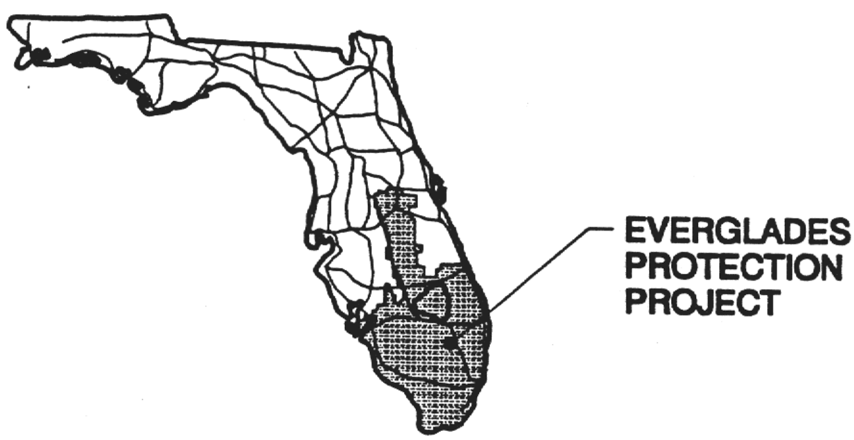
EVERGLADES PROTECTION PROJECT

PALM BEACH COUNTY, FLORIDA

CONCEPTUAL DESIGN

FEBRUARY 15, 1994



92-166-1-002

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ENGINEERS · ARCHITECTS · CONSULTANTS

February 15, 1994

Mr. Zan Kugler, P.E.
Director, Engineering Division
South Florida Water Management District
P.O. Box 24680
West Palm Beach, FL 33416-4680

SFWMDEPP
South Florida Water Management District
Everglades Protection Project
Conceptual Design
Project No. 92-166-1-002

Dear Zan:

Burns & McDonnell is pleased to present this Conceptual Design for the Everglades Protection Project. The preparation of this document was authorized by the District through its execution of Amendment No. 2A to Contract C-3021.

This Conceptual Design is, with but one significant deviation, based on a technical plan for the Everglades Protection Project originally formulated by the Technical Mediation Group, one of three groups formed in an attempt to negotiate and mediate issues surrounding the current proposed Surface Water Improvement and Management Plan (SWIM) for the Everglades. Stormwater Treatment Area No. 5 has been relocated from its original position in the northerly end of the Rotenberger Tract to a position extending from Levee L-3 to the westerly line of the Rotenberger Tract.

It is indeed unfortunate that the full range of issues surrounding the SWIM Plan could not, at least to this point, be successfully mediated. It must be noted that, while the mediated technical plan on which this Conceptual Design is based enjoyed widespread acceptance within the Technical Mediation Group and other forums, that acceptance was generally predicated upon the successful resolution of all issues, which has not to date been achieved.

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Burns & McDonnell

The Conceptual Design presented in this document represents the efforts of a number of agencies and individuals with often disparate viewpoints.

We recognize and gratefully acknowledge the contributions of the members of the Technical Mediation Group and District staff to this Conceptual Design for the Everglades Protection Project.

Sincerely,

Joel A. Cerwick, P.E.
Vice President

Galen E. Miller, P.E.
Project Manager

JAC/GEM/bje

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
EVERGLADES PROTECTION PROJECT

CONCEPTUAL DESIGN

INDEX AND CERTIFICATION PAGE

REPORT INDEX

* Exclusive of Figures listed on pp. TC-7 and TC-8.

ENGINEER'S CERTIFICATION

I hereby certify, as a Professional Engineer in the State of Florida, that the information in this document was assembled under my direct responsible charge, and is based on information and data that was available and obtained from governmental agencies and other parties identified herein. The Engineer cannot be held responsible for added or deleted information once distributed. This report is not intended or represented to be suitable for any reuse by the South Florida Water Management District or others without specific verification or adaptation by the Engineer. This certification is provided in accordance with the Florida Board of Professional Engineers' Rule on Certification under Chapter 21H-29.

Galen E. Miller, P.E.

Date:

(Reproductions are not valid unless signed, dated and embossed with an Engineer's seal)

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

The conceptual plan for the Everglades Protection Project defined in this document is intended, upon its acceptance and approval, to modify certain elements of the current proposed Surface Water Improvement and Management (SWIM) Plan for the Everglades. The current proposed SWIM Plan includes the construction of four stormwater treatment areas to reduce the nutrient load (phosphorus in particular) discharged to the Everglades Protection Area (EPA) from the Everglades Agricultural Area (EAA), together with the implementation of Best Management Practices (BMPs) in the EAA to reduce phosphorus loads carried in agricultural drainage waters.

The conceptual plan described in this document is based on a technical plan originally developed by the Technical Mediation Group, one of three groups formed to negotiate and mediate issues surrounding the current proposed SWIM Plan for the Everglades in an attempt to settle related litigation. The only substantive difference between the conceptual plan presented herein and that developed by the Technical Mediation Group is in the geographic location of one of the six stormwater treatment areas included in the plan.

It should be noted that, while the Technical Mediation Group did reach general acceptance on a mediated technical plan, that acceptance was predicated on an ability to reach similar acceptance and agreement on all other issues involved in the mediation effort. That general resolution of all other issues has not been achieved.

Design of the technical plan is based on a continuation of the Chapter 40E-63 Rule in its present form, which requires the implementation of BMPs resulting in a not less than 25 percent reduction in phosphorus loads discharged from the EAA, with not more than a 20 percent reduction in discharge volumes, both as compared to historic levels.

That regulatory approach is coupled with the construction of large constructed wetlands (Stormwater Treatment Areas, or STAs) to result in a reduction of the long-term flow-weighted average concentration of total phosphorus in treated discharges to an interim goal of 0.05 gm/m^3.

The technical plan, which is described in detail in Part IV, includes the construction of six STAs with an aggregate effective treatment area of 40,452 acres, treating runoff from a total tributary area of 769,479 acres, together with substantial modification of the primary drainage system in and adjacent to the EAA for improved deliveries of water to the remnant Everglades. The plan also incorporates other benefits such as improved flood protection in certain areas, an increase in the quantity of water delivered to the Everglades Protection Area, and a reduction in the quantity of fresh water lost to tide (with attendant reduction in impacts on those estuaries which presently receive those discharges).

In comparison, the current proposed SWIM Plan for the Everglades, if updated to reflect revisions in basic data and analytical refinements subsequent to its adoption, would include the construction of three STAs with an aggregate effective treatment area of 27,742 acres (reduced from the originally proposed 31,975 acres) treating runoff from a total tributary area of approximately 565,000 acres.

The intended operation of the various component elements of the overall plan is described in Part VII, and is subject to confirmation during subsequent, more detailed topographic and hydraulic analyses. It is further recommended that substantial modeling and analysis of the project in a regional context be conducted to both refine the operational parameters of the Everglades Protection Project and to identify opportunities for improved operation of the regional system in achieving overall goals and objectives for restoration of the Everglades.

The total estimated capital cost of this conceptual plan is $468.6 million, including $116.8 million for land acquisition. The incremental average annual cost (excluding monitoring costs) for operation and maintenance of the South Florida Water Management District system resulting from implementation of the conceptual plan is estimated to be $6.36 million. That amount includes

$4.9 million in incremental operation and maintenance expense for the six stormwater treatment areas. All the above costs are expressed in third quarter, F.Y. 1993 dollars.

One possible schedule for implementation of the Everglades Protection Project is developed and described in Part VIII. That schedule is based on a number of significant assumptions concerning sources of funding, implementation responsibilities, and prioritization of the various components of the overall plan. Any substantive change in those assumptions may be expected to impact the implementation schedule presented herein. The schedule is developed assuming a starting date of July 1, 1994, with final physical completion of all elements of the plan projected on April 1, 2005.

* * * * *

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

CONCEPTUAL DESIGN
OF
EVERGLADES PROTECTION PROJECT

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PART I
INTRODUCTION

PART I

INTRODUCTION

A. GENERAL

This document defines in detail the physical nature of and estimated costs for a conceptual plan for the Everglades Protection Project. It also defines the technical bases on which the plan is developed and the intended operation of the completed project, together with a possible schedule for project implementation.

The plan presented herein is based on a technical plan that was initially formulated by the Technical Mediation Group formed as one part of the overall effort in mediating the various outstanding issues and litigation surrounding the current proposed Surface Water Improvement and Management (SWIM) Plan for the Everglades. The Technical Mediation Group was initially composed of representatives of:

- The South Florida Water Management District.
- The Florida Department of Environmental Protection.
- The United States Fish and Wildlife Service.
- U.S. Sugar Corporation.
- Flo-Sun, Inc.
- Sugar Cane Growers Cooperative of Florida.
- Florida Fruit and Vegetable Association.
- Florida Wildlife Federation, Inc.
- Florida Audubon Society, Inc.

- The Miccosukee Tribe of Indians.

Certain of the meetings of the Technical Mediation Group were also attended by representatives of:

- Jacksonville District, U.S. Army Corps of Engineers.

- The Seminole Indian Tribe.

- Technical consultants to agricultural interests in the C-139 Basin, and technical and engineering consultants to the various parties represented on the Technical Mediation Group.

The Technical Mediation Group was assisted in its discussions and the formulation of the mediated technical plan by William J. Walker, Jr., PhD, and Robert H. Kadlec, PhD, technical consultants to the United States Department of Justice; and Burns & McDonnell, acting under contract to the South Florida Water Management District.

The discussions of the Technical Mediation Group culminated in the acceptance by the various representatives (with the single exception of the Sugar Cane Growers Cooperative) of a technical plan as generally described in a letter dated May 10, 1993 from Galen Miller of Burns & McDonnell to Zan Kugler of the South Florida Water Management District, and attachments thereto.

Subsequent to May 10, the mediated technical plan was presented to and discussed with a wider variety of interests potentially affected by implementation of the plan. Those discussions have resulted in certain refinements and adjustments to the original mediated plan.

The only substantive variation between the conceptual plan defined in this document and that outlined in the May 10, 1993 letter is the physical location of Stormwater Treatment Area No. 5 (STA-5). That facility, intended to reduce phosphorus concentrations in discharges from the C-139

Basin, was originally sited in the north end of the Rotenberger Tract. It has been relocated to a position between Levee L-3 and the Rotenberger Tract, and will occupy lands presently in agricultural production. That relocation has been made at the request of the South Florida Water Management District in response to objections voiced to the use of a part of the Rotenberger Tract for a stormwater treatment area.

B. OBJECTIVES

The technical plan is developed to address the following primary objectives:

- Reduction of the long-term, flow-weighted average concentration of total phosphorus in discharges from the Everglades Agricultural Area (EAA) to the Everglades Protection Area (EPA) to an interim goal of 0.05 gm/m^3.

- The restoration of hydroperiod on currently overdrained areas in Water Conservation Area 2A (WCA-2A) and Water Conservation Area 3A (WCA-3A).

- Provision of means to offset reductions in volumetric discharges to the EPA resulting from both the implementation of Best Management Practices (BMPs) in the EAA and the construction and operation of treatment works in the EAA, with water of suitable quality.

Secondary objectives addressed by the technical plan include:

- An increase in the quantity of water retained in the Everglades system through redirection of runoff from the C-51 West and L-8 Basins.

- A reduction in the discharge of fresh water and associated pollutants to the Lake Worth estuary.

- Improved flood protection in the C-51 West Basin, and realization of the intended level of flood protection in the C-51 East Basin.

- The restoration of hydroperiod on the Rotenberger Tract with water of suitable quality.

- The provision of a source of treated water supply for the Holey Land.

- A reduction in localized water quality problems in Lake Okeechobee associated with discharges from special drainage districts adjacent to the Lake.

All the above objectives are to be met without impairment of the level of flood protection afforded the EAA in the current design and operation of the Central and South Florida Flood Control Project.

In addition to meeting the above objectives, implementation of the mediated technical plan is expected to result in the following additional benefits:

- A slight improvement in the level of flood protection afforded the L-8 Basin, and in particular the Indian Trail Water Control District, through a reduction in tailwater elevations in the L-8 Borrow Canal during runoff events.

- A slight improvement in the level of flood protection afforded the Seminole Tribe's reservation lands along the L-28 Borrow Canal, together with improved access to suitable quality water for water supply.

- A reduction in the quantity of phosphorus and other parameters of concern discharged from the Western Basins to the Everglades Protection Area.

C. BASIC DEFINITION OF TECHNICAL PLAN

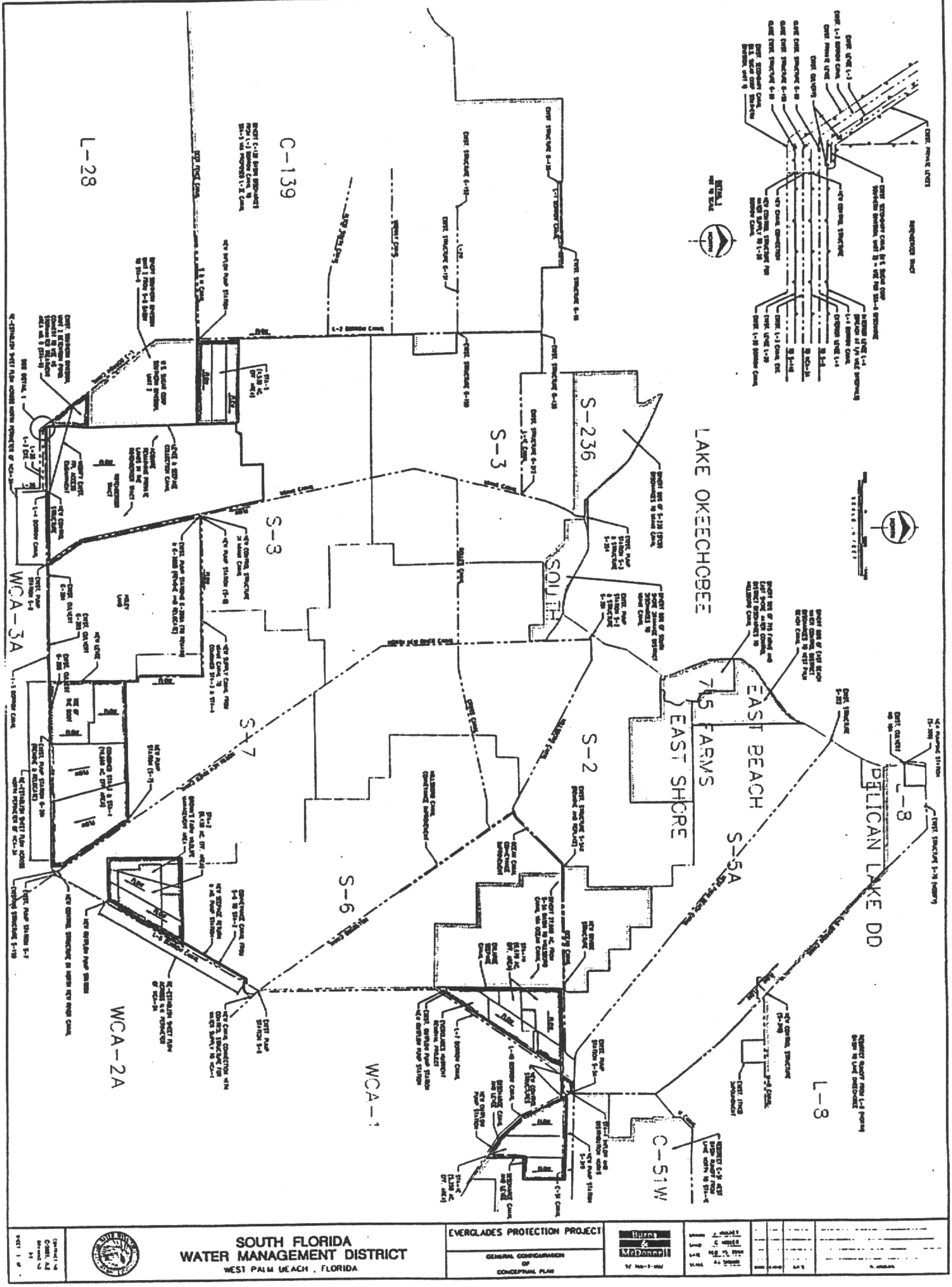
The general configuration of the physical facilities and hydrographic system charges incorporated in the technical plan is shown in Figure I-1. Salient features of the plan include:

- The development of Stormwater Treatment Area No. 6 to treat runoff from U.S. Sugar Corporation's Southern Division Ranch, Unit 2, an area of approximately 11,200 acres situated between the Rotenberger Tract and Levee L-3. This area is presently tributary to Pump Station S-8 via the L-4 Borrow Canal; runoff presently passes through a privately owned detention basin, and is discharged to the L-4 Borrow Canal immediately downstream of existing Structure G-88. The existing detention basin would be converted to use as STA-6, and would continue to discharge to the L-4 Borrow Canal.

- The construction of Stormwater Treatment Area No. 5 immediately west of and adjacent to the Rotenberger Tract, intended to improve the quality of water discharged from the C-139 Basin. Discharges from this STA would be used for hydroperiod restoration on the Rotenberger Tract. The development of this STA would also provide a source of suitable quality (meeting the interim 50 ppb goal for total phosphorus) water to both the Holey Land (via existing Pump Station G-200) and to the northerly perimeter of WCA-3A west of the Miami Canal (via the L-4 Borrow Canal). The C-139 basin presently discharges primarily to L-28, although some discharges are made to the EAA via G-88 and G-136, and to the northwesterly perimeter of WCA-3A via Structure G-89 and the L-3 Canal Extension.

- Reestablishing sheet flow across an approximate 3.5-mile length of the northerly perimeter of WCA-3A extending west from the Miami Canal (West WCA-3A hydroperiod restoration). Treated discharges from STA-5 would serve as the source of water supply.

- Redirection of discharges from the S-236 basin (South Florida Conservancy District Planning Unit No. 5) and South Shore Drainage


L-28
C-139
LAKE OKEECHOBEE
S-236
S-3
S-8
SOUTH
WCA-3A
S-7
S-2
715 FARMS
EAST BEACH
EAST SHORE
PELICAN LAKE DD
L-8
S-5A
S-6
WCA-2A
WCA-1
C-51W
L-8
SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA
EVERGLADES PROTECTION PROJECT
GENERAL CONFIGURATION OF CONCEPTUAL PLAN
Burns & McDonnell

District to the Miami Canal for eventual treatment in a combined STA-3 and STA-4, thus removing the majority of those discharges from Lake Okeechobee (it should be noted that some part of those discharges may still be directed to the Lake, dependent upon the timing of Pump Station S-3 operation).

- Construction of a Stormwater Treatment Area (combined STA-3 and STA-4) to serve the combined runoff from:

    - The S-8 basin (less the U.S. Sugar Corporation's Southern Division Ranch, Unit 2).

    - The S-7 basin.

    - The S-236 basin and South Shore Drainage District.

    - That part of the C-139 basin runoff historically discharged to the Miami Canal via Structure G-136 and the L-1E Canal.

  This combined treatment area is also intended to provide capacity for the treatment of additional Lake Okeechobee regulatory releases prior to their discharge to the Everglades Protection Area.

- Reestablishing sheet flow across approximately the easterly 8.5 miles of the northerly perimeter of WCA-3A (East WCA-3A hydroperiod restoration); treated discharges from the combined STA-3 and STA-4 would serve as the source of water supply.

- Implementation of the federally authorized C-51 West End Flood Protection Project (with certain significant modifications) and the direction of discharges from that project to STA-1 for treatment prior to release to Water Conservation Area No. 1. The inclusion of this feature in the modified plan is intended to redirect C-51 West Basin runoff from the Lake Worth estuary to the Loxahatchee National Wildlife Refuge, thus benefitting both water bodies.

However, the lack of sufficient available lands in the vicinity of proposed STA-1 to fully accommodate and treat all inflows from the S-5A and C-51 West basins requires that a portion of those inflows be diverted to Pump Station S-6 and STA-2.

- The construction of physical works necessary for the diversion of a part of the S-5A Basin runoff to Pump Station S-6 and STA-2, including increased conveyance capacity in the primary canal system where necessary for that purpose.

- The construction of Stormwater Treatment Area No. 1 (STA-1) to serve both the S-5A and C-51 West basins (less those discharges diverted to Pump Station S-6 and STA-2). This facility will be composed of two separate areas (STA-1W and STA-1E), hydraulically connected by STA-1 Inflow and Distribution Works in the north end of WCA-1.

- The diversion of discharges from the East Shore Water Control District and the 715 Farms area from Lake Okeechobee to Pump Station S-6 and STA-2.

- The diversion of discharges from the East Beach Water Control District from Lake Okeechobee to the West Palm Beach Canal and, after treatment in STA-1, to WCA-1.

- The construction of Stormwater Treatment Area No. 2 to accommodate both S-6 basin runoff and the increased inflow resulting from diversion of a portion of the STA-1 inflow to Pump Station S-6, and diversions from the special drainage districts on the east shore of Lake Okeechobee.

- Reestablishing sheet flow along the northwesterly perimeter of Water Conservation Area No. 2A. Treated discharges from STA-2 would serve as the source of water supply.

- Redirection of runoff from the northerly part of the L-8 Basin (consisting primarily of the Dupuis Reserve and the J.W. Corbett Wildlife Management Area) to Lake Okeechobee.

- The restoration of hydroperiod on the Rotenberger Tract. The water necessary for this hydroperiod restoration would consist of treated discharges from proposed Stormwater Treatment Area No. 5.

A summary of the basic design data employed in development of the technical plan is included as Attachment A to this document.

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PART II
PHOSPHORUS REDUCTION TECHNOLOGIES

PART II

PHOSPHORUS REDUCTION TECHNOLOGIES

A. CURRENT PROPOSED SWIM PLAN

The Marjory Stoneman Douglas Everglades Protection Act was enacted by the 1991 Florida Legislature to enhance and strengthen the provisions of the Surface Water Improvement and Management Act (F.S. 373.451-373.4595) as it is applied to the Everglades Protection Area. The Everglades Protection Area is defined in the Everglades Protection Act as including Water Conservation Areas 1, 2A, 2B, 3A, 3B, the Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the Everglades National Park.

One requirement of that Act is that the South Florida Water Management District adopt an Everglades Surface Water Improvement and Management (SWIM) Plan which includes strategies for developing programs and projects designed to bring the District's facilities into compliance with applicable water quality standards.

By its August 1991 approval of a Settlement Agreement among the United States, the South Florida Management District, and the Florida Department of Environmental Regulation in Case No. 88-1886-CIV-HOEVELER before the United States District Court, Southern District of Florida (reference 8) and its subsequent adoption of the March 13, 1992 SWIM Plan (reference 7), the SFWMD Board of Governors agreed to a compliance strategy which included the following components:

- The construction and operation of Stormwater Treatment Areas (STAs), large scale wetland treatment systems which will process storm runoff for the removal of nutrients.

- The initiation of a regulatory program having as its goal the reduction of present total phosphorus loads from the Everglades Agricultural Area to each Stormwater Treatment Area by 25 percent. That regulatory program includes the development and implementation of Best Management

Practices (BMPs) by property owners in the Everglades Agricultural Area. That regulatory program has subsequently been implemented through the District's promulgation of its Chapter 40E-63 Rule.

- The initiation and conduct of a comprehensive, long-term, multi-agency research and monitoring program intended to:
  - Numerically define the applicable water quality standards.
  - Assess current and continuing responses of the Everglades Protection Area to nutrient input levels.

Reference 1 presents conceptual designs for the first of those components, the construction and operation of Stormwater Treatment Areas (STAs). Conceptual designs were developed for:

- Stormwater Treatment Area No. 1 (STA-1), serving the area tributary to Pump Station S-5A.

- Stormwater Treatment Area No. 2 (STA-2), serving the area tributary to Pump Station S-6.

- Stormwater Treatment Area No. 3 (STA-3), serving the area tributary to Pump Station S-7.

- Stormwater Treatment Area No. 4 (STA-4), serving the area tributary to Pump Station S-8.

In 1988, the South Florida Water Management District initiated a program to convert 3742 acres of state-owned lands in the Everglades Agricultural Area from its previous use as a leased agricultural area to use as a Stormwater Treatment Area. Facilities included in that program, commonly known as the Everglades Nutrient Removal (ENR) Project, are now complete.

The Everglades Nutrient Removal Project as it is presently formulated is intended to reduce nutrient levels (primarily phosphorus) from a portion of the water discharged from the District's Pump Station S-5A to Water

Conservation Area No. 1 (the Arthur R. Marshall Loxahatchee National Wildlife Refuge), and to provide a prototype for the development and refinement of the larger-scale wetland treatment systems.

The conceptual design of STA-1 was developed to incorporate the current ENR Project, and to permit the continued operation of the ENR Project throughout construction of STA-1.

Conceptual designs for the Stormwater Treatment Areas were developed to meet the following specific objectives, which were developed consistent with guidance contained in reference 8.

- Delivery of a long-term average flow-weighted mean phosphorus concentration of 50 parts per billion or less at each point of inflow to the Everglades Protection Area.

- Treatment of all historic discharge from Pump Stations S-5A, S-6, S-7, and S-8 during a base period of 1979-1988; those discharges are modified to reflect a 20 percent reduction in the volume of runoff from the Everglades Agricultural Area resulting from the implementation of Best Management Practices, as well as a 25 percent reduction in the total phosphorus load discharged.

- Achieve a reduction of 85 percent in the total phosphorus load discharged to the Loxahatchee Refuge, and 80 percent in the total phosphorus load discharged from the four primary pump stations to the EPA.

The conceptual design varied from that suggested in the SWIM Plan primarily in that all discharge from the four primary pumping stations would be treated in the STAs. The SWIM Plan (Appendix F) had contemplated that flows (and phosphorus loads) originating from sources outside the regulated portion of the EAA would be bypassed around the STAs and discharged untreated to the EPA, or otherwise handled.

The Stormwater Treatment Areas defined in reference 1 would have included lands presently owned by the State of Florida and SFWMD. Of the total 35,167 acres, 30,145 acres would have been lands presently held in private ownership.

The following is a comparison of the effective areas of the Stormwater Treatment Areas defined in Reference 1 to those contemplated in the Settlement Agreement and SWIM Plan.

Location	Effective Area in Acres By Settlement Agreement	Effective Area in Acres Conceptual Design
Stormwater Treatment Area No. 1	11,800	11,191
Stormwater Treatment Area No. 2	3,700	4,595
Stormwater Treatment Area No. 3	4,950	5,683
Stormwater Treatment Area No. 4	12,150	10,506
TOTAL	32,600	31,975

The terms of the existing Settlement Agreement and the Marjory Stoneman Douglas Everglades Protection Act require the District to implement mitigation measures to offset flow reductions to the Everglades Protection Area resulting from efforts to improve water quality. Potential mitigation measures cited in the Settlement Agreement include:

- Declaring a water shortage when necessary.
- Implementing supply side management.
- Releasing water from Lake Okeechobee.
- Reducing water retention in the Everglades Agricultural Area.
- Adding flow from east of the Everglades Protection Area.

The current proposed SWIM Plan and the March 1, 1992 conceptual design for the Stormwater Treatment Areas included no specific mechanisms for increasing the flow of water to the EPA to offset volumetric reductions resulting from the implementation of Best Management Practices and the construction of the STAs.

The estimated cost of the four stormwater treatment areas defined in reference 1, including land acquisition, construction, wetland development, engineering, design, planning, construction management, and contingencies, was $325.3 million (excluding ENR Project costs). Those costs were expressed in February 1992, dollars, and included no allowance for cost inflation or escalation which may occur. Further, that estimate did not include any financing costs (e.g., interest on bonds, etc.). The total estimated cost was distributed among the various treatment are as follows:

Treatment Area	Estimated Cost
STA-1	$114.1 MM
STA-2	57.4 MM
STA-3	59.9 MM
STA-4	93.9 MM

An additional objective of the Marjory Stoneman Douglas Everglades Protection Act is the restoration of a suitable hydroperiod in the Everglades Protection Area (EPA). While reference 1 does not directly address the potential reduction in the quantity of water discharged to the EPA, it does include conceptual designs for certain alterations to the Central and Southern Florida Flood Control Project. Those alterations are intended to redistribute discharges from stations S-6, S-7, and S-8 along the upstream perimeters of Water Conservation Areas 2A and 3A. The total estimated cost for those alterations was $34.7 million.

The Marjory Stoneman Douglas Everglades Protection Act also creates the authority for the formation of a stormwater utility in the regulated portion of the Everglades Agricultural Area. That utility would assess the various parcels of land in the EAA based on their contribution to the phosphorus load discharge from the EAA. Those assessments would then be used to fund construction of the stormwater treatment areas.

That utility has not yet been created; the methodology for apportionment of costs among the various parcels of land in the EAA has not been established. Further, no determination has been made of the relative responsibility of the utility for the costs associated with the SWIM Plan and the stormwater treatment areas. In addition, the method of funding those costs not to be borne by the EAA stormwater utility has not been determined.

B. EVALUATION OF ALTERNATIVE TREATMENT TECHNOLOGIES

Concurrent with its approval of the current proposed SWIM Plan for the Everglades, the District's Board of Governors directed the evaluation of alternate treatment technologies, with the intent to modify the SWIM Plan to the extent found to be appropriate as a result of that evaluation. A contract for the evaluation (Contract C-3051) was awarded to Brown and Caldwell, Consultants, who subsequently prepared the evaluation under a series of amendments to that contract.

1. PHASE 1 EVALUATION

Under Amendment No. 1 to Contract C-3051, Brown & Caldwell assembled a listing of possible technologies for the reduction of nutrient loads in EAA runoff, and defined specific methods and procedures to be used in both noneconomic and economic analyses for initial evaluation of the various technologies. Under Amendment No. 2 to Contract C-3051, Brown & Caldwell applied those methods and procedures in evaluation of alternative technologies at different scales of application (basin scale, subbasin scale, and farm scale), and recommended a reduced list of technologies for more detailed evaluation in Phase II.

The following treatment technologies were evaluated in Phase I:

- Chemical treatment.
- Limerock sorption.
- Sedimentation in limestone borrows.
- Percolation ponds.
- Deep well injection.
- Aquifer storage and recovery.
- Water quality/supply diversion plan.
- Algal turf scrubbers.
- Nutrient management system.
- Ozone treatment.

- Sediment dredging.
- Wetlands.
- Managed wetlands.
- Direct filtration.
- Barge treatment.
- Overland flow.

Detailed descriptions of those technologies and a more complete discussion of the evaluation and its results may be found in reference 18.

The following conclusions (excerpted from reference 18) were reached concerning those treatment technologies most applicable at the basin, subbasin, and farm scale.

a. Basin Scale

At the basin scale of application, the three top rated treatment technologies are wetlands (STAs), managed wetlands, and direct filtration. No one technology has a clear advantage over the other two. All three technologies have excellent phosphorus removal capabilities, although there is some question about the ability of the STAs to reduce phosphorus levels by 75 percent on a consistent and reliable basis. The managed wetlands system, as developed for this evaluation, uses somewhat more land than the STAs. The direct filtration alternative uses significantly less land. The direct filtration alternative and the managed wetlands alternative both have similar capital costs to the STAs. Implementation schedule favors direct filtration, since less land needs to be purchased, construction time will be less, and start-up will be faster. However, conceptual design of the STAs has already been accomplished and the permitting process has already been initiated.

b. <u>Subbasin Scale</u>

The three treatment technologies top rated at the basin scale are also top rated at the subbasin scale. The major differences are the increased cost and permitting requirements and the potentially longer implementation schedule associated with the larger number of treatment facilities.

c. <u>Farm Scale</u>

At the individual farm scale, the three top rated treatment technologies are wetlands, managed wetlands, and chemical treatment. The wetlands and managed wetlands alternatives require that significant percentages of farm land be taken out of production, whereas chemical treatment can be accomplished in on-farm canals. Limestone borrow areas can be used as sedimentation basins to enhance phosphorus removal performance if they are located nearby. On-farm chemical treatment also offers the capability to enhance the phosphorus removal performance of water table management BMPs that include hydraulic improvements or storage of drainage water on farm prior to discharge.

It was recommended that the District move forward with the detailed evaluation of the top rated technologies for each scale of application in the EAA.

2. <u>PHASE II EVALUATION</u>

Under Amendment No. 4 to Contract C-3051, Brown & Caldwell performed additional investigations of the three technologies most highly rated during the Phase I Evaluation (stormwater treatment areas; direct filtration; and chemical treatment with wetlands). A complete discussion of that evaluation and conclusions resulting therefrom may be found in reference 21.

At the basin scale, detailed evaluations were prepared for the S-5A and S-7 basins. The following summary conclusions and recommendations resulting from that evaluation are excerpted from reference 21.

a. Direct Filtration

Direct filtration appears to be an attractive alternative to STAs for the following reasons:

(1) Lower Cost: Capital, operation and maintenance (O&M), and present worth costs are lower for direct filtration than STAs. Costs vary with the filtration rate. If high-rate direct filtration at a maximum rate of 11 gpm/sq ft is proven feasible by means of pilot tests, and sludge can be disposed on dedicated land adjacent to the treatment plant, significant cost savings can be achieved. The present worth of constructing and operating high-rate direct filtration plans for 20 years is shown below compared with the cost of constructing and operating STAs:

Basin	Direct filtration	STA
S-5A	$110 million	$153 million
S-7	$ 48 million	$ 82 million

(2) Less Land Required: Direct filtration requires 424 acres of land, including sludge disposal, at Basin S-5A, while the STA requires 12,200 acres. At Basin S-7, direct filtration requires 186 acres, while the STA requires 6220 acres. This means not only lower capital costs for the purchase of land, but also less revenue loss to the community as a result of not removing nearly as much agricultural land from production.

(3) Proven Technology: Direct filtration has been used to treat surface runoff waters for decades. The Wahnbach Reservoir direct filtration plant in Germany has been treating agricultural drainage water to reduce phosphorus from about 0.2 to 0.005 mg/l for 15 years in a situation similar to the EAA. The ability of the STAs to reduce phosphorus concentration in the EAA is based on the transferability of research performed on WCA 2A. Critical design instruction

from the Everglades Nutrient Removal Project will not be available in time to address many of the questions concerning the STA design criteria prior to the time that design of the recommended alternative must begin.

(4) Immediate Phosphorus Removal: When the direct filtration plant is placed in operation it will immediately reduce phosphorus concentrations to 0.05 mg/l. There will be no long start-up period required to reach steady state equilibrium before phosphorus can be removed to the proper level as with the STAs.

(5) Extended Operation: With proper O&M and periodic replacement of worn out equipment, the direct filtration plants will perform indefinitely. The useful life of the STAs has not been determined.

(6) Low Phosphorus Levels: The design of the direct filtration system is based on achieving an effluent phosphorus concentration of 0.010 mg/l or one-fifth of the target concentration of 0.050 mg/l. For Basin S-5A, this low phosphorus concentration will be achieved on 74 percent of the flow days based on discharge data for the period of record. For Basin S-7, 56 percent of the flow days are below the treatment plant capacity and, therefore, are treated to the .010 mg/l level.

(7) Expandability and Flexibility: The direct filtration system provides the District with the flexibility to construct systems in modules, thus avoiding the initial cost of constructing an entire system. Modular construction also offers flexibility for adjusting to reduced flows and phosphorus loads that exceed the target levels for on-farm best management practices. In addition, direct filtration, unlike STAs, is not limited by a phosphorus retention

capability, so that lake releases and other non-EAA generated flows could be included more economically in the design. The ability to achieve low phosphorus levels also provides the flexibility to meet possible future regulation requirements for phosphorus discharges from the EAA. Finally, phosphorus levels could be reduced significantly by the use of equalization preceding the treatment system without modifying the treatment system itself.

b. Chemical Treatment with a Wetland

The chemical treatment with a wetland alternative for Basin S-5A does not appear to be an attractive option. In this alternative, chemical pretreatment is used to remove some of the phosphorus (from 0.187 to 0.1 mg/l) prior to flow through a wetland. The capital cost and present worth of chemical treatment with a wetland, including dedicated land disposal of sludge, are more than the STA; the annual O&M costs are comparable. The present worth of chemical treatment with a wetland is $205 million compared with $153 million for the STA. The land required for the chemical treatment with a wetland is 6200 acres compared with 12,200 acres for the STA.

c. Chemical Treatment

The chemical treatment alternative for Basin S-7 is an attractive alternative compared with the STA; however, it is not as attractive when compared with direct filtration. The capital, O&M, and present worth costs are all lower for chemical treatment than for the STA. The present worth for chemical treatment, including dedicated land disposal of sludge, is $74 million compared with $82 million for the STA. The land required for chemical treatment is 470 acres compared with 6220 acres for the STA. The other advantages cited above for direct filtration also apply to chemical treatment at Basin S-7.

d. Recommendations:

The following are recommendations concerning the basin-scale alternative treatment technologies:

(1) Direct filtration should be considered a viable alternative to STAs in all basins of the EAA. Direct filtration should be included in the upcoming Plan Formulation phase of the Everglades Protection Project.

(2) Bench scale and pilot plant testing of the direct filtration process on EAA waters should proceed immediately.

3. FURTHER ANALYSIS OF CHEMICAL TREATMENT PROCESSES

Under Amendment No. 6 to Contract C-3051, Brown & Caldwell prepared a further analysis and development of chemical treatment processes, applied to each of the four primary basins of the EAA. A complete discussion of that analysis may be found in reference 20.

Principal refinements in the analysis, as compared to the Phase II results, included incorporation of the results of bench scale treatability analyses, and the addition of flow equalization basins upstream of the treatment plants.

a. Summary of Amendment No. 6

The following discussion of the scope of services performed by Brown & Caldwell under Amendment No. 6, and their conclusions resulting from those analyses, is excerpted from reference 20.

Amendment No. 6 uses testing of EAA waters to determine estimated dosage rates and conditions for the chemical treatment technologies. The bench scale testing of actual EAA waters allows the incorporation of these results into a revised preliminary design and costs analysis. Direct filtration treatment and costs is determined for both high-rate (11 gpm/sq ft) and low-rate (6 gpm/sq ft) surface loading rates on the filters. In addition, it was determined that flow equalization allows for a reduction in treatment plant capacity and lengthens the time of treatment plant utilization. The effects of the estimated particulate phosphorus reduction due to flow equalization is presented.

(1) Scope of Amendment No. 6 Evaluation (Reference 20): This report comprises the Final Draft Report of Amendment 6, Contract C-3051, Evaluation of Alternative Treatment Technologies. As shown in the Table of Contents, the report is made up of five technical memoranda. These memoranda address the following tasks as defined in the original scope of services:

Technical Memorandum No. 1 (Tasks 2-4): Bench scale testing methods and results, raw water quality data, and sludge testing results.

Technical Memorandum No. 2 (Task 8): Daily flow and P load data development. Application of BMP and flow equalization basin reductions to flow and P load data.

Technical Memorandum No. 3 (Task 9): Flow equalization/direct filtration treatment plant sizing optimization. Conceptual unit process design (basis of design table).

Technical Memorandum No. 4 (Task 9): Preliminary cost estimates of direct filtration technology including capital, O&M, and 20-year present worth estimates.

Technical Memorandum No. 5: Sedimentation technology analysis, cost estimates and comparison of sedimentation versus direct filtration.

Bench scale testing of runoff waters (Technical Memorandum No. 1) from the Everglades Agricultural Area (EAA) is followed by daily flow and P load data development (Technical Memorandum No. 2). After treatment plant and flow equalization basin sizing is completed, the conceptual unit design is presented (Technical Memorandum No. 3) followed by capital, O&M, and present worth cost estimates (Technical Memorandum No. 4). In the final memorandum, (Technical Memorandum No. 5), sedimentation technology analysis and cost estimates are presented, along with a discussion of sedimentation versus direct filtration. Pertinent appendices are contained at the end of each technical memorandum, such that each memorandum is a stand-alone document.

In addition, the report contains a process flow sheet diagram and general site layouts of the direct filtration treatment process (Technical Memorandum No. 3).

(2) <u>Results of Amendment No. 6 Evaluation</u>: Complete results and discussion of bench scale test results and their implications are presented in detail in Technical Memorandum No. 1. While all of the results of the bench scale testing are considered important to chemical treatment and direct filtration technology analysis, the following is an abbreviated list of these results:

(a) Chemical additives evaluated were to determine the optimum dosage and conditions under which the most efficient phosphorus removal is realized.

(b) The optimum pH for alum treatment in the bench scale testing was about pH 7.0. The optimum pH for iron treatment was approximately pH 7.5. Phosphorus and coagulant residuals were both low in these pH ranges, and solids separations were effective.

(c) Alum was the most effective primary coagulant for direct filtration because it could obtain low total phosphorus (7-12 ug/l) and low coagulant residuals (0.5 mg/L) at relatively low Al doses, in the neighborhood of 6 mg/L (0.22 mM). Also, alum produces less chemical sludge than iron compounds at the same molar dosage. Iron compounds could not attain these low P residuals until higher doses were used (about 0.3 mM or 16 mg/L Fe). Whether these iron doses can be accommodated by direct filtration systems needs to be determined by pilot testing. If they cannot, then iron treatment would only be used with sedimentation systems.

(d) Increase in chemical dosages, from those assumed in the Amendment No. 4 report, were due to a higher actual organic content than that assumed in the Amendment No. 4 report. In other words, waters tested showed higher organic content over surface runoff waters currently treated in Wahnbach, Germany. The revised dosage rates do allow for removal of P to levels realized by the German plant.

(e) If lower total phosphorus residuals are needed, or evidence about Al toxicity in water or sludges preclude the use of alum, then iron becomes the favored coagulant. However, relatively high iron doses (>0.3 mM) will be needed to attain low total phosphorus residuals, which may favor the use of sedimentation systems, which are typically not limited by solids loading rates. Also, iron may be required if runoff waters are significantly more concentrated in total phosphorus or other coagulant-demanding substances (algae or dissolved organics, for example) than the runoff waters processed in this study. Pretreatment to reduce coagulant demand would be evaluated in the pilot study. Ferric chloride appears to be a better coagulant than ferric sulfate.

(f) Direct filtration achieves low P and coagulant residuals at relatively modest reagent dosages. (Note that filtration is likely to produce somewhat better effluent quality at pilot and full scale than it did at bench scale). Sedimentation usually cannot achieve the same level of effluent quality, even when higher coagulant doses are used. However, sedimentation is simpler than direct filtration, and may be less costly overall. Both alternatives should be tested during the pilot scale investigation.

(g) Use of an anionic polymer produced faster-forming, larger, stronger and discrete floc. These floc were vastly more amenable to filtration and sedimentation than floc generated when no anionic polymer was used. Use of anionic polymers should allow filtration or sedimentation processes to operate at higher rates with better treatment efficiency. Anionic polymers are relatively cost effective, because they are used in small amounts.

Use of a cationic polymer (in conjunction with an anionic polymer) may have improved turbidity removals and reduced coagulant residuals. The cationic polymers should be further investigated to improve reduction of metals.

(h) To determine the effects of chemical treatment on the water chemistry, a detailed scan of raw and treated water was conducted. Alum treatment of Batch D (the fourth in a series of grab samples of EAA runoff) water produced significant reductions in total phosphorus and color, moderate reductions in COD and TOC, and minor reductions in DOC and silica. Aluminum and sodium concentrations increased slightly. Iron and manganese concentrations were reduced slightly. Sulfate concentration increased moderately on a mass basis, but increased greatly on a percentage basis. Changes in trace element concentrations could not be measured as they were below the detection limits.

(i) Analysis of the sludge generated during alum treatment of Batch D water showed that only chromium, and possibly selenium, had the potential for exceeding the TCLP limits. Current results indicate that it is unlikely that chemical treatment plant sludges are a hazardous waste. Additional tests are needed under pilot plant conditions.

In parallel with bench scale testing of EAA waters, treatment plant sizing in combination with flow equalization of runoff waters was modeled using existing daily flow and phosphorus load data over the 9.75-year period of record 1979 to 1988. The following tabulation presents the optimal flow equalization basins areas and the corresponding direct filtration treatment plant capacity as determined by the modeling of daily flows and phosphorus loads over the period of record.

Locations	FE Basin Area/Treatment Plant Capacity with FE Basin Reductions*	FE Basin Area/Treatment Plant Capacity without FE Basin Reductions
Basin S-5A	2,700 acres, 200 MGD	2,800 acres, 260 MGD
Basin S-6	1,700 acres, 150 MGD	1,700 acres, 190 MGD
Basin S-7	1,400 acres, 130 MGD	1,700 acres, 190 MGD
Basin S-8	2,400 acres, 340 MGD	2,800 acres, 450 MGD

*Assumes a 35 percent reduction in particulate phosphorus.

b. Summary of Estimated Costs

As discussed by Brown & Caldwell in reference 20, Technical Memorandum No. 5, it was concluded that direct filtration is a potentially more efficient, reliable, and cost-effective phosphorus removal technology for application to EAA runoff waters than chemical treatment followed by sedimentation. Detailed cost information was presented for the preferred direct filtration technology, and is used in the following discussion.

Brown & Caldwell recommends in reference 20 the conduct of a pilot scale test of chemical treatment technologies to further refine design criteria and estimated costs. Significant factors affecting both capital and operation and maintenance costs which have not yet been resolved include:

- The required loading rate for filters (e.g. high rate vs. low rate).

- The influence of flow equalization basins upstream of the treatment plants on phosphorus reductions.

- Final selection of chemical additives and dosages.

The above factors combine to result in a wide range of estimated costs, confirming the need for further testing at the pilot scale prior to drawing final conclusions concerning the efficiency of a chemical treatment process.

(1) Range of Estimated Capital Costs: The following tabulation is a summary of the probable range of capital costs for the various treatment works, taken from data presented in reference 20. "Low End" costs are compiled upon the assumption of both high-rate filtration and a 35 percent reduction in particulate phosphorus in the flow equalization basins. "High End" costs are compiled upon the assumption of

low-rate filtration and no reduction in phosphorus loading due to the flow equalization basins.

	Range of Capital Cost	
Basin	Low End ($Million)	High End ($Million)
S-5A	83.23	95.97
S-6	52.37	64.34
S-7	62.02	79.15
S-8	91.83	119.70
Total	289.45	359.16

(2) Range of Estimated Operation and Maintenance Costs: The following tabulation is a summary of the probable range of annual operation and maintenance costs for the treatment plants, taken directly from reference 20. These costs were developed upon the assumption of:

- A 35 percent reduction in particulate loading on the treatment plants due to the presence of the flow equalization basins.

- The use of alum as the primary coagulant.

- The suitability of dedicated land disposal for residuals management.

	Range of O&M Cost	
Basin	Low End ($Million)	High End ($Million)
S-5A	2.77	2.87
S-6	2.39	2.49
S-7	2.38	2.51
S-8	3.82	4.04
Total	11.36	11.91

The only variation assumed between the "Low End" and "High End" costs was low-rate vs. high-rate filtration.

A change in any of the primary assumptions listed above could be expected to significantly affect (increase) the estimated average annual costs for operation and maintenance.

4. FURTHER ANALYSIS OF STORMWATER TREATMENT AREAS

The evaluations of alternative treatment technologies prepared by Brown & Caldwell and discussed above all employed, for purposes of comparison, the conceptual designs of the stormwater treatment areas defined in reference 1.

Subsequent to publication of reference 1, the basic hydrologic and nutrient load data upon which that document was based have been subject to continued development and refinement. The revised hydrologic and phosphorus load data for the historic period of record (water years 1979-1988) are developed and discussed in detail in references 2 and 3, prepared by Burns & McDonnell under Amendment No. 1 to Contract C-3021. Those revised data were employed by Brown & Caldwell in its work under Amendments 4 and 6 to Contract C-3051.

In addition to refinement of historic data, the basis for design of the stormwater treatment areas underwent substantial review and modification concurrent with Brown & Caldwell's work in evaluation of alternative treatment technologies. An analysis of the results of those modifications on the required effective treatment areas of the various STAs ma be found in reference 17, prepared by Burns & McDonnell under Amendment 1 to Contract C-3021.

The basic form of analytical expression employed in calculating the effective area of any given STA has been revised from that presented in reference 1 to reflect the form of analysis used by consultants to the U.S. Department of Justice in their continued analysis of data from Water Conservation Area 2A (WCA-2A), and which forms the basis for the estimated performance of the STAs. In addition, the value of the "settling rate" constant was revised, reflective of both the change in analytical form and the results of continued review and analysis of available data from WCA-2A. A more complete definition of the current basis for design of stormwater treatment areas is included in Section D of this Part II.

As was the case for the March 31, 1992 "Conceptual Design," the effective treatment areas recommended in reference 17 are based upon a long-term average of a 20 percent reduction in the volume, and a 25 percent reduction in the total phosphorus load, historically discharged from the EAA as a whole, consistent with the current Surface Water Improvement and Management (SWIM) Plan for the Everglades and the Chapter 40E-63 Rule under which Best Management Practices (BMPs) are required to be implemented by agricultural interests in the EAA. However, the analysis varies from that presented in the Conceptual Design in:

- The calculated magnitude of volumes and total phosphorus loads in historic discharges from the EAA to the EPA.

- The distribution of the overall reduction in discharge volumes and total phosphorus loads among the various basins of the EAA.

- Allowances in the analysis for volumetric and total phosphorus load inflows from sources other than the EAA.

Calculated historic discharge volumes were very similar to those presented in reference 1, varying (increased) by but 0.01 percent over consistent periods of record. However, estimates of total phosphorus loads historically discharged to the EPA were increased approximately 5.6 percent above those reflected in reference 1.

With respect to the distribution of volumetric and TP load reductions due to the implementation of BMPs, analyses in reference 1 were based on a uniform reduction throughout the EAA. The analysis in reference 17 recognizes the variability in historic discharges from the various basins, and employs variable percentage reductions by basin, aggregating to the objectives defined in the Chapter 40E-63 Rule for the EAA as a whole; reductions applied in each basin are developed and discussed in detail in reference 4.

The March 31, 1992 Conceptual Design was based on treatment of all historic discharges to the EPA without distinction as to source, and to that extent was inconsistent with the current proposed SWIM Plan for the Everglades, which considers only treatment of agricultural discharges from the EAA.

Analyses presented in reference 17 consider the impact on the required effective treatment areas for each STA for a wide variety of potential choices which can be made relative to the accommodation of inflows from sources other than the EAA.

It was recommended in reference 17 that the following inflows from other sources be included in the design, in addition to historic volumes and TP loads discharged in EAA drainage (modified for the presence of BMPS).

- In the S-5A basin (STA-1).
  - Historic Lake Okeechobee releases at S-352 which were discharged to Water Conservation Area 1 through Pump Station S-5A.
  - S-5A basin runoff which was historically discharged to the L-8 and C-51 canals east of Pump Station S-5A.

- In the S-6 basin (STA-2), those Lake Okeechobee releases at S-351 which were historically discharged to WCA-1 through Pump Station S-6.

- In the S-7 basin (STA-3), Lake Okeechobee regulatory releases from S-351 which were either discharged to WCA-2A through Pump Station S-7, or to WCA-3A through Structure S-150.

- In the S-8 basin (STA-4).
  - Lake Okeechobee regulatory releases from S-354 which were discharged to WCA-3A through Pump Station S-8.
  - Historic inflows to the basin from Structure G-88 and Structure G-136.

An additional variation from the March 31, 1992 Conceptual Design was the value of the apparent long-term average "settling rate" constant employed in the analysis, which is increased from 8 meters per year to 10.2 meters per year as recommended by technical consultants to the U.S. Department of Justice. Other, less significant variations in input parameters were also made.

The composite effect of the various modifications described above was to reduce the effective treatment area of each STA as indicated in the following tabulation:

	Effective Area in Acres		
Location	March 31, 1992 Conceptual Design	Reference 17 Analysis	Change
STA-1	11,191	8,877	(2,314)
STA-2	4,595	4,342	(253)
STA-3	5,683	4,259	(1,424)
STA-4	10,506	9,281	(1,225)
Total	31,975	26,759	(5,216)

Should a single, combined stormwater treatment area serving both the S-7 and S-8 basins be developed in the S-7 basin, the recommended effective area of that STA would be 14,523 acres.

It was the intent that, given no other substantive changes (such as the potential selection of an alternative treatment technology), the current proposed SWIM Plan for the Everglades be modified to reflect the above changes in the required effective treatment areas, together with certain other modifications to the Basis for Design.

Burns & McDonnell subsequently initiated the preparation of modified conceptual designs of the stormwater treatment areas (and adjacent hydroperiod restoration works) under Amendment No. 2 to Contract C-3021. That work was interrupted by the initiation of the mediation process, and was not finally completed and documented.

The work had progressed to the point that modified conceptual designs (and capital cost estimates) had been prepared for:

- Stormwater Treatment Area No. 2 (STA-2).
- WCA-2A Hydroperiod Restoration Works.
- A combined stormwater treatment area (STA-3/4) serving the S-7 and S-8 basins.
- WCA-3A Hydroperiod Restoration Works along the north perimeter of WCA-3A between the "Toe of the Boot" addition to the Holey Land and the North New River Canal.

The following is a summary of the estimated capital costs for the above facilities.

	Estimated Cost in $ Million					
Plan Element	Constructed Facilities	Eny., Plan, Des., & C.M.	Land Acq.	Contingency Cont.	Contingency Lane	Total Cost
STA-2	27.49	4.12	14.15	5.50	4.95	56.21
STA-3/4	68.89	10.33	36.50	13.78	12.78	142.28
Subtotal	96.38	14.45	50.65	19.28	17.73	198.49
WCA-2A Hydro.	4.50	0.68	0.00	0.90	0.00	6.08
WCA-3A Hydro.	7.97	1.06	0.00	1.41	0.00	15.62
Subtotal	11.57	1.74	0.00	2.31	0.00	15.62
TOTAL	197.95	16.19	50.65	21.59	17.73	214.11

The total estimated capital cost for STA-2 and STA-3/4 was reduced by $12.71 million (6.0 percent) as compared to the total estimated cost for STA-2, STA-3, and STA-4 presented in reference 1; the total effective treatment area had been reduced by 9.2 percent (from 20,784 acres to 18,865 acres).

A modified conceptual design and capital cost estimate for STA-1 had not been completed. Given a reduction in effective area, as compared to reference 1, of 20.7 percent (from 11,191 acres to 8,877 acres) for STA-1, it is anticipated that the capital cost for a modified STA-1 would be reduced from $114.1 million to approximately $95 million.

The total capital cost for an updated SWIM Plan, reflecting the revised basis for design, would then be approximately $309.1 million, of which approximately $293.5 million would be associated with the three stormwater treatment areas.

Of the total 27,742 acres of effective treatment area in the modified STAs, approximately 24,106 acres would consist of lands presently owned by private interests.

Modification of the current proposed SWIM Plan for the Everglades as suggested above would still not address the need for offsetting volumetric reductions in flow to the EPA resulting from implementation of the SWIM Plan.

5. SELECTION OF TREATMENT TECHNOLOGY

The Technical Mediation Group had available for its consideration all information developed as a result of the evaluation of alternative treatment technologies performed by Brown and Caldwell under Contract C-3051 and the further analysis of stormwater treatment areas prepared by Burns & McDonnell under Contract C-3021 in its selection of the treatment technology to be employed in the mediated technical plan. The Technical Mediation Group subsequently accepted the use of stormwater treatment areas (constructed wetlands) as the technology to be employed in achieving the interim goal of a long-term flow-weighted average total phosphorus concentration of 0.05 gm/m^3 in discharges to the Everglades Protection Area.

Primary factors favoring the use of constructed wetlands considered in that acceptance included:

- The potentially broad range in capital costs for use of a chemical treatment technology.

- The need for additional testing and development to further refine the basis for design of chemical treatment plants, and the attendant impact on implementation schedule.

- The uncertain impact of the discharge of chemically treated waters to the receiving marshes and water bodies.

- The lack of a clearly defined capital cost advantage for use of chemical treatment technology as compared to constructed wetlands ("low end" capital cost of $289.45 million for direct filtration plants, as compared to an updated cost estimate for the stormwater treatment areas of approximately $293.5 million).

- The significantly higher annual operation and maintenance costs anticipated for chemical treatment plants, as compared to constructed wetlands.

- The uncertain impact on receiving marshes and water bodies of continued "slug" releases of untreated water bypassed around chemical treatment plants during periods of high flow.

- The greater sensitivity of chemical treatment plants employing hydraulic bypass to variation in flow rate and nutrient concentration and speciation.

While accepting the use of constructed wetlands in achieving the interim goal, the Technical Mediation Group also recognized the need for continued development of the chemical treatment technologies so that more definitive information would be available should a further lowering of phosphorus concentration (beyond the 0.05 gm/m^3 interim goal) eventually become necessary.

The Technical Mediation Group further recognized and accepted the following potential disadvantages in use of constructed wetlands:

- A greater economic impact on the EAA than would result from use of chemical treatment technologies, due primarily to the markedly greater surface areas required for STAs, reducing both agricultural production and the available tax base.

- The increased time required for start-up and full performance of a constructed wetland, as compared to chemical treatment technologies.

- The uncertainty in performance of the constructed wetlands (the probable range of performance is discussed in Section D of this Part II).

- The reduced flexibility in design (as compared to chemical treatment plants) for incremental implementation or subsequent expansion.

C. EVALUATION OF BEST MANAGEMENT PRACTICES

Concurrent with their evaluation of alternative treatment technologies, Brown and Caldwell, in association with Mock, Roos & Associates, Inc., performed an evaluation of on-farm best management practices in the EAA. That evaluation was conducted under Amendment No. 3 to Contract C-3051. A complete discussion of the evaluation and its results may be found in reference 19.

The objectives of that evaluation were to:

- Assess the phosphorus reduction potential of on-farm BMPs in the Everglades Agricultural Area.

- Estimate the capital and annual operating costs associated with implementation of BMPs in the EAA.

- Identify the BMPs required to achieve 25, 35 and 45 percent phosphorus load reductions.

- Estimate the average annual cost associated with implementation of those BMPs.

The following is a summary of the primary agricultural activities (total acreage and estimated baseline average annual phosphorus load discharged) considered in that analysis

Activity	Total Area (acres)	Baseline Phosphorus Discharge (lb/ac/yr)	Baseline Phosphorus Discharge (met.ton/yr)
Sugar Cane	460,000	0.58	121.0
Vegetable	25,000	2.11	23.9
Sod	22,000	0.74	7.4
Total	507,000		152.3

It was noted that the above total phosphorus discharge was significantly less than the measured average annual total phosphorus load discharged in EAA runoff during water years 1979-1988 (233.8 metric tons per year, see Table III-3); the difference was ascribed to contributions from point sources.

Reference 19 resulted in the following summary of estimated costs for implementation of BMPs capable of achieving reduction of 25, 35, and 45 percent in phosphorus discharges from the three primary agricultural uses evaluated.

Activity	Cost ($/acre)* for P Load Reduction of 25%	35%	45%
Sugar Cane	0.51	1.07	12.23
Vegetable	(16.62)	(8.08)	36.74
Sod	10.43	36.74	72.80

*As compared to historic agricultural practices

With respect to the EAA as a whole, the total reduction in phosphorus loads discharged necessary to achieve varying levels of reduction are summarized below:

% Reduction	Ave.-Annual P Load (met., ton)	Reduction from Historic (met., ton)
0	233.8	0
25	175.4	58.4
35	152.0	81.8
45	128.6	105.2

As indicated in reference 19, the total phosphorus load discharged from the EAA originates not only from agricultural fields, but also from point sources (such as wastewater treatment plants, sugar mills, etc.) and other non-point sources (urban lands, etc.). The data acquired during the 1979-1988 base period does not allow a distinction as to source.

In "Phosphorus Loads to the Water Conservation Areas from the Belle Glade and South Bay POTWs Diverted to a Deep Injection Well," prepared by Hutcheon Engineers and dated May, 1992, it is reported that 11.2 metric tons of phosphorus per year have been removed from EAA discharges through a diversion of their discharges to a deep injection well. This diversion was accomplished subsequent to 1988, with the result that the 11.2 metric ton per year reduction can now be considered as available in reducing total loads from the EAA at no incremental (future) cost.

Under Amendment No. 5 to Contract C-3051, Brown and Caldwell prepared an estimate of the historic phosphorus loads contributed to the EAA canal system from sugar mills in the EAA (reference 27). Those estimates were based on analysis of U.S. Sugar Corporation's Bryant and Clewiston mills, and the results extrapolated to the other mills in the EAA, resulting in an estimated average annual load contribution from the mills of 121.7 metric tons. However, it was concluded that the correlation between phosphorus discharged by the mills and phosphorus leaving the EAA was poor, with the result that a decrease in the phosphorus loading from the

$$\frac{[(\overline{R}-\overline{ET})\hat{C}+K_e\hat{C}-\overline{R}\hat{C}_R]}{[(\overline{R}-\overline{ET})\hat{C}_O+K_e\hat{C}_O-\overline{R}\hat{C}_R]} = \left(\frac{[\overline{Q}_O+(\overline{R}-\overline{ET})A]}{\overline{Q}_O}\right)^{-\left(1+\left[\frac{K_e}{(\overline{R}-\overline{ET})}\right]\right)}$$

where R = wet time average rainfall (m/yr)

$\overline{ET}$ = wet time average evapotranspiration (m/yr)

$\hat{C}$ = mass average discharge concentration of total phosphorus (gm/m^3)

$\hat{C}_R$ = mass average concentration of total phosphorus in rainfall (gm/m^3); includes dry/fall

$\hat{C}_o$ = mass average inflow concentration of total phosphorus (gm/m^3)

K_e = effective settling rate constant (m/yr)

$\bar{Q}_o$ = inflow volumetric flow rate (m^3/yr)

A = surface area (m^2)

With parameter grouping, the above equation can be restated in the form

$$\hat{C} = r\hat{C}_R + (\hat{C}_O - r\hat{C}_R)(1 + aA)^{-(1 + K_e/[\overline{R} - \overline{ET}])}$$

where

$$a = \frac{\overline{R} - \overline{ET}}{\overline{Q}_O} \quad and \quad r = \frac{\overline{R}}{(\overline{R} - \overline{ET} + Ke)}$$

b. Application and Input Parameters

The above form of analytical expression is applied to average annual data. The conceptual design reflected in this mediated technical plan is based on historic data over the period water years 1979-1988 (where available), resulting in a 10-year average.

