melaleuca and climbing fern, which favor more moist conditions than currently exist in SGGE. The current melaleuca eradication effort in the Picayune State Forest by the Florida Division of Forestry should greatly reduce the threat by this species in the restored SGGE. Biological control agents are the best long term hope for controlling the climbing fern throughout South Florida, although chemical and, in localized situations, mechanical control can reduce its rate of spread until effective biological controls become available. Given the planned

exotic vegetation monitoring and control program, it is reasonable to expect that while some exotic vegetation will undoubtedly always be present in SGGE, it is unlikely to be a significant presence or to affect the viability of natural communities in the area.

Given the expected changes in the plant communities following restoration, the vegetation monitoring effort would be fairly intensive over the first ten years following construction and then gradually decrease in intensity over the next forty years. This would allow evaluation of short term mortality in existing communities, rates of reinvasion where major components have been lost, and trends towards the development of more diverse mature communities over longer time periods.

H.3.3.2 Plant Community Sampling

The plant community sampling methodologies are designed to address the two most important questions concerning the effects of the SGGE restoration project. One is to monitor all vegetative strata within examples of the major plant community types to determine changes in species composition and dominance. A second is to evaluate restoration effects on invasive plant species, particularly the exotic Brazilian pepper. Although it is a native species, sabal palm (*Sabal palmetto*) dominance, density, and recruitment is also of importance because one of the primary differences observed on the 1940 and 1995 Natural Resource Conservation Service (NRCS) vegetation maps is its dramatic spread throughout SGGE, which has greatly increased fire frequency and severity in the area.

The vegetation sampling will be divided into three parts, the first documenting vegetation changes of major plant communities along several belt transects associated with each of the water level monitoring wells. The second focusing on characterization of vegetation changes at the previously-sampled NRCS locations, including sites within SGGE and adjacent public lands. All of these sites may not be included in the post-construction monitoring depending on how well they complement vegetation sites selected at the new monitoring wells. The third will monitor the restored canal and road footprints to expedite control of undesirable invasive species on these disturbed sites.

<u>Resampling of NRCS Vegetation Plots</u>

Characteristics of the vegetation at the 41 sites previously sampled by Jim Burch and NRCS will be determined using methods similar to those used in the original 1999 sampling (Figure H-3). One additional sampling event will occur prior to construction to provide an up-to-date baseline, and resampling will occur at one, three, and five years following the completion of construction and then every five years for the fifty-year life of the project or until the sites are

considered restored. For those sites within the portions of SGGE and adjacent lands included in the area to be restored, the restoration target is the original plant community that was present prior to drainage of SGGE. This assumes that the hydropatterns at each site will be comparable to those present prior to drainage. In some localized areas, this may not be the case because of organic soil loss, proximity to pumps, severe soil disturbance, or an altered fire regime. However, these new plant communities should be natural communities appropriate to the new hydrologic, fire, and substrate conditions.

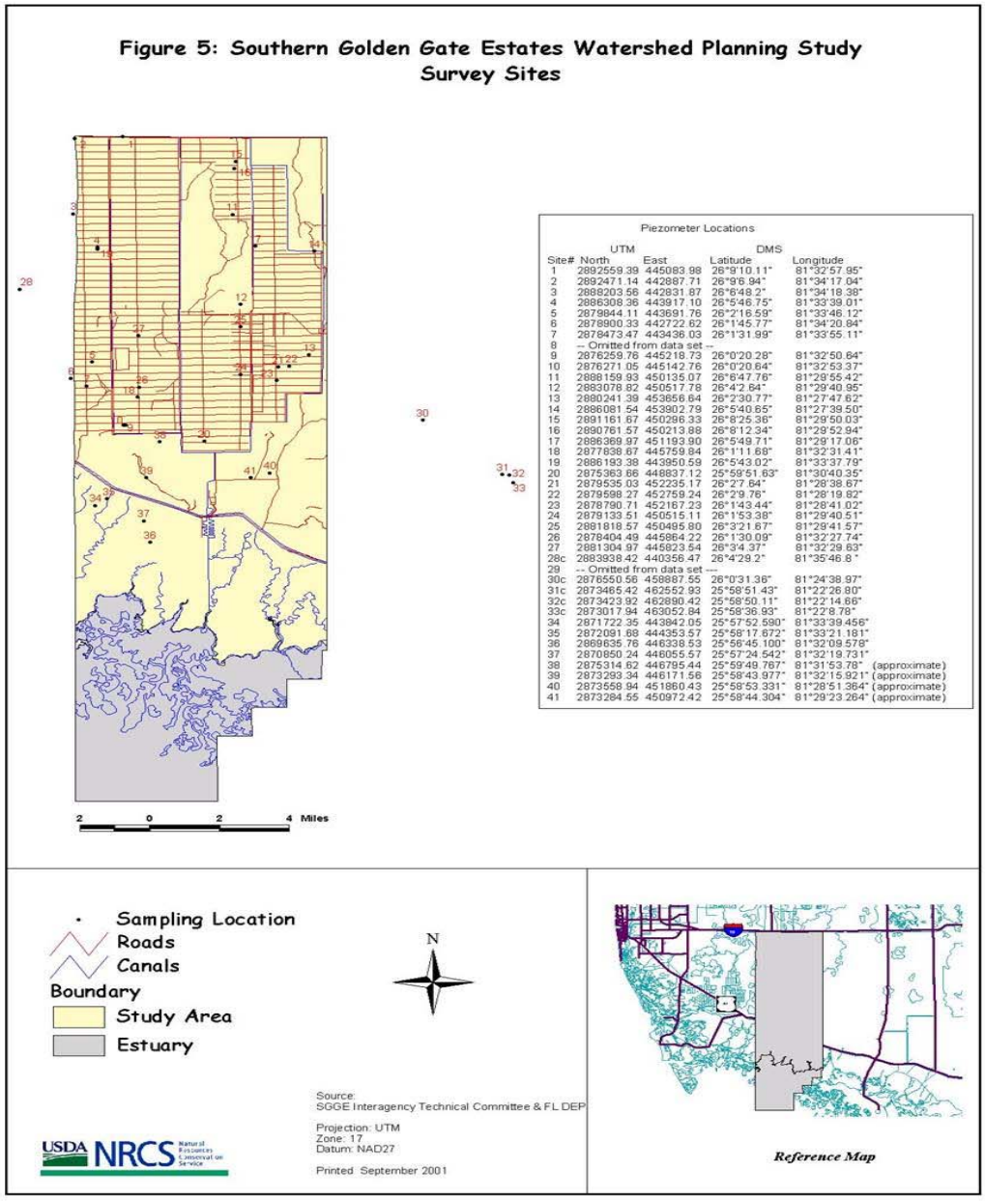

Figure H-3 Location of Jim Burch's (NRCS) vegetation and surface water level monitoring sites.

Visual estimates of tree canopy, shrub canopy, and groundcover will be used as an indicator of plant community structure within and around each sample quadrat.

Vascular plant species within each quadrat will be identified and listed as Obligate (OBL), Facultative Wet (FACW), Facultative (FAC), or Upland (UP) based on the Florida Department of Environmental Protection Hydric Soil Field Indicators lists. Other vascular plant species that occurred near (generally within 10 m), but not within the sample quadrat, will be listed to provide a more complete description of the plant community in which the quadrat is located.

A line intercept method (Bendix 1994) will be used to quantify the cover of each vascular plant species encountered within a quadrat. Cover will be quantified by measuring the length of each species' canopy that intercepts a vertical plane along four randomly selected 10 m long lines within each quadrat. The lines will be randomly selected to allow comparisons of variances among sites of similar community types (Greig-Smith, 1983). Abundance measures will be taken for trees (woody plants >2.0 m tall), shrubs (woody plants 0.5 m - 2.0 m tall), and groundcover (herbs or woody plants <0.5 m tall). Cover is expressed as meters per 10 m transect (i.e., meters intercepted), and this value will be multiplied by ten to provide an estimate of percent cover within each 10 x 10 m quadrat.

A few additional sampling locations may be established in portions of SGGE, which were not originally sampled because the land was not in public ownership in 1999. These would be designed to provide a more complete spatial coverage of SGGE as well as a better representation of its major plant community types.

Expanded Sampling of Vegetation Plots

One or more permanently marked 50 m transects will be established at each of the new well sites within representative plant communities. In addition, one 50 m transect will be added to each of the NRCS sites to be retained for post-construction sampling. Transect will be located in relatively uniform stands of vegetation, both in terms of the existing community and the likely restored community. Where feasible, the suite of sites along each band of the new monitoring wells should provide at least three examples of each of the existing major plant community types and the major plant communities likely to be present following restoration. The 50 m transects will be sampled using methods similar to those utilized on the Florida Panther National Wildlife Refuge (FPNWR), with some modification to include the canopy stratum (Main et al. 2000). The primary reason for adding the transects is to allow direct comparisons with the extensive database on FPNWR, which will be used as a control for the more disturbed SGGE sites.

The vegetation along the transects will be divided into 4 strata based on DEP 62-340.200, F.A.C. (1996) of the Florida Wetlands Delineation Manual, Delineation of the Landward Extent of Wetlands and Surface Waters. Canopy trees are defined as those woody plants with a diameter at breast height (DBH) greater than 10 cm (approx. 4 in). The subcanopy consists of tree species (excluding common shrubs such as wax-myrtle, willow, Brazilian pepper, and saltbush) with a DBH between 2.5 and 10 cm (1-4 in). The shrub layer consists of trees with a DBH less than 2.5 cm (1 in) and common shrub species (as mentioned above) of any size. Ground cover consists of all plants not found in the other strata and consists of herbaceous species primarily.

Sabal palms (*Sabal palmetto*) will be separated into the following strata: 1) canopy palms with apical meristems above 8 ft, 2) subcanopy palms with apical meristems greater than breast height (4.5 ft) but less than 8 ft, 3) shrub layer palms with apical meristem just above ground level to breast height (4.5 ft), 4) groundcover strata palms will be individuals with palmate leaves but apical meristem still at ground level (i.e. no trunk), and 5) seedlings defined as individuals without palmate leaves. For palms with trunks, the presence or absence of adventitious roots will be recorded.

Canopy and subcanopy trees (and sabal palms in all strata) will be sampled along 5 m wide belt transects (Mueller-Dombois and Ellenberg 1974). Diameters of all canopy trees will be measured and they will be tagged to facilitate re-sampling and to document mortality and recruitment. Subcanopy trees will be counted by species to estimate density, but not measured or tagged. Cabbage palms, but not other tree species, will be counted in the shrub, groundcover, and seedling strata.

The composition and cover of shrub species, as defined above, will be quantified using the line-intercept method (Mueller-Dombois and Ellenberg 1974, Canfield 1941, Lindsey 1955) along each of the transects. Intercept lengths include all overhanging or underlying shrub canopy. Saw palmetto (*Serenoa repens*) was always considered a shrub. From these data, percent coverage will be estimated.

Species composition and cover of herbaceous ground cover species will be quantified using 0.5 m^2 rectangular quadrats (40.5" x 20.75") placed at 10 m intervals along the transect using Daubenmire (1959) cover classes. There are six cover classes including: 1) 0-5%, 2) 5-25%, 3) 25-50%, 4) 50-75%, 5) 75-95%, and 6) 95-100%.

All plant species whose stems originate from within the quadrat will be assigned cover class values. Shrub species will be assigned cover class values if any part of the plant overhangs the quadrat regardless of where the stems originate.

Sabal palm coverage will be recorded separately for the shrub, groundcover, and seedling strata.

In addition to the quantitative sampling, qualitative records should be kept of all plant species observed within each sampling site by habitat. These random observations will be incorporated into the site species lists as was done by NRCS.

An initial set of samples will be collected prior to construction. After construction is complete, sampling will occur at one, three, and five years, and then every five years for the fifty year life of the project, although sampling may be terminated at individual sites that are considered restored. For those sites within the portions of SGGE and adjacent lands that are included in the area to be restored, the restoration target is the original plant community that was present prior to drainage of SGGE. This assumes that the hydropatterns at each site will be comparable to those present prior to drainage. In some localized areas, different communities may be present because of organic soil loss, proximity to pumps, severe soil disturbance, or an altered fire regime. However, these new plant communities should be natural communities appropriate to the new hydrologic, fire, and substrate conditions.

H.3.3.3 Monitoring of Canal and Construction Footprint Areas

Florida Division of Forestry (FDOF) will annually assess the occurrence of exotic and nuisance vegetation on restored areas within canal and road construction footprints. This will be accomplished by traversing these areas on the ground and producing GIS maps showing the location and density of each problem species. Notes will also be taken on the physical and biological characteristics of the sites and adjacent plant communities where these species are found. The maps would then be used to plan and carry out control efforts. Control treatments will also be documented in the GIS database being maintained by FDOF. This monitoring will continue until stable plant communities become established and exotics have not been encountered for five years. At this point, monitoring of those portions of the footprint areas that meet these criteria may be terminated, and they will then be incorporated into the overall SGGE exotic pest plants monitoring program.

Photographs of the footprint areas will be taken when the problem species are being mapped, at the time of treatment, and periodically thereafter to document their elimination.

H.3.3.4 Nomenclature and Voucher Specimen Collection

All plant nomenclature will follow Wunderlin (1998) with certain exceptions, including any taxonomic changes generally accepted since publication. To avoid confusion, the synonyms will also be provided in the species list.

A large number of reference specimens for plant species in the area already have been collected and are stored at the FPNWR herbarium and the Fakahatchee Strand State Preserve (FSSP) herbarium. Additional voucher specimens will be collected for any plant species observed, except threatened and endangered species, which are not already present in the FPNWR or FSSP herbarium. Biologists at Picayune Strand State Forest (PSSF) and FSSP will manage voucher specimens and will provide Quality Assurance and Quality Control for plant identification. They will solicit outside assistance as needed for verification.

H.3.3.5 Data Entry and Management

The data on vegetation sampling will be organized within an Access database, with appropriate crosswalks between the SGGE, NRCS, and FPNWR vegetation datasets. The primary contact for the database will be Mike Barry or another designated individual at the FDOF Division of Forestry.

H.3.3.6 Rare Plant Survey

A general baseline survey of the SGGE project area entitled Survey for Rare Plants on Picayune Strand State Forest, Collier County, Florida, an FNAI Ecological Survey was completed in June 2001. This report is available on the SGGE WEB site at: www.evergladesplan.org/pm/projects/docs_30_sgge_pir.cfm

H.3.3.7 Fire Monitoring

Because fire is so important to the reestablishment of natural vegetation on the SGGE Project Area, DOF will maintain records of wildfires and prescribed burns on the SGGE Project Area, in particular those affecting established vegetative monitoring transects.

H.3.3.8 Literature Cited

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H.3.4 Fish and Wildlife Habitat

Fish and Wildlife habitat benefits are directly related to above objectives 5 (restore habitat for listed species), 6 (increase fish and wildlife resources), and 7 (restore ecological connectivity and provide contiguous habitat protection to adjacent public lands). The restoration of SGGE, in particular the elimination of most roads, hydrologic restoration, and the reestablishment of more natural vegetative communities, will help meet wildlife objectives 5, 6, and 7. There is a plethora of fish, birds, and mammals that could be monitored and studied; however, due to limited funding, decisions are needed as to which species provide the best examples of the SGGE ecosystem restoration. Also, monitoring must be done to satisfy Section 7 Endangered Species Act (ESA) regulatory requirements.

H.3.4.1 Federal Threatened and Endangered Species Surveys

The following discussions of monitoring and adaptive assessment plan for federally listed threatened and endangered species that may be present in the SGGE Study Area has been adapted from the U.S Fish and Wildlife Service's draft CAR.

West Indian Manatee

1. Two years of field data have been collected through funding from the USGS Place-Based Studies that document the current distribution and status of the manatee population. Provide for at least one more year of baseline studies, conduct interim studies based on project schedule to determine effects of project construction phasing on manatees using an adaptive management approach, and conduct three years of post-restoration field studies on manatee distribution throughout the area of the Ten Thousand Islands Region affected by the SGGE hydrologic restoration.

2. Provide baseline, mid-project, and post-project flow data for input into the Port of the Islands marina basin from the Faka Union Canal. SFWMD will provide this data from the gauge station just north of US Highway 41.

