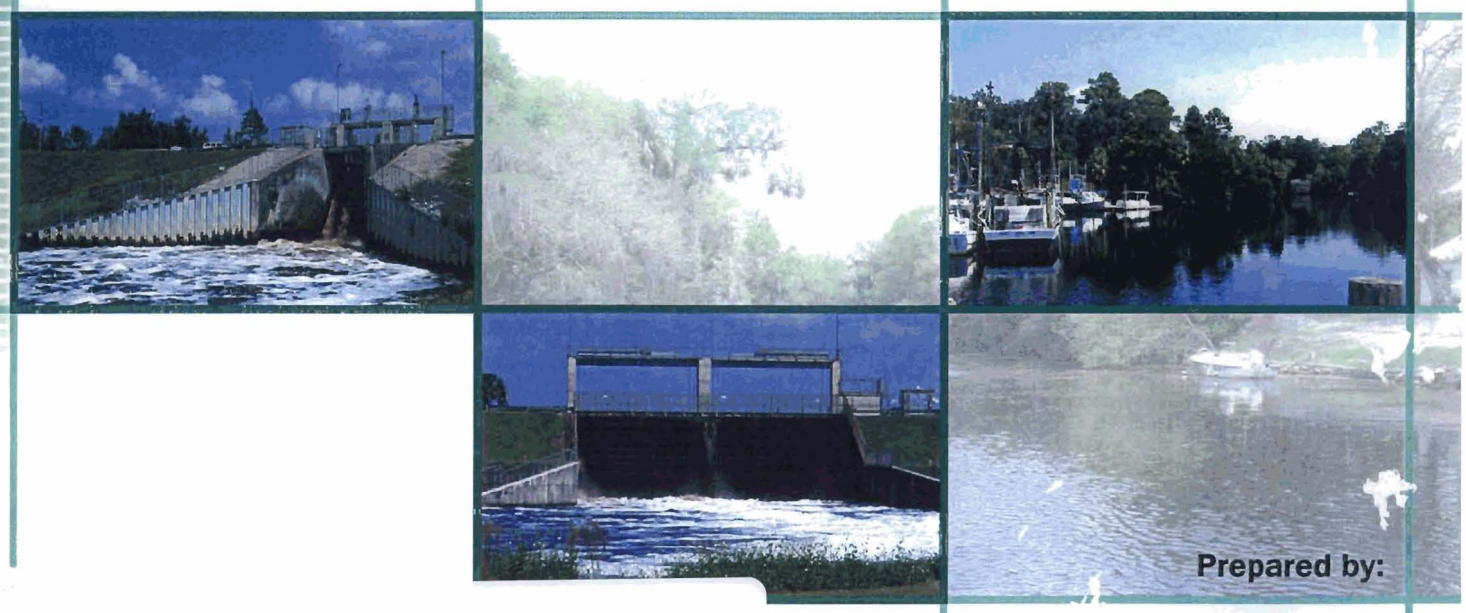
West Terminus - Cross-Florida Greenway Assessment

Work Order 1 Final Report

Lower Withlacoochee River Restoration Alternatives Feasibility Study

Prepared for:

SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
7329 Broad Street
Brooksville, Florida 34604



Prepared by:

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December 31, 2003

WEST TERMINUS - CROSS-FLORIDA GREENWAY ASSESSMENT
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1 GENERAL PROJECT INFORMATION

1.1 Background

The West Terminus Cross-Florida Greenway is comprised of a number of facilities, which are part of the Cross Florida Barge Canal system. The Cross Florida Barge Canal system and its components are illustrated on **Figure 1**. The system was partially constructed in the 1960's and later abandoned in the early 1970's. Authorized by the U.S. Congress during the 1940's, the project was intended to facilitate the movement of ocean going vessels traveling between the Atlantic Ocean and the Gulf of Mexico, the Caribbean Sea, and the Panama Canal. The Barge Canal facilities were designed by the U.S. Army Corps of Engineers. Significant elements of the overall project completed by the Corps within the west terminus area include: 1) the portion of the canal from the Gulf of Mexico to the Inglis Lock; 2) the Inglis Lock; the Inglis (Lake Rousseau) Dam; 3) the Bypass Channel and Spillway; and the 4) Rock Dam.

Construction of the Barge Canal system was halted during the Nixon administration in 1971 because of concerns related to cost and the project's effect on the environment. Although construction activities ended three decades ago, it was not until 1990 that the official construction de-authorization was approved by Congress and signed by President Bush (after an extensive study by the Corps of Engineers). Subsequent to its de-authorization, the Inglis Lock and associated facilities became part of the Cross Florida Greenbelt State Recreation and Conservation Area that was established by the Florida State Legislature through the enactment of a law (F.S. 90-328). Currently, the Cross Florida Barge Canal facilities constructed near Inglis are owned by the Florida Department of Environmental Protection (FDEP). With the exception of the Main Dam and Bypass Channel Spillway, these facilities are operated by FDEP's Office of Greenways and Trails. The dam and spillway are operated by the Southwest Florida Water Management District.

1.2 Purpose

The portion of the Withlacoochee River downstream of Inglis Dam has undergone significant alteration since the turn of the twentieth century. The construction of the Cross-Florida Barge Canal in the 1960's created additional impacts to the segment of the river downstream of the canal. Construction of the barge canal included a dam on the Withlaccochee River known locally as the "Rock Dam". This dam effectively severs all flows released from the Inglis Dam main gates including large flood flows. The lower segment of the river downstream of the Rock Dam receives flows only from the bypass channel system via a spillway at its western terminus. The maximum flow rate from this bypass system is estimated to be 1,540 cfs, which is considerably less than flood flow rates expected for the river system. The changes described above have altered the historic flow regime of the Withlacoochee River downstream of Inglis Dam, which have created environmental impacts. It should be noted, pursuant to the results of a recent dam safety planning study, the Rock Dam is presently being reconstructed as a flood protection levee. The flood protection levee is designed to offer full protection to downstream structures on the Withlacoochee River in case of an Inglis Dam failure.

A Basin Initiative was requested by the Withlacoochee River Basin Board in fiscal year 2003 to evaluate restoration alternatives for the portion of the Withlacoochee River downstream of Inglis Dam. The purpose of this study is to carry out this Basin Initiative and evaluate a number of restoration alternatives, which are intended to mitigate some of the environmental impacts created by the construction of the Cross-Florida Barge Canal. The list below is a summary of alternatives that are to be evaluated as part of this study. Each of the alternatives will be evaluated with respect to their impact on flooding, natural systems, water quality, and navigation. In addition, a cost to construct and maintain the facilities necessary for each of the alternatives will be estimated. This information and the results of the evaluation will be used to create a decision matrix, which will be useful in determining the feasibility of each alternative.

1. Remove the Rock Dam, which presently severs the connection of the lower and upper river segments, and construct a variable-elevation control structure in the Barge Canal.

2. Replace the Rock Dam with a variable-elevation control structure (at the same location), construct a variable-elevation control structure in the Barge Canal, and construct a lock for navigation.

3. Reconstruct the Bypass Channel spillway with increased discharge capacity to facilitate increased flows in the lower segment of the river.

4. No improvement/baseline condition alternative.

The restoration alternatives study has been broken down into two work orders. The report contained herein is intended to document the tasks conducted as part of Work Order 1. The tasks are listed below, and were taken from the District Scope of Work. The following sections of this report address each of the tasks listed below in the order shown.

1.1.2.1	Review Existing Watershed Parameters
1.1.2.2	Field Reconnaissance
1.1.2.3	Hydraulic Features Inventory
1.1.2.4	Identification of Surveys to be Performed
1.1.2.5	Update Watershed Parameters
1.1.2.6	Phase I Report of Findings

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2 DATA COLLECTION AND ASSESSMENT

The data collection and assessment task was conducted as part of Task 1.1.2.1 Review Existing Watershed Parameters, defined in the scope-of-work. This task included acquiring and reviewing available data from studies previously conducted by URS, FDOT, FDEP and others for the subject area, as well as available data on navigation, natural systems and cost. The results of this data collection and assessment task were used to determine required field reconnaissance (Task 1.1.2.2) and to identify additional information and land survey requirements (Task 1.1.2.4). An inventory of the data collected as part of this study is contained in Table 1.

Table 2-1
INVENTORY OF DATA COLLECTED

TITLE	SOURCE	DATE
Reports and other Documents:		
Lake Rousseau Dam Failure Assessment, Final Report	URS Tampa	February, 2001
Lake Rousseau Dam Failure Assessment, Supplemental Numerical Modeling Report	URS Tampa	March, 2003
Emergency Action Plan - Inglis Main Dam and Bypass Channel Dam	URS Tampa	February, 2003
Boat User Survey - US 19/US 98 Cross Florida Barge Canal Bridge from West Cornflower Drive to West Foss Grove Path	Florida Department of Transportation	November, 2002
Inglis Lock Rehabilitation and New Smaller Lock Study - Volume I Rehabilitation Alternative	Bergmann Associates &	January, 2002
Dept. of Env. Protection Office of Greenways and Trails - Marjorie Harris Carr Cross Florida Greenway - Levy Construction Plans	URS	October, 2002
Report Geotechnical Engineering Services - Flood Protection Levee at Lower Withlacoochee and Cross Florida Barge Canal - Levy County, FL	URS Corporation	April, 2001
Addendum Report Geotechnical Engineering Services - Flood Protection Levee Alternatives - Lower Withlacoochee and Cross Florida Barge Canal - Levy County, FL	URS Corporation	April, 2002
Structure Profile - Channel G Salinity Barrier with Construction Costs	SWFWMD	June, 2002
Structure Profile - S-159 Lower with Construction Costs	SWFWMD	February, 2001
Structure Profile - S-551 Salinity Barrier with Construction Costs	SWFWMD	April, 2001
Structure Profile - S-155	SWFWMD	February, 2001
Yankeetown Watershed Mgmt. Plan Update	Jones, Edmunds and Associates	October,2003
US 19 Bridge Over Florida Barge Canal PD&E Study - Plan and Profile	Florida Department of Transportation	February, 2003
SR 55 (US 19) Over Withlacoochee River - Construction Plan Set	State of Florida Department of Transportation Structures	1970
SWFWMD Aerial Topography, 22 Sections Within the Study Area in T17S, R16E and T17s, R17E		Various
Regulation Manuel for Lower Hillsborough Flood Detention Area and Tampa Bypass Canal	USACOE, Jacksonville District	N/A
Digital Aerials with Contours - For the following Sections: 1, 3, 4, 5, 6, 7, 17, 16, 19, 30, 31, 16, 17, 24, 25, 26, 27, 32, 33, 34, 35, 36/16/16	SWFWMD	August, 2003
Lake Rousseau Dam Failure Assessment, Hydrologic and Hydraulic Models used for Study	URS Tampa	February, 2001
Lake Rousseau Dam Failure Assessment Study, Supplemental Numerical Modeling Hydraulic Models used for Study	URS Tampa	March, 2003

Table 2-1 (Continued)
INVENTORY OF DATA COLLECTED

TITLE	SOURCE	DATE
Emergency Action Plan - Inglis Main Dam and Bypass Channel Dam, Affected Structure Data Base with Finished Floor Elevations	URS Tampa	February, 2003
Emergency Action Plan - Inglis Main Dam and Bypass Channel Dam, Hydraulic Models for Allowable Flood Flows Assessment	URS Tampa	February, 2003
1970 Cross-Florida Barge Canal-Plans for Construction of Inglis Spillway and Dam	United States Army Corp of Engineers	March, 1970
Detailed Design Memorandum No. 10, Cross Florida Barge Canal, Inglis Spillway and Dam	Department of the Army, Jacksonville District Corps of Engineers	September, 1966
Cross-Florida Barge Canal Project, Inglis Bypass Spillway, Pre-Inspection Brochure	Department of the Army, Jacksonville District Corps of Engineers	N/A
Water Control Plan for Inglis Project Works	State of Florida, DEP, Office of Greenways and Trails	June, 2001
Assessment of Navigation Alternatives	Greiner, Inc.	November, 1993
Evaluation of "Special Assessment and Review of the Inglis Works and Navigation Options"	Greenway Trails FDEP	July, 1994
Conceptual Design for Implementation of the Lake Rousseau Operations and Management Plan	Greiner, Inc.	June, 1992
Inglis Lock Usage	FDEP	May, 1999
Dam Breach Analysis	Greiner, Inc.	May, 1992
Draft - Lake Rousseau Operations and Mgnt Study	South West Florida Water Management Disttict	August, 1988
Lake Rousseau Operations and Management Study	South West Florida Water Management Disttict	February, 1989
An Analysis of Vegetation-Salinity Relationships in Seven Tidal Rivers on the Coast of West-Central Florida (Draft)	South West Florida Water Management Disttict	December, 2002
Functions of the Inglis Project Works on the Former Cross Florida Barge Canal	Greiner, Inc.	December, 1993
Cross Florida Barge Canal Inglis Lock Bypass Channel Channel Sections	Department of the Army, Jacksonville District Corps of Engineers	February, 1968
Cross-Florida Barge Canal Inglis Lock Cooling Water Bypass Channel Layout Plan & Sections	Department of the Army, Jacksonville District Corps of Engineers	January, 1966
Cross-Florida Barge Canal Inglis Lock-Bypass Channel Layout Plan	Department of the Army, Jacksonville District Corps of Engineers	February, 1968
Hydrologic Data:		
Withlacoochee River near Holder - Daily Streamflow / 1928 to 2002	USGS 02313000	September, 2003
Withlacoochee River near Holder - Peak Streamflow / 1932 to 2002	USGS 02313000	September, 2003
Rainbow Springs near Dunnellon - Daily Streamflow / 1965 to 2002	USGS 02313000	September, 2003
Rainbow Springs near Dunnellon - Peak Streamflow / 1965 to 2002	USGS 02313000	September, 2003
Withlacoochee River at Inglis Dam near Dunnellon - Daily Streamflow / 1969 to 2001	USGS 02313230	September, 2003
Withlacoochee River at Inglis Dam near Dunnellon - Peak Streamflow / 1970 to 2001	USGS 02313230	September, 2003
Withlacoochee River at Bypass Channel near Inglis - Daily Streamflow / 1970 to 2001	USGS 02313250	September, 2003
Withlacoochee River at Bypass Channel near Inglis - Peak Streamflow / 1971 to 2001	USGS 02313250	September, 2003
Cedar Key Tide Gage (Adjusted for Withlacoochee River, Various P.O.R.)	NOAA Station No. 8727520	N/A
Environmental Data Inventory:		
US Department of Agricultural, Natural Resources Conservation Service	Citrus County Soil Survey	October, 1988
US Department of Agricultural, Natural Resources Conservation Service	Levy County Soil Survey	September, 1996
National Wetlands Inventory Maps	US Fish and Wildlife Service	Various
Florida Department of Transportation, Florida Land Use, Cover and Forms Classification System, 3rd Edition		1999

Table 2-1 (Continued)
INVENTORY OF DATA COLLECTED

TITLE	SOURCE	DATE
US Fish and Wildlife Service, Classification of Wetlands and Deepwater Habitats of the United States	Cowardin, et.al	1979
Inglis Lock Rehabilitation and New Smaller Lock Study, Environmental Assessment	Bergmann Associates & URS Corporation	January, 2002
7.5 Minute Series Topographic Quadrangles: Yankeetown SE, Fla.Yankeetown, Fla.Red Level, Fla.Crystal River, FlaDunnellon, Fla.	US Geological Survey	19911993198195419 54
GFC Biodiversity Hot Spots - grid	Florida Game and Fresh Water Fish Commission	N/A
GFC Habitat and Landcover - grid	Florida Game and Fresh Water Fish Commission	N/A
GFC Priority Wetland Habitats - grid	Florida Game and Fresh Water Fish Commission	N/A
GFC Strategic Habitat Conservation Areas - grid	Florida Game and Fresh Water Fish Commission	N/A
Property Appraiser Office		
Property Value & Structure Information - Parcel 06-17-17-03970-001-00	Levy County Soil Survey	October, 2003
Property Value & Structure Information - Parcel 05-17-17-03961-000-00	Levy County Soil Survey	October, 2003
Property Value & Structure Information - Parcel 06-17-17-03967-000-00	Levy County Soil Survey	October, 2003
Property Value & Structure Information - Parcel 05-17-17-03965-000-00	Levy County Soil Survey	October, 2003

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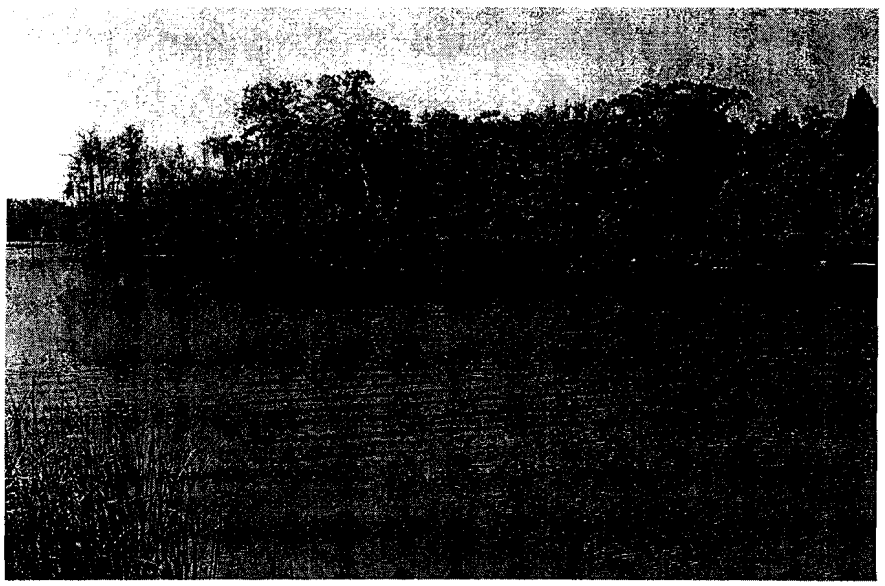
3 FIELD RECONNAISSANCE

The field reconnaissance task was conducted as part of Task 1.1.2.2 Field Reconnaissance, defined in the scope-of-work. Following a review of the data collected for this study, a field reconnaissance visit was scheduled. The reconnaissance work was intended to familiarize personnel working on the project with the project site including layout of the system, known flooding areas and environmentally sensitive areas. This fieldwork was also used to acquire any available background information from local sources.

Representatives from the Southwest Florida Water Management District, URS and the Florida Department of Environmental Protection, Office of Greenways and Trails participated in the field reconnaissance. The field work consisted of: 1) meeting with government officials and representatives from the Towns of Inglis and Yankeetown to document flood prone areas and gather information on flood events and tides, 2) visiting flood prone and environmentally sensitive areas, 3) and touring the Cross-Florida Barge Canal facilities. The photograph shown below was taken near the south end of Magnolia Avenue located on the west end of Yankeetown. The photograph illustrates a wetland area on the north side of the river. Appendix A of this report contains full documentation of the field reconnaissance work conducted on September 12, 2003 including photographs of the areas and facilities visited.



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4 CROSS-FLORIDA BARGE CANAL SYSTEM COMPONENTS INVENTORY

The system component inventory task was conducted as part of Task 1.1.2.3 Hydraulic Features Inventory, defined in the scope-of-work.

4.1 Introduction

The west terminus portion of the Cross-Florida Barge Canal System consists of a number of components, which are illustrated on **Figure 1**. The system components include hydraulic structures and associated facilities, which are summarized as follows:

- Lake Rousseau,
- Inglis Dam and Main Spillway,
- Withlacoochee River – Upper Segment,
- Cross-Florida Barge Canal,
- Rock Dam,
- Inglis Lock,
- Bypass Channel and Bypass Channel Spillway,
- Withlacoochee River – Lower Segment,
- US-19 Bridge at Withlacoochee River,
- US-19 Bridge at Barge Canal, and
- Lock Access Road Bridge at Bypass Channel.

Section 4.2 of this inventory provides a brief description and a photograph of each of the Cross-Florida Barge Canal System components. Section 4.3 provides a design summary in tabular form for each of the components.

4.2 Description Of Features

Lake Rousseau

Lake Rousseau is a man-made impoundment of the Withlacoochee River formed primarily by Inglis Dam. The lake is located in Citrus and Levy Counties and presently serves to supply water for the Inglis Lock and barge canal system. The lake is characterized by large shallow areas that vary in depth from zero feet on the east end to ten feet on the west end. Given the shallow nature of the lake and only minimum freeboard, this lake provides only minor flood protection and little long term water storage. There are three outlets for water from the lake including: (1) the Main

Spillway, (2) the Bypass Spillway, and (3) Inglis Lock. A view of the west end of the lake is shown in **Photo 4-1**.

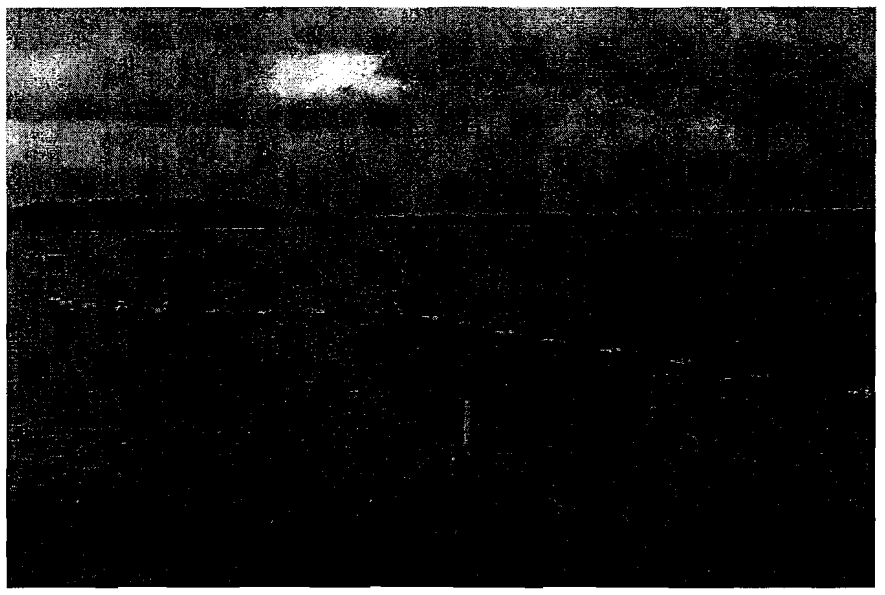

Photo 4-1: Lake Rousseau looking northwest from Inglis Dam

Inglis Dam and Main Spillway

A dam in one form or another has been in place at the Inglis Dam site since 1908. The dam is located 8 ½ miles upstream of the mouth of the Withlacoochee River and about two miles east of US-19. Inglis Dam is an earthen embankment approximately 34 feet high and 1,100 feet long. It is built across the Withlacoochee River valley and creates the Lake Rousseau reservoir. The dam's appurtenant facilities include a two-gate spillway system with ogee weirs, which are used to control flood stages in the reservoir. **Photo 4-2** illustrates the dam and spillway system. Discharge from the main spillway system enters the short segment of the Withlacoochee River upstream of the Barge Canal. **Photo 4-3** illustrates the outlet pool below the spillway. **Figure 2** is plan of Inglis Dam and the main spillway.

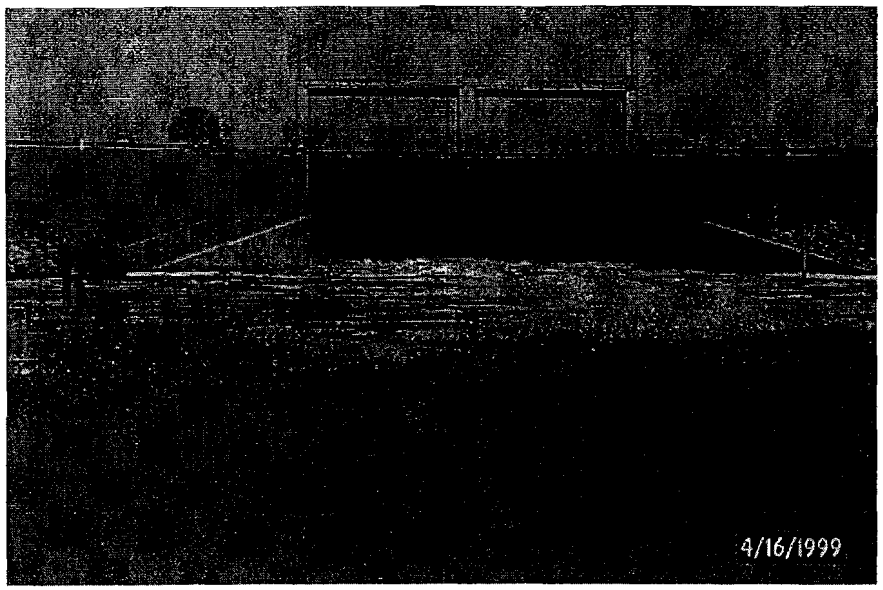

Photo 4-2: Inglis Dam and Main Spillway

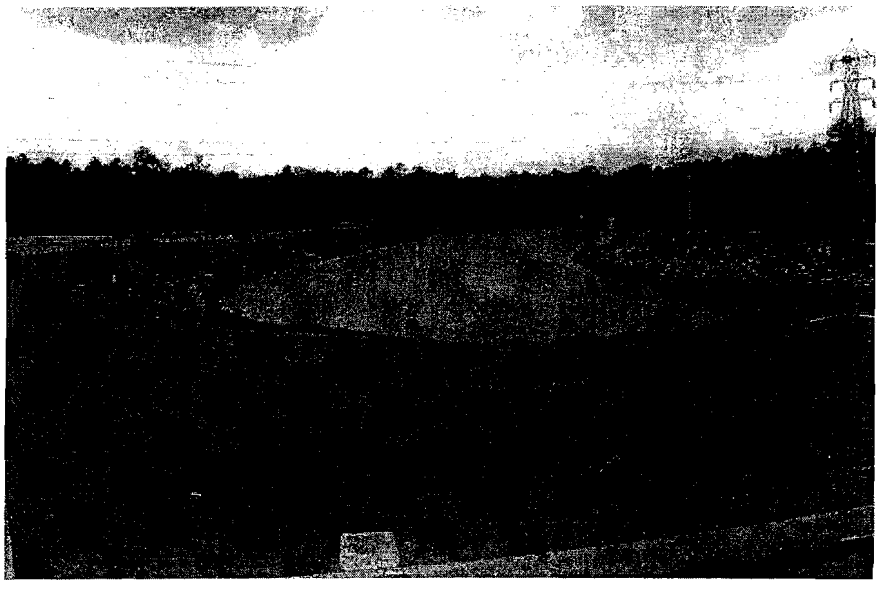

Photo 4-3: Main Spillway outlet pool, also head area for the Withlacoochee River - Upper Segment

Withlacoochee River – Upper Segment

The segment of the Withlacoochee River located between the Barge Canal and Inglis Dam is commonly referred to as the Upper Segment. This river segment, which is approximately 1.44 miles long and has an average bottom slope of 0.1 percent, carries flood flows discharged

through the Inglis Dam Main Spillway. This natural conveyance system is characterized by forested channel banks and flood plain areas. Urbanization is occurring on the south bank of the system over the entire reach length. As of December 2002 there were 15 known residences in this reach, several of whom have docks on the river. **Photo 4-4** illustrates a typical segment of this reach.

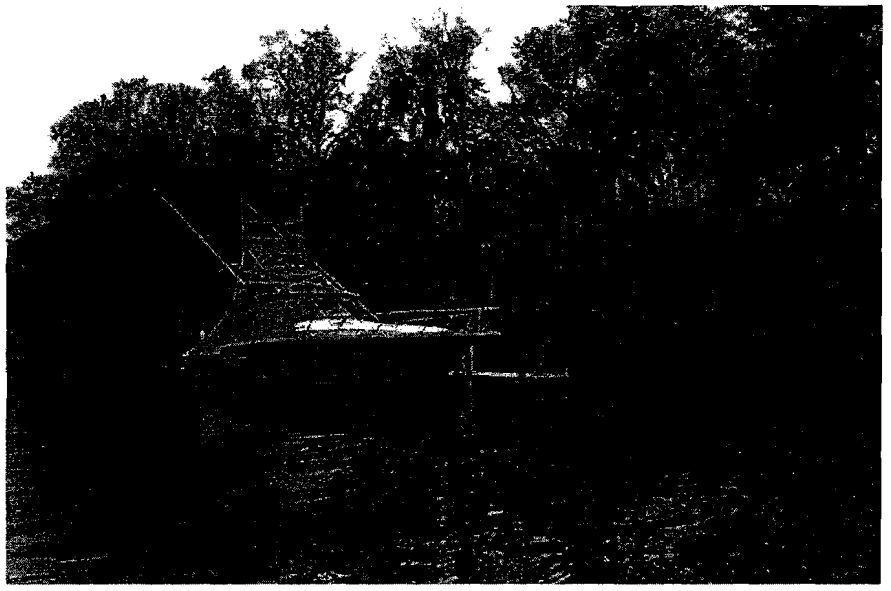

Photo 4-4: Withlacoochee River - Upper Segment

Cross-Florida Barge Canal

The Cross-Florida Barge Canal within the west terminus area is approximately 7.4 miles long. The canal begins on its west end at the Gulf of Mexico and terminates on the east end at Inglis Lock. The canal, a prismatic channel, was designed to provide a minimum draft of 12 feet and ranges in width from 350 feet to 500 feet. The Barge Canal has a 1,500 feet long waiting basin at the west end of the lock. **Figure 3** illustrates a typical section of the Barge Canal.

