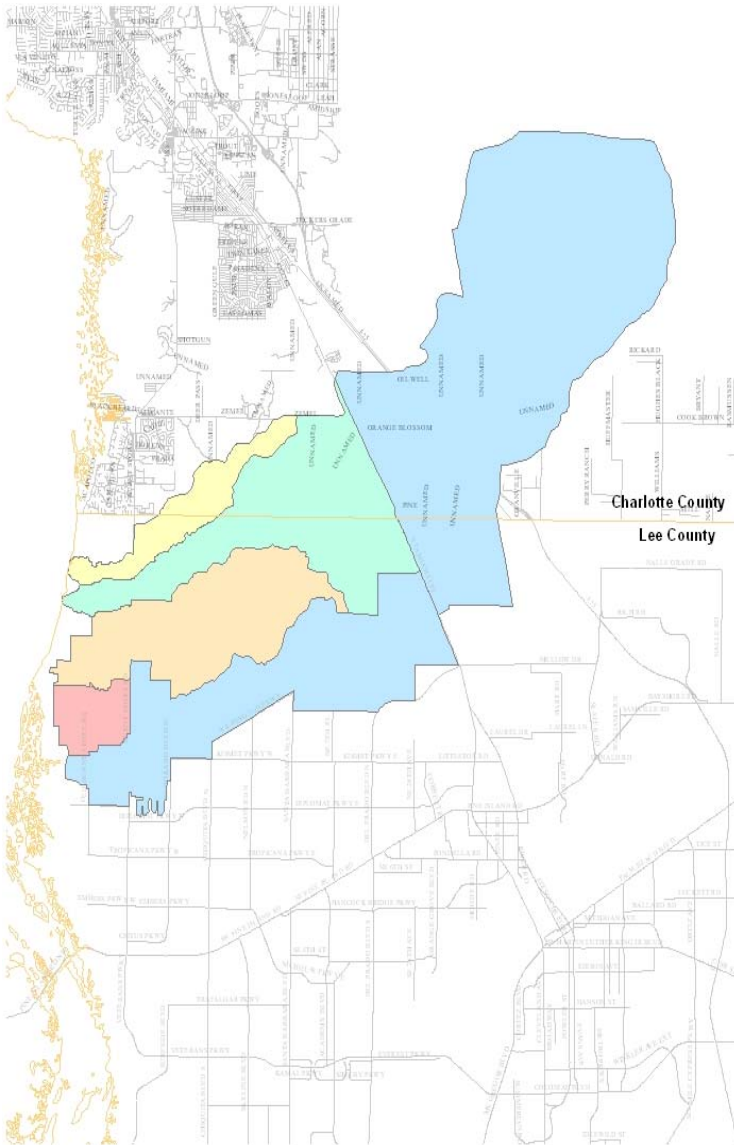


FINAL TECHNICAL MEMORANDUM

Yucca Pens Hydrologic Restoration Plan

(Work Order No: 4600000893-WO03)



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January 28, 2010
08006.02

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1.0 INTRODUCTION

The following summary of the background information on the project area was extracted from the statement of work prepared by the South Florida Water Management District (SFWMD or District), which was included in the work order no. 4600000893-WO03.

In the 1950's, almost all of the watershed areas in the South Charlotte, North Lee County and Fred C. Babcock-Cecil M. Webb (Babcock-Webb) Wildlife Management Area (WMA) were drained by sheet flow in a southwesterly or southerly direction. There was no significant development to block this southwesterly and southerly sheet flow. The next 30 years, 1950 – 1980, brought development into these sheet flow areas and significant flooding began to occur. Sheet flow from the Babcock-Webb area of 40 square miles remained unchanged. Topographic changes since the 1980's have further blocked, constricted and concentrated what were formerly sheet flow areas. Expanded development in the study area has exacerbated both constrictions and flooding in these newly developed sheet flow areas. Sheet flows prior to 1975 normally crossed over U.S. 41 near the Charlotte/Lee County line. This was blocked when the west lanes of U.S. 41 were raised in 1975. Sheet flow from the upper reaches of the Gator Slough watershed (Babcock-Webb Area) was concentrated at the 145-ft wide bridge under I-75 near the Charlotte/Lee County line when it was constructed in 1980.

The Yucca Pens Unit includes a portion of the Babcock-Webb WMA in both Lee and Charlotte Counties. A *Conceptual Plan for Fred C. Babcock-Cecil M. Webb Wildlife Management Area 2003-2008* (Conceptual Plan) has been developed by the Florida Fish and Wildlife Conservation Commission (FWC) and approved by the Florida Department of Environmental Protection (FDEP). The Conceptual Plan contains resource management goals, objectives and strategies to restore and maintain the area hydrology to natural conditions where feasible. Historic sheet flow to the south has been significantly impeded due to development and diking, resulting in abnormally high water levels that cause degradation to the native upland habitat. The Conceptual Plan strategies specifically include working with the county and state government agencies to restore historical sheet flow to the area and contracting to complete a hydrology study of the Yucca Pens Unit. Additionally, Yucca Pens restoration is a component of the *Tentatively Selected Plan* of the *Southwest Florida Feasibility Study*. The purpose of this project is to conduct a reconnaissance study of the water characteristics of the Yucca Pens Unit in order to identify water management goals as well as available and needed data to make informed water management decisions in the area. Ultimately, the project information will be used to contribute to the net ecosystem benefit in the Cape Coral North Spreader watershed as part of the FDEP Ecosystem Management Agreement Process.

Previous Planning Activities

This area was described in the *Northwest Lee County Surface Water Management Plan*



prepared for Lee County by Boyle Engineering and completed in 2005. The main focus of this study was to develop a Geographic Information System (GIS) database necessary for surface water management, develop a hydrologic/hydraulic model of the surface water management system, identify issues of concern, and assess existing and future level of service deficiencies for flooding along Burnt Store Road. Water quality modeling was also performed. The data developed in this study should provide a basis for the proposed restoration plan for the Yucca Pens Unit.

In 2004, Johnson Engineering prepared a report for the District entitled *South Charlotte County, North Lee County, Babcock/Webb Surface Water Management Concept Plan* to address flooding concerns in the vicinity of the Babcock-Webb WMA. The recommendations of this report should be considered in the preparation of the restoration plan.

1.1 PROJECT OBJECTIVE

The ultimate goal of this project is to restore historic sheet flow to the Yucca Pens Unit. However, the primary objective of this contract (work order no. 4600000893-WO03) is to conduct a reconnaissance study of the water characteristics of the Yucca Pens project area. This study is intended to assist in making informed decisions to develop a multifunctional water management plan for implementing hydrologic restoration in the Yucca Pens area. The project has investigated the potential for restoring the historic outfall to the following systems: 1) Yucca Pen Creek, 2) Durden Creek, 3) Greenwell Branch, 4) Longview Run, and 5) Gator Slough. Runoff to these five systems (watersheds) originates in the Babcock-Webb WMA and passes through Charlotte County to reach the outfall in Lee County. A number of entities will be involved in the solution to this restoration including SFWMD, Southwest Florida Water Management District (SWFWMD), Lee and Charlotte counties specifically Lee County Natural Resources Division, Lee County Department of Transportation, Charlotte County Public Works Department, Charlotte County Growth Management Department, as well as the City of Cape Coral, FWC, FDEP, Florida Department of Transportation (FDOT), Charlotte Harbor Preserve State Park, Charlotte Harbor Aquatic Preserves, U.S. Fish and Wildlife Service (FWS), and the Seminole Gulf Railway. Successful implementation of the recommendations of this plan will involve cooperation among all involved. A Yucca Pens Interagency Deliverable Review Team (IDRT) has been assembled by the District.

Restoration of the historic flow will reduce the amount of water that has been redirected to Gator Slough and lessen the impact of damaging point discharges through the Gator Slough Canal. The multifunctional water management plan will thus contribute to the net ecosystem benefit in the Cape Coral North Spreader watershed for the Ecosystem Management Agreement Process. A desired outcome of the project is that the FWC will implement the recommended hydrologic restoration plan for the Yucca Pens area in phases.



The restoration plan will be designed to meet the following objectives:

1. Restoration of sheet flow across the Yucca Pens unit
2. Provide outfall from Babcock-Webb WMA to the Yucca Pens unit – potential flow ways include Oil Well Road at I-75 and Harper & McNew Property at I-75
3. Investigate ways to allow water from the U.S. 41 ditch to sheet flow across Yucca Pens unit
4. Restoration of the ecological integrity of the ecosystem
5. Improvement of water retention and aquifer recharge
6. Restoration of flow severed by previous construction
7. Restoration of historic outfall to Charlotte Harbor
8. Reduction in unnatural point discharges from Gator Slough

1.2 SCOPE OF WORK

The work in this project consists of the reconnaissance study of the water characteristics in the Yucca Pens area; a conceptual planning level evaluation of the issues relating to water supply, flood protection, water quality and natural systems; and development of a multifunctional water management plan for hydrologic restoration of the Yucca Pens area. The multifunctional water management plan includes information on required permits for restoration. The project includes field verification of the water characteristics as well as relevant research and a compilation and synthesis of existing information on hydrologic conditions within the Yucca Pens study area.

This study is a master planning level study, and is not intended to serve as an engineering study. All references to design during this study indicate conceptual planning level design without details. Implementation of any design recommendation developed during this study will require engineering analysis and design, which is beyond the scope of this contract.

The current work order (Work Order No: 4600000893-WO03) is divided into several technical and deliverable tasks and sub-tasks as summarized below.

Task 1: Prepare Summary Report and Metadata

Sub-Task 1.1: Kick-Off Meeting

The scope of this subtask included attending the kickoff meeting with the District staff with primary focus on a) clarifying the project requirements along with establishing lines of communication and project schedule, b) receive all relevant data collected and assembled by the District, and c) receive a geodatabase and the base map for the project prepared by the District.



Sub-Task 1.2: Literature/Data Review

The scope of this sub-task included brief reviews of all documents, reports, and other relevant data provided by the District with focus on gaining better understanding of the challenges facing the Yucca Pens area with respect to the long term plan requirements and the goal to restore historic sheet flow to the area.

Sub-Task 1.3: Prepare Summary Report and Metadata

This included preparing and submitting the narrative description for the study area and metadata for the project base map.

BPC Group Inc. (BPC) completed Task 1 of the work order, and submitted the final report in September 2009 (Final Summary Report, Yucca Pens Hydrologic Restoration Plan, Task 1: Summary Report and Metadata; Work Order No: 4600000893-WO03; September 4, 2009).

Task 2: Complete Reconnaissance Study of Yucca Pens Study Area & Technical Memorandum

Sub-Task 2.1: Update Site Specific Data

This included developing the historic drainage pattern in the study area as well as conducting a limited visual field verification of hydrologic data, infrastructures, and drainage patterns including limited GPS survey (not at sub-meter level and not conducted by a licensed surveyor) as appropriate. The scope also included a complete water budget analysis solely based on the results from the *Northwest Lee County Surface Water Management Plan* report and other studies to build a spreadsheet model to analyze outfall restoration.

Sub-Task 2.2: Address Water Quality Issues

The scope of this subtask included customizing the existing ERD spreadsheet model or substitute with a more appropriate basin scale water quality model for evaluation of impacts from pollutants specific to the study area and to determine the efficiencies of potential BMPs. This analysis would be solely based on the data provided by the District.

Sub-Task 2.3: Prepare Draft Technical Memorandum for Multifunctional Water Management Plan

This included preparation of the 95% complete draft technical memorandum (TM) along with the field reconnaissance survey and analytical calculation results for the study area. The final TM shall incorporate the appropriate and applicable review comments from the District and the IDRT and be submitted within two weeks from receiving the comments.

This TM presents the findings of Task 2. A draft copy of this Task 2 TM dated December 11, 2009 was submitted to the Interagency Deliverable Review Team (IDRT) members for



their review. The comments from the IDRT members along with the responses to these comments are presented in Appendix D.

1.3 SUMMARY OF TASK 1 REPORT

This section presents a brief summary of the activities completed during Task 1 and the findings and recommendations documented in the Task 1 Report. For complete details on the documentation and findings, the reader is referred to the Task 1 Report (Final Summary Report, Yucca Pens Hydrologic Restoration Plan, Task 1: Summary Report and Metadata; Work Order No: 4600000893-WO03; September 4, 2009). This report is also listed in the reference section of this TM as “BPC Group, 2009”.

BPC reviewed all available documents and data to become familiar with the project extent and needs, and to gain better understanding of the challenges facing the Yucca Pens project area with respect to the long term plan requirements and the goal to restore historic sheet flow within the project area.

The Yucca Pens Hydrologic Restoration project area includes the following five watersheds: Yucca Pen Creek, Durden Creek, Greenwell Branch, Longview Run, and Gator Slough. Geographically, the Yucca Pens project area extends from Babcock-Webb WMA in Charlotte County along the north and east to Charlotte Harbor along the west and Gator Slough canal on the south. The approximate extent of the project area, as presented in Task 1, is shown on Figure 1-1. The road maps were downloaded from the county websites of Lee and Charlotte counties. The study area consisted of approximately 52.8 square miles west of US 41 and about 44.8 square miles east of US 41. The approximate Yucca Pens project boundary shown on Figure 1-1 was generated by combining watershed boundary shapefiles provided by the District. These boundaries were refined through limited site reconnaissance activities during Task 2, and the revised watershed boundaries are presented later in this TM.

Some of the previous studies were conducted for flood control studies, while the others were aimed at restoration activities. The current study is not a flood control project; rather the objective of this project is to develop conceptual hydrologic restoration plans. Based on the objectives of the current project, following is a summary of the relevant recommendations from previous studies presented in the Task 1 Report.

Northwest Lee County Surface Water Management Plan, March 2005

- Develop new topographic data for the study area; use updated topographic data to refine the delineated watershed boundary; develop a GIS database for the study area to capture all watershed relevant information; collect more hydraulics and conveyance data within Long View Run watershed; and install weather station on Burnt Store Road for better accuracy of rainfall data for the study area.



- A detailed field survey should be conducted for engineering design purpose; update the runoff curve number of each sub-basin according to future developments and other landuse changes; update time of concentration of individual sub-basins according to the new topographic data; and determine accurate seasonal high water elevations to design flood control/water quality improvement structures. The curve number and time of concentration are standard hydrologic model parameters used to estimate runoff (for definition refer to “Urban Hydrology for Small Watersheds, TR-55, June 1986; Engineering Division, U.S. Department of Agriculture”).
- For future study in the watersheds, the developed watershed model should be converted into ICPR Version 3.0; convert the Cape Coral canal system model from SWMM to ICPR Version 3.0 for integrated study of Northwest Lee region and City of Cape Coral canal system.
- Purchase additional right of way on Burnt Store Road if the roadway expansion occurs; maintain control structures on Burnt Store Road on a regular interval for full conveyance capacity of the control structures; construct wet or dry retention / detention system within the unincorporated areas of Lee County east of Burnt Store Road to provide treatment for 1-inch of runoff from developed areas.

Water Management Study: Cecil M. Webb Wildlife Management Area, June 1983

- Proposed a Water Management Plan that included the following phased approach:
 - Implement a Pilot Plan that includes immediate maintenance of the two existing Webb Lake outfall structures, the creation of a bypass flow way west of Webb Lake Road, and structural improvements to the North Prong of Alligator Creek and to the South Branch of Myrtle Slough;
 - Create a Tucker’s Grade water control system;
 - Construct a single outlet control structure on each of the five maintenance channels identified in the report to control 60 percent of the outflow from the Webb WMA; and
 - Create a major retention Area at the intersection of Tucker’s Grade and SAL Grade.

Lee County Interim Surface Water Management Master Plan, May 1990

- Gator Slough is highly altered system which sends water rapidly to the estuary in Matlacha Pass and this characteristic has caused damage to the seagrasses in the shallow waters adjacent to the mouths of small natural creeks extending from the spreader system.
- Charlotte and Lee Counties will need to cooperate on any watershed work in Charlotte County for any development that would increase the rate of water in Gator Slough.
- Repair portions of the spreader waterway’s seaward edge to better distribute water to the estuarine areas; and place fixed weir structures adjacent to the canal in Section 23 and 27 to reduce over drainage and control canal sedimentation.



- Divert or provide longer detention in the Cape Coral canal system to reduce the existing impacts to seagrass.
- Add the adjacent wetlands on the eastern side of U.S. 41 to the flow way.

Matlacha Pass Hydrologic Restoration Project - Phase 1, March 2007

- Expand and improve cross-drain culverts under Burnt Store Road to improve east west flow pattern, and side drains and roadside ditches along Burnt Store Road to improve conveyance within the individual basins in order to reduce inter basin flows between Greenwell Branch and Gator Slough Basins; and remove cross drain at the intersection of Durden Parkway and Burnt Store Road.

Surface Water Management Conceptual Plan: South Charlotte County, North Lee County, and Babcock/Webb, 2003

- Acquire online storage areas where practical to attenuate flood flows as they move south in addition to the right-of-ways along Gator Slough Outfall, such as Oil Well Grade Road to the 145-foot I-75 Bridge.

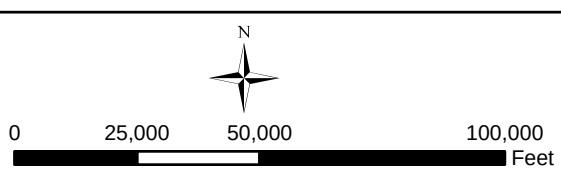
Legend

- Yucca Pens Project Area
- Major Roads and Streets
- County Boundary

Approximate Project Area

Charlotte County

Lee County



Source:
 Charlotte County Roads Layer: Charlotte County Government GIS systems
 Lee County Roads Layer: Lee County Government GIS systems
 Watershed Boundary: Provided by SFWMD (Northwest Lee County
 Surface Water Management Plan; "YuccaPenStudy_east.shp"
 shapefile by SFWMD)

Approximate Extent of Project Area

Figure 1-1

08006.02A

2.0 SITE RECONNAISSANCE

2.1 VISUAL FIELD INSPECTION

BPC Group conducted a limited visual reconnaissance of the Yucca Pens project area from July 20, 2009 to July 29, 2009. The scope of the site reconnaissance included visual verification and documentation of GPS coordinates of limited hydrologic features, including infrastructures and drainage patterns using a hand held Garmin GPSMAP 76CSx. According to the manufacturer's specification, this device has a GPS accuracy of ± 10 m (33 ft) and an altimeter accuracy of ± 10 ft. The type of structures or hydrologic features observed during the visual field inspection included: culverts, bridges, weirs, outfalls, canals and flow ways, swales and ditches, trails including dirt roads and ATV trails, and Babcock-Webb WMA gates. As indicated in the scope of work, this visual field inspection was not a complete site reconnaissance survey. It was only a limited visual field verification of selected accessible hydrologic features. The GPS coordinates of these hydrologic features were recorded in the GPS device known as waypoints.

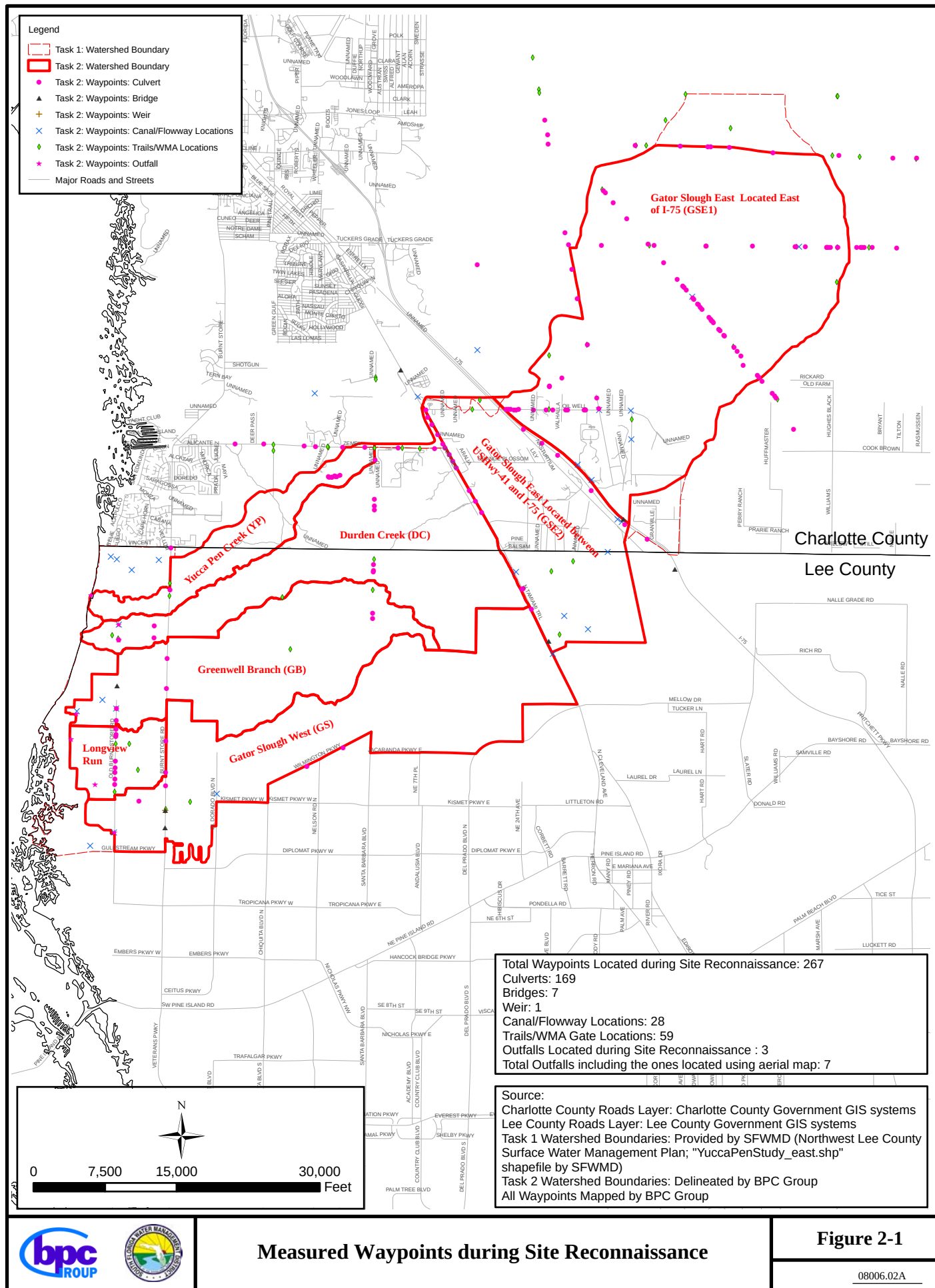
The copies of the field logs documented during the site reconnaissance are presented in Appendix A. The photographs of the selected structures captured during the field inspection are also presented in Appendix A. A discussion of these photographs along with further details on the field inspection results are presented below in the next several subsections.

2.1.1 Distribution of the Waypoints

A total of 267 waypoints were recorded during the field reconnaissance of the project area. The GPS waypoints were imported to the GIS, and were organized into several layers. Following is the breakdown of the distribution of these waypoints.

- 169 Culvert Locations of which 10 culverts are equipped with flap/sliding gates
- 7 Bridge Locations
- 1 Weir Location
- 28 Canal and/or Flow Way Locations (several waypoints along each canal/flow way)
- 3 Outfall Locations
- 59 waypoints representing the Trails and WMA Gate Locations. Several waypoints recorded along each trail within the study area and other intermediate locations including the WMA gates. The trails included dirt roads and ATV trails.

The locations and distribution of the waypoints are shown on Figure 2-1.



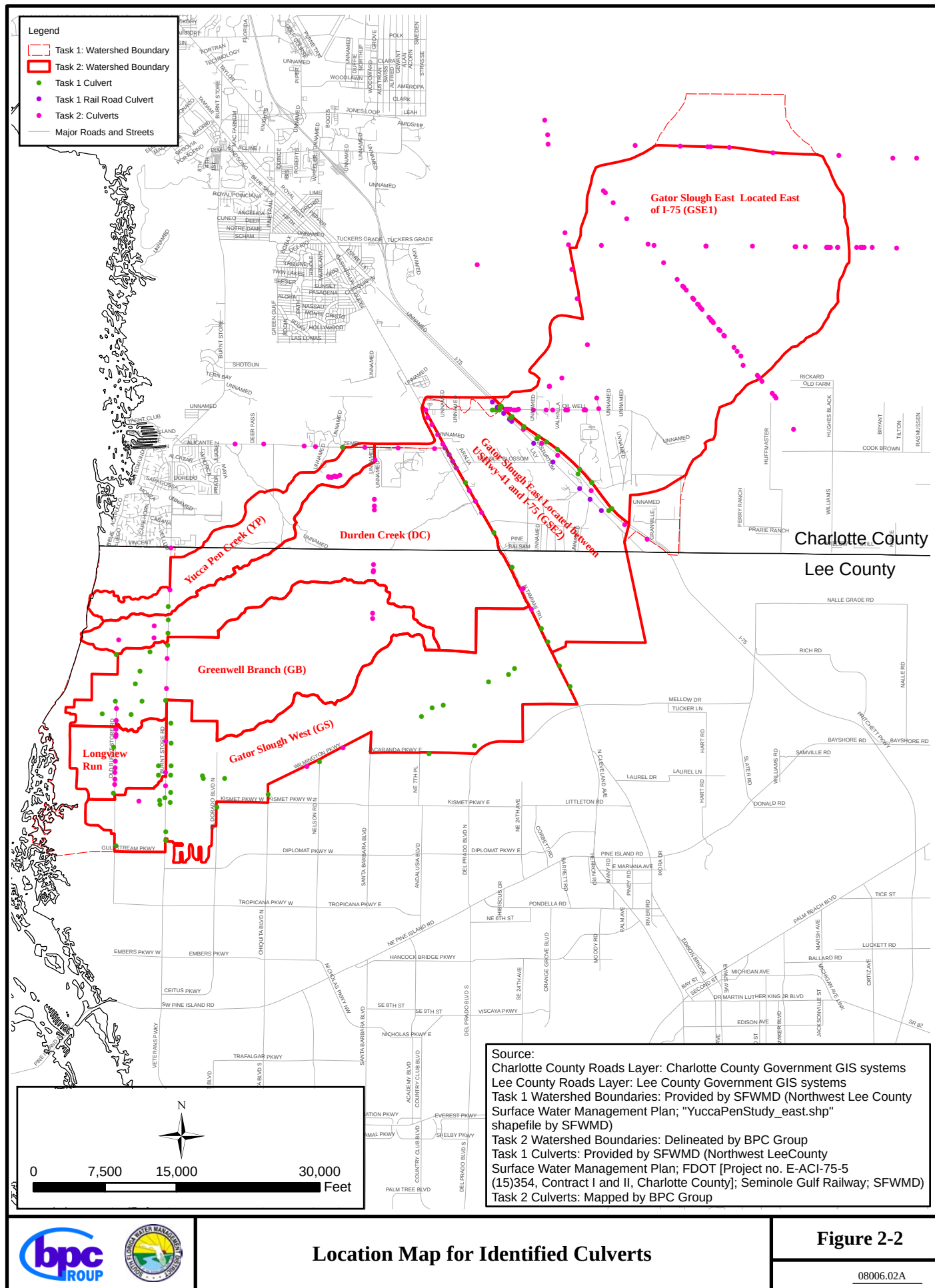
2.1.2 Flow Control Structures

The flow control structures include individual culverts, bridges, weirs, drop structures, and outfalls within the study area. The canals and flow ways are presented in Section 2.1.3. As indicated above, the flow control structures surveyed during this task account for a total 180 waypoints. The waypoint measurements of these individual flow control structures were compared with the culverts, bridges, weirs, drop structures, and outfalls presented in Task 1. The geodatabase prepared during the Task 1 consisted of 198 points representing culverts and bridges. A majority of these structure locations were approximated from Google maps, were not field verified, and did not have dimensional information including vertical elevations. The Task 1 structures with no dimensional information that overlap with the field reconnaissance waypoints were replaced with the field GPS information. The 198 locations from Task 1 were thus reduced to 86 waypoints. The Task 1 locations which were removed from the current geodatabase are listed below.

S-1, S-2, S-3, S-4, S-8, S-12, S-14, S-18, S-24, S-25, S-26, S-26, S-26 S-29, S-30, S-31, S-32, S-33, S-34, S-35, S-36, S-37, S-38, S-39, S-40, S-41, S-42, S-43, S-54, P-3190, P-5110, P-5130, P-6260, P-3305B, P-4005, P-4050a, RR-1, RR-2, RR-3, RR-4, RR-5, RR-6, RR-17, RR-18, RR-19, RR-20, RR-20.5, RR-21, RR-22, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 16, 17, 18, 19 G-1, G-2, G-3, G-4, G-5, G-6, G-7, G-8, G-9, G-10, G-11, G-15, G-20, G-21, G-22, G-23, G-24, G-25, G-26, G-27, G-28, G-29, G-30, G-31, G-32, G-33, G-34, G-35, G-36, G-41, G-43, G-45, G-47, G-48, G-49, G-50, G-51, G-52, G-53, G-54, G-55, G-56, G-57, G-58, G-59, and G-60.

The updated geodatabase along with the metadata is discussed later in this TM. Figure 2-2 presents the culvert locations, which include 169 culverts obtained from field reconnaissance during Task 2 (this task) and 86 culverts retained from Task 1. The vertical elevations of the field verified culvert locations were measured during site reconnaissance at the top of the culverts, and are included in the geodatabase. As indicated earlier, these elevations are limited by the measurement accuracy of the hand held GPS unit, which is ± 10 ft. They may only be used for qualitative and relative data interpretation. Since little information on hydraulic structures was available for the watershed GSE1 (within Babcock-Webb WMA), a large number of culverts were identified within this watershed. Similarly, maximum information was available for the watershed GS, and therefore few measurements were taken in this watershed. The distribution of the field verified culverts amongst various watersheds is given below.

Watershed GSE1:	100	Watershed GB:	6
Watershed GSE2:	10	Watershed YP:	16
Watershed GS:	4	Watershed LV:	10
Watershed DC:	23		



Location Map for Identified Culverts

Figure 2-2

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A number of culverts were partially blocked with debris, vegetation, or sedimentation. Few other culverts were broken or partially damaged. Appendix A presents a number of these culverts having maintenance issues. The photographs in this appendix also present culverts which are clean and need no corrective actions.

Figure 2-3 presents the bridge locations, which include 7 bridges obtained from field reconnaissance during this task and 2 bridges across Seminole Gulf Railway tracks retained from Task 1. These two railroad bridges are located within the private property of the Seminole Gulf Railway, and BPC did not have access to verify their locations. Figure 2-4 presents the location map for the weirs, drop structures, and outfalls. Appendix A also presents some photographs of the bridges, weirs, and outfalls recorded during the field reconnaissance.

2.1.3 Canals and Flow Ways

The waypoints measured along the canals and flow ways were joined using aerial photographs and topographic information to represent the canals as a line feature instead of point features in the geodatabase. A total of 28 waypoints were obtained during the site reconnaissance representing 19 canals/flow ways. Figure 2-5 presents the locations of these canals and flow ways. Appendix A presents some of the photographs of these features.

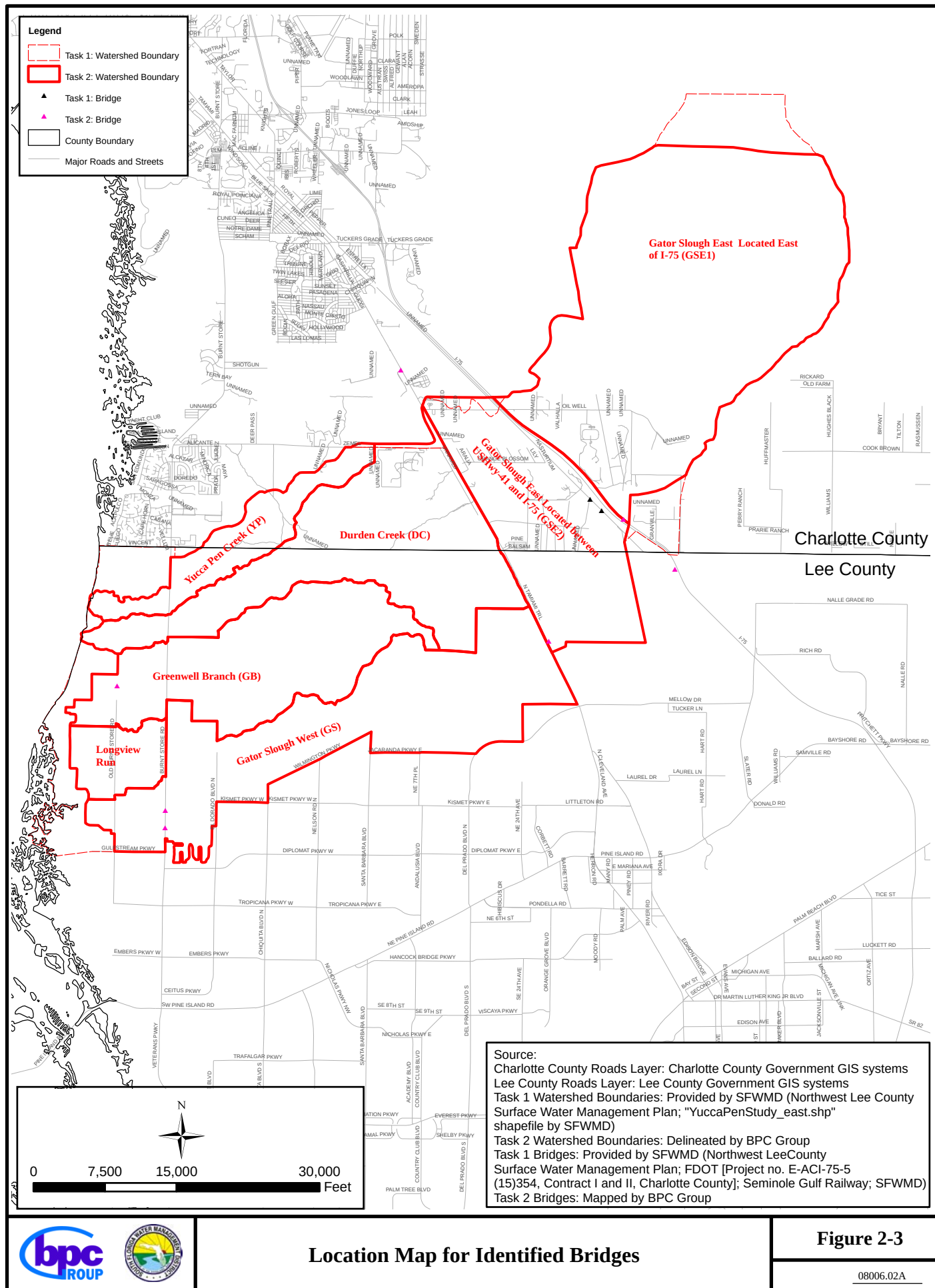
2.1.4 ATV Trails

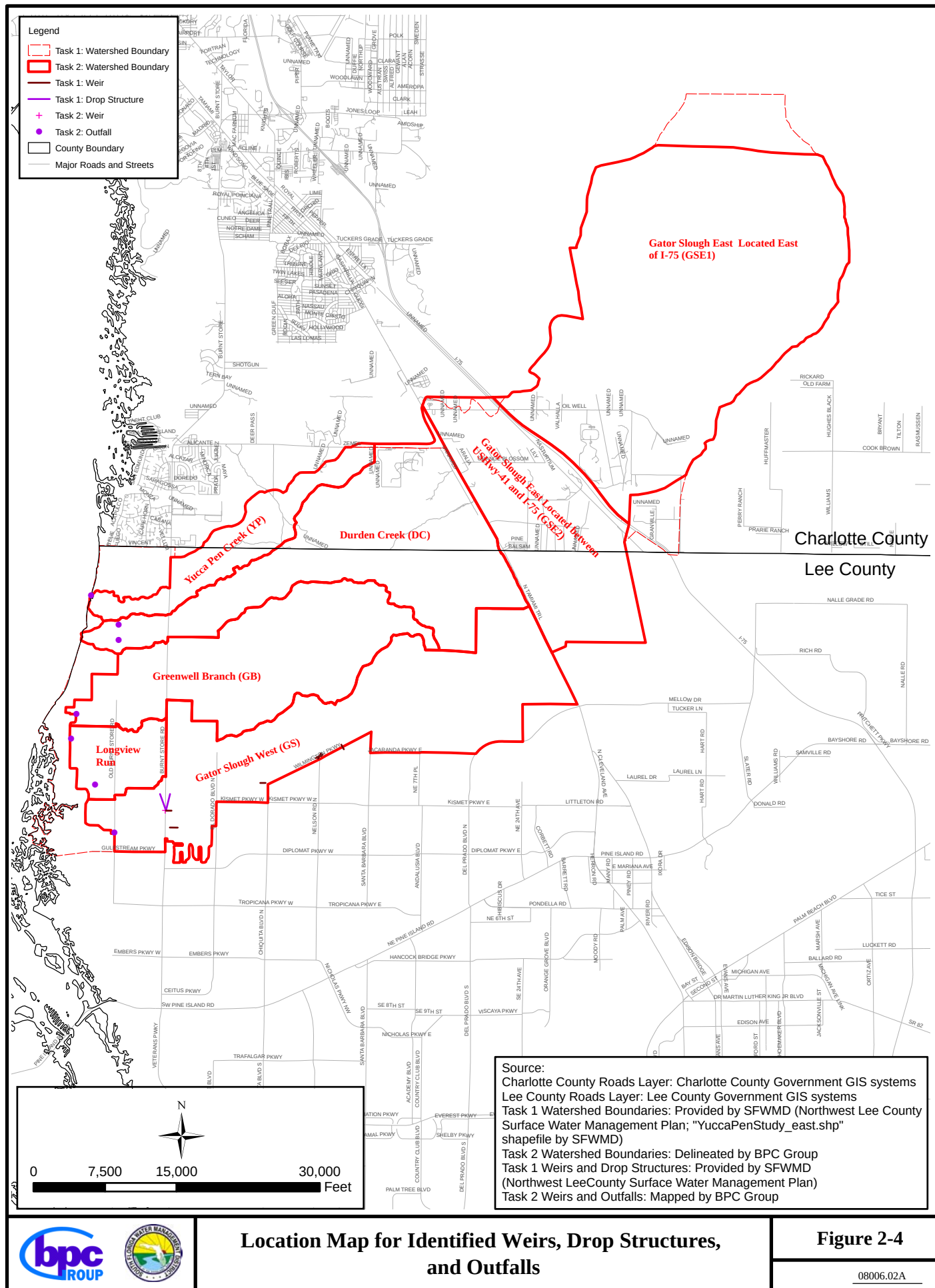
BPC Group tracked 26 ATV Trails, which may act as potential sheet flow obstruction and/or flow ways in and around the project area. These trails were represented by 42 waypoints during the site reconnaissance. Figure 2-6 presents the approximate tracing of these ATV trails. Some of these ATV trails or portions of these trails, based on their higher topographic locations, are likely to act as flow barrier. The other trails could act as either flow way or flow barrier. The available topographic information along and around these trails is inadequate to classify either way. Photographs of some of these trails are presented in Appendix A.