3. Monitor construction activities to ensure they are consistent with the Standard Manatee Construction Protection Guidelines if in-water activities (currently not anticipated) are needed in Faka Union Canal south of Faka Union Weir No. 1.

4. Conduct baseline and post-project (5-year intervals for 20 years) seagrass surveys in Faka Union Bay.

Florida Panther

1. Conduct 1-year pre-project baseline and post-project (5-year intervals for 20 years) prey density studies using aerial transects consistent with Florida Fish and Wildlife Conservation Commission (FWC) recommended methodology. The Service recommends contracting directly with FWC. Prey density is an accurate predictor of improvement in panther habitat.

2. Assess and characterize baseline pre-project FWC panther telemetry data in the Study Area including Fakahatchee Strand, Big Cypress Preserve, Belle Meade portion of Picayune Strand State Forest, and Florida Panther National Wildlife Refuge. Assess and characterize post-project panther telemetry, including abundance and distribution of panthers over landscape, changes in habitat utilization, if any, numbers of breeding females, and changes in population age distribution. Post-project

assessments should be conducted every 3 years. The Service recommends contracting directly with FWC for data compilation and review.

3. Coordinate with FWC using their telemetry data to determine if panther denning activities are occurring in potential project construction areas. Will be included in contract plans and specifications.

4. The SFAM team will monitor DOF and SFWMD management decisions and relate to FWC telemetry data to assess the post project effects on panthers every 5 years for the life of the project.

Red-Cockaded Woodpecker

1. Conduct and/or assess any ongoing baseline population surveys of RCWs within SGGE.

2. Conduct and/or assess post-project population surveys of RCWs in SGGE at 5-year intervals beginning 5 years after completion of construction.

3. The SFAM team will monitor DOF and SFWMD management decisions and relate to RCW survey data to assess the post project effects every 5 years for the life of the project.

Wood Storks and Wading Birds

1. Monitor the yearly productivity of wood stork nesting colonies at Corkscrew Sanctuary and new colonies that may immerge within 30 km of the Project Area. At this time, RECOVER's Systematic Reconnaissance Flights (SRF) program for wood stork and wading bird surveys that will include nesting colonies extends only to the western boundary of Big Cypress National Preserve. Recover will be contacted to determine possible extension of the SRF program to cover the Corkscrew sanctuary and the SGGE Study Area.

2. Conduct baseline wading bird surveys during wet season (July 1 through January 30). Replicate these surveys on yearly basis during project construction, 1 year after restoration, and then at 5-year intervals for 20 years.

3. Assess the potential for exotic fish populations to move from canals to natural wetlands and affect wood stork forage fish populations after restoration is completed.

4. A baseline dry season survey (January 1 through June 30) entitled The Distribution and Abundance of Wading Birds in Southern Golden Gate Estates and Surrounding Areas (Nelson D. et al, 2001) has been conducted. Follow-up surveys will be performed during the first three years, the fifth year, and every five years after post construction.

5. The SFAM team will monitor DOF and SFWMD management decisions as they relate to post project effects on wood storks and wading birds every 5 years for the life of the project.

Bald Eagle/Snail Kite/Eastern Indigo Snake/American Crocodile

1. Every 5 years for the life of the project the SFAM team will monitor hydrologic data, vegetation transect information, and DOF - SFWMD management decisions as they relate to post project restoration effects on bald eagles, snail kites, indigo snakes, and American crocodiles. The team will contact FWS when it is determined that surveys of these species may be needed.

H.3.4.2 State Listed Threatened and Endangered Species

Certain state listed species are either known to or are expected to occupy the SGGE Study Area. These are listed in Tables H - 1 and H - 2. The Corps and SFWMD will need to consult with the FWC and DOF to determine potential impacts to these species and the need for remediation activities (*e.g.,* construction precautions or relocation requirements). The SFWMD, FWC, and DOF are sponsoring or conducting various surveys for general plants and animals including listed species, some of which may be useful for project baselines such as the FWC telemetry monitoring of the Florida panther. Baseline survey information will provide for existing biodiversity analyses across the Project area. State listed wading birds and the Florida black bear are among the animal species existing on the site. DOF in consultation with SFWMD and FWC will continue to monitor for these species and adapt the DOF management strategy for protection as needed.

Due to limited project funding for monitoring, the SFAM team plus DOF needs to meet before finalizing the PIR to determine survey priorities for state listed species.

Table H-1 State-listed animals of Southern Golden Gate Estates and associated estuaries

Scientific Name	Common Name	State Status
Ajaia ajaja	Roseate spoonbill	SSC
Alligator mississippensis	American alligator	T-SA
Aramus guarauna	Limpkin	SSC
Caretta caretta caretta	Atlantic loggerhead turtle	T
Charadrius melodus	Piping plover	T
Charadrius alexandrinus tenuirostris	Southeastern snowy plover	T
Chelonia mydas mydas	Atlantic green turtle	E
Crocodylus acutus	American crocodile	E
Dermochelys coriacea	Leatherback turtle	E
Drymarchon corais couperi	Eastern indigo snake	T
Egretta caerulea	Little blue heron	SSC
Egretta rufescens	Reddish egret	SSC
Egretta thula	Snowy egret	SSC
Egretta tricolor	Tricolored heron	SSC
Eudocimus albus	White ibis	SSC
Falco sparverius paulus	Southeastern American kestrel	T
Felis concolor coryi	Florida panther	E
Gopherus polyphemus	Gopher tortoise	SSC
Grus canadensis pratensis	Florida sandhill crane	T
Haematopus palliatus	American oystercatcher	SSC
Haliaeetus leucocephalus	Bald eagle	T
Lepidochelys kempi	Atlantic ridley turtle	E
Mustela vison evergladensis	Everglades mink	E
Mycteria americana	Wood stork	E
Pelicanus occidentalis	Brown pelican	SSC
Picoides borealis	Red-cockaded woodpecker	T
Polyborus plancus adubonii	Audubon's crested caracara	T
Rhynchops niger	Black skimmer	SSC
Sciurus niger avicennia	Big Cypress (mangrove) fox squirrel	T
Sterna antillarum	Least tern	T
Sterna dougallii	Roseate tern	T
Trichechus manatus	West Indian manatee	E
Ursus americanus floridanus	Florida black bear	T

Key to Listed Species Designated Status:
E = Endangered
T = Threatened
T-SA = Threatened Due to Similarity of Appearance
SSC = Species of Special Concern

Table H-2 Picayune Strand State Forest state-listed plants

Scientific Name	Common Name	State Status
Acrostichum danaeifolium	Giant leather fern	C
Asclepias longifolia	Milkweed	LE
Bourreria verticillata		LE
Callicarpa Americana	Beautyberry	LE
Cladium jamaicense	Saw grass	LE
Desmodium paniculatum		C
Dichanthelium acuminatum	Grass	LE
Dichanthelium dichotomum	Grass	LE
Ficus aurea	Florida strangler fig	LE
Ipomoea tuba	Morning glory	LT
Juncus roemerianus	Black needle rush	LE
Kosteletzka virginica	Saltmarsh mallow	C
Lachnocaulon anceps	Bog buttons	C
Myrcianthes fragrans (= Eugenia simpsonii)	Simpson's ironwood; Simpson's stopper	LE
Phytolaca Americana	Pokeweed	LE
Rhynchospora divergens	Beakrush	T
Rhynchospora inundata	Horned beakrush	E
Rivina humilis	Blood berry	LE
Roystonea elata	Royal palm	LE
Ruellia caroliniensis	Wild petunia	LE
Sabal palmetto	Cabbage palm	LT
Samolus erbracteatus	Pimpernel	LE
Tillandsia usneoides	Spanish moss	T

Key to Listed Species Designated Status:

LE = Listed as Endangered Plants in the Preservation of Native Flora of Florida Act. Defined as species of plants native to Florida that are in imminent danger of extinction within the state, the survival of which is unlikely if the causes of a decline in the number of plants continue, and includes all species determined to be endangered or threatened pursuant to the Federal Endangered Species Act of 1973, as amended.

PE = Proposed for listing by Florida Department of Agriculture and Consumer Services (FDACS) as Endangered.

LT = Listed as Threatened Plants in the Preservation of Native Flora of Florida Act. Defined as species native to Florida that are in rapid decline in the number of plants within the state, but which have not so decreased in such number as to cause them to be endangered.

PT = Proposed by the FDACS for listing as Threatened.

CE = Listed as a Commercially Exploited Plant in the Preservation of Native Flora of Florida Act.

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H.3.5 Estuarine

Estuarine benefits are directly related to above objective 1 (reestablish natural freshwater flows to estuary). The canal infrastructure that was part of the SGGE subdivision development severely disrupted natural flows to Blackwater Bay, Pumpkin Bay, and Faka-Union Bay as well as other smaller bays and estuaries within the Ten Thousand Islands region (Figure H-4). The following plans propose to monitor changes in flows and their effects to the estuaries resulting

from implementation of tentatively recommended alternative 3D. The PDT established performance measures for changes in salinity, physiologic, and ecologic aspects of oysters, oyster reef crabs, and nekton community structure.



Figure H-4 Location of estuarine bays downstream of Southern Golden Gate Estates

H.3.5.1 Oyster Reefs

Aspects of oyster physiology and distribution are highly sensitive to water quality, particularly salinity (Savarese & Volety 2001). The American oyster, *Crasostrea virginica*, thrives best in brackish water (see references in Kennedy, 1996). Although oysters tolerate salinities between 0–42‰, growth is maximized at salinities of 14–28‰; slower growth, poor spat production, and excessive valve closure occur at salinities below 14‰ (Shumway 1996). In addition, increased reef complexity, generated by a higher living density of oysters per unit area of reef, enriches the secondary community in higher species abundances and diversity (Coen et al. 1999, Posey et al. 1999). Many of these secondary organisms support commercially important species of fin-fish and crustaceans. Consequently, physiologic and ecological characteristics are potential measures of the effectiveness of estuarine restoration downstream of SGGE. Various aspects of oyster physiology, particularly those associated with growth and reproduction, serve as direct monitors of salinity. Aspects associated with reef complexity and aerial coverage are indirect measures of ecosystem structure and health. Baseline data already exist for the current state of oyster physiology and ecology for two impacted estuaries in the Ten Thousand Islands (Faka Union and Blackwater Bays) (Savarese & Volety 2001, Savarese et al. 2003), and a study of the pristine estuary proposed as a control, Fakahatchee, was just completed (Savarese et al. 2004).

The methodologies proposed below for monitoring aspects of oyster physiology and ecology to gauge estuarine health have been successfully employed to study a number of estuaries in Southwest Florida, including the Ten Thousand Islands (Savarese & Volety 2001; Savarese et al. 2003, Savarese et al. 2004), Estero Bay (Savarese et al. 2003), and the Caloosahatchee (Tolley et al. 2003, Volety & Tolley 2003). These methods have also been adopted as performance measures for estuaries governed by the Southwest Florida Feasibility Study.

H.3.5.1.1 Design of the Monitoring Plan

Overview.-- The spatial patterns of oyster physiology and distribution along the upstream- downstream axis of the altered estuaries (Blackwater Bay, Pumpkin Bay, and Faka Union) should resemble those in the relatively pristine Fakahatchee estuary. Comparisons will be made employing the spatial homologue approach (see Savarese & Volety 2001; homologues are regions of comparable geomorphology among adjacent estuaries that are assumed to have had comparable ecology and water quality prior to human alteration). Figures H-5 and H-6 show the upstream-downstream distribution of the homologous regions for Blackwater River and FakaUnion Bay, respectively. Fakahatchee estuary will serve as the reference site for target conditions.

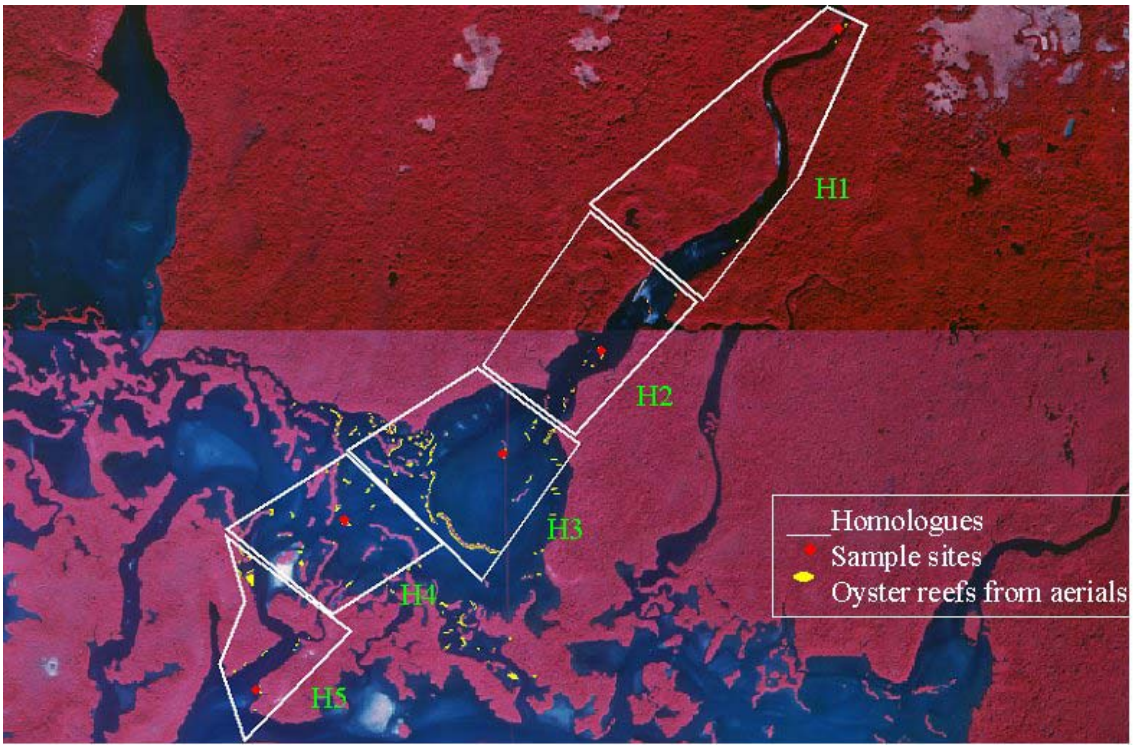

Figure H-5 Homologue regions along the Blackwater River

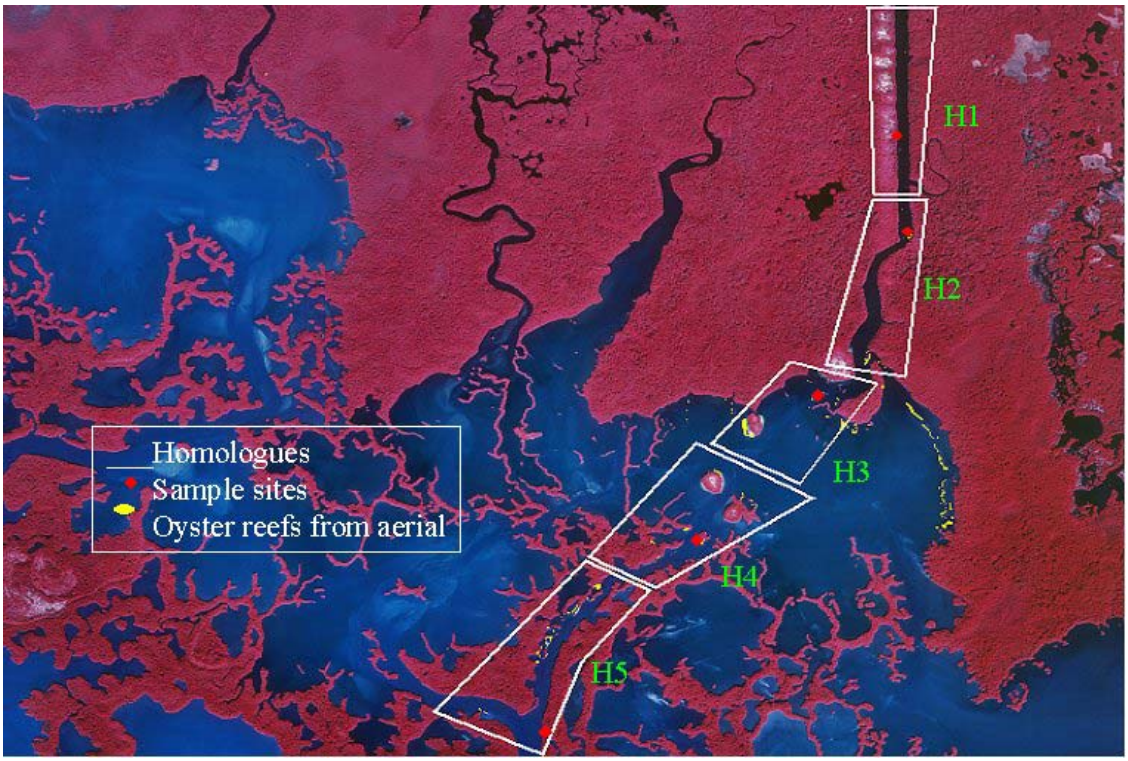

Figure H-6 Homologue regions along Faka Union Bay

The aspects of oyster physiology and ecology that will be monitored include: oyster living density (the number of living oysters per unit area of reef), recruitment rate, mortality, disease susceptibility, condition index, reef distribution and aerial extent (i.e., reef mapping), and the diversity and abundance of reef-dwelling crustacean and fish species (i.e., reef dwellers). Five spatial homologues will be monitored along the upstream-downstream axis in the four estuaries (Blackwater, Pumpkin, Faka Union, and Fakahatchee). (See Savarese & Volety 2001 and Savarese et al. 2003 for methodological details.)