The Cross-Florida Barge Canal in this reach is characterized as having steep side slopes, which are heavily vegetated with trees and shrubs, and spoil rows are located on both sides adjacent to the top of bank. The spoil rows were placed as part of canal construction and exist throughout most of the reach. The Barge Canal receives flood flows from the upper segment of the Withlacoochee River and conveys these flows to the Gulf of Mexico. **Photos 4-5 and 4-6** illustrate the Barge Canal in this reach.

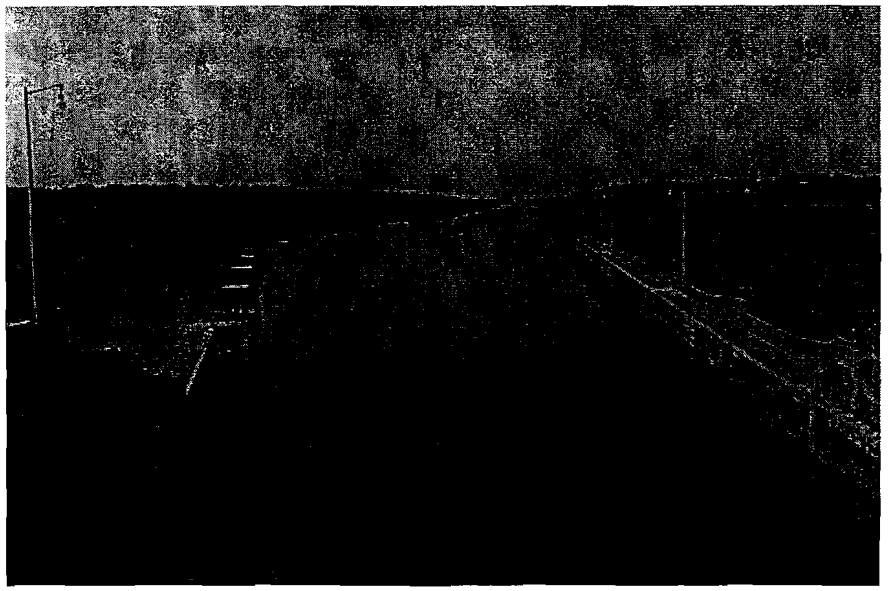

Photo 4-5: Cross-Florida Barge Canal looking west from Inglis Lock

Photo 4-6: Cross-Florida Barge Canal at confluence with Withlacoochee River - Upper Segment

Rock Dam

The Rock Dam is located on the Withlacoochee River about 6 ½ miles upstream of the mouth. This facility forms the right bank of the Barge Canal and is technically a levee as there are no discharge facilities to pass flow to downstream areas, and it was not designed to overflow. The construction of this facility effectively severed the upper and lower segments of the

Withlacoochee River and allowed flood flows from the upper segment to be shunted down the Barge Canal. The facility as originally constructed consisted of an earthen embankment with top of bank elevation higher than the 100-year flood stage within the Barge Canal. The facility is currently being reconstructed with a higher top elevation as a dam safety measure. The new facility incorporates an MSE wall into the existing embankment. **Figures 4 and 5** are sections of the existing Rock Dam and proposed flood protection levee. **Photos 4-7 and 4-8** illustrate the existing Rock Dam and proposed flood protection levee.

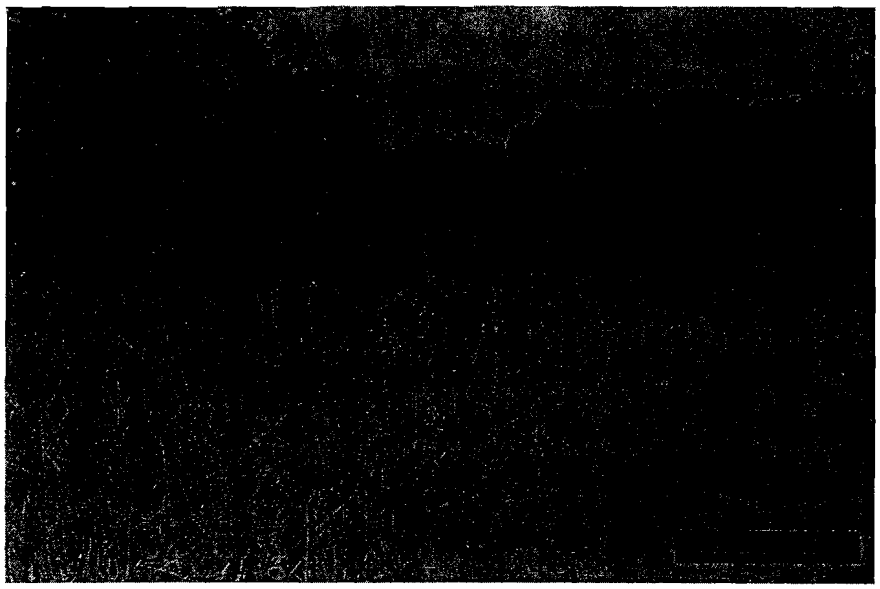

Photo 4-7: Rock Dam

Photo 4-8: Flood protection levee under construction

Inglis Lock

Inglis Lock is located at the eastern terminus of the Barge Canal. The lock was designed to raise and lower ocean-going vessels between the Gulf of Mexico and Lake Rousseau, and works with water levels in the range of –2 to 28 ft-NGVD. One lockage cycle requires about 11 million gallons of water supplied from Lake Rousseau (Inglis Pool). **Photos 4-9, 4-10 and 4-11** illustrate the Inglis Lock and its associated gates. At present, Inglis Lock is not operational. The State of Florida is in the process of developing design plans for future renovations.

Photo 4-9: Inglis Lock

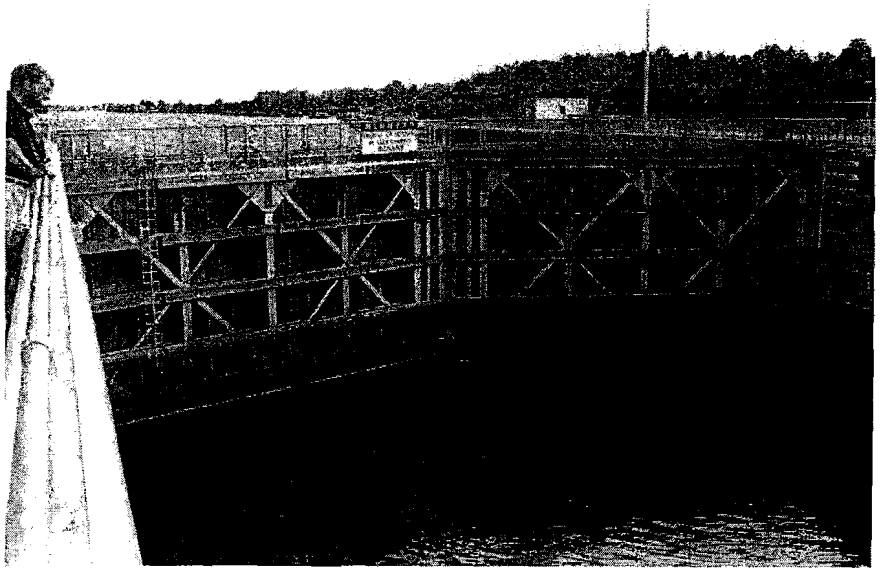

Photo 4-10: Inglis Lock – Head Gate

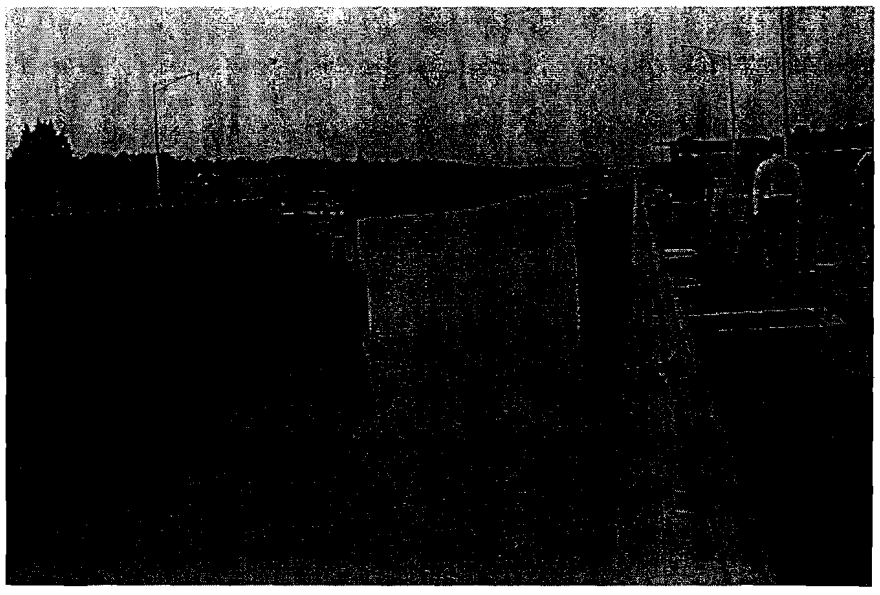

Photo 4-11: Inglis Lock – Tail Gate

Bypass Channel and Bypass Channel Spillway

The Bypass Channel and Spillway system is located north and west of Inglis Lock. These facilities allow for the controlled discharge of water from Lake Rousseau to the lower segment of the Withlacoochee River, which was necessitated due to the severance of the upper and lower segments of the river by the Rock Dam. **Figure 6** illustrates the Bypass Channel cross-sections. **Figure 7** is the Bypass Channel Spillway plan. **Figure 10** illustrates the Bypass Channel System layout. **Photos 4-12, through 4-15** illustrate the Bypass Channel and Spillway.

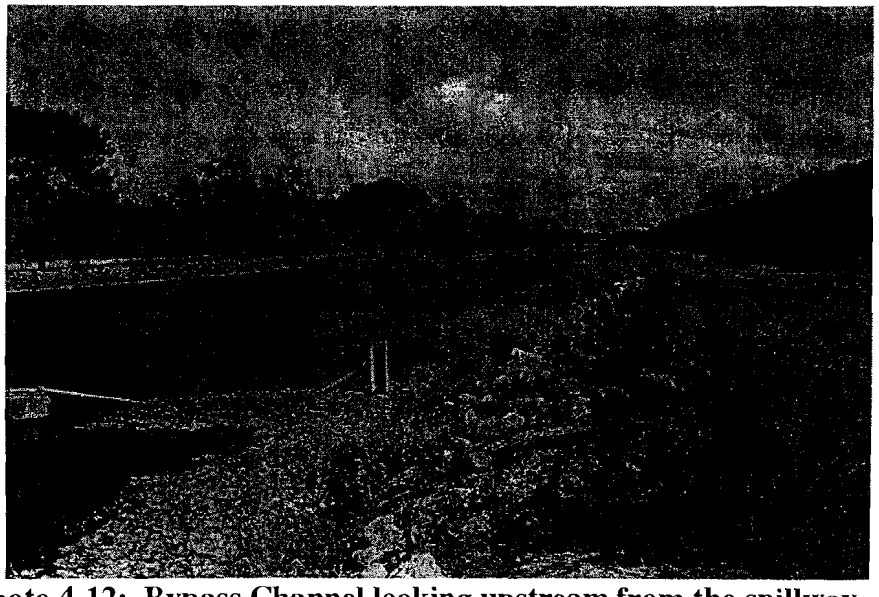

Photo 4-12: Bypass Channel looking upstream from the spillway

Photo 4-13: Bypass Channel Spillway

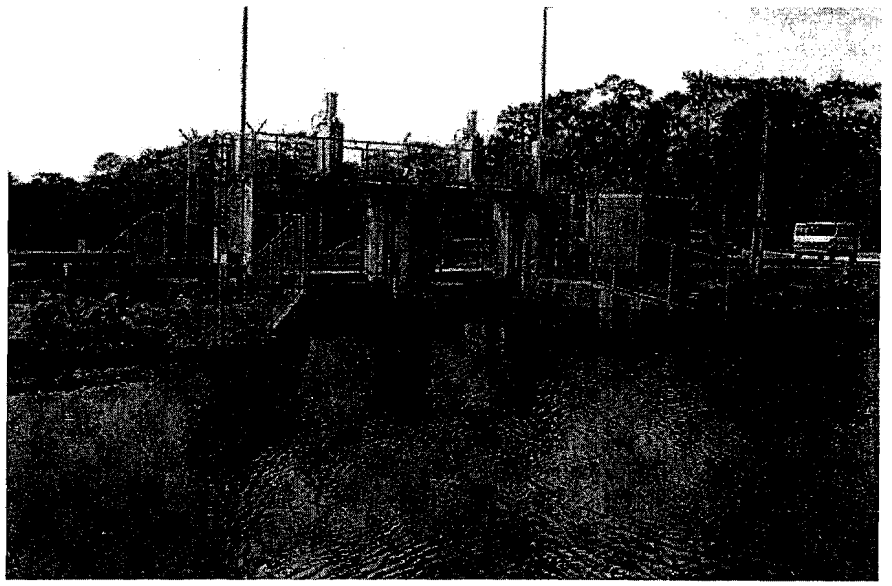

Photo 4-14: Bypass Channel Spillway – upstream side

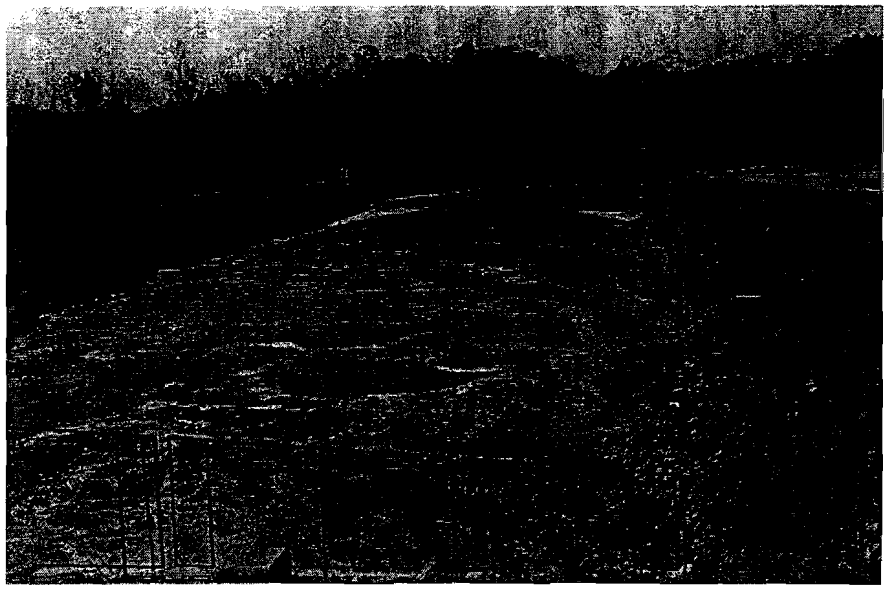

Photo 4-15: Bypass Channel Spillway outlet pool, also head area for the Withlacoochee River - Lower Segment

Withlacoochee River – Lower Segment

The segment of the Withlacoochee River starting at the mouth and going upstream to the Bypass Channel Spillway is commonly referred to as the Lower Segment. The lower segment is approximately 6.5 miles long and has an average bottom slope of 0.006 percent. The primary source of fresh water for this segment of the river is from Lake Rousseau via the Bypass Channel Spillway. This natural conveyance system is characterized by forested channel banks and flood plain areas. Urbanization is occurring primarily on the north bank of the system over the entire reach length and to a lesser degree on the south bank areas. As of December 2002 there were 448 known residences in this reach and a large number docks on the river. This reach contains a single pair of bridges that serve US-19. **Photos 4-16 and 4-17** illustrate some typical areas within this segment.

Photo 4-16: Withlacoochee River - Lower Segment at Coast Guard Station

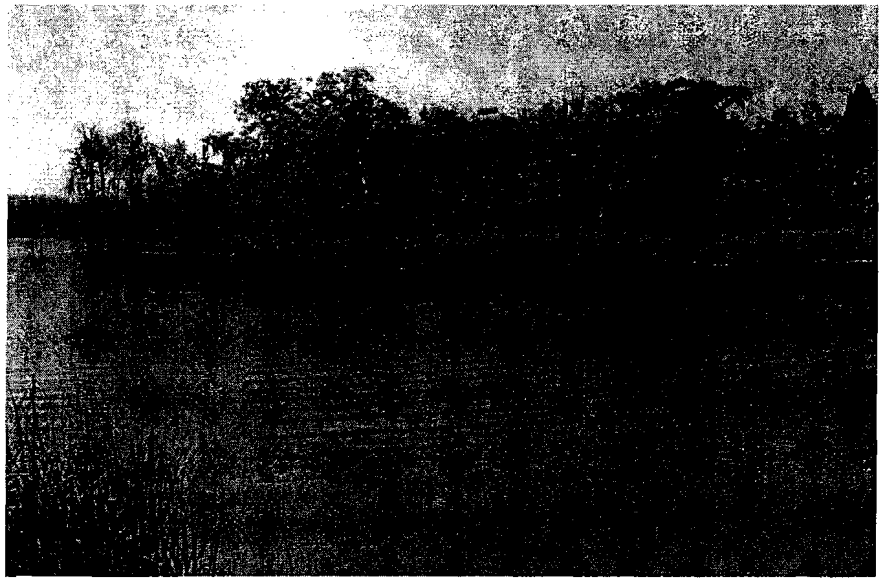

Photo 4-17: Withlacoochee River - Lower Segment at West Yankeetown

US-19 Bridge at Withlacoochee River

The US-19 Bridge at the Withlacoochee River was constructed circa 1970. This bridge consists of two spans each with two lanes. The bridge low member is at elevation 13.6 ft-NGVD and is

suitable in height to accommodate only relatively small vessels. **Photo 4-18** illustrates the existing bridge. **Figure 8** is a plan and elevation of the bridge.

Photo 4-18: US-19 Bridge over Withlacoochee River

US-19 Bridge at Barge Canal

The existing US-19 Bridge at the barge canal was constructed as part of the Cross-Florida Barge Canal System. The bridge is a single span two-lane bridge with sufficient height to accommodate ocean-going vessels. **Photos 4-19 and 4-20** illustrate the existing bridge. **Figure 9**, Alternative 1 is a profile of a proposed bridge that is equivalent to the existing span. A second bridge is being planned at this location as part of the Florida Suncoast Parkway expansion. **Figure 9**, Alternative 2 is a profile of a proposed bridge.

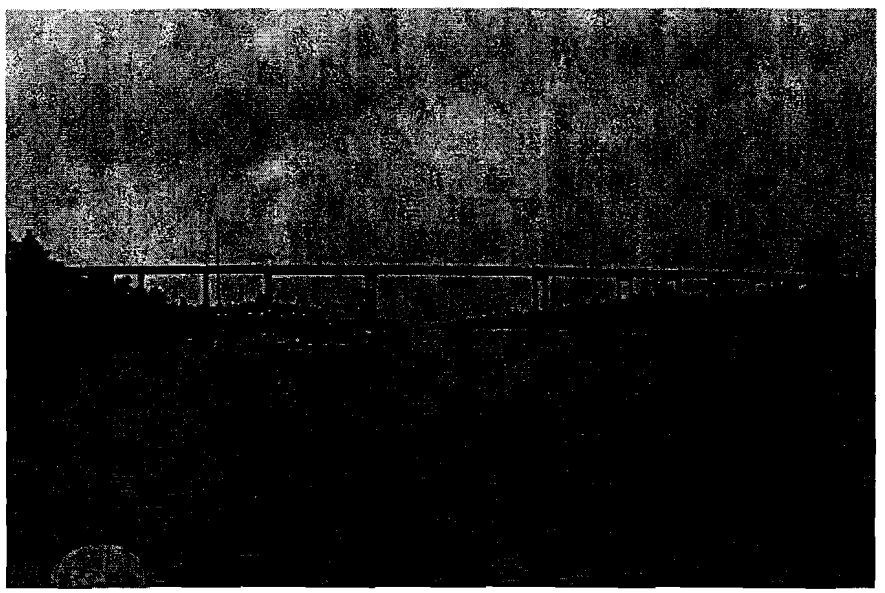

Photo 4-19: US-19 Bridge over Barge Canal

Photo 4-20: US-19 Bridge over Barge Canal with canal in background

Lock Access Road Bridge at Bypass Channel

The Lock Access Road Bridge at the Bypass Channel was constructed as part of the Cross-Florida Barge Canal System. The bridge consists of three concrete box culverts wide enough to accommodate two traffic lanes. This bridge forms the flow control for the Bypass Channel System. **Photo 4-21** illustrates the existing bridge. **Figure 10** illustrates the location and alignment of the lock access road at the Bypass Channel.

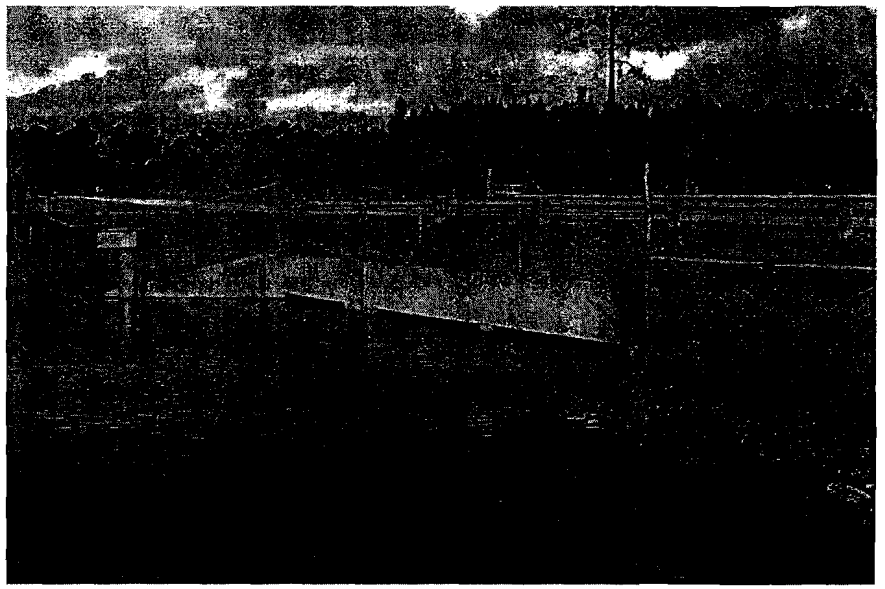

Photo 4-21: Lock Access Road Bridge over Bypass Channel

4.3 Summary of Features

The table below presents a summary of design parameters for each of the Barge Canal System components.

Table 4-1
SYSTEM COMPONENT DESIGN SUMMARY

System Component	Design Data		Plans and Details
Lake Rousseau	• Length	11 mi	
	• Surface Area	6.5 mi^2	
	• Normal Pool	27.5 ft-NGVD	
	• Drainage Area	2,020 mi^2	
Inglis Dam and Main Spillway	• Earthen Embankment:		Figure 2
	– Length	1,100 ft	
	– Top Elevation	34 ft-NGVD	
	– Crown Width	32 ft	
	– Side Slopes:		
	Pool Side	6:1	
	Land Side	3:1	
	• Horizontal Apron Elev.	(-)7.0 ft-NGVD	
	• Spillway:		
	– Hydraulic Design Condition:		
	Discharge	18,000 cfs	
	Headwater Elev.	27 ft-NGVD	
	Tailwater Elev.	17.2 ft-NGVD	
	– Crest:		
	Shape	Ogee	
	Elevation	11.3 ft-NGVD	
	Net Length	80 ft.	
	– Control Gates:		
	Number	2	
	Width x Height	40 ft x 16.7 ft.	
Withlacoochee River - Upper Segment	• Length	1.44 mi	
	• Channel Slope	0.1%	
	• Bottom Elev.	(-)6.5 → (-)14.0 ft-NGVD	
Cross-Florida Barge Canal	• Canal Segment Length	7.4 mi	Figure 3
	• Channel Geometry:		
	– Shape	Trapazoidal	
	– TOB Elev.	10-15 ft-NGVD	
	– Top Width	350-500 ft	
	– Bottom Elev. (typ)	(-)14 ft-NGVD	
Rock Dam (Existing)	• Earthen Embankment:		Figure 4
	– Length	350 ft	
	– Top Elevation	15 ft-NGVD	
	– Crown Width	≧20 ft	
	– Side Slopes:		
	Upstream Side	3:1	
	Downstream Side	2:1	
Rock Dam (Proposed Flood Protection Level)	• Earthen Embankment:		Figure 5
	– Length	682 ft	
	– Top Elev.	33.8 ft-NGVD	
	– Side Slopes:		

Table 4-1 (Continued)
SYSTEM COMPONENT DESIGN SUMMARY

System Component	Design Data		Plans and Details
	Upstream Side	3:1	
	Downstream Side	2:1	
	– Access Bench:		
	Elevation	20 ft-NGVD	
	Width (typ)	20 ft	
	• MSE Wall:		
	– Length	660 ft	
	– Top Elev.	34 ft-NGVD	
	– Base Elev.	20.5 ft-NGVD	
	– Top Berm Width (typ)	10 ft	
	– Facing	Segmental Concrete Block	
Inglis Lock	• Lock Chamber:		
	– Length (nominal)	600 ft	
	– Width (nominal)	84 ft	
	– Bottom Elev.	(-)14 ft-NGVD	
	– Draft (min)	12 ft	
	• Upstream Pool	24 → 28 ft-NGVD	
	• Downstream Pool	(-)3 → 9.6 ft-NGVD	
	• Miter Gates:		
	– Top Elev.	31.5 ft-NGVD	
	– Tail Gate Height	47.5 ft	
	– Head Gate Height	21.5 ft	
Bypass Channel	• Length	8,500 ft	Figure 6
	• Bottom Width	5 ft	
	• Side Slopes	3:1	
	• Bottom Elev.	12 ft-NGVD	
	• Top of Bank Elev. (typ)	≧30 ft-NGVD	
Bypass Channel Spillway	• Hydraulic Design Condition:		Figure 7
	– Design Discharge	1,100 cfs	
	– Maximum Discharge	1,540 cfs	
	– Headwater Elev.	25.9 ft-NGVD	
	– Tailwater Elev. (tidal)	0.8 ft-NGVD	
	• Control Gates:		
	– Number	2	
	– Width x Height	14 ft x 7 ft	
	• Crest:		
	– Shape	Ogee	
	– Elevation	21.0 ft-NGVD	
	– Net Length	28 ft	
	• Horizontal Apron Elev.	(-)9.5 ft-NGVD	
Withlacoochee River - Lower Segment	• Channel Length	6.5 mi	
	• Bottom Elev.	(-)6 → (-)8 ft-NGVD	
	• Channel Slope	0.006%	
US-19 Bridge at Withlacoochee River	• Number Spans	2	Figure 8
	• Lanes Each Span	2	
	• Clear Span Length	215 ft	
	• Low Chord Elev.	13.6 ft-NGVD	
US-19 Bridge at Barge Canal (existing)	• Number Spans	1	Figure 9
	• Lanes Each Span	2	
	• Clear Span Length	1,694 ft	
	• Bridge w/Abutments	4,100 ft	
	• Vertical Clearance	65 ft	
US-19 Bridge at Barge Canal	• Number Spans	1	Figure 9

Table 4-1 (Continued)
SYSTEM COMPONENT DESIGN SUMMARY

System Component	Design Data		Plans and Details
(proposed)	• Lanes Each Span	2	
	• Clear Span Length	753 ft	
	• Vertical Clearance	40 ft	
Lock Access Road Bridge at Bypass Channel	• Lanes	2	Figure 10
	• Hydraulic Design Condition:		
	– Design Discharge	1,540 cfs	
	– Headwater Elev.	26.9 ft-NGVD	
	– Tailwater Elev. (tidal)	26.5 ft-NGVD	
	• Box Culvert:		
	– Number of Openings	3	
	– Width x Height	12 ft x 12 ft	
	– Invert Elev.	16 ft-NGVD	

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5 ADDITIONAL INFORMATION AND LAND SURVEY REQUIREMENTS

The **Additional Information and Land Survey Requirements** task was conducted as part of Task 1.1.2.4 Identification of Surveys to be Performed, defined in the scope-of-work.

5.1 Introduction

Available data were collected and assessed as part of Task 1.1.2.1. Critical additional data survey needs for studies to be conducted under Work Order 1 and Work Order 2 of this project have been identified as part of Task 1.1.2.4. These additional data and survey needs are summarized briefly below:

- Long-term tide data for the mouth of the Withlacoochee River and Barge Canal,
- Land survey data of river and barge canal cross-sections to refine existing data,
- Land survey data of Bypass Channel cross-sections,
- Land survey to support structure siting studies, and
- Property data to support the land acquisition and cost assessment.

Section 5.2 below provides a detailed purpose and description of the additional data required. Section 5.3 provides a summary table of the required data as well as estimated cost for data and survey acquisition. Please note that design data for existing structures and bridges associated with the Cross-Florida Barge Canal system will be taken from available design documents.