(1) Fixed Input Parameters: The following input parameters are common to the analysis of each stormwater treatment area:

- The effective settling rate constant (Ke) is taken as 10.2 m/yr.

- The average annual rainfall (1979-1988), averaged over the EAA as a whole, is taken as 48.53 inches (1.233 m).

- The total atmospheric deposition of phosphorus (both dry and wet fall) is taken as equivalent to a concentration of 0.05 gm/m^3 total phosphorus in rainfall. This is considered a conservative (e.g. upper boundary) estimate.

- The average annual pan evaporation (1979-1988), averaged over the EAA as a whole, is taken as 64.65 inches. That pan evaporation is converted to evapotranspiration by a factor of 0.7, resulting in an average annual evapotranspirative loss of 45.26 inches.

- The average discharge concentration is assigned at 0.05 gm/m^3, equal to the interim goal for discharges to the Everglades Protection Area.

(2) Variable Input Parameters: Inflow volumes and mean inflow concentrations of total phosphorus vary between the different STAs. The estimated average annual inflow volume and total phosphorus load for each STA is defined in Part IV of this document.

2. PROBABLE RANGE OF PERFORMANCE

An analysis of the sensitivity of the calculated long-term performance of the STAs to variations in the values of input parameters was presented in reference 17. That analysis is repeated herein, given its importance in judging the probable long-term performance of the stormwater treatment areas.

To facilitate the analysis, a hypothetical stormwater treatment area (STA) was considered, with historic inflow volumes and total phosphorus loads associated with Everglades Agricultural Area (EAA) runoff established at the average of the values developed in Part III of reference 17 for the four basins. Other input parameters were established at the values report in ParT III and Part IV of reference 17 for calculation of effective areas.

Potential contributions to inflow volumes and loads from other sources were not considered in the analysis, as their inclusion would have a tendency to dampen or mask the sensitivity of the STA performance in reduction of total phosphorus loads from the EAA to variations in the input parameters.

Input data employed for the base condition analysis of the hypothetical STA is summarized in Table II-1. The effective treatment area of 6482 acres identified in that listing was calculated to achieve a long-term average flow-weighted concentration of 0.050 gm/m^3 in discharges from the STA.

Table II-1

SENSITIVITY ANALYSIS
INPUT DATA FOR BASE CONDITION

Description	Unit	Value
Historic Runoff Volume	221,138	ac.ft/yr
Historic TP Load	49,040	Kg/yr
Influence of Best Management Practices:		
Volume Reduction	20	%
TP Load Reduction	25	%
Area Adjustment Factors (1):		
Volume	1.5875	ac.ft/ac/yr
TP Load	0.3356	Kg/ac/yr
Atmospheric Data:		
Ave. Annual Rainfall	48.53	in.
Ave. Annual Pan Evaporation	64.65	in.
Pan Coefficient	0.70	---
TP Conc. in Bulk Rainfall	0.0500	gm/m^3
Flow-Weighted Discharge Concentration	0.0500	gm/m^3
Settling Rate Constant	10.20	m/yr
Effective Treatment Area	6,482	ac.

(1) Adjustment of inflow volumes and loads to reflect influence of conversion of lands to use in stormwater treatment areas.

a. Analysis Results

A tabulation of the variations in the input parameters considered in the analysis, and the influence of those variations on the calculated long-term average flow-weighted discharge concentration from the hypothetical STA, is presented in Table II-2.

Table II-2

RESULTS OF STA SENSITIVITY ANALYSIS

	Est. Max. Values				Est. Min. Values			
Parameter	Plus (%)	Max. Value	C	% Change	Minus (%)	Min. Value	C	% Change
BMP Reductions								
- Volume	50	30	0.0478	(4.4)	(50)	10	0.0510	2.0
- TP Load	40	35	0.0435	(13.0)	(40)	15	0.0565	13.0
Area Adj. Factors								
- Volume	15	1.8256	0.0499	(0.2)	(15)	1.3494	0.0501	0.2
- TP Load	25	0.4195	0.0493	(1.4)	(25)	0.2517	0.0507	1.4
Atmospheric Data								
- Rainfall	10	53.38	0.0501	0.2	(10)	43.68	0.0499	(0.2)
- Pan Evap.	10	71.12	0.0503	0.6	(10)	58.10	0.0497	(0.6)
- Pan Factor	15	0.805	0.0504	0.8	(15)	0.595	0.0496	(0.8)
- TP Conc.	40	0.07	0.0517	3.4	(40)	0.03	0.0483	(3.4)
Settling Rate*	13.7	11.6	0.0423	(15.4)	(12.7)	8.9	0.0585	17.0

*Est. max. and min. values established at 90 percent confidence limits identified in reference 11.

For the above analysis, the effective treatment area was held at the 6482-acre value reported in Table II-1. For each of the 20 separate analyses, all other input parameters were held at the values listed in Table II-1, with the exception of the parameter being evaluated.

(1) Evaluation: Based on the analytical results report in Table II-2, the long-term average flow-weighted concentration of total phosphorus in discharges from the stormwater treatment areas is most sensitive to the settling rate constant, followed by average annual TP load reductions due to implementation of Best Management Practices. The performance of the stormwater treatment areas is indicated to be relatively insensitive to all other input parameters, within the range of variation considered.

A quantitative ranking of the sensitivity of STA performance to variations in input parameters is presented in Table II-3. The ranking is developed for both absolute impact on the discharge concentration, and for relative impact (e.g., percent change in discharge concentration as a ratio to percent change in input parameter).

Table II-3

STA SENSITIVITY ANALYSIS
RANKING OF INPUT PARAMETERS

Sensitivity Rank	Parameter	Abs. Impact on C (%)	Max. Parameter Variation %	Relative Impact
1.	Settling Rate Constant	17.0	12.7	1.339
2.	BMP TP Load Red.*	13.0	40	0.325
3.	BMP Volume Reduction*	4.4	50	0.088
4.	TP Conc. in Rainfall	3.4	40	0.085
5.	Area Adjustment for TP Load	1.4	25	0.056
6.	Pan Factor for ET	0.8	15	0.053
7.	Ave. Ann. Pan Evap.	0.6	10	0.060
8.	Ave. Ann. Rainfall	0.2	10	0.020
9.	Area Adjustment for Volume	0.2	15	0.013

*Applied as a percentage of historic data.

(2) Extreme Values: Table II-4 summarizes the results of two additional analyses conducted to assess the probable extreme range of long-term average flow weighted concentrations from the hypothetical STA. That extreme range is developed upon the assumption of additive variations in input parameters, and an effective treatment area of 6482 acres.

PART III
BASIN DATA

PART III

BASIN DATA

A. EVERGLADES AGRICULTURAL AREA

The primary emphasis of both the current (1992) Surface Water Improvement and Management (SWIM) Plan for the Everglades and the conceptual plan described in this document plan is a reduction in nutrient loads discharged to the Everglades Protection Area (EPA) from that part of the Everglades Agricultural Area (EAA) regulated under the District's 40E-63 Rule. Those discharges have been the subject of extensive previous analysis, and are most recently discussed in detail in references 2, 3, 4 and 17. Information presented herein is but a summary of pertinent data obtained from those references and directly applicable to design of the mediated technical plan components discussed in Part IV.

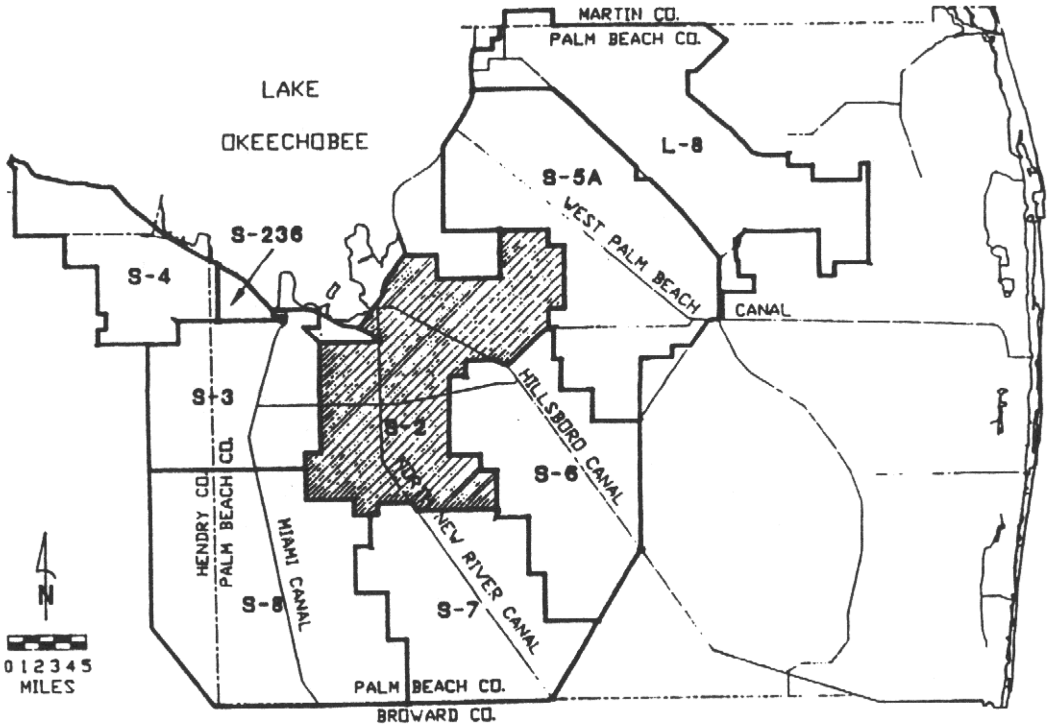
1. HYDROLOGIC BASINS

The primary hydrologic basins of the EAA regulated under the Chapter 40E-63 Rule include the S-2, S-3, S-5A, S-6, S-7, and S-8 basins. A more complete description of those basins can be found in reference 14. The general location, extent, and primary hydrographic features of those basins, taken from reference 14, are shown on Figures III-1 through III-6, respectively.

For the balance of this discussion, the S-8 and S-3 basins are combined. The S-7 basin is divided into those areas generally tributary to the North New River Canal and to the Hillsboro Canal. That part tributary to the North New River Canal is combined with the S-7 basin; that part tributary to the Hillsboro Canal is combined with the S-6 basin.

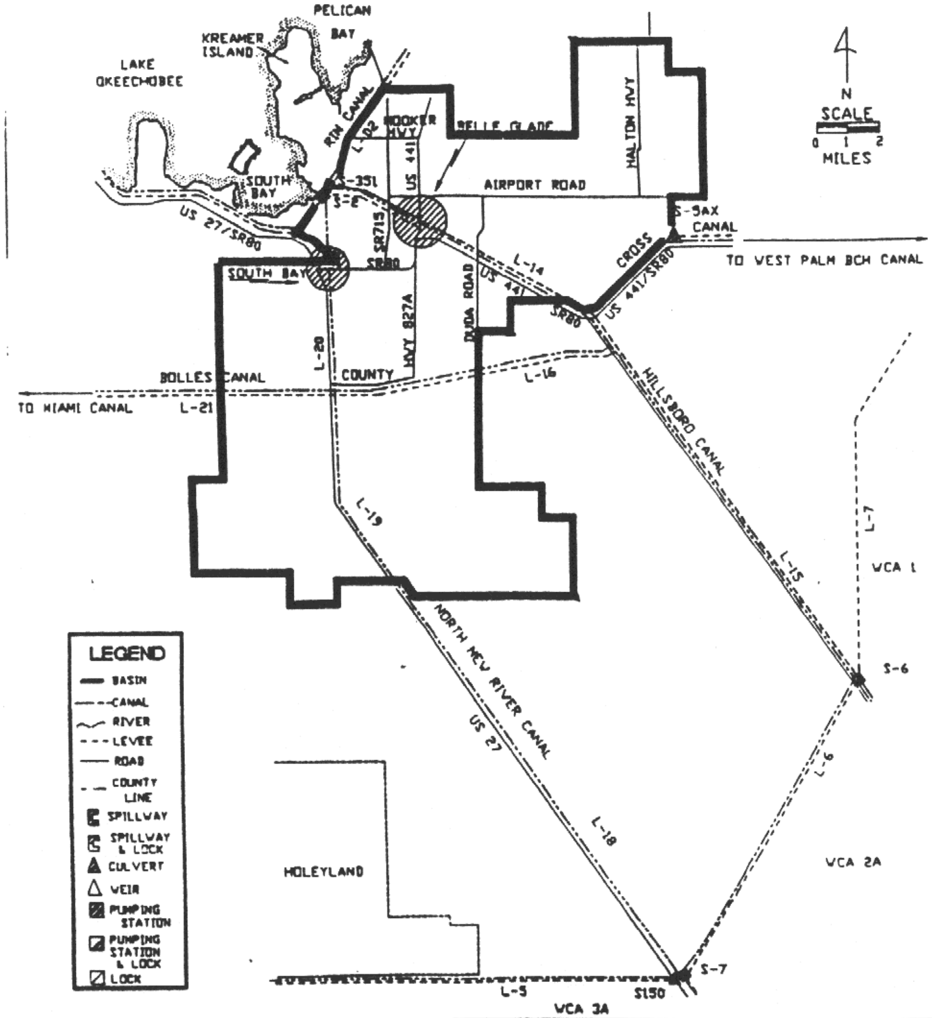
As a result of those combinations, four primary hydrologic basins are defined:

- The S-5A Basin.
- The S-6/S-2 Basin.



S-2 BASIN LOCATION MAP

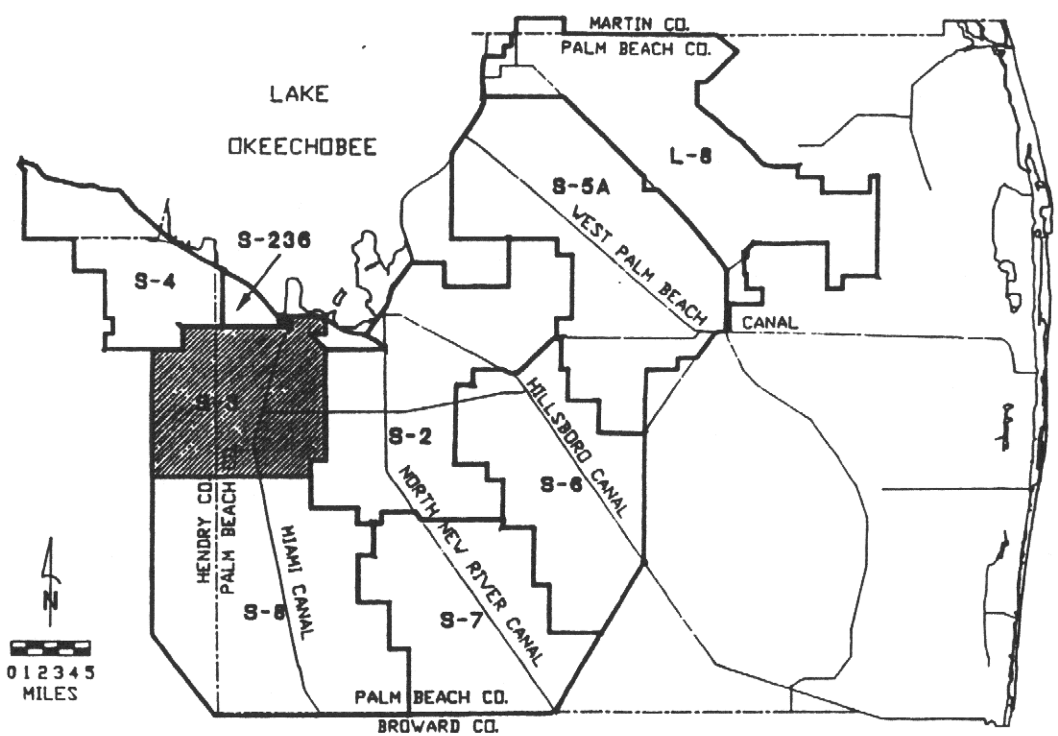
S-2 BASIN



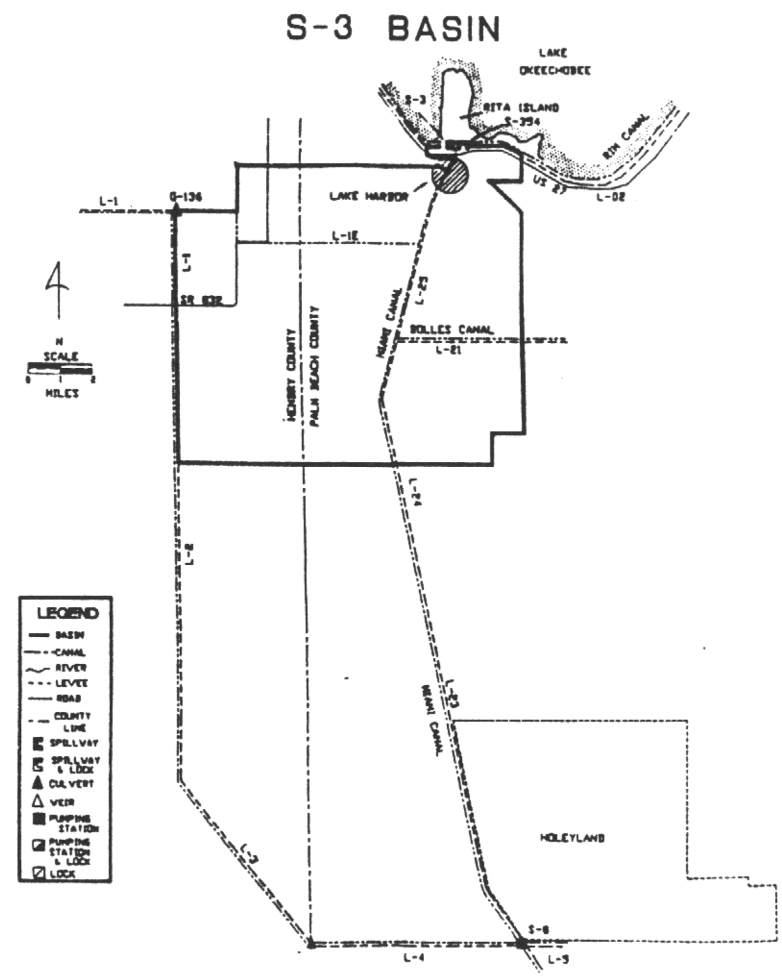
THE S-2 BASIN MAP

Burns & McDonnell

FIGURE III-1
S-2 BASIN



S-3 BASIN LOCATION MAP

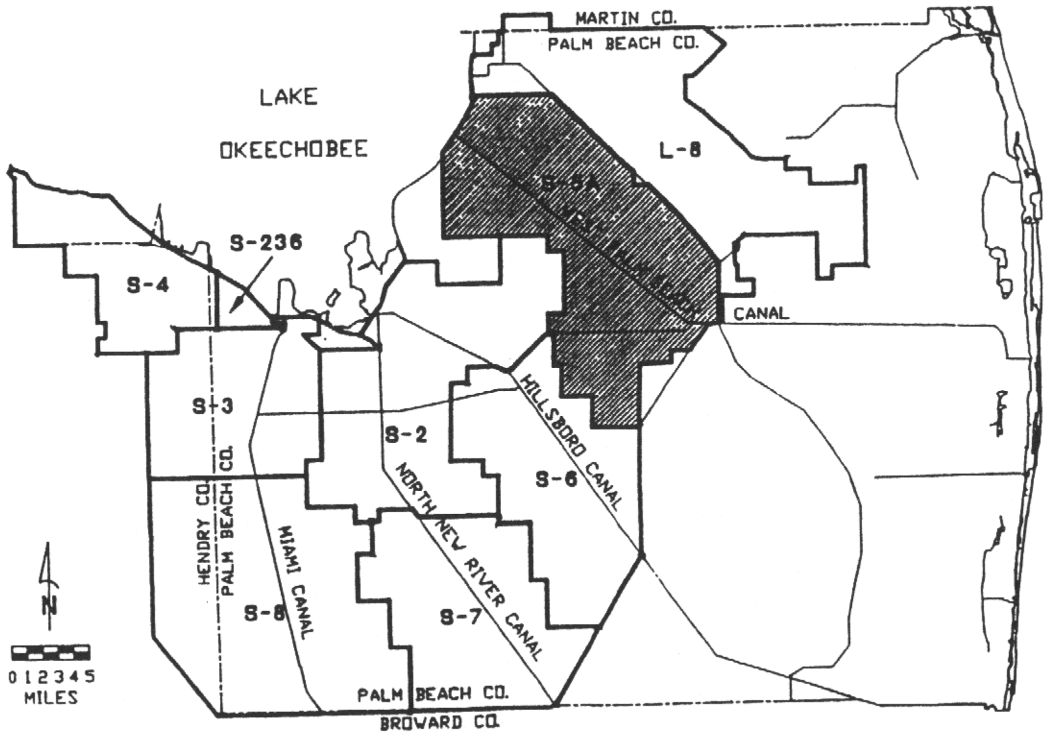


THE S-3 BASIN MAP

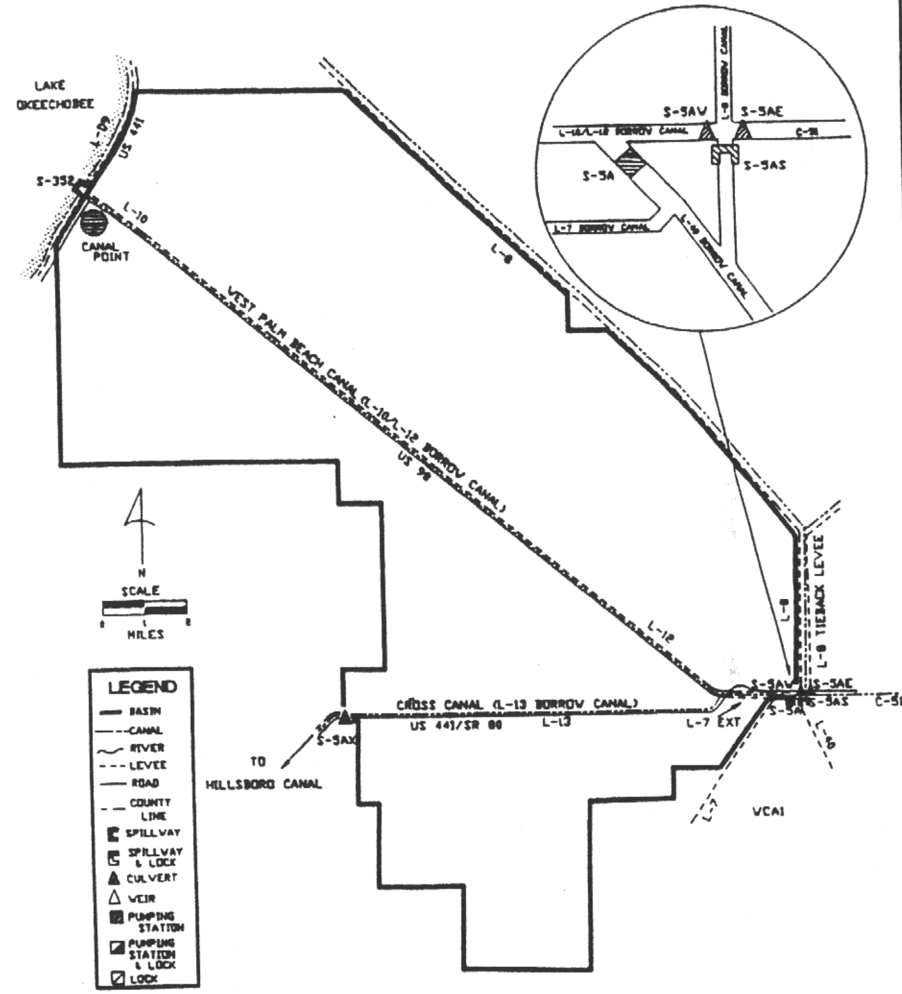
Burns & McDonnell

FIGURE III-2
S-3 BASIN

S-5A BASIN



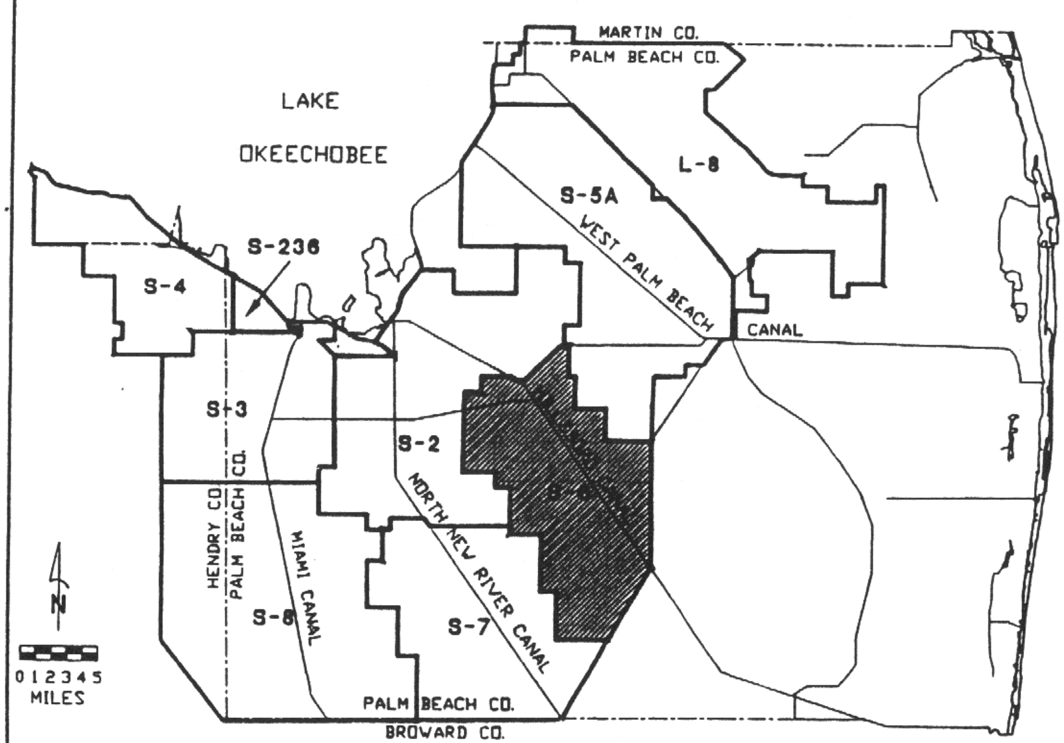
S-5A BASIN LOCATION MAP



THE S-5A BASIN MAP

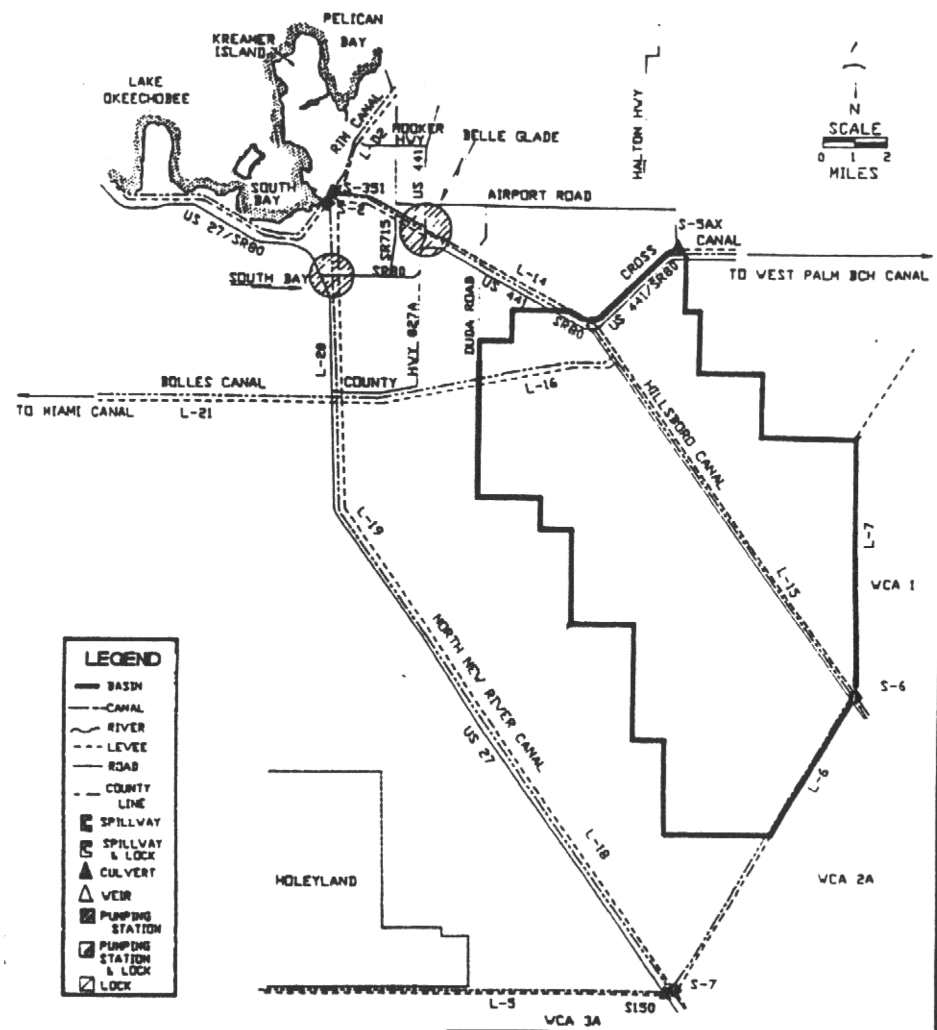
Burns & McDonnell

FIGURE III-3
S-5A BASIN



S-6 BASIN LOCATION MAP

S-6 BASIN

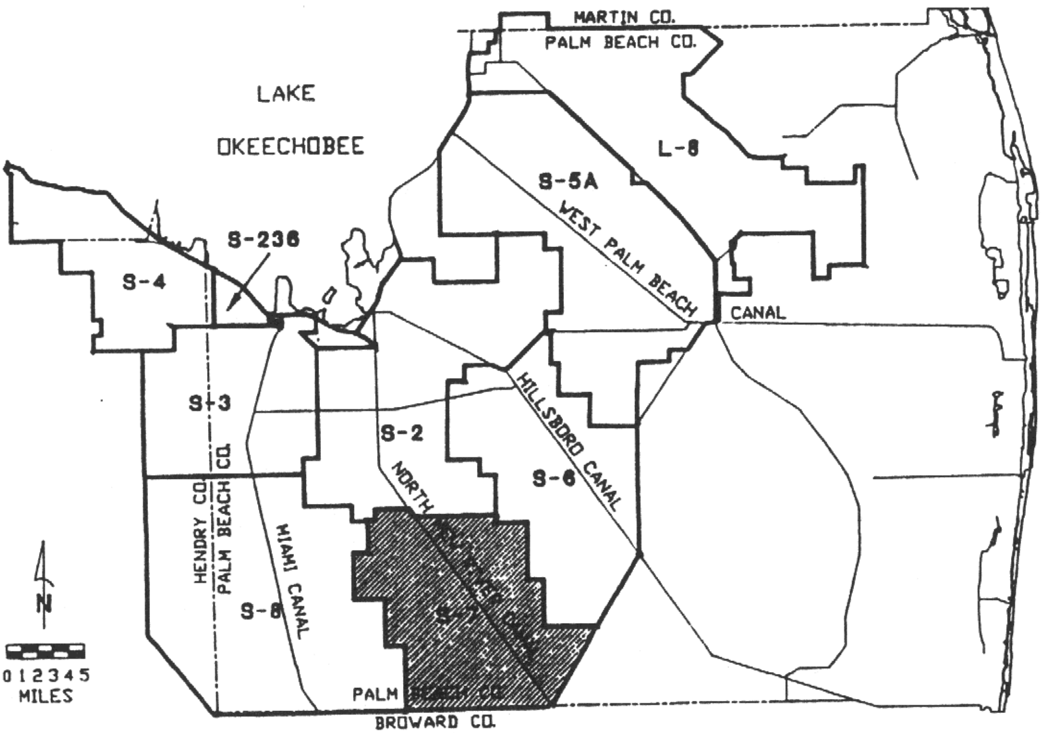


THE S-6 BASIN MAP

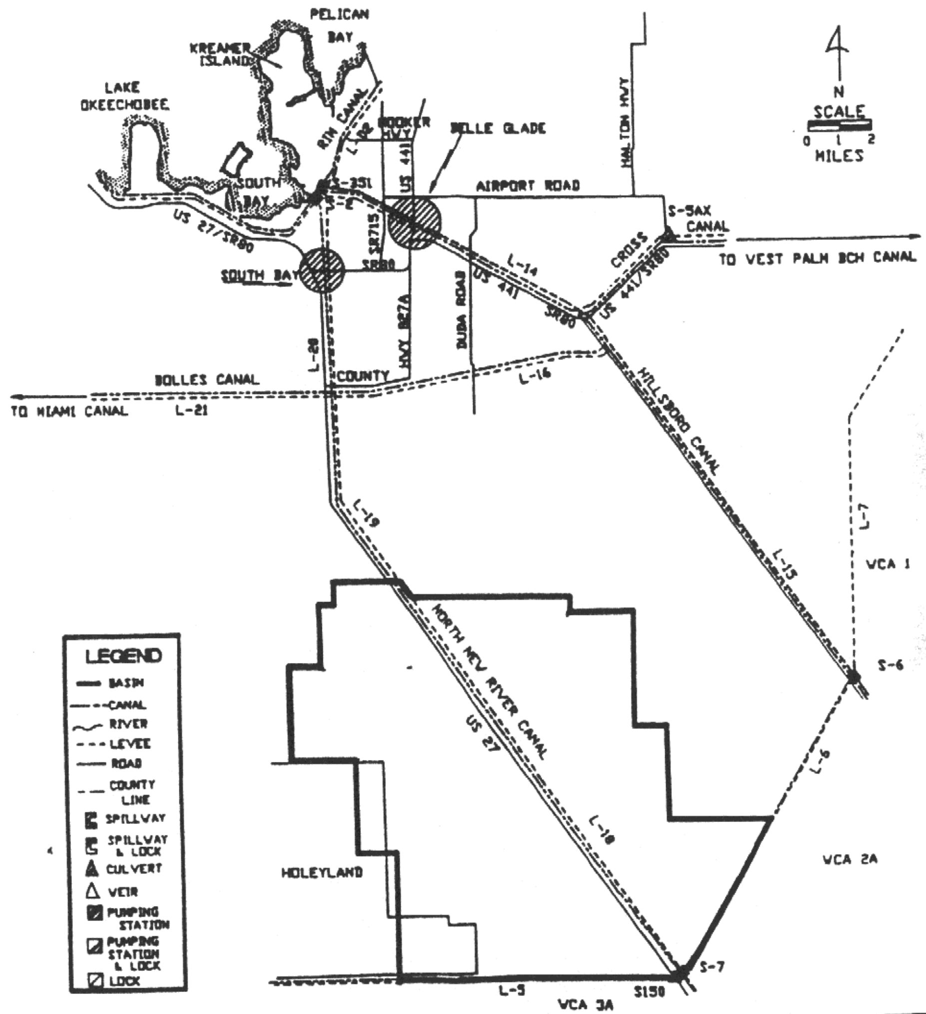
Burns & McDonnell

FIGURE III-4
S-6 BASIN

S-7 BASIN



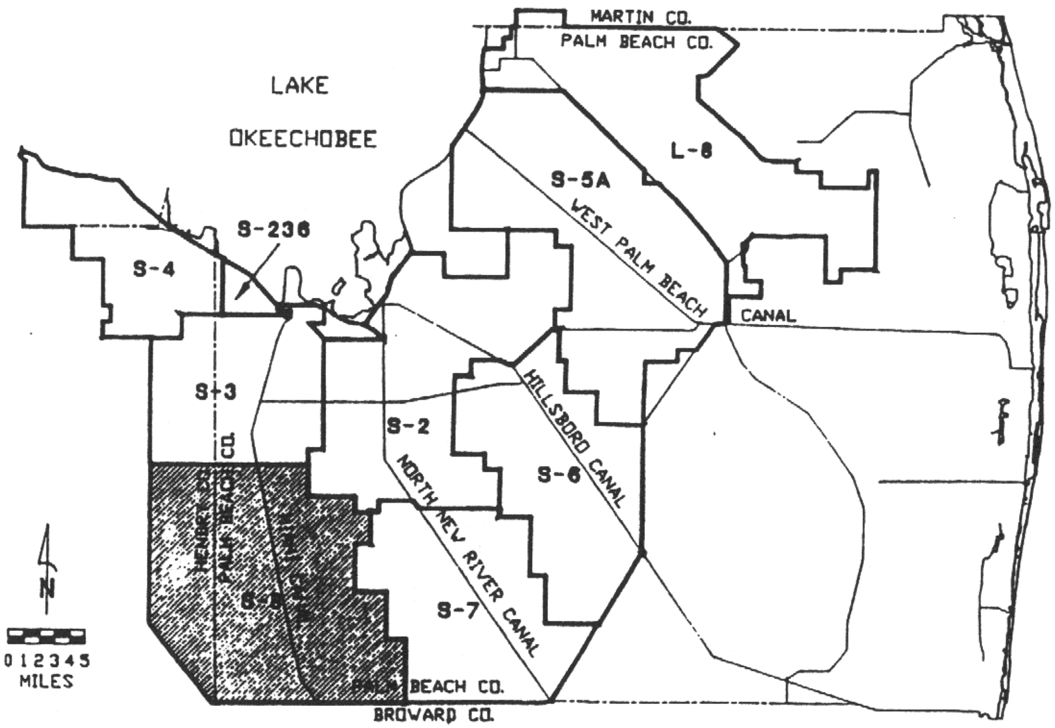
S-7 BASIN LOCATION MAP



THE S-7 BASIN MAP

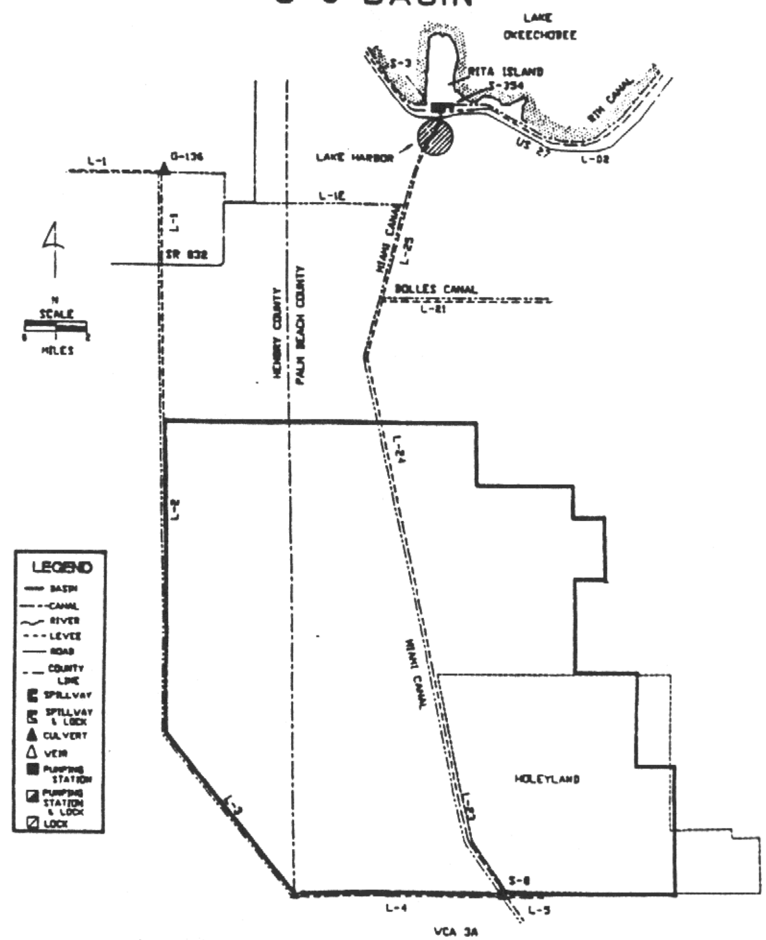
Burns & McDonnell

FIGURE III-5
S-7 BASIN



S-8 BASIN LOCATION MAP

S-8 BASIN



THE S-8 BASIN MAP

Burns & McDonnell

FIGURE III-6
S-8 BASIN

- The S-7/S-2 Basin.
- The S-8/S-3 Basin.

Previous analyses of discharges from the above four basins were prepared for a period of record including water years 1979-1988. A summary of total basin areas is presented in Table III-1. Two separate values are reported for each basin, including:

- The total land area included in the legal description of the basin boundaries.

- That area which was considered to be actively managed and contributing to runoff during the period of record analyzed.

Table III-1

EAA BASIN AREAS

Basin	Legal Area (ac)	Contributing Area (ac)
S-2	106,063	106,043
S-3	63,112	63,367
S-5A	123,369	126,910
S-6	84,454	81,773
S-7	84,452	75,353
S-8	128,758	70,275
TOTAL	590,188	523,721

The combined contributing areas for the four primary hydrologic basins are:

- S-5A: 126,910 acres.
- S-6/S-2: 121,009 acres.
- S-7/S-2: 142,160 acres.
- S-8/S-3: 133,642 acres.

2. HISTORIC DISCHARGE DATA

A summary of the historic average annual discharge volumes and loads from the EAA to various receiving waters is presented in Table III-2.

Table III-2

HISTORIC EAA DISCHARGES, 1979-1988

Discharge Point	Discharge To	Contributed From	Average Annual Discharge Volume (ac-ft)	TP Load (Kg)	TP Conc. (gm/m^3)
S-2/S-351	Lake	EAA (S-6/S-2)	39,547	10,007	0.205
		EAA (S-7/S-2)	53,454	13,725	0.208
		Subtotal	93,001	23,732	0.207
S-3/S-354	Lake	EAA (S-8/S-3)	47,154	9,763	0.168
S-5A	EPA	EAA (S-5A)	256,802	71,228	0.225
		Lake	2,312	570	0.200
		L-8/C-51	55,637	4,380	0.064
		Subtotal	314,750	76,178	0.196
S-6	EPA	EAA (S-6/S-2)	154,847	29,132	0.153
		Lake	2,901	294	0.082
		Subtotal	157,748	29,426	0.151
S-7/S-150	EPA	EAA (S-7/S-2)	220,791	29,730	0.135
		Lake	54,484	4,510	0.067
		Subtotal	275,275	34,240	0.101
S-8	EPA	EAA (S-8/S-3)	250,914	66,036	0.213
		Lake	41,234	4,098	0.081
		C-139 Basin	20,395	5,829	0.232
		Subtotal	312,544	75,963	0.197
S-5A (W)	L-8/C-51	EAA (S-5A)	15,981	3,775	0.192
S-352	Lake	EAA (S-5A)	2,754	356	0.105
All	All	All	1,219,207	253,433	0.169

A summary of historic runoff volumes and associated total phosphorus loads from the primary hydrologic basins of the EAA is presented in Table III-3.

Table III-3

HISTORIC EAA RUNOFF, 1979-1988

	Average Annual Discharge		
Basin	Volume (ac-ft)	TP Load (Kg)	TP Conc. (gm/m^3)
S-5A	275,537	75,359	0.222
S-6/S-2	194,394	39,139	0.163
S-7/S-2	274,245	43,455	0.128
S-8/S-3	298,068	75,799	0.206
TOTAL	1,042,243	233,752	0.182

3. IMPLEMENTATION OF BMPs

Historic runoff data from the EAA is modified to reflect the implementation of Best Management Practices (BMPs) as are required under the Chapter 40E-63 Rule. Those modifications are developed to result in not less than 25 percent reduction in total phosphorus loads in EAA runoff and not more than a 20 percent reduction in runoff volumes. Those reductions apply to the EAA as a whole; variations between basins can be anticipated.

EAA runoff, modified to reflect the implementation of BMPs, on which this conceptual design is based is summarized in Table III-4.

Table III-4

EAA RUNOFF MODIFIED FOR BMPs, 1979-1988

	Average Annual Discharge		
Basin	Volume (ac-ft)	TP Load (Kg)	TP Conc. (gm/m^3)
S-5A	208,358	53,706	0.209
S-6/S-2	166,454	31,386	0.153
S-7/S-2	226,960	33,769	0.121
S-8/S-3	232,022	56,453	0.197
TOTAL	833,694	175,314	0.170

4. MODIFIED DISCHARGE DATA

In addition to the volumetric and total phosphorus load reductions resulting from implementation of BMPs in the EAA, certain other modifications to historic EAA discharges are made.

- Historic water supply releases from the Lake which passed through the S-7 and S-8 pump stations are removed from consideration. Historic regulatory releases from the Lake which passed through those stations remain in the analysis.

- Historic discharges from the C-139 Basin through Pump Station S-8 are removed. Those discharges are separately included and discussed with the C-139 Basin data in Section C of this Part III.

- Historic discharges from the L-8 and C-51 basins through Pump Station S-5A are removed. Those discharges are separately included and discussed with the L-8 and C-51 basin data in Sections D and E, respectively, of this Part III.

- S-5A Basin discharges to L-8 and C-51, modified for BMPs, are considered redirected to WCA-1 through Pump Station S-5A.

Table III-5 summarizes the modified EAA discharge data.

Table III-5

MODIFIED EAA DISCHARGES, 1979-1988

Discharge Point	Discharge To	Contributed From	Average Annual Discharge Volume (ac-ft)	TP Load (Kg)	TP Conc. (gm/m^3)
S-2/S-351	Lake	EAA (S-6/S-2)	33,224	7,927	0.193
		EAA (S-7/S-2)	42,500	10,285	0.196
		Subtotal	75,724	18,212	0.195
S-3/S-354	Lake	EAA (S-8/S-3)	36,342	7,056	0.157
S-5A	EPA	EAA (S-5A)	206,293	53,454	0.210
		Lake	2,311	570	0.200
		Subtotal	208,604	54,024	0.210
S-6	EPA	EAA (S-6/S-2)	133,230	23,459	0.143
		Lake	2,901	294	0.082
		Subtotal	136,131	23,753	0.141
S-7/S-150	EPA	EAA (S-7/S-2)	184,460	23,484	0.103
		Lake	8,243	707	0.070
		Subtotal	192,703	24,191	0.102
S-8	EPA	EAA (S-8/S-3)	195,680	49,397	0.205
		Lake	7,713	683	0.072
		Subtotal	203,393	50,080	0.200
S-352	Lake	EAA (S-5A)	2,065	252	0.099
All	All	All	854,962	170,512	0.162

a. Areal Adjustment Factors for STAs

The modified EAA discharge data shown in Table III-5 will be further adjusted to reflect additional reductions due to the conversion of land to use in stormwater treatment areas (STAs). Those adjustments will vary by basin. Table III-6 lists areal adjustment factors (taken from reference 4) which will be employed; EAA runoff volumes and loads will be reduced by the product of those factors and that part of any given basin in which areas which historically contributed to runoff are converted to use in STAs.

Table III-6

AREAL ADJUSTMENT FACTORS FOR STAs

Basin	Average Annual Discharge Reductions Volume (ac-ft)	TP Load (Kg)
S-5A	1.6418	0.4232
S-6/S-2	1.3756	0.2594
S-7/S-2	1.5965	0.2375
S-8/S-3	1.7361	0.4224

As discussed in Part IV, the stormwater treatment areas will be situated in the lower parts of the basins, adjacent to the EPA. Areal adjustments to EAA runoff to reflect the conversion of lands to use in treatment works will be applied to the EAA runoff discharged to the EPA.

B. 298 DISTRICTS AND 715 FARMS

The Everglades Agricultural Area (EAA) includes a number of special drainage districts and other areas which discharge at least some of their runoff directly to Lake Okeechobee. The following areas are included in the total basin area addressed by this conceptual plan.

- The South Florida Conservancy District, Unit 5 (S-236 Basin).
- The South Shore Drainage District.
- The East Beach Water Control District.
- The East Shore Water Control District.

The above are all special drainage districts organized under Chapter 298 of the Florida Statutes. An additional area, designated as the 715 Farms area, is also addressed. The general location of these basins and their primary hydrographic features are shown on Figures III-7 and III-8.

1. BASIN DESCRIPTIONS

The five basins discussed herein encompass a total of approximately 32,081 acres along the south and east shores of Lake Okeechobee, and are situated primarily in Palm Beach County (the westerly two miles of

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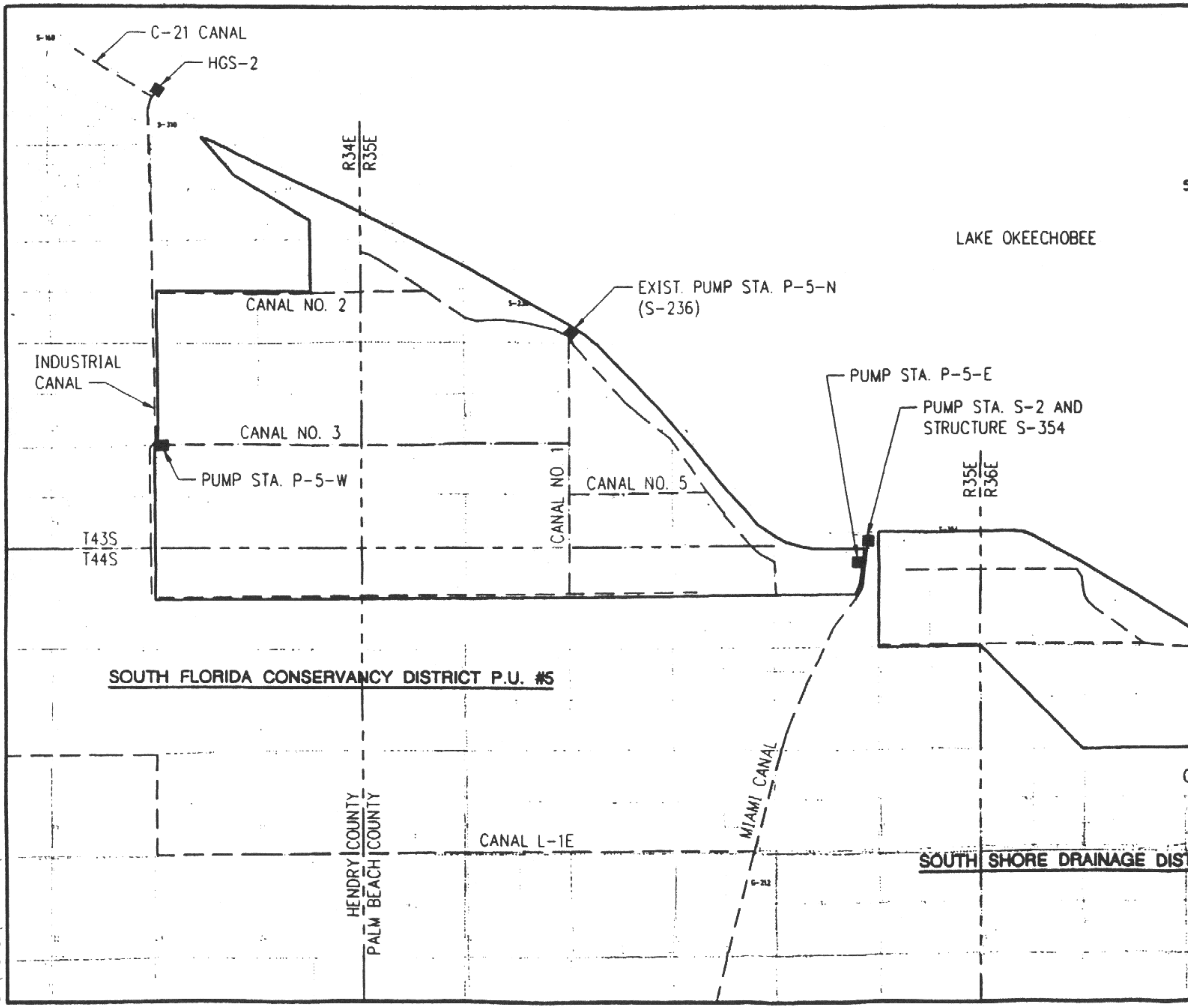

Figure III-7
SOUTH SHORE
298 DISTRICTS

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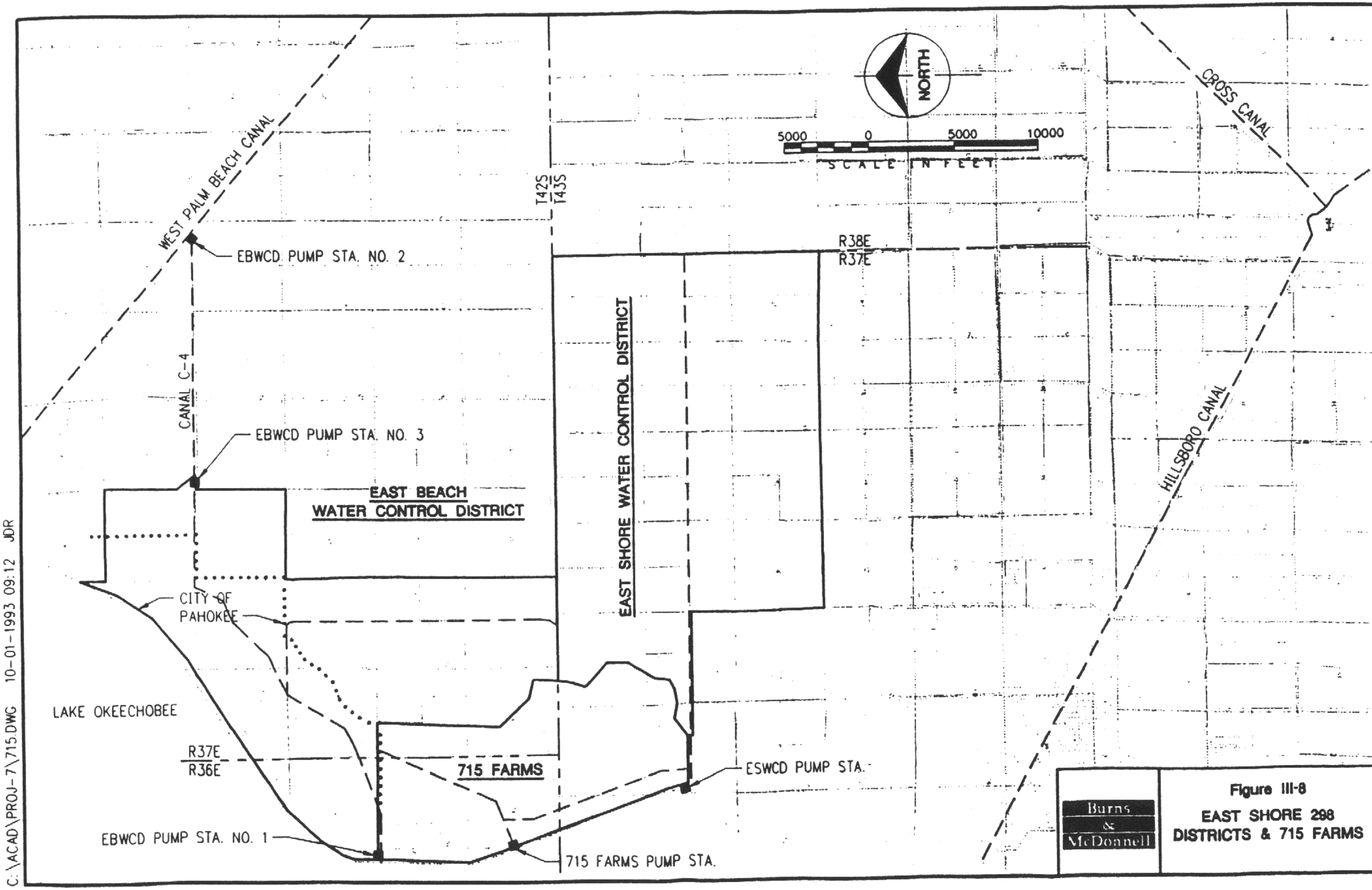


Figure III-8
EAST SHORE 298
DISTRICTS & 715 FARMS

the South Florida Conservancy District are situated in Hendry County). The following is additional descriptive data on each of those basins, taken generally from reference 23 for the 298 Districts.

a. <u>South Florida Conservancy District, Unit No. 5 (SFCD)</u>
The SFCD is situated on the south shore of Lake Okeechobee immediately west of the Miami Canal, and includes a total of approximately 9,775 acres (reference 23). Land use is primarily agricultural (sugar cane and truck crops).

The SFCD is presently served by a total of three pumping stations.

(1) <u>Pump Station P-5-E</u> is located on the west bank of the Miami Canal, and discharges to the Miami Canal. It is equipped with a single angular pump with a diesel drive,and has a nominal capacity of 34,000 gpm (76 cfs). No irrigation supply capability is included at this station.

(2) <u>Pump Station P-5-N</u> is located on the south bank of Lake Okeechobee, and discharges directly to the Lake. It is equipped with three 38,150 gpm (85 cfs) vertical pumps with diesel drives. No irrigation supply capability is included at this station.

This station is presently operated only when the combined capacity of stations P-5-E and P-5-W is inadequate to prevent flooding in the District.

(3) <u>Pump Station P-5-W</u> discharges to the Industrial Canal (in the S-4 Basin) at the west line of the SFCD. It is equipped with two 36,000 gpm (80 cfs) vertical pumps with diesel drives, and two 48,000-gpm (107 cfs) vertical pumps with diesel drives. Irrigation capability is provided from the Industrial Canal by gravity flow through two 36-inch diameter tubes.

While this station does not technically discharge directly to Lake Okeechobee, the majority of its discharges are eventually routed to the Lake through the Industrial Canal (and Canal C-21) via Hurricane Gate No. 2 (and Pump Station S-4).

b. South Shore Drainage District (SSDD)

The SSDD is located on the south shore of Lake Okeechobee, extending generally between the Miami Canal and the North New River Canal, and includes a total of approximately 4,230 acres (reference 23). Basin land use is primarily agricultural, but does include the City of South Bay in the eastern end of the District.

The SSDD is presently served by a total of two pumping stations.

(1) The Bean City Pump Station is located on the south shore of Lake Okeechobee, and discharges directly to the Lake. It is equipped with two 50,000-gpm (111 cfs) two-way pumps with diesel drives.

(2) The South Bay Pump Station is located on the west bank of and discharges to the North New River. It is equipped with two 10,000-gpm (22 cfs) vertical pumps driven by electric motors, and is intended to serve the City of South Bay exclusively.

c. East Beach Water Control District (EBWCD)

The EBWCD is located on the east shore of Lake Okeechobee south and west of the West Palm Beach Canal, and includes a total of approximately 6,542 acres. The Pahokee Water Control District is situated between the EBWCD and the West Palm Beach Canal. The basin is primarily agricultural in character, but does include the City of Pahokee.

The EBWCD is presently served by three pumping stations.

(1) Pump Station 1 is located on the east shore of Lake Okeechobee and discharges directly to the Lake. It is equipped with three pumps each having a nominal capacity of 50,000 gpm (111 cfs).

(2) Pump Station 2 is located on and discharges to the West Palm Beach Canal. Discharges from the EBWCD are conveyed to Pump Station 2 through the C-4 Canal. It is equipped with a total of three pumps. Two pumps each have a nominal capacity of 16,000 gpm (36 cfs); the third pump has a nominal capacity of 22,000 gpm (49 cfs).

(3) Pump Station 3 is located on the C-4 Canal at the easterly boundary of the EBWCD, and discharges to the C-4 Canal. Its discharge is subsequently routed through Pump Station 2 to the West Palm Beach Canal. This station is equipped with two pumps each having a nominal capacity of 22,000 gpm (49 cfs).

d. East Shore Water Control District (ESWCD)

The ESWCD is situated between the West Palm Beach and Hillsboro Canals, and is abutted on the west by the 715 Farms area, which physically separates the ESWCD from Lake Okeechobee. It is abutted on the north by the Pahokee Water Control District, and on the east by the Highland Glades Drainage District. It includes a total of approximately 8,136 acres (reference 23) in agricultural use.

The ESWCD is presently served by a single pumping station on the east shore of Lake Okeechobee that discharges directly to the Lake. Runoff from the ESWCD is carried to the pumping station through a conveyance canal following the south line of the 715 Farms area.

e. 715 Farms

The 715 Farms area (also known as Closter Farms) consists of approximately 3,398 acres of agricultural lands presently owned by the State of Florida and leased to private interests. Sale of these lands to private interests has been previously approved.

This area abuts the east shore of Lake Okeechobee, and is served by a single pumping station that discharges directly to the Lake. The station is equipped with three pumps, having a total nominal capacity of 91,000 gpm (203 cfs).