Methods: Living Density.-- Oyster living density, an indirect measure of reef productivity, varies considerably along an estuarine salinity gradient. Patterns attributable to human alterations in freshwater flow were detected in Blackwater and Faka Union (Savarese & Volety 2001). Living densities were recently acquired for Fakahatchee. No data for this attribute exist for Pumpkin bay. In addition, the patterns of change in living density throughout the restoration process should be monitored.

Oyster living density at 3 reefs at each homologue among the 4 estuaries should be monitored twice during any given year, once during the wet and once during the dry season. Four 0.25-m^2 quadrats will be randomly located at the mean-low-tide height at each reef. The mean-low-tide contour is routinely the tidal height at which living density is greatest. The number of living oysters within each quadrat will be counted and compared among reefs and among homologues.

Methods: Reef Distribution & Aerial Extent.-- A considerable difference in the distribution of oyster reefs was noted previously between Blackwater and Faka Union estuaries (Savarese & Volety 2001). A substantial reduction in reef area and a downstream spatial shift exists in reef distribution when Faka Union is compared with Blackwater. This is attributed to the effects of freshwater inundation at Faka Union due to the presence of the SGGE canal system. The distribution of oyster reefs in Fakahatchee should represent the target conditions toward which the other Ten Thousand Islands' estuaries will shift. Reef distribution has never been documented in Fakahatchee or Pumpkin, and changes in the pattern of reef distribution among all estuaries must be monitored throughout the restoration period.

Aerial helicopter surveys, flown during the winter months when low tides are more extreme, will be used to photograph and map oyster reefs. Data from digital and 35-mm slides will be transferred to a GIS database (using ArcView), and the aerial extent and spatial distribution of reefs will be analyzed. Reef localities will be groundtruthed through subsequent fieldwork.

Methods: Recruitment Rate.-- Environmental conditions also affect larval recruitment. Oyster larvae respond to chemical cues from hard substrates and

old oyster shells colonized by bacterial film and adults. In addition, recruits may queue to physical environmental aspects, such as water flow, salinity, and temperature (see Kennedy 1996). These effects typically cause larvae to settle more frequently in areas with dense accumulations of adults and in areas with low flushing rates where larvae are trapped. Anthropogenically altered water quality or poor oyster health may cause a shift in patterns of recruitment. Oyster recruitment experiments have been conducted successfully in Blackwater and Faka Union (Savarese & Volety 2001) and in the Caloosahatchee (Volety & Tolley 2003). They have not been attempted in Fakahatchee or Pumpkin Bays, and they should be maintained in all estuaries throughout the restoration period.

Oyster recruitment monitoring will be conducted using hanging shell substrates. Hanging shell substrates will be constructed by stringing together dead, disarticulated oyster shells onto 12-inch long, heavy-test monofilament line. This technique is well established and used by scientists investigating oyster larval settlement and recruitment (Bartol & Mann 1997, Bartol & Mann 1999). Three sets of 6 hanging substrates will be suspended at each homologue and revisited quarterly. Stringers will be returned to the lab, and new recruits will be counted.

Methods: Mortality.-- Pulses of freshwater may cause high rates of mortality among oyster populations. In its present altered state, Faka Union experiences extended periods of freshwater inundation, and this has been shown to cause mass mortality events for oysters (Savarese & Volety 2001). Mortality experiments, therefore, serve as sentinels of the effects of freshwater pulses.

Juvenile oysters will be deployed in plastic wire-mesh cages to evaluate survival (excluding predation mortality) at one of the replicate reefs at each homologue. Juvenile oysters will be obtained from an oyster aquaculture facility located somewhere in Florida. Two sets of 400 oysters each will be caged (mesh size 0.5 cm) and placed at each site. For each quarter and cage, the number of surviving oysters will be counted, and growth of 50 randomly selected oysters will be measured using calipers.

Methods: Disease Susceptibility.-- For nearly fifty years, eastern oyster populations along the east and gulf coast of the United States have been ravaged by the highly pathogenic protozoan parasite, *Perkinsus marinus* (Mackin 1962, Andrews & Hewatt 1957, Andrews 1988, Burreson & Ragone-Calvo 1996, Soniat, 1996). Higher salinities and temperatures significantly enhance *P. marinus* infections in oysters (Andrews 1988, Burreson & Ragone-Calvo 1996, Chu & Volety 1997, Soniat 1996). Consequently, changes in freshwater delivery to the Ten Thousand Islands will affect the distribution of disease. Monitoring of *P. marinus* infection has been done consistently for 4 years in the

Caloosahatchee (Volety & Tolley 2003), and for a number of years inconsistently in Estero (Savarese et al. 2003), and the Ten Thousand Islands (Savarese & Volety 2001, Savarese et al. 2004). Data, however, from the Ten Thousand Islands have been limited and no data have been collected for Pumpkin Bay.

In order to compare the effects of altered freshwater input variability, *P. marinus* disease susceptibility in oysters will be monitored along salinity gradients. A total of 15 oysters per reef (3 reefs at each homologue) will be collected quarterly (every 3 months) throughout the year. Oysters will be assayed for the presence of *P. marinus* using Ray's fluid thioglycollate medium technique (Ray 1954, Volety et al. 2000). Samples of gill and digestive diverticulum will be incubated in the medium for 4-5 days. *P. marinus* meronts enlarge in the medium and stain blue-black with Lugol's iodine allowing for visual identification under a microscope. The intensity of infection will be recorded using a modified Mackin scale (Mackin 1962) in which 0 = no infection, 1 = very light, 2 = light, 3 = light-moderate, 4 = moderate, 5 = moderate-heavy, and 6 = heavy.

Methods: Condition Index.-- Condition index is a standard measure that assesses the physiological state of an oyster and effectively integrates an oyster's energy allocation to growth and reproduction. It is calculated as the ratio of dry meat weight to dry shell weight (Lucas & Beninger 1985). Because temperature and salinity affect oyster growth and reproduction, condition index is a good measure of oyster response to environmental stress. Since the metabolic energy remaining after daily maintenance is converted into biomass, an oyster stressed either by water quality or by disease has less energy for growth or reproduction. Consequently, a comparison of oyster condition index among the oyster reefs throughout the four affected estuaries will be maintained throughout the restoration period.

Oysters will be collected for condition index determination quarterly and at the same time disease prevalence is surveyed. Oysters will be shucked open, and the meat will be separated and placed into pre-weighed aluminum boats. Both meat and shell will be dried in an oven at 65°C for 24 h and will subsequently be weighed to the nearest 0.01 g. Condition index will be expressed as dry meat weight/dry shell weight x 100.

Methods: Reef Dwellers.-- Oyster reefs are recognized as essential fish habitat in Southwest Florida's estuaries. As such, they support high levels of secondary productivity and typically harbor diverse and abundant assemblages of reef-dwelling organisms. Prior work in the Caloosahatchee (Volety & Tolley 2003) and Faka Union (Savarese et al. 2003) has demonstrated that many species of fin-fish, particularly Florida blenny (*Chasmodes saburrae*), code goby (*Gobiosoma robustum*), skilletfish (*Gobiesox strumosus*), gulf toadfish (*Opsanus beta*), and juvenile pinfish (*Lagodon rhomboides*), and crustaceans, dominated by

the porcelain crab, *Petrolisthes armatus*, the mud crabs, *Eurypanopeus depressus* and *Panopeus herbstii*, pistol shrimp (*Alpheus heterochaelis*), and juveniles of the commercially important stone crab (*Menippe mercenaria*), are frequently collected in association with oyster reefs. Variability in the composition of these reef-dwelling communities reflects variation in water quality and reef complexity. Consequently, the monitoring of secondary productivity provides a measure of ecosystem-level structure and function.

Reef-resident and facultative fishes and decapods will be collected by deploying 1-m^2 lift nets (Crabtree & Dean 1982) at each reef site at each homologue. Nets will be constructed using 3.2-cm PVC frames and 6.4-mm delta-weave netting dipped in vinyl. The bag on each net will measure 0.5 m in height and the net bottom will have a 1.6-mm liner to prevent the escapement of small organisms. Lift nets will be filled with approximately 5-10 liter (volume displacement) of oyster clusters and will be anchored to the sediments using PVC stakes. Nets will be deployed subtidally at each homologue quarterly and left out for a period of 2–4 weeks. After that time, they will be pulled and any associated fishes and decapod crustaceans will be collected. After removal from the nets, organisms will be transported on ice back to the laboratory.

All fishes and decapod crustaceans will be identified to the lowest taxonomic level possible, and a subsample of each species will be measured to the nearest 0.1 mm (standard length for fishes; carapace width or length for decapods) and will be weighed to the nearest 0.01 g wet weight. For each species, regression analysis will be used to describe the relationship between organism size and wet weight. Using these regressions, biomass will be estimated by calculating wet weight for the mean size of organisms collected for each sample. Resulting biomass estimates (normalized to oyster density or unit area) will be compared among sites and among estuaries. Using the abundance data collected from the lift-net samples, the following metrics will also be applied to assess the relative value of oyster reefs as essential fish habitat: organism abundance (normalized to oyster density, oyster volume, and unit area sampled), species diversity (Shannon-Wiener Diversity Index, H'), species richness, and the percent dominance by the most abundant species in each sample. The resulting metrics will be compared within and among estuaries using analysis of variance.

Baseline Monitoring.-- Ideally 2 years (i.e., prior to restoration) of baseline monitoring data should exist for all measures. One year of baseline data exist for all measures at all 5 homologues for Blackwater. One year of complete baseline data exist for Faka Union with a second year of incomplete data (for only living density, disease susceptibility, condition index, and reef-dwellers and only for 3 of 5 homologues). One year of incomplete data exist for Fakahatchee (living density, disease susceptibility, and condition index and only for 3 of 5 homologues). Lastly, no preliminary data exist for Pumpkin Bay.

To fill these monitoring gaps, the following list outlines a prioritized baseline monitoring strategy (from highest to lowest):

1. Complete baseline. A second year of monitoring, for all the above listed aspects of oyster physiology and ecology, should be conducted at all 5 homologues in Blackwater and Faka Union. One year of complete monitoring should be conducted in Fakahatchee (all measures and all homologues). Two years of complete monitoring should be conducted in Pumpkin.
2. Reduction of homologues. This plan would conduct everything outlined in 1 but only for 3 of 5 homologues. If so, homologues 3-5 are the homologues of choice.
3. Reduction in number of measures. The monitoring plan could be further streamlined by reducing the number of measures considered. If chosen, it is recommended that: (1) Reef distribution should be mapped in Fakahatchee and Pumpkin, since reef mapping has never been conducted in these two estuaries. (2) Oyster living density, condition index, and disease susceptibility should be completed for a second year at Blackwater and Fakahatchee, and for one or two years at Pumpkin. (3) Recruitment should be monitored for one-year at all 4 estuaries. (4) This strategy completely eliminates the monitoring of reef dwellers and mortality.
4. Further reduction in measures. Strategy 3 could be further streamlined by eliminating recruitment.
5. Minimum baseline strategy. The bare-essential baseline monitoring effort that is needed includes: reef mapping for Fakahatchee and Pumpkin, the assessment of living density, condition index, and disease susceptibility at 3 homologues for one-year at Pumpkin.

Regardless of the strategy chosen, monitoring should be done at the following frequencies. Measurements should be made annually for reef distribution and aerial extent; biseasonally (wet vs. dry season) for living density; and quarterly for disease susceptibility, recruitment, mortality, condition index, and diversity and abundance of the reef community.

Construction Phase Monitoring. -- During the construction phase, it is recommended that the same monitoring strategy employed during the baseline phase be maintained. Reef mapping, however, need only be conducted once near the end of the construction phase (assuming construction takes no more than 3 years).

Post-construction Monitoring. -- The monitoring strategy chosen for the baseline and construction phases should be maintained for the first 10 years after construction is complete. Again, reef mapping need only occur once every 2-3 years. If the level of effort can not be maintained throughout the 10-year post-construction phase, the monitoring effort could be reduced following the prioritization strategy listed above for baseline monitoring. Monitoring should

continue during the 10-50 year post-construction interval, but at a much more limited extent. Reef mapping, living density, condition index, and disease susceptibility should be evaluated once every 5 years.

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H.3.5.2 Oyster Reef Crabs, Nekton, and Benthic Mapping

This section outlines recommended protocols for monitoring nekton and oyster reef crab populations in four estuaries co-managed by the Florida Department of Environmental Protection and the U.S. Fish and Wildlife Service that will be affected by the Southern Golden Gate Estates (SGGE) Hydrologic Restoration Project. The timing and quantity of fresh water flowing into three of these estuaries (Faka Union Bay, Pumpkin Bay, and Blackwater River) has been altered due to channelization of natural watershed sheetflow and increases in freshwater storage for aquifer recharge and irrigation. The SGGE Restoration Project is an opportunity to redistribute watershed sheet flow and restore the natural timing and quantity of fresh water flowing into these estuaries.

The ecological goals of this restoration plan include the reestablishment of historic flowways, sheetflow and hydroperiod of wetlands, and the reduction of point discharges and concentrated shock loads of freshwater to improve the health and productivity of the Ten Thousand Islands estuaries. Performance measures have been developed to evaluate hydrologic restoration efforts in the SGGE project area as they relate to the downstream receiving estuaries. The performance measures include hydrologic targets for meeting healthy salinity regimes within the estuaries and desirable levels in the abundance and composition of known estuarine species.

Since December 2000, staff at the Rookery Bay National Estuarine Research Reserve (FDEP) have deployed dataloggers to record water quality at continuous one-half hour intervals. Monthly nekton sampling was conducted within the Ten Thousand Islands region (Fakahatchee Bay, Faka Union Bay, and Pumpkin Bay). This monitoring has been used to develop a biological performance metric for the SGGE Project referenced to the conditions observed at Fakahatchee Bay, an estuary with relatively natural freshwater inflow.

Hester-Dendy artificial substrates were used to sample oyster reef crab populations monthly within these estuaries. A fourth estuary, Pumpkin Bay, was added to this monitoring effort in December 2003. This monitoring indicates that the relative abundances of the euryhaline (*Eurypanopeus depressus)* and stenohaline (*Petrolisthes armatus*) crab populations provide a useful ecological performance measure to guide freshwater inflow restoration projects (Shirley et al., In Press). This metric has been proposed as a biological performance criterion for the SGGE Project guided by the conditions observed at Fakahatchee Bay, an estuary with more natural freshwater inflow.