5.2 Description of Data Required

Tide Data

Long-term tide data will be acquired for the mouth of the Withlacoochee River and Barge Canal. Data will be obtained from NOAA for the Cedar Key Station (ID 8727520), and will be adjusted to represent tidal conditions in the Barge Canal and the Withlacoochee River at or near the mouth of each system.

This tide data will be used, as the downstream boundary condition for the hydraulic models that will be developed to assess impacts to natural systems and water quality in the river and canal. Additionally, portions of the time series will be used as the downstream boundary conditions for the flood impact assessment and navigation assessment. Hourly data for years 1960, 1982, 1993, 1996, and 1999 will be requested from NOAA. The estimated cost of this data acquisition is $75, based on correspondence with NOAA personnel.

Land Survey Data

Land survey data will be required at a number of locations in support of the hydraulic and siting studies that will be conducted as part of Work Order 2 of this project. Previously developed

hydraulic models of the Withlacoochee River and Barge Canal system in the West Terminus area were used to assess flooding that would occur due to a failure of Inglis Dam. The cross-sectional configuration of the main channel was of relative less importance than that of the overbank areas, as most of the flow was conveyed in the overbank areas for these high flow studies. **Figure 11** illustrates the location of cross-sections used in the previous studies.

The existing models will be refined to include more accurate main channel data as part of the West Terminus study. This will be done to improve the accuracy of long-term low flow simulations that will be conducted as part of the natural systems and water quality assessments. To accomplish this, bank-to-bank surveys at selected cross-sections (20) in the Withlacoochee River, Barge Canal and Bypass Channel will be conducted, and the new information incorporated into the models. **Figure 11** illustrates the location of the cross-sections that will be surveyed as part of this study.

It should be noted that Cross-Sections 21 and 29 would be extended beyond the Barge Canal top of channel bank to include the adjacent spoil berms on each side. This will be done to aid in the siting of control and lock structures, which will be evaluated as part of this study. Additionally, Cross-Sections 33 through 35 will be entirely new sections developed as part of this study. At present cross-sections are not available for the Bypass Channel. Cross-Sections 33 through 35 will also be extended a sufficient length beyond the existing top of bank to facilitate potential design improvements to the Bypass Channel. The remaining 15 cross-sections will extend from bank to bank.

A preliminary estimate by a surveyor familiar this the West Terminus area indicates that the survey work described above will cost approximately $13,000.

Property Data

The Barge Canal and adjacent spoil areas are owned by the State of Florida. Any proposed structures that are to be sited in the Barge Canal are assumed to have no property acquisition issues. This study also includes assessing potential structural revisions to the Bypass Channel Control Structure and Bypass Channel. Areas north of this system are under private ownership. In order to assess property acquisition and development costs of any potential alternatives, information concerning property boundary and ownership must be acquired for the affected areas.

Property data will be collected from the appropriate municipality or county Tax Assessor once the affected areas are determined. Data on property ownership and parcel boundary will be taken from available records. Property boundary surveys will not be conducted as part of this data collection effort. In previous work conducted by URS in this locality, a survey subcontractor was used to conduct a similar data collection exercise. A preliminary estimate by a surveyor familiar this the West Terminus area indicates that the property data collection described above will cost approximately $2,000.

5.3 Summary Data Table and Estimated Costs

The following table is a summary of the additional data that is anticipated to be required to complete the proposed studies in Work Orders 1 and 2 of this project. These information

requirements are based on the work completed to date and may change as additional work is completed.

Table 5-1
ADDITIONAL INFORMATION REQUIREMENT SUMMARY

Required Data	Estimated Cost
Tide Data: • Cedar Key Tide Gage (NOAA Station 8727520), hourly data for years 1960, 1982, 1993, 1996, and 1999.	$75
Land Survey Data • Selected bank-to-bank cross-sections including four (4) on the Upper Withlacoochee River segment, ten (10) on the Lower Withlacoochee River segment and three (3) on the Barge Canal, • Cross-sections (3) on the Bypass Channel and adjacent areas, • Survey of selected overbank areas to support structure siting.	$13,000
Property Data • Property data collection for areas adjacent to Bypass Channel System to support the land acquisition and cost assessment.	$2,000
Total	$15,075

A detailed survey and data collection scope of work will be prepared during Work Order 2 of this project. This scope of work will be provided to the survey subcontractor and will be used as a basis for a cost proposal.

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6 HYDROLOGIC STUDIES

The Hydrologic Studies task was conducted as part of Task 1.1.2.5 Update Watershed Parameters defined in the scope-of-work.

6.1 Background

The hydrologic studies conducted as part of this task will be used in support of the restoration alternatives analysis, which will be conducted under Work Order 2 of this project. This task builds upon the hydrologic studies conducted as part of previous studies of the Cross Florida Barge Canal system and includes the following subtasks:

- Long-term flow assessment,
- Flood flow assessment for a selected flood frequency, and
- Tidal assessment.

Hydrologic analyses were conducted to determine long-term flow and flood flow hydrographs for the segment of the Withlacoochee River downstream of Inglis Dam. These hydrographs will be used as input to the hydraulic routing models, which will be developed under Work Order 2. Hydrographs were developed for the baseline condition (Alternative 4), which simulates the system as it exists today. Hydrographs were also developed to assess the proposed restoration alternatives condition (Alternatives 1, 2 and 3), which are described in Section 1.2 of this report. The development of long-term flow and flood flow hydrographs is described in detail in the following sections.

It is important to note that baseline conditions (Alternative 4) were determined from Lake Rousseau discharge data for the long-term flow analysis and from adjusted reservoir inflow data for the flood flow analysis. The Lake Rousseau discharge data most accurately represents baseline conditions. However, discharge data were not available for the selected flood frequency, thus inflow data were used to estimate reservoir discharge for the flood flow analysis. For the remaining alternatives (Alternatives 1, 2, and 3) reservoir discharge hydrographs were developed from adjusted reservoir inflow data. This reservoir inflow data most accurately represents the system under alternative conditions, as it is free from the operational influences due to discharge from Inglis Dam main gates and the bypass channel.

Hydrologic analyses were also conducted to determine tidal conditions in the Withlacoochee River. This tidal information was used to develop tide stage hydrographs for long-term flow and flood flow model simulations. These tide stage hydrographs were used as downstream boundary conditions in the simulation models. The development of the tide stage hydrographs for long-term flow and flood flow simulations is described in detail in the following sections.

6.2 Data

The long-term flow and flood flow hydrographs used in this study were developed from existing streamflow records from the U.S.G.S. gaging stations listed below. **Figure 12** illustrates the location of the selected gage stations. The first two gages listed below measure the majority of

the water that flows into the Lake Rousseau reservoir. The latter two gages measure discharges from the reservoir to the Withlacoochee River downstream reaches from the Inglis Dam and the Bypass Spillway respectively.

1. Withlacoochee River near Holder, USGS Station No. 02313000
2. Rainbow Springs near Dunnelon, USGS Station No. 02313100
3. Withlacoochee River at Inglis Dam Near Dunnellon, USGS Station No. 02313230 (Main Gates)
4. Withlacoochee River Bypass Channel near Inglis, USGS 02313250

Tidal stage hydrographs for the proposed tidal boundary at the Gulf of Mexico were developed from data obtained for the NOAA Cedar Key tide station (NOAA Station No. 8727520). Hourly tide data were estimated for several years (1960, 1996) by NOAA. NOAA also made estimates of tidal variations at the mouth of the Withlacoochee River from data for the Cedar Key station.

6.3 Long-Term Flow Hydrographs Assessment

Long-term (one-year duration) daily flow hydrographs representative of the "Average Year" condition were selected for use in the natural systems and water quality modeling assessments. Mean annual streamflow, which is a volumetric indicator was used as basis for its selection. Separate hydrographs were developed for the baseline condition and the alternatives condition as described below in Sections 6.3.1 and 6.3.2.

The statistically "Average Year" was determined by analyzing 75 years of record from the USGS gaging station near Holder, Florida (No. 02313000). This gage has the longest record of all of the gages selected for use in this study, and accounts for flows from 89 percent of the Lake Rousseau watershed. The time series of mean annual streamflows was analyzed by using the Weibull formula:

$$p = m/(n+1)$$

where p is the probability, m is the ranking position, and n is the number of data points.

The Weibull formula was used to identify years with flows corresponding to 50 percent probability or median year. For the purpose of this study, it is assumed that the median year represents the **"Average Year"** condition. The flow hydrograph for year 1987 with a mean annual flow of 908 cfs has a 49 percent occurrence probability, and was the closest to 50 percent probability. However, the annual flow distribution was atypical due to an event that produced a flow of over 3,000 cfs in April with the remainder of the year having relatively low flows. The flow hydrograph for year 1996 with a mean annual flow of 877 cfs has a 47 percent occurrence probability and a reasonable annual flow distribution. For this reason, the 1996 flow hydrograph was selected for use in this study as the "Average Year" condition. **Figure 13** shows a comparison of the 1987 and 1996 flow hydrographs for the USGS gaging station near Holder, Florida. It should be noted that 910 cfs is the computed mean annual flow for the median year. The year 1996 selected flow hydrograph with a mean annual flow of 877 cfs has about 3.6 percent less volume of flow than the statistically median year.

6.3.1 Alternative 4, Baseline Condition Hydrograph

As described above, the "Average Year" flow condition was determined to be 1996. The long-term flow hydrograph for the baseline condition (Alternative 4) was determined from Lake Rousseau discharge data. Presently, discharge occurs from Lake Rousseau from two locations, the main gates and the Bypass Channel spillway system. These discharge locations have the associated USGS gage stations listed below:

- USGS Station No. 02313230 (Main Gates)
- USGS Station No. 02313250 (Bypass Channel)

The flow records for year 1996 were extracted from the period of record for each of the gage stations listed above. **Figure 14** illustrates the "Average Year" flow hydrograph selected for use in the long-term simulations. These hydrographs represent discharges from Lake Rousseau, which will be used as the upstream boundary condition in the simulation models.

6.3.2 Alternatives 1, 2, and 3 Hydrographs

The alternatives proposed as part of this study require a change in the manner in which water is discharged from Lake Rousseau relative to the baseline condition. Proposed modifications to the system that will be assessed include making the Inglis Dam main gates the primary discharge point for the system and re-sizing the Bypass Channel system. This reservoir outflow will be manipulated in the hydraulic study to determine its destination (i.e. all directly to the Withlacoochee, or a portion to the Bypass Channel etc.). For the alternatives modeling, the total potential outflow from the reservoir is required. The potential outflow may therefore, be different from the baseline condition due to different gate manipulations to meet downstream demand criteria. The potential discharge for use in the alternatives assessment should then be an estimate of outflow without current reservoir spillway system manipulations. The long-term flow hydrograph for the Lake Rousseau outflow was determined as described below.

Again, the "Average Year" flow condition was determined to be 1996. Total potential discharge (outflow) from the reservoir was determined by combining the 1996 daily flows at the Withlacoochee River near Holder (USGS Station No. 02313000) with the daily flows at Rainbow Springs near Dunnelon (USGS Station No. 02313100). This composite hydrograph represents the total potential **measured** inflow into the reservoir. The total potential discharge from the reservoir was computed by adjusting this composite hydrograph by a factor of 1.05. This factor was determined by comparing discharge volumes for the existing condition reservoir outflow (combined main gate and bypass channel discharge) with the total potential **measured** inflow. This comparison indicated that for the year 1996 about five percent more runoff volume discharges from the reservoir than could be accounted for by the measured inflow. This difference can be attributed primarily to the additional catchment area downstream of the Holder station, which drains to the reservoir. This catchment area accounts for about 11 percent of the total watershed area. This factor also accounts for evaporation or other losses.

6.4 Flood Flow Hydrographs Assessment

Flood flow hydrographs representative of the 100-year flood frequency were selected for use in the flood assessment. Separate hydrographs were developed for the baseline condition and the alternatives conditions as described below.

6.4.1 Selection of Flood Event

The statistically derived "100-year" flood flow was determined by analyzing 75 years of record from the USGS gaging station near Holder, Florida (No. 02313000). This gage has the longest record of all of the gages selected for use in this study, and accounts for flows from 89 percent of the Lake Rousseau watershed. The 100-year flood discharge was determined using a time series of annual peak instantaneous discharges that were fitted to the Log Pearson Type III Frequency Distribution. The results of this analysis are presented in Table 6-1, which provides a summary of estimated flood frequency versus flow rate for a series of flood frequencies from the two (2) to 200 year return period.

Table 6-1
FLOOD FREQUENCY ANALYSIS FOR WITHLACOOCHEE NEAR HOLDER

Return Period (yrs)	Flow (cfs)
2	2,132
5	3,638
10	4,758
20	5,906
50	7,488
100	8,741
200	10,046

As indicated in Table 6-1, the 100-year flood flow rate is estimated to be 8,741 cfs. The time series of annual peak instantaneous discharges for the 75-year period of record were examined to determine if there was a corresponding flood flow rate in the data. The closest flow rate in the data, is a peak flow of 8,660 cfs, which occurred on April 5, 1960. This measured flow is approximately 99 percent of the estimated 100-year flow calculated from the frequency analysis. Next, the hydrograph of the event associated with the April 5, 1960 peak flow was examined for reasonableness. The hydrograph of this event has a time base of approximately 75 days and appears to be reasonable in terms of its shape. No other precipitation events of any significance occurred during this period. It should be noted that the Withalcoochee River system, by virtue of a large amount of floodplain storage, has relatively long peak lag times associated with it. The flood event that culminated with a peak flow of 8,660 cfs on April 5, 1960 was selected for use in this study as the 100-year flood frequency.

Hourly flow data is typically desirable for detailed hydraulic modeling such as that proposed for use in this study. However, hourly flow records were not available for the selected USGS gage. Therefore, an assessment was conducted to determine the suitability of using average daily flows in this study. A comparison of maximum instantaneous peak flows with daily average flows for a

number of data points was conducted for this assessment. The results of this comparison showed that the instantaneous peak flows compared well with the daily average flows in most instances. This is due primarily to the size and characteristic of the Withlacoochee River watershed, which produces long flood duration's with peak flow rates well in excess of one (1) day. The daily flow data available for the selected USGS gage (Station No. 02313000) were therefore found acceptable for use in the analysis.

6.4.2 Reservoir Inflow and Discharge Hydrographs

The lake Rousseau reservoir receives flow contributions form three major sources. Two of the sources are gaged including the USGS station near Holder, Florida (No. 02313000) and the USGS Rainbow Springs station near Dunnelon, Florida (No. 02313100). The third inflow consists of runoff from the area surrounding the lake, which is downstream of the Holder gage. The flow contribution measured at the Holder gage is the dominant inflow, with approximately 89 percent of the total contributing watershed to the reservoir being upstream of the gage. The directly contributing ungaged areas surrounding the lake accounts for approximately 11 percent of the total watershed. Rainbow Springs, which has no contributing drainage area, contributes lesser flows than the river at Holder. Flows from each of these sources must be considered in the development of an inflow hydrograph for the lake.

As described above, data from the USGS station near Holder, Florida (No. 02313000) was used to conduct the frequency analysis and to select a 100-year flood event (April 5, 1960). It should be noted that gage data were not available for any of the other three gages used in this study for 1960. As such, flow contribution from Rainbow Springs as well as the areas surrounding the lake for the 100-year flood had to be estimated.

Flood flows for Rainbow Springs were estimated from available gage data for the period of record 1970 to 2002. The highest flow on record (1,060 cfs), which occurred on September 19, 1998, was selected for use in the study. It was assumed that the 1998 daily hydrograph for Rainbow Springs was similar to the 1960 Rainbow Springs daily hydrograph. The assumption that the 1960 flow from Rainbow Springs could be estimated from the 1998 records was based on the fact, that flood flow from the springs is relatively constant in comparison to the river flow. In support of this assumption, it was found that the second highest peak flow at the Holder station occurred on March 21, 1998 and had a magnitude of 5,310 cfs, while the measured flow at Rainbow Springs on this date was 1,030 cfs, which is only 30 cfs different from the measured 1,060 cfs maximum on September 19, 1998.

The daily flow hydrograph for the 100-year event as documented in Section 6.4.1, was added to the daily flow hydrograph for Rainbow Springs (1998) for a similar time base. This was accomplished by superimposing one hydrograph on the other and by assuming peak flows were coincident. This composite hydrograph represents the estimated total **measured** inflow into the reservoir.

This hydrograph was further adjusted to determine the **estimated** total potential outflow from the reservoir. The estimated total potential outflow was computed by adjusting this measured inflow hydrograph by a factor of 1.04. This factor was determined by comparing annual volumes of measured inflow with reservoir outflow volumes from the combined Inglis Dam main gates and

Bypass Channel spillway. These reservoir discharge volumes were determined from the USGS gage stations at each of these locations. The comparison indicated that the measured inflow hydrograph should be incremented by about four (4) percent to account for the ungaged contributing areas and to account for evaporation and other losses from the lake. The estimated 100-year event, total potential discharge hydrograph for the Lake Rousseau system is illustrated on **Figure 15**.

6.4.3 Alternative 4, Baseline Condition Hydrograph

The estimated 100-year event, total potential discharge hydrograph for the Lake Rousseau system was used to estimate discharge from the system under baseline conditions. For baseline conditions discharge would occur from the Inglis Dam main gates and from the Bypass Channel system via the spillway. For this analysis, it was assumed that the bypass channel would be operated at its maximum discharge capacity of 1,540 cfs. Thus, the remaining flow (8,660–1,540 = 7,210 cfs) would be discharged from the main gates, which have a design capacity of approximately 18,000 cfs. The Inglis Dam main gate discharge hydrograph was constructed by subtracting the constant 1,540 cfs flow (Bypass System) from the total potential discharge hydrograph for the Lake Rousseau system. **Figure 15** illustrates the resultant Inglis Dam main gate hydrograph and the Bypass Channel discharge hydrograph.

6.4.4 Alternative 1, 2, and 3, Proposed Conditions

As indicated in Section 6.3.2, the alternatives proposed as part of this study require a change in the manner in which water is discharged from Lake Rousseau relative to the baseline condition. Proposed modifications to the system that will be assessed include making the Inglis Dam main gates the primary discharge point for the system and re-sizing the Bypass Channel system. This reservoir outflow will be manipulated in the hydraulic study to determine its destination (i.e. all directly to the Withlacoochee, or a portion to a Bypass Channel etc.). For the alternatives modeling, the total potential outflow from the reservoir is required. The total potential discharge hydrograph for the Lake Rousseau system is the hydrograph that will be used to assess Alternatives 1 and 2. **Figure 16** illustrates the discharge hydrograph that will be used for these alternatives. Alternative 3 requires increasing the discharge capacity of the Bypass Channel system. The maximum allowable flow rate of the proposed Bypass Channel system will be determined as part of this study. The allowable discharge hydrograph for the bypass system will be abstracted from the total potential discharge hydrograph for the Lake Rousseau system (Figure 16) to develop the Inglis Dam main gate discharge hydrograph.

The potential outflow for the alternatives may therefore, be different from the baseline condition due to different gate manipulations to meet downstream demand criteria. The potential outflow for use in the alternatives assessment should then be an estimate of outflow without current reservoir manipulations. The long-term flow hydrograph for the Lake Rousseau outflow was determined as described below.

6.5 Tide Stage Hydrographs

An analysis was conducted to determine tidal conditions in the Withlacoochee River. This tidal information was used to develop tide stage hydrographs for long-term flow and flood flow model

simulations. The tide stage hydrographs were used as downstream boundary conditions in the simulation models.

Tidal stage hydrographs for the boundary at the Gulf of Mexico were developed from the NOAA Cedar Key tide station (NOAA Station No. 8727520). Hourly tide data were estimated for several years by NOAA. NOAA made estimates of tidal variations at the mouth of the Withlacoochee River from data for the Cedar Key station. NOAA's estimates were provided in Mean Lower Low Water datum (MLLW) and were converted to NGVD by using the relationship between NGVD and MLLW for Cedar Key.

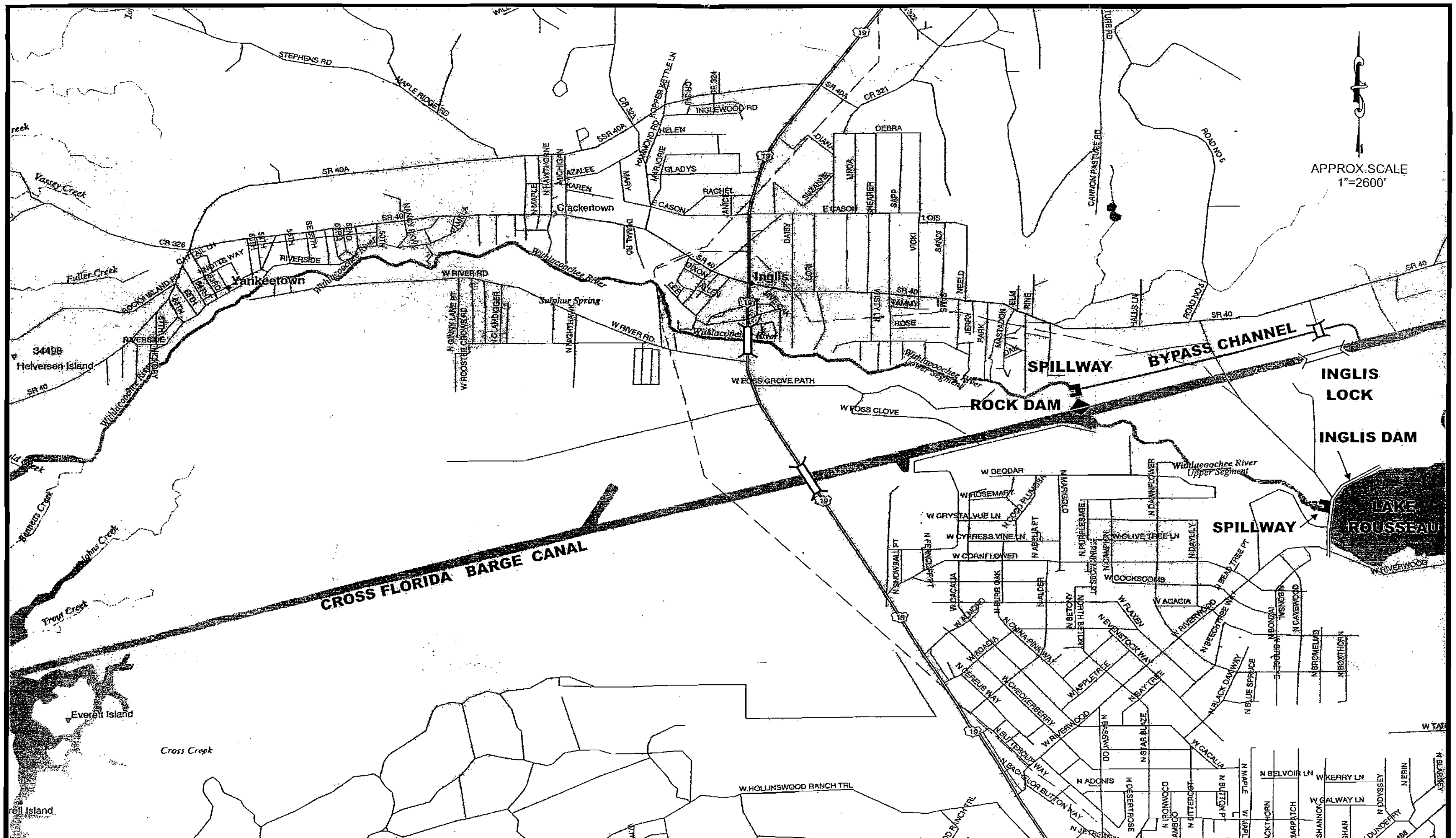
6.5.1 Long-term Flow Assessment

Hourly tide data for the year 1996 was selected for use in the long-term flow assessment. This year was selected to correlate with the "Average Year" condition for the Withlacoochee River system as detailed in Section 6.3. **Figure 17** illustrates the first 50 days of record for the 1996 tidal variation of the Withlacoochee River near the mouth. The maximum tide stage during the year was 5.88 ft-NGVD and occurred on June 30, and the minimum was tide stage was 0.48 ft-NGVD and occurred on January 18. This information will be used as the downstream boundary condition for all of the proposed alternatives assessments of natural systems and water quality.

6.5.2 Flood Flow Assessment

Hourly tide data for the year 1960 was selected for use in the flood flow assessment. This year was selected to correlate with the 100-year flood event on the Withlacoochee River system as detailed in Section 6.4. This information will be used as the downstream boundary condition for all of the proposed alternatives assessment of flooding.

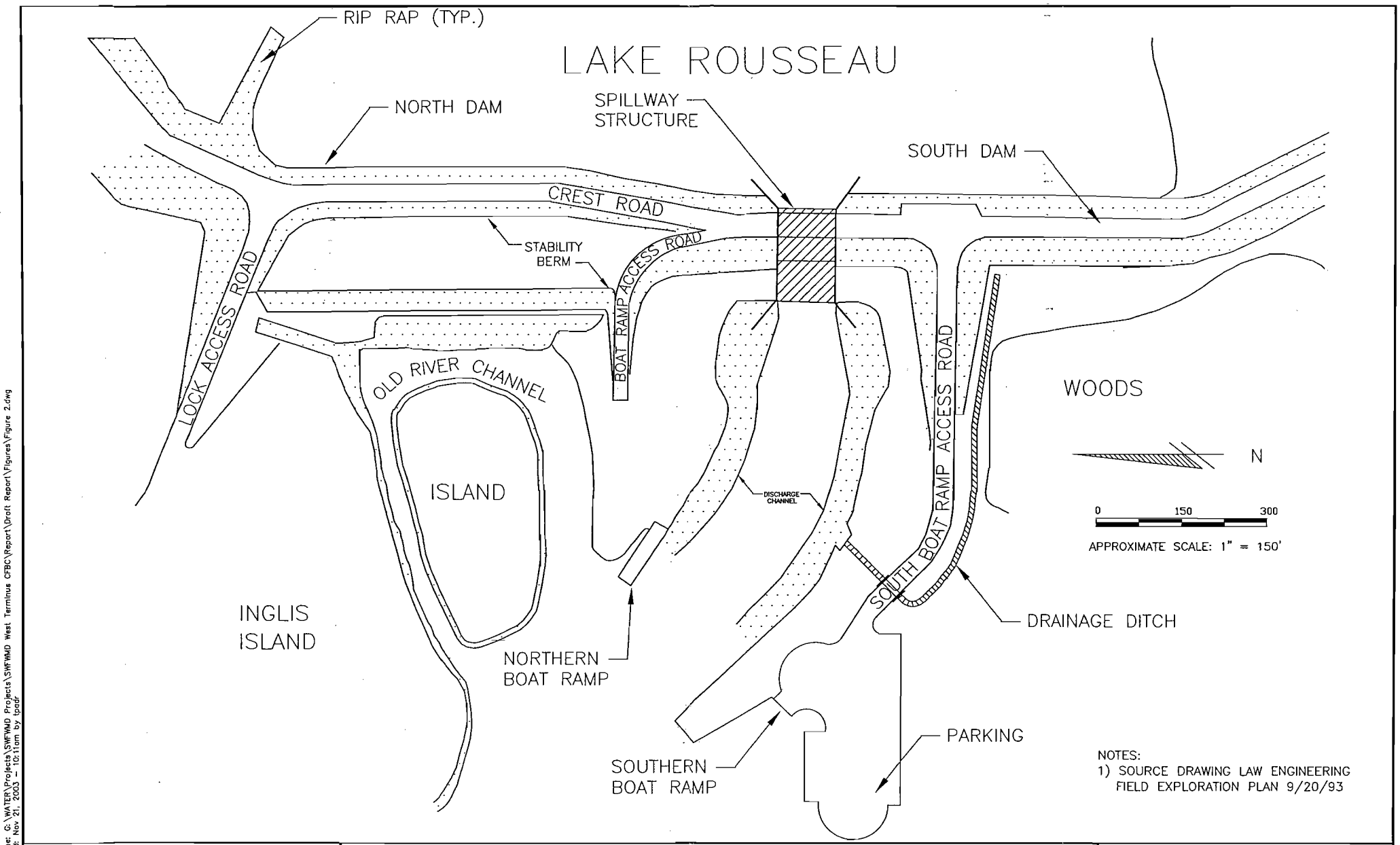
FIGURES



URS

WEST TERMINUS CROSS - FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 1
CROSS-FLORIDA BARGE CANAL
SYSTEM COMPONENTS

