C-111 ENGINEERING DOCUMENTATION REPORT

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List of Acronyms

B/C	Benefit to Cost
BC	Borrow Canal
BO	Biological Opinion
C-111	Canal 111[1]
C&SF	Central and Southern Florida
CERP	Comprehensive Everglades Restoration Plan
CFS	Cubic Feet per Second
CSOP	Combined Structural and Operational Plan
CSSS	Cape Sable Seaside Sparrow
CWCCIS	Civil Works Construction Cost Index System
DERM	Department of Environmental Resource Management
EA	Environmental Assessment
EDR	Engineering Documentation Report
EIS	Environmental Impact Statement
ENP	Everglades National Park
ESA	Endangered Species Act
FDA	Frog Pond Detention Area
FDOT	Florida Department of Transportation
FEIS	Final Environmental Impact Statement
FONSI	Finding of No Significant Impact
FSMDA	Frog Pond Seepage Management Detention Area
GDM	General Design Memorandum
GRR	General Re-evaluation Report
IOP	Interim Operational Plan
ISOP	Interim Structural and Operational Plan
L-31(N)	L-31 North[2]
LERRD	Lands, Easements, Rights-of-Way, Relocations and Disposal Areas
LIDAR	Light Detection and Ranging
MWD	Modified Water Deliveries
NDA	North Detention Area
NED	National Economic Development
NEPA	National Environmental Policy Act
NER	National Ecosystem Restoration
NGVD	National Geodetic Vertical Datum
OMB	Office of Management and Budget
PED	Pre-Construction, Engineering, and Design
P&S	Plans and Specifications
PL	Public Law
ROD	Record of Decision

[1] Other canals are also identified by a preceding "C-"canal number.
[2] Other levees are also identified by a preceding "L-"levee number. Letter in parentheses, "( )", if any, provides an additional identifier (global direction).

RPA	Reasonable and Prudent Alternative
S-332B	Structure 332B[3]
SDA	South Detention Area
SDCS	South Dade Conveyance System
SFWMD	South Florida Water Management District
SMA	Square Mile Area
SPF	Standard Project Flood
STA	Stormwater Treatment Area
TSP	Tentatively Selected Plan
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
WCA-3A	Water Conservation Area 3A
WRDA	Water Resources Development Act

[3] Other structures are also identified by a preceding "S-"structure number. Letter in parentheses, "()", if any, provides an additional identifier.

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INTRODUCTION

The Canal 111 (C-111) project is located to the East of the C-111 canal in Southern Miami-Dade County and is an integral part of the overall Central and Southern Florida (C&SF) Project.

1.1 SCOPE AND PURPOSE

The C-111 project modifications to the C&SF Project are defined by its authorizing legislation and the 1994 General Re-evaluation Report (GRR). The purpose of this EDR is to define the design refinements for the C-111 Project, that are different from the authorized C-111 1994 GRR, and that are not included in previous design documents, in a consistent manner to enhance water deliveries to Everglades National Park (ENP) while maintaining the other authorized purposes of the project.

1.2 PROJECT AUTHORIZATION

1.2.1 Water Resources Development Act of 1996

The C-111 Project modifications to the C&SF Project were authorized by Section 316 of the Water Resources Development Act (WRDA) of 1996 *(Public Law 843, 104th Congress)*:

> *SEC. 316. CENTRAL AND SOUTHERN FLORIDA, CANAL 111.*
> *(a) IN GENERAL.—The project for Central and Southern Florida, authorized by section 203 of the Flood Control Act of 1948 (62 Stat. 1176) and modified by section 203 of the Flood Control Act of 1968 (82 Stat. 740–741), is modified to authorize the Secretary to implement the recommended plan of improvement contained in a report entitled ''Central and Southern Florida Project, Final Integrated General Reevaluation Report and Environmental Impact Statement, Canal 111 (C–111), South Dade County, Florida'', dated May 1994, including acquisition by non-Federal interests of such portions of the Frog Pond and Rocky Glades areas as are needed for the project.*
> *(b) COST SHARING.—*
> *(1) FEDERAL SHARE.—The Federal share of the cost of implementing the plan of improvement shall be 50 percent.*
> *(2) SECRETARY OF INTERIOR RESPONSIBILITY.—The Secretary of the Interior shall pay 25 percent of the cost of acquiring such portions of the Frog Pond and Rocky Glades areas as are needed for the project. The amount paid by the Secretary of the Interior shall be included as part of the Federal share of the cost of implementing the plan.*

(3) OPERATION AND MAINTENANCE.—The non-Federal share of operation and maintenance costs of the improvements undertaken pursuant to this section shall be 100 percent; except that the Federal Government shall reimburse the non-Federal interest with respect to the project 60 percent of the costs of operating and maintaining pump stations that pump water into Taylor Slough in the Everglades National Park.

1.2.2 Interim Structural and Operational Plan (ISOP) and Interim Operational Plan (IOP)

In February 1999, the U.S. Fish and Wildlife Service (USFWS) issued a Final Biological Opinion (BO) under provisions of the Endangered Species Act (ESA) that presented a Reasonable and Prudent Alternative (RPA) to avoid jeopardizing the Cape Sable seaside sparrow (CSSS) during the interim period leading up to completion of the Modified Water Deliveries project. The USFWS RPA recommended that certain hydrologic conditions be maintained in the sparrow's breeding habitat to avoid jeopardizing the continued existence of the species.

The USFWS BO brought about the Interim Structural and Operational Plan (ISOP) (USACE 2000). The ISOP was designed to meet the conditions of the USFWS RPA included in the USFWS BO from March 2000 until implementation of the Interim Operational Plan (IOP) in 2002. The Record of Decision (ROD) for IOP was signed in July 2002, and IOP was implemented to continue USFWS RPA protective measures for the CSSS. By an order issued in March 2006 by the United States District Court for the Southeastern District of Florida Miami Division, resolving a lawsuit by the Miccosukee Tribe regarding the National Environmental Policy Act (NEPA) compliance and other matters related to IOP, the Corps was required to issue a supplement to its 2002 FEIS, which resulted in the December 2006 Final Supplemental EIS (FEIS) for IOP for the Protection of the CSSS. A ROD for the December 2006 FEIS was signed May 2007.

1.3 HISTORY OF THE PROJECT

The purpose of this section is to provide the history and background of the C&SF Project, and describe how the C-111 Project modifications of the C&SF Project came to be. The intent is to provide a timeline of pertinent authorizations and amendments and partial construction of the C-111 Project, from the 1940's to the existing condition today, since some of the structural design refinements in this EDR are dependent upon ongoing construction of the C-111 Project and the Comprehensive Everglades Restoration Plan (CERP) (see Section 1.6.1 *Comprehensive Everglades Restoration Plan*).

1.3.1 C&SF Project History

In 1947, 100 inches of rain fell on south Florida, more than tripling the region's total rainfall for 1945 and ending one of the worst droughts in Florida history. In a few

weeks, the rain had drenched farmland and filled lakes and canals. Then in the space of just 25 days, two hurricanes and a tropical disturbance dumped more water on an already saturated area. When the rains finally ceased, 90 percent of southeastern Florida, from Orlando to the Keys, was under water. The Corps estimated the total damage of this disaster at more than $59,000,000.

Following the disastrous flood in 1947, the problems of the area came to a climax. This flood, coupled with the experiences of the drought in 1945 and the intrusion of saltwater into the aquifer made it imperative that immediate corrective action be started. These actions were needed to prevent further loss of life and damage to property because of floods, and to conserve water for beneficial uses during periods of drought.

Acting upon the requests of many local agencies concerned with flood control and water conservation, and under the authority of various flood control acts, river and harbor acts of Congress, and resolutions of appropriate congressional committees, the Corps' Jacksonville District conducted public hearings throughout the area to determine the desires of the many local interests and to collect data from which to formulate a plan.

Views expressed during the public hearings stated that the problems were too large and complex for the capabilities of either the State of Florida or local agencies acting alone, therefore making it practically impossible for either to draft a plan that would be satisfactory to all. A Comprehensive Plan for flood control and water conservation, which would encompass the entire area, while satisfying the major needs expressed by the various agencies, would be beneficial to the greatest number and to the largest portion of the area, and be performed by the Federal government, with local cooperation, seemed to offer the best solution.

A comprehensive report was prepared by the Corps and submitted to higher authority on December 19, 1947. This report stated that the problems of flood protection, drainage, and water control were considered to be physically interrelated, and that the St. Johns, Kissimmee, Lake Okeechobee, Caloosahatchee, and Everglades drainage areas all formed a single economic unit. Accordingly, it recommended a comprehensive program in the interest of *"flood control, drainage and related purposes."*

Congress approved the plan as part of the *Flood Control Act of June 30, 1948,* and the report was published in *House Document No. 643, 80th Congress, Second Session.* The basic purpose of the overall Central and Southern Florida Flood Control Project, quoted from *House Document No. 643,* reads:

> *"In its natural state the part of central and southern Florida considered in this report was a vast wilderness of water, forest, prairie, and marshland. The forces of nature had combined to establish a fine balance which supported the vegetable, animal and human life that prevailed and resulted in building up the land to the condition in which white man first found it. A large part of this*

land, the Everglades, was still in a formative stage when its development began. The inherent fertility of the area and its resources made its development and use inevitable. This development, however, resulted in physical changes which altered the natural balance between water and soil, and much of the development was undertaken without any real knowledge of the area or of the hazards involved. The parched prairies and burning mucklands of the Everglades in 1945, the flooding of thousands of acres of farms and communities in 1947, and the intrusion of salt water into land water supplies of the east coast are basically the results of altering the balance of natural forces. The basic problem of this area is, therefore, to restore the natural balance between soil and water in this area insofar as possible by establishing protective works, controls, and procedures for conservation and use of water and land."

The Governor of Florida approved the plan for the State of Florida in February 1948. The following year, the Florida State Legislature formed the Central and Southern Florida Flood Control District, later to become the South Florida Water Management District, to act as a single agency with which the Federal government could deal on all matters of local cooperation.

The C&SF Project, first phase, was authorized by the *Flood Control Act of June 30, 1948* for the purposes of flood control, water level control, water conservation, prevention of salt water intrusion, and preservation of fish and wildlife. The first phase consisted of most of the works necessary to afford flood protection to the agricultural development south of Lake Okeechobee and to the highly developed urban area along the Lower East Coast of the State. The second phase, consisting of all remaining works of the original *Comprehensive Plan*, was authorized by the *Flood Control Act of September 3, 1954.* Two interim Flood Control Acts were authorized between 1954 and the Flood Control Act of October 23, 1962[4], which authorized C-111 Project modifications to the C&SF Project. Additional detail on the C-111 Project modifications to the C&SF Project are included in the next section.

1.3.2 C-111 Project History

In the late 1950s, local interests in southern Dade County requested the C&SF Project be modified to provide an adequate system of canals to provide drainage for urban development, with water control structures to prevent over-drainage of agricultural lands and contamination of groundwater by saltwater intrusion. The United States Army Corps of Engineers (USACE) published a Survey Review Report on South Dade County in 1959, which was published in Senate Document 87-183 and authorized by the 1962 Flood Control Act. The Flood Control Act of 1962 authorized a project for southern Dade County to remove 40-percent of the standard project flood runoff from the drainage area, to reduce depth and duration of larger floods, and to provide water control to prevent over-drainage of the area.

[4] The interim Flood Control Acts were dated July 3, 1958 and July 14, 1960.

To accomplish this, the plan provided for gravity drainage of the South Dade area by a primary system of 12 canals, including C-111, and provided the necessary outlets to serve a system of secondary canals proposed by local interests. Local interests were responsible for constructing and maintaining lateral drainage facilities as necessary to realize the benefits made available by the federally authorized project improvements.

The plan recommended in the 1962 Act was reviewed in the 1963 General Design Memorandum for South Dade County and was modified to effect conciliation of the desires of the ENP, local interests, and land developers. The plan was designed to remove the 40-percent standard project flood (SPF) from the entire 196 square mile drainage area without exceeding the design water surface profile, reduce the depth and duration of floods of greater magnitude than the 40-percent SPF, prevent over-drainage of the area by maintaining optimal water levels in the project canals, insofar as possible, and controlling discharge within permissible limits, prevent saltwater intrusion from entering the area through the canals and water control structures and to provide facilities to convey up to 500 cubic feet per second to ENP when normal runoff is available within the natural drainage limits. The proposed plan required the construction of L-31N and L-31W and their borrow canals for a distance of 21 miles, extending south from the existing part of L-31N to a point about 1.5 miles south of State Road 27. The purposes of the L-31N and L-31 W canals and levees were to protect the South Dade County study area from overflow from the west and to provide water supply to ENP.

The Everglades National Park-South Dade Conveyance System (SDCS) was authorized by the 1968 Flood Control Act. In the 1973 General Design Memorandum for the plan outlined in the 1968 Flood Control Act, modifications included enlarging existing canals such as C-111 to permit supplemental water supply from Water Conservation Area 3A (WCA-3A) to south Dade County and ENP. The plan was designed to serve dual purpose for water control, to:
(1) maintain adequate elevations in the canals to recharge groundwater and
(2) maintain head at the coastal structures to prevent saltwater intrusion. In addition to maintaining water surface elevations, the plan recognized that adequate head must be available to transport or convey water throughout the system and yet not create excessive transient seepage losses with a water surface elevation that is too high. No additional flood damage reduction, beyond the level provided in the 1962 authorization, was authorized for C-111 area as a result of this Act. The USACE terminology has shifted towards the use of the term "flood damage reduction" projects, as opposed to "flood damage protection" projects, to better convey the intended function of federally authorized flood damage reduction projects.

Environmental concerns caused construction to be discontinued before all authorized project features recommended in the 1962 Flood Control Act were completed. In 1970, Congress enacted Public Law 91-282 which prescribed a monthly schedule of minimum water deliveries that must be provided to ENP from the C&SF project. From 1983 through 1988 additional studies were conducted to

complete the authorized plan of improvement for flood damage reduction, environmental enhancement and water management in the C-111 basin as constructed. The recommended plan contained in the 1988 C-111 GDM, Addendum 2, focused on preventing large, damaging discharges to Barnes Sound via S-197 and increasing flows to northeast Florida Bay via flows from the lower C-111. From 1988 to 1990, several actions developed that changed the scope and schedule for completion of the C-111 report.

The United States Congress, finding that the Everglades National Park is a nationally and internationally significant resource and the park has been adversely affected and continues to be adversely affected by external factors which have altered the ecosystem including the natural hydrologic conditions within the park, enacted the Everglades National Park Protection and Expansion Act (PL-101-229) in 1989. The Secretary of the Army was directed in the analysis, design and engineering associated with completion of works and operations in the C-111 basin area of the East Everglades, to take all measures which are feasible and consistent with the purposes of the C&SF project to protect natural values associated with ENP. The Act further stated in Section 104 that nothing in this section should be construed to limit the operation of C&SF project facilities to achieve their design objectives, as set forth in the Congressional authorization and any subsequent modifications thereof.

From 1989 to 1994, the Corps continued to work with the SFWMD, ENP and USFWS to address plans which would protect the natural values of ENP while preserving the other authorized project purposes. As a result of this continued project reformulation effort to reconcile the desires of the stakeholders and complete the C-111 project in response to the 1962 and 1968 Flood Control Acts and the legislative direction contained in the Everglades National Protection and Expansion Act of 1989 requiring the Secretary of the Army to "take all measures which are feasible and consistent with the purposes of the (C-111) project to protect natural values associated with the Everglades National Park", the USACE completed the C-111 General Reevaluation Report (GRR) in 1994.

The 1994 C-111 GRR recommended additional modifications to provide restoration of the ecosystem in Taylor Slough and the eastern panhandle of ENP, while maintaining flood damage reduction within the C-111 basin. As such, one of the objectives stated in the C-111 GRR was to preserve the existing level of flood damage reduction in the C-111 basin east of L-31N and C-111. The document also states that the original operating levels and discharge capacities were intended to provide flood damage reduction for storms up to the 40-percent SPF. The 1994 GRR further states that the flood protection preservation objective involves maintaining the original design canal stages and discharge capacities while restoring more natural hydrologic conditions within ENP. The design optimal canal stages are summarized in Section 2.2 of the 1994 GRR and provided below. All alternatives examined in the C-111 GRR, including the recommended plan, were evaluated based on maintaining design optimal canal stages under these flood conditions. Results of these evaluations indicated that the additional capacity provided by the

S-332A, B, C and D pump stations addressed the objective of maintaining flood capacity by pumping to the buffer area and discharging surface waters to ENP. The 1994 GRR further identified that although the plans were evaluated using design optimal canal stages, the focus of the GRR was to develop a structural plan that provided the greatest flexibility in providing restoration while maintaining flood damage reduction. Therefore, the purpose of the 1994 GRR was to maintain the level of flood damage reduction already provided by the authorities of the Flood Control Acts of 1962 and 1968, not to augment or diminish these already existing benefits.

Table 1

Optimum Stages in ENP-South Dade Conveyance System

Canal	Reach	Elevation (Feet, NGVD)
Levee 31(N) Borrow Canal	US 41 to S-331	5.0
Levee 31(N) Rem. Borrow Canal	S-331 to S-176	5.5
Canal 111	S-176 to S-177	4.5
Canal 111	S-177 to S-18C	2.0
Levee 31(W) Borrow Canal	S-174 to S-175	4.5
Canal 103	L-31(N) Rem. To S-167	5.5
Canal 103	S-167 to S-179	3.5
Canal 103	S-179 to S-20F	2.0
Canal 102	L-31(N) Rem. To S-165	5.5
Canal 102	S-165 to S-21A	2.0
Canal 1	S-319(N) to S-148	5.0
Canal 1	S-148 to S-21	2.0

1.4 FUNDING SINCE AUTHORIZATION

Fiscal Year	Yearly Work Allowance		Grand Total
	Federal	Non-Federal	
1993	$ 8,281,000	$ 1,561,000	$ 9,842,000
1994	$ 2,058,000	$ 0	$ 11,900,000
1995	$ 4,200,000	$ 0	$ 16,100,000
1996	$ 48,000	$ 84,000	$ 16,232,000
1997	$ 7,703,000	$ 768,000	$ 24,703,000
1998	$ 7,438,000	$ 787,000	$ 32,928,000
1999	$ 3,850,000	$ 630,000	$ 37,408,000
2000	$ 6,253,000	$ 624,000	$ 44,285,000
2001	$ 7,242,000	$44,680,000 (**)	$ 92,207,000
2002	$ 6,238,000	$ 0	$102,445,000
2003	$ 1,946,000	$ 148,000	$104,539,000
2004	$20,165,000	$ 165,000	$124,869,000
2005	$ 5,761,000	$ 0	$130,630,000
2006	$ 5,467,000	$ 0	$136,097,000

(**) Lands

1.5 REFERENCE AND PRIOR REPORTS

a) Part 5 Supplement 37 – General Design Memorandum, South Dade County - September 12, 1963

b) Part 5 Supplement 38 – Detail Design Memorandum, Canal 111, Sections 1 and Control Structure 18C - December 31, 1963

c) Part 5 Supplement 43 – Detail Design Memorandum, Canal 111, Sections 2 and 3; Canal 111(E) and Control Structures 176, 177, and 178 - August 31, 1965

d) Canal 111 (C-111) General Reevaluation Report and Environmental Impact Statement - May 1994

e) Part V, Supplement 59 – Canal 111 (C-111), Section 1 Taylor Slough Bridges – February 1997

1.6 CURRENT STUDIES

1.6.1 Combined Structural and Operational Plan

The Combined Structural and Operational Plan (CSOP) is an integrated structural and operational plan for two modifications of the C&SF Project -Modified Water Deliveries (MWD) project and the C-111 canal project. The purpose of CSOP is to define the operations for the C-111 and MWD projects that are consistent with their respective project purposes as defined by their authorizing legislation and further

refined by subsequent general design memoranda (GDM) and general re-evaluation reports (GRR). This EDR will reference CSOP often since CSOP will define operations for the C-111 Project modifications to the C&SF Project and integrate C-111's operations with MWD to ENP Project modifications to the C&SF Project. The system in the study area is currently operated pursuant to the Interim Operational Plan (IOP) for the Protection of the Cape Sable Seaside Sparrow (May 2002).

1.6.2 Comprehensive Everglades Restoration Plan

The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore, protect and preserve the water resources of central and southern Florida, including the Everglades. It covers 16 counties over an 18,000-square-mile area and centers on an update of the Central & Southern Florida (C&SF) Project also known as the Restudy. The goal of CERP is to capture fresh water that now flows unused to the ocean and the gulf and redirect it to areas that need it most. The majority of the water will be devoted to environmental restoration, reviving a dying ecosystem. The remaining water will benefit cities and farmers by enhancing water supplies for the south Florida economy. CERP was authorized in the Water Resources Development Act (WRDA) of 2000. It includes more than 60 elements, will take more than 30 years to construct and will cost an estimated $7.8 billion. There are several elements in CERP that are inter-related with some of the features of the C-111 Project modifications to the C&SF Project, especially the C-111 Spreader Canal. See http://www.evergladesplan.org for more information on CERP.

1.7 PROJECT COOPERATION AGREEMENT CHANGES

The PCA will be amended to add the cost sharing changes as dictated by WRDA 1996 once the Engineering Documentation Report is approved.

1.8 REAL ESTATE CHANGES

All Land, Easements, Rights-of-Way, Relocation, and Disposal Areas (LERRD) for the C-111 were authorized and approved in a Real Estate Design Memorandum to the Integrated General Reevaluation Report and Environmental Impact Statement, dated May 1994 for the Canal 111 (C-111), South Dade County, Florida. It is estimated that approximately 4,957 acres will be required in the Rocky Glades area, of which approximately 4,767 acres has been acquired by the SFWMD and approximately 5,215 in the Frog Pond area has been acquired by the SFWMD. The National Park Service (Everglades National Park) conveyed approximately 1,058 acres to SFWMD pursuant to Public Law 108-423. For the Southern Glades, the SFWMD will provide 250.5 acres for the C-111N spreader canal. Real Estate cost estimates are based on: (1) funds already expended by SFWMD in the acquisition of lands in the Frog Pond and Rocky Glades area, together with SFWMD's actual

administrative costs; (2) estimated costs of acquisition of the remaining 192 acres in the Rocky Glades area by SFWMD, together with an estimate of SFWMD's future administrative costs; (3) the National Park Service's land acquisition and administrative costs, both actual and estimated; (4) future Corps administrative costs, estimated; and (5) actual and estimated costs associated with the demolition and removal of structures on the Rocky Glades and Frog Pond lands. Total estimated real estate costs are $132,227,000. An up-dated real estate plan is provided for this comprehensive plan. Revised real estate costs and other changes, is presented in the up-dated Real Estate Plan, Appendix A.

1.9 CHANGE IN PURPOSE, SCOPE AND LOCATION OF AUTHORIZED PROJECT

There is no change in the purpose, scope or location of the authorized C-111 Project modifications to the C&SF Project.

1.10 PROJECT DESCRIPTION AND DESIGN REFINEMENTS

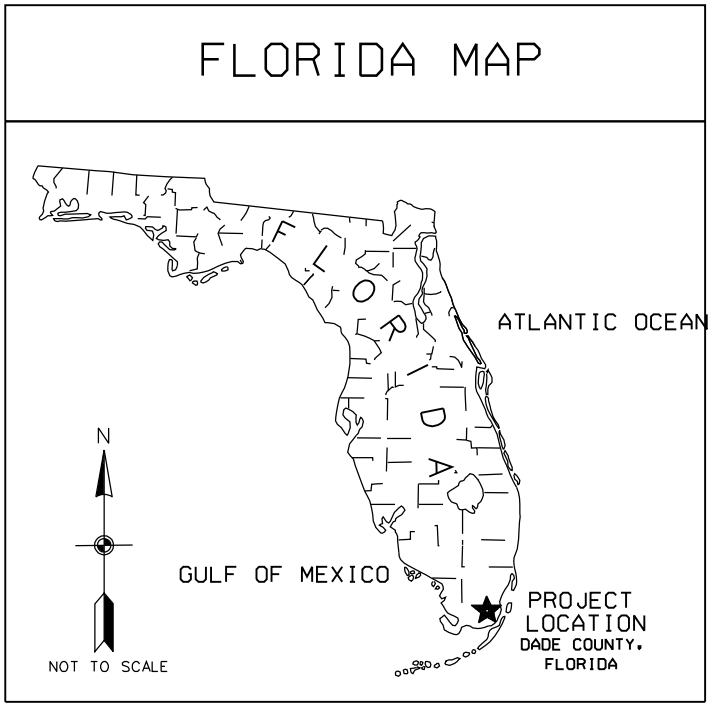
A general location map can be found on Figure 1. Table 2 gives the description of the authorized project features and the modification to those features. This paragraph contains the description of features in the first section and then the breakdown of what is left to build for each feature and which contract it will be constructed under. The features will be described north to south. See Figure 2 for the Layout of the C-111 Proposed Features. The geology of the area has not changed from the Section 2 discussion in the 1994 C-111 GRR.