2. HISTORIC DISCHARGES TO LAKE OKEECHOBEE

Record data on discharges to Lake Okeechobee from the 298 Districts and the 715 Farms area was furnished by the Florida Department of Environmental Protection (DEP), and consists of information provided to DEP by the districts in fulfillment of certain of the conditions of Temporary Operating Permits (TOPs) issued by DEP in 1986. The data generally extends from January 1, 1987 through May 31, 1993. This analysis includes the six full calendar years of 1987-1992, inclusive, and excludes the five months of data during 1993. The various pumping stations were recalibrated just prior to 1987; discharge records prior to that date were based on noncalibrated pump ratings, and are therefore suspect.

The data furnished includes only direct discharges to the Lake, and as a result excludes discharges from:

- SFCD pumping station P-5-E and P-5-W.
- SSDD South Bay pump station.
- ESWCD Pump Stations No. 2 and 3.

With the exception of the SFCD pumping station P-5-W, the excluded discharges are not directed to the Lake, but are instead delivered to the primary canal system on the EAA. The exclusion of the SFCD station P-5-W is significant, as the majority of its discharges are ultimately delivered to the Lake, and given the current operational bias in the SFCD to minimize use of pumping station P-5-N.

a. Volumetric Discharges

Data furnished by DEP includes daily discharge volumes to Lake Okeechobee and daily rainfall depths. A summary of that data (excluding SFCD Pump Station P-5-N) is presented in Table III-7.

Table III-7

HISTORIC 298 DISTRICT DISCHARGES

Calendar Year	EBWCD Volume (ac-ft)	EBWCD Rain (in)	ESWCD Volume (ac-ft)	ESWCD Rain (in)	SSDD Volume (ac-ft)	SSDD Rain (in)	715 Farms Volume (ac-ft)	715 Farms Rain (in)
1987	5,807	45.86	7,496	43.82	8,007	55.89	11,227	43.35
1988	7,652	41.12	12,948	42.61	6,672	52.19	8,283	46.30
1989	2,800	34.06	5,160	43.14	3,176	41.26	3,758	33.84
1990	957	37.78	2,105	48.02	1,984	42.21	4,052	37.80
1991	5,363	54.32	8,289	52.16	6,539	57.44	6,272	52.25
1992	9,719	65.88	15,334	62.18	4,814	54.04	13,330	64.05
Total	32,298	279.02	51,332	291.93	31,192	303.03	46,921	277.59
Avg.	5,383	46.50	8,555	48.66	5,199	50.50	7,820	46.26

Although the period of record includes significant droughts during 1989 and 1990, the reported average annual rainfall depths on the above areas varies from 95.3 to 104.1 percent of the average annual rainfall depth during water years 1979-1988 (48.53 inches) used in analysis of the Everglades Agricultural Area.

A summary of the data furnished for the SFCD Pump Station P-5-N is presented in Table III-8. This data represents but a fraction of the total discharge from the SFCD to the Lake, the majority of which is discharged to the Industrial Canal via Pump Station P-5-W.

Table III-8

HISTORIC SFCD UNIT P-5-N DISCHARGES

Calendar Year	Discharge Volume (ac-ft)	Rainfall Depth (in)
1987	6,567	40.16
1988	4,356	43.39
1989	1,378	36.04
1990	899	42.26
1991	3,884	56.53
1992	3,407	44.10
Total	20,491	262.48
Avg.	3,415	43.75

In the absence of data on discharges from pumping station P-5-W, the total average annual discharge from the SFCD is estimated to be 19,450 acre-feet, computed assuming an average annual discharge depth of 23.88 inches (equal to the average for the EAA for the period 1979-1988) from the 9,775-acre basin. Of the total, approximately 90 percent is assumed to be delivered to the Lake (of the total installed pumping capacity serving the basin, roughly 10 percent is situated in P-5-E and discharges to the Miami Canal), yielding an estimated average annual discharge of 17,500 acre-feet.

The following is a summary of the average annual historic discharge volumes from these districts to Lake Okeechobee considered in this conceptual design, and a comparison to similar data reported in reference 23 for the period 1979-1986 (1980-1986 for the SSDD).

- SFCD; 17,500 acre-feet per year (80.1 percent of the 1979-1986 average reported in reference 23).

- SSDD; 5,199 acre-feet per year (59.5 percent of the 1980-1986 average reported in reference 23).

- EBWCD; 5,383 acre-feet per year (67.9 percent of the 1979-1986 average reported in reference 23).

- ESWCD; 8,555 acre-feet per year (80.3 percent of the 1979-1986 average reported in reference 23).

- 715 Farms; 7,820 acre-feet per year (no data in reference 23).

The two data sets are separated by the recalibration of pump ratings, which is believed to account for the majority of the differences.

b. Total Phosphorus Discharges

Data furnished by the DEP includes reported total phosphorus concentrations measured from composite samples obtained over the period including calendar years 1987-1992. The total number of samples reported over that period are:

- 26 at SFCD's Pump Station P-5-N (05/20/87-01/09/93).
- 52 at SSDD's Bean City Pump Station (05/20/87-01/25/93).
- 40 at EBWCD's Pump Station 1 (05/20/87-01/09/93).
- 39 at ESWCD's Pump Station (05/20/87-05/29/93).
- 61 at the 715 Farms pump station (05/01/87-11/11/90).

The reported concentration in each sample was applied to all daily discharges subsequent to the previous sample, and the resultant total phosphorus load carried in the discharge was calculated. A summary of the calculated total phosphorus loads and flow-weighted average total phosphorus concentrations in discharges to Lake Okeechobee is presented in Table III-9.

Table III-9

HISTORIC 298 DISTRICT TP LOAD DISCHARGES

Calendar Year	EBWCD		ESWCD		SSDD		715 Farms		SFCD	
	Load	Conc	Load	Conc	Load	Conc	Load	Conc	Load	Conc
1987	2.65	0.370	1.83	0.198	0.56	0.057	4.16	0.301	0.68	0.083
1988	3.53	0.380	3.90	0.244	1.10	0.133	4.59	0.449	1.32	0.246
1989	1.93	0.560	1.30	0.205	0.55	0.140	1.66	0.357	0.25	0.148
1990	0.60	0.507	0.53	0.203	0.41	0.168	0.96	0.191	0.14	0.128
1991	2.54	0.385	1.75	0.171	0.96	0.119	1.08	0.140	0.77	0.161
1992	4.46	0.372	2.99	0.158	0.52	0.088	2.04	0.124	0.49	0.118
Total	15.74	-----	12.30	-----	4.10	-----	14.48	-----	3.66	-----
Avg.	2.62	0.395	2.05	0.194	0.68	0.107	2.41	0.250	0.61	0.145

(All loads in metric tons, all concentrations in gm/m^3).

With the exception of the SFCD, the above average annual total phosphorus loads and flow-weighted mean TP concentrations are taken as historic data. At the SFCD, the above flow-weighted average concentration of 0.145 gm/m^3 (taken from an average annual volume of 3,415 acre-feet) is applied to the estimated average annual discharge volume to the Lake of 17,500 acre-feet, yielding an average annual TP load of 3.13 metric tons.

3. MODIFICATIONS TO HISTORIC DATA

The various 298 Districts (and the 715 Farms area) considered in this discussion are not included in that part of the Everglades Agricultural Area regulated under the Chapter 40E-63 Rule. However, it is assumed for this conceptual design that Best Management Practices (BMPs) will be implemented throughout these districts in a fashion generally consistent with that required under the Chapter 40E-63 Rule, resulting in a not less than a 25 percent reduction in average annual total phosphorus loads and not more than a 20 percent reduction in average annual discharge volumes.

The resultant (modified) average annual discharges from these special districts are summarized in Table III-10.

Table III-10

MODIFIED 298 DISTRICT DISCHARGES

District	Average Annual Discharge Volume (ac-ft)	TP Load (met. tons)	TP Conc. (gm/m^3)
SFCD	14,000	2.35	0.136
SSDD	4,159	0.51	0.100
Subtotal, South	18,159	2.86	0.128
EBWCD	5,383	2.62	0.395
ESWCD	6,844	1.54	0.182
715 Farms	6,256	1.81	0.235
Subtotal, East	18,483	5.97	0.262
Total	36,642	8.83	0.195

The EBWCD represents a special case, in that much of the area served by the EBWCD Pump Station No. 1 is within the City of Pahokee. The implementation of BMPs in the EBWCD, while of value in reducing TP loads discharge to the EAA at Pump Station 2, are not expected to markedly affect EBWCD discharges to the Lake.

C. C-139 BASIN

The C-139 Basin is the most northerly of the four primary hydrologic basins forming the Western Basins; other basins include the Feeder Canal Basin, the L-28 Basin, and the L-28 Tieback Basin. These basins are all tributary to the Everglades Protection Area.

The conceptual plan for the Everglades Protection Project directly addresses only the C-139 Basin; it will eventually be necessary to address the quality of water discharged from the three other primary hydrologic basins in the Western Basins. The District has initiated planning efforts outside the scope of the mediated technical plan toward that end.

1. BASIN DESCRIPTION

The following descriptive information for the C-139 Basin is taken, and in some cases directly excerpted, from reference 22. The location and a simplified map of the C-139 Basin, taken largely from reference 22, are shown on Figure III-9.

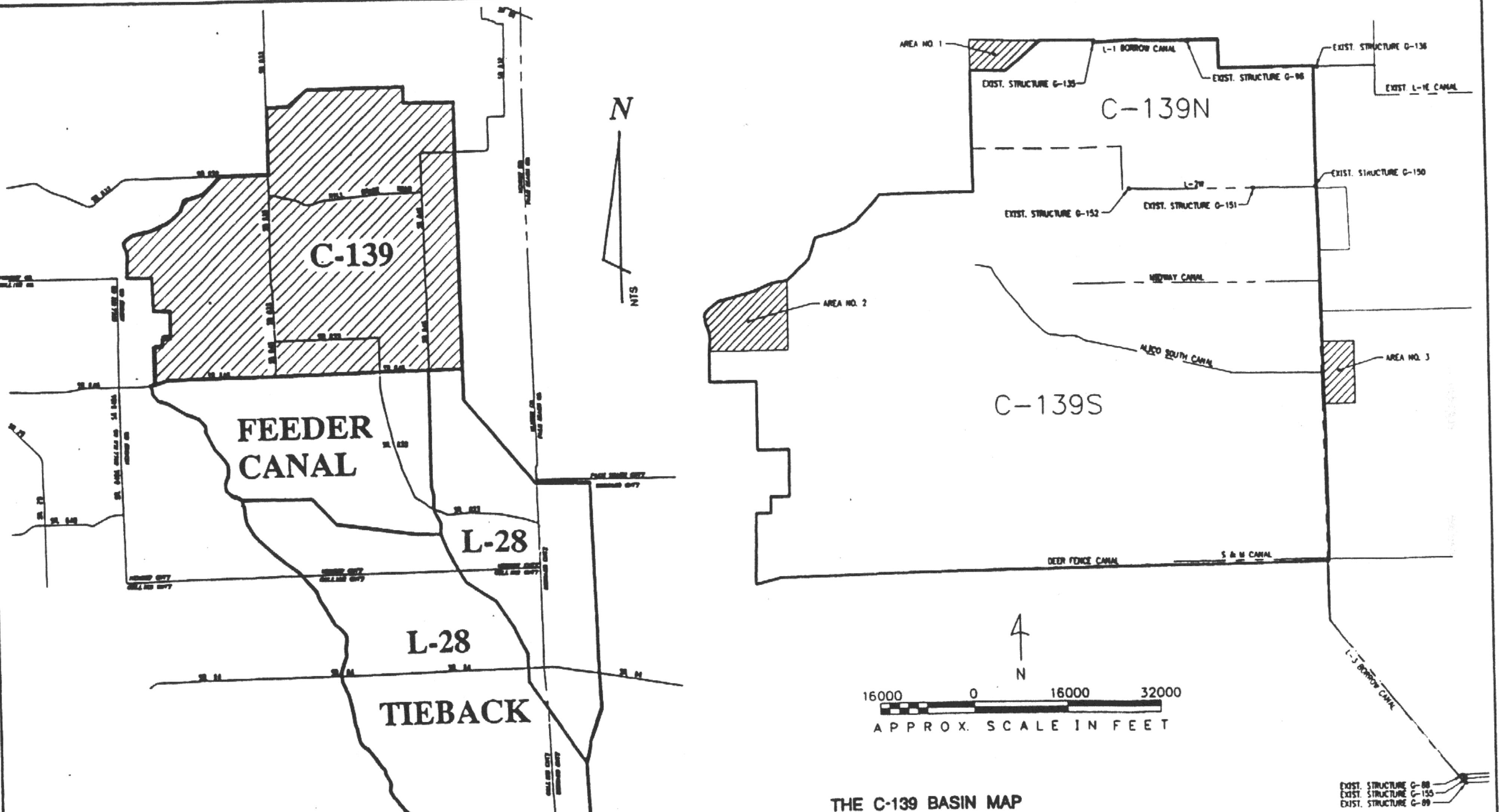
a. Tributary Area

The total area of the C-139 Basin, based on historical boundaries established by the District, is approximately 169,500 acres. Analyses conducted by Mock, Roos & Associates in preparation of reference 22 indicate that actual drainage basin boundaries do not match, exactly, the legally described SFWMD basin boundaries. The following is a description of the most significant variations between the actual and legally described boundaries of the C-139 Basin.

- Area No. 1 consists of approximately 1,130 acres of land and discharges runoff east through Hagman Canal to Flaghole Road Ditch and the headwaters of the L-1 Canal. Discharge from the Hagman Canal was included in the analysis as part of the C-139 Basin because the canal outfalls to Flaghole Road Ditch at a point that is upstream of SFWMD's G-135 Structure. The boundaries of Area No. 1 were determined by review of Surface Water Management Permit No. 26-00318-S.

- Area No. 2 which consists of approximately 2,900 acres of land owned by Alico, Inc. was considered not to be contributing flow to the C-139 Basin by virtue of a drainage study performed by Alico's engineer, Johnson-Prewitt & Associates, Inc. The study included an inventory of drainage facilities and a drainage pattern assessment which demonstrated that this area drains west with an ultimate outfall to the C-43 Canal.

- Area No. 3 consists of approximately 1,240 acres of land that is covered under Surface Water Management Permit No. 26-00004-S/W which indicates that this area drained via a pump station to the L-2 Canal. SFWMD records indicate that the permit was canceled. However, SFWMD Field Representative, Robert Pierce,



THE C-139 BASIN MAP

SFWMD Western Basins

C-139 LOCATION BASIN MAP

Burns & McDonnell

FIGURE III-9
C-139 BASIN

has indicated that the permit was reinstated. Field observations have confirmed that a drainage connection is maintained to the L-2 Canal via a pump station. The connection has existed for many years which warranted adding the area into the analysis for the C-139 Basin.

The adjusted tributary area of the C-139 Basin, as reported in reference 22, is 168,437 acres.

b. Drainage System

The primary canals within the C-139 Basin consist of the L-1, L-2, and L-3 Borrow Canals. These canals were constructed in the 1950's primarily for fill material to construct levees L-1, L-2, and L-3. The canals were later improved for increased drainage capacity, however, flooding still occurred in the northern portions of the Basin. Alternatives were explored in the late 1970s and early 1980s to solve some of the flooding problems. The final plan agreed to by SFWMD, Hendry County and affected landowners and referred to as the "Modified Hendry County Plan" proposed the construction of two additional canals and four water control structures.

The two major improvements as a result of the plan included the L-1E Canal and the G-150 Structure. The G-150 Structure is operated fully open during normal climate conditions to allow base flow between the L-1 and L-2 Canals. However, during major rain events the structure is closed to prevent the backwater effects of the L-2 Canal from entering the L-1 Canal. Runoff from the L-1 Canal during major storm events is directed to the L-1E Canal via the G-136 Structure which consists of risers with flashboards that are removed during such events.

There is an additional outfall for the northern areas of the C-139 Basin located at the headwaters of the L-1 Canal. Structure G-135 consists of a flashboard riser that is capable of allowing flow to discharge north into Flaghole Road Ditch which eventually outfalls into the C-43 Canal. This structure was originally intended as an emergency outfall for Montura Ranch prior to the implementation of the "Modified Hendry County Plan" improvements. However, SFWMD staff has indicated that the structure is still operated by permission from Flaghole Drainage District which is generally given when the tailwater elevation is at or below 19.0 feet NGVD. For purposes of the Mock, Roos study it was assumed that the structure would be closed during the storm event then opened after the period of rainfall distribution.

There are several secondary canals located within the C-139 Basin that convey flow from west to east into the L-2 and L-3 Canals at locations south of Structure G-150. The L-2W Canal was constructed as part of the "Modified Hendry County Plan" to serve a portion of Montura Ranch's drainage as well as drainage from properties owned by Alico, Inc. Construction of the canal also included construction of Structure G-151 (a.k.a. Alico North Outfall Structure), which is located at the headwaters of the canal, and construction of Structure G-151 located at the crossing of State Road 846. Both structures include flashboards that are removed during major storm events. The L-2W Canal has an open channel connection to the L-2 Canal with no structure or other restriction controlling its outflow.

Midway Canal predominately serves lands owned by Alico, Inc. and is located midway through their property, hence its name. The canal which was recently constructed replaced a smaller canal at this location. Flow from the canal discharges to the L-2 Canal via a sheetpile weir.

Alico South Canal also primarily serves lands owned by Alico, Inc. The canal divides into two canals east of the crossing at State Road 846. The northern branch of the canal which for purposes of this study is referred to as New Alico South Canal (a.k.a. Blue

Heron Grove Canal) was recently constructed and includes a culvert connection to the L-2 Canal. Old Alico South Canal travels south then east before outfalling to the L-2 Canal via a sheetpile weir. The L-2 Canal right-of-way ends south of the secondary canal connection an the L-3 Canal right-of-way begins.

S&M Canal (a.k.a. Gulf Western Canal) serves areas that have been permitted for citrus production and its located adjacent and parallel to Deer Fence Canal which also serves many areas that have been permitted for citrus, many of which are either under construction or have been recently constructed. S&M Canal outfalls into the L-3 Canal via a sheetpile weir. Deer Fence Canal has an open channel connection to the L-3 Canal, however flow is controlled by flashboard risers further upstream east of State Road 846.

There are a total of five outfall locations for the C-139 Basin. Two of these outfalls were previously described and serve areas north of Structure G-150. The remaining three outfalls are located adjacent to each other at the southeastern limits of L-3 Canal. Structure G-88 consists of flashboard risers that discharge flow from the L-3 Canal to the L-4 Canal which is eventually pumped to Conservation Area No. 3A via S-8 Pump Station. Structure G-155 consists of a large flashboard spillway that distributes most of L-3 Canal's flow to Conservation Area No. 3A via an extension of the L-3 Canal. Structure G-89 consists of flashboard risers that discharge flow from the L-3 Canal to the L-28 Canal. G-88 and G-155 Structures are operated by removing the flashboards during major storm events. G-89 flashboards are removed with permission of the Miccusukee Indian Reservation.

c. <u>Land Use</u>

A summary of the permitted and actual (1987-1988) land use in the C-139 Basin, using data taken from reference 22, is presented in Table III-11. The analysis divided C-139 into two basins, C-139N

(North) and C-139S (South). The basin was divided because the water from C-139N discharges (during significant storm events) through the G-136 Structure into the L-1E Canal and C-139S drains south through the L-2 and L-3 Canals. The divide between these two basins cannot be clearly defined through the residential development known as Montura Ranch. This is attributed to the fact that Montura Ranch pumps its runoff to a single reservoir which discharges to both the L-1 and L-2W Canals. The areas mapped for the current land use map did not differentiate between reservoirs, preserved areas and roads within the designated land use areas.

Table III-11

C-139 BASIN LAND USES

	Area in Acres					
	Basin C-139N		Basin C-139S		Total	
Land Use	Permitted	Actual*	Permitted	Actual*	Permitted	Actual*
Unimproved Pasture	2,947	2,980	8,464	8,537	11,411	11,517
Residential	8,021	8,021	1,284	1,283	9,305	9,304
Improved Pasture	10,953	12,129	24,936	56,393	35,889	68,522
Truck Crops	0	0	19,239	6,967	19,239	6,967
Citrus	4,059	2,704	44,184	11,938	48,243	14,642
Sugar Cane	865	865	0	0	865	865
Ornamental	0	0	1,068	1,068	1,068	1,068
Native	3,056	3,202	39,361	52,348	42,417	55,550
TOTAL	29,901	29,901	138,536	138,534	168,437	168,435

* For the period 1987-1988.

2. HISTORICAL DISCHARGES

Reference 7 reports the average annual runoff volume and total phosphorus load discharged through the L-3 Canal to WCA-3A to have been 74,000 acre-feet and 22.9 metric tons, respectively, based on an average flow weighted total phosphorous concentration of 0.251 gm/m^3, during the period including water years 1979-1988. Those discharges originate from the C-139 Basin.

The above average annual discharges exclude discharges from the C-139 Basin through Structures G-136 and G-88. References 2 and 3 report the average annual volume and total phosphorus load discharged through Structure G-136 during water years 1979-1988 to have been 10,605 acre-feet and 693 kilograms, respectively (flow-weighted average concentration of 0.053 gm/m^3). Those same references report the average annual volume and total phosphorus load discharged through Structure G-88 during that same period to have been 13,015 acre-feet and 5,136 kilograms, respectively (flow-weighted average concentration of 0.320 gm/m^3). The aggregate average annual volume and total phosphorus load discharged through structures G-88 and G-136 is 23,620 acre-feet and 5,829 kilograms; the resultant flow-weighted average concentration of total phosphorus is 0.200 gm/m^3.

Given the above, the total average annual volume and total phosphorus load discharged from the C-139 Basin during the period water years 1979-1988 is estimated to be 98,000 acre-feet and 28.7 metric tons, respectively. The resultant flow-weighted average concentration of total phosphorus is 0.237 gm/m^3, higher than for any other source of inflow to the Water Conservation Areas as reported in reference 7. For comparison, reference 7 reports average annual volumes and total phosphorus loads discharged from S-140 and at station L-28I (in essence, the balance of the Western Basins) to have been 175,870 acre-feet and 26 metric tons, respectively (flow-weighted average total phosphorus concentration of 0.122 gm/m^3).

3. MODIFICATION TO HISTORIC DATA

There is at present no planned program for the implementation of Best Management Practices (BMPs) in the C-139 Basin. As a result, no regulatory modification to historic runoff volumes and phosphorus loads is assumed.

D. L-8 BASIN

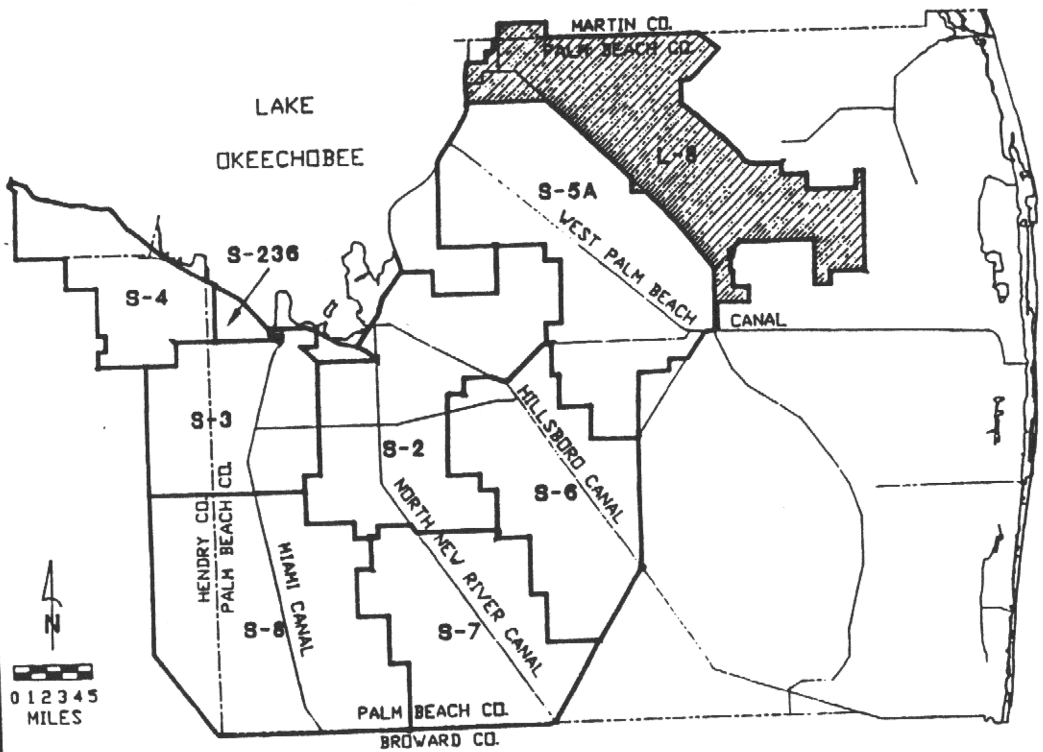
The L-8 Basin encompasses 171.2 square miles in northwestern Palm Beach County (168.1 square miles) and southwestern Martin County (2.1 square miles). A more complete description of the basin and its primary hydrographic features can be found in reference 14. Figure III-10 shows the location and a simplified map of the L-8 Basin, both taken from reference 14.

A significant hydrologic feature not shown in Figure III-10 is the M-O Canal, which serves as the outlet for the Indian Trail Water Control District. That canal discharges to the L-8 Borrow Canal at a point approximately 6.7 miles upstream (northwesterly) of the confluence of the L-8 Borrow Canal with the City of West Palm Beach's M-Canal.

Of the total basin area of 171.2 square miles, approximately 87.4 square miles are tributary to the L-8 Borrow Canal upstream (north) of the M-O Canal (reference 12). That area includes 46.8 square miles in the J.W. Corbett Wildlife Management Area, and 29.3 square miles in the adjacent Dupuis Reserve. Both those areas are publicly owned and managed for wildlife and environmental restoration values. The balance of the 87.4 square miles (11.3 square miles) consist of agricultural lands primarily in sugar cane; roughly 95 percent of those lands are tributary to the L-8 Borrow Canal between Culvert #10A and Structure S-76.

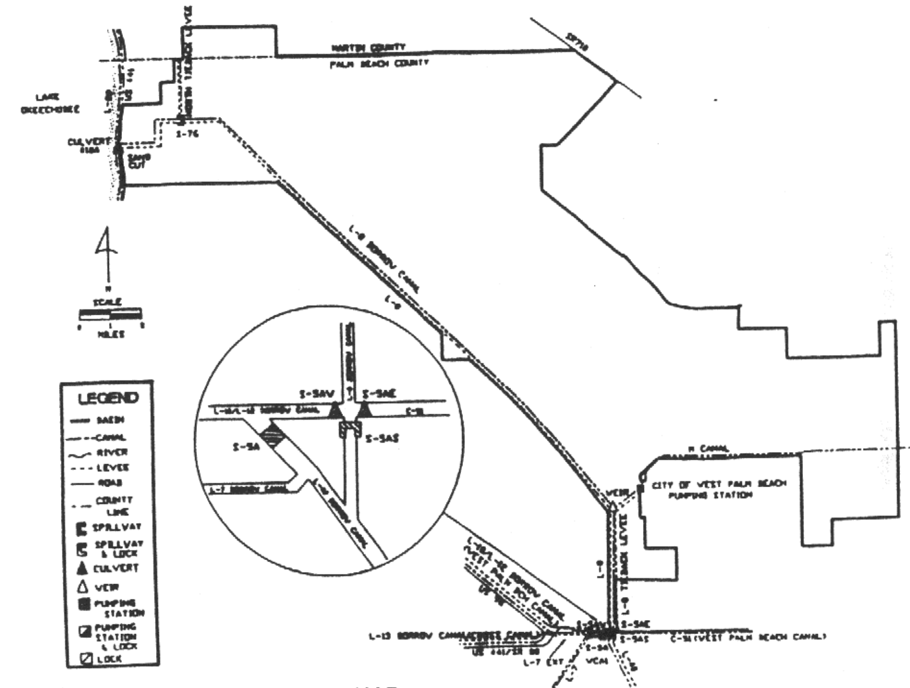
The Indian Trail Water Control District (ITWCD) encompasses a defined service area of 28.9 square miles. An additional 1.0 square miles (Section 16, T.436 S., R.41 E.) is tributary to the ITWCD system, although not included in its defined service area. Land use in the ITWCD is primarily suburban residential. An additional 12.0 square miles of agricultural and rural residential lands are actively managed and directly tributary to the L-8 Borrow Canal downstream of its confluence with the M-O Canal.

The balance of the L-8 Basin (41.9 square miles) is considered to be ineffectively drained and not significantly contributing to L-8 Basin runoff.



L-8 BASIN LOCATION MAP

L-8 BASIN



THE L-8 BASIN MAP

FIGURE III-10
L-8 BASIN

Burns & McDonnell

1. <u>HISTORIC WATER BALANCE</u>

Over a nine-year period of record including water years 1980-1988 (gage data at Culvert #10A prior to water year 1980 is not available), the average annual runoff from the L-8 Basin was calculated to be 187,039 acre-feet (reference 12).

Runoff from the L-8 Basin can be delivered to a variety of receiving water bodies, including:

- Lake Okeechobee (via Culvert #10A).

- The S-5A Basin (via Structure S-5AW and the L-10/L-12 Borrow Canal).

- Water Conservation Area No. 1 (WCA-1) via S-5AS, or S-5AW and Pump Station S-5A.

- The C-51 Canal (Via S-5AE).

- The City of West Palm Beach's M-Canal system, through which L-8 Basin runoff and basin inflows from other sources is supplied as a source of supplemental water to the City's Water Catchment Area.

An analysis of historic runoff from the L-8 Basin over the period water years 1980-1988 is presented in reference 12, and is summarized in Table III-12.

Table III-12

HISTORIC L-8 BASIN RUNOFF

Water Year	L-8 Basin Runoff and Receiving Water Body (ac-ft)					
	Lake Okeechobee	M Canal	C-51 via S-5AE	WCA-1	S-5A Basin	Total *
1980	1,319	20,416	20,055	47,191	2,007	90,988
1981	25,545	37,325	4,762	11,181	3,086	81,900
1982	62,029	42,714	24,547	47,429	14,477	191,197
1983	4,951	16,776	107,066	95,498	38,263	262,552
1984	9,199	36,692	63,739	82,524	25,987	218,140
1985	2,455	66,900	21,971	72,861	46,042	210,230
1986	20,602	94,659	48,417	132,071	18,783	314,533
1987	11,982	67,073	11,000	9,394	13,898	113,345
1988	61,190	56,842	25,857	46,931	9,644	200,461
Avg.	22,141	48,821	36,379	60,565	19,132	187,039

*May not add up exactly due to rounding.

Water users in the L-8 Basin can receive water not only from L-8 Basin runoff, but also from sources external to the L-8 Basin, including:

- Lake Okeechobee (via Culvert #10A).

- WCA-1, the S-5A Basin, and the C-51 West Basin via the S-5A complex.

Table III-13 summarizes both gross and net supplemental inflows to the L-8 Basin from Lake Okeechobee and the S-5A complex, developed from data presented in reference 12.

Table III-13

HISTORIC L-8 BASIN SUPPLEMENTAL INFLOWS

Water Year	Supplemental Inflow By Source (ac-ft): Lake Okeechobee Gross	Lake Okeechobee Net	S-5A Complex Gross	S-5A Complex Net	Total Gross	Total Net
1980	19,716	18,397	19,541	(49,712)	39,357	(31,315)
1981	26,007	462	43,171	24,142	69,178	24,604
1982	(19,593)	(81,622)	62,187	(24,266)	42,594	(105,888)
1983	35,272	30,321	(25,904)	(266,731)	9,368	(236,410)
1984	16,950	7,751	(8,792)	(163,458)	8,158	(155,707)
1985	36,426	33,971	(6,569)	(147,443)	29,857	(113,472)
1986	6,180	(14,422)	(1,599)	(200,870)	4,581	(215,292)
1987	79,688	67,706	(1,512)	(35,804)	78,176	31,902
1988	59,566	(1,624)	(28,269)	(110,701)	31,297	(112,325)
Avg.	28,912	6,771	5,806	(108,316)	34,718	(101,545)

In the above tabulation, gross supplemental inflows represent a summation of all inflows to the L-8 Basin from the indicated source; the net inflow is the difference between inflows to the basin and discharges from the basin at the same point.

Insufficient gage data is available to distribute the total L-8 Basin runoff by source. Preliminary estimates developed in reference 12 result in the following approximate average annual distribution of the 187,039 acre-feet per year average annual runoff:

- 101,004 acre-feet per year from the J.W. Corbett Wildlife Management Area and Dupuis Reserve.
- 15,895 acre-feet per year from agricultural lands tributary to the L-8 Borrow Canal north of the M-O Canal.
- 53,240 acre-feet per year from the Indian Trail Water Control District.
- 16,900 acre-feet per year from agricultural and rural residential lands tributary to the L-8 Borrow Canal south of the M-O Canal.

2. HISTORIC PHOSPHORUS LOADS IN L-8 BASIN RUNOFF

Available data relative to the quality of water discharged from the L-8 Basin is limited in nature. Preliminary estimates of average total phosphorus concentrations are taken from reference 12, and summarized, together with average annual phosphorus loads, in Table III-14.

Table III-14

ESTIMATED L-8 BASIN PHOSPHORUS DISCHARGES

Source	Avg. Ann. Volume (ac-ft)	Avg. TP Conc. (gm/m^3)	Avg. Ann. TP Load (Kg)
Corbett and Dupuis	101,004	0.035	4,360
Ag. Lands			
- North of M-O Canal	15,895	0.226	4,431
- South of M-O Canal	16,900	0.226	4,711
ITWCD	53,250	0.185*	12,149
Total	187,039	0.111	25,651

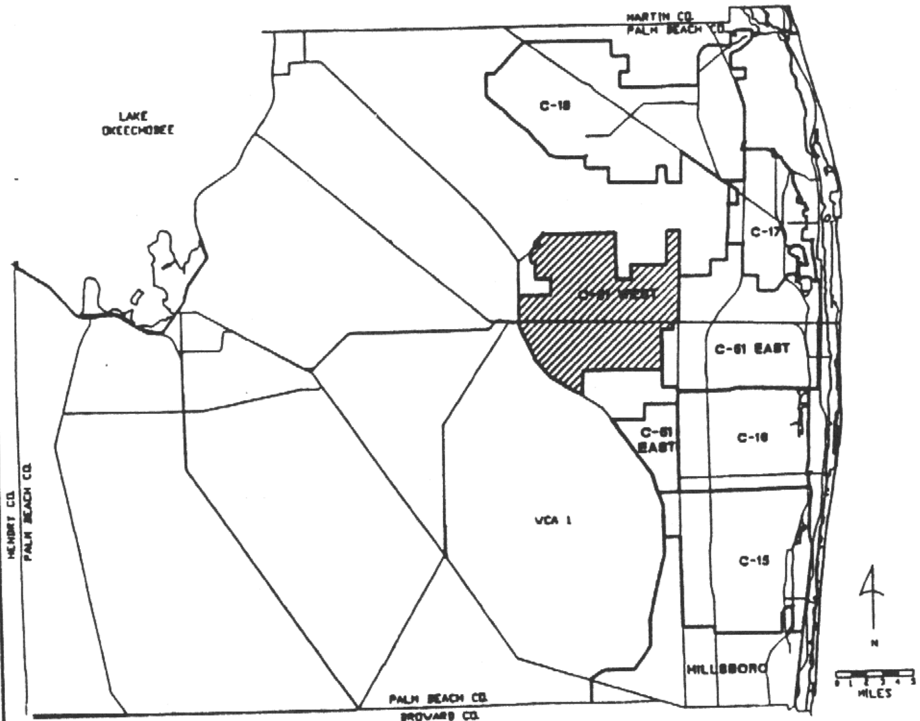
*Modified from reference 12 to parallel average concentrations in C-51 West Basin runoff (see Section E of this Part III).

3. MODIFICATIONS TO HISTORIC DATA

The L-8 Basin, while technically included in the overall definition of the Everglades Agricultural Area, is excluded from those lands regulated by the Chapter 40E-63 Rule. No modifications to historic runoff volumes and phosphorus loads from the L-8 Basin due to implementation of Best Management Practices is assumed in this analysis.

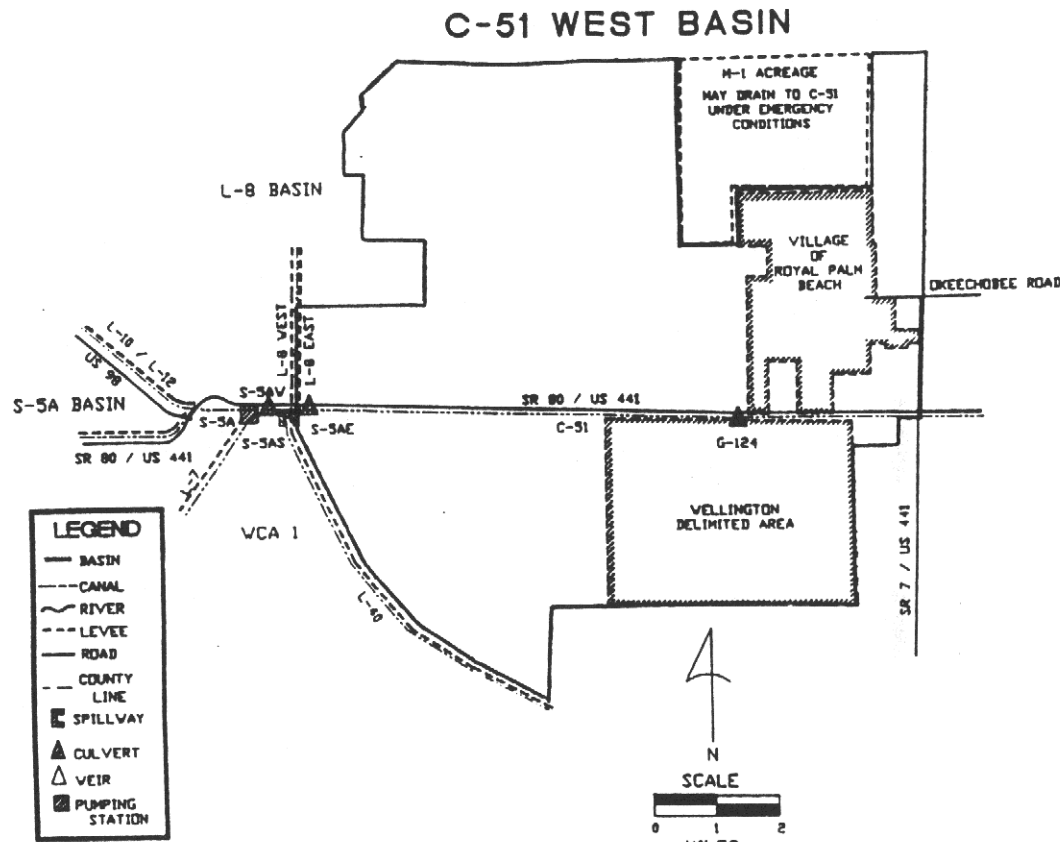
E. C-51 WEST BASIN

As described in reference 15, the overall C-51 Basin has an area of approximately 164.3 square miles and is located in eastern Palm Beach County. The basin is comprised of two subbasins, C-51 West (79.5 miles as reported in reference 15) and C-51 East. State Road 7 is generally the boundary between the basins. A more complete description of the C-51 Basin and its primary hydrographic features can be found in reference 15. This analysis is focused on the C-51 West subbasin. Figure III-11 shows



C-51 WEST BASIN LOCATION MAP

C-51 WEST BASIN



THE C-51 WEST BASIN

Burns & McDonnell

FIGURE III-11
C-51 WEST BASIN

the location and a simplified map of the C-51 West Basin, both taken from reference 15. The total area of the C-51 West Basin is reported in reference 24 to be 73 square miles; that value is used in this analysis and discussion.

1. HISTORIC WATER BALANCE

Gage data for runoff from the C-51 West Basin exists only at Structure S-5AE, and represents but a small fraction of the total runoff from the basin. The Jacksonville District, Corps of Engineers, in connection with its studies of the C-51 Basin, developed a watershed simulation model calibrated to available gage data in the C-51 Basin as a whole. That simulation model is structured to permit separate identification of runoff from the C-51 West subbasin. That simulation model was developed and applied to the period encompassing water years 1961-1985. The calculated runoff from the C-51 West Basin resulting from application of that model is presented in detail in reference 12, and is summarized in Table III-15.

Table III-15

HISTORIC C-51 WEST BASIN WATER BALANCE

Water Year	C-51 West Basin Runoff (ac-ft)	Discharge at S-5AE Inflow (ac-ft)	Outflow (ac-ft)	Net (ac-ft)	Discharge at S.R. 7* (ac-ft)
1961	79,482	414,726	0	414,726	494,208
1962	122,694	22,643	79	22,564	145,258
1963	77,554	192,417	0	192,417	269,971
1964	101,455	150,319	240	150,079	251,534
1965	110,450	197,780	62	197,718	308,168
1966	187,636	252,845	3,701	249,144	436,781
1967	106,149	230,507	0	230,507	336,656
1968	143,631	85,416	2,104	83,312	226,943
1969	127,511	134,124	5,641	128,483	255,994
1970	152,265	229,436	14	229,422	381,687
1971	77,054	56,233	0	56,233	133,287
1972	141,388	7,855	5,175	2,680	144,068
1973	106,413	9,900	0	9,900	116,313
1974	104,241	32,307	14,192	18,115	122,356
1975	120,065	36,462	135	36,327	156,393
1976	112,155	45,501	750	44,751	156,906
1977	120,916	10,625	4,548	6,077	126,994
1978	117,699	24,361	0	24,361	142,060
1979	118,719	78,343	1,142	77,201	195,919

Table III-15 (continued)

HISTORIC C-51 WEST BASIN WATER BALANCE

Water Year	C-51 West Basin Runoff (ac-ft)	Discharge at S-5AE Inflow (ac-ft)	Outflow (ac-ft)	Net (ac-ft)	Discharge at S.R. 7* (ac-ft)
1980	110,519	56,624	0	56,624	167,143
1981	101,564	26,932	458	26,474	128,038
1982	134,364	68,533	34,011	34,522	168,887
1983	147,755	222,432	5,581	216,851	364,606
1984	146,049	197,302	8,612	188,690	334,739
1985	107,306	28,612	20,156	8,456	115,762
Avg.	119,002	112,489	4,264	108,225	227,226

*Includes both discharges to the east of S.R. 7 and any withdrawals from the C-51 West canal for water supply.

Inspection of the above data, with particular emphasis on inflows to the C-51 West Basin at S-5AE, suggests that water management strategies may have resulted in three separate hydrologic regimes for the basin, as follows:

- 1961-1970: Probably indicative of initial water management strategies following completion of large portions of the Central and South Florida Flood Control Project.

- 1971-1978: Period following construction and full-scale operation of the City of West Palm Beach's M-Canal system as it presently exists.

- 1979-1985: Period following implementation of the Interim Action Plan for Lake Okeechobee.

Table III-16 summarizes average annual data for the C-51 West Basin if separated into those three periods.

Table III-16

CHANGES IN HISTORIC C-51 WEST BASIN WATER BALANCE

Period (Water Years)	C-51 West Basin Runoff (ac-ft/yr)	Discharge at S-5AE Inflow (ac-ft)/yr	Outflow (ac-ft)/yr	Net (ac-ft)/yr	Discharge at S.R. 7* (ac-ft)/yr
1961-1970	120,883	191,021	1,184	189,837	310,720
1971-1978	112,491	27,906	3,100	24,806	137,297
1979-1985	123,754	96,968	9,994	86,974	210,788

Average annual runoff from the C-51 West Basin has been relatively stable throughout the full 25-year period. Accordingly, the 25-year average annual runoff of 119,002 ac-ft/year is used in this analysis.

2. HISTORICAL PHOSPHORUS LOADS IN C-51 WEST BASIN RUNOFF

Available data relative to the quality of water discharged from the C-51 West Basin is limited in nature. One estimate of average total phosphorus concentrations, resulting in a flow-weighted concentration of 0.276 gm/m^3, is presented in reference 12.

That estimate was based on a total of but six data points taken from water quality sampling station C51SR7, located on the C-51 Canal at State Route 7. Total phosphorus concentrations in those samples was applied to discharges estimated from the USCOE simulation model of the C-51 West Basin; the results of the analysis were heavily influenced by a single data point.

For this analysis, average flow-weighted total phosphorus concentrations in C-51 West Basin runoff are estimated on the basis of data collected at S-5AE, for which a greater number of data points are available, and can be applied to measured discharges. The resultant flow-weighted average total phosphorus concentration is 0.185 gm/m^3; that value is adopted for use in this conceptual design. A listing of the data utilized in that estimate is presented in Table III-17.

Table III-17

TP LOAD ESTIMATE AT STRUCTURE S-5AE

Sample Date Mo.	Day	Yr.	TP Conc. (gm/m^3)	Daily Discharge* (ac-ft)	Daily TP Load (Kg)
03	24	82	0.096	736	87
03	25	82	0.052	764	49
03	30	82	0.318	1,743	684
06	01	82	0.161	1,065	212
06	08	82	0.170	1,186	249
06	22	82	0.230	159	45
06	24	82	0.215	1,049	278
06	25	82	0.318	718	282
11	09	82	0.045	1,267	70
10	18	83	0.098	432	52
10	16	84	0.195	52	13
06	25	85	0.063	817	63
07	24	85	0.560	660	456
09	17	85	0.066	762	62
	TOTAL		0.185	11,410	2,602

*Using only samples obtained during discharge to the west.

When that value is applied to the average annual runoff volume from the C-51 West Basin of 119,002 acre-feet, the estimated average annual total phosphorus load in runoff from the C-51 West Basin is estimated to be 27,156 Kilograms.

3. MODIFICATIONS TO HISTORIC DATA

There is at present no planned program for the implementation of Best Management Practices (BMPs) in the C-51 West Basin. As a result, no regulatory modification to historic runoff volumes and phosphorus loads is assumed.

It should be noted that the runoff volumes for the C-51 West Basin include contributions from the Acme Improvement District. That Chapter 298 district is now developing a regulatory program including the planned institution of Best Management Practices, which, when implemented, may serve to reduce both average annual runoff volumes and total phosphorus loads from the C-51 West Basin.

The development of a storm water treatment area (STA) in the C-51 West Basin will act to reduce average annual runoff volumes and total phosphorus loads. These modifications are estimated to include a reduction in average annual runoff of 2.547 acre-feet, and a reduction in average annual total phosphorus load of 0.582 Kilograms, per acre of effective treatment area. Analyses to determine the required effective treatment area of any STA in the C-51 West Basin will include a reduction in the assigned inflow volumes and total phosphorus loads to reflect the above reductions per unit area.

* * * * *

PART IV
TECHNICAL PLAN COMPONENTS

PART IV

TECHNICAL PLAN COMPONENTS

A. GENERAL

This Part IV provides a detailed description of the various component elements of the technical plan. With the exception of Stormwater Treatment Area No. 5 (STA-5), the descriptions define the physical nature of the conceptual design originally developed by the technical mediation group. The conceptual design of STA-5 varies from that envisioned by the technical mediation group primarily in its geographic location, and is discussed more fully in Section B of this Part IV. It should be noted that additional modifications to the detailed description of the various plan components can and will result from the continued development of more detailed designs, and as additional, site-specific topographic and subsurface information becomes available.

For convenience, descriptions of the various component elements of the overall plan are grouped in this Part IV by basin. That grouping is not intended to suggest that improvements associated with any given basin can proceed (or be substantially modified) without careful consideration of the potential influence on other plan components in the same or other basins. The various plan components are highly interrelated, and must each be considered in the broader context of the overall Everglades Protection Project.

1. BASIS FOR DESIGN OF STORMWATER TREATMENT AREAS

The technical plan includes the construction of a number of Stormwater Treatment Areas (STAs), which are large constructed wetlands intended to reduce the level of nutrients (phosphorus) in storm runoff and agricultural drainage prior to its discharge to the Everglades Protection Area (EPA). The STAs, acting in combination with the implementation of Best Management Practices (BMPs) in that part of the Everglades Agricultural Area (EAA) regulated under Chapter 40E-53 of the Rules of the South Florida Water Management District, are intended to reduce the concentration of total phosphorus in those discharges to a long-term, flow-weighted average of 50 parts per billion (ppb) at all points of release to the EPA.

The 50 ppb objective is an interim goal established in the Surface Water Improvement and Management (SWIM) Plan for the Everglades. Current State of Florida standards for phosphorus concentrations in discharges to Class III water bodies and Outstanding Florida Waters (OFW) are narrative in nature. It is intended that ongoing research and monitoring eventually result in the establishment of numeric standards for those discharges. The timing for establishment of those standards is not presently known with certainty, but is expected to be a number of years in the future. Should those standards be substantially below the 50 ppb interim goal (as is presently anticipated), it may be necessary to substantively expand or modify the technical plan components described herein to conform to those standards.

The following is a summary of the primary bases for design of the various Stormwater Treatment Areas.

a. Inflow Volumes and Total Phosphorus Loads

It is intended that the STAs receive and treat all discharges from the following areas prior to their release to the EPA:

- That part of the Everglade Agricultural Area regulated under the Chapter 40E-63 Rule (the S-2, S-3, S-5A, S-6, S-7, and S-8 basins), all in Palm Beach county.

- The C-139 Basin in Hendry County.

- The C-51 West Basin in Palm Beach County.

- Historic regulatory releases from Lake Okeechobee to the EPA.

- Discharges from the following special districts and areas which are to be partially diverted from Lake Okeechobee to the EPA:
  - The South Florida Conservancy District, Planning Unit No. 5.
  - The South Shore Drainage District.
  - The East Beach Water Control District.
  - The 715 Farms area.
  - The East Shore Water Control District.

Historic volumetric and total phosphorus load discharges are based on a period of record including water years 1979-1988. Those historic discharges are then modified to reflect the implementation of BMPs in that part of the EAA regulated under the Chapter 40E-63 Rule, as well as in the above-listed special districts and areas (other than the East Beach Water Control District). Historic discharge volumes and loads are adjusted to reflect not less than a 25 percent reduction in total phosphorus loads, and not more than a 20 percent reduction in discharge volumes.

Part III of this document includes summaries of the historic and modified discharge volumes and loads upon which the conceptual design of this technical plan is based.

In addition to the above-described discharge volumes and loads, certain of the facilities included in the technical plan are sized to accommodate an increase in the average annual volume of regulatory releases from Lake Okeechobee to the Everglades Protection Area.

b. <u>Calculation of Required Effective Treatment Area</u>

The effective area of any given Stormwater Treatment Area is calculated using the methods and parameters described in Part II, Section D of this document. In the calculation of required treatment areas, design inflow volumes and loads are further adjusted to reflect additional reductions resulting from the conversion of large land areas to use in the stormwater treatment areas.

2. DIVERSION AND REDIRECTION OF DISCHARGES

In addition to the implementation of strategies to reduce total phosphorus loads discharged to the Everglades Protection Area, the technical plan includes strategies for the diversion and redirection of discharges to both increase the volume of water retained in the regional system (thereby increasing water supply and reducing fresh water impacts on certain estuaries), and to redirect discharges to more appropriate points of release. The following is a summary of the primary such strategies included in the technical plan.

- Discharges from existing Pump Station S-6 will be removed from Water Conservation No. 1 (the Arthur R. Marshall Loxahatchee National Wildlife Refuge) and redirected to Water Conservation No. 2A, for the dual purposes of:

  - Substantially reducing the total phosphorous load discharged to the Refuge.

  - Providing a source of water supply for restoration of hydroperiod along the northwesterly perimeter of WCA-2A.

- Runoff from the C-51 West Basin, which presently is discharged to tide in the Lake Worth estuary, will be redirected to Water Conservation Area No. 1, thereby eliminating the loss of water to tide and relieving fresh water (and associated pollutant load) impacts on Lake Worth.

- Runoff from the northern portion of the L-8 Basin, which is comprised primarily of the Dupuis Reserve and the J.W. Corbett State Wildlife Management Area, will be redirected to Lake Okeechobee; much of this runoff is presently discharged to the Lake Worth estuary via the C-51 Canal.

- A substantial part of the discharges from a number of Chapter 298 drainage districts and the 715 Farms area will be diverted from Lake Okeechobee to the EPA, primarily to alleviate localized water quality problems in Lake Okeechobee associated with those discharges.

- Discharges from the C-139 Basin will be redirected to serve as a source of water for the restoration of hydroperiod on the Rotenberger Tract and along the northerly perimeter of WCA-3A west of Miami Canal.

- A portion of the runoff and agricultural discharges from the S-5A Basin will be removed from Water Conservation No. 1 and redirected to Water Conservation Area No. 2A.

- Certain of the works of the Central and South Florida Flood Control Project will be modified to result in an approximation of sheet flow along, and the restoration of hydroperiod on, previously overdrained areas of WCA-2A and WCA-3A.

B. WESTERN BASINS

This Section describes proposed modifications and improvements generally associated with the Western Basins, and in particular the C-139 Basin. As noted in Part III, the balance of the Western Basins south of the C-139 Basin also drain to the Everglades Protection Area, and at present discharge water with nutrient levels exceeding the interim goal for total phosphorus of 0.05 gm/m^3. Potential modifications and improvements for the lower three primary hydrologic basins of the Western Basins are not included in this conceptual plan; it is assumed they will eventually be addressed as the result of other planning efforts now being conducted by the District.

The primary objectives of the western basin improvements included in this conceptual plan are to:

- Restore hydroperiod on the Rotenberger Tract.

- Provide a source of treated water supply for the Holey Land.

- Reduce nutrient loads presently discharged to WCA-3A from the L-3 Borrow Canal.

- Restore hydroperiod on the northerly portion of WCA-3A situated generally between the Miami Canal and Levee L-28.

Primary plan components originally envisioned by the technical mediation group included:

- Redirection of runoff from the C-139 Basin, which presently discharges primarily to WCA-3A via the L-3 Canal Extension (through structure G-155) and existing Pump Station S-140 (through Structure G-89 and the L-28 Borrow Canal) to the northerly end of the Rotenberger Tract through construction of the L-3E Canal. Those redirected discharges would serve as the primary source of water supply for the hydroperiod restoration objectives defined for the western basins improvements.

- The development of Stormwater Treatment Area No. 5 (STA-5) in the northerly end of the Rotenberger Tract, intended to reduce the long-term flow-weighted average total phosphorus concentration in discharges from the C-139 Basin to the interim goal of 0.05 gm/m^3.

- The acquisition of remaining private in-holdings on the Rotenberger Tract, and the construction of those physical facilities necessary to restore hydroperiod on the Rotenberger Tract.

- Modification of the L-4 Levee and Borrow Canal system necessary to develop an approximation of sheet flow along the northerly perimeter of WCA-3A west of the Miami Canal.

Secondary benefits occurring to the western basins plan components include:

- The potential for a slight improvement in the level of flood protection afforded the C-139 Basin.

- The provision of a potential source of treated water supply to the Seminole Indian Reservation, in the immediate vicinity of existing structure G-89.

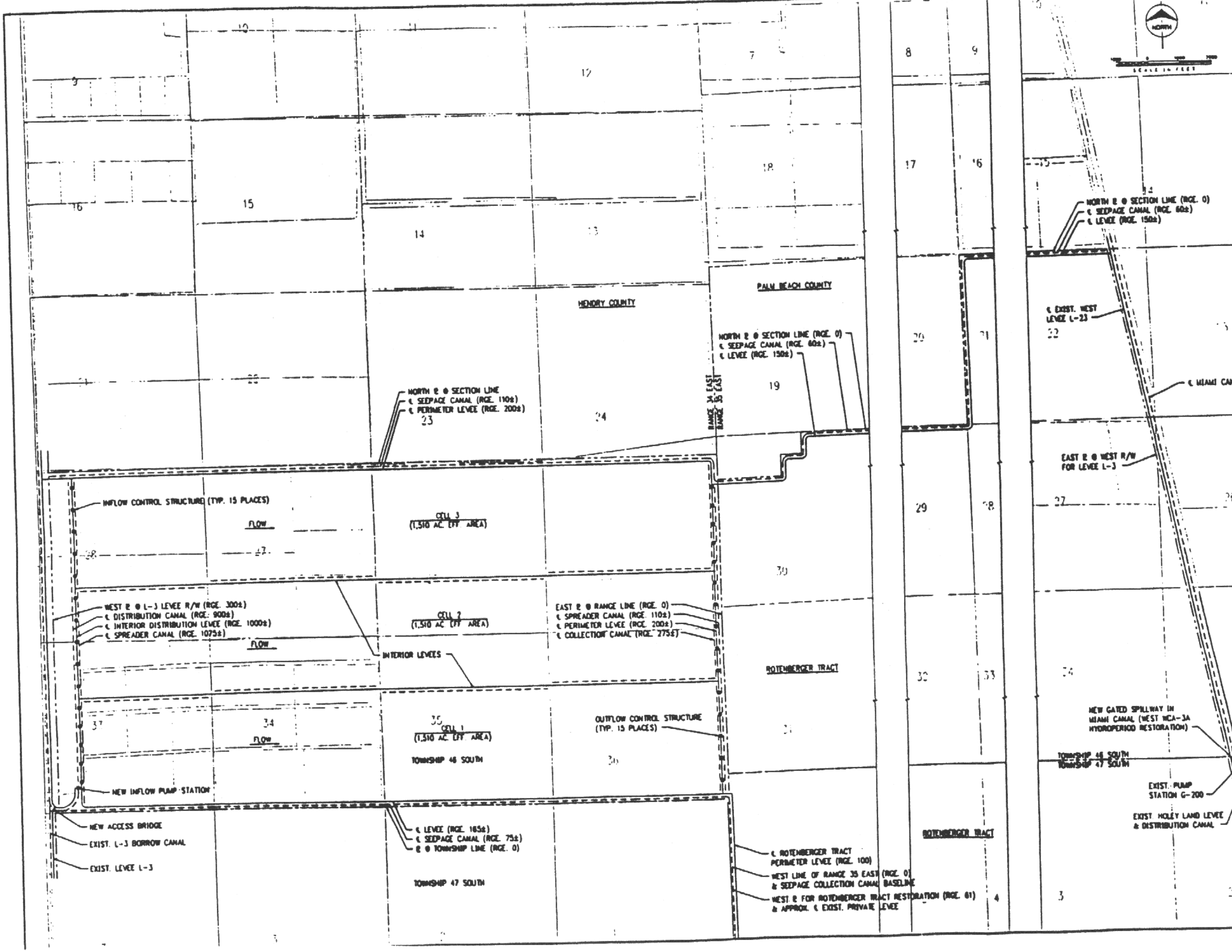
- The potential for a slight improvement in the level of flood protection afforded the Seminole Indian Reservation through a reduction (essentially elimination) of inflows to the L-28 Borrow Canal from the L-3 Borrow Canal through structure G-89.

The technical plan described herein varies from that originally developed by the technical mediation group primarily in the location of Stormwater Treatment Area No. 5 (STA-5). STA-5 has been removed from the Rotenberger Tract, and is relocated to a position extending east from Levee L-3 to the westerly line of the Rotenberger Tract, immediately north of and parallel to the south line of Township 46 South, Range 34 East in Hendry County. STA-5 will now occupy roughly 8 sections of what are presently agricultural lands in the S-8 Basin.

Given the above-described relocation of STA-5, the originally proposed L-3E Canal, which was intended to convey runoff from the C-139 Basin to STA-5, is no longer required, and is not further discussed herein.

1. <u>STORMWATER TREATMENT AREA NO. 5</u>

Stormwater Treatment Area No. 5 (STA-5) will consist of a constructed wetland providing an effective treatment area of 4,530 acres. This facility is intended to reduce the long-term flow-weighted average concentration of total phosphorus in runoff from the C-139 Basin to the interim goal of 0.05 gm/m^3 prior to its discharge to the Rotenberger Tract.



EVERGLADES PROTECTION PROJECT

CONCEPTUAL PLAN
STORMWATER TREATMENT AREA NO. 5

Burns & McDonnell

SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA

STA-5 is sized to accommodate all runoff from the C-139 Basin except that portion historically discharged through structure G-136 and the L-1E Canal to the Miami Canal; those discharges are included in planned inflows to the Combined STA-3 and STA-4. The net design inflow to STA-5 aggregates to an annual average of 87,000 acre-feet and 28.0 kilograms of total phosphorus (flow weighted average inflow concentration of 0.261 gm/m^3). As STA-5 occupies lands not within the C-139 Basin, no adjustment to the design inflow is made for conversion of lands to use in STA-5; design inflows to combined STA-3 and STA-4 are adjusted to reflect the conversion of lands now in the S-8 Basin to use in STA-5.

The conceptual design of Stormwater Treatment Area No. 5 is based on conveying not less than the historic peak rate of runoff from the C-139 Basin which occurred during the period water years 1979-1988. That peak rate of discharge was 1,850 cfs, occurring on June 26, 1982, and is equivalent to a removal rate of 0.34-inch per day from the C-139 South basin.

a. <u>Description of Physical Facilities</u>

STA-5 will be developed in three parallel cells extending easterly from Levee L-3 to the west line of the Rotenberger Tract. Inflow to STA-5 will consist of C-139 Basin runoff and accumulated seepage from the southerly perimeter of STA-5 and the westerly perimeter of the Rotenberger Tract south of STA-5.