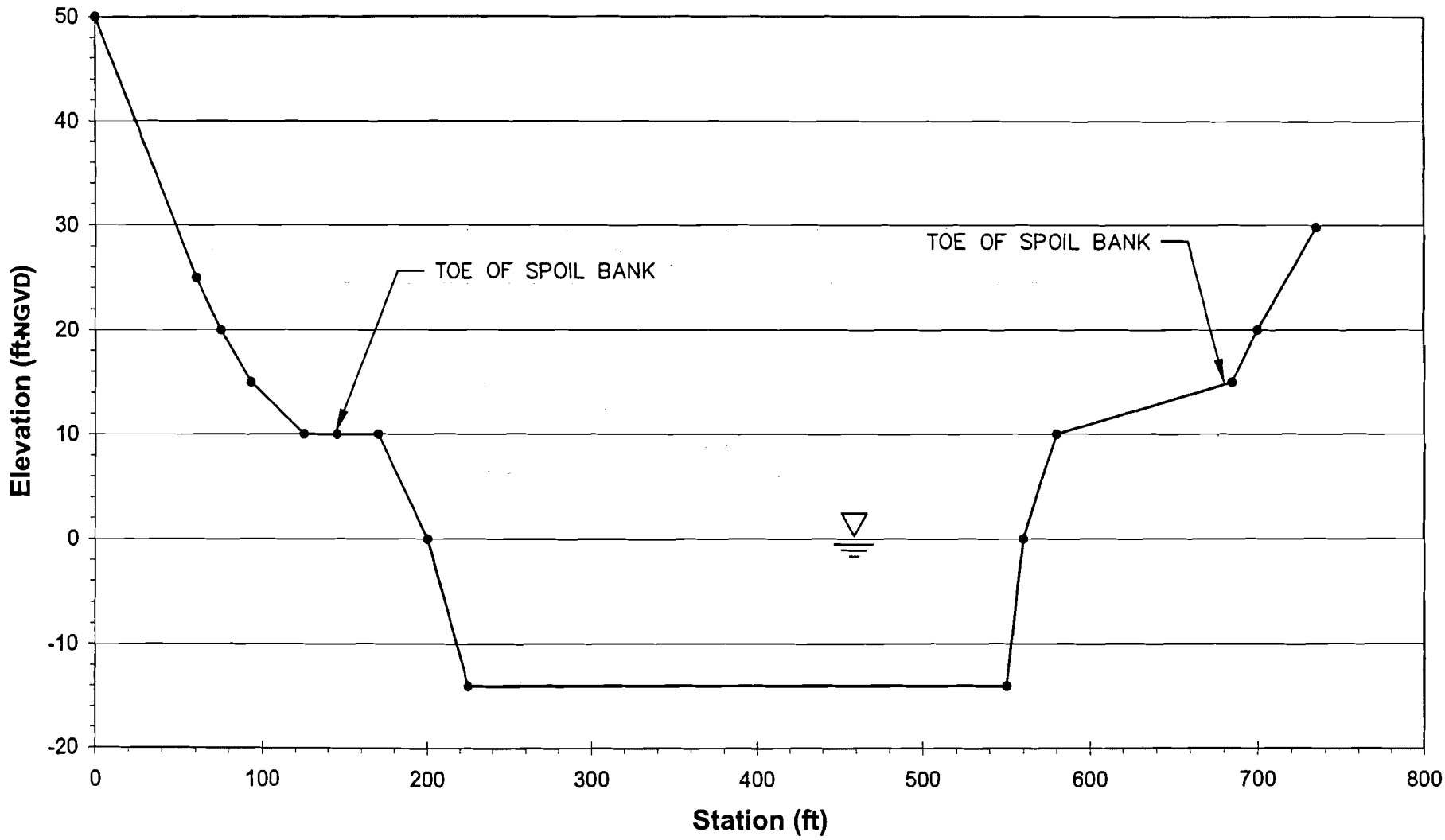


NOTES:
1) SOURCE DRAWING LAW ENGINEERING FIELD EXPLORATION PLAN 9/20/93

URS Corporation Southern
7650 West Courtney
Campbell Causeway
Tampa, FL 33607-1462
No. 00000002

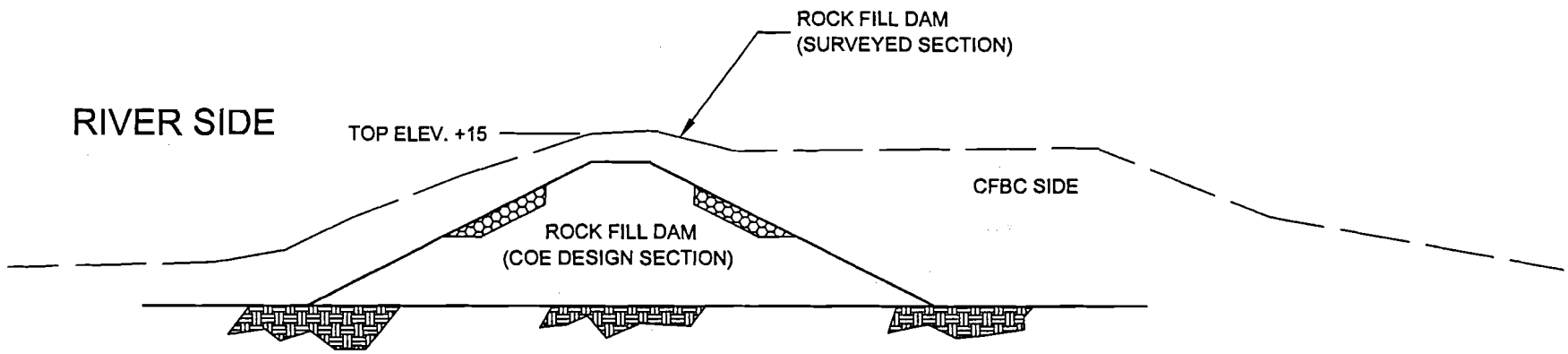
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 2
INGLIS DAM PLAN



URS Corporation Southern 7650 West Courtney Campbell Causeway Tampa, FL 33607-1462 No. 00000002	WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT Southwest Florida Water Management District	FIGURE 3 BARGE CANAL CROSS-SECTION (Typical)

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Figures\Figure 3.dwg
Last Modified: Nov 21, 2003 - 8:51am by tpate



Survey Performed February 2001

SCALE: 1" = 30'

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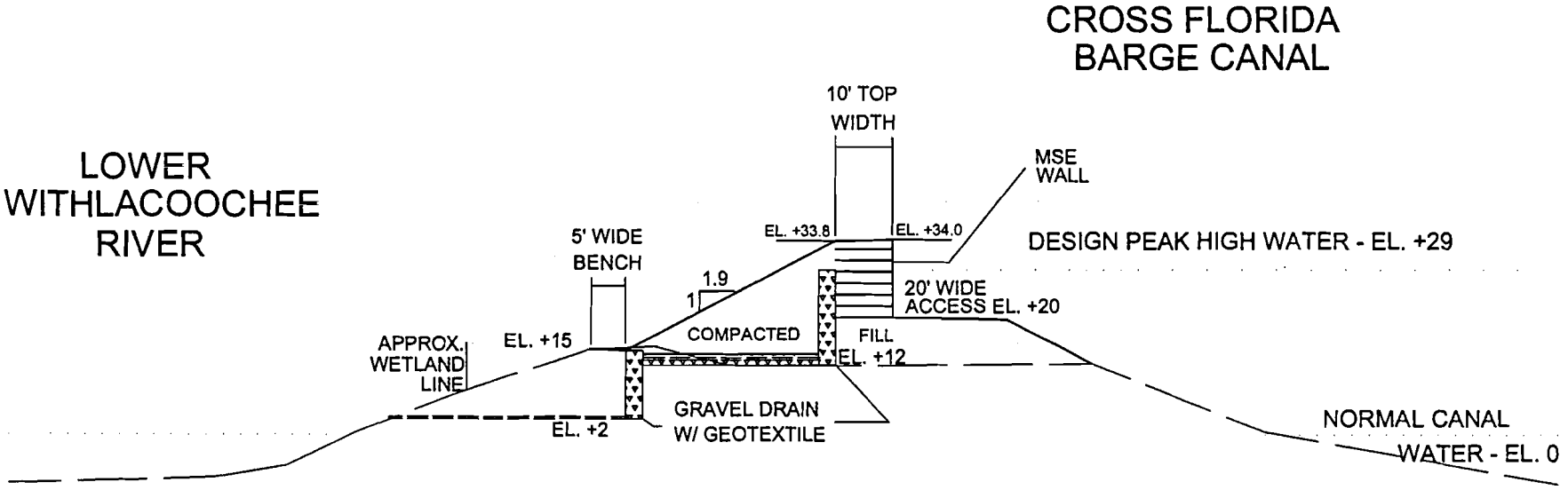
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 4
ROCK DAM – EXISTING SECTION



Note: All elevations are stated in feet NGVD.

SCALE: 1" = 30'

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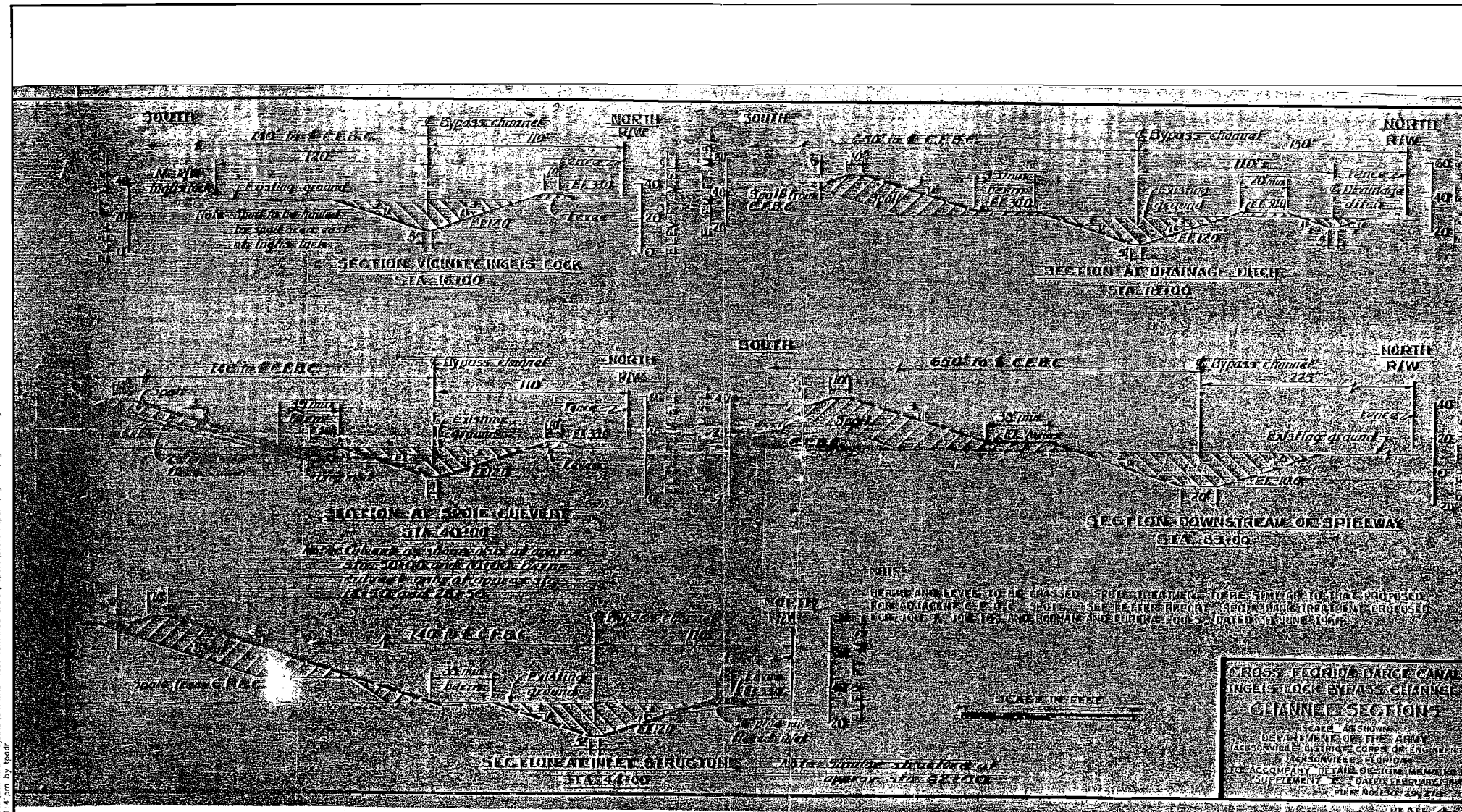
No. 00000002

WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

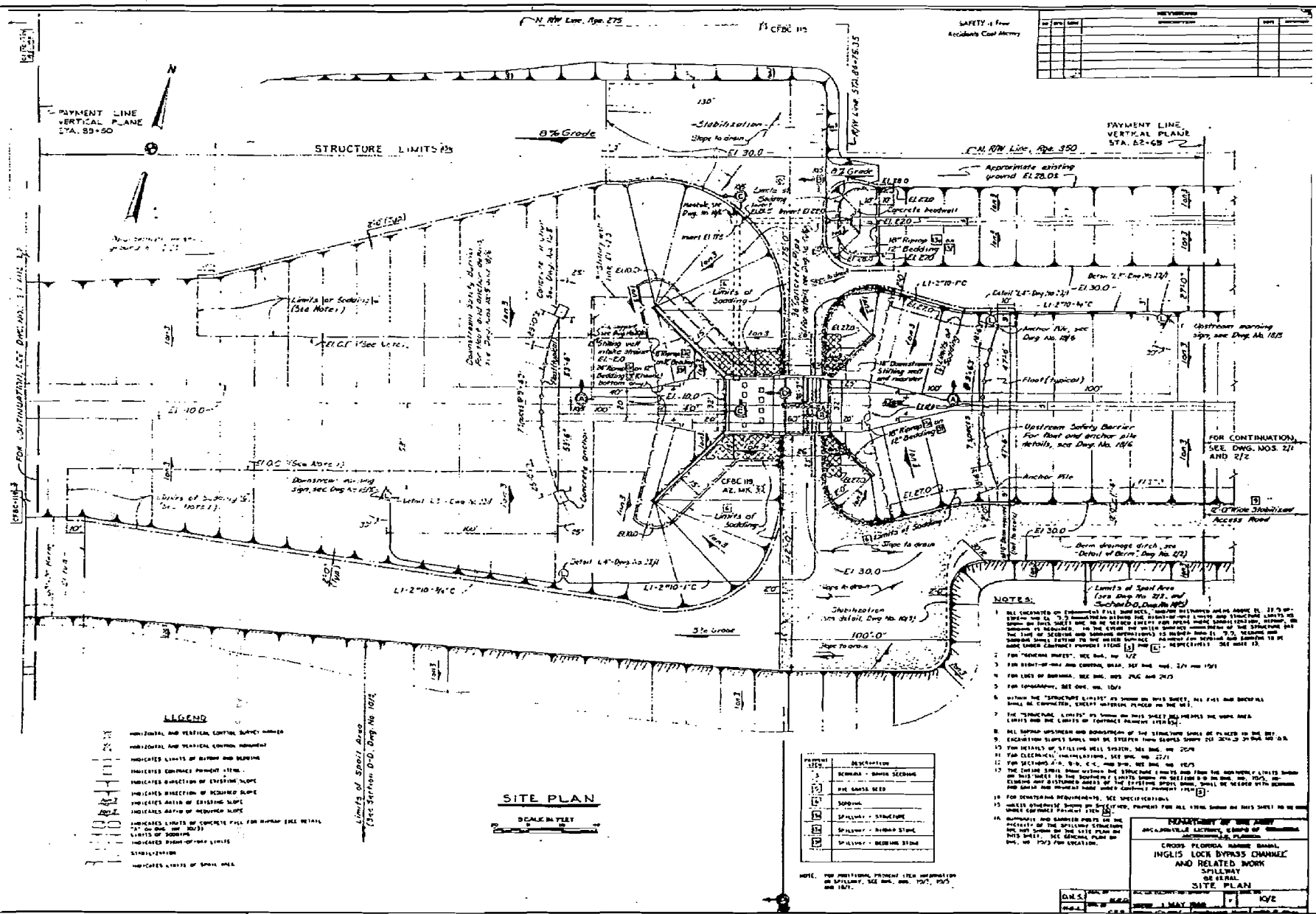
FIGURE 5
PROPOSED FLOOD PROTECTION LEVEE
TYPICAL SECTION – MSE WALL ALTERNATE

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 5.dwg
Last Modified: Nov 21, 2003 - 8:57am by tpadr



URS Corporation Southern 7650 West Courtney Campbell Causeway Tampa, FL 33607-1462 No. 00000002	WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT Southwest Florida Water Management District	FIGURE 6 BYPASS CHANNEL CROSS–SECTIONS

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 6.dwg
Last Modified: Nov 21, 2003 – 1:41pm by tpadr



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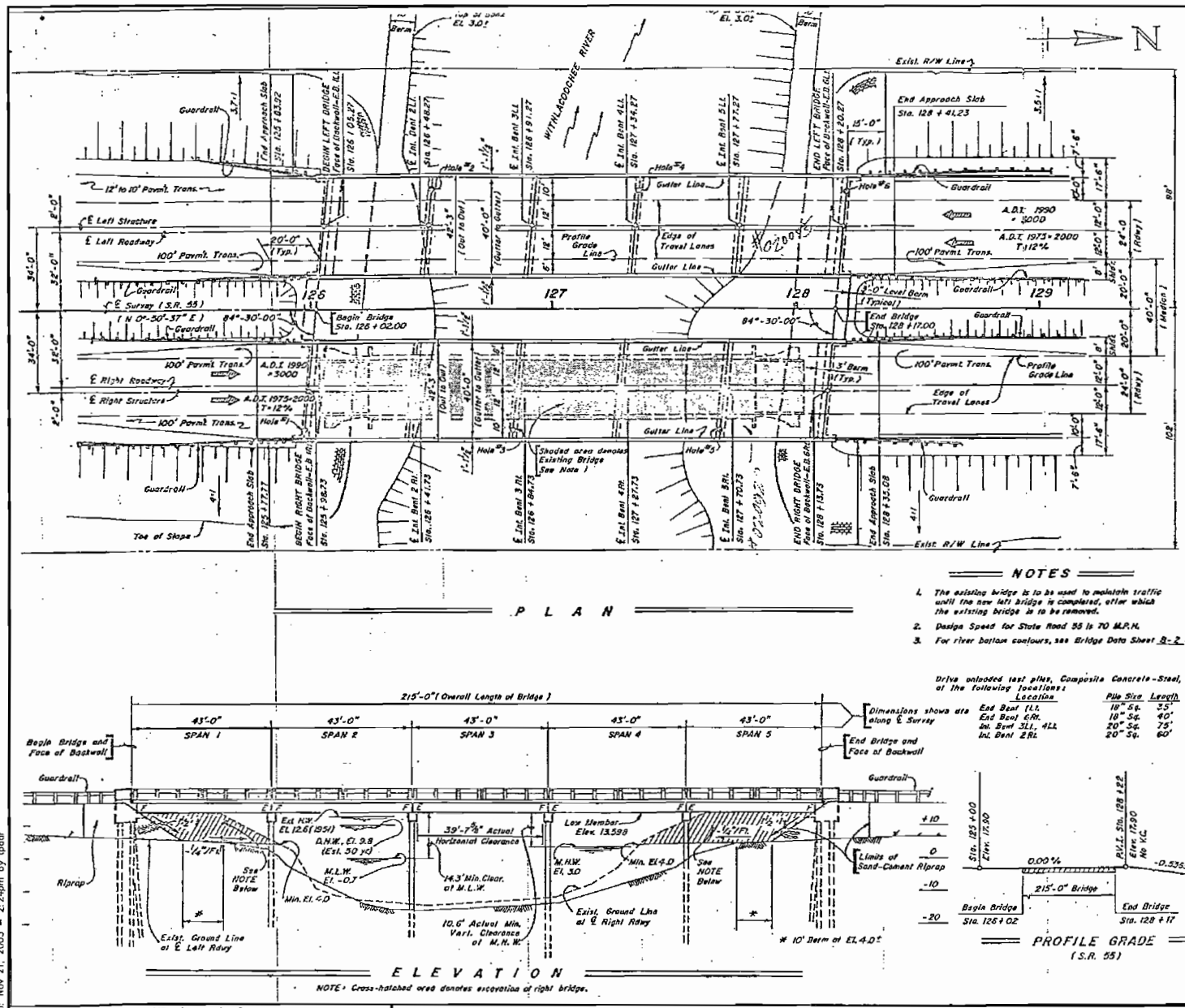
No. 00000002

WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 7
BYPASS CHANNEL SPILLWAY

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 7.dwg
Last Modified: Nov 21, 2003 – 2:21pm by tpadr



NOTES

1. The existing bridge is to be used to maintain traffic until the new left bridge is completed, after which the existing bridge is to be removed.
2. Design Speed for State Road 55 is 70 M.P.H.
3. For river bottom contours, see Bridge Data Sheet B-2.

Drive unloaded test piles, Composite Concrete-Steel, at the following locations:

Location	Pile Size	Length
End Bent 1 Lt.	18" Sq.	35'
End Bent 6 Rt.	18" Sq.	40'
Int. Bent 3 Lt., 4 Lt.	20" Sq.	75'
Int. Bent 2 Rt.	20" Sq.	60'

GENERAL PLAN AND ELEVATION

ESTIMATED BRIDGE QUANTITIES

	NO.	ITEM DESCRIPTION	UNIT	QUANTITY
(1)	115-1	Removal of Existing Structures	L.S.	1
	400-1-5	Class A Concrete (Substructure)	Cu.Yd.	179
	400-2-4	Class AA Concrete (Superstructure)	Cu.Yd.	480
	400-6-1	Concrete Headrail (Safety Cure)	Lin.Ft.	860
	415-1-2	Reinforcing Steel (Bridge)	Pound	159,700
	450-1-1	Prestressed Beams (Type II)	Lin.Ft.	2,150
	455-5-2	Composite Concrete-Steel Piling Furnished (18" Sq. Prestressed)	Lin. Ft.	1,400
	455-5-3	Composite Concrete-Steel Piling Furnished (20" Sq. Prestressed)	Lin. Ft.	2,170
	455-6-2	Composite Concrete-Steel Piling Driven (18" Sq. Prestressed)	Lin. Ft.	1,400
	455-6-3	Composite Concrete-Steel Piling Driven (20" Sq. Prestressed)	Lin. Ft.	2,100
	455-9-31	Unloaded Test Piles (Composite Concrete-Steel (18" Sq. Prestressed)	Lin. Ft.	75
	455-9-32	Unloaded Test Piles (Composite Concrete-Steel (20" Sq. Prestressed)	Lin. Ft.	210
(3)	455-10-60	Test Loads (60 Tons)	Each	1
(3)	455-10-110	Test Loads (110 Tons)	Each	1
(2)	455-14	Preformed Pile Holes	Each	40
	455-55-2	Pile Splices (18" Sq.)	Each	3
	455-55-3	Pile Splices (20" Sq.)	Each	5
	530-1-8	Riprap (Sand-Cement)	Cu.Yd.	159

(1) See Note 1, this Sheet.
(2) The Quantity of Preformed Pile Holes may be increased, decreased, or omitted as directed by the Engineer.
(3) Test Loads may be increased in Number, or omitted as directed by the Engineer.

INDEX OF BRIDGE DRAWINGS

NOTE: Payment for Incidental Items not specifically covered in individual bid items shall be included in the contract unit prices for bid items.

Number of Composite Neoprene Bearing Pads required for Type II Beams = 100.

3	FLA.	F-025-2(15)		B-1

Plans prepared by W. K. DAUGHERTY CONSULTING ENGINEERS LAKE CITY, FLORIDA

STATE OF FLORIDA DEPARTMENT OF TRANSPORTATION STRUCTURES

S.R. 55 OVER WITHLACOOCHEE RIVER

ROAD NO.	COUNTY	PROJECT NO.
55	CITRUS	02030-3512

	Name	Date
Designed by	R.C.L.	10-70
Checked by	D.L.M.	10-70
Quantities by	W.W.N.	12-70
Checked by	D.L.M.	12-70
Supervised by	D.L.M.	

APPROVED FOR

STATE BRIDGE ENGINEER, STRUCTURES

Drawing No. B-1 of 17 sheets

State No. 10779

URS Corporation Southern
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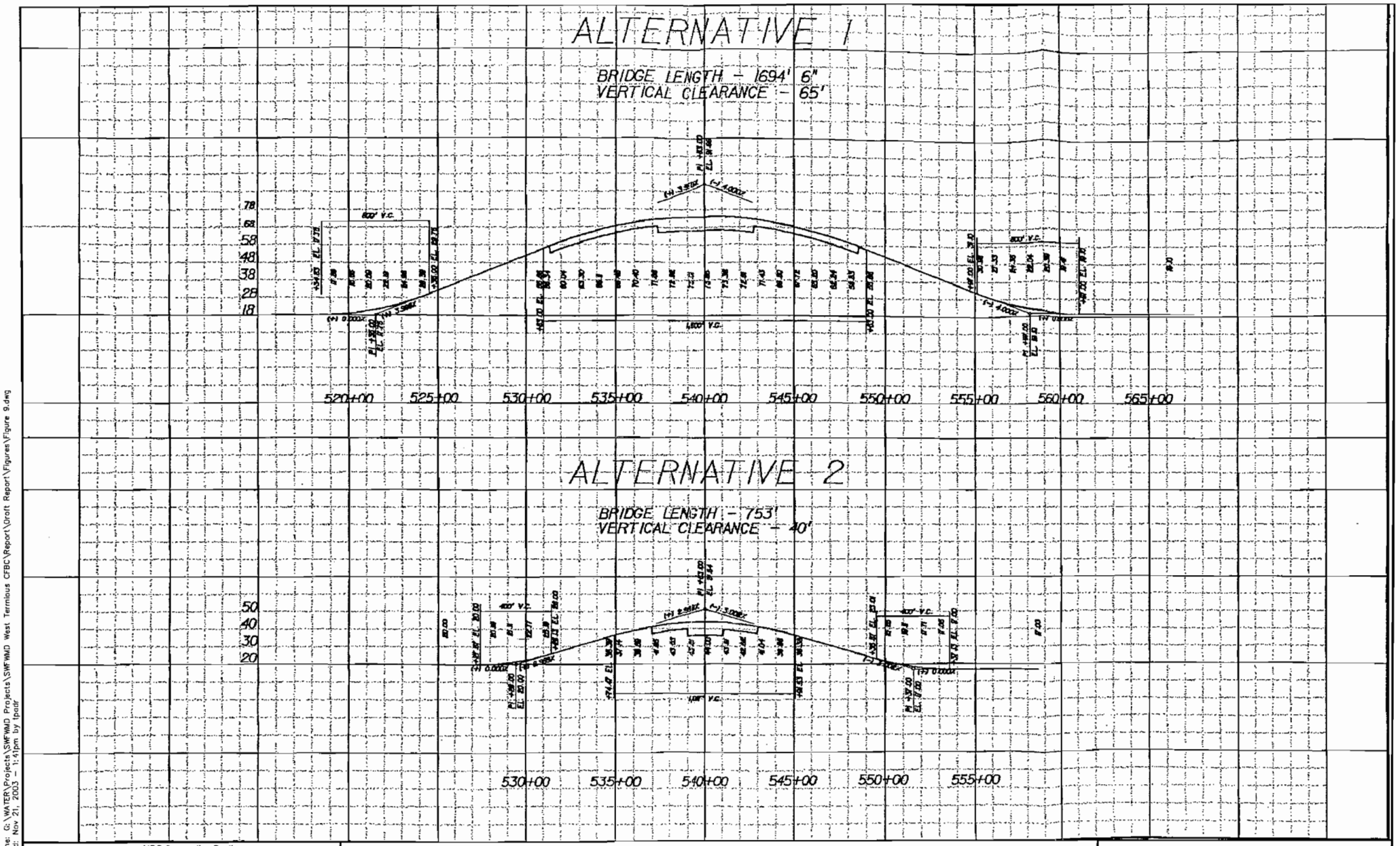
Tampa, FL 33607-1462
No. 00000002

WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

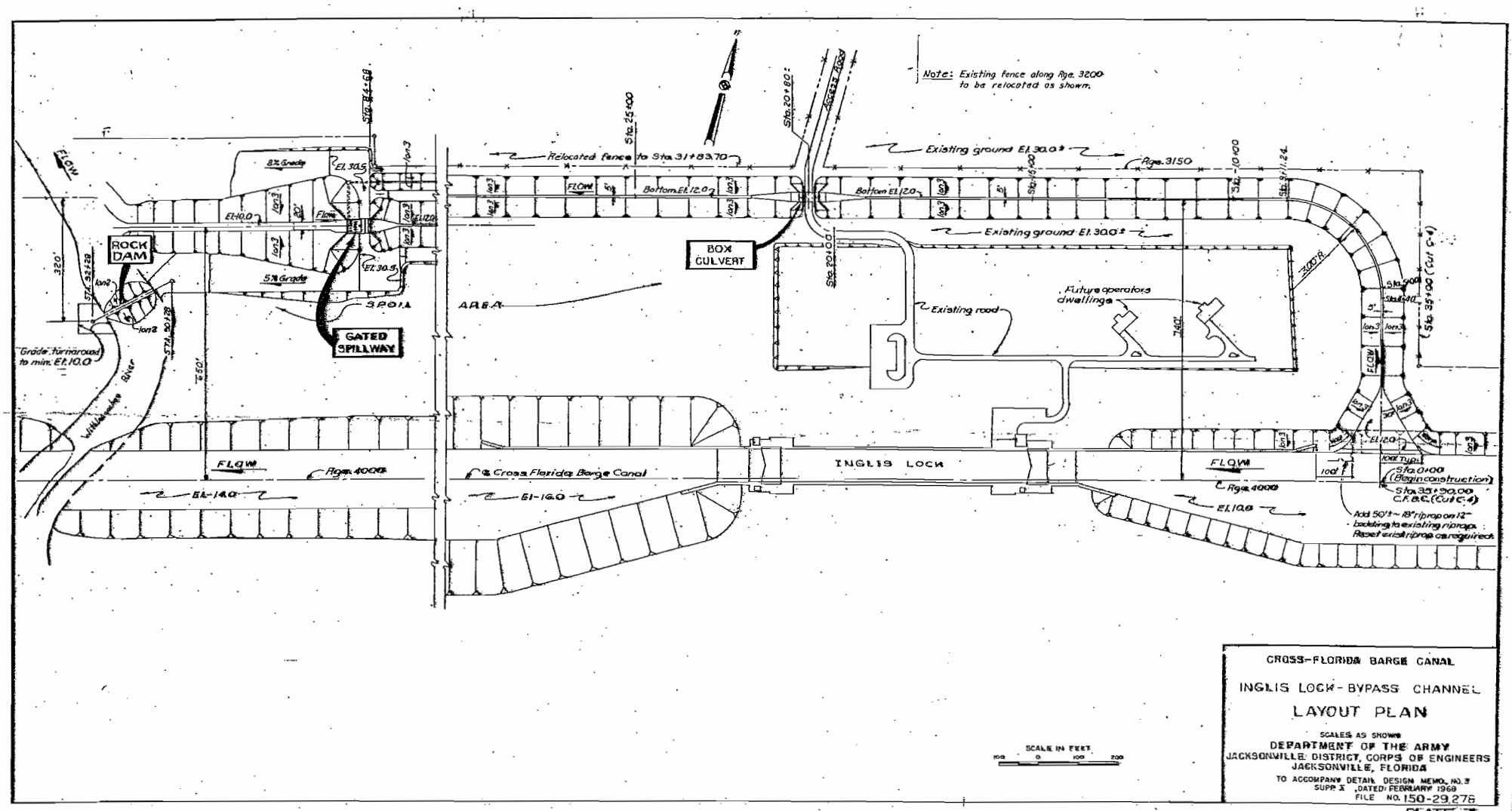
FIGURE 8
US-19 BRIDGE WITHLACOOCHEE RIVER

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 8.dwg
Last Modified: Nov 21, 2003 – 2:24pm by tpadr



URS Corporation Southern 7650 West Courtney Campbell Causeway Tampa, FL 33607-1462 No. 00000002	WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT Southwest Florida Water Management District	FIGURE 9 US–19 BRIDGE BARGE CANAL

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 9.dwg
Last Modified: Nov 21, 2003 – 1:41pm by lpuls



CROSS-FLORIDA BARGE CANAL

INGLIS LOCK - BYPASS CHANNEL

LAYOUT PLAN

SCALES AS SHOWN

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT, CORPS OF ENGINEERS
JACKSONVILLE, FLORIDA

TO ACCOMPANY DETAIL DESIGN MEMO. NO. 3 SUPP 1 , DATED: FEBRUARY 1968
FILE NO. 150-29.276

PLATE 3

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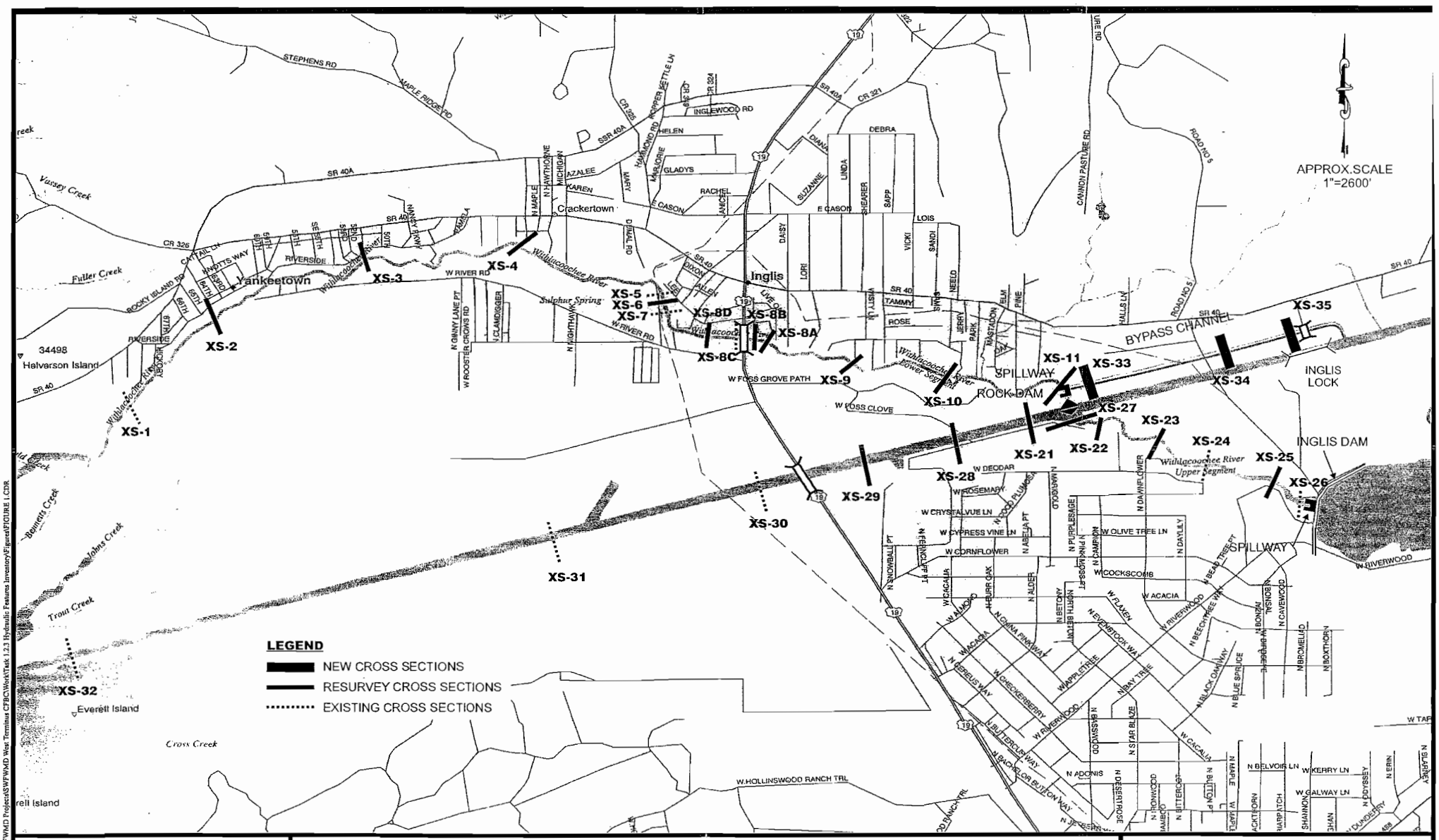
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 10
BYPASS CHANNEL SYSTEM LAYOUT PLAN

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 10.dwg
Last Modified: Nov 21, 2003 – 1:41pm by tpadr

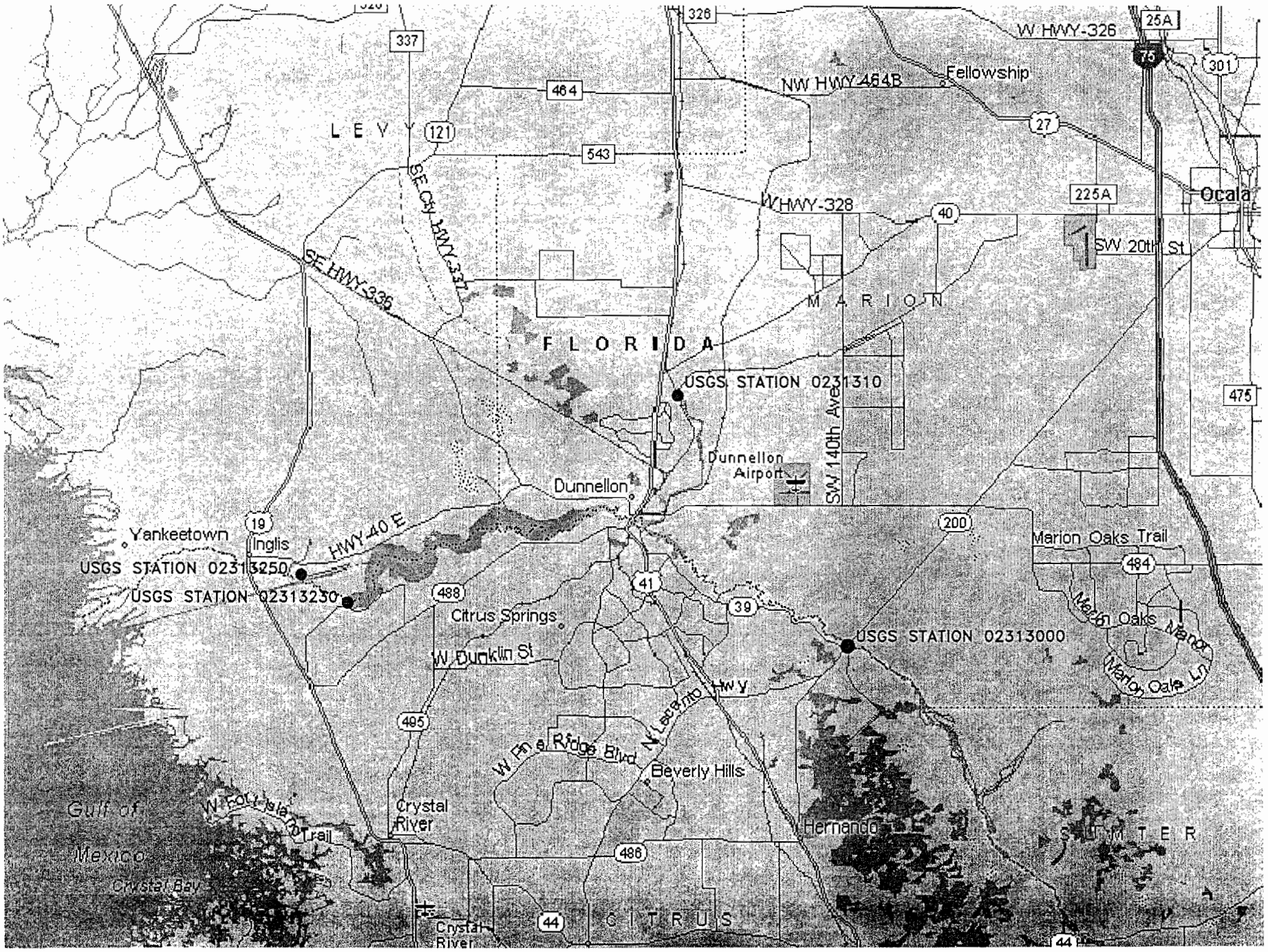


G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Work\Task 1.2.3 Hydraulic Features Inventory\Figures\FIGURE 1.CDR

URS

WEST TERMINUS - CROSS FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 11
ADDITIONAL LAND SURVEY LOCATIONS



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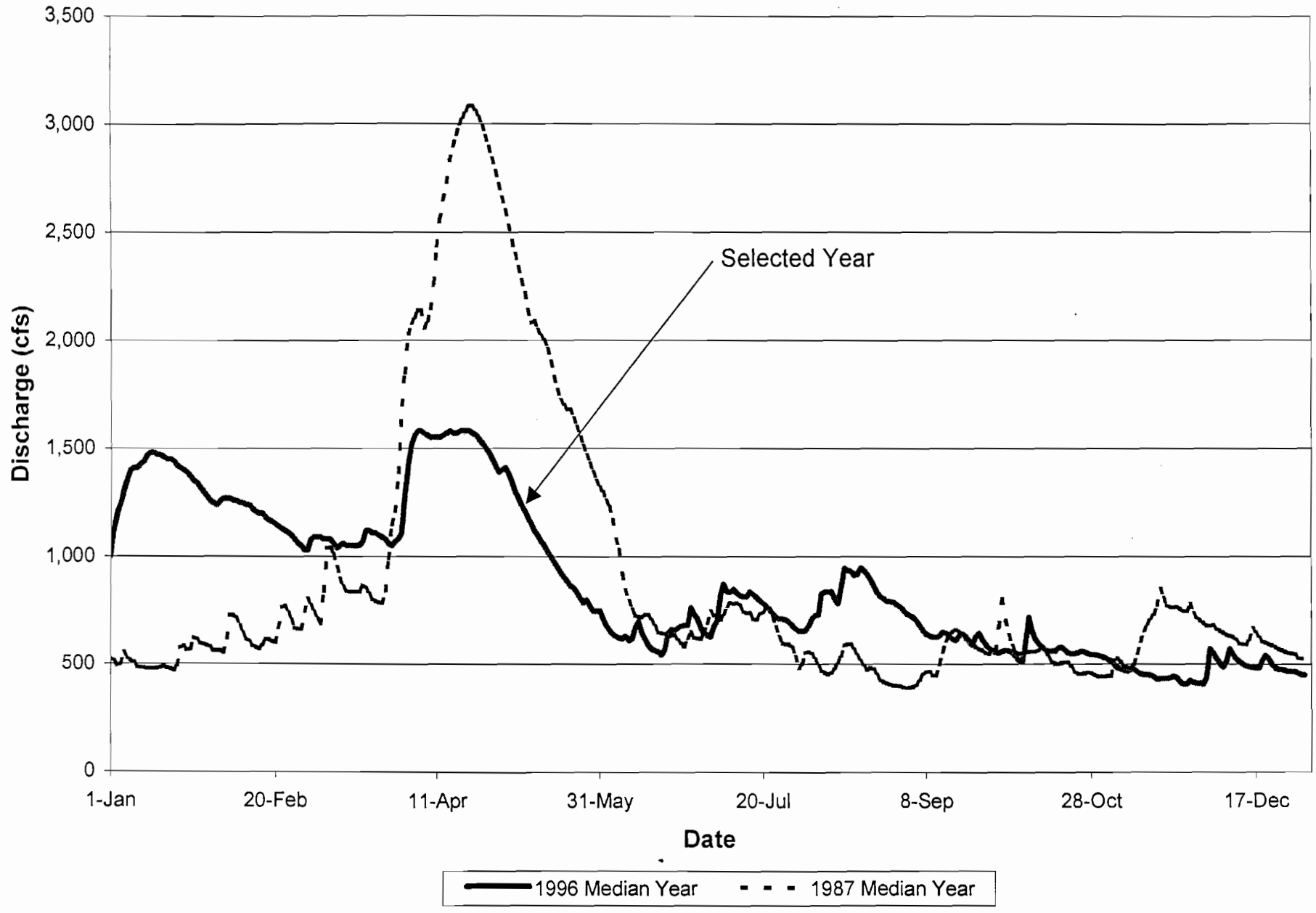
No. 00000002

WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 12
USGS GAGE LOCATIONS

Comparison of Daily Streamflow for Median Years
(Withlacoochee River near Holder, Florida)



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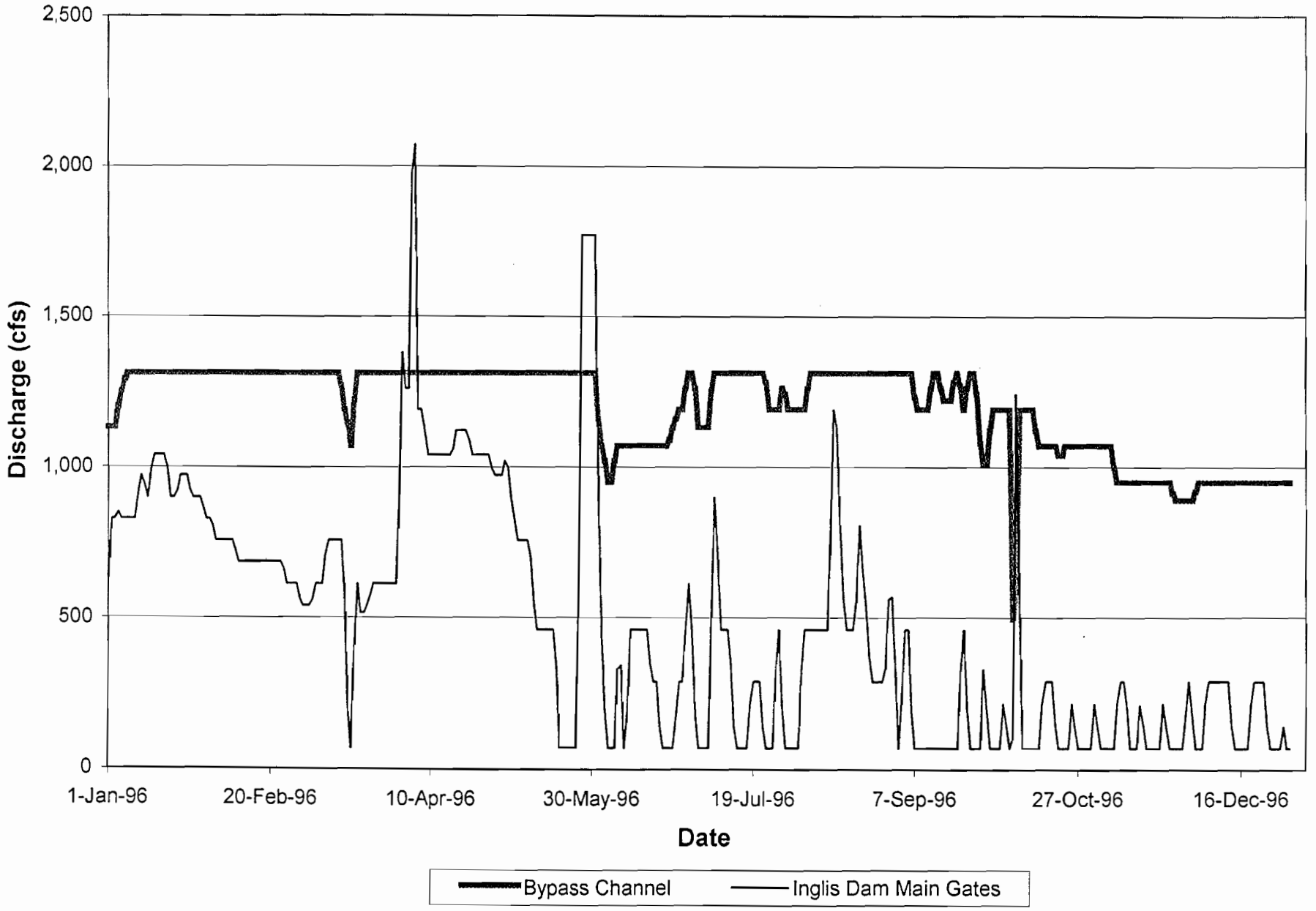
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 13
COMPARISON OF DAILY STREAMFLOW
FOR MEDIAN YEARS

Lake Rousseau Median Year Discharge
Alternative 4 (Baseline Condition)



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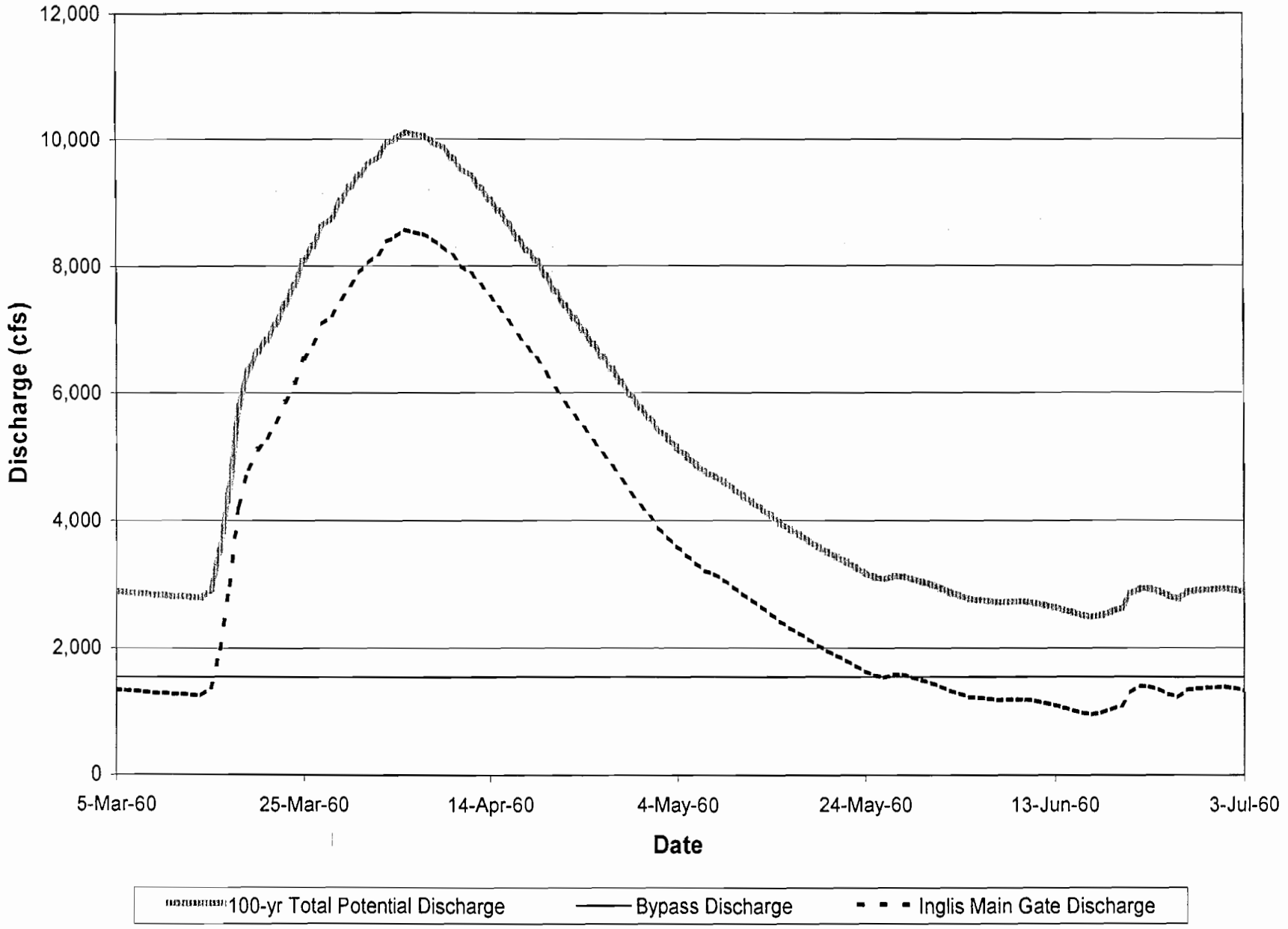
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 14
LAKE ROUSSEAU MEDIAN YEAR DISCHARGE
ALTERNATIVE 4 (Baseline Condition)

Lake Rousseau 100-year Discharge
Alternative 4 (Baseline Condition)



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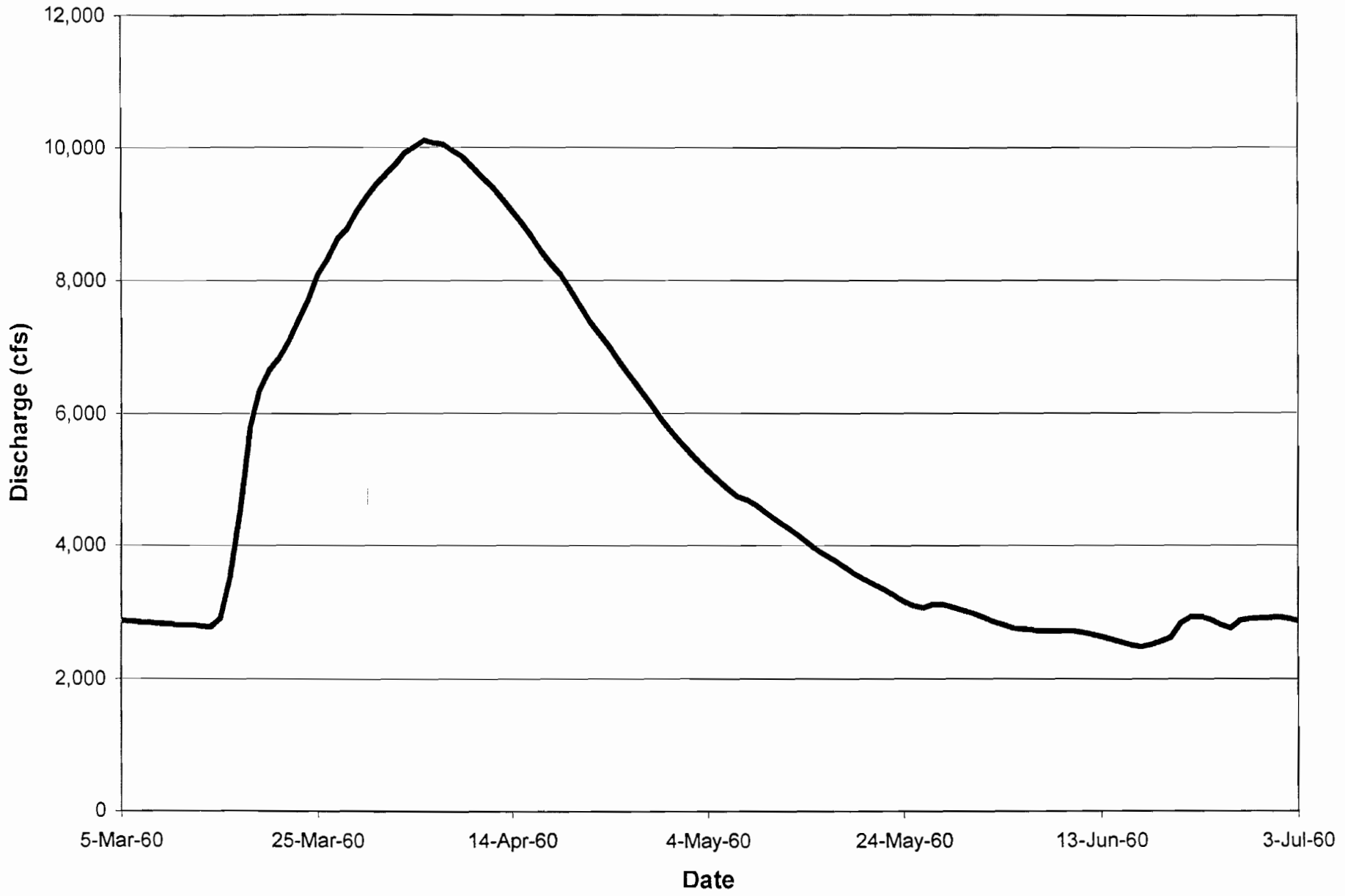
WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 15
LAKE ROUSSEAU 100-YEAR DISCHARGE
ALTERNATIVE 4 (Baseline Condition)

Drawing Name: G:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 15.dwg
Last Modified: Nov 25, 2003 - 11:15am by tpoe

Lake Rousseau 100-year Discharge
Alternatives 1,2 and 3



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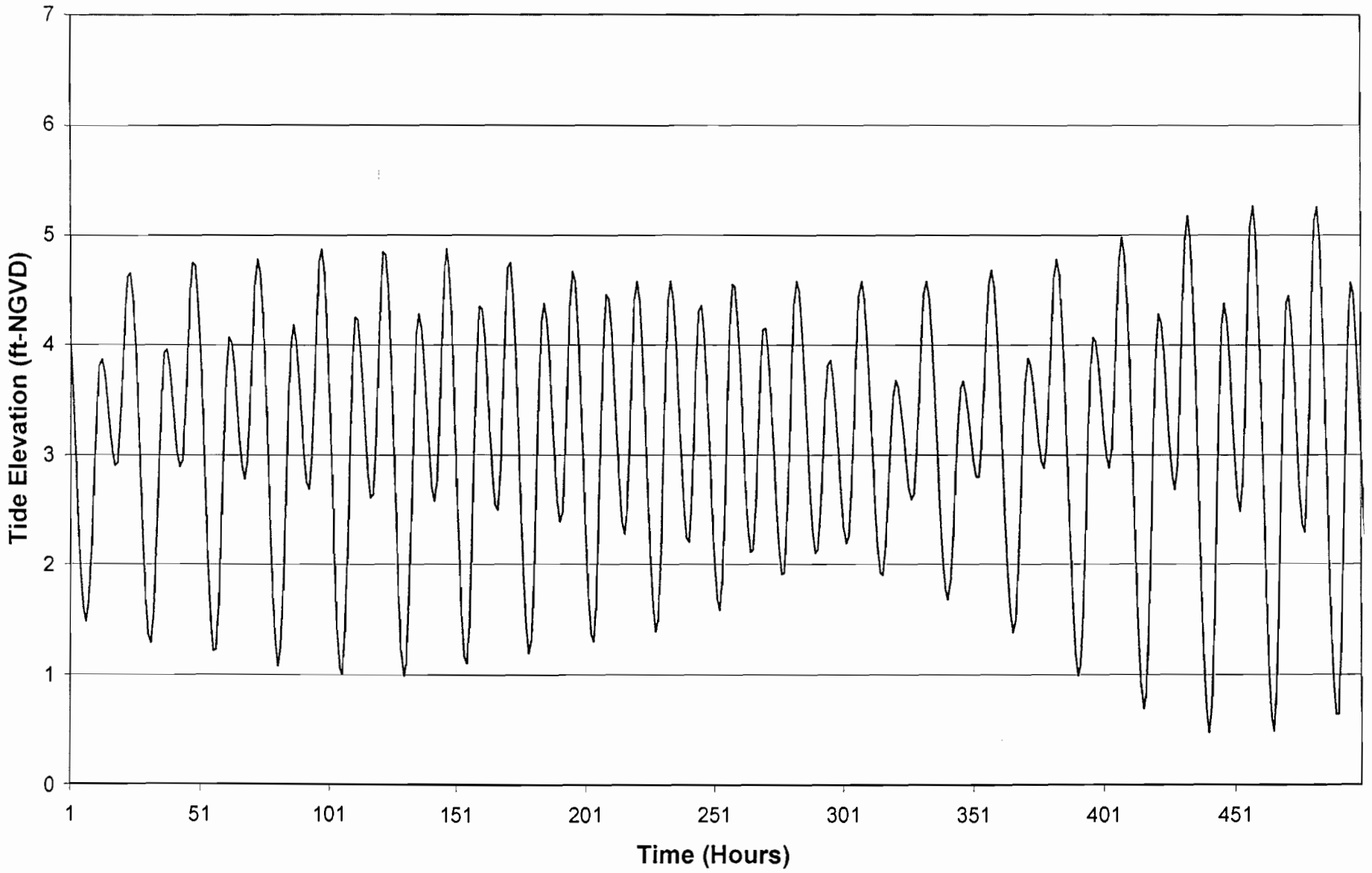
No. 00000002

WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT
Southwest Florida Water Management District

FIGURE 16
LAKE ROUSSEAU 100-YEAR DISCHARGE
ALTERNATIVES 1, 2 AND 3

Withlacoochee River Tidal Variation - Median Year
Baseline Condition (First 500 hours of 1-Year Dataset)



URS Corporation Southern 7650 West Courtney Campbell Causeway Tampa, FL 33607-1462 No. 00000002	WEST TERMINUS CROSS – FLORIDA GREENWAY ASSESSMENT Southwest Florida Water Management District	FIGURE 17 WITHLACOOCHEE RIVER TIDAL VARIATION–MEDIAN YEAR BASELINE CONDITION

Drawing Name: S:\WATER\Projects\SWFWMD Projects\SWFWMD West Terminus CFBC\Report\Draft Report\Figures\Figure 17.dwg
Last Modified: Nov 25, 2003 - 11:18am by tpodr

APPENDIX A

FIELD RECONNAISSANCE SUMMARY – SEPTEMBER 12, 2003

WEST TERMINUS – CROSS FLORIDA GREENWAY ASSESSMENT
Field Reconnaissance Summary – September 12, 2003

- Attendees:
  - Lisann Morris/SWFWMD
  - Dale Ravencraft/SWFWMD
  - Joe Ruperto/URS
  - Mike Walters/URS
  - Kevin Conner/URS
  - Jim Wolfe/FDEP-OGT

- Met at 10:15 a.m.