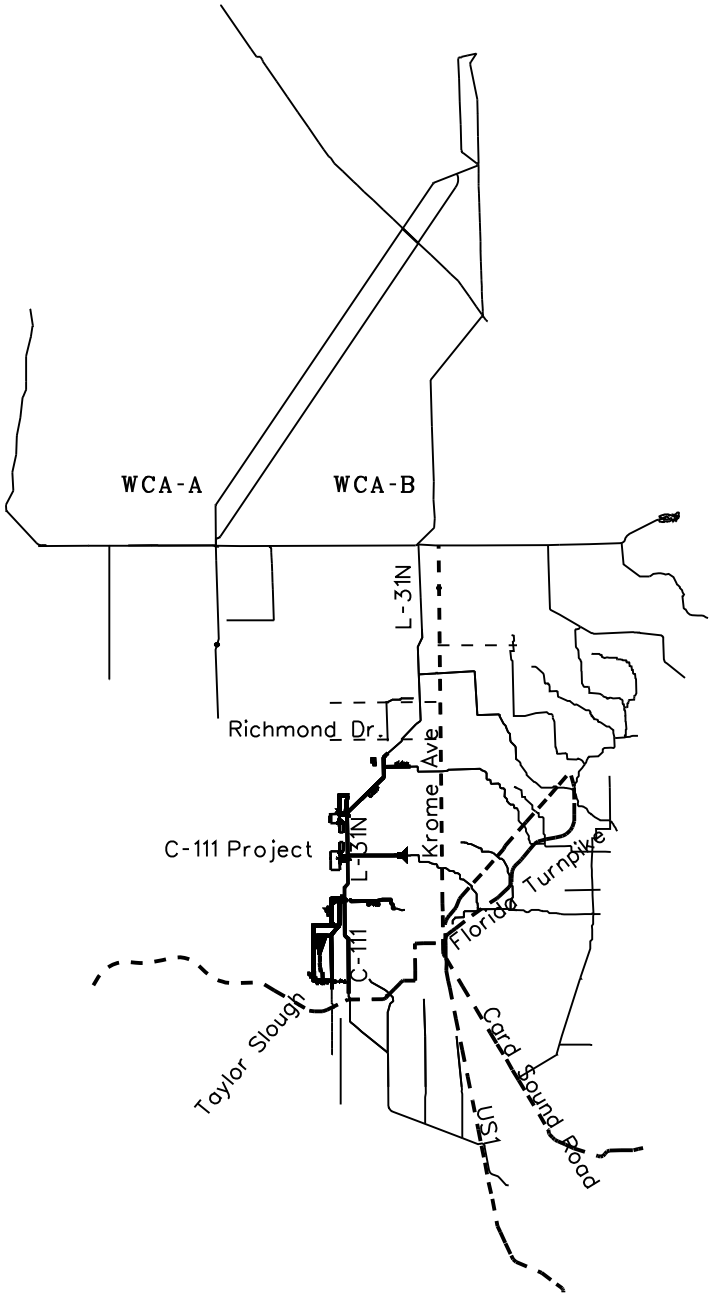
1.10.1 C-111 Project (Design Refinements to 1994 C-111 GRR Recommended Plan)

The following describes refinements to the 1994 General Reevaluation Report (GRR) and new components incorporated to maintain the authorized purposes of the Canal 111 (C-111) project-- restore more natural hydroperiods in Taylor Slough in the ENP and lower section of C-111, and address flooding problems in the adjacent urban and agricultural areas of the C-111 basin in an acceptable and implementable manner. Each of the sub-sections herein describes the specific design refinement and its purpose, which are based upon not only ecological benefits, but also consider the flood damage reduction needs of the C-111 basin per the authorized purposes. Design refinements are also based upon lessons learned, implementation strategy resulting from emergency contracts and evaluations performed by the CSOP PDT, since the approval of the 1994 GRR.

1.10.1.1 Detention Areas

The following is a brief description of the detention areas within the C-111 project lands.





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Ckd by: G.J.N.
DWN by: G.J.N.

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Reference files:
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C-111 Engineering Documentation Report
GENERAL LOCATION MAP

Figure 1

Table 2

Authorized Project Features and Modifications to Give Perspective of Changes:

Feature	***Authorized in 1994 GRR***	***Purpose of Authorized Feature***	***Modification***	***Purpose of Modification***	***Constructed /Constructed Under***
Three 84" CMP w/flap gates	Structure would consist of 3 corrugated metal pipes with flap gate controls.	Culvert connector would allow the delivery of water to the L-31W BC to deliver water to S-332 and S-175. When stages were higher in the L-31W BC than in the C-111 canal flap gates would close to prevent draining water from L-31W BC.	Eliminated.	With the incorporation of the Frogpond Detention Area (FDA) S-332 is no longer needed to provide flows to Taylor Slough.	No/N/A
Twenty-four 36 inch culverts with risers	The culverts would have an invert of 3.5 feet (2.5-3 ft below grade) and the risers would have 48 inch length.	Structures would be located on the west side of the retention/detention in the L-31W Tieback Levee discharging west into ENP.	Eliminated	In order to protect ENP from surface water discharges, this feature was removed.	No/N/A
S-332A	A 300 cfs diesel driven pump station with 4 pumps (75 cfs each).	This pump station was located the furthest north and would pump from the L-31N borrow canal to west of the S-332D Tieback levee directly into ENP utilizing a 0.5-mile long concrete lined canal (see below). This pump station would provide flows to the Taylor Slough Headwaters in the northern part of the rocky Glades and aid the other	Eliminated	It was more practicable and cost-effective to eliminate S-332A and increase the capacity at S-332B and S-322C. In addition the re-design of 8.5 SMA places S-357 pump outlet in the same general area.	No/N/A

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
		pump stations in providing the level of flood protection in the C-111 Basin.			
S-332B	A 300 cfs diesel driven pump station with 4 pumps (75 cfs each).	Located approx. halfway between C-102 and C-103 on the L-31N BC this pump station would discharge into the northern part of the C-111 retention/detention area via a ½ mile concrete lined channel (see below). The retention/detention area is formed by parts of the L-31W Tieback and S-332D Tieback Levees.	The capacity of the pump station would be increased to 575 cfs--four 125 pumps with diesel engines and one 75 cfs pump with an electric motor would deliver water to the Northern and Southern Detention Area (NDA and SDA respectively) via a 500 foot flowway (see below).	Pump station capacity increased to provide additional capacity in conjunction with the elimination of S-332A. In addition the increased capacity offsets seepage losses from the flowway.	YES and NO/ Temporary Constructed under ISOP and Permanent will be constructed under Contract 10.
S-332C	A 300 cfs diesel driven pump station with 4 pumps (75 cfs each).	Located approx. near the confluence of the C-103 canal and the L-31N BC this pump station would discharge into the central part of the C-111 retention/detention area via a ½ mile concrete lined channel (see below). The retention/detention area is formed by parts of the L-31W Tieback and S-332D Tieback Levees.	The capacity of the pump station would be increased to 575 cfs--four 125 pumps with diesel engines and one 75 cfs pump with an electric motor would deliver water to the Northern and Southern Detention Area (NDA and SDA respectively) via a 500 foot	Pump station capacity increased to provide additional capacity in conjunction with the elimination of S-332A. In addition the increased capacity offsets seepage losses from the floway.	YES and NO/ Temporary Constructed under ISOP and Permanent will be constructed under Contract 11.

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
			flowway (see below).		
S-332D	A 300 cfs diesel driven pump station with 4 pumps (75 cfs each).	Located adjacent to S-174 this pump station would discharge into the southern part of the C-111 retention/detention area via the L-31W which would be lined with concrete. The retention/detention area is formed by parts of the L-31W Tieback and S-332D Tieback Levees.	No change due to CSOP. In 1996 during detailed design, S-332D capacity increased to 575 cfs based on updated estimates of return seepage. Structural mediations made during the 2002 CSSS Emergency contract replaced the concrete lined canal with the Frog Pond High Head Cell, which flow into leveed cells which weren't in the original plan.	No Change	YES/ Pump Station S-332D Contract
State Road 9336 (Bridge)	Replace existing Bridge	To establish historic sheet flow patterns in Taylor Slough, the existing bridge will be replaced by a longer bridge,	No change, feature has been constructed.	No change.	YES/ Taylor Slough Bridge Contract

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
		elevated roadway, or series of culverts over Taylor Slough in order to achieve a more spatial distribution of the flow. As documented on Part V, Supplement 59 Canal 111 (C-111), Section 1 Taylor Slough Bridges, the recommendation was to replace existing bridge (100 ft) with a 375 ft bridge, add another 250 ft bridge and a 4x8 box culvert.			
Connector Canal from C-111	The connector canal would have a 10-foot bottom width, 1 to 1 side slopes, and an invert of -12 ft, NGVD1929.	The canal would connect C-111 with the L-31W borrow canal just north of S-175. The new canal would provide water to the west (S-332) and south (S-175). A culvert would be installed on the western end (see above) to prevent backflow back to C-111.	Eliminated	With the incorporation of the Frogpond Detention Area (FDA) S-332 is no longer needed to provide flows to Taylor Slough.	NO/N/A
Connector Canal at S-332B	Approximately ½ mile concrete lined canal with a 10-foot bottom width, 1 to 1 side slopes, and an invert of 3.2 ft,	Purpose is to discharge water taken from the L-31N borrow canal and convey the water ½ mile west across the C-111 Buffer Lands to the retention /	CSOP will modify the design to allow for the water to flow across a 500 foot wide conveyance area contained	With increased capacity at the S-332B pump station, it is more cost effective to construct a 500 ft wide flowway	NO/To be Constructed under Contract 10.

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
	NGVD1929.	detention area. The purpose of the concrete lining is to inhibit seepage and reduce pumping of return flow by increasing the seepage flow path back to the L-31N borrow canal.	by levees. At the western end a control structure will be added to divert water in any combination to either the NDA or SDA (See Below new features).	(23.6 acres) and to allow a minimum amount of return seepage to the L-31N borrow canal. Experience in the area shows that in general the current detention areas (S-332B West, S-332B North, and S-332C) seep approximately 0.1 to 0.3 cfs/acre, wet and dry periods respectively.	
Connector Canal at S-332C	Approximately ½ mile concrete lined canal with a 10-foot bottom width, 1 to 1 side slopes, and an invert of 3.2 ft, NGVD1929.	Purpose is to discharge water taken from the L-31N borrow canal and convey the water ½ mile west across the C-111 Buffer Lands to the retention / detention area. The purpose of the concrete lining is to inhibit seepage and reduce pumping of return flow by increasing the seepage flow path back to the L-31N borrow canal.	CSOP will modify the design to allow for the water to flow across a 500 ft wide conveyance area contained by levees. At the western end a simple passive weir will be constructed across the flowway to maintain a minimum stage within the flowway to prevent	With increased capacity at the S-332C pump station it is more cost effective to construct a 500 foot wide flowway (23.6 acres) and to allow a minimum amount of return seepage to the L-31N borrow canal. Experience in the area shows that in general the current detention areas	NO/To be constructed under Contract 11.

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
			excessive velocities creating scour problems along the containment levees.	(S-332B West, S-332B North, and S-332C) seep approximately 0.1 to 0.3 cfs/acre, wet and dry periods respectively.	
Fill-in L-31W from S-332	Approx. 25,500 feet of the L-31W borrow canal would be backfilled by pushing in the adjacent levee.	This would restore the western part of the Frogpond to the Taylor Slough System.	Proposes to completely backfill 27,800 ft and partial backfill of 19,300 feet of the canal. The adjacent levee (L-31W) will remain intact. Material from the C-111 Spoil Mound degrade will be utilized as a borrow source.	Levee is not being degraded because it acts as the western levee to the Frogpond Detention Area (FDA) and there are environmental concerns with restoring agricultural lands back into the natural environment. Backfilling the L-31W borrow canal will aid in the prevention of seepage losses from ENP. Partial backfill is also being done to reduce seepage losses south of S-175 but allow for the continued recreational use in this area.	NO/ To be constructed under Contract 9.
C-111 North	A canal would be constructed from the confluence of the C-111 and C-111E canals extending eastward toward US	This new canal would be supplied water from the S-332E pump station and would initiate sheetflow southward towards the panhandle of ENP	No change, This item will be reevaluated at a later date..	No change.	NO/Reevaluated at a later date.

Feature	***Authorized in 1994 GRR***	***Purpose of Authorized Feature***	***Modification***	***Purpose of Modification***	***Constructed /Constructed Under***
	Highway 1.	through the Southern Glades.			
Canal C-109	Nine canal plugs would be placed in the C-109 canal. Fill material would come from the spoil mound removal along the south side of the C-111 canal.	Plugs would be constructed to help promote sheet flow from north to south within the Southern Glades lands between the C-109 and C-110 canal.	CSOP no action required.	This work has been completed by the Florida Department of Transportation (FDOT) as part of mitigating for the widening of US Highway 1. FDOT completely backfilled the entire canal instead of plugs as part of their mitigation.	YES/By FDOT
Canal C-110	Ten canal plugs would be placed in the C-110 canal. Fill material would come from the spoil mound removal along the south side of the C-111 canal.	Plugs would be constructed to help promote sheet flow from north to south within the Southern Glades lands between the C-109 and C-110 canal.	No change, deferred to CERP, will be added as a part of the C-111 Spreader Canal Project.	No change.	NO/Deferred to CERP
Aerojet Canal	The Aerojet canal was not reviewed in the 1994 C-111 GRR.	Plugs would be constructed to help promote sheet flow from north to south within the Southern Glades lands.	Four canal plugs would be placed in the Aerojet canal. Fill material would come from the spoil mound removal along the south side of the C-111 canal.	To prevent the over draining of the Northern part of the Area.	NO/ To be constructed under Contract 9
Canal C-111	Degrade the disposal banks on the southern side of the canal	When the canal was excavated gaps were left in the spoil mounds to allow flow	No change, feature has been constructed.	No change.	NO/To be used in Contract 9

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
	along the east-west run of C-111 upstream S-197.	southward into the panhandle area of ENP. The removal of the spoil mounds would allow a broader expanse of flow into the panhandle of ENP allowing the natural sheetflow that characterizes the Glades. As documented in *Part V, Supplement 60 Canal 111 (C-111), C-111 Spoil Mound Removal*, this work has been completed.			
Connector Canal from S-332A	Approximately ½ mile concrete lined canal with a 10-foot bottom width, 1 to 1 side slopes, and an invert of 3.2 ft, NGVD1929.	Purpose is to discharge water taken from the L-31N borrow canal and convey the water ½ mile west across the C-111 Buffer Lands to the west side of the S-332D tieback levee. Water would be allowed to flow from the canal directly into ENP based on the natural topography of the area. The purpose of the concrete lining is to inhibit seepage and reduce pumping of return flow by increasing the seepage flow	Eliminated	It was more practicable and cost-effective to eliminate S-332A and increase the capacity at S-332B and S-322C. In addition the re-design of 8.5 SMA places S-357 pump outlet in the same general area.	NO/N/A

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
		path back to the L-31N borrow canal.			
Exist L-31W Borrow Cl/S332D	Requires lining approximately a ½ mile of the existing L-31W borrow canal downstream of S-174 to the west side of the S-332D tieback levee.	Purpose is to discharge water taken from the L-31N borrow canal and convey the water ½ mile west across the C-111 Buffer Lands to the retention / detention area. The purpose of the concrete lining is to inhibit seepage and reduce pumping of return flow by increasing the seepage flow path back to the L-31N borrow canal	Changes the conveyance to a high head cell that feeds water to the Frogpond Detention Area (FDA). This feature was constructed in 2002 as part of the Cape Sable Seaside Sparrow Emergency Construction work.	With the incorporation of the Frogpond Detention Area the S-332D pump station pumps into a high head cell that takes the place of lining the L-31W borrow canal.	NO/IOP
L-31W Tieback Levee	This new levee would be constructed in two segments roughly parallel to the existing L-31N & C-111 and approx. 1 mile west. Segment 1 (Southern) would start near S-175 on the L-31W levee and proceed due north for three miles tying back into the L-31W levee. Segment 2 (Northern) would start approximately 1 mile west of	Southern Segment completes the L-31W tieback levee allowing the removal of parts of the L-31W levee, which restores part of the Frogpond area back to the natural system of Taylor Slough. Northern segment forms the western boundary of the retention / detention area.	This levee would be extended further north to tie into the 8.5 Square Mile Area perimeter levee at Richmond Drive. Also the alignment will be varied within the Frogpond to create the Frogpond Detention Area (FDA). In addition the levee elevations would be increased from 7 to 10.5 ft (NGVD	This will allow the extension of the retention/detention area (hydraulic ridge) further north, minimizing seepage losses from ENP and preventing the direct discharge of surface water into ENP. Levee heights were increased to increase storage volume to prevent overflow and maximize the use of project lands.	YES and NO/ 37,712 ft. was constructed under IOP. 5,180 ft. was constructed under ISOP and will be removed and replaced under Contract 7. Contract 7 contains 21,542 ft. Contract 8 contains 21,730 ft. which completes the levee. The portion in Contract 8 is not authorized in the 1994 GRR. The 1994 GRR recommended 3 to 4 foot levees. The levees will be 6 feet above

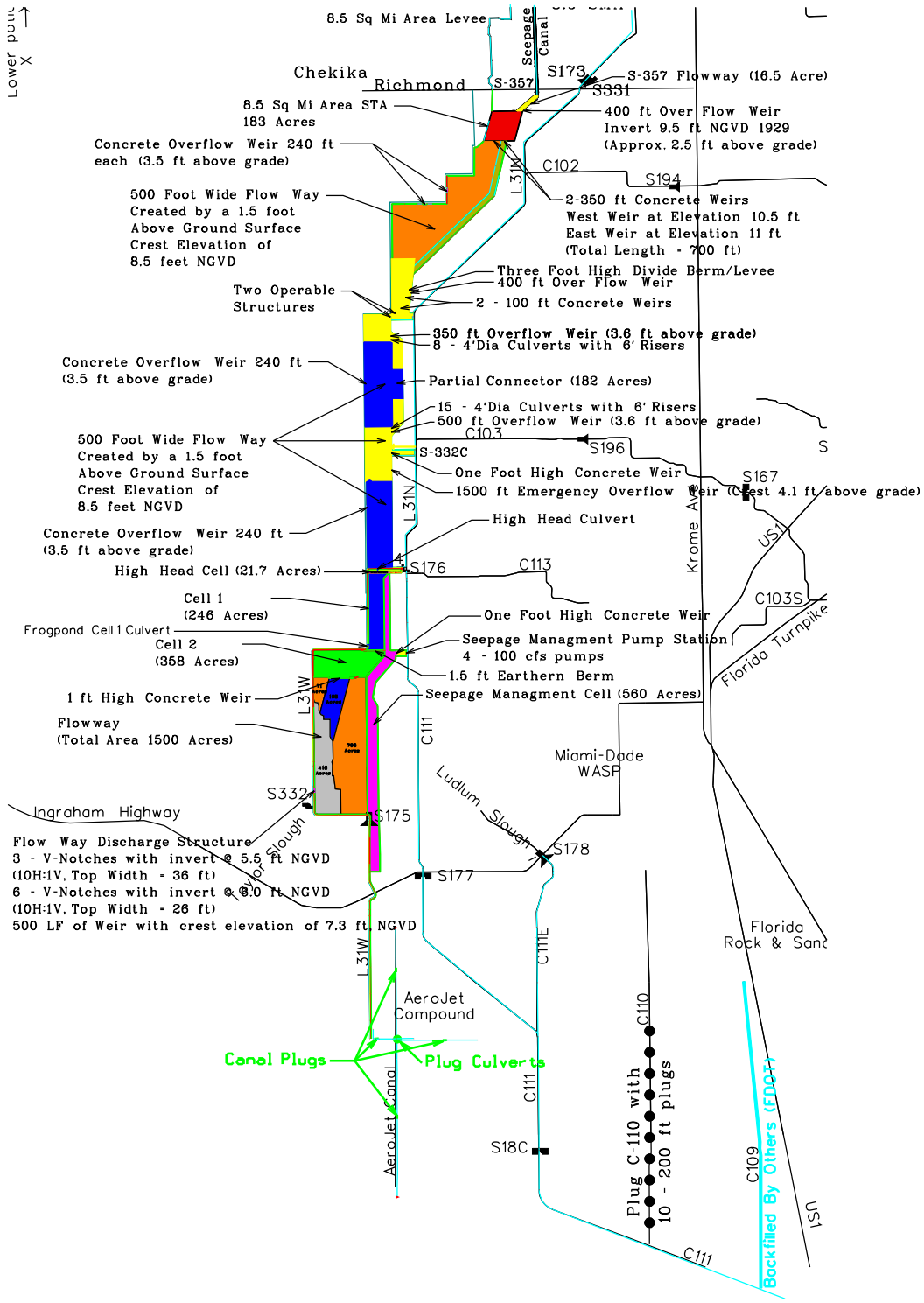
Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
	S-174 on the L-31W levee and proceed north to high ground within the Rocky Glades.		1929) to 12 to 14 ft (NGVD 1929, approximately 6 ft above grade). As part of the 2000 and 2002 Emergency Contracts for the protection of the Cape Sable Seaside Sparrow, portions of the levee system were constructed where lands had been certified to the Corps. This included building the S-332BW (2000) and S-332BN, S-332C, and FDA (2002) detention areas.		grade.
S-332E	A 50 cfs diesel driven pump.	Located at the junction of C-111 and C-111E, this pump station would discharge water into the new C-111 North canal to promote sheet flow south towards the panhandle of ENP.	No change, this item will be reevaluated at a later date..	No change.	NO/Reevaluated at a later date.
300 ft Spillway (Weir)	A 300 foot trapezoidal spillway	Crest length was sized to pass 50% of the maximum	With the elimination of the culvert	Spillways will serve as emergency	NO/To be constructed under Contract

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
	constructed in the L-31W Tieback Levee.	pump capacity of the three pump stations S-332B, S-332C, and S-332D from the retention/detention area and discharge west into ENP. The culvert risers would pass the balance of the pump capacity.	structures and the increase in detention area, three additional weirs will be added for a total of four. Each spillway will be 240 ft long capable of passing approx. 250 cfs with ½ ft of head.	overflow structures discharging to the west.	8.
S-332D Tieback Levee	Levee would run parallel and about ½ mile west of L-31N. The levee would start at the S-332D pump station and proceed north paralleling L-31N, tying into high ground in the Rocky Glades south of Richmond Drive.	Levee serves two purposes. In the south it forms the eastern part of the retention/detention (hydraulic ridge) area and in the north it forms a buffer zone between the L-31N and new levee to prevent discharges from S-332A from flowing back towards the L-31N levee.	This levee would be slightly re-aligned and tie from the L-31W levee west of S-174 north to the 8.5 Square Mile Area Stormwater Treatment Area. In addition, the levee elevations would be increased from 7 to 10.5 ft (NGVD 1929) to 12 to 14 ft (NGVD 1929, approximately 6 ft above grade). As part of the 2000 and 2002 Emergency Contracts for the protection	Forms the eastern levee for the Southern and Northern Detentions Areas (SDA and NDA respectively).	YES and NO/ 2,580 ft. was constructed under ISOP, which was removed under IOP. 15,938 ft. was constructed under IOP. 11,190 ft. is to be contracted under Contract 7. 16, 178 ft. is to be constructed under Contract 8.

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
			of the Cape Sable Seaside Sparrow. portions of the levee system were constructed where lands had been certified to the Corps. This included building the S-332BW (2000) and S-332BN, and S-332C detention areas.		
500 ft Flowway	No	Was not part of the original 1994 GRR.	Add a 500 ft Flowway to the NDA and SDA.	This component will contain the hydraulic ridge to the eastern 500 feet of the NDA and SDA during low flow periods. An approximate 1.5 ft berm will be constructed to keep the flow to the eastern side.	NO/To be constructed under Contract 8.
S-332B Discharge Control Structure	No.	Was not part of the original 1994 GRR.	Add a control structure to flow water to the NDA created by extension of the L-31West and S-332D tie back levees.	The control structure will allow the diversion of flow from the S-332B Flowway to either the north or west to maximize the operational flexibility of the detention system. The divide structure will be designed	Yes and No/Under IOP pipes were installed from the temporary S-332B pump station to the S-332B North Detention Area. Contract 10 will construct this permanent feature.