A new Inflow Pump Station will be constructed near the southwesterly corner of STA-5. The nominal discharge capacity of this station will be 1,960 cfs, composed of:

- 1,850 cfs from the C-139 Basin.

- An allowance of 60 cfs for accumulated seepage along the westerly perimeter of the Rotenberger Tract.

- An allowance of 50 cfs for accumulated seepage along the southerly perimeter of STA-5.

The new Inflow Pump Station will discharge to a new distribution canal and interior levee system extending along and immediately east of Levee L-3. Inflows to STA-5 will be discharged through the interior levee along the new distribution canal via a series of inflow control structures, and will be carried through STA-5 from west to east; stages in STA-5 will be controlled by a series of outflow control structures passing through a new north-south levee forming the easterly perimeter of STA-5, and discharging directly to the Rotenberger Tract.

New perimeter levees will be required along the northern and southern boundaries of STA-5; borrow canals for those levees will be exterior of the treatment area, and are intended to serve as seepage collection canals.

b. <u>Land Acquisition</u>

Acquisition of the following privately owned lands, all in Township 46 South, Range 34 East, Hendry County, will be necessary for STA-5.

- Sections 25, 26, 27, 34, 35 and 36 in their entirety.

- That part of Sections 28 and 33 lying east of the easterly right-of-way line for Levee L-3.

2. <u>ROTENBERGER TRACT RESTORATION</u>

This plan element is intended to restore hydroperiod on the Rotenberger Tract, a total of slightly over 29,000 acres.

a. Description of Physical Facilities

The following physical facilities are included in the Rotenberger Tract Restoration plan component.

- New levee and seepage collection canal along the westerly perimeters of the Rotenberger Tract.
- Modification of an existing FPL access road across the southerly end of the Rotenberger Tract to permit the continuation of sheet flow across the FPL line alignment.
- Provision of facilities for conveying water supply from the Rotenberger Tract and the L-4 Borrow Canal to the L-28 Borrow Canal.

The existing west Levee L-23 will serve as the easterly perimeter levee for the Rotenberger Tract Restoration.

(1) New Levee and Seepage Collection Canal: A new levee will be constructed along the west and north perimeters of the Rotenberger Tract, extending generally from a point near the southwest corner of Section 30, Township 46 South, Range 35 East to a point near the northeast corner of Section 22, Township 46 South, Range 35 East. At its southern end, the new levee will tie into an existing privately owned levee at the northeasterly corner of proposed Stormwater Treatment Area No. 6. At its northeasterly end, the new levee will tie into the existing Levee L-23.

The levee along the west perimeter of the Rotenberger Tract south of STA-5 will be constructed immediately east of the range line. Material for construction of the levee will be obtained by enlargement of an existing privately owned borrow ditch situated just west of the range line. That enlarged borrow ditch will serve as a seepage collection canal draining north to the new seepage collection canal along the south boundary of STA-5.

Between the south end of the new levee and Levee L-4, the Rotenberger Tract abuts proposed Stormwater Treatment Area No. 6. Over this two mile length, no seepage control is provided; an existing privately owned levee would serve to divide the Rotenberger Tract from STA-6.

(2) Holey Land Water Supply: The routing of water supply to the Holey Land would be from the lower end of the Rotenberger Tract to existing Pump Station G-200 via the L-4 Borrow Canal and the Miami Canal, as the inflow would have had the potential water quality improvement benefit potentially afforded by the Rotenberger Tract.

(3) Modification of FPL Access Road: An existing FPL overhead power transmission line extends across the southwesterly corner of the Rotenberger Tract, from a point near the northwest corner of Section 6, Township 48 South, Range 35 East to a point near the south quarter corner of Section 3, Township 48 South, Range 35 East. From that point, the FPL line continues easterly, approximately 400 feet north of and parallel to the L-4 Borrow Canal, to the Miami Canal. Throughout that entire reach, the FPL line is parallelled on its north side by an access embankment, with access pads to support poles at intervals of approximately 1,320 feet. Fill material for the existing access embankment was obtained from an adjacent borrow ditch on the south side of the embankment. The overall length of this access embankment is approximately 35,100 feet.

Modifications to the FPL access embankment are divided into two distinct segments. The first segment extends from the westerly line of the Rotenberger Tract to the deflection point in the FPL alignment near the south quarter corner of Section 3. The second segment extends from that point easterly to the Miami Canal. The existing access embankment top is estimated to be between elevation 14.5 and 15.0 ft. NGVD, with a top width varying from 20 to 28 feet.

In Segment 1, the top elevation of the access embankment will be increased to approximate elevation 17.0 ft. NGVD, with a top width of 24 feet. Material for enlargement of the embankment will be obtained from a new borrow ditch on its north side, which would subsequently serve as a collection canal for sheet flow on the Rotenberger Tract. Culverts with flashboard risers on their north ends will be constructed at approximately 1,320-foot intervals across the embankment, connecting the new and existing borrow ditches. The existing borrow ditch on the south side of the embankment would then serve as a spreader canal for a continuation of sheet flow to the south. It is anticipated that blasting will not be permitted for excavation of the new borrow ditch.

In Segment 2, the enlarged FPL access embankment will serve to replace the L-4 levees, and will be constructed to a top elevation of 19.0 ft. NGVD and a top width of 24 feet. Material for that enlargement will be obtained from both a new borrow ditch along the north side of the embankment, and from material obtained from removal of the existing south Levee L-4; the excavation and haul of material from the south Levee L-4 is included in the West WCA-3A Hydroperiod Restoration works. Outflow control culverts will be constructed across the enlarged embankment at roughly 2,600-foot centers, and will be equipped with reinforced concrete inlet structures with stop logs. The stop logs would be removed during the wet season, and reinstalled during the dry season. Each culvert will discharge to a new canal leading to the L-4 Borrow Canal; the existing north Levee L-4 will be breached at the new canal crossings.

(4) Water Supply to L-28 Borrow Canal: Physical facilities necessary for the delivery of water to the L-28 Borrow Canal will consist of:

- Breaches in the westerly 3.5 mile length of north Levee L-4 at approximate 1/4-mile intervals, permitting flow from Segment 1 of the FPL access embankment modification to the L-4 Borrow Canal.

- The construction of a new canal connection between the L-4 Borrow Canal and the L-28 Borrow Canal near the southwest corner of Section 6, Township 48 South, Range 35 East.

- The construction of a new control structures (culverts with sluice gate control) in both Levee L-28 and the south Levee L-4.

The required discharge capacity of the new control structures is not presently known. They are each assumed to consist of a single 84-inch diameter culvert.

b. Land Acquisition

The majority of the lands necessary for the Rotenberger Tract Restoration are presently in public ownership. Inspection of reference 25 indicates that the Florida State Game and Fresh Water Fish Commission controls approximately 4,200 acres of the Rotenberger Tract in Township 47 South, and that the South Florida Water Management District owns 10 acres in that same township. That same reference indicates that 3,840 acres (Sections 1 through 6 of Township 48 south, Range 35 East) are lands of the United States included in the Seminole Indian Reservation. The balance of publicly owned lands in the Rotenberger Tract are shown to be under the control of the Trustees of the Internal Improvement Fund of the State of Florida.

Acquisition of the following privately owned lands will be necessary for the Rotenberger Tract Restoration.

(1) <u>Township 47 South, Range 34 East</u>: The easterly 61 feet of Sections 1, 12, 13, 24 and 25, except approximately the south 540 feet of Section 25, and the easterly 70 feet of the south 540 feet of Section 25 and the easterly 70 feet of Section 36, aggregating to roughly 45 acres.

(2) <u>Township 48 South, Range 34 East</u>: The easterly 70 feet of Section 1 (roughly 8 acres).

(3) <u>Township 46 South, Range 35 East</u>:

- Section 27, and that part of Sections 26 and 35 lying west of the westerly right-of-way line for Levee L-23 and the Miami Canal.
- Approximately 40 acres in four separate tracts in Section 21.
- Approximately 30 acres in three separate tracts in Section 29.
- Approximately 40 acres in four separate tracts in Section 33.

The total acquisition in Township 46 South, Range 35 East is estimated to aggregate to 944 acres.

(4) <u>Township 47 South, Range 35 East</u>:

- In Section 3, approximately 440 acres in multiple ownerships.

- In Section 4, approximately 400 acres in multiple ownerships.

- In Section 5, 30 acres in two ownerships.

- In Section 6, approximately 220 acres in multiple ownerships.

- In Section 8, approximately 300 acres in multiple ownerships.

- In Section 9, 30 acres in three ownerships.

- In Section 11, approximately 150 acres in multiple ownerships.

- In Section 17, 20 acres in a single ownership.

- In Section 18, approximately 440 acres in multiple ownerships.

- In Section 20, approximately 270 acres in multiple ownerships.

- In Section 25, approximately 100 acres in multiple ownerships.

- In Section 28, approximately 260 acres in multiple ownerships.

- In Section 29, 20 acres in a single ownership.

- Section 30 in its entirety (640 acres in one ownership).

- In Section 32, approximately 120 acres in multiple ownerships.

- In Section 35, approximately 540 acres in multiple ownerships.

The total acquisition in Township 47 South, Range 35 East is estimated to aggregate to 3,980 acres.

c. Water Quality to Seminole Indian Reservation

The intended long term flow-weighted average concentration of total phosphorus in discharges from STA-5 is 0.05 gm/m^3. Prior to reaching the north line of the Seminole Indian Reservation, those discharges must also pass over approximately 20,200 acres of the Rotenberger Tract.

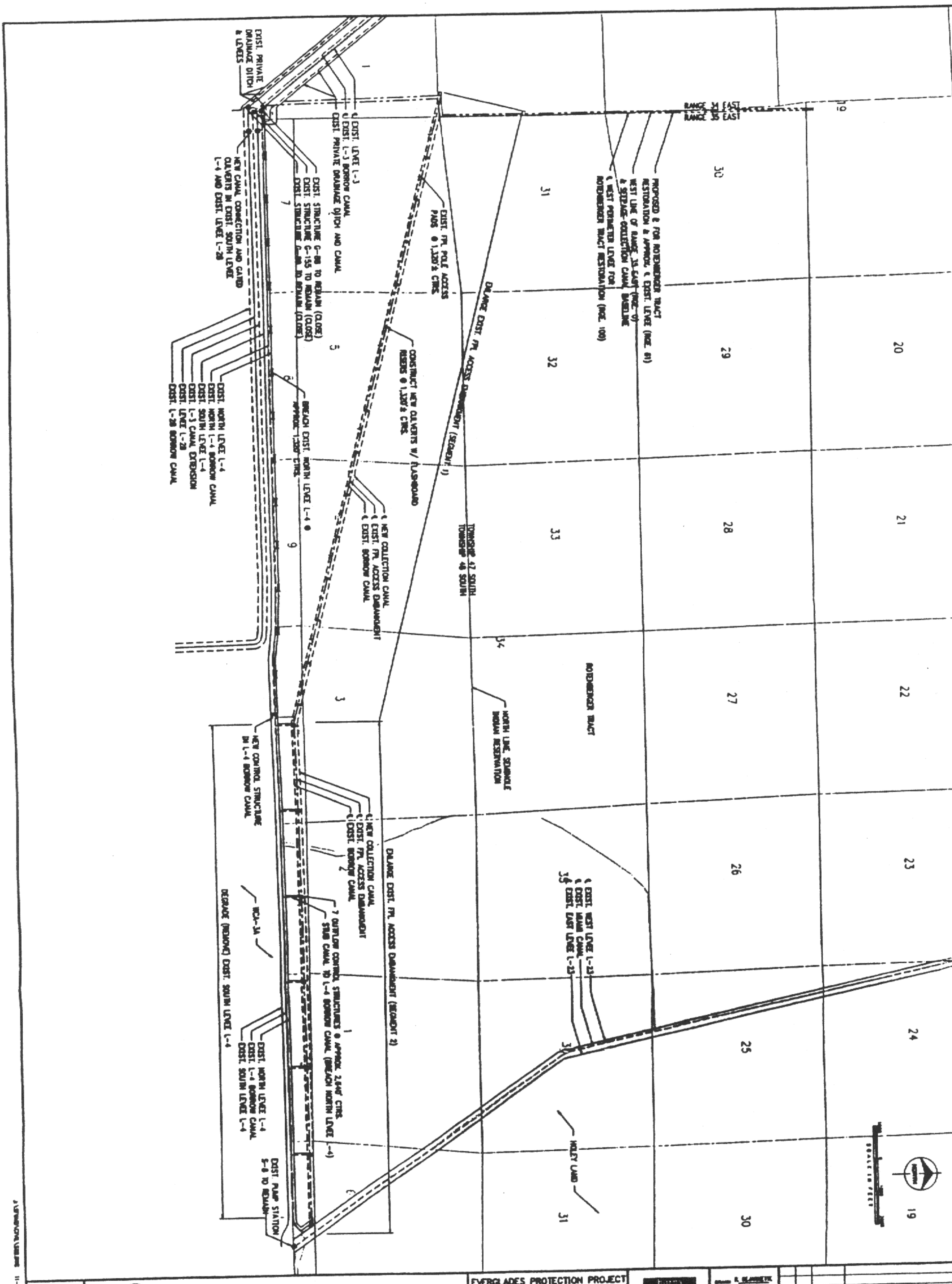
Although it is not certain that 20,200-acre area will act in a fashion entirely similar to that contemplated for the stormwater treatment areas, application of the analytical method for phosphorus reduction in STA's indicates a potential reduction to a long-term average of less than 0.01 gm/m^3 in discharges from STA-5 at the north line of the Reservation.

3. WEST WCA-3A HYDROPERIOD RESTORATION

The objective of this plan element is to restore hydroperiod along the northerly perimeter of WCA-3A west of the Miami Canal and east of Levee L-28 through development of a sheet flow approximation along the affected three mile length.

The sources of water supply for this sheet flow approximation include:

- Discharges from the Rotenberger Tract, consisting primarily of treated outflows from STA-5 plus (or minus) net rainfall on the balance of the Rotenberger Tract.



SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA

EVERGLADES PROTECTION PROJECT

CONCEPTUAL PLAN
WEST WCA-3A HYDROPERIOD RESTORATION

- Outflows from Stormwater Treatment Area No. 6, which will discharge to the L-4 Borrow Canal near the southwest corner of Section 6, Township 48 South, Range 35 East.

The intended sheet flow approximation will be developed through:

- Removal of the easterly three miles of the existing south Levee L-4; the function of the L-4 levees will be replaced by he enlargement of the FPL access embankment (Segment 2); the north Levee L-4 will have been breached at multiple locations as a part of the Rotenberger Tract restoration.

- The construction of a control structure in the L-4 Borrow Canal near the south quarter corner of Section 3, Township 48 South, Range 35 East.

- Elevation of stages in the L-4 Borrow Canal to permit sheet flow to the south, requiring the construction of a new control structure in the Miami Canal at the north line of Township 47 South, Range 35 East.

a. <u>Description of Physical Facilities</u>
The following items of physical construction are included in the West WCA-3A Hydroperiod Restoration.

(1) <u>Removal of South Levee L-4</u>: The existing embankment will be removed to prevailing grade between Levee L-23 (Miami Canal) and the south quarter corner of Section 6-48-35. Material removed from south Levee L-4 will serve as one source of the fill material necessary for enlargement of the FPL access embankment in Segment 2. A new segment of north-south levee will be constructed between the FPL access embankment and the existing south Levee L-4 at the westerly end of the south Levee L-4 removal, crossing the L-4 Borrow Canal.

(2) New Control Structure in L-4 Borrow Canal: A new control structure will be situated in the L-4 Borrow Canal, passing through the new north-south levee connecting the FPL access embankment and the existing south Levee L-4. This structure will serve to control discharges from STA-6 and Segment 1 of the FPL access embankment to the easterly reach of the L-4 Borrow Canal. The nominal capacity of this structure is 1,080 cfs, composed of 350 cfs from STA-6 and up to 730 cfs from Segment 1 of the FPL access embankment enlargement; it is unlikely that the 730 cfs from the FPL Segment 1 construction would be realized except under severe and prolonged runoff events. This structure is anticipated to consist of a two-bay gated spillway with telemetric control.

The presence of this structure, acting in combination with the culverts beneath Segment 1 of the FPL access embankment, will permit the approximately 1,300 acres situated between Segment 1 of the FPL access embankment and the westerly reach of Levee L-4 to act as a surface water storage impoundment, should that be considered desirable.

(3) New Control Structure in Miami Canal: The development of a sheet flow approximation along the northerly perimeter of WCA-3A will require stages in the L-4 Borrow Canal (and the directly connected length of the Miami Canal) to be elevated above optimum stages in the Everglades Agricultural Area. To prevent undesirable impacts on private lands tributary to the Miami Canal upstream (north) of the Holey Land and the Rotenberger Tract, it will be necessary to construct a new control structure in the Miami Canal.

The new control structure will be situated in the Miami Canal at the north line of Township 47 South, Range 35 East, between existing pump station G-200 (Holey Land inflow source) and the new supply Canal serving the combined

Stormwater Treatment Area 3 and 4 (STA-3/4). This location is selected to separate the supply for Pump Station G-200 from untreated flows in the Miami Canal. The Holey Land may then be fed from the lower end of the Rotenberger Tract via the L-4 Borrow Canal and the Miami Canal.

Definition of the nominal discharge capacity of this structure is somewhat problematic, as it may be operated for any of the following conditions:

- Full or partial bypass of STA-3/4 during runoff events in the S-8 and S-3 basins.

- Full or partial bypass of STA-3/4 during periods of regulatory release from Lake Okeechobee to the Miami Canal.

- Bypass of STA-3/4 during periods of water supply releases from Lake Okeechobee intended for delivery to Dade County via the Miami Canal.

Full bypass under runoff events in the S-8 and S-3 basins would require a nominal capacity of 4,170 cfs, equal to the nominal capacity of existing Pump Station S-8. Full bypass of regulatory releases from the Lake would require a nominal capacity of roughly 2,000 cfs (the estimated delivery capacity of the Miami Canal for that condition).

Capital cost estimates summarized in Part V are based on provision of a nominal discharge capacity of 2,000 cfs during periods of regulatory releases from Lake Okeechobee. This structure is anticipated to consist of a two-bay gated spillway with telemetric control.

b. Land Acquisition

All elements of physical construction intended for the West WCA-3A Hydroperiod Restoration plan component will be situated within existing rights-of-way or perpetual easements for the Central and South Florida Flood Control Project.

4. USE OF EXISTING FACILITIES

Existing structures G-88, G-155, and G-89 will remain in place; stop logs will be installed to full height to prevent discharge under most conditions. Stop logs would be removed from structure G-155 to permit discharge to the L-3 Canal Extension only under extreme flooding conditions, or when there may be an operational need to fully or partially bypass STA-5. Stop logs would be removed from structure G-89 either to supplement emergency releases through G-155, or, when acceptable to both the Seminole Tribe and the District, as a direct source of (untreated) water supply from the C-139 Basin to Reservation lands south of Levee L-28.

C. 298 DISTRICTS AND 715 FARMS

This Section discusses proposed modifications and improvements associated with the four Chapter 298 special districts and 715 Farms area which presently discharge directly to Lake Okeechobee. The primary objective of these modifications and improvements is to reduce total phosphorus loads discharged directly to the Lake from these areas by not less than 80 percent.

That reduction will be accomplished through a combination of the following:

- Implementation of Best Management Practices as discussed in Part III.

- Diversion of discharges from the Lake to the Everglades Protection Area (EPA); that diversion will require that sufficient treatment capacity be provided to reduce the total long-term, flow-weighted average total phosphorus concentration in those diverted flows to the interim goal of 0.05 gm/m^3 prior to their discharge to the EPA.

A conceptual design report defining the nature of the physical works necessary for the diversions has reportedly been developed by others but is not presently available. It is our understanding that conceptual design is developed upon the basic premise that, on a long-term average basis, 80 percent of the volume (and load) historically discharged from these areas (after modifications to reflect the implementation of Best Management Practices) is to be diverted to other water bodies as generally described below.

1. SFCD AND SSDD

Discharges to Lake Okeechobee from the South Florida Conservancy District, Unit No. 5 (SFCD) and the South Shore Drainage District (SSDD) will be partially diverted to the Miami Canal, and will increase the total runoff volumes and loads discharged to the Miami Canal. Runoff diverted from the SFCD and SSDD will be treated in Combined STA-3/4 prior to its discharge to EPA (see Section G of this Part IV).

Not all runoff diverted to the Miami Canal will be delivered to the EPA. The discharges from the SFCD and the SSDD will be delivered to the Miami Canal within one mile of Pump Station S-3, with the result that those discharges will be conveyed to the Lake through S-3 whenever S-3 is in operation. The distribution of these discharges between the Lake and the EPA will be variable; a precise computation of that distribution is not presently practicable.

One approach would be to assume that the distribution would parallel that for the S-8 and S-3 basin as a whole (see Part III, Section A); that assumption would result in an assignment of 84.3 percent of the diverted volume to the EPA, and 15.7 percent to the Lake.

2. ESWCD AND 715 FARMS

Discharges to Lake Okeechobee from the East Shore Water Control District (ESWCD) and the 715 Farms area will be partially diverted to the Hillsboro Canal, and will increase the total runoff volumes and loads discharged to the Hillsboro Canal. Runoff diverted from those areas will be treated in Stormwater Treatment Area No. 2 (STA-2) prior to its discharge to the Everglades Protection Area (EPA).

Not all runoff diverted to the Hillsboro Canal will be delivered to the EPA; some part of the diversion will be delivered to Lake Okeechobee through Pumping Station S-2. The distribution of those discharges between the Lake and the EPA will be variable; a precise computation of that distribution is not presently practicable.

One approach would be to assume that the distribution would parallel that for the S-6/S-2 Basin as a whole (see Part III, Section A); that assumption would result in an assignment of 80.0 percent of the diverted volume to the EPA, and 20.0 percent to the Lake.

3. EBWCD

Discharges to Lake Okeechobee from the East Beach Water Control District (EBWCD) will be partially diverted to the West Palm Beach Canal, and will increase the total runoff volumes and loads discharged to the West Palm Beach Canal. Runoff diverted from the EBWCD will be treated in the STA-1 complex (primarily STA-1W) prior to its discharge to the Loxahatchee National Wildlife Refuge (WCA-1).

D. EASTERN BASINS

This Section describes proposed modifications and improvements in the L-8 and C-51 West Basins. The basic objective of these modifications and improvements is to increase the quantity of water retained in the system, potentially enhancing water availability for both the Everglades Protection Area and urban and agricultural uses.

Primary plan components include:

- Diversion of runoff from the northern part of the L-8 Basin (consisting primarily of the J.W. Corbett Wildlife Management Area and the Dupuis Reserve) to Lake Okeechobee, thereby reducing volumetric and nutrient loads on water treatment facilities, and reducing losses to tide.

- Redirection of runoff from the C-51 West Basin, which presently discharges primarily to tide at Lake Worth, to the west, thereby retaining that water in the system. That redirection will be accomplished through construction of the C-51 West End Flood Control Project, an authorized element of the Central and South Florida Flood Control Project.

- Construction of Storm Water Treatment Area No. 1 East (STA-1E), intended to reduce the long-term flow-weighted total phosphorus concentration in runoff from the C-51 West Basin (and, to a lesser extent, contributions from other sources) to 0.05 gm/m^3 prior to its discharge to WCA-1.

Secondary benefits accruing to the eastern basins plan components include:

- Improved flood protection for the C-51 West Basin.

- A reduction in fresh water discharges (and associated nutrient and pollutant loads) to the Lake Worth estuary.

- An improvement in flood protection for the Indian Trail Water Control District (ITWCD) through a reduction in the extent to which L-8 basin runoff influences tailwater elevations in the ITWCD's M-O Canal.

1. <u>C-51 WEST END FLOOD CONTROL PROJECT</u>

   The C-51 West End Flood Control Project as it is presently formulated is described in detail in reference 24. That project is an essential element of the overall plan for flood control along the West Palm

Beach Canal. Its implementation will not only result in improved flood protection for the C-51 West Basin, but will also permit realization of the full flood control benefits intended for the C-51 East Basin.

Incorporation of the C-51 West End Flood Control Project into the Everglades Protection Project will require certain substantive modifications to the federally authorized flood control project. Most significant is the intended modification of project operation to greatly reduce (eliminate to the extent practicable) discharges to Lake Worth from the C-51 West Basin. In addition, the federally authorized project would, on infrequent occasions (return period of 10 years on average), result in direct discharges from the C-51 West Basin to WCA-1. The conceptual plan described herein would eliminate those direct discharges.

a. <u>Federally Authorized Project Definition</u>

The following descriptive information on the C-51 West End Flood Control Project as it is presently authorized is excerpted from reference 24.

(1) <u>Authorizing Laws</u>: West Palm Beach Canal improvement for flood control was partially authorized in the Flood Control Act approved June 30, 1948 (Public Law 858, 80th Congress, 2nd Session). The portion of West Palm Beach Canal which is included in the Flood Control Act extends from Lake Okeechobee to Structure 5A(W), at the junction of Levees 8 and 40. A subsequent review was made of the Comprehensive Report for Flood Control and other purposes, House Document 643, 80th Congress, 2nd Session, to determine the advisability of further modification of West Palm Beach Canal. As a result of reviews Public Law 87-874, 87th Congress, H.R. 13273, October 23, 1962, authorized improvements to West Palm Beach Canal from Structure 5A(E) to Lake Worth for flood control. Public Law modification of

works for water supply, distribution, and conservation of water resources was authorized by Public Law 90-483, 90th Congress, August 13, 1968.

(2) Purpose and Scope: Reference 24 presents detail designs for a partial modification to the authorized plan of improvement for West Palm Beach Canal (C-51) west of State Road 7 (SR-7) as presented in Part V, Supplement 54, Detailed Design Memorandum. An additional purpose of that document is to provide a brief explanation of various alternatives and changes made in the progression of this study since its authorization in 1948. Features of the proposed plan are discussed in terms of design, cost, benefits, and possible impact on the environment. The project features considered are Pumping Station 319 (S-319), Spillway 155A (S-155A), Canal 51 (C-51) between S-319 and S-155A, Gated Culverts S-360, and the detention area bounded by Levee 85 and part of Levee 40.

The federally authorized plan for the C-51 basin (designated Plan A in reference 24) is intended to result in 30-year flood protection for eastern C-51, and, when combined with local zoning and discharge regulations, 10-year flood protection for western C-51.

An alternative plan considered was a no-action plan which includes finishing channel work east of SR-7 and doing no further work. Eastern C-51 with S-155 and channel work completed to Florida Turnpike, and no further work to western C-51, would have 8- to 10-year flood protection for the east and less than 5-year protection in the west.

(3) Project Elements: The federally authorized project (designated Plan A in reference 24) was derived to provide flood protection for a mixed agriculture and urban area that

is becoming totally urbanized, due to its proximity to West Palm Beach. Flood protection is provided by a combination of project improvements with stringent zoning and permitted discharge requirements. Limiting the impact of the project now and in the future on WCA-1 is a primary objective of Plan A.

(a) Description of Eastern C-51: Features of the flood protection plan in eastern C-51 include the following:

<u>1.</u> Construction of spillway S-155 and the removal of U.S. 1 Highway Bridge, which included the old lock and control structure. The contract was awarded May 1982 and completed in January of 1985. S-155 prevents over drainage of the area east of S-155A and serves as a salinity control structure. S-155 has a design discharge capacity of 4,800 cfs.

<u>2.</u> Enlargement of Canal 51 from Lake Worth to Florida East Coast Railroad Bridge. This work was completed in January 1985.

<u>3.</u> Replacement of Florida East Coast Railroad Bridge was completed in 1984.

<u>4.</u> Enlargement of 0.9 miles of Canal 51 from Forest Hill Boulevard to Summit Boulevard was awarded in October 1985 and completed in September 1986.

<u>5.</u> Enlargement of 4.0 miles of Canal 51 from Kirk Road to the Florida Turnpike was awarded August 18, 1989 and was completed in 1991.

(b) Description of Western C-51: Project features in western C-51 include:

1. S-155A would be constructed 800 feet west of SR-7 with a discharge capacity of 1,000 cfs. The spillway is limited to discharging when eastern C-51 is not subject to flooding. Flows less than 1,000 cfs in western C-51 would be discharged through S-155A and not pumped by S-319.

2. Six miles of existing C-51 channel would be enlarged.

3. A 40-foot maintenance berm would be constructed on the south side of C-51 for the 6-mile reach of enlarged C-51 channel. The maintenance berm would have a minimum crown elevation 18 feet, NGVD, to provide maintenance access to the canal and control overland flow into C-51.

4. Pump Station S-319 is designed with a capacity of 3,840 cfs to pump an average annual volume of 39,120 acre-feet into a detention area.

5. A 2.5-square-mile detention area is bounded by 20.5-foot-high levees composed of 5.4 miles of new L-85 and 2.8 miles of raised L-40. The detention area will contain the 10-year frequency storm event runoff pumped by S-319.

6. Twin culverts are included in S-319, with a total capacity of 1,000 cfs. The purpose of the culverts is to drain the detention area to C-51 after flooding has subsided and C-51 stages are back to normal.

7. S-360 has four gated culverts with a total discharge capacity of 3,840 cfs. The culverts are located in L-40 and discharge into WCA-1 when the detention area storage capacity is exceeded, allowing S-319 to continue to provide flood protection.

8. G-124 (a manually operated culvert control structure) will be removed from the C-51 channel east of Big Blue Trace Road. The structure was constructed by South Florida Water Management District (SFWMD).

b. Modifications to the Federally Authorized Project

The following is a summary of the manner in which the federally authorized project will be modified for incorporation into the Everglades Protection Project. The most significant modification will be the reduction of discharges to Lake Worth, with C-51 West Basin runoff directed instead to WCA-1. Runoff from the C-51 West Basin will pass through Storm Water Treatment Area 1E (STA-1E) for water quality improvement prior to its discharge to WCA-1. The addition of STA-1E is the primary cause of the following modifications to the federally authorized project.

(1) Pumping Station S-319 will be relocated to a point approximately 1.7 miles east of its presently planned location, where it will serve as the inflow pump station for STA-1E. The design of Pump Station S-319 will be greatly altered due to a variety of changed conditions resulting from the Everglades Protection Project.

- The design capacity of S-319 can theoretically be reduced as a result of conversion of a part of the C-51 West Basin to use in STA-1E. That conversion will act to reduce the area tributary to the C-51 Canal and S-319 by 5,350 acres. The majority of these lands are presently permitted to discharge at a rate of 1 inch per day, although a small percentage of the total are permitted to discharge at a rate of 1.6 inches per day. It would therefore appear practicable to reduce the design capacity of S-319 from 3,840 cfs to approximately 3,600 cfs (actual capacity subject to further analysis).

- The design static head differential across S-319 will be markedly reduced as a result of replacement of the currently planned detention area with STA-1E; the maximum operational pool in STA-1E will be roughly 7.5 feet lower than that contemplated for the detention basin.

(2) <u>Structure S-360</u> will no longer be required.

(3) <u>The 2.5-square-mile detention area</u> including Levee L-85 and modifications to Levee L-40, will no longer be required, although the lands originally intended for that use will be incorporated into STA-1E.

(4) <u>C-51 West Canal Enlargements</u> will in all probability be reduced due to both the relocation of S-319 and the above-described reduction in tributary area.

(5) <u>Structure S-155A</u> would remain largely as intended under the federally authorized plan, but would remain normally closed and operated on a very infrequent basis.

2. <u>L-8 BASIN IMPROVEMENTS</u>

L-8 Basin improvements included in the technical plan for the Everglades Protection Project are intended to redirect runoff from the northern part of the L-8 Basin to Lake Okeechobee. The following facilities are included, and are generally consistent with facilities described in Part VIII of reference 12.

- The construction of a divide structure in the L-8 Borrow Canal at or near the southerly boundary of the J.W. Corbett Wildlife Management Area. The location of this structure would be similar to that intended for Structure S-316, an authorized element of the Central and South Florida Flood Control Project. This structure would be normally closed, permitting the elevation of stages in the L-8 Borrow Canal northwesterly of the structure, as would be necessary for gravity discharge to Lake Okeechobee. This structure would be normally closed, but could be operated to permit discharge from the northerly part of the L-8 Basin to the south and east along the L-8 Borrow Canal.

  The nominal capacity of this structure is presently anticipated to be 544 cfs, comprised of 511 cfs from the Corbett WMA and the Dupuis Reserve (equivalent to a removal rate of 1/4-inch per day from the 76.1 square miles of those areas tributary to the L-8 Borrow Canal) and 33 cfs (permitted discharge rate) from agricultural lands tributary to the L-8 Borrow Canal downstream (east) of existing Structure S-76.

- The renovation of existing Structure S-76 (which is presently fully open and inoperable) with the addition of control facilities necessary for either automatic or remote (via the District's telemetry system) operation.

Completion of the above elements would permit the elevation of stages in the L-8 Borrow Canal necessary to allow, under most circumstances, gravity discharge from the northerly part of the L-8 Basin to the Lake.

That potential for gravity discharge would be reduced or, in extreme circumstances, eliminated whenever Lake Okeechobee stages are at or above the maximum regulation stage of 17.5 ft NGVD. To assure the ability to discharge to the Lake under all conditions, the conceptual plan also includes the construction of a storm water pumping station at or near existing Culvert #10A. It should here be noted that the C&SFFCP also includes authorization for a storm water pumping station (S-309) at this same location.

The intended capacity for this new pumping station is a minimum of 844 cfs, equal to the nominal capacity of the divide structure in the L-8 Borrow Canal plus the presently permitted discharges from agricultural lands tributary to the L-8 Borrow Canal between Structure S-76 and Culvert #10A.

As discussed in paragraph D.1.a.(2) of Part III, the northerly part of the L-8 Borrow Canal and proposed Pump Station S-309 are the intended subject of a future federal design memorandum (Addendum 1 to Part V, Supplement 51, General Design Memorandum), the development of which may result in some modification to the conceptual design of the northern L-8 Basin improvements considered herein.

a. L-8 Marsh Restoration

The construction of facilities on the J.W. Corbett State Wildlife Management Area to restore hydroperiod was recently completed in fulfillment of the off-site mitigation requirements of the Conditions for Certification PA 84-20, for the North County Regional Resource Recovery Project. As a result of the construction of those projects, stages in the L-8 Marsh Area of Corbett are now normally held between elevation 17.0 ft NGVD and elevation 19.0 ft NGVD.

The Save Our Rivers Division of the South Florida Water Management District has budgeted funds for the construction of facilities (levee and culverts) along the east bank of the L-8 Canal between S-75 and the J.W. Corbett State Wildlife Management Area intended to restore hydroperiod to the balance of the L-8 Marsh. The most recent (October 16, 1992) estimate of the construction cost for those facilities, prepared by the District's Engineering Division, is $2,023,848, which amount is exclusive of any costs for engineering, planning, design, construction management or contingencies. That effort as it is presently formulated intends the establishment of a normal stage of 19.0 ft NGVD in the remaining L-8 Marsh.

Implementation of the conceptual plan for the northern L-8 Basin may eliminate the need for the proposed Save Our Rivers (SOR) project along the Dupuis Reserve, as the presence of the proposed structures and improvements would permit achievement of the marsh restoration objectives simply through elevation of stages in the adjacent reach of the L-8 Borrow Canal.

However, it should be noted that Culvert #10A and the L-8 Borrow Canal presently serves as a route for delivery of water supply from Lake Okeechobee to the L-8 and C-51 basins, as well as, to a lesser extent, WCA-1. The imposition of elevated stages between the Lake and points of water supply delivery may eliminate the ability to make water supply releases along the L-8 Borrow Canal (dependent upon the operation schedule for the L-8 Marsh, which has not yet been defined).

One possible alternative to use of the L-8 Borrow Canal for water supply deliveries is increased reliance on the L-10/L-12 (West Palm Beach) Canal. Additional analysis is necessary to verify the suitability of increased reliance on the L-10/L-12 Canal. Alternatively, the SOR Project, generally as now contemplated, may be implemented in addition to the L-8 Basin improvements considered in this conceptual plan. Such an addition, if needed, would be funded through the Save Our Rivers program, and is therefore not included in the Everglades Protection Project conceptual design or funding projections.

b. <u>Southern L-8 Basin</u>

Runoff from the southern part of the L-8 Basin, consisting primarily of discharges from the Indian Trail Water Control

District, but also including discharges from the 12.0 square miles directly tributary to the L-8 Borrow Canal downstream (south and east) of the M-0 Canal, is not addressed in the conceptual design of the Everglades Protection Project.

The proper operation of the Everglades Protection Project, and in particular, Storm Water Treatment Area 1E, depends on diversion of runoff from these areas (average annual volume of 70,140 acre-feet, average annual total of phosphorus load of 16,860 Kilograms) away from the S-5A complex.

It is assumed that these discharges will be addressed in the ongoing deliberations of the Palm Beach County Water Supply Plan Advisory Committee. One possible means of addressing these discharges is addressed in Part VIII of reference 12, and consists of the following primary components.

- Implementation of the "Section 1 Plan" for diversion of ITWCD runoff from lands south of the M Canal directly to the City of West Palm Beach's Water Catchment Area.

- Enlargement of the existing ITWCD impoundment to serve both as a means of surface storage and to improve the quality of water discharged from the ITWCD.

- Enlargement (increased conveyance) of the City of West Palm Beach's M-Canal system.

The total estimated cost of the above improvements, as reported in reference 12, is $32.12 million.

Other alternatives may exist for the southern L-8 Basin, and should properly be developed and evaluated under planning initiatives other than the Everglades Protection Project.

3. STORM WATER TREATMENT AREA 1 EAST

Storm water Treatment Area No. 1 East (STA-1E) will consist of a constructed wetland providing an effective treatment area of 5,350 acres, and will be located immediately east of WCA-1. This facility will operate in parallel with Storm Water Treatment Area No. 1 West (STA-1W) to reduce the long-term flow-weighted average concentration of total phosphorus in runoff from both the C-51 West and S-5A basins to the interim goal of 0.05 gm/m^3 prior to their discharge to WCA-1.

Those two treatment areas will be hydraulically connected through the STA-1 Inflow and Distribution Works located in the northerly end of WCA-1, and more fully described in paragraph E.2 of this Part IV.

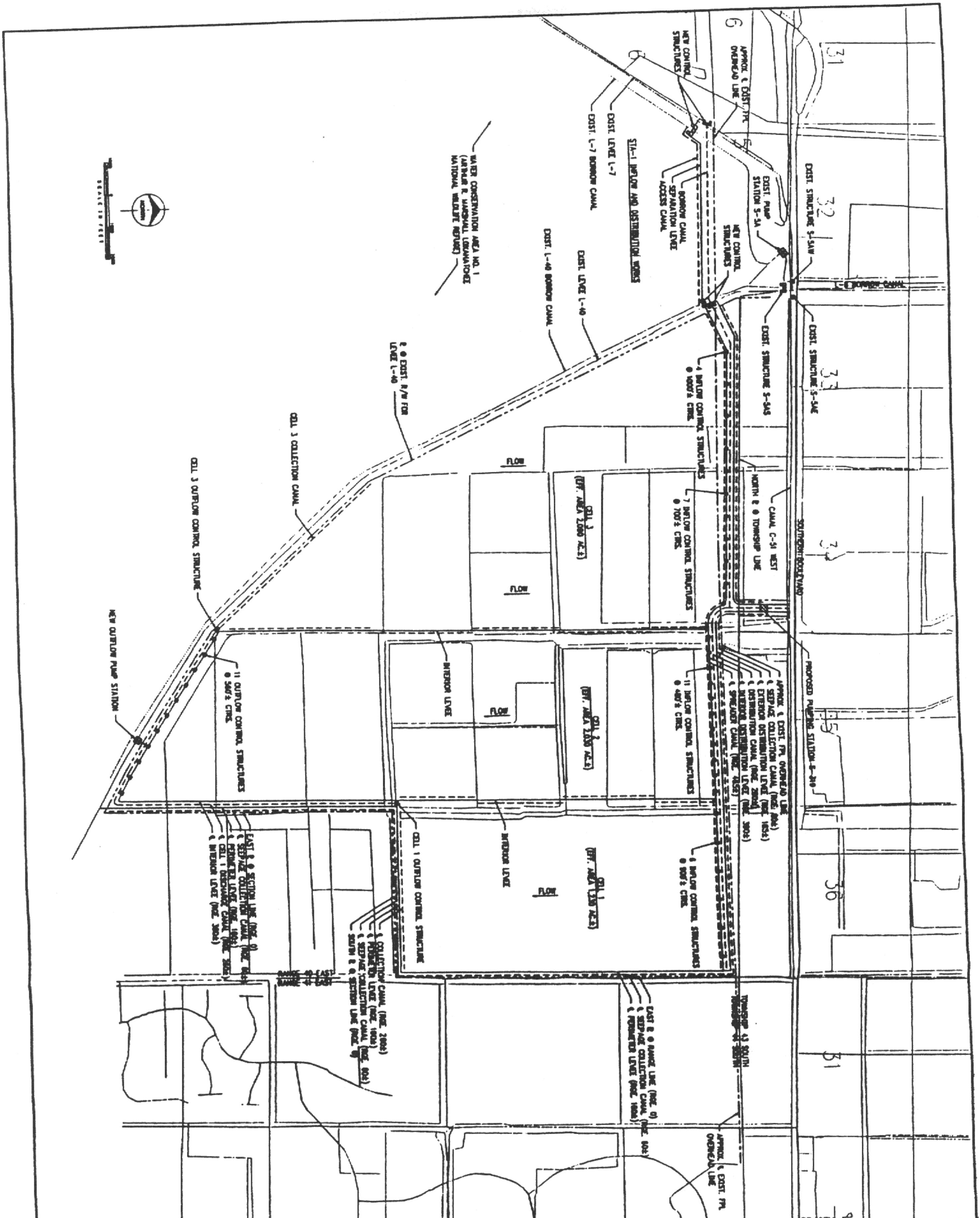
The following is a summary of the estimated average annual inflow volumes and total phosphorus loads to STA-1E considered in this conceptual plan:

- Total C-51 West Basin Runoff = 119.0 thousand ac-ft/yr.
  Total C-51 West Basin TP Load = 27.2 metric tons/yr.

- After reduction due to conversion of lands to use in STA-1E:
  - Net C-51 West Basin Runoff = 105.4 thousand ac-ft/yr.
  - Net C-51 West Basin TP Load = 24.0 metric tons/yr.

- C-51 West Basin runoff diverted to STA-1W via WCA-1 Inflow and Distribution Works:
  - Volume = 11.5 thousand ac-ft/yr.
  - Load = 2.6 metric tons/yr.

- Net C-51 West Basin runoff treated in STA-1E:
  - Volume = 93.9 thousand ac-ft/yr.
  - Load = 21.4 metric tons/yr.



EVERGLADES PROTECTION PROJECT

SOUTH FLORIDA
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WEST PALM BEACH, FLORIDA

- S-5A Basin runoff diverted to STA-1E via WCA-1 Inflow and Distribution Works:
  - Volume = 31.0 thousand ac-ft/yr.
  - Load = 8.0 metric tons/yr.

- Total Inflow to STA-1E:
  - Volume = 124.9 thousand ac-ft/yr.
  - Load = 29.5 metric tons/yr.
  - Ave. Inflow Conc. = 0.191 gm/m^3.

STA-1E is developed to occupy virtually all reasonably available and contiguous lands east of WCA-1 and south of the C-51 Canal. Inflows to this treatment area would be delivered by both the new control structure in Levee L-40 (a part of the WCA-1 Inflow and Distribution Works) and Pump Station S-319 (an element of the C-51 West End Flood Control Project). Treated discharges would be lifted to WCA-1 by a new outflow pumping station having a nominal capacity of 3,000 cfs; S-319 inflows exceeding that rate would, when STA-1E is at or near the maximum planned operation pool, be discharged west to STA-1W via the control structures in the north end of WCA-1.

a. STA-1E Land Acquisition

Acquisition of the following lands will be necessary for development of Storm Water Treatment Area 1E, all in Palm Beach County.

(1) Township 43 South, Range 40 East: Lands to be acquired in this township are limited to the acquisition of a right-of-way for a canal connection between the C-51 West canal and the northeast corner of STA-1E. That right-of-way will consist of the westerly 500 feet (maximum) of the easterly 1,000 feet of that part of Section 34 lying south of the existing right-of-way for the C-51 canal.

The above location for the canal connection is preliminary, and may be modified as a result of more detailed analyses.

(2) Township 44 South, Range 40 East:

- Sections 1, 2, 3, 11, 12 and 14 in their entirety.

- That part of Sections 4, 9, 10, 15, 22, and 23 lying east of the northeasterly right-of-way line for Levee L-40 and the L-40 borrow canal.

Total land acquisition is estimated to include 5,850 acres of privately owned lands. Of that total, approximately 1,920 acres are in citrus production; 1,280 acres are presently fallow; and the balance of 2,650 acres are primarily in sugar cane.

E. S-5A BASIN

This Section describes proposed modifications and improvements in the S-5A Basin. The basic objective of these modifications and improvements is to reduce the total phosphorus load discharged to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (WCA-1) from the S-5A Basin.

Primary plan components include:

- The diversion of a portion of the S-5A Basin to the Hillsboro Canal. The bulk of diverted discharges (roughly 80 percent) will be treated in Stormwater Treatment Area No. 2 (STA-2) and subsequently discharged to Water Conservation Area 2A (WCA-2A), bypassing WCA-1. STA-2 is discussed in Section F of this Part IV. The remaining 20 percent of the diverted volume and load will be discharged to Lake Okeechobee at existing Pump Station S-2.

- The construction of physical works in the north end of WCA-1 to convey discharges from the S-5A Basin to either Stormwater Treatment Area No. 1 West (STA-1W) or Stormwater Treatment Area No. 1 East (STA-1E). STA-1E is discussed in Section D of this Part IV.

- The construction of Stormwater Treatment Area No. 1 West (STA-1W), intended to reduce the long-term flow-weighted total phosphorus concentration in runoff from the S-5A Basin (and, to a lesser extent, contribution from other sources) to 0.05 gm/m^3 prior to its discharge to WCA-1.

1. <u>RUNOFF DIVERSION</u>

It is intended that an average annual volume of 39,600 acre-feet, and an average annual total phosphorus load of 10,200 kilograms, be diverted from the S-5A Basin to the Hillsboro Canal; the bulk of that diversion would subsequently be treated in STA-2 and then discharged to WCA-2A.

This conceptual design assumes a continuation of the historic (1979-1988) distribution of discharges from the S-6/S-2 Basin between Pump Stations S-2 and S-6 (see Part III, Section A), which resulted in 80.0 percent of the S-6/S-2 Basin runoff being delivered to Pump Station S-6. On that basis, eighty percent of the total diversion (31,680 acre-feet per year and 8,160 kilograms of total phosphorus per year) is assigned to Pump Station S-6. The balance (7,920 acre-feet and 2,040 kilogram total phosphorus per year) is assumed discharged to the Lake at Pump Station S-2.

Using the areal adjustment factors listed in Table III-6 for the S-5A Basin, it would be necessary to fully divert approximately 24,100 acres of the S-5A Basin to the Hillsboro Canal.

Existing Structure S-5AX is situated on the Ocean Canal at the current divide between the S-5A and S-6/S-2 basins, near the northwest corner of Section 3, Township 44 South, Range 38 East. This structure will be removed and replaced, and a new divide structure constructed in the Ocean Canal near the northeast corner of Section 4, Township 44 South, Range 39 East, roughly 5.5 miles east of Structure S-5AX. A total of approximately 27,550 acres of the S-5A Basin will be tributary to the Ocean Canal at that point (after construction of STA-1W). Full diversion of runoff from that entire area would exceed the targeted diversion by approximately fourteen percent.

The extent to which runoff from the 27,550 acre area can be diverted to S-6 is controlled not only by the available conveyance capacity in the Ocean and Hillsboro canals, but also by the available discharge capacity of Pump Station S-6.

An analysis was prepared to assess the extent to which diversions from the S-5A Basin could be directed to S-6. That analysis was conducted on a daily basis over a ten-year period encompassing water years 1979-1988. In that analysis, varying maximum rates of diversion were assumed, and the available diversion rate on each day computed as the lesser of:

- The specified maximum diversion rate.

- The unutilized capacity of Pump Station S-6 (e.g. the daily difference between the nominal S-6 capacity of 2,925 cfs and the record daily discharge).

- 21 percent of the record daily runoff from the S-5A Basin (e.g. basin runoff on each day was assumed to have been contributed at a uniform rate from the entire basin, and only that part associated with the 27,550 acre diverted area considered available).

The above analysis was prepared on the basis of historic discharges. An additional analysis was prepared to evaluate the potential influence of BMP's on the results, applying estimated annual reductions for the S-5A Basin (taken from reference 4) to daily data.

Neither of the above two analyses can be considered truly representative of design conditions, which can be expected to be intermediate to the analyses conducted. The following is a summary of the results of these analyses:

Maximum Diversion Rate (cfs)	Average Annual Diverted Volume Historic Data (ac-ft)	With BMP Reductions (ac-ft)
200	26,166	23,818
400	39,497	33,440
600	44,858	36,155
800	46,403	36,485
1,000	46,610	36,530

It is therefore concluded that the maximum rate of diversion should be somewhat in excess of 400 cfs, and that maximum diversion rates exceeding 600 cfs would have little influence on average annual diverted volumes. This conceptual design is therefore based on providing a firm diversion capacity of 600 cfs from the S-5A Basin for all S-6 discharges up to 2,925 cfs (e.g. 2,325 cfs from the S-6/S-2 Basin concurrent with 600 cfs from the S-5A Basin).

a. Basis for Hydraulic Design

The conceptual design of canal conveyance improvements and associated structures is developed to provide adequate capacity to achieve the intended maximum diversion rate of 600 cfs with water surface elevations and design discharges at various points along the system as listed in Table IV-1.

Table IV-1

CONCEPT DESIGN CRITERIA
HILLSBORO AND OCEAN CANALS

Canal	Location	Design Discharge (cfs)	Design W.S. Elev. (Ft. NGVD)
Hillsboro	Pump Station S-6		8.50
		2,925	
Hillsboro	8.0 Mi. N.W. of S-6		10.50
		2,600	
Hillsboro	Confluence with Cross Canal		11.30
		2,000	
Hillsboro	Confluence with Ocean Canal		11.50

Ocean	Confluence with Hillsboro Canal		11.50
		1,200	
Ocean	Structure S-5AX (T.W. el.)		12.00
		600	
Ocean	Structure S-5AX (H.W. el.)		12.25
		600	
Ocean	New Divide Structure		12.50

The existing canals were analyzed through use of the HEC-2 Water Surface Profiles computer program developed by the Hydrologic Engineering Center of the U.S. Army Corps of Engineers at Davis, California. Cross section data for the Hillsboro Canal was taken from the U.S. Army Corps of Engineers record drawings for the Hillsboro Canal, dated September 1955. Cross section data for the Ocean Canal was taken from cross sections surveyed by the South Florida Water Management District in August, 1985 and March, 1986. A Manning's roughness coefficient ("n") value of 0.028 (in channel) was used in the analysis. The channel improvement option of HEC-2 was used to evaluate increases in channel cross sections necessary to conform to the hydraulic design criteria listed in Table IV-1.

b. Description of Physical Facilities

Physical facilities included in the S-5A Basin Runoff Diversion plan component include:

- Enlargement of the Hillsboro Canal, extending southeasterly from its confluence with the Ocean Canal a total distance of approximately 34,800 feet.
- Enlargement of the Ocean Canal between its confluence with the Hillsboro Canal and existing Structure S-5AX, and continuing to the east from Structure S-5AX a distance of approximately 30,000 feet.
- Removal and replacement of existing Structure S-5AX.
- Construction of a new divide structure on the Ocean Canal near the northwest corner of STA-1W.
- Bridge replacements where necessary due to canal enlargements.

(1) Hillsboro Canal Enlargement: Enlargement of the Hillsboro Canal will be limited to the left (easterly) bank and, to a lesser extent, a lowering of the channel invert. The enlargement will consist of the excavation of a trapezoidal channel having a bottom width of twenty feet at elevation -10.0 ft. NGVD, and side slopes of 2H:1V. The centerline of the trapezoidal channel will be established 115 feet westerly of the centerline of the existing East Levee L-15; existing canal cross-sectional area beyond the above defined typical cross section will remain. Material excavated from the Hillsboro Canal will be spoiled along East Levee L-15, between the levee and the existing easterly right-of-way line of the Hillsboro Canal and Levee L-15.

(2) Ocean Canal Enlargement: Between the Hillsboro Canal and Structure S-5AX, the Ocean Canal will be enlarged to a

trapezoidal channel having a bottom width of twenty feet at elevation of -5.0 ft. NGVD, and side slopes of 2H:1V. The centerline of the improved channel will be located approximately 80 feet northwest of the centerline of old State Route 80 (except in the immediate vicinity of the Hillsboro Canal, where the separation will be increased).

East of existing Structure S-5AX, the Ocean Canal will be enlarged to a trapezoidal channel having a bottom width of twenty feet at elevation -4.0 ft. NGVD, and side slopes of 2H:1V. The centerline of the improved channel will be located approximately 80 feet north of the centerline of old State Route 80. This enlargement will extend a distance of approximately 30,000 feet easterly of existing Structure S-5AX, to the new divide structure in the Ocean Canal.

Material excavated from the Ocean Canal will be spoiled along the north bank of the Ocean Canal.

(3) Structure S-5AX Replacement: Existing Structure S-5AX consists of a four-barrel gated culvert. Each barrel consists of a 72-in. diameter CMP, 68 feet in length, at invert elevation 5.5 ft. NGVD. The existing structure will be removed and replaced at its current location with a gated spillway capable of passing 600 cfs with headwater elevation of 12.25 ft. NGVD, tailwater elevation 12.00 ft. NGVD. The structure will operate automatically in response to headwater; gate openings will be limited by tailwater elevation to maintain maximum discharge rates at 600 cfs.

(4) New Divide Structure: This structure will be located in the Ocean Canal near the northwest corner of STA-1W, approximately 30,000 feet east of S-5AX. It will consist of a gated spillway that will be normally closed; gate operation would be automatic in response to headwater elevation,

intended to maintain headwater in the Ocean Canal at prescribed levels when inflows from the diverted part of the S-5A Basin exceed the capacity of the new S-5AX structure. Under extreme circumstances, this structure should be capable of passing approximately 1,200 cfs (rough equal to a removal rate of one inch per day from the 27,550 acres tributary to the Ocean Canal between S-5AX and the new divide structure), with headwater at elevation 12.5 ft. NGVD.

(5) Bridge Replacements: Enlargement of the Hillsboro and Ocean canals will require replacement of a number of existing roadway bridges. A total of 3 bridges over the Ocean Canal east of S-5AX, and 3 bridges over the Ocean Canal west of S-5AX will need to be replaced. With the exception of one bridge located roughly 200 feet west of S-5AX, those bridges will be replaced with two-lane bridges affording a clear width of 28 feet (gross width of 32 feet) and having a length of approximately 100 feet. The bridge immediately west of S-5AX will be replaced to match existing width (estimated to be a gross width of 48 feet).

Other than the bridge carrying old State Route 80 over the Hillsboro Canal (discussed below), a total of two bridges cross the Hillsboro Canal within the improved reach and will be replaced. A third bridge crosses the Hillsboro Canal at the downstream end of the improvement, and is intended to remain in place. The replacement bridges are expected to have a gross width of 32 feet (28 feet net width) and an overall length of approximately 132 feet.

The bridge carrying old State Route 80 over the Hillsboro Canal will be replaced with a new structure affording a net width of 44 feet (two-lane roadway with full width shoulders); the estimated gross width of the structure is 48 feet. The cost for effecting this replacement will be dramatically affected by a determination as to whether or not the roadway can be closed during construction of the new structure. The cost estimate for this replacement is developed assuming the need to carry traffic through the construction area; the new bridge would be constructed just south of the existing bridge, and approximately 1800 lineal feet of new approach roadway constructed, tieing into the existing roadway alignment each side of the bridge. The new bridge would have an estimated length of 132 feet.

c. Land Acquisition

It is intended that materials excavated for enlargement of the Hillsboro Canal be spoiled on existing District right-of-way, which extends approximately 125 feet easterly of the centerline of existing East Levee L-15, and for construction of an elevated berm along the east bank of the Hillsboro Canal. The spoil pile would be approximately 10 feet in height (above existing grade) if the acquisition of additional right-of-way is to be avoided (as is intended in this conceptual design).

Along the Ocean Canal, material excavated for canal enlargement will be placed in a new berm and levee along the north bank of the Ocean Canal. The estimated width of right-of-way necessary for the enlargement extends approximately 260 feet north of the centerline of old State Route 80; final definition of right-of-way requirements should be delayed pending final design. The cost estimate included herein assumes the necessity of acquiring a 100-foot width of right-of-way along the Ocean Canal east of S-5AX, and 200 feet west of S-5AX.

2. STA-1 INFLOW AND DISTRIBUTION FACILITIES

This plan component includes the construction of physical works in the north end of Water Conservation Area No. 1 (WCA-1) to convey discharges from existing Pump Station S-5A to either Stormwater Treatment Area No. 1W (STA-1W) or Stormwater Treatment Area No. 1E

(STA-1E). In addition, these facilities will permit the transfer of flow between STA-1E and STA-1W, allowing the utilization of both STAs in the treatment of runoff from both the S-5A Basin and the C-51 West Basin.

Specific objectives to be met by these facilities include:

- The delivery of up to 3,600 cfs from S-5A (1,200 cfs) is to be delivered to STA-1E.

- The transfer of up to 840 cfs from STA-1E to STA-1W (equal to the difference in nominal capacity of Pump Station S-319 and the new outflow pump station for STA-1E).

- Provision of a means to directly discharge the full nominal capacity of S-5A to WCA-1, bypassing both STA-1E and STA-1W.

The overall conceptual design of the STA-1 complex (Inflow and Distribution Facilities, STA-1E, and STA-1W) is developed to take advantage of the difference in timing of runoff events from the S-5A and C-51 west basins in reducing the required capacity of primary hydraulic components of the treatment facilities.

The combined nominal capacity of existing Pump Station S-5A and proposed Pump Station S-319 is 8,640 cfs; the combined nominal capacity of all outflow pumping stations from STA-1E and STA-1W is 6,600 cfs.

A preliminary analysis of available data (a common 6-year period including water years 1979-1985) for the S-5A and C-51 west basins indicates that, given the intended diversion of L-8 basin discharges from S-5A, the STA-1 facilities described herein would have resulted in no bypass of untreated flow to WCA-1. For that same condition, it would have been necessary to discharge to the east through proposed structure S-155A (discharge to Lake Worth) on but one day, with a total discharge volume of 1,983 acre-feet. That analysis utilized historic S-5A discharge data, and considered neither the implementation of BMPs nor the intended diversion of a part of the S-5A basin.

a. Description of Physical Facilities

A new levee will be constructed across the northerly end of WCA-1 to separate the STA-1 inflow and distribution works from the balance of WCA-1. That separation levee will be located just south of an existing FPL overhead power transmission line traversing WCA-1.

New control structures (gated spillways) will be located in the L-7 and L-40 borrow canals where those canals are crossed by the new separation levee. These structures will be normally closed, and opened only when necessary to fully or partially bypass the adjacent treatment areas. They (and existing Structure S-5AS) may also be opened to deliver water supply releases from WCA-1 to the L-8 and C-51 canals.

Additional control structures will be constructed in Levee L-40 and Levee L-7 to control the distribution of S-5A discharges between STA-1W and STA-1E, and to permit the transfer of flow between the two treatment areas.