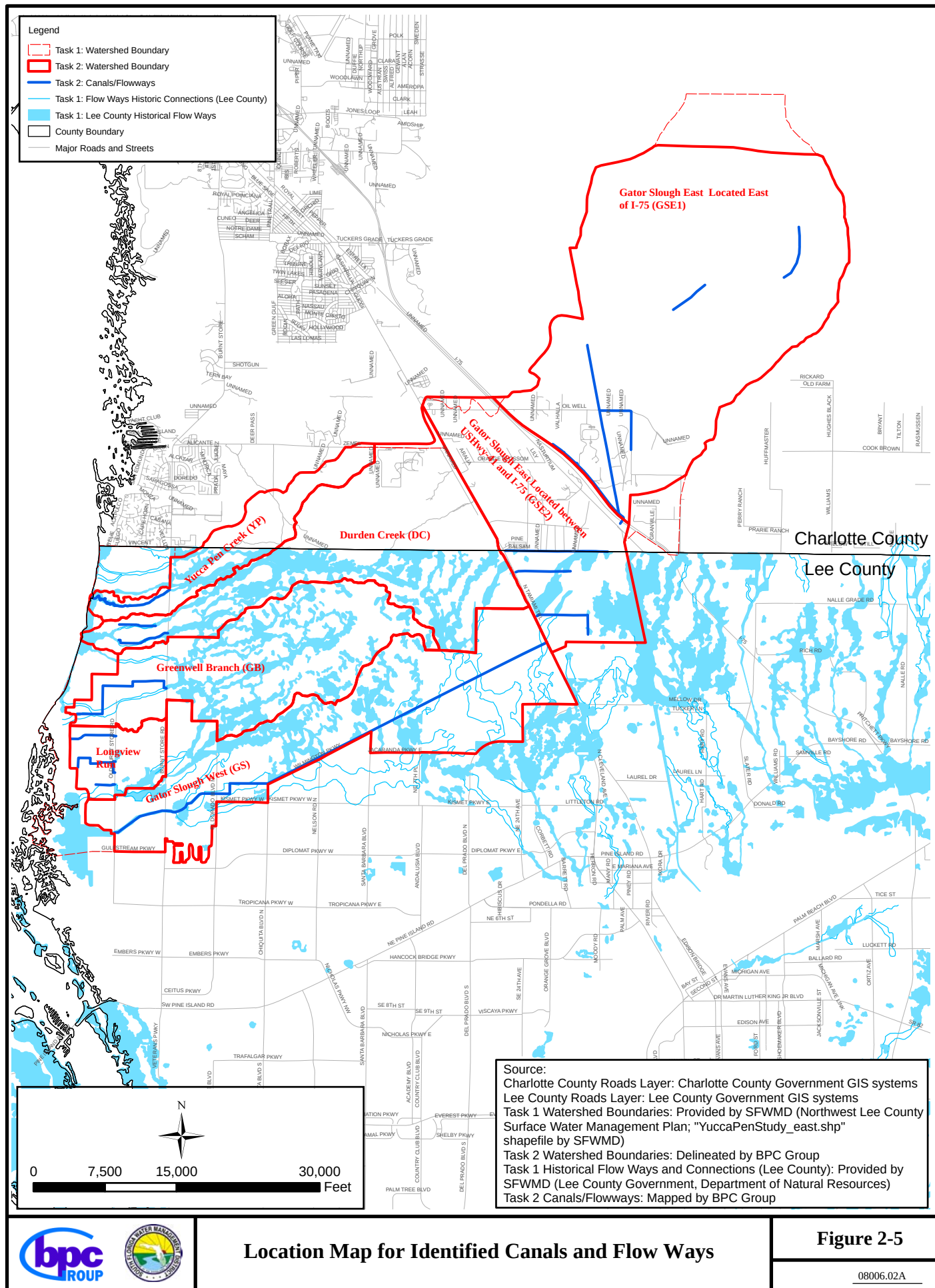
2.2 HISTORIC DRAINAGE PATTERN (UPDATED WATERSHED BOUNDARIES)

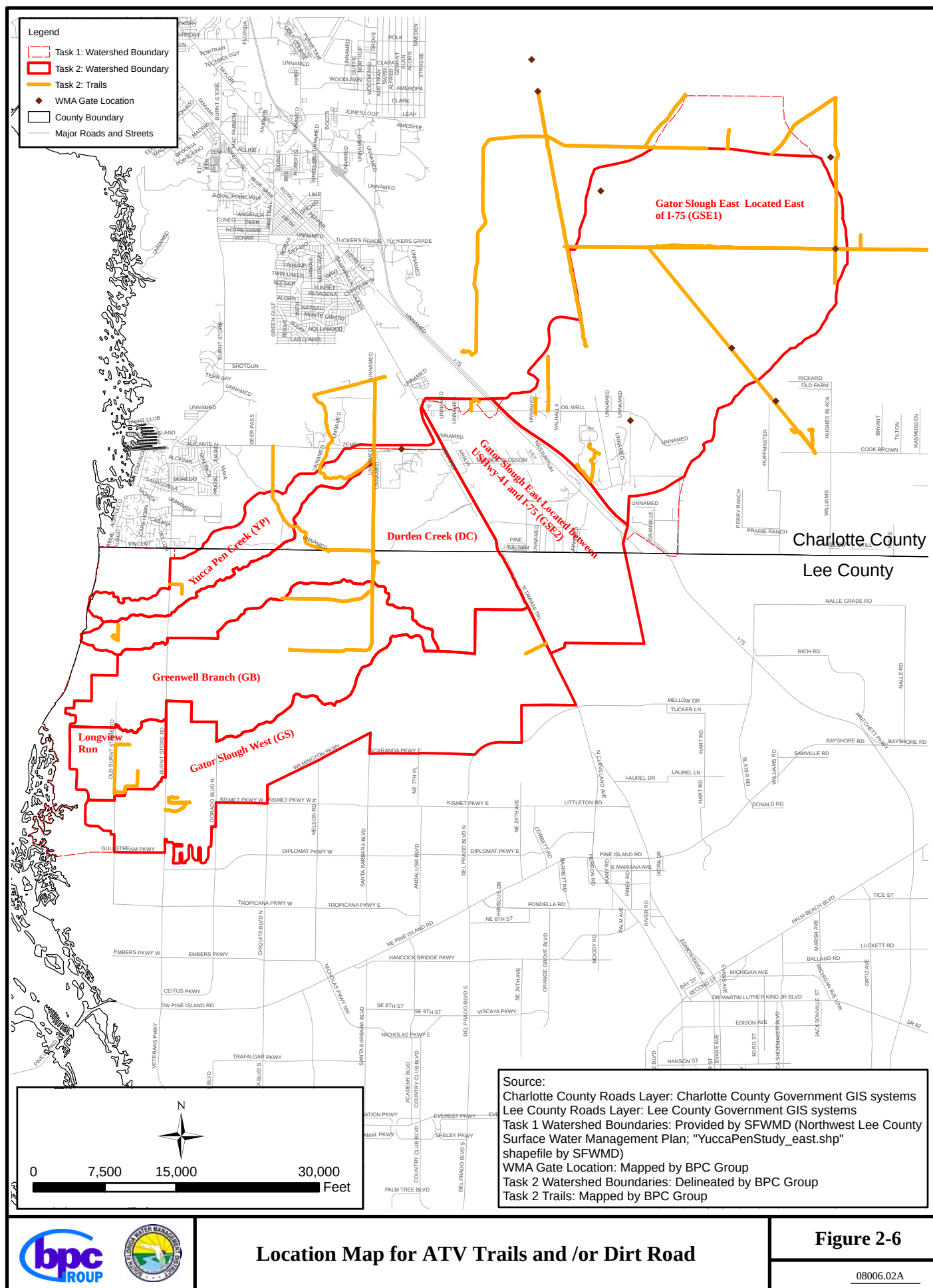
Based on the field reconnaissance survey and the GPS waypoints along with the topographic contours and the Digital Elevation Model (DEM) presented in Task 1 report, the boundaries of the watersheds and the project area were modified as appropriate. Figure 2-1 presents the seven watersheds (5 watersheds west of US Hwy 41 similar to the Northwest Lee Stormwater Management Plan Report, and two watersheds east of US Hwy 41) as described below.

- Gator Slough East watershed located east of I-75 (GSE1): boundary was modified from the one presented in Task 1 Report







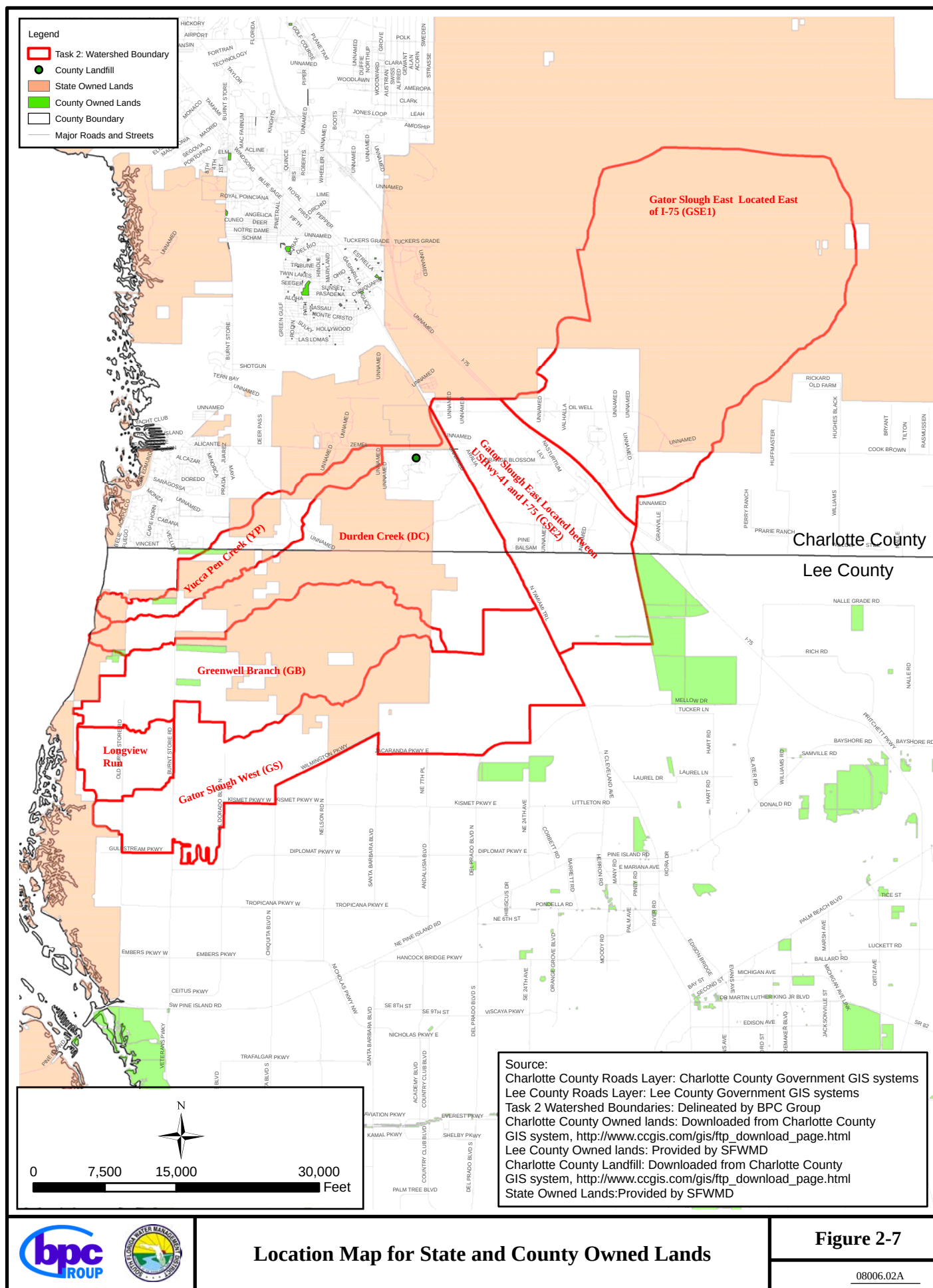


- Gator Slough East watershed located between US Hwy 41 and I-75 (GSE2): boundary was modified from the one presented in Task 1 Report
- Gator Slough West watershed located west of US Hwy 41 (GS): boundary remained unchanged from the one presented in Task 1 Report
- Durden Creek watershed located west of US Hwy 41 (DC): boundary was modified from the one presented in Task 1 Report
- Yucca Pen Creek watershed located west of US Hwy 41 (YP): boundary was modified from the one presented in Task 1 Report
- Greenwell Branch watershed located west of US Hwy 41 (GB): boundary remained unchanged from the one presented in Task 1 Report
- Longview Run watershed located west of US Hwy 41 (LV): boundary remained unchanged from the one presented in Task 1 Report

Figure 2-1 presents the comparison of the updated watershed boundaries with the boundaries presented in Task 1 Report. The old boundaries are shown as broken lines, and the modified (new) boundaries are shown as solid lines.

The historic flow ways and the historic flow way connections for the Lee County portions of the project area are shown on Figure 2-5. The historic flow way map for the Charlotte County area was not available. Therefore, the Babcock-Webb WMA portion in Charlotte County does not show any flow ways. The majority of this WMA is expected to be overlaid with natural flow ways (historic and current). This flow way map would be useful in developing the restoration plans presented later in this TM. The major canals, ditches, and significant swales are also shown on this map. As can be seen from Figure 2-5, the area between US Hwy 41 and I-75 in the watershed GSE2 is well developed and the flow is channelized. Similarly, urban development accounts for most of the area within GSEBS (see Figure 3-1), and the drainage pattern in this watershed is well channelized with engineering control structures. This watershed has minimal scope for restoration of historic flow ways. The restoration of historic drainage pattern in this portion of the watershed may not be practical. On the other hand, the current drainage patterns in the YP and DC watersheds west of Burnt Store Road follow the historic flow ways. The channel geometries may however be different. Please note that some of these flow ways do not have correct timing and distribution of flows, and the basins do not have the same amount of storage. Similarly, there are little manmade obstructions in restoring the historic flow ways in major portions of the YP, DC, and GB watersheds.

The development of conceptual designs should consider the availability of state and county owned lands such that the impact of potential land acquisition can be incorporated into the alternatives evaluation. Figure 2-7 presents the state and county owned lands. As shown on this figure, most of the lands are owned by the State of Florida. A small portion is owned by the Lee County within the project area. Charlotte County does not own much land within the Yucca Pens project area.



2.3 UPDATED GEODATABASE

2.3.1 Base Map and Geodatabase

All the figures included in this TM and the Task 1 deliverable constitutes the base map. The updated geodatabase includes some layers from Task 1 geodatabase which were not modified during this task and the other layers that were generated during limited field verification survey or modified from the earlier geodatabase. The detailed list of this updated geodatabase is given below.

Layers Unchanged from Task 1 Geodatabase:

- Topographic details
- Land use conditions
- Aerial maps
- Wetlands
- Hydrologic conditions of soils
- Roads and streets, including highways

Layers Modified from Task 1 Geodatabase:

- Watershed boundaries
- Hydraulic structures
 - o Culverts
 - o Bridges
 - o Weirs, Drop Structures, Outfalls
 - o Canals and Flow Ways

Layers Generated during This Task:

- State and County Lands
- Historic Flow Ways
- Waypoints (Field Reconnaissance)
- Major Swales/Ditches
- ATV Trails and Dirt Roads

The GIS coverages for the majority of these layers were provided by the District from various sources as indicated in the Task 1 Summary Report and Metadata. BPC downloaded the GIS coverages for the other features from the web sites of Lee and Charlotte counties. BPC measured the waypoints during site reconnaissance using a hand held GPS unit. The geodatabase and the coverages were modified as appropriate to suit the objective and scope of this study. All the features are cataloged as separate layers in the ArcGIS (version 9.2) environment.

An electronic copy of the ArcGIS (version 9.2) coverages of the base map is included in a DVD and presented in Appendix C. A “Task 2 Readme” file listing the summary of

directory structure is included in the DVD. Further details on the data organization and a hard copy of the “Task 2 Readme” file are included in Appendix C.

2.3.2 Metadata for Base Map

BPC has prepared the FGDC compliant metadata for each layer that is included in the base map coverage. In compliance with FGDC, the metadata from original files were imported for each feature class, and then edited the metadata files to update the incomplete information and the technical details on the modifications. A total of 67 metadata files were generated for the base map presented in this TM, which are grouped in accordance with the directory structure given below.

Layers Unchanged from Task 1 Geodatabase:

- Topo_East.gdb – 1 metadata file
- Landuse_East.gdb – 10 metadata files
- Aerials – 2 metadata files for aerials of Lee and Charlotte Counties, one for each county (a total of 195 tiles)
- Wetland – 3 metadata files
- Soils – 2 metadata file
- Roads – 2 metadata files
- Contour – 1 metadata file
- Boundaries – 9 metadata files
- Structure – 1 metadata file (Drop Structure)

Layers Modified from Task 1 Geodatabase:

- Hydraulic structures
 - o Culverts - 1 metadata files
 - o Bridges - 1 metadata file
 - o Weirs/Outfalls - 1 metadata file

Layers Generated during This Task:

- Hydraulic structures
 - o Culverts - 1 metadata file
 - o Bridges - 1 metadata file
 - o Weirs/Outfalls - 2 metadata files
 - o Canals and Flow Ways - 3 metadata files
- Watershed Boundaries – 7 metadata files
- Watershed Boundaries for Modeling - 11 metadata files
- State and County Lands - 5 metadata files
- Major Swales/Ditches - 1 metadata file
- Waypoints – 1 metadata file
- ATV Trails and Dirt Roads - 1 metadata file

In accordance with the scope of work, BPC prepared the metadata files in the XML format using ArcCatalog. These metadata files are included within the GIS coverages (Appendix C). For convenience of the readers, BPC has also prepared copies of these metadata files in HTML format, and they are included in the DVD. A complete list of these metadata file names are presented in Appendix C. A hard copy of the actual content of an example of a metadata file (e.g., "Waypoints.shp") is presented in Appendix C.

3.0 HYDROLOGIC ANALYSES

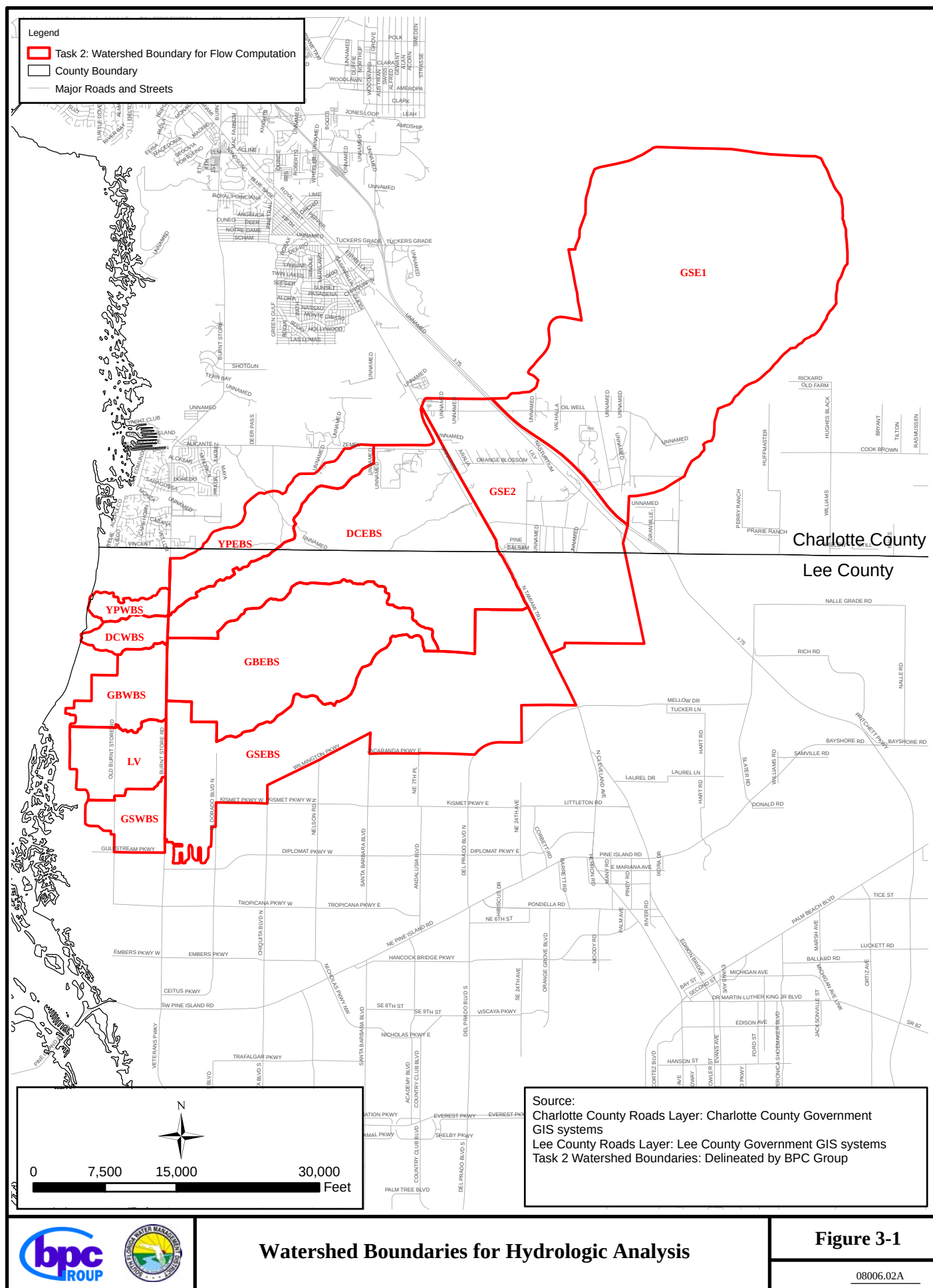
The objectives of the present study include computation of the water budget analysis and water quality conditions at the basin level. The five watersheds located west of US Hwy 41 (GS, DC, YP, GB, and LV) were subdivided along Burn Store Road. Therefore, the study area was divided into 11 sub-basins as shown on Figure 3-1. These sub-basins are Gator Slough east of I-75 (GSE1), Gator Slough between US 41 and I-75 (GSE2), Yucca Pens Creek east of Burnt Store Road (YPEBS), Yucca Pens Creek west of Burnt Store Road (YPWBS), Durden Creek east of Burnt Store Road (DCEBS), Durden Creek west of Burnt Store Road (DCWBS), Greenwell Branch east of Burnt Store Road (GBEBS), Greenwell Branch west of Burnt Store Road (GBWBS), Gator Slough east of Burnt Store Road (GSEBS), Gator Slough west of Burnt Store Road (GSWBS), and Longview Run (LV). The surface areas for the watersheds are summarized in Table 3-1. The stage-area relationships for the watersheds were derived from the one-foot contour map provided by the SFWMD and supplemented by the limited survey and numerous field inspections conducted during the study.

3.1 WATER BUDGET ANALYSIS

3.1.1 Flow Computation

To analyze the flow at basin/sub-basin level, a computer model for the study area was developed. The Interconnected Channel and Pond Routing (ICPR, Version 3) Program was used to model the study area by simulating the rainfall and runoff and then hydraulically routing the runoff. This model represents only a conceptual planning level model, and should not be used for any feasibility study or engineering design purpose. In order to estimate the runoff generated in each modeled watershed, the Soil Conservation Service (SCS) Unit Hydrograph method was utilized. The runoff hydrograph generated by the SCS method is a function of site-specific curve number, time of concentration, and the particular storm event used for simulation.

Runoff Curve Number. SCS runoff Curve Number (CN) method was used to compute the runoff volume from rainfall. The curve numbers for the model were developed using hydrologic soil groups, soil conditions, and land uses. A weighted CN was computed for each watershed based on hydrologic soil group and land use as described in TR-55 (2nd Edition, June 1986). The area weighted curve numbers were calculated for each watershed by intersecting the soil type and land use data within each watershed using GIS. Directly Connected Impervious Area (DCIA) percentages were neglected in the model since its contribution to the total runoff generation is very low. Most of the watersheds are covered by Rangeland and Forest. The computed CN values the watersheds are presented in Table 3-1. The CN values ranged from 83.3 for watershed LV to 90.1 for watershed GSE1.



Time of Concentration. An additional input parameter for the SCS Unit Hydrograph Method is the watershed time of concentration. The time of concentration (t_c) is the time for runoff to travel from the hydraulically most distant point of the watershed to a point of interest within the watershed (TR-55, 2nd Edition, June 1986). This parameter controls at what point in the storm event the entire basin is contributing runoff. For the purpose of this study, the “point of interest” is the topographic depression or the lowest elevation point for each watershed. The time of concentration computations were performed based on the general topography and field observations. The storm water runoff from each watershed flows to the topographic depressions or lowest point. The t_c values were calculated based on the equations and procedures outlined in TR-55 (2nd Edition, June 1986). The computed t_c values for the watersheds are presented in Table 3-1. The t_c values ranged from 216.96 minutes for watershed YPWBS to 2524.87 minutes for watershed GSE1.

Table 3-1 Summary of Hydrologic Computation by Watershed for a 25-Year, 72-Hour Storm

Watershed	Total Area (ac)	Curve Number	Time of Concentration (min)	25yr-72hr Rainfall (in)	Runoff (in)	Runoff (ac-ft)
GSE1	19430	88.8	2525	10.5	9.119	14764.5
GSE2	7041	90.1	1010	10.5	9.282	5446.0
GSEBS	9450	87.3	1233	10.5	8.930	7032.5
GSWBS	1021	86.9	604	10.5	8.879	755.4
YPEBS	2200	89.1	495	10.5	9.156	1678.3
YPWBS	438	84.0	217	10.5	8.510	310.4
DCEBS	8572	89.7	939	10.5	9.232	6594
DCWBS	602	84.4	278	10.5	8.561	429.5
GBEBS	5912	87.3	767	10.5	8.930	4399.3
GBWBS	1427	88.3	245	10.5	9.056	1077.2
LV	1567	83.3	539	10.5	8.421	1099.4

Rainfall Distribution. To implement the SCS Unit Hydrograph Method, a rainfall distribution must be specified for the desired storm event as a function of time for the watershed’s unit hydrograph. For the purpose of this study, the standard Florida Modified or FLMOD (ICPR, Version 3) rainfall distribution records were used. A 25yr-72hr storm with a rainfall total of 10.5 inches was considered for water budget analysis. In addition, a 2yr-24hr storm event with a total of 4.5 inches was also simulated in the current model.

Peaking Factor. The peak rate factor is critical for the determination of peak discharge. The peak rate factor is used to represent the effect of watershed storage on hydrograph shape. The factor generally varies from 100 to 600. High values represent little or no storage with steep land slopes. Lower values are used for watersheds with significant ponding effects due to very little or no slope and containing abundant surface storage. Accordingly, the peak rate factor of 256 was used for all watersheds in this study due to moderate surface storage and mild slopes. Selection of the peak rate factor was based on the procedures outlined in the

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document entitled “Procedure for Selection of SCS Peak Rate Factors for Use in MSSW Permit Applications”, SJRWMD, April 1990.

Boundary Conditions. The boundary conditions (i.e., headwater / tailwater relationships) utilized for the model represented stage and/or flow conditions at downstream points. Since the ultimate receiving depressional area to the west of the project area for each watershed is either a wetland or a canal and there is no stage-area information for this area, a time-stage tailwater condition was estimated from nearby drainage features. The time-stage at the boundary nodes for each watershed was set at the contour elevation represented in the map. The normal seasonal high water level within the project area is expected to be very high, within one foot of the ground surface.

3.1.2 Results and Discussion

The hydrologic runoff computations are summarized in Table 3-1. The ICPR model outputs are presented in Appendix B.

Based on the flow computations results from the ICPR model, a water budget computation was performed for each watershed and the water budget results are summarized in Table 3-2. As can be seen from this table, there are inter-basin flows in Yucca Creek and Durden Creek watersheds.

Table 3-2 Summary of Water Budget by Watershed for a 25-Year, 72-Hour Storm

Watershed	Rainfall	Upstream Inflow	Net Inter-basin Flow		Total Inflow	Infiltration/Storage		Outflow	
	(ac-ft)	(ac-ft)	(ac-ft)	% of Rainfall	(ac-ft)	(ac-ft)	% of Total Inflow	(ac-ft)	% of Total Inflow
GSE1	17001	0	0	0.0	17001	9969	58.6	7032	41.4
GSE2	6161	7032	0	0.0	13192	2661	20.2	10531	79.8
GSEBS	8269	10531	2349	28.4	21149	4217	19.9	16932	80.1
GSWBS	893	16440	0	0.0	17333	253	1.5	17080	98.5
YPEBS	1925	0	351	18.2	2276	595	26.1	1681	73.9
YPWBS	383	2032	0	0.0	2415	-54	-2.2	2469	102.2
DCEBS	7500	0	-2320	-30.9	5180	-488	-9.4	5668	109.4
DCWBS	527	1378	0	0.0	1905	109	5.7	1796	94.3
GBEBS	5173	0	-379	-7.3	4794	605	12.6	4188	87.4
GBWBS	1249	1460	0	0.0	2709	178	6.6	2532	93.4
LV	1371	492	0	0.0	1863	356	19.1	1507	80.9
Total	50451	39366	---	---	89817	18402	20.5	71415	79.5

Notes: Upstream inflow occurs at the upstream end of the sub-basin, and obtained from ICPR model results;
Inter-basin flows were obtained from ICPR model results;
Total Inflow = Rainfall + Upstream Inflow + Net Inter-basin Flow;

3.2 WATER QUALITY ANALYSIS

The purpose of the evaluation was to identify relative changes in nonpoint source pollutant loadings due to changes in land use, areas served by septic tank, point sources and existing BMPs. This conceptual evaluation was performed using the Watershed Management Model (WMM), Version 4.24. The WMM was originally developed by CDM under a contract with USEPA using Visual Basic® and MS Access®. The model is a "stand alone" application that runs in Microsoft Windows 95® or greater. The model provides a basis for planning-level evaluations of the long-term (annual or seasonal) basin pollution loads and the relative benefits of pollution management strategies to reduce these loads.

Model Capabilities: This model may be used to estimate annual or seasonal pollutant loads from many sources within a basin/watershed. The primary data required to use WMM include storm water event mean concentrations (EMCs) for each pollutant type, land use, impervious area, and average annual rainfall. The following summarizes the model capabilities (WMM User's Manual, Version 4.24).

- Estimates annual storm water runoff pollution loads and concentrations for nutrients (total phosphorus, dissolved phosphorus, total nitrogen, ammonia plus organic nitrogen), heavy metals (lead, copper, zinc, cadmium), and oxygen demand (BOD₅, COD) and sediment (total suspended solids, total dissolved solids) based upon EMCs, land use, percent impervious, and annual rainfall;
- Estimates annual pollution loads from stream baseflow;
- Estimates point source loads for comparison with relative magnitude of other watershed pollution loads;
- Estimates pollution loads from failing septic tanks;
- Applies a delivery ratio to account for reduction in runoff pollution load due to settling of particulate matter in stream courses; and
- Estimates stormwater runoff pollution load reduction due to partial or full-scale implementation of onsite or regional BMPs;

Model Limitations: The WMM was developed to estimate the relative changes in nonpoint source pollutant loads (average annual or seasonal) due to changes in land use or from the cumulative effects of alternative watershed management decisions (e.g. treatment BMPs). The models should be applied to appropriate spatial (basin wide) and temporal (average annual or seasonal) scales. It is not appropriate to use these input/output models for analysis of short-term (i.e., daily, weekly) water quality impacts. It is also not appropriate to use WMM to estimate absolute loads for a given outfall system without specific monitoring data for that system. The scale of this model and its output may not be appropriate for analysis of nutrient loadings from development projects.

3.2.1 Development of Model

3.2.1.1 Nonpoint Source Analysis

Nonpoint pollution loading factors (lbs/acre/year) for different land use categories are based upon annual runoff volumes and EMCs for different pollutants.

Land Use: As described earlier in this TM, the land use coverages were obtained from the South Florida Water Management District (SFWMD). For simplification, the FLUCCS categories were consolidated into 15 major categories for the purpose of implementing the WMM. These consolidated categories of land use are presented in Table 3-3. These consolidated land use categories generally correspond to land use categories that have EMC data available. Table 3-4 presents the acreages of each of the consolidated land use categories in the major watersheds for the existing land use conditions.

Table 3-3 Land Use Categories for WMM

FLUCCS Land Use Category	WMM Land Use Category
Upland Coniferous Forest Upland Hardwood Forest	Forest/Rural Open
Field and Row Crops Improved Pasture Unimproved Pasture	Agricultural/Pasture
Barren, Spoil Land	Urban Open
Parks, Recreation, Golf	Recreational
Extractive, Borrow, Holding Ponds	Extractive
Residential Low Density	Low Density Residential
Residential Medium Density	Medium Density Residential
Residential High Density	High Density Residential
Commercial and Services	Commercial
Institutional	Institutional
Transportation, Communications, Utilities (FLUCCS Codes: 8300,8350,8360, 8200)	Industrial
Transportation, Communications, Utilities (FLUCCS Codes: 8100, 8140)	Highways
Fresh water	Water
Mangrove, Saltwater Marsh Freshwater Marsh, Wet Prairie	Wetlands
Rangeland	Rangeland

Source: SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report. Basins 43 and 81 cover Yucca Pens Project area.

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Table 3-4 Land Use Acreage by Watershed for WMM

WMM Land Use	GSE1		GSE2		GSEBS	
	Acreage	%	Acreage	%	Acreage	%
Forest / Rural Open	3201.2	16.5	613.5	8.7	1544.0	16.3
Urban Open	0.0	0.0	48.0	0.7	129.2	1.4
Agricultural / Pasture	1276.5	6.6	1094.3	15.5	0.1	0.0
Low Density Residential	1.2	0.0	67.0	1.0	108.5	1.1
Medium Density Residential	0.0	0.0	710.5	10.1	532.9	5.6
High Density Residential	0.0	0.0	13.2	0.2	305.1	3.2
Commercial	0.0	0.0	9.6	0.1	29.6	0.3
Industrial	5.2	0.0	0.0	0.0	0.0	0.0
Highways	38.3	0.2	224.6	3.2	13.6	0.1
Water	1465.1	7.5	168.1	2.4	494.9	5.2
Rangeland	7502.8	38.6	1010.6	14.4	4709.3	49.8
Extractive	0.0	0.0	339.6	4.8	0.0	0.0
Institutional	106.3	0.5	5.3	0.1	0.0	0.0
Recreational	0.0	0.0	138.9	2.0	356.2	3.8
Wetlands	5832.9	30.0	2597.7	36.9	1227.0	13.0
Total	19429.5	100.0	7041.1	100.0	9450.3	100.0

WMM Land Use	GSWBS		YPEBS		YPWBS	
	Acreage	%	Acreage	%	Acreage	%
Forest / Rural Open	104.9	10.3	1009.3	45.9	249.5	57.0
Urban Open	26.1	2.6	0.0	0.0	0.0	0.0
Agricultural / Pasture	0.0	0.0	0.0	0.0	0.0	0.0
Low Density Residential	20.2	2.0	0.0	0.0	0.2	0.1
Medium Density Residential	0.0	0.0	0.4	0.0	0.0	0.0
High Density Residential	0.0	0.0	0.0	0.0	0.1	0.0
Commercial	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Highways	0.0	0.0	0.0	0.0	0.0	0.0
Water	182.8	17.9	6.3	0.3	2.9	0.7
Rangeland	682.5	66.9	111.8	5.1	105.8	24.2
Extractive	0.0	0.0	0	0.0	0.0	0.0
Institutional	0.0	0.0	0	0.0	0.0	0.0
Recreational	0.0	0.0	0	0.0	0.0	0.0
Wetlands	4.5	0.4	1071.7	48.7	79.1	18.1
Total	1021.0	100.0	2199.5	100.0	437.7	100.0

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WMM Land Use	DCEBS		DCWBS		GBEBS	
	Acreage	%	Acreage	%	Acreage	%
Forest / Rural Open	2931.8	34.2	235.2	39.1	2399.9	40.6
Urban Open	0.0	0.0	0.0	0.0	42.2	0.7
Agricultural / Pasture	80.7	0.9	0.0	0.0	0.0	0.0
Low Density Residential	0.0	0.0	0.0	0.0	0.0	0.0
Medium Density Residential	5.3	0.1	0.0	0.0	0.0	0.0
High Density Residential	0.0	0.0	0.0	0.0	0.0	0.0
Commercial	0.5	0.0	0.0	0.0	0.0	0.0
Industrial	383.3	4.5	0.0	0.0	0.0	0.0
Highways	23.5	0.3	0.0	0.0	0.0	0.0
Water	161.9	1.9	23.5	3.9	139.9	2.4
Rangeland	1077.9	12.6	275.4	45.7	1394.9	23.6
Extractive	0.0	0.0	0.0	0.0	0.0	0.0
Institutional	13.7	0.2	0.0	0.0	0.0	0.0
Recreational	0.0	0.0	0.0	0.0	0.0	0.0
Wetlands	3892.9	45.4	68.0	11.3	1934.9	32.7
Total	8571.5	100.0	602.0	100.0	5911.8	100.0

WMM Land Use	GBWBS		LV	
	Acreage	%	Acreage	%
Forest / Rural Open	77.4	5.4	357.6	22.8
Urban Open	112.0	7.8	14.9	1.0
Agricultural / Pasture	0.0	0.0	38.4	2.4
Low Density Residential	0.0	0.0	0.0	0.0
Medium Density Residential	0.0	0.0	0.0	0.0
High Density Residential	0.0	0.0	0.0	0.0
Commercial	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0
Highways	0.0	0.0	10.0	0.6
Water	327.0	22.9	255.5	16.3
Rangeland	899.0	63.0	861.6	55.0
Extractive	0	0.0	0	0.0
Institutional	0.0	0.0	0	0.0
Recreational	0.0	0.0	0	0.0
Wetlands	12.1	0.8	28.7	1.8
Total	1427.4	100.0	1566.7	100.0

Annual Runoff Volume: The annual runoff volumes for the pervious/impervious areas in each land use category are calculated by multiplying the average annual rainfall volume by a runoff coefficient. The WMM calculates the total average annual surface runoff from land use L by weighting the impervious and pervious area runoff factors for each land use category as follows.

$$R_L = [C_P + (C_I - C_P) IMP_L] * I \quad \text{(Equation 3-1)}$$

Where:

- R_L = total average annual surface runoff from land use L (in/yr);
- IMP_L = fractional imperviousness of land use L;
- I = long-term average annual precipitation (in/ yr);
- C_p = pervious area runoff coefficient; and
- C_i = impervious area runoff coefficient.

The model then calculates the total runoff in a watershed by computing the area-weighted sum of R_L for all land uses. For rural/agricultural (nonurban) land uses, the pervious fraction represents the major source of runoff or stream flow, while impervious areas are the predominant contributors for most urban land uses. The typical values of 0.95 and 0.1 were used in the model for the runoff coefficients for impervious and pervious areas within the study area, respectively (WMM User's Manual, Version 4.24).

Annual Rainfall: The annual rainfall value used for the Yucca Pens Project area is 53.8 inches as reported in the "SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report", which was based on the analysis of Average annual rainfall records for the Page Field station for a period of one year. As reported in the Plan, the wet season (May to October) had an average of 42.3 inches of rainfall, or 79% of the annual total, and the dry season (October to May) had 11.5 inches of rain, or 21% of the annual total.

Event Mean Concentrations: The EMC is a flow-weighted average concentration for a storm event and is defined as the sum of individual measurements of storm water pollution loads divided by the storm runoff volume. The EMC is widely used as the primary statistic for evaluations of storm water quality data and as the storm water pollutant loading factor in analyses of pollutant loadings to receiving waters. Over the past 20 years, nonpoint pollution monitoring studies throughout the U.S. have shown that annual "per acre" discharges of urban storm water pollution (e.g., nutrients, metals, BOD₅) are positively related to the amount of imperviousness in the land use (i.e., the more imperviousness the greater the nonpoint pollution load) and that the EMC is fairly consistent for a given land use.

Nonpoint pollution loading analyses typically consist of applying land use specific stormwater pollution loading factors to land use scenarios in the watershed under study. Runoff volumes are computed for the land use category based on the percent impervious of the land use and the annual rainfall. These runoff volumes are multiplied by land use specific mean EMC load factors (mg/l) to obtain nonpoint pollution loads by land use category. This analysis can be performed on a sub-area or basin-wide basis, and the results can be used for performing load allocations or analyzing pollution control alternatives, or for input into a riverine water quality model.

Selection of nonpoint pollution loading factors depends on the availability and accuracy of local monitoring data as well as the effective transfer of literature values for nonpoint

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pollution loading factors to a particular study area. For this study, the EMC values for the WMM were adopted from the “SFWMD’s Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report”. The EMC values for the land use categories used in the WMM are presented in Table 3-5.