Feature	*Authorized in 1994 GRR*	*Purpose of Authorized Feature*	*Modification*	*Purpose of Modification*	*Constructed /Constructed Under*
				such that the entire capacity of the pump station can be passed either west or north with a ft of head loss. In addition, the structure will maintain a certain depth within the detention area to minimize the erosive velocities in the flowway along the levee toes.	
Partial Connector	No.	Was not in the original 1994 GRR.	This feature was incorporated during the 2002 IOP Emergency Contract to connect the S-332B West and S-332C Detention areas due to the lack of available lands (ENP lands, Land Swap). The complete partial connector was also unable to be constructed due to two	The purpose of this structure is to create the continuous hydraulic ridge between the S-332B West and S-332C detention areas. This component contains two stop log structures and two passive overflow weirs, one each (of both structures) from S-332B West and S-332C detention areas.	Yes and NO/IOP and Contract 7

Feature	***Authorized in 1994 GRR***	***Purpose of Authorized Feature***	***Modification***	***Purpose of Modification***	***Constructed /Constructed Under***
			small privately owned parcels.		
C-111 Frog pond Detention Area (FDA)	The 1994 C-111 GRR planned to incorporate this area into a buffer zone between Taylor Slough and the C-111 Canal.	To provide a buffer between the Project Features and the L-31 North Canal.	A system that uses the L-31W and L-31W Tieback levees for the main containment levees and is divided into four cells: high head cell (21.5 acres), Cell 1 (246 acres), Cell 2 (354 acres), and Flowway (1483 acres)	During the 2002 CSOP Emergency Contract, to maximize the usage of project lands and to enhance delivery of water to Taylor Slough, an interim plan was enacted that created a flow-through detention system from the S-332D pump station to Taylor Slough.	YES/IOP



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Designed by: T.L.F.
Ckd by: G.J.N.
DWN by: T.L.F.

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Reference files:
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GENERAL LAYOUT C-111 BASIN

Figure
2

1.10.1.1.1 C-111 North Detention Area (NDA)

Location

The C-111 North Detention Area (NDA) is located in the northern part of the Rocky Glades. The area extends from the S-332B pump station in the south to the 8.5 Square Mile Area Stormwater Treatment Area (8.5 SMA STA) in the north. See Figure 3.

Refinement to the 1994 C-111 GRR

The 1994 C-111 GRR did not have a detention area in the northern portion of the Rocky Glades but rather discharged water west of the S-332D Tieback Levee to flow into the ENP. With concerns of water quality and impacts of direct discharges into ENP, this EDR is recommending that the hydraulic ridge concept be extended north to tie into the 8.5 SMA STA. The hydraulic ridge is described in the 1994 report as detention/retention areas that contain water to maintain water flows into ENP.

Purpose

This area was added to extend the hydraulic ridge north to the 8.5 SMA STA and to maximize the usage of project lands. Two pump stations supply water to this area: the S-357 from the 8.5 SMA (from the north) and the S-332B (from the south). The total acreage within the area is approximately 1,441 acres and is divided into three areas: 1) flowway area (232 acres), 2) main detention area (1180 acres), and 3) additional storage in southern part of the NDA (29 acres).

1.10.1.1.2 C-111 South Detention Area (SDA)

Location

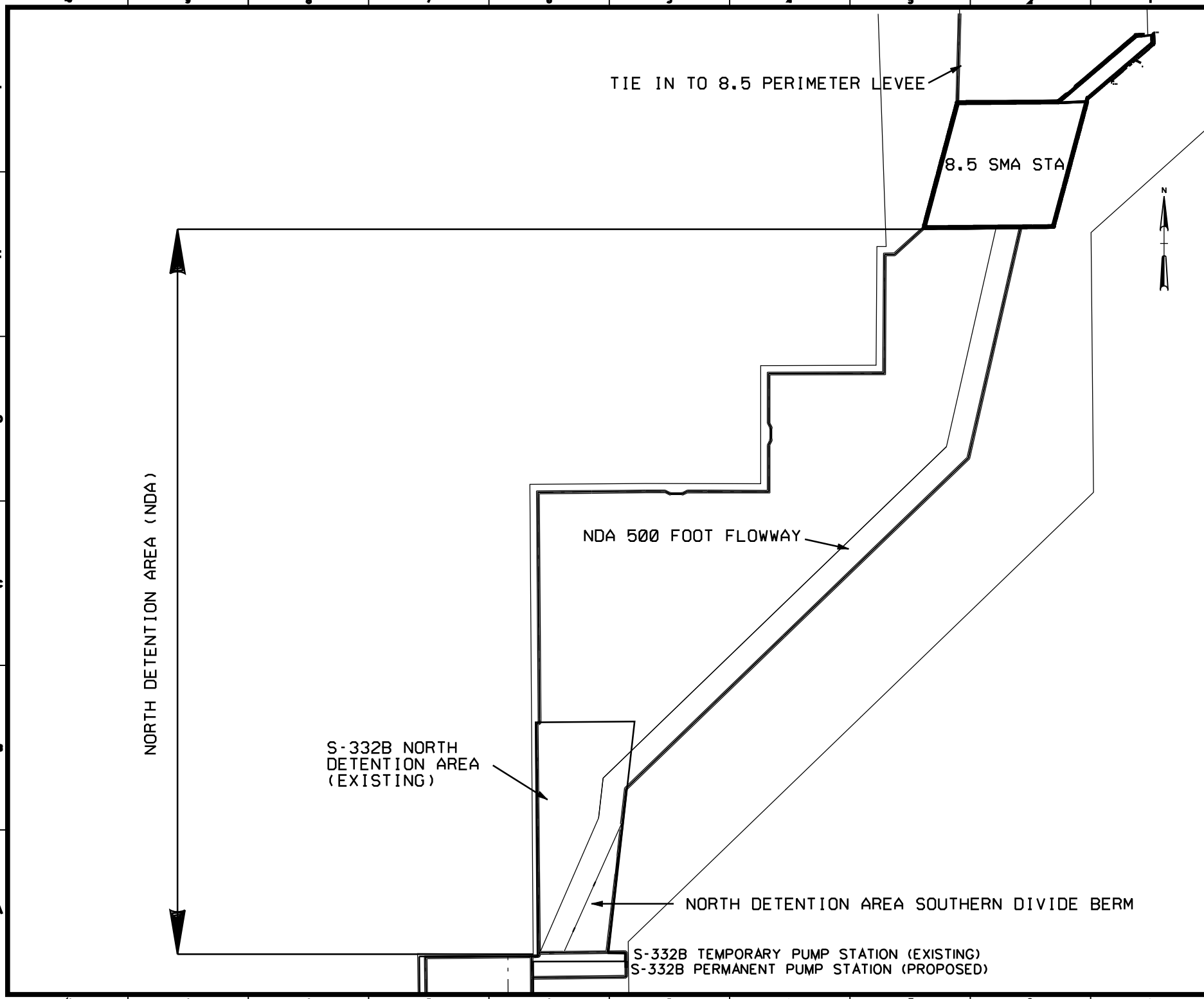
The C-111 South Detention Area (SDA) is located in the southern part of the Rocky Glades. The area extends from the S-332B pump station in the north to the Frog Pond in the south (S-332D pump station). See Figure 4.

Refinement to the 1994 C-111 GRR

The concept from the 1994 C-111 GRR is maintained except that the levee heights were raised to allow deeper storage within the detention area (hydraulic ridge).

Purpose

The SDA forms the hydraulic ridge between the S-332B and S-332D pump stations. Three pump stations supply water to this area: the S-332B (north), the S-332C (central) and the S-332D (south). The total acreage within the area is approximately 1,310 acres and is divided into two areas: 1) flowway area (325 acres) and 2) main detention area (985 acres).



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STABASE.DGN
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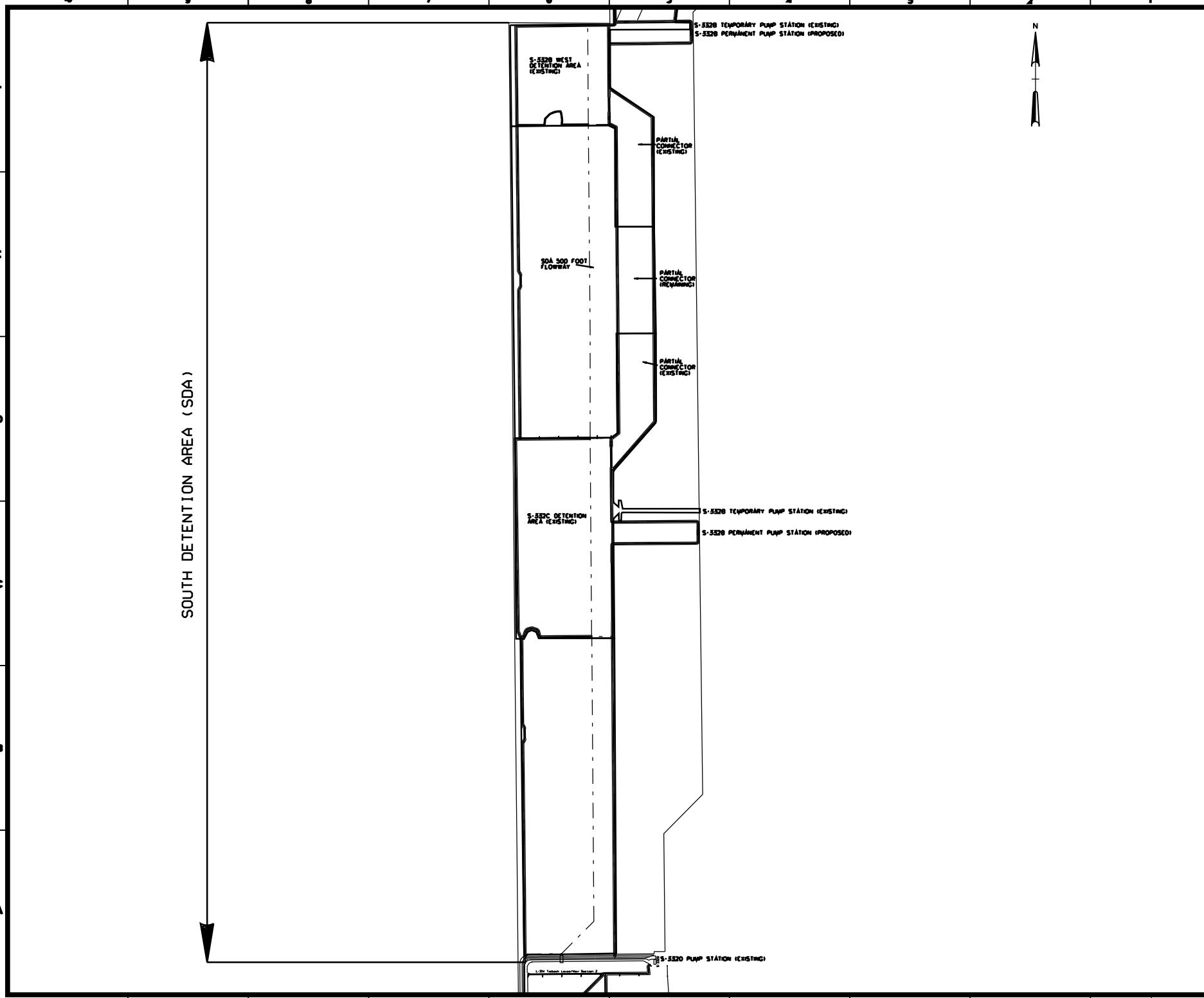
Reference files:
Figure03_EDR.DGN
File name:

C-111 Engineering
Documentation Report
NORTH DETENTION AREA

Figure
3



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Reference files:
Figure04_EDR.DGN
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C-111 Engineering Documentation Report
SOUTH DETENTION AREA (SDA)

Figure 4

1.10.1.1.3 Frog Pond Detention Area (FDA)

Location

The Frog Pond Detention Area (FDA) is located within the Frog Pond lands. The area extends from S-332D pump station in the north to S-332 pump station in the south. See Figure 5.

Refinements to the 1994 C-111 GRR

The 1994 C-111 GRR planned to incorporate this area into a buffer zone between Taylor Slough and the C-111 Canal. During the 2002 IOP Emergency Contract, to maximize the usage of project lands and to improve delivery of water to Taylor Slough, an interim plan was enacted that created a flow through the detention system from the S-332D pump station to Taylor Slough. This EDR incorporates this interim plan.

Purpose

The FDA serves as a continuation of the hydraulic ridge reducing seepage losses from Taylor Slough and is used to make environmental water deliveries to Taylor Slough. This system also allows for the ability for continuous pumping of flood flows from the SDCS into Taylor Slough. The S-332D pump station is the only pump station that supplies water to the FDA. The total acreage within the FDA is approximately 2,100 acres and is divided into 4 cells: 1) High Head Cell (21.5 acres), 2) Cell 1 (246.5 acres), 3) Cell 2 (354.5), and 4) Cell 3 (1484 acres).

1.10.1.1.4 Frog Pond Seepage Management Detention Area (FSMDA)

Location

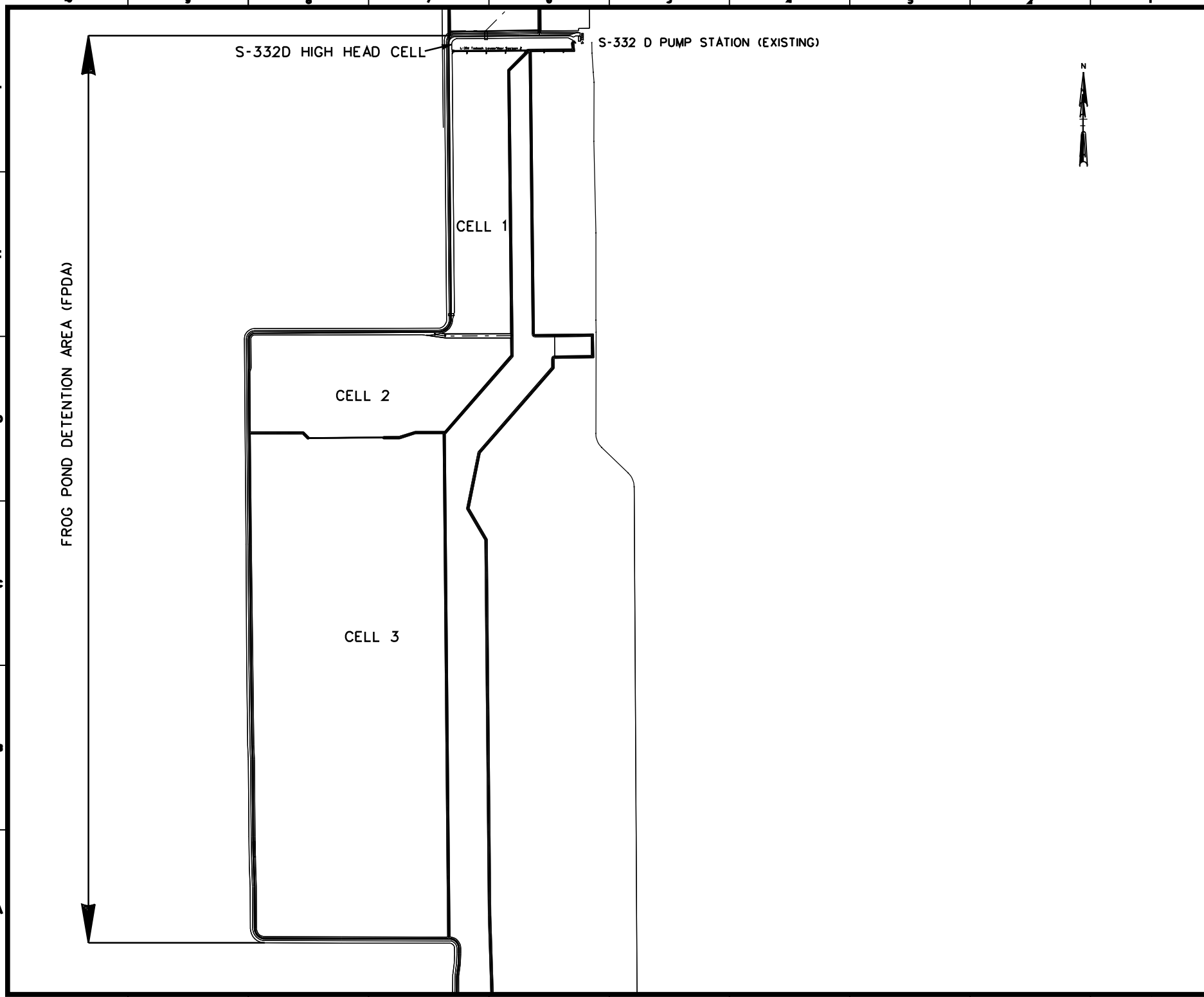
The FSMDA is located immediately east of the FDA within the Frog Pond lands.

Purpose

The FSMDA (544 acres) will serve as a seepage management system reducing the amount of seepage losses to the east from the FDA. Seepage losses from the FDA to the C-111 canal increase the amount of flows to the ENP panhandle and reduce the amount delivered to Taylor Slough. The current plan is to construct this feature but work will be deferred until such time as the CERP pilot project for L-31N Seepage Management is completed. Once this CERP pilot project is completed, a decision will be made regarding the viability of using a seepage cutoff wall instead of a detention system to control seepage from the FDA.

1.10.1.2 Pump Stations

The 1994 GRR recommended plan included the construction of five pump stations. One pump station (S-332A) was to discharge directly west of the S-332D Tieback levee. Three (S-332B, S-332C, and S-332D) were to discharge into the hydraulic ridge (retention/detention area) created by the L-31W Tieback and S-332D Tieback



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Reference files:
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C-111 Engineering Documentation Report
FROG POND DETENTION AREA (FPDA)

Figure 5

levees. The fifth (S-332E) pump station was to re-hydrate the Southern Glades lands north and east of the C-111 canal. This section provides a brief description of the 1994 GRR plan and this EDR's recommendations. Figure 2 shows a general overview of the C-111 components of the recommended plan. The primary structural components of the recommended plan for the pumping stations include substructure, operating floor, superstructure, axial flow pumps and diesel/electrical engines. The substructure includes the sumps and water passages that conduct water to the pump intakes. The operating floor supports pumps, diesel engines, and generators. The superstructure is the enclosure for equipment and personnel areas in the plant. Miscellaneous structural items include cranes, a service bridge, retaining wall, and trash rack. See Figure 6 for Typical Permanent Pump Station.

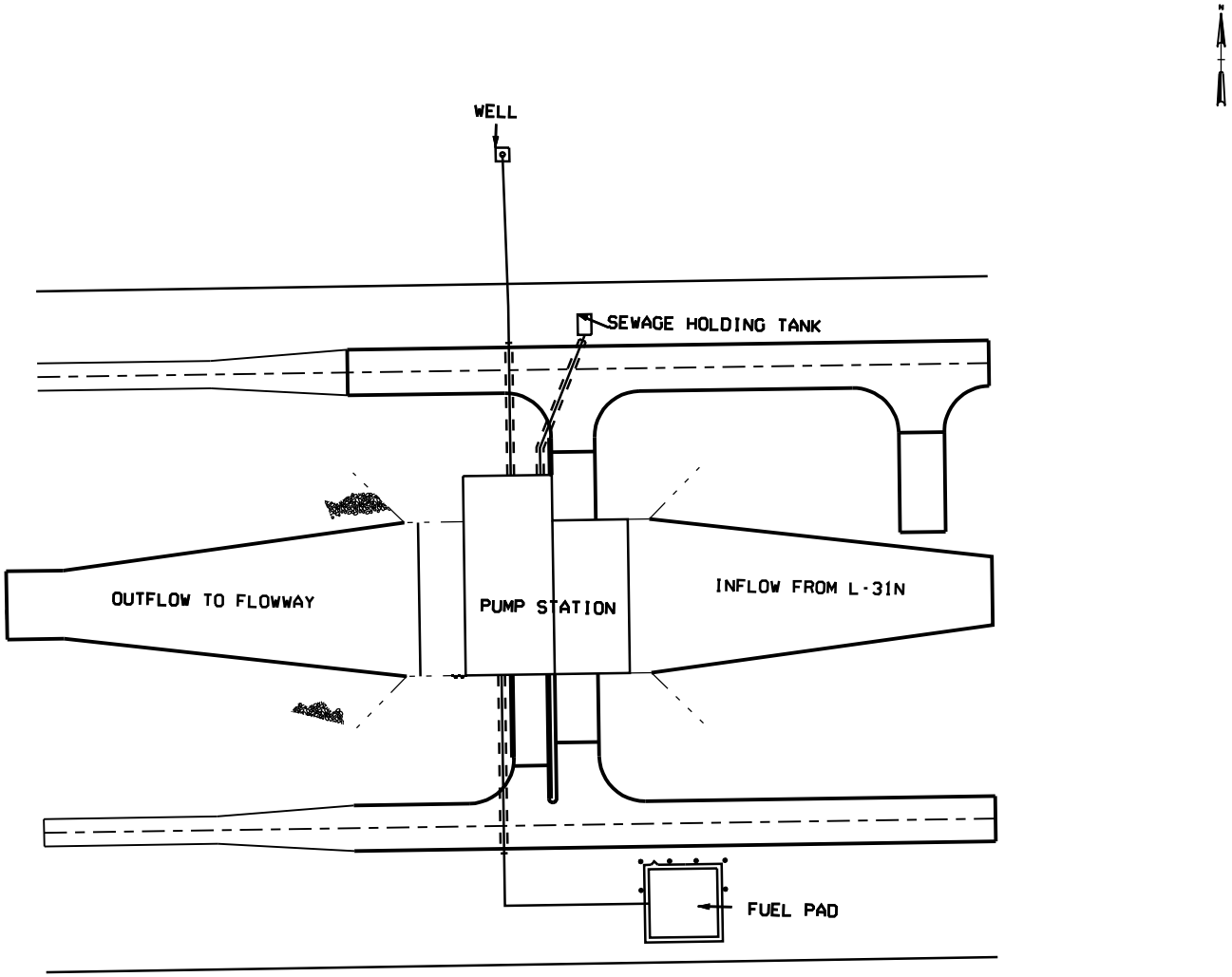
1.10.1.2.1 S-332A

Pursuant to recommendations developed during CSOP's evaluations, this EDR recommends that the S-332A pump station not be constructed. With the increase in pumping capacity at S-332B, S-332C, and S-332D and the relocation of the S-357 pump station to the southern end of the 8.5 Square Mile Area (authorized in July 2000 Omnibus Appropriations Bill), the S-332A pump station is no longer required. The modeling completed to date has not shown any adverse impacts to the level of service that the 1994 GRR planned for the C-111 Basin.

1.10.1.2.2 S-332B

<u>Refinement to the 1994 C-111 GRR</u>
Pursuant to recommendations developed during CSOP's evaluations, this EDR recommends that the pump station capacity be increased from 300 cfs (1994 C-111 GRR) to 575 cfs. Discharge will be passed into a 500-foot wide flowway (see Section 1.10.1.4.2, S-332B Flowway) system extending from the L-31N borrow canal west to the S-332D Tieback Levee, instead of a concrete lined channel as proposed in the 1994 C-111 GRR. In addition, flows will be split between the NDA and SDA detention areas via the S-332B Discharge Control Structure (see Section 1.10.1.5.3). During the 2000 ISOP Emergency Contract a temporary pump station was constructed with 575 cfs capacity (four 125-cfs diesel powered pumps and one 75-cfs electric powered pump) that pumped into the S-332B west detention area (available lands during the contract). Later in 2002 during the IOP Emergency Contract, two pumps were diverted into the interim S-332B North Detention Area.

<u>Purpose</u>
The purpose of this pump station is to maintain the level of service for flood damage reduction for the C-111 Basin, as well as to generate the hydraulic ridge between the L-31N Borrow Canal and the Everglades National Park. The hydraulic ridge will reduce the seepage loss from ENP. S-332B will pump water from the L-31N borrow canal between structures S-331 and S-176.



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C-111 Engineering Documentation Report
TYPICAL PUMP STATION

Figure 6

Location
The S-332B pump station location will be in the same general vicinity as that proposed in the 1994 GRR, which is midway between C-103 and C-102 along the L-31N borrow canal.

Physical Feature
The pump station will consist of four 125-cfs diesel pumps and one 75-cfs electric pump (Table 3). The main pumps will be powered by diesel engines so pumping capabilities will be available during electrical power outages. The 75 cfs electric pump will provide capacity at lower water levels and offer some flexibility in the pump rates. The maximum pumping rate at this station will be 500 cfs because when all four diesel pumps are running, the electric pump will be off.

1.10.1.2.3 S-332C

Refinement to the 1994 C-111 GRR
Pursuant to recommendations developed during CSOP's evaluations, this EDR recommends that the pump station capacity be increased from 300 cfs (1994 C-111 GRR) to 575 cfs. Discharge will be into a 500 foot wide flowway (see Section 1.10.1.4.3 S-332C Flowway) system extending from the L-31N borrow canal west to the S-332D Tieback Levee, instead of a concrete lined channel as proposed in the 1994 C-111 GRR. During the 2002 IOP Emergency Contract a temporary pump station was constructed with 575 cfs capacity (four 125-cfs diesel powered pumps and one 75-cfs electric powered pump) that pumped into the S-332C detention area (available lands during the contract).

Purpose
The purpose of this pump station is to maintain the level of service for flood damage reduction for the C-111 Basin, as well as to generate the hydraulic ridge between the L-31N Borrow Canal and the ENP. S-332C will pump water from the L-31N borrow canal between structures S-331 and S-176.

Location
The S-332C pump station location will be in the same general vicinity as that proposed in the 1994 GRR, which is located just south of the confluence of the C-103 canal and the L-31N borrow canal.

Physical Feature
The pump station will consist of four 125-cfs diesel pumps and one 75-cfs electric pump (Table 4). The main pumps will be powered by diesel engines, to provide pumping capabilities during electrical power outages. The 75-cfs electric pump is to provide capacity at lower levels and offer some flexibility in the pump rates. The maximum pumping rate at this station is 500 cfs. When all diesel pumps are running, the electric pump is off.