(1) Separation Levee in WCA-1: The separation levee will be approximately 6,100 in length, and will extend across WCA-1 from Levee L-7 to Levee L-40, crossing both the L-7 and L-40 borrow canals. The top elevation of existing levees L-7 and L-40 at the point of connection is approximately elevation 24.0 ft. NGVD; the top elevation of the new separation levee will be at elevation 21.25 ft. NGVD, three feet above the anticipated maximum operational stage between Pump Station S-5A and the separation levee. The top elevation of this levee is reduced to permit overflow in the event of a

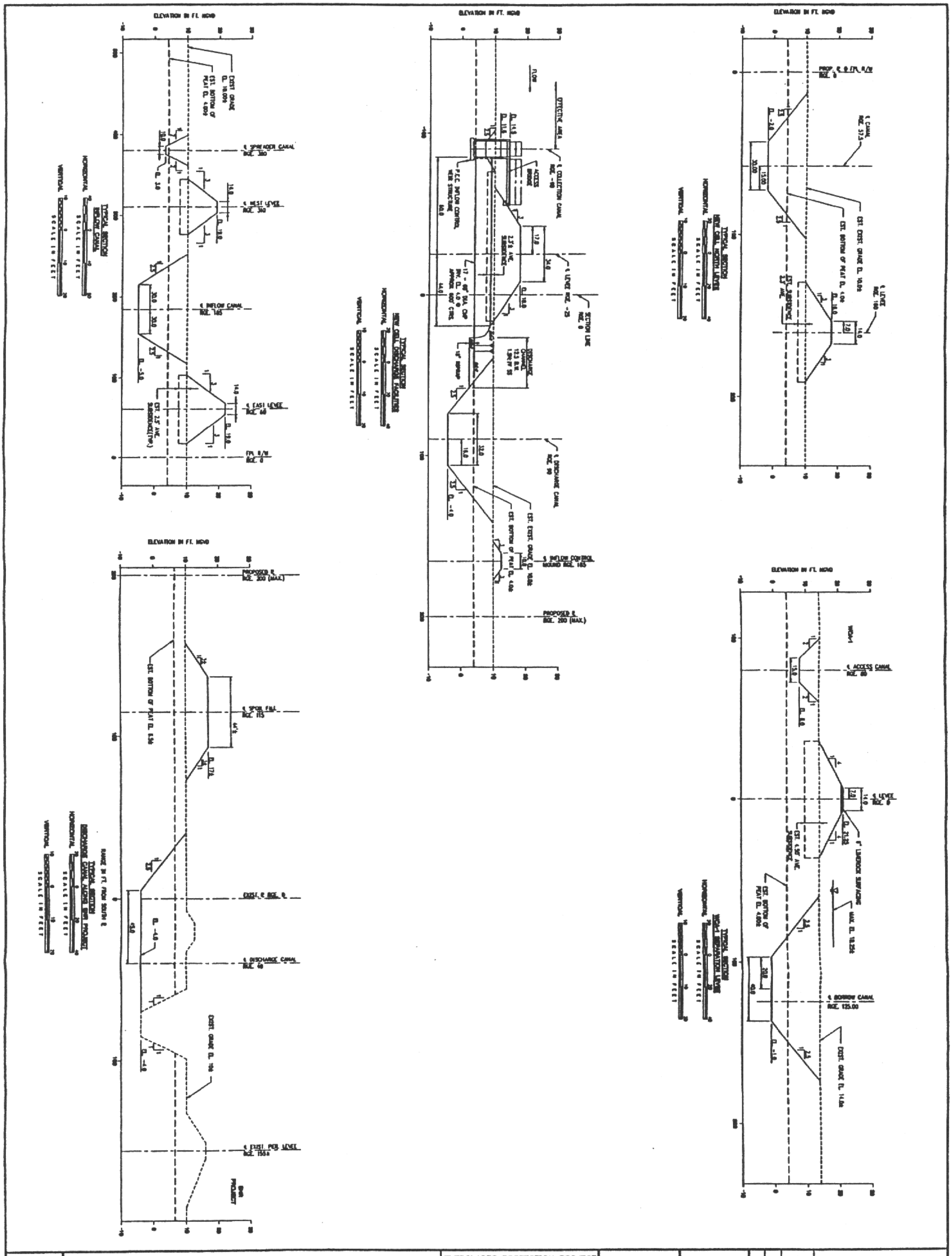
concurrent need to bypass STA-1E and STA-1W, and operational failure of the new control structures in the L-7 and L-40 borrow canals.

Material for construction of this levee will be obtained from two parallel borrow canals. The borrow canal on the south side of the separation levee will be developed to serve as an access canal between the L-7 and L-40 borrow canals, and will be constructed to a bottom width of 15 feet at elevation 8.0 ft. NGVD.

The borrow canal on the north side of the separation levee will be constructed to a cross section necessary to supply the balance of the material needed for the separation levee, and will subsequently serve to increase conveyance capacity between the L-7 and L-40 borrow canals.

(2) L-7 and L-40 Borrow Canal Control Structures: These structures are intended to, acting in parallel, discharge the full 4,800 cfs nominal capacity of Pump Station S-5A directly to WCA-1 in the event of a need to bypass STA-1E and STA-1W. Each structure is assigned a nominal capacity of 2,400 cfs with headwater at elevation 18.25 ft. NGVD and tailwater at elevation 18.0 ft. NGVD. Each structure is anticipated to consist of a two-bay gated spillway with telemetric control capabilities. These structures will be normally closed, but may also be operated for water supply deliveries from WCA-1 to the C-51 Canal and L-8 Borrow Canal.

(3) Control Structure in Levee L-40: This structure is intended to permit the discharge of up to 1,200 cfs from Pump Station S-5A to STA-1E, and up to 840 cfs from Pump Station S-319 to the STA-1 inflow and distribution works and, ultimately, STA-1W. It is presently anticipated to consist of a two-bay gated spillway with telemetric control capability.



SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH , FLORIDA

EVERGLADES PROTECTION PROJECT

TYPICAL SECTIONS
STORMWATER TREATMENT AREA 1W

Burns & McDonnell

DRAWN	R. DEJARNETTE
CHKD	G. MILLER
DATE	NOVEMBER 5, 1993
SCALE	AS SHOWN

DWN	CHKD	DATE	REVISIONS

- A gross inflow of 206,293 acre-feet and 53,454 kilograms of total phosphorus from the S-5A Basin (see Table III-5). Those gross inflows are then modified to reflect the conversion of lands in the S-5A Basin to use in STA-1W, and the intended partial diversion of runoff from the S-5A Basin to STA-1E and the Hillsboro Canal.

  - The average annual reduction in inflow volumes and loads due to conversion of lands to use in STA-1W is computed as the product of the 6,670-acre effective area of STA-1W multiplied by the areal adjustment factors for the S-5A Basin listed in Table III-6. Those reductions total 10,951 acre-feet and 2,823 kilograms of total phosphorus per year.

  - The estimated average annual diversion of S-5A Basin runoff to STA-1E is 31,000 acre-feet and 8,000 kilograms of total phosphorus.

  - The estimated average annual diversion of S-5A Basin runoff to the Hillsboro Canal is 39,600 acre-feet and 10,200 kilograms total phosphorus.

  The net average annual inflow to STA-1W from the S-5A Basin is then estimated to be 124,742 acre-feet and 32,431 kilograms of total phosphorus.

- Historic (1979-1988) Lake Okeechobee releases at Structure S-354 discharged to WCA-1 at Pump Station S-5A, averaging 2,311 acre-feet and 570 kilograms total phosphorus per year.

- An average annual volume of 4,300 acre-feet and an average annual total phosphorus load of 2,100 kilograms diverted from the East Beach Water Control District (EBWCD) to the West Palm Beach Canal (see Section C of this Part IV).

- An estimated average annual inflow from the C-51 West Basin through the STA-1 Inflow and Distribution Works of 11,500 acre-feet and 2,600 kilograms total phosphorus.

The total average annual inflows to STA-1W are then estimated to be 142,853 acre-feet and 37,701 kilograms total phosphorus (average inflow concentration of 0.214 gm/m^3).

Of the total effective treatment area necessary for STA-1W, 3,636 acres are available in the existing Everglades Nutrient Removal (ENR) Project; the balance will be obtained through a northerly expansion of the ENR Project.

Upon completion of the ENR Project expansion, STA-1W will be composed of three treatment paths operating in parallel, two in the existing ENR Project, and one in the new expansion. A final determination of the distribution of peak hydraulic loads to the various cells will be made after additional detailed hydraulic analysis of the existing ENR Project; this conceptual design anticipates a peak (combined) inflow in the two cells of the ENR Project of 1,400 cfs (limited by the conveyance capacity of the ENR Project as presently configured) with the remaining 2,200 cfs peak inflow directed to the new treatment area. The peak inflow to the ENR Project will be increased up to a maximum of 1,960 cfs if supported by the results of the more detailed hydraulic analysis.

a. Treatment Area Expansion

Expansion of the ENR Project to serve as STA-1W will occupy all lands immediately north of the ENR Project, generally bounded by existing FPL rights-of-way on both the north and east. A new inflow canal with flanking levees will be extended from Levee L-7 along the easterly perimeter of the expansion area, and will serve to distribute flows to both the new treatment area and the existing ENR Project.

A series of inflow control structures will discharge flows from the inflow canal to the new treatment area. Those inflow control structures will consist of culverts equipped with sluice gates to permit both partial closure (throttling to facilitate an even distribution of flow) and full closure in the event it is desirable to remove the new treatment area from service while continuing to operate the ENR Project.

The new treatment area will be developed as a single cell; flows will pass through that cell from east to west, discharging through a series of outflow control structures along the west line of the new cell. The new treatment area will be traversed by FPL's proposed Andytown-Martin No. 2 500-kV line. It will be necessary as a part of the project to construct an enlarged access embankment along that line, and to raise FPL's power pole access pads.

A new perimeter levee will be constructed to form the north line of the expanded area. Material for construction of that embankment will be obtained from an exterior borrow canal, which will subsequently serve to convey seepage from the new treatment area east to the existing ENR Project supply canal; it will be necessary to construct an uncontrolled culvert through the new control structure in Levee L-7 to deliver those seepage flows south to the ENR Project supply canal south of the new inflow canal from WCA-1.

b. <u>Modification of the Existing ENR Project</u>

The conceptual design of STA-1W is developed to minimize interruption of the ENR Project, which is intended to remain in service and operational throughout the construction and start-up of the new treatment area. However, certain physical modifications to the ENR Project will be necessary as a result of the increased peak hydraulic loading on the ENR Project (projected to increase from an existing peak inflow of 600 cfs to approximately 1,400 cfs).

(1) Supply Canal and Inflow Pump Stations: These existing facilities will be used to return seepage from the north and east lines of the new treatment area to the upstream end of the existing ENR Project. No modification of the existing supply canal should be necessary for that purpose. However, modification of the Inflow Pump Station will be necessary.

Upon completion of STA-1W, the existing inflow pumps will no longer be needed. Those pumps and associated primary control equipment will be removed and salvaged, and will be available for potential reuse elsewhere on the overall Everglades Protection Project. The existing seepage pumps will remain in place and operational; an existing steel sheet piling wall dividing the inflow and seepage return suction bays will be removed.

Minor structural modifications (closing of floor penetrations, etc.) will be made in that part of the station from which the inflow pumps are removed, and the interior space on the operating floor made available for other uses.

(2) New Inflow Structure: A new structure will be constructed at the southerly end of the inflow canal, and will replace the function of the existing ENR Project inflow pump station. This structure is intended to deliver up to approximately 1,400 cfs from the new inflow canal to existing Distribution Canal D-1 in the ENR Project. This structure is presently anticipated to consist of a gated spillway, with gate openings modulated to control the distribution of STA-1W inflows between the ENR Project and the new treatment area.

(3) Internal Structures: Existing culverts and hydraulic control structures within the ENR were designed and constructed to accommodate the future hydraulic loads, and no significant modification of those structures (other than removal of stop logs) is intended.

However, the proper distribution of flows across the northerly end of Cell 2 of the ENR Project will require the excavation of a new distribution canal east-west across Section 11, T.46 S., R.39 E. Material excavated for that canal will be used to fill the adjacent seepage collection canal exterior of the ENR Project perimeter levee.

(4) Outflow Facilities: The existing ENR Project outflow pump station will remain in place and operational, and will serve as the primary means for control of stages in the ENR Project. However, its 450 cfs capacity falls far short of the intended 1,400 cfs future peak discharge from the ENR Project.

Two additional outflow control structures, each with a nominal capacity of 500 cfs, will be constructed in the ENR Project's perimeter levee adjacent to existing collection canal C-2, and will be used to direct ENR Project discharges exceeding the capacity of the existing Outflow Pumping Station to the new Outflow Pumping Station described below.

c. New Discharge Facilities

The peak discharge from the new treatment area (up to 2,200 cfs) will be routed south along the west wide of the existing ENR Project through a new discharge canal. That canal will lead to a new Outflow Pump Station in Levee L-7, which will discharge to the L-7 Borrow Canal in WCA-1.

(1) Discharge Canal: The existing seepage collection canal along the west side of the ENR Project will be enlarged to serve as the new discharge canal, and is intended to convey 2,200 cfs given water surface elevations of 9.5 ft. NGVD at the northwest corner of Section 15, T.46 S., R. 39 E., and 8.5 ft. NGVD near the west quarter corner of Section 34, T.46 S., R. 39 E. From that point, the discharge canal will extend south and east roughly 1,250 feet to the new Outflow Pump Station, receiving an additional inflow of up to 1,000 cfs from the new ENR Project outflow control structures.

This canal is expected to consist of the hydraulic equivalent of a trapezoidal channel having a bottom width of 90 feet at elevation -4.0 ft. NGVD, and a side slope of 2.5H:1V on its westerly bank. Construction of this enlargement will require the acquisition of a strip of land 200-foot wide along the west side of the ENR Project for canal enlargement and spoil fill placement. It is intended that the spoil fill will subsequently be made available to adjacent property owners for access. In addition, it will be necessary to replace an existing privately owned landing strip over roughly a half-mile length of the new spoil fill.

(2) Outflow Pump Station: The new Outflow Pump Station is anticipated to provide a nominal capacity of 3,200 cfs, equal to the sum of the intended 2,200 cfs peak discharge from the new treatment area and the intended 1,000 cfs peak discharge through the new ENR Project outflow control structures. Existing Levee L-7 will be relocated in the immediate vicinity of the Outflow Pump Station to facilitate the desired orientation of the outfall canal to the L-7 Borrow Canal (in line with the L-7 Borrow Canal to the south to minimize the direct introduction of discharges to the WCA-1 interior marsh).

d. STA-1W Land Acquisition

Acquisition of the following lands will be necessary for development of Stormwater Treatment Area 1W, all in Palm Beach County.

(1) Township 44 South, Range 40 East: That part of Sections 6 and 7 lying west of the westerly right-of-way line of the Florida Power and Light (FPL) right-of-way for the existing Andytown-Martin No. 1 500-kV line paralleling Levee L-7.

(2) Township 44 South, Range 39 East:

- That part of Sections 1, 2, and 3 lying south of the south right-of-way line of the FPL right-of-way for the Corbett-Orange River overhead power transmission line paralleling Palm Beach County Route 80.
- Section 10 in its entirety.
- That part of Sections 11 and 12 lying north of the existing northerly boundary of the Everglades Nutrient Removal Project.
- A strip of land having a maximum width of 200 feet along the east lines of Sections 4 (south of the FPL Corbett-Orange River line), 9, 16, 21, 28, and 33.

In addition to the above lands to be acquired, STA-1W will also incorporate all publicly held lands now situated in the Everglades Nutrient Removal Project.

F. S-6 BASIN

This section describes proposed modifications and improvements in the S-6 Basin. The primary objectives of these improvements are to:

- Reduce the total phosphorus load discharged to the Everglades Protection Area, with particular emphasis on reduction of loads discharged to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (WCA-1).

- Restore hydroperiod along the northwesterly perimeter of Water Conservation Area No. 2A.

Primary plan components of the S-6 Basin improvements include:

- Stormwater Treatment Area No. 2 (STA-2), intended to, acting in combination with implementation of BMPs as required under the Chapter 40E-63 Rule, reduce the long-term flow-weighted average total phosphorus concentration in discharges from the S-6/S-2 Basin (and, to a lesser extent, contributions from other sources) to the interim goal of 0.05 gm/m^3.

- WCA-2A Hydroperiod Restoration Works, consisting of a modification of the L-6 levees and borrow canal to result in an approximation of sheet flow onto WCA-2A.

All discharges from Pump Station S-6 will be treated in STA-2 and subsequently discharged to the (modified) L-6 levee and borrow canal system, which will then serve to distribute those discharges along the entire northwesterly perimeter of WCA-2A. Pump Station S-6 discharges will be entirely removed from WCA-1 (except as otherwise discussed under the description of physical works associated with the WCA-2A Hydroperiod Restoration).

1. STORMWATER TREATMENT AREA NO. 2

Stormwater Treatment Area No. 2 (STA-2) will be developed to provide a total effective treatment area of 6,430 acres, situated generally on and surrounding the Brown's Farm Wildlife Management Area. Lands to be converted in STA-2 include approximately 1,130 acres of privately owned lands in the S-6 Basin and 1,450 acres of privately owned or managed lands in the S-7 Basin. The balance of lands necessary for STA-2 are in the Brown's Farm Wildlife Management Area, and are not considered to have appreciably contributed to the historic (1979-1988) runoff volumes and loads summarized in Part III.

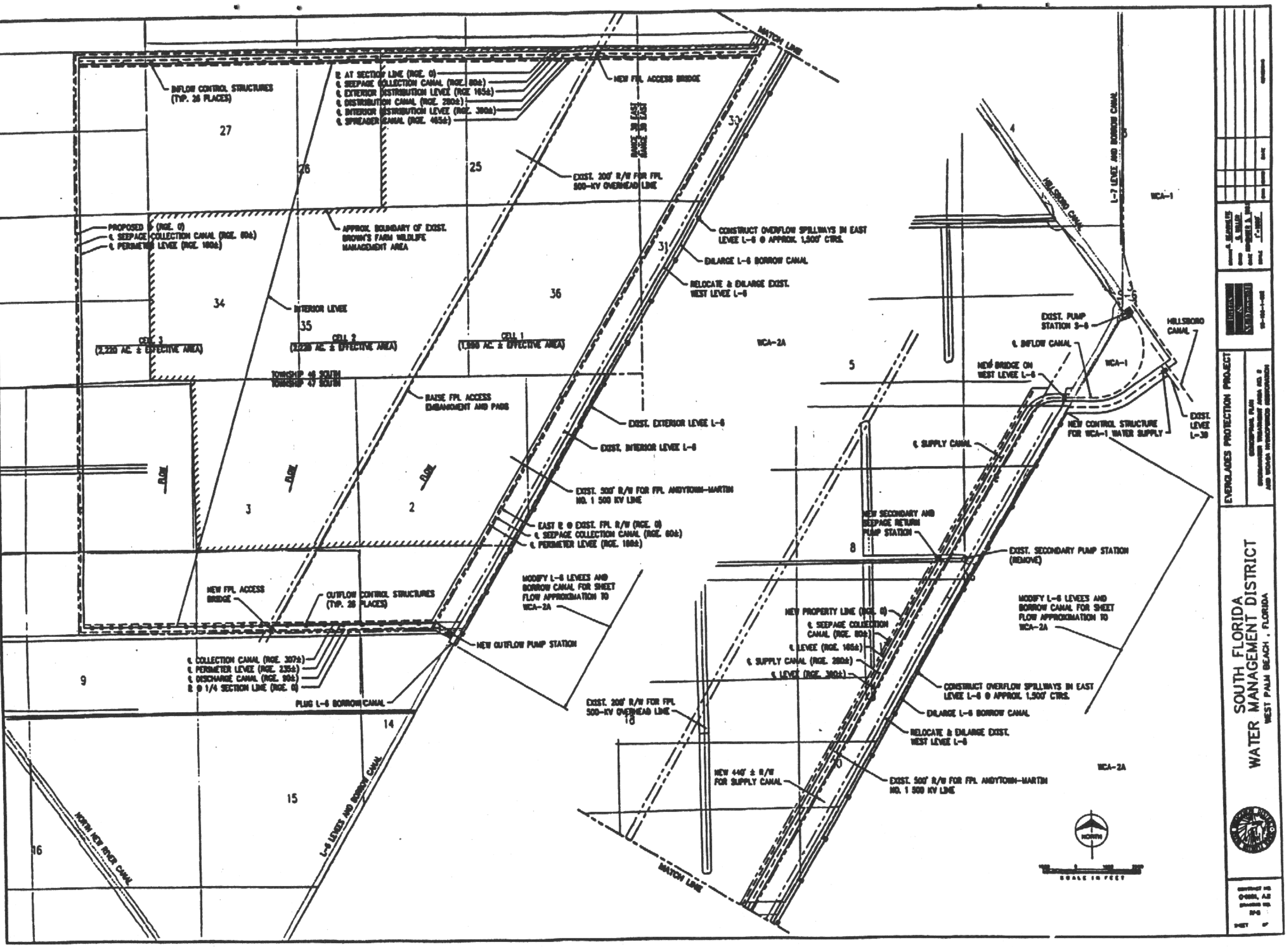
Average annual inflow volumes and loads on which the design of STA-2 is based are projected to include 174,641 acre-feet and 33,764 kilograms of total phosphorus (ave. inflow TP concentration of 0.157 gm/m^3), composed of the following:

- 133,230 acre-feet and 23,459 kilograms total phosphorus from the S-6/S-2 Basin (see Table III-5), reduced using the areal adjustment factors for the S-6/S-2 basin shown in Table III-6 to reflect the conversion of 1,130 acres of the S-6 Basin to use in STA-2. The net inflow volumes and loads from the S-6/S-2 Basin are 131,676 acre-feet and 23,166 kilograms total phosphorus.

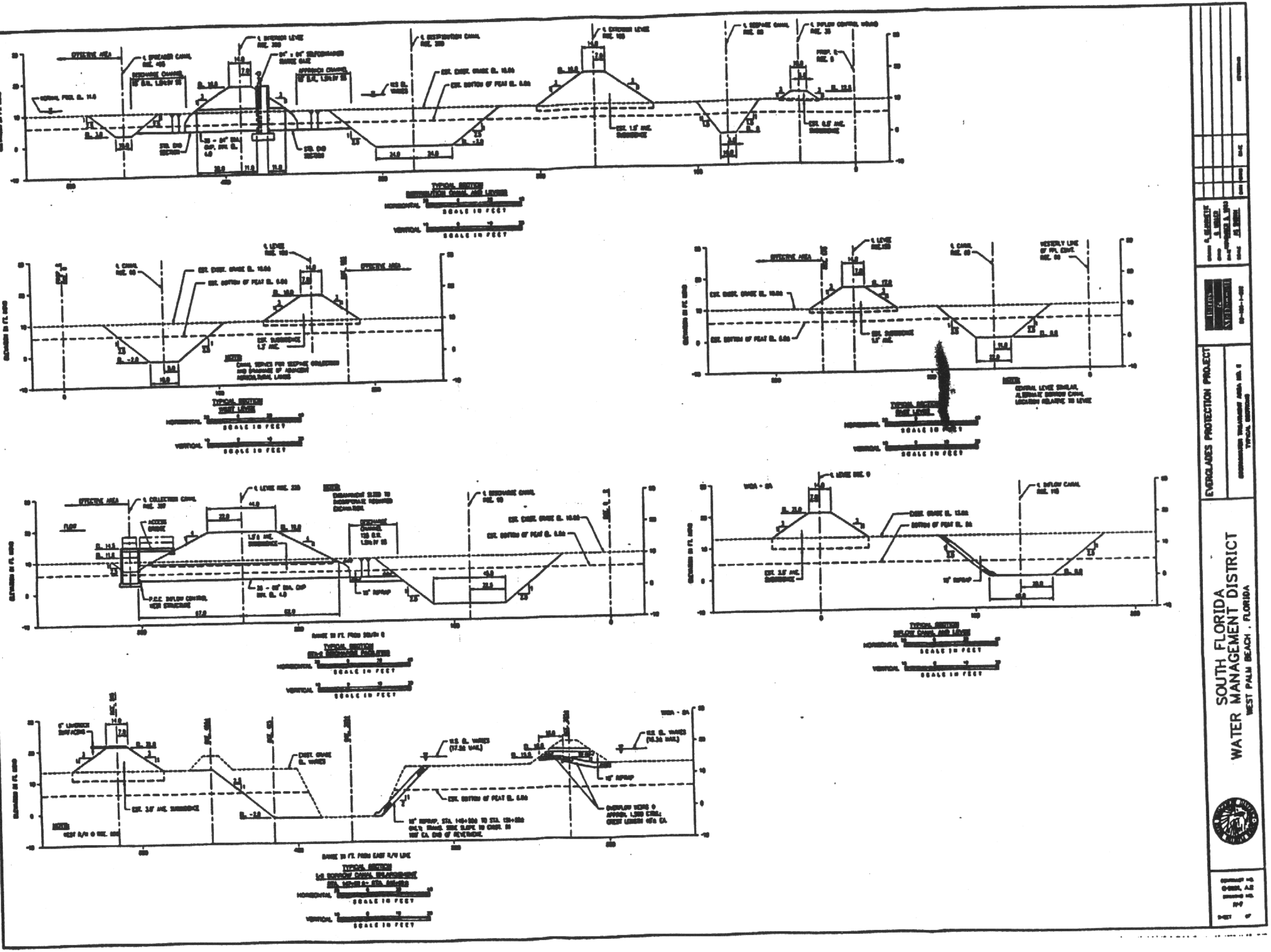
- 2,901 acre-feet and 294 kilograms total phosphorus from Lake Okeechobee, equal to historic Lake releases discharged through Pump Station S-6 during the 1979-1988 base period.

- Eighty percent of runoff volumes and loads diverted from the S-5A Basin to the Hillsboro Canal, and 64 percent of the volumes and loads now discharged from the East Shore Water Control District (ESWCD) and the 715 Farms area to Lake Okeechobee. The relative contribution of those areas to STA-2 are estimated to be:

  - 31,680 acre-feet and 8,160 kilograms total phosphorus from the S-5A Basin.



SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA
EVERGLADES PROTECTION PROJECT
INFLOW CONTROL STRUCTURES (TYP. 26 PLACES)
℄ AT SECTION LINE (RGE. 0)
℄ SEEPAGE COLLECTION CANAL (RGE. 80±)
℄ EXTERIOR DISTRIBUTION LEVEE (RGE 165±)
℄ DISTRIBUTION CANAL (RGE. 280±)
℄ INTERIOR DISTRIBUTION LEVEE (RGE. 390±)
℄ SPREADER CANAL (RGE. 465±)
NEW FPL ACCESS BRIDGE
RANGE 38 EAST
RANGE 39 EAST
EXIST. 200' R/W FOR FPL 500-KV OVERHEAD LINE
PROPOSED ℄ (RGE. 0)
℄ SEEPAGE COLLECTION CANAL (RGE. 80±)
℄ PERIMETER LEVEE (RGE. 180±)
APPROX. BOUNDARY OF EXIST. BROWN'S FARM WILDLIFE MANAGEMENT AREA
CONSTRUCT OVERFLOW SPILLWAYS IN EAST LEVEE L-6 @ APPROX. 1,500' CTRS.
ENLARGE L-6 BORROW CANAL
RELOCATE & ENLARGE EXIST. WEST LEVEE L-6
INTERIOR LEVEE
CELL 3 (2,220 AC. ± EFFECTIVE AREA)
CELL 2 (2,220 AC. ± EFFECTIVE AREA)
CELL 1 (1,800 AC. ± EFFECTIVE AREA)
TOWNSHIP 46 SOUTH
TOWNSHIP 47 SOUTH
RAISE FPL ACCESS EMBANKMENT AND PADS
EXIST. EXTERIOR LEVEE L-6
EXIST. INTERIOR LEVEE L-6
FLOW
EXIST. 500' R/W FOR FPL ANDYTOWN-MARTIN NO. 1 500 KV LINE
EAST ℄ @ EXIST. FPL R/W (RGE. 0)
℄ SEEPAGE COLLECTION CANAL (RGE. 60±)
℄ PERIMETER LEVEE (RGE. 180±)
MODIFY L-6 LEVEES AND BORROW CANAL FOR SHEET FLOW APPROXIMATION TO WCA-2A
NEW FPL ACCESS BRIDGE
OUTFLOW CONTROL STRUCTURES (TYP. 26 PLACES)
NEW OUTFLOW PUMP STATION
℄ COLLECTION CANAL (RGE. 307±)
℄ PERIMETER LEVEE (RGE. 235±)
℄ DISCHARGE CANAL (RGE. 90±)
℄ @ 1/4 SECTION LINE (RGE. 0)
PLUG L-6 BORROW CANAL
L-6 LEVEES AND BORROW CANAL
NORTH NEW RIVER CANAL
MATCH LINE
WCA-2A
WCA-1
L-7 LEVEE AND BORROW CANAL
HILLSBORO CANAL
EXIST. PUMP STATION S-6
℄ INFLOW CANAL
NEW BRIDGE ON WEST LEVEE L-6
NEW CONTROL STRUCTURE FOR WCA-1 WATER SUPPLY
EXIST. LEVEE L-39
℄ SUPPLY CANAL
NEW SECONDARY AND SEEPAGE RETURN PUMP STATION
EXIST. SECONDARY PUMP STATION (REMOVE)
NEW PROPERTY LINE (RGE. 0)
℄ SEEPAGE COLLECTION CANAL (RGE. 80±)
℄ LEVEE (RGE. 165±)
℄ SUPPLY CANAL (RGE. 280±)
℄ LEVEE (RGE. 380±)
CONSTRUCT OVERFLOW SPILLWAYS IN EAST LEVEE L-6 @ APPROX. 1,500' CTRS.
ENLARGE L-6 BORROW CANAL
RELOCATE & ENLARGE EXIST. WEST LEVEE L-6
EXIST. 200' R/W FOR FPL 500-KV OVERHEAD LINE
NEW 440' ± R/W FOR SUPPLY CANAL
EXIST. 500' R/W FOR FPL ANDYTOWN-MARTIN NO. 1 500 KV LINE
MODIFY L-6 LEVEES AND BORROW CANAL FOR SHEET FLOW APPROXIMATION TO WCA-2A
NORTH
SCALE IN FEET


SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH , FLORIDA
EVERGLADES PROTECTION PROJECT

- 4,380 acre-feet and 986 kilograms total phosphorus from the ESWCD.

- 4,004 acre-feet and 1,158 kilograms total phosphorus from the 715 Farms area.

a. <u>Description of Physical Facilities</u>

Existing Pump Station S-6 will serve as the inflow pumping station to STA-2. This station presently discharges to the Hillsboro Canal in WCA-1; the Hillsboro Canal will be plugged downstream of S-6, and a new inflow canal and levee constructed to direct S-6 discharges to and across the L-6 levee and borrow canal system. That inflow canal will discharge to the upper end of a new supply canal, flanked each side by new levees, constructed along and immediately northwest of an existing Florida Power & Light (FPL) right-of-way along and adjacent to the Levee L-6 right-of-way.

The new supply canal and levees will extend southwesterly from the north line of Section 9, T.46 S., R.38 E. a distance of approximately 18,500 feet to the north line of Section 30, T.46 S., R.38 E. (the north line of the Brown's Farm Wildlife Management Area), where it will discharge to the STA-2 inflow distribution canal. The new supply canal will interrupt an existing secondary canal serving a total (permitted) area of 9,980 acres, requiring replacement of an existing local drainage district pumping station (445 cfs capacity) on and tributary to the L-6 Borrow Canal.

The supply canal will discharge to a distribution canal and parallel levees extending across the northern perimeter of STA-2. A series of inflow control structures will discharge flows from the distribution canal to the treatment area. Those inflow control structures will consist of culverts equipped with sluice gates to permit both partial closure (throttling to facilitate an even distribution of flow) and full closure in the event it is desired to remove one of more cells of STA-2 from service.

STA-2 will be divided into three parallel cells through construction of interior levees. The interior levee separating the two easternmost cells will consist of enlargement of an existing FPL access embankment recently constructed for FPL's Andytown-Martin No. 2 500-kV overhead power transmission line. Access pads to pole foundations at intervals of 1/4-mile will be enlarged (raised) as well. Flows will pass through STA-2 from north to south, and will be discharged through a series of outflow control structures (situated in a new perimeter levee along the southerly edge of STA-2) to a new discharge canal. The outflow control structures will consist of culverts with fixed weirs at their upstream ends, and will be otherwise uncontrolled.

The new discharge canal will extend across the southerly perimeter of STA-2, and will convey treatment area discharges easterly to a new outflow pump station situated at the southeasterly corner of STA-2. That new outflow pump station will discharge to the L-6 Borrow Canal, which will be modified as discussed for the WCA-2A Hydroperiod Restoration works.

(1) Inflow Pumping Stations: Existing Pump Station S-6, which has a nominal capacity of 2,925 cfs, will serve as the primary inflow station for STA-2.

A second inflow pump station will be situated on the supply canal between S-6 and STA-2, and will replace the function of an existing secondary pump station having a nominal (permitted) capacity of 445 cfs. The primary mechanical end control equipment now housed in the existing pumping station will be salvaged and reused in the new pumping station. In addition, this station will house new seepage return pumps; the design capacity of the seepage return pumps will be determined during detailed design. An allowance of 75 cfs is included therefore in this conceptual design.

These new seepage return pumps will serve the westerly and northerly perimeter of STA-2, as well as the westerly perimeter of the supply canal and levees extending between S-6 and STA-2.

Seepage along the easterly perimeter of STA-2 and the supply canal will be directed southwesterly to the new discharge canal, and lifted directly to the L-6 Borrow Canal by the new outflow pump station.

(2) Outflow Pumping Station: The new outflow pumping station for STA-2 is intended to have a nominal capacity of 3,370 cfs, equal to the combined capacity of existing Pump Station S-6 and the existing secondary pump station to be replaced.

(3) Brown's Farm: No clearing, discing, or other special preparations will be conducted on the treatment area lands now occupied by the Brown's Farm Wildlife Management Area.

b. STA-2 Land Acquisition

Acquisition of the following lands will be necessary for development of Stormwater Treatment Area No. 2, all in Palm Beach County.

(1) Township 46 South, Range 38 East:

- That part of Section 26 not presently included in T.I.I.T.F. holdings for the Brown's Farm Wildlife Management Area.

- Section 27 in its entirety.

- Approximately the east three-quarters of the east half of Sections 28 and 33; the west line of this acquisition will be adjusted as required to obtain the required effective treatment area.

(2) Township 47 South, Range 38 East:

- The east half of Section 4, and the east quarter of the west half of Section 4.

- The east half of the north half, and the east quarter of the west half of the north half of Section 9.

The west lines of the above two acquisitions will be adjusted as required to obtain the required effective treatment area.

- The north half of Section 10.

(3) Township 46 South, Range 39 East: A strip of land up to 440 feet in width lying along and westerly of the westerly line of a Florida Power & Light (FPL) right-of-way lying adjacent to the Levee L-6 right-of-way in Sections 8, 9, 17, 19 and 20.

In addition to the above lands, STA-2 will also occupy all publicly held lands now situated in the Brown's Farm Wildlife Management Area, as well as those publicly held lands in the north half of Section 11, T.46 S., R.38 E. now leased to private interests.

2. WCA-2A HYDROPERIOD RESTORATION

The existing L-6 levees and borrow canal will be modified to result in a sheet flow approximation along the northwesterly perimeter of WCA-2A, restoring hydroperiod in this normally overdrained area. This modification will extend from the new outflow pump station for STA-2 northeasterly to the STA-2 inflow canal from S-6, a total length of approximately 39,750 feet. Through that reach, existing grade elevations in WCA-2A along the existing east Levee L-6 vary from approximately 12.5 to 13.9 feet NGVD, averaging roughly 13.4 feet NGVD.

A length of approximately 14,750 feet of the L-6 system extending southwesterly from the STA-2 outflow pump station to the North New River Canal will not be modified. Through this reach, existing grade elevations along east Levee L-6 vary from 12.5 NGVD to 10.5 ft NGVD, averaging roughly 11.4 ft NGVD. Exclusion of this area from the hydroperiod restoration works is considered justified in light of its lower elevation and proximity to existing Pump Station S-7, suggesting a lesser need for restoration of hydroperiod.

In addition to the restoration of sheet flow to the northwesterly perimeter of WCA-2A, these works include facilities for the delivery of treated water from STA-2 to Water Conservation Area No. 1 (WCA-1), providing a possible means to augment inflows to WCA-1 during extended drought conditions.

a. <u>Description of Physical Works</u>

The WCA-2A Hydroperiod Restoration plan component includes the following physical works:

- Relocation and enlargement of existing West Levee L-6.
- Modification of existing East Levee L-6 for direct discharge to WCA-2A.
- Enlargement of the L-6 Borrow Canal.
- A new canal and control structure connecting the enlarged L-6 Borrow Canal to the Hillsboro Canal in WCA-1 (WCA-1 Water Supply).

(1) West Levee L-6: The existing West Levee L-6 will be relocated to a line approximately 60 feet westerly of its present location, and will be raised to elevation 21.0 feet NGVD (the design top of levee an elevation for East Levee L-6), replacing the WCA-2A containment function of existing East Levee L-6. It will also be necessary, in connection with this work, to modify existing FPL access pads extending northwesterly from existing West Levee L-6 at 1/4-mile intervals to maintain access to overhead transmission line pole foundations.

(2) East Levee L-6: East Levee L-6 will be modified to permit the direct discharge of the 3,370 cfs nominal capacity of the STA-2 outflow pump station to WCA-2A along the full 39,750 feet length of L-6 modifications. For a fully uniform flow distribution, the resultant unit discharge in WCA-2A would be 0.085 cfs/ft. Given an estimated surface gradient in WCA-2A of approximately 0.00006 ft/ft, the maximum depth of flow immediately east of East Levee L-6 is estimated to be 2.3 feet, resulting in a water surface elevation along East Levee L-6 varying from 14.8 to 16.2 feet NGVD, averaging roughly 15.7 feet NGVD.

A series of overflow weirs will be constructed in East Levee L-6; for this conceptual design, a spacing of approximately 1,500 feet is assumed. The minimum weir crest elevation will be established at 15.5 feet NGVD; crest elevations and/or lengths will vary along the length of L-6 to correspond to the calculated water surface elevation in the enlarged L-6 Borrow Canal. Each weir will have a crest width of 16 feet, and a length of roughly 48 feet. Crests will be constructed of reinforced concrete to facilitate vehicular traffic; slopes downstream (east) of the weirs will be revetted with stone riprap for erosion control.

In addition, the East Levee L-6 embankment will be removed to elevation 18.0 feet NGVD throughout its length, affording an increased width of travelled way. Excavated material will be spoiled along the existing embankment.

(3) L-6 Borrow Canal: The existing L-6 Borrow Canal will be enlarged through excavation of its westerly bank. The required extent of enlargement will be that necessary to provide sufficient materials for relocation and enlargement of West Levee L-6, and raising access ramps to FPL power pole pads along L-6. The enlarged canal is anticipated to have a bottom width of approximately 70 feet at elevation -2.0 feet NGVD, and a top width (at elevation 13.5 feet NGVD) of roughly 125 feet.

(4) WCA Water Supply: A new canal will be extended from the northerly end of the modified L-6 Borrow Canal to the Hillsboro Canal, and a new control structure established in existing Levee L-39 to permit the discharge of treated water from STA-2 to the Hillsboro Canal in WCA-1. The desired capacity of these facilities is presently indeterminate.

This conceptual design is based on delivery of 1,120 cfs (one-third the capacity of the STA-2 outflow pump station) to WCA-1 given a water surface elevation in the Hillsboro Canal of 14.0 feet NGVD; a water surface elevation immediately upstream of Levee L-39 of 15.0 feet NGVD; and a water surface elevation at the southerly end of the modified L-6 Borrow Canal of 15.5 feet NGVD (equal to the minimum crest elevation for overflow spillways to WCA-2A).

The control structure is expected to consist of the hydraulic equivalent of three 120-inch diameter culverts, each equipped with vertical lift gates housed in a reinforced concrete gate structure.

b. Land Acquisition

All lands required for construction of the WCA-2A Hydroperiod Restoration works are situated within the existing right-of-way for Levee L-6, with the exception of roughly 110 acres in the immediate vicinity of Pump Station S-6; those lands are primarily in WCA-2A, with a small percentage in WCA-1. As a result, no land acquisition will be necessary for the WCA-2A Hydroperiod Restoration.

G. S-7/S-8 BASINS

This section describes proposed modifications and improvements in the S-7 and S-8 basins. The primary objectives of these improvements are to:

- Reduce the total phosphorus load discharged to the Everglades Protection Area from those basins.

- Restore hydroperiod along the northerly perimeter of Water Conservation Area 3A along a 9.25-mile length of the L-5 levee system extending west from the North New River Canal.

Primary plan components of the S-7/S-8 Basin improvements include:

- A new stormwater treatment area, designated Combined Stormwater Treatment Area 3 and 4, intended to, acting in combination with the implementation of BMPs as required under the Chapter 40E-63 Rule, reduce the long-term flow-weighted average total phosphorus concentration in discharges from the S-7/S-2 Basin and the S-8/S-3 Basin (and, to a lesser extent, contributions from other sources) to the interim goal of 0.05 gm/m^3.

- East WCA-3A Hydroperiod Restoration works, consisting of a modification of the L-5 levees and borrow canal to result in an approximation of sheet flow onto WCA-3A.

- Stormwater Treatment Area No. 6 (STA-6), intended to, acting in combination with the implementation of BMPs as required under the Chapter 40E-63 Rule, reduce the long-term flow-weighted average total phosphorus concentration in discharges from a selected area of the S-8/S-3 Basin to the interim goal of 0.05 gm/m^3.

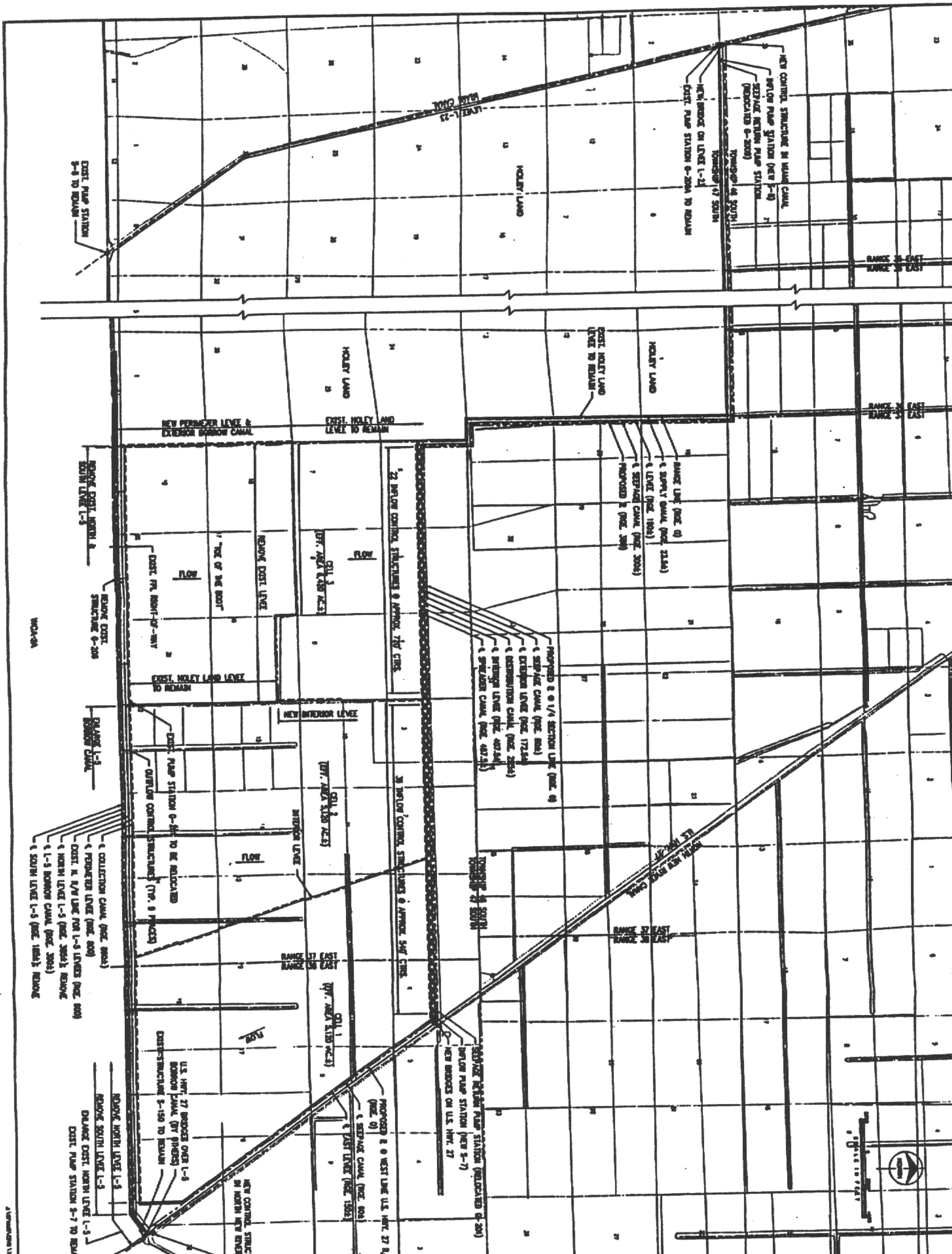
Discharges from STA-6 would serve as a source of treated water supply for the L-28 Water Supply and West WCA-3A Hydroperiod Restoration works described in Section B of this Part IV.

1. <u>COMBINED STORMWATER TREATMENT AREA 3 AND 4</u>

The Combined Stormwater Treatment Area 3 and 4 (STA-3/4) will be developed to provide a total effective treatment area of 16,660 acres, extending generally from the Holey Land to U.S. Highway 27 (along the North New River Canal), and north approximately 3.5 miles from the L-5 levee and canal system. Lands to be converted to use in STA-3/4 include approximately 13,070 acres of privately held lands in the S-7 Basin; the remaining 3,590 acres of effective treatment area will be obtained through use of the "Toe of the Boot" addition to the Holey Land as an integral part of STA-3/4.

STA-3/4 is intended to accommodate inflows from the following sources:

- Historic runoff from the S-8/S-3 and S-7/S-2 Basins, modified to reflect:
  - Reduced runoff volumes and total phosphorus loads resulting from implementation of BMPs (taken from Table III-5).
  - Reductions in design inflow volumes and loads resulting from the conversion of 13,070 acres of the S-7 Basin to use in STA-3/4, using the areal adjustment factors listed in Table III-6.
  - Reductions in design inflow volumes and loads resulting from the conversion of 1,450 acres of the S-7 Basin to use in STA-2 (see

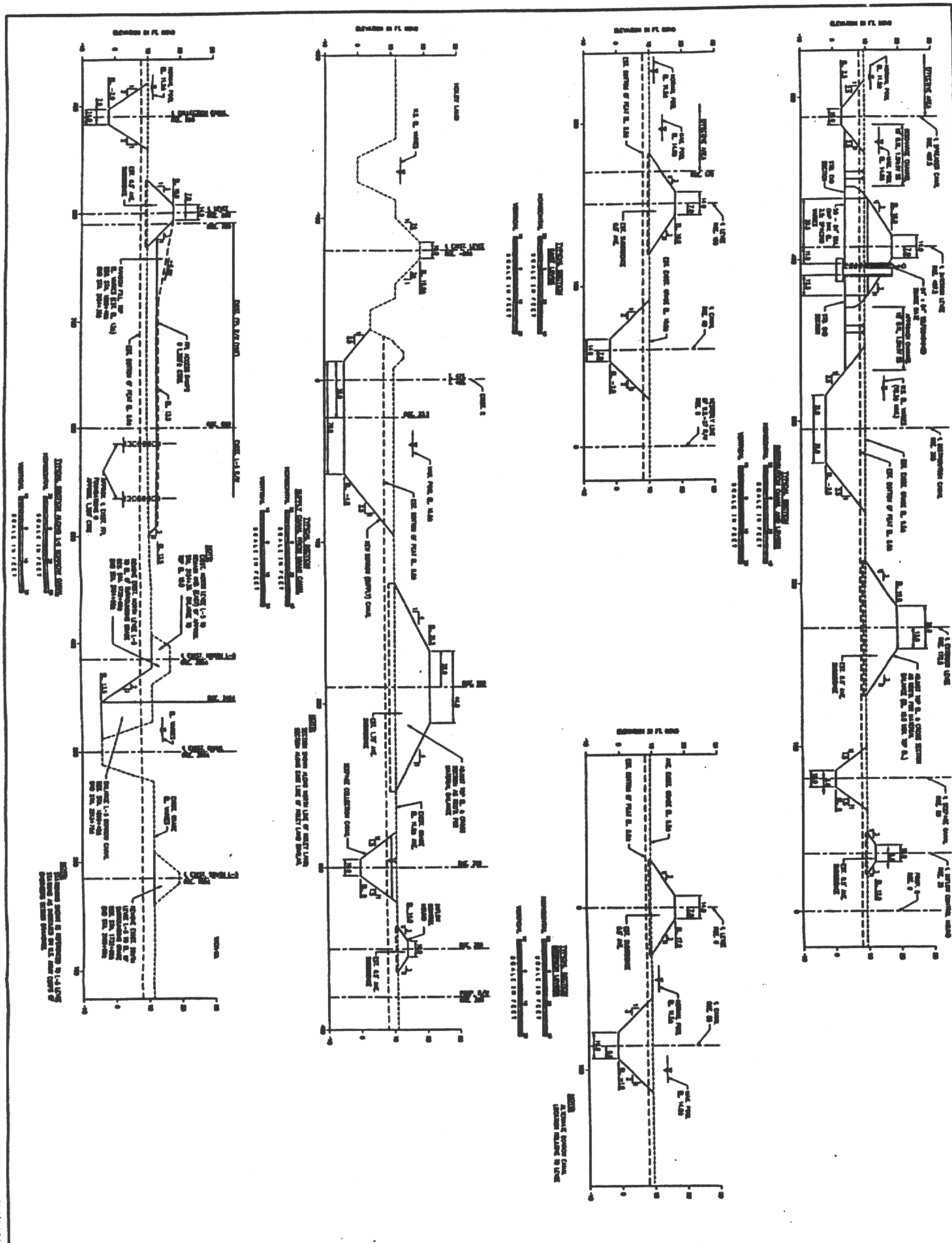


SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA

EVERGLADES PROTECTION PROJECT

CONCEPTUAL PLAN
STORMWATER TREATMENT AREA NO. 3/4
AND EAST WCA-3A HYDROPERIOD RESTORATION

Burns & McDonnell



SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH, FLORIDA

EVERGLADES PROTECTION PROJECT

Section F of this Part IV), using the areal adjustment factors listed in Table III-6.

- The removal of 11,200 acres from the S-8/S-3 Basin (STA-6 and its tributary area), using the areal adjustment factors listed in Table III-6.

- Reductions in design inflow volumes and loads resulting from the conversion of 4,530 acres of the S-8 Basin to use in STA-5, using the areal adjustment factors listed in Table III-6.

- Historic discharges from Pump Station S-8 originating in the C-139 Basin and delivered to the Miami Canal through Structure G-136 and the L-1E Canal.

- Historic regulatory releases from Lake Okeechobee discharged to the Everglades Protection Area (EPA) through Pumping Station S-7, Pumping Station S-8, and Structure S-150.

- Historic discharges from the South Florida Conservancy District Unit No. 5 (SFCD) and South Shore Drainage District (SSDD), diverted from Lake Okeechobee to the Miami Canal. As discussed in Section C of this Part IV, 67 percent of these diverted volumes and loads are assumed delivered to STA-3/4; the remaining 33 percent is assumed delivered to Lake Okeechobee through Pumping Station S-3.

- An allowance for additional Lake Okeechobee releases as water supply for the Everglades.

A summary of the design average annual inflow volumes and total phosphorus loads to STA-3/4 is presented in Table IV-2.

Table IV-2

STA-3/4 DESIGN INFLOWS

Source	Average Annual Inflow Volume (ac-ft)	TP Load (Kg)	TP Conc. (gm/m³)
S-7/S-2 Basin			
- Gross Inflow	184,460	23,484	0.103
- Reduction for lands used in STA-3/4	(20,866)	(3,104)	0.121
- Reduction for lands used in STA-2	(2,315)	(344)	0.121
- Net Inflow	161,279	20,036	0.101
S-8/S-3 Basin			
- Gross Inflow	195,680	49,397	0.205
- Reduction for lands used in STA-5	(7,865)	(1,913)	0.197
- Reduction for lands diverted to STA-6	(19,444)	(4,731)	0.197
- Net Inflow	168,371	42,753	0.205
C-139 Basin (@ G-136)	10,605	693	0.053
SFCD (67%)	9,380	1,574	0.136
SSDD (67%)	2,787	344	0.100
Subtotal, all private sources	352,422	65,400	0.150
Historic Lake Okeechobee Reg. Releases	15,956	1,390	0.071
Additional Lake Okeechobee Release	236,375	20,410	0.070
TOTAL INFLOW	604,753	87,200	0.120

The average annual allowance of 236,375 acre-feet for additional releases from Lake Okeechobee is slightly greater than the total volumetric reduction resulting from implementation of BMPs throughout the regulated area of the EAA (difference of 208,549 acre-feet obtained by comparison of data in Tables III-3 and III-4).

a. Description of Physical Facilities

STA-3/4 is intended to treat all flows in the Miami Canal and North New River Canal (other than water supply releases from Lake Okeechobee intended for the Lower East Coast) which would otherwise be discharged to the EPA through Pump Station S-7, Pump Station S-8, and Structure S-150. Inflows to STA-3/4 will be delivered from the Miami Canal through construction of a new inflow pump station (New S-8) near the northwest corner of the Holey Land and a conveyance canal and levee along the north and east perimeter of the Holey Land. Inflows to STA-3/4 will be delivered from the North New River Canal through construction of a second new inflow pump station (New S-7) at the northeasterly corner of STA-3/4, immediately west of U.S. Highway 27.

The new inflow pump stations will both discharge to a common distribution canal and parallel levees extending across the northern perimeter of STA-3/4. A series of inflow control structures will discharge flows from the distribution canal to the treatment area. Those inflow control structures will consist of culverts equipped with sluice gates to permit both partial closure (throttling to facilitate an even distribution of flow) and full closure in the event it is desired to remove one or more cells of STA-3/4 from service.

STA-3/4 will be divided into three parallel cells through construction of interior levees. Flows will pass through STA-3/4 from north to south.

A new collection canal and perimeter levee will be constructed along the south perimeter of STA-3/4. These facilities will be situated immediately north of an existing FPL right-of-way along and adjacent to the existing right-of-way for Levee L-5. This new perimeter levee will replace the WCA-3A containment function now provided by the south Levee L-5, which will be removed as discussed under the description of the East WCA-3A Hydroperiod Restoration works.

The collection canal in each of the three cells will discharge through the south perimeter levee at three locations; those discharge points will be controlled by normally open outflow control structures. Those outflow control culverts will discharge to new stub canals extending south from the perimeter levee to the L-5 Borrow Canal.

Discharges from STA-3/4 will then be distributed along the perimeter of WCA-3A and to existing Pump Station S-7 (which will serve as an outflow pump station) as discussed under the description of the East WCA-3A Hydroperiod Restoration works.

(1) <u>New Inflow Pump Stations</u>: The new inflow pump stations will replace the flood protection function of existing Pump Station S-7 and S-8, and will therefore be provided the same nominal discharge capacity (4,170 cfs for the New S-8, and 2,490 cfs for the New S-7).

(2) <u>Supply Canal from Miami Canal</u>: This facility will be approximately 60,000 feet in length, and is intended to deliver the nominal capacity of New S-8 (4,170 cfs) to the westerly end of the STA-3/4 distribution canal with a maximum tailwater elevation at New S-8 at or below elevation 17.0 feet NGVD. The new canal will consist of a major enlargement of the existing seepage collection canal along the north and east perimeters of the Holey Land. Material excavated for the supply canal will be placed in an adjacent and parallel levee, the final crest elevation and cross section of which will be adjusted as required to obtain a material balance.

As stages in the new supply canal will normally be above surrounding grade elevations, a new seepage collection canal and inflow control mound will be constructed along the exterior perimeter of the supply canal.

A new seepage return pump station will lift accumulated seepage back into the supply canal. This station is anticipated to consist of a relocation of existing pump Station G-200B (Holey Land seepage return pump station).

(3) Connection at North New River Canal: A short new supply canal, crossing U.S. Highway 27, will feed the New S-7 pump station. Development of this canal will require the construction of two new bridges on U.S. Highway 27, which will have been expanded to a four-lane divided roadway prior to construction of STA-3/4.

(4) Seepage Return Along North Perimeter: Water surface elevations in the distribution canal along the north perimeter of STA-3/4 will typically be above surrounding grade elevations. A seepage collection canal and inflow control mound will be constructed along the north property line. Accumulated seepage will be directed to the east, where it will be lifted into the distribution canal by a seepage return pumping station. That seepage return pump station is presently anticipated to consist of a relocation of existing Pumping Station G-201 (existing seepage return pump station at the southeast corner of the "Toe of the Boot" addition to the Holey Land).

(5) "Toe of the Boot": A new levee will be constructed along the west line of the "Toe of the Boot," separating that area from the balance of the Holey Land. The existing levee along the north line of the "Toe of the Boot" will be degraded (removed) to elevation 12.0 feet NGVD to permit sheet flow from north to south. The existing levee along the east line of the "Toe of the Boot" will remain in place, and will form a part of the interior levee separating the two westernmost cells of STA-3/4.

Existing Pumping Station G-201, located at the southeast corner of the "Toe of the Boot," will be removed from service, and primary mechanical and control equipment relocated to the new seepage return pump station at the northeast corner of STA-3/4.

Existing Structure G-206, located at the L-5 levee system and which presently discharges to WCA-3A, will be removed.

(6) <u>Outflow Control Structures</u>: Three outflow control structures will serve each cell of STA-3/4. The nominal design capacity of each of these structures is 740 cfs, equal to one-ninth of the peak design inflow from New S-8 and New S-7 of 6,660 cfs. These structures are expected to consist of a reinforced concrete spillway with a single vertical lift roller gate, and will normally be full open. They would be closed only when it is desired to remove the cell they control from service.

b. <u>Combined STA-3/4 Land Acquisition</u>
Acquisition of the following lands will be necessary for development of Combined Stormwater Treatment Area 3 and 4, all in Palm Beach County.

(1) <u>Township 47 South, Range 38 East</u>:

- That part of Sections 8, 16, 17, and 21, and that part of the south half of Section 6, lying west of the west right-of-way line of U.S. Highway 27, except that part of Section 21 in Florida Power & Light Company (FPL) right-of-way.

- Sections 7, 18, 19 and 20, except that part of Sections 19 and 20 in FPL right-of-way along and adjacent to Levee L-5.

(2) <u>Township 47 South, Range 37 East</u>:

- The south half of Sections 1, 2, 3, 4, 5, and 6.

- Sections 7 through 15, inclusive, in their entirety.

- Sections 22 through 24 in their entirety.

- The north half of the north half of Section 16.

- The west 380 feet of the north half of Section 6.

(3) Township 46 South, Range 37 East:

- The west 380 feet of Sections 19, 30, and 31.

- The south 380 feet of Section 31, extending from the west line of Section 31 to a point 380 feet easterly of the northwest corner of Section 6, T.47 S., R.37 E.

- The west 380 feet of the south 380 feet of Section 18.

(4) Township 46 South, Range 36 East: The south 380 feet of Sections 31-36, inclusive.

(5) Township 46 South, Range 35 East:

- The south 380 feet of Section 36 (publicly held lands presently leased to private interests).

- The south 380 feet of that part of Section 35 lying east of the east right-of-way line for Levee L-23.

In addition to the above lands to be acquired, the Combined STA-3/4 will also incorporate publicly held lands in the Toe of the Boot addition to the Holey Land, which encompasses Sections 17-21, inclusive, the south half of Section 16, and the south half of the north half of Section 16, all in Township 47 South, Range 37 East.

c. Disposition of Existing Structures

Existing Pumping Stations S-7 and S-8, and existing Structure S-150, will all remain in place and operational. Pumping Station S-7 will serve as an outflow pump station for STA-3/4. Both S-7 and S-8 will be used for Lower East Coast water supply deliveries, as well as for hydraulic bypass of STA-3/4 when required by hydrologic or operational constraints.

2. <u>EAST WCA-3A HYDROPERIOD RESTORATION</u>

The existing L-5 levees and borrow canal will be modified to result in a sheet flow approximation along the northerly perimeter of WCA-3A adjacent to STA-3/4, restoring hydroperiod in this normally overdrained area. This modification will extend from the North New River Canal westerly to the west line of STA-3/4, a total distance of approximately 48,000 feet. Through that reach, existing grade elevation in WCA-3A along the existing South Levee L-5 vary from approximately 11.0 feet NGVD to 12.2 feet NGVD, averaging roughly 11.7 feet NGVD.

The peak design discharge from STA-3/4 is established at the maximum combined inflow from New S-7 and New S-8 of 6,660 cfs; that peak discharge will seldom be experienced, given the significant inflow attenuation effect of STA-3/4. Discharges approaching that design peak will be divided; up to 2,490 cfs will be routed east through the L-5 Borrow Canal to existing Pumping Station S-7, which will then discharge to the North New River Canal in WCA-2A. The balance of the peak discharge from STA-3/4 (up to 4,170 cfs) will be directed to WCA-3A along a 46,600 foot length, resulting in an average peak unit discharge of 0.09 cfs/ft. Unit discharges are expected to vary from 0.07 to 0.11 cfs/ft under peak discharge conditions, reflecting variations in both the ground surface elevation in WCA-3A and in the water surface elevation in the L-5 Borrow Canal.

Given an estimated surface gradient in WCA-3A of 0.00005 ft/ft, the estimated water surface elevation in the L-5 Borrow Canal (enlarged as subsequently discussed) under a peak (total) discharge of 6,660 cfs varies from 13.0 ft NGVD at the North New River Canal to 13.9 ft NGVD at the west line of STA-3/4.

a. Description of Physical Works

The East WCA-3A Hydroperiod Restoration plan component includes the following physical works:

- Removal of existing North and South Levee L-5 all along the southerly perimeter of STA-3/4, a total length of roughly 46,200 feet.

- Enlargement of the L-5 Borrow Canal for increased conveyance, extending from the North New River Canal west a distance of approximately 32,300 feet.

- Construction of a new gated spillway in the North New River Canal immediately upstream of the L-5 and L-6 Borrow Canals.

(1) North Levee L-5: The existing North Levee L-5 will be removed to surrounding grade elevation all along the south perimeter of STA-3/4. Material excavated from this levee will be used to provide new access ramps and pads for existing FPL power poles, with longitudinal access obtained along the new perimeter levee along the south line of STA-3/4. The balance of excavated materials will be spoiled as a general area fill.

East of the east line of STA-3/4, the existing North Levee L-5 will remain in place, but will be enlarged and raised to elevation 19.0 ft NGVD.