Benthic habitat mapping (sediment characteristics, bathymetry, submerged attached and unattached aquatic vegetation, and oyster reefs) and habitat suitability modeling for species composition in four estuaries is also recommended. The objective is to develop pre- and post-restoration benthic habitat coverage for Faka Union Bay, Pumpkin Bay, Blackwater River, and Fakahatchee Bay. Coverage is currently being developed for Fakahatchee and Faka Union Bays. Knowledge of benthic habitat distribution patterns will greatly assist investigations of species diversity and fish habitat suitability. Comparison of species similarity (diversity and abundance) between Blackwater River, Pumpkin Bay and Faka Union Bay (strongly impacted by altered freshwater inflow) and Fakahatchee Bay (considered to be more natural) need comparative information on additional controlling factors such as differences in benthic habitat distribution. Additionally, the proposed mapping will provide a present-day baseline data set for comparison with future change that may result from watershed restoration or other factors such as sea-level rise and climate change.

Habitat suitability modeling offers an approach to predict the occurrence and abundance of estuarine species given a suite of habitat characteristics. These characteristics are derived from mapping water quality, water depth, and substrate distributions (sediment grain composition, oyster reef, submerged attached, and unattached vegetation). This plan will support the gathering of benthic habitat information and the derivation of habitat suitability models prior to the SGGE Restoration Project. At five-year post-construction, these same estuaries will be remapped, and the habitat suitability models will be applied to this new set of information.

Purpose and Scope

The SGGE biological monitoring design utilizes details from existing monitoring programs and calls for the initiation of sites and protocols that are specific to this restoration project. Monitoring sites, parameters, and frequency will target the most efficient and cost effective means for identifying system outputs (projected restoration benefits) and tracking performance in meeting biological endpoints. Fakahatchee Bay will be used as a reference site to assess the abiotic and biotic condition of the restored estuaries. Fakahatchee Bay's fresh water originates, primarily as natural overland sheetflow, from a watershed that is mostly protected by wildlife conservation areas.

The primary goal of the nekton monitoring component is to examine nekton species composition linked to habitat water quality in three estuaries: Fakahatchee Bay, Pumpkin Bay, and Faka Union Bay (Figure H-4.). The primary goal of the oyster reef crab monitoring component is to examine the relative abundance of stenohaline (*Petrolisthes armatus*) and euryhaline (*Eurypanopeus depressus*) crab populations relative to abiotic water quality of four estuaries: Fakahatchee Bay, Faka Union Bay, Blackwater River, and Pumpkin Bay (Figure H-4). The primary goal of the benthic habitat mapping is to provide information on a major missing component required for Habitat Suitability Modeling in two estuaries for which this information is missing and all four estuaries post-restoration. Temporal components for the these activities are identified to address biotic and abiotic monitoring needs associated in tracking the project during the pre-construction (baseline) and throughout construction (project component start-up phases) and post construction (operational) phase.

H.3.5.2.1 Monitoring Design Components

The monitoring components for assessing nekton and oyster reef crab performance and impacts for the SGGE restoration are detailed for each of the project phases over time. The monitoring design is subject to change based on future permit negotiations and the need for adaptive assessment strategies as construction phases are completed. The assessment indicators selected as

relevant to the SGGE will be linked to freshwater inflow and are based on region and project specific considerations. Assessment performance measures are used to measure real responses as a basis for tracking how well the project is meeting its goals.

H.3.5.2.1.1 Nekton Methods

Four bottom trawls per estuary will be conducted each month. The collection sites will be randomly selected within each estuary from a 10 x 10 m grid drawn on a nautical chart. Each collection will use a 6 m otter trawl with a 3 mm mesh liner pulled for 5 minutes (approximately 0.1 km). The collections for each month will be scheduled within the same 4-day period during an ebbing tide. All fish, shrimp, and crabs were identified in the field to species, when possible, and then counted and measured (cm).

Catch per unit effort (CPUE) will be calculated as the number of fish, shrimp, and crabs collected per trawl. For statistical analysis, CPUEs should be log transformed by $\log_{10}(x+)$ if needed to control heteroscedasticity and to conform to normality assumptions. An ANOVA followed by a Tukey-Kramer multiple comparison procedure will be used to test for the effects of location, season, and year on CPUE. In addition, patterns in species composition, as influenced by year, season, and location and the relative influence of water quality on these patterns, will be analyzed using non-parametric analyses.

For these latter procedures, the fish CPUE will be transformed ($4\sqrt{}$) to emphasize the contribution of more sensitive yet less abundant species, and a Bray-Curtis similarity matrix will be calculated for each year, estuary, and season. Group average sorting from these matrices will be used to produce dendrograms. Multidimensional scaling (MDS) analyses will be used to convert the similarity matrixes into two-dimensional ordinations. An analysis of similarity (ANOSIM) will be used to test for significant differences in species composition for each season and location. A Spearman Rank correlation procedure will be used to relate the abiotic and biotic data. The abiotic data used in this analysis will be the means, maximum, and standard deviation of salinity (ppt), salinity change (ppt/hour), temperature (^{o}C), dissolved oxygen (ppm), depth (m), pH (units), and turbidity (NTU), summarized over each season, year, and location from the automated water quality monitoring dataset generated by the water quality component of the SGGE monitoring plan. P-values for the resultant correlation coefficients will be calculated using standard statistical procedures.

Specific Performance Measure and Target for Adaptive Management

Performance Measure: Abundance and Composition of Nekton.

Target: Abundance and Composition should be similar (75% by Bray Curtis) to composition in Fakahatchee and Pumpkin Bays.

Pre-Construction (Baseline)

Since December 2000, staff at the Rookery Bay National Estuarine Research Reserve have conducted bottom trawls to sample nekton populations monthly within Fakahatchee Bay, Faka Union Bay, and Pumpkin Bay (Shirley et al., In Press). This monitoring indicates that nekton species composition patterns are a useful, sensitive, and consistent indicator of altered freshwater inflow that can provide a useful ecological performance measure to guide freshwater inflow restoration projects.

Multidimensional scaling ordination analyses of the similarity in species composition for Fakahatchee Bay revealed distinct seasonal patterns (Figure H-7). This analysis identified the late wet season and the late dry season as extremes separated by the "transitional" early dry and early wet seasons. The results of an ANOSIM procedure indicated a significant ($p \leq 0.05$) influence of season but not year on this pattern. The ANOSIM procedure also indicated a significant interaction effect of season and year with the species composition being significantly $p \leq 0.05$ different across each year during the same season except for the late wet season. Using the water quality data collected with automated datalogger stations, the Spearman Rank correlation procedure indicated that minimum salinity (i.e., maximum freshwater inflow), ($\rho_s = 0.65$ for 2001; $\rho_s = 0.45$ for 2002) was the best-correlated single abiotic variable to the observed species composition patterns. Furthermore, analysis of the 2001 dataset indicated that Fakahatchee Bay species composition was significantly different from Faka Union Bay during all seasons with the exception the early dry season (Figure H-8).

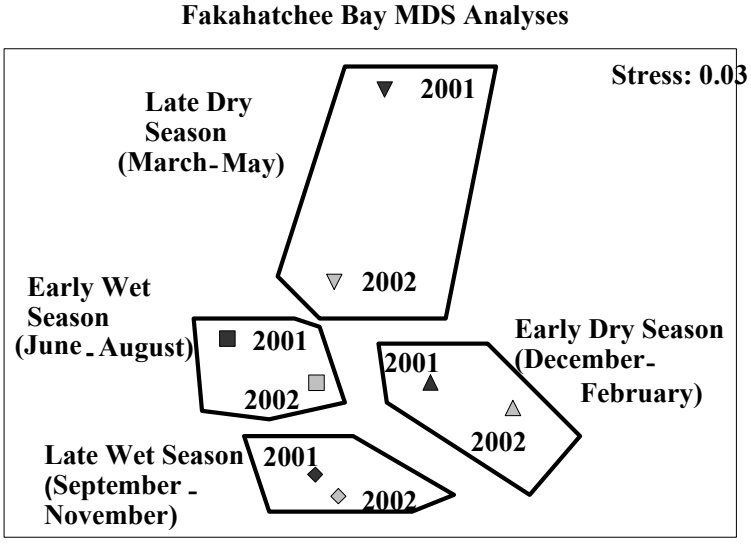

Figure H-7 Results of multidimensional scaling ordination of species composition siimlarity for Fakahatchee Bay by season and year

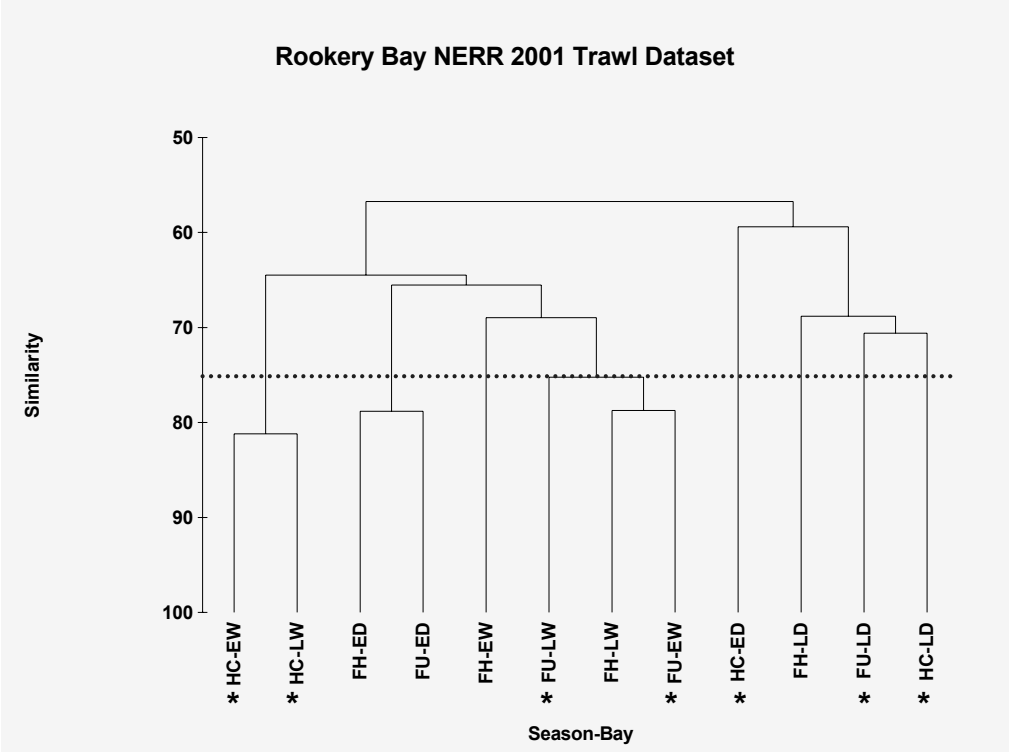

Figure H-8 Dendrogram of species composition similarity for Fakahatchee Bay (FB), Faka Union Bay (FU) and Henderson Creek (HC) during the early dry (ED), late dry (LD), early wet (EW) and late wet (LW) season of 2001. The asterisks indicate a significant ($p \leq 0.05$) difference from Fakahatchee Bay during the same season. The dashed line indicates a Bray-Curtis similarity value of 75

A 75% Bray-Curtis similarity index appears to be reasonable initial threshold value to assess the restoration of nekton community structure. As additional information is obtained through hydrological modeling and habitat mapping an adjustment of this threshold value may be necessary.

H.3.5.2.1.2 Oyster Reef Crab Methods:

Crab populations will be sampled monthly by placing eight Hester-Dendy samplers on two separate oyster reefs within each of the four estuaries being studied. The oyster reefs are located at approximately the same distance from the headwaters of each estuary, within the mesohaline zone where oyster reefs begin to form well-defined clumps. Past experience indicated that these zones have similar salinities during the late-dry season. Samplers will be located at a water depth that would ensure they remained submerged during an average low tide (i.e. at an approximate depth of 1 m MHW). Samplers will be recovered after

14 days of deployment, disassembled, and their contents will be cleaned on a 1-mm sieve. All *Petrolisthes armatus* and *Eurypanopeus depressus* will be enumerated, and crabs > 5 mm will be measured to the nearest 0.1 mm.

The ratio of post-juvenile stenohaline to euryhaline crab abundance (STENOHALINE:EURYHALINE) will be calculated for each Hester Dendy. The STENOHALINE:EURYHALINE will be calculated as: (Number of *P. armatus* +1)/(Number of *E. depressus* +1) for all crabs > 5-mm carapace width. If necessary, these data will be log transformed by $\log_{10}(X+1)$ to control heteroscedasticity and conform to normality assumptions. The larger size class was chosen as the focus of this monitoring to lessen the immediate effect of larval recruitment on the metric. An ANOVA procedure followed by preplanned LSD multiple comparisons will be used to test for differences in the mean STENOHALINE:EURYHALINE for Fakahatchee Bay versus the other estuaries during the same season and year.

Specific Performance Measure and Target for Adaptive Management

1. Performance Measure: Relative abundance of stenohaline versus euryhaline oyster reef crabs.

Target: The ratio of stenohaline:euryhaline crabs should not be statistically different ($p = 0.05$) in the restored estuaries from the ratios of these species calculated from populations sampled on oyster reefs in Fakahatchee Bay.

Pre-Construction (Baseline)

Since 2000, staff at the Rookery Bay National Esurarine Research Reserve have deployed Hester-Dendy artificial substrates to sample oyster reef crab populations monthly within Fakahatchee Bay, Faka Union Bay, and Blackwater River. In December 2003, Hester-Dendy samplers were also deployed in Pumpkin Bay. This monitoring has shown that the relative abundance of the euryhaline (*Eurypanopeus depressus*) and stenohaline (*Petrolisthes armatus*) crab populations provide a useful ecological performance measure to guide freshwater inflow restoration projects (Figure H-9).

As of December 2003, a total of 8334 *P. armatus* and *E.* have been collected by the samplers. Within the reference estuary, Fakahatchee Bay, the mean STENOHALINE:EURYHALINE was maintained consistently above 1 indicating that the crab populations of this site were more stenohaline, especially during the late dry and early wet season.

In 2001, for both the late dry season and early wet season, the mean STENOHALINE:EURYHALINE was significantly greater ($p \leq 0.05$) in the Fakahatchee Bay estuary than in the Faka Union Bay estuary (Figure H-9).

The mean values for the STENOHALINE:EURYHALINE were not significantly different ($p > 0.05$) for Fakahatchee Bay versus the Blackwater River estuary for any season during that year.

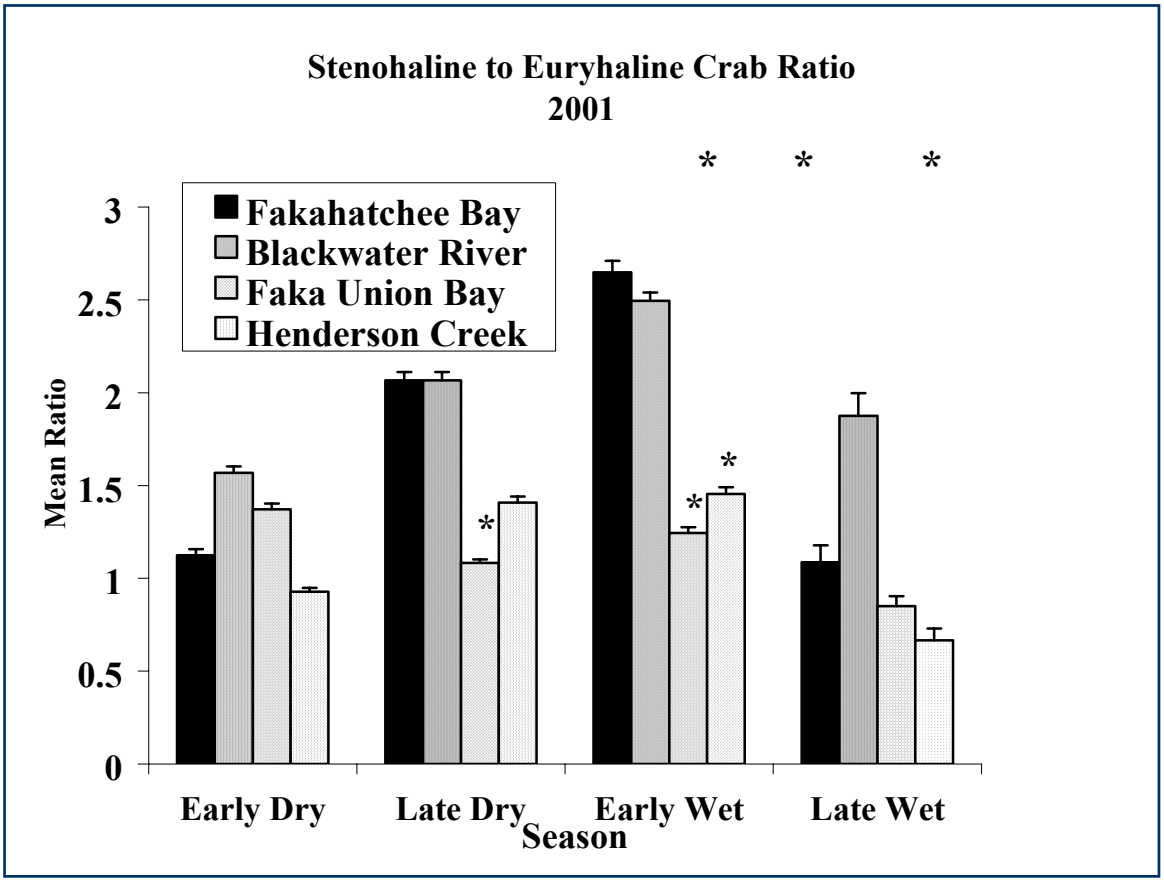

Figure H-9 Mean (+ standard error) stenohaline to euryhaline crab abundance for Fakahatchee Bay, Faka Union Bay, and Henderson Creek during 2001. The asterisks indicate a significant difference ($p \leq 0.05$) in this value compared to Fakahatchee Bay.