Table 3-5 Land Use EMC Values for WMM

WMM Land Use	EMC Values (mg/L)					
	BOD	COD	TSS	TDS	TP	DP
Forest/Rural Open	1	51	11	100	0.05	0.04
Urban Open	10	69	63	120	0.37	0.23
Agricultural / Pasture	4	51	13	100	0.64	0.26
Low Density Residential	13	71	27	117	0.39	0.24
Medium Density Residential	9	65	59	117	0.39	0.24
High Density Residential	8	53	72	73	0.37	0.17
Commercial	14	83	77	130	0.28	0.20
Industrial	14	83	77	130	0.28	0.20
Highways	11	99	121	189	0.40	0.15
Water	2	51	5	100	0.06	0.03
Rangeland	3	51	12	100	0.345	0.15
Extractive	14	83	77	130	0.28	0.2
Institutional	9	65	59	117	0.39	0.24
Recreational	13	71	27	117	0.39	0.24
Wetlands	2	51	5	100	0.06	0.03

WMM Land Use	EMC Values (mg/L)					
	TKN	NO ₂ /NO ₃	Pb	Cu	Zn	Cd
Forest/Rural Open	0.86	0.30	0.001	0.001	0.000	0.001
Urban Open	1.73	0.52	0.017	0.023	0.085	0.001
Agricultural / Pasture	2.62	0.56	0.005	0.004	0.023	0.000
Low Density Residential	1.39	0.63	0.016	0.012	0.051	0.002
Medium Density Residential	1.79	0.55	0.016	0.023	0.073	0.001
High Density Residential	1.82	0.63	0.015	0.031	0.065	0.001
Commercial	1.47	0.40	0.023	0.024	0.132	0.002
Industrial	1.47	0.40	0.023	0.024	0.132	0.002
Highways	1.51	0.61	0.040	0.024	0.207	0.002
Water	0.72	0.24	0.000	0.000	0.000	0.000
Rangeland	1.74	0.43	0.003	0.002	0.115	0.000
Extractive	1.47	0.4	0.023	0.024	0.132	0.002
Institutional	1.79	0.55	0.016	0.023	0.073	0.001
Recreational	1.39	0.63	0.016	0.012	0.051	0.002
Wetlands	0.72	0.24	0.000	0.000	0.000	0.000

Nonpoint Pollution Loading Factors and Annual Load: WMM estimates pollutant loadings based upon nonpoint pollution loading factors (expressed as lbs/ac/yr) that vary by land use and the percent imperviousness associated with each land use. The pollution loading factor M_L is computed for each land use L by the following equation.

$$M_L = EMC_L * R_L * K \quad \text{(Equation 3-2)}$$

Where:

- M_L = loading factor for land use L (lbs/ac/yr);
- EMC_L = event mean concentration of runoff from land use L (mg/l); EMC_L varies by land use and by pollutant;
- R_L = total average annual surface runoff from land use L computed from Equation 3-1 (in/ yr); and
- K = 0.2266, a unit conversion constant.

The total annual pollution load from a watershed is computed by multiplying the pollutant loading factor M_L by the acreage in each land use and then summing for all land uses. The EMC coverage is typically not changed for various land use scenarios within a given study basin, but any number of land use data sets can be created to examine and compare different land use scenarios (e.g., existing versus future) or land use management scenarios.

3.2.1.2 BMP Evaluation for Nonpoint Sources

BMP Identification and Pollution Removal Efficiencies: The existing BMP treatment areas were identified using existing aerial photography, site visits, and local knowledge of the area as well as parcel maps. Table 3-6 presents the BMP type and the acreage and percent land use served by each type of BMP under existing conditions.

Table 3-6 Existing Land Use BMP Treatment Data

WMM Land Use	GSE1		GSE2		GSEBS	
	Wet Detention		Wet Detention		Wet Detention	
	Acre	% Land Use	Acre	% Land Use	Acre	% Land Use
Forest / Rural Open	0.0	0.0	0.0	0.0	0.0	0.0
Urban Open	0.0	24.0	11.5	24.0	31.0	24.0
Agricultural / Pasture	25.5	2.0	21.9	2.0	0.0	2.0
Low Density Residential	0.0	0.0	0.0	0.0	0.0	0.0
Medium Density Residential	0.0	1.0	7.1	1.0	5.3	1.0
High Density Residential	0.0	7.0	0.9	7.0	21.4	7.0
Commercial	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Highways	2.3	6.0	13.5	6.0	0.8	6.0
Water	0.0	0.0	0.0	0.0	0.0	0.0
Rangeland	150.1	2.0	20.2	2.0	94.2	2.0
Extractive	0.0	48.0	163	48.0	0.0	48.0
Institutional	101.0	95.0	5.1	95.0	0.0	95.0
Recreational	0.0	7.0	9.7	7.0	24.9	7.0
Wetlands	0.0	0.0	0.0	0.0	0.0	0.0

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WMM Land Use	GSWBS		YPEBS		YPWBS	
	Wet Detention		Wet Detention		Wet Detention	
	Acre	% Land Use	Acre	% Land Use	Acre	% Land Use
Forest / Rural Open	0.0	0.0	0.0	0.0	0.0	0.0
Urban Open	6.3	24.0	0.0	24.0	0.0	24.0
Agricultural / Pasture	0.0	2.0	0.0	2.0	0.0	2.0
Low Density Residential	0.0	0.0	0.0	0.0	0.0	0.0
Medium Density Residential	0.0	1.0	0.0	1.0	0.0	1.0
High Density Residential	0.0	7.0	0.0	7.0	0.0	7.0
Commercial	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Highways	0.0	6.0	0.0	6.0	0.0	6.0
Water	0.0	0.0	0.0	0.0	0.0	0.0
Rangeland	13.7	2.0	2.2	2.0	2.1	2.0
Extractive	0.0	48.0	0.0	48.0	0.0	48.0
Institutional	0.0	95.0	0.0	95.0	0.0	95.0
Recreational	0.0	7.0	0.0	7.0	0.0	7.0
Wetlands	0.0	0.0	0.0	0.0	0.0	0.0

WMM Land Use	DCEBS		DCWBS		GBEBS	
	Wet Detention		Wet Detention		Wet Detention	
	Acre	% Land Use	Acre	% Land Use	Acre	% Land Use
Forest / Rural Open	0.0	0.0	0.0	0.0	0.0	0.0
Urban Open	0.0	24.0	0.0	24.0	10.1	24.0
Agricultural / Pasture	1.6	2.0	0.0	2.0	0.0	2.0
Low Density Residential	0.0	0.0	0.0	0.0	0.0	0.0
Medium Density Residential	0.1	1.0	0.0	1.0	0.0	1.0
High Density Residential	0.0	7.0	0.0	7.0	0.0	7.0
Commercial	0.0	0.0	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0	0.0	0.0
Highways	1.4	6.0	0.0	6.0	0.0	6.0
Water	0.0	0.0	0.0	0.0	0.0	0.0
Rangeland	21.6	2.0	5.5	2.0	27.9	2.0
Extractive	0.0	48.0	0.0	48.0	0.0	48.0
Institutional	13.0	95.0	0.0	95.0	0.0	95.0
Recreational	0.0	7.0	0.0	7.0	0.0	7.0
Wetlands	0.0	0.0	0.0	0.0	0.0	0.0

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WMM Land Use	GBWBS		LVR	
	Wet Detention		Wet Detention	
	Acre	% Land Use	Acre	% Land Use
Forest / Rural Open	0.0	0.0	0.0	0.0
Urban Open	26.9	24.0	3.6	24.0
Agricultural / Pasture	0.0	2.0	0.8	2.0
Low Density Residential	0.0	0.0	0.0	0.0
Medium Density Residential	0.0	1.0	0.0	1.0
High Density Residential	0.0	7.0	0.0	7.0
Commercial	0.0	0.0	0.0	0.0
Industrial	0.0	0.0	0.0	0.0
Highways	0.0	6.0	0.6	6.0
Water	0.0	0.0	0.0	0.0
Rangeland	18.0	2.0	17.2	2.0
Extractive	0.0	48.0	0.0	48.0
Institutional	0.0	95.0	0.0	95.0
Recreational	0.0	7.0	0.0	7.0
Wetlands	0.0	0.0	0.0	0.0

The WMM applies constant removal efficiency for each pollutant to all land use types to simulate treatment BMPs. Published literature values of the typical range of pollutant removal efficiencies for swales, extended dry and wet detention ponds, baffle boxes and retention ponds are presented in Table 3-7 (WMM User's Manual, Version 4.24).

For the current study, four types of BMPs were identified in the Yucca Pens watershed: wet detention, retention (lake), wet and dry detention (treatment train) swales, and wetlands. The treatment removal efficiencies for wet detention, retention, and swales were based on published literature values as presented in Table 3-7. Treatment wetlands are treated as wet detention in the WMM as their abilities in removing pollutants are similar. Table 3-8 presents the removal efficiencies of the treatment BMPs used in the WMM for the study area.

Table 3-7 Ranges of BMP Removal Efficiencies (%)

Parameter	Dry Detention	Wet Detention	Swale	Baffle Boxes	Retention Ponds
BOD ₅	20 - 30	20 - 30	20 - 40	0	90
COD	20 - 30	20 - 30	20 - 40	0	90
TSS	60 - 90	80 - 90	70 - 90	80	90
TDS	0	30 - 40	0 - 10	0	90
Total-P	20 - 30	40 - 65	30 - 50	35	90
Dissolved-P	0	60 - 70	0 - 20	0	90
TKN	10 - 20	20 - 30	30 - 50	5	90
NO ₂ +NO ₃	0	30 - 40	30 - 50	0	90
Lead	70 - 80	70 - 80	60 - 90	75	90
Copper	50 - 60	60 - 70	40 - 60	50	90
Zinc	40 - 50	40 - 50	40 - 50	35	90
Cadmium	70 - 80	70 - 80	50 - 80	60	90

Source: WMM User Manual, Version 4.24



Table 3-8 BMP Removal Efficiencies Used in WMM (%)

Parameter	Dry Detention	Wet Detention	Retention and Exfiltration
BOD	20	30	90
COD	20	30	90
TSS	80	85	90
TDS	0	30	90
TP	20	50	90
DP	0	65	90
TKN	10	25	90
NO ₂ /NO ₃	0	35	90
Lead	70	75	90
Copper	50	65	90
Zinc	40	45	90
Cadmium	70	75	90

Source: SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report"

Pollutant Loading Reduction from BMPs: The WMM computes the effectiveness of BMPs in reducing nonpoint source loads for each land use in each watershed. Up to five BMPs per land use can be specified in the model. The percent reduction in nonpoint pollution per pollutant type in each watershed of the basin is calculated using the following relationship.

$$P_{L, SB} = \sum AC_{i,SB} (REM_i) \quad (\text{Equation 3-3})$$

Where:

- $P_{L, SB}$ = percent of annual nonpoint pollution load captured in sub-basin SB by application of the five BMP types on land use L;
- $AC_{i,SB}$ = fractional area coverage of BMP type i (=1 through 5) on sub-basin SB;
- REM_i = removal efficiency of BMP type i (=1 through 5); varies by pollutant type but not by land use or sub-basin.

Equation 3-3 enables the user to examine the effectiveness of various BMPs and the degree of BMP coverage within a watershed. Coverage might vary depending upon whether the BMP is applied to new development only, existing plus new development, etc. Also, topography may limit the areal coverage of some BMPs.

The nonpoint pollution load from a watershed is thus computed by combining Equations 3-2 and 3-3 and summing over all land uses and all sub-basins, i.e.

$$MASS = \sum_{SB=1}^n \sum_{L=1}^{15} M_{L,SB} (1 - P_{L,SB}) \quad (\text{Equation 3-4})$$

Where:

MASS = annual nonpoint pollution load washed off the watershed in lbs/yr with BMPs taken into account.

The resultant model is a very versatile yet simple algorithm for examining and comparing nonpoint pollution management alternatives for effectiveness in reducing nonpoint pollution.

3.2.1.3 Failing Septic Tank Impacts Analysis

The WMM assesses the impact of failing septic tank by applying a multiplication factor to the surface runoff load. This multiplication factor is applied only to the phosphorus (dissolved P, total P) and nitrogen (TKN, NO₂+NO₃) parameters. The factor used for the phosphorus parameters was 2.1, and 2.0 was used for the nitrogen parameters (i.e., nitrogen load for a residential area with failing septic tanks is estimated to be 2.0 times the load from a residential area without failing septic tanks).

To assess the increase in surface runoff load due to failing septic tanks, WMM considers the multiplication factor (discussed above), the percent septic tank coverage, and the percent failure rate. The percent failure rate used for this study was 10%. The range of concentrations of total-P and total-N in the septic system leachate based upon literature values are given below in Table 3-9 (SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report).

Table 3-9 Summary of Septic Loading Rates

Concentration Level	Total-P (mg/L)	Total-N (mg/L)
Low	1.0	7.5
Medium	2.0	15.0
High	4.0	30.0

Source: SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report"

For this study, the pollutant loading factors due to failing septic systems were adopted from the "SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report". In this study, it was presumed that all areas currently not served by sanitary sewer are served by septic tanks.

3.2.1.4 Point Source Loadings Analysis

Pollutant loadings from point source discharges such as package wastewater treatment plants (WWTP), regional WWTPs, and industrial sources can also be estimated to determine the relative contributions of point versus other watershed pollution loadings. Four point sources were identified within the study area. Table 3-10 shows the Point Source Data used in the WMM Model.



Table 3-10: Point Source Data

Contaminant (mg/L)	Watershed (WWTP Name)			
	GSE1 (Charlotte Correctional Institution)	GSE2 (Herons Glen aka: Del Vera WWTP)	GSEBS (Lake Fairways Six)	YPEBS (Burnt Store WWTF)
Flow (mgd)	0.18	0.13	0.16	0.25
BOD	5.51	5.51	5.51	5.51
COD	0.00	0.00	0.00	0.00
TSS	2.94	2.94	2.94	2.94
TDS	601	601	601	601
TP	0.30	0.30	0.30	0.30
DP	0.00	0.00	0.00	0.00
TKN	1.30	1.30	1.30	1.30
NO ₂ /NO ₃	3.33	3.33	3.33	3.33
Pb	0.005	0.005	0.005	0.005
Cu	0.002	0.002	0.002	0.002
Zn	0.052	0.052	0.052	0.052
Cd	0.006	0.006	0.006	0.006

Source: SFWMD's Nutrient Load Assessment, Estero Bay & Caloosahatchee River Watershed, January 2007, Final Report

3.2.2 Discussion of Results

This section presents the results of the WMM analysis for the existing land use conditions for the study area with BMPs considered under annual rainfall. The WMM output is presented in Appendix B.

The annual pollutant load estimates for each watershed within the Yucca Pens drainage basin obtained from the WMM are summarized in Table 3-11. This table presents the pollutant load estimates for with and without the BMP treatment conditions. The percentage reduction due to the BMP treatments is also presented in Table 3-11. As can be seen from this table, TDS, TSS, COD, and BOD account for most of the pollutant loads for each watershed within the study area. The greatest percentages of reduction due to BMP treatments were observed within the watersheds GSE1 and GSE2. The Cu, Pb, and Cd had the greatest percent reduction in pollutant loads due to BMP treatments for each watershed.

The total TP loads from the watersheds within the drainage basin were estimated at 28,906 lbs/yr without BMPs and 28,561 lbs/yr with BMP treatments. The total TKN loads from the watersheds within the drainage basin were estimated at 197,944 lbs/yr without BMPs and 197,119 lbs/yr with BMP treatments. The wet detention ponds accounted for the majority of the BMP treatments in this drainage basin.

Table 3-11 Annual Pollutant Load Analysis Results from WMM for Existing Conditions

Pollutant Load Estimates-Annual Pollutant Loads w/o BMPs

Watershed Name	Area (acres)	DCIA (acres)	%DCIA	Flow (ac-ft/yr)	Annual Pollutant Loads (lbs/yr)											
					BOD	COD	TSS	TDS	TKN	NO2+3	DP	TP	Cd	Cu	Pb	Zn
GSE1	19,429	2,023	10.4	23,099	154,000	2,430,000	1,630,000	7,220,000	60,414	16,256	4,190	8,348	14	78	89	1,479
GSE2	7,041	1,322	18.8	10,689	134,000	1,410,000	1,070,000	3,650,000	33,442	10,351	3,074	5,868	16	206	219	1,259
GSEBS	9,450	995	10.5	11,359	126,000	1,260,000	1,210,000	3,660,000	37,176	11,176	3,321	6,326	16	200	148	1,333
GSWBS	1,021	70	6.8	1,064	9,576	111,000	116,000	326,000	3,229	756	268	517	0.85	8	7	128
YPEBS	2,200	281	12.8	3,070	17,218	299,000	81,434	1,290,000	6,792	4,067	319	753	6	5	8	72
YPWBS	438	24	5.5	434	2,236	42,773	24,426	132,000	1,041	251	68	116	0.40	1	1	19
DCEBS	8,572	1,371	16.0	11,924	105,000	1,440,000	682,000	3,640,000	28,439	7,441	2,078	3,407	12	107	107	743
DCWBS	602	28	4.6	577	3,593	56,045	47,706	176,000	1,545	355	110	206	0.49	2	2	46
GBEBS	5,912	578	9.8	6,823	38,257	715,000	346,000	2,050,000	15,958	3,998	1,025	1,798	4	19	19	278
GBWBS	1,428	151	10.5	1,690	17,496	190,000	184,000	519,000	5,259	1,277	464	862	1	21	17	208
LVR	1,567	100	6.4	1,606	12,637	167,000	163,000	498,000	4,649	1,091	359	705	1	10	11	174
Total	57,660	6,943	112.1	72,335	620,013	8,120,818	5,554,566	23,161,000	197,944	57,019	15,276	28,906	71.7	657	628	5,739

Pollutant Load Estimates-Annual Pollutant Loads w/ BMPs

Watershed Name	Area (acres)	DCIA (acres)	%DCIA	Flow (ac-ft/yr)	Annual Pollutant Loads (lbs/yr)											
					BOD	COD	TSS	TDS	TKN	NO2+3	DP	TP	Cd	Cu	Pb	Zn
GSE1	19,429	2,023	10.4	23,099	153,000	2,420,000	1,590,000	7,200,000	60,106	16,129	4,091	8,214	13	70	82	1,454
GSE2	7,041	1,322	18.8	10,689	130,000	1,390,000	1,020,000	3,620,000	33,141	10,237	2,970	5,750	15	194	206	1,215
GSEBS	9,450	995	10.5	11,359	126,000	1,250,000	1,200,000	3,650,000	37,052	11,123	3,280	6,272	16	197	145	1,322
GSWBS	1,021	70	6.8	1,064	9,562	111,000	115,000	326,000	3,225	755	268	515	0.84	8	7	127
YPEBS	2,200	281	12.8	3,070	17,216	299,000	81,316	1,290,000	6,792	4,067	319	753	6	5	8	72
YPWBS	438	24	5.5	434	2,234	42,751	24,310	132,000	1,040	251	68	116	0.40	1	1	19
DCEBS	8,572	1,371	16.0	11,924	105,000	1,430,000	678,000	3,640,000	28,401	7,425	2,066	3,391	12	106	106	740
DCWBS	602	28	4.6	577	3,587	55,989	47,414	176,000	1,544	355	110	205	0.49	2	2	46
GBEBS	5,912	578	9.8	6,823	38,034	714,000	341,000	2,050,000	15,922	3,983	1,013	1,783	4	18	18	275
GBWBS	1,428	151	10.5	1,690	17,478	190,000	183,000	519,000	5,254	1,275	463	860	1	21	17	207
LVR	1,567	100	6.4	1,606	12,599	167,000	161,000	497,000	4,642	1,088	357	702	1	10	11	172
Total	57,660	6,943	112.1	72,335	614,710	8,069,740	5,441,040	23,100,000	197,119	56,688	15,005	28,561	69.7	632	603	5,649

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Pollutant Load Estimates-Annual Pollutant Loads – Percent Reduction Due to BMPs

Watershed Name	Area (acres)	DCIA (acres)	%DCIA	Flow (ac-ft/yr)	Pollutants Reduction (%)											
					BOD	COD	TSS	TDS	TKN	NO2+3	DP	TP	Cd	Cu	Pb	Zn
GSE1	19,429	2,023	10.4	23,099	1.1	0.5	2.4	0.3	0.5	0.8	2.4	1.6	3.4	10.8	8.2	1.7
GSE2	7,041	1,322	18.8	10,689	2.4	1.4	4.8	0.8	0.9	1.1	3.4	2.0	6.8	5.6	5.8	3.5
GSEBS	9,450	995	10.5	11,359	0.6	0.5	1.4	0.3	0.3	0.5	1.2	0.9	1.4	1.7	2.1	0.9
GSWBS	1,021	70	6.8	1,064	0.1	0.1	0.6	0.1	0.1	0.2	0.3	0.3	0.4	0.2	0.3	0.4
YPEBS	2,200	281	12.8	3,070	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
YPWBS	438	24	5.5	434	0.1	0.1	0.5	0.0	0.1	0.1	0.2	0.2	0.1	0.3	0.3	0.4
DCEBS	8,572	1,371	16.0	11,924	0.2	0.1	0.7	0.1	0.1	0.2	0.6	0.5	0.5	1.0	0.8	0.4
DCWBS	602	28	4.6	577	0.2	0.1	0.6	0.1	0.1	0.2	0.3	0.3	0.3	0.3	0.4	0.4
GBEBS	5,912	578	9.8	6,823	0.6	0.2	1.4	0.1	0.2	0.4	1.1	0.8	1.3	5.2	4.7	1.2
GBWBS	1,428	151	10.5	1,690	0.1	0.1	0.5	0.1	0.1	0.1	0.3	0.2	0.3	0.1	0.2	0.3
LVR	1,567	100	6.4	1,606	0.3	0.2	1.0	0.1	0.2	0.3	0.5	0.5	1.1	1.2	1.9	0.7
Total	57,660	6,943	112.1	72,335	0.9	0.6	2.0	0.3	0.4	0.6	1.8	1.2	2.8	3.8	4.0	1.6

4.0 MULTI-FUNCTIONAL WATER MANAGEMENT PLAN

4.1 CONCEPTUAL PLAN FORMULATION

4.1.1 Restoration Planning Requirements

An integrated or multi-functional restoration plan is essential to achieve the desired goal for the study area, which is to restore the sheet flow conditions over the project area to the historic level. Over the years, significant developments have taken place in portions of the project area. It is impractical to displace the existing areas of development and restore the flow to historic conditions in its entirety. Therefore, the emphasis in developing the conceptual plans is given to pragmatic concepts for restoration of the historic flow conditions within the project area. It should be noted that flood protection is considered as a potential restoration constraint such that restoration should not decrease existing flood protection in currently developed areas. Some of the high level elements of the conceptual plan may include the following requirements.

- Historic sheet flow restoration
- Restoring more natural flows to Charlotte Harbor
- Watershed Water Quality Improvement (discharging to Charlotte Harbor)
- Ground Water Recharge (to protect and enhance the fish and wildlife habitats)
- Hydroperiod Maintenance (for vegetation management and protection and enhancement of the fish and wildlife habitats)
- Land Acquisition and Management (to address operational issues)

The scope of this study did not include development and implementation of an adequate model that would simulate the flood conditions within the study area. As indicated earlier in Task 1 Report, there are a number of studies completed in the past, which have addressed various issues for portions of the project area. However, no comprehensive study has been completed to-date for the entire project area addressing integrated issues. The basis of developing conceptual restoration plans is therefore adopted from the previously completed study reports supplemented with limited data collected during this study.

The primary impediments to restoration of historic flow ways are the constructed flow barriers in the project area. These barriers cause sheet flows to become concentrated point discharges through engineered structures. The three primary such barriers are:

- a) I-75: All flows east of I-75 in the sub-basin GSE1 discharge through the I-75 Bridge to the neighboring sub-basin GSE2. The I-75 Bridge is shown on Figure 4-1, which is located at the southern end of the sub-basin GSE1.
- b) US Hwy 41 (N. Tamiami Road): The entire flow from the sub-basin GSE2 between I-75 and US Hwy 41, including the flows from GSE1 through the I-75 Bridge, is

diverted to the Gator Slough Canal through the US-41 Bridge, which is located at the southwest end of the sub-basin GSE2 as shown on Figure 4-1.

- c) Burnt Store Road: The majority of flows generated from the drainage basins between US Hwy 41 and Burnt Store Road encompassing more than 75% of the project area are blocked off at the Burnt Store Road. These flows are routed to the Gator Slough Canal through the Gator Slough Weir as shown on Figure 4-1.

There are many other secondary flow barriers present throughout the study area, such as trails, secondary roads, local dikes and diversion structures, etc. For proper implementation and effective function of any hydrologic restoration plan, it is essential to create dispersion of flows from concentrated point structures to areal flow diversions such as sheet flows.

The majority of the runoff from GSE1, GSE2, and GS flows through the Gator Slough Canal to Matlacha Pass. In addition, flows from GBEB and DCEB discharge to the Gator Slough Canal. The key to restoring historic flow ways in the project area is to equitably redistribute the flow into the other watersheds instead of Gator Slough Canal.

4.1.2 Planning Level Conceptual Design

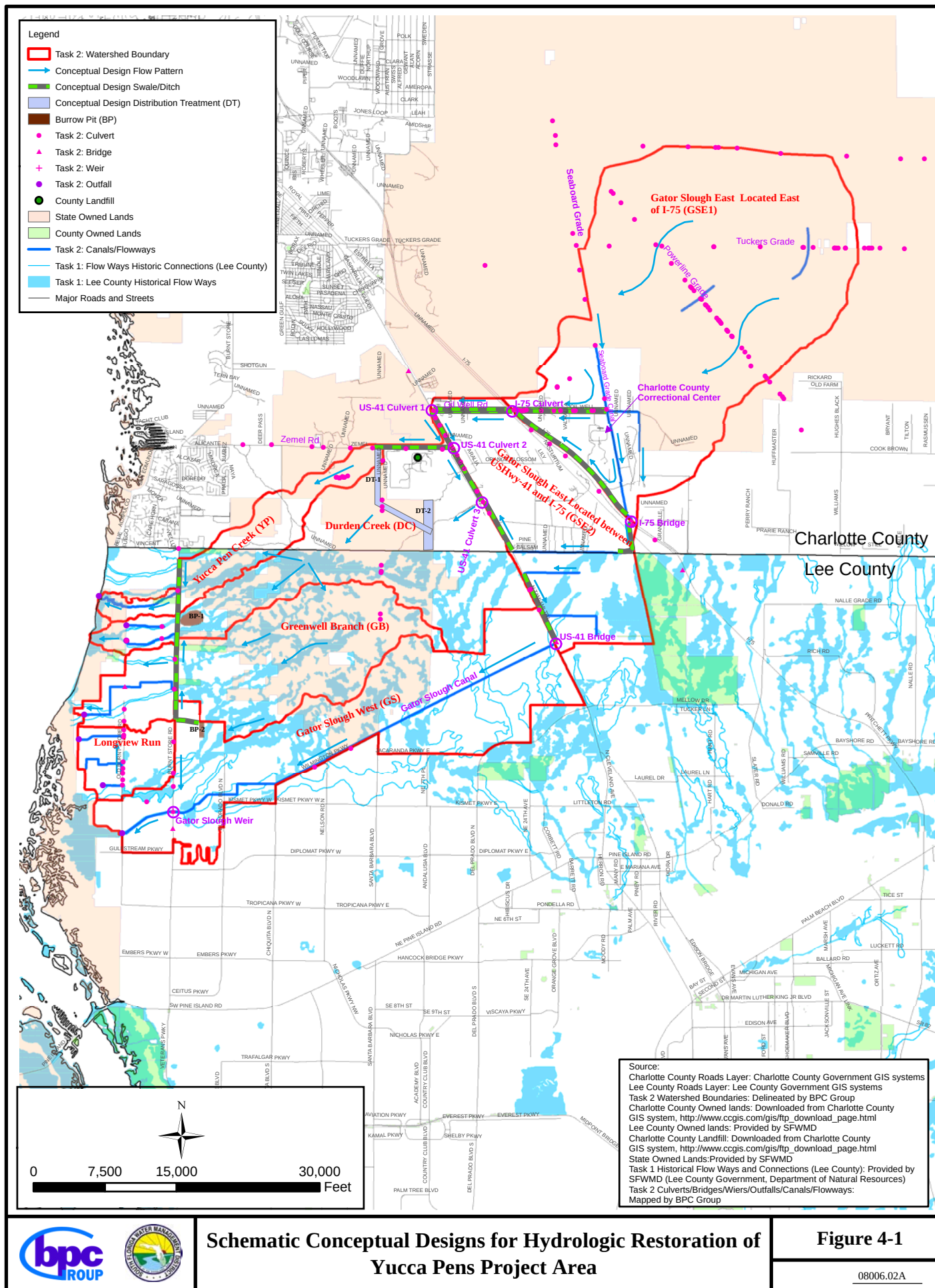
Figure 4-1 presents a composite overlay of the state and county owned lands, historic flow ways and historic flow connections, and watershed boundaries for specific sub-basins. This figure is utilized to develop the conceptual designs. Following is a list of concepts (planning level conceptual designs) that may be implemented to achieve the hydrologic restoration goal. Please note that a feasibility evaluation of the concepts presented in this TM is essential, but was not performed during this study. Such an evaluation of the concepts is beyond the scope of this study. All of the following conceptual designs are presented with a common key element that all restoration plans are based on the assumption of gravity drainage.

- Flow Diversions in GSE1
- Flow Diversions in GSE2
- Flow Distribution and Treatment Enhancement in DCEBS/YPEBS
- Protect and Perpetuate Flow Ways in YPEBS, GBEBs, and DCEBS
- Restore Historic Flow across Burnt Store Road
- Improved Monitoring System for Performance Measures

A careful consideration was given to the current level of state and county owned lands to avoid massive land acquisition process. In addition, these conceptual designs are designed to address multi-functional elements listed in Section 4.1.1. Further details on these planning level conceptual designs are given below.

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It should be noted that details of the conceptual design elements to address the timing and quantity of water released downstream, protection and enhancement of native upland habitats for fish and wildlife species, hydroperiod improvements, and ground water recharges are beyond the current scope of work. An engineering study is necessary to address these issues, and is recommended as a follow up to this conceptual plan document.

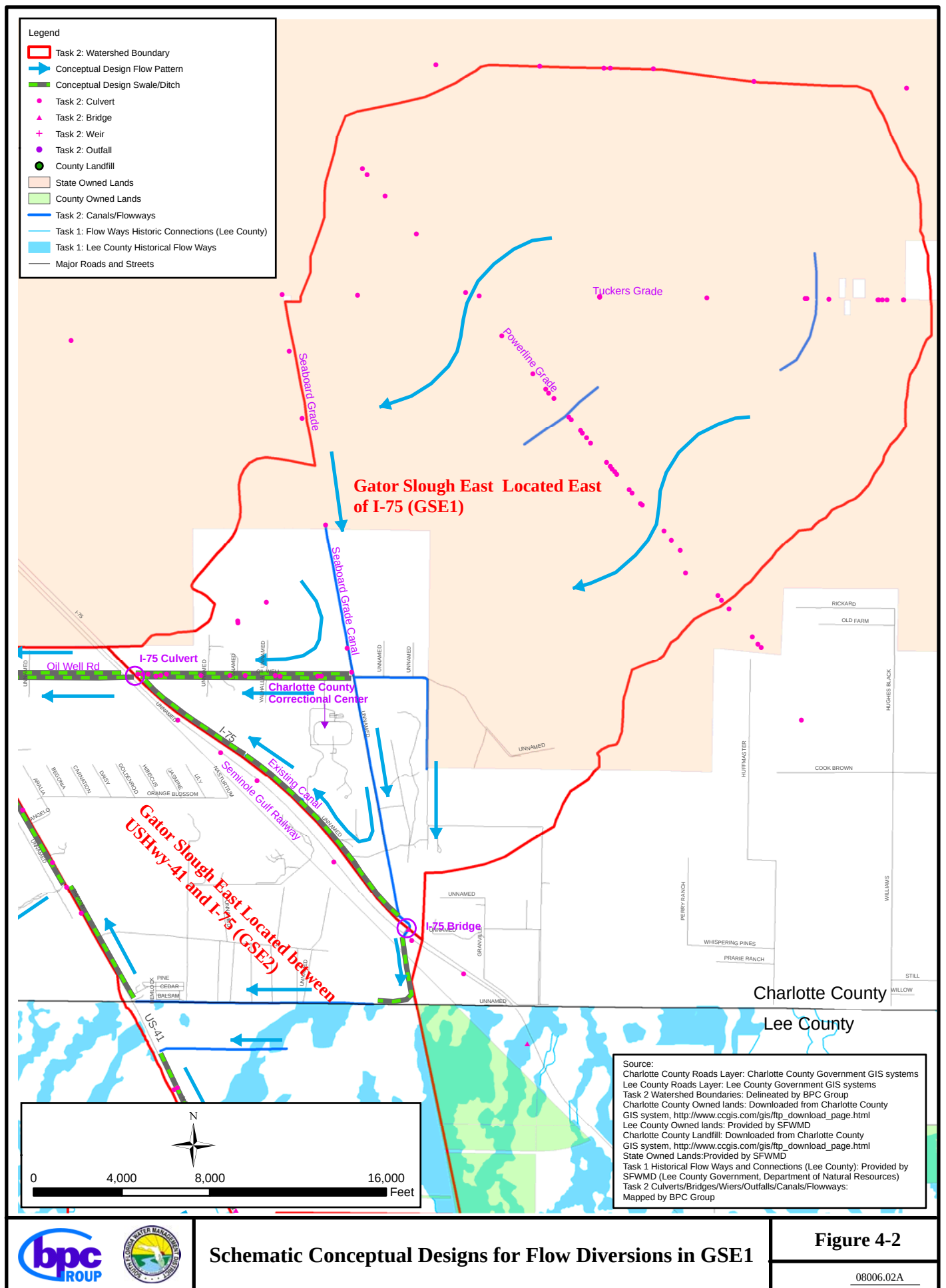


Concept: Flow Diversions in GSE1

The watershed GSE1 encompasses 19,430 acres and generates about 14,765 ac-ft of runoff during a 25-year, 72-hour storm event. The outflow from this watershed to GSE2 during this storm event is 7,032 ac-ft. It has been reported that sheet flows existed in the Babcock-Webb WMA prior to construction of the I-75 Bridge in 1980. After the bridge construction, the flow from this entire watershed was concentrated into one point discharge outfall. The majority of the land in this watershed is owned by the state and managed by the FWC. There is great opportunity to restore the sheet flows in this watershed with adequate maintenance and minimal construction as given below.

- The majority of the land east of Powerline Grade and north of Tuckers Grade consists of upland forests and rangeland. Based on the 2-ft contour map and the 10-ft DEM prepared during Task 1, the topography slopes southwesterly and the surface drainage from this area occurs naturally through overland flow (sheet flow). Tuckers Grade and Powerline Grade act as barriers, and the discharge across these road barriers is controlled through a series of culverts. These culverts are shown on Figure 4-2 and details of these culverts are given in Section 2.0 of this TM. The periodic cleaning or regular maintenance of these culverts should allow for sheet flow to occur between Powerline Grade and Seaboard Grade with gravity discharge to the Seaboard Grade Canal. The flow pattern from the area east of Seaboard Grade Canal will remain unchanged from flowing through the I-75 Bridge at the south end of the watershed GSE1. The conceptual flow pattern is schematically shown on Figure 4-2.
- The storm runoff generated in the area north of Oil Well Road and west of Seaboard Grade Canal may be diverted westward to the intersection of Oil Well Road and I-75 through dry swales. The area west of Correctional Center may also be diverted westward to the intersection of Oil Well Road and I-75 through the existing canal along east of I-75. This conceptual design will require construction of adequate flow control structures underneath I-75 and conveyance of the flow westward to ditches along US Hwy 41 through a constructed swale/ditch along the south side of Oil Well Road. This conceptual design will reduce the flow constriction at the I-75 Bridge outfall. In addition, the existing canal along the east of I-75 may need to be regraded and reconfigured (making them shallower and wider) such that the ground water table in the watershed is raised to support the fish and wildlife and enhance the hydroperiods in the watershed. The conceptual design is schematically shown on Figure 4-2.

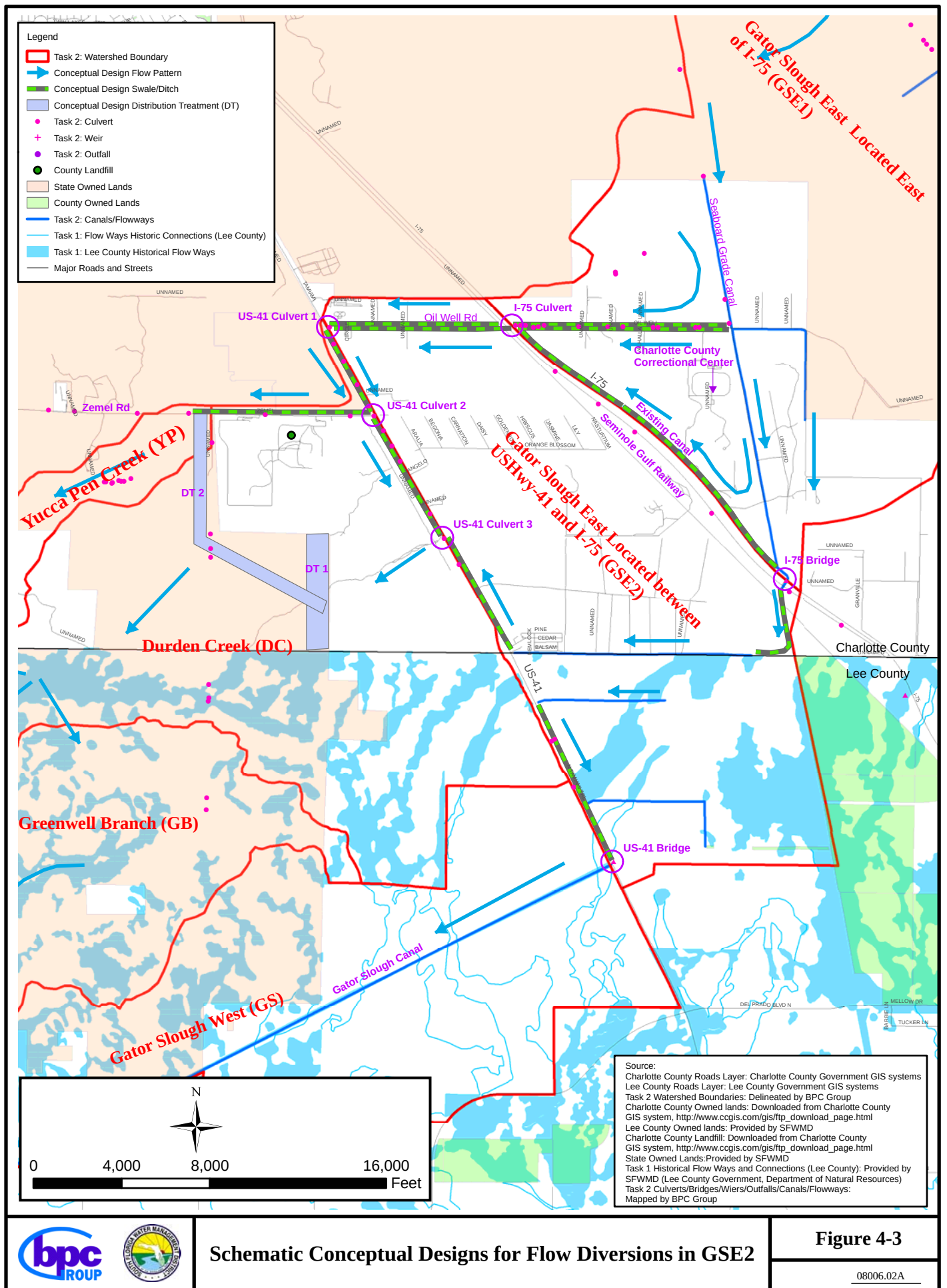
It should be noted that an engineering evaluation of the conceptual designs presented above is essential, but not performed during this study due to limitations of the current scope of work.



Concept: Flow Diversions in GSE2

The watershed GSE2 encompasses 7,041 acres and generates about 5,446 ac-ft of runoff during a 25-year, 72-hour storm event. The inflow from the watershed GSE1 is 7,032 ac-ft entering this watershed through the I-75 Bridge. Currently, almost the entire flow from this watershed is diverted to the Gator Slough Canal through the US-41 Bridge located at the southeast end of the watershed as shown on Figure 4-3. Almost all of the land in this watershed is privately owned. Therefore, restoring sheet flow within this watershed may not be cost effective. However, the flows from this watershed may be diverted away from the Gator Slough Canal to other watersheds located west of US Hwy 41, where there is great opportunity for restoration of the sheet flows. This conceptual design may require some land acquisition. The construction of this conceptual design is described below.