Table 3
Engineering Documentation Report (EDR)
Hydraulic Design Table
Pump Station S-332B

Discharge Capacity

Total	575 cfs
Number of Diesel Pumps	4 - 125 cfs each
Number of Electric Pumps	1 - 75 cfs

Intake Water Surface Elevation

Maximum Pumping	6.5 ft	(Note 2)
Maximum Pumping Normal	4.6 ft	
Maximum Non-Pumping	4.6 ft/4.5 ft	Wet/Dry
Normal Start Pumping	4.6 ft/ 4.5ft	Wet/Dry
Normal Drawdown Pumping	4.4 ft/ 4.3ft	Wet/Dry
Minimum Non-Pumping	4.3 ft	
Minimum Drawdown Pumping	1.0 ft	(Head losses thru trash Rack)

Discharge Water-Surface Elevation

Maximum Pumping	9.1 ft
Normal Pumping (Water Supply)	8.3 ft
Minimum Normal Pumping	4.0 ft
Minimum Non-Pumping	2.0 ft

Wet Season Operation			Dry Season Operation		
On	Off	Capacity	On	Off	Capacity
4.5	4.3	75 cfs	4.6	4.4	75 cfs
4.6	4.4	125 cfs	4.7	4.5	125 cfs
4.6	4.4	250 cfs	4.7	4.5	250 cfs
4.7	4.5	375 cfs	4.8	4.6	375 cfs
4.8	4.6	500 cfs	4.9	4.7	500 cfs

Marsh Operational Gradient Limits (Note 3)

Month	Gradient	Month	Gradient
Jan	0.1	Jul	0.4
Feb	0.1	Aug	0.4
Mar	0.1	Sep	0.4
Apr	0.1	Oct	0.3
May	0.1	Nov	0.2
Jun	0.4	Dec	0.1

Mandatory On Levels (Note 4)

S-176 HW	# Pumps	Capacity
5.0	2	250 cfs
5.3	3	375 cfs
5.5	4	500 cfs

Notes:

1) All elevations refer to National Geodetic Vertical Datum of 1929 (NGVD29)
2) Elevation taken from the May 1994 Final Integrated General Reevaluation Report and Environmental Impact Statement Canal 111 (C-111) South Dade County, Florida Table A-16.
3) Marsh operations is based on a 3-day rolling average from comparing certain ground water gages.
4) Marsh Operational constraints are removed when the head water stage at S-176 reaches and exceeds listed triggers.

Table 4
Engineering Documentation Report (EDR)
Hydraulic Design Table
Pump Station S-332C

Discharge Capacity

Total	575 cfs
Number of Diesel Pumps	4 - 125 cfs each
Number of Electric Pumps	1 - 75 cfs

Intake Water Surface Elevation

Maximum Pumping	6.5 ft	(Note 2)
Maximum Pumping Normal	4.6 ft	
Maximum Non-Pumping	4.6 ft/4.5 ft	Wet/Dry
Normal Start Pumping	4.6 ft/ 4.5ft	Wet/Dry
Normal Drawdown Pumping	4.4 ft/ 4.3ft	Wet/Dry
Minimum Non-Pumping	4.3 ft	
Minimum Drawdown Pumping	1.0 ft	(Head losses thru trash Rack)

Discharge Water-Surface Elevation

Maximum Pumping	9.1 ft
Normal Pumping (Water Supply)	8.3 ft
Minimum Normal Pumping	4.0 ft
Minimum Non-Pumping	2.0 ft

Wet Season Operation			Dry Season Operation		
On	Off	Capacity	On	Off	Capacity
4.5	4.3	75 cfs	4.6	4.4	75 cfs
4.6	4.4	125 cfs	4.7	4.5	125 cfs
4.6	4.4	250 cfs	4.7	4.5	250 cfs
4.7	4.5	375 cfs	4.8	4.6	375 cfs
4.8	4.6	500 cfs	4.9	4.7	500 cfs

Marsh Operational Gradient Limits (Note 3)

Month	Gradient	Month	Gradient
Jan	0.1	Jul	0.4
Feb	0.1	Aug	0.4
Mar	0.1	Sep	0.4
Apr	0.1	Oct	0.3
May	0.1	Nov	0.2
Jun	0.4	Dec	0.1

Mandatory On Levels (Note 4)

S-176 HW	# Pumps	Capacity
5.0	2	250 cfs
5.3	3	375 cfs
5.5	4	500 cfs

Notes:

1) All elevations refer to National Geodetic Vertical Datum of 1929 (NGVD29)
2) Elevation taken from the May 1994 Final Integrated General Reevaluation Report and Environmental Impact Statement Canal 111 (C-111) South Dade County, Florida Table A-16.
3) Marsh operations is based on a 3-day rolling average from comparing certain ground water gages.
4) Marsh Operational constraints are removed when the head water stage at S-176 reaches and exceeds listed triggers.

1.10.1.2.4 S-332D

Refinement to the 1994 C-111 GRR

The 1994 C-111 GRR recommended the capacity for the pump station to be 300 cfs. However, in 1996, during the development of Plans and Specifications (P&S), the capacity of this pump station was increased from 300 cfs to 500 cfs to maintain the 500 cfs flood conveyance capacity of the L-31W canal, given that downstream seepage limits the operation of the S-174 structure below its full capacity. When initially constructed, the pump station discharged directly into the L-31W borrow canal to deliver flows to Taylor Slough while land acquisition was proceeding within the Rocky Glades. As envisioned in the 1994 C-111 GRR, once the real estate acquisition was completed and the L-31W Tieback and S-332D Tieback Levees were completed, discharges would later be re-routed into the southern part of the SDA (as originally authorized). During the 2002 IOP Emergency Contract, to maximize the use of project lands, the connection with the L-31W borrow canal was closed and the FDA was created. The lands within Frog Pond area were then utilized as a flow through detention system to provide flows to Taylor Slough. No refinements are being proposed for the S-332D pump station.

Purpose

The original purpose of the S-332D was to work in conjunction with S-332B and S-332C to maintain the level of service for flood damage reduction for the C-111 Basin, as well as to generate the hydraulic ridge between the L-31N borrow canal and the Everglades National Park. This purpose has been adapted to incorporate lands within the Frog Pond into the detention system. Flows will now be delivered to Taylor Slough via a flow through detention system. To increase the flexibility of the system, a culvert structure will be added to the High Head Cell that will allow the discharge of water north depending on capacity in the upstream or downstream detention areas.

Location

The S-332D pump station is be located just west of S-176 and south of S-174 and discharges water from the southern end of the L-31N borrow canal into the Frog Pond High Head Cell.

Physical Feature

The pump station consists of four 125-cfs diesel pumps and one 75-cfs electric pump (Table 5). The main pumps is powered by diesel engines, to provide pumping capabilities even during electrical power outages. The 75 cfs electric pump is to provide capacity at lower levels and offer some flexibility in the pump rates. The maximum pumping rate at this station is 500 cfs. When all diesel pumps are running, the electric pump is off.

Table 5
Engineering Documentation Report (EDR)
Hydraulic Design Table
Pump Station S-332D

Discharge Capacity

Total	575 cfs
Number of Diesel Pumps	4 - 125 cfs each
Number of Electric Pumps	1 - 75 cfs

Intake Water Surface Elevation

Maximum Pumping	6.5 ft	(Note 2)
Maximum Pumping Normal	4.6 ft	
Maximum Non-Pumping	4.6 ft/4.5 ft	Wet/Dry
Normal Start Pumping	4.6 ft/ 4.5ft	Wet/Dry
Normal Drawdown Pumping	4.4 ft/ 4.3ft	Wet/Dry
Minimum Non-Pumping	4.3 ft	
Minimum Drawdown Pumping	1.0 ft	(Head losses thru trash Rack)

Discharge Water-Surface Elevation

Maximum Pumping	9.1 ft
Normal Pumping (Water Supply)	8.3 ft
Minimum Normal Pumping	4.0 ft
Minimum Non-Pumping	2.0 ft

Operations

Wet Season Operation

On	Off	Capacity
4.6	4.4	125 cfs
4.7	4.5	250 cfs
4.8	4.6	375 cfs
4.9	4.7	500 cfs

Dry Season Operation

On	Off	Capacity
4.5	4.3	75 cfs
4.7	4.5	125 cfs
4.8	4.6	250 cfs
4.9	4.7	375 cfs
5.0	4.8	500 cfs

Notes:

1) All elevations refer to National Geodetic Vertical Datum of 1929 (NGVD29)
2) Elevation taken from the May 1994 Final Integrated General Reevaluation Report and Environmental Impact Statement Canal 111 (C-111) South Dade County, Florida Table A-16.

1.10.1.2.5 S-332E

The construction and operation of the S-332E pump station (which discharges into the Eastern Spreader Canal, C-111N, see Section 1.10.1.4.5) shall be reevaluated at a later date.

1.10.1.2.6 Frog Pond Seepage Management Pump Station

<u>Purpose</u>
The Frog Pond Seepage Management Pump Station will be used to maintain stages within the FSMDA to prevent seepage losses from the FDA to the east towards C-111.

<u>Location</u>
The pump station will be located approximately 1.5 miles south of S-176 along the western side of the C-111 canal. The FPSM Pump Station is deferred to the CERP C-111 Spreader Canal.

<u>Physical Feature</u>
The pump station will consist of four 50-cfs electric engines. The Frog Pond Seepage Management Pump Station is being deferred to the CERP C-111 Spreader Canal Project.

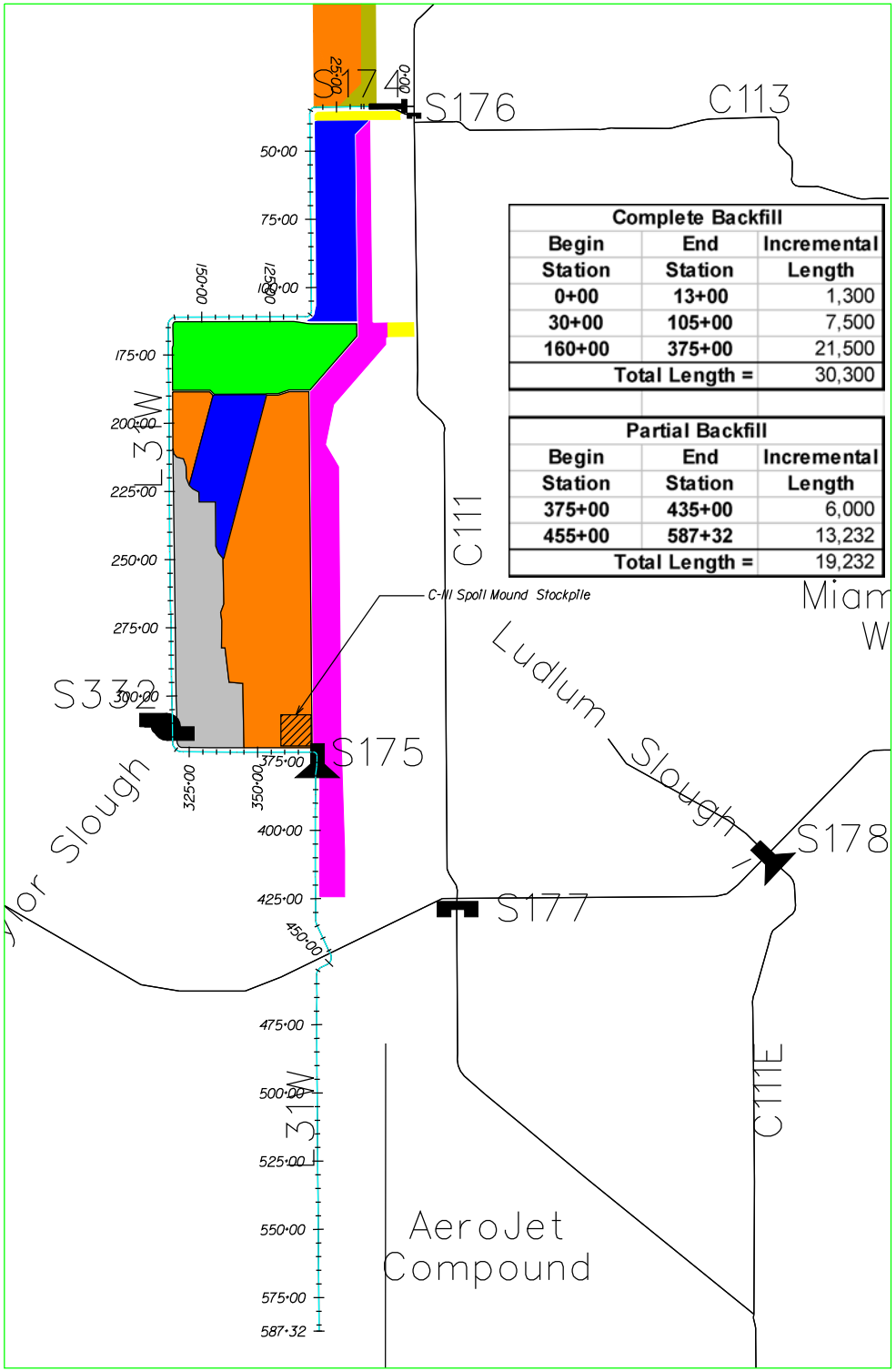
1.10.1.3 Levees

1.10.1.3.1 L-31W

<u>Refinement to the 1994 C-111 GRR</u>
The L-31W levee was originally planned in the 1994 C-111 GRR to be degraded from the S-332 pump station north (approximately 25,500 feet) to where the levee ties into the L-31W Tieback levee. With the utilization of the Frog Pond area as part of the detention system, the L-31W levee will not be degraded. The adjacent borrow canal however will be backfilled for a total distance of 30,300 feet and partial backfilling for 19,300 feet (see Figure 7) utilizing material from the C-111 Spoil Mound Degrade. The material for this backfill is stockpiled within the Frog Pond area just north of S-175.

<u>Purpose</u>
The L-31W borrow canal is to be backfilled to prevent the canal from acting as a sump and pulling water out of ENP.

<u>Physical Feature</u> (Table 6)
The complete backfill of the L-31W borrow canal will start at the S-176 structure (station 0+00) and proceed due west for 1300 feet (300 feet past the S-332D Tieback



Complete Backfill		
Begin Station	End Station	Incremental Length
0+00	13+00	1,300
30+00	105+00	7,500
160+00	375+00	21,500
	Total Length =	30,300

Partial Backfill		
Begin Station	End Station	Incremental Length
375+00	435+00	6,000
455+00	587+32	13,232
	Total Length =	19,232

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Reference files:
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C-111 Engineering Documentation Report
Limits of Backfill for the L-31W Borrow Canal

Figure 7

Table 6
Engineering Documentation Report (EDR)
L-31W Borrow Canal
Limits of Backfill

Station (ft)	Canal Invert (ft)	Top of Bank (ft)	Backfill Elevation (ft)	Canal Bottom Width (ft)	Canal Side Slope (1V to H)	Cross Sectional Area (ft^2)	Volume of Material (cy)	Total Length of Segment (ft)
0+00	-13	6.8	6.8	30	1	986.04		
					Complete Backfill =		43,438	1,300
13+00	-12	5.3	5.3	30	1	818.29		
No Backfill (This area will be used as a spreader canal for the S-332D High Head Cell Cu								1,700
30+00	-11.6	6	6	30	1	837.76		
					Complete Backfill =		223,794	7,500
105+00	-11	5.6	5.6	30	1	773.56		
No Backfill (Serves as a spreader system for the Frog Pond Cell 1 Culvert Structure.)								5,500
160+00	-11	4.6	4.6	30	1	711.36		
					Complete Backfill =		345,197	12,500
285+00	-12.6	4.1	4.1	30	1	779.89		
No Backfill (Serves as a spreader system for the Frog Pond Flowway Weir.)								2,500
310+00	-11.6	4.8	4.8	30	1	760.96		
					Complete Backfill =		202,030	6,500
375+00	-14.3	4.5	4.5	30	1	917.44		
375+01	-14.3	4.5	0.5	30	1	663.04		
					Partial Backfill =		151,330	5,999
435+00	-13.4	6	2	30	1	699.16		
No Backfill (Canal will not be partially backfilled within a 1,000 ft US and DS of State Rd 9336.)								
455+00	-12	3.7	-0.3	30	1	487.89		
					Partial Backfill =		240,413	13,232
587+32	-13.5	2.3	-1.7	30	1	493.24		

Total Length of Complete Backfill = 27,800 ft
Total Required Volume for Complete Backfill = 814,458 cubic yards

Total Length of Partial Backfill = 19,231 ft
Total Required Volume for Partial Backfill = 391,744 cubic yards

Total Volume required for L-31W Borrow Canal = 1,206,000

Notes:
1) All elevations refer to NGVD 1929.
2) Elevations were taken from COE survey number 98-213.

Levee). The next 1700 feet of the borrow canal will be left intact to act as a spreader canal for the Frog Pond High Head Culvert (see Section 1.10.1.5.9). At station 30+00 (300 feet east of the L-31W Tieback Levee), backfill will begin again and go to station 105+00, just north of the Frog Pond Cell 1 Culvert structure (see Section 1.10.1.5.11). From station 105+00 to 160+00, the borrow canal will be left intact to act as a spreader canal for the Frog Pond Cell 1 Culvert structure. From station 160+00 to 285+00 and 310+00 to 375+00 (structure S-175), the borrow canal will be completely backfilled. The segment from 285+00 to 310+00 will not be backfilled. This segment will be used to distribute flows discharged by the Frog Pond Discharge Structure (see Section 1.10.1.5.13) into Taylor Slough. Partial backfill will extend from station 375+00 to 435+00 (approximately 1,000 feet north of Ingraham Highway). One thousand (1,000) feet south of Ingraham Highway (station 455+00) partial backfill will begin again and extend to the end of the L-31W borrow canal (station 587+32). Partial backfill of the canal brings the invert of the canal to approximately 4 feet below average ground elevation.

1.10.1.3.2 L-31W Tieback Levee

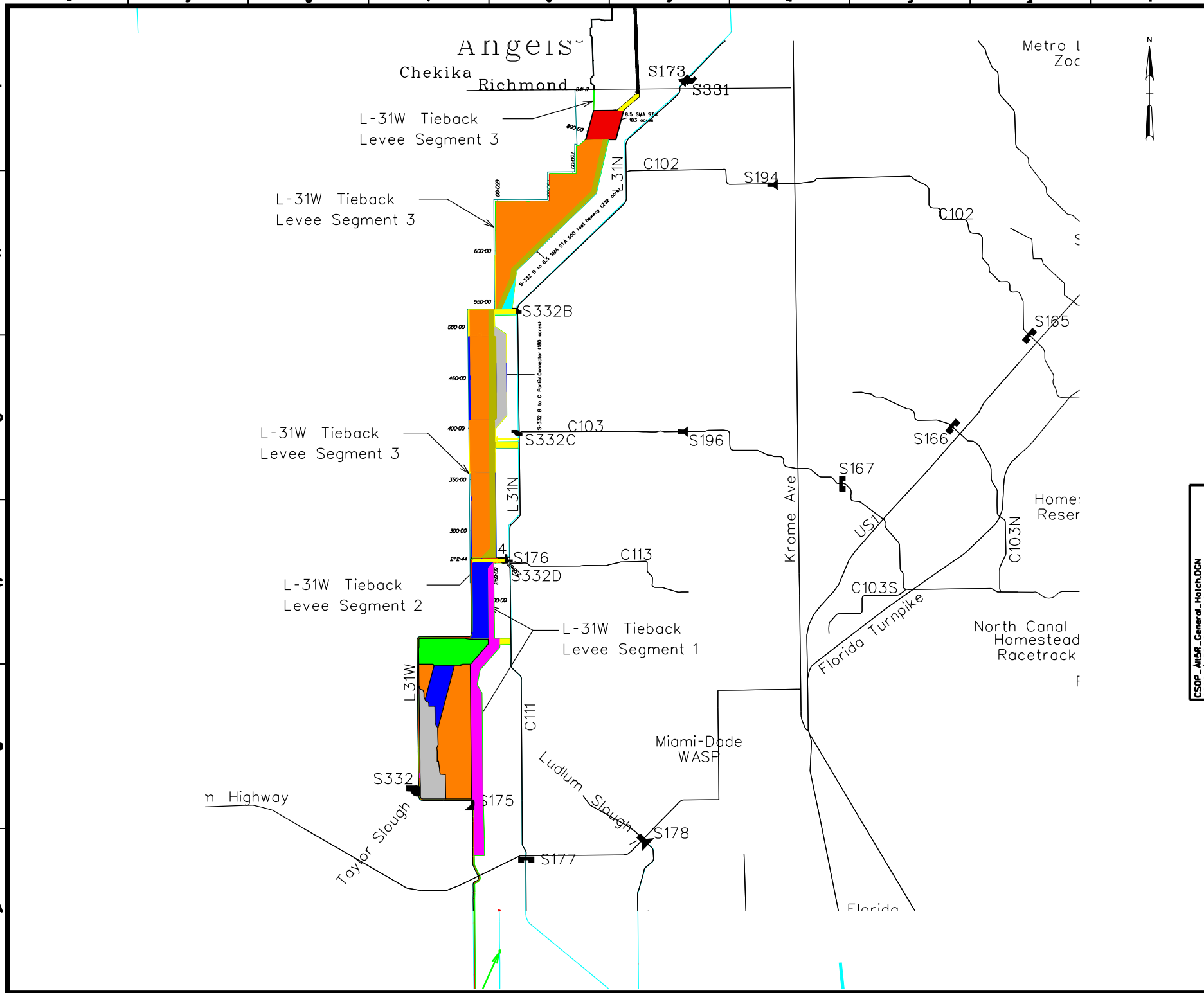
<u>Refinement to the 1994 C-111 GRR</u>
The 1994 C-111 GRR called for a new north-south levee to be constructed roughly parallel to the existing L-31N levee, beginning at L-31W near S-175 and extending northward approximately 9.25 miles to higher ground in the Rocky Glades area in the vicinity of S-332B, to form the western containment levee of the retention/detention area (SDA). Based on the authorized 2000 8.5 SMA Report, the goal now is to extend the retention/detention area (hydraulic ridge) north to the 8.5 Square Mile Area, tying the tieback levee into the 8.5 SMA perimeter levee at Richmond Drive. This increases the length of the levee by 6.75 miles for a total length of approximately 16 miles. To increase the storage capacity of the retention/detention area, the levee heights were increased 2 to 3 feet to make the retention/detention areas surrounded by 6 foot levees.

<u>Purpose</u>
This levee is divided into three segments for discussion purposes (see Figure 8):
Segment 1

Segment 1 is a north-south levee within the Frog Pond area that parallels L-31W from S-175 to S-332D (24,000 feet). This part of the levee system forms the eastern containment levee for the Frog Pond Detention Cells. This levee was constructed in 2002 as part of the CSSS Emergency Contract.

1.10.1.3.2.1 Segment 2

Segment 2 is the east-west levee within the Frog Pond area that starts on the south side of S-332D and extends east (3,400 feet) to L-31W. In conjunction with the L-31W levee, this portion of the levee forms the Frog Pond High Head Cell (21.5 acres) which discharges water primarily south over the Frog Pond High Head Weir (see



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Reference files:
Figure08_EDR.DGN
File name:

C-111 Engineering
Documentation Report
L-31W TIEBACK LEVEE LOCATION

Figure
8

Section 1.10.1.5.8) and secondarily north via Frog Pond High Head Culvert (see Section 1.10.1.5.9). This levee was constructed in 2002 as part of the CSSS Emergency Contract.

1.10.1.3.2.2Segment 3

Segment 3 starts in the northwest corner of the Frog Pond and proceeds north (56,800 feet) to tie into the 8.5 Square Mile Area Perimeter Levee. In conjunction with the S-332D Tieback Levee, this portion of levee forms the western containment levee for the hydraulic ridge/detention area that extends from the Frog Pond north to the 8.5 Square Mile Area. The detention area is divided into two areas: the NDA (S-332B North to S-357, total of 1,140 acres) and the SDA (S-332B to S-332D total of 1,309 acres). Three thousand (3000) feet of the levee will be built as part of the 8.5 Square Mile Area Stormwater Treatment Area (8.5 SMA STA) starting at station 791+50. The western toe of the levee will be constructed so that it is offset from the ENP boundary by 150 feet.

<u>Physical Feature</u> (Table 7)
Material for the construction of the levee will be obtained from the scraping of adjacent agriculture land within the detention area. If additional material is needed, additional lands will be scraped within the buffer area between the retention/detention area and the L-31N borrow canal. The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be added to supplement for levee stabilization due to deeper detention. Levee crests will be on average 6 feet above grade.

1.10.1.3.3 S-332D Tieback Levee

<u>Refinements to the 1994 C-111 GRR</u>
Slight refinement to the levee alignment was made from the 1994 C-111 GRR report and, to increase the storage capacity of the retention/detention area, the levee heights were increased 2 to 3 feet to make the retention/detention areas surrounded by 6 foot levees. The northern terminus of the levee will be in the southeast corner of the 8.5 SMA STA (see Figure 9).