Again, in 2002, the mean STENOHALINE:EURYHALINE was significantly greater ($p \leq 0.05$) for Fakahatchee Bay versus Faka Union in the early wet season (Figure H-10). In contrast to the previous year, there was not a significant ($p > 0.05$) difference in the mean STENOHALINE:EURYHALINE for Fakahatchee Bay versus Faka Union Bay during the late dry season. In addition, Faka Union Bay had a significantly lower ($p \leq 0.05$) mean STENOHALINE:EURYHALINE than Fakahatchee Bay during the late wet season. During the early dry season that year, the Blackwater River mean STENOHALINE:EURYHALINE was significantly greater ($p \leq 0.05$) than that of Fakahatchee Bay, a trend that began in the late wet season of 2001 (Figure H-10.

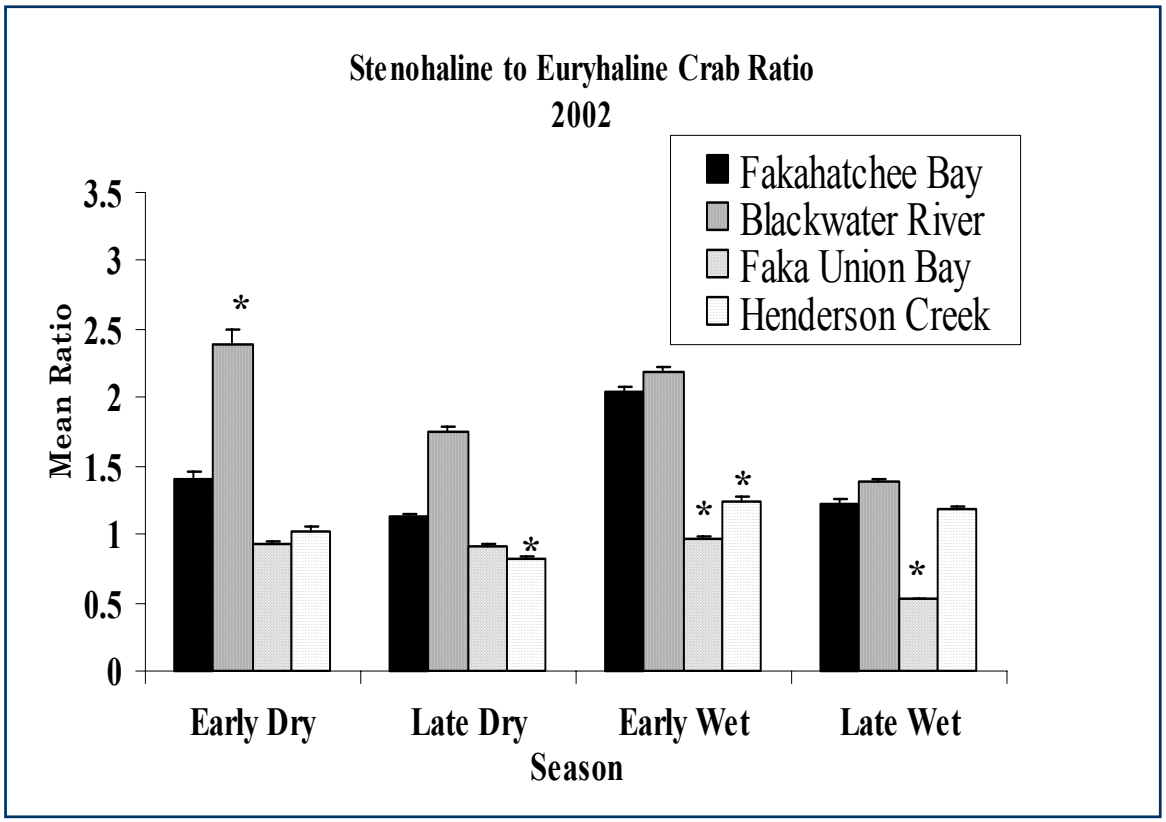

Figure H-10 Mean (+ standard error) stenohaline to euryhaline crab abundance for Fakahatchee Bay, Faka Union Bay, and Henderson Creek during 2002. The asterisks indicate a significant difference ($p \leq 0.05$) in this value compared to Fakahatchee Bay.

In 2003, the mean STENOHALINE:EURYHALINE of stenohaline to euryhaline crabs in Blackwater River was greater than that of Fakahatchee Bay during both the late dry and early wet and late wet seasons ($p \leq 0.05$, Figure H-11.). There were no significant differences ($p > 0.05$) in the mean STENOHALINE:EURYHALINE for Fakahatchee Bay versus Faka Union Bay for any season. During 2003, the seasonal minimum salinity values, an indicator of freshwater inflow, were also consistently low in Fakahatchee Bay (Figure H-11).

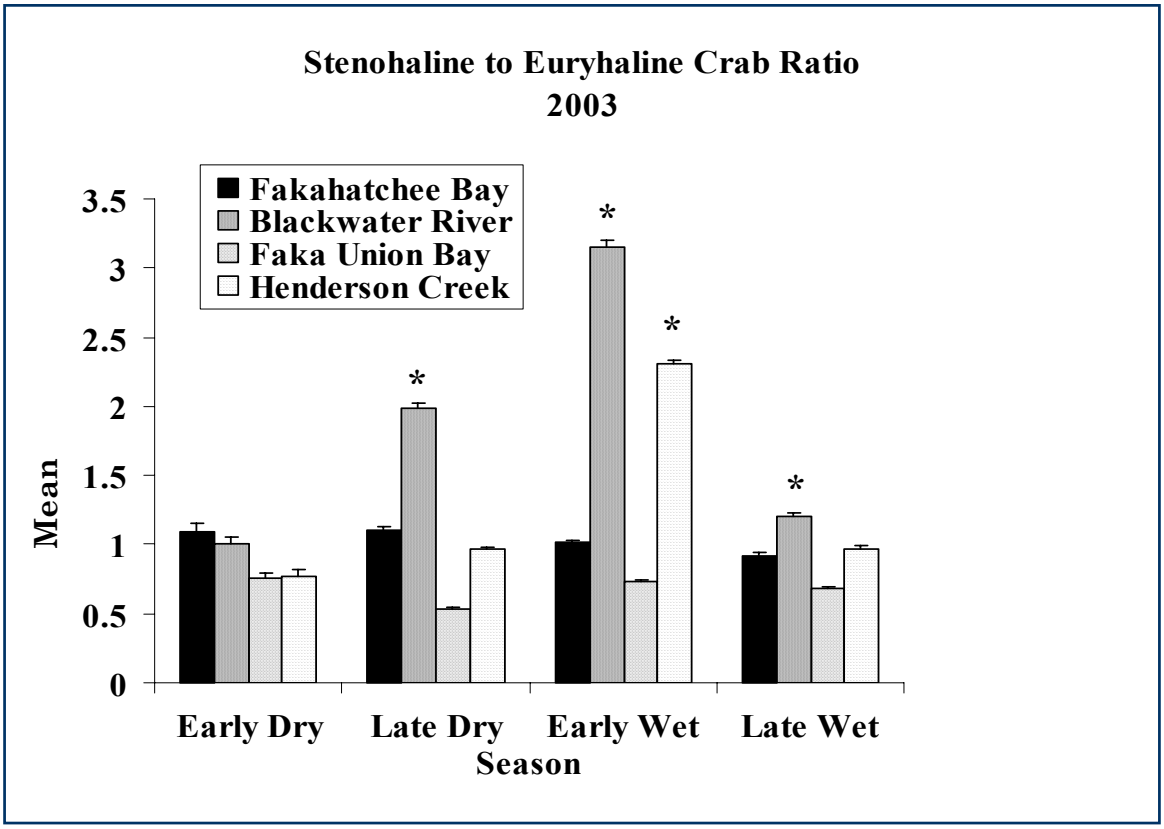

Figure H-11 Mean (+ standard error) stenohaline to euryhaline crab abundance for Fakahatchee Bay, Faka Union Bay, and Henderson Creek during 2003. The asterisks indicate a significant difference ($p \leq 0.05$) in this value compared to Fakahatchee Bay.

The most striking abiotic difference among the estuaries being monitored was the extreme salinity fluctuations observed during the early/late wet and early dry seasons (May through February) in Faka Union Bay. The management strategy of quickly draining the watershed to prevent upstream flooding of residential areas delivers unnaturally large volumes of freshwater into this estuary and extends the influence of the wet season into the early dry season. This effect would explain the consistently low STENOHALINE:EURYHALINE values in Faka Union Bay. When statistically different from Fakahatchee Bay's mean STENOHALINE:EURYHALINE, Faka Union's mean STENOHALINE:EURYHALINE are always lower. Freshwater inflow into the Blackwater River estuary is thought to be restricted due to the Southern Golden Gate Canal system that intercepts natural watershed sheet flow and shunts it to the Faka Union Bay estuary. This change in flow is reflected in the significantly higher STENOHALINE:EURYHALINE values observed for this estuary relative to Fakahatchee Bay during the early dry season of 2002 and the late dry/early wet seasons of 2003.

Although not always statistically significant, the observed STENOHALINE:EURYHALINE values tended to be higher in Blackwater River than Fakahatchee Bay for nine of the twelve seasons thus far studied. Furthermore, during eight of these nine seasons, the STENOHALINE:EURYHALINE values for the Faka Union Estuary tended to be lower relative to Fakahatchee Bay.

Linking Abiotic and Biotic Datasets

A Spearman correlation procedure indicated that, for Fakahatchee Bay with all years combined, minimum salinity with a one-season lag was the best single correlated abiotic variable to the mean STENO:EURY (ρ_s = 0.82; Figure H-12). The second most correlated variable to the mean STENO:EURY was maximum salinity with no lag (ρ_s = 0.75), followed by maximum salinity change with a one-season lag (ρ_s = -0.66) and then mean temperature with a one-season lag (ρ_s = -0.62). These correlations were all significant at the $p \leq 0.05$ level.

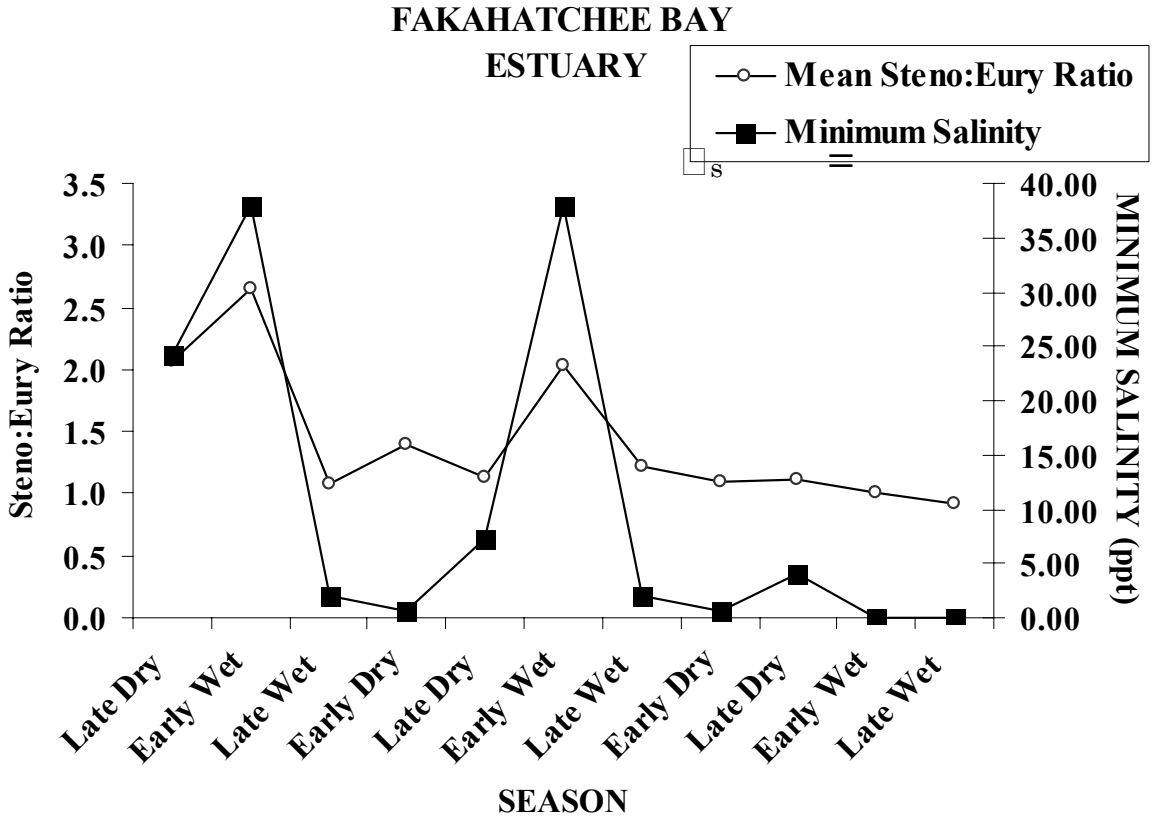

Figure H-12 Mean STENO:EURY versus minimum salinity (ppt) with a one season lag for Fakahatchee Bay

Combining the data for all estuaries and years, this procedure identified mean salinity change with a one-season lag as the single best correlated abiotic variable to the mean STENO:EURY (ρ_s = -0.67; Figure H-13). This variable was followed by mean salinity with a one-season lag (ρ_s = 0.55) and the standard deviation in salinity with a one-season lag (ρ_s = -0.5).