- The dominant land use within the Lee County portion of the watershed GSE2 consists of residential, urban, and wetlands as shown on Figure 3-6 of the Task1 Summary Report and Metadata. Currently, the surface drainage from this section of the watershed discharges to the Gator Slough Canal through the Gator Slough Bridge outfall structure. The flow pattern in this section of the watershed consists of canals/ditches along US Hwy 41 and overland flow through wetlands as schematically shown on Figure 4-3. The flow pattern in this section may be left unmodified.
- The land in the Charlotte County portion of the watershed predominantly consists of barren lands, holding ponds, rangeland, and wetlands. The entire inflow from the watershed GSE1 entering through the I-75 Bridge may be diverted through modification of the existing canal/ditch along the county line as shown on Figure 4-3. This ditch extends from Seminole Gulf Railway to US Hwy 41. There are a number of outfalls along US Hwy 41 such as US-41 Culvert 3 as shown on Figure 4-3, which can be enhanced to convey the desired flows westward to the Durden Creek watershed. This will reduce the hydraulic load to the Gator Slough Canal, raise the ground water table to support the fish and wildlife, and enhance the hydroperiods in the watershed.
- The flows diverted from Oil Well Road can be routed through US-41 Culvert 1 to the reconstructed swale/ditch along the west side of US Hwy 41 as shown on Figure 4-3. The proposed culvert across US Hwy 41 can be enhanced and the swales, ditches, and/or canals can be reconstructed to maintain wider and shallower flow geometries along the west side of US Hwy 41 and along the north side of Zemel Road. The proposed enhancement can convey the desired flows westward to the Yucca Pen Creek watershed to follow the historic flow ways. This proposed enhancement will be performed within the state owned lands. This conceptual design will reduce the hydraulic load to the Gator Slough Canal, raise the ground water table to support the fish and wildlife, and enhance the hydroperiods in the watershed.



Schematic Conceptual Designs for Flow Diversions in GSE2

Figure 4-3

08006.02A

- The flows diverted from Oil Well Road can also be routed through the reconstructed swale/ditch along the east side of US Hwy 41 through US-41 Culvert 2 as shown on Figure 4-3. The swales, ditches, and/or canals can be reconstructed to maintain wider and shallower flow geometries. There are a number of outfalls along US Hwy 41, which can be enhanced to convey the desired flows westward to the Durden Creek watershed. This conceptual design is likely to require acquisition of privately owned lands since there is no state or county owned land available along the US Hwy 41. This conceptual design will reduce the hydraulic load to the Gator Slough Canal, raise the ground water table to support the fish and wildlife, and enhance the hydroperiods in the watershed.

It should be noted that an engineering evaluation of the conceptual designs presented above is essential, but not performed during this study due to limitations of the current scope of work.

Concept: Flow Distribution and Treatment Enhancement in DCEBS/YPEBS

The sub-basin DCEBS (Durden Creek watershed east of Burnt Store Road) encompasses 8,572 acres and generates about 6,594 ac-ft of runoff during a 25-year, 72-hour storm event. In addition, the inflow from the watershed GSE2 may be in excess of 10,000 ac-ft during the design storm event. Currently, the majority of the land in this watershed along with the watersheds GBEBS and YPEBS (Greenwell Branch and Yucca Pen Creek east of Burnt Store Road) is state and county owned, and the traces of the historic flow ways are free from urban development. The predominant land use in this watershed is wetland and upland forests. Therefore, restoring sheet flow within these watersheds may not require land acquisition. The construction of this conceptual design is described below

- It is proposed that an elongated flow distribution structure such as a shallow storage and treatment area may be constructed near upstream of DCEBS within the state owned land and the flow may be redirected to follow the historic flow ways in the DCEBS and GBEBS. The tentative location of this storage and treatment facility is schematically shown as DT1 on Figure 4-4. The distribution structure may be constructed with natural vegetation for biological treatment of the nutrients and other pollutants being carried from the upstream watersheds. This may also work as a fresh water filter marsh. The design of such a facility should emphasize more on detention and distribution of flow by gravity (overflow through banks), rather than storage of the runoff for a long period of time.
- Alternatively, an elongated flow distribution structure such as a shallow storage and treatment area may be constructed near upstream of YPEBS and DCEBS within the state owned land and the flow may be redirected to follow the historic flow ways in the DCEBS, GBEBS, and YPEBS. The tentative location of this storage and treatment facility is schematically shown as DT2 on Figure 4-4. The distribution

structure may be constructed with natural vegetation for biological treatment of the nutrients and other pollutants being carried from the upstream watersheds. This may also work as a fresh water filter marsh. The design of such a facility should emphasize more on detention and distribution of flow by gravity (overflow through banks), rather than storage of runoff for long time.

It should be noted that an engineering evaluation of the conceptual designs presented above is essential, but not performed during this study due to limitations of the current scope of work.

Concept: Protect and Perpetuate Flow Ways in YPEBS, GBEBS, and DCEBS

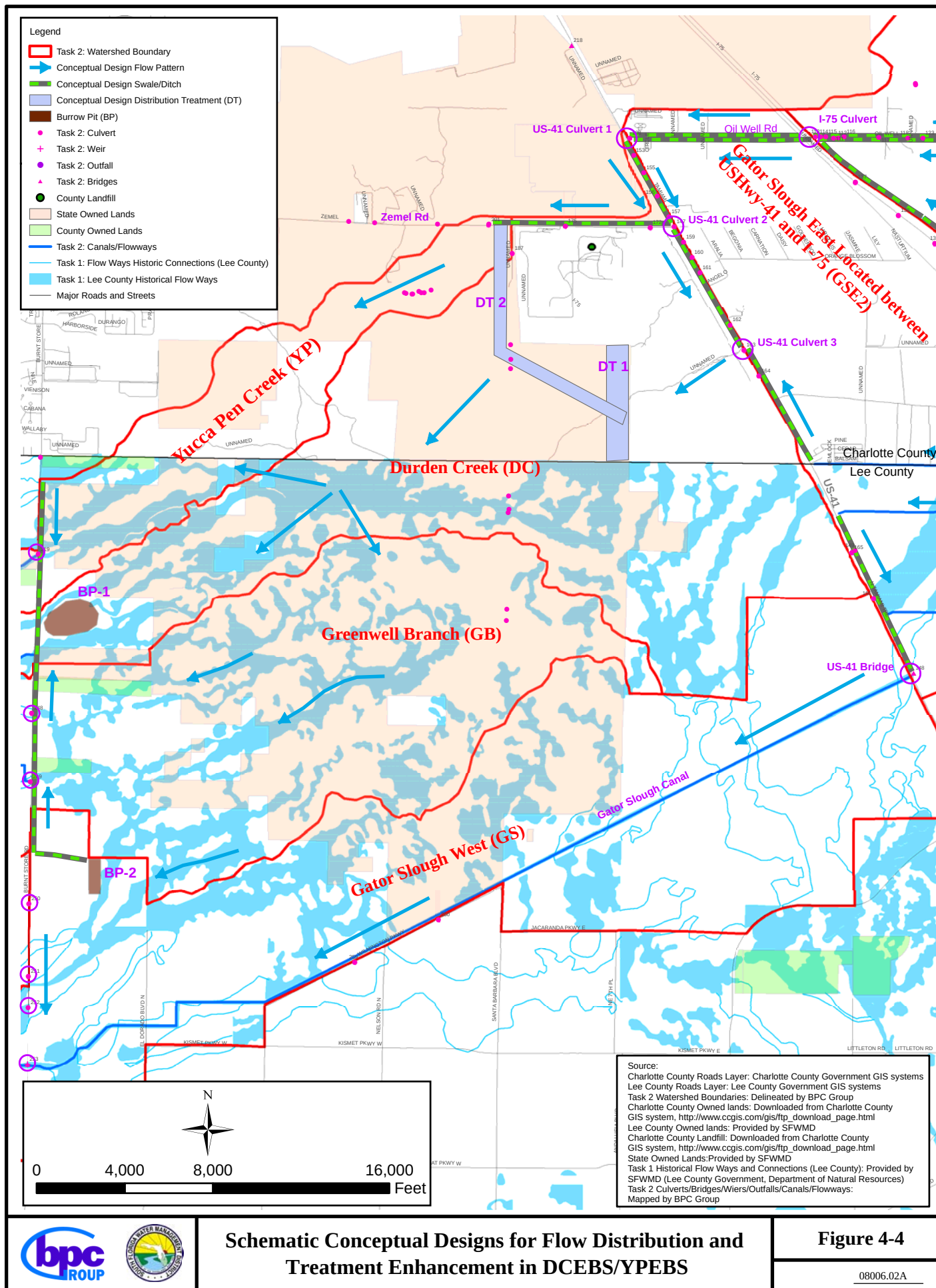
The central portions of these watersheds are free from development. A majority of the land within these watersheds is owned by the state. The wetlands and rangeland are the predominant land use categories in these watersheds. Appropriate attention along with adequate maintenance should be given to protect the status and action should be taken now to better define the flow ways and inventory the structures to naturally enhance the flow crossings in its intended path. The details of this conceptual design are given below.

- Identify and implement plans for improvement of runoff storage, reduction of overdrainage, and rerouting of excess flows to other outlets. This would also include evaluation of watershed loss and channelization within the watersheds. The primary goal is to avoid extreme fluctuations in flows to improve the timing of freshwater flows.
- Develop BMP guidelines for drainage network maintenance programs such that downstream impacts to water quality and sediment load reduction can be attained.
- Encourage the maintenance of drainage conveyances consistent with BMPs that maximize water quality benefits to receiving waters.

It should be noted that the details of these conceptual designs can only be achieved by a comprehensive engineering evaluation, which is beyond the current scope of work.

Concept: Restore Historic Flow across Burnt Store Road

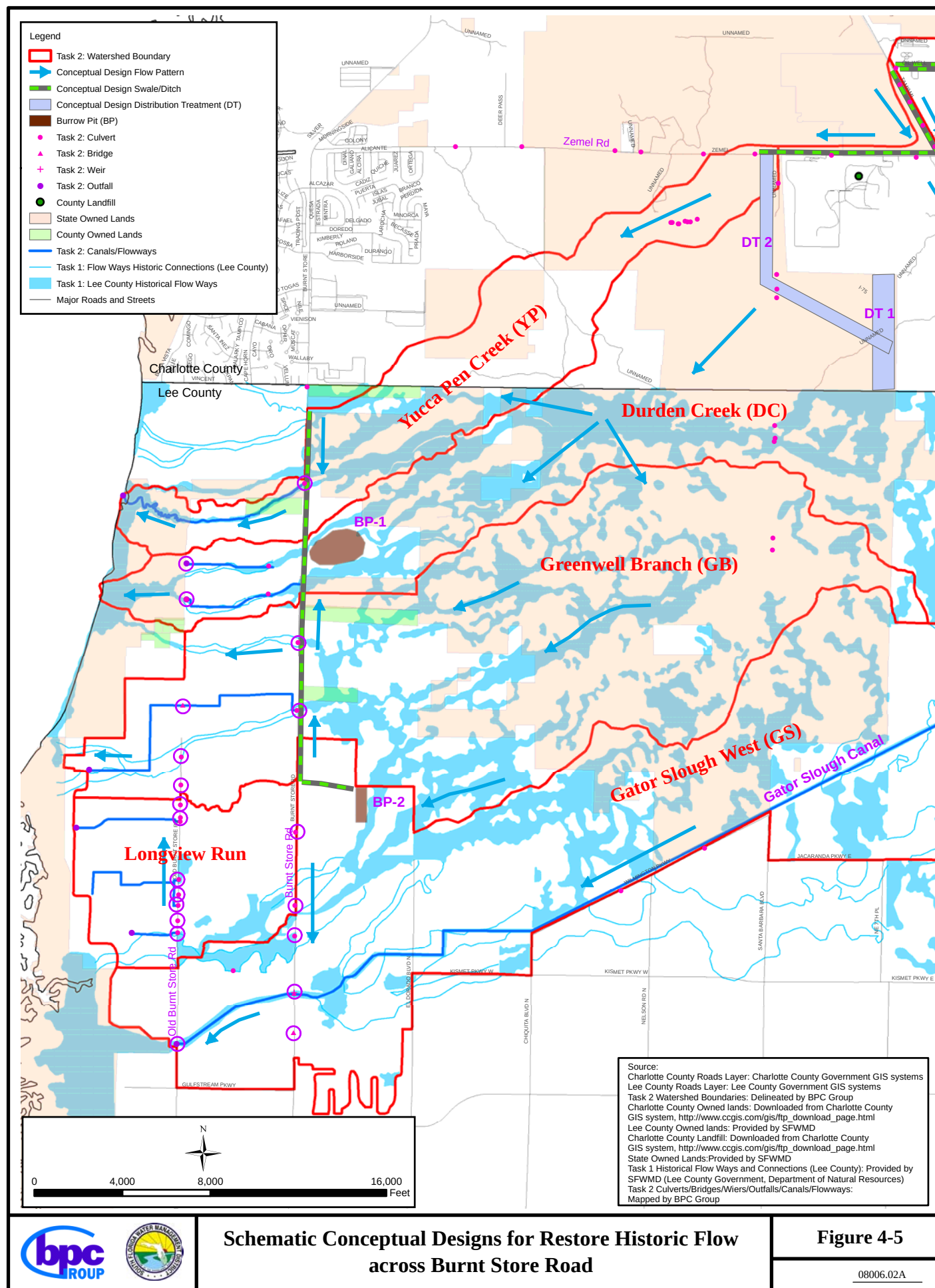
The historic flow ways in YPEBS, GBEBS and DCEBS are blocked by Burnt Store Road from flowing to the west. Currently, the stormwater runoff from these three watersheds is diverted southeasterly to the Gator Slough Canal and discharges through the Gator Slough Weir (see Figure 4-5). This flow pattern overloads the Gator Slough Canal outfall to Matlacha Pass. The flows from the flow ways can be diverted from discharging to Gator Slough, and managed along the east side of Burnt Store Road using improved drainage control features as described below.



Schematic Conceptual Designs for Flow Distribution and Treatment Enhancement in DCEBS/YPEBS

Figure 4-4

08006.02A



- The state or county does not own the lands along both sides of the Burnt Store Road. It is proposed to improve drainage control features by constructing shallow and wide ditches and/or storage impoundments to control the discharge. The goal is to divert the current flow pattern away from Gator Slough Canal such that the discharge through the Gator Slough Weir to Matlacha Pass can be reduced. The existing borrow pits, shown as BP1 and BP2 on Figure 4-5, with some control structures may be used for flow diversion, attenuation and water quality treatment. The existing borrow pits BP1 and BP2 are privately owned lands. Appropriate enhancement to the existing culvert outfalls such as BSR-Culvert 1 through BSR-Culvert 7 underneath the Burnt Store Road will be necessary to control the discharge rates. A schematic sketch of this conceptual design is shown on Figure 4-5.

It should be noted that the details on the geometry and configuration of this conceptual design features can only be achieved by a comprehensive engineering evaluation, which is beyond the current scope of work.

Concept: Improved Monitoring System for Performance Measures

The current status of the database containing the real site specific data on surface water, ground water, site topography, hydraulic control structures, water quality, and ecosystem (species and habitats) are limited. The existing information on the quality of discharge coming off of the Charlotte Harbor Landfill is limited, which may play an important role on the hydrologic restoration plan. It is strongly recommended that a monitoring program be implemented such that site specific valuable information can be collected that would be helpful in implementing any of the proposed conceptual plans. The monitoring system will serve a dual purpose: a) it will be helpful in developing the baseline conditions and engineering design, and b) it will serve as control points for the performance measures. The design of a monitoring program should capture the seasonal water levels, shifts in vegetation community composition, impact on seagrasses in Matlacha Pass and Charlotte Harbor, and hydroperiod targets for restored habitats. The exact details of the improved monitoring system should be consistent with the comprehensive analyses of the overall hydrologic system, which is beyond the current scope of work.

4.1.3 Permitting Requirements

Any of the structural improvement will require a series of permits. The most common reports and permits that may be required for the above listed conceptual designs are listed below. It should be noted that not all conceptual designs will require all the permits listed below.

- Environmental Assessment or Environmental Impact Statement
- Wetlands and Threatened and Endangered (T&E) Species Impact Approval from the FWC

- 404 Permit from the USACE
- Environmental Resource Permit
- Dewatering Permit (Water Use Permit) from SFWMD
- FDOT Right-of-Way Permit
- Construction Permits from Charlotte County
- Construction Permits from Lee County
- Construction Permits from City of Cape Coral

The actual scope of the conceptual design will determine the level of permitting requirements. However, following is a brief outline of the permitting requirements for the various conceptual designs presented above.

- Flow Diversions in GSE1: Environmental Resource Permit, Construction Permits from Charlotte County, FDOT ROW Permit
- Flow Diversions in GSE2: Environmental Resource Permit, Construction Permits from Charlotte and Lee Counties, FDOT ROW Permit
- Flow Distribution and Treatment Enhancement in DCEBS/YPEBS: Environmental Impact Statement, 404 Permit from the USACE, Environmental Resource Permit, Construction Permits from Charlotte and Lee Counties
- Protect and Perpetuate Flow Ways in YPEBS, GBEBS, and DCEBS: Environmental Impact Statement, Environmental Resource Permit, Construction Permits from Charlotte and Lee Counties
- Restore Historic Flow across Burnt Store Road: Environmental Impact Statement or Environmental Assessment, 404 Permit from the USACE, Environmental Resource Permit, Construction Permits from Lee County
- Improved Monitoring System for Performance Measures: Wetlands and T&E Species Impact Approval from the FWC, Construction Permits from Charlotte and Lee Counties and the City of Cape Coral, FDOT ROW

4.1.4 Order of Magnitude Cost Estimate

The benefits and the cost estimates for the various concepts presented in this report are given below. It should be noted that the cost estimates are not accurate since the actual scope of the conceptual designs are not materialized. The actual cost estimates, based on comprehensive engineering analysis, may significantly differ from the values presented below.

- Flow Diversions in GSE1
 - Benefits: Reduce flow to Gator Slough Canal, redistribute the stormwater runoff outfalls, enhance the hydroperiods, support fish and wildlife and vegetation, improve water quality
 - Approximate Total Cost: \$1,500,000
 - Construction - \$ 800,00



- Land Acquisition - \$ 350,000
 - Construction Management - \$ 100,000
 - Feasibility Study, Design and Permitting - \$250,000
- Flow Diversions in GSE2
 - Benefits: Reduce flow to Gator Slough Canal, redistribute the stormwater runoff outfalls, enhance the hydroperiods, support fish and wildlife and vegetation, improve water quality
 - Approximate Total Cost: \$2,200,000
 - Construction - \$ 1,100,000
 - Land Acquisition - \$ 750,000
 - Construction Management - \$ 100,000
 - Feasibility Study, Design and Permitting - \$250,000
- Flow Distribution and Treatment Enhancement in DCEBS/YPEBS
 - Benefits: Ensure restoration of historic flow ways, enhance the hydroperiods, support fish and wildlife and vegetation, improve water quality
 - Approximate Total Cost: \$4,500,000
 - Construction - \$ 3,300,000
 - Land Acquisition - \$ 300,000
 - Construction Management - \$ 400,000
 - Feasibility Study, Design and Permitting - \$500,000
- Protect and Perpetuate Flow Ways in YPEBS, GBEBS, and DCEBS
 - Benefits: Enhance restoration of historic flow ways, enhance the hydroperiods, support fish and wildlife and vegetation, improve water quality
 - Approximate Total Cost: \$400,000
 - Construction - \$ 250,000
 - Land Acquisition - \$ 0
 - Construction Management - \$ 50,000
 - Feasibility Study, Design and Permitting - \$100,000
- Restore Historic Flow across Burnt Store Road
 - Benefits: Reduce flow to Gator Slough Canal, redistribute the stormwater runoff outfalls, enhance the hydroperiods, support fish and wildlife and vegetation, improve water quality
 - Approximate Total Cost: \$1,700,000
 - Construction - \$ 1,000,000
 - Land Acquisition - \$ 400,000
 - Construction Management - \$ 100,000
 - Feasibility Study, Design and Permitting - \$200,000

- Improved Monitoring System for Performance Measures
 - Benefits: Source of information for design of restoration plans, performance measures for implemented restoration plans, assist evaluate the hydroperiods and water quality improvement.
 - Approximate Total Cost: \$350,000
 - Construction - \$ 200,000
 - Land Acquisition - \$ 0
 - Construction Management - \$ 0
 - Feasibility Study, Design and Permitting - \$150,000

4.2 RESTORATION IMPROVEMENT ALTERNATIVES

4.2.1 Water Quality Best Management Practices (BMPs)

For the purpose of this project, the goal is to incorporate appropriate types of BMPs into the designs such that the water quality discharging to the Matlacha Pass and Charlotte Harbor is improved. The water quality discussed here refers to the chemical constituents such as nutrients, etc. Although the water quality improvement is directly focused on freshwater wetlands within the watershed, the receiving waters (estuarine areas of Matlacha Pass and Charlotte Harbor) will also be affected. The improvement is typically measured over the current conditions or over the conventional way of stormwater discharges. Currently, most of the stormwater runoff from the Yucca Pens watershed discharges through the Gator Slough Canal to Matlacha Pass. Such a concentrated discharge is typically not efficient in improving the water quality.

The various BMPs that may be incorporated within the conceptual design of the restoration plans may include one or more of the followings:

- Dry Swale: This BMP is most suitable for the sub-basins GSE1, GSE2, and along roadways in other sub-basins. For example, the proposed swales along the north and south sides of Oil Well Road may be suitable for this BMP type. This treatment option provides a high level of removal of nutrients and other inorganics. The removal efficiency for dry retention basins is about 90%. However, the primary purpose of this treatment option is conveyance, and therefore the removal efficiency of these dry swales for nutrients would be less than that of the dry retention basins.
- Wet Detention Pond: This BMP can be constructed in any basin. For example, the proposed use of borrow pits along east of Burnt Store Road are suitable to be developed as the wet detention ponds. The removal efficiencies of nutrients and other inorganics for this BMP are lower than the dry ponds. The typical removal efficiencies for various compounds for this BMP are given in Section 3.2 of this report.
- Storm Water Treatment Area (STA): This BMP controls discharge rates and removes nutrients through vegetation. The District has wide experience in constructing and

managing STAs of different sizes. The proposed concepts for construction of flow distribution and treatment facilities in the DCEBS and YPEBS watersheds are examples of this BMP.

- **Filter Marsh:** This BMP behaves similarly to wetlands or STAs depending on the size and components of the design. Currently, the filter marsh concept is proposed along Old Burnt Store Road and the outfall structures.
- **Flow Way and Proposed Ditch:** The shallow and wide ditches proposed in the conceptual designs in this TM are similar to certain flow ways which are populated with naturally occurring vegetation. These types of BMPs not only control the quantity of flows, but also control the timing of discharge, removal of nutrients and other inorganics, and improve the water quality at the downstream end. The examples of these BMPs include the proposed ditches along the east side of Burnt Store Road, north side of Zemel Road, and east side of I-75.

4.2.2 Passive Low Maintenance Conceptual Designs

As indicated earlier, the key element of the recommended conceptual design is the gravity drain system. In addition, the recommended conceptual designs presented in this report are intended to be low maintenance systems with no pumps. For example, the conceptual designs include shallow and wide flow ways with native vegetations to convey the stormwater runoff rather than the narrow and deep canals. This conceptual design may include more land acquisition at the start, but will need very low maintenance and improve the water quality.

For example, dry swales are proposed along Oil Well Road for the flow diversions conceptual design in the GSE1 watershed. The dry swales need very little maintenance except for periodical mowing. The shallow and wide ditches with vegetation are proposed in the conceptual designs rather than the deep canals along I-75, Zemel Road, US Hwy 41, and Burnt Store Road. This type of design requires simple engineering design, less expensive structures, and low maintenance. These designs may require vegetation control only few times a year. Similarly, the burrow pits and distribution and treatment facilities proposed in DCEBS and YPEBS watersheds are expected to be shallow, free of pumps maintaining gravity system for inflow and outflow, and require low maintenance of the berms and overflow structures.

The details of the low maintenance conceptual designs are emphasized during the engineering analysis and design phase.

4.2.3 Other Multi-Functional Alternatives

As described above, most of the recommended conceptual designs are multi-functional in nature. The flood control and water quality are common to all the proposed conceptual designs. In addition, these designs enhance the hydroperiods supporting healthy growth of

vegetation and maintenance of the fish and wildlife. Since the volume of runoff is the key factor and there are concentrated urban areas within the project area, flood control and maintenance of the flood control structures would be key elements in the restoration plan development.

4.3 RECOMMENDED MULTI-FUNCTIONAL WATER MANAGEMENT PLAN

This section presents a brief outline of the step process for implementation of a multi-functional water management plan. The multi-functional water management plan is intended to address the conceptual actions aimed at improving the hydrologic and water quality characteristics of natural systems including freshwater wetlands, and the receiving estuarine systems. This plan is aimed at improving the following elements.

- Historic sheet flow restoration
- Restoring more natural flows to Charlotte Harbor
- Watershed Water Quality Improvement (discharging to Charlotte Harbor)
- Ground Water Recharge (to protect and enhance the fish and wildlife habitats)
- Hydroperiod Maintenance (for vegetation management and protection and enhancement of the fish and wildlife habitats)
- Land Acquisition and Management (to address operational issues)

Based on the information contained in this TM, the recommended water management plan includes the following elements.

- Coordinate with the agencies managing the roadways and current I-75 widening permit applicants to evaluate potential for partial implementation of some of the conceptual designs presented in this document.
- Complete further engineering analysis of selected alternatives that would include the followings.
 - Implement a monitoring network system;
 - Perform a comprehensive site investigation;
 - Develop and implement a detailed flow evaluation model;
 - Develop and implement an integrated water quality model; and
 - Formulate and evaluate specific alternatives including conceptual layouts, preliminary designs, and detailed cost estimates.

The engineering analysis should evaluate the conceptual designs proposed in this document, and be able to narrow down the specific designs most effective to achieve the project goals. The engineering analysis should recommend an alternative for implementation.

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- Survey onsite/nearby wetlands for signs of biological indicators for average wet season water levels (stain lines, lichen lines, adventitious roots, etc.). Available surface water monitoring data in the area may be useful and can be cost saving factor.
- Prepare an environmental assessment or an environmental impact statement as appropriate based on the recommendation from the engineering analysis.
- Develop a detailed engineering design for the alternative recommended during the engineering analysis. This should include the detailed design plans and specifications, permit applications and approvals, preparation of bid specification package, and selection of a contractor for construction. The detailed design should emphasize the maintenance of the existing and future drainage features, which is critical in achieving the design goals.

The conceptual designs presented in this document address all of the above issues either by individual concepts or with a combination of more than one concept. The conceptual plans presented in this TM needs technical evaluation with more specific design features.

APPENDIX A
Site Reconnaissance Field Logs and
Photographs of Selected Structures (July 20-29, 2009)

Field Log Sheet

File No.: 08006.02 Date: July 20, 2009 Start Time: 1:00 am/pm End Time: 4:45 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Cloudy, mild, ~ 75°F to 80°F

[illegible]

DRAFT TECHNICAL MEMORANDUM; OCTOBER 26, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Field Log Sheet

File No.: 08006.02 Date: July 21, 2009 Start Time: 9:20 am/pm End Time: 12:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Clear, warm, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
009	N26°51'29.3"	W81°53'01.6"	1-24" CPP	~3" of sediment at base of culvert	GJR AVA
010	N26°51'29.4"	W81°52'01.2"	1-24" CPP + 2-24" CMP	~1" of sediment at base; metal culverts are completely corroded	GJR AVA
011	N26°51'29.2"	W81°51'07.5"	2-48" CMP	Culverts are partially corroded; water at base	GJR AVA
012	N26°51'29.2"	W81°50'18.3"	1-18" CMP	South side covered w/ vegetation; rocks at both ends	GJR AVA
013	N26°51'29.2"	W81°50'17.4"	1-24" CPP	<1" of sediment at base of culvert	GJR AVA
014	N26°51'28.8"	W81°50'13.6"		Pond on south side of Tucker's Grade Road	GJR AVA
015	N26°51'29.0"	W81°50'06.4"	2-42" CMP	16" of standing water at base of culvert	GJR AVA
016	N26°51'28.9"	W81°49'41.4"	2-24" CPP	~1" of sediment at base of culvert	GJR AVA
017	N26°51'28.9"	W81°49'39.5"	1-16" CMP	Completely corroded + Filled (blocked) w/ sediments	GJR AVA
018	N26°51'28.9"	W81°49'37.2"	1-12" CMP	Partially corroded	GJR AVA
019	N26°51'28.9"	W81°49'29.4"		Gate at Tucker's Grade Rd. at Zone D boundary	GJR AVA
020	N26°51'28.9"	W81°49'28.9"	1-24" CPP	~10" of sediment at base of culvert	GJR AVA
021	N26°51'11.4"	W81°52'50.1"	2-36" CPP	<1" of sediment at base + little vegetation at both ends	GJR AVA
022	N26°50'54.7"	W81°52'34.4"	1-18" CPP	~3" of sediment at base; both ends partially blocked w/ rocks	GJR AVA
023	N26°50'47.9"	W81°52'27.9"	1-18" CPP	~3" of sediment at base; heavy vegetation at west end	GJR AVA
024	N26°50'46.1"	W81°52'26.4"	1-18" CPP	~3" of sediment at base; heavy vegetation at both ends	GJR AVA
025	N26°50'43.7"	W81°52'23.8"	1-30" CPP	~10" of sediment at base of culvert	GJR AVA
026	N26°50'36.6"	W81°52'16.9"		Pond on east side of Power line Grade	GJR AVA
027	N26°50'35.3"	W81°52'16.2"	1-24" CPP	<1" of sediment at base of culvert	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 21, 2009 Start Time: 12:35 am/pm End Time: 3:25 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Partly sunny, warm, ~85°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
028	N26°50'34.2"	W81°52'15.1"	1-24" CPP	~2" of sediment at base of culvert	GJR AVA
029	N26°50'29.3"	W81°52'10.4"	1-24" CPP	~1" of sediment at base; Partially blocked at West end	GJR AVA
030	N26°50'28.3"	W81°52'09.4"	1-24" CPP	~1" of sediment at base; heavy vegetation at west end	GJR AVA
031	N26°50'26.1"	W81°52'07.3"	1-18" CPP	~2" of sediment at base; West end partially blocked	GJR AVA
032	N26°50'23.8"	W81°52'05.3"	1-24" CPP	~2" of sediment at base; West end almost blocked completely	GJR AVA
033	N26°50'15.3"	W81°51'57.2"	1-18" CPP	~1" of sediment at base of culvert	GJR AVA
034	N26°50'13.2"	W81°51'55.3"	1-26" CPP	Heavy vegetation on west end of culvert	GJR AVA
035	N26°50'12.3"	W81°51'54.4"	1-36" CPP	~1" of sediment at base of culvert	GJR AVA
036	N26°50'10.9"	W81°51'53.1"	1-36" CPP	~3" of sediment & rocks at base on West end	GJR AVA
037	N26°50'09.7"	W81°51'52.1"	1-24" CPP	~1" of sediment at base; Partially block at west end	GJR AVA
038	N26°50'03.0"	W81°51'45.8"	1-24" CPP	~6" of sediment at base; West end almost blocked off Half filled w/ sediments & rocks on east end.	GJR AVA
039	N26°50'01.5"	W81°51'44.3"	1-24" CPP	Almost completely blocked at west end	GJR AVA
040	N26°49'56.9"	W81°51'40.0"	1-24" CPP	Both ends half blocked w/ rocks, sediment, vegetation	GJR AVA
041	N26°49'56.1"	W81°51'39.2"	1-24" CPP	~2" of sediment at base; heavy vegetation on East end	GJR AVA
042	N26°49'45.2"	W81°51'29.1"		Gate at Powerline Grade	GJR AVA
043	N26°49'44.5"	W81°51'28.2"	1-24" CPP	Heavy vegetation on West end	GJR AVA
044	N26°49'40.5"	W81°51'24.5"	2-24" CPP	~2" of sediment at base of culvert	GJR AVA
045	N26°49'35.8"	W81°51'20.1"	2-24" CPP	>6" of sediment at base of culvert	GJR AVA
046	N26°49'25.8"	W81°51'17.3"	1-42" CMP	Partially corroded; heavy vegetation at West end	GJR AVA

DRAFT TECHNICAL MEMORANDUM; OCTOBER 26, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Field Log Sheet

File No.: 08006.02 Date: July 21, 2009 Start Time: 3:35 am/pm pm End Time: 6:30 am/pm pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Partly Cloudy, hot, ~90°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
047	N26°49'15.7"	W81°51'01.0"	1-24" CPP	>6" of sediment at base of culvert	GJR AVA
048	N26°49'13.7"	W81°50'59.1"	1-24" CPP	>6" of sediment at base; west end partially blocked	GJR AVA
049	N26°49'09.8"	W81°50'55.4"	2-24" CPP	Heavy vegetation at west end of culverts	GJR AVA
050	N26°48'57.3"	W81°50'43.6"	1-24" CPP	Heavy vegetation at west end of culvert	GJR AVA
051	N26°48'54.3"	W81°50'40.8"	2-24" CPP	<1" of sediment at base of culverts	GJR AVA
052	N26°48'52.5"	W81°50'39.2"	1-24" CPP	<1" of sediment at base of culvert	GJR AVA
053	N26°48'50.6"	W81°50'37.6"		Gate at Powerline Grade	GJR AVA
054	N26°51'42.1"	W81°54'44.6"	2-48" CMP	~18" of stagnant water at base	GJR AVA
055	N26°53'13.5"	W81°55'04.9"	2-48" CMP	~30" of standing water at base	GJR AVA
056	N26°53'23.2"	W81°55'05.4"	2-48" CMP	Block off completely at North end	GJR AVA
057	N26°54'06.6"	W81°52'26.2"		End of Frack unmapped trail	GJR AVA
058	N26°53'39.6"	W81°52'49.2"		Middle of Frack unmapped trail	GJR AVA
059	N26°53'13.3"	W81°53'11.5"		Beginning of Frack unmapped trail	GJR AVA
060	N26°53'12.4"	W81°52'32.0"	2-48" CMP	Both culverts submerged in water	GJR AVA
061	N26°53'12.0"	W81°51'59.9"	2-48" CMP	Both culverts submerged in water	GJR AVA
062	N26°53'12.0"	W81°51'56.7"	1-24" CPP	~18" of stagnant water at base	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 22, 2009 Start Time: 8:45 am/pm End Time: 2:00 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Clear, warm, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
063	N26°51'04.2"	W81°54'36.5"	2-48" CMP	Dense vegetation on both ends of culverts	GJR AVA
064	N26°50'34.0"	W81°54'29.9"	2-48" CMP	Dense vegetation on west end of culverts	GJR AVA
065	N26°49'45.9"	W81°54'18.2"		Intersection of unmapped trails	GJR AVA
066	N26°49'46.1"	W81°54'17.6"	2-48" CMP	Both culverts are completely corroded	GJR AVA
067	N26°53'38.3"	W81°55'08.8"	1-48" CMP	Partially corroded; >8" of sediment at base	GJR AVA
068	N26°54'10.2"	W81°55'16.0"		Gate at end of Seaboard Grade Rd	GJR AVA
069	N26°54'43.1"	W81°55'23.4"		End of Northern end of Seaboard Grade Rd	GJR AVA
070	N26°54'07.0"	W81°55'15.5"	Water flow over Road	Depression that has puddled at canal on East of Rd	GJR AVA
071	N26°53'11.7"	W81°51'35.1"	1-24" CPP on Tram Rd	Culvert almost blocked on south end. Located at beginning of Road 3.	GJR AVA
072	N26°53'31.9"	W81°51'33.8"		located at end of Road 3.	GJR AVA
073	N26°53'06.4"	W81°50'44.6"	1-24" CCP under Rd 4 at Tram Gr intersection	12" of sediment at base of culvert. Located at beginning of Rd 4.	GJR AVA
074	N26°54'05.5"	W81°49'30.7"	Tram Grade Road	located at end of Road 4.	GJR AVA
075	N26°53'03.9"	W81°49'35.8"	Tram Grade Road	Wetlands area in Zone C near Zone D boundary	GJR AVA
076	N26°54'05.3"	W81°49'30.2"		Northern end of Road 5	GJR AVA
077	N26°53'03.8"	W81°49'28.2"	1-36" CMP at Rd 5 + Tram Grade Rd intersection	Partially corroded; >30" of water at base	GJR AVA
078			1-36" CMP at Rd 5 + Tram Grade Rd	Partially corroded; >30" of water at base	GJR AVA
078	N26°50'53.1"	W81°49'29.8"		Ex Southern end of Road 9.	GJR AVA
079	N26°51'28.9"	W81°48'52.6"	Tucker's Grade Road	SE corner of lake on north side of Tucker's Gr.	GJR AVA
080	N26°51'28.8"	W81°48'49.1"	2-48" CMP on Tucker's Grade Road	Lake draining South into ditch	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 22, 2009 Start Time: 2:10 am/pm End Time: 6:40 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Partly cloudy, hot, humid, ~90°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
081	N26°51'28.7"	W81°48'20.8"	2-48" CMP on Tuckers Grade Road	Lake draining south into pond	GJR AVA
082	N26°51'28.5"	W81°47'21.4"	corner of 8A Road 8A + Tuckers Grade Road	SW corner of Lake on Tuckers Grade Rd	GJR AVA
083	N26°51'31.1"	W81°47'20.3"	On Road 8A	~100' from Tuckers Grade Road	GJR AVA
084	N26°51'28.3"	W81°47'14.6"	1-24" CPP on under Tuckers Grade Road	Draining to the south	GJR AVA
085	N26°51'28.2"	W81°47'07.8"	1-24" CPP under Tuckers Grade Road	Draining to the north; at Tuckers Grade + Rd 7	GJR AVA
086	N26°50'07.6"	W81°47'09.3"		South end of Road 7	GJR AVA
087	N26°51'28.1"	W81°47'08.1"	2-28" CPP under Tucker Grade Road	Draining to the north; at Tuckers Grade E. of Rd 7	GJR AVA
088	N26°51'28.0"	W81°46'14.8"	1-28" CPP under Tucker Grade Road	Draining north; at Tuckers Grade, east of Rd 7	GJR AVA
089	N26°51'27.8"	W81°45'52.1"		At Tuckers Grade Road near US 31	GJR AVA
090	N26°51'27.9"	W81°45'59.5"	1-24" CPP under Tucker Grade Road	Draining North; West of US 31	GJR AVA
091	N26°51'28.0"	W81°46'04.2"	2-28" CPP under Tucker Grade Road	Draining north; located at Rd 6 intersection	GJR AVA
092	N26°51'28.1"	W81°46'07.9"	2-28" CPP under Tucker Grade Road	Flow obstruction at both ends	GJR AVA
093	N26°51'28.7"	W81°48'58.3"	2-26" CPP under Tucker Grade Road	Flow is stagnant at both ends; West of Lake	GJR AVA
094	N26°51'28.8"	W81°49'00.5"	Same as above	Same as above	GJR AVA
095	N26°51'28.8"	W81°49'02.4"	1-24" CPP under Tucker Grade Road	Flow is stagnant at both ends; West of Lake	GJR AVA
096	N26°51'28.8"	W81°49'07.0"	Same as above	Same as above	GJR AVA
097	N26°51'28.9"	W81°49'29.0"	1-24" CPP under Tucker Grade Road	~8" of sediment at base; At Rd 5 intersection	GJR AVA
098	N26°51'28.9"	W81°49'46.8"	2-24" CPP under Tucker Grade Road	Dry at both ends; near unmarked road	GJR AVA
099	N26°51'29.3"	W81°52'01.2"	2-24" CMP under Tucker Grade Road	Completely Corroded	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 23, 2009 Start Time: 8:30 am/pm End Time: 1:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, clear, warm, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
100	N26°49'39.9"	W81°56'25.1"	Webb Lake	South end of Oilwell grade Road	GJR AVA
101	N26°51'08.1"	W81°56'25.8"	Culvert under Oilwell Rd		GJR AVA
102	N26°53'13.0"	W81°53'24.1"	1-24" CPP under Tram Grade Road	Culvert completely submerged in Stagnant water at both ends	GJR AVA
103	N26°53'01.5"	W81°48'25.7"	2-48" CMP under Tram Grade Road	Both partially submerged in water	GJR AVA
104	N26°53'01.4"	W81°47'58.8"	2-24" CPP under Tram Grade Road		GJR AVA
105	N26°53'01.8"	W81°47'35.5"	2-24" CPP under Tram Grade Road		GJR AVA
106	N26°53'03.4"	W81°46'01.4"		Rd 6 + Tram Grade Intersection	GJR AVA
107	N26°51'28.0"	W81°46'04.3"		Rd 6 + Tucker Grade Intersection	GJR AVA
108	N26°48'37.3"	W81°57'24.1"	2-24" CCP under Oilwell Rd	Oilwell Rd + US 41 intersection	GJR AVA
109	N26°48'47.8"	W81°56'21.7"	Wetland Area	On unmarked trail off Oil Well Rd	GJR AVA
110	N26°48'38.1"	W81°56'30.6"		Start of Trail at the Oilwell Rd	AVA GJR
111	N26°48'38.0"	W81°55'40.5"	1-48" CMP	Along Oil Well Rd near I-75; completely corroded	GJR AVA
112	N26°48'38.2"	W81°55'39.7"	1-24" CCP	Oil Well Under Oil Well Rd near I-75	GJR AVA
113	N26°48'38.6"	W81°55'51.1"	1-18" CCP	Oil Well Grade Rd overpass above I-7	GJR AVA
114	N26°48'38.6"	W81°55'48.6"	Same as above	Same as above	GJR AVA
115	N26°48'38.7"	W81°55'46.1"	Same as above	Same as above	GJR AVA
116	N26°48'38.8"	W81°55'36.8"	1-24" CMP under Oil Well Rd	End completely blocked Near I-75; ~4" of sediment at base	GJR AVA
did not save 117	N26°48'38.3"	W81°55'32.8"	1-24" ECP under Oil Well Rd (1-18" x 12")	Near I-75; ~1" of sediment at base	GJR AVA
117	N26°48'38.4"	W81°55'19.5"	1-18" x 12" ECP under Oil Well Road	East of I-75; Culvert sloping north	GJR AVA