<u>Purpose</u>
The levee starts in the Frog Pond approximately a half mile east of L-31N and proceeds north (45,800 feet) to tie into the 8.5 SMA STA. In conjunction with the L-31W Tieback Levee, this portion of the levee forms the eastern containment levee for the hydraulic ridge/detention area that extends from the Frog Pond north to the 8.5 Square Mile Area. The detention area is divided into two areas; the northern area (S-332B North to S-357, total of 1,441 acres) and the southern area (S-332B to S-332D, total of 1,310 acres).

Table 7
Engineering Documentation Report (EDR)
L-31W Tieback Levee

Station	Segment #	Crest Elevation (ft)	Remarks
0+00	1	12.0	Starts Just North of S-175
238+67	1	12.0	
Segment Change			
238+67	2	12.0	Starts at the S-332D Pump Station
253+02	2	12.0	
253+42	2	8.1	**Frog Pond High Head Overflow Weir**
271+82	2	8.1	
272+22	2	12.0	
272+44	2	12.0	
Segment Change			
272+44	3	13.0	
329+72	3	13.0	Begin 1 on 10 Transition to overflow weir.
330+07	3	9.5	**Western Overflow Weir #1 (SAD)**
330+42	3	9.5	
332+77	3	13.0	End 1 on 10 transition from Overflow weir
356+53	3	13.0	Ties into Southern part of (Temporary Detention Area at S-332C).
This portion of the levee was completed during the 2002 CSSS Emergency Contract			
409+18	3	13.0	Ties into Northern part of Temporary Detention Area at S-332C).
448+82	3	13.0	
449+17	3	9.5	**Western Overflow Weir #2 (SDA)**
451+57	3	9.5	
332+77	3	13.0	
540+41	3	13.0	
540+51	3	14.0	Northern End of SDA
542+92	3	14.0	Southern End of NDA
542+97	3	13.0	Utilizes part of temporary S-332B North Detention Area
595+00	3	13.0	
678+10	3	13.0	
678+35	3	10.5	**Western Overflow Weir #3 (NDA)**
680+75	3	10.5	
332+77	3	13.0	
712+49	3	13.0	
712+74	3	10.5	**Western Overflow Weir #4 (NDA)**
715+02	3	10.5	
332+77	3	13.0	
792+00	3	13.0	Ties into Southwest corner of 8.5 SMA STA Levee
This portion is being constructed as part of the 8.5 SMA project.			
821+37	3	13.0	Ties into Northwest corner of 8.5 SMA STA Levee
841+65	3	13.0	Northern limit of Levee ties to 8.5 SMA Perimeter Levee

Table 7 (Continued)
Engineering Documentation Report (EDR)
L-31W Tieback Levee

General Levee Properties

Total Length of Levee =	84,165	ft
Levee Top Width =	15	ft
Side Slope 1 on	4	(V:H)

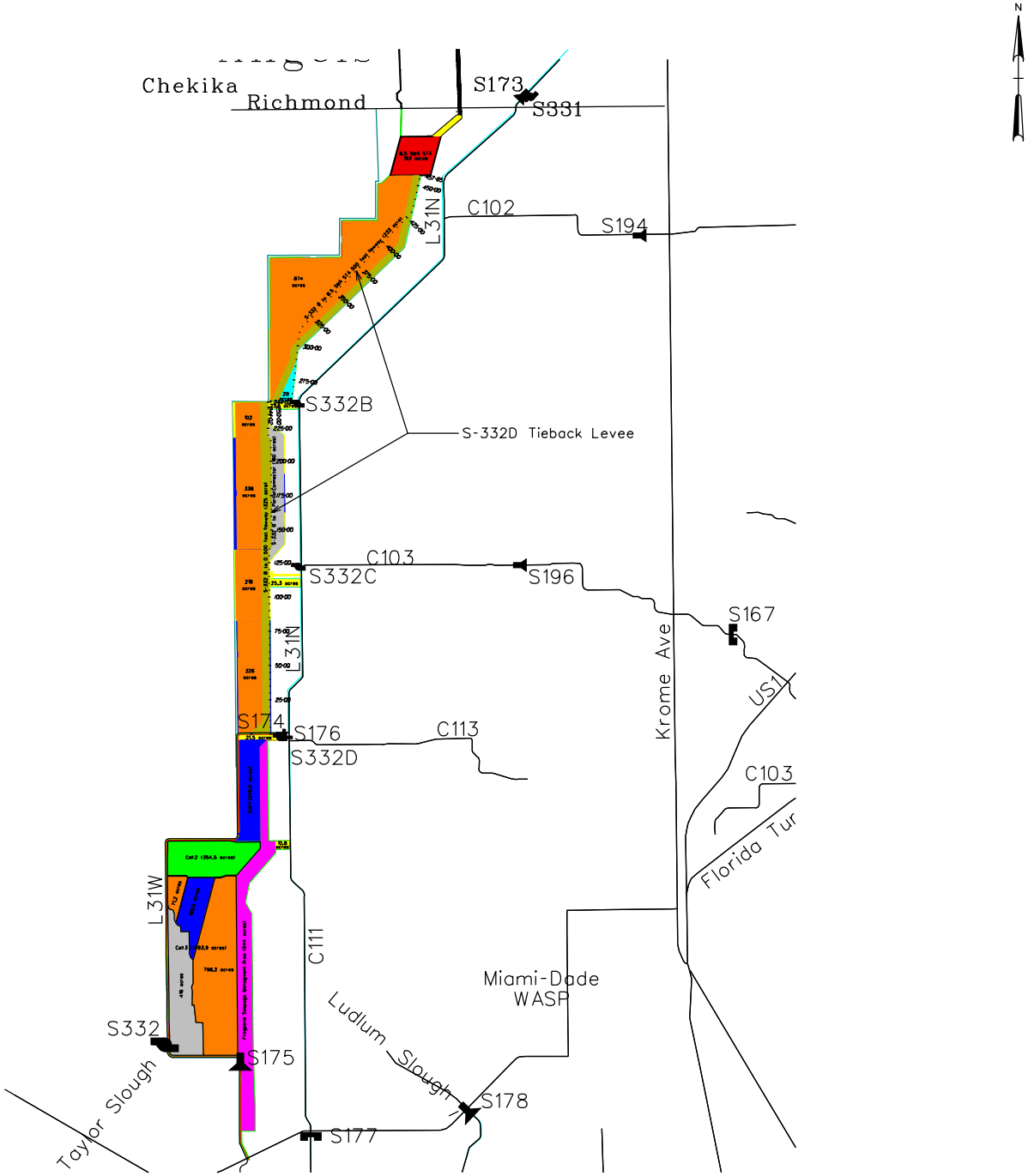
Segment 1

Length =	23,867	ft
Average Ground Elevation =	6	ft, NGVD29
Average Crest Elevation =	12	ft, NGVD29
Depth of Overburden =	0.67	ft
Levee Height =	6	ft
Levee Cross Sectional Area =	277.8	sq ft (per foot of levee)
Required Volume =	245,543	cubic yards (1 to 1 ratio)
Compacted Fill =	282,375	Increased embankment fill by 15% due to compaction of soil.
Grassing =	35.3	acres
Clearing and Grubbing =	34.5	acres
Toe Drains =	Yes	Located on East side of Levee
)verburden in agricultural areas =	0.67	ft
Required Scraping for Levee Embankment (Acre) =	261	acres

Segment 2

Length =	3,377	ft
Average Ground Elevation =	6	ft, NGVD29
Average Crest Elevation =	12	ft, NGVD29
Depth of Overburden =	0.67	ft
Levee Height =	6	ft
Levee Cross Sectional Area =	277.8	sq ft (per foot of levee)
Required Volume =	34,743	cubic yards (1 to 1 ratio)
Compacted Fill =	39,954	Increased embankment fill by 15% due to compaction of soil.
Grassing =	5.0	acres
Clearing and Grubbing =	4.9	acres
Toe Drains =	Yes	Located on East side of Levee
)verburden in agricultural areas =	0.67	ft
Required Scraping for Levee Embankment (Acre) =	37	acres

Segment 3	**Total**		**Remaining**
Length =	49,019	ft (Does not include length from the 8.5 SMA STA.)	36,523
Average Ground Elevation =	6.5	ft, NGVD29	6.5
Average Crest Elevation =	13	ft, NGVD29	13
Depth of Overburden =	0.67	ft	0.67
Levee Height =	6.5	ft	6.5
Levee Cross Sectional Area =	312.9	sq ft (per foot of levee)	312.9
Required Volume =	568,156	cubic yards (1 to 1 ratio)	423,321
Compacted Fill =	653,380	Increased embankment fill by 15% due to compaction of s	486,819
Grassing =	77.2	acres	57.5
Clearing and Grubbing =	75.4	acres	56.2
Toe Drains =	Yes	Located on East side of Levee	Yes
)verburden in agricultural areas =	0.67	ft	0.67
Required Scraping for Levee Embankment (Acre) =	604	acres	450



US Army Corps of Engineers
Jacksonville District

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Ckd by: G.J.N.
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CSOP_All5R_General_Hatch.DGN
Figure12_Eng_appendix.DGN
South_Dade_Canals.DGN
brdr ANSI_E.DGN
Reference files:
Figure09_EDR.DGN
File name:

C-111 Engineering Documentation Report

S-332D TIEBACK LEVEE

Figure 9

Physical Feature (Table 8)
Material for the construction of the levee will be obtained from the scraping of adjacent agriculture land within the detention area. If additional material is needed, additional lands will be scraped within the buffer area between the retention/detention area and the L-31N borrow canal. The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be added to supplement for levee stabilization due to deeper detention. Levee crests will be on average 6 feet above grade.

1.10.1.3.4 East-West Levees

Refinements to the 1994 C-111 GRR
These levees were not included in the 1994 C-111 GRR but were constructed during the 2000 and 2002 Emergency Contracts for the protection of the Cape Sable Seaside Sparrow. Due to congressional approval needed for a real estate exchange (Land Swap) between the Department of Interior (ENP) and the South Florida Water Management District (SFWMD), the levees were constructed as temporary features during these efforts so that parts of the hydraulic ridge could be constructed and operated. East-west levees are incorporated into three distinct detention areas: 1) S-332B West Detention Area (Constructed in 2000, 145 acres), 2) S-332B North Detention Area (Constructed in 2002, 226 acres), and 3) S-332C Detention Area (Constructed in 2002, 288 acres). Congressional approval has been given and the land swap is completed.

Purpose
These features were constructed during the 2000 and 2002 Emergency Contracts. These features will be removed during final build out of the project.

Physical Feature
The levees were constructed from material obtained from scraping the interior of the respective detention area. The levee crown width is 15 feet with 1 vertical on 4 horizontal side slopes with toe drains for levee stabilization due to deeper detention depths. Levee crests are on average 6 feet above grade. Material from the degraded portion of the levee will be incorporated into other levee segments to be constructed.

1.10.1.3.5 Partial Connector Levees

Purpose
The partial connector is a product of the 2002 Emergency contract. The Land Swap between the SFWMD and ENP had not been finalized. To create a continuous hydraulic ridge between S-332B and S-332C, an area within the buffer area (lands between L-31N and S-332D tieback levee) was planned to be incorporated into the detention system. The SFWMD had been purchasing lands in the Rocky Glades area and two parcels were all that were remaining to complete the connection. In

Table 8
Engineering Documentation Report (EDR)
S-332D Tieback Levee

Station	Segment #	Crest Elevation (ft)	
0+00		13.0	Starts along the L-31W levee approx. 1000 feet west of S-332D.
83+40		13.0	Beginning of Existing Temporary S-332C Detention Area
87+03		13.0	
87+32		10.1	**1500 ft Emergency Overflow Weir**
102+32		10.1	**(Discharges east into the C-111 buffer area)**
102+61		13.0	
107+14		13.0	
107+69		7.5	**S-332C Flowway Weir**
112+69		7.5	**(Controls stages and velocities within the S-332C flowway.)**
113+24		13.0	
126+94		13.0	
127+28		9.6	
129+78		9.6	**Centerline of 500 ft weir connection to Partial Connector.**
132+28		9.6	
132+62		13.0	
133+32	**Segment 1 Southern Detention Area (SDA) Eastern Containment Levee**	13.0	**Centerline of 15 Stop log Riser Structures connecting to Partial Connector.**
134+75		13.0	End of Existing Temporary S-332C Detention Area/Beg Part Conn.
162+60		13.0	End of Temporary Southern Partial Connector
191+10		13.0	Beginning of Temporary Northern Partial Connector
218+45		13.0	Beginning of Existing Temporary S-332B West Detention Area/End of Northern Partial Connector
219+83		13.0	**Centerline of 8 Stop log Riser Structures connecting to Partial Connector.**
221+27		13.0	
221+61		9.6	
223+36		9.6	**Centerline of 350 ft weir connection to Partial Connector.**
225+11		9.6	
225+45		13.0	
241+57		13.0	**Centerline of the S-332B Flowway Control Structure (Discharging south).**
244+02		13.0	End of Segment 1 (Northern end of SDA)
244+02		14.0	Beginning of Segment 2 (Southern End of NDA)/Beginning of Temporary S-332B North Detention Area.
246+91		14.0	**Centerline of the S-332B Flowway Control Structure (Discharging south).**
259+60		14.0	
259+50		13.0	
277+30		13.0	
277+50	**Segment 2 Northern Detention Area (SDA) Eastern Containment Levee**	11.0	**400 ft Emergency Overflow Weir**
281+50		11.0	**(Discharges east into the C-111 Buffer Area)**
281+70		13.0	
296+85		13.0	End of Temporary S-332B North Detention Area
458+63		13.0	Terminates into Southeast corner of 8.5 SMA STA Levee

Table 8 (Continued)
Engineering Documentation Report (EDR)
L-31W Tieback Levee

General Levee Properties

Total Length of Levee =	45,863	ft
Levee Top Width =	15	ft
Side Slope 1 on	4	(V:H)

Segment 1	**Total**		**Remaining**
Length =	24,402	ft	11,190
Average Ground Elevation =	6.5	ft, NGVD29	6.5
Average Crest Elevation =	13	ft, NGVD29	13
Depth of Overburden =	0.67	ft	0.67
Levee Height =	6.5	ft	6.5
Levee Cross Sectional Area =	312.9	sq ft (per foot of levee)	312.9
Required Volume =	282,828	cubic yards (1 to 1 ratio)	129,698
Compacted Fill =	325,253	Increased embankment fill by 15% due to compaction of soil.	149,153
Grassing =	38.4	acres	17.6
Clearing and Grubbing =	37.5	acres	17.2
Toe Drains =	Yes	Located on East side of Levee	Yes
Overburden in agricultural areas =	0.67	ft	0.67
Required Scraping for Levee Embankment (Acre) =	301	acres	138

Segment 2	**Total**		**Remaining**
Length =	21,461	ft	16,178
Average Ground Elevation =	6.5	ft, NGVD29	6.5
Average Crest Elevation =	13	ft, NGVD29	13
Depth of Overburden =	0.67	ft	0.67
Levee Height =	6.5	ft	6.5
Levee Cross Sectional Area =	312.9	sq ft (per foot of levee)	312.9
Required Volume =	248,744	cubic yards (1 to 1 ratio)	187,512
Compacted Fill =	286,056	Increased embankment fill by 15% due to compaction of soil.	215,638
Grassing =	33.8	acres	25.5
Clearing and Grubbing =	33.0	acres	24.9
Toe Drains =	Yes	Located on East side of Levee	Yes
Overburden in agricultural areas =	0.67	ft	0.67
Required Scraping for Levee Embankment (Acre) =	265	acres	199

the end, these two parcels were not obtained in time and this area was divided into two smaller detention areas. Pursuant to recommendations developed during CSOP's evaluations, this EDR is proposing to finalize the connection and to use this for an additional storage capacity when stages within the C-111 SDA (S-332B to S-332D) exceed 3 ft above average grade. Inflows are controlled by four structures into the area, two stop-log structures (see Section 1.10.1.5.5) and two passive overflow weirs (see Section 1.10.1.5.6). See Figure 10.

<u>Physical Feature</u> (Table 9)
The two east-west levees that closed off the two partial areas will be degraded and material will be incorporated into construction of the north-south levee that forms the eastern containment levee. The western levee is part of the S-332D Tieback Levee (see Section 1.10.1.3.3). Material for the construction of the levee will be obtained from the scraping of adjacent agriculture land within the detention area. If additional material is needed, additional lands will be scraped within the buffer area between the retention/detention area and the L-31N borrow canal. The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be added to supplement for levee stabilization. Levee crests will be, on average, 6 feet above grade.

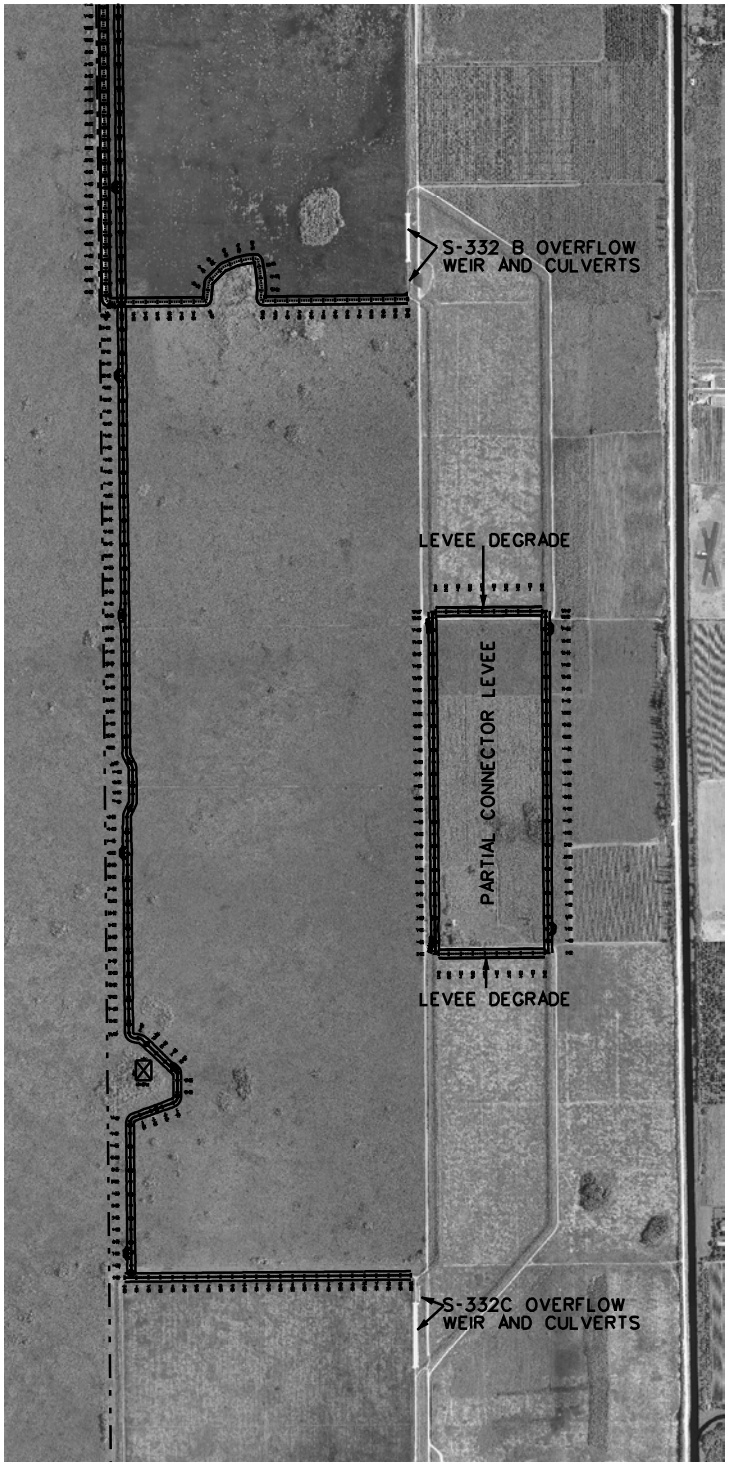
1.10.1.3.6 NDA Southern Divide Berm

<u>Purpose</u>
The purpose of this 3 foot high berm is to offset the lower portion of the C-111 NDA further away from the L-31N borrow canal. This will reduce the seepage losses from the area by increasing the seepage length. Once stages exceed 2.75 feet above average ground within the area, the two overflow weirs (see Section 1.10.1.5.16) built into the berm section will begin to utilize this part of the detention system.

<u>Physical Feature</u> (Table 10)
The berm will have a 12 foot top width with 1 on 4 (V:H) side slopes and a crest elevation approximately 3 feet above grade. The total length of the berm is 3,250 feet.

1.10.1.3.7 Frog Pond Seepage Management Levees

<u>Purpose</u>
This is a locally preferred option of the SFWMD that works in conjunction with the Frog Pond Seepage Management Pump Station (see Section 1.10.1.2.6) and Frog Pond Seepage Management Flowway Overflow Weir (see Section 1.10.1.5.14). This levee system in conjunction with the L-31W and L-31W Tieback Levee forms a detention area (544 acres) that inhibits the seepage losses to the east from the Frog Pond Detention System (Cells 1, 2, and 3). Water will be pumped from the C-111 canal to maintain the hydraulic ridge. This feature is a functional replacement for the C-111 Connector Canal that reduces the amount of water that Taylor Slough is



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GRAPHIC SCALES

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Reference files:
Figure10_EDR.DGN
File name:

C-111 Engineering
Documentation Report
Partial Connector Levees

Figure
10

Table 9
Engineering Documentation Report (EDR)
S-332 B to C Partial Connector Levee

Station	Crest Elevation (ft)	
0+00	13	Start of Levee at S-332D Tieback Levee Segment 1 (Beginning of Temporary Southern Partial Connector)
39+70	13	(End of Temp Southern Partial Connector)
68+20		(Beginning of Temporary Northern Partial Connector)
109+61	13	End Levee at S-332D Tieback Levee Segment 1 (End of Temp NDA)

General Levee Properties	Total		Remaining
Total Length of Levee =	10,961	ft	2,850
Levee Top Width =	15	ft	15
Side Slope 1 on	4	(V:H)	4
Length =	10,961	ft	2,850
Average Ground Elevation =	6.5	ft, NGVD29	6.5
Average Crest Elevation =	13	ft, NGVD29	13
Depth of Overburden =	0.67	ft	0.67
Levee Height =	6.5	ft	6.5
Levee Cross Sectional Area =	312.9	sq ft (per foot of levee)	312.9
Required Volume =	127,044	cubic yards (1 to 1 ratio)	33,033
Compacted Fill =	146,100	Increased embankment fill by 15% due to compaction of soil.	37,988
Grassing =	17.3	acres	4.5
Clearing and Grubbing =	16.9	acres	4.4
Toe Drains =	Yes	Located on outside part of Levee	Yes
Overburden in agricultural areas =	0.67	ft	0.67
Required Scraping for Levee Embankment (Acre) =	135	acres	35
Interior Area of Flowway =	23.62	acres (Required Scraping for WQ	23.62

Table 10
Engineering Documentation Report (EDR)
NDA Southern Divide Berm

Station	Crest Elevation (ft)	
0+00	13	Start of Levee at S-332D Tieback Levee Segment 1 (Beginning of Temporary Southern Partial Connector)
39+70	13	(End of Temp Southern Partial Connector)
68+20		(Beginning of Temporary Northern Partial Connector)
109+61	13	End Levee at S-332D Tieback Levee Segment 1 (End of Temp NDA)

General Levee Properties	Total	
Total Length of Levee =	3,250	ft
Levee Top Width =	15	ft
Side Slope 1 on	4	(V:H)
Length =	3,250	ft
Average Ground Elevation =	6.5	ft, NGVD29
Average Crest Elevation =	9.5	ft, NGVD29
Depth of Overburden =	0.67	ft
Levee Height =	3	ft
Levee Cross Sectional Area =	108.8	sq ft (per foot of levee)
Required Volume =	13,094	cubic yards (1 to 1 ratio)
Compacted Fill =	15,058	Increased embankment fill by 15% due to compaction of soil.
Grassing =	3.0	acres
Clearing and Grubbing =	2.9	acres
Toe Drains =	Yes	Located on outside part of Levee
Overburden in agricultural areas =	0.67	ft
Required Scraping for Levee Embankment (Acre) =	14	acres

losing to the C-111 canal. The Frog Pond Seepage Management Levees will be deferred to the CERP C-111 Spreader Canal.

<u>Physical Feature</u>
Material for the construction of the levee will be obtained from the scraping of adjacent agriculture land within the detention area. If additional material is needed, additional lands will be scraped within the buffer area between the retention/detention area and the L-31N borrow canal. The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be added to supplement for levee stabilization due to deeper detention. Levee crests will be on average 6 feet above grade.