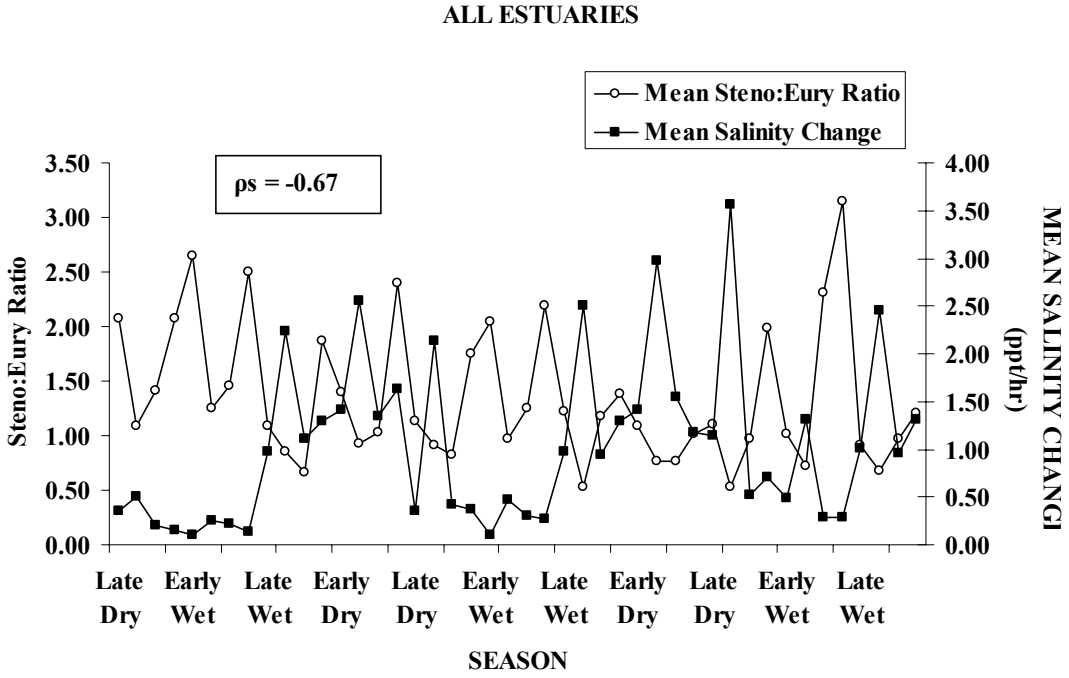

Figure H-13 Mean STENO:EURY versus mean salinity change (absolute value, ppt/hr) with a one-season lag for all estuaries

Using a one-season lag, the results indicate that in all estuaries for 2001, minimum salinity (ρ_s = 0.72) was most correlated to the mean STENO:EURY followed by the mean salinity change (ρ_s = -0.61). In 2002 and 2003, mean salinity change with a one-season lag (both years, ρ_s = -0.76) was the most correlated abiotic variable to the mean STENO:EURY. These correlations were all significant at the $p \leq 0.05$ level.

H.3.5.2.1.3 Benthic Habitat

Habitat Mapping Methods

Acoustic remote sensing methods (side-scan sonar and 50 kHz echo sounding) combined with tradition bottom sampling and ground truthing, to develop continuous coverage maps depicting multiple layers of benthic substrate characteristics, such as bathymetry, bottom type (such as seagrass, hardbottoms, oyster reef, tidal scour areas), and sedimentary facies attributes,

such as grain size and composition (carbonate and organic carbon content). Fakahatchee Bay and Faka Union Bay benthic habitat mapping during the pre-construction phase is currently funded by the South Florida water Management District. Funding for additional mapping will allow for benthic mapping of Pumpkin Bay and Blackwater River during the pre-construction phase of the project and mapping of all bays during the fifth-year post-construction.

Habitat Suitability Modeling

The monitoring components needed to model habitat suitability are water quality, water depth, and substrate characteristics (sediment grain size, oyster reef, submerged attached, and unattached vegetation). Habitat suitability modeling of estuarine species composition of Fakahatchee, including salinity, will allow freshwater inflow to be linked to estuarine species composition of Faka Union Bay, Blackwater River, and Pumpkin Bay. These models will be useful for guiding the adaptive management of freshwater inflow to conserve the natural biodiversity of the estuaries of the Ten Thousand Islands region.

Specific Performance Measure and Target for Adaptive Management

Performance Measure: Species composition of estuarine nekton and benthos.

Target: Freshwater inflow rates are adjusted so that species composition (as an index of similarity) of the restored estuaries are similar to Fakahatchee Bay, taking into account the natural differences in benthic and water quality habitat characteristics.

Pre-Construction (Baseline)

Benthic habitat mapping of Fakahatchee Bay and Faka Union Bay is currently funded and underway. Funds are needed for mapping benthic habitats of Pumpkin Bay and Blackwater River using the same methods. A habitat suitability model, linking benthic maps and water quality to estuarine species composition (as an index of species similarity) for Fakahatchee Bay versus the freshwater inflow altered estuaries, must be developed. This model, based on Fakahatchee Bay as a reference site, can be used to predict the species composition of Faka Union Bay, Pumpkin Bay, and Blackwater River under various freshwater inflow conditions and can be used to assess the deviations of the other estuaries from natural conditions, thereby setting target goals for the restoration project. Collections of nekton and benthic fauna, currently conducted by Florida DEP staff, will be used to derive and validate the model. In addition, a salinity model is needed to predict estuary-wide salinity based on measurements at a fixed near-continuous monitoring station within each estuary. Field measurements using a towed datalogger along with available information for wind speed and direction, tidal stage and freshwater inflow rate will be used to derive this model.

During Construction (Start-up Construction Phases)
The SGGE construction projects will occur in phases and therefore present an added level of complexity to the monitoring design for the project area. To maximize the information gained from monitoring during the construction phases, adaptive assessment strategies will be developed as the restoration progresses. Continued nekton monitoring within the same estuaries and deployment of Hester-Dendy samplers for crabs at the same oyster reef sites is recommended with an annual assessment based on data analyses. Benthic Habitat Mapping and Suitability Modeling are not being proposed for this phase.

Post Construction (Operational) Phase
Monitoring objectives and requirements for the post construction phase of the SGGE restoration will depend largely on permit requirements and the final design and operational plan for the project area. Monitoring for assessment during the post construction phase should concentrate on estuarine biota, hydrologic and ecological data, since these are the areas for which project performance measures were developed. Investigation and monitoring of the ecological components such as vegetation and hydrologic regimes will provide the most appropriate means for assessing restoration performance. These data should be available to evaluate the system responses within the project area and can be used in the development of empirical relationships between ecological responses and water quality characteristics in restored estuarine areas. A minimal ten-year post-construction dataset is recommended to fully assess the response of the estuarine biota to the restoration project.

As with the baseline dataset, a Spearman correlation procedure will be used to relate nekton species composition patterns or the mean STENOHALINE:EURYHALINE values obtained for each season, year, and location to corresponding water quality conditions. Water quality data used in this analysis will be the mean, minimum, maximum, and standard deviation of salinity (ppt), salinity change (absolute value; ppt/hour), temperature (^{o}C) , dissolved oxygen (ppm), pH (units), and turbidity (NTU) summarized over each season, year, and location for the automated water quality monitoring dataset. Correlations between seasonal patterns in nekton species composition or mean STENOHALINE:EURYHALINE values versus water quality will be examined using no lag and a one-season lag. For the one-season lag, each season's biotic data will be matched to the previous season's abiotic dataset. The goal of this analysis will be to identify the single most correlated abiotic variable to the observed nekton species composition or oyster reef crab abundance patterns and to examine which statistic (mean, maximum, minimum, standard deviation) associated with this variable best explained the observed pattern of the nekton species composition or mean STENOHALINE:EURYHALINE values. If the nekton species composition or STENOHALINE:EURYHALINE of crab

populations of Faka Union Bay, Pumpkin Bay or for reef crabs in Blackwater Bay are found to be significantly different from Fakahatchee Bay, correlations of this ratio to habitat salinity can be used to guide adaptive management of freshwater inflow requirements of each bay.

A five year post-construction benthic habitat mapping and application of the habitat suitability model developed in the pre-construction phase is recommended to fully assess the response of the estuarine biota to the restoration project. A new benthic habitat map will be generated using new data for Fakahatchee Bay, Faka Union Bay, Pumpkin Bay, and Blackwater River. The habitat suitability model generated during the pre-construction phase will be used to predict the species composition (as an index of similarity) of Fakahatchee Bay versus Faka Union Bay, Pumpkin Bay, and Blackwater River. If the actual nekton species composition of Faka Union Bay or Pumpkin Bay is found to be significantly different from Fakahatchee Bay, this model will be used to guide the adaptive management of freshwater requirements of each bay.

H.3.5.2.2 Data Quality Objectives

Data Uses, Resolutions, and Conclusions
The data will be used to fulfill the purposes listed in section 2.0 and to assure the project conserves the natural biodiversity of the affected estuaries.

Data Quality
Data quality refers to the level of uncertainty associated with a particular data point or value. To ensure that this dataset minimizes uncertainty associated with sampling errors the monitoring protocol will be consistent throughout the pre-construction, during construction and post-construction phases of this project.

Expected Levels and Concern Triggers
The six year baseline monitoring dataset for the reference location, Fakahatchee Bay, can be used to generate outlier analyses statistics that can be used to identify unusual results during subsequent phases of the monitoring plan.

Quality Assurance/Quality Control
The use of this monitoring strategy in an estuarine environment does not have written standards for QA/QC. It is important that the monitoring and analyses protocol established during the pre-construction phase of the project remains consistent through the subsequent phases. A written protocol will guide the monitoring throughout all phases of construction. The quality of the monitoring results will be demonstrated by publication in a peer reviewed journal.

Field Sampling Protocols
The field sampling protocol uses statistically correct procedures for comparisons between the reference and restored estuaries. Voucher specimens will be saved for scrutiny by taxonomic experts.

H.3.5.2.3 Literature Cited

Shirley, M., V. McGee, T. Jones., B. Anderson and J. Schmid (In Press). The Relative Abundance of Stenohaline and Euryhaline Oyster Reef Crab Populations as a Tool for Managing Freshwater Inflow to Estuaries. Journal of Coastal Research.

Shirley, M., P. O'Donnell, V. McGee and T. Jones (In Press). Nekton species composition as a biological indicator of altered freshwater flow into estuaries. In: Estuarine Indicators (S. Bortone, Editor). CRC Press.

H.3.6 Water Quality

This document serves as a comprehensive reference for monitoring surface water quality characteristics within the Southern Golden Gate Estates Hydrologic Restoration Project (SGGE) study area and also details a system of biological testing for contaminants. Groundwater quality has been identified as a concern solely for the Hazardous, Toxic, and Radioactive Waste (HTRW) process and will be addressed in the remediation monitoring plan. The monitoring detailed in this plan has been designed to provide the water quality information base needed to evaluate the SGGE's performance in meeting restoration goals and to facilitate effective, science based management decisions concerning project design and operation. The guidance contained in this document will assist in maintaining consistency in sampling locations, parameter lists, and frequencies as well as providing documentation of the project scope and an ongoing historical perspective.

SGGE has undergone extensive hydrologic alteration due to the construction of a network of canals, levees, and roads built in the 1950s when the area was being prepared for development. Prior to development, the area was characterized by seasonal flooding and broad, slow moving sheet flow that sustained wetland vegetation, rejuvenated freshwater aquifers, and provided a balanced fresh water distribution to the Ten Thousand Islands estuary complex. Changes in the timing and quantity of flow have caused water quality impairments to the project area and have impacted the downstream local estuary systems of the Ten Thousand Islands region. These local estuaries are being impacted by the large

centralized freshwater inputs through the Faka-Union Canal that contribute to lowered average salinity in Faka-Union Bay and deprive historical fresh water sheetflow to bays to the east and west of the canal (e.g. Fakahatchee, Pumpkin Bay, and Blackwater River), resulting in extended hypersaline periods. Considerable land use changes in the area upstream of the project have also influenced the water quality characteristics of the SSGE area and the downstream receiving estuaries.

The ecological goals of this restoration plan include the reestablishment of historic flowways, sheetflow and hydroperiod of wetlands, and the reduction of point discharges and concentrated shock loads of freshwater to improve the health and productivity of the Ten Thousand Islands estuaries. Performance measures have been developed to evaluate hydrologic restoration efforts in the SGGE project area as they relate to the downstream receiving estuaries. The performance measures include hydrologic targets for meeting healthy salinity regimes within the estuaries and desirable levels in the abundance and composition of known dominant fish species.

The SGGE hydrologic restoration is classified as a Category C project according to CERP Guidance Memorandum (CGM) 023.00. Category C level projects are those "for which a water quality improvement is not specifically identified in the Comprehensive Plan as a project purpose or a criterion to be addressed during design". However, the SGGE project is expected to produce water quality benefits based on the restoration of a more natural hydrologic regime to the project area and the subsequent potential for improvement of the existing altered condition of the downstream receiving estuaries. According to CGM 023.00, the SGGE must identify constraints for water quality. Taking into account the previous land uses within the project area and the findings of the Phase I and II Environmental Site Assessment (ESA), the principal water quality consideration for the SGGE has been identified as the potential for introduction of water quality impairments to the project area, as well as its downstream receiving water bodies. Accordingly, the SGGE is under constraint during construction and operation, to not cause or contribute to violations of state water quality standards or to introduce pollutants of concern into the trophic system.

Purpose and Scope

The SGGE water quality monitoring design utilizes details from existing monitoring programs and calls for the initiation of sites and protocols that are specific to this restoration project. Monitoring sites, parameters, and frequency will target the most efficient and cost effective means for identifying system outputs (projected restoration benefits) and tracking performance in meeting the water quality constraints listed above. The monitoring design encompasses three components: fresh water, estuarine waters, and analysis of toxins in tissue.

These three components will function to enable a comprehensive view of the water quality dynamics associated with this project. Temporal components for the three matrices are identified to address the water quality monitoring needs associated in tracking the project during the pre-construction (baseline), throughout construction (project component start-up phases) and the post construction (operational) phase. Considerations for differences in duration of operational influences on each of the water quality matrices have also been incorporated into the monitoring design.

Components of several existing surface water monitoring initiatives will be leveraged to obtain applicable data for the SGGE restoration plan. These geographical and scientifically relevant programs are the Collier County Water Quality (CCWQ) monitoring program, the South Florida Estuarine Water Quality Monitoring Network, and the FDEP Rookery Bay National Estuarine Research Reserve Continuous Monitoring Network. A comprehensive map detailing the sites currently being collected through these programs, as well as sites that will need to be established during the course of the restoration, is given in Figure H-14. These programs are currently funded by the SFWMD (District) through cost share agreements and incorporate both significant portions of both the fresh and estuarine components identified for evaluation of the restoration project. Contractual services for the collection of fish tissue for toxin analysis will be negotiated during 2005. In many cases, the current level of surface water monitoring supplied through the three programs mentioned above is more extensive in parameter and frequency levels than needed for the goals of the SGGE monitoring plan. There are also gaps in the appropriate levels of monitoring needed to adequately evaluate the SGGE restoration. This design details the current levels of monitoring (distinguishing the parameters and frequencies appropriate for SGGE responsibility-funding) and will identify the additional monitoring needs for all phases of the restoration.

H.3.6.1 Monitoring Design Components

The three components for assessing water quality performance and impacts for SGGE restoration are detailed for each of the project phases over time. The monitoring design is subject to change based on future permit negotiations and the need for adaptive assessment strategies as construction phases are completed. The assessment indicators selected as relevant to SGGE are based on region and project specific considerations. These parameters are similar to those detailed in the water quality ecological model template developed by the South West Florida Feasibility Study (SWFFS). Assessment performance measures are used to measure real responses as a basis for tracking how well the project is meeting its goals.