- Spoke to Mayor of Inglis:
  - Only minor flooding problems in Inglis due to Withlacoochee River.
  - Mayor specifically identified Palm Circle Dr., south of SR-40 and east of US 19.

- Visited Palm Circle Drive in the afternoon:
  - Review of mapping indicates that ground elevation in the vicinity of residential buildings is 9 ft. Riverbank elevation is 5 ft, and yard elevations range from 5 ft to 8ft.

- Visited Yankeetown Town Hall:
  - Met with Fire Department Lt. Rob Kubustek to discuss local tide induced flooding.
  - Rob indicated that the tides in Yankeetown are not well represented by the nearest NOAA tide guage. He believes there are timing and height differences.
  - Rob offered to provide his tide information.
    Contact numbers:
    (352) 447-0118 (home)
    (352) 447-4643 (office)
    (352) 506-0008 (pgr)
  - Received a copy of the Yankeetown Watershed Management Plan by JEA. There are two areas indicated to flood by tidal influence including:
    1 West end of town in the vicinity of Magnolia, and
    2 Town center between 62nd and 66th Streets.

- Visited the sites indicated above in the morning:
  - In general Hickory Ave., Magnolia Ave and Palm Dr. are very low. River bank elevations as well as yard elevations are below elevation 5 ft. See Photos 1 through 6.
  - 22 Palm Dr. (McCrimmon) has a Finished Floor El= 7.01 ft. The owner provided the following information:
    Had 1ft water in house 1993, and
    Had 1"-2" water in house 1996
  - Marina at Hickory, see Photo 7.

- The area on Riverside Drive between 63rd and 64th Streets (north side) is all below elevation 4 ft with the riverbank at or below elevation 5 ft. See Photo 8.

- Visited Coast Guard Station.
  - See Photo 9.

- Visited the Rock Dam Construction Site and the Bypass Channel Spillway.
  - See Photos 10 through 12.
  - Note that spillway was releasing 1,540 cts allowable maximum.

- Visited Inglis Lock.

- Visited Inglis Dam.
  - See Photo 13.

- Visited the upper segment of the river just below the dam via Dawnflower Ave. and Deoder.

Photo 1: House on Magnolia Avenue with stain line.

Photo 2: Canal on east side of Magnolia Avenue, Rob Kubistek residence.

Photo 3: Canal at Magnolia Avenue terminus looking south towards river.

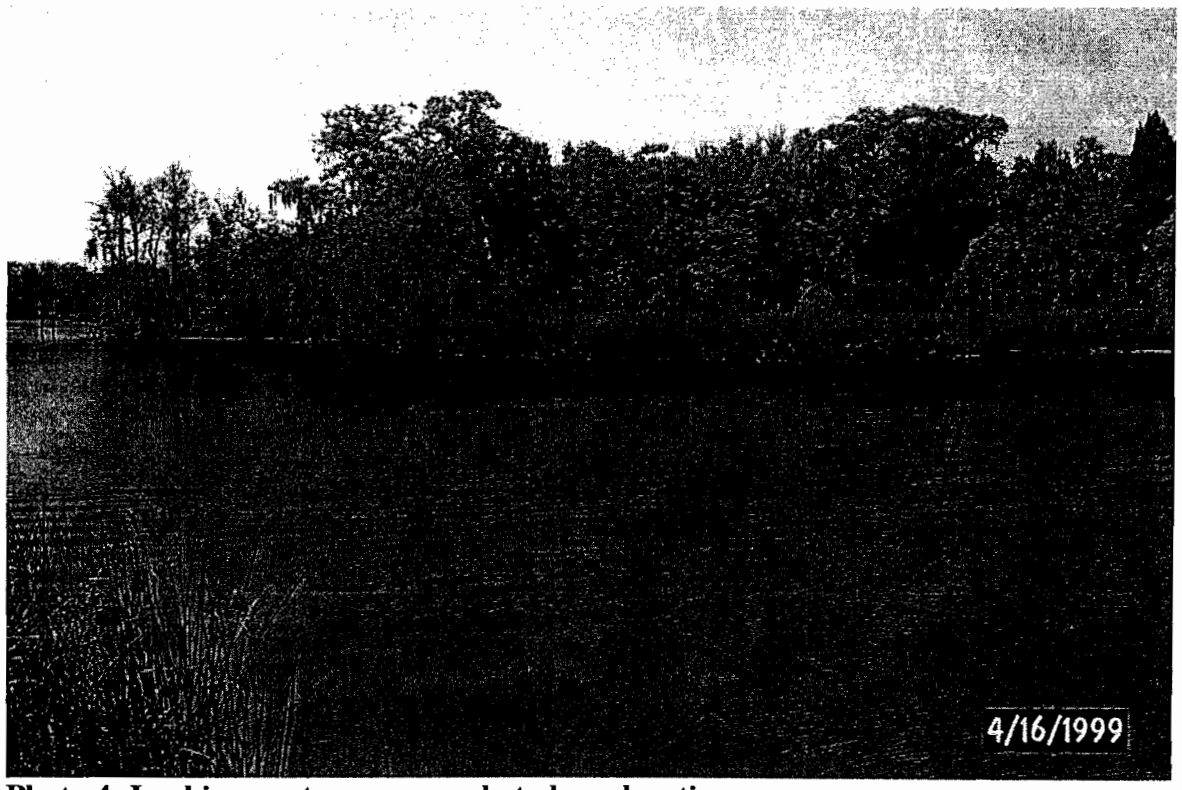


Photo 4: Looking west across canal at above location.

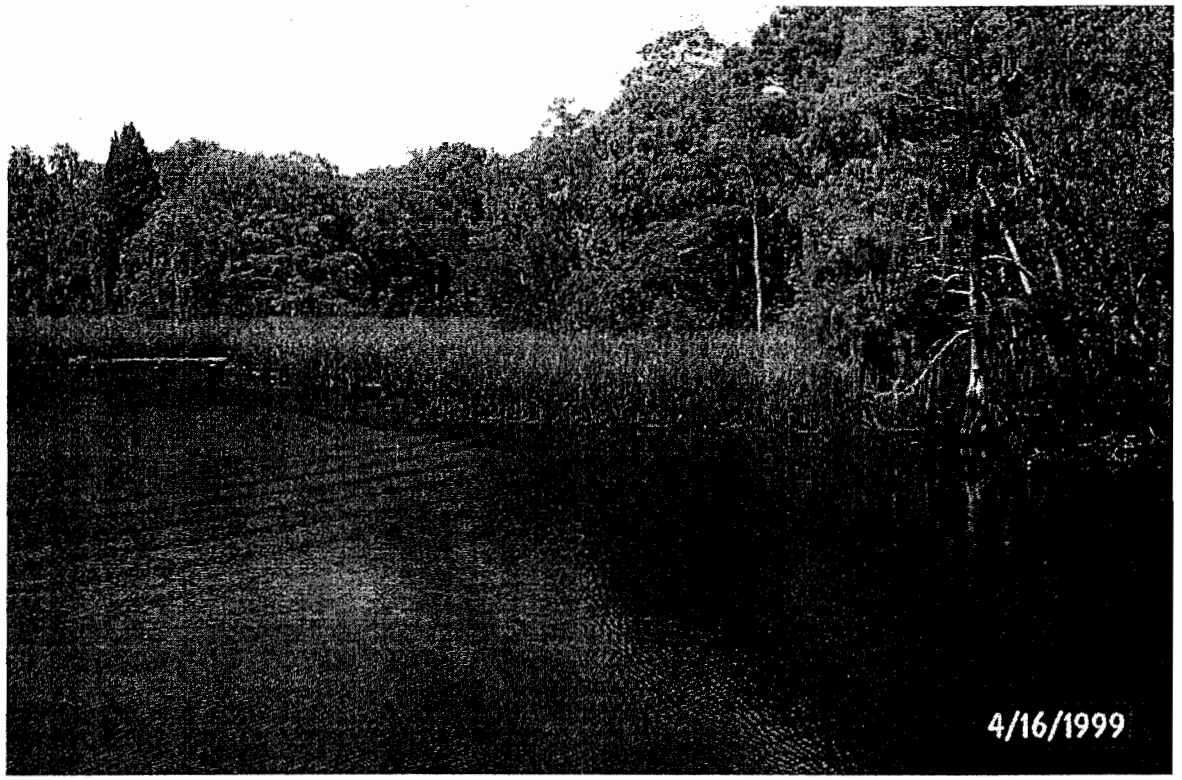


Photo 5: Canal at Palm Drive terminus looking southwest towards river.

Photo 6: Looking west across canal at above location.

Photo 7: Hickory Avenue Marina looking north towards wetland on right bank.

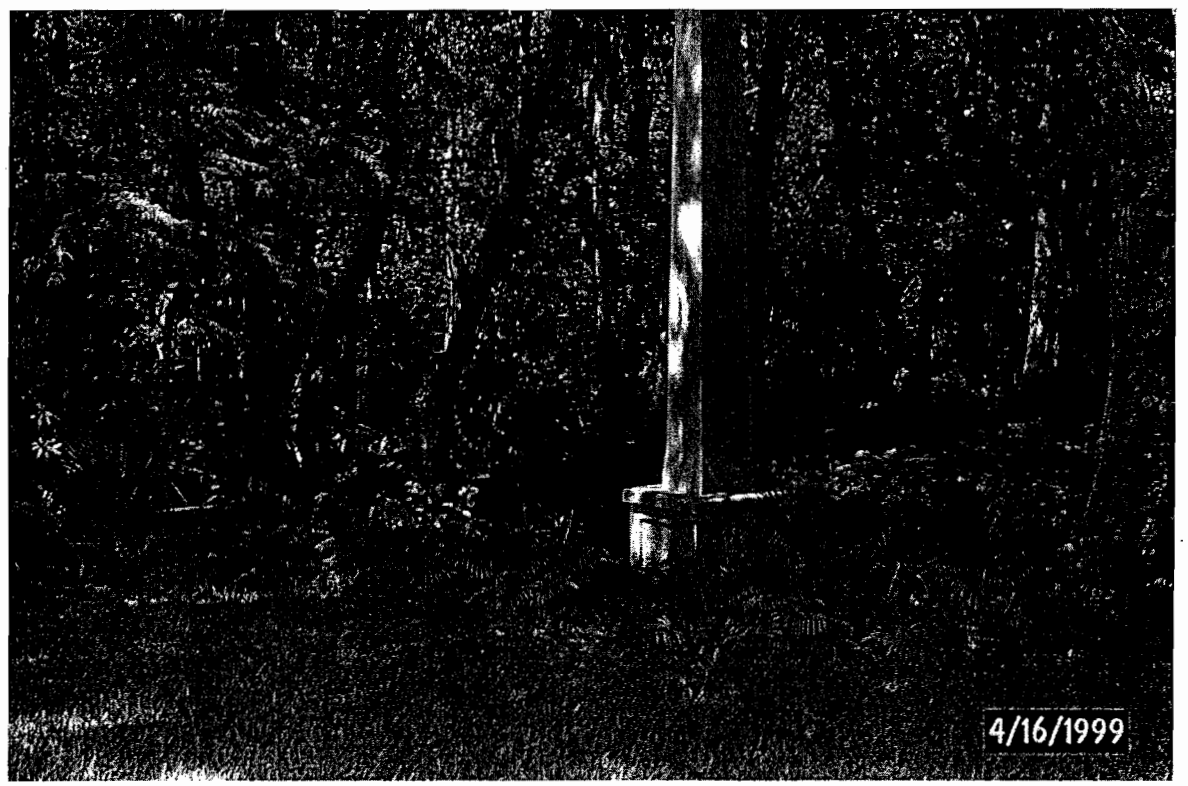


Photo 8: Depressional area at Riverside Drive and 64th Street.

Photo 9: Coast Guard Station w/SWFWMD gage.

Photo 10: Confluence of Barge canal at Upper Segment Withlacoochee River.

Photo 11: Rock Dam construction site looking at west spoil bank tie in.

Photo 12: Rock Dam construction site looking at east spoil bank tie in.

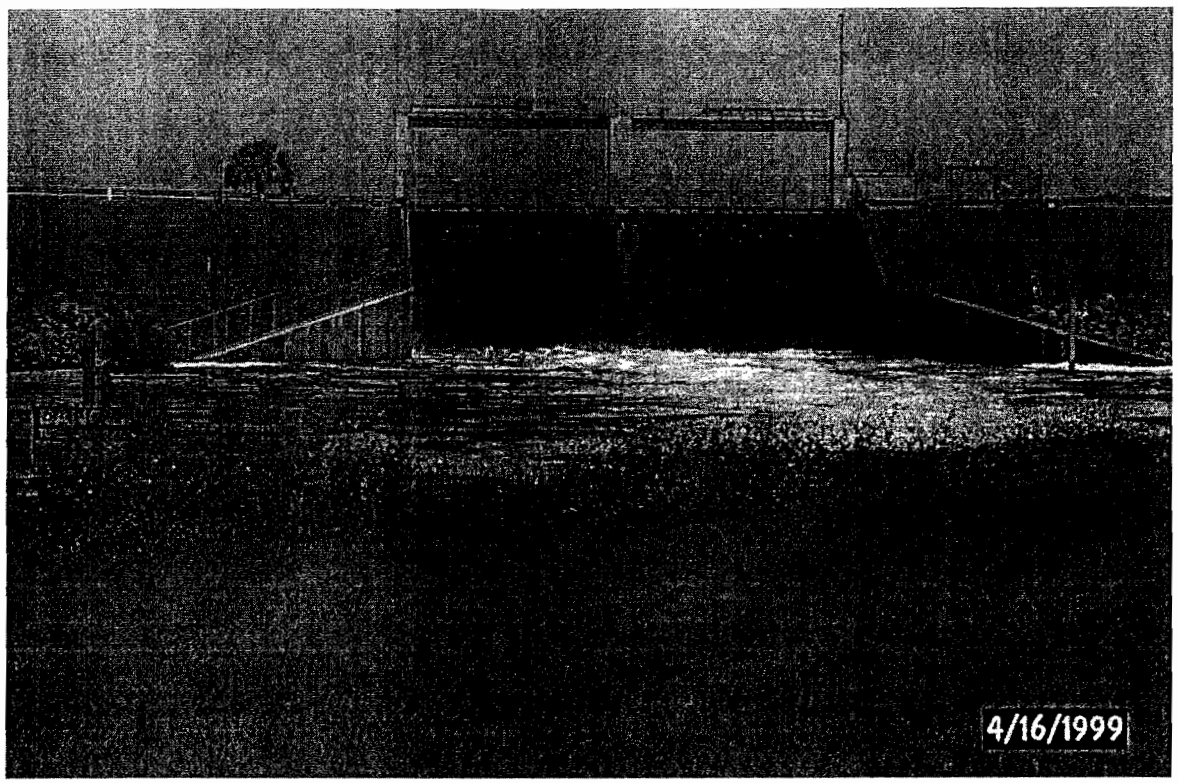


Photo 13: Inglis Dam main gates.

APPENDIX B

HYDROLOGIC ANALYSIS DOCUMENTATION

NOAA's NATIONAL OCEAN SERVICE

CENTER FOR OPERATIONAL OCEANOGRAPHIC PRODUCTS AND SERVICES

Products and Services Division
1305 East-West Highway
SSMC Bldg. # 4 – N/OPS3
Silver Spring, MD 20910-3281
301-713-2815
301-713-4500 (fax)
http://www.tidesandcurrents.noaa.gov

CO-OPS

TO:

Michael Walters
URS
7650 West Courtney Campbell Causeway
Waterford Plaza, Suite 700
Tampa, FL 33607-1462

DATE: October 1, 2003
ACCOUNT#: 04-0001
LOG#: 10331

Todd Ehret
Physical Oceanographer for
Tide & Tidal Current Predictions
E-mail: Todd.Ehret@noaa.gov

** IMPORTANT NOTICE **

The enclosed data are based upon the latest information available as of the date of your request. The official Tide and Tidal Current prediction tables are published annually on October 1, for the following calendar year. Tide and Tidal Current predictions requested prior to the publishing date of the official tables are subject to change. Please check the information provided to insure completeness and readability of hard-copy and electronic media. This is not an invoice. Please retain a copy of this page for reference on future requests.

Enclosed:

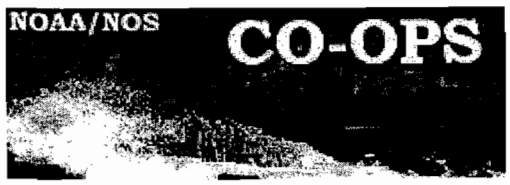
Tide predictions at "Withlacoochee River Entrance, Florida" for

- 1960
- 1982
- 1993
- 1996
- 1999

Provided on diskette in International Format, 24-Hour Clock, Daylight Saving Time.

Please Note: These predictions are based on the latest information we have available for the station at "Withlacoochee River Entrance, Florida". These predictions may not match the published predictions for these dates.

An invoice for $65.00 has been mailed separately.



Center for Operational Oceanographic Products and Services (CO-OPS)

Station Information for Cedar Key, FL

Water Level Station Information:

Station Name: **Cedar Key, FL**
Station Identification Number: **8727520**
Latitude: **29° 8.1' N**
Longitude: **83° 1.9' W**
Date Established: **Mar 12 1914**
Maximum Water Level: **5.15 ft. above MHHW**
(10/07/1996)
Minimum Water Level: **-4.21 ft. below MLLW**
(09/18/1947)
Mean Range: **2.83 ft.**
Diurnal Range: **3.80 ft.**
Tidal and Geodetic Datums: **Click HERE**
Bench Mark Data Sheet: **Click HERE**

EPOCH Update Information: NEW

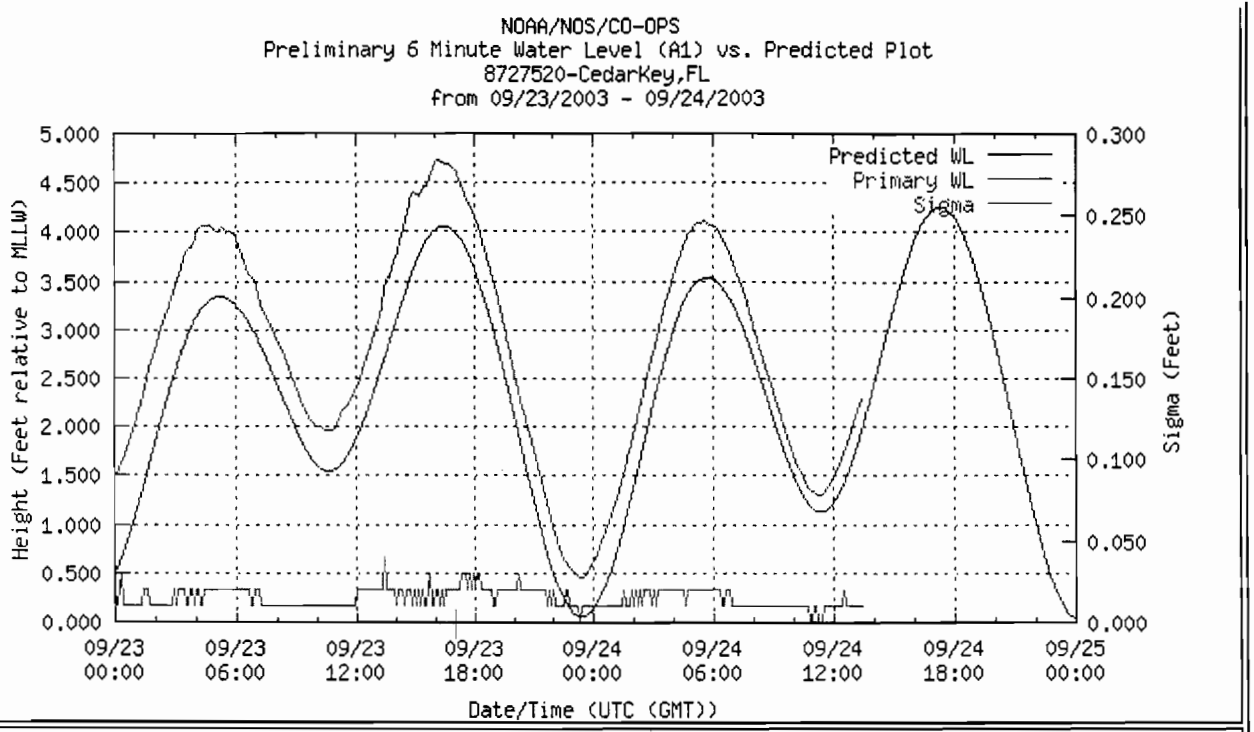
EPOCH Datum Comparison:	**Click HERE -**	check datum differences between the old epoch (1960-1978) and the new epoch (1983-2001)
Superceded Bench Mark Data Sheet:	**Click HERE -**	bench mark sheet on the old Tidal Datum Epoch (1960-1978)
Superceded Datums:	**Click HERE -**	datums on the old Tidal Datum Epoch (1960-1978)
Mean Sea Level Differences List:	**Click HERE -**	mean sea level differences between the two epochs for all stations.

Mean Sea Level Difference: for 8727520 Cedar Key, FL	**1983-2001**	**1960-1978**	**Difference:**
	3.84 ft.	3.70 ft.	0.14 ft.

Data Types Available:

Primary Water Level
Backup Water Level
Wind
Air Temperature
Water Temperature
Barometric Pressure

Current Water Level Data Plot



Sigma - Standard deviation of 1 second samples used to compute the water level height.

Retrieve Data Listing

Data Inventory
Station Data Plots
Water Level Data Listing (preliminary)
Water Level Data Listing (historical)
Meteorological/Oceanographic Data Listing

Location:

To reach the tidal bench marks from the Post Office at Second Avenue and C Street in Cedar Key, proceed SE on C Street for 0.03 km (0.2 mi) to Levy County Pier. The bench marks are in the area between the Fish House and G Street going east/west and between Whiddon Street and the county pier going north/south. The tide gauge and staff are at the NW end of the restroom building near the foot of the pier.

Station Location Map

Click HERE for Map
(Not for navigational use)

For other questions contact us at:

NOAA, National Ocean Service
Center for Operational Oceanographic Products and Services (CO-OPS)
1305 East-West Highway
Silver Spring, Maryland 20910 U.S.A.

Telephone: 1-301-713-2877 or 2890
Fax: 1-301-713-4437
Website: http://co-ops.nos.noaa.gov
E-mail: Stephen.Lyles@noaa.gov

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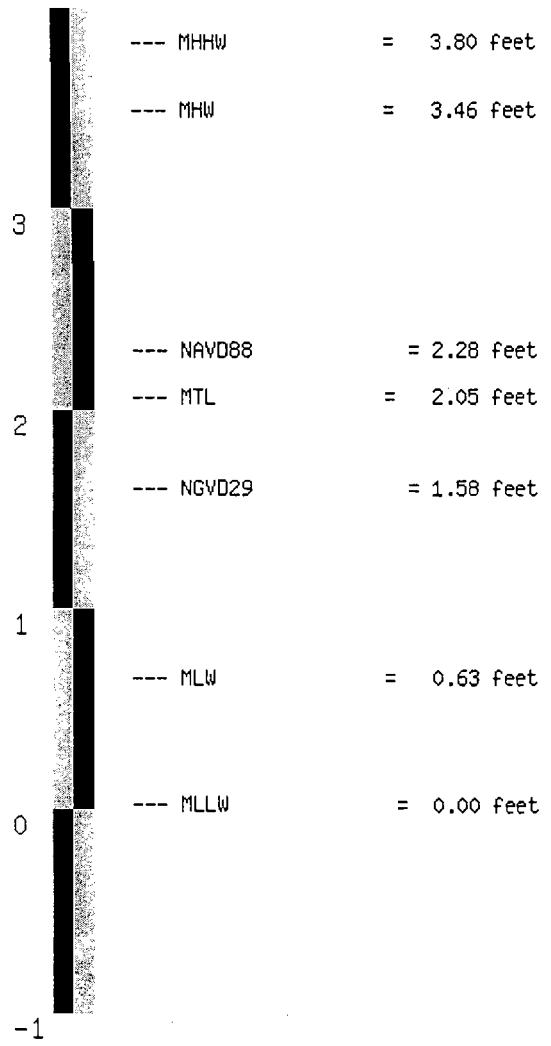
* Home * PORTS * Predictions *Observations *Bench Marks * FAQ Station Locator
*Publications *About CO-OPS *Product Info.