1.10.1.4 Canals

1.10.1.4.1 S-332A

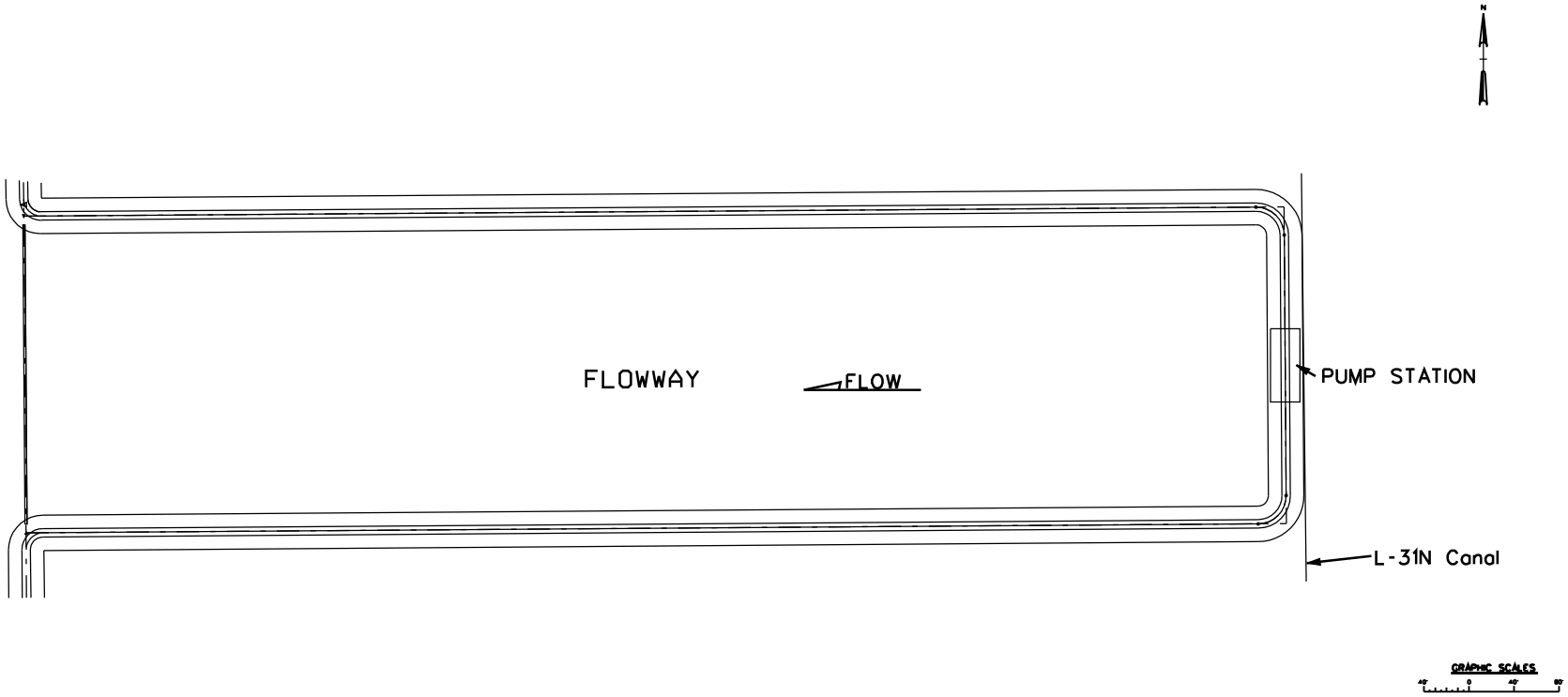
With the increase in pumping capacity at S-332B, S-332C, S-332D and the relocation of the S-357 pump station to the southern end of the 8.5 Square Mile Area (included in the authorized 2000 8.5 SMA Report), the S-332A pump station and its associated canal are no longer needed.

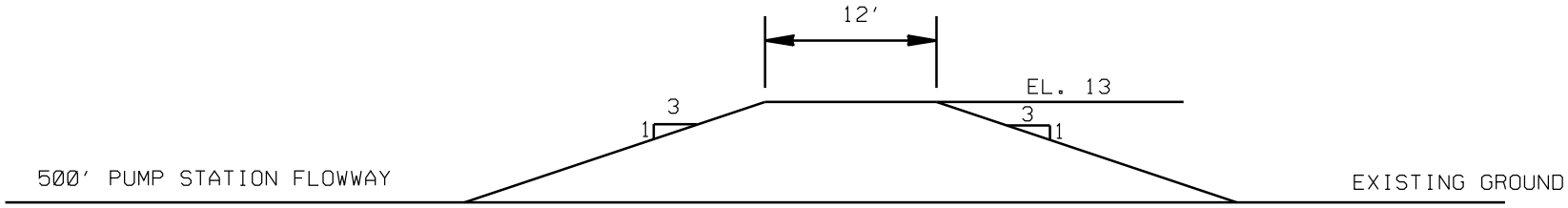
1.10.1.4.2 S-332B Flowway

<u>Refinement to 1994 C-111 GRR</u>
The 1994 C-111 GRR had a 0.5-mile long concrete-lined canal from the S-332B pump station to the retention/detention area just west of the S-332D Tieback Levee. The concrete lined canals would be provided to minimize return seepage to L-31N. Due to the increased capacity at the S-332B pump station, it is more economical to construct a 500 foot wide flowway (23.6 acres) and to allow a minimum amount of return seepage to the L-31N borrow canal. Experience in the area shows that in general, the current detention areas (S-332B West, S-332B North, and S-332C) seep approximately 0.1 to 0.3 cfs/acre, wet and dry periods, respectively. Figure 11 is a typical flowway.

<u>Purpose</u>
The purpose of the flowway is to convey water from the L-31N canal to the NDA and SDA detention areas. Depths and distribution of flows for the S-332B flowway will be controlled by the S-332B Discharge Control Structure (see Section 1.10.1.5.3). The S-332B Discharge Control Structure will also be operated to minimize scouring velocities along the toe of the levees.

<u>Physical Features</u> (Table 11)
The flowway will be contained by a portion of the S-332D Tieback Levee in addition to a new segment of levee (3,100 feet). The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be utilized for levee stabilization. Levee crests will be on average 6 feet above grade. In addition, the





TYPICAL FLOWWAY LEVEE

NOT TO SCALE

US Army Corps of Engineers
Jacksonville District

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CSOP_Alt5R_General.DGN
brdr ANSI_E.DGN
Reference files:
Figure11_EDR.DGN
File name:

C-111 Engineering Documentation Report
TYPICAL FLOWWAY

Figure 11

Table 11
Engineering Documentation Report (EDR)
S-332B Flowway Levee

Station	Crest Elevation (ft)	
0+00	14	Start of Levee at S-332D Tieback Levee Segment 1
23+40	14	S-332B Pump Station
24+70	14	
31+00	14	End of Levee at S-332D Tieback Levee Segment 2

General Levee Properties

Total Length of Levee =	3,100	ft
Levee Top Width =	15	ft
Side Slope 1 on	4	(V:H)
Length =	3,100	ft
Average Ground Elevation =	6.5	ft, NGVD29
Average Crest Elevation =	14	ft, NGVD29
Depth of Overburden =	0.67	ft
Levee Height =	7.5	ft
Levee Cross Sectional Area =	389.3	sq ft (per foot of levee)
Required Volume =	44,695	cubic yards (1 to 1 ratio)
Compacted Fill =	51,399	Increased embankment fill by 15% due to compaction of soil.
Grassing =	5.5	acres
Clearing and Grubbing =	5.3	acres
Toe Drains =	Yes	Located on outside part of Levee
)verburden in agricultural areas =	0.67	ft
Required Scraping for Levee Embankment (Acre) =	48	acres
Interior Area of Flowway =	23.62	acres (Required Scraping for WQC)

entire area within the flowway will be scraped to the cap rock and any agriculture wells within the area will be sealed by local standards (Miami-Dade Department of Environmental Resource Management (DERM)). The conceptual design for flowways is to maintain velocities less than 1 ft/s. The control structures maintain depths of a minimum 1 ft and a maximum of 4 ft.

1.10.1.4.3 S-332C Flowway

Refinements to 1994 C-111 GRR

The 1994 C-111 GRR had a 0.5-mile long concrete lined canal from the S-332C pump station to the retention/detention area just west of the S-332D Tieback Levee. The concrete lined canals would be provided to minimize return seepage to L-31N. With increased capacity at the S-332C pump station, it is more economical to construct a 500 foot wide flowway (23.6 acres) and to allow a minimum amount of return seepage to the L-31N borrow canal. Experience in the area shows that in general, the current detention areas (S-332B West, S-332B North, and S-332C) seep approximately 0.1 to 0.3 cfs/acre, wet and dry periods, respectively. The conceptual design for flowways is to maintain velocities less than 1 ft/s. The control structures maintain depths of a minimum 1 ft and a maximum of 4 ft.

Purpose

The purpose of the flowway is to convey water from the L-31N canal to the retention/detention areas. Depths of flow for the S-332C flowway will be controlled by a discharge control structure (see Section 1.10.1.5.4) to minimize scouring velocities along the toe of the levees.

Physical Features (Table 12)

The flowway will be contained by a new segment of levee (5,000 feet). The levee crown width will be 15 feet with 1 vertical on 4 horizontal side slopes. Toe drains will be utilized for levee stabilization. Levee crests will be on average 6 feet above grade. In addition, the entire area within the flowway will be scraped to the cap rock and any agriculture wells within the area will be sealed by local standards (Miami-Dade DERM). The conceptual design for flowways is to maintain velocities less than 1 ft/s. The control structures are there to maintain depths of a minimum 1 ft and a maximum of 4 ft.

1.10.1.4.4 S-332D High Head Cell

Refinements to 1994 C-111 GRR

The 1994 C-111 GRR had the pump station placed alongside the S-174 structure, and discharging into the existing L-31W borrow canal. To prevent seepage back to the L-31N and C-111 canals, the existing canal (L-31W borrow canal) would be concrete lined. With the design modifications made during the 2002 CSSS Emergency contract, the Frog Pond High Head Cell will replace the concrete lined channel.

Table 12
Engineering Documentation Report (EDR)
S-332C Flowway Levee

Station	Crest Elevation (ft)	
0+00	14	Start of Levee at S-332D Tieback Levee Segment 1
24+30	14	S-332C Pump Station
25+70	14	
49+98	14	End of Levee at S-332D Tieback Levee Segment 1

General Levee Properties

Total Length of Levee =	4,998	ft
Levee Top Width =	15	ft
Side Slope 1 on	4	(V:H)
Length =	4,998	ft
Average Ground Elevation =	6.5	ft, NGVD29
Average Crest Elevation =	14	ft, NGVD29
Depth of Overburden =	0.67	ft
Levee Height =	7.5	ft
Levee Cross Sectional Area =	389.3	sq ft (per foot of levee)
Required Volume =	72,060	cubic yards (1 to 1 ratio)
Compacted Fill =	82,869	Increased embankment fill by 15% due to compaction of soil.
Grassing =	8.8	acres
Clearing and Grubbing =	8.6	acres
Toe Drains =	Yes	Located on outside part of Levee
)verburden in agricultural areas =	0.67	ft
Required Scraping for Levee Embankment (Acre) =	77	acres
Interior Area of Flowway =	25.3	acres (Required Scraping for WQC)

Purpose

The purpose of the high head cell is to convey water from the L-31N canal to either the Frog Pond Detention Area (primary location) or the SDA (secondary location). Within the high head cell, water is controlled by two structures: the Frog Pond High Head Cell Weir (see Section 1.10.1.5.8) and the Frog Pond High Head Cell Culvert (see Section 1.10.1.5.9).

Physical Feature

This feature includes no additional construction. The L-31W levee comprises the west and north levees and segment 2 of the L-31W Tieback Levee comprises the southern levee.

1.10.1.4.5 Eastern Spreader Canal (C-111N)

The construction and operation of the S-332E pump station/C-111N shall be reevaluated at later date.

The 1994 C-111 GRR planned for the existing pump stations S-332 and S-332I to remain in operation. With the backfill of L-31W borrow canal north of these structures, it became necessary to create a connection between the C-111 canal and the L-31W borrow canal. This EDR recommends that these structures be de-authorized, demolished, and that this feature not be constructed. With the creation of the Frog Pond Detention System, water deliveries to Taylor Slough can be made via the S-332D pump station.

1.10.1.4.6 Canal 109 (C-109)

The 1994 C-111 GRR included placement of nine plugs in C-109. This work has been completed by Florida Department of Transportation (FDOT). The FDOT improved US 1 by widening the road and in the process backfilled the canal for mitigation credits for the road impact.

1.10.1.4.7 Canal 110 (C-110)

There are no refinements to the 1994 C-111 GRR plan. The GRR called for ten plugs to be constructed in the canal to help promote sheetflow from north to south between these canals (C-109 and C-110). Material for the construction of the plugs would be obtained from the adjacent disposal mounds. This work is still planned for the C-111 project but is being deferred until the CERP C-111 Spreader Canal Project determines the full extent of backfilling required for ecological restoration of the Southern Glades area.

1.10.1.4.8 Aerojet Canal

Purpose

Canal plugs will be constructed in the existing Aerojet Canal to reduce the southward flow of water during dry conditions. This will improve the nearby hydroperiods of the Southern Glades and reduce the unnaturally large flows, supplied through the Frog Pond Detention Area (via S-332D), that are then lost from Taylor Slough. These plugs will greatly reduce the surface water conveyance capacity when the water level reaches ground surface. In addition, the plugs will slightly reduce the surface water conveyance as they stop flow through the canal, but do not prevent flow altogether, i.e. flow continues around the plugs, through the marsh, and subsequently back into the canal.

Location

The Aerojet Canal is located approximately 1 mile south of Ingraham Highway and halfway between L-31W and C-111. The Aeroject Canal extends approximately 4.75 miles due south of its starting point. Constructed as part of a testing facility, the canal is approximately 20 feet deep and has a road that runs parallel to it along its east side. Approximately two miles south of the beginning of the canal, a separate canal runs east-west. The western terminus of the east-west canal connects into the L-31W borrow canal and extends east approximately 10,000 feet.

Physical Feature

Four canal plugs will be placed in the canal, two in the north-south canal and two in the east-west canal. These plugs will have a 100 foot top width in the direction of flow, 1 on 5 (V:H) side slopes, and will be backfilled to 1 foot above the surrounding grade. Material will be obtained from the C-111 Spoil Mound stock pile within the Frog Pond area. In addition, there are existing earthen canal crossings at the confluence of the two canals. Until field investigations can be performed, it is assumed that culverts exist in these crossings that will also need to be plugged.

1.10.1.4.9 Frog Pond Seepage Management Area Flowway

Purpose

A 500-foot flowway will be created to connect the new Frog Pond Seepage Management Pump Station to the detention area.

Physical Feature

The Frog Pond Seepage Management Levee system will create the two levees for this feature (see Section 1.10.1.2.6 Frog Pond Seepage Management Pump Station). The Frog Pond Seepage Management Area Flowway is being deferred to the CERP C-111 Spreader Canal Project.

1.10.1.5 Control Structures

1.10.1.5.1 Overflow Weirs to the West through L-31W Tieback Levee

Refinements to 1994 C-111 GRR

The 1994 C-111 GRR planned for twenty –four (24) 36-inch diameter culvert/risers to convey water from the retention/detention area westward (through the L-31W tieback levee) towards ENP, and one emergency overflow weir (300 feet). Each feature was designed to pass 50% of the maximum pump capacity of the three pump stations S-332B, S-332C, and S-332D, with 0.5 feet of head difference. Pursuant to evaluations by the CSOP PDT, this EDR recommends placing four overflow weirs in the L-31W Tieback levee. Two weirs will be placed in each detention area.

Location
The two weirs in the C-111 NDA will be located approximately 2 miles north of the S-332B Control Structure. One will be in the center of the east-west run of the L-31W Tieback Levee and the other will be in the north-south run of the tieback levee. The two weirs in the C-111 SDA will be located on the L-31W Tieback Levee. The first will be halfway between the S-332B and S-332C pump stations and the second will be halfway between the S-332C and S-332D pump stations.

Purpose
The purpose of these structures is to maintain the level of service for flood damage reduction for the C-111 Basin. When stages exceed 3.5 within the respective detention area, water will begin to be discharged west of the L-31W tieback levee, towards ENP.

Physical Feature (Table 13)
Weirs will each be 240 feet long and designed to pass 250 cfs with 0.5 feet of head (see Figure 12). The weir will be constructed from concrete with a filter fabric underlayment. The weir will have a 12-foot top width and 1 on 3 (V:H) side slopes.

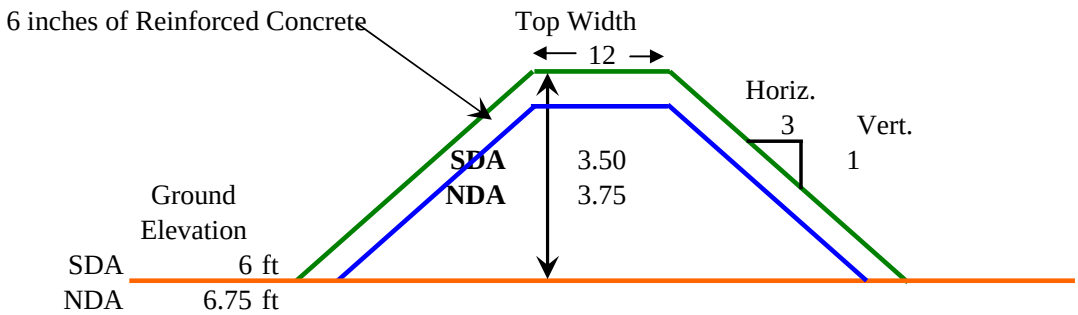
1.10.1.5.2 NDA Eastern Overflow Weir

Purpose
This feature was constructed during the 2002 IOP Emergency Contract to provide an emergency outlet to the temporary S-332B North Detention Area that discharges water to the east into the C-111 buffer lands (see Figure 13). It will remain as a component of the completed project and provide an additional level of protection to the integrity of the levees in this area.

Location
Located on the S-332D Tieback Levee approximately 0.25 mile north of the S-332B pump station.

Table 13
Engineering Documentation Report (EDR)
Southern and Northern Detention Areas (SDA and NDA) Western Emergency Overflow Weirs

Number of Structures	4	(two in the NDA and two in the SDA)
Weir Length	240	ft, each
Crest Elevation		
SDA	9.5	ft, NGVD29
NDA	10.5	ft, NGVD29



Individual Weirs

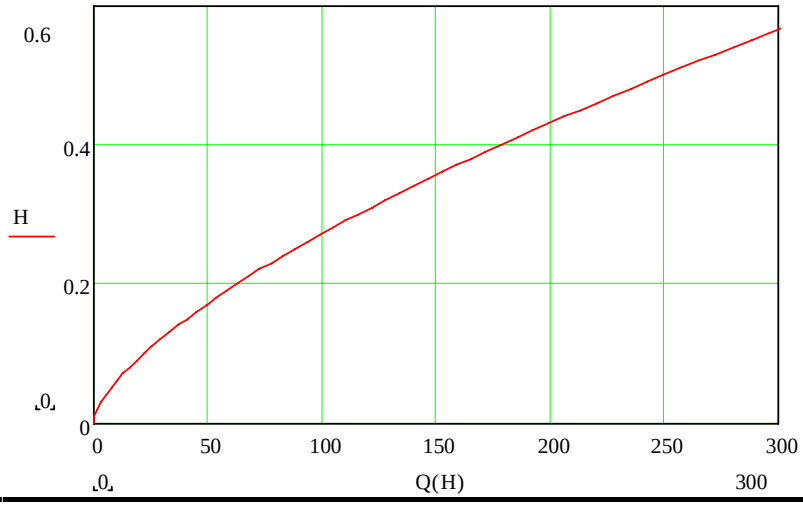
Total Length of Concrete =	310	ft (includes 1 on 10 ramps from levee crest)
Thickness of concrete overflow Weir =	0.5	ft
General Cross Sectional Area =	20	sq ft (concrete per foot of weir)
Total Volume of Concrete =	230	cubic yards per location
Wire Mesh Reinforcement =	11072	sq ft (6-6-10 wire)

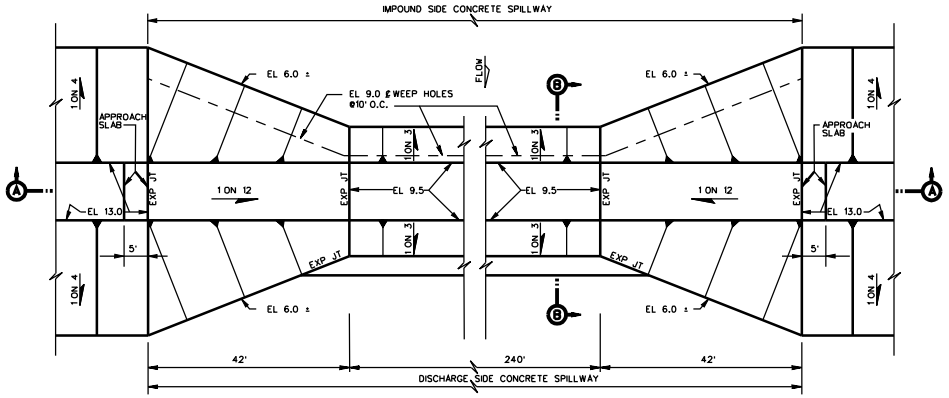
Hydraulic Design

Design Condition

Discharge	250	cfs
Headwater Elevation	10 & 11	ft, SDA and NDA respectively
Tailwater Elevation	---	ft, assumed no tailwater influence

Discharge Rating Curve





WEIR PLAN - FLOWWAY
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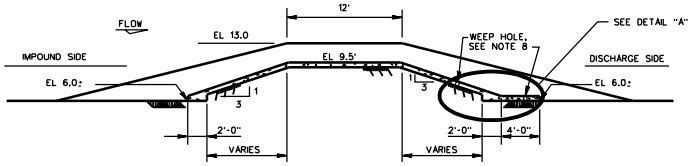
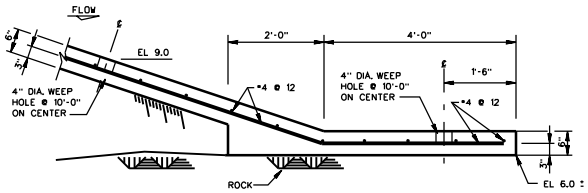


SECTION B-B
SCALE: 8



DETAIL "A"
SCALE: D

NOT TO SCALE

US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

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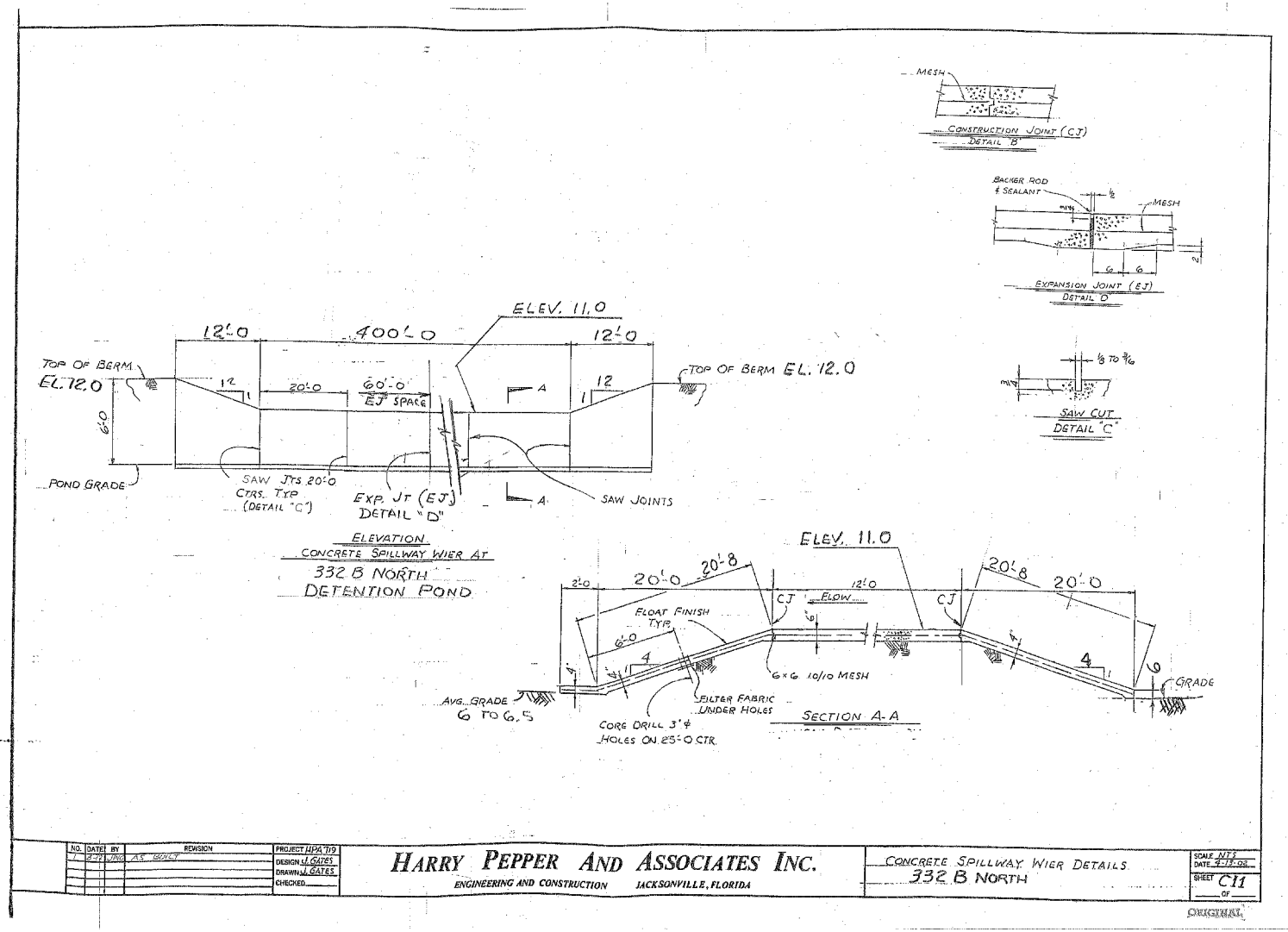
Reference files:
Figure12_EDR.DGN
File name:

C-111 Engineering Documentation Report
WESTERN OVERFLOW WEIR

Figure
12



NO.	DATE	BY	REVISION
1	9-11	DRG	AS BUILT

PROJECT HPA 719
DESIGN W. GATES
DRAWN W. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

CONCRETE SPILLWAY WIER DETAILS
332 B NORTH

SCALE NTS
DATE 4-13-06
SHEET C11 OF

ORIGINAL

US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files:
Figure13_EDR.DGN
File name:

C-111 Engineering Documentation Report
NDA EASTERN OVERFLOW WEIR
AS-BUILT

Figure 13

Physical Feature
This 400 foot over flow weir is constructed of cast in place concrete with a 12 foot top width and 1 on 3 (V:H) side slopes. Transition slopes from levee crest to weir crest are 1 on 10 (V:H). The weir was placed 3.6' above inside pond grade.