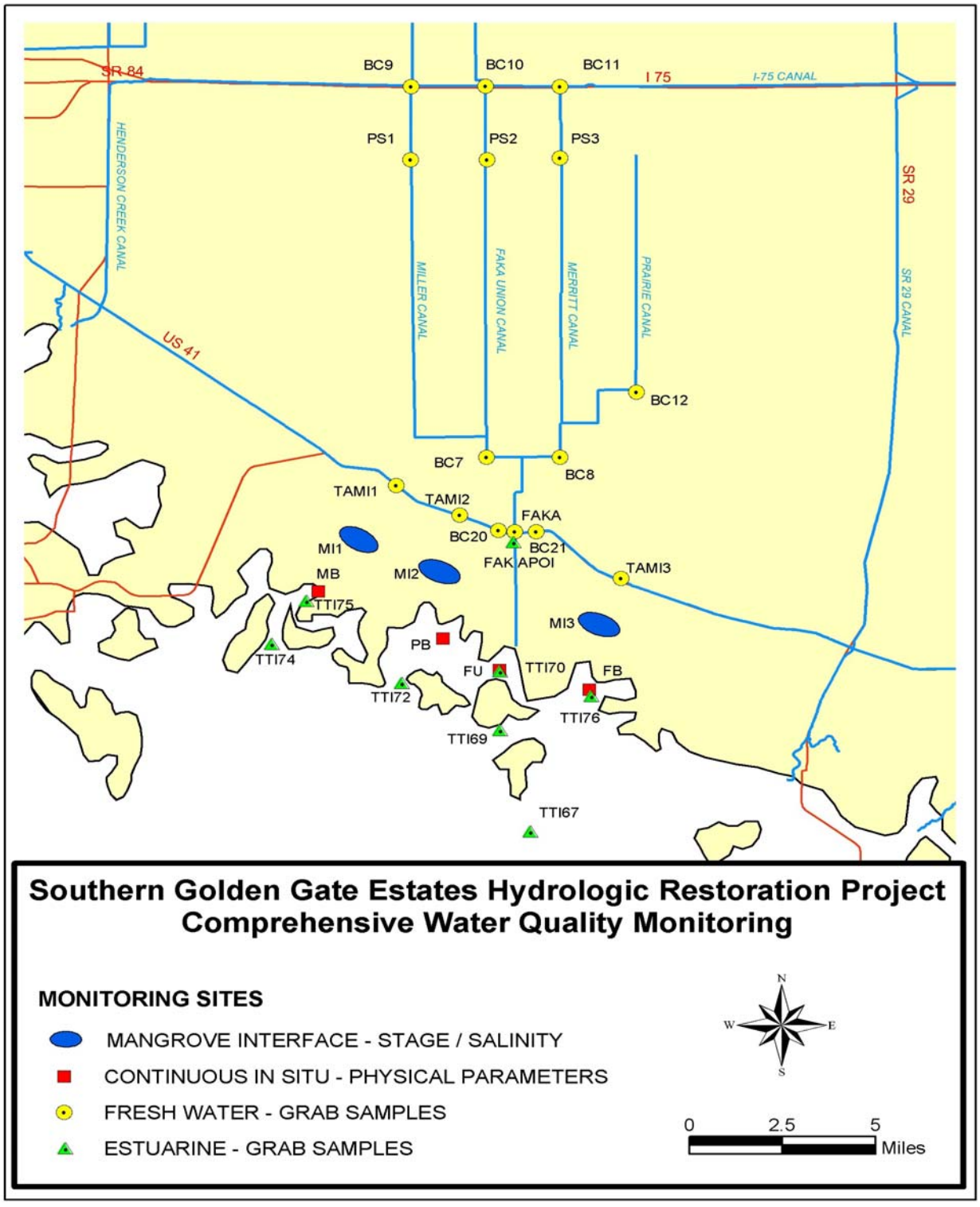

Figure H-14 Comprehensive Baseline (Current and Proposed) Surface Water Monitoring Locations Relevant to the SGGE Hydrologic Restoration Project

H.3.6.1.1 Fresh Water Component

Pre-Construction (Baseline)

Fresh water surface sites were established along the inflows to and major outflows from the project area for the past five years. These sites provide a historical record of the water quality conditions for the project area and surface water grab samples at these sites that will be continued until the project construction phases eliminate these locations as relevant areas for sampling. Construction activities will alter the nature of the project area significantly, and many of the current sites (located in canals) will not be accessible and/or will not be able to achieve the data functions currently served. Current and proposed fresh water sampling locations and descriptions are given in Table H-3. In order to sufficiently evaluate compliance with Class III water quality standards and to determine if the SGGE is meeting the water quality constraint for this project, it is necessary to conduct periodic, comprehensive sampling events that cover the spectrum of parameters for which a water quality standard has been set. It is also necessary to establish a baseline data set to compare during construction and post-construction collections against. A single baseline sampling event will be conducted at the major inflows and outflows to the project area before the major construction phases begin. A list of the Class III parameters to be included along with their regulatory limits is detailed in Table H-4. The current and proposed sample parameters and frequencies for routine baseline monitoring, as well as those parameters distinguished to be relevant to the needs of the restoration evaluation, are given in Table H-5.

During Construction (Start-up Construction Phases)

The SGGE construction projects will occur in phases and, therefore, present an added level of complexity to the freshwater monitoring design for the project area. To maximize the information gained from monitoring during the construction phases, adaptive assessment strategies will be developed as the restoration progresses. Surface water grab sampling locations will be situated along transects within the project area that have been developed for vegetation and hydrologic monitoring (Figure H-1). These sites have fixed point structures that will serve to maintain consistency in the surface water collections. The surface water sites will be sampled as the water levels return to the project area, and four sites from each transect line will be sampled per year (16 sites total). A list of parameters and frequencies for freshwater grab sampling within the project area during construction start up phases is given in Table H-6. Samples collected at the inflow pump stations and at the transect sites will include the analysis of sulfate to compliment the fish tissue collections at or near these sites (elevated levels of sulfate are thought to be associated with increases in methyl mercury production). A one time Class III sampling event will also be conducted at all the major inflows and outflows during the Start-up Construction Phase.

Table H-3 Baseline (current and proposed) fresh water monitoring site locations and descriptions

STATION	MATRIX	LOCATION DESCRIPTION	LAT*	LONG*
BC7	SW-FRESH	Faka Union Canal at west bend of "T"	25 59 33.936	81 31 18.516
BC8	SW-FRESH	Merritt Canal at east bend of "T"	25 05 05.766	81 29 25.764
BC9	SW-FRESH	Miller Canal at intersection of I-75	26 09 11.412	81 33 18.936
BC10	SW-FRESH	Faka Union Canal at intersection of I-75 (FAKAUC75)	26 06 11.304	81 03 08.424
BC11	SW-FRESH	Merritt Canal at intersection of I-75	26 09 12.636	81 29 26.304
BC12	SW-FRESH	Prairie Canal at the end of 82nd Ave. S.E.	26 00 31.788	81 27 29.196
FAKA	SW-FRESH	Gauging station north of weir at the intersection of US41 and Faka Union Canal	25 57 37.825	81 30 34.236
BC20	SW-FRESH	Bridge #52 on US 41E, 1st bridge west of Faka Union Canal	25 57 39.744	81 30 59.904
BC21	SW-FRESH	Bridge #55 on US 41E (TAMBR55), 2nd bridge east of Faka Union Canal	25 57 37.692	81 30 00.792
TAMI 1	SW-FRESH (PROPOSED NEW)		N/A**	N/A**
TAMI 2	SW-FRESH (PROPOSED NEW)		N/A	N/A
TAMI 3	SW-FRESH (PROPOSED NEW)		N/A	N/A

* The standard positional goal for site coordinates is ±1 meter. This standard can be obtained with a professional grade DGPS system. The coordinates are relative to NAD83 HARN horizontal datum.

** Coordinates not yet available (pending completion of Tamiami Trail Culvert Project).

Table H-4 Class III water quality criteria for freshwater monitoring sites

Parameter	Units	Regulatory Limit
Alkalinity	mg/L as CaCO3	Shall not be below 20
Ammonia (un-ionized)	mg/L as NH3	<0.02
Antimony	micrograms/L	<4300
Arsenic (total)	micrograms/L	<50
Fecal Coliforms	#/100 ml	< monthly ave. 200
Total Coliforms	#/100 ml	< monthly ave. 1000
Benzene	micrograms/L	<71.28 annual ave.
Beryllium	micrograms/L	<0.13 annual ave.
BOD		
Cadmium	micrograms/L	<e(0.7852[lnH]-3.49)
Carbon tetrachloride	micrograms/L	<4.42 annual ave.
Chlorine (total residual)	mg/L	<0.01
Chromium (trivalent)	micrograms/L	Cr(III) <e(0.819[lnH]+0.6848)
Chromium (hexavalent)	micrograms/L	<11
Conductance, Specific	micromhos/cm	lesser of 50% over backgrd or 1275
Copper	micrograms/L	<e(0.8545[lnH]-1.702
Cyanide	micrograms/L	<5.2
1,1-Dichloroethylene		
(1,1-di-chloroethene)	micrograms/L	<3.2 annual ave.
Dichloromethane		
(methylene chloride	micrograms/L	<1580 annual ave.
2,4-Dinitrotoluene	micrograms/L	<9.1 annual ave.
Dissolved Oxygen	mg/L	Not less than 5.0.
Fluorides	mg/L	<10
Bromoform	micrograms/L	<360 annual ave.
Chlorodibromomethane	micrograms/L	<34 annual ave.
Chloroform	micrograms/L	<470.8 annual ave.
Chloromethane	micrograms/L	<470.8 annual ave.
Dichlorobromo-methane	micrograms/L	<22 annual ave.
Hexachlorobutadiene	micrograms/L	<49.7 annual ave.
Iron	mg/L	<1.0
Lead	micrograms/L	<c(1.273[lnH]-4.705)
Mercury	micrograms/L	<0.012
Nickel	micrograms/L	<(0.846[lnH]+0.0584)
Oils and Grease	mg/L	<5.0
Pesticides/Herbicides		
Aldrin	micrograms/L	<0.00014 annual ave/3 max
Beta-hexachlorocyclo-		

Parameter	Units	Regulatory Limit
hexane (b-BHC)	micrograms/L	<0.046 annual ave.
Chlordane	micrograms/L	<0.00059 annual ave/0.0043 max
DDT	micrograms/L	<0.00059 annual ave/0.001 max
Demeton	micrograms/L	<0.1
Dieldrin	micrograms/L	<0.00014 annual ave/0.0019 max
Endosulfan	micrograms/L	<0.056
Endrin	micrograms/L	<0.0023
Guthion	micrograms/L	<0.01
Heptachlor	micrograms/L	<0.00021 annual ave./0.0038 max
Lindane		
(g-benzene hexachloride)	micrograms/L	<0.063 annual ave/0.08 max
Malathion	micrograms/L	<0.01
Methoxychlor	micrograms/L	<0.03
Mirex	micrograms/L	<0.001
Parathion	micrograms/L	<0.04
Toxaphene	micrograms/L	<0.0002
pH	standard units	6.5 - 8.5
2-chlorophenol	micrograms/L	<400
2,4-dichlorophenol	micrograms/L	<790
Pentachlorophenol	micrograms/L	<30max
2,4,6-trichlorophenol	micrograms/L	<6.5 annual ave.
2,4-dinitropheol	mg/L	<14.26
Phenol	mg/L	<0.3
Phthalate Esters	mg/L	<0.1
Polychlorinated Biphenyls	mg/L	<0.000045
PAHs	mg/L	<0.031 annual ave.
Acenaphthene	mg/L	<2.7
Anthracene	mg/L	<110
Fluoranthene	mg/L	<0.370
Fluorene	mg/L	<14
Pyrene	mg/L	<11
Combined Radium 226/228	Picocuries/L	<5
Gross alpha incl. Radium, excl. Radon & Uranium	Picocuries/L	< 15
Selenium	micrograms/L	<5
Silver	micrograms/L	<0.07
1,1,2,2-Tetrachloroethane	micrograms/L	<10.8
Tetrachloroethylene	micrograms/L	<8.85
Thallium	micrograms/L	<6.3
Trichloroethylene	micrograms/L	<80.7 annual ave.
Turbidity	NTU	<29 above natural background

Table H-5 Parameters and frequency for historic and proposed routine baseline sample collections at SGGE freshwater monitoring sites

Parameter	Group	Frequency	SGGE (Specific Need)
PH	Field Parameter	Monthly	YES
Temperature	Field Parameter	Monthly	YES
Dissolved Oxygen	Field Parameter	Monthly	YES
Specific Conductance	Field Parameter	Monthly	YES
Secchi Depth	Field Parameter	Monthly	YES
Total Depth	Field Parameter	Monthly	YES
Sample Depth	Field Parameter	Monthly	YES
Ammonium	Routine Lab	Monthly	YES
Color	Routine Lab	Monthly	
Dissolved Inorganic Nitrogen	Routine Lab	Monthly	
Hardness	Routine Lab	Monthly	
Nitrate	Routine Lab	Monthly	
Nitrate + Nitrite (NOx)	Routine Lab	Monthly	YES
Nitrite	Routine Lab	Monthly	
Ortho Phosphate	Routine Lab	Monthly	
Total Dissolved Solids	Routine Lab	Monthly	
Total Kjeldahl Nitrogen	Routine Lab	Monthly	YES
Total Nitrogen	Routine Lab (Calculated)	Monthly	YES
Total Organic Carbon	Routine Lab	Monthly	
Total Organic Nitrogen	Routine Lab	Monthly	
Total Phosphorus	Routine Lab	Monthly	YES
Total Suspended Solids	Routine Lab	Monthly	
Turbidity	Routine Lab	Monthly	YES
Chlorophyll A	Biological	Monthly	
Phaeophytin	Biological	Monthly	
Fecal Coliform	Biological	Monthly	
Total Coliform	Biological	Monthly	
Alkalinity	Major Ion	*Quarterly*	
Calcium	Major Ion	*Quarterly*	
Chloride	Major Ion	*Quarterly*	
Fluoride	Major Ion	*Quarterly*	
Magnesium	Major Ion	*Quarterly*	
Silicate	Major Ion	*Quarterly*	
Sulfate	Major Ion	*Quarterly*	YES
Arsenic	Trace Metals	*Quarterly*	
Cadmium	Trace Metals	*Quarterly*	
Chromium	Trace Metals	*Quarterly*	
Copper	Trace Metals	*Quarterly*	

Table H-6 Parameter and frequency list for fresh water grab sample collections during the construction start-up phases.

Parameter	Matrix	Frequency
PH	Fresh SW –Field Parameter	Quarterly (Wet season)
Temperature	Fresh SW –Field Parameter	Quarterly (Wet season)
Dissolved Oxygen	Fresh SW –Field Parameter	Quarterly (Wet season)
Specific Conductance	Fresh SW –Field Parameter	Quarterly (Wet season)
Secchi Depth	Fresh SW –Field Parameter	Quarterly (Wet season)
Total Depth	Fresh SW –Field Parameter	Quarterly (Wet season)
Sample Depth	Fresh SW –Field Parameter	Quarterly (Wet season)
Nitrate + Nitrite (NOx)	Fresh SW –Routine Lab	Quarterly (Wet season)
Total Kjeldahl Nitrogen	Fresh SW –Routine Lab	Quarterly (Wet season)
Total Nitrogen	Fresh SW –Routine Lab	Quarterly (Wet season)
Total Phosphorus	Fresh SW –Routine Lab	Quarterly (Wet season)
Turbidity	Fresh SW –Routine Lab	Quarterly (Wet season)
Sulfate	Fresh SW –Major Ion	Quarterly (Wet season)

In order to assess effects of the construction phases on down stream estuaries, several additional sampling sites will be established along the Tamiami Trail located to the south of the project area (Figure H-14). The Tamiami Trail project will be completed before the construction phases within the SGGE are finished and once this project is completed, the additional sites at the newly established culverts will be identified. These sampling sites will be located at areas that have the largest potential impact (flow capability) to the downstream estuaries of the Ten Thousand Islands. As such, the sampling will occur upstream of culverts draining to the main tributaries (e.g. Royal Palm Creek, Blackwater River, Pumpkin River, etc.). Sampling locations at culverts along the Tamiami trail will also be established to the east of the Faka Union canal, as SGGE Restoration benefits should extend to these estuaries as well. The list of parameters and frequency for monitoring inflows to downstream estuaries is the same as Table H-5, with the exception of sulfate, which will not be required at these sites. The proposed Tamiami Trail sites will also be part of the Class III water quality monitoring event that will take place one time during this phase of the restoration.

Post Construction (Operational) Phase

Monitoring objectives and requirements for the post construction phase of the SGGE restoration will depend largely on permit requirements and the final design and operational plan for the project area. Monitoring for assessment during the post construction phase should concentrate on hydrologic and ecological data, since these are the areas for which project performance measures were developed. Investigation and monitoring of the ecological components, such as vegetation and hydrologic regimes, will provide the most

appropriate means for assessing restoration performance. Fresh water sample collections from within the project area can be reduced to the parameters and frequencies that will give us the best correlation with the vegetative response of the project area. This data should be available to evaluate the system responses within the project area and can be used in the development of empirical relationships between ecological responses and water quality characteristics in restored wetland areas. A one time Class III sampling event will also be conducted at the beginning of the Operational Phase for all the major inflows and outflows. Monthly surface water grab samples should be collected upstream of the proposed pump stations on the north end of the project for the first three years after construction is completed. Quarterly samples should be collected at the locations until year five after construction. Sampling of the interior wetland areas should utilize the same transects detailed for monitoring during the construction start-up phases (above). Quarterly grab samples should be collected at these 16 interior wetland sites (utilizing the hydrologic transects) for the first five years after construction is completed. Sites along the Tamiami Trail identified during the construction start-up phases will be sampled on a monthly basis for the first year after construction. These outflow sites will be sampled quarterly for years two through five after construction. The four samples per year may need to be concentrated over the wet season months depending on the availability of surface water and sheetflow during the rest of the year. One annual (wet season) sample for the collection of pesticides and other priority pollutants will be collected at the inflow sites to the estuaries for the first three years after construction is completed. Parameters and frequencies for the pump stations, interior wetland sites and outflows along the Tamiami trail are given in Table H-7.