Date created
Wed Sep 24 09:56:21 EDT 2003

Elevation Information for PID = AR1204, VM = 751
Station_ID --- 8727520



--- MHHW = 3.80 feet

--- MHW = 3.46 feet

--- NAVD88 = 2.28 feet

--- MTL = 2.05 feet

--- NGVD29 = 1.58 feet

--- MLW = 0.63 feet

--- MLLW = 0.00 feet

Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Site Map for Florida

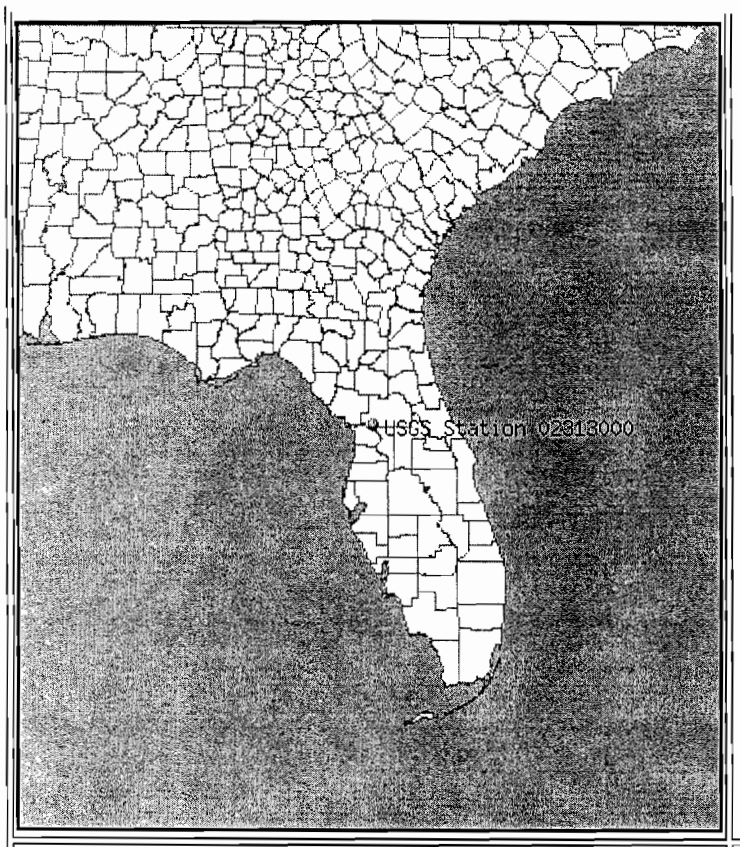
Click Here for information on data reliability

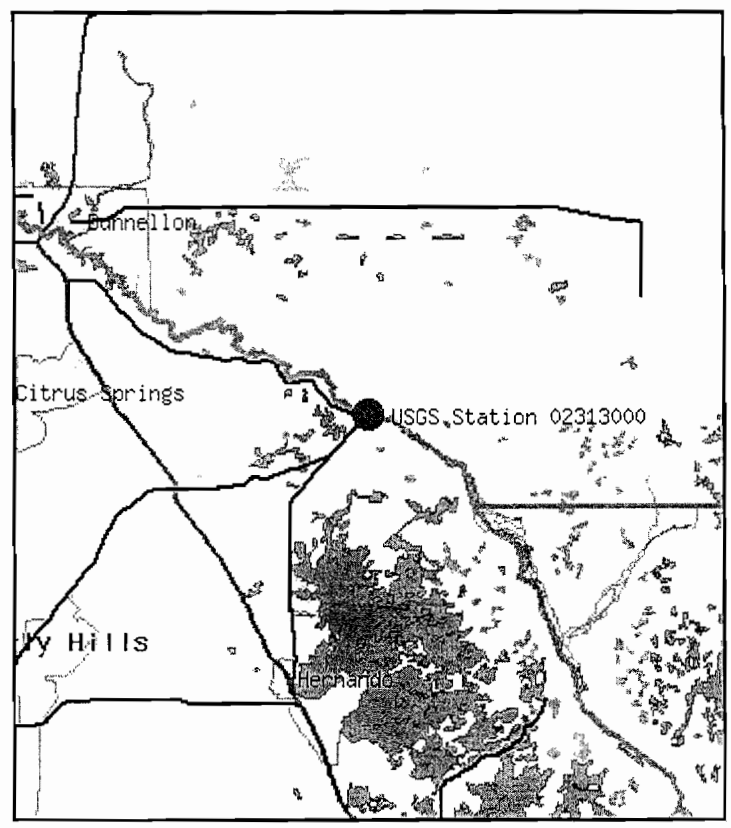
USGS 02313000 WITHLACOOCHEE RIVER NR HOLDER, FLA.

Available data for this site: Station site map | GO

Marion County, Florida
Hydrologic Unit Code 03100208
Latitude 28°59'19", Longitude 82°20'59" NAD27
Drainage area 1,820.00 square miles
Gage datum 27.52 feet above sea level NGVD29

Location of the site in Florida.	Site map.





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Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov Top
Feedback on this website gs-w-fl_NWISWeb_Maintainer@usgs.gov Explanation of terms

NWIS Site Inventory for Florida: Site Map
http://waterdata.usgs.gov/fl/nwis/nwismap?

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Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

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USGS 02313000 WITHLACOOCHEE RIVER NR HOLDER, FLA.

Available data for this site: Station home page | GO

Station Description

LOCATION
Latitude 28°59'19", Longitude 82°20'59" NAD27,
Marion County, Florida , Hydrologic Unit 03100208

DRAINAGE AREA
1,820.00 square miles

GAGE
Datum of gage is 27.52 feet above sea level NGVD29.

STATION TYPE:
Surface Water

STATION DATA:

Data Type	Begin Date	End Date	Count
Real-time	This is a real-time site		
Peak streamflow	1932-09-09	2002-09-28	71
Daily streamflow	1928-09-01	2002-09-30	26116
Water Quality Samples	1950-01-01	1999-09-01	561

SITE OPERATION:
Site is located in Florida; record is maintained by Florida - Altamonte Springs Office
CONTACT INFORMATION
Email questions about this station to gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov

Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov Top
Feedback on this websitegs-w-fl_NWISWeb_Maintainer@usgs.gov Explanation of terms
**** USGS 02313000 WITHLACOOCHEE RIVER NR HOLDER, FLA.**
http://waterdata.usgs.gov/fl/nwis/nwisman?

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0.65 0.66

Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Site Map for Florida

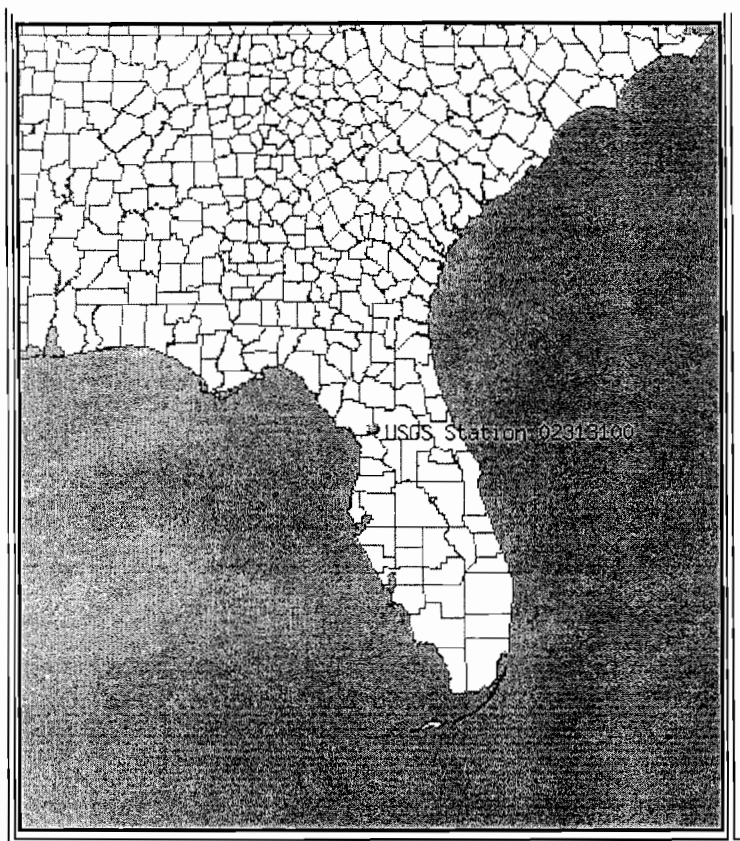
Click Here for information on data reliability

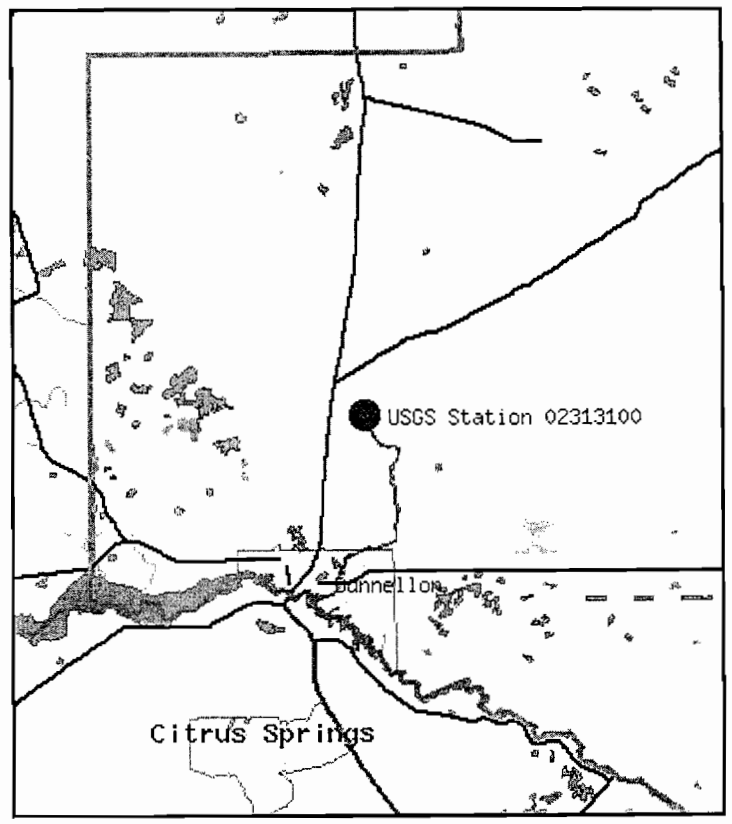
USGS 02313100 RAINBOW SPRINGS NEAR DUNNELLON, FLA.

Available data for this site: Station site map | GO

Marion County, Florida
Hydrologic Unit Code 03100208
Latitude 29°06'08", Longitude 82°26'16" NAD27
Gage datum 28.34 feet above sea level NGVD29

Location of the site in Florida.	Site map.





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Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov
Feedback on this websitegs-w-fl_NWISWeb_Maintainer@usgs.gov

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NWIS Site Inventory for Florida: Site Map
http://waterdata.usgs.gov/fl/nwis/nwismap?

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Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

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USGS 02313100 RAINBOW SPRINGS NEAR DUNNELLON, FLA.

Available data for this site: Station home page | GO

Station Description

LOCATION

Latitude 29°06'08", Longitude 82°26'16" NAD27,
Marion County, Florida , Hydrologic Unit 03100208

GAGE

Datum of gage is 28.34 feet above sea level NGVD29.

STATION TYPE:

Spring

STATION DATA:

Data Type	Begin Date	End Date	Count
Peak streamflow	1965-10-01	2001-10-23	34
Daily streamflow	1965-01-01	2002-09-30	13787
Water Quality Samples	1898-12-22	1999-09-02	624

SITE OPERATION:

Site is located in Florida; record is maintained by Florida - Altamonte Springs Office

CONTACT INFORMATION

Email questions about this station to gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov

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**** USGS 02313100 RAINBOW SPRINGS NEAR DUNNELLON, FLA.**
http://waterdata.usgs.gov/fl/nwis/nwisman?

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0.64 0.63

Water Resources

Data Category: Surface Water | Geographic Area: Florida | GO

Daily Streamflow for Florida

Click Here for information on data reliability

USGS 02313230 WITHLACOOCHEE R AT INGLIS DAM NR DUNNELLON, FLA.

Available data for this site: Surface-water: Daily streamflow | GO

Levy County, Florida
Hydrologic Unit Code 03100208
Latitude 29°00'35", Longitude 82°37'01" NAD27
Drainage area 2,020.00 square miles

Period of record

From	To	Count
1969-10-01	2002-09-30	12053

Choose Output Format

Retrieve Daily streamflow data for Selected Sites

Choose one of the following options for displaying data for the sites meeting the criteria above:

Retrieve data from: [ ] to: [ ] (YYYY-MM-DD -- **Blank = all data**)

- (•) Graphs of data [log scale]
- ( ) Tab-separated data [YYYY-MM-DD] [Save to file]

Submit Reset Help

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Daily Streamflow -- 1 sites found
http://waterdata.usgs.gov/fl/nwis/discharge?

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0.65 0.65

Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Site Map for Florida

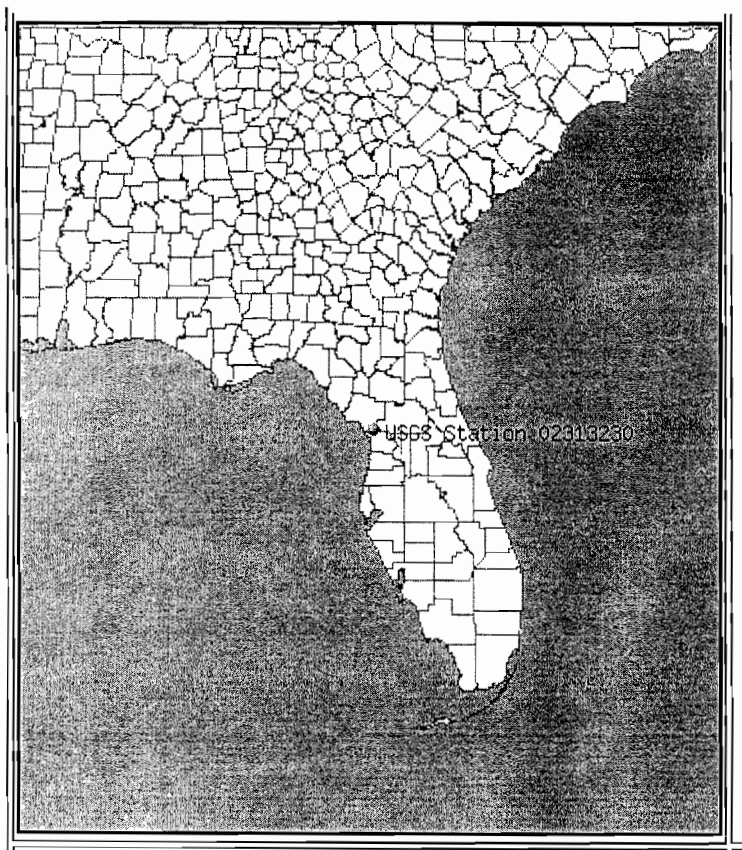
Click Here for information on data reliability

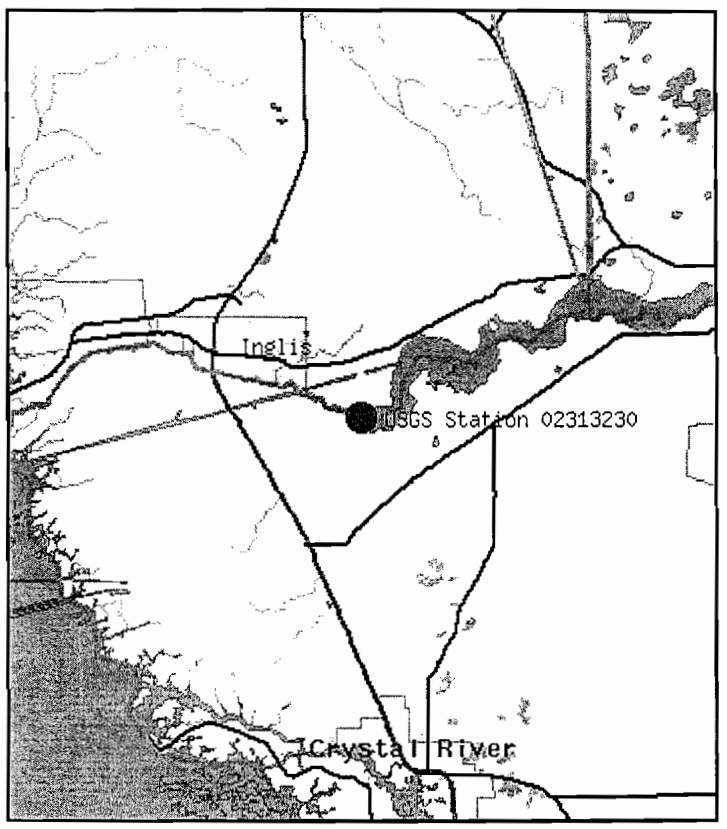
USGS 02313230 WITHLACOOCHEE R AT INGLIS DAM NR DUNNELLON, FLA.

Available data for this site: Station site map | GO

Levy County, Florida
Hydrologic Unit Code 03100208
Latitude 29°00'35", Longitude 82°37'01" NAD27
Drainage area 2,020.00 square miles

Location of the site in Florida.	Site map.





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Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Click Here for information on data reliability

USGS 02313230 WITHLACOOCHEE R AT INGLIS DAM NR DUNNELLON, FLA.

Available data for this site: Station home page | GO

Station Description

LOCATION
Latitude 29°00'35", Longitude 82°37'01" NAD27,
Levy County, Florida , Hydrologic Unit 03100208

DRAINAGE AREA
2,020.00 square miles

STATION TYPE:
Surface Water

STATION DATA:

Data Type	Begin Date	End Date	Count
Peak streamflow	1970-01-21	2002-09-26	33
Daily streamflow	1969-10-01	2002-09-30	12053
Water Quality Samples	1963-03-21	1999-06-30	191

SITE OPERATION:
Site is located in Florida; record is maintained by Florida - Altamonte Springs Office

CONTACT INFORMATION

Email questions about this station to gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov

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Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov Top
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**** USGS 02313230 WITHLACOOCHEE R AT INGLIS DAM NR DUNNELLON, FLA.**
http://waterdata.usgs.gov/fl/nwis/nwisman?

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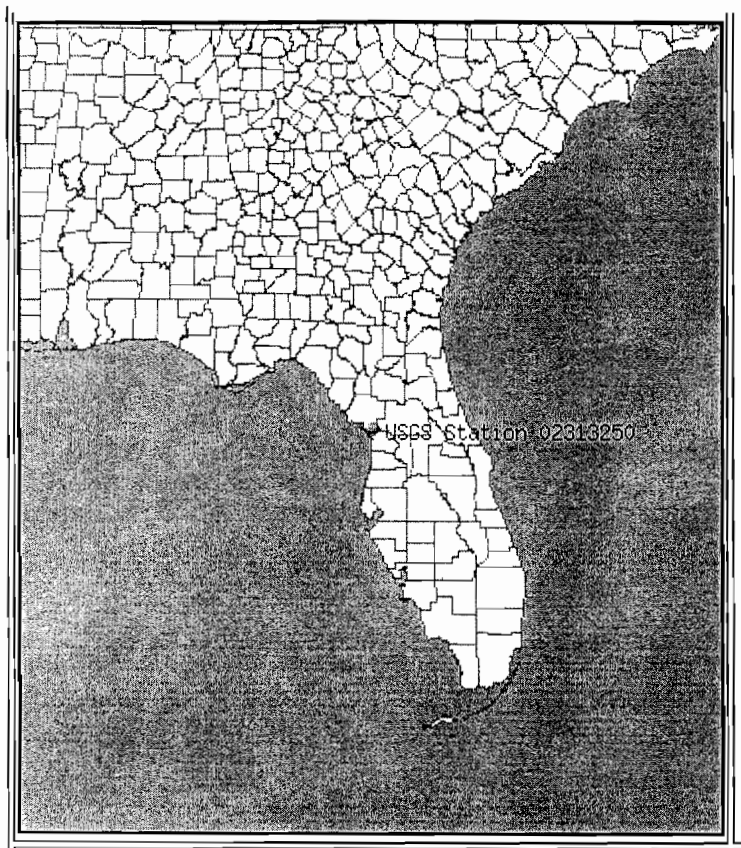
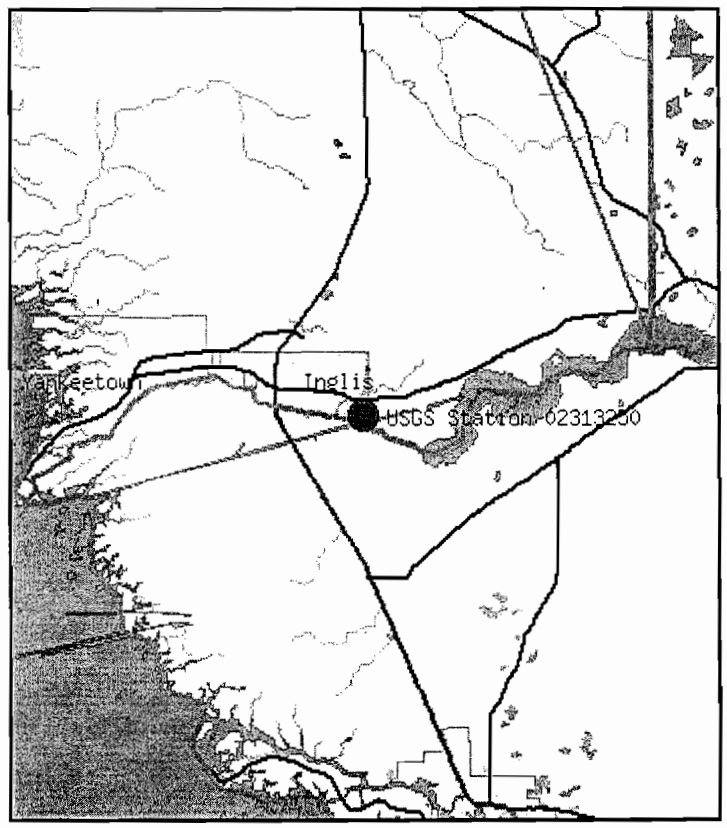
0.64 0.64





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Maps are generated by US Census Bureau TIGER Mapping Service.

Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov
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NWIS Site Inventory for Florida: Site Map
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Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Site Map for Florida

Click Here for information on data reliability

USGS 02313250 WITHLACOOCHEE R BYPASS CHANNEL NR INGLIS FLA

Available data for this site: Station site map | GO

Levy County, Florida
Hydrologic Unit Code 03100208
Latitude 29°01'15", Longitude 82°38'17" NAD27

Location of the site in Florida.	Site map.

Water Resources

Data Category: Site Information | Geographic Area: Florida | GO

Click Here for information on data reliability

USGS 02313250 WITHLACOOCHEE R BYPASS CHANNEL NR INGLIS FLA

Available data for this site: Station home page | GO

Station Description

LOCATION
Latitude 29°01'15", Longitude 82°38'17" NAD27,
Levy County, Florida , Hydrologic Unit 03100208

STATION TYPE:
Surface Water

STATION DATA:

Data Type	Begin Date	End Date	Count
Peak streamflow	1971-09-09	2001-10-08	28
Daily streamflow	1970-01-01	2002-09-30	11961
Water Quality Samples	1971-05-04	1984-10-16	44

SITE OPERATION:
Site is located in Florida; record is maintained by Florida - Altamonte Springs Office

CONTACT INFORMATION
Email questions about this station to gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov

Questions about data gs-w-fl_NWISWeb_Data_Inquiries@usgs.gov
Feedback on this website gs-w-fl_NWISWeb_Maintainer@usgs.gov

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**** USGS 02313250 WITHLACOOCHEE R BYPASS CHANNEL NR INGLIS FLA**
http://waterdata.usgs.gov/fl/nwis/nwisman?

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0.64 0.64

```
#
#
# US Geological Survey, Water Resources Data
# retrieved: 2003-09-19 16:19:19 EDT
#
# This file contains Calendar Year Streamflow Statistics
#
# This file includes the following columns:
#
#
# agency_cd  agency code
# site_no    USGS site number
# year_nu    Calendar year for value
# mean_va    annual-mean value in cubic-feet per-second.
#             if there is not complete record
#             for a year this field is blank
#
#
# Sites in this file include:
# USGS 02313000 WITHLACOOCHEE RIVER NR HOLDER, FLA.
#
#
```

agency_cd	site_no	year_nu	mean_va
5s	15s	4s	12n
USGS	02313000	1932	320
USGS	02313000	1933	1201
USGS	02313000	1934	1755
USGS	02313000	1935	954
USGS	02313000	1936	1263
USGS	02313000	1937	1148
USGS	02313000	1938	937
USGS	02313000	1939	1010
USGS	02313000	1940	709
USGS	02313000	1941	989
USGS	02313000	1942	1067
USGS	02313000	1943	912
USGS	02313000	1944	698
USGS	02313000	1945	1675
USGS	02313000	1946	1271
USGS	02313000	1947	1477
USGS	02313000	1948	1591
USGS	02313000	1949	1474
USGS	02313000	1950	1251
USGS	02313000	1951	847
USGS	02313000	1952	894
USGS	02313000	1953	1689
USGS	02313000	1954	936
USGS	02313000	1955	484
USGS	02313000	1956	327
USGS	02313000	1957	771
USGS	02313000	1958	1265
USGS	02313000	1959	2829
USGS	02313000	1960	3561
USGS	02313000	1961	837
USGS	02313000	1962	480
USGS	02313000	1963	608
USGS	02313000	1964	1474
USGS	02313000	1965	1274
USGS	02313000	1966	1704
USGS	02313000	1967	830
USGS	02313000	1968	979
USGS	02313000	1969	1268
USGS	02313000	1970	1456
USGS	02313000	1971	799
USGS	02313000	1972	612
USGS	02313000	1973	762
USGS	02313000	1974	979
USGS	02313000	1975	476
USGS	02313000	1976	737
USGS	02313000	1977	438
USGS	02313000	1978	822
USGS	02313000	1979	1125

USGS	02313000	1980	662
USGS	02313000	1981	276
USGS	02313000	1982	1542
USGS	02313000	1983	1538
USGS	02313000	1984	1201
USGS	02313000	1985	710
USGS	02313000	1986	705
USGS	02313000	1987	908
USGS	02313000	1988	1108
USGS	02313000	1989	564
USGS	02313000	1990	314
USGS	02313000	1991	531
USGS	02313000	1992	230
USGS	02313000	1993	363
USGS	02313000	1994	746
USGS	02313000	1995	1117
USGS	02313000	1996	877
USGS	02313000	1997	408
USGS	02313000	1998	1927
USGS	02313000	1999	362
USGS	02313000	2000	110
USGS	02313000	2001	274

```
#
# U.S. Geological Survey
# National Water Information System
# Retrieved: 2003-09-15 09:48:31 EDT
#
# ----------------------WARNING----------------------
# The data you have obtained from this automated
# U.S. Geological Survey database have not received
# Director's approval and as such are provisional
# and subject to revision.  The data are released
# on the condition that neither the USGS nor the
# United States Government may be held liable for
# any damages resulting from its use.
#
# This file contains the annual peak streamflow data.
#
# This information includes the following fields:
#
#  agency_cd      Agency Code
#  site_no        USGS station number
#  peak_dt        format YYYY-MM-DD
#  peak_va        Annual peak streamflow value in cfs
#  peak_cd        Peak Discharge-Qualification codes (see explanation below)
#  gage_ht        Gage height for the associated peak streamflow in feet
#  gage_ht_cd     Gage height qualification codes
#  year_last_pk   Peak streamflow reported is the highest since this year
#  ag_dt          Date of maximum gage-height for water year (if not concurrent with peak)
#  ag_tm          Time of maximum gage-height for water year (if not concurrent with peak
#  ag_gage_ht     maximum Gage height for water year in feet (if not concurrent with peak
#  ag_gage_ht_cd maximum Gage height code
#
# Sites in this file include:
#  USGS 02313000 WITHLACOOCHEE RIVER NR HOLDER, FLA.
#
# Peak Streamflow-Qualification Codes(peak_cd):
#   1 ... Discharge is a Maximum Daily Average
#   2 ... Discharge is an Estimate
#   3 ... Discharge affected by Dam Failure
#   4 ... Discharge less than indicated value,
#           which is Minimum Recordable Discharge at this site
#   5 ... Discharge affected to unknown degree by
#           Regulation or Diversion
#   6 ... Discharge affected by Regulation or Diversion
#   7 ... Discharge is an Historic Peak
#   8 ... Discharge actually greater than indicated value
#   9 ... Discharge due to Snowmelt, Hurricane,
#           Ice-Jam or Debris Dam breakup
#   A ... Year of occurrence is unknown or not exact
#   B ... Month or Day of occurrence is unknown or not exact
#   C ... All or part of the record affected by Urbanization,
#           Mining, Agricultural changes, Channelization, or other
#   D ... Base Discharge changed during this year
#   E ... Only Annual Maximum Peak available for this year
#
# Gage height qualification codes(gage_ht_cd,ag_gage_ht_cd):
#   1 ... Gage height affected by backwater
#   2 ... Gage height not the maximum for the year
#   3 ... Gage height at different site and(or) datum
#   4 ... Gage height below minimum recordable elevation
#   5 ... Gage height is an estimate
#   6 ... Gage datum changed during this year
#
#
```

agency_cd	site_no	peak_dt	peak_tm	peak_va	peak_cd	gage_ht	gage_ht_cd	year_last_pk	ag_dt	ag_tm	ag_gage_ht	ag_gage_ht_cd	modify_dt
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USGS	02313000	1932-09-09			555					1933-10-01			3.85		2003-09-14 03:58:33
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USGS	02313000	1934-07-08			6740		11.63							2003-09-14 03:58:33	
USGS	02313000	1935-09-28			3290		8.86							2003-09-14 03:58:33	
USGS	02313000	1936-03-11			2800		7.66			1937-10-01			8.85		2003-09-14 03:58:33
USGS	02313000	1937-08-31			3090		8.46							2003-09-14 03:58:33	
USGS	02313000	1937-10-03			2240		7.03							2003-09-14 03:58:33	
USGS	02313000	1939-09-24			2720		7.94							2003-09-14 03:58:33	