1.10.1.5.3 S-332B Discharge Control Structure

Refinement to 1994 C-111 GRR
No control structure was envisioned in the 1994 C-111 GRR. Instead, the GRR provided for the S-332B Canal to be extended past the S-332D tieback levee and water would be discharged into the retention/detention area. With the incorporation of the C-111 NDA and the flowway system for a canal, it becomes necessary to control the flows.

Purpose
The control structure will allow the diversion of flows either to the north or west to maximize the operational flexibility of the detention system. The divide structure will be designed such that the entire capacity of the pump station can be passed either west or north with a foot of head loss. In addition the structure will maintain a certain depth within the detention area to minimize the erosive velocities in the flowway along the levee toes.

Location
These two structures are located on the western end of the S-332B Flowway, approximately 2,000 feet west of pump station S-332B.

Physical Feature (Table 14)
Two structures will be constructed in the same general vicinity. One discharges north and the other discharges west. Each structure will consist of 5 concrete box culverts (3 ft high by 6 ft wide) with slide gates (see Figure 14). Telemetry will be used to control the distribution of flow between the two detention areas.

1.10.1.5.4 S-332C Discharge Control Structure

Refinement to 1994 C-111 GRR
No control structure was envisioned in the 1994 C-111 GRR. Instead, the GRR provided for the S-332C Canal to be extended past the S-332D tieback levee and water would be discharged into the retention/detention area. With the incorporation of the flowway system, it becomes necessary to control the flows within the flowway area.

Purpose
The purpose of this simple overflow weir is to increase the stage within the flowway area during low flows and startup operations to prevent excessive velocities from eroding the toe of the levee.

Table 14
Engineering Documentation Report (EDR)
S-332B Control Culverts

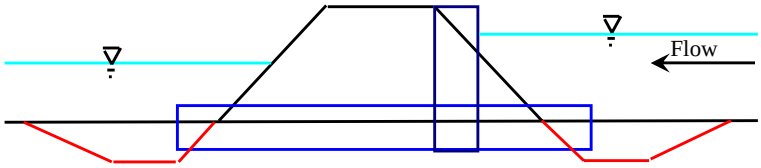
Purpose: These two structures are located on the western end of the S-332B flowway system. Structures are controlled by telemetry and allow for the distribution of flow from the S-332B pump station to either the C-111 Northern Detention Area (NDA) and/or the C-111 Southern Detention Area (SDA). The ability to split the flow allows the operational flexibility to maximize the usage of the two storage areas.

Culvert Data

Number of Structures	2
Number of Barrels per Structure	4
Barrel Type	Concrete Box Culverts
Dimensions:	
Height	3 ft
Width	6 ft
Length	80 ft
Invert Elevation	4 ft, (2 feet below grade)
Type of Control	Slide Gate

Discharge and Approach Sump

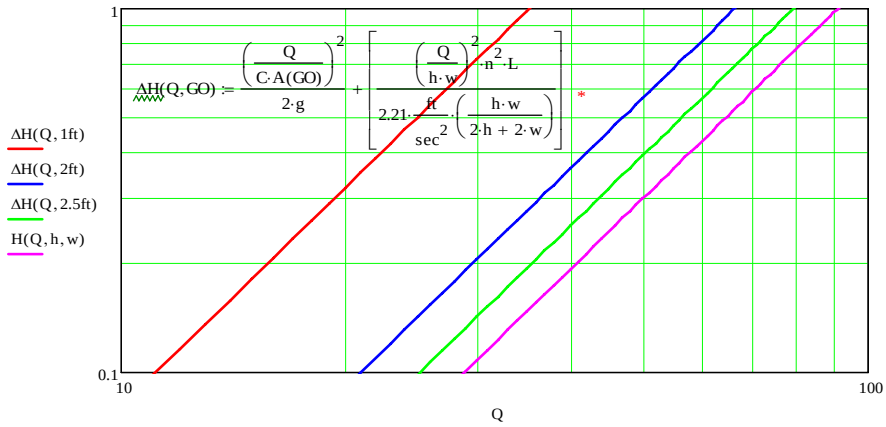
Width of Approach/Discharge Area =	62 ft, (Assumes 10 ft passed end culverts and the width of the box culvert between each culvert.)
Length of Approach/Discharge Area =	20 ft
Side Slopes 1V to	5 H
Invert Elevation =	3.5 ft
Approx. Ground Elevation =	6 ft
Cross Sectional Area =	75 sq ft
Volume to be excavated =	380 cubic yards (US and DS total per location)

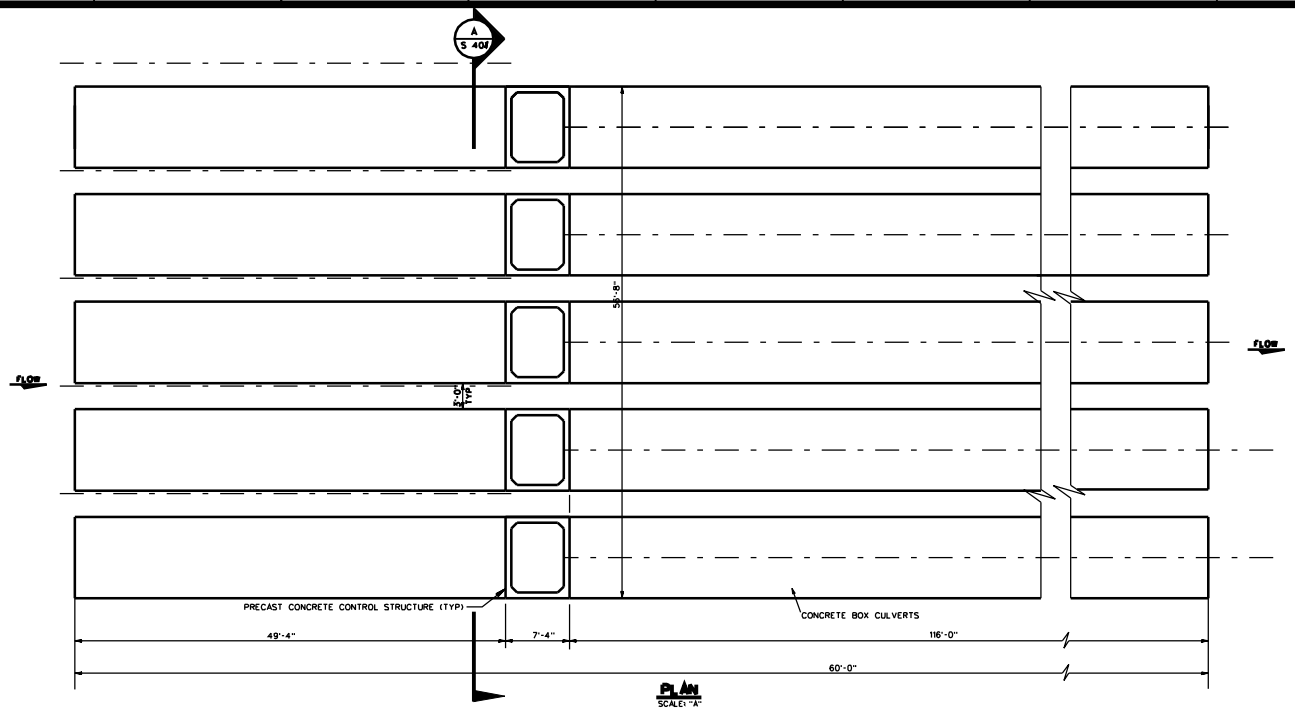


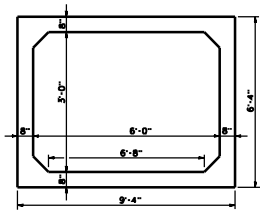
Design Condition

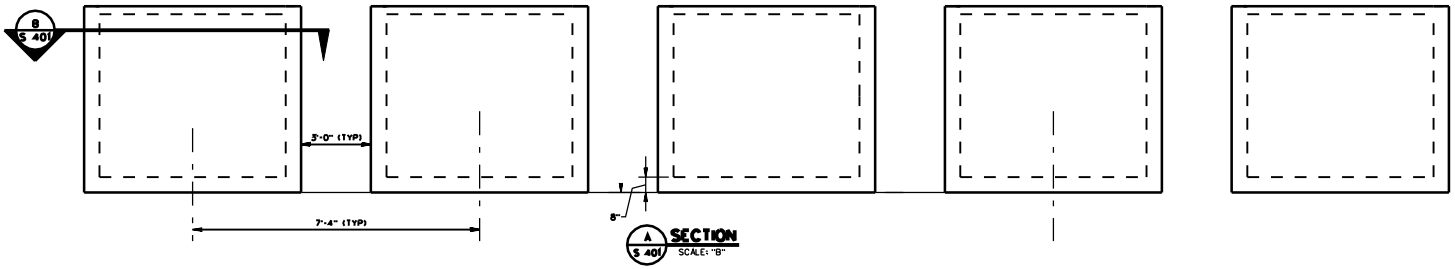
Discharge	250 cfs
Delta H	0.5 ft, (Assumes culv are flowing full and fully open.)

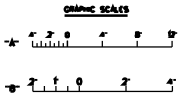
Discharge Rating Curve











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Jacksonville District

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Ckd by: G.J.N.
DWN by: G.J.N.

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Reference files:
Figure14_EDR.DGN
File name:

C-111 Engineering
Documentation Report
S332B FLOWWAY CONTROL
STRUCTURE

Figure
14

Location
This structure is located on the western end of the S-332B Flowway, approximately 2,000 feet west of pump station S-332B.

Physical Feature (Table 15)
Two possible construction techniques are being investigated (decisions will be made during detail design):

1.10.1.5.4.1 Option 1: Concrete Curb

The existing overburden should already be removed as part of the scraping for perimeter levee construction. A six-inch deep trench should be excavated for the toe of the curb. A curbing machine should be used to place a concrete curb within the trench that will have a height and width of 2 feet, giving an elevation of 1.5 feet above grade.

1.10.1.5.4.2 Option 2: Pre-Cast Piles
Placing pre-cast concrete piles end on end for the total length. Piles would be cast in 50 foot segments (890 piles). Each pile will be placed in a trench that would be cut approximately 6 inches into the rock. In addition, a poly-ethylene seal will be placed at the ends of all the piles.

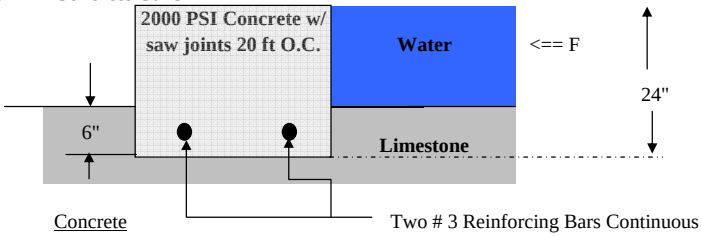
1.10.1.5.5 Culvert Connections to the Partial Connector

Purpose
These two culvert structures were originally constructed as part of the 2002 CSSS Emergency contract to discharge water from the S-332B West and the S-332C detention area into the partial connector to form a continuous hydraulic ridge between the two detention areas. With the completion of the C-111 project, these structures will be utilized to take advantage of additional storage capacity (S-332B to S-332D). This area will not be used until stages exceed 3 feet due to its proximity to the L-31N canal.

Physical Features (Table 16)
The two culvert structures consist of eight 4-foot diameter culverts with 6-foot risers, approximately 2,300 feet south of the S-332B inflow point; and fifteen 4- foot diameter culverts with 6 foot risers, approximately 1,700 feet north of the S-332C inflow point (see Figures 15 and 16, respectively). Culverts were set with the inverts 2 feet below grade and aluminum walkways were constructed for access. The control portion of the stop-log riser extends upwards to an even elevation equal to the levee crest. The stop-log riser from the S-332B West Detention Area has a flow capacity of 125 CFS. The stop-log riser from the S-332C Detention Area has a flow capacity of 250 CFS.

Table 15
Engineering Documentation Report (EDR)
S-332C Control Structure

A) Option 1 -- Concrete Curb



Concrete

Total length =	500	ft
Width =	2	ft
Height =	2	ft
Area =	4	sq ft (per foot of curb)
Volume =	81	cubic yards of concrete (Added an additional 10%)

Rock Excavation

Width =	2.25	ft
Depth =	0.5	ft
Area =	1.125	sq ft (per foot of curb)
Volume =	21	cubic yards of rock Excavation

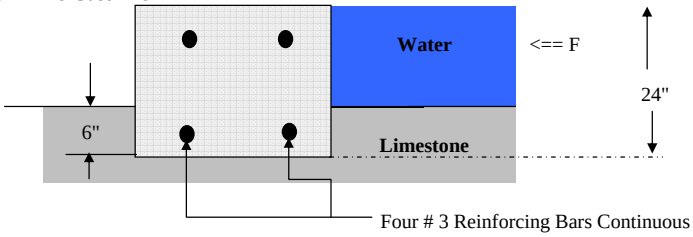
Formwork

Number of sides =	2	
Height =	2	ft
Area =	2,000	sq ft

Rebar

Number of Bars =	2			
Diameter =	0.375	inches		
Weight =	0.375	lbs/ft		
Lbs of Steel =	375	lbs		
Lap Splice & supports =	7.50%		28	lbs
Total Steel Quantity =	403	lbs		

B) Option 2 Pre-Cast Pile



Concrete

Total length =	500	ft
Width =	2	ft
Height =	2	ft
Area =	4	sq ft (per foot of curb)
Volume =	81	cubic yards of concrete (Added an additional 10%)

Rock Excavation

Width =	2.25	ft
Depth =	0.5	ft
Area =	1.125	sq ft (per foot of curb)
Volume =	21	cubic yards of rock Excavation

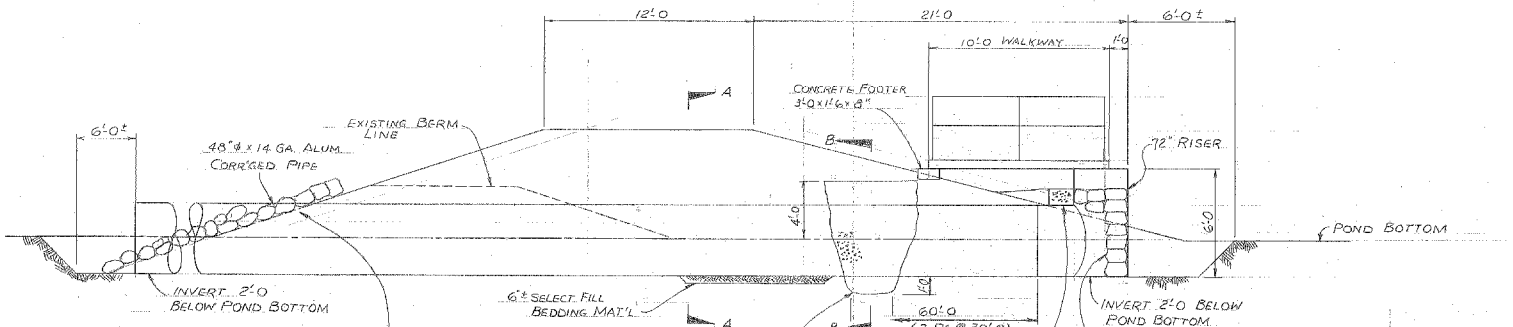
Rebar

Number of Bars =	4	
Diameter =	3/8	inches
Weight =	0.375	lbs/ft
Tons of Steel =	750	lbs

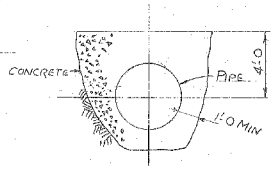
Length of Pre-Stressed Piles =	50	ft
Number of Piles =	10	
Poly-Ethylene Seals =	9	

Table 16
Engineering Documentation Report (EDR)
Stop-Log Culvert Connections to Partial Connector

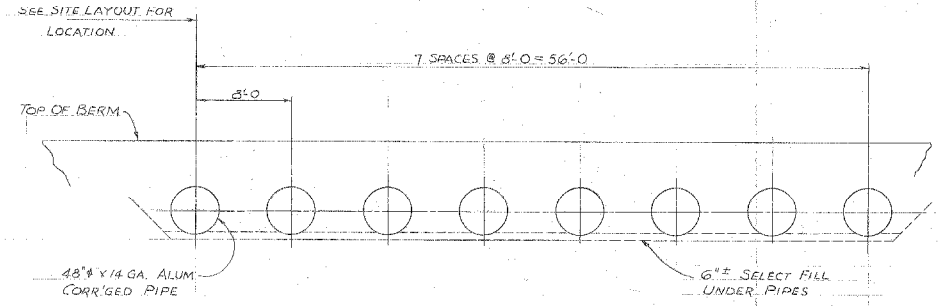
	Northern part of Partial Connector	Southern part of Partial Connector	
Number of Culverts	8	15	
Culvert Diameter	4 ft	4 ft	
Culvert Length	66 ft	66 ft	
Culvert Invert	4 ft	4 ft	(Approximately 2 ft below grade)
Material Type	Corrugated Aluminum Pipe (CAP)		
Riser Width	6 ft	6 ft	
Riser Height	6 ft	6 ft	
Culvert Spacing	8 ft	8 ft	Center to Center
Walkway	Aluminum for each riser		



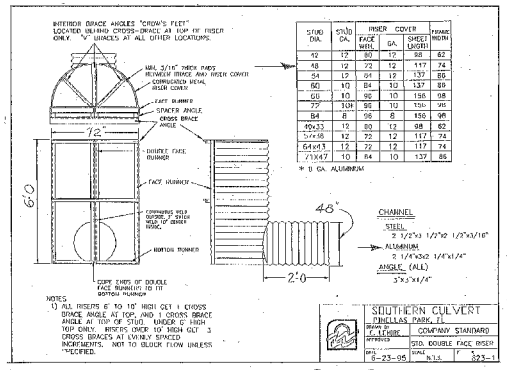
SECTION THRU 332 B
EAST DETENTION POND BERM
48"ϕ STOP LOG RISER



SECTION B-B



SECTION A-A



STUD DIA.	STUD GA.	RISER COVER FACE WIDTH	RISER COVER GA.	RISER COVER SHEET LENGTH	FRAME WIDTH
42	12	80	12	98	62
48	12	72	12	117	74
54	12	64	12	137	86
60	10	84	10	137	89
66	10	96	10	156	98
72	10*	96	10	156	98
84	8	96	8	156	98
40x33	12	80	12	98	62
54x48	12	72	12	117	74
64x53	12	72	12	117	74
71x47	10	84	10	137	86

* 8 GA. ALUMINUM

RISER DETAIL

RECORD DRAWING
DACW17-02-C-0018
AUGUST 2002

HARRY PEPPER & ASSOC., INC.

NO.	DATE	BY	REVISION
1	8-12	JWC	AS BUILT

PROJECT H/PATIO
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.

ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

48"ϕ STOP LOG RISERS
332 B EAST DETENTION POND BERM

SCALE N/A
DATE 4-27-02
SHEET C6
OF

ORIGINAL

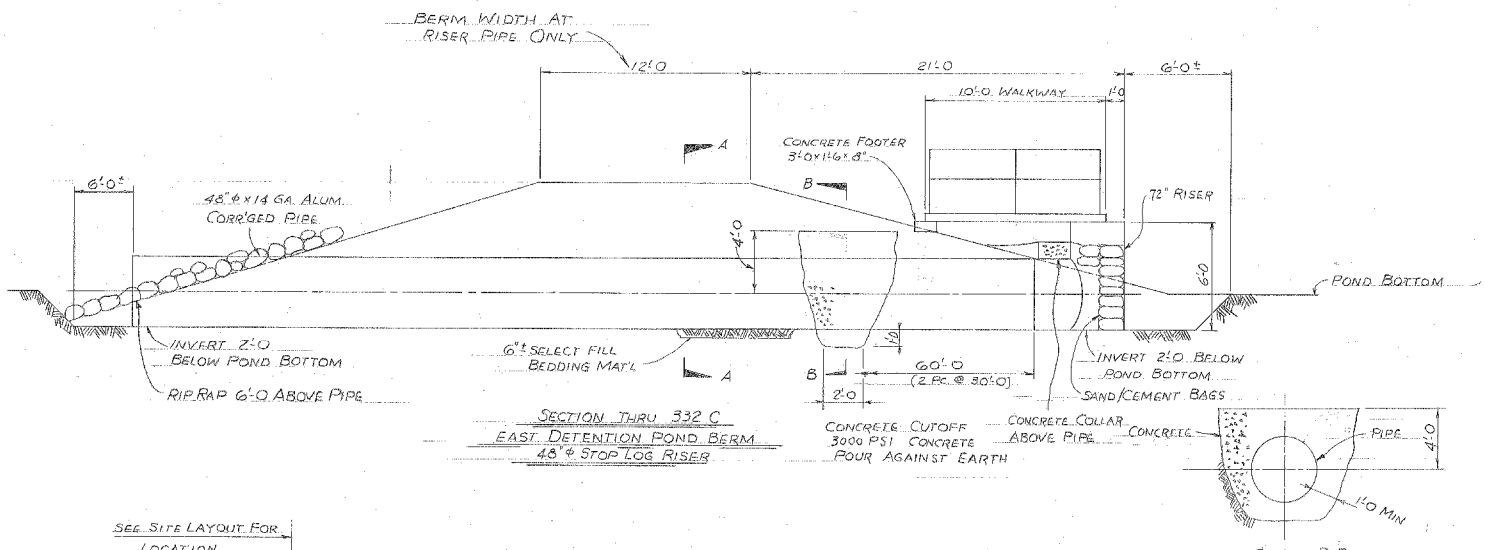
US Army Corps of Engineers
Jacksonville District

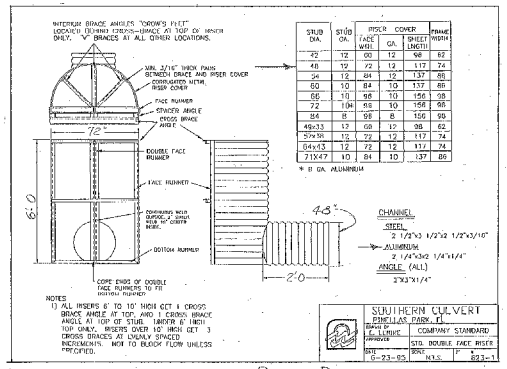
Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files:
Figure15_EDR.DGN
File name:

C-111 Engineering Documentation Report
8-BARREL CONNECTION TO PARTIAL CONNECTOR AS-BUILT

Figure 15





STUB DIA.	STUB GA.	RISER COVER FACE WIDTH	RISER COVER GA.	RISER COVER SHEET LENGTH	FRAME WIDTH
42"	12	60	12	98	62
48	12	72	12	117	74
54	12	84	12	137	86
60	10	84	10	137	86
66	10	96	10	156	98
72	10*	96	10	156	98
84	8	96	8	156	99
49x33	12	60	12	98	62
57x38	12	72	12	117	74
64x43	12	72	12	117	74
71x47	10	84	10	137	86

* 8 GA. ALUMINUM

RISER DETAIL

RECORD DRAWING
DACW17-02-C-0018
AUGUST 2002

HARRY PEPPER & ASSOC., INC.