Table H-7 Post Construction monitoring design at SGGE freshwater sites.

Station Type	# of Sites	Frequency	Post Construction Year	Parameter
SGGE Inflows (pump stations)	3	Monthly	0 through 3	Field parameters, Nitrate + Nitrite (NOx), Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus, Ammonia,Turbidity, Sulfate
	3	Quarterly	4 through 5	
Interior Wetland Sites	16	Quarterly (Seasonal)	0 through 5	Field parameters, Nitrate + Nitrite (NOx), Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus, Ammonia, Turbidity, Sulfate
Outflow sites to Estuaries (Tamiami Trail Culverts)	TBD	Monthly	Year 1	Field parameters, Nitrate + Nitrite (NOx), Total Kjeldahl Nitrogen, Total Nitrogen, Total Phosphorus, Ammonia, Turbidity
		Quarterly	2 through 5	
		Annually	0 through 3	Chlorinated acids, Organochlorine compounds, Organophosphorus & nitrogen compounds, Urea and other Pesticides

H.3.6.1.2 Estuarine Component

Pre-Construction (Baseline)

Several water quality sampling sites have been established for over a decade in the downstream receiving estuaries of the SGGE (Figure H-14). Current sampling locations and descriptions as well as three newly proposed sites are given in Table H-8. The locations, frequencies, and parameter lists currently being conducted in the project study area provide an acceptable level of relevant data to evaluate pre-construction surface water baseline conditions. Three additional sites located at the mangrove interface areas for Blackwater Bay, Pumpkin Bay, and Fakahatchee Bay will also be established to track salinity and stage levels for these crucial transitional zones. A portion of the monitoring currently conducted at the designated sites have a more comprehensive parameter list than that required for the water quality objectives of the SGGE. The parameter list and frequency of sampling the baseline fresh water sites is given in Table H-8. Parameters germane to the baseline monitoring needs of the SGGE are specified.

Table H-8 Proposed SGGE baseline estuarine water monitoring site locations and descriptions.

STATION	MATRIX	LOCATION DESCRIPTION	LAT.	LONG.
FAKAUPOI	SW-ESTUARINE	Faka-Union Canal at entrance to Port of the Islands marina	25 57 21.384	81 30 37.84
TTI67	SW-ESTUARINE	West Pass	25 49.820	81 30.170
TTI69	SW-ESTUARINE	Faka-Union Pass	25 52.450	81 30.960
TTI70	SW-ESTUARINE	Faka-Union River	25 54.000	81 30.960
TTI72	SW-ESTUARINE	Dismal Key	25 53.668	81 33.532
TTI74	SW-ESTUARINE	Shell Key	25 54.670	81 36.920
TTI75	SW-ESTUARINE	Blackwater River	25 55.788	81 36.019
TTI76	SW-ESTUARINE	Fakahatchee Bay	25 53.369	81 28.592
PB	SW-ESTUARINE	Pumpkin Bay	25.31833	80.30333
MB	CONTINUOUS-ESTUARINE	Middle Blackwater River	25.9343	81.5946
FU	CONTINUOUS-ESTUARINE	Faka Union Bay	25.9005	81.5159
FA	CONTINUOUS-ESTUARINE	Fakahatchee Bay	25.8922	81.4770
MI 1	CONTINUOUS-MANGROVE INTERFACE	Blackwater Bay Transect	Not Yet Established	Not Yet Established
MI 2	CONTINUOUS-MANGROVE INTERFACE	Pumpkin Bay Transect	Not Yet Established	Not Yet Established
MI 3	CONTINUOUS-MANGROVE INTERFACE	Fakahatchee Bay Transect	Not Yet Established	Not Yet Established

During Construction (Start-up Construction Phases)

Water quality monitoring for downstream estuarine systems during the construction phases will be consistent with the parameter and frequency (monthly and continuous) levels given in Table H-9. Those parameters identified as relevant to SGGE will be continued during this phase if the current funding for these monitoring programs is no longer available.

Table H-9 Parameters and frequency for routine (baseline and during construction phases) sample collections at SGGE estuarine monitoring sites

Parameter	Group	Frequency	SGGE Relevant
Diffusive Light (PAR) Attenuation (Kd)	Field Parameter	Monthly	YES
Dissolved Oxygen	Field Parameter	Monthly, Continuous	YES
pH	Field Parameter	Monthly, Continuous	
Salinity (with Stage)	Field Parameter	Monthly, Continuous	YES
Temperature	Field Parameter	Monthly	
Alkaline Phosphatase Activity (APA)	Biological	Monthly	
Chlorophyll A	Biological	Monthly	YES
Ammonium (NH4+)	Routine Lab	Monthly	
Nitrate + Nitrite (NOx)	Routine Lab	Monthly	
Nitrate (NO3)	Routine Lab	Monthly	
Nitrite (NO2-)	Routine Lab	Monthly	
Silicate	Major Ion	Monthly	
Soluble Reactive Phosphorus (SRP)	Routine Lab	Monthly	YES
Total Nitrogen (TN)	Routine Lab	Monthly	YES
Total Organic Carbon (TOC)	Routine Lab	Monthly	
Total Organic Nitrogen (TON)	Routine Lab	Monthly	YES
Total Phosphorus (TP)	Routine Lab	Monthly	YES
Total Suspended Solids	Routine Lab	Monthly	
Turbidity	Routine Lab	Monthly	YES

Post Construction (Operational) Phase

Post construction monitoring within the estuarine systems should concentrate on evaluating if the desired salinity regimes within the estuaries are being met through the hydrologic performance measures established for the Faka Union Canal. It is therefore critical that, at a minimum, the continuous salinity measurements for the sites listed in Table H-10 be continued for at least ten years after construction completion.

Table H-10 Minimum monitoring requirements for downstream estuarine sites during the SGGE post construction phase

Station Type	# of Sites	Frequency	Post Construction Year	Parameter
FDEP Rookery Bay NERR Continuous In-Situ Stations	4	Continuous (Serviced Monthly)	0 through 10	Physical Parameters (datasonde array)
Estuarine Grab Sites	7	Monthly	0 through 10	Physical Parameters, Nutrients and Chlorophyll A (see Table 6)
Mangrove Interface Sites	3	Continuous	0 through 10	Physical Parameters (datasonde array) with Stage

H.3.6.1.3 Biological Component (Tissue Analysis)

The CERP Guidance Memorandum (CGM) 023.0 states that mercury and pesticides are to be treated as water quality constraints. The introduction of persistent bioaccumulative toxicants (PBTs) into the water column and subsequent transport and settling into the sediments of receiving downstream estuaries has been documented to cause acute and chronic effects in upper trophic level predators, including humans (USEPA 2002). The testing for toxins is a necessary part of evaluating whether the SGGE restoration is meeting the water quality constraint. Pesticides and other organic toxicants can be released suddenly from flooded soils during hydrologic operations, and these types of activities have also been shown to affect the rates of methylation potential for mercury and can produce harmful levels of mercury in aquatic wildlife, resulting in fish consumption warnings and human health concerns. The following factors are thought to be associated with increased MeHg production, particularly when in combination with certain site conditions (taken from CGM 042.00 – *in draft*):

- increased proportion of source water from direct rainfall relative to surface water runoff (explanatory note: rain contains elevated levels of bioavailable inorganic Hg, particularly during summer; whereas, surface water runoff has already lost Hg through evasion back to atmosphere, sorption, and deposition, and biological uptake);

- elevated levels of oxidized sulfur compounds (e.g., sulfate, etc.) in inflows or sediments (explanatory note: used as electron acceptor by SRBs);

- drawdown-drying, followed by rewetting (explanatory note: allows constituents in the sediments/soil to oxidize) large bioavailable carbon source (explanatory note: feeds SRBs).

Due to the presence of contaminated soils within the project area, concerns over the suspension of organochlorides, polycyclic aromatic hydrocarbons, and/or other toxins into the water column have been raised. It is essential that the SGGE carefully track levels of toxicants (Hg, pesticides, and heavy metals) within the trophic system in order to adequately determine if the project is meeting the water quality constraint and to enable managers to react to any evidence of risks to the faunal communities associated with the project area. Tissue analysis will be conducted on samples of grass shrimp and fish tissue. Grass shrimp (*Palaemonetes vulgaris*) allow for indications of toxins in the primary trophic range (finer scale) and can give an early indication if bioaccumulation of toxicants is occurring. In order to evaluate transfer of contaminants to higher trophic levels, fish tissue will be obtained from either mosquito fish (*Gambusia holbrooki*) or the sailfin molly (*Poecilia latipinna*), depending on availability within the project area . If elevated toxin levels are found for these species, additional sampling of higher trophic level fish (sunfish or largemouth bass) will be triggered. One sample is composited from at least 100 individual organisms at each site. Additional quality assurance samples will also be collected for each phase (see cost estimate).

Pre-Construction (Baseline)

In order to determine if SGGE is causing or contributing to introductions of toxicants into the trophic system, it is essential to establish a baseline for these indicators before construction begins. Screening for existing contaminants will occur during the baseline year wet season (within the year before major construction) across the SGGE property. Sampling will take place, as water levels allow, at locations along the hydrologic transects (Figure H-1). The design for baseline tissue analysis monitoring is given in Table H-11.

During Construction (Phase II)

Screening for potential toxicants entering the trophic system during the construction start up phases will only be necessary after a specific area of the project has become flooded for the first time (Table H-11). Sampling should occur as soon as possible in newly flooded areas (within the first month). Adaptive assessment for additional sampling (finer scale and additional trophic levels) may be necessary as the project construction phases come on line.

Table H-11 Baseline (across project area) and during construction (area specific) toxicant tissue sampling requirements

Sample Type	Number of Sites	Parameter	Frequency
Grass Shrimp	25	THg, Organochlorine Pesticides, Oganonitrogen and Phosphorus Pesticides, Trace metals	Baseline Year, First Time Flood (Wet season)
Sailfin Molly, Mosquito fish, or Lepomids	25	THg, Organochlorine Pesticides, Oganonitrogen and Phosphorus Pesticides, Trace metals	Baseline Year, First Time Flood (Wet season)

Post Construction (Operational Phase)

Post construction toxicant sampling requirements will depend largely on permit requirements and findings from the Phase II tissue analyses. Operational monitoring design for contaminants must be able to assess any potential problems associated with the operation of the project area (water levels, changes in upstream land use, etc.) Since SGGE will be operated to achieve natural system targets, it is more likely not to have the types of problems (i.e. methylization of mercury) associated with other hydrologic projects (e.g. STAs and reservoirs). A design for monitoring toxicants within the SGGE project area during the post construction period is given in Table H-12.

Table H-12 Post Construction toxicant monitoring of tissue requirements

Sample Type	Number of Sites	Parameter	Post Construction Year	Frequency
Grass Shrimp	TBD	THg, Organochlorine Pesticides, Oganonitrogen and Phosphorus Pesticides, Trace metals	O through 2	Annual (Seasonal)
			Year 5	Annual (Wet Season)
Sailfin Molly, Mosquito fish or Lepomids	TBD	THg, Organochlorine Pesticides, Oganonitrogen and Phosphorus Pesticides, Trace metals	O through 2	Annual (Seasonal)
			Year 5	Annual (Wet Season)

H.3.6.2 Data Quality Objectives

Data Uses, Resolutions, and Conclusions
The data will be used to fulfill the purposes listed in Section 2.0 and to assure the project is meeting the water quality constraint defined as not causing or contributing to violation of state water quality standards or the introduction of priority pollutants into the trophic system.

Data Quality
Data quality refers to the level of uncertainty associated with a particular data point or value. This is assessed by examining the quality of collection and analysis, determining compliance to method and regulatory requirements, determining precision and accuracy of analysis, and any other background information affecting the data. In most cases, data quality can be determined by calculating relative standard deviation (RSD) from quarterly replicate samples. The SFWMD recommends an RSD of <20%. Data not meeting the quality objectives must be qualified using standard FDEP qualifier codes
(F.A.C. 62-160).

Expected Levels and Concern Triggers
A phased, multi-tiered approach to sampling will be used to identify if thresholds of concern are crossed (water quality standards, etc.) and trigger additional monitoring for particular parameters at increased frequency or for a finer scaled investigation.

Quality Assurance/Quality Control

Field Sampling Protocols
Collection of data for the SGGE shall have at least two qualified samplers, with at least two years experience in environmental monitoring, present at each event. All samples must be collected according to the requirements under F.A.C. 62-160 (Florida Department of Environmental Protection (DEP QA Rule)) and the supporting Field Sampling Standard Operating Procedures (SOPs) for the collection of surface water samples. In accordance with this Rule, sampling entities must posses and maintain a Field Quality Manual.

Samples are collected in accordance with the FDEP Quality Assurance Rule, 62-160.200 & 62-160.320, F.A.C., and the Field Sampling Quality Manual. Applicable sections of the manual include surface water grab collection methods, decontamination, field test methods, and quality control procedures. Additional data may be found in FDEP Biology Section SOPs document.

Laboratory Analysis
All water quality and biological samples shall be analyzed by a laboratory that is accredited through the National Environmental Laboratory Accreditation Program (NELAP) or certified by the Florida Department of Health (FDOH). All laboratories performing work associated with the SGGE project must have a current quality manual that follows the National Environmental Laboratory Accreditation Conference (NELAC) guidelines or a current Comprehensive Quality Assurance Plan (COMQAP). Laboratory analyses must achieve the minimum detection limits set for this project and report results in the appropriate units.

H.4 COST ESTIMATES

In developing costs for this monitoring plan, it is anticipated that two full-time staff will be located onsite at or near the DOF work center in SGGE. Their primary responsibility will be to supervise and support the monitoring program in inland portions of SGGE, most of which will be contracted with private parties or other agencies. The onsite staff at the DOF work center will also be responsible for coordination and synthesis of the overall SGGE monitoring effort. Adequate support facilities currently are available for the estuarine monitoring.

Table H-13 lists the estimated cost of monitoring by each ecosystem resource. For pre-construction and construction, the totals for each resource and the grand total are in Table H-13. For the 50-year post-construction phase, most of the resources are not monitored every year. Table H-13 displays the estimated cost per year for each resource and the number of years of monitoring.

For the purpose of comparing the total costs of alternatives, the monitoring during pre-construction and construction is grouped with the construction cost estimates. The post-construction monitoring costs are a separate cost item for the comparison among alternatives. The average annual cost estimate for post-construction monitoring is $778,000. This average annual estimate takes into account the cost per year, the different schedule and number of years of monitoring for the different resources, and an interest rate to allow comparison of expenditures that are up to 50 years apart.

Table H-13 Cost estimates for monitoring

	Pre-Construction & Construction phase (5 years total)		Post-Construction phase (50 years total)	
Resource	**No. Yrs.**	**Subtotal**	**No. Yrs.**	**Annual Rate**
Oyster Reef Crab	5	$239,000	10	$44,825
Nekton	5	$316,000	10	$59,250
Benthic Habitat Mapping	1	$310,000	1	$270,000
Oysters:				
5 Homologues, 4 Estuaries	5	$1,500,000	10	$300,000
Reef Mapping	2	$10,000	10	$2,000
Water Quality	5	$1,406,000	10	$204,300
Hydrology	5	$500,000	50	$100,000
Vegetation	1	$150,000	50	$36,000
Onsite support	5	$1,150,000	10 (years 1-10)	$180,000
			40 (years 11-50)	$100,000
Listed Species	5	$1,250,000	10	$250,000
Inland Fish and Wildlife	5	$600,000	10	$120,000
Total Cost		$7,431,000		---