DRAFT TECHNICAL MEMORANDUM; OCTOBER 26, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Field Log Sheet

File No.: 08006.02 Date: July 23, 2009 Start Time: 2:30 am/pm End Time: 6:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, hot, humid, ~90°F ~~to 95°F~~

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
118	N26°48'38.4"	W81°55'04.9"	1-18"x24" ECP under Oil Well Rd, E of I-75	~3" of sediment at base	GJR AVA
119	N26°49'35.1"	W81°55'01.9"	1-48" CCP under unnamed Rd off Oil Well Rd	Be North end of unnamed Road off Oil Well Road	GJR AVA
120	N26°49'02.8"	W81°55'01.3"	1-48" CCP under unnamed Rd off Oil Well Rd	Water & heavy vegetation at both ends	GJR AVA
121	N26°49'02.2"	W81°55'01.3"	1-41" CCP under unnamed Rd off Oil Well Rd	Water & heavy vegetation at both ends	GJR AVA
122	N26°48'38.8"	W81°55'01.6"	South end of unnamed Rd	Intersection w/ Oil Well Rd	GJR AVA
123	N26°48'38.4"	W81°54'57.4"	1-18"x24" ECP under Oil Well Road	~1" of sediment at base	GJR AVA
124	N26°49'11.3"	W81°54'47.0"	1-48" CCP under Valhalla Drive	North of Oil Well Rd	GJR AVA
125	N26°48'38.4"	W81°54'42.3"	1-18"x12" ECP under Oil Well Road		GJR AVA
126	N26°48'38.4"	W81°54'39.9"	1-18"x12" ECP under Oil Well Road		GJR AVA
127	N26°48'38.5"	W81°54'21.1"	Same as above	Heavy vegetation at both ends	GJR AVA
128	N26°48'38.4"	W81°54'19.2"	Same as above		GJR AVA
129	N26°48'29.3"	W81°53'25.9"	East end of Oil Well Rd	Intersection of Pancari Rd + Oil Well Rd	GJR AVA
130	N26°48'37.9"	W81°53'27.0"	Canal along Oil Well Rd	Draining west	GJR AVA
131	N26°48'08.8"	W81°53'26.8"	Canal E of Oil Well Rd	Flowing west	GJR AVA
132	N26°48'38.2"	W81°54'03.8"	Canal along Oil Well Rd at Flowing West	Intersection of Oil Well Rd + Jack Ave.	GJR AVA
133	N26°48'40.2"	W81°54'04.2"	1-18" CCP under Jack Ave on South end	Located near Oil Well Rd	GJR AVA
134	N26°48'50.9"	W81°54'06.4"	1-18" CCP under Jack Ave		GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 24, 2009 Start Time: 9:30 am/pm End Time: 6:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, hot, humid, ~ 85°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
135	N26°47'25.7"	W81°54'11.9"	Canal at Correct	Parallel Along I-75 at Charlotte County located at Correctional Facility; Flow is stagnant	GJR AVA
136	N26°47'41.9"	W81°54'28.0"	Canal along I-75	located at Charlotte County Correctional Facility	GJR AVA
137	N26°48'18.3"	W81°55'31.0"	1-12'x3' BCP under I-75 near	Flow is west; located near Oil Well Rd.	GJR AVA
138	N26°48'03.8"	W81°55'09.4"	1-24" CCP under I-75 south of Oil Well Rd.	Flow is west along culvert	GJR AVA
139	N26°47'51.3"	W81°54'51.1"	Same as above	Same as above	GJR AVA
140	N26°47'15.1"	W81°54'12.3"	3-24" CCP under I-75	Flow is west east along culverts	GJR AVA
141	N26°46'45.8"	W81°53'41.7"	Canal along I-75		GJR AVA
142	N26°46'43.0"	W81°53'36.6"	Canal under I-75	Flow is west under I-75 overpass	GJR AVA
143	N26°46'40.2"	W81°53'33.1"	2-24" CCP under I-75	Heavy vegetation at both ends	GJR AVA
144	N26°46'25.3"	W81°53'07.1"	2-32" CCP under I-75	Flow is west through culverts	GJR AVA
145	N26°45'54.3"	W81°52'35.0"	3-12'x3' BCP under I-75	Canal flowing east through culverts	GJR AVA
146	N26°46'45.3"	W81°53'34.8"	I-75 bridge (overpass)	Canal under bridge flowing west	GJR AVA
147	N26°47'57.8"	W81°57'01.6"	1-36" CCP under Zemel Rd	At intersection of Zemel Rd + US 41	GJR AVA
148	N26°44'38.6"	W81°55'00.2"	Canal under U.S. 41 3-12'x5' BCP	~ 50' wide, flowing west	GJR AVA
149	N26°45'33.3"	W81°55'29.9"	2-36" CCP under US 41 near Lakeville Cr.	Flow through culverts is eastward	GJR AVA
150	N26°45'50.1"	W81°53'38.5"	Canal flowing from east Canal flowing from north	Intersection of 2 canals at U.S. 41	GJR AVA
151	N26°45'51.0"	W81°54'57.7"		Tracing canal flowing east from U.S. 41	GJR AVA
152	N26°46'01.6"	W81°54'32.6"		Same as above	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 25, 2009 Start Time: 8:45 am/pm End Time: 4:15 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, very warm, humid, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
153	N26°48'29.7"	W81°57'22.6"	2-36" CCP under US 41 near Oil Well Rd	Just south of Oil Well Rd; Flowing east through culvert	GJR AVA
154	N26°48'22.3"	W81°57'16.0"	Storm drain 3'x5' along US 41 on median	~1 mile south of Oil Well Rd; flow is to the west	GJR AVA
155	N26°48'21.9"	W81°57'16.9"	1-18" CCP under US 41 ~1 mi. South of Oil Well Rd	~6" of sediment at base, vegetation	GJR AVA
156	N26°48'11.6"	W81°57'10.2"	1-18" CCP under US 41 ~1.5 mi South of Oil Well Rd	Flow is west from storm drain on median	GJR AVA
157	N26°48'02.2"	W81°57'04.2"	1-18" CCP under US 41 ~2 mi South of Oil Well Rd	Flow is west from storm drain on median	GJR AVA
158	N26°48'51.0"	W81°57'33.5"	Canal to US 41 ~1.5 miles north of Zemel Rd	Canal is flowing west	GJR AVA
159	N26°47'51.1"	W81°56'56.7"	1-18" CCP under US 41 ~0.25 mi south of Zemel Rd	Flow is west from storm drain on median	GJR AVA
160	N26°47'44.1"	W81°56'52.5"	1-18" CCP under US 41 ~0.5 mi S of Zemel Rd	Flow is west from storm drain on median	GJR AVA
161	N26°47'37.3"	W81°56'48.4"	2-36" CCP under US 41 ~0.75 mi S of Zemel Rd	Flow is to the east through culvert	GJR AVA
162	N26°47'14.0"	W81°56'33.2"	1-18" CCP under US 41 ~3 mi South of Zemel Rd	Flow is to the west from storm drain on median	GJR AVA
163	N26°47'02.9"	W81°56'26.0"	1-18" CCP under US 41 ~3.5 mi S of Zemel Rd	Flow is West from storm drain on median	GJR AVA
164	N26°46'51.3"	W81°56'18.6"	1-18" CCP under US 41 ~4 mi South of Zemel Rd	Flow is West from storm drain on median	GJR AVA
165	N26°45'30.5"	W81°55'31.5"	2-36" CCP under US 41 ~0.1 mi S. of Lakeville Rd	Flow appears to be east through culverts	GJR AVA
166	N26°45'12.0"	W81°55'20.4"	2-36" CCP under US 41 ~0.1 mi N. of Pine Lakes Blvd	Flow appears to be east through culverts	GJR AVA
167	N26°44'45.9"	W81°54'47.4"	Gator Slough	Tracking NE	GJR AVA
168	N26°44'51.0"	W81°54'14.8"	Channel	Same as above	GJR AVA
169	N26°45'05.3"	W81°54'42.4"	Channel	Same as above	GJR AVA
170	N26°44'25.4"	W81°54'55.0"	1-18" CCP under US 41 ~50' N submerged	~50' North of Fountain View Blvd; Flowing west	GJR AVA
171	N26°46'11.8"	W81°53'58.6"	Channel	@ Via Montana Way	GJR AVA

DRAFT TECHNICAL MEMORANDUM; OCTOBER 26, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Field Log Sheet

File No.: 08006.02 Date: July 26, 2009 Start Time: 9:00 am/pm End Time: 11:50 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Cloudy, warm, occasional drizzle, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
172	N26°47'57.4"	W81°57'13.5"	2-10" Circular Plastic culverts off Zemel Rd	Near landfill (mound) ~0.5 mi from US41, draining N	GJR AVA
173	N26°47'57.5"	W81°57'30.8"	Zemel Rd Landfill Driveway + Zemel Rd	Zemel Rd Municipal Solid Waste Mgmt Facility	GJR AVA
174	N26°47'57.9"	W81°57'50.9"	Gate to off road on N side of Zemel Road	located across from landfill	GJR AVA
175	N26°47'57.9"	W81°57'55.9"	2-22"x14" ECP under Zemel Rd, N of landfill area	North ends of culverts almost completely blocked	GJR AVA
176	N26°47'57.7"	W81°58'23.1"	N end of Seminole Grade	Intersection of Seminole Grade Rd + Zemel Rd	GJR AVA
177	N26°47'57.8"	W81°59'16.4"	Rd 3 + Zemel Rd	South end of Road 3	GJR AVA
178	N26°47'27.3"	W81°59'16.2"	2-12" CPP under Road 3	~1" of sediment at base	GJR AVA
179	N26°47'27.1"	W81°59'15.4"	1-12" CPP under Road 3	~1" of sediment at base	GJR AVA
180	N26°47'26.7"	W81°59'12.5"	1-12" CPP under Road 3	~2" of sediment at base	GJR AVA
181	N26°47'26.7"	W81°59'12.1"	Same as above	Same as above	GJR AVA
182	N26°47'27.9"	W81°59'0.90"	Same as above	Same as above	GJR AVA
183	N26°47'27.4"	W81°59'06.4"	Same as above	Same as above	GJR AVA
184	N26°47'27.5"	W81°59'07.8"	Same as above	~3" of sediment at base	GJR AVA
185	N26°47'28.7"	W81°59'02.9"	2-12" CPP under Road 3	Same as above	GJR AVA
186	N26°47'45.9"	W81°58'22.4"	Rd 3 + Seminole Grade	North East end of Road 3	GJR AVA
187	N26°47'45.2"	W81°58'22.4"	1-18" CPP under Seminole Grade Rd ~50' S of Rd 3	~6" of sediment at base	GJR AVA
188	N26°47'04.4"	W81°58'22.9"	2-18" ECP under Seminole Grade Rd	~5" of sediment at base	GJR AVA
189	N26°46'57.8"	W81°58'22.8"	1-18" CPP under Seminole Grade Rd	Submerged under water	GJR AVA
190	N26°46'53.7"	W81°58'22.8"	2-18" CPP under Seminole Grade Rd	West end submerged in water	GJR AVA

Field Log Sheet

File No.: 08006.02 Date: July 26, 2009 Start Time: 12:00 am/pm pm End Time: 3:15 am/pm pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Cloudy, warm, periodic drizzle, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
191	N26°46'01.8"	W81°58'22.6"	Unnamed Road & SG Rd	Beginning of unnamed road of Seminole Grade	GJR AVA
192	N26°45'56.6"	W81°58'23.3"	4-24" CCP under Seminole Grade Rd	Water on west end of culverts	GJR AVA
193	N26°45'50.9"	W81°58'23.1"	2-24" CCP under Seminole Grade Rd	Partially submerged in water	GJR AVA
194	N26°45'49.3"	W81°58'23.5"	4-24" CCP under Seminole Grade Road	Mostly submerged in water; tracking South	GJR AVA
195	N26°45'30.7"	W81°58'23.8"	Unnamed Road & Seminole Grade Road	Beginning of track of unnamed road	GJR AVA
196	N26°45'22.1"	W81°00'08.3"	end of unnamed road	End of track of unnamed road	GJR AVA
197	N26°45'06.0"	W81°58'23.8"	3-12" CCP under Seminole Grade Road	Partially submerged in water on west end	GJR AVA
198	N26°45'00.7"	W81°58'24.0"	3-24" CCP under Seminole Grade Road	Water on both sides of culverts	GJR AVA
199	N26°44'28.6"	W81°59'58.6"	Near South end of Seminole Grade Road	Tracking South	GJR AVA
200	N26°49'10.6"	W81°58'22.4"	North end of Seminole Grade Rd at Canal	End of track	GJR AVA
201	N26°47'58.0"	W81°58'34.2"	1-18"x12" ECP under Zemel Rd tracking West	Near Seminole Grade Rd; ~1" of sediment	GJR AVA
202	N26°47'58.1"	W81°59'00.0"	1-18"x12" ECP under Zemel Rd tracking West	~1" of sediment at base	GJR AVA
203	N26°47'58.2"	W81°59'17.2"	Beginning Rd 1 track	Intersection of Rd 3 & Zemel Rd	GJR AVA
204	N26°48'53.5"	W81°59'32.8"	Canal	Canal at Rd 1	GJR AVA
205	N26°49'08.6"	W81°58'22.2"	Rd 1 & Zemel Rd	End of Rd 1 Track	GJR AVA
206	N26°47'58.7"	W81°59'31.4"	1-18"x12" ECP under Zemel Rd	~10" of sediment at base; tracking West	GJR AVA
207	N26°47'59.1"	W81°59'44.4"	3-36"x24" ECP under Zemel Rd	Heavy vegetation at South end of culverts	GJR AVA
208	N26°48'00.2"	W81°00'20.0"	unnamed trail	Intersection of Zemel Rd & trail	GJR AVA
209	N26°47'53.9"	W82°00'19.9"	unnamed trail	End of access on trail	GJR AVA

Field Log Sheet

File No.: 08006.02

Date: July 26, 2009

Start Time: 3:20 am/pm

End Time: 6:15 am/pm

Project Name: Yucca Pens Hydrologic Restoration Plan

Weather Conditions: Partly cloudy, hot, humid, ~ 90°F

[illegible]

Field Log Sheet

File No.: 08006.02 Date: July 27, 2009 Start Time: 8:45 am/pm End Time: 4:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, Warm, ~80°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
218	N26°49'18.6"	W81°57'53.5"	3-9'x8' BOX culverts under US 41 at canal	Canal is flowing west; ~1 mi N of Oil Well R	GJR AVA
219	N26°45'28.8"	W82°02'18.4"	2-10'x8' box culverts at 1200 St Burnt Store Rd	Canal is flowing east through culverts	GJR AVA
220	N26°45'35.6"	W82°02'18.3"		Trail S of Charlie Rd & E of Burnt Store	GJR AVA
221	N26°45'22.6"	W82°02'19.0"		San O ther end of Trail	GJR AVA
222	N26°44'39.1"	W82°02'36.3"	4-36" CCP under NW 34 Ave near NW 45 St	Canal flowing west through culverts	GJR AVA
223	N26°44'51.5"	W82°02'36.1"	4-36" CCP under NW 34 Ave near NW 47 St	Canal flowing west through culverts	GJR AVA
224	N26°44'52.6"	W82°03'17.0"	Canal flowing West	Canal flowing into wetlands area flowing into Charlie Rd	GJR AVA
225	N26°44'36.5"	W82°03'17.2"	4-42" CMP under Old Burnt Store Rd	Canal flowing west through at location	GJR AVA
226	N26°44'41.5"	W82°03'24.6"	unnamed trail	End of trail at canal	GJR AVA
227	N26°44'37.8"	W82°03'17.6"	old Burnt Store Rd & unnamed trail	End of trail at Old Burnt Store Rd	GJR AVA
228	N26°43'22.1"	W82°04'04.8"	Canal ~100' wide at NW 46 Ph + NW 36 St	Canal is flowing to the north	GJR AVA
229	N26°43'34.1"	W82°03'35.5"	Canal ~100' wide at 125002 Caloosa Pkwy	Canal is flowing to the north	GJR AVA
230	N26°43'25.7"	W82°03'19.4"	Canal ~100' wide at old Burnt Store Rd	Canal is flowing west	GJR AVA
231	N26°41'17.3"	W82°03'20.7"	Canal ~200' wide at 125737 Old Burnt Store	Canal is flowing east	GJR AVA
232	N26°41'03.3"	W82°03'48.2"	~50' Arm from tributary to ~300' Canal along NW 44 Ave	Canal is flowing north; near Gulf Stream Pkwy	GJR AVA
233	N26°42'21.9"	W82°02'53.6"	small Burnt End of Trail Trail on N side of Rd	North of At East At end of access on trail E of Old Burnt Store Rd	GJR AVA
234	N26°41'59.4"	W82°03'20.4"	End of Trail	At W end of Trail at Old Burnt Store Rd	GJR AVA
235	N26°42'06.7"	W82°03'20.2"	1-30" CMP under old Burnt Store Road	Drains west to canal; Tracking north	GJR AVA
236	N26°42'12.1"	W82°03'20.1"	1-24" CCP under Burnt Store Road		GJR AVA

Field Log Sheet

File No.: 08006.02

Date: July 27, 2009

Start Time: 4:35 am/pm

End Time: 5:50 am/pm

Project Name: Yucca Pens Hydrologic Restoration Plan

Weather Conditions: Partly sunny, very warm, humid, ~85°F

[illegible]

Field Log Sheet

File No.: 08006.02 Date: July 28, 2009 Start Time: 9:45 am/pm End Time: 3:30 am/pm
Project Name: Yucca Pens Hydrologic Restoration Plan Weather Conditions: Sunny, clear, very warm, humid, ~85°F

Structure ID (if available)	Measured Coordinates		Structure Type and Description of Location	Remarks/Description	Logged By
	Latitude	Longitude			
248	N26°44'17.5"	W82°02'21.1"	4-24" CCP under Old Burnt Store Rd	Culverts drain eastward; tracking south	GJR AVA
249	N26°43'46.9"	W82°02'21.4"	3-30" CCP under Old Burnt Store Rd	Large rocks at both ends; drains west to canal	GJR AVA
250	N26°42'52.4"	W82°02'21.6"	4-36" x 24" under Old Burnt Store Rd	ECP trending west	GJR AVA
251	N26°42'19.6"	W82°02'21.6"	2-30" CCP under Old Burnt Store Rd	Swale at both ends; tracking S uphill	GJR AVA
252	N26°42'05.8"	W82°02'21.6"	4-30" CCP under Old Burnt Store Rd	Swale at both ends	GJR AVA
253	N26°41'40.2"	W82°02'21.7"	Canal ~100' wide at 120025 Old Burnt Store	Flowing west	GJR AVA
254	N26°41'49.3"	W82°01'53.0"	Trail on east side of Old Burnt Store Rd	At SE end of trail along canal; tracking trail	GJR AVA
255	N26°41'41.8"	W82°02'21.3"	At intersection of trail + Old Burnt Store Rd	Canal along S side of trail; end of track	GJR AVA
256	N26°41'22.5"	W82°02'21.8"	Arroz Canal ~50' wide at 120033 Burnt Store Rd	Canal Flowing west	GJR AVA
257	N26°41'50.1"	W82°02'52.0"	1-48" CMP under Kismet Pkwy at NW 36 Ave	Flow through culvert is south to lake	GJR AVA
258	N26°41'57.9"	W82°01'22.3"	~100' wide canal at 125716 El Dorado Blvd	Flow is west	GJR AVA
259	N26°42'27.2"	W81°59'38.5"	4-48" CCP under Wilmington at NW 9 Pl	2 culverts are open + 2 culverts are closed on S end ~50' wide canal Flowing North through culverts	GJR AVA
260	N26°42'46.6"	W81°58'56.8"	7-48" CCP under Wilmington at NW 4 Pl	Located between NW 5 NW 5 Ave + NW 4 Pl	GJR AVA
261	N26°43'32.9"	W81°57'25.5"	~70' wide canal flowing under Andalusia Blvd	Flow is regulated by gate on North end Flowing west into Gater Slough	GJR AVA

Field Log Sheet

File No.:

08006.02

Date:

July 29, 2009

Start Time:

9:20

End Time:

2:00

am/pm

Project Name: Yucca Pens Hydrologic Restoration Plan

Weather Conditions:

Sunny, warm - ~ 85°F

[illegible]

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Culverts

	Culvert Structure ID: 3 Watershed: GSE1 Photo # 100_0204		Culvert Structure ID: 4 Watershed: GSE1 Photo # 100_0059
Culvert Completely Blocked; 24" CPP under Tram Grade at intersection with Road 3; on north side facing south		Culvert Completely Blocked; 24" CPP under Powerline Grade; on west side facing east	
	Culvert Structure ID: 9 Watershed: GSE1 Photo # 100_073		Culvert Structure ID: 10 Watershed: GSE1 Photo # 100_0075
Culvert Completely Blocked; 24" CPP under Tuckers Grade; on south side facing north		One 24" CCP and two 24" completely corroded CMP under Tuckers Grade; on south side facing north	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

	Culvert Structure ID: 11 Watershed: GSE1 Photo # 100_0077		Culvert Structure ID: 11 Watershed: GSE1 Photo # 100_0079
Two 48" partially corroded CMP under Tuckers Grade; on north side facing north		Flow Obstruction; Two 48" partially corroded CMP under Tuckers Grade; on south side facing south	
	Culvert Structure ID: 11 Watershed: GSE1 Photo # 100_0080		Culvert Structure ID: 13 Watershed: GSE1 Photo # 100_0083
Flow Obstruction; Two 48" partially corroded CMP under Tuckers Grade; on south side facing south		Culvert Partially Blocked; 24" CPP under Tuckers Grade; on south side facing north	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 Culvert Structure ID: 17 Watershed: GSE1 Photo # 100_0092	 Culvert Structure ID: 18 Watershed: GSE1 Photo # 100_0094
Culvert Completely Blocked; 16" completely corroded CMP under Tuckers Grade; on north side facing south.	Culvert Completely Blocked; 12" partially corroded CMP under Tuckers Grade; on north side facing south.
 Culvert Structure ID: 21 Watershed: GSE1 Photo # 100_0102	 Culvert Structure ID: 24 Watershed: GSE1 Photo # 100_0110
One Culvert Partially Blocked and Broken; Two 36" CPP under Powerline Grade; on west side facing east.	Culvert Completely Blocked; 18" CPP under Powerline Grade; on east side facing west

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 Culvert Structure ID: 25 Watershed: GSE1 Photo # 100_0112	 Culvert Structure ID: 28 Watershed: GSE1 Photo # 100_0114
Culvert Completely Blocked; 30" CPP under Powerline Grade; on east side facing west	Culvert Completely Broken and Blocked; 24" damaged CPP under Powerline Grade; on east side facing west
 Culvert Structure ID: 31 Watershed: GSE1 Photo # 100_0127	 Culvert Structure ID: 34 Watershed: GSE1 Photo # 100_0134
Culvert Completely Blocked; 18" CPP draining into pond on east side of Powerline Grade; standing on east side facing east	Culvert Completely Blocked; 26" CPP under Powerline Grade; on east side facing west

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)



Culvert
Structure ID: 36
Watershed: GSE1
Photo # 100_0152

Culvert Completely Blocked; 24" CPP under Powerline Grade; on east side facing west



Culvert
Structure ID: 253
Watershed: GS
Photo # 100_0601

Culvert Completely Blocked; Canal at the intersection of Van Buren Pkwy and NW 27th Pl; facing NE



Culvert
Structure ID: 113
Watershed: GSE1
Photo # 100_0274

Culvert Partially Blocked; Two 48" CCP under Oil Well Rd; on south side facing north



Culvert
Structure ID: 120
Watershed: GSE1
Photo # 100_0283

Culvert Completely Blocked; 48" CCP under Oil Well Rd; on north side facing south

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YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER No: 4600000893-WO03)

	Culvert Structure ID: 132 Watershed: GSE1 Photo # 100_0295		Culvert Structure ID: 132 Watershed: GSE1 Photo # 100_0297
One Culvert completely blocked and two others partially blocked; 3 culverts @ the intersection of Jack Ave. and Oil Well Rd; south side of Oil well Rd facing west.		Three Culverts Partially Blocked; The other end of picture 100_0295; on east side of Jacks Ave standing on Oil Well Rd and facing northeast.	
	Culvert Structure ID: 145 Watershed GSE1 Photo # 100_0324		Culvert Structure ID: 175 Watershed: YP Photo # 100_0408
No Blockage; Three 12' x 3' BCP under I-75; south bound facing east		Culverts Completely Blocked; Two 22" x 14" ECP under Zemel Rd; on north side facing west	

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YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

	Culvert Structure ID: 192 Watershed: YP Photo # 100_0418		Culvert Structure ID: 199 Watershed: YP Photo # 100_0441
Culvert Partially Blocked; Two 24" CPP on east side of Seminole Grade facing south		Culvert Partially Blocked; 18" x 12" ECP under Zemel Rd; on northside facing north	
	Culvert Structure ID: 199 Watershed: YP Photo # 100_0442		Culvert Structure ID: 214 Watershed: GB Photo # 100_0471
Culvert Partially Blocked; 18" x 12" ECP under Zemel Rd; on northside facing west		Flow Blockage by Vegetation; Box culvert under BurntStore Road, just south of Charlee Rd; on west side facing west	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER No: 4600000893-WO03)

Bridges



Bridge
Structure ID: 142
Watershed: GSE1
Photo # 100_0319

No Blockage; Bridge on I-75 south bound facing east



Bridge
Structure ID: 146
Watershed: GSE1
Photo # 100_0328

No Blockage; Bridge on I-75 south bound facing south-east; GSE1 outfall



Bridge
Structure ID: 146
Watershed: GSE1
Photo # 100_0331

Same as Photo # 100_0328; except that picture taken facing NE



Bridge
Structure ID: 148
Watershed: GS
Photo # 100_0338

No Blockage; Bridge on US-41 north bound facing north-west;

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)



**Bridge
Structure ID: 214
Watershed: GB
Photo # 100_0469**

No Blockage, Bridge on BurntStore road, just south of charlee road; on west side facing north



**Bridge
Structure ID: 229
Watershed: LV
Photo # 100_0497**

No Blockage, Bridge under Caloosa Pkwy, facing west



**Bridge
Structure ID: 231
Watershed: GS
Photo # 100_0526**

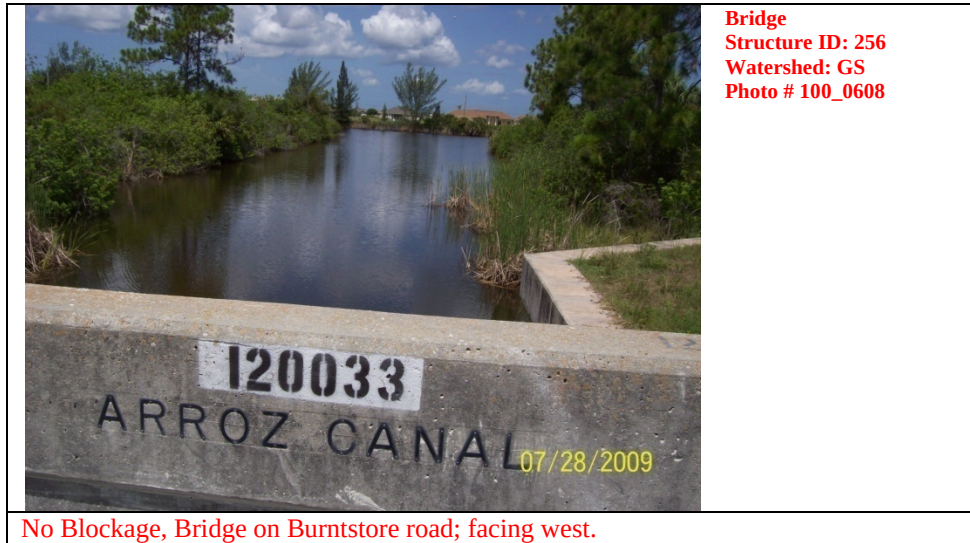
No Blockage, Bridge under Old Burntstore road facing south



**Bridge
Structure ID: 231
Watershed: GS
Photo # 100_0527**

No Blockage, Bridge under Old Burntstore road facing west

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YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER No: 4600000893-WO03)



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YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Weir/Drop Structure



**Weir/Drop Structure
Structure ID: 253
Watershed: GS
Photo # 100_0584**



**Weir/Drop Structure
Structure ID: 253
Watershed: GS
Photo # 100_0585**

No Blockage, Weir on GatorSlough Canal, facing east

Same location as 100_584; facing south-east



**Weir/Drop Structure
Structure ID: 253
Watershed: GS
Photo # 100_0586**



**Weir/Drop Structure
Structure ID: 253
Watershed: GS
Photo # 100_0597**

Same location as 100_584; facing north-east

Same location as 100_584; facing south-east

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

Canals

 07/22/2009	Canal Structure ID: 81 Watershed: GSE1 Photo # 100_0221	 07/23/2009	Canal Structure ID: 131 Watershed: GSE1 Photo # 100_0294
No Blockage, Lake discharging into Canal flowing south-west across Tuckers Grade; facing south-west.		No Blockage, Canal along south side of Oil Well Rd at intersection with Jack Ave; facing east	
 07/24/2009	Canal Structure ID: 145 Watershed: GSE1 Photo # 100_0324	 07/24/2009	Canal Structure ID: 145 Watershed: GSE1 Photo # 100_0327
No Blockage, Canal flowing under I-75, south bound facing east.		No Blockage, Canal at I-75; on east side facing east	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

	Canal Structure ID: 167 Watershed: GS Photo # 100_0382		Canal Structure ID: 171 Watershed: GS Photo # 100_0392
No Blockage, Gator Slough Canal flowing under US 41; on west side of US 41 facing west		Canal Blockage just south of Harper & McNew Property, facing north	
	Canal Structure ID: 171 Watershed: GS Photo # 100_0393		Canal Structure ID: 214 Watershed: GS Photo # 100_0466
Blockage in the canal flowing into ditch on US-41, just south of Harper & McNew Property facing east		Canal connecting pond and canal on Cape Coral Blvd; facing north-west	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 Canal Structure ID: 230 Watershed: GS Photo # 100_0592	 Canal Structure ID: 222 Watershed: LV Photo # 100_0603
No Blockage, Gator Slough Canal flowing under Burnt Store Rd; flow regulated by weir; facing east	No Blockage, Canal flowing under NW 34 th Ave; on south side facing east
 Canal Structure ID: 229 Watershed: GS Photo # 100_0647	 Canal Structure ID: 257 Watershed: GS Photo # 100_0627
No Blockage, Syracuse Canal, facing south	Culvert draining into Canal @ Kismet Pkwy; facing south

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER No: 4600000893-WO03)

Swales/Ditch

 07/23/2009	Swale/Ditch Structure ID: 109 Watershed: GSE2 Photo # 100_0270	 07/23/2009	Swale/Ditch Structure ID: 108 Watershed: GSE2 Photo # 100_0266
 07/23/2009	Swale/Ditch Structure ID: 108 Watershed: GSE2 Photo # 100_0267	 07/23/2009	Canal Structure ID: 108 Watershed: GSE2 Photo # 100_0269
Swale along north side of Oil Well Rd; facing west		Swale along south side of Oil Well Rd; facing east	
Same location as 100_0266, facing west		Swale along north side of Oil Well Rd; facing east	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 07/23/2009	Swale/Ditch Structure ID: 116 Watershed: GSE1 Photo # 100_0280	 07/23/2009	Swale/Ditch Structure ID: 116 Watershed: GSE1 Photo # 100_0279
Flow obstruction in Swale on north side of Oil Well Rd; on north side facing east		Flow obstruction in Swale south side of Oil Well Rd; on south side facing east	
 07/23/2009	Swale/Ditch Structure ID: 108 Watershed: GSE2 Photo # 100_0264	 07/24/2009	Swale/Ditch Structure ID: 147 Watershed: DC Photo # 100_0333
Ditch along US 41 sloping south; south side of Oil Well Rd facing south		Ditch @ intersection of Zemel Rd and US 41; on south-west side of intersection facing north	

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)



Swale/Ditch
Structure ID: 147
Watershed: DC
Photo # 100_0334

Same location as 100_0334, facing south



Swale/Ditch
Structure ID: 148
Watershed: GSE2
Photo # 100_0342

Ditch along east side of US 41; on east side facing south



Swale/Ditch
Structure ID: 149
Watershed: GSE2
Photo # 100_0343

Same location as 100_0342, facing north



Swale/Ditch
Structure ID: 153
Watershed: DC
Photo # 100_0357

Ditch sloping north along west side of US 41; on west side facing south

DRAFT TECHNICAL MEMORANDUM; NOVEMBER 23, 2009
YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 Swale/Ditch Structure ID: 153 Watershed: DC Photo # 100_0358	 Swale/Ditch Structure ID: 154 Watershed: DC Photo # 100_0359
Same location as 100_0357; facing north	Storm drain at US 41 median connected to culvert under both sides of US-41
 Swale/Ditch Structure ID: 172 Watershed: YP Photo # 100_0399	 Swale/Ditch Structure ID: 172 Watershed: YP Photo # 100_0401
Swale on Zemel Rd close to intersection with US 41; on north side of Zemel Rd facing west	Swale on south side of Zemel Rd Landfill; facing west

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YUCCA PENS HYDROLOGIC RESTORATION PLAN (WORK ORDER NO: 4600000893-WO03)

 Swale/Ditch Structure ID: 175 Watershed: YP Photo # 100_0407 07/26/2009	 Swale/Ditch Structure ID: 235 Watershed: GS Photo # 100_0535 07/27/2009
Swale on Zemel Rd; just north of Landfill, on south side facing west	Swale on Old Burnt Store Rd near Kismet Pkwy; on east side facing south
 Swale/Ditch Structure ID: 235 Watershed: GS Photo # 100_0536 07/27/2009	 Swale/Ditch Structure ID: 239 Watershed: GS Photo # 100_0578 07/28/2009
Blocked by vegetation, Same location as 100_0535, facing south	Swale Old Burnt Store Rd; on east side facing north

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 Swale/Ditch Structure ID: Watershed: GS Photo # 100_0580 07/28/2009	 Canal Structure ID: Watershed: GS Photo # 100_0583 07/28/2009
@ the intersection of Delilah Dr and Burnt Store Rd; east side facing south	@ the intersection of Delilah Dr and Burnt Store Rd; west side facing north
 Canal Structure ID: Watershed: GS Photo # 100_0594 07/28/2009	 Canal Structure ID: Watershed: GS Photo # 100_0595 07/28/2009
Swale along Burnt Store Rd; on east side facing north	Swale along Burnt Store Rd where surface water flows into storm drains that drain into Gator Slough canal; on east side of canal facing south

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Outfall



Outfall
Structure ID: 225
Watershed : DC
Photo # 100_0487



Outfall
Structure ID: 230
Watershed: GB
Photo # 100_0529

Durden Creek Outfall to Wetlands, facing west

Greenwell Branch Outfall into Canal; facing west



Outfall
Structure ID: 231
Watershed: LVR
Photo # 100_0522



Detention Pond
Structure ID: 232
Watershed: DC
Photo # 100_0564

Longview Run Outfall to Canal; facing north

No Blockage; Detention pond inside Zemel Rd Landfill; facing north.