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USGS	02313000	1945-08-19	5330	10.54			2003-09-14 03:58:33
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USGS	02313000	1948-10-06	3020	8.28	1947-09-30	10.34	2003-09-14 03:58:33
USGS	02313000	1950-09-23	4980	10.40			2003-09-14 03:58:33
USGS	02313000	1951-01-07	1400	4.74	1952-10-01	10.32	2003-09-14 03:58:33
USGS	02313000	1952-03-30	1550	5.25			2003-09-14 03:58:33
USGS	02313000	1953-05-02	1710	5.77	1953-09-30	10.10	2003-09-14 03:58:33
USGS	02313000	1953-10-09	5050	10.46			2003-09-14 03:58:33
USGS	02313000	1955-09-28	1220	4.25			2003-09-14 03:58:33
USGS	02313000	1956-01-27	601	2.25	1957-10-01	4.21	2003-09-14 03:58:33
USGS	02313000	1956-11-12	959	3.48	1955-09-30	6.39	2003-09-14 03:58:33
USGS	02313000	1958-03-26	3240	8.27			2003-09-14 03:58:33
USGS	02313000	1959-04-07	4600	9.95			2003-09-14 03:58:33
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USGS	02313000	1960-10-10	7060	12.05			2003-09-14 03:58:33
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USGS	02313000	1964-10-04	3980	9.22			2003-09-14 03:58:33
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USGS	02313000	1971-09-17	2070	6.10			2003-09-14 03:58:33
USGS	02313000	1972-04-05	1160	3.94	1973-10-01	4.74	2003-09-14 03:58:33
USGS	02313000	1973-09-29	1490	5.76			2003-09-14 03:58:33
USGS	02313000	1974-08-06	2730	7.92			2003-09-14 03:58:33
USGS	02313000	1974-10-01	1590	4.90			2003-09-14 03:58:33
USGS	02313000	1976-08-19	1520	5.14			2003-09-14 03:58:33
USGS	02313000	1977-02-05	1050	3.85			2003-09-14 03:58:33
USGS	02313000	1978-03-12	2150	7.29			2003-09-14 03:58:33
USGS	02313000	1979-05-16	1420 E	5.17			2003-09-14 03:58:33
USGS	02313000	1979-10-13	4160	9.45			2003-09-14 03:58:33
USGS	02313000	1980-11-28	930 E	2.91			2003-09-14 03:58:33
USGS	02313000	1982-09-28	3390	8.48			2003-09-14 03:58:33
USGS	02313000	1982-10-07	3680	8.86			2003-09-14 03:58:33
USGS	02313000	1984-05-06	1990	5.90			2003-09-14 03:58:33
USGS	02313000	1985-09-25	3100	8.43			2003-09-14 03:58:33
USGS	02313000	1986-03-19	1860	5.57			2003-09-14 03:58:33
USGS	02313000	1987-04-21	3100	8.54	1987-04-22	8.55	2003-09-14 03:58:33
USGS	02313000	1988-03-14	1500		1988-09-30	8.15	2003-09-14 03:58:33
USGS	02313000	1988-10-01	2950	8.16			2003-09-14 03:58:33
USGS	02313000	1990-01-08	800	2.35			2003-09-14 03:58:33
USGS	02313000	1991-08-14	1770	5.67			2003-09-14 03:58:33
USGS	02313000	1991-10-05	531	1.88			2003-09-14 03:58:33
USGS	02313000	1992-10-03	1510	4.94			2003-09-14 03:58:33
USGS	02313000	1994-01-31	814	3.01			2003-09-14 03:58:33
USGS	02313000	1995-09-27	2480	7.05			2003-09-14 03:58:33
USGS	02313000	1995-10-23	3450	8.46			2003-09-14 03:58:33
USGS	02313000	1996-10-08	740	2.45			2003-09-14 03:58:33
USGS	02313000	1998-03-21	5360	10.69			2003-09-14 03:58:33
USGS	02313000	1998-10-02	1700	4.88			2003-09-14 03:58:33
USGS	02313000	1999-11-02	530	1.50			2003-09-14 03:58:33
USGS	02313000	2001-09-15	661	2.38	2001-09-30	3.21	2003-09-14 03:58:33
USGS	02313000	2002-09-28	1630	5.33			2003-09-14 03:58:33

```
#
# U.S. Geological Survey
# National Water Information System
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#
# This file contains the annual peak streamflow data.
#
# This information includes the following fields:
#
#  agency_cd      Agency Code
#  site_no        USGS station number
#  peak_dt        format YYYY-MM-DD
#  peak_va        Annual peak streamflow value in cfs
#  peak_cd        Peak Discharge-Qualification codes (see explanation below)
#  gage_ht        Gage height for the associated peak streamflow in feet
#  gage_ht_cd     Gage height qualification codes
#  year_last_pk   Peak streamflow reported is the highest since this year
#  ag_dt          Date of maximum gage-height for water year (if not concurrent with peak)
#  ag_tm          Time of maximum gage-height for water year (if not concurrent with peak
#  ag_gage_ht     maximum Gage height for water year in feet (if not concurrent with peak
#  ag_gage_ht_cd  maximum Gage height code
#
# Sites in this file include:
#  USGS 02313100 RAINBOW SPRINGS NEAR DUNNELLON, FLA.
#
# Peak Streamflow-Qualification Codes(peak_cd):
#    1 ... Discharge is a Maximum Daily Average
#    2 ... Discharge is an Estimate
#    3 ... Discharge affected by Dam Failure
#    4 ... Discharge less than indicated value,
#            which is Minimum Recordable Discharge at this site
#    5 ... Discharge affected to unknown degree by
#            Regulation or Diversion
#    6 ... Discharge affected by Regulation or Diversion
#    7 ... Discharge is an Historic Peak
#    8 ... Discharge actually greater than indicated value
#    9 ... Discharge due to Snowmelt, Hurricane,
#            Ice-Jam or Debris Dam breakup
#    A ... Year of occurrence is unknown or not exact
#    B ... Month or Day of occurrence is unknown or not exact
#    C ... All or part of the record affected by Urbanization,
#             Mining, Agricultural changes, Channelization, or other
#    D ... Base Discharge changed during this year
#    E ... Only Annual Maximum Peak available for this year
#
# Gage height qualification codes(gage_ht_cd,ag_gage_ht_cd):
#    1 ... Gage height affected by backwater
#    2 ... Gage height not the maximum for the year
#    3 ... Gage height at different site and(or) datum
#    4 ... Gage height below minimum recordable elevation
#    5 ... Gage height is an estimate
#    6 ... Gage datum changed during this year
#
#
```

agency_cd	site_no	peak_dt	peak_tm	peak_va	peak_cd	gage_ht	gage_ht_cd	year_last_pk	ag_dt	ag_tm	ag_gage_ht	ag_gage_ht_cd	modify_dt
5s	15s	10d	6s	8s	27s	8s	13s	4s	10d	6s	8s	11s	19d				
USGS	02313100		1965-10-01			1040	1						2003-09-14 03:58:33
USGS	02313100		1966-10-17			945	1						2003-09-14 03:58:33
USGS	02313100		1968-09-19			856	1						2003-09-14 03:58:33
USGS	02313100		1968-10-29			867	1						2003-09-14 03:58:33
USGS	02313100		1970-09-11			993	1						2003-09-14 03:58:33
USGS	02313100		1970-10-01			978				1970-10-20		3.44	2003-09-14 03:58:33
USGS	02313100		1971-10-19			785				1971-11-05		2.79	2003-09-14 03:58:33
USGS	02313100		1972-10-08			744	1			1971-08-21		2.61	2003-09-14 03:58:33

USGS	02313100	1974-09-25	755	1	1975-10-11	2.69	2003-09-14 03:58:33
USGS	02313100	1974-10-01	750		1974-10-22	2.44	2003-09-14 03:58:33
USGS	02313100	1976-08-18	692	1	1976-09-13	2.57	2003-09-14 03:58:33
USGS	02313100	1977-02-05	684	1	1978-11-03	2.48	2003-09-14 03:58:33
USGS	02313100	1978-03-26	852	1	1978-03-16	3.08	2003-09-14 03:58:33
USGS	02313100	1982-09-30	987	1	1982-08-30	3.31	2003-09-14 03:58:33
USGS	02313100	1982-10-07	1000	1	1982-11-03	3.61	2003-09-14 03:58:33
USGS	02313100	1983-10-17	891	1	1983-10-05	3.10	2003-09-14 03:58:33
USGS	02313100	1985-09-20	915	1	1985-09-27	3.32	2003-09-14 03:58:33
USGS	02313100	1985-10-01	904	1	1985-11-14	2.94	2003-09-14 03:58:33
USGS	02313100	1987-04-25	879		1987-04-07	2.75	2003-09-14 03:58:33
USGS	02313100	1988-09-19	1060		1988-06-29	3.32	2003-09-14 03:58:33
USGS	02313100	1988-10-01	1010	1	1987-05-31	2.18	2003-09-14 03:58:33
USGS	02313100	1989-10-21	643		1988-08-29	2.34	2003-09-14 03:58:33
USGS	02313100	1991-08-30	693		1991-09-19	2.50	2003-09-14 03:58:33
USGS	02313100	1991-10-02	667	1	1991-11-26	2.33	2003-09-14 03:58:33
USGS	02313100	1992-10-25	756	1	1992-12-03	2.60	2003-09-14 03:58:33
USGS	02313100	1994-03-04	707	1	1994-09-27	2.63	2003-09-14 03:58:33
USGS	02313100	1994-11-21	707	1	1994-10-14	3.44	2003-09-14 03:58:33
USGS	02313100	1996-08-30	783	1	1996-08-30	3.99	2003-09-14 03:58:33
USGS	02313100	1996-10-07	774	1	1996-10-07	3.90	2003-09-14 03:58:33
USGS	02313100	1998-03-21	1030	1	1998-04-06	3.43	2003-09-14 03:58:33
USGS	02313100	1998-11-05	892	1	1998-10-14	2.91	2003-09-14 03:58:33
USGS	02313100	1999-10-22	608	1	1999-10-26	1.97	2003-09-14 03:58:33
USGS	02313100	2001-09-27	626	1	2001-08-30	2.13	2003-09-14 03:58:33
USGS	02313100	2001-10-23	650	1	2001-11-05	2.48	2003-09-14 03:58:33

```
#
# U.S. Geological Survey
# National Water Information System
# Retrieved: 2003-09-15 10:10:30 EDT
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#
# This file contains the annual peak streamflow data.
#
# This information includes the following fields:
#
#  agency_cd     Agency Code
#  site_no       USGS station number
#  peak_dt       format YYYY-MM-DD
#  peak_va       Annual peak streamflow value in cfs
#  peak_cd       Peak Discharge-Qualification codes (see explanation below)
#  gage_ht       Gage height for the associated peak streamflow in feet
#  gage_ht_cd    Gage height qualification codes
#  year_last_pk  Peak streamflow reported is the highest since this year
#  ag_dt         Date of maximum gage-height for water year (if not concurrent with peak)
#  ag_tm         Time of maximum gage-height for water year (if not concurrent with peak
#  ag_gage_ht    maximum Gage height for water year in feet (if not concurrent with peak
#  ag_gage_ht_cd maximum Gage height code
#
# Sites in this file include:
#  USGS 02313230 WITHLACOOCHEE R AT INGLIS DAM NR DUNNELLON, FLA.
#
# Peak Streamflow-Qualification Codes(peak_cd):
#   1 ... Discharge is a Maximum Daily Average
#   2 ... Discharge is an Estimate
#   3 ... Discharge affected by Dam Failure
#   4 ... Discharge less than indicated value,
#           which is Minimum Recordable Discharge at this site
#   5 ... Discharge affected to unknown degree by
#           Regulation or Diversion
#   6 ... Discharge affected by Regulation or Diversion
#   7 ... Discharge is an Historic Peak
#   8 ... Discharge actually greater than indicated value
#   9 ... Discharge due to Snowmelt, Hurricane,
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#   A ... Year of occurrence is unknown or not exact
#   B ... Month or Day of occurrence is unknown or not exact
#   C ... All or part of the record affected by Urbanization,
#           Mining, Agricultural changes, Channelization, or other
#   D ... Base Discharge changed during this year
#   E ... Only Annual Maximum Peak available for this year
#
# Gage height qualification codes(gage_ht_cd,ag_gage_ht_cd):
#   1 ... Gage height affected by backwater
#   2 ... Gage height not the maximum for the year
#   3 ... Gage height at different site and(or) datum
#   4 ... Gage height below minimum recordable elevation
#   5 ... Gage height is an estimate
#   6 ... Gage datum changed during this year
#
#
```

agency_cd	site_no	peak_dt	peak_tm	peak_va	peak_cd	gage_ht	gage_ht_cd	year_last_pk	ag_dt	ag_tm	ag_gage_ht	ag_gage_ht_cd	modify_dt
5s	15s	10d	6s	8s	27s	8s	13s	4s	10d	6s	8s	11s	19d				
USGS	02313230		1970-01-21			3600	1,6				1970-08-11		27.98	2003-09-14 03:58:33
USGS	02313230		1971-09-17			1450	1,6				1971-06-26		28.07	2003-09-14 03:58:33
USGS	02313230		1972-09-08			2540	1,6				1972-04-03		28.05	2003-09-14 03:58:33
USGS	02313230		1972-10-08			2440	1,6				1971-09-01		27.99	2003-09-14 03:58:33
USGS	02313230		1974-08-07			2560	1,6				1975-10-17		27.81	2003-09-14 03:58:33
USGS	02313230		1974-10-01			685	1,6				1973-06-21		27.71	2003-09-14 03:58:33
USGS	02313230		1976-05-24			890	1,6				1976-04-08		27.86	2003-09-14 03:58:33
USGS	02313230		1976-10-01			370	1,6				1975-07-15		27.83	2003-09-14 03:58:33

USGS	02313230	1978-03-09	2220		1978-03-03	27.94		2003-09-14 03:58:33
USGS	02313230	1979-09-30	1940	1,6	1979-05-14	27.78		2003-09-14 03:58:33
USGS	02313230	1979-10-12	4500	1,6	1978-06-26	27.90		2003-09-14 03:58:33
USGS	02313230	1980-11-25	170	1,6	1980-11-24	27.74		2003-09-14 03:58:33
USGS	02313230	1982-09-23	4280	1,6,C	1982-06-19	28.28	1	2003-09-14 03:58:33
USGS	02313230	1982-10-08	3820	1,6,C	1981-06-13	27.95	1	2003-09-14 03:58:33
USGS	02313230	1984-03-29	2180	1,6,C	1984-05-05	28.01	1	2003-09-14 03:58:33
USGS	02313230	1985-09-01	3560	1,6,C	1985-06-14	27.92	1	2003-09-14 03:58:33
USGS	02313230	1985-11-01	2540	1,6	1984-01-23	28.05		2003-09-14 03:58:33
USGS	02313230	1987-04-21	3680	1,6,C	1987-09-30	27.92	1	2003-09-14 03:58:33
USGS	02313230	1988-09-06	4370	1,6,C	1989-11-17	27.94	1	2003-09-14 03:58:33
USGS	02313230	1988-10-01	2790	1,6,C	1987-03-02	27.96	1	2003-09-14 03:58:33
USGS	02313230	1990-01-10	900	1,6,C	1990-07-14	27.95	1	2003-09-14 03:58:33
USGS	02313230	1991-07-28	1620	1,6,C	1992-10-11	28.02	1	2003-09-14 03:58:33
USGS	02313230	1992-09-05	1010	1,6,C	1992-09-04	27.90		2003-09-14 03:58:33
USGS	02313230	1992-10-03	3020	1,6,C	1992-10-03	28.05		2003-09-14 03:58:33
USGS	02313230	1994-09-21	1480	1,6,C	1994-07-12	28.25		2003-09-14 03:58:33
USGS	02313230	1994-10-12	1910	1,6,C	1993-08-19	28.02		2003-09-14 03:58:33
USGS	02313230	1995-10-05	2790	1,6,C	1994-04-04	27.92		2003-09-14 03:58:33
USGS	02313230	1996-10-08	1240	1,6,C	1996-12-04	27.83		2003-09-14 03:58:33
USGS	02313230	1998-03-20	6000	1,6,C	1999-12-25	28.06		2003-09-14 03:58:33
USGS	02313230	1998-10-01	2319	1,6,C	1997-06-04	28.05		2003-09-14 03:58:33
USGS	02313230	2000-09-18	948	1,6,C	2001-10-21	27.81		2003-09-14 03:58:33
USGS	02313230	2001-09-16	1300	1,6,C	2001-09-25	27.92		2003-09-14 03:58:33
USGS	02313230	2002-09-26	1690	1,6,C	2002-06-23	28.01		2003-09-14 03:58:33

```
#
# U.S. Geological Survey
# National Water Information System
# Retrieved: 2003-09-15 10:12:18 EDT
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#
# This file contains the annual peak streamflow data.
#
# This information includes the following fields:
#
#  agency_cd      Agency Code
#  site_no        USGS station number
#  peak_dt        format YYYY-MM-DD
#  peak_va        Annual peak streamflow value in cfs
#  peak_cd        Peak Discharge-Qualification codes (see explanation below)
#  gage_ht        Gage height for the associated peak streamflow in feet
#  gage_ht_cd     Gage height qualification codes
#  year_last_pk   Peak streamflow reported is the highest since this year
#  ag_dt          Date of maximum gage-height for water year (if not concurrent with peak)
#  ag_tm          Time of maximum gage-height for water year (if not concurrent with peak
#  ag_gage_ht     maximum Gage height for water year in feet (if not concurrent with peak
#  ag_gage_ht_cd maximum Gage height code
#
# Sites in this file include:
#  USGS 02313250 WITHLACOOCHEE R BYPASS CHANNEL NR INGLIS FLA
#
# Peak Streamflow-Qualification Codes(peak_cd):
#   1 ... Discharge is a Maximum Daily Average
#   2 ... Discharge is an Estimate
#   3 ... Discharge affected by Dam Failure
#   4 ... Discharge less than indicated value,
#           which is Minimum Recordable Discharge at this site
#   5 ... Discharge affected to unknown degree by
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#   6 ... Discharge affected by Regulation or Diversion
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#
# Gage height qualification codes(gage_ht_cd,ag_gage_ht_cd):
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#   2 ... Gage height not the maximum for the year
#   3 ... Gage height at different site and(or) datum
#   4 ... Gage height below minimum recordable elevation
#   5 ... Gage height is an estimate
#   6 ... Gage datum changed during this year
#
#
```

agency_cd	site_no	peak_dt	peak_tm	peak_va	peak_cd	gage_ht	gage_ht_cd	year_last_pk	ag_dt	ag_tm	ag_gage_ht	ag_gage_ht_cd	modify_dt
5s	15s	10d	6s	8s	27s	8s	13s	4s	10d	6s	8s	11s	19d				
USGS	02313250		1971-09-09			1550	1,6				1971-06-22		27.52	2003-09-14 03:58:33	
USGS	02313250		1972-04-09			1690	1,6				1972-06-19		27.79	2003-09-14 03:58:33	
USGS	02313250		1973-09-02			1740	1,6				1973-09-01		27.66	2003-09-14 03:58:33	
USGS	02313250		1973-10-06			1660	1,6				1972-04-25		27.43	2003-09-14 03:58:33	
USGS	02313250		1974-10-01			1550	1,6				1973-09-24		27.44	2003-09-14 03:58:33	
USGS	02313250		1976-06-30			1620	1,6				1976-06-23		28.16	2003-09-14 03:58:33	
USGS	02313250		1977-01-04			1630	1,6				1977-05-19		28.31	2003-09-14 03:58:33	
USGS	02313250		1978-08-02			1600	1,6				1978-08-15		28.20	2003-09-14 03:58:33	

USGS	02313250	1982-06-19	1800	1,6,C	1982-06-18	27.80	1	2003-09-14 03:58:33
USGS	02313250	1983-02-19	1610	1,6,C	1983-01-20	27.76	1	2003-09-14 03:58:33
USGS	02313250	1984-02-22	1760	1,6,C	1984-05-05	27.93		2003-09-14 03:58:33
USGS	02313250	1985-08-16	1540	1,6,C	1985-06-14	27.73		2003-09-14 03:58:33
USGS	02313250	1986-01-22	1670	1,6	1987-10-31	27.90		2003-09-14 03:58:33
USGS	02313250	1987-03-09	1580	1,6	1987-06-03	28.20		2003-09-14 03:58:33
USGS	02313250	1987-10-01	1840	1,6	1986-09-06	28.12		2003-09-14 03:58:33
USGS	02313250	1989-02-01	1640	1,6	1989-06-08	27.76		2003-09-14 03:58:33
USGS	02313250	1990-07-15	1540	1,6	1990-07-14	27.78		2003-09-14 03:58:33
USGS	02313250	1991-09-10	1630	1,6	1991-01-30	27.98		2003-09-14 03:58:33
USGS	02313250	1991-10-06	1160	1,6	1990-01-17	27.83		2003-09-14 03:58:33
USGS	02313250	1994-01-31	1310	1,6	1994-01-02	28.20		2003-09-14 03:58:33
USGS	02313250	1994-10-27	1400	1,6	1994-10-15	27.98		2003-09-14 03:58:33
USGS	02313250	1995-10-07	1310	1,6	1994-04-18	28.14		2003-09-14 03:58:33
USGS	02313250	1997-09-30	1310	1,6	1997-09-29	28.00		2003-09-14 03:58:33
USGS	02313250	1997-12-25	1820	1,6	1996-09-06	27.72		2003-09-14 03:58:33
USGS	02313250	1998-10-03	1580	1,6	1997-08-11	27.96		2003-09-14 03:58:33
USGS	02313250	1999-10-22	1260	1,6	1998-03-31	27.89		2003-09-14 03:58:33
USGS	02313250	2001-09-29	1500	1,6	2001-07-23	27.84		2003-09-14 03:58:33
USGS	02313250	2001-10-08	1540	1,6	2000-06-23	27.89		2003-09-14 03:58:33

1 Flood Frequency Analysis
Time Series (Water Year) of Maximum Instanteous Discharge
URS
Withlachochee River nr Holder, cfs

RANK	QUANTITY	CALIFORNIA	GINGORTEN	BLOM
1	530.0	1.39	.79	.88
2	531.0	2.78	2.19	2.28
3	555.0	4.17	3.60	3.68
4	601.0	5.56	5.01	5.09
5	661.0	6.94	6.41	6.49
6	740.0	8.33	7.82	7.89
7	800.0	9.72	9.22	9.30
8	814.0	11.11	10.63	10.70
9	930.0	12.50	12.04	12.11
10	959.0	13.89	13.44	13.51
11	1020.0	15.28	14.85	14.91
12	1050.0	16.67	16.25	16.32
13	1160.0	18.06	17.66	17.72
14	1220.0	19.44	19.07	19.12
15	1350.0	20.83	20.47	20.53
16	1400.0	22.22	21.88	21.93
17	1400.0	23.61	23.28	23.33
18	1420.0	25.00	24.69	24.74
19	1460.0	26.39	26.10	26.14
20	1490.0	27.78	27.50	27.54
21	1500.0	29.17	28.91	28.95
22	1510.0	30.56	30.31	30.35
23	1520.0	31.94	31.72	31.75
24	1550.0	33.33	33.13	33.16
25	1590.0	34.72	34.53	34.56
26	1630.0	36.11	35.94	35.96
27	1700.0	37.50	37.35	37.37
28	1710.0	38.89	38.75	38.77
29	1770.0	40.28	40.16	40.18
30	1860.0	41.67	41.56	41.58
31	1890.0	43.06	42.97	42.98
32	1900.0	44.44	44.38	44.39
33	1990.0	45.83	45.78	45.79
34	2060.0	47.22	47.19	47.19
35	2070.0	48.61	48.59	48.60
36	2120.0	50.00	50.00	50.00
37	2150.0	51.39	51.41	51.40
38	2170.0	52.78	52.81	52.81
39	2240.0	54.17	54.22	54.21
40	2260.0	55.56	55.62	55.61
41	2480.0	56.94	57.03	57.02
42	2700.0	58.33	58.44	58.42
43	2720.0	59.72	59.84	59.82
44	2730.0	61.11	61.25	61.23
45	2780.0	62.50	62.65	62.63
46	2800.0	63.89	64.06	64.04
47	2950.0	65.28	65.47	65.44
48	3000.0	66.67	66.87	66.84
49	3020.0	68.06	68.28	68.25
50	3090.0	69.44	69.69	69.65

1 Flood Frequency Analysis
Time Series (Water Year) of Maximum Instanteous Discharge
URS
Withlachochee River nr Holder, cfs

RANK	QUANTITY	CALIFORNIA	GINGORTEN	BLOM
51	3100.0	70.83	71.09	71.05
52	3100.0	72.22	72.50	72.46
53	3210.0	73.61	73.90	73.86
54	3240.0	75.00	75.31	75.26
55	3290.0	76.39	76.72	76.67
56	3390.0	77.78	78.12	78.07
57	3430.0	79.17	79.53	79.47
58	3450.0	80.56	80.93	80.88

59	3680.0	81.94	82.34	82.28
60	3970.0	83.33	83.75	83.68
61	3980.0	84.72	85.15	85.09
62	4160.0	86.11	86.56	86.49
63	4600.0	87.50	87.96	87.89
64	4980.0	88.89	89.37	89.30
65	5050.0	90.28	90.78	90.70
66	5330.0	91.67	92.18	92.11
67	5360.0	93.06	93.59	93.51
68	5860.0	94.44	94.99	94.91
69	6740.0	95.83	96.40	96.32
70	7060.0	97.22	97.81	97.72
71	8660.0	98.61	99.21	99.12

DISTRIBUTION		CHI TEST	
NORMAL	296.20	416.96	365.85
LOG-NORMAL	6.65	10.01	8.87
LOG-PEARSON T3	6.57	5.86	5.55
EXPONENTIAL	23.89	21.11	21.23
EXTREME VALUE T1	100.66	92.59	86.25

	LIN	LOG
MEAN=	2551.986	3.320
STDV=	1657.641	.283
SKEW=	1.396	-.182

DISTRIBUTION	PROBABILITY OF NONE EXCEEDENCY				
	50.0%	80.0%	90.0%	95.0%	98.0%
NORMAL	2552.0	3947.1	4676.3	5278.6	5956.4
LOG-NORMAL	2090.3	3620.5	4824.7	6115.7	7986.3
LOG-PEARSON T3	2132.1	3638.2	4758.3	5906.1	7487.6
EXPONENTIAL	2043.3	3562.2	4711.2	5860.2	7379.1
EXTREME VALUE T1	2279.9	3745.4	4715.7	5646.4	6851.1

99.0% 99.5%
6408.2 6821.8
9541.5 11228.8
8740.6 10046.0
8528.1 9677.1
7753.9 8653.3

• 2552.0 3947.1 4676.3 5278.6 5956.4 6408.2 6821.8
LOG-NORMAL 2090.3 3620.5 4824.7 6115.7 7986.3
9541.5 11228.8

1 STREAMFLOW FREQUENCY ANALYSIS
TIME SERIES OF ANNUAL MAXIMA FOR WITHLACHOOCEE AT INGLIS AND BYPASS
URS FOR THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT
ONE-DAY MAXIMUMS WITHLACOOCHEE

RANK	QUANTITY	CALIFORNIA	GINGORTEN	BLOM
1	1320.0	2.94	1.69	1.88
2	1393.0	5.88	4.71	4.89
3	1660.0	8.82	7.73	7.89
4	1700.0	11.76	10.75	10.90
5	1847.0	14.71	13.77	13.91
6	2047.0	17.65	16.79	16.92
7	2133.0	20.59	19.81	19.92
8	2164.0	23.53	22.83	22.93
9	2210.0	26.47	25.85	25.94
10	2469.0	29.41	28.86	28.95
11	2500.0	32.35	31.88	31.95
12	2700.0	35.29	34.90	34.96
13	2800.0	38.24	37.92	37.97
14	2910.0	41.18	40.94	40.98
15	2970.0	44.12	43.96	43.98
16	2980.0	47.06	46.98	46.99
17	2990.0	50.00	50.00	50.00
18	3050.0	52.94	53.02	53.01
19	3217.0	55.88	56.04	56.02
20	3280.0	58.82	59.06	59.02
21	3360.0	61.76	62.08	62.03
22	3380.0	64.71	65.10	65.04
23	3630.0	67.65	68.12	68.05
24	3880.0	70.59	71.14	71.05
25	3960.0	73.53	74.15	74.06
26	4230.0	76.47	77.17	77.07
27	4520.0	79.41	80.19	80.08
28	4710.0	82.35	83.21	83.08
29	4815.0	85.29	86.23	86.09
30	5050.0	88.24	89.25	89.10
31	5139.0	91.18	92.27	92.11
32	5232.0	94.12	95.29	95.11
33	6979.0	97.06	98.31	98.12

DISTRIBUTION		CHI TEST	
NORMAL	28.40	58.47	49.30
LOG-NORMAL	7.96	6.56	6.36
LOG-PEARSON T3	8.09	5.53	5.59
EXPONENTIAL	35.30	32.99	32.89
EXTREME VALUE T1	10.55	6.54	6.81

	LIN	LOG
MEAN=	3249.242	3.478
STDV=	1298.470	.176
SKEW=	.791	-.156

1 STREAMFLOW FREQUENCY ANALYSIS
TIME SERIES OF ANNUAL MAXIMA FOR WITHLACHOOCEE AT INGLIS AND BYPASS
URS FOR THE SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT

DISTRIBUTION	PROBABILITY OF NONE EXCEEDENCY						
	50.0%	80.0%	90.0%	95.0%	98.0%	99.0%	99.5%
NORMAL	3249.2	4342.1	4913.3	5385.0	5916.0	6269.9	6593.9
LOG-NORMAL	3007.3	4227.3	5050.8	5850.5	6903.1	7708.0	8526.7
LOG-PEARSON T3	3039.0	4238.5	5014.4	5744.1	6671.9	7358.8	8038.8
EXPONENTIAL	2850.8	4040.6	4940.6	5840.6	7030.4	7930.4	8830.5
EXTREME VALUE T1	3036.1	4184.1	4944.1	5673.2	6616.8	7324.0	8028.6

•	3249.2	4342.1	4913.3	5385.0	5916.0	6269.9	6593.9			
			LOG-NORMAL		3007.3	4227.3	5050.8	5850.5	6903.1	
7708.0	8526.7									
			LOG-PEARSON T3		3039.0	4238.				