(2) South Levee L-5: The existing South Levee L-5 will be removed to surrounding grade elevation east from the west line of STA-3/4 a distance of approximately 46,600 feet. Excavated material will be transported north of the L-5

Borrow Canal, where it will be spoiled in a general area fill.

(3) <u>L-5 Borrow Canal Enlargement</u>: The L-5 Borrow Canal will be enlarged over a length of approximately 32,300 feet, extending from the North New River Canal to the southeasterly corner of the "Toe of the Boot" addition to the Holey Land. Enlargement will generally be performed along the north bank only, facilitating placement of excavated materials in a general area spoil fill north of the existing North Levee L-5.

Replacement of an existing roadway bridge carrying U.S. Highway 27 over the L-5 Borrow Canal would be necessary for enlargement of the canal. However, replacement of the existing bridge and construction of a second bridge is presently scheduled for inclusion in a Florida Department of Transportation project for widening and improvement of U.S. 27; the design configuration of the new bridges is consistent with the planned enlargement of the L-5 Borrow Canal, and no cost therefore is included in the conceptual cost estimate for the East WCA-3A Hydroperiod Restoration works.

(4) <u>Gated Spillway in North New River</u>: The development of a sheet flow approximation along the northerly perimeter of WCA-3A will require stages in the L-5 Borrow Canal (and the directly connected length of the North New River Canal and L-6 Borrow Canal) to be elevated above optimum stages in the Everglades Agricultural Area. To prevent undesirable impacts on private lands tributary to the North New River Canal north of existing Pumping Station S-7, it will be necessary to construct a new control structure in the North New River Canal.

Definition of the nominal discharge capacity of this structure is somewhat problematic, as it may be operated for any of the following conditions:

- Full or partial bypass of STA-3/4 during runoff events in the S-7 and S-2 Basins.
- Full or partial bypass of STA-3/4 during periods of regulatory release from Lake Okeechobee to the North New River Canal.
- Bypass of STA-3/4 during periods of water supply releases from Lake Okeechobee intended for delivery to Broward County via the North New River Canal.

Full bypass under runoff events in the S-7 and S-2 Basins would require a nominal capacity of 2,490 cfs, equal to the nominal capacity of existing Pump Station S-7. Full bypass of regulatory releases from the Lake would require a nominal capacity of roughly 1,600 cfs (the estimated delivery capacity of the North New River Canal for that condition).

Capital cost estimates summarized in Part V are based on provision of a nominal discharge capacity of 1,600 cfs during periods of regulatory releases from Lake Okeechobee. This structure is anticipated to consist of a two-bay gated spillway with telemetric control.

b. Land Acquisition

All elements of physical construction intended for the East WCA-3A Hydroperiod Restoration plan component (with the exception of spoil fill placement on FPL right-of-way) will be situated within existing rights-of-way or perpetual easements for the Central and South Florida Flood Control Project.

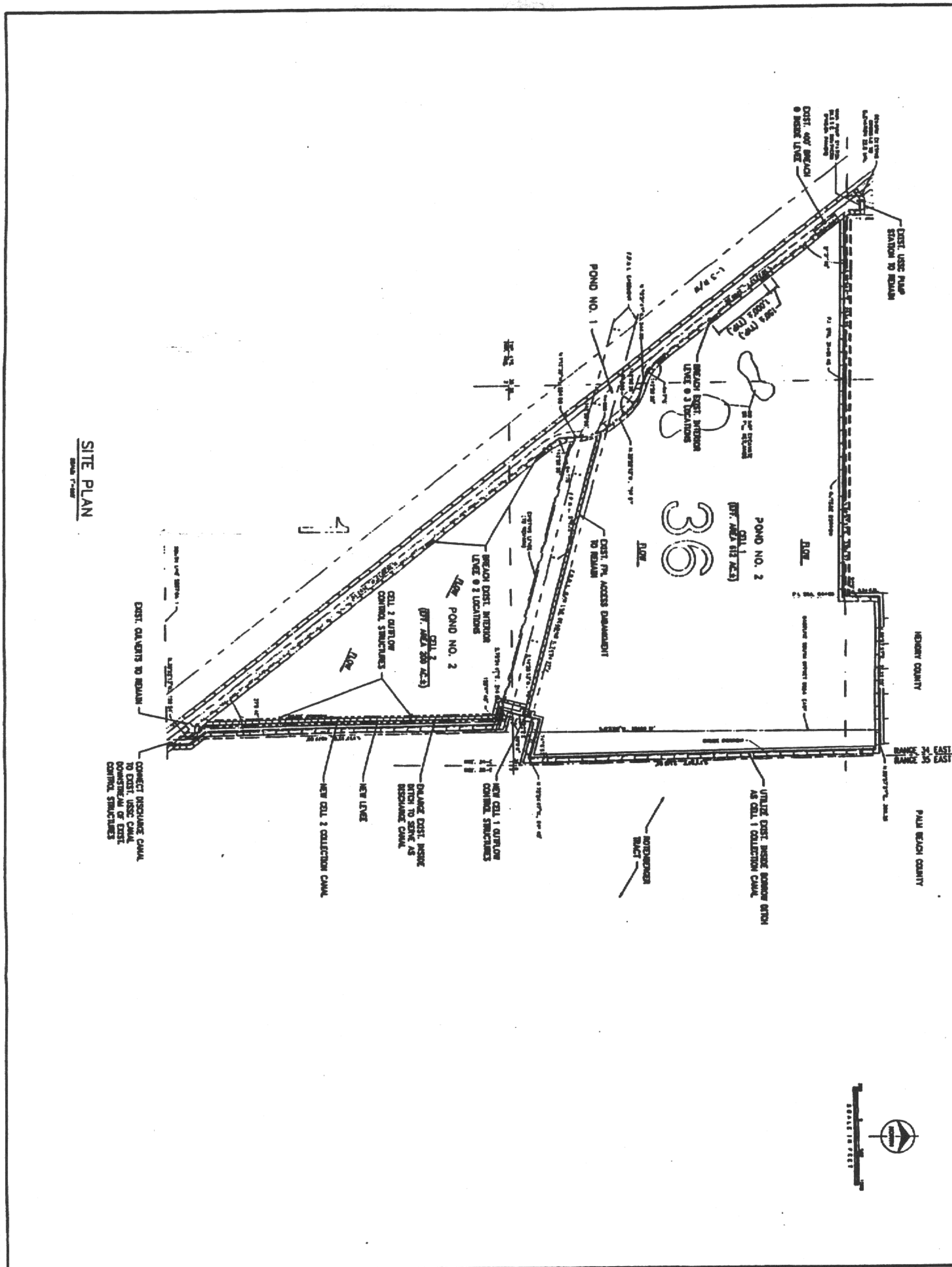
3. STORMWATER TREATMENT AREA NO. 6

Stormwater Treatment Area No. 6 (STA-6) will be developed to provide a total effective treatment area of not less than 812 acres. STA-6 will serve lands under a single ownership, consisting of United States Sugar Corporation's Southern Division Ranch Unit 2. The total area of that single parcel of land is approximately 11,200 acres, situated immediately west of the Rotenberger Tract and north of Levee L-3 in Townships 47 and 48 South, Range 34 East, in Hendry County.

Lands occupied by STA-6 and those lands it serves were historically in the S-8 Basin. As indicated in Table IV-2, average annual runoff volumes and loads diverted from the S-8 Basin to STA-6 are estimated to be 19,444 acre-feet and 4,731 kilograms of total phosphorus, respectively, based on the areal adjustment factors listed in Table III-6. Those same volumes and loads are taken as the gross design inflows to STA-6. Net design inflows are computed by reducing the gross inflows by the product of the effective 812-acre treatment area multiplied by the areal adjustment factors in Table III-6. The net design average annual inflow volumes and loads to STA-6 are then taken as 18,034 acre-feet and 4,388 kilograms of total phosphorus.

STA-6 will occupy lands now in use as a stormwater detention area serving the USSC property. That existing detention basin will be modified to more closely approach the design configuration of a stormwater treatment area.

STA-6 is intended to reduce the long-term flow-weighted average total phosphorus concentration in discharges from USSC's Southern Division Ranch, Unit 2 to the interim goal of 0.05 gm/m^3 prior to their release to the Everglades Protection Area. Water quality data for discharges from the existing detention basin suggest the possibility that no substantive modification of the detention basin would be necessary to meet that objective; however, the data is limited to the extent that a determination to that effect is not presently possible.



SOUTH FLORIDA
WATER MANAGEMENT DISTRICT
WEST PALM BEACH , FLORIDA

EVERGLADES PROTECTION PROJECT

CONCEPTUAL PLAN
STORMWATER TREATMENT AREA NO. 6

Burns & McDonnell

This section describes minimum modifications which should be made to the existing detention area in the event that compliance with the interim goal cannot be adequately documented.

a. Description of Existing Detention Basin

The existing USSC detention basin occupies a triangular area of approximately 1,000 acres generally bounded by the east line of Range 34 East on the east; the northeasterly right-of-way line for Levee L-3 on the southwest; and the north lines of Sections 35 and 36, Township 47 South, Range 34 East on the north. The area is traversed by an existing FPL overhead power transmission line and access embankment which crosses from west to east near the south line of Township 47 South.

An existing USSC pump station delivers runoff from its 10,200-acre service area to the detention basin at the northwest corner of the detention basin. This pump station has an installed capacity of 360 cfs.

Discharges from the pumping station are initially directed to a USSC canal parallelling Levee L-3 and eventually discharging to the L-4 Borrow Canal immediately downstream of Structure G-88. Stages in that canal (designated as "Pond 1") are controlled by a series of culverts with risers situated in the canal at the southerly tip of the detention basin. As inflows to Pond 1 exceed the intended discharge through those control culverts, stages in Pond 1 rise and water is introduced to Pond 2, which includes the bulk of the surface area occupied by the detention basin. Those volumes are subsequently released back to Pond 1 and, eventually, the L-4 Borrow Canal as stages recede in Pond 1.

b. Description of Modified Detention Basin

The existing USSC pump station will remain in service and function as the inflow pumping station for STA-6. The existing canals and levees between that pumping station and the control culverts at the southerly tip of STA-6 will be modified to direct all inflows across the surface of existing Pond 2. Pond 2 will be developed as two parallel treatment cells, separated by the FPL access embankment. Cell 1 will be situated north of the FPL line; Cell 2 will be situated south of the FPL line.

Cell 1 will provide an effective treatment area of approximately 610 acres all north of the FPL right-of-way, 75 percent of the total effective area of STA-6. The design peak rate of flow across Cell 1 is then taken as 270 cfs. Flows will be directed across Cell 1 from west to east. An existing borrow ditch immediately west of an existing levee along the east side of STA-6 will serve as a collection canal for Cell 1. That existing borrow ditch provides a waterway area of roughly 250 square feet below the existing ground surface, and should be adequate for the intended service without enlargement. New outflow control structures will be placed in the FPL access embankment at its intersection with the existing borrow ditch. These structures are anticipated to each consist of an 84-inch diameter CMP with a reinforced concrete weir structure at its upstream end, and will be otherwise uncontrolled. Inflows to Cell 1 will be effected through breaching the existing levee now separating Pond 1 and Pond 2; a total of three new breaches will be provided, each 150 feet in length.

The existing inside borrow ditch along the east line of Cell 2 will be enlarged, and excavated material used to construct a new levee immediately west of the enlarged borrow ditch. That enlarged borrow ditch will then serve as a discharge canal for both Cell 1 and Cell 2. Two outflow control structures will be provided for Cell 2, each discharging through the new levee to the enlarged borrow ditch (discharge canal). These structures are each anticipated to consist of a 48-inch diameter CMP with a reinforced concrete weir structure at its upstream end. As was the case for Cell 1, inflows to Cell 2 will be effected through breaching the existing levee dividing Pond 1 from Pond 2.

The discharge canal will then be routed to intersect the existing USSC discharge canal at a point just downstream of the existing USSC control culverts, which will remain in place and operational, but be normally closed.

It should be noted that this minimum modification to the existing detention basin is developed upon the assumption that the capacity of the inflow pump station will remain at 360 cfs. Any significant increase in that capacity will require further, potentially extensive, modification to STA-6.

c. Land Acquisition

Acquisition for the following lands, all in Hendry County, would be necessary for conversion of the existing privately owned detention basis to use as a publicly owned and operated Stormwater Treatment Area 6.

(1) Township 47 South, Range 34 East:

- That part of Sections 35 and 36 lying east of the easterly right-of-way for Levee L-3.

- The east 2,400 feet of the south 540 feet of Section 25.

(2) Township 48 South, Range 34 East: That part of Section 1 lying east of the easterly right-of-way for Levee L-3.

In addition, it would be necessary to acquire lands presently occupied by the discharge canal from the existing detention basin to the L-4 Borrow Canal, located in the northwest quarter of the northwest quarter of Section 7, Township 48 South, Range 35 East in Broward County.

* * * * *

PART V
CAPITAL COST ESTIMATES

PART V

CAPITAL COST ESTIMATES

A. GENERAL

This Part V summarizes the estimated capital costs for the various components of the technical plan described in Part IV. Cost estimates presented herein represent Burns & McDonnell's opinion of the probable capital cost of the physical components and lands required for those plan components. All costs are in third quarter, Fiscal Year 1993 dollars, and include no allowances for escalation. Financing costs (as might be required for the issuance of bonds) are also excluded. Estimates of the annual cost for operation and maintenance of the completed project are separately addressed in Part VI.

The conceptual cost estimates are developed generally without benefit of appraised land values or detailed information on topography and subsurface conditions. Continued development of the design can, and probably will, result in changes to the estimated capital costs presented herein.

Similarly, construction costs can be influenced by the contracting process and market conditions (which can be neither predicted nor controlled).

An additional item of some significance is that contingent costs applied for land acquisition are developed (with some exceptions) upon the assumption of a "willing seller." Should acquisition of lands through eminent domain proceedings be generally required, those costs could increase commensurately.

B. BASIS FOR CAPITAL COST ESTIMATES

Capital cost estimates summarized herein are developed to define expenditures necessary for modification of the system as it presently exists to that intended by the technical plan.

Cost estimates generally exclude:

- Previous investment in physical works (as for the Everglades Nutrient Removal Project or works of the Central and South Florida Flood Control Project incorporated in the plan).

- The value of publicly owned lands occupied by the various component elements of the plan.

Further, the cost estimates do not include any anticipated expenditures for the use of lands now owned or controlled by Florida Power and Light Co., but does include expenditures necessary to modify FPL maintenance and access facilities potentially impacted by the construction and/or operation of the various works.

Unit cost estimates for the various items of construction are generally based on information presented in Part III of reference 1, increased to reflect escalation subsequent to the publication of reference 1.

C. <u>SUMMARY OF CAPITAL COST ESTIMATES</u>

Detailed conceptual estimates of the capital cost for the various component elements of the technical plan are presented in Attachment B. A summary of those estimated costs is presented in Table V-1.

Table V-1
SUMMARY CAPITAL COST ESTIMATE

Plan Element	Estimated Cost in $ Million: Constr. Fac.	Engr., Plan, Des., & C.M	Land Acq.	Contingency Const.	Contingency Land	Total Cost
Western Basins						
• STA-5	16.84	2.53	10.05	3.37	3.02	35.81
• Rotenberger Tract	7.00	1.05	3.71	1.40	1.52	14.68
• West WCA-3A Hydro.	4.47	0.67	0.00	0.90	0.00	6.04
Subtotal	28.31	4.25	13.76	5.67	4.54	56.53
Eastern Basins						
• C-51 West Project	20.23	3.04	0.00	3.40	0.00	26.67
• L-8 Basin	4.69	0.70	0.00	0.94	0.00	6.33
• STA-1E	28.30	4.25	35.01	5.66	6.57	79.79
Subtotal	53.22	7.99	35.01	10.00	6.57	112.79
EAA						
• STA-1 Inflow & Dist.	9.82	1.47	0.00	1.97	0.00	13.26
• STA-1W	27.76	4.17	11.71	5.55	1.17	50.36
• S-5A Basin Div.	13.81	2.07	0.53	2.76	0.16	19.33
• STA-2	35.78	5.37	5.94	7.16	0.59	54.84
• WCA-2A Hydro.	7.01	1.05	0.00	1.40	0.00	9.46
• STA-3/4	67.39	10.11	32.93	13.48	3.29	127.20
• East WCA-3A Hydro.	9.12	1.37	0.00	1.82	0.00	12.31
• STA-6	0.50	0.08	0.50	0.10	0.05	1.23
Subtotal	171.19	25.69	51.61	34.24	5.26	287.99
TOTAL EST. COST	252.72	37.93	100.38	49.91	16.37	457.31

The above totals are exclusive of capital costs for diversion of the 298 Districts and 715 Farm areas, for which an allowance of $11.5 million is made. When that allowance is included, the total estimated capital cost of the project is $468.56 million in third quarter F.Y. 1993 dollars.

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PART VI
OPERATION AND MAINTENANCE COSTS

PART VI

OPERATION AND MAINTENANCE COSTS

A. GENERAL

This Part VI summarizes estimated average annual costs for operation and maintenance of the various component elements of the technical plan described in Part IV. Capital cost estimates are addressed separately (see Part V). The accuracy of the O&M cost estimates is subject to many of the same limitations discussed in Part V for the capital cost estimates, and should be considered accordingly.

The O&M cost estimates summarized herein are intended to define the incremental costs (e.g., increases above existing expenditures for operation and maintenance) associated with implementation of the technical plan, and excludes costs for operation and maintenance of existing features or those features which are essentially replaced "in kind". This analysis further excludes organizational costs which may be necessary for integration of treatment and conveyance system command and control functions into the South Florida Water Management District's existing operational structure.

All costs are expressed in third quarter, 1993 dollars, and include no allowance for escalation.

B. BASIS FOR AVERAGE ANNUAL O&M ESTIMATES

The following generalized estimates form the basis for the average annual O&M estimates developed for each component element.

1. PUMPING STATIONS

a. Fuel Consumption

Estimates are based on a fuel cost of $0.70 per gallon, and a consumption of 1.0 gallon per acre-foot of pumped volume (considered representative of the probable range of differential pumping heads and pump and drive equipment applicable to this project).

b. <u>Labor Costs</u>

Labor costs are developed assuming one supervisor per primary pump station (at an average annual salary of $36,000). Operator salaries are assigned at $29,000 per year. For analysis, the above salaries are increased by 52.6 percent for payroll overheads and burdens, yielding an annual cost per supervisor of $54,950, and an annual cost per operator of $44,250. Labor costs estimated on that basis are then increased 11 percent to reflect the probable regular use of overtime in pump station operation.

In the analysis, it is considered that each new inflow pump station will require one additional supervisor and three additional operators, generally paralleling staffing now provided for the District's primary pumping stations. It is further considered that each new outflow pump station will require one additional supervisor and five operators, increased from the staffing of inflow pump stations to reflect the anticipated greater number of operating hours.

It should be noted that the staffing and operation of existing Pumping Station S-5A and S6 will be unaffected by the project, with the result that all operation and maintenance costs for new outflow pump stations at STA-1E, STA-1W, and STA-2 are marginal costs directly associated with the stormwater treatment areas.

At combined STA-3/4, the total complement of operating personnel upon completion of the treatment area will increase to three supervisors and eleven operators (current staffing at S-7 and S-8 includes two supervisors and six operators). As a result, the O&M cost estimate for Combined STA-3/4 includes the marginal addition of one supervisor and five operators.

The total average annual pumping at Combined STA-3/4 is estimated to be 592,200 acre-feet. Unlike STA-1E, STA-1W, and STA-2, only a portion of that volume will be double pumped (use of existing S-7 as an outflow pump station). The proportion of the total volume which will be double pumped is not presently known; for this analysis, it is assumed that 50 percent of the inflow volumes (equal to 296,100 acre-feet per year) will be pumped at existing Pump Station S-7.

The inflow pump station for STA-6 is an existing privately owned facility; no incremental O&M cost is considered in this analysis.

c. <u>Equipment Maintenance</u>

Equipment maintenance costs (lubrications, filters, gaskets, minor and major overhauls, etc.) are estimated at $20,000 per primary pumping unit per year.

d. <u>Equipment Replacement</u>

Equipment and machinery are estimated to represent approximately 55 percent of the first cost for the pumping station; it is estimated for this analysis that pumps will require major rehabilitation at the end of 30 years, and that diesel engines will require replacement at that same time. With allowance for salvage, etc., it is assumed for this analysis that a cost equivalent to 35 percent of the first cost of the facility at 30 years will be necessary for equipment replacement and major rehabilitation.

That function is represented in the annual O&M estimates by assignment of an annual value of 0.74 percent of the first cost of the facility, developed assuming a real rate of return on invested capital of 3 percent, yielding 35 percent of the initial cost of the station after 30 years.

e. Structure Maintenance

An allowance of $50,000 per year is included for the normal maintenance of structures for each pump station. That amount is intended to include charges for electrical service.

f. Additional Support Personnel

The project includes the addition of numerous primary pumping stations and a lesser (e.g., seepage return) pumping stations. These additions are expected to result in a need for five additional machinists and mechanical support personnel, at a cost equivalent to that defined in 1.b above for pump-station operators. As a result, the increment average annual operation and maintenance cost due to addition of the project also includes an annual amount of $221,250 for those additional support personnel.

2. LEVEE MAINTENANCE

Estimates of average annual costs for levee maintenance are based on District experience, which indicates average annual costs of:

- $50 per acre for mowing of level surfaces (such as levee crown).
- $200 per acre for mowing of sloped surface such as the anticipated 3H:1V levee side slopes.
- $140 per acre for spraying (exotics control and growth retardance).

In this analysis, it is assumed that:

- The top of all levees will be regularly mowed.
- The exterior side slopes of perimeter levees will be regularly mowed.

- The tops and both side slopes of all levees will be regularly sprayed.

Given the anticipated levee geometrics, the above translates to an estimated average annual cost of $1,720 per mile for perimeter (exterior) levees, and $1,140 per mile for interior levees.

3. <u>MONITORING COSTS</u>

Annual costs of water quality monitoring for determination of compliance with potential permit modifications, together with operational monitoring as may be desired, are excluded from this analysis. It is assumed that those costs will be addressed by others as one element of an overall research and development program for improved understanding of the needs and limitations imposed by maintenance and restoration of the Everglades ecosystem.

4. <u>WETLANDS MAINTENANCE</u>

An average annual allowance of $20 per acre of effective treatment area is included for such activities as spot spraying for exotics control, minor structure maintenance, and similar activities.

5. <u>PRIMARY CONTROL STRUCTURES</u>

Primary control structures (gated spillways, etc.) will require regular maintenance, estimated at $10,000 per year. In addition, it is reasonable to anticipate major equipment rehabilitation. Costs for mechanical and electrical equipment (gates, gate hoists, hydraulic systems, etc.) represent approximately 20 percent of the estimated first cost of the primary control structures. It is estimated for this analysis that an amount equal to 10 percent of the first cost will be required at the end of 20 years, requiring an annual investment (given a real rate of return of 3 percent on invested funds) equal to 0.37 percent of the estimated first cost of the structure.

6. <u>SEEPAGE RETURN PUMP STATIONS</u>

An allowance of $100,000 per year is included for operation and maintenance of any given seepage return pump station.

A. <u>SUMMARY OF O&M COST ESTIMATES</u>

Detailed conceptual cost estimates of the incremental average annual cost for operation and maintenance of the majority of the component elements of the technical plan are included in Attachment C. Certain of the component elements are not included, as follows:

- No estimate is included for Stormwater Treatment Area No. 6, as the incremental expense for operation and maintenance of this facility is expected to be but nominally greater than the existing stormwater detention basin it replaces. An allowance of $25,000 in incremental average annual expense is made.

- No estimates are included for the various 298 Districts and 715 Farms area.

An overall summary of the estimated incremental average annual costs for operation and maintenance of the technical plan is presented in Table VI-1.

Table VI-1

SUMMARY COST ESTIMATE
INCREMENTAL O&M EXPENSE

Plan Component	Avg. Ann. Incremental O&M Expense ($1,000)
Treatment Facilities	
STA-1 Inflow and Distribution	78
STA-1E	722
STA-1W	1,081
STA-2	926
STA-3/4	1,527
STA-5	538
STA-6 (Allowance)	25
Subtotal, Treatment Facilities	$4,897
Other Facilities	
C-51 West End Project	501
L-8 Basin Improvements	406
West WCA-3A Hydroperiod Restoration	35
East WCA-3A Hydroperiod Restoration	29
WCA-2A Hydroperiod Restoration	56
Rotenberger Tract Restoration	170
S-5A Basin Runoff Diversion	46
Subtotal, Other Facilities	$1,243
Additional Machinists and Mechanical Support Personnel	$ 221
TOTAL ESTIMATED COST	$6,361

The above total is exclusive of incremental operation and maintenance costs associated with facilities for diversion of runoff from the 298 Districts and 715 Farms area.

* * * * *

PART VII
INTENDED OPERATION OF PLAN COMPONENTS

PART VII

INTENDED OPERATION OF PLAN COMPONENTS

A. GENERAL

This Part VII defines the proposed operation of the Everglades Protection Project. The basis for design of the various component elements of the Project, together with a description of the various physical facilities comprising the component elements, are included elsewhere in this document.

1. PURPOSE AND INTENT

The operations plan described herein is preliminary in nature, and will be refined as the Project progresses through preliminary design, detailed design, and construction. It is meant primarily as a statement of intent, and includes specific elevation references and operational procedures only to the extent necessary to fully define that intent, and to serve as the basis for subsequent, detailed hydraulic and operational modeling.

2. NEED FOR ADDITIONAL MODELING

It will eventually be necessary to conduct both detailed hydraulic modeling of the physical works to define/confirm limiting elevations and conveyance requirements, and operational (hydrologic) modeling over an extended period of record to confirm the extent to which the Project meets intended objectives relative to the timing and distribution of flows.

Detailed hydraulic modeling will be performed as a normal and essential element of the design of the project, and may proceed with but limited dependence on system operations. It will be used to fully define physical design criteria for the various component elements and facilities of the Project and to confirm controlling elevations and discharges.

The results of the detailed hydraulic modeling of the Project components will eventually be integrated into a comprehensive model of the overall system, which will consider not only the detailed hydraulics but also the regional context in which the Project will exist (regulation schedules in receiving water bodies, water supply demands, etc.). That overall model will then be operated to determine those changes in system operation which may eventually be necessary to fully achieve the objectives of both the Everglades Protection Project and the Central and South Florida Project for Flood Control and Other Purposes.

It is intended that the information presented herein be sufficiently detailed to permit initial development and application of the operational model so that the concurrent impact of changes in the regional system (such as modifications to regulation schedules) and implementation of the Everglades Protection Project may be evaluated during the design process.

3. FUTURE REVISIONS

It is fully anticipated that revisions to this operating plan will be made by the South Florida Water Management District in the future as additional information becomes available and regional needs and demands are more fully understood.

B. OPERATIONAL OVERVIEW

Other than as expressly described herein, it is intended that the operation of the primary drainage, flood control, and water supply system in and immediately adjacent to the Everglades Agricultural Area (EAA) continue as presently established.

1. DRAINAGE AND FLOOD PROTECTION

The completion and operation of the Everglades Protection Project will not reduce the level of service for drainage and flood protection now afforded by the Works of the District in the EAA.

In certain instances, it is intended that completion of the Everglades Protection Project will result in an improved level of flood protection. This intended improvement is limited primarily to the C-51 West Basin and, to a lesser extent, the L-8 Basin. Other slight improvements in flood protection may result in limited areas from implementation of the Project; those improvements are incidental in nature.

It is not intended that implementation of the technical plan affect the operation of the Interim Action Plan (IAP) for Lake Okeechobee, as it is embodied in the Lake Okeechobee Operating Permit (LOOP).

2. WATER SUPPLY

It is not intended that implementation and operation of the Everglades Protection Project act to limit or curtail existing water rights or consumptive use permits, or to reserve or allocate water for any particular use.

It is, however, anticipated that the Project, coupled with the implementation of Best Management Practices (BMPs) in the EAA, will result in a long-term average reduction in both the quantity of supplemental water needed by the EAA as a whole, and the quantity of water discharged from the EAA to both the Everglades Protection Area (EPA) and Lake Okeechobee. It is further anticipated that the reduced need for supplemental water in the EAA will result in an additional volume of water retained in Lake Okeechobee equal to or greater than the reduction in volumetric discharges to the EPA.

It is the intent that the reduced volumetric discharge to the EPA be offset by additional releases from Lake Okeechobee directed to the EPA, in fulfillment of one requirement of the Marjory Stoneman Douglas Everglades Protection Act. These additional releases are hereinafter referred to as "BMP Makeup Releases".

3. LAKE OKEECHOBEE RELEASES

Releases from Lake Okeechobee to the primary drainage and water supply system in the EAA are presently made for the following purposes:

- Regulatory releases as may be required to maintain Lake Okeechobee at or below regulation schedule.
- Supplemental releases (water supply) necessary to maintain canal stages in the EAA at optimum levels.
- Water supply releases intended for delivery through the EAA to the Lower East Coast (Palm Beach, Broward, and Dade Counties) via the West Palm Beach, North New River, and Miami Canals and, to a lesser extent, the L-8 Borrow Canal.

Upon completion of the project, it may also, under extreme circumstances, be necessary to effect additional Lake releases to maintain minimum operational depths in the Stormwater Treatment Areas (STAs).

a. Regulatory Releases

Regulatory releases from Lake Okeechobee are presently made to the canal system in the EAA; to the east through the St. Lucie Canal; and to the west through the Caloosahatchee River. The bulk of the regulatory releases are presently made to the St. Lucie Canal and the Caloosahatchee.

It is the intent that, to the maximum practicable extent (e.g., without sacrificing flood protection in the EAA), regulatory releases from Lake Okeechobee be directed to the EPA through the EAA, and that those releases be treated in the STAs for water quality improvement prior to their release to the EPA.

As discussed earlier in this document, the various STAs are sized to accommodate historic regulatory releases. In addition, STA-3/4 is sized to accept an additional average annual regulatory Lake release in excess of 200,000 acre-feet.

Over the period 1979-1988, total regulatory releases from Lake Okeechobee averaged over 500,000 acre-feet per year, well in excess of the intended increase in regulatory discharges to the EPA resulting from implementation of the technical plan. However, the bulk of those releases were made to the St. Lucie Canal and Caloosahatchee River. The South Florida Water Management District is continuing its efforts to analyze the extent to which the intended increase in regulatory discharges to the EPA can be realized without substantive modifications to the regional system (e.g., Lake Okeechobee regulation schedule, the conveyance capacity of the primary canal system, etc.).

The initial analysis prepared by the District ("Preliminary Effort to Simulate the May 10, 1993 Conceptual Design of the Everglades Protection Plan Using the South Florida Water Management Model", June 24, 1993) indicated that, without modification of historic operational practices, the desired increase in regulatory discharges to the EPA could not be realized. Subsequent to the release of that document, the District has modified the simulation to permit regulatory discharges to the EPA when the water conservation areas are at regulation schedule, triggering serial regulatory releases through the system. Given only that change in historic operational practice, the modified simulation indicates an average annual increase in regulatory discharges to the EPA of 120,000 acre-foot per year.

That same simulation indicates an average annual discharge to the EPA (considering the inflows from the C-51 West Basin, in addition to increased regulatory discharges) of 1,389,000 acre-feet, 28.3 percent greater than the "without project" simulation for the same period.

It is anticipated that an even greater increase in regulatory discharges to the EPA is practicable with additional operational changes. All District simulations to date have been conducted on the assumption that regulatory discharges to the EPA are limited to those periods when gravity discharge from the EAA to the EPA is possible, consistent with operational practice during the 1979-1988 base period. Further increases would be available if operational practice is modified to permit regulatory discharges to the EPA through use of the District's primary pumping stations (S-5A, S-6, S-7, and S-8). Additional simulations based on that assumption are planned, but are not yet completed.

An indication of the potential impact of that change in operational practice on regulatory discharges to the EPA is afforded by review of recent operation. Over the 12-month period ending April 30, 1993, regulatory releases from Lake Okeechobee to the EPA, using the primary pumping stations, totalled 933,865 acre-feet. When compared to the maximum simulated regulatory discharge to the EPA (377,00 acre-feet during 1983, without use of pumping stations) during the 1979-1988 base period, it is apparent that substantial additional regulatory releases to the EPA, above those reflected in the most recent District simulations, are achievable with no more than changed operational practices.

It is concluded that:

- Adequate Lake Okeechobee regulatory release volumes are available to supply the intended increase in such discharges to the EPA.

- The intended increase can be realized simply through modification of historic operational practice; modification to Lake regulation schedules or the conveyance capacity of the primary canal system in the EAA should not be necessary.

In fact, it may be practicable to increase regulatory discharges to the EPA to a degree well in excess of that intended. Should such be done, it should be recognized that the flow-weighted average concentration of total phosphorus in discharges to the EPA would be calculated to exceed the interim goal of 0.05 gm/m^3.

b. <u>Lower East Coast Water Supply</u>

Lake releases for the direct supply of water to the Lower East Coast will be bypassed around the STAs.

c. <u>BMP Makeup Water</u>

As discussed in paragraph B.2 above, it is the intent that volumetric reductions in discharges to the EPA resulting from implementation of BMPs and construction of the Everglades Protection Project be offset by additional releases from Lake Okeechobee. It is further intended that those additional releases be effected in the dry season for the dual purposes of:

- Temporally extending hydroperiod in the receiving areas of the EPA for the purposes of benefitting the ecosystem.

- Timing the releases to avoid interference with STA operation and efficiency during the wet season, thus taking advantage of any potential increased STA efficiency which may result from an extended and more uniform hydraulic loading of the STAs.

It is recognized that the analytical basis for design of the STAs provides no directly quantifiable assurance of an increase in STA efficiency due to an extended and more uniform hydraulic loading than that experienced in WCA-2A. As discussed in Parts III and IV, the design inflows and loads to the STAs do not include allowance for BMP makeup water. Analyses performed by others for the Department of Justice indicate that, given an estimated average annual BMP makeup water release of 182,400 acre-feet at an average TP concentration of 0.07 gm/m^3, and assuming no increase in STA operating efficiency, the long-term flow-weighted average total phosphorus concentration in discharges from the STAs (as a whole) would be 0.054 gm/m^3.

(1) Calculation of BMP Makeup Water Volume: Appendix 3 of the District's Chapter 40E-63 Rule, "Everglades Agricultural Area Regulatory Program", defines a methodology for computation of "historic" phosphorus loads discharged from the EAA based on rainfall. That same computational methodology, with some adjustments, may be used to compute "historic" volumetric discharges from the EAA.

It is intended that model be recalibrated and applied for the purpose of computing BMP makeup water requirements. In each year, the recalibrated model will be operated to reflect rainfall during that 12-month period, and the discharge which would have been predicted to occur under historic conditions computed. That computed discharge will then be compared to measured discharges to the EPA, and the difference (if any) assigned as the required additional release of BMP makeup water.

The recalibrated model will be applied over 12-month periods; the end date of the 12-month period will be selected considering both statistical fit and to permit adequate time for subsequent computation of available release volume and administrative processes. An ending date of July 1 is presently anticipated. The required release of BMP makeup water will then be calculated, and the resultant release volume available to be effected reported the District's Board of Governors. Barring dispute, that calculated volume will then be released to the EPA, to the extent compatible with the following statement of intent.

Timing and distribution of those releases will be established by the District to maximize benefits for the natural balance in the EPA. The extent to which those releases are desired can be expected to vary from year to year. The extent to which those release volumes can be maintained in storage until release is desired may be further affected by the potential influence of reduced Lake elevations (e.g., scheduled declines in regulatory elevations and actual Lake stage during late winter and early spring).

It will be necessary to consider two primary factors in recalibration of the model:

- The model will be recalibrated on the basis of discharge volume, not discharge load.

- The model as presently constituted considers total discharges from the EAA. The recalibrated model should consider only discharges to the EPA.

(2) Implementation Considerations: As discussed above, given no other changes in design inflow volumes and loads, or in the apparent efficiency of the STAs in reducing nutrient loads, routing of BMP makeup water through the STAs would be expected to result in average TP concentrations in discharges from the STAs exceeding the interim goal of 0.05 gm/m^3. It is intended that the BMP makeup water releases nonetheless commence concurrent with initial operation of the STAs. It is anticipated that the potential for TP concentrations exceeding the interim goal is reduced due to the following considerations:

- The design inflow volumes and loads to the STAs are based on a reduction of 25 percent in total phosphorus loads discharged from the EAA, as compared to historic discharges. BMP reductions in excess of the regulatory requirement, if realized, will make additional capacity available in the STAs for reduction of nutrient loads in Lake releases.

- Although not presently quantifiable, there is some indication that an improved efficiency (e.g., higher apparent average settling rate) in the STAs may result from the extended hydroperiod in the STAs as compared to the historic hydroperiod in WCA-2A.

d. Minimum Stage Maintenance in STAs

As discussed in paragraph C.1 of this Part VII, operation of the STAs will require maintenance of a minimum depth, the purpose of which is to prevent the release of stored phosphorus during rewetting after dry-out. Additional releases will be made from Lake Okeechobee to the STAs as may be necessary for the maintenance of minimum stages. This is anticipated to be a rare occurrence; preliminary modeling conducted by the District indicated no need for such releases over the period including water years 1979-1988.

C. STORMWATER TREATMENT AREA OPERATIONAL CRITERIA

The following is a summary of the operational criteria generally applicable to each of the Stormwater Treatment Areas.

1. DEPTH-DURATION AND EXTREMES

It is intended that operation of the STAs conform to the following depth criteria, all measured from representative existing grade in any given cell:

- Minimum depth of six inches (0.5 feet).
- Maximum depth of 4.5 feet.
- Mean (time-weighted) depth of approximately 2.0 feet.

The minimum and mean depths will be controlled primarily through selection of the weir crest elevation of outflow control structures. Analyses to date indicate that a weir crest (e.g., static pool depth) 1.25 feet above representative grade elevation will result in a mean depth closely approximating the target of 2.0 feet while minimizing the need for additional Lake releases to maintain the minimum depth of 0.5 feet.

The design of the various inflow and outflow structures will be developed to accommodate the maximum design inflow (on a steady-state basis) without exceeding the maximum design depth of 4.5 feet.

2. INFLOW PUMPING

Inflow pump stations at each STA will be operated in direct response to runoff conditions and canal stages. It is intended that operation of the inflow pump stations closely parallel (duplicate) the existing operation of the District's primary pumping stations.

3. INTERIOR STRUCTURES

Each cell of each STA will be equipped with both inflow and outflow control structures designed to both control stages within the STA at desired levels, and to effectively distribute flows within the cell to approach as closely as practicable a uniform flow distribution.

Inflow control structures will consist of gated culverts. Gate openings at each culvert will be initially adjusted to result in the desired distribution of flows across the inflow end of the cell, and will thereafter be closed or opened only when it is desired to remove a cell from service (should such be needed for any purpose). Modulation of gate openings may be necessary from time to time to fully promote the effective distribution of flows.

Outflow control structures will typically consist of culverts with fixed weirs on their upstream ends, with the weir crest elevation established 1.25 feet above representative existing grade elevation in the cell they serve.

Other than the above described adjustment to gate openings at inflow control structures, it is intended that the inflow and outflow control structures operate passively in direct response to inflows.

4. OUTFLOWS

Discharges from the STAs will result in direct response to inflows, attenuated by the combined influences of transitory storage in the STAs and the hydraulic restrictions imposed by the outflow control structures. Outflow pumping stations and similar facilities will be operated in direct response to the otherwise uncontrolled discharges from the STAs.

5. SEEPAGE

The conceptual design of the STAs described in Part IV includes facilities for the interception of seepage from the STAs. Where practicable, those seepage flows will be returned to the STA for treatment prior to their eventual discharge to the receiving water bodies.

D. FLOW DIVERSIONS

The technical plan for the Everglades Protection Project includes substantial investment in works for the redirection and diversion of runoff from areas both within and without the EAA. Those redirections and diversions are intended to accomplish two primary objectives:

- Increase the amount of water retained in the regional system by reducing the loss of fresh water to tide, with attendant beneficial impact on estuaries now receiving those discharges.

- Redirect and redistribute discharges to both spatially and temporally enhance hydroperiod.

The following is a description of the intended operation of those works for the redirection and diversion of flows.

1. L-8 BASIN

This Section presents a summary of the intended operation of works for the diversion of runoff from the north L-8 Basin to Lake Okeechobee. Excluded from this discussion are any works for the redirection, storage, treatment or general accommodation of runoff from the south L-8 Basin. The nature of those works, and their intended operation, are assumed to be the subject of analyses now being conducted by and for the Palm Beach County Water Supply Advisory Committee.

a. Normal Operations

The L-8 Basin diversion works will normally be operated to direct runoff from the north L-8 Basin, consisting primarily of the Dupuis Reserve and the J.W. Corbett Wildlife Management Area, to Lake Okeechobee via Structure S-76, Culvert #10A, and Pump Station S-309. The release of flow through Structure S-316 to the L-8 Borrow Canal south and east of S-316 will be permitted only under emergency conditions, or as described in paragraph D.1.b for water supply operations.

(1) Culvert No. 10A: This structure will operate automatically to discharge from the L-8 Borrow Canal to Lake Okeechobee whenever L-8 stages exceed those in the Lake.

(2) Pump Station S-309: This pump station will operate to augment the capacity of Culvert #10A for discharges to the Lake, and to maintain stages in the L-8 Borrow Canal downstream (west) of S-76 within an optimum range of 10.0 - 12.5 ft. NGVD (within its capacity to do so).

(3) Existing Structure S-76: Structure S-76 is intended to operate automatically to maintain headwater elevations in the L-8 Borrow Canal (east of the structure) at or below the planned regulation stage for the L-8 Marsh Restoration (presently assumed to be elevation 19.0 ft. NGVD). Gate openings will be modulated (reduced) as necessary to limit tailwater elevations in the L-8 Borrow Canal (west of the structure) to defined limiting stages (presently assumed to be elevation 18.0 ft. NGVD prior to construction of S-309, and elevation 15.0 ft. NGVD subsequent to construction of S-309).

(4) Proposed Structure S-316: Under normal operation, Structure S-316 would be opened only for emergency purposes, defined as occurring under either of the following conditions:

(a) Lake Okeechobee at or above maximum regulation schedule stage: Under this condition, Structure S-316 would be operated to replace the function of S-76. S-76 would be operated only when stages in the L-8 Borrow Canal between S-76 and S-316 reach maximum design stage (presently assumed to be elevation 21.5 ft. NGVD).

(b) Lake Okeechobee below maximum regulation schedule stage: Under this condition, S-316 would be opened only when stages in the L-8 Borrow Canal between S-76 and S-316 reach maximum design stage (21.5 ft. NGVD); gate openings will be modulated to maintain that stage until such time as the available capacity at S-76 equals inflows to the L-8 Borrow Canal between S-76 and S-316, at which time S-316 will be fully closed.

b. Water Supply Operations

Structure S-316 will be operated to supply water to the L-8 Borrow Canal southeast of S-316 as required to maintain L-8 stages at optimum levels. The order of operation will be sequenced in accordance with the following hierarchy.

- When there is a need for water in the south L-8 Borrow Canal, and a runoff event is occurring in the north L-8 Basin, Structure S-316 will be operated in lieu of Structure S-76.

- When there is a need for water in the south L-8 Borrow Canal which cannot be met from other sources of supply, S-316 will be operated to draw down stages in the north L-8 Borrow Canal; stages in the J.W. Corbett Wildlife Management Area will remain controlled by the existing structures. Stages in the Dupuis Reserve will be controlled by the levee and control structures which are to be constructed by the District under the Save Our Rivers program. The drawdown of the L-8 Borrow Canal will proceed until its stage is at or below that in Lake Okeechobee.

- After exhaustion of available storage in and along the L-8 Borrow Canal, Culvert #10A and Structure S-76 will be opened to permit the release of water from Lake Okeechobee to and through Structure S-316.

2. C-51 WEST BASIN

This Section presents a summary of the intended operation of the C-51 West End Flood Control Project for the dual purposes of flood protection and diversion of runoff from the C-51 West Basin to regional storage in WCA-1.

a. Normal Operations

Under most conditions, Pump Station S-319 will operate to lift all discharges from the C-51 West Basin to Stormwater Treatment Area No. 1 East (STA-1E). Pump operations will be structured to maintain stages in the C-51 West Canal at optimum levels (wet conditions elevation 13.0 ft. NGVD, dry conditions elevation 14.0 ft. NGVD), within S-319's capacity to do so. Structure S-155A will be normally closed.

b. Emergency Operations

When inflows to the C-51 West Canal exceed the capacity of S-319 (either actual capacity, or reduced capacity due to stage constraints in STA-1E), then S-155A will be opened to release excess flows to the C-51 East Canal at a rate limited by the capacity of S-155A with tailwater elevations (in the C-51 East Canal) at or below elevation 11.7 ft. NGVD.

When the aggregate available capacity of S-319 and S-155A are insufficient to meet inflows, then an emergency bypass condition will be declared, and the system operated as may be necessary to maintain acceptable stages in the C-51 West Canal. Emergency operations may include, but not necessarily be limited to:

- Operation of the STA-1 Inflow and Distribution works to bypass a part of the S-319 discharge directly to WCA-1.

- Operation of existing structures S-5AE and S-5AW to divert flow from the C-51 West Canal to the L-10/L-12 Borrow Canal, coupled if necessary with operation of S-5A and additional bypass directly to WCA-1.

3. S-5A BASIN RUNOFF DIVERSION

As discussed in Part IV, the physical works constituting this plan component include 2 new structures on the Ocean Canal and conveyance improvements along the Ocean and Hillsboro Canals. One of the two new structures is a replacement of existing Structure S-5AX at its present location; the second is a new divide structure on the Ocean Canal near the northwest corner of STA-1W.

It is intended that the Ocean Canal between those two structures be maintained at a normal stage of approximately 11.5 ft. NGVD.

Inflows to the intermediate reach of the Ocean Canal will be normally discharged west through the new Structure S-5AX, up to a maximum of 600 cfs. It will be necessary to modulate gate openings at S-5AX to:

- Limit maximum discharges to 600 cfs.

- Further reduce maximum discharges through S-5AX as necessary to avoid exceeding the discharge capacity of existing Pump Station S-6.

Normal maximum gate openings at S-5AX will be established to result in a maximum discharge of 600 cfs for variable headwater and tailwater elevations and stage differentials. Further reductions in discharge through S-5AX will be keyed to stages in the Ocean Canal immediately west of S-5AX (e.g., gate openings will be reduced as necessary to maintain tailwater no higher than 12.0 ft. NGVD).

When inflows to the Ocean Canal exceed the allowable discharge through S-5AX, stages in the Ocean Canal will be allowed to increase to 12.5 ft. NGVD. As that stage is attained, the new divide structure near the northwest corner of STA-1W will operate automatically to maintain stage at 12.5 ft. NGVD, within its capacity to do so.

4. <u>298 DISTRICTS/715 FARMS</u>

The specific nature of physical works for the diversion of discharges from the 298 Districts and 715 Farms area is not presently known. It is intended that those works serve as the primary means for removal of runoff and drainage water from these areas.

It is anticipated that existing pump stations on Lake Okeechobee will remain in place and operational. The existing facilities will be operated only when operation of the new diversion works cannot maintain canal stages at acceptable levels (e.g., the existing pump stations are intended to provide "peaking" capacity only).

5. C-139 BASIN

This section presents a summary of the intended operation of works for the diversion of runoff from the C-139 Basin to use in restoration of the Rotenberger Tract.

a. C-139 North Basin

No change is intended in the operation of existing Structures G-150 and G-136.

b. C-139 South Basin

Runoff from the C-139 South Basin will normally be diverted through STA-5 to the Rotenberger Tract. This basin presently discharges to the L-4 Borrow Canal through existing Structure G-88; the L-3 Borrow Canal Extension through Existing Structure G-155; and the L-28 Borrow Canal through existing Structure G-89. Those existing structures will be closed under normal operations, and opened only as described below for emergency conditions.

(1) Inflow Pump Station for STA-5: This structure will be operated in response to headwater elevation to generally maintain stages in the L-3 Canal at elevation 14.5 ft. NGVD (dry season) or 12.5 ft. NGVD (wet season). The structure will be designed to maintain stages in the L-3 Canal at or below existing stages for any given return period event, up to its design discharge capacity.

(2) Existing Structure G-155: This structure will be normally closed, and would be opened (flash boards removed) only

when discharges in the L-3 Canal exceed the capacity of the STA-5 inflow pump station.

(3) Existing Structure G-88: There is no intended future operation of this structure.

(4) Existing Structure G-89: This structure will be operated only upon the request of the Seminole Tribe and the concurrence of the South Florida Water Management District for the purpose of supplying water directly from the L-3 Borrow Canal to the L-28 Borrow Canal.

E. STA-1 COMPLEX

The Stormwater Treatment Area No. 1 (STA-1) complex is composed of three primary components:

- The STA-1 Inflow and Distribution Works in the north end of Water Conservation Area No. 1 (WCA-1).
- Stormwater Treatment Area No. 1 East (STA-1E).
- Stormwater Treatment Area No. 1 West (STA-1W).

A general description of the intended operation of the stormwater treatment areas is included in Section C of this Part VII. The following is a description of special provisions for operation of the STA-1 complex.

1. STA-1 INFLOW AND DISTRIBUTION WORKS

The STA-1 Inflow and Distribution Works are intended to fulfill the following primary functions.

- The distribution of discharges from existing Pump Station S-5A to both STA-1E and STA-1W for treatment prior to their release to WCA-1.

- To transfer flows from STA-1E to STA-1W when required by operational constraints in STA-1E.

- To fully or partially bypass S-5A discharges around STA-1E and STA-1W when required by operational constraints in the two treatment areas.

- To deliver water supply releases from WCA-1 to the L-8 and C-51 canals.

Realization of the intended operation of the STA-1 complex will require that certain modifications be made to the operation of existing structures in the S-5A complex as well.

Definition of the intended operation of the STA-1 complex is based upon the following (estimated) controlling elevations, all of which are subject to confirmation by subsequent topographic and hydraulic analyses.

Component Element	Description	Elevation (ft. NGVD)
STA-1 I&D	Representative Existing Grade Elevation	14.0
	Maximum Operational Stage	18.5
	Minimum Operational Stage	N/A
	Static Pool Elevation	15.25
STA-1E	Representative Existing Grade Elevation	13.0
	Maximum Operational Stage	17.5
	Maximum Distribution Canal Stage	13.5
	Minimum Operational Stage	18.5
	Static Pool Elevation	14.25
STA-1W	Representative Existing Grade Elevation	10.0
	Maximum Operational Stage	14.5
	Maximum Inflow Canal Stage	10.5
	Minimum Operational Stage	11.25
	Static Pool Elevation	15.5

a. Distribution of S-5A Discharges

Discharges from Pump Station S-5A will normally be distributed between STA-1E and STA-1W through operation of the new control structures in Levee 7 (STA-1W) and Levee 40 (STA-1E). It is intended that, on average, 82 percent of the S-5A discharges be delivered to STA-1W, and 18 percent be delivered to STA-1E.

Deliveries to STA-1E will potentially be influenced by inflows to STA-1E from the C-51 West Basin (via new Pump Station S-319); concurrent runoff events in the S-5A and C-51 west basins will on occasion act to limit discharges to STA-1E from S-5A, requiring that the percentage of S-5A discharges normally delivered to STA-1E exceed the intended long-term average. A target percentage of 25 percent is assumed for normal operations; operating experience may eventually require that that percentage be adjusted to obtain the desired average distribution.

During periods of discharge from S-5A, gate openings in the new Levee L-7 and Levee L-40 control structures will be modulated to direct approximately 75 percent of the S-5A discharge to STA-1W, and 25 percent to STA-1E. As the stage in the STA-1E distribution canal approaches elevation 18.5 ft. NGVD, the gate openings in the Levee L-40 control structure will be further modulated (reduced) to maintain that stage at or below elevation 18.5 ft. NGVD. As the stage in the STA-1W Inflow Canal approaches elevation 15.5 ft. NGVD, the gate openings in the Levee L-7 control structure will be further modulated (reduced) to maintain that stage at or below elevation 15.5 ft. NGVD.

Gate openings at both structures will commence when the stage in the STA-1 Inflow and Distribution Works exceeds elevation 15.75 ft. NGVD, and will be modulated to maintain the desired flow distribution until the stage returns to 15.75 ft. NGVD, at which time the gates will be fully closed.

b. <u>Flow Transfers, STA-1E to STA-1W</u>

On occasion, inflows to STA-1E from new Pump Station S-319 will exceed the available hydraulic capacity in STA-1E. In that instance, and when additional hydraulic capacity remains in STA-1W, the control structures in Levee L-7 and Levee L-40 will be operated to maintain stage in the STA-1E distribution canal at elevation 18.5 ft. NGVD. When no hydraulic capacity remains in STA-1W to receive that flow (e.g., STA-1W Inflow Canal stage at elevation 15.5 ft. NGVD), a bypass condition will be declared, and operations will be as described below.

c. <u>Bypass Operations</u>

Hydraulic bypass of STA-1E and STA-1W will occur only when the combined discharges from S-5A and S-319 would exceed the combined hydraulic capacity of STA-1E and STA-1W.

When stages in the STA-1E distribution canal reach elevation 18.5 ft. NGVD, discharges from new Pump Station S-319 will be reduced to maintain that stage, and excess inflows to the C-51 west canal discharged to the east through new Structure S-155A when capacity is available in the C-51 East Canal to receive those discharges (e.g., tailwater elevation at S-155A at or below elevation 11.7 ft. NGVD, and discharges through existing Structure S-155 less than design maximum of 4,800 cfs).

When insufficient capacity is available in the C-51 East Canal to receive that excess inflow, then new Pump Station S-319 will continue to discharge up to its normal capacity, and stages in the STA-1E distribution canal will be maintained at elevation 18.5 ft. NGVD by the concurrent operation of the new control structure in Levee L-40 and the new control structures in the L-7 and L-40 borrow canals, resulting in a hydraulic bypass of untreated flows to WCA-1.

The new control structures in the L-7 and L-40 borrow canals would otherwise be operated to bypass flows directly to WCA-1 only when inflows from S-5A exceed the available hydraulic capacity of STA-1W and STA-1E.

d. <u>Water Supply Releases from STA-1 Complex</u>

It will occasionally be necessary to release water from the STA-1 complex to the L-8 and C-51 West canals to maintain adequate stages in those canals. When the stage in STA-1E is at or above the design static pool elevation of 14.25 ft. NGVD, those releases will be effected through opening the gated culvert included with new Pump Station S-319, in essence supplying those demands from STA-1E.

When STA-1E is at or below the design static pool elevation of 14.25 ft. NGVD, or the demand for water exceeds the capacity of the gated culvert at S-319, then the new control structure in the L-40 Borrow Canal and existing Structure S-5AS will be opened to supply that demand from WCA-1.

e. <u>Operation of Existing Structures</u>

The following is a discussion of the intended change in operation of existing Structures S-5AW, S-5AS, and S-5AE.

(1) <u>Existing Structure S-5AW</u>: This structure will be normally closed, and will be operated only under the following conditions.

(a) When stages in the L-10/L-12 Borrow Canal west of S-5AW are at or above optimum, and an unmet demand for water exists in the L-8 and C-51 west canals, S-5AW will be operated to supply water from the S-5A Basin to the L-8 and C-51 West canals.

(b) When stages in the L-8 and C-51 west canals are at or above optimum, and an unmet demand for water exists in the L-10/L-12 Borrow Canal, S-5AW will be operated to supply water from the L-8 and C-51 West basins to the S-5A basin.

(2) <u>Existing Structure S-5AS</u>: This structure will be normally closed, and will be opened only when necessary to supply water from WCA-1 to the L-8 and C-51 West canals.

(3) <u>Existing Structure S-5AE</u>: Until such time as works by others in the L-8 South basin are complete and operational, this structure will be maintained full open. Following completion of those works, this structure will be normally closed, and will be opened only to release excess flows from the L-8 basin to the C-51 West canal, or as required for water supply purposes (e.g., operated concurrently with S-5AS and the new control structure in the L-40 Borrow Canal).

2. <u>STA-1E</u>

Stormwater Treatment Area No. 1 East (STA-1E) will normally be operated as described in Section C of this Part VII. Modification of normal operations for bypass conditions will be as described in paragraph VII.1.b. and in paragraph VII.D.2.

The new outflow pump station for STA-1E will be operated in direct response to discharges from STA-1E to maintain stages in the STA-1E discharge canal at prescribed levels (presently expected to be approximate elevation 10.5 ft. NGVD at the pump suction).

3. <u>STA-1W</u>

Stormwater Treatment Area No. 1 West (STA-1W) will normally be operated as described in Section C of this Part VII. The following discussion defines the specific operations of structures controlling the distribution of flows between the existing ENR Project and the new treatment area cell, together with the two outflow pumping stations for STA-1W.

a. <u>New ENR Project Inflow Control Structure</u>

The operation of this structure (which replaces the function of the existing Inflow Pump Station for the Everglades Nutrient Removal (ENR) Project) will be modulated to obtain the desired distribution of STA-1W inflows between the ENR Project and the new treatment area north of the ENR Project. It is intended that a long-term average of approximately 55 percent of the total inflow to STA-1W be delivered to the ENR Project.

It is presently estimated that the hydraulic capacity of the ENR Project is approximately 1,400 cfs; capacity limitations will be confirmed through subsequent, more detailed hydraulic analyses of the ENR Project. Given an intended maximum inflow to STA-1W of 3,600 cfs through the new control structure in

Levee L-7, the desired long-term average distribution cannot be met under peak inflow conditions. This will require that greater than 55 percent of the inflows to STA-1W be delivered to the ENR Project under normal conditions.

For STA-1W inflows up to approximately 2,400 cfs, it is assumed that a target of roughly 60 percent of the total inflow will be delivered to the ENR Project; for total inflows exceeding 2,400 cfs, inflows to the ENR Project will be limited to its hydraulic capacity at maximum operational stages. Operating experience may eventually require that the target percentage for delivery to the ENR Project be adjusted to obtain the desired long-term average distribution.

b. Existing ENR Project Outflow Pump Station

The existing ENR Project outflow pump station will remain in place and operational, and will be operated up to its capacity to maintain stages in the ENR Project Collection Canal C-2 at or below approximate elevation 12.0 ft. NGVD. The desired start-stop elevations of the various pumps in this facility will be established in subsequent, more detailed hydraulic analyses of the ENR Project. Pump operations will be automatic in response to stages in Collection Canal C-2.

c. New ENR Project Outflow Control Structures

These structures will be situated in the existing ENR Project Perimeter Levee adjacent to Collection Canal C-2, and will serve to direct ENR Project discharges exceeding the capacity of the existing ENR Project Outflow Pump Station to the new STA-1W Outflow Pump Station. These structures will be normally closed, and will operate only when stages in Collection Canal C-2 exceed elevation 12.0 ft. NGVD. The structures will then operate automatically in response to Collection Canal C-2 stage, and will develop their full intended capacity when stages in Collection Canal C-2 reach approximate elevation 13.0 ft. NGVD.

d. New Outflow Pump Station

The new STA-1W outflow pump station will be operated in direct response to discharges from STA-1W to maintain stages in the STA-1W discharge canal at prescribed levels (presently expected to be approximate elevation 8.0 ft. NGVD at the pump suction).

F. STA-2 AND WCA-2A HYDROPERIOD RESTORATION

A general description of the intended operation of the stormwater treatment areas is included in Section C of this Part VII. The following is a description of special provisions for operation of Stormwater Treatment Area No. 2 (STA-2), as well as the WCA-2A Hydroperiod Restoration Works to which it discharges.

1. STORMWATER TREATMENT AREA NO. 2 (STA-2)

STA-2 will normally be operated as described in Section C of this Part VII. The following summary of controlling stages in STA-2 is based on an estimated representative grade elevation in STA-2 of 10.0 ft. NGVD, and are subject to confirmation during subsequent, more detailed topographic and hydraulic analyses.

Minimum Operating Level	-	10.5 ft. NGVD
Static Pool Elevation	-	11.25 ft. NGVD
Approx. Mean Stage	-	12.0 ft. NGVD
Max. Operating Pool	-	14.5 ft. NGVD
Max. Inflow and Supply Canal Stage	-	16.0 ft. NGVD

STA-2 is unlike the other stormwater treatment areas included in the Everglades Protection Project in that no hydraulic bypass facilities will be available. The only means for effecting a reduction in inflows to STA-2 is through increased operation of pumping stations

S-5A, S-2, and/or New S-7, and reliance on the primary canal system in the EAA for redistribution of Hillsboro Canal inflows.

a. <u>Inflow Pumping Stations</u>

STA-2 will be served by two inflow pump stations, which include existing Pump Station S-6 and the relocated secondary pumping station on the STA-2 Supply Canal. Both pump station are intended to operate in the future consistent with their present and established operation.

Of particular note is the intent that the relocated secondary pump station continue to be operated and maintained by its present owner.

b. <u>New Outflow Pump Station</u>

The new STA-2 Outflow Pump Station will be operated (in direct response to discharges from STA-2) to maintain stages in the STA-2 discharge canal at prescribed levels (presently anticipated to be at approximate elevation 8.5 ft. NGVD).