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	Outfall Structure ID: 232 Watershed: DC Photo # 100_0566		Outfall Structure ID: 50 Watershed: GSE1 Photo # 100_0165
No Blockage; Culvert draining from Zemel Rd Landfill to the south into wetland area; facing south. Outfall can be seen to the wetlands		Outfall on west side of Powerline Grade from culvert draining west; standing on Powerline Grade facing east	

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Trail/Dirt Road



**Trail/Dirt Road
Structure ID: 59
Watershed: GSE1
Photo # 100_179**



**Trail/Dirt Road
Structure ID: 70
Watershed: GSE1
Photo # 100_0202**

Trail just north of Tram Grade at Post 2; facing north

Trail just north of Tram Grade at Post 3; facing north



**Trail/ Dirt Road
Structure ID: 21
Watershed GSE1
Photo # 100_0103**



**Trail/ Dirt Road
Structure ID: 50
Watershed: GSE1
Photo # 100_0162**

Dirt Road on Powerline Grade; facing south

Dirt Road on Powerline Grade; facing west

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	Trail/Dirt Road Structure ID: 86 Watershed: GSE1 Photo # 100_0229		Trail/Dirt Road Structure ID: 86 Watershed: GSE1 Photo # 100_0232
Road 8 at the intersection with Road 7; facing east		Road 8 sloping east; facing west	
	Trail/Dirt Road Structure ID: Watershed : YP Photo # 100_0415		Trail/Dirt Road Structure ID: Watershed: YP Photo # 100_0416
Trail on Seminole Grade; on west side facing west		Same location as 100_0415; facing south-west	

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Trail/Dirt Road
Structure ID: 59
Watershed: YP
Photo # 100_0425



Trail/Dirt Road
Structure ID: 70
Watershed: YP
Photo # 100_0426

Trail on Seminole Grade Rd; facing west

Trail on Seminole Grade Rd; facing west



Trail/Dirt Road
Structure ID: 199
Watershed: YP
Photo # 100_0427



Trail/Dirt Road
Structure ID: 199
Watershed: YP
Photo # 100_0428

Trail on Seminole Grade Rd; facing west

Trail on Seminole Grade Rd; Wetland area on south side of Seminole Grade Rd; on south side facing west

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 Trail/Dirt Road Structure ID: 199 Watershed: YP Photo # 100_0429	 Trail/Dirt Road Structure ID: 199 Watershed: YP Photo # 100_0431
Same as location 100_0429; flooding can be seen.	
 Trail/Dirt Road Structure ID: Watershed: YP Photo # 100_0432	 Trail/Dirt Road Structure ID: Watershed: YP Photo # 100_0435
Flow obstruction (gravel pile) on east side of Seminole Grade; facing south	Trail on east side of Seminole Grade; facing west

APPENDIX B
Results of Hydrologic Models (ICPR and WMM)

Basin Name: DCEBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N9
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 125.19
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 938.93
Time Shift (hrs): 0.00
Area (ac): 8571.460
Vol of Unit Hyd (in): 1.000
Curve Number: 89.700
DCIA (%): 0.000

Time Max (hrs): 47.25
Flow Max (cfs): 2103.00
Runoff Volume (in): 9.234
Runoff Volume (ft3): 287319210

Basin Name: DCWBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N10
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 37.00
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 277.48
Time Shift (hrs): 0.00
Area (ac): 602.020
Vol of Unit Hyd (in): 1.000
Curve Number: 84.400
DCIA (%): 0.000

Time Max (hrs): 39.00
Flow Max (cfs): 346.89
Runoff Volume (in): 8.563
Runoff Volume (ft3): 18712401

Basin Name: GBEBBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N7
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 102.23
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 766.73
Time Shift (hrs): 0.00
Area (ac): 5911.780
Vol of Unit Hyd (in): 1.000
Curve Number: 87.300
DCIA (%): 0.000

Time Max (hrs): 45.00
Flow Max (cfs): 1648.48
Runoff Volume (in): 8.933
Runoff Volume (ft3): 191693756

Basin Name: GBWBS
Group Name: BASE

Simulation: 25yr-72hr
Node Name: N8
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 32.72
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 245.41
Time Shift (hrs): 0.00
Area (ac): 1427.390
Vol of Unit Hyd (in): 1.000
Curve Number: 88.300
DCIA (%): 0.000

Time Max (hrs): 38.50
Flow Max (cfs): 936.55
Runoff Volume (in): 9.058
Runoff Volume (ft3): 46932898

Basin Name: GSE1
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N1
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 336.64
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 2524.87
Time Shift (hrs): 0.00
Area (ac): 19429.500
Vol of Unit Hyd (in): 1.000
Curve Number: 88.800
DCIA (%): 0.000

Time Max (hrs): 68.50
Flow Max (cfs): 2139.19
Runoff Volume (in): 9.122
Runoff Volume (ft3): 643342958

Basin Name: GSE2
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N2
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 134.66
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 1009.96
Time Shift (hrs): 0.00
Area (ac): 7041.070
Vol of Unit Hyd (in): 1.000
Curve Number: 90.100
DCIA (%): 0.000

Time Max (hrs): 48.00
Flow Max (cfs): 1639.64
Runoff Volume (in): 9.284
Runoff Volume (ft3): 237301722

Basin Name: GSEBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N3

Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 164.36
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 1232.75
Time Shift (hrs): 0.00
Area (ac): 9450.300
Vol of Unit Hyd (in): 1.000
Curve Number: 87.300
DCIA (%): 0.000

Time Max (hrs): 51.00
Flow Max (cfs): 1814.58
Runoff Volume (in): 8.933
Runoff Volume (ft3): 306432414

Basin Name: GSWBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N4
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 80.51
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 603.85
Time Shift (hrs): 0.00
Area (ac): 1020.950
Vol of Unit Hyd (in): 1.000
Curve Number: 86.900
DCIA (%): 0.000

Time Max (hrs): 43.00
Flow Max (cfs): 340.52
Runoff Volume (in): 8.882
Runoff Volume (ft3): 32915785

Basin Name: LVR
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N6
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 71.83
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 538.76
Time Shift (hrs): 0.00
Area (ac): 1566.730
Vol of Unit Hyd (in): 1.000
Curve Number: 83.300
DCIA (%): 0.000

Time Max (hrs): 42.25
Flow Max (cfs): 543.08
Runoff Volume (in): 8.424
Runoff Volume (ft3): 47906882

Basin Name: YPEBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N11
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 65.95
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 494.62
Time Shift (hrs): 0.00
Area (ac): 2199.460
Vol of Unit Hyd (in): 1.000
Curve Number: 89.100
DCIA (%): 0.000

Time Max (hrs): 41.50
Flow Max (cfs): 876.40
Runoff Volume (in): 9.159
Runoff Volume (ft3): 73123066

Basin Name: YPWBS
Group Name: BASE
Simulation: 25yr-72hr
Node Name: N12
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 28.93
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 10.500
Storm Duration (hrs): 72.00
Status: Onsite
Time of Conc (min): 216.96
Time Shift (hrs): 0.00
Area (ac): 437.670
Vol of Unit Hyd (in): 1.000
Curve Number: 84.000
DCIA (%): 0.000

Time Max (hrs): 38.25
Flow Max (cfs): 297.43
Runoff Volume (in): 8.509
Runoff Volume (ft3): 13517879

Basin Name: DCEBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N9
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 125.19
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 938.93
Time Shift (hrs): 0.00
Area (ac): 8571.460
Vol of Unit Hyd (in): 1.000
Curve Number: 89.700
DCIA (%): 0.000

Time Max (hrs): 24.25
Flow Max (cfs): 958.27
Runoff Volume (in): 3.364
Runoff Volume (ft3): 104675639

Basin Name: DCWBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N10
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0

Spec Time Inc (min): 37.00
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 277.48
Time Shift (hrs): 0.00
Area (ac): 602.020
Vol of Unit Hyd (in): 1.000
Curve Number: 84.400
DCIA (%): 0.000

Time Max (hrs): 15.50
Flow Max (cfs): 149.67
Runoff Volume (in): 2.852
Runoff Volume (ft3): 6232409

Basin Name: GBEBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N7
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 102.23
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 766.73
Time Shift (hrs): 0.00
Area (ac): 5911.780
Vol of Unit Hyd (in): 1.000
Curve Number: 87.300
DCIA (%): 0.000

Time Max (hrs): 22.00
Flow Max (cfs): 722.42
Runoff Volume (in): 3.127
Runoff Volume (ft3): 67102303

Basin Name: GBWBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N8
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 32.72
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 245.41
Time Shift (hrs): 0.00
Area (ac): 1427.390
Vol of Unit Hyd (in): 1.000
Curve Number: 88.300
DCIA (%): 0.000

Time Max (hrs): 15.00
Flow Max (cfs): 445.65
Runoff Volume (in): 3.224
Runoff Volume (ft3): 16706672

Basin Name: GSE1
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N1
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 336.64
Comp Time Inc (min): 15.00

Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 2524.87
Time Shift (hrs): 0.00
Area (ac): 19429.500
Vol of Unit Hyd (in): 1.000
Curve Number: 88.800
DCIA (%): 0.000

Time Max (hrs): 42.50
Flow Max (cfs): 878.04
Runoff Volume (in): 3.274
Runoff Volume (ft3): 230923208

Basin Name: GSE2
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N2
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 134.66
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 1009.96
Time Shift (hrs): 0.00
Area (ac): 7041.070
Vol of Unit Hyd (in): 1.000
Curve Number: 90.100
DCIA (%): 0.000

Time Max (hrs): 25.25
Flow Max (cfs): 750.28
Runoff Volume (in): 3.405
Runoff Volume (ft3): 87022725

Basin Name: GSEBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N3
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 164.36
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 1232.75
Time Shift (hrs): 0.00
Area (ac): 9450.300
Vol of Unit Hyd (in): 1.000
Curve Number: 87.300
DCIA (%): 0.000

Time Max (hrs): 28.25
Flow Max (cfs): 781.95
Runoff Volume (in): 3.127
Runoff Volume (ft3): 107266512

Basin Name: GSWBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N4
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 80.51
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500

Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 603.85
Time Shift (hrs): 0.00
Area (ac): 1020.950
Vol of Unit Hyd (in): 1.000
Curve Number: 86.900
DCIA (%): 0.000

Time Max (hrs): 19.75
Flow Max (cfs): 149.09
Runoff Volume (in): 3.088
Runoff Volume (ft3): 11444526

Basin Name: LVR
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N6
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 71.83
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 538.76
Time Shift (hrs): 0.00
Area (ac): 1566.730
Vol of Unit Hyd (in): 1.000
Curve Number: 83.300
DCIA (%): 0.000

Time Max (hrs): 19.00
Flow Max (cfs): 221.89
Runoff Volume (in): 2.752
Runoff Volume (ft3): 15650275

Basin Name: YPEBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N11
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 65.95
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite
Time of Conc (min): 494.62
Time Shift (hrs): 0.00
Area (ac): 2199.460
Vol of Unit Hyd (in): 1.000
Curve Number: 89.100
DCIA (%): 0.000

Time Max (hrs): 18.25
Flow Max (cfs): 404.12
Runoff Volume (in): 3.304
Runoff Volume (ft3): 26377761

Basin Name: YPWBS
Group Name: BASE
Simulation: 2yr-24hr
Node Name: N12
Basin Type: SCS Unit Hydrograph

Unit Hydrograph: Uh256
Peaking Fator: 256.0
Spec Time Inc (min): 28.93
Comp Time Inc (min): 15.00
Rainfall File: Flmod
Rainfall Amount (in): 4.500
Storm Duration (hrs): 24.00
Status: Onsite

Time of Conc (min): 216.96
Time Shift (hrs): 0.00
Area (ac): 437.670
Vol of Unit Hyd (in): 1.000
Curve Number: 84.000
DCIA (%): 0.000

Time Max (hrs): 14.50
Flow Max (cfs): 130.00
Runoff Volume (in): 2.814
Runoff Volume (ft3): 4470888

Name	Group	Simulation	Max Time Stage hrs	Max Stage ft	Warning Stage ft	Max Delta Stage ft	Max Surf Area ft2	Max Time Inflow hrs	Max Inflow cfs	Max Time Outflow hrs	Max Outflow cfs
N1	BASE	25yr-72hr	175.58	25.76	28.00	0.0005	234144000	68.50	2139.19	72.23	465.92
N10	BASE	25yr-72hr	39.52	0.22	2.00	-0.0009	1451012	39.00	388.52	39.52	384.39
N10a	BASE	25yr-72hr	0.00	0.00	2.00	0.0000	188444	39.52	384.39	0.00	0.00
N11	BASE	25yr-72hr	43.49	10.05	12.00	0.0082	1543332	41.50	876.40	43.44	827.60
N11a	BASE	25yr-72hr	47.95	9.06	12.00	0.0034	2761903	43.44	827.60	47.97	631.21
N12	BASE	25yr-72hr	50.43	0.58	2.00	0.0005	8086815	47.41	732.05	50.43	689.93
N12a	BASE	25yr-72hr	0.00	0.00	2.00	0.0000	188066	50.43	689.93	0.00	0.00
N1a	BASE	25yr-72hr	179.76	25.62	28.00	0.0009	11704058	72.23	465.92	153.52	418.96
N2	BASE	25yr-72hr	105.97	16.35	18.00	0.0026	90315729	48.25	1722.30	82.25	864.06
N2a	BASE	25yr-72hr	108.45	16.16	18.00	0.0009	17029022	82.25	864.06	108.94	637.56
N3	BASE	25yr-72hr	97.19	6.22	7.00	0.0025	51770093	52.78	2028.65	97.02	1289.32
N3a	BASE	25yr-72hr	97.29	5.21	7.00	0.0044	618848	97.02	1289.32	97.50	1289.31
N4	BASE	25yr-72hr	93.54	0.68	5.00	-0.0006	24431674	87.62	1311.42	93.54	1306.97
N4a	BASE	25yr-72hr	0.00	0.00	5.00	0.0000	250663	93.54	1306.97	0.00	0.00
N5	BASE	25yr-72hr	99.13	6.98	9.00	-0.0777	353	101.81	182.99	101.81	182.99
N5a	BASE	25yr-72hr	101.80	6.10	9.00	0.0001	965487	99.13	57.09	101.80	56.92
N6	BASE	25yr-72hr	42.76	0.17	6.00	-0.0010	2988830	42.25	543.08	42.76	540.75
N6a	BASE	25yr-72hr	0.00	0.00	6.00	0.0000	250641	42.76	540.75	0.00	0.00
N7	BASE	25yr-72hr	101.81	11.69	11.00	0.0020	107864967	45.25	1654.52	101.81	275.43
N7a	BASE	25yr-72hr	104.27	8.36	11.00	0.0003	3579506	101.81	92.44	104.26	92.42
N8	BASE	25yr-72hr	40.89	0.42	6.00	0.0008	11717947	38.50	937.01	40.89	742.40
N8a	BASE	25yr-72hr	0.00	0.00	6.00	0.0000	250566	40.89	742.40	0.00	0.00
N9	BASE	25yr-72hr	105.45	12.68	11.00	0.0035	160768771	47.25	2103.00	115.77	226.54
N9a	BASE	25yr-72hr	106.43	8.13	11.00	0.0007	771447	105.45	82.74	106.43	82.74
N1	BASE	2yr-24hr	137.73	24.06	28.00	0.0006	101556203	42.50	878.04	52.65	257.19
N10	BASE	2yr-24hr	0.00	0.10	2.00	-0.0009	999890	15.50	150.51	0.00	245.25
N10a	BASE	2yr-24hr	0.00	0.00	2.00	0.0000	188444	0.00	245.25	0.00	0.00
N11	BASE	2yr-24hr	19.67	7.61	12.00	0.0082	697395	18.25	404.12	19.63	390.19
N11a	BASE	2yr-24hr	27.36	6.47	12.00	0.0031	2755152	19.63	390.19	27.34	260.91
N12	BASE	2yr-24hr	26.87	0.14	2.00	-0.0004	7675491	25.17	297.97	26.87	292.40
N12a	BASE	2yr-24hr	0.00	0.00	2.00	0.0000	188066	26.87	292.40	0.00	0.00
N1a	BASE	2yr-24hr	139.03	24.02	28.00	0.0009	9404956	52.65	257.19	137.35	170.30
N2	BASE	2yr-24hr	41.50	14.85	18.00	0.0024	16926158	25.26	802.23	41.30	476.59
N2a	BASE	2yr-24hr	70.65	14.33	18.00	0.0011	16999322	41.30	476.59	70.58	306.68
N3	BASE	2yr-24hr	65.85	2.60	7.00	0.0021	20963382	28.99	871.26	65.19	512.48
N3a	BASE	2yr-24hr	65.91	2.50	7.00	0.0050	606686	65.19	512.48	65.96	512.45
N4	BASE	2yr-24hr	63.87	0.14	5.00	-0.0006	23022057	60.93	521.09	63.87	520.35
N4a	BASE	2yr-24hr	0.00	0.00	5.00	0.0000	250663	63.87	520.35	0.00	0.00
N5	BASE	2yr-24hr	0.00	5.40	9.00	-0.0777	125	79.52	15.91	0.00	21.05
N5a	BASE	2yr-24hr	0.00	5.20	9.00	0.0000	276436	0.00	0.00	0.00	0.00
N6	BASE	2yr-24hr	0.00	0.10	6.00	-0.0010	2394824	19.00	221.89	0.00	412.50
N6a	BASE	2yr-24hr	0.00	0.00	6.00	0.0000	250641	0.00	412.50	0.00	0.00
N7	BASE	2yr-24hr	79.52	10.33	11.00	0.0018	46396283	22.01	722.41	79.52	67.21
N7a	BASE	2yr-24hr	81.98	8.25	11.00	0.0002	3579265	79.52	51.30	81.98	51.23
N8	BASE	2yr-24hr	16.58	0.14	6.00	0.0005	10803496	15.00	445.65	16.58	386.34
N8a	BASE	2yr-24hr	0.00	0.00	6.00	0.0000	250566	16.58	386.34	0.00	0.00
N9	BASE	2yr-24hr	79.50	11.57	11.00	0.0037	95540805	24.26	958.25	79.50	101.16
N9a	BASE	2yr-24hr	80.57	8.05	11.00	0.0008	771131	79.50	65.39	80.57	65.38

Name	Group	Simulation	Max Time Flow hrs	Max Flow cfs	Max Delta Q cfs	Max Time US Stage hrs	Max US Stage ft	Max Time DS Stage hrs	Max DS Stage ft
CN10N10a	BASE	25yr-72hr	39.52	384.39	245.252	39.52	0.22	0.00	0.00
CN11a12	BASE	25yr-72hr	47.97	631.21	126.520	47.95	9.06	50.43	0.58
CN12N12a	BASE	25yr-72hr	50.43	689.93	244.993	50.43	0.58	0.00	0.00
CN1aN2	BASE	25yr-72hr	153.52	418.96	13.940	179.76	25.62	105.97	16.35
CN2aN3	BASE	25yr-72hr	108.94	637.56	37.024	108.45	16.16	97.19	6.22
CN3aN4	BASE	25yr-72hr	97.50	1289.31	-217.010	97.29	5.21	93.54	0.68
CN4N4a	BASE	25yr-72hr	93.54	1306.97	430.657	93.54	0.68	0.00	0.00
CN5aN6	BASE	25yr-72hr	101.80	56.92	0.009	101.80	6.10	42.76	0.17
CN6N6a	BASE	25yr-72hr	42.76	540.75	412.499	42.76	0.17	0.00	0.00
CN7aN8	BASE	25yr-72hr	104.26	92.42	0.055	104.27	8.36	40.89	0.42
CN8N8a	BASE	25yr-72hr	40.89	742.40	326.981	40.89	0.42	0.00	0.00
CN9aN10	BASE	25yr-72hr	106.43	82.74	0.086	106.43	8.13	39.52	0.22
N11N11a	BASE	25yr-72hr	43.44	827.60	194.471	43.49	10.05	47.95	9.06
N1N1a	BASE	25yr-72hr	72.23	465.92	96.346	175.58	25.76	179.76	25.62
N2N2a	BASE	25yr-72hr	82.25	864.06	97.259	105.97	16.35	108.45	16.16
N3N3a	BASE	25yr-72hr	97.02	1289.32	192.788	97.19	6.22	97.29	5.21
N5N5a	BASE	25yr-72hr	99.13	57.09	0.266	99.13	6.98	99.13	6.17
N7N7a	BASE	25yr-72hr	101.81	92.44	-0.474	101.81	11.69	55.04	10.00
N9N9a	BASE	25yr-72hr	105.45	82.74	0.088	105.45	12.68	105.45	9.25
WN11N9-0	BASE	25yr-72hr	0.00	0.00	-0.006	43.49	10.05	105.45	12.68
WN5N3-0	BASE	25yr-72hr	138.76	132.20	21.048	99.13	6.98	97.19	6.22
WN7N5-0	BASE	25yr-72hr	101.81	182.99	0.045	101.81	11.69	99.13	6.98
WN9N7-0	BASE	25yr-72hr	120.14	144.10	0.064	105.45	12.68	101.81	11.69
CN10N10a	BASE	2yr-24hr	0.00	245.25	245.252	0.00	0.10	0.00	0.00
CN11a12	BASE	2yr-24hr	27.34	260.91	126.520	27.36	6.47	26.87	0.14
CN12N12a	BASE	2yr-24hr	26.87	292.40	244.993	26.87	0.14	0.00	0.00
CN1aN2	BASE	2yr-24hr	137.35	170.30	13.940	139.03	24.02	41.50	14.85
CN2aN3	BASE	2yr-24hr	70.58	306.68	37.024	70.65	14.33	65.85	2.60
CN3aN4	BASE	2yr-24hr	65.96	512.45	-217.010	65.91	2.50	63.87	0.14
CN4N4a	BASE	2yr-24hr	63.87	520.35	430.657	63.87	0.14	0.00	0.00
CN5aN6	BASE	2yr-24hr	0.00	0.00	0.000	0.00	5.20	0.00	0.10
CN6N6a	BASE	2yr-24hr	0.00	412.50	412.499	0.00	0.10	0.00	0.00
CN7aN8	BASE	2yr-24hr	81.98	51.23	0.040	81.98	8.25	16.58	0.14
CN8N8a	BASE	2yr-24hr	16.58	386.34	326.981	16.58	0.14	0.00	0.00
CN9aN10	BASE	2yr-24hr	80.57	65.38	0.079	80.57	8.05	0.00	0.10
N11N11a	BASE	2yr-24hr	19.63	390.19	-195.107	19.67	7.61	29.54	6.41
N1N1a	BASE	2yr-24hr	52.65	257.19	96.346	137.73	24.06	139.03	24.02
N2N2a	BASE	2yr-24hr	41.30	476.59	265.758	41.50	14.85	70.65	14.33
N3N3a	BASE	2yr-24hr	65.19	512.48	-339.118	65.85	2.60	65.91	2.50
N5N5a	BASE	2yr-24hr	0.00	0.00	0.000	0.00	5.40	0.00	5.20
N7N7a	BASE	2yr-24hr	79.52	51.30	0.563	79.52	10.33	78.29	9.31
N9N9a	BASE	2yr-24hr	79.50	65.39	0.093	79.50	11.57	79.50	8.99
WN11N9-0	BASE	2yr-24hr	0.00	0.00	0.000	19.67	7.61	79.50	11.57
WN5N3-0	BASE	2yr-24hr	0.00	21.05	21.048	0.00	5.40	65.85	2.60
WN7N5-0	BASE	2yr-24hr	79.52	15.91	0.006	79.52	10.33	0.00	5.40
WN9N7-0	BASE	2yr-24hr	79.50	35.78	0.028	79.50	11.57	79.52	10.33

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---- Basins -----
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      Name: DCEBS              Node: N9              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 938.93
      Area(ac): 8571.460             Time Shift(hrs): 0.00
      Curve Number: 89.70            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

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      Name: DCWBS              Node: N10             Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 277.48
      Area(ac): 602.020             Time Shift(hrs): 0.00
      Curve Number: 84.40            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

-----

      Name: GBEBS              Node: N7              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 766.73
      Area(ac): 5911.780             Time Shift(hrs): 0.00
      Curve Number: 87.30            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

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      Name: GBWBS              Node: N8              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 245.41
      Area(ac): 1427.390             Time Shift(hrs): 0.00
      Curve Number: 88.30            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

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      Name: GSE1              Node: N1              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 2524.87
      Area(ac): 19429.500            Time Shift(hrs): 0.00
      Curve Number: 88.80            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

-----

      Name: GSE2              Node: N2              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 1009.96
      Area(ac): 7041.070             Time Shift(hrs): 0.00
      Curve Number: 90.10            Max Allowable Q(cfs): 999999.000
      DCIA(%): 0.00

-----

      Name: GSEBS              Node: N3              Status: Onsite
      Group: BASE              Type: SCS Unit Hydrograph CN

      Unit Hydrograph: Uh256          Peaking Factor: 256.0
      Rainfall File:                Storm Duration(hrs): 0.00
      Rainfall Amount(in): 0.000      Time of Conc(min): 1232.75

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Area(ac): 9450.300 Time Shift(hrs): 0.00
Curve Number: 87.30 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: GSWBS Node: N4 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 603.85
Area(ac): 1020.950 Time Shift(hrs): 0.00
Curve Number: 86.90 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: LVR Node: N6 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 538.76
Area(ac): 1566.730 Time Shift(hrs): 0.00
Curve Number: 83.30 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: YPEBS Node: N11 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 494.62
Area(ac): 2199.460 Time Shift(hrs): 0.00
Curve Number: 89.10 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

Name: YPWBS Node: N12 Status: Onsite
Group: BASE Type: SCS Unit Hydrograph CN

Unit Hydrograph: Uh256 Peaking Factor: 256.0
Rainfall File: Storm Duration(hrs): 0.00
Rainfall Amount(in): 0.000 Time of Conc(min): 216.96
Area(ac): 437.670 Time Shift(hrs): 0.00
Curve Number: 84.00 Max Allowable Q(cfs): 999999.000
DCIA(%): 0.00

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Nodes
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Name: N1 Base Flow(cfs): 0.000 Init Stage(ft): 22.500
Group: BASE Warn Stage(ft): 28.000
Type: Stage/Area

Node at the east end of culvert at Subbasin "GSE1"; GatorSlough East of I-75
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
21.000	0.0020
25.000	3050.7200
30.000	18432.2800
35.000	19429.8000

Name: N10 Base Flow(cfs): 0.000 Init Stage(ft): 0.100
Group: BASE Warn Stage(ft): 2.000
Type: Stage/Area

Outfall at Subbasin "DCWBS"; Durden Creek West of Burnt Store Road
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-5.000	0.0020
0.000	0.0200
5.000	247.4000

10.000	602.0300		

Name: N10a	Base Flow(cfs): 0.000	Init Stage(ft): 0.000	
Group: BASE		Warn Stage(ft): 2.000	
Type: Time/Stage			
Time(hrs)	Stage(ft)		

0.00	0.000		
250.00	0.000		

Name: N11	Base Flow(cfs): 0.000	Init Stage(ft): 4.000	
Group: BASE		Warn Stage(ft): 12.000	
Type: Stage/Area			
Node at the east end of culvert at Subbasin "YPEBS"; Yucca Pen Creek East of Burnt Store Road			
Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

4.000	0.0020		
10.000	26.5900		
15.000	865.8600		
20.000	2199.4600		

Name: N11a	Base Flow(cfs): 0.000	Init Stage(ft): 5.000	
Group: BASE		Warn Stage(ft): 12.000	
Type: Stage/Area			
Node at the west end of culvert at Subbasin "YPEBS"; Yucca Pen Creek East of Burnt Store Road			
Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

0.000	0.0020		
20.000	0.0020		

Name: N12	Base Flow(cfs): 0.000	Init Stage(ft): 0.100	
Group: BASE		Warn Stage(ft): 2.000	
Type: Stage/Area			
Outfall at Subbasin "YPWBS"; Yucca Pen Creek West of Burnt Store Road			
Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

-5.000	0.0020		
5.000	211.4700		
10.000	437.6700		

Name: N12a	Base Flow(cfs): 0.000	Init Stage(ft): 0.000	
Group: BASE		Warn Stage(ft): 2.000	
Type: Time/Stage			
Time(hrs)	Stage(ft)		

0.00	0.000		
250.00	0.000		

Name: N1a	Base Flow(cfs): 0.000	Init Stage(ft): 21.500	
Group: BASE		Warn Stage(ft): 28.000	
Type: Stage/Area			
Node at the west end of culvert at Subbasin "GSE1"; GatorSlough East of I-75			
Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

21.000	0.0020		
35.000	0.0020		

Name: N2	Base Flow(cfs): 0.000	Init Stage(ft): 13.000	
Group: BASE		Warn Stage(ft): 18.000	
Type: Stage/Area			
Node at the east end of culvert at Subbasin "GSE2"; GatorSlough West of I-75			

Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
5.000	20.1900
10.000	73.1900
15.000	191.8100
20.000	6216.6750
25.000	7040.5150
30.000	7041.0750

Name: N2a	Base Flow(cfs): 0.000	Init Stage(ft): 12.000
Group: BASE		Warn Stage(ft): 18.000
Type: Stage/Area		

Node at the west end of culvert at Subbasin "GSE2"; GatorSlough West of I-75
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
5.000	0.0020
30.000	0.0020

Name: N3	Base Flow(cfs): 0.000	Init Stage(ft): -0.500
Group: BASE		Warn Stage(ft): 7.000
Type: Stage/Area		

Node at the east end of culvert at Subbasin "GSEBS"; GatorSlough East of Burnstore Road
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-5.000	1.6200
0.000	8.1300
5.000	167.1300
10.000	2745.8900
15.000	9433.6300
20.000	9450.2500

Name: N3a	Base Flow(cfs): 0.000	Init Stage(ft): -1.600
Group: BASE		Warn Stage(ft): 7.000
Type: Stage/Area		

Node at the west end of culvert at Subbasin "GSEBS"; GatorSlough East of Burnstore Road
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-5.000	0.0020
20.000	0.0020

Name: N4	Base Flow(cfs): 0.000	Init Stage(ft): 0.100
Group: BASE		Warn Stage(ft): 5.000
Type: Stage/Area		

Outfall from subbasin "GSWBS"; GatorSlough West of Burnstore Road
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-3.000	0.0020
0.000	500.4400
5.000	798.6600
10.000	1020.9600

Name: N4a	Base Flow(cfs): 0.000	Init Stage(ft): 0.000
Group: BASE		Warn Stage(ft): 5.000
Type: Time/Stage		

Time(hrs)	Stage(ft)
0.00	0.000
250.00	0.000

Name: N5	Base Flow(cfs): 0.000	Init Stage(ft): 5.400
Group: BASE		Warn Stage(ft): 9.000
Type: Stage/Area		

Node at the east end of culvert at Subbasin "LVR"; Longview Run

Warning stage obtained from 2ft contour map
Initial stage obtained from P-5110 structure ID

Stage(ft)	Area(ac)
5.000	0.0020
15.000	0.0020

Name: N5a	Base Flow(cfs): 0.000	Init Stage(ft): 5.200
Group: BASE		Warn Stage(ft): 9.000
Type: Stage/Area		

Node at the west end of culvert at Subbasin "LVR"; Longview Run
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-5.000	0.0020
20.000	0.0020

Name: N6	Base Flow(cfs): 0.000	Init Stage(ft): 0.100
Group: BASE		Warn Stage(ft): 6.000
Type: Stage/Area		

Outfall at Subbasin "LVR"; Longview Run
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
0.000	11.4700
5.000	1058.0000
10.000	1566.7200

Name: N6a	Base Flow(cfs): 0.000	Init Stage(ft): 0.000
Group: BASE		Warn Stage(ft): 6.000
Type: Time/Stage		

Time(hrs)	Stage(ft)
0.00	0.000
250.00	0.000

Name: N7	Base Flow(cfs): 0.000	Init Stage(ft): 8.100
Group: BASE		Warn Stage(ft): 11.000
Type: Stage/Area		

Node at the east end of culvert at Subbasin "GBEBS"; Greenwell Branch East of Burnt Store Road
Warning stage obtained from 2ft contour map
Initial stage obtained from P-3190 structure ID

Stage(ft)	Area(ac)
5.000	2.2000
10.000	720.4800
15.000	5911.2900

Name: N7a	Base Flow(cfs): 0.000	Init Stage(ft): 8.000
Group: BASE		Warn Stage(ft): 11.000
Type: Stage/Area		

Node at the west end of culvert at Subbasin "GBEBS"; Greenwell Branch East of Burnt Store Road
Warning stage obtained from 2ft contour map
Initial stage obtained from P-3190 structure ID

Stage(ft)	Area(ac)
5.000	0.0020
20.000	0.0020

Name: N8	Base Flow(cfs): 0.000	Init Stage(ft): 0.100
Group: BASE		Warn Stage(ft): 6.000
Type: Stage/Area		

Outfall at Subbasin "GBWBS"; Greenwell Branch West of Burnt Store Road
Warning stage obtained from 2ft contour map

Stage(ft)	Area(ac)
-2.000	0.0020

5.000	524.2300		
10.000	1427.3900		

Name: N8a	Base Flow(cfs): 0.000	Init Stage(ft): 0.000	
Group: BASE		Warn Stage(ft): 6.000	
Type: Time/Stage			
Time(hrs)	Stage(ft)		

0.00	0.000		
250.00	0.000		

Name: N9	Base Flow(cfs): 0.000	Init Stage(ft): 8.100	
Group: BASE		Warn Stage(ft): 11.000	
Type: Stage/Area			
Node at the east end of culvert at Subbasin "DCEBS"; Durden Creek East of Burnt Store Road Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

5.000	0.0020		
10.000	69.2700		
15.000	6834.9700		
20.000	8475.4300		
25.000	8489.9000		
30.000	8504.9400		

Name: N9a	Base Flow(cfs): 0.000	Init Stage(ft): 7.500	
Group: BASE		Warn Stage(ft): 11.000	
Type: Stage/Area			
Node at the west end of culvert at Subbasin "DCEBS"; Durden Creek East of Burnt Store Road Warning stage obtained from 2ft contour map			
Stage(ft)	Area(ac)		

0.000	0.0020		
70.000	0.0020		
=====			
=== Cross Sections =====			
=====			
Name:	Group: BASE		
Encroachment: No			
Station(ft)	Elevation(ft)	Manning's N	

=====			
=== Pipes =====			
=====			
Name: N11N11a	From Node: N11	Length(ft): 40.00	
Group: BASE	To Node: N11a	Count: 2	
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic	
Geometry: Rectangular	Rectangular	Solution Algorithm: Most Restrictive	
Span(in): 120.00	120.00	Flow: Both	
Rise(in): 84.00	84.00	Entrance Loss Coef: 0.00	
Invert(ft): 4.000	3.000	Exit Loss Coef: 1.00	
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00	
Top Clip(in): 1.000	1.000	Outlet Ctrl Spec: Use dc or tw	
Bot Clip(in): 1.000	1.000	Inlet Ctrl Spec: Use dc	
		Stabilizer Option: None	
Upstream FHWA Inlet Edge Description: Rectangular Box: 30° to 75° wingwall flares			
Downstream FHWA Inlet Edge Description: Rectangular Box: 30° to 75° wingwall flares			
Inverts obtained from P-1040 structure ID			

Name: N1N1a	From Node: N1	Length(ft): 100.00	
Group: BASE	To Node: N1a	Count: 3	
		Friction Equation: Automatic	

	UPSTREAM	DOWNSTREAM	Solution Algorithm: Most Restrictive
Geometry:	Rectangular	Rectangular	Flow: Both
Span(in):	144.00	144.00	Entrance Loss Coef: 0.50
Rise(in):	60.00	60.00	Exit Loss Coef: 1.00
Invert(ft):	21.500	20.500	Bend Loss Coef: 0.50
Manning's N:	0.013000	0.013000	Outlet Ctrl Spec: Use dn or tw
Top Clip(in):	1.000	1.000	Inlet Ctrl Spec: Use dc
Bot Clip(in):	1.000	1.000	Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Downstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Name: N2N2a	From Node: N2	Length(ft): 80.00
Group: BASE	To Node: N2a	Count: 3
		Friction Equation: Automatic
		Solution Algorithm: Most Restrictive
		Flow: Both
Geometry: Rectangular	Rectangular	Entrance Loss Coef: 0.00
Span(in): 144.00	144.00	Exit Loss Coef: 1.00
Rise(in): 60.00	60.00	Bend Loss Coef: 0.00
Invert(ft): 12.000	11.000	Outlet Ctrl Spec: Use dc or tw
Manning's N: 0.013000	0.013000	Inlet Ctrl Spec: Use dc
Top Clip(in): 1.000	1.000	Stabilizer Option: None
Bot Clip(in): 1.000	1.000	

Upstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Downstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Name: N3N3a	From Node: N3	Length(ft): 80.00
Group: BASE	To Node: N3a	Count: 3
		Friction Equation: Automatic
		Solution Algorithm: Most Restrictive
		Flow: Both
Geometry: Rectangular	Rectangular	Entrance Loss Coef: 0.00
Span(in): 144.00	144.00	Exit Loss Coef: 1.00
Rise(in): 60.00	60.00	Bend Loss Coef: 0.00
Invert(ft): -1.500	-2.600	Outlet Ctrl Spec: Use dc or tw
Manning's N: 0.013000	0.013000	Inlet Ctrl Spec: Use dc
Top Clip(in): 1.000	1.000	Stabilizer Option: None
Bot Clip(in): 1.000	1.000	

Upstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Downstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Inverts Obtained from P-6550 structure ID

Name: N5N5a	From Node: N5	Length(ft): 40.00
Group: BASE	To Node: N5a	Count: 4
		Friction Equation: Automatic
		Solution Algorithm: Most Restrictive
		Flow: Both
Geometry: Rectangular	Rectangular	Entrance Loss Coef: 0.00
Span(in): 36.00	36.00	Exit Loss Coef: 1.00
Rise(in): 24.00	24.00	Bend Loss Coef: 0.00
Invert(ft): 5.400	5.200	Outlet Ctrl Spec: Use dc or tw
Manning's N: 0.013000	0.013000	Inlet Ctrl Spec: Use dc
Top Clip(in): 1.000	1.000	Stabilizer Option: None
Bot Clip(in): 1.000	1.000	

Upstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Downstream FHWA Inlet Edge Description:
Rectangular Box: 30° to 75° wingwall flares

Inverts obtained from P-5110 structure ID

Name: N7N7a	From Node: N7	Length(ft): 40.00
Group: BASE	To Node: N7a	Count: 4
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 24.00	24.00	Flow: Both
Rise(in): 24.00	24.00	Entrance Loss Coef: 0.00
Invert(ft): 8.100	8.000	Exit Loss Coef: 1.00
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00
Top Clip(in): 1.000	1.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 1.000	1.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Inverts obtained from Countour GIS Map

Name: N9N9a	From Node: N9	Length(ft): 40.00
Group: BASE	To Node: N9a	Count: 2
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Circular	Circular	Solution Algorithm: Most Restrictive
Span(in): 30.00	30.00	Flow: Both
Rise(in): 30.00	30.00	Entrance Loss Coef: 0.00
Invert(ft): 8.100	7.500	Exit Loss Coef: 1.00
Manning's N: 0.013000	0.013000	Bend Loss Coef: 0.00
Top Clip(in): 1.000	1.000	Outlet Ctrl Spec: Use dc or tw
Bot Clip(in): 1.000	1.000	Inlet Ctrl Spec: Use dc
		Stabilizer Option: None

Upstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Downstream FHWA Inlet Edge Description:
Circular Concrete: Square edge w/ headwall

Inverts obtained from P-2040 structure ID

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==== Channels =====
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Name: CN10N10a	From Node: N10	Length(ft): 500.00
Group: BASE	To Node: N10a	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): -3.000	-4.000	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft): 750.000	750.000	
LtSdSlp(h/v): 0.50	0.50	
RtSdSlp(h/v): 0.50	0.50	

Name: CN11a12	From Node: N11a	Length(ft): 10974.00
Group: BASE	To Node: N12	Count: 1
UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): 3.000	-3.000	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top Width(ft):		

Depth(ft):
 Bot Width(ft): 500.000 500.000
 LtSdSlp(h/v): 0.30 0.30
 RtSdSlp(h/v): 0.30 0.30

Name: CN12N12a	From Node: N12	Length(ft): 500.00
Group: BASE	To Node: N12a	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): -3.000	-4.000	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft): 750.000	750.000	
LtSdSlp(h/v): 0.30	0.30	
RtSdSlp(h/v): 0.30	0.30	

Name: CN1aN2	From Node: N1a	Length(ft): 22500.00
Group: BASE	To Node: N2	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Parabolic	Parabolic	Solution Algorithm: Automatic
Invert(ft): 20.500	12.000	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top Width(ft): 750.000	750.000	
Depth(ft): 2.500	2.500	
Bot Width(ft):		
LtSdSlp(h/v):		
RtSdSlp(h/v):		

Name: CN2aN3	From Node: N2a	Length(ft): 45200.00
Group: BASE	To Node: N3	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): 11.000	-1.500	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef: 0.000
Main XSec:		Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec: Use dc
Aux XSec1:		Stabilizer Option: None
AuxElev2(ft):		
Aux XSec2:		
Top Width(ft):		
Depth(ft):		
Bot Width(ft): 750.000	750.000	
LtSdSlp(h/v): 0.30	0.30	
RtSdSlp(h/v): 0.30	0.30	

Name: CN3aN4	From Node: N3a	Length(ft): 11572.00
Group: BASE	To Node: N4	Count: 1

UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft): -2.600	-3.600	Flow: Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef: 0.100
Manning's N: 0.050000	0.050000	Expansion Coef: 0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef: 0.000

Bot Clip(ft):	0.000	0.000	Exit Loss Coef:	0.000
Main XSec:			Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec:	Use dc
Aux XSec1:			Stabilizer Option:	None
AuxElev2(ft):				
Aux XSec2:				
Top Width(ft):				
Depth(ft):				
Bot Width(ft):	100.000	100.000		
LtSdSlp(h/v):	0.50	0.50		
RtSdSlp(h/v):	0.50	0.50		

Name:	CN4N4a	From Node:	N4	Length(ft):	500.00
Group:	BASE	To Node:	N4a	Count:	1

UPSTREAM	DOWNSTREAM	Friction Equation:	Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft): -3.600	-4.600	Flow:	Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef:	0.100
Manning's N: 0.500000	0.500000	Expansion Coef:	0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef:	0.000
Main XSec:		Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec:	Use dc
Aux XSec1:		Stabilizer Option:	None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	1000.000	1000.000	
LtSdSlp(h/v):	0.50	0.50	
RtSdSlp(h/v):	0.50	0.00	

Name:	CN5aN6	From Node:	N5a	Length(ft):	12807.00
Group:	BASE	To Node:	N6	Count:	1

UPSTREAM	DOWNSTREAM	Friction Equation:	Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft): 5.200	0.000	Flow:	Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef:	0.100
Manning's N: 0.050000	0.050000	Expansion Coef:	0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef:	0.000
Main XSec:		Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec:	Use dc
Aux XSec1:		Stabilizer Option:	None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	150.000	150.000	
LtSdSlp(h/v):	0.50	0.50	
RtSdSlp(h/v):	0.50	0.50	

Name:	CN6N6a	From Node:	N6	Length(ft):	500.00
Group:	BASE	To Node:	N6a	Count:	1

UPSTREAM	DOWNSTREAM	Friction Equation:	Automatic
Geometry: Trapezoidal	Trapezoidal	Solution Algorithm:	Automatic
Invert(ft): -3.500	-4.500	Flow:	Both
TClpInitZ(ft): 9999.000	9999.000	Contraction Coef:	0.100
Manning's N: 0.500000	0.500000	Expansion Coef:	0.300
Top Clip(ft): 0.000	0.000	Entrance Loss Coef:	0.000
Bot Clip(ft): 0.000	0.000	Exit Loss Coef:	0.000
Main XSec:		Outlet Ctrl Spec:	Use dc or tw
AuxElev1(ft):		Inlet Ctrl Spec:	Use dc
Aux XSec1:		Stabilizer Option:	None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	1000.000	1000.000	
LtSdSlp(h/v):	0.30	0.30	
RtSdSlp(h/v):	0.30	0.30	

Name:	CN7aN8	From Node:	N7a	Length(ft):	14300.00
Group:	BASE	To Node:	N8	Count:	1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	8.000	-3.000	Flow: Both
TClpInitZ(ft):	9999.000	9999.000	Contraction Coef: 0.100
Manning's N:	0.050000	0.050000	Expansion Coef: 0.300
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	500.000	500.000	
LtSdSlp(h/v):	0.30	0.30	
RtSdSlp(h/v):	0.30	0.30	

Name: CN8N8a	From Node: N8	Length(ft): 500.00
Group: BASE	To Node: N8a	Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	-3.000	-4.000	Flow: Both
TClpInitZ(ft):	9999.000	9999.000	Contraction Coef: 0.100
Manning's N:	0.500000	0.500000	Expansion Coef: 0.300
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	1000.000	1000.000	
LtSdSlp(h/v):	0.30	0.30	
RtSdSlp(h/v):	0.30	0.30	

Name: CN9aN10	From Node: N9a	Length(ft): 10200.00
Group: BASE	To Node: N10	Count: 1

	UPSTREAM	DOWNSTREAM	Friction Equation: Automatic
Geometry:	Trapezoidal	Trapezoidal	Solution Algorithm: Automatic
Invert(ft):	7.500	-3.000	Flow: Both
TClpInitZ(ft):	9999.000	9999.000	Contraction Coef: 0.100
Manning's N:	0.050000	0.050000	Expansion Coef: 0.300
Top Clip(ft):	0.000	0.000	Entrance Loss Coef: 0.000
Bot Clip(ft):	0.000	0.000	Exit Loss Coef: 0.000
Main XSec:			Outlet Ctrl Spec: Use dc or tw
AuxElev1(ft):			Inlet Ctrl Spec: Use dc
Aux XSec1:			Stabilizer Option: None
AuxElev2(ft):			
Aux XSec2:			
Top Width(ft):			
Depth(ft):			
Bot Width(ft):	150.000	150.000	
LtSdSlp(h/v):	0.50	0.50	
RtSdSlp(h/v):	0.50	0.50	

=====
 Weirs =====
 =====

Name: WN11N9-0	From Node: N11
Group: BASE	To Node: N9
Flow: Both	Count: 1
Type: Horizontal	Geometry: Rectangular

Span(in):	120.00
Rise(in):	36.00
Invert(ft):	12.000
Control Elevation(ft):	12.000

Bottom Clip(in):	0.000
Top Clip(in):	0.000
Weir Discharge Coef:	3.200
Orifice Discharge Coef:	0.600

TABLE

```

-----
Name: WN5N3-0      From Node: N5
Group: BASE        To Node: N3
Flow: Both         Count: 1
Type: Horizontal   Geometry: Rectangular

                Span(in): 120.00
                Rise(in): 36.00
                Invert(ft): 5.000
Control Elevation(ft): 5.000

                Bottom Clip(in): 0.000
                Top Clip(in): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

                TABLE

```

```

-----
Name: WN7N5-0      From Node: N7
Group: BASE        To Node: N5
Flow: Both         Count: 1
Type: Horizontal   Geometry: Rectangular

                Span(in): 120.00
                Rise(in): 36.00
                Invert(ft): 10.000
Control Elevation(ft): 10.000

                Bottom Clip(in): 0.000
                Top Clip(in): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

                TABLE

```

```

-----
Name: WN9N7-0      From Node: N9
Group: BASE        To Node: N7
Flow: Both         Count: 1
Type: Horizontal   Geometry: Rectangular

                Span(in): 120.00
                Rise(in): 36.00
                Invert(ft): 11.000
Control Elevation(ft): 11.000

                Bottom Clip(in): 0.000
                Top Clip(in): 0.000
Weir Discharge Coef: 3.200
Orifice Discharge Coef: 0.600

                TABLE

```

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=====
==== Hydrology Simulations =====
=====

```

```

Name: 25yr-72hr
Filename: U:\Projects-Continuing\08006.02-Yucca Pens Hydrologic Restoration Plan\08006.02-Data Analysis\08006.02-Yu
Override Defaults: Yes
Storm Duration(hrs): 72.00
Rainfall File: Flmod
Rainfall Amount(in): 10.50

Time(hrs)      Print Inc(min)
-----
9999.000      5.00

```

```

-----
Name: 2yr-24hr
Filename: U:\Projects-Continuing\08006.02-Yucca Pens Hydrologic Restoration Plan\08006.02-Data Analysis\08006.02-Yu
Override Defaults: Yes
Storm Duration(hrs): 24.00
Rainfall File: Flmod
Rainfall Amount(in): 4.50