2. <u>WCA-2A HYDROPERIOD RESTORATION WORKS</u>

Other than as discussed below for the supply of treated water to WCA-1, the WCA-2A Hydroperiod Restoration Works are intended to operate passively in direct response to inflows to the (enlarged) L-6 Borrow Canal from the STA-2 outflow pump station. Other than the enlarged L-6 Borrow Canal, hydraulic elements of the WCA-2A Hydroperiod Restoration works will consist of fixed crest overflow weirs in the existing East Levee L-6. The nominal crest elevation of those weirs is 15.50 ft. NGVD, roughly 2.1 feet above the average existing grade elevation in WCA-2A along East Levee L-6.

For L-6 Borrow Canal stages at or below elevation 15.50 ft. NGVD, there would be no discharges to WCA-2A. As stages in the L-6 Borrow

Canal rise above 15.50 ft. NGVD, the weirs will operate passively to discharge to WCA-2A. The maximum design stage in the L-6 Borrow Canal, corresponding to steady-state conditions under full discharge from the STA-2 Outflow Pump Station, is presently anticipated to be at approximate elevation 17.5 ft. NGVD.

The WCA-2A Hydroperiod Restoration works also include the construction of gated culverts through Levee L-39, capable of directing treated discharges from STA-2 to WCA-1. These structures would be normally closed, and would be manually opened only under the concurrent conditions of:

- A need for water in WCA-1, as might be required to offset water supply withdrawals by areas east of WCA-1 during low stages in WCA-1.

- An availability of water from STA-2.

It should be noted that STA-2 is not intended to function as a water supply storage reservoir; discharges from STA-2 will not be artificially reduced or restricted for that purpose.

G. STA-3/4 AND EAST WCA-3A HYDROPERIOD RESTORATION

A general description of the intended operation of the stormwater treatment areas is included in Section C of this Part VII. The following is a description of special provisions for operation of the Combined Stormwater Treatment Area No. 3 and 4 (STA-3/4) and the East WCA-3A Hydroperiod Restoration Works to which it discharges.

1. STA-3/4

The following summary of controlling stages in STA-3/4 is based on an estimated representative grade elevation in STA-3/4 of 9.5 ft. NGVD, and are subject to confirmation during subsequent, more detailed topographic and hydraulic analyses.

Minimum Operating Level	-	10.0 ft. NGVD
Static Pool Elevation	-	11.0 ft. NGVD*
Approx. Mean Stage	-	11.75 ft. NGVD*
Max. Operating Pool	-	14.0 ft. NGVD
Max. Distribution Canal Stage	-	15.3 ft. NGVD
Max. Supply Canal Stage		17.0 ft. NGVD**

* Slightly (0.25') above normal criteria due to anticipated backwater effect from operation of the East WCA-3A Hydroperiod Restoration Works.

** In the new Supply Canal from the Miami Canal, at New Pump Station S-8.

a. <u>Normal Operations</u>

STA-3/4 includes two new pumping stations (New S-7 and New S-8) intended to replace the normal drainage and flood control functions of existing Pump Stations S-7 and S-8. These pumping stations will normally operate in a fashion consistent with the present and established operation of existing Pump Stations S-7 and S-8.

The STA-3/4 outflow control structures will normally be full-open; stages in STA-3/4 will be controlled by operation of the East WCA-3A Hydroperiod Restoration Works.

b. <u>Bypass Operations</u>

An hydraulic bypass of STA-3/4 can occur under either of the following conditions:

- To bypass water supply releases from Lake Okeechobee intended for delivery to the Lower East Coast.

- Under emergency conditions, when combined discharges in the Miami and North New River Canals exceed the operational capacity of STA-3/4.

(1) Water Supply Bypass: Existing Pump Station S-8 would be operated to deliver water supply to the Miami Canal and Dade County, consistent with concurrent practice. S-8 operation would initially draw down stages in the L-4 Borrow Canal, the Miami Canal along the Holey Land and the Rotenberger Tract, and the directly connected length of the L-5 Borrow Canal (e.g., west of existing structure G-204) to a stage at or below the stage in the Miami Canal north of the Holey Land.

At that time, the new control structure in the Miami Canal (included in the West WCA-3A Hydroperiod Restoration Works) would be opened, and Lake releases to the Miami Canal passed through to existing Pump Station S-8.

Existing Pump Station S-7 would be operated to deliver water supply to the North New River Canal and Broward County, consistent with current practice. S-7 operation would initially draw down stages in the L-5 Borrow Canal (east of existing Structure G-205), the North New River Canal, the directly connected length of the L-6 Borrow Canal (e.g., southwest of the STA-2 outflow pump station), and STA-3/4 to a stage of elevation 10.0 ft. NGVD.

At that time, the STA-3/4 outflow control structures would be closed, the new control structure in the North New River Canal (included in the East WCA-3A Hydroperiod Restoration Works) would be opened, and Lake releases to the North New River Canal passed through to existing Pump Station S-7.

(2) Emergency Bypass: Existing Pump Station S-7 will serve as an outflow pumping station for STA-3/4, and can therefore not be considered available for use as an emergency bypass of STA-3/4. Emergency bypasses will be limited to the Miami Canal, and will require the concurrent operation of

both the new control structure in the Miami Canal at the northwest corner of the Holey Land and existing Pump Station S-8.

2. <u>EAST WCA-3A HYDROPERIOD RESTORATION</u>

Existing Pump Station S-7 and the modified L-5 levee and borrow canal system will be operated to both control stages in STA-3/4 and to restore sheet-flow approximation to the northern perimeter of WCA-3A. After removal of the existing South Levee L-5, sheet flow to WCA-3A will occur whenever stages in the (enlarged) L-5 Borrow Canal exceed existing grade elevations in WCA-3A along the south bank of the L-5 Borrow Canal. Those existing grade elevations range from approximate elevation 11.0 ft. NGVD to 12.2 ft. NGVD, averaging 11.7 ft. NGVD.

Pumping Station S-7 will be operated in direct response to discharges from STA-3/4, with the number of pumps brought on line staggered with increasing stages in the L-5 Borrow Canal to develop sheet flow conditions in WCA-3A. The following discussion of the intended operation of existing Pump Station S-7 is subject to confirmation through subsequent, more detailed topographic, hydraulic, and operational analyses.

S-7 will initially be operated to maintain stages in the North New River Canal (downstream of the new control structure in the North New River Canal) at elevation 11.0 ft. NGVD, up to an STA-3/4 discharge equal to the nominal capacity of one pump (830 cfs). As STA-3/4 discharges increase above that level, North New River Canal stages will be allowed to rise to elevation 12.2 ft. NGVD, at which time a second pump in S-7 would be brought on line, and operated to maintain that stage. The third pump in S-7 would be bought on line only as STA-3/4 discharges continue to increase, and would be operated to maintain a stage in the North New River of 13.0 ft. NGVD.

H. STA-5 AND STA-6

A general description of the intended operation of the stormwater treatment areas is included in Section C of this Part VII. The following is a description of special provisions for operation of Stormwater Treatment Area No. 5 (STA-5) and Stormwater Treatment Area No. 6 (STA-6).

1. STORMWATER TREATMENT AREA NO. 5 (STA-5)

The following summary of controlling stages in STA-5 is based on an estimated representative grade elevation in STA-5 of 12.5 ft. NGVD, and are subject to confirmation during subsequent more detailed topographic and hydraulic analysis.

Minimum Operating Level	-	13.0 ft. NGVD
Static Pool Elevation	-	13.75 ft. NGVD
Approx. Mean Stage	-	14.5 ft. NGVD
Max. Operating Pool	-	17.0 ft. NGVD
Max. Distribution Canal Stage	-	18.0 ft. NGVD

a. Normal Operations

The new Inflow Pump Station for STA-5 will operate to accept all discharges from the C-139 Basin in the L-3 Borrow Canal at its confluence with the Deer Fence Canal, up to the hydraulic capacity of the Inflow Pump Station.

The STA-5 Inflow Pump Station will be operated (in direct response to those inflows) to maintain stages in the L-3 Canal at prescribed levels.

There is no outflow pumping station for STA-5. The STA-5 outflow control structures will operate passively to discharge directly to the Rotenberger Tract.

b. Bypass Operations

When discharges in the L-3 Borrow Canal exceed the operational capacity of STA-5 (e.g., the Inflow Pump Station can no longer maintain acceptable stages in the L-3 Canal), excess flows will be bypassed entirely around STA-5 and the Rotenberger Tract by operation (removal of stop logs) at existing Structure G-155, permitting flow along the L-3 Borrow Canal and to the L-3 Borrow Canal Extension.

2. STORMWATER TREATMENT AREA NO. 6 (STA-6)

The following summary of controlling stages in STA-6 is based on an estimated representative grade elevation in STA-6 of 13.0 ft. NGVD, and are subject to confirmation during subsequent, more detailed topographic and hydraulic analysis.

Minimum Operating Level	=	13.5 ft. NGVD
Static Pool Elevation	=	14.25 ft. NGVD
Approx. Mean Stage	=	15.0 ft. NGVD
Max. Operating Pool	=	17.5 ft. NGVD
Max. Distribution Canal *Stage	=	18.0 ft. NGVD

* Existing detention area "Pond 1"

The maximum design stage in the distribution canal (18.0 ft. NGVD) is 1.0 feet above the design high water surface elevation shown on U.S. Sugar Corporation construction drawings for the existing detention basin (which will be converted to use as STA-6). Subsequent analyses will consider the potential for reducing this maximum stage to levels more consistent with the existing design.

a. Normal Operations

The existing U.S. Sugar Corporation pumping station serving its Southern Division Ranch, Unit 2 will serve as the inflow pump station for STA-6, and is intended to operate in the future in a fashion consistent with its present and established operation.

There is no planned outflow pumping station; STA-6 will discharge by gravity through the new outflow control structures and enlarged discharge canal directly to the L-28 Water Supply Storage Area included in the Rotenberger Tract Restoration plan component. As discussed in Section I of this Part VII, that area will normally be held at an operating stage of 14.0 ft. NGVD.

b. Bypass Operations

An hydraulic bypass of STA-6 will be permitted only under extreme conditions, and then only with the concurrent approval of the South Florida Water Management District and the Seminole Tribe.

A partial bypass of STA-6 (e.g., bypass concurrent with operation of STA-6) will require the manual operation (opening) of existing U.S. Sugar Corporation culverts in what is now Pond 1 of the existing detention basin.

A full bypass of STA-6 will require that stages in the L-28 Water Supply Storage Area be substantially lowered, requiring the concurrent operation of both the new stage control structure in the L-4 Borrow Canal and either existing Pump Station S-8 or existing Pump Station G-200A.

I. ROTENBERGER TRACT, HOLEY LAND AND WEST WCA-3A HYDROPERIOD RESTORATION

This Section defines the intended operation of structures associated with restoration of hydroperiod on the Rotenberger Tract and that part of the northerly perimeter of WCA-3A lying between the Miami Canal and Levee L-28.

In addition to their primary hydroperiod restoration function, these structures are also intended to fulfill the following secondary objectives:

- Delivery of water supply to the Holey Land.

- Delivery of water supply to the L-28 Borrow Canal.

Sources of water for the above water supply deliveries include discharges from both Stormwater Treatment Area No. 5 (STA-5) and Stormwater Treatment Area No. 6 (STA-6).

In addition, certain of the physical works included in these plan components will be used, under certain conditions, to:

- Permit the transfer of Lake Okeechobee water supply releases for the Lower East Coast (Dade County) to the Miami Canal downstream of existing Pump Station S-8.

- Effect emergency bypass of discharges in the Miami Canal around Combined Stormwater Treatment Area 3 and 4 (STA-3/4).

Operation for the above two functions are described in Section G of this Part VII.

1. ASSUMED REGULATION SCHEDULES

Definition of the intended operation of the various structures is based on the following assumed regulation schedules, all of which are subject to confirmation. Water surface elevations are assigned using an estimated elevation of 12.5 ft. NGVD as representative of existing grade elevations throughout the Rotenberger Tract and along the northerly perimeter of WCA-3A west of the Miami Canal.

It is not intended that there be any change in the present regulation schedule or operation of the Holey Land and its inflow

(G-200A) and outflow (G-204 and G-205) structures. It should be noted that existing outflow structure G-206 will be removed in connection with the construction of STA-3/4 and the East WCA-3A Hydroperiod Restoration Works.

a. <u>Rotenberger Tract</u>

Controlled stages in the Rotenberger Tract will be established at elevation 13.0 ft. NGVD (wet season) and 14.0 ft. NGVD (dry season). Stages will rise above those elevations in direct response to rainfall (and discharges from STA-5). Maximum stages are presently indeterminate, but are expected to be approximately elevation 14.0 ft. NGVD (wet season) and 14.5 ft. NGVD (dry season), except under extreme rainfall conditions.

During the wet season, there would be no water supply releases from the Rotenberger Tract below elevation 13.0 ft. NGVD.

During the dry season, releases from the Rotenberger Tract to the L-4 Borrow Canal would be permitted for all Rotenberger Tract stages above elevation 13.0 ft. NGVD.

b. <u>L-28 Water Supply Storage</u>

This area is that portion of the Rotenberger Tract generally bounded by Segment 1 of the FPL access embankment on the north; the existing South Levee L-4 on the south; and STA-6 on the west. It is intended that this area be held at a normal stage of 14.0 ft. NGVD year-round. Releases from this area to the L-4 Borrow Canal would be effected only as necessary to limit the storage area stage to 14.0 ft. NGVD. Releases from this area to the L-28 Borrow Canal (water supply) would be permitted for all storage area stages.

c. <u>L-4 Borrow Canal</u>

Stages in the L-4 Borrow Canal (and the hydraulically connected length of the Miami Canal along the Rotenberger Tract and the Holey Land) will be held at a normal elevation of 12.5 ft. NGVD year-round, to the extent sufficient water is available from the Rotenberger Tract to maintain that stage. Under drought conditions, water would be released from the Rotenberger Tract to maintain stage in the L-4 Borrow Canal (only for Rotenberger Tract stages at or above 13.0 ft. NGVD).

During rainfall and runoff events, the stage in the L-4 Borrow Canal will be allowed to rise to elevation 13.5 ft. NGVD; stage increases will occur in direct response to backwater influences resulting from the sheet flow discharge to WCA-3A.

Stages in the L-4 Borrow Canal will be limited to a maximum of 13.5 ft. NGVD through operation of existing Pump Station S-8.

2. <u>OPERATION OF STAGE CONTROL STRUCTURES</u>

The following is a summary of the intended operation of the various structures controlling stages in the above areas.

a. <u>FPL Segment 1</u>

The series of culverts beneath Segment 1 of the FPL access embankment will be equipped with stop log risers. Stop logs will be installed to elevation 14.25 ft. NGVD year-round. These structures will operate passively, discharging from the Rotenberger Tract to the L-28 Water Supply Storage area whenever Rotenberger Tract stages exceed elevation 14.25 ft. NGVD.

b. FPL Segment 2

The control structures through Segment 2 of the FPL access embankment will discharge from the Rotenberger Tract to the L-4 Borrow Canal. These structures will be fitted with fixed weirs at elevation 13.0 ft. NGVD on their northerly ends. During the dry season, weir extension plates will be added to the weirs to extend the control elevation to 14.0 ft. NGVD. Except as discussed below for the supply of water to the L-4 Borrow Canal, these structures are intended to operate passively.

The inlet structures will be equipped with manually operated slide gates to permit dry season water supply releases from the Rotenberger Tract to the L-4 Borrow Canal as may be necessary to maintain a stage of 12.5 ft. NGVD in the L-4 Borrow Canal.

c. New Control Structure in L-4 Borrow Canal

The new control structure in the L-4 Borrow Canal will operate automatically in response to headwater elevation to maintain water surface elevations in the L-28 Water Supply Storage Area. The structure would open as stages exceed approximate elevation 14.0 ft. NGVD, and close as stages recede to approximate elevation 14.0 ft. NGVD. The probable final operating range for this structure is 13.8 to 14.2 ft. NGVD.

3. WATER SUPPLY OPERATIONS

The following is a summary of the intended operation for delivery of water to the Holey Land and L-28 Borrow Canal.

a. Holey Land

Existing Pump Station G-200A will continue to supply water to the Holey Land from the Miami Canal downstream of the new control structure in the Miami Canal included in the West WCA-

3A Hydroperiod Restoration Works. As the stage in the Miami Canal at G-200A is drawn below elevation 12.5 ft. NGVD, water supply releases will be made from the Rotenberger Tract, through the control structures in Segment 2 of the FPL access embankment, to the L-4 Borrow Canal. The L-4 Borrow Canal will be directly connected to and feed the Miami Canal at G-200A.

b. <u>L-28 Borrow Canal</u>

The following is a summary of the intended hierarchy for water supply deliveries to the L-28 Borrow Canal in the immediate vicinity of existing Structure G-89.

(1) <u>Supply from L-4 Borrow Canal and WCA-3A</u>: It is assumed that there is a sufficient hydraulic connection between the L-4 Borrow Canal, WCA-3A and the L-3 Borrow Canal Extension east of existing Structure G-155 such that when the L-4 Borrow Canal (and adjacent WCA-3A) stage is at or above elevation 12.5 ft. NGVD, the stage in the L-3 Borrow Canal Extension east of existing structure G-155 will also be at or above 12.5 ft. NGVD. If this assumption is incorrect, measures will be taken to establish such a hydraulic connection. Water supply to the L-28 Borrow Canal would be accomplished by opening the new gated culvert in Levee L-28 between the L-28 Borrow Canal and the L-3 Borrow Canal Extension.

(2) <u>Supply from L-28 Water Supply Storage Area</u>: When stages in the L-4 Borrow Canal are below 12.5 ft. NGVD, the L-28 Borrow Canal will be supplied from the storage area along and south of Segment 1 of the FPL access embankment. That operation will require opening both the new gated culvert in Levee L-28, and the new gated culvert in the South Levee L-4.

Measures will be taken to ensure that the water in the L-3 Borrow Canal Extension east of existing structure G-155 does not flow east or south below elevation 12.5 ft. NGVD during water supply deliveries to the L-28 Borrow Canal.

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PART VIII
IMPLEMENTATION SCHEDULE

PART VIII
IMPLEMENTATION SCHEDULE

A. GENERAL

This Part VIII defines one possible schedule for implementation of the Everglades Protection Project, together with the key assumptions made in development of that schedule. It must be recognized that substantive deviation from any of the listed assumptions can and will impact the scheduled dates for completion of the various activities and physical elements of the Project.

The single most significant assumption made is that implementation activities and construction will be constrained to available funding; e.g., expenditures will be scheduled such that they may be funded on a "pay as you go" basis without the need for the issuance of bonds or other forms of public indebtedness.

B. PRIMARY ASSUMPTIONS

The implementation schedule for the Everglades Protection Project is developed to result in the earliest practicable completion of all elements of the plan as they are described in Part IV, given the funding assumptions defined herein. It is prepared upon the primary assumption that no indebtedness will be incurred over the life of the project, requiring that expenditures be scheduled and made only when sufficient funds are available therefore. An additional significant assumption made in development of the project schedule is that all necessary permitting activities are structured and completed such that they will not impact the project schedule, other than those activities necessary for compliance with the National Environmental Policy Act (NEPA) of 1969, as amended. The schedule is developed upon the following assumptions concerning NEPA compliance:

- The preparation of a full Environmental Impact Statement (EIS) will be required for:

- The C-51 West End Flood Control Project.
- Stormwater Treatment Area No. 1 East (STA-1E).

- The preparation of an environmental assessment, extending at least through a Finding of No Significant Impact (FONSI), will be required for those plan elements substantively modifying the existing Central and South Florida Flood Control Project, including:

  - West WCA-3A Hydroperiod Restoration.
  - East WCA-3A Hydroperiod Restoration.
  - WCA-2A Hydroperiod Restoration.
  - STA-1 Inflow and Distribution works in the north end of WCA-1.
  - Diversion of Pump Station S-6 Discharges from WCA-1 to WCA-2A.
  - S-5A Basin Runoff Diversion.

Should Non-Point Discharge Elimination System (NPDES) permits be required for the project or parts of the project by either the United States Environmental Protection Agency or the Florida Department of Environmental Protection, it is assumed that the conditions of those permits will not substantively alter or modify the design, operation or cost of the project. It is further assumed that the permitting process, if required, will not impact the project implementation schedule.

1. ASSUMED FUNDING SOURCES

The following is a summary of funding sources, amounts, and the timing of payments assumed in the development of the project schedule. It is assumed that an Everglades Restoration Construction Project account will be established by the South Florida Water Management District; except as otherwise described herein, all incomes and expenditures for the Everglades Protection Project will pass through this account.

a. <u>South Florida Water Management District</u>

The District will annually commit ad valorem tax income to the account. The amount of that commitment will be $21,800,000 in Fiscal Year 1994, and will be increased by 5 percent per year thereafter. Those commitments will continue until such time as sufficient funds are available to meet the projected cash needs for construction of the Everglades Protection Project.

In each fiscal year, it is assumed that 50 percent of the total annual amount is available to the account in the first quarter of the fiscal year, and that 25 percent of the total annual amount is available to the account in the second and third quarters of the fiscal year.

As used in this document, a Fiscal year is defined as beginning October 1 and ending September 30.

b. <u>Everglades Agricultural Area (EAA)</u>

A minimum payment to the account of $11.625 Million will be made each year by or for private interests in the EAA, defined for this purpose as that part of the EAA presently regulated under the Chapter 40E-63 Rule, together with:

- The South Florida Conservancy District, Planning Unit No. 5.
- The South Shore Drainage District.
- The East Shore Water Control District.
- The East Beach Water Control District.
- The 715 Farms Area.

The first such payment to the account will be made in F.Y. 1996; it is assumed that 50 percent of the total annual amount is available to the account in the first quarter of each fiscal year, and that 25 percent of the total annual amount is available to the account in the second and third quarter of the fiscal year.

c. <u>C-139 Basin</u>

An annual payment to the account in the amount of $840,000 will be made by or for private interests in the C-139 Basin. The first such payment will be made in Fiscal Year 1996; it is assumed that the timing of receipt by the fund will parallel that for the District ad-valorem tax and the fund income from the EAA.

d. <u>Florida Power & Light Mitigation Fund</u>

A total amount of $14,000,000 in remaining monies from the FPL Mitigation Fund is considered available for use in defraying expenditures for the Everglades Protection Project. Those Funds will be transferred into the account as a reimbursement of account expenditures until those funds are exhausted; monies from this source are applied as income in the same fiscal year quarters as expenditures are made for the acquisition of lands in combined STA-3/4 (e.g., the Mace Sod property).

e. <u>Preservation 2000</u>

A total amount of $33,000,000 in monies from the Preservation 2000 Fund of the State of Florida and available to the SFWMD will be used for the purpose of land acquisition. That amount is composed of $21,000,000 in P-2000 funds made available by the SFWMD in its Fiscal Year 1993 budget, and $12,000,000 made available in Fiscal Year 1994. It is assumed that those funds are made available in the same Fiscal Year quarter as expenditures for land acquisition in STA-1W, STA-2, and STA-5.

f. State of Florida

A total amount of $30,000,000 will be deposited into the account by the State of Florida; it is assumed that those monies will be made available to the account in the second quarter of Fiscal Year 1996. The source of these funds is not presently defined, but may consist of the sale or exchange of certain state-owned lands in the Everglades Agricultural Area.

g. CARL Funds

State of Florida CARL Funds administered by the Department of Environmental Protection (DEP) will be used for the acquisition of remaining private lands in the Rotenberger Tract; the total estimated cost of these acquisitions is $5,234,000. These funds will not be deposited into the Everglades Restoration Construction Project account, and will instead be administered directly by DEP.

h. United States Government

The United States Government will fund the construction of the C-51 West End Flood Control Project and Stormwater Treatment Area 1 East in the total amount (fourth quarter F.Y. 1993 Dollars) of $86,955,000. That amount will be increased to reflect cost escalation between the third quarter F.Y. 1993 and the time of expenditure. The total amount of $86,955,000 is composed of $38,560,000 in currently authorized Federal funding for the C-51 West End Flood Control Project, and $48,385,000 in funding from the Department of the Interior.

Those funds are expected to be administered by the United States Government acting through the Jacksonville District, U.S. Army Corps of Engineers, and will not pass through the Everglades Restoration Project account.

The balance of the estimated capital cost for those two plan elements ($19,505,000, subsequently escalated) will be paid from the Everglades Restoration Construction Project account.

2. INTERRELATIONSHIP BETWEEN COMPONENT ELEMENTS

The technical plan is composed of a number of distinct but highly interrelated component elements. The project schedule is developed to recognize the following constraints and schedule dependencies between those various component elements.

a. Western Basins

With but one exception, the various improvements associated with the Western Basins may proceed independently of all other plan components. That exception is the proposed control structure in the Miami Canal included in the West WCA-3A Hydroperiod Restoration works, the construction of which should not begin until flows in the Miami Canal, primarily from the S-8 and S-3 basins, have been diverted to STA-3/4. Component plan elements considered to be associated with the Western Basins include:

- Stormwater Treatment Area No. 5 (STA-5).
- Rotenberger Tract Restoration.
- West WCA-3A Hydroperiod Restoration.

The modification of the existing U.S. Sugar Corporation's detention basin as may be necessary for use as Stormwater Treatment Area No. 6 (STA-6) should be complete prior to completion of the West WCA-3A Hydroperiod Restoration works.

b. Eastern Basins

The various improvements associated with the Eastern Basins may proceed independently of all other plan components. Eastern Basins improvements include:

- Diversion of runoff from the northern part of the L-8 Basin to Lake Okeechobee.
- The C-51 West End Flood Control Project.
- Stormwater Treatment Area No. 1 East.

c. 298 District Diversions

The diversion of discharge from the 298 Districts and the 715 Farms area should not be completed prior to the completion of the treatment area intended for the diverted flows. As a result, diversion of the South Florida Conservancy District, Planning Unit 5 and the South Shore Drainage District is dependent upon completion of STA-3/4; diversion of the East Shore Water Control District, and the 715 Farms area is dependent upon completion of STA-2 and the WCA-2A Hydroperiod Restoration works, as well as the S-5A Basin Runoff Diversion works. Diversion of the East Beach Water Control District is dependent upon completion of STA-1W and the S-5A Basin Runoff Diversion works.

d. S-5A Basin Runoff Diversion

Diversion of discharges from the S-5A Basin to the Hillsboro Canal should not be completed until such time as STA-2 is complete and operational.

3. <u>PRIORITIZATION OF COMPONENT ELEMENTS</u>

The project schedule is developed to reflect the following assumed prioritization for completion of the various components of the overall project.

- <u>First Priority</u>: The highest priority is assumed to include those component elements necessary for protection of the Loxahatchee National Wildlife Refuge. The component elements necessary for that purpose will be funded first, and include:

  - The STA-1 inflow and distribution works.
  - Stormwater Treatment Area 1 West.
  - Stormwater Treatment Area 2 (requires completion of WCA-2A Hydroperiod Restoration works as well).
  - S-5A Basin Runoff Diversion.

  As discussed in paragraph B.4.a of this Part VIII, responsibility for implementation of the STA-1 Inflow and Distribution Works and STA-1W will lie with the United States government, funded through the Everglades Restoration Construction Project account. The timing of those expenditures is controlled by the assumed completion date for these two project components defined in paragraph B.6 of this Part VIII.

- <u>Second Priority</u>: Improvements associated with the Western Basins are afforded the second highest priority in expenditure of funds, and include:

  - Stormwater Treatment Area No. 6.
  - Stormwater Treatment Area No. 5.
  - Rotenberger Tract Restoration.
  - West WCA-3A Hydroperiod Restoration.

- Third Priority: Local (SFWMD) funding for the C-51 West End Flood Control Project and Stormwater Treatment Area No. 1 East is afforded the third highest priority in the expenditure of funds from the Everglades Restoration Construction Project account.

  The timing of those expenditures is controlled by the assumptions listed in paragraph B.6 of this Part VIII.

- Fourth Priority: Includes the diversion of discharges from the East Shore Water Control District, the East Beach Water Control District, and the 715 Farms area.

- Fifth Priority: Includes the construction of Combined Stormwater Treatment Area 3 and 4 (STA-3/4) and the East WCA-3A Hydroperiod Restoration works.

- Sixth Priority: Includes the diversion of discharges from the South Florida Conservancy District, Planning Unit 5 and the South Shore Drainage District.

- Seventh Priority: All remaining improvements, including Pump Station S-309 in the L-8 Basin.

4. ASSUMED IMPLEMENTATION RESPONSIBILITIES

The project schedule is developed upon the assumption that, except as otherwise described below, the responsibility for implementation of the Everglades Protection Project will lie with the South Florida Water Management District.

a. <u>United States Government</u>

The United States Government will be responsible for implementation of the C-51 West End Flood Control Project, Stormwater Treatment Area No. 1 East, Stormwater Treatment Area No. 1 West and the STA-1 Inflow and Distribution Works. In addition, it is assumed that the Jacksonville District, U.S. Army Corps of Engineers will be responsible for the preparation of all environmental assessments which may be required for proposed substantive modifications to the Central and South Florida Flood Control Project.

The C-51 West End Flood Control Project and STA-1E will be funded through a cost-share arrangement between the United States government and the South Florida Water Management District. STA-1W and the STA-1 Inflow and Distribution Works will be funded through the Everglades Restoration Construction Project account.

The total estimated cost for these four plan components is $170.08 million (third quarter F.Y. 1993 dollars); of that total, $86.96 million (51.12 percent) will be funded by the United States government as described in paragraph B.1.h of this Part VIII.

b. <u>Florida Department of Environmental Protection (DEP)</u>

DEP will be responsible for the acquisition of all remaining privately held lands now within the Rotenberger Tract.

c. <u>298 Districts/715 Farms</u>

The 298 Districts and the owner of the 715 Farms area will be responsible for implementation of the diversion of their discharges from Lake Okeechobee. Expenditures for that purpose will be reimbursed from the Everglades Restoration Construction

Project account established by the South Florida Water Management District.

5. <u>ESCALATION AND INTEREST</u>

All estimated costs reported in Parts V and VI are expressed in third quarter F.Y. 1993 dollars. Scheduled expenditures are developed upon the assumption that all costs will escalate at an average annual rate of 3.5 percent from third quarter F.Y. 1993.

Interest income is included in the analysis, computed quarterly at an annual rate of 3.5 percent applied to the fund balance in the Everglades Restoration Construction Project account. No interest is computed on fund income received in the same quarter as it is expended.

6. <u>ASSUMED CONTROL DATES</u>

The schedule is developed upon the assumption of a July 1, 1994 start date for all activities, which assumes authorization of initial expenditures by the District's Board of Governors at its June, 1994 meeting. Any delay in that start date will result in a similar delay in the scheduled completion dates for all activities and plan elements.

An implementation schedule for the C-51 West End Flood Control Project and Stormwater Treatment Area No. 1 East has not been defined by the United States Government. For this analysis, it is assumed that local expenditures in support of that effort will be made in twelve equal (third quarter F.Y. 1993 dollars) quarterly increments extending from the fourth quarter F.Y. 1998 through the third quarter F.Y. 2001, in anticipation of an <u>assumed</u> July 1, 2001 completion date for these two plan components. Those expenditures will be escalated to reflect cost inflation subsequent to the third quarter F.Y. 1993, taken for the analysis as 3.5 percent per year.

Similarly, an implementation schedule for Stormwater Treatment Area No. 1 West and the STA-1 Inflow and Distribution Works has not been defined by the United States Government. For this analysis, it is assumed that local expenditures funding that effort will be made to support an <u>assumed</u> January 1, 1999 completion date for those two plan elements.

Substantive changes in the assumed completion dates for project components to be implemented by the United States Government can be expected to impact Everglades Restoration Construction Project cash flow, potentially resulting in modification of supportable completion dates for other project components.

C. <u>SCHEDULED EXPENDITURES</u>

The implementation schedule presented herein is based on funding the various project costs summarized in Part V (capital cost estimates) and Part VI (incremental operation and maintenance costs), escalated to reflect anticipated inflation subsequent to the third quarter of Fiscal Year 1993. Certain of the estimated project costs will not be funded through the Everglades Restoration Construction Project account, or are to be implemented by others than the South Florida Water Management District, and are not directly reflected in the schedule.

1. <u>CAPITAL COSTS</u>

Except as otherwise described below, all estimated capital costs are considered in development of the schedule.

a. <u>C-51 West End Flood Control Project and STA-1E</u>

These two project components have a total estimated capital cost of $106.46 million, and are assumed to be the implementation responsibility of the United States government. Of that total estimated capital cost, $86.96 million is assumed to be funded by the United States government. The balance of

$19.50 million represents the local share of the cost of those two project elements, and is included in the schedule analysis as described in paragraph VIII.B.6.

While Stormwater Treatment Area No. 1 West and the STA-1 Inflow and Distribution Works are also assumed to be the implementation responsibility of the United States government, it has been assumed that the aggregate $63.62 million estimated cost for these two components will be locally funded. As a result, the scheduled expenditures include all those funds.

b. Rotenberger Tract Restoration

The total estimated cost of this plan component is $14.68 million. That total includes $5.23 million for the acquisition of remaining private lands in the Rotenberger Tract, assumed to be the responsibility of the Florida Department of Environmental Protection acting through the CARL program. Scheduled expenditures for this plan component are reduced by the estimated cost of land acquisition to $9.45 million.

c. 298 Districts/715 Farms

While the responsibility for implementation of the diversion of discharges from the 298 Districts and 715 Farms area is expected to lie with those districts and the owner of the 715 Farms area, it is assumed that the diversion costs will be funded by the Everglades Restoration Construction Project account. Those costs are therefore included in the schedule.

As discussed in Part IV, the specific nature of works necessary for the diversion is not presently known; the project capital cost estimate includes an allowance of $11.5 million for completion of those works. In development of the implementation schedule, it is assumed that those costs are distributed as roughly one-third to the southern districts

(South Florida Conservancy District Planning Unit No. 5 and South Shore Drainage District) and two-thirds to the eastern districts (715 Farms, East Shore Water Control District and East Beach Water Control District). The construction durations and expenditures reflected in the schedule are approximations only, as the preparation of a specific schedule requires more information than is presently available.

2. OPERATION AND MAINTENANCE COSTS

The implementation schedule is developed assuming that operation and maintenance costs for the various treatment facilities will be funded through the Everglades Restoration Construction Project account. Incremental operation and maintenance costs for other facilities are not considered in the analysis, as it is assumed they will be funded through the District's overall operations budget and will not in any event be separately identifiable. The distribution of incremental operation and maintenance costs between treatment facilities and other facilities is shown in Table VI-1. Operation and maintenance costs for any given treatment facility are initially applied in the first quarter following the scheduled completion date of the facility.

3. RESEARCH AND MONITORING COSTS

No research and monitoring costs are considered in development of the implementation schedule, implying that such expenditures will be funded through sources other than the Everglades Restoration Construction Project account.

D. RESULTS OF SCHEDULE ANALYSIS

A detailed cash flow analysis for the Everglades Protection Project is included as Attachment D to this document. That analysis and the resultant implementation schedule is based on the various assumptions defined in this Part VIII. The analysis extends only through physical completion of the various component elements of the project; in the latter years of the analysis, fund income is reduced for the single purpose of balancing fund income and expenditures. No attempt is made to suggest the desired duration of annual fund income from any given source, or to result in any predetermined relative overall contribution to the effort from any given funding source.

The resultant milestone completion dates for the various components of the Everglades Protection Project, constrained to reflect assumed funding, are summarized in Table VIII-1.

TABLE VIII-1
IMPLEMENTATION SCHEDULE
MILESTONE COMPLETION DATES

Project Component	Estimated Completion Date (Mo./Day/Yr.) Final Design	Land Acq.	Const.
Stormwater Treatment Area No. 6	07/01/96	07/01/96	10/01/97
Stormwater Treatment Area No. 5	04/01/96	07/01/96	01/01/99
Diversion of SFCD & SSDD [(2)]	07/01/02	10/01/02	04/01/04
West WCA-3A Hydroperiod Restoration	10/01/96	N/A	04/01/98
- Control Structure in Miami Canal	07/01/03	N/A	04/01/05
Diversion of ESWCD & 715 Farms [(2)]	04/01/00	10/01/97	07/01/99
Diversion of EBWCD [(2)]	10/01/97	10/01/97	07/01/99
Combined Stormwater Treatment Area 3 & 4	10/01/97	07/01/00	10/01/03
East WCA-3A Hydroperiod Restoration	10/01/01	N/A	10/01/03
- Control Structure in North New River	07/01/03	N/A	04/01/05
C-51 West End Flood Control Project [(3)]	04/01/98	07/01/98	07/01/01
S-5A Basin Runoff Diversion	01/01/97	04/01/97	07/01/99
STA-1 Inflow and Distribution Works [(3)]	01/01/96	N/A	01/01/99
Stormwater Treatment Area No. 1 (West) [(3)]	01/01/96	04/01/96	01/01/99
Stormwater Treatment Area No. 1 (East) [(3)]	04/01/98	07/01/98	07/01/01
Stormwater Treatment Area No. 2	01/01/96	04/01/96	02/01/99
WCA-2A Hydroperiod Restoration	04/01/97	N/A	01/01/99
L-8 Basin Diversion	10/01/95	N/A	01/01/97
- Pump Station S-309	01/01/03	N/A	04/01/05
Rotenberger Tract Restoration	04/01/96	10/01/96	07/01/98

NOTES: (1) Assumed completion date.
(2) Implementation responsibility of 298 Districts and 715 Farms.
(3) Implementation responsibility of United States Government.

The above construction completion dates are the earliest that can be supported given the various assumptions defined in this Part VIII. The scheduled completion dates for Final Design and Land Acquisition are the latest dates those activities can be completed without impacting the construction completion dates.

* * * * *

REFERENCES

REFERENCES

1. *Conceptual Design, Stormwater Treatment Areas, Everglades Protection Project*; prepared for the South Florida Water Management District by Burns & McDonnell; March 31, 1992.

2. Technical Memorandum: *Historical Discharge Data for the Everglades Agricultural Area, TM-3021-A1-002*; prepared for the South Florida Water Management District by Burns & McDonnell; November 18, 1992.

3. Technical Memorandum: *Historical Phosphorus Loads for the Everglades Agricultural Area, TM-3021-A1-003*; prepared for the South Florida Water Management District by Burns & McDonnell; February 4, 1994.

4. Technical Memorandum: *Adjustments to EAA Discharges Due to Implementation of Best Management Practices, TM-3021-A1-004*; prepared for the South Florida Water Management District by Burns & McDonnell; February 4, 1994.

5. *Time Averaged, Spatially Variable Mass Balances for Phosphorus and Water in Wetlands*; prepared for the United States Department of Justice by Robert H. Kadlec, Wetland Management Services; December 20, 1992.

6. *Review of the Everglades Protection Project Conceptual Design, Stormwater Treatment Areas*; prepared for the South Florida Water Management District by Nolte and Associates, Inc., Sacramento, California; December, 1992.

7. *Surface Water Improvement and Management Plan for the Everglades*; South Florida Water Management District; March 13, 1992.

8. *Settlement Agreement, Case No. 88-1886-CIV-HOEVELER*; Before the United States District Court, Southern District of Florida; July 11, 1991; approved by the Court on February 24, 1992.

9. *Refinements to Phosphorus Uptake Relationship for Everglades Stormwater Treatment Areas Based Upon Data From Water Conservation Area 2A*; W. William Walker, Jr.; August 28, 1992.

10. *Everglades Protection Stormwater Treatment Area Design Support, Phosphorus Removal in Wetland Treatment Areas, Principles and Data*; Robert H. Kadlec and Susan Newman; July, 1992.

11. *A Mass-Balance Model for Estimating Phosphorus Settling Rate in Everglades Water Conservation Area-2A*; prepared for the U.S. Department of Justice by William W. Walker, Jr., Ph.D.; March 8, 1993.

12. *Conceptual Design, C-51 West End Project*; prepared for the South Florida Water Management District by Burns & McDonnell; February 26, 1993.

13. *Marjory Stoneman Douglas Everglades Protection Act*; 1991 Legislature of the State of Florida, CS/CS/CS/HB, 2157 & 1871, 2nd Engrossed.

14. Technical Memorandum: *An Atlas of the Everglades Agricultural Area Surface Water Management Basins*; South Florida Water Management District; September, 1989.

15. Technical Memorandum: *An Atlas of Eastern Palm Beach County Surface Water Management Basins*; South Florida Water Management District; June, 1988.

16. Technical Memorandum: *An Atlas of Surface Water Management Basins in the Everglades: The Water Conservation Areas and Everglades National Park*; South Florida Water Management District; September, 1991.

17. Technical Memorandum: *Recommended Effective Areas of Stormwater Treatment Areas (STAs)*; prepared for the South Florida Water Management District by Burns & McDonnell; February 4, 1994.

18. *Everglades Protection Project, Phase I Evaluation of Alternative Treatment Technologies*; prepared for the South Florida Water Management District by Brown and Caldwell; January 19, 1993.

19. *Everglades Protection Project, Evaluation of On-Farm Best Management Practices*; prepared for the South Florida Water Management District by Brown and Caldwell; April 30, 1993.

20. *Everglades Protection Project, Analysis and Development of Chemical Treatment Processes*; prepared for the South Florida Water Management District by Brown and Caldwell; June 1, 1993.

21. *Everglades Protection Project, Phase II Evaluation of Alternative Treatment Technologies*; prepared for the South Florida Water Management District by Brown and Caldwell, May 15, 1993.

22. *Western Basins Environmental Assessment, Report Nos. 1, 2, and 4 through 8*; prepared for the South Florida Water Management District by Mock, Roos, and Associates; January 6, 1993.

23. *Analysis of Control Strategies for Reduction of Phosphorus Loads to Lake Okeechobee from the Special 298 Drainage Districts*; prepared for the South Florida Conservancy District, South Shore Drainage District, East Shore Water Control District, and East Beach Water Control District by CH_2M Hill; October, 1987.

24. Central and Southern Florida Project for Flood Control and Other Purposes: *Part V, Supplement 54, Detail Design Memorandum, Addendum 2 (Revised); Coastal Areas South of St. Lucie Canal; Canal 51-West End, Control Structures 155A, 360, Pumping Station 319 and Levee 85*; Jacksonville District, U.S. Army Corps of Engineers; June, 1992.

25. *Palm Beach County, 1991 Plat Directory*; Palm Beach County Soil & Water Conservation District.

26. *Hendry/Glades Counties, 1992 Plat Directory*; Hendry Soil and Water Conservation District and Glades Soil and Water Conservation District.

27. *Everglades Protection Project, Assessment of Historic Phosphorus Load Contribution from Sugar Mills in the EAA*; prepared for the South Florida Water Management District by Brown and Caldwell, July 27, 1993.

* * * * *

ATTACHMENT A
DATA SUMMARY

ATTACHMENT A

DATA SUMMARY
TABLE OF CONTENTS

NOTE: This Attachment includes data not only for the technical plan described in Part IV but also for the current (March, 1992) proposed SWIM Plan as it would be updated to reflect subsequent data revision and analytical refinements only. Data for the updated SWIM Plan is included for comparative purposes only.

TABLE A-1

AREAS TRIBUTARY TO TREATMENT WORKS

Basin	Area (acres) Tributary to Treatment Works	
	Updated SWIM Plan	Technical Plan
S-5A	126,910	126,910
S-6/S-2	121,009	121,009
S-7/S-2	142,160	142,160
S-8/S-3	133,642	133,642
C-51 West	0	46,720
C-139	41,250*	168,435
SFCD	0	9,775**
SSDD	0	4,230**
ESWCD	0	8,136**
EBWCD	0	5,064**
715 Farms	0	3,398**
TOTAL	564,971	769,479

* Equivalent area based on proportion of total runoff treated.

** Total diverted area; not all runoff treated; variable proportion of runoff will continue to be discharged to Lake Okeechobee.

TABLE A-2

SUMMARY OF EFFECTIVE STA TREATMENT AREAS FOR UPDATED SWIM PLAN

Treatment Area	Effective Treatment Area (acres)		
	Public Lands	Private Lands	Total Area
STA-1	3,636	5,241	8,877
STA-2	0	4,342	4,342
STA-3/4	0	14,523	14,523
TOTAL	3,636	24,106	27,742

TABLE A-3

SUMMARY OF EFFECTIVE STA TREATMENT AREAS FOR MEDIATED TECHNICAL PLAN

Treatment Area	Effective Treatment Area (acres)		
	Public Lands	Private Lands	Total Area
STA-1E	0	5,350	5,350
STA-1W	3,636	3,034	6,670
STA-2	4,410*	2,020	6,430
STA-3/4	3,590	13,070	16,660
STA-5	0	4,530	4,530
STA-6	0	812	812
TOTAL	11,636	28,816	40,452

* Includes 190 acres of public lands presently leased to private interests.

TABLE A-4

SUMMARY OF HISTORIC DISCHARGES

Contributing Basin	Average Annual Volumes and Loads Discharged To							
	EPA		Lake Okeechobee		Other		Total	
	Volume	Load	Volume	Load	Volume	Load	Volume	Load
EAA								
• S-5A	256.8	71.2	2.7	0.4	16.0	3.8	275.5	75.4
• S-6/S-2	154.9	29.1	39.5	10.0	0.0	0.0	194.4	39.1
• S-7/S-2	220.8	29.8	53.4	13.7	0.0	0.0	274.2	43.5
• S-8/S-3	250.9	66.0	47.2	9.8	0.0	0.0	298.1	75.8
SUBTOTAL	883.4	196.1	142.8	33.9	16.0	3.8	1,042.2	233.8
C-51 West	4.9	0.9	0.0	0.0	114.1	26.3	119.0	27.2
L-8	50.7	3.5	22.1	4.7	114.2	17.5	187.0	25.7
C-139	98.0	28.7	0.0	0.0	0.0	0.0	98.8	28.7
298 Districts								
SFCD	0.0	0.0	17.5	3.1	0.0	0.0	17.5	3.1
SSDD	0.0	0.0	5.2	0.7	0.0	0.0	5.2	0.7
ESWCD	0.0	0.0	8.6	2.0	0.0	0.0	8.6	2.0
EBWCD	0.0	0.0	5.4	2.6	0.0	0.0	5.4	2.6
715 Farms	0.0	0.0	7.8	2.4	0.0	0.0	7.8	2.4
SUBTOTAL	0.0	0.0	44.5	10.8	0.0	0.0	44.5	10.8
Lake*	21.1	2.3	N/A	N/A	N/A	N/A	21.1	2.3
TOTAL	1,058.1	231.5	209.4	49.4	244.3	47.6	1,511.8	328.5

* Excludes historic water supply releases to Lower East Coast at S-7 and S-8.

NOTE: All volumes in 1,000 acre.feet; all loads in metric tons of total phosphorus.

TABLE A-5

SUMMARY OF TECHNICAL PLAN DISCHARGES

Contributing Basin	Average Annual Volumes and Loads Discharged To: EPA Volume	EPA Load	Lake Okeechobee Volume	Lake Okeechobee Load	Other Volume	Other Load	Total Volume	Total Load
Treated:								
STA-1E	126.4	7.2	0.0	0.0	0.0	0.0	126.4	7.8
STA-1W	144.7	8.9	0.0	0.0	0.0	0.0	144.7	8.9
STA-2	175.8	10.8	0.0	0.0	0.0	0.0	175.8	10.8
STA-3/4	609.3	37.6	0.0	0.0	0.0	0.0	609.3	37.6
STA-5	88.2*	5.4*	0.0	0.0	0.0	0.0	88.2	5.4
STA-6	18.3	1.1	0.0	0.0	0.0	0.0	18.3	1.1
SUBTOTAL	1,162.7	71.6	0.0	0.0	0.0	0.0	1,162.7	71.6
Direct:								
L-8	0.0	0.0	116.9	8.8	70.1	16.9	187.0	25.7
C-51 West	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SFCD	0.0	0.0	4.6	0.8	0.0	0.0	4.6	0.8
SSDD	0.0	0.0	1.4	0.2	0.0	0.0	1.4	0.2
ESWCD	0.0	0.0	2.5	0.6	0.0	0.0	2.5	0.6
EBWCD	0.0	0.0	1.1	0.5	0.0	0.0	1.1	0.5
715 Farms	0.0	0.0	2.3	0.7	0.0	0.0	2.3	0.7
S-5A	0.0	0.0	10.0	10.5	0.0	0.0	10.0	10.5
S-6/S-2	0.0	0.0	33.2	7.9	0.0	0.0	33.2	7.9
S-7/S-2	0.0	0.0	42.5	10.3	0.0	0.0	42.5	10.3
S-8/S-3	0.0	0.0	36.3	7.1	0.0	0.0	36.3	7.1
C-139	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
SUBTOTAL	0.0	0.0	250.8	47.4	70.1	16.9	320.9	64.3
TOTAL	1,162.7	71.6	250.8	47.4	70.1	16.9	1,483.6	135.9

* Discharge actually to Rotenberger Tract and Holey Land; further improvement in water quality anticipated prior to discharge to EPA.

NOTE: All volumes in 1,000 acre.feet; all loads in metric tons of total phosphorus. Data excludes water supply releases to Lower East Coast at S-7 and S-8.

Above data excludes BMP makeup water releases from Lake Okeechobee (average annual volume of 173,700 acre-feet), which would increase average annual discharge to EPA to 1,336.4 thousand acre-feet.

Discharges to Lake from 298 Districts/715 Farms includes both direct discharges and that part of diverted volume and load discharged to Lake at S-2 and S-3.

TABLE A-6

SUMMARY OF UPDATED SWIM PLAN*

Contributing Basin	Average Annual Volumes and Loads Discharged To: EPA		Lake Okeechobee		Other		Total	
	Volume	Load	Volume	Load	Volume	Load	Volume	Load
Treated								
STA-1	196.5	12.1	0.0	0.0	0.0	0.0	196.5	12.1
STA-2	131.3	8.1	0.0	0.0	0.0	0.0	131.3	8.1
STA-3/4	420.5	25.9	0.0	0.0	0.0	0.0	420.5	25.9
SUBTOTAL	748.3	46.1	0.0	0.0	0.0	0.0	748.3	46.1
Direct:								
L-8	50.7	3.5	22.1	4.7	114.2	17.5	187.0	25.7
C-51 West	4.9	0.9	0.0	0.0	114.1	26.3	119.0	27.2
SFCD	0.0	0.0	17.5	3.1	0.0	0.0	17.5	3.1
SSDD	0.0	0.0	5.2	0.7	0.0	0.0	5.2	0.7
ESWCD	0.0	0.0	8.6	2.0	0.0	0.0	8.6	2.0
EBWCD	0.0	0.0	5.4	2.6	0.0	0.0	5.4	2.6
715 Farms	0.0	0.0	7.8	2.4	0.0	0.0	7.8	2.4
S-5A	0.0	0.0	2.1	0.3	0.0	0.0	2.1	0.3
S-6/S-2	0.0	0.0	33.2	7.9	0.0	0.0	33.2	7.9
S-7/S-2	0.0	0.0	42.5	10.3	0.0	0.0	42.5	10.3
S-8/S-3	0.0	0.0	36.3	7.1	0.0	0.0	36.3	7.1
C-139	74.0	22.9	0.0	0.0	0.0	0.0	74.0	22.9
SUBTOTAL	129.6	27.3	237.4	41.1	228.3	43.8	538.6	112.2
TOTAL	877.9	73.4	237.4	41.1	228.3	43.8	1,343.6	158.3

* Current (March, 1992) proposed SWIM Plan updated for subsequent data revision and analytical refinements only. Excludes water supply releases to Lower East Coast at S-7 and S-8.

ATTACHMENT B

CAPITAL COST ESTIMATTES
TABLE OF CONTENTS

TABLE B-1
CONCEPTUAL COST ESTIMATE
STORMWATER TREATMENT AREA NO. 6

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Cell 1 Inflow				
a.	Clearing	2	Ac.	1,100	2,200
b.	Levee Excavation	5,200	Cu. Yd.	4.00	20,800
c.	Grassing	2	Ac.	1,900	3,800
	Subtotal, Cell 1 Inflow				$26,800
2.	Cell 1 Outflow Structures				
a.	Excavation for Trenches and Structures	600	Cu. Yd.	5.00	3,000
b.	Backfill for Trenches and Structures	400	Cu. Yd.	3.00	1,200
c.	84" Dia. CMP	140	Lin. Ft.	120.00	16,800
d.	Reinforced Concrete	45	Cu. Yd.	330.00	14,850
e.	Std. End Section for 84" CMP	2	Each	1,000	2,000
f.	Dewatering, per structure	2	Each	3,750	7,500
g.	Access Bridges	62	Lin. Ft.	180.00	11,160
h.	Bridge Footings	3	Cu. Yd.	200.00	600
i.	Outlet Channel Excavation	4,000	Cu. Yd.	6.00	24,000
j.	Closure Panels, 10′ x 3′	4	Each	1,000	4,000
k.	Riprap	200	Ton	50.00	10,000
	Subtotal, Cell 1 Outflow Structures				$95,110
3.	Discharge Canal				
a.	Clearing (120′ x 5,100′)	14	Ac.	1,100	15,400
b.	Borrow Canal Enlargement	74,000	Cu. Yd.	2.50	185,000
c.	Levee Embankment	60,000	Cu. Yd.	1.50	90,000
d.	Grassing (80′ x 5,100′)	9	Ac.	1,900	17,100
	Subtotal, Cell 1 Discharge Canal				$307,500
4.	Cell 2 Inflow				
a.	Clearing	1	Ac.	1,100	1,100
b.	Levee Excavation	1,800	Cu. Yd.	4.00	7,200
c.	Grassing	1	Ac.	1,900	1,900
	Subtotal, Cell 2 Inflow Works				$10,200

(Cont'd next page)

TABLE B-1 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
5.	Cell 2 Outflow Structures				
a.	Collection Canal Excavation	5,000	Cu. Yd.	2.50	12,500
b.	Excavation for Trenches and Structures	500	Cu. Yd.	5.00	2,500
c.	Backfill for Trenches and Structures	400	Lin. Ft.	3.00	1,200
d.	48" Dia. CMP	140	Lin. Ft.	75.00	10,500
e.	Reinforced Concrete	20	Cu. Yd.	330.00	6,600
f.	Std. End Section for 48" CMP	2	Each	500.00	1,000
g.	Dewatering, per structure	2	Each	3,000	6,000
h.	Access Bridges	62	Lin. Ft.	180.00	11,160
i.	Bridge Footings	3	Cu. Yd.	200.00	600
j.	Closure Panels, 10' x 3'	4	Each	1,000	4,000
k.	Riprap	150	Ton	50.00	7,500
	Subtotal, Cell 2 Outflow Structures				$63,560
	SUBTOTAL				$503,170
	Engineering, Planning, Design and Construction Management @ 15%				75,480
	Contingency @ 20%				100,630
	TOTAL ESTIMATED COST				$679,280

TABLE B-2
CONCEPTUAL COST ESTIMATE
STORMWATER TREATMENT AREA NO. 5

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Inflow Pump Station (1,570 cfs capacity	Job	Lump	Sum	$7,400,000
2.	Inflow Distribution Works				
a.	Clearing	62	Ac.	$1,100	68,200
b.	Spreader Canal Excavation	27,000	Cu. Yd.	2.50	67,500
c.	Distribution Canal Excavation	190,000	Cu. Yd.	2.50	475,000
d.	Levee Embankment	164,000	Cu. Yd.	1.50	246,000
e.	Grassing	40	Ac.	1,900	96,000
f.	Excavation for Trenches and Structures	3,500	Cu. Yd.	5.00	17,500
g.	Backfill for Trenches and Structures	2,800	Cu. Yd.	3.00	8,400
h.	84" Diameter CMP	800	Lin. Ft.	120.00	96,000
i.	Reinforced Concrete	415	Cu. Yd.	330.00	136,950
j.	84" x 84" sluice gates	16	Each	12,000	192,000
k.	End Sections for 84" CMP	32	Each	1,000	32,000
l.	Outlet Channel Excavation	5,600	Cu. Yd.	6.00	33,600
m.	Dewatering (per structure)	16	Each	5,000	80,000
	Subtotal, Inflow Distribution Works				$1,549,150
3.	Discharge Facilities				
a.	Clearing	58	Ac.	1,100	63,800
b.	Spreader Canal Excavation	122,000	Cu. Yd.	2.50	305,000
c.	Collection Canal Excavation	60,000	Cu. Yd.	1.50	90,000
d.	Levee Embankment	138,000	Cu. Yd.	2.50	345,000
e.	Excavation for Trenches and Structures	3,700	Cu. Yd.	5.00	18,500
f.	Backfill for Trenches and Structures	2,900	Cu. Yd.	3.00	8,700
g.	60" Dia. CMP	960	Lin. Ft.	90.00	86,400
h.	Reinforced Concrete	335	Cu. Yd.	330.00	110,550
i.	Std. End Section for 60" CMP	16	Each	750.00	12,000
j.	Dewatering, per structure	16	Each	5,000	80,000
k.	Access Bridges	500	Lin. Ft.	180.00	90,000
l.	Bridge Footings	20	Cu. Yd.	200.00	4,000
m.	Outlet Channel Excavation	3,200	Cu. Yd.	6.00	19,200
n.	Closure Panels, 10' x 3'	32	Each	1,000	32,000
o.	Riprap	1,600	Ton	50.00	80,000
p.	Grassing	32	Ac.	1,900	60,800
	Subtotal, Discharge Facilities				$1,405,950

(Cont'd next page)

TABLE B-2 (cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
4.	Internal Levees				
a.	Clearing	110	Ac.	1,100	121,000
b.	Canal Excavation	285,000	Cu. Yd.	2.50	712,500
c.	Levee Embankment	214,000	Cu. Yd.	1.50	321,000
d.	Grassing	80	Ac.	1,900	152,000
	Subtotal, Internal Levees				$1,306,500
5.	Perimeter Levees				
a.	Clearing	102	Ac.	1,100	112,200
b.	Canal Excavation	432,000	Cu. Yd.	2.50	1,080,000
c.	Levee Embankment	310,000	Cu. Yd.	1.50	465,000
d.	Grassing	65	Ac.	1,900	123,500
	Subtotal, Perimeter Levees				$1,780,700
6.	Internal Land Preparation	4,530	Ac.	100.00	453,000
7.	Internal Grading and Berms	Job	Lump	Allow	2,200,000
8.	Power Line to Pump Station	5.0	Mi.	150,000	750,000
	SUBTOTAL				$16,845,300
	Engineering, Planning, Design and Construction Management @ 15%				2,526,800
	Contingency @ 20%				3,369,100
	TOTAL, CONSTRUCTED FACILITIES				$22,741,200
	Land Acquisition	5,026	Ac.	2,000	10,052,000
	Contingency @ 30%				3,015,600
	TOTAL, LAND ACQUISITION				$13,067,600
	TOTAL ESTIMATED COST				$35,808,800

TABLE B-3
CONCEPTUAL COST ESTIMATE
ROTENBERGER TRACT RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	West and North Perimeter Levee				
a.	Clearing	184	Ac.	$1,100	$ 202,400
b.	Canal Excavation	816,000	Cu. Yd.	2.50	2,040,000
c.	Levee Embankment	613,000	Cu. Yd.	1.50	919,500
d.	Grassing	116	Ac.	1,900	220,400
e.	Access Culverts	Job	Lump	Sum	40,000
	SUBTOTAL, PERIMETER LEVEE				$3,422,300
2.	Seepage Return Pump Station	Job	Lump	Sum	$900,000
3.	Modification of FPL Access Road, Segment 1				
a.	Clearing	39	Ac.	1,100	42,900
b.	Canal Excavation	112,000	Cu. Yd.	7.00	784,000
c.	Embankment	84,000	Cu. Yd.	1.50	126,000
d.	Grassing	19	Ac.	1,900	36,100
e.	Excavation for Trenches	3,500	Cu. Yd.	7.00	24,500
f.	Backfill for Trenches	3,200	Cu. Yd.	3.00	9,600
g.	72-in. dia. CMP	780	Lin. Ft.	100.00	78,000
h.	Risers, Stop Logs, and End Walls	13	Ea.	6,000	78,000
i.	Dewatering for culvert installation	13	Ea.	2,000	26,000
	SUBTOTAL, FPL SEGMENT 1				$1,205,100
4.	Modification of FPL Access Road, Segment 2				
a.	Clearing	53	Ac.	1,100	$ 58,300
b.	Collection Canal Excavation	75,000	Cu. Yd.	7.00	525,000
c.	Embankment	173,000	Cu. Yd.	1.50	259,500
d.	Grassing	28	Ac.	1,900	53,200
e.	Excavation for Trenches	3,000	Cu. Yd.	7.00	21,000
f.	Backfill for Trenches	2,800	Cu. Yd.	3.00	8,400
g.	84" Dia. CMP	560	Lin. Ft.	120.00	67,200
h.	Reinforced Concrete	175	Cu. Yd.	330.00	57,750
i.	Std. End Section for 84" CMP	7	Ea.	1,000	7,000
j.	Outlet Canal Excavation	22,000	Cu. Yd.	5.00	110,000
k.	Outlet Canal Fill	16,500	Cu. Yd.	1.50	24,750
l.	Riprap	840	Ton	50.00	42,000
m.	Access Bridges	210	Lin. Ft.	180.00	37,800
n.	Bridge Footings	8	Cu. Yd.	200.00	1,600
	SUBTOTAL, FPL SEGMENT 2				$1,273,500

(Cont'd next page)