Time(hrs)      Print Inc(min)
-----
9999.000      5.00

```

```

=====
==== Routing Simulations =====
=====

```

```

Name: 25yr-72hr      Hydrology Sim: 25yr-72hr

```

Filename: U:\Projects-Continuing\08006.02-Yucca Pens Hydrologic Restoration Plan\08006.02-Data Analysis\08006.02-Yu

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 250.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

Name: 2yr-24hr Hydrology Sim: 2yr-24hr
Filename: U:\Projects-Continuing\08006.02-Yucca Pens Hydrologic Restoration Plan\08006.02-Data Analysis\08006.02-Yu

Execute: Yes Restart: No Patch: No
Alternative: No

Max Delta Z(ft): 1.00 Delta Z Factor: 0.00500
Time Step Optimizer: 10.000
Start Time(hrs): 0.000 End Time(hrs): 250.00
Min Calc Time(sec): 0.5000 Max Calc Time(sec): 60.0000
Boundary Stages: Boundary Flows:

Time(hrs)	Print Inc(min)
999.000	15.000

Group	Run
BASE	Yes

=====
==== Boundary Conditions =====
=====

Name: N12	Node: N12	Type: Stage
Time(hrs)	Stage(ft)	
0.000	1.000	
1000.000	1.000	

Name: N6	Node: N6	Type: Stage
Time(hrs)	Stage(ft)	
0.000	1.000	
1000.000	1.000	

Name: N4	Node: N4	Type: Stage
Time(hrs)	Stage(ft)	
0.000	1.000	
1000.000	1.000	

Name: N8	Node: N8	Type: Stage
Time(hrs)	Stage(ft)	
0.000	1.000	
1000.000	1.000	

Name: N10	Node: N10	Type: Stage
Time(hrs)	Stage(ft)	
0.000	1.000	
1000.000	1.000	

08006.02_YPHRP_WMM_Task2EC

<u>Name</u>	<u>Jurisdiction</u>	<u>Tributary Area (acres)</u>	<u>DCIA (acres)</u>	<u>DCIA (%)</u>	<u>Loading Factor</u>	<u>Parameter</u>	<u>Units</u>	<u>Storm Water</u>	<u>Base Flow</u>	<u>Point Source</u>	<u>CSO</u>	<u>Total</u>	<u>Storm Water with BMP Controls</u>	<u>CSOs with Controls</u>	<u>Total with Controls</u>	<u>Reduction (%)</u>
GSE2	GatorSlough We	7,041	1,322	18.8		Flow	(ac-ft/yr)	8,197	2,347	146	0	10,689	8,197	0	10,689	0.0
GSE2	GatorSlough We	7,041	1,322	18.8	medium	BOD	lbs/yr	1.24E+005	7,661	2,183	0	1.34E+005	1.21E+005	0	1.30E+005	2.4
GSE2	GatorSlough We	7,041	1,322	18.8	medium	Cd	lbs/yr	14	0	2	0	16	13	0	15	6.8
GSE2	GatorSlough We	7,041	1,322	18.8	medium	COD	lbs/yr	1.36E+006	44,689	0	0	1.41E+006	1.34E+006	0	1.39E+006	1.4
GSE2	GatorSlough We	7,041	1,322	18.8	medium	Cu	lbs/yr	199	6	0.87	0	206	187	0	194	5.6
GSE2	GatorSlough We	7,041	1,322	18.8	medium	DP	lbs/yr	2,691	383	0	0	3,074	2,587	0	2,970	3.4
GSE2	GatorSlough We	7,041	1,322	18.8	medium	NO23	lbs/yr	8,776	255	1,319	0	10,351	8,662	0	10,237	1.1
GSE2	GatorSlough We	7,041	1,322	18.8	medium	Pb	lbs/yr	211	6	2	0	219	198	0	206	5.8
GSE2	GatorSlough We	7,041	1,322	18.8	medium	TDS	lbs/yr	2.55E+006	8.62E+005	2.38E+005	0	3.65E+006	2.52E+006	0	3.62E+006	0.8
GSE2	GatorSlough We	7,041	1,322	18.8	medium	TKN	lbs/yr	28,330	4,597	515	0	33,442	28,030	0	33,141	0.9
GSE2	GatorSlough We	7,041	1,322	18.8	medium	TP	lbs/yr	5,239	511	119	0	5,868	5,121	0	5,750	2.0
GSE2	GatorSlough We	7,041	1,322	18.8	medium	TSS	lbs/yr	9.72E+005	95,763	1,165	0	1.07E+006	9.21E+005	0	1.02E+006	4.8
GSE2	GatorSlough We	7,041	1,322	18.8	medium	Zn	lbs/yr	1,188	51	20	0	1,259	1,144	0	1,215	3.5
GSE1	GatorSlough Ee	19,429	2,023	10.4		Flow	(ac-ft/yr)	16,421	6,476	202	0	23,099	16,421	0	23,099	0.0
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	BOD	lbs/yr	1.30E+005	21,140	3,022	0	1.54E+005	1.28E+005	0	1.53E+005	1.1
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	Cd	lbs/yr	11	0	3	0	14	10	0	13	3.4
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	COD	lbs/yr	2.31E+006	1.23E+005	0	0	2.43E+006	2.29E+006	0	2.42E+006	0.5
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	Cu	lbs/yr	59	18	1	0	78	51	0	70	10.8
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	DP	lbs/yr	3,133	1,057	0	0	4,190	3,034	0	4,091	2.4
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	NO23	lbs/yr	13,725	705	1,826	0	16,256	13,598	0	16,129	0.8
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	Pb	lbs/yr	68	18	3	0	89	61	0	82	8.2
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	TDS	lbs/yr	4.51E+006	2.38E+006	3.30E+005	0	7.22E+006	4.49E+006	0	7.20E+006	0.3
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	TKN	lbs/yr	47,016	12,684	713	0	60,414	46,709	0	60,106	0.5
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	TP	lbs/yr	6,774	1,409	165	0	8,348	6,640	0	8,214	1.6
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	TSS	lbs/yr	1.37E+006	2.64E+005	1,613	0	1.63E+006	1.33E+006	0	1.59E+006	2.4
GSE1	GatorSlough Ee	19,429	2,023	10.4	medium	Zn	lbs/yr	1,310	141	28	0	1,479	1,285	0	1,454	1.7
GSEB	GatorSlough Ea	9,450	995	10.5		Flow	(ac-ft/yr)	8,029	3,150	179	0	11,359	8,029	0	11,359	0.0
GSEB	GatorSlough Ea	9,450	995	10.5	medium	BOD	lbs/yr	1.14E+005	10,282	2,686	0	1.26E+005	1.13E+005	0	1.26E+005	0.6
GSEB	GatorSlough Ea	9,450	995	10.5	medium	Cd	lbs/yr	13	0	3	0	16	13	0	16	1.4
GSEB	GatorSlough Ea	9,450	995	10.5	medium	COD	lbs/yr	1.20E+006	59,981	0	0	1.26E+006	1.19E+006	0	1.25E+006	0.5
GSEB	GatorSlough Ea	9,450	995	10.5	medium	Cu	lbs/yr	191	9	1	0	200	187	0	197	1.7
GSEB	GatorSlough Ea	9,450	995	10.5	medium	DP	lbs/yr	2,807	514	0	0	3,321	2,766	0	3,280	1.2
GSEB	GatorSlough Ea	9,450	995	10.5	medium	NO23	lbs/yr	9,210	343	1,624	0	11,176	9,157	0	11,123	0.5
GSEB	GatorSlough Ea	9,450	995	10.5	medium	Pb	lbs/yr	137	9	2	0	148	134	0	145	2.1
GSEB	GatorSlough Ea	9,450	995	10.5	medium	TDS	lbs/yr	2.21E+006	1.16E+006	2.93E+005	0	3.66E+006	2.20E+006	0	3.65E+006	0.3
GSEB	GatorSlough Ea	9,450	995	10.5	medium	TKN	lbs/yr	30,373	6,169	634	0	37,176	30,249	0	37,052	0.3
GSEB	GatorSlough Ea	9,450	995	10.5	medium	TP	lbs/yr	5,494	685	146	0	6,326	5,440	0	6,272	0.9
GSEB	GatorSlough Ea	9,450	995	10.5	medium	TSS	lbs/yr	1.08E+006	1.29E+005	1,433	0	1.21E+006	1.07E+006	0	1.20E+006	1.4

<u>Name</u>	<u>Jurisdiction</u>	<u>Tributary Area (acres)</u>	<u>DCIA (acres)</u>	<u>DCIA (%)</u>	<u>Loading Factor</u>	<u>Parameter</u>	<u>Units</u>	<u>Storm_ Water</u>	<u>Base Flow</u>	<u>Point Source</u>	<u>CSO</u>	<u>Total</u>	<u>Storm Water with BMP Controls</u>	<u>CSOs with Controls</u>	<u>Total with Controls</u>	<u>Reduction (%)</u>
GSEB	GatorSlough Ea	9,450	995	10.5	medium	Zn	lbs/yr	1,240	69	25	0	1,333	1,228	0	1,322	0.9
GSW	GatorSlough We	1,021	70	6.8		Flow	(ac-ft/yr)	724	340	0	0	1,064	724	0	1,064	0.0
GSW	GatorSlough We	1,021	70	6.8	medium	BOD	lbs/yr	8,465	1,111	0	0	9,576	8,451	0	9,562	0.1
GSW	GatorSlough We	1,021	70	6.8	medium	Cd	lbs/yr	0.85	0	0	0	0.85	0.84	0	0.84	0.4
GSW	GatorSlough We	1,021	70	6.8	medium	COD	lbs/yr	1.04E+005	6,480	0	0	1.11E+005	1.04E+005	0	1.11E+005	0.1
GSW	GatorSlough We	1,021	70	6.8	medium	Cu	lbs/yr	7	0.93	0	0	8	7	0	8	0.2
GSW	GatorSlough We	1,021	70	6.8	medium	DP	lbs/yr	213	56	0	0	268	212	0	268	0.3
GSW	GatorSlough We	1,021	70	6.8	medium	NO23	lbs/yr	719	37	0	0	756	718	0	755	0.2
GSW	GatorSlough We	1,021	70	6.8	medium	Pb	lbs/yr	6	0.93	0	0	7	6	0	7	0.3
GSW	GatorSlough We	1,021	70	6.8	medium	TDS	lbs/yr	2.01E+005	1.25E+005	0	0	3.26E+005	2.01E+005	0	3.26E+005	0.1
GSW	GatorSlough We	1,021	70	6.8	medium	TKN	lbs/yr	2,562	667	0	0	3,229	2,559	0	3,225	0.1
GSW	GatorSlough We	1,021	70	6.8	medium	TP	lbs/yr	443	74	0	0	517	441	0	515	0.3
GSW	GatorSlough We	1,021	70	6.8	medium	TSS	lbs/yr	1.02E+005	13,886	0	0	1.16E+005	1.01E+005	0	1.15E+005	0.6
GSW	GatorSlough We	1,021	70	6.8	medium	Zn	lbs/yr	120	7	0	0	128	120	0	127	0.4
YPEB	Yucca Pen wate	2,200	281	12.8		Flow	(ac-ft/yr)	2,056	733	280	0	3,070	2,056	0	3,070	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	BOD	lbs/yr	10,628	2,393	4,197	0	17,218	10,625	0	17,216	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	Cd	lbs/yr	1	0	4	0	6	1	0	6	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	COD	lbs/yr	2.85E+005	13,960	0	0	2.99E+005	2.85E+005	0	2.99E+005	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	Cu	lbs/yr	2	2	2	0	5	2	0	5	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	DP	lbs/yr	199	120	0	0	319	199	0	319	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	NO23	lbs/yr	1,451	80	2,537	0	4,067	1,451	0	4,067	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	Pb	lbs/yr	2	2	4	0	8	2	0	8	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	TDS	lbs/yr	5.59E+005	2.69E+005	4.58E+005	0	1.29E+006	5.59E+005	0	1.29E+006	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	TKN	lbs/yr	4,366	1,436	990	0	6,792	4,366	0	6,792	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	TP	lbs/yr	365	160	229	0	753	365	0	753	0.0
YPEB	Yucca Pen wate	2,200	281	12.8	medium	TSS	lbs/yr	49,280	29,915	2,240	0	81,434	49,161	0	81,316	0.1
YPEB	Yucca Pen wate	2,200	281	12.8	medium	Zn	lbs/yr	17	16	39	0	72	17	0	72	0.1
YPW	Yucca Pen Wate	438	24	5.5		Flow	(ac-ft/yr)	288	146	0	0	434	288	0	434	0.0
YPW	Yucca Pen Wate	438	24	5.5	medium	BOD	lbs/yr	1,760	476	0	0	2,236	1,757	0	2,234	0.1
YPW	Yucca Pen Wate	438	24	5.5	medium	Cd	lbs/yr	0.40	0	0	0	0.40	0.40	0	0.40	0.1
YPW	Yucca Pen Wate	438	24	5.5	medium	COD	lbs/yr	39,995	2,778	0	0	42,773	39,973	0	42,751	0.1
YPW	Yucca Pen Wate	438	24	5.5	medium	Cu	lbs/yr	0.72	0.40	0	0	1	0.71	0	1	0.3
YPW	Yucca Pen Wate	438	24	5.5	medium	DP	lbs/yr	44	24	0	0	68	44	0	68	0.2
YPW	Yucca Pen Wate	438	24	5.5	medium	NO23	lbs/yr	235	16	0	0	251	235	0	251	0.1
YPW	Yucca Pen Wate	438	24	5.5	medium	Pb	lbs/yr	0.77	0.40	0	0	1	0.77	0	1	0.3
YPW	Yucca Pen Wate	438	24	5.5	medium	TDS	lbs/yr	78,381	53,575	0	0	1.32E+005	78,338	0	1.32E+005	0.0
YPW	Yucca Pen Wate	438	24	5.5	medium	TKN	lbs/yr	755	286	0	0	1,041	754	0	1,040	0.1
YPW	Yucca Pen Wate	438	24	5.5	medium	TP	lbs/yr	84	32	0	0	116	84	0	116	0.2
YPW	Yucca Pen Wate	438	24	5.5	medium	TSS	lbs/yr	18,474	5,953	0	0	24,426	18,358	0	24,310	0.5
YPW	Yucca Pen Wate	438	24	5.5	medium	Zn	lbs/yr	16	3	0	0	19	16	0	19	0.4

<u>Name</u>	<u>Jurisdiction</u>	<u>Tributary Area (acres)</u>	<u>DCIA (acres)</u>	<u>DCIA (%)</u>	<u>Loading Factor</u>	<u>Parameter</u>	<u>Units</u>	<u>Storm_ Water</u>	<u>Base Flow</u>	<u>Point Source</u>	<u>CSO</u>	<u>Total</u>	<u>Storm Water with BMP Controls</u>	<u>CSOs with Controls</u>	<u>Total with Controls</u>	<u>Reduction (%)</u>
DCEB Durden Creek W		8,572	1,371	16.0		Flow	(ac-ft/yr)	9,067	2,857	0	0	11,924	9,067	0	11,924	0.0
DCEB Durden Creek W		8,572	1,371	16.0	medium	BOD	lbs/yr	95,395	9,326	0	0	1.05E+005	95,188	0	1.05E+005	0.2
DCEB Durden Creek W		8,572	1,371	16.0	medium	Cd	lbs/yr	12	0	0	0	12	12	0	12	0.5
DCEB Durden Creek W		8,572	1,371	16.0	medium	COD	lbs/yr	1.38E+006	54,403	0	0	1.44E+006	1.38E+006	0	1.43E+006	0.1
DCEB Durden Creek W		8,572	1,371	16.0	medium	Cu	lbs/yr	99	8	0	0	107	98	0	106	1.0
DCEB Durden Creek W		8,572	1,371	16.0	medium	DP	lbs/yr	1,611	466	0	0	2,078	1,599	0	2,066	0.6
DCEB Durden Creek W		8,572	1,371	16.0	medium	NO23	lbs/yr	7,130	311	0	0	7,441	7,114	0	7,425	0.2
DCEB Durden Creek W		8,572	1,371	16.0	medium	Pb	lbs/yr	100	8	0	0	107	99	0	106	0.8
DCEB Durden Creek W		8,572	1,371	16.0	medium	TDS	lbs/yr	2.59E+006	1.05E+006	0	0	3.64E+006	2.59E+006	0	3.64E+006	0.1
DCEB Durden Creek W		8,572	1,371	16.0	medium	TKN	lbs/yr	22,843	5,596	0	0	28,439	22,805	0	28,401	0.1
DCEB Durden Creek W		8,572	1,371	16.0	medium	TP	lbs/yr	2,785	622	0	0	3,407	2,769	0	3,391	0.5
DCEB Durden Creek W		8,572	1,371	16.0	medium	TSS	lbs/yr	5.66E+005	1.17E+005	0	0	6.82E+005	5.61E+005	0	6.78E+005	0.7
DCEB Durden Creek W		8,572	1,371	16.0	medium	Zn	lbs/yr	680	62	0	0	743	677	0	740	0.4
DCW Durden Creek W		602	28	4.6		Flow	(ac-ft/yr)	377	201	0	0	577	377	0	577	0.0
DCW Durden Creek W		602	28	4.6	medium	BOD	lbs/yr	2,938	655	0	0	3,593	2,932	0	3,587	0.2
DCW Durden Creek W		602	28	4.6	medium	Cd	lbs/yr	0.49	0	0	0	0.49	0.49	0	0.49	0.3
DCW Durden Creek W		602	28	4.6	medium	COD	lbs/yr	52,224	3,822	0	0	56,045	52,168	0	55,989	0.1
DCW Durden Creek W		602	28	4.6	medium	Cu	lbs/yr	1	0.55	0	0	2	1	0	2	0.3
DCW Durden Creek W		602	28	4.6	medium	DP	lbs/yr	78	33	0	0	110	77	0	110	0.3
DCW Durden Creek W		602	28	4.6	medium	NO23	lbs/yr	334	22	0	0	355	333	0	355	0.2
DCW Durden Creek W		602	28	4.6	medium	Pb	lbs/yr	1	0.55	0	0	2	1	0	2	0.4
DCW Durden Creek W		602	28	4.6	medium	TDS	lbs/yr	1.02E+005	73,701	0	0	1.76E+005	1.02E+005	0	1.76E+005	0.1
DCW Durden Creek W		602	28	4.6	medium	TKN	lbs/yr	1,152	393	0	0	1,545	1,151	0	1,544	0.1
DCW Durden Creek W		602	28	4.6	medium	TP	lbs/yr	162	44	0	0	206	162	0	205	0.3
DCW Durden Creek W		602	28	4.6	medium	TSS	lbs/yr	39,517	8,189	0	0	47,706	39,225	0	47,414	0.6
DCW Durden Creek W		602	28	4.6	medium	Zn	lbs/yr	42	4	0	0	46	42	0	46	0.4
GBEB Greenwell Bran		5,912	578	9.8		Flow	(ac-ft/yr)	4,852	1,971	0	0	6,823	4,852	0	6,823	0.0
GBEB Greenwell Bran		5,912	578	9.8	medium	BOD	lbs/yr	31,825	6,432	0	0	38,257	31,602	0	38,034	0.6
GBEB Greenwell Bran		5,912	578	9.8	medium	Cd	lbs/yr	4	0	0	0	4	4	0	4	1.3
GBEB Greenwell Bran		5,912	578	9.8	medium	COD	lbs/yr	6.78E+005	37,522	0	0	7.15E+005	6.76E+005	0	7.14E+005	0.2
GBEB Greenwell Bran		5,912	578	9.8	medium	Cu	lbs/yr	14	5	0	0	19	13	0	18	5.2
GBEB Greenwell Bran		5,912	578	9.8	medium	DP	lbs/yr	703	322	0	0	1,025	692	0	1,013	1.1
GBEB Greenwell Bran		5,912	578	9.8	medium	NO23	lbs/yr	3,783	214	0	0	3,998	3,769	0	3,983	0.4
GBEB Greenwell Bran		5,912	578	9.8	medium	Pb	lbs/yr	13	5	0	0	19	12	0	18	4.7
GBEB Greenwell Bran		5,912	578	9.8	medium	TDS	lbs/yr	1.32E+006	7.24E+005	0	0	2.05E+006	1.32E+006	0	2.05E+006	0.1
GBEB Greenwell Bran		5,912	578	9.8	medium	TKN	lbs/yr	12,099	3,859	0	0	15,958	12,063	0	15,922	0.2
GBEB Greenwell Bran		5,912	578	9.8	medium	TP	lbs/yr	1,369	429	0	0	1,798	1,354	0	1,783	0.8
GBEB Greenwell Bran		5,912	578	9.8	medium	TSS	lbs/yr	2.65E+005	80,404	0	0	3.46E+005	2.61E+005	0	3.41E+005	1.4
GBEB Greenwell Bran		5,912	578	9.8	medium	Zn	lbs/yr	235	43	0	0	278	232	0	275	1.2
GBW Greenwell Bran		1,428	151	10.5		Flow	(ac-ft/yr)	1,214	476	0	0	1,690	1,214	0	1,690	0.0
GBW Greenwell Bran		1,428	151	10.5	medium	BOD	lbs/yr	15,943	1,553	0	0	17,496	15,925	0	17,478	0.1

<u>Name</u>	<u>Jurisdiction</u>	<u>Tributary Area (acres)</u>	<u>DCIA (acres)</u>	<u>DCIA (%)</u>	<u>Loading Factor</u>	<u>Parameter</u>	<u>Units</u>	<u>Storm_ Water</u>	<u>Base Flow</u>	<u>Point Source</u>	<u>CSO</u>	<u>Total</u>	<u>Storm Water with BMP Controls</u>	<u>CSOs with Controls</u>	<u>Total with Controls</u>	<u>Reduction (%)</u>
GBW	Greenwell Bran	1,428	151	10.5	medium	Cd	lbs/yr	1	0	0	0	1	1	0	1	0.3
GBW	Greenwell Bran	1,428	151	10.5	medium	COD	lbs/yr	1.81E+005	9,060	0	0	1.90E+005	1.81E+005	0	1.90E+005	0.1
GBW	Greenwell Bran	1,428	151	10.5	medium	Cu	lbs/yr	20	1	0	0	21	20	0	21	0.1
GBW	Greenwell Bran	1,428	151	10.5	medium	DP	lbs/yr	386	78	0	0	464	385	0	463	0.3
GBW	Greenwell Bran	1,428	151	10.5	medium	NO23	lbs/yr	1,225	52	0	0	1,277	1,223	0	1,275	0.1
GBW	Greenwell Bran	1,428	151	10.5	medium	Pb	lbs/yr	16	1	0	0	17	16	0	17	0.2
GBW	Greenwell Bran	1,428	151	10.5	medium	TDS	lbs/yr	3.44E+005	1.75E+005	0	0	5.19E+005	3.44E+005	0	5.19E+005	0.1
GBW	Greenwell Bran	1,428	151	10.5	medium	TKN	lbs/yr	4,327	932	0	0	5,259	4,322	0	5,254	0.1
GBW	Greenwell Bran	1,428	151	10.5	medium	TP	lbs/yr	758	104	0	0	862	756	0	860	0.2
GBW	Greenwell Bran	1,428	151	10.5	medium	TSS	lbs/yr	1.65E+005	19,415	0	0	1.84E+005	1.64E+005	0	1.83E+005	0.5
GBW	Greenwell Bran	1,428	151	10.5	medium	Zn	lbs/yr	198	10	0	0	208	197	0	207	0.3
LVR	Longview Run V	1,567	100	6.4		Flow	(ac-ft/yr)	1,084	522	0	0	1,606	1,084	0	1,606	0.0
LVR	Longview Run V	1,567	100	6.4	medium	BOD	lbs/yr	10,932	1,705	0	0	12,637	10,894	0	12,599	0.3
LVR	Longview Run V	1,567	100	6.4	medium	Cd	lbs/yr	1	0	0	0	1	1	0	1	1.0
LVR	Longview Run V	1,567	100	6.4	medium	COD	lbs/yr	1.57E+005	9,944	0	0	1.67E+005	1.57E+005	0	1.67E+005	0.2
LVR	Longview Run V	1,567	100	6.4	medium	Cu	lbs/yr	8	1	0	0	10	8	0	10	1.2
LVR	Longview Run V	1,567	100	6.4	medium	DP	lbs/yr	273	85	0	0	359	272	0	357	0.5
LVR	Longview Run V	1,567	100	6.4	medium	NO23	lbs/yr	1,034	57	0	0	1,091	1,031	0	1,088	0.3
LVR	Longview Run V	1,567	100	6.4	medium	Pb	lbs/yr	10	1	0	0	11	10	0	11	1.9
LVR	Longview Run V	1,567	100	6.4	medium	TDS	lbs/yr	3.06E+005	1.92E+005	0	0	4.98E+005	3.05E+005	0	4.97E+005	0.1
LVR	Longview Run V	1,567	100	6.4	medium	TKN	lbs/yr	3,627	1,023	0	0	4,649	3,619	0	4,642	0.2
LVR	Longview Run V	1,567	100	6.4	medium	TP	lbs/yr	592	114	0	0	705	589	0	702	0.5
LVR	Longview Run V	1,567	100	6.4	medium	TSS	lbs/yr	1.42E+005	21,308	0	0	1.63E+005	1.40E+005	0	1.61E+005	1.0
LVR	Longview Run V	1,567	100	6.4	medium	Zn	lbs/yr	162	11	0	0	174	161	0	172	0.7

APPENDIX C

Geodatabase and Metadata Files

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
File: Task 2 Readme

NOTE:

This file contains an inventory of the digital data found on the Yucca Pens Hydrologic Restoration Plan DVD. This DVD contains all of the report text, figures, and digital data (GIS coverages including geodatabase) for Task 2 of the study. The main directory structure in the DVD is given below.

<u>Folder Name</u>	<u>Description</u>
Readme	Contains the "Task 2 Readme" file (contents of this file)
Report	Contains complete report including Figures and Appendices
Task 1-Base Map	Contains ArcGIS Coverages (includes metadata in XML format)
Task 2-GIS Files	Contains ArcGIS Coverages (includes metadata in XML format)
Task 2-GIS Metadata/Task 1 GIS files	Contains all metadata files for Task 1 GIS files in HTML format
Task 2-GIS Metadata/Task 2 GIS files	Contains all metadata files for Task 2 GIS files in HTML format

CONDITIONS OF USE:

BPC Group provides this digital data for the express use of:
South Florida Water Management District.

Data contained herein may be subject to change without notice. Responsibility for the accuracy of current conditions and/or digital transfers is solely that of the user. The user of this information must determine the suitability for the intended purpose.

These "CONDITIONS OF USE" shall be supplied to all users of this data.

In order to access data recorded on this DVD, a compatible PC along with the following software is required:

- Windows XP or higher
- Microsoft Office Professional (2003 or later)
- ArcGIS Version 9.2 or higher
- Adobe Acrobat reader 8 or later or equivalent PDF reader
- Internet Explorer Version 8 or higher or comparable software

The total hard disk space required to load all data on this DVD is approximately 3 gigabytes.

NOTE: All data presented in this DVD is for planning purposes only; they may not be suitable for engineering analysis; and the end user is solely responsible for its use. It must be verified in the field prior to any design use.

DVD Inventory

<u>Folder Name</u>	<u>Description</u>
Readme	Contains the content of this file (Task 2 Readme).
Report	Contains complete report including Figures and Appendices.

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
[File: Task 2 Readme](#)

Task 1-Base Map	Contains ArcGIS Coverages maintained/edited from Task 1 (includes metadata in XML format).
Aerials	Contains aerials for Lee and Charlotte counties (195 tiles) (each aerial is represented by 3 files: *.sdw, *.sid, *.aux).
Boundaries	Contains 1 Personal Geodatabase file with 7 features classes containing the boundary information for Yucca Pen Creek, Durden Creek, Greenwell Branch, Longview and Gator Slough watershed. The Folder also contains 2 shapefiles of Florida County Boundary and Yucca Pens Project Area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
Contour	Contains only 1 Geodatabase file of 1 ft contours for Yucca Pens project area.
LandUse_East.gdb	Contains 2004/2005 Land Use/ Land Cover Geodatabase file for Yucca Pens project area.
Roads	Contains 2 shapefiles representing the Roads and Streets information for Lee and Charlotte County (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
Soils	Contains 2 shapefiles representing Soils in Lee and Charlotte County for Yucca Pens project area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
Structures	Contains 4 shapefiles representing the Culverts, Bridges, Weirs and Drop Structures area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx). Folder also contains 1 personal geodatabase with 2 feature classes representing Historic Flow Ways (Lee County) and Flow Way connections information for Lee County inside the Yucca Pens project
Topo_East.gdb	Contains 10 ft DEM for Covering Yucca Pens project area.
Wetland	Contains 3 shapefiles representing the three categories of Wetlands inside the Yucca Pens project area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
Task 2-GIS Files	Contains ArcGIS Coverages created for Task 2 (includes metadata in XML format).
ATV Trails	Contains a shapefile for Trails/Dirt Roads inside the Yucca Pens Project Area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
State & County Owned Lands	Contains 5 shapefiles representing the Florida State Owned Lands, Lee County and Charlotte County Owned Lands, Charlotte County Facilities and Harper and McNew Property layer (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).
Structures	Contains 7 shapefiles representing the Culverts, Bridges, Weirs, Canals, Outfalls. Swales/ditches, and Waypoints (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
File: Task 2 Readme

WatershedBoundaries Contains 7 shapefiles representing the Task 2 delineated watershed boundaries inside Yucca Pens Project Area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).

Watershed Boundaries
for Modeling Contains 11 shapefiles representing the Task 2 delineated watershed boundaries exclusively for Hydrologic and Water Quality Modeling for Yucca Pens Project Area (each shapefile is represented by 6 files: *.dbf, *.prj, *.sbn, *.sbx, *.shp, *.shx).

Task 2 GIS Metadata/Task 1 GIS Files

Aerials	Contains 2 metadata files representing Aerials of Charlotte and Lee County.
Boundaries	Contains 9 metadata files for Boundaries
Contour	Contains 1 metadata file for Contours.
LandUse_East.gdb	Contains 10 metadata files for Land Use/Land Cover
Roads	Contains 2 metadata files for Roads
Soils	Contains 2 metadata files for Soils
Structures	Contains 6 metadata files for Structures
Topo_East.gdb	Contains 1 metadata file for DEM
Wetland	Contains 3 metadata files for Wetlands

Task 2 GIS Metadata/Task 2 GIS Files

ATV Trails	Contains 1 metadata file for Trails/Dirt Roads
State & County Owned Lands	Contains 5 metadata files representing Florida State Owned Lands, Lee County and Charlotte County Owned Lands, Charlotte County Facilities and Harper and McNew Property layer.
Structures	Contains 7 metadata files for Structures
Watershed Boundaries	Contains 7 metadata files for Watershed Boundaries
Watershed Boundaries for Modeling	Contains 11 metadata files for Watershed Boundaries for modeling

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
List of Metadata Files in HTML Format

**List of Metadata Files in HTML Format included in the
“Task 2 GIS Metadata/Task 1 GIS Files” folder.**

Folder: Aerials

(2007/2008 Aerials for Lee and Charlotte Counties)

There are 195 raster files of aerials: one file for each tile of the aerials. These represent the aerials for two counties: Lee and Charlotte Counties. The following two files are listed as representative of the Lee County metadata file and Charlotte County metadata file.

charlotte county aerials.html

Contains 1 Metadata file for 189 tiles for Charlotte County

lee county aerials.html

Contains 1 Metadata file for 6 tiles for Lee county

Folder: Boundaries

(Watershed boundaries and County boundaries)

cntbnd.html

Metadata file for cntbnd.shp

durden_creek.html

Metadata file for feature class Durden_Creek
(Boundary.mdb)

gator_slough.html

Metadata file for feature class Gator_Slough
(Boundary.mdb)

gator_slough_divide.html

Metadata file for feature class Gator_Slough_Divide
(Boundary.mdb)

greenwell_branch.html

Metadata file for feature class Greenwell_Branch
(Boundary.mdb)

longview_run.html

Metadata file for feature class Longview_Run
(Boundary.mdb)

yucca_pens_creek.html

Metadata file for feature class Yucca_Pens_Creek
(Boundary.mdb)

yucca_pens_unit.html

Metadata file for feature class Yucca_Pens_Unit
(Boundary.mdb)

yucca_pens_project_area.html

Metadata file for yucca_pens_project_area.shp

Folder: Contour

(Topographic Contours for the Project Area)

contour10_1ft_east.html

Metadata file for contour10_1ft_east

Folder: Landuse_East.gdb

(2004/2005 Land Use Land Cover Maps)

fdem_tiles_east.html

Metadata file for fdem_tiles_east

flu_234.html

Metadata file for flu_234

flu_main.html

Metadata file for flu_main

flu_misc.html

Metadata file for flu_misc

flu_model.html

Metadata file for flu_model

landuse_fluccs.html

Metadata file for landuse_fluccs

landuse_source.html

Metadata file for landuse_source

lu_main.html

Metadata file for lu_main

lu_model.html

Metadata file for lu_model

stats.html

Metadata file for stats

Folder: Roads

(Major roads and streets for the project area)

MajorRoads.html

Metadata file for MajorRoads.shp

streets.html

Metadata file for streets.shp

Folder: Soils

(NRCS soils maps for the project area)

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
List of Metadata Files in HTML Format

Soils_clipped_Lee.html
 Soils_clipped_Charlotte.html

Metadata file for Soils_clipped_Lee.shp
 Metadata file for Soils_clipped_Charlotte.shp

Folder: Structures

drop_structures_082609.html
 flowways2005.html

 flowwayshistoricconnections.html

 sgrr_bridges_culverts.html
 task_1_structures_edited.html
 weir090409.html

(Hydraulic structures: culverts, canals, weirs)

Metadata file for Drop_Structures_082609.shp
 Metadata file for feature class Flowways2005
 (Flowways2005.mdb)
 Metadata file for feature class FlowwaysHistoricConnections
 (Flowways2005.mdb)
 Metadata file for SGRR_bridges_culverts.shp
 Metadata file for Task_1_Structures_edited.shp
 Metadata file for weir090409.shp

Folder: Topo East.gdb

topoeast_10ft.html

(DEM raster datasets for the project area)

Metadata file for topoeast_10ft

Folder: Wetland

category_1.html
 category_2.html
 category_3.html

(Wetland categories for the project area)

Metadata file for category_1.shp
 Metadata file for category_2.shp
 Metadata file for category_3.shp

**List of Metadata Files in HTML Format included in the
 “*Task 2 GIS Metadata/Task 2 GIS Files*” folder.**

Folder: ATV Trail

track_10.html

(ATV Trails/Dirt Roads categories for the project area)

Metadata file for Track_10.shp

Folder: State&County Owned lands

charlotte_county_owned_lands.html
 county_facilites.html
 county-owned-lands.html
 harper and mcnew property.html
 state_owned_lands.html

(State and County owned lands for the project area)

Metadata file for Charlotte_County_Owned_Lands.shp
 Metadata file for County_Facilities.shp
 Metadata file for County-Owned-Lands.shp
 Metadata file for Harper and McNew Property.shp
 Metadata file for State_Owned_Lands.shp

Folder: Structures

allculverts_bpc.html
 bridges_bpc.html
 canal_line_bpc.html
 outfall.html
 swale_ditch.html
 waypoints.html
 weir_bpc.htm

(Hydraulic structures: culverts, canals, weirs)

Metadata file for AllCulverts_BPC.shp
 Metadata file for Bridges_BPC.shp
 Metadata file for Canal_Line_BPC.shp
 Metadata file for Outfall.shp
 Metadata file for Swale_Ditch.shp
 Metadata file for Waypoints.shp
 Metadata file for Weir_BPC.shp

Folder: Watershed Boundaries

durden_creek.html
 gatorslough_e1.html
 gatorslough_e2.html
 gatorslough_west.html

(Watershed Boundaries in the project area)

Metadata file for Durden_Creek.shp
 Metadata file for GatorSlough_E1.shp
 Metadata file for GatorSlough_E2.shp
 Metadata file for GatorSlough_West.shp

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
List of Metadata Files in HTML Format

greenwell_branch.html
longview_run.html
yucca_pens_creek.html

Metadata file for Greenwell_Branch.shp
Metadata file for Longview_Run.shp
Metadata file for Yucca_Pens_Creek.shp

Folder: Watershed Boundaries
For Modeling

durden_ebs.html
durden_wbs.html
gatorslough_e1.html
gatorslough_e2.html
gatorslough_ebs.html
gatorslough_wbs.html
greenwell_ebs.html
greenwell_wbs.html
longview_run.html
yucca_ebs.html
yucca_wbs.html

(Watershed Boundaries for ICPR &WMM Model)

Metadata file for Durden_EBS.shp
Metadata file for Durden_WBS.shp
Metadata file for GatorSlough_E1.shp
Metadata file for GatorSlough_E2.shp
Metadata file for GatorSlough_EBS.shp
Metadata file for GatorSlough_WBS.shp
Metadata file for Greenwell_EBS.shp
Metadata file for Greenwell_WBS.shp
Metadata file for Longview_Run.shp
Metadata file for Yucca_EBS.shp
Metadata file for Yucca_WBS.shp

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Metadata:

- [Identification Information](#)
- [Data Quality Information](#)
- [Spatial Data Organization Information](#)
- [Spatial Reference Information](#)
- [Entity and Attribute Information](#)
- [Distribution Information](#)
- [Metadata Reference Information](#)

Identification Information:

Citation:

Citation Information:

Originator: BPC Group

Publication Date: 10/26/2009

Publication Time: 10:00 am

Title: Waypoints

Geospatial Data Presentation Form: vector digital data

Online Linkage:

\\filesrv\Users\Projects-Continuing\08006.02-Yucca Pens Hydrologic Restoration Plan\08006.02-Data Analysis\08006.02-Yucca Pens Hydrologic Restoration Plan - Task 2\08006.02-Task 2-GIS Files\Structures\Waypoints.shp

Description:

Abstract:

BPC Group conducted field reconnaissance of Yucca Pens Project Area from July 20th 2009 to July 29th 2009. A total of 267 waypoints were recorded during this process using Garmin 76CSX handheld GPS. The GPS waypoints were imported to the GIS, and were organized into several layers. Following is the breakdown of the distribution of these waypoints.

169 Culvert Locations of which 10 culverts are attached with flap/sliding gates 7 Bridge Locations 1 Weir Location 28 Canal and/or Flow Way Locations (several waypoints along each canal/flow way) 3 Outfall Locations 59 waypoints representing the Trails and WMA Gate Locations. Several waypoints recorded along each trail within the study area and other intermediate locations including the WMA gates. The trails included dirt roads and ATV trails.

Purpose: Conduct a Site Reconnaissance Study of Yucca Pens Area

Time Period of Content:

Time Period Information:

Single Date/Time:

Calendar Date: 10/26/2009

Currentness Reference:

The feature class is created by BPC Group after preliminary site investigation of the area

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Status:

Progress: Planned

Maintenance_and_Update_Frequency: As needed

Spatial_Domain:

Bounding_Coordinates:

West_Bounding_Coordinate: -82.071679

East_Bounding_Coordinate: -81.763349

North_Bounding_Coordinate: 26.912910

South_Bounding_Coordinate: 26.688023

Keywords:

Theme:

Theme_Keyword: Waypoints, Yucca Pens Project Area

Access_Constraints: No Access Constraints

Use_Constraints: No User Constraints

Point_of_Contact:

Contact_Information:

Contact_Organization_Primary:

Contact_Organization: BPC Group

Contact_Person: Bijay K. Panigrahi

Contact_Address:

Address_Type: mailing and physical address

Address: 6925 Lake Ellenor Drive, Suite 112

City: Orlando

State_or_Province: Florida

Postal_Code: 32809

Country: USA

Contact_Voice_Telephone: 407-851-5020

Contact_Electronic_Mail_Address: bpanigrahi@bpcgi.com

Security_Information:

Native_Data_Set_Environment:

Microsoft Windows XP Version 5.1 (Build 2600) Service Pack 3; ESRI ArcCatalog 9.2.6.1500

Data_Quality_Information:

Attribute_Accuracy:

Attribute_Accuracy_Report:

According to the manufacturer's specification, this device has a GPS accuracy of ± 10 m (33 ft) and an altimeter accuracy of ± 10 ft.

Positional_Accuracy:

Horizontal_Positional_Accuracy:

Horizontal_Positional_Accuracy_Report: Good

Vertical_Positional_Accuracy:

Vertical_Positional_Accuracy_Report: Good

Lineage:

Process_Step:

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Process_Step:

Process_Description: Dataset copied.

Source_Used_Citation_Abbreviation:

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml9F4.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml362.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml364.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml366.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml567.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xmlF5.tmp

Process_Step:

Process_Description: Metadata imported.

Source_Used_Citation_Abbreviation:

C:\DOCUME~1\aaduvala\LOCALS~1\Temp\xml1F5.tmp

Spatial_Data_Organization_Information:

Direct_Spatial_Reference_Method: Vector

Point_and_Vector_Object_Information:

SDTS_Terms_Description:

SDTS_Point_and_Vector_Object_Type: Entity point

Point_and_Vector_Object_Count: 267

Spatial_Reference_Information:

Horizontal_Coordinate_System_Definition:

Planar:

Map_Projection:

Map_Projection_Name: Transverse Mercator

Transverse_Mercator:

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Scale_Factor_at_Central_Meridian: 0.999941
Longitude_of_Central_Meridian: -81.000000
Latitude_of_Projection-Origin: 24.333333
False_Easting: 656166.666667
False_Northing: 0.000000
Planar_Coordinate_Information:
Planar_Coordinate_Encoding_Method: coordinate pair
Coordinate_Representation:
Abcissa_Resolution: 0.001
Ordinate_Resolution: 0.001
Planar_Distance_Units: survey feet
Geodetic_Model:
Horizontal_Datum_Name: D_North_American_1983_HARN
Ellipsoid_Name: Geodetic Reference System 80
Semi-major_Axis: 6378137.000000
Denominator_of_Flattening_Ratio: 298.257222
Vertical_Coordinate_System_Definition:
Altitude_System_Definition:
Altitude_Datum_Name: North American Vertical Datum of 1988
Altitude_Resolution: 0.001
Altitude_Distance_Units: feet
Altitude_Encoding_Method:
Explicit elevation coordinate included with horizontal coordinates

Entity_and_Attribute_Information:
Detailed_Description:
Entity_Type:
Entity_Type_Label: Waypoints
Attribute:
Attribute_Label: FID
Attribute_Definition: Internal feature number.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain:
Sequential unique whole numbers that are automatically generated.
Attribute:
Attribute_Label: SHAPE
Attribute_Definition: Feature geometry.
Attribute_Definition_Source: ESRI
Attribute_Domain_Values:
Unrepresentable_Domain: Coordinates defining the features.
Attribute:
Attribute_Label: Shape
Attribute_Definition: Feature geometry.
Attribute_Definition_Source: ESRI

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Attribute_Domain_Values:

Unrepresentable_Domain: Coordinates defining the features.

Attribute:

Attribute_Label: TYPE

Attribute:

Attribute_Label: IDENT

Attribute:

Attribute_Label: LAT

Attribute:

Attribute_Label: LONG

Attribute:

Attribute_Label: Y_PROJ

Attribute:

Attribute_Label: X_PROJ

Attribute:

Attribute_Label: COMMENT

Attribute:

Attribute_Label: DISPLAY

Attribute:

Attribute_Label: SYMBOL

Attribute:

Attribute_Label: UNUSED1

Attribute:

Attribute_Label: DIST

Attribute:

Attribute_Label: PROX_INDEX

Attribute:

Attribute_Label: COLOR

Attribute:

Attribute_Label: ALTITUDE

Attribute:

Attribute_Label: DEPTH

Attribute:

Attribute_Label: TEMP

Attribute:

Attribute_Label: TIME

Attribute:

Attribute_Label: WPT_CLASS

Attribute:

Attribute_Label: SUB_CLASS

Attribute:

Attribute_Label: ATTRIB

Attribute:

Attribute_Label: LINK

Attribute:

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Attribute_Label: STATE
Attribute:
Attribute_Label: COUNTRY
Attribute:
Attribute_Label: CITY
Attribute:
Attribute_Label: ADDRESS
Attribute:
Attribute_Label: FACILITY
Attribute:
Attribute_Label: CROSSROAD
Attribute:
Attribute_Label: UNUSED2
Attribute:
Attribute_Label: ETE
Attribute:
Attribute_Label: DTYPE
Attribute:
Attribute_Label: MODEL
Attribute:
Attribute_Label: FILENAME
Attribute:
Attribute_Label: LTIME

Distribution_Information:

Resource_Description: Downloadable Data
Standard_Order_Process:
Digital_Form:
Digital_Transfer_Information:
Transfer_Size: 0.021

Metadata_Reference_Information:

Metadata_Date: 10/26/2009
Metadata_Contact:
Contact_Information:
Contact_Organization_Primary:
Contact_Organization: BPC Group
Contact_Person: Bijay K. Panigrahi
Contact_Address:
Address_Type: mailing and physical address
Address: 6925 Lake Ellenor Drive, Suite 112
City: Orlando
State_or_Province: Florida
Postal_Code: 32809
Country: USA

Task 2 Technical Memorandum
Yucca Pens Hydrologic Restoration Plan
Example of Metadata File for “Waypoints.shp”

Contact_Voice_Telephone: 407-851-5020
Contact_Electronic_Mail_Address: bpanigrahi@bpcgi.com
Metadata_Standard_Name: FGDC Content Standards for Digital Geospatial Metadata
Metadata_Standard_Version: FGDC-STD-001-1998
Metadata_Time_Convention: local time
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile
Metadata_Extensions:
Online_Linkage: <<http://www.esri.com/metadata/esriprof80.html>>
Profile_Name: ESRI Metadata Profile

Generated by [mp](#) version 2.9.6 on Wed Oct 28 10:34:09 2009

APPENDIX D
Response to Interagency Deliverable Review Team Comments

**YUCCA PENS HYDROLOGIC RESTORATION PLAN
INTERAGENCY DELIVERABLE REVIEW TEAM COMBINED COMMENT SHEET**

TECHNICAL MEMORANDUM DELIVERABLE DRAFT 12-11-09

Instructions:

Section #: Indicate Section such as 3.4 or 3.4.1 as applicable and **Page #**

Line #: If multiple lines are included in your comment, please copy and paste the referenced text or include the first line followed by a hyphen and the last line without spaces

Comments: Please be very specific with your comments

Language or verbal changes - Please cut and paste the original excerpt, strike through words to be omitted and underline added words

Comments needing references - Please provide an electronic version (pdf or word) of references or web addresses to reference the document

Name: This is the name of the person making the comment

Agency/Organization: Please spell out agency acronyms at least once

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
General Comment	Based on my limited knowledge of hydrological subjects the report looks to provide a good starting point.	Mike Kemmerer / Florida Fish and Wildlife Conservation Commission	Thank you.
General Comments	The Interconnected Channel and Pond Routing (ICPR) hydrologic / hydraulic computations provided results for the 25 year-72 hour and 2 year-24 hour storm events. Charlotte County requires submittal of the 25 year - 24 hour storm event results.	John DeGiovine / Charlotte County Public Works	Beyond the current scope of work. This may be considered in an engineering study.
General comment	How will restoration of sheet flow be addressed in areas where development is planned to occur?	John DeGiovine / Charlotte County Public Works	Beyond the current scope of work. This may be considered in an engineering study.
General comments on calculations	To provide a complete review of the hydrologic / hydraulic computations (ADICPR) the following additional information is necessary: Survey field notes and survey datum, additional information on how the boundary stage's were determined, a node / reach network diagram, TR-55 computations for CN and Tc determinations. Provide / describe the choice for using mannings "N" values that range from 0.05 to 0.50 for the channel reaches. Please verify / describe the reason for the channel bottom / top widths being in excess of 750-1000 feet wide.	John DeGiovine / Charlotte County Public Works	Acknowledged. This may be considered for the engineering study. Values and dimensions were taken from existing studies (primarily from the "Northwest Lee County Surface Water Management Plan, March 2005")
Section 4, Page 4-9, Line 11	Under this heading reference is made to encourage maintenance of drainage conveyance's in specific basins. It also states that the State owns a majority of the lands where these conveyance's exist. Will the State develop and fund a maintenance plan to address these?	John DeGiovine / Charlotte County Public Works	The development of the maintenance plan may be considered in the recommended engineering study. However, a state funded maintenance plan is not considered at this time.
Section 4.3, Page 4-16	I suggest that the "Recommended Multifunctional Water Management Plan" include a drainage conveyance maintenance plan. This does not have to be linked with a more detailed design project as referenced in Section 4.3, Page 4-17, Line 42. Future projects could be delayed due to funding issues and should not delay maintenance efforts.	John DeGiovine / Charlotte County Public Works	Drainage conveyance maintenance plan is typically part of the engineering study & design. The detailed conveyance system need to be evaluated for its feasibility.
Section 2, Figure 2-2	Recommend showing those culverts which were identified as needing maintenance on the location map with a specific identifier (figure 2-2, Page 2-4) as referenced on Page 2-5, Lines 1-4.	John DeGiovine / Charlotte County Public Works	Current study is very limited in scope, which does not include a more comprehensive infrastructure survey that is needed for engineering analysis and maintenance plan. This may be considered in an engineering study.
Section 1, Page 1-6, Line 34	Change the word "Volume" to Rate to be consistent with current Water Management criteria.	John DeGiovine / Charlotte County Public Works	Incorporated. "Volume" was extracted from the original report.
General Comment	In general I am concerned that the recommendations will be considered as valid, with further design planning and installation of improvements, based on this document. A major missing part - which is recognized - is that the vertical data collected is with instruments that are not sensitive enough for this area of Florida. I think the document should include a listing of the limitations of the study at the beginning of the report.	Stephanie R. Smith, P.E. / City of Cape Coral	This TM repeatedly states that this is not an engineering document and that an engineering study is required for any design whatsoever.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
page 3.3	Under section for Rainfall Distribution, concern that the rainfall amount for the 25 yr. 3 day at 10.5 in. should be looked at more carefully. More data may be available for this specific area and a statistical analysis could be run to determine a more accurate total rainfall amount.	Stephanie R. Smith, P.E. / City of Cape Coral	Beyond the current scope of work. Such details may be considered in the recommended engineering study.
page 3.4	Under section for boundary conditions, the statement that the normal wet season water table is within 1 ft of the ground surface should be looked at more carefully. While it is understood that water ponds at various locations within the study area probably because of inadequate outfalls, conditions may have been created over time that now require the water table to be as it is and which may in fact be above the ground.	Stephanie R. Smith, P.E. / City of Cape Coral	Beyond the current scope of work. Such details may be considered in the recommended engineering study.
	It does not appear that infiltration was considered in the analysis of the run-off from the site. This is probably a large component of the water budget for the site.	Stephanie R. Smith, P.E. / City of Cape Coral	Please refer to Table 3-2 in the TM for Infiltration / Storage.
page 3.9	Under annual rainfall, using data from Page Field may not really be very accurate for this area. More data may be available from other sources for the rainfall in this specific area.	Stephanie R. Smith, P.E. / City of Cape Coral	Beyond the current scope of work. Such details may be considered in the recommended engineering study.
General Comment	While the report discusses the problems associated with Burnt Store Road restricting flow, there is no analysis of the conveyance capacity of the natural or man-made conveyance systems downstream of Burnt Store road. If the intent is to re-establish flows through the system and away from Gator Slough, then these systems downstream from Burnt Store Road must be included in the design study.	Stephanie R. Smith, P.E. / City of Cape Coral	Beyond the current scope of work. This will be addressed in the future phases as warranted.
	We (DEP-Charlotte Harbor Aquatic Preserves) were going to combine our comments with Parks (Charlotte Harbor Preserve State Park). However, at this time the Aquatic Preserves do not have any comments in reference to this deliverable. Please keep us in the loop as if there are any changes to the conceptual report we may want to send additional comments.	Melynda A. Brown / FDEP-Charlotte Harbor Aquatic Preserves	Acknowledged. Thank you.
	The conceptual plan looks pretty good keeping in mind that a more detailed comprehensive engineering analysis is still required. We understand that there will be an engineering analysis and design phase evaluation at a later time. On a large scale note were references to Gator Slough and Matlacha Pass. Most of the water is currently diverted to Gator Slough and ultimately Matlacha Pass, but no reference is made to the Cape Coral North Spreader Waterway Canal. We believe that it should be referenced by name since that is the receiving water body prior to discharge to Matlacha Pass for a lot of the watershed.	John Aspiolea / Charlotte Harbor Preserve State Park	North Spreader Canal (NSC) analysis was not within the scope of the current study. NSC will be addressed in the future phases as warranted according to the finalized NSEMA Consent Agreement between FDEP and the City of Cape Coral.
	The concept plan is to improve runoff storage and re-route excess flows mainly north and west to restore historic flow ways as best as practical and reduce current flows to Gator Slough. This will help restore the drainage problems in Yucca Pen and reduce excessive flows to Gator Slough. Although there is a plan to develop BMP's for a drainage network maintenance that will address downstream impacts to water quality and sediment load reduction, the timing and quantity of water released downstream may also be critical to wetlands and flow ways of the Charlotte Harbor Preserve State Park. Aaron Adams from Mote Marine could provide help determining marine life that could be impacted by the additional water. Improved water quality and restored flow ways is a great, but if there is a faucet on(lots of water) and faucet off(no water) effect (like it is currently), it will need to be evaluated to determine if there will be any detrimental impacts to the creeks as result from the proposed project.	John Aspiolea / Charlotte Harbor Preserve State Park	Beyond the current scope of work. It is acknowledged that timing and quantity of water released downstream are critical factors, which will be addressed as warranted in the recommended engineering study.
	There should be the mention of the importance of land acquisition west of Burnt Store Road. Particularly the area along the remaining portion of Yucca Pen Creek west of Burnt Store Road. There is still property of considerable size in this area that could be purchased as additional STA's or for further protection of Yucca Pen Creek from development and associated stormwater contributions. These areas may also be critical for accepting additional flows from east of Burnt Store Road. If they are developed, we can't put additional sheet flow through them. Acquisition of the remaining private lands on the north and south banks of the creek would allow the highest possible flows under Burnt Store Road, without threatening developed areas.	John Aspiolea / Charlotte Harbor Preserve State Park	Beyond the current scope of work. Such details will be addressed as warranted in the recommended engineering study.
	One more thing to consider is the quality of the discharge coming off of the Charlotte Harbor Land Fill. The monitoring program should consider this area since there could be questions regarding the quality of the water discharged from this site.	John Aspiolea / Charlotte Harbor Preserve State Park	The text in Section 4 has been appropriately expanded to incorporate this issue.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
	Our staff greatly appreciated the opportunity to thoroughly evaluate the plan. We hope that our additions to the plan can be accommodated. We anxiously await further detailed evaluation and, ultimately, implementation of this project.	John Aspiolea / Charlotte Harbor Preserve State Park	Acknowledged.
	We commend the authors' work to provide a comprehensive summary and synopsis of such a wealth of information available in the Yucca Pens study area. The report is thorough, organized, and well written. Accordingly, most of our comments are conceptual rather than editorial, and apply broadly to each section of the report.	Jennifer Nelson / Florida Department of Environmental Protection (FDEP)	Thank you.
Sec. 1, p. 1-3, lines 2-10	Although previously referenced on p. 1-2, we suggest adding 'reduction in unnatural point discharges from Gator Slough' as an explicit restoration objective listed on page 1-3.	Jennifer Nelson / FDEP	The text in Section 1.1 has been appropriately expanded to incorporate this issue.
Sec. 2, p.2-10, line 26	Suggest adding reference to Figure 3.1 when discussing GSEBS because Figure 2.5 does not show GSEBS.	Jennifer Nelson / FDEP	The text in Section 2 has been appropriately expanded to incorporate this issue.
Sec. 2, p.2-10, lines 24-29	While restoring the historic flowway in this area may not be practical, are there opportunities to better retain stormwater to reduce runoff? If so, suggest mentioning in Section 4.0.	Jennifer Nelson / FDEP	This is already considered within the Design Concepts. However, further details of such consideration will be addressed as warranted during the recommended engineering study.
Section 3	We feel that the hydrologic analysis presented in Section 3.0 did not report results at a time scale that is appropriate for addressing impacts to aquatic resources in receiving water bodies west of Burnt Store Rd. Specifically, reporting water budget and pollutant loading results annually does not capture the seasonal and event-based variability in the timing and duration of freshwater discharges which has been cited by the technical community as a major issue in the study area. This is of particular importance, as intra-annual (seasonal) variation in hydroperiod is a major influence on water quality and biota in areas west of Burnt Store including tidal creeks, ephemeral wetlands and oligohaline marshes.	Jennifer Nelson / FDEP	Beyond the current scope of work. It is acknowledged that timing and quantity of water released downstream are critical factors, which will be addressed as warranted in the recommended engineering study.
Sec. 3, p.3-1, lines 38-40	Lines 38-40 state that no DCIA was calculated because "most of the watersheds are covered by Rangeland and Forest", however on p. 2-10, Line 26 it is stated that urban development accounts for most of the area within GSEBS. Please clarify this statement and explain why DCIA was not calculated in this watershed (GSEBS).	Jennifer Nelson / FDEP	Beyond the current scope of work. The scope of modeling was very limited. Such details will be considered in the recommended engineering study.
Section 3	Is the goal of analyses conducted in Section 3.0 to identify the problems which are intended to be addressed by the conceptual plans presented in Section 4.0? If so, please elaborate as to how findings were used to help develop the conceptual design of projects.	Jennifer Nelson / FDEP	Please refer to the "Concepts" described in Section 4 which conceptually incorporates the results from Section 3.
Sec. 4, p. 4-1, line 16	Flood protection should not be identified as a goal of this hydrologic restoration plan. Rather, flood protection should be considered as a potential restoration constraint such that restoration should not decrease existing flood protection in currently developed areas.	Jennifer Nelson / FDEP	Concurred. The text in Section 4 has been appropriately revised to indicate that flood protection is a potential restoration constraint such that restoration should not decrease existing flood protection in currently developed areas.
Section 4	Overall, the document successfully addresses the issue of hydraulic load to, and discharges from, Gator Slough. However, we feel that conceptual design elements discussed in Section 4 (p. 4-1, Lines 16-21) are not specific enough to ensure that the remaining restoration objectives outlined in Section 1.0 will be met, including restoring historic outfalls to Charlotte Harbor, restore ecological integrity, improve aquifer recharge. Specifically, it is unclear as to how design concepts will provide the following outcomes: -Restored timing, quantity, quality, distribution, of freshwater to wetlands, tidal creeks, and Charlotte Harbor -Improve hydroperiod of vegetation communities -Improve water quality in receiving water bodies -Protect and enhance native upland habitats for fish and wildlife species -Restore groundwater levels to historic conditions	Jennifer Nelson / FDEP	The text in Section 4 has been appropriately expanded to incorporate these issues. However, the requested details are beyond the current scope of work. Such details will be addressed as warranted in the recommended engineering study.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
Section 4	To allow better comparison of restored flows to existing flow patterns, we suggest the authors add current flow ways to supplement the conceptual flow patterns represented in Figures 4-2, 4-3, 4-4, and 4-5. Existing flow ways are discussed in each section very well but would be more easily understood if represented on a map.	Jennifer Nelson / FDEP	This will more appropriately be addressed in the recommended engineering study.
Section 4	In Section 1.0 Summary of Task 1 Report (p. 1-7), the authors summarize the objectives of the several management and restoration efforts within the study area. Please elaborate as to how these objectives and any completed construction are considered in the design concepts outlined in Section 4.0. For example, it is unclear as to which projects are being proposed and how they relate to or supplement the recently completed efforts of Lee County and the SFWMD for the Matlacha Pass Hydrologic Restoration Project. Will the Burnt Store Rd. design concept (p. 4-9, Lines 35-43) include future phases of Matlacha Pass Restoration Project? Or will these concepts be used to supplement the Matlacha Pass project? How? Provide similar explanation for current or ongoing projects throughout the study area.	Jennifer Nelson / FDEP	Addressing such details require a more detailed model and engineering analysis, which is beyond the current scope of work. This will be more appropriately addressed in the recommended engineering study.
Sec. 4, p.4-9, lines 35-43	This section does not adequately explain how historic flowways across Burnt Store Rd. will be restored through the proposed designs.	Jennifer Nelson / FDEP	Beyond the current scope of work. This will be addressed in the future phases as warranted.
Section 4	The authors frequently state that outcomes of restored sheet flow include 'raise the ground water table to support the fish and wildlife, and enhance the hydroperiods' (p. 4-4, 4-6, 4-8, etc.). Please be more specific as to how the proposed conceptual design will improve hydroperiod, water quality, and fish and wildlife habitat.	Jennifer Nelson / FDEP	The text in Section 4 has been appropriately expanded to incorporate these issues. However, the requested details are beyond the current scope of work. Such details will be addressed as warranted in the recommended engineering study.
Section 4	Raising groundwater levels is cited as a benefit of several design concepts (see comment above) however, throughout the report the problem of altered groundwater levels is not clearly addressed. Please identify groundwater level issues within the study area and provide details as to how proposed projects address these issues.	Jennifer Nelson / FDEP	The text in Section 4 has been appropriately expanded to incorporate these issues. However, the requested details are beyond the current scope of work. Such details will be addressed as warranted in the recommended engineering study.
Section 4	Section 4 includes many references to the goal of reducing flows to Gator Slough. In addition to this goal, we suggest that restoring more natural flows of freshwater to the Charlotte Harbor estuary through historic flowways also needs to be cited as a goal. This should include a more detailed definition of 'historic flowway restoration' with references to the quantity, timing, and quality of flows through these flowways into the tidal creeks.	Jennifer Nelson / FDEP	Freshwater discharge to Charlotte Harbor through Gator Slough is obvious and inherent to the subject hydrologic system. This will be added to the text. The requested details is beyond the current scope of work. This will be addressed as warranted in the recommended engineering study.
Sec. 4, p.4-12, lines 16-26	The monitoring system should include monitoring that will yield data that allow for the determination of optimum flow within restored flowways and appropriate target discharges to the receiving estuary. This may include biological, water quality, and flow monitoring in order to set targets based on ecological components of the ecosystems.	Jennifer Nelson / FDEP	The text in Section 4 has been appropriately expanded to incorporate these issues. Flow monitoring may be addressed in the recommended engineering study as warranted.
Sec. 4, p.4-15, line 11	Add "and Charlotte Harbor" to this sentence, as these projects will be affecting flows to Charlotte Harbor through the restored historic flowways.	Jennifer Nelson / FDEP	The text has been updated.
Sec. 4.2.1 p. 4-15, lines 20-43	In addition to the BMPs listed, please add all conceptual infrastructure components (BMPs) to this list and discuss all benefits including water quality improvement, habitat enhancement, and expected hydrologic benefits, e.g. benefit of culvert improvements, flowway restoration, ditch enhancements. Please provide as much design detail as possible at this conceptual phase.	Jennifer Nelson / FDEP	The scope of current study does not include engineering analysis to provide design details. This will be addressed in the recommended engineering study.
Sec. 4, p. 4-15, lines 20-24	Dry retention basins can have high pollutant removal efficiencies because they hold stormwater until it percolates through the soil (not discharging to a surface water). However, if the designed purpose of the dry retention swale is conveyance, efficiencies will not approach 90% particularly during high rainfall storm events. Please revise this section to more accurately describe the expected benefits of dry swales. Where nutrient removal efficiencies are identified, please distinguish between nitrogen and phosphorus removal. Additional clarification and detail is necessary to evaluate the benefit of each BMP.	Jennifer Nelson / FDEP	The text has been updated with clarification.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
Sec. 4, p. 4-17, lines 2-9	This plan is aimed at improving the following elements. • Flood Control (for existing and future conditions) • Watershed Water Quality Improvement (discharging to Charlotte Harbor) • Ground Water Recharge (to meet future demands and to protect and enhance the fish and wildlife habitats) • Hydroperiod Maintenance (for vegetation management) • Land Acquisition and Management (to address operational issues)" Why is flood control listed as a goal of this plan? It was our understanding that this plan was intended to provide a conceptual design leading to ecosystem benefits. This should be removed as a goal or aim. Also, why is "to meet future demands" a reason that ground water recharge is an aim of the projects? Water supply for future demand should not be a goal of this project.	Jennifer Nelson / FDEP	The text has been updated documenting removal of phrases ("flood control" and "to meet future demands") from the goal.
Section 4	We also suggest expanding upon the remaining items (<i>Watershed Water Quality Improvement, Ground Water Recharge, Hydroperiod Maintenance, & Land Acquisition and Management</i>) to better explain the framework under which the conceptual projects were designed as noted in the following four comments.	Jennifer Nelson / FDEP	Beyond the current scope of work. This will be more appropriately addressed in the recommended engineering study.
Section 4	<i>Watershed Water Quality Improvement</i> (discharging to Charlotte Harbor) – Is this referring to water quality improvements within the watershed (freshwater wetlands) or in the receiving waters (estuarine areas of Matlacha Pass and Charlotte Harbor)? And is "water quality" here referring to chemical constituents (nutrients, etc.) or salinity regimes? We believe that all of these should be included in the goals.	Jennifer Nelson / FDEP	The text has been updated with clarification.
Section 4	<i>Ground Water Recharge</i> (to meet future demands and to protect and enhance the fish and wildlife habitats) – Suggest elaborating on how groundwater recharge will protect and enhance fish and wildlife habitats (e.g. southern portions of Yucca Pens are drained due to Gator Slough. This is negatively affecting native habitats in this area by...). In addition, implementing BMPs that increase infiltration instead of runoff reduces pollutant loads to receiving waters and enhances recharge of the surficial aquifer to help support water levels and hydroperiods of freshwater wetlands, etc.	Jennifer Nelson / FDEP	This will be addressed as warranted in the engineering study.
Section 4	<i>Hydroperiod Maintenance</i> (for vegetation management) – Unsure what exactly "vegetation management" is referring to, but elaboration on hydroperiod maintenance is suggested. Appropriate hydroperiods of freshwater wetlands is essential for maintaining the ecological integrity of these habitats. It seems that this goal is aimed at the watershed wetlands and restored flowway wetlands. Please clarify and elaborate.	Jennifer Nelson / FDEP	The text has been updated with clarification.
Section 4	<i>Land Acquisition and Management</i> (to address operational issues) – We suggest adding the identification of private parcels for potential land acquisition that are strategically located to facilitate flowway restoration. Also, suggest stating that restored area management should be coordinated with land managers and incorporated into land management plans.	Jennifer Nelson / FDEP	This will more appropriately be addressed in the future as warranted after an engineering analysis is completed.
Section 4 (Not sure which bullet this comment is referring to)	Note: This comment is related to Section 4, Bullet 2. We understand that the goal of the multi-functional water management plan is to contribute to ecosystem benefits both at the outfall of Gator Slough and within the watersheds and the receiving water bodies. However, the level of detail throughout the report does not demonstrate 1) what ecosystem benefits will be provided, and 2) how the conceptual designs will result in these ecosystem benefits. We suggest it be made clearer that ecosystem benefit is the ultimate goal in addition to the immediate objective to restore historic flowways. It is our understanding that alterations within the watershed have created degraded ecological conditions both within habitats of the watershed itself, and within receiving waterbodies (Matlacha Pass estuary via Gator Slough Canal), and Charlotte Harbor estuary (via altered flowways and tributaries). Is it the case that the proposed projects aim to reverse some of this degradation and move toward more historic conditions? If so, please make this clear and better explain how the proposed projects will accomplish this.	Jennifer Nelson / FDEP	Restoration of ecological integrity of the ecosystem is listed as goal no. 4 in Section 1, Introduction. An engineering analysis is required to address these issues, which is not included in the current scope of work.
Section 4	Benefit to the estuarine portions of the study area is implied however, please provide more detail within the description of each design concept as to how proposed upstream flowway restoration will improve hydrologic condition in the areas west of Burnt Store Road.	Jennifer Nelson / FDEP	Beyond the current scope of work. This will be addressed in the future phases as warranted after the recommended engineering study is completed.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
Sec. 4, p.4-17, lines 32-34	Is the purpose of determining the wet season water levels to identify restoration targets or to evaluate the degree of alteration from natural water levels? In addition to water levels, we suggest discussion of hydroperiod targets for restored habitats, as they are a crucial component of designing any restoration project involving water levels.	Jennifer Nelson / FDEP	The text in Section 4 has been updated with clarification.
Sec. 4, p.4-17, lines 11-12	The recommended water management plan should also include an analysis to determine flow targets for the estuary "outfalls" based on the needs of selected components of the biological community.	Jennifer Nelson / FDEP	Concurred. Beyond the current scope of work. This may be addressed in the recommended engineering study.
General (from e-mail cover sheet)	In general, we support the project, especially in conjunction with any federal efforts under SWFFS; and favor improved drainage only where it contributes to restoring sheetflow wetlands and downstream estuaries. Restoration of historic flows to estuaries is most important where that delivery is over the broadest possible landscape. Where that landscape is destroyed by development (Cape Coral), multiple small discharges are preferred over routing to a larger outflow.	Kim Dryden / U.S. Fish & Wildlife Service	Concurred.
Sec. 1, p. 1-2, line 30	Please add U.S. Fish and Wildlife Service to list of reviewers	Kim Dryden / U.S. Fish & Wildlife Service	The text has been updated to include FWS.
Sec. 1, p.1-4	There does not seem to be a thorough discussion on listed species, state and federal in this document, especially with regard to how hydrology might affect their habitat. In particular, specific hydroperiods must be maintained to support hydric pine flatwoods, as too much water for too long will result in the loss of forage and nesting habitat for this species. Also, hydroperiods consistent with providing conditions of drawdown for wading birds should be a target of the restoration efforts. Hydroperiods that support sandhill crane nesting should also be a target of this effort. Sub-basin level analysis may be required to evaluate these potential opportunities or effects may be needed at the design stage. FWC should be consulted along with the FWS.	Kim Dryden / U.S. Fish & Wildlife Service	Concurred. Beyond the current scope of work. This will be included as warranted in the recommended engineering study.
Sec. 2, p. 2-10	Documents indicated that there are no specific flowways identified within the Webb. This seems inconsistent with the Johnson Study and has FWC been consulted and concurred with this assumption?	Kim Dryden / U.S. Fish & Wildlife Service	FWC reviewed the Task 1 report, which included a review of all available documents at the time. Any new materials should be included in the engineering study.
Sec. 4, p. 4-1, line 20	Fish and wildlife resources are referenced with referenced to groundwater improvement but the listing of fish and wildlife resources related to the role of hydroperiods in restoring vegetation seems to be missing. Hydroperiods related to historic vegetation should be targeted except where specific listed species concerns may require management of sub-basins to prevent loss of listed species.	Kim Dryden / U.S. Fish & Wildlife Service	The text in Section 4 has been updated with clarification.
Sec. 4, p.4-17, line 32	Seems to indicate that targeted hydroperiods would result from on-site determinations of water levels using physical factors: instead soils or historic vegetation maps should be used to determine pre-drainage vegetation thereby providing target hydroperiods; per Duever methodologies used for PSRP and SWFFS. See SWFFS pre-development maps	Kim Dryden / U.S. Fish & Wildlife Service	Beyond the current scope of work. This will be included as warranted in the recommended engineering study.
	Curious why the Railroad grade was not pointed out as one of the top restrictors to historic flows. They list I_75 and Us-41 and development but not the RR. Also it seems critical that we get detailed survey information of this impediment to flow. The consultant basically stated that no access was provided. There may already be data available.	Roland Ottolini / Lee County Natural Resources Div.	Seminole Gulf Railway culvert and bridge data were reviewed and mapped for this project. The railroad grade west of I-75 is a major impediment. The railroad grade and I-75 are very close to each other, and for the purpose of conceptual plan, they are considered as one unit. However, they will be addressed as separate entities in the engineering analysis, which is essential for design and beyond.
	The study also cites a Lee County Interim SW Master Plan. That study is outdated and was replaced with subsequent master plan studies for the area.	Roland Ottolini / Lee County Natural Resources Div.	Acknowledged.
	Task 2.1 should include a bullet on "Management plan for the Charlotte Harbor Buffer State Park and Aquatic Preserve"	Anura Karuna-Muni / Lee County Natural Resources Div.	Not relevant to this TM.
	Fig 3-9a should be supplemented with specifications and an inventory of all structures identified in the figure.	Anura Karuna-Muni / Lee County Natural Resources Div.	Not relevant to this TM.
	Task 4: See the attached figure. Restoration of the flow way in Durden Creek need to be listed.	Anura Karuna-Muni / Lee County Natural Resources Div.	Not relevant to this TM.

Section #, Page #, and Line #	Comment	Name/Agency	Response to Comments
(from e-mail cover Sheet)	I would say that these comments (for the Draft Technical Memorandum) are in addition to my original set of comments (submitted for Task 1), which I did not repeat here.	Laura Laymen / SFWMD	Acknowledged.
Sec. 1.1, p.1-2, line 29-30	I think the Charlotte Harbor Aquatic Preserve should be mentioned as a coordinating agency (they are part of DEP), especially since one of the negative effects of the current drainage patterns is seagrass impacts in Matlacha Pass. I think they should be mentioned specifically.	Laura Laymen / SFWMD	Charlotte Harbor Aquatic Preserve is an active member of the Interagency Deliverable Review Team, and the text will be updated.
Sec. 4.1.2, p.4-12, lines 18-26	Monitoring should be as extensive as possible and feasible given the budget, using any existing monitoring reports or information available, including any ERP permit wetland monitoring. Monitoring wells should be installed to a depth of at least 10 feet, to capture dry season and drought water levels. Vegetation monitoring to see shifts in community composition would also be helpful to see ecological changes. Monitoring should include seagrasses in Matlacha Pass and wherever else is appropriate in Charlotte Harbor Aquatic Preserve.	Laura Laymen / SFWMD	The text in Section 4 has been updated with clarification. The details shall be addressed as warranted in the engineering study.
Sec. 4.1.3, p.4-12, lines 35-43	Permits required may also include dewatering permits (water use permits) from the SFWMD for installation of structures and water management facilities. Noah Kugler would be the contact in this office.	Laura Laymen / SFWMD	The text has been updated. Typically, they will be part of the construction permit package.
(from e-mail cover sheet)	The report identifies 3 major restrictions (I-75, US-41, and Burnt Store Road). Based on all the discussions to date I was under the impression that the railroad grade west of I75 would be a major impediment. However, it was not listed and I did not see much of a discussion related to this feature. Based on that, I am led to believe the work completed show this will not be a constriction as others had pointed out earlier in the process.	Bill Foley / SFWMD	Seminole Gulf Railway culvert and bridge data were reviewed and mapped for this project. The railroad grade west of I-75 is a major impediment. The railroad grade and I-75 are very close to each other, and for the purpose of conceptual plan, they are considered as one unit. However, they will be addressed as separate entity in the engineering analysis, which is essential for design and beyond.
Sec. 3.2, p.3-5, 33-40	It is appropriate to include the statement about the relative changes in pollutant loadings. However, given the hydrologic characteristics of southwest Florida and the data supplied in Section 3.2.1.1 of this report, it is also appropriate to add a statement that this model and its outputs are not appropriate for analysis being completed related to nutrient loadings from development projects. The statement in this paragraph indicates only that site specific data may be required.	Bill Foley / SFWMD	The text has been updated with clarification.
Sec. 4.1.2, p.4-4, lines 29-32	Provide an order of magnitude estimate on the additional capacity that would be required under I-75 with a more defined description of the location. In addition, a statement stating that this value and specific location would be refined during the engineering analysis is also appropriate.	Bill Foley / SFWMD	Current scope of work did not include estimations to such level. This will be addressed as warranted in the recommended engineering study.
Sec. 4.1.2, p. 4-12, lines 5-6	Please clarify if BP-1 and/or BP-2 is in either state or county ownership. The discussion is to use these features with control structures to control flows and they are not immediately adjacent to Burnt Store Road.	Bill Foley / SFWMD	They are privately owned. The text has been updated with clarification.
Sec. 4.1.4, p.4-13, lines 36-39	Please clarify if these costs also include the design and construction of additional conveyances under I-75.	Bill Foley / SFWMD	Yes. They are directly related to scope presented in each "concept".