TABLE B-3 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
5.	Water Supply to L-28 Borrow Canal				
a.	Clearing	16	Ac.	1,100	17,600
b.	Excavation (Canal)	5,000	Cu. Yd.	2.50	12,500
c.	Excavation (Breach North L-4)	14,000	Cu. Yd.	3.00	42,000
d.	Backfill at Structures	4,000	Cu. Yd.	3.00	12,000
e.	84" Dia. CMP	240	Lin. Ft.	120.00	28,800
f.	End Sections for 84" CMP	4	Ea.	1,000	4,000
g.	Reinforced Concrete	52	Cu. Yd.	330.00	17,160
h.	Dewatering per structure	2	Ea.	5,000	10,000
i.	84" x 84" Sluice Gates	2	Ea.	12,000	24,000
j.	Grassing	16	Ac.	1,900	30,400
	SUBTOTAL, L-28 WATER SUPPLY				$ 198,460
	SUBTOTAL				$6,999,360
	Engineering, Planning, Design and Construction Management @ 15%				1,049,900
	Contingency @ 20%				1,399,900
	TOTAL, CONSTRUCTED FACILITIES				$9,449,160
	Land Acquisition	4,977	Ac.		3,715,700
	Contingency				1,518,010
	TOTAL, Land Acquisition				$5,233,710
	TOTAL ESTIMATED COST				$14,682,870

TABLE B-4
CONCEPTUAL COST ESTIMATE
WEST WCA-3A HYDROPERIOD RESTORATION

Item No.		Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.		Remove South Levee L-4				
	a.	Clearing	36	Ac.	$1,100	$ 39,600
	b.	Excavation	127,000	Cu. Yd.	1.50	190,500
	c.	Haul to FPL Access Embankment, 3 Mi. Round Trip	127,000	Cu. Yd.	5.00	635,000
	d.	Grassing	36	Ac.	1,900	68,400
		SUBTOTAL, REMOVE SOUTH LEVEE L-4				$ 933,500
2.		New control structure in L-4 Borrow Canal; 1,080 cfs capacity	Job	Lump	Sum	1,457,000
3.		New control structure in Miami Canal; 2,000 cfs capacity	Job	Lump	Sum	2,081,000
		SUBTOTAL				$4,471,500
		Engineering, Planning, Design and Construction Management @ 15%				670,700
		Contingency @ 20%				894,300
		TOTAL ESTIMATED COST				$6,036,500

TABLE B-5
CONCEPTUAL COST ESTIMATE
COMBINED STA-3 AND STA-4

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Inflow Pump Station (S-7)	Job	Lump	Sum	$ 9,130,000
2.	Inflow Pump Station (S-8)	Job	Lump	Sum	14,630,000
3.	Inflow Distribution Works				
a.	U.S. Highway 27 Bridges - 2 bridges, ea. 48' x 160'	15,360	Sq. Ft.	$ 65.00	998,400
b.	Temp. Crossovers at U.S. Hwy 27	2	Ea.	100,000	200,000
c.	U.S.-27 Traffic Handling and Signing	Job	Lump	Allow	50,000
d.	Utility Relocation at U.S. Hwy 27	Job	Lump	Allow	100,000
e.	Clearing (520' x 35,000')	418	Ac.	1,100	459,800
f.	Seepage Collection Canal Excavation	299,000	Cu. Yd.	2.50	747,500
g.	Spreader Canal Excavation	250,000	Cu. Yd.	2.50	625,000
h.	Distribution Canal Excavation	1,120,000	Cu. Yd.	2.50	2,800,000
i.	Inflow Control Mound	73,000	Cu. Yd.	1.00	73,000
j.	Interior Levee Embankment	503,000	Cu. Yd.	1.50	754,500
k.	Exterior Levee Embankment	725,000	Cu. Yd.	1.50	1,087,500
l.	Grassing (320' x 35,000')	257	Ac.	1,900	488,300
m.	Excavation for Trenches and Structures	16,700	Cu. Yd.	5.00	83,500
n.	Backfill for Trenches and Structures	13,400	Cu. Yd.	3.00	40,200
o.	84-in. dia. CMP	3,074	Lin. Ft.	120.00	368,880
p.	Reinforced Concrete for Structures	1,500	Cu. Yd.	330.00	495,000
q.	84" x 84" Sluice Gates, Self-Contained	58	Ea.	12,000	696,000
r.	End Sections for 84" CMP	116	Ea.	1,000	116,000
s.	Approach and Discharge Channel Excavation	20,000	Cu. Yd.	6.00	120,000
t.	Dewatering (per structure)	58	Ea.	5,000	290,000
	SUBTOTAL, Inflow Distribution Works				$10,593,580
4.	Supply Canal from Miami Canal				
a.	Clearing (405' x 60,000')	558	Ac.	1,100	613,800
b.	Seepage Canal Excavation	648,000	Cu. Yd.	2.50	1,620,000
c.	Supply Canal Excavation	3,426,000	Cu. Yd.	2.50	8,565,000
d.	Inflow Control Mound Fill	158,000	Cu. Yd.	1.00	158,000
e.	Levee Fill	2,388,000	Cu. Yd.	1.50	3,582,000
f.	Grassing (235' x 60,000')	324	Ac.	1,900	615,600
g.	New Bridge on L-23 33' x 160'	5,280	Sq. Ft.	65.00	343,200
	SUBTOTAL, Supply Canal				$15,497,600

(Cont'd next page)

TABLE B-5 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
5.	East Levee				
a.	Clearing (200' x 22,000')	101	Ac.	1,100	111,100
b.	Canal Excavation	338,000	Cu. Yd.	2.50	845,000
c.	Levee Embankment	248,000	Cu. Yd.	1.50	372,000
d.	Grassing (140' x 22,000')	71	Ac.	1,900	134,900
	SUBTOTAL, East Levee				$1,463,000
6.	Interior Levees				
a.	Clearing (160' x 28,000')	103	Ac.	1,100	113,300
b.	Canal Excavation	403,000	Cu. Yd.	2.50	1,007,500
c.	Levee Embankment	314,000	Cu. Yd.	1.50	471,000
d.	Grassing (100' x 28,000')	64	Ac.	1,900	121,600
	SUBTOTAL, Interior Levees				$1,713,400
7.	Relocate Pump Station G-200B	Job	Lump	Sum	580,000
8.	Relocate Pump Station G-201	Job	Lump	Sum	810,000
9.	Toe of the Boot Addition				
a.	Degrade Exist. Levee @ North	138,000	Cu. Yd.	2.00	276,000
b.	Clearing (200' x 10,300')	47	Ac.	1,100	51,700
c.	Canal Excavation	169,000	Cu. Yd.	2.50	422,500
d.	Levee Embankment	124,000	Cu. Yd.	1.50	186,000
e.	Grassing (140' x 10,300')	33	Ac.	1,900	62,700
	SUBTOTAL, Toe of the Boot Addition				$998,900
10.	Collection Canal and Levee				
a.	Clearing (180' x 46,000')	190	Ac.	1,100	209,000
b.	Canal Excavation	777,000	Cu. Yd.	2.50	1,942,500
c.	Levee Embankment	571,000	Cu. Yd.	1.50	856,500
d.	Grassing (120' x 46,000')	127	Ac.	1,900	241,300
e.	Outlet Canal Excavation	75,000	Cu. Yd.	2.50	187,500
f.	Outlet Canal Spoil Fill	56,000	Cu. Yd.	1.00	56,000
g.	Outflow Control Structures	9	Ea.	375,000	3,375,000
	SUBTOTAL, Collection Canal and Levee				$6,867,800
11.	Disk Treatment Area Interior	13,070	Ac.	100.00	1,307,000
12.	Degrade Interior Berms & Canals (North-South)	12.0	Mi.	200,000	2,400,000
13.	Degrade Interior Berms (East-West)	14.0	Mi.	100,000	1,400,000
	SUBTOTAL, CONSTRUCTION COST				$67,391,280
	Engineering, Planning, Design and Construction Management @ 15%				10,108,700
	Contingency @ 20%				13,478,300
	TOTAL, CONSTRUCTED FACILITIES				$90,978,280

TABLE B-5 (Cont'd)

Land Acquisition:

Parcel No.	Estimated Acreage (ac.)	Estimated Unit Cost ($/ac.)	Estimated Cost ($)
1	0	2,300	0
2	7,605	2,000	15,210,000
3	1,250	2,400	3,000,000
4	2,500	2,460	6,150,000
5	2,950	2,460	7,257,000
6	350	2,600	910,000
7	175	2,300	402,500
SUBTOTAL			$32,929,500
Contingency @ 10%			3,292,950
TOTAL ESTIMATED LAND COST			$36,222,450
TOTAL ESTIMATED COST			$127,200,730

TABLE B-6
CONCEPTUAL COST ESTIMATE
EAST WCA-3A HYDROPERIOD RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Clearing (100' X 46,000')	106	Ac	$1,100	$116,600
2.	Excavate South Levee L-5	372,000	Cu. Yd.	1.50	558,000
3.	Haul from South Side to North Side, 1 Mi. Round Trip	372,000	Cu. Yd.	2.00	744,000
4.	Temp. Fill for Canal Crossings (Place and Remove); 1/2 mi. intervals	60,000	Cu. Yd.	6.00	360,000
5.	Excavate North Levee L-5	311,000	Cu. Yd.	1.50	466,500
6.	L-5 Borrow Canal Excavation	775,000	Cu. Yd.	2.50	1,937,500
7.	Dozer Push N. Side Excavation to Fill	1,086,000	Cu. Yd.	1.00	1,086,000
8.	Fill Placement and Compaction	1,458,000	Cu. Yd.	1.00	1,458,000
9.	Grassing (280' x 46,000')	296	Ac.	1,900	562,400
10.	New Gated Spillway in North New River (1,600 cfs capacity)	Job	Lump	Sum	1,830,000
	SUBTOTAL				$9,119,000
	Engineering, Planning, Design and Construction Management + @ 15%				1,367,850
	Contingency @ 20%				1,823,800
	TOTAL ESTIMATED COST				$12,310,650

TABLE B-7
CONCEPTUAL COST ESTIMATE
C-51 WEST END PROJECT

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Pumping Station S-319 (Structure)	Job	Lump	Sum	$6,371,000
2.	Pumping Station S-319 (Machinery)	Job	Lump	Sum	8,459,000
3.	Structure S-155A	Job	Lump	Sum	1,598,000
4.	West End Canal Improvements	Job	Lump	Sum	7,199,000
	SUBTOTAL, Construction Costs (Inc. Contingency)				$23,627,000
	Planning, Engineering, Design and Const. Management				3,047,000
	TOTAL ESTIMATED COST				$26,674,000

NOTE: Costs taken from June, 1992 Design Memorandum Construction cost subtotal includes contingency amounts, taken as $3,398,000 for this analysis.

TABLE B-8
CONCEPTUAL COST ESTIMATE
S-5A BASIN RUNOFF DIVERSION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Hillsboro Canal Enlargement				
a.	Clearing (34,800' x 200')	160	Ac.	$1,100	176,000
b.	Excavation	950,000	Cu. Yd.	2.50	2,375,000
c.	Berm Embankment	150,000	Cu. Yd.	1.50	225,000
d.	Spoil Fill	610,000	Cu. Yd.	2.00	1,220,000
e.	Grassing (34,800' x 160')	128	Ac.	1,900	243,200
f.	Replace Secondary Bridges (2 @ 32' x 132')	8,448	Sq. Ft.	65.00	549,120
g.	Replace old S.R. 80 Bridge				
(1)	Bridge (48' x 132')	6,336	Sq. Ft.	65.00	411,840
(2)	Demolish existing bridge	Job	Lump	Sum	30,000
(3)	Roadway Grading and Fill	20,000	Cu. Yd.	5.00	100,000
(4)	Roadway Pavement (10" A.C.)	2,600	Ton	40.00	104,000
(5)	Remove Exist. Roadway	Job	Lump	Sum	25,000
(6)	Pavement Marking and Signing	Job	Lump	Sum	10,000
(7)	Traffic Handling during Construction	Job	Lump	Allow	50,000
	SUBTOTAL, HILLSBORO CANAL ENLARGEMENT				$5,519,160
2.	Ocean Canal Enlargement				
a.	Clearing (47,500' x 160')	174	Ac.	1,100	191,400
b.	Canal Excavation	850,000	Cu. Yd.	2.50	2,125,000
c.	Excavate Exist. North Levee	200,000	Cu. Yd.	1.50	300,000
d.	Embankment	850,000	Cu. Yd.	1.50	1,275,000
e.	Grassing	174	Ac.	1,900	330,600
f.	Bridge Replacement (5 @ 32'x 100', 1 @ 48' x 100')	20,800	Sq. Ft.	65.00	1,352,000
	SUBTOTAL, OCEAN CANAL ENLARGEMENT				$5,574,000
3.	Replace Structure S-5AX	Job	Lump	Sum	1,100,000
4.	New Divide Structure	Job	Lump	Sum	1,620,000
	SUBTOTAL, CONSTRUCTION COST				$13,813,160
	Engineering, Planning, Design, and Construction Management @ 15%				2,072,000
	Contingency @ 20%				2,762,640
	TOTAL, CONSTRUCTED FACILITIES				$18,647,800
	Land Acquuisition	150	Ac.	$3,500	525,000
	Contingency @ 30%				157,500
	SUBTOTAL, LAND ACQUISITION				$ 682,500
	TOTAL ESTIMATED COST				$19,330,300

TABLE B-9
CONCEPTUAL COST ESTIMATE
STA-1 INFLOW AND DISTRIBUTION FACILITIES

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	New Gated Spillway in L-7 Borrow Canal; 2,400 cfs capacity	Job	Lump	Sum	$2,333,000
2.	New Gated Spillway in L-40 Borrow Canal; 2,400 cfs capacity	Job	Lump	Sum	2,333,000
3.	New Control Structure in Levee L-7; 3,600 cfs capacity	Job	Lump	Sum	2,600,000
4.	New Control Structure in Levee L-40; 1,200 cfs capacity	Job	Lump	Sum	1,560,000
5.	Separation Levee in WCA-1				
a.	Clearing (300' x 6,100')	42	Ac.	$1,100	46,200
b.	Access Canal Excavation	34,000	Cu. Yd.	2.50	85,000
c.	Borrow Canal Excavation	220,000	Cu. Yd.	2.50	550,000
d.	Compacted Fill	150,000	Cu. Yd.	1.50	225,000
e.	Grassing (140' x 6,100')	20	Ac.	1,900	38,000
f.	6" Limerock Surfacing	3,100	Ton	16.00	49,600
	SUBTOTAL, Separation Levee				$993,800
	SUBTOTAL, Constructed Facilities				$9,819,800
	Engineering, Planning, Design, and Construction Management @ 15%				1,473,000
	Contingency @ 20%				1,964,000
	TOTAL ESTIMATED COST				$13,256,800

TABLE B-10
CONCEPTUAL COST ESTIMATE
STORMWATER TREATMENT AREA NO. 1 (WEST)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Inflow Canal and Levees				
a.	Clearing (400' x 10,000')	92	Ac.	$1,100	$ 101,200
b.	Inflow Canal Excavation	542,000	Cu. Yd.	2.50	1,355,000
c.	Spreader Canal Excavation	50,000	Cu. Yd.	2.50	125,000
d.	Seepage Canal Excavation	14,000	Cu. Yd.	2.50	35,000
e.	Levee Embankment	400,000	Cu. Yd.	1.50	600,000
f.	Grassing (210' x 10,000')	48	Ac.	1,900	91,200
	SUBTOTAL, Supply Canal and Levees				$2,307,400
2.	Inflow Facilities to New Treatment Area				
a.	Excavation for Trenches and Structures	3,800	Cu. Yd.	5.00	19,000
b.	Backfill for Trenches and Structures	3,100	Cu. Yd.	3.00	9,300
c.	84-in. dia. CMP	850	Lin. Ft.	120.00	102,000
d.	Reinforced Concrete	460	Cu. Yd.	330.00	151,800
e.	84" x 84" Sluice Gates	17	Ea.	12,000	204,000
f.	End Sections for 84" CMP	34	Ea.	1,000	34,000
g.	Structure Channel Excavation	5,900	Cu. Yd.	6.00	35,400
h.	Dewatering (per structure)	17	Ea.	5,000	85,000
	SUBTOTAL, Inflow Facilities to New Area				$640,500
3	FPL Access Embankment				
a.	Clearing	34	Ac.	1,100	37,400
b.	Excavation	125,000	Cu. Yd.	2.50	312,500
c.	Embankment	82,000	Cu. Yd.	1.50	123,000
d.	Grassing	23	Ac.	1,900	43,700
e.	84-in. dia. CMP	850	Lin. Ft.	120.00	102,000
f.	Std. End Sections for 84" CMP	34	Ea.	1,000	34,000
g.	Excavation for Trenches	3,700	Cu. Yd.	5.00	18,500
h.	Backfill for Trenches	2,900	Cu. Yd.	3.00	8,700
i.	Dewatering for Structure	17	Ea.	2,500	42,500
	SUBTOTAL				$722,300

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TABLE B-10 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
4.	New Treatment Area Outflow Facilities				
a.	Clearing (340' x 10,400')	81	Ac.	1,100	89,100
b.	Discharge Canal Excavation	347,000	Cu. Yd.	2.50	867,500
c.	Collection Canal Excavation	65,000	Cu. Yd.	2.50	162,500
d.	Inflow Control Mound	26,000	Cu. Yd.	1.00	26,000
e.	Levee Embankment	250,000	Cu. Yd.	1.50	375,000
f.	Excavation for Trenches and Structures	8,500	Cu. Yd.	5.00	42,500
g.	Backfill for Trenches and Structures	6,800	Cu. Yd.	3.00	20,400
h.	60" Dia. CMP	1,768	Lin. Ft.	90.00	159,120
i.	Reinforced Conc. Inlet Structures	350	Cu. Yd.	330.00	115,500
j.	Std. End Section for 60" CMP	17	Ea.	750.00	12,750
k.	Dewatering, per structure	17	Ea.	5,000	85,000
l.	Access Bridges	527	Lin. Ft.	180.00	94,860
m.	Bridge Footings	21	Cu. Yd.	200.00	4,200
n.	Outlet Channel Excavation	3,400	Cu. Yd.	6.00	20,400
o.	Closure Panels, 10' x 3'	34	Ea.	1,000.00	34,000
p.	Riprap	1,700	Ton	50.00	85,000
q.	Grassing (200' x 10,400')	48	Ac.	1,900.00	91,200
	SUBTOTAL, New Treatment Area Outflow Facilities				$2,285,030
5.	New Inflow Structure for ENR Project	Job	Lump	Sum	1,700,000
6.	Add'l Outflow Structures for ENR Project (2 req'd @ 500 cfs each)	2	Ea.	500,000	1,000,000
7.	New Outflow Pump Station (3,200 cfs capacity)	Job	Lump	Sum	11,500,800
8.	New Treatment Area North Levee				
a.	Clearing (200' x 18,700')	86	Ac.	1,100	94,600
b.	Seepage Canal Excavation	500,000	Cu. Yd.	2.50	1,250,000
c.	Levee Embankment	310,000	Cu. Yd.	1.50	465,000
d.	Grassing (140' x 18,700')	60	Ac.	1,900	114,000
	SUBTOTAL				$1,923,600
9.	Enlarged Discharge Canal (20,000')				
a.	Clearing (240' x 20,000')	110	Ac.	1,100	121,000
b.	Canal Excavation	780,000	Cu. Yd.	2.50	1,950,000
c.	Embankment	554,000	Cu. Yd.	1.50	831,000
d.	Grassing (120' x 20,000')	55	Ac.	1,900	104,500
e.	Airstrip Pavement Replacement	3,800	Ton	40.00	52,000
	SUBTOTAL				$3,158,500

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TABLE B-10 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
10.	Modification of Existing Inflow Pump Station	Job	Lump	Allow	150,000
11.	Internal Grading in New Treatment Area	Job	Lump	Allow	1,500,000
12.	Disk New Treatment Area	3,034	Ac.	100.00	303,400
13.	New Distribution Canal in ENR Project				
a.	Clearing (100' x 4,700')	11	Ac.	1,100	12,100
b.	Excavation	90,000	Cu. Yd.	3.50	315,000
c.	Fill Existing Seepage Canal	90,000	Cu. Yd.	2.50	225,000
d.	Grassing (100' x 4,700')	11	Ac.	1,900	20,900
	SUBTOTAL, New Distribution Canal				$573,000
	SUBTOTAL, Constructed Facilities				$27,763,730
	Engineering, Planning, Design and Construction Management @ 15%				4,164,600
	Contingency @ 20%				5,552,700
	TOTAL, Constructed Facilities				$37,481,030
	Land Acquisition				
	Treatment Area	3,200	Ac.	3,500	11,200,000
	Discharge Canal	145	Ac.	3,500	507,500
	Contingency @ 10%				1,170,750
	TOTAL, Land Acquisition				$12,878,250
	TOTAL ESTIMATED COST				$50,359,280

TABLE B-11
CONCEPTUAL COST ESTIMATE
STORMWATER TREATMENT AREA NO. 1 (EAST)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	New Outflow Pump Station (3,000 cfs capacity)	Job	Lump	Sum	$10,885,500
2.	Inflow Distribution Works				
a.	Clearing	195	Ac.	$1,100	214,500
b.	Spreader Canal Excavation	148,000	Cu. Yd.	2.50	370,000
c.	Distribution Canal Excavation	1,196,000	Cu. Yd.	2.50	2,990,000
d.	Levee Embankment	941,000	Cu. Yd.	1.50	1,411,500
e.	Grassing	108	Ac.	1,900	205,200
f.	Excavation for Trenches	5,300	Cu. Yd.	5.00	26,500
g.	Backfill for Trenches	4,300	Cu. Yd.	3.00	12,900
h.	84" Dia. CMP	1,200	Lin. Ft.	120.00	144,000
i.	Reinforced Concrete	630	Cu. Yd.	330.00	207,900
j.	84" x 84" Sluice Gates	28	Ea.	12,000	336,000
k.	End Sections for 84" CMP	56	Ea.	1,000	56,000
l.	Structure Channel Excavation	8,300	Cu. Yd.	6.00	49,800
m.	Dewatering (per structure)	28	Ea.	5,000	140,000
	SUBTOTAL, Inflow Distribution Works				$6,164,300
3.	East Levee (24,700')				
a.	Clearing	124	Ac.	1,100	136,400
b.	Canal Excavation	594,000	Cu. Yd.	2.50	1,485,000
c.	Inflow Control Mound	65,000	Cu. Yd.	1.00	65,000
d.	Levee Embankment	358,000	Cu. Yd.	1.50	537,000
e.	Grassing	79	Ac.	1,900	150,100
	SUBTOTAL, East Levee				$2,373,500
4.	Central Levee (34,500')				
a.	Clearing	158	Ac.	1,100	173,800
b.	Excavation	601,000	Cu. Yd.	2.50	1,502,500
c.	Levee Embankment	414,000	Cu. Yd.	1.50	621,000
d.	Grassing	102	Ac.	1,900	193,800
	SUBTOTAL, Central Levee				$2,491,100

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Table B-11 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
5.	Discharge Facilities				
a.	Clearing	90	Ac.	1,100	99,000
b.	Discharge Canal Excavation	318,000	Cu. Yd.	2.50	795,000
c.	Collection Canal Excavation	36,000	Cu. Yd.	2.50	90,000
d.	Levee Embankment	245,000	Cu. Yd.	1.50	367,500
e.	Excavation for Trenches	9,400	Cu. Yd.	5.00	47,000
f.	Backfill for Trenches	7,500	Cu. Yd.	3.00	22,500
g.	60" Dia. CMP	2,400	Lin. Ft.	90.00	216,000
h.	Reinforced Concrete	500	Cu. Yd.	330.00	165,000
i.	Std. End Section for 60" CMP	24	Ea.	750.00	18,000
j.	Dewatering, per structure	24	Ea.	5,000	120,000
k.	Access Bridges	744	Lin. Ft.	180.00	133,920
l.	Bridge Footings	30	Cu. Yd.	200.00	6,000
m.	Outlet Channel Excavation	4,800	Cu. Yd.	6.00	28,800
n.	Closure Panels (10' x 3')	48	Ea.	1,000	48,000
o.	Riprap	2,400	Ton	50.00	120,000
p.	Grassing	50	Ac.	1,900	95,000
	SUBTOTAL, Discharge Facilities				$2,371,720
6.	Internal Grading	Job	Lump	Allow	2,675,000
7.	Prepare Treatment Area Interior	5,350	Ac.	250.00	1,337,500
	SUBTOTAL, Construction Cost				$28,298,620
	Engineering, Planning, Design, and Construction Management @ 15%				4,244,790
	Contingency @ 20%				5,659,720
	SUBTOTAL, Constructed Facilities				$38,203,130
	Land Acquisition:				
	Parcel 1	1,920	Ac.	8,000	15,360,000
	Parcel 2	3,930	Ac.	5,000	19,650,000
	Subtotal				$35,010,000
	Contingency:				
	19,650,000 @ 10%				1,965,000
	15,360,000 @ 30%				4,608,000
	Subtotal				$6,573,000
	SUBTOTAL, Land Acquisition				$41,583,000
	TOTAL ESTIMATED COST				$79,786,130

TABLE B-12
STA-2 CONCEPTUAL COST ESTIMATE

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Outflow Pump Station; 3,370 cfs capacity	Job	Lump	Sum	$11,900,000
2.	New Seepage Return and Agricultural Drainage Pump Station; 520 cfs capacity	Job	Lump	Sum	2,000,000
3.	Discharge Facilities				
a.	Clearing (340' x 11,600')	91	Ac.	$1,100.00	100,100
b.	Discharge Canal Excavation ($46\ yd^3/ft \times 11,600\ ft$)	534,000	Cu. Yd.	2.50	1,335,000
c.	Collection Canal Excavation ($2.7\ yd.^3/ft \times 10,900\ ft$)	29,400	Cu. Yd.	2.50	73,500
d.	Embankment Placement and Compaction	375,000	Cu. Yd.	1.50	562,500
e.	Excavation for Trenches and Structures	13,000	Cu. Yd.	5.00	65,000
f.	Backfill for Trenches and Structures	10,400	Cu. Yd.	3.00	31,200
g.	60" Dia. CMP	3,354	Lin. Ft.	90.00	301,860
h.	Reinforced Conc. Inlet Structures Std. End Section for 60" CMP	537	Cu. Yd.	330.00	177,210
i.	Dewatering, per structure	26	Ea.	750.00	19,500
j.	Access Bridges	26	Ea.	5,000.00	130,000
k.	Bridge Footings	806	Lin. Ft.	180.00	145,080
l.	Outlet Channel Excavation	32	Cu. Yd.	200.00	6,400
m.	Closure Panels, 10' x 3'	5,200	Cu. Yd.	6.00	31,200
n.	Riprap	52	Ea.	1,000.00	52,000
o.	Grassing (220' x 11,600')	2,600	Ton	50.00	130,000
p.		59	Ac.	1,900.00	112,100
	SUBTOTAL, Discharge Facilities				$3,272,650
4.	West Levee				
a.	Clearing (220' x 18,000')	91	Ac.	1,100.00	100,100
b.	Excavation	385,000	Cu. Yd.	2.50	962,500
c.	Embankment Placement and Compaction	257,000	Cu. Yd.	1.50	385,500
d.	Grassing (140' x 18,000')	58	Ac.	1,900.00	110,200
	SUBTOTAL, West Levee				$1,558,300
5.	East & Central Levees				
a.	Clearing (200' x 59,600')	274	Ac.	1,100.00	301,400
b.	Excavation	1,038,000	Cu. Yd.	2.50	2,595,000
c.	Embankment Placement and Compaction	677,000	Cu. Yd.	1.50	1,015,500
d.	Grassing (130' x 59,600')	178	Ac.	1,900.00	338,200
	SUBTOTAL, East and Central Levees				$4,250,100

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TABLE B-12 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
6.	Inflow Distribution Works				
a.	Clearing (500' x 21,300')	244	Ac.	1,100.00	268,400
b.	Spreader Canal Excavation	150,400	Cu. Yd.	2.50	376,000
	(21,100')				
c.	Distribution Canal Excavation	738,000	Cu. Yd.	2.50	1,845,000
	(21,300')				
d.	Seepage Canal Excavation	197,200	Cu. Yd.	2.50	493,000
	(21,300')				
e.	Interior Levee Embankment	313,000	Cu. Yd.	1.50	469,500
	(21,300')				
f.	Exterior Levee Embankment	372,000	Cu. Yd.	1.50	558,000
	(21,300')				
g.	Inflow Control Mound (21,300')	44,400	Cu. Yd.	1.00	44,400
	Grassing (300' x 21,300')				
h.	Excavation for Trenches and	147	Ac.	1,900.00	279,300
i.	Structures	5,600	Cu. Yd.	3.00	16,800
	Backfill for Trenches and				
j.	Structures	5,600	Cu. Yd.	5.00	28,000
	84" Dia. CMP				
k.	Reinforced Concrete for	1,300	Lin. Ft.	120.00	156,000
l.	Structures	672	Cu. Yd.	330.00	221,760
	84" x 84" Sluice Gates, Self-				
m.	Contained	26	Ea.	12,000	312,000
	End Sections for 84" CMP				
n.	Approach and Discharge Channel	52	Ea.	1,000.00	52,000
o.	Excavation	9,000	Cu. Yd.	6.00	54,000
	Dewatering (per structure)				
p.		26	Ea.	5,000.00	130,000
	SUBTOTAL, Inflow Distribution Works				$5,304,160
7.	Inflow Canal and Levee				
a.	Clearing (200' x 4500')	21	Ac.	1,100.00	23,100
b.	Excavation	160,000	Cu. Yd.	2.50	400,000
c.	Embankment Placement and	110,000	Cu. Yd.	1.50	165,000
	Compaction				
d.	Grassing (100' x 4500')	10	Ac.	1,900.00	19,000
e.	18" Riprap	10,500	Ton	50.00	525,000
	SUBTOTAL, Inflow Canal and Levee				$1,132,100

(Cont'd next page)

TABLE B-12 (Cont'd)

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
8.	Conveyance Canal and Levees				
a.	Clearing (440' x 19,600')	198	Ac.	1,100.00	217,800
b.	Seepage Canal Excavation	181,000	Cu. Yd.	2.50	452,500
c.	Supply Canal Excavation	680,000	Cu. Yd.	2.50	1,700,000
d.	Levee Embankment	630,000	Cu. Yd.	1.50	945,000
e.	Inflow Control Mound	40,900	Cu. Yd.	1.00	40,900
f.	18" Riprap	7,500	Ton	50.00	375,000
g.	Grassing (290' x 19,600')	130	Ac.	1,900.00	247,000
	SUBTOTAL, Conveyance Canal and Levees				$3,978,200
9.	Miscellaneous Construction				
a.	FPL Access Bridges (2 req'd, 20' x 130')	5,200	Sq. Ft.	65.00	338,000
b.	Bridge on West L-6 (32' x 140')	4,480	Sq. Ft.	65.00	291,200
	Power Lines to Pump Station				
c.	Interior Grading	3.5	Mi.	150,000	525,000
d.	Disk Treatment Area Interior (Ag.	Job	Lump	Sum	1,000,000
e.	Lands)	2,350	Ac.	100.00	235,000
	SUBTOTAL, Miscellaneous Construction				$2,389,200
	SUBTOTAL				35,784,710
	Planning, Engineering, Design and Construction Management @ 15%				5,367,700
	Contingency @ 20%				7,157,000
	TOTAL CONSTRUCTED FACILITIES				$48,309,410
	Land Acquisition, STA-2				
	Parcel 1	1,390	Ac.	2,000.00	2,780,00
	Parcel 2	480	Ac.	2,460.00	1,180,800
	Parcel 3	380	Ac.	2,460.00	934,800
	Parcel 4	190	Ac.	2,460.00	467,400
	Subtotal				5,363,000
	Land Acquisition, Supply Canal	191	Ac.	3,000.00	573,000
	Contingency @ 10%				593,600
	SUBTOTAL, LAND ACQUISITION				$6,529,600
	TOTAL ESTIMATED COST				$54,839,010

TABLE B-13
CONCEPTUAL COST ESTIMATE
WCA-2A HYDROPERIOD RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Clearing (200' x 39,750')	183	Ac	$1,100.00	201,300
2.	Excavate West Levee L-5	130,000	Cu. Yd.	2.00	260,000
3.	Canal Enlargement West of C.L., Excavate and Dozer Push	960,000	Cu. Yd.	3.00	2,880,000
4.	Excavate East Levee L-5 to 18.0	83,000	Cu. Yd.	3.00	249,000
5.	Spillway Construction in East Levee L-6				
a.	Excavation	6,300	Cu. Yd.	6.00	37,800
b.	Riprap	5,750	Ton	50.00	287,500
c.	Reinforced Concrete	780	Cu. Yd.	300.00	234,000
d.	Granular Bedding	2,850	Ton	16.00	45,600
e.	Erosion Control Fabric	1,950	Sq. Yd.	4.00	7,800
	SUBTOTAL, SPILLWAY CONSTRUCTION				$612,700
6.	Enlarge Ramps to FPL Access Pads	15,000	Cu. Yd.	5.00	75,000
7.	Excavate East Bank Vic. Inflow	2,100	Cu. Yd.	4.00	8,400
8.	Haul to Plug, Place	2,100	Cu. Yd.	6.00	12,600
9.	18" Riprap vic. Inflow	1,600	Ton	50.00	80,000
10.	Place and Compact Levee Embankment	660,000	Cu. Yd.	1.50	990,000
11.	Limerock Surfacing on West Levee	20,100	Ton	16.00	321,600
12.	Grassing (150' x 39,750')	137	Ac.	1,900.00	260,300
13.	WCA-1 Water Supply Facilities				
a.	Clearing (250' x 3,500')	20	Ac.	1,100	22,000
b.	Canal Excavation	125,000	Cu. Yd.	2.50	312,500
c.	Levee Embankment	86,000	Cu. Yd.	1.50	129,000
d.	Grassing (150' x 3,500')	12	Ac.	1,900	22,800
e.	120-in. dia. CMP	360	Lin. Ft.	220.00	79,200
f.	Care and Diversion of Water	Job	Lump	Sum	40,000
g.	Excavation and Backfill	6,000	Cu. Yd.	8.00	48,000
h.	Vertical Lift Gates	3	Ea.	37,500	112,500
i.	Gate Operating Machinery	3	Ea.	32,500	97,500
j.	Gate Structure	Job	Lump	Sum	120,000
k.	Electrical Work	Job	Lump	Sum	30,000
l.	Levee L-39 Site Restoration	Job	Lump	Sum	15,000
m.	Riprap	500	Ton	50.00	25,000
	SUBTOTAL, WCA-1 WATER SUPPLY				$1,053,500
	SUBTOTAL, CONSTRUCTED FACILITIES				$7,004,400
	Engineering, Planning, Design and Construction Management + @ 15%				1,050,700
	Contingency @ 20%				1,400,900
	TOTAL ESTIMATED COST				$9,456,000

TABLE B-14
CONCEPTUAL COST ESTIMATE
L-8 BASIN

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Structure S-76 Modifications				
a.	Replace Gate Operators	3	Ea.	$40,000	$120,000
b.	Control Building	1	Ea.	37,500	37,500
c.	Electrical Power Generation and Fuel Storage and Supply	Job	Lump	Sum	28,500
d.	Water Level Sensors	Job	Lump	Sum	10,000
e.	Electrical & Instrumentation Systems	Job	Lump	Sum	75,000
f.	Safety Barriers	Job	Lump	Sum	5,000
g.	Site Restoration and Grassing	Job	Lump	Sum	5,000
h.	Mobilization and Demobilization	Job	Lump	Sum	25,000
	SUBTOTAL, Structure S-76 Modifications				$306,000
2.	Structure S-316				
a.	120-inch CMP	200	Lin. Ft.	$220.00	$44,000
b.	Care and Diversion of Water	Job	Lump	Sum	30,000
c.	Fill	5,500	Cu. Yd.	6.00	33,000
d.	Vertical Lift Gates	2	Ea.	37,500	75,00
e.	Gate Operating Machinery	2	Ea.	32,500	65,000
f.	Guardrail	600	Lin. Ft.	20.00	12,000
g.	Gate Structure	Job	Lump	Sum	90,000
h.	Electrical Work	Job	Lump	Sum	20,000
i.	Site Restoration	Job	Lump	Sum	15,000
j.	Mobilization and Demobilization	Job	Lump	Sum	40,000
	SUBTOTAL, Structure S-316				$424,000
3.	New Pumping Station (900 cfs capacity)	Job	Lump	Sum	3,960,000
	TOTAL ESTIMATED CONSTRUCTION COST				$4,690,000
	Planning, Engineering, Design and Construction Management @ 15%				703,500
	Contingency, Construction @ 20%				938,000
	TOTAL ESTIMATED COST				$6,331,500

ATTACHMENT C
OPERATION AND MAINTENANCE COST ESTIMATES

ATTACHMENT C

CONCEPTUAL COST ESTIMATES
INCREMENTAL OPERATION AND MAINTENANCE EXPENSE
TABLE OF CONTENTS

TABLE C-1
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-1 INFLOW AND DISTRIBUTION WORKS

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Control Structures (4)				
a.	Structure Maintenance	4	Ea.	$10,000	$ 40,000
b.	Equipment Replacement	Job	Lump	Allow.	32,670
	Subtotal, Control Structures				72,670
2.	Levee Maintenance	1.3	Mi.	1,140	1,482
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	180	Ac.	20,000	3,600
	TOTAL ESTIMATED COST				$ 77,752

TABLE C-2
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-1W*

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Outflow Pump Stations (2)				
a.	Labor Costs				
	- Supervisor	1	Ea.	$54,950	$ 54,950
	- Operators	5	Ea.	44,250	221,250
	- Overtime Allowance	Job	Lump	Allow.	30,380
b.	Fuel Consumption & Power	144,700	Ac-Ft	0.70	101,290
c.	Equipment Maintenance/Unit	4	Ea.	20,000	80,000
d.	Equipment Replacement	Job	Lump	Allow.	85,110
e.	Structure Maintenance	Job	Lump	Allow.	100,000
	Subtotal, Outflow Pump Stations				$ 672,980
2.	Levee Maintenance				
a.	Exterior Levees	11.4	Mi.	$ 1,720	$ 19,608
b.	Interior Levees	12.8	Mi.	1,140	14,592
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	6,670	Ac.	20.00	133,400
5.	Seepage Return Pump Station	1	Ea.	100,000	100,000
6.	Existing Outflow Pump Station	1	Ea.	100,000	100,000
7.	Control Structures (3)				
a.	Structure Maintenance	3	Ea.	10,000	30,000
b.	Equipment Replacement	Job	Lump	Allow.	9,990
	Subtotal, Control Structures				39,990
	TOTAL ESTIMATED COST				$1,080,570

* Includes existing Everglades Nutrient Removal Project.

TABLE C-3
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-1E

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Outflow Pump Station				
a.	Labor Costs				
	- Supervisor	1	Ea.	$54,950	$ 54,950
	- Operators	5	Ea.	44,250	221,250
	- Overtime Allowance	Job	Lump	Allow.	30,380
b.	Fuel Consumption	124,900	Ac-Ft	0.70	87,430
c.	Equipment Maintenance/Unit	3	Ea.	20,000	60,000
d.	Equipment Replacement	Job	Lump	Allow.	80,550
e.	Structure Maintenance	Job	Lump	Allow.	50,000
	Subtotal, Outflow Pump Station				584,560
2.	Levee Maintenance				
a.	Exterior Levees	8.6	Mi.	1,720	14,792
b.	Interior Levees	14.1	Mi.	1,140	16,074
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	5,350	Ac.	20.00	107,000
	TOTAL ESTIMATED COST				$ 722,426

TABLE C-4
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-2

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Outflow Pump Station				
a.	Labor Costs				
	- Supervisor	1	Ea.	$54,950	$ 54,950
	- Operators	5	Ea.	44,250	221,250
	- Overtime Allowance	Job	Lump	Allow.	30,380
b.	Fuel Consumption	176,400	Ac-Ft	0.70	123,480
c.	Equipment Maintenance/Unit	4	Ea.	20,000	80,000
d.	Equipment Replacement	Job	Lump	Allow.	88,060
e.	Structure Maintenance	Job	Lump	Allow.	50,000
	Subtotal, Outflow Pump Stations				648,120
2.	Levee Maintenance				
a.	Exterior Levee	20.1	Mi.	1,720	34,572
b.	Interior Levee	12.7	Mi.	1,140	14,478
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	6,430	Ac.	20.00	128,600
5.	Seepage Return Pump Station	1	Ea.	100,000	100,000
	TOTAL ESTIMATED COST				$ 925,770

NOTE: Excludes costs for operation and maintenance of new secondary (inflow) pump station.

TABLE C-5
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-3/4

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Inflow Pump Stations (2)				
a.	Labor Costs				
	- Supervisor	1	Ea.	$54,950	$ 54,950
	- Operators	5	Ea.	44,250	221,250
	- Overtime Allowance	Job	Lump	Allow.	30,380
b.	Fuel Consumption	294,000	Ac-Ft	0.70	205,800
c.	Equipment Maintenance/Unit	7	Ea.	20,000	140,000
d.	Equipment Replacement	Job	Lump	Allow.	175,820
e.	Structure Maintenance	Job	Lump	Allow.	100,000
	Subtotal, Inflow Pump Stations				$ 928,200
2.	Levee Maintenance				
a.	Exterior Levee	30.6	Mi.	1,720	52,632
b.	Interior Levee	11.4	Mi.	1,140	12,996
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	16,660	Ac.	20.00	333,200
5.	Seepage Return Pump Stations	2	Ea.	100,000	200,000
	TOTAL ESTIMATED COST				$1,527,028

TABLE C-6
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR STA-5

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Inflow Pump Station				
a.	Labor Costs				
	- Supervisor	1	Ea.	$54,950	$ 54,950
	- Operators	3	Ea.	44,250	132,750
	- Overtime Allowance	Job	Lump	Allow.	20,650
b.	Fuel Consumption	85,200	Ac-Ft	0.70	59,640
c.	Equipment Maintenance/Unit	3	Ea.	20,000	60,000
d.	Equipment Replacement	Job	Lump	Allow.	45,210
e.	Structure Maintenance	Job	Lump	Allow.	50,000
	Subtotal, Inflow Pump Station				423,200
2.	Levee Maintenance				
a.	Exterior Levees	8.8	Mi.	1,720	15,136
b.	Interior Levees	7.8	Mi.	1,140	8,892
3.	Monitoring Costs (not included)				
4.	Wetlands Maintenance	4,530	Ac.	20.00	90,600
	TOTAL ESTIMATED COST				$ 537,828

TABLE C-7
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR C-51 WEST END PROJECT

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Pumping Station S-319				
a.	Labor Costs				
-	Supervisor	1	Ea.	$54,950	$ 54,950
-	Operators	3	Ea.	44,250	132,750
-	Overtime Allowance	Job	Lump	Allow	20,650
b.	Fuel Consumption	105,400	Ac. Ft.	0.70	73,780
c.	Equipment Maintenance/Unit	3	Ea.	20,000	60,000
d.	Equipment Replacement	Job	Lump	Allow	93,960
e.	Structure Maintenance	Job	Lump	Allow	50,000
	SUBTOTAL, Pumping Station S-319				$486,090
2.	Control Structure S-155A				
a.	Structure Maintenance	1	Ea.	10,000	10,000
b.	Equipment Replacement	Job	Lump	Allow	5,060
	SUBTOTAL, Control Structure S-155A				15,060
	TOTAL ESTIMATED COST				$501,150

NOTE: No incremental cost assigned for levee maintenance.

TABLE C-8
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR L-8 BASIN IMPROVEMENTS

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Pumping Station S-309				
a.	Labor Costs				
-	Supervisor	1	Ea.	$54,950	$54,950
-	Operators	3	Ea.	44,250	132,750
-	Overtime Allowance	Job	Lump	Allow	20,650
b.	Fuel Consumption	116,000	Ac. Ft.	0.70	81,200
c.	Equipment Maintenance Unit	3	Ea.	20,000	60,000
d.	Equipment Replacement	Job	Lump	Allow	29,300
	SUBTOTAL, Pumping Station S-309				$378,850
2.	Control Structures S-76 & S-316				
a.	Structure Maintenance	2	Ea.	10,000	20,000
b.	Equipment Replacement				
-	S-316				1,570
-	S-76 (0.0037 x $1,394,000*)	Job	Lump	Allow	5,160
	SUBTOTAL, Control Structures				$26,730
	TOTAL ESTIMATED COST				$405,580

* Estimated replacement cost for S-76.

TABLE C-9
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR WEST WCA-3A HYDROPERIOD RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Control Structures (2)				
a.	Structure Maintenance	2	Ea.	$10,000	$20,000
b.	Equipment Replacement	Job	Lump	Allow	13,090
	SUBTOTAL, Control Structures				$33,090
2.	Wetlands Maintenance (6,000' x 600')	83	Ac.	20.00	1,660
	TOTAL ESTIMATED COST				$34,750

TABLE C-10
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR EAST WCA-3A HYDROPERIOD RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Control Structures				
a.	Structure Maintenance	1	Ea.	$10,000	$10,000
b.	Equipment Replacement	Job	Lump	Allow	6,770
	SUBTOTAL, Control Structures				$16,770
2.	Wetlands Maintenance (600' x 46,000')	634	Ac.	20.00	12,680
	TOTAL ESTIMATED COST				$29,450

TABLE C-11
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR WCA-2A HYDROPERIOD RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Control Structures @ L-39				
a.	Structure Maintenance	Job	Lump	Allow	$10,000
b.	Equipment Replacement	Job	Lump	Allow	2,100
	SUBTOTAL, Control Structures				$12,100
2.	Maintain Modified East Levee L-6	8.2	Mi.	1,720	14,104
3.	Spillway Maintenance	Job	Lump	Allow	30,000
	TOTAL ESTIMATED COST				$56,204

TABLE C-12
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR ROTENBERGER TRACT RESTORATION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Levee Maintenance				
a.	West & North Perimeter Levee	11.7	Mi.	$1,720	$20,124
b.	Enlarged FPL Access Embankment	6.5	Mi.	1,140	7,410
2.	Wetlands Maintenance Vic. L-4	1,120	Ac.	20.00	22,400
3.	Culvert Operation and Maintenance	Job	Lump	Allow	20,000
4.	Seepage Return Pump Station	1	Ea.	100,000	100,000
	TOTAL ESTIMATED COST				$169,934

TABLE C-13
CONCEPTUAL COST ESTIMATE
ANNUAL O&M FOR S-5A BASIN RUNOFF DIVERSION

Item No.	Description	Est. Qty.	Unit	Unit Cost	Total Cost
1.	Control Structures				
a.	Structure Maintenance	2	Ea.	$10,000	$20,000
b.	Equipment Replacement	Job	Lump	Sum	10,060
	SUBTOTAL, Control Structures				$30,060
2.	Levee Maintenance	9.0	Mi.	1,720	15,480
	TOTAL ESTIMATED COST				$45,540

ATTACHMENT D

SCHEDULED FUND INCOME AND EXPENDITURES

SFWMDEPP 92-166-1-002
EVERGLADES PROTECTION PROJECT
IMPLEMENTATION SCHEDULE CONSTRAINED TO ASSUMED FUNDING

SCHEDULE DEFINITION: February 11, 1994
July 1, 1994 assumed start

PLAN ELEMENTS INCLUDED:

NO.	TITLE	COMPLETION DATE	
10	Planning & Gen. Des.	N/A	
11	STA-6	10/01/97	
12	STA-5 (Alt. No. 1)	01/01/99	
13	South 298's	04/01/04	
14	West WCA-3A Hydro.	04/01/96	(Gated Spillway 04/01/05)
15	East 298's & 715	07/01/99	
16	Combined STA-3/4	10/01/03	
17	East WCA-3A Hydro.	10/01/03	(Gated Spillway 04/01/05)
18	C-51 West End	07/01/01	(Assumed)
19	S-5A Basin Div.	07/01/99	
20	STA-1 Inf. & Dist.	01/01/99	(Assumed)
21	STA-1W	01/01/99	(Assumed)
22	STA-1E	07/01/01	(Assumed)
23	STA-2	02/01/99	
24	WCA-2A Hydroperiod	01/01/99	
25	L-8 Basin	01/01/97	(Pump Station 04/01/05)
26	Rotenberger Rest.	07/01/98	

ESCALATION 3.50 %/yr
INTEREST INCOME 3.50 %/yr
INTEREST EXPENSE N/A

ANNUAL INCOME
DISTRICT AD-VALOREM 21,800,000 (0.1 mil, escalated at 5 %/yr from FY 1994)

BASIN	EAA	C-139	298/715
RATE	11625000 $/yr	840000 $/yr	incl. @ EAA

OTHER INCOME:

P-2000 FUNDS	$33,000,000 TOTAL
FPL MIT. FUND	$14,000,000 TOTAL
STATE OF FLA.	$30,000,000 TOTAL
CARL FUNDS	$5,234,000 TOTAL

FED. FUNDING:

For:	Amount:
P.E. 10	$410,000
P.E. 18	$20,005,000
P.E. 22	$66,539,500

(Note: Federal funding in 3rd Qtr. F.Y. 1993 dollars)

Source:	Amount:
C&SFFCP	$38,560,000
DEPT. of INT.	$48,395,000
TOTAL	$86,955,000

PROJECT FUND INCOME (EXCLUSIVE OF EARNED INTEREST)

FISCAL YEAR	QTR	STATE LANDS	FPL MIT	P-2000 FUNDS	EAA & 298	C-139 BASIN	SFWMD AD-VAL.	GROSS INCOME	STA-1W & I.& D.	STA-IE	O & M STA-2 & SUPP.	EXPENSE STA-3/4	STA-5 & 6	TOTAL	NET INCOME
93	4				0	0	0	0	0	0	0	0	0	0	0
94	1				0	0	10900000	10900000	0	0	0	0	0	0	10900000
	2				0	0	5450000	5450000	0	0	0	0	0	0	5450000
	3		12200000		0	0	5450000	17650000	0	0	0	0	0	0	17650000
	4		482500		0	0	0	482500	0	0	0	0	0	0	482500
95	1		482500		0	0	11445000	11927500	0	0	0	0	0	0	11927500
	2		482500		0	0	5722500	6205000	0	0	0	0	0	0	6205000
	3		352500		0	0	5722500	6075000	0	0	0	0	0	0	6075000
	4				0	0	0	0	0	0	0	0	0	0	0
96	1				5812500	420000	12017250	18249750	0	0	0	0	0	0	18249750
	2	30000000		21150873	2906250	210000	6008625	60275748	0	0	0	0	0	0	60275748
	3			11849127	2906250	210000	6008625	20974002	0	0	0	0	0	0	20974002
	4				0	0	0	0	0	0	0	0	0	0	0
97	1				5812500	420000	12818112	18850612	0	0	0	0	0	0	18850612
	2				2906250	210000	6309056	9425306	0	0	0	0	0	0	9425306
	3				2906250	210000	6309056	9425306	0	0	0	0	0	0	9425306
	4				0	0	0	0	0	0	0	0	0	0	0
98	1				5812500	420000	13249018	19481518	0	0	0	0	7234	7234	19474284
	2				2906250	210000	6624509	9740759	0	0	0	0	7296	7296	9733463
	3				2906250	210000	6624509	9740759	0	0	0	0	7359	7359	9733400
	4				0	0	0	0	0	0	0	0	7423	7423	-7423
99	1				5812500	420000	13911469	20143969	0	0	0	0	7467	7467	20136482
	2				2906250	210000	6955735	10071985	349896	0	230938	0	170015	750851	9321133
	3				2906250	210000	6955735	10071985	352920	0	349400	0	171484	873804	9198180
	4				0	0	0	0	355968	0	352418	0	172965	881351	-881351
00	1				5812500	420000	14607042	20839542	359043	0	355462	0	174459	888964	19950578
	2				2906250	210000	7303521	10419771	362144	0	358533	0	175966	896642	9523129
	3				2906250	210000	7303521	10419771	365272	0	361629	0	177486	904387	9515384
	4				0	0	0	0	368427	0	364753	0	179019	912199	-912199
01	1				5812500	420000	15337395	21569895	371610	0	367903	0	180565	920078	20649817
	2				2906250	210000	7666697	10784947	374819	0	371061	0	182124	928025	9856922
	3				2906250	210000	7666697	10784947	378057	0	374266	0	183698	936041	9848907
	4				0	0	0	0	381322	237824	377519	0	185284	1181950	-1181950
02	1				5812500	420000	16104264	22336764	384616	239878	380760	0	186885	1192159	21144605
	2				2906250	210000	8052132	11168382	387936	241950	384069	0	188499	1202456	9965926
	3				2906250	210000	8052132	11168382	391269	244040	387386	0	190127	1212842	9955540
	4				0	0	0	0	394666	246148	390732	0	191769	1223316	-1223316
03	1				5812500	420000	16909478	23141978	398077	248274	394107	0	193426	1233885	21908093
	2				2906250	210000	8454739	11570989	401516	250419	397511	0	195096	1244542	10326447
	3				2906250	210000	8454739	11570989	404984	252582	400945	0	196781	1255292	10315697
	4				0	0	0	0	408482	254763	404406	538506	198481	1804640	-1804640
04	1				5812500	420000	4994362	11226862	412010	256964	407901	543157	200195	1820228	9406654
	2				2906250	210000	0	3116250	415569	259183	411424	547849	201925	1835950	1280300
	3				2906250	210000	0	3116250	419158	261422	414978	552581	203669	1851808	1264442
	4				0	0	0	0	422779	263680	418562	557354	205426	1867803	-1867803
05	1				5812500	420000	0	6232500	426430	265958	422178	562166	207202	1883936	4348564
	2				2906250	210000	0	3116250	430114	268255	425824	567023	208992	1900208	1216042
	3				2352034	169953	0	2521987	433829	270572	429502	571921	210797	1916621	605366
	4				0	0	0	0	437576	272909	433212	576861	212616	1933176	-1933176
		30000000	14000000	33000000	115695784	8359953	279192439	480248176	10588516	4334821	10367446	5017420	5161754	35489958	444758219

CASH FLOW ANALYSIS

FY	QTR	PROJECT EXPENDITURES NON-ESC.	ESC FACTOR	ESCALATED	ACC. EXPEND.	INCOME	ACC. INCOME
93	4	$0	1.0000	$0	$0	$0	$0
94	1	$0	1.0086	$0	0	$10,900,000	10,900,000
	2	$0	1.0173	$0	0	$5,450,000	16,350,000
	3	$12,332,400	1.0261	$12,654,729	12,654,729	$17,650,000	34,000,000
	4	$666,304	1.0350	$689,625	13,344,354	$482,500	34,482,500
95	1	$739,880	1.0439	$772,369	14,116,723	$11,927,500	46,410,000
	2	$820,864	1.0530	$864,124	14,980,847	$6,205,000	52,615,000
	3	$1,020,763	1.0621	$1,084,103	16,064,950	$6,075,000	58,690,000
	4	$899,755	1.0712	$963,840	17,028,790	$0	58,690,000
96	1	$1,277,139	1.0805	$1,379,920	18,408,710	$18,249,750	76,939,750
	2	$20,978,323	1.0898	$22,862,391	41,271,101	$60,275,748	137,215,498
	3	$15,485,679	1.0992	$17,022,221	58,293,322	$20,974,002	158,189,500
	4	$4,658,490	1.1087	$5,164,951	63,458,273	$0	158,189,500
97	1	$7,561,852	1.1183	$8,456,376	71,914,649	$18,850,612	177,040,113
	2	$12,568,557	1.1280	$14,176,749	86,091,398	$9,425,306	186,465,419
	3	$15,048,008	1.1377	$17,120,062	103,211,460	$9,425,306	195,890,725
	4	$20,824,042	1.1475	$23,896,067	127,107,527	$0	195,890,725
98	1	$21,807,176	1.1574	$25,240,382	152,347,908	$19,474,284	215,365,009
	2	$21,952,335	1.1674	$25,627,857	177,975,765	$9,733,463	225,098,472
	3	$21,326,184	1.1775	$25,111,914	203,087,679	$9,733,400	234,831,871
	4	$20,607,868	1.1877	$24,475,683	227,563,362	($7,423)	234,824,448
99	1	$15,930,344	1.1979	$19,083,674	246,647,036	$20,136,482	254,960,930
	2	$6,537,726	1.2083	$7,899,482	254,546,519	$9,321,133	264,282,063
	3	$4,834,107	1.2187	$5,891,465	260,437,983	$9,198,180	273,480,244
	4	$2,149,078	1.2293	$2,641,766	263,079,749	($881,351)	272,598,892
00	1	$2,455,676	1.2399	$3,044,977	266,124,725	$19,950,578	292,549,471
	2	$14,245,777	1.2506	$17,815,516	283,940,242	$9,523,129	302,072,599
	3	$11,736,739	1.2614	$14,804,536	298,744,778	$9,515,384	311,587,983
	4	$3,026,792	1.2723	$3,850,925	302,595,703	($912,198)	310,675,785
01	1	$4,202,889	1.2833	$5,393,409	307,989,112	$20,649,817	331,325,601
	2	$4,631,474	1.2944	$5,994,761	313,983,873	$9,856,922	341,182,524
	3	$6,044,218	1.3055	$7,890,923	321,874,796	$9,848,907	351,031,430
	4	$6,473,182	1.3168	$8,523,945	330,398,741	($1,181,950)	349,849,480
02	1	$9,220,751	1.3282	$12,246,844	342,645,585	$21,144,605	370,994,086
	2	$11,269,802	1.3397	$15,097,379	357,742,964	$9,965,926	380,960,012
	3	$11,758,839	1.3512	$15,888,851	373,631,815	$9,955,540	390,915,551
	4	$11,897,216	1.3629	$16,214,884	389,846,499	($1,223,318)	389,692,233
03	1	$10,753,407	1.3747	$14,782,379	404,628,878	$21,908,093	411,600,326
	2	$10,877,817	1.3865	$15,082,283	419,711,161	$10,326,447	421,926,773
	3	$11,055,439	1.3985	$15,461,243	435,172,404	$10,315,697	432,242,469
	4	$6,877,763	1.4106	$9,701,764	444,874,168	($1,804,640)	430,437,829
04	1	$1,946,713	1.4228	$2,769,750	447,643,917	$9,406,654	439,844,483
	2	$2,001,920	1.4351	$2,872,899	450,516,816	$1,280,300	441,124,783
	3	$1,745,430	1.4475	$2,526,453	453,043,269	$1,264,442	442,389,225
	4	$1,468,240	1.4600	$2,143,586	455,186,855	($1,867,803)	440,521,423
05	1	$1,468,240	1.4726	$2,162,101	457,348,956	$4,348,564	444,869,987
	2	$1,428,240	1.4853	$2,121,364	459,470,320	$1,216,042	446,086,029
	3	$0	1.4981	$0	459,470,320	$605,366	446,691,394
	4	$0	1.5111	$0	459,470,320	($1,933,176)	444,758,219
TOTAL		$376,613,000		$459,470,320		$440,521,423	

FINANCIAL ANALYSIS

FY	QTR	FUND BALANCE	INTEREST INCOME	INTEREST EXPENSE
93	4	$0	$0	$0
94	1	10,900,000	94,148	$0
	2	16,444,148	142,035	$0
	3	21,581,454	186,409	$0
	4	21,560,738	186,230	$0
95	1	32,902,099	284,190	$0
	2	38,527,165	332,776	$0
	3	43,850,838	378,759	$0
	4	43,265,758	373,706	$0
96	1	60,509,293	522,646	$0
	2	98,445,296	850,316	$0
	3	103,247,393	891,794	$0
	4	98,974,236	854,885	$0
97	1	110,223,357	952,048	$0
	2	106,423,962	919,231	$0
	3	99,648,438	860,708	$0
	4	76,613,079	661,741	$0
98	1	71,508,723	617,653	$0
	2	56,231,981	485,701	$0
	3	41,339,168	357,065	$0
	4	17,213,127	148,677	$0
99	1	18,414,612	159,055	$0
	2	19,995,318	172,708	$0
	3	23,474,742	202,762	$0
	4	20,154,387	174,082	$0
00	1	37,234,071	321,607	$0
	2	29,263,291	252,760	$0
	3	24,226,899	209,259	$0
	4	19,673,034	169,925	$0
01	1	35,099,366	303,169	$0
	2	39,264,696	339,147	$0
	3	41,561,826	358,988	$0
	4	32,214,920	278,255	$0
02	1	41,390,936	357,512	$0
	2	36,616,995	316,277	$0
	3	30,999,960	267,760	$0
	4	13,829,718	119,453	$0
03	1	21,074,886	182,033	$0
	2	16,501,083	142,527	$0
	3	11,498,064	99,314	$0
	4	90,974	786	$0
04	1	6,728,664	58,118	$0
	2	5,194,183	44,864	$0
	3	3,977,037	34,351	$0
	4	(0)	0	$0
05	1	2,186,463	18,885	$0
	2	1,300,026	11,229	$0
	3	1,916,621	16,555	$0
	4	(0)	0	$0
TOTAL			$14,712,102	$0

TOTAL EXPEND:

CAPITAL	$459,470,320
O & M EXP.	$35,489,958
TOTAL	$494,960,278

TOTAL INCOME:

AD-VAL.	$279,192,439
OTHER	$77,000,000
INTEREST	$14,712,102
EAA/C-139	$124,055,737
TOTAL	$494,960,278

NOTE: Above totals exclude federal funds & expenditures,
and costs & CARL funds for land acq. in Rotenberger Tract