NO.	DATE	BY	REVISION
1	2-12	JWG	AS BUILT

PROJECT HPA 719
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

48"φ STOP LOG RISERS
332C EAST DETENTION POND BERM

SCALE N/A
DATE 4-29-02
SHEET C7 OF

US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files:
Figure16_EDR.DGN
File name:

C-111 Engineering Documentation Report
15 BARREL CONNECTION TO PARTIAL CONNECTOR AS-BUILT

Figure 16

1.10.1.5.6 Weir Connections to the Partial Connector

Purpose

These two weir structures were originally constructed as part of the 2002 CSSS Emergency contract to discharge water from the S-332B West and the S-332C detention area into the partial connector to form a continuous hydraulic ridge between the two detention areas. With the completion of the C-111 project, these structures will be utilized to take advantage of additional storage capacity (S-332B to S-332D).

Physical Feature (Table 17)

The two passive overflow weirs are constructed of cast in place concrete and have lengths of 350 feet and 500 feet, north and south weir, respectively (see Figure 17). Both weirs have an average crest elevation of 9 ft (NGVD 1929, approximately 3.6 feet above grade). The weir crest are 12 feet wide with 1 on 3 (V:H) side slopes.

1.10.1.5.7 SDA Eastern Overflow Weir

Purpose

This feature was constructed during the 2002 IOP Emergency Contract to provide an emergency outlet to the temporary S-332C Detention Area that discharges water to the east into the C-111 buffer lands. It will remain as a component of the completed project and provide an additional level of protection to the integrity of the levees in this area.

Physical Feature (Table 18)

This passive concrete overflow weir has a crest elevation of 10.1 feet (NGVD 1929, approximately 4.1 feet above grade), constructed of cast in place concrete with a 12 foot top width and 1 on 3 (V:H) side slopes (see Figure 18).

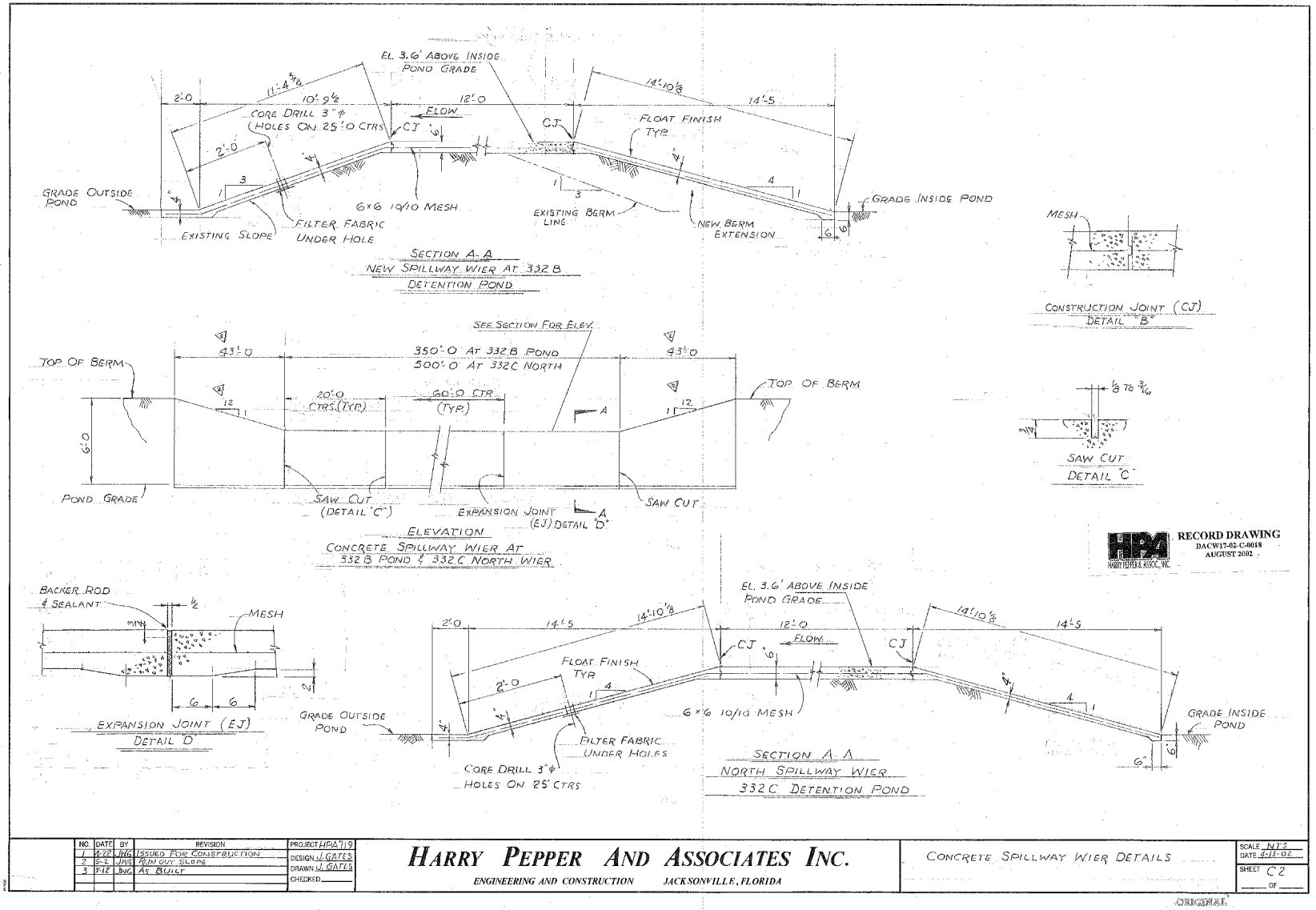
1.10.1.5.8 Frog Pond High Head Cell Weir

Purpose

Constructed during the 2002 IOP Emergency Contract to provide a high head cell to deliver water south into the Frog Pond Detention System and finally to Taylor Slough. The reason for constructing the High Head Cell was that the deeper stages would help settle out particulates from the water column before continuing through the system. An additional reason at the time was to do a field test with several cells to test treatment technologies for the removal of phosphorous (periphyton technologies). This high head cell would provide a constant elevation pool to deliver water to the different treatment cells. However this test was never performed and is now being conducted in other projects.

Table 17
Engineering Documentation Report (EDR)
Weir Connections to Partial Connector

	Northern part of Partial Connector	Southern part of Partial Connector	
Weir Type	Broadcrested		
Weir Length	350 ft	500 ft	
Crest Width	12 ft	12 ft	
Crest Elevation	9.5 ft	9.5 ft	(Approximately 3.5 feet above grade)
Side Slopes	1 on 4	1 on 4	V to H, US and DS
Slab Thickness			
Crest	0.5 ft	0.5 ft	
Side Slopes	0.333 ft	0.333 ft	
Design Condition			
Discharge	350	500	cfs
Headwater Elevation	10.0 ft	10.0 ft	
Tailwater Elevation	No influence		
Velocity	2 ft/s	2 ft/s	



NO.	DATE	BY	REVISION
1	4-22	JNG	ISSUED FOR CONSTRUCTION
2	6-2	JNG	RUN OUT SLOPE
3	7-12	JNG	AS BUILT

PROJECT HPA 719
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

CONCRETE SPILLWAY WIER DETAILS

SCALE N.T.S.
DATE 7-13-02
SHEET C2 OF

ORIGINAL

US Army Corps of Engineers
Jacksonville District

Ckd by: G.J.N.
Designed by: G.J.N.
DWN by: G.J.N.

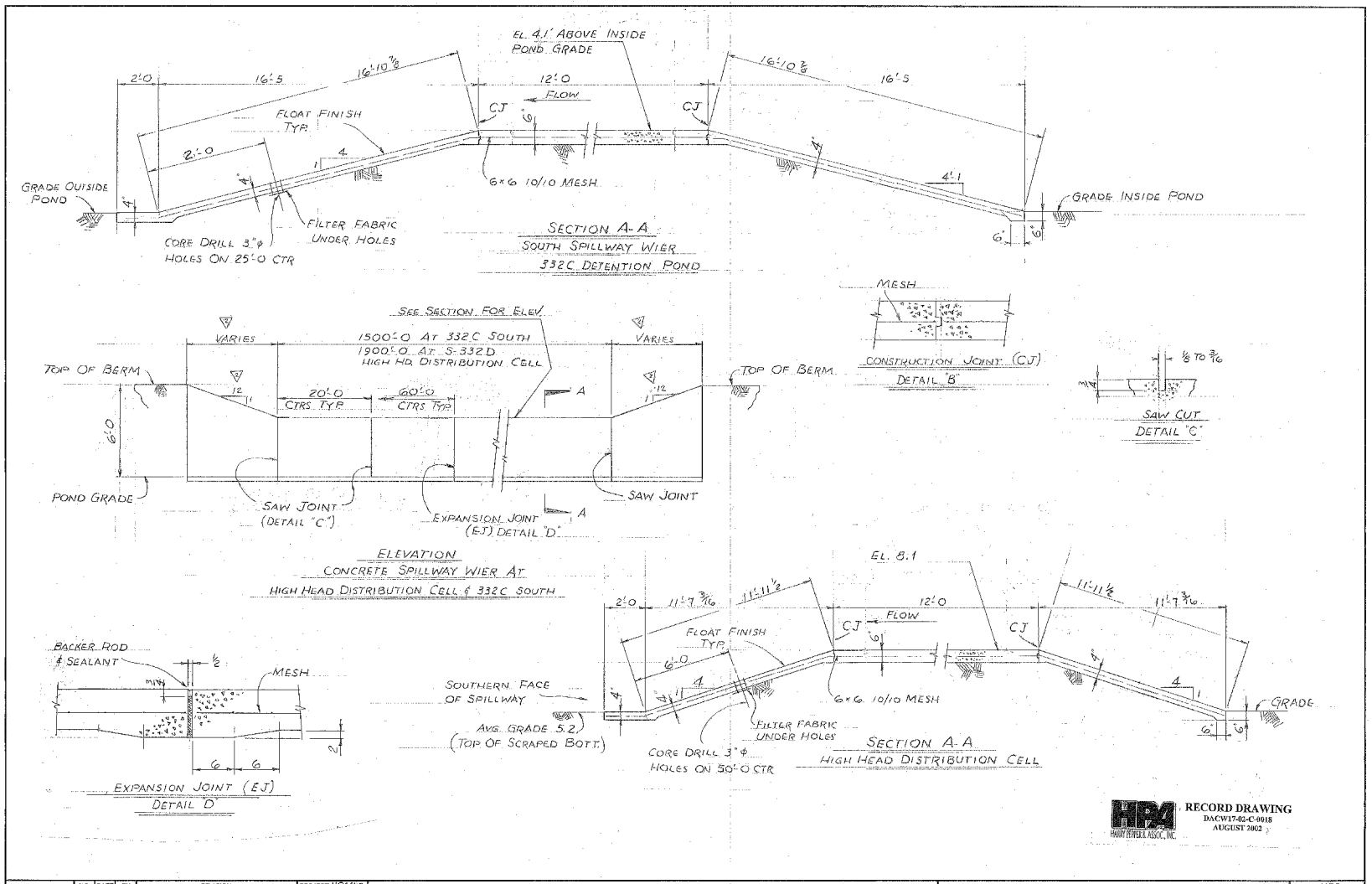
brdr ANSI_E.DGN
Reference files: Figure17_EDR.DGN
File name:

C-111 Engineering Documentation Report
WEIR CONNECTIONS TO PARTIAL CONNECTOR AS-BUILTS

Figure 17

Table 18
Engineering Documentation Report (EDR)
C-111 NDA and SDA Eastern Emergency Overflow Weir

Weir Type	Broadcrested		
Weir Length	400 ft	1,500 ft	
Crest Width	12 ft	12 ft	
Crest Elevation	10.1 ft	10.1 ft	(Approximately 4.1 feet above grade)
Side Slopes	1 on 4	1 on 4	V to H, US and DS
Slab Thickness			
Crest	0.5 ft	0.5 ft	
Side Slopes	0.333 ft	0.333 ft	
Design Condition			
Discharge	400	1500	cfs
Headwater Elevation	10.6 ft	10.6 ft	
Tailwater Elevation	No influence	No influence	



NO.	DATE	BY	REVISION
1	6-22	JNG	ISSUED FOR CONST.
2	5-6	JNG	RUN OUT SLOPE
3	8-12	JNG	AS BUILT

PROJECT HPA#119
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

CONCRETE SPILLWAY WIER DETAILS

SCALE NTS
DATE 4-13-02
SHEET C3
OF

ORIGINAL

US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files:
Figure18_EDR.dgn
File name:

C-111 Engineering Documentation Report
SDA EASTERN WEIR/FROG POND
HIGH HEAD WEIR, AS-BUILT

Figure 18

Physical Feature (Table 19)
An 1840-foot broad crested concrete overflow weir with a crest elevation of 8.1 feet (NGVD29) and 1 on 3 (V:H) side slopes that discharges into Cell 1 of the Frog Pond (see Figure 18).

1.10.1.5.9 Frog Pond High Head Cell Culvert

Purpose
This gated culvert structure will maximize the operational flexibility of the Frog Pond detention area by allowing the discharge of water to the north (S-332B and S-332D Detention/Retention Zone). The gated culvert will be designed to pass 50% of the total capacity of the S-332D pump station (575 cfs) into the L-31W Borrow Canal (BC) with a half foot of head loss. The L-31W BC will act as a distribution canal to help distribute flows evenly to this portion of the detention/retention zone.

Physical Feature (Table 20)
This structure is designed to pass 250 cfs north through four 5-foot diameter culverts with a 0.5 foot of head loss. The structure will have slide gates controlled by telemetry from the S-331 command building (see Figure 19).

1.10.1.5.10 Frog Pond Cell 1 Berm/Weir

Purpose
Constructed during the 2002 CSSS Emergency contract to maintain stages within Cell 1 at a minimum depth of 1.5 feet.

Physical Feature (Table 21)
Earthen Overflow Weir at the southern end of Cell 1 is approximately 2,100 feet in length, 100 feet wide, and 1 on 3 side (V:H) slopes with a crest elevation approximately 1.5 feet above grade (Based on CSOP LIDAR it appears this berm is approximately elevation 6.5 ft, NGVD29).

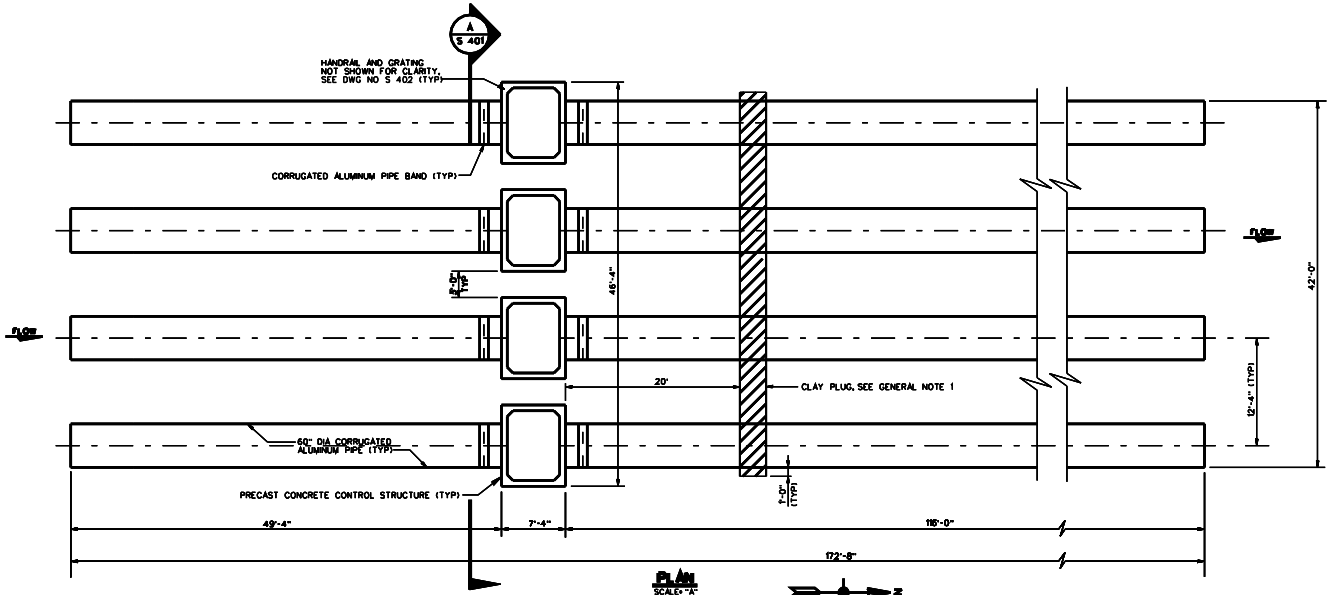
1.10.1.5.11 Frog Pond Cell 1 Culvert

Purpose
Constructed during the 2002 CSSS Emergency to pass water from Cell 1 into the L-31W borrow canal for water supply needs for Taylor Slough. It was expected that water deliveries to Taylor Slough might be difficult based on assumed infiltration rates so this structure was built to short circuit the remainder of the system for water supply to Taylor Slough. The intent of this structure will be maintained during future operations.

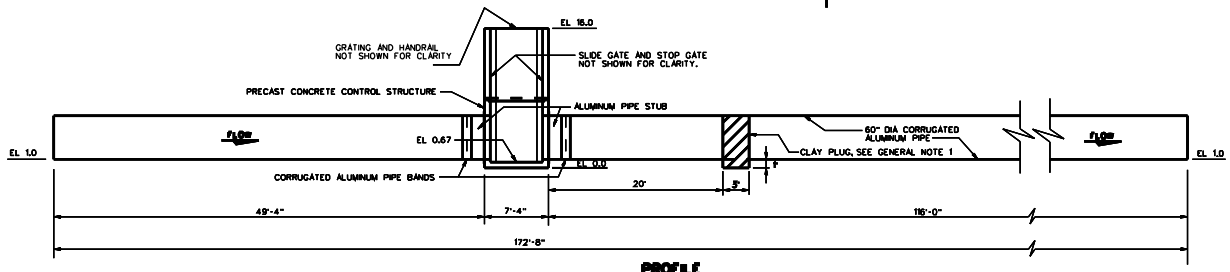
Physical Feature (Table 22)
This culvert structure consists of eight 60-inch slide gated culverts through the L-31W tieback levee with inverts set 5 feet below grade (see Figures 20 and 21). The

Table 19
Engineering Documentation Report (EDR)
C-111 Frog Pond High Head Weir

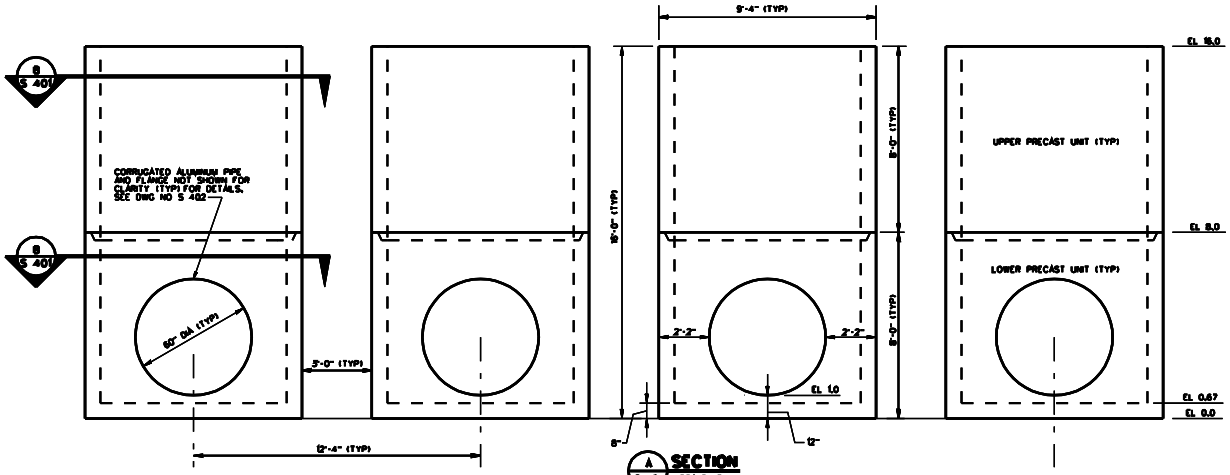
Weir Type	Broadcrested	
Weir Length	1,900 ft	
Crest Width	12 ft	
Crest Elevation	8.2 ft	(Approximately 3 feet above grade)
Side Slopes	1 on 4	V to H, US and DS
Slab Thickness		
Crest	0.5 ft	
Side Slopes	0.333 ft	
Design Condition		
Discharge	500	cfs
Headwater Elevation	8.45 ft	
Tailwater Elevation	No influence	



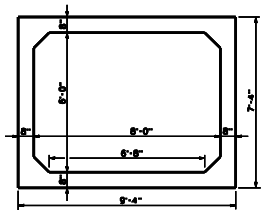
PLAN
SCALE: "A"



PROFILE
SCALE: "A"



A S 401 SECTION
SCALE: "B"



B S 401 SECTION
SCALE: "B"

GRAPHIC SCALES

CONCRETE PRECAST UNIT NOTES:

1. PRECAST UNITS SHALL BE DESIGNED TO MEET THE REQUIREMENTS OF ASTM C 1433-02a, TABLE 1. DESIGN REQUIREMENTS FOR PRECAST CONCRETE BOX SECTIONS UNDER EARTH DEAD AND HS20 LIVE LOAD CONDITIONS. SPAN SHALL BE 8 FEET AND RISE SHALL BE 6 FEET AND DESIGN EARTH COVER SHALL BE 10 FEET.
2. PRECAST SECTION JOINTS SHALL BE WATER TIGHT AND SEALED WITH EXTERNAL SEALING BANDS THAT MEET THE REQUIREMENTS OF ASTM C 877-02. BANDS SHALL BE TYPE II WITH STEEL STRAPS.
3. TOP AND BOTTOM UNITS OF THE CONTROL STRUCTURE SHALL INCLUDE EMBEDDED ANGLE. FOR DETAILS, REFER TO DWG NO S 403.
4. THE BOTTOM SLAB OF THE LOWER PRECAST UNIT SHALL HAVE THE SAME REINFORCEMENT AS THE WALLS.

GENERAL NOTES:

1. CLAY PLUG SHALL BE CONTINUOUS UNDER AND BETWEEN THE CORRUGATED ALUMINUM PIPE. FOR CLAY PLUG SPECIFICATIONS, REFER TO SECTION 02377, CLAY BARRIER PLUG.
2. CONTRACTOR MAY USE PLYWOOD OR SAND BAGS TO FORM THE CLAY PLUG.
3. FOR CORRUGATED ALUMINUM PIPE SPECIFICATIONS, REFER TO SECTION 02630, STORM DRAINAGE.

US Army Corps of Engineers
Jacksonville District

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DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files:
Figure19_EDR.dgn
File name:

C-111 Engineering Documentation Report
FROG POND HIGH HEAD CELL
CULVERT PLAN AND SECTION

Figure 19

Table 20
Engineering Documentation Report (EDR)
Frog Pond High Head Culvert

Purpose: This structure is located on L-31W within the Frog Pond High Head Cell. The culvert will allow:
1) Discharge of 50% of the capacity of S-332D with 1/2 foot of head.
2) Water from S-332D to be discharged north when there is capacity in the C-111 Southern Detention Area (C-111 SDA).
3) When stages in the C-111 SDA are above 8.6 feet then flow south can be initiated.

Design Condition

Discharge	250	cfs
Headwater Elevation	8.5	ft (High Head Cell)
Tailwater Elevation	8	ft (C-111 SDA)

Normal Conditions (Flow North)

Headwater Elevation	8.1 to 8.6	ft (High Head Cell)
Tailwater Elevation	6 to 8	ft (C-111 SDA)

Maximum Head Difference

Headwater Elevation	8.6	ft (High Head Cell)
Tailwater Elevation	10	ft (C-111 SDA)

Special Condition (Flow South)

If/When stages in the C-111 SDA are high enough before overtopping of overflow weirs.

Headwater Elevation	8.6	ft (High Head Cell)
Tailwater Elevation	10	ft (C-111 SDA)

Discharge Capacity limits of the Frog Pond Detention System would have to

Culvert Data

Number of Barrels	4	
Barrel Type	Circular - Corrugated Aluminum Pipe (CAP)	
Diameter	5	ft
Length	173	ft
Invert Elevation	1	ft
Type of Control	Slide Gate	

Table 21
Engineering Documentation Report (EDR)
C-111 Frog Pond Cell 1 Berm/Weir

Weir Type	Earthen Broadcrested	
Weir Length	2,100 ft	
Crest Width	100 ft	
Crest Elevation	6.5 ft	(Approximately 1.5 feet above grade)
Side Slopes	1 on 3	V to H, US and DS

Design Condition

Discharge	500	cfs
Headwater Elevation	6.75 ft	
Tailwater Elevation	No influence	

Table 22
Engineering Documentation Report (EDR)
Frog Pond Cell 1 Culvert

Culvert Data

Number of Barrels	8	
Barrel Type	Circular - Corrugated Aluminum Pipe (CAP)	
Diameter	5	ft
Length	140	ft
Invert Elevation	0	ft (approximately 5 ft below grade)
Type of Control	Slide Gate	

Design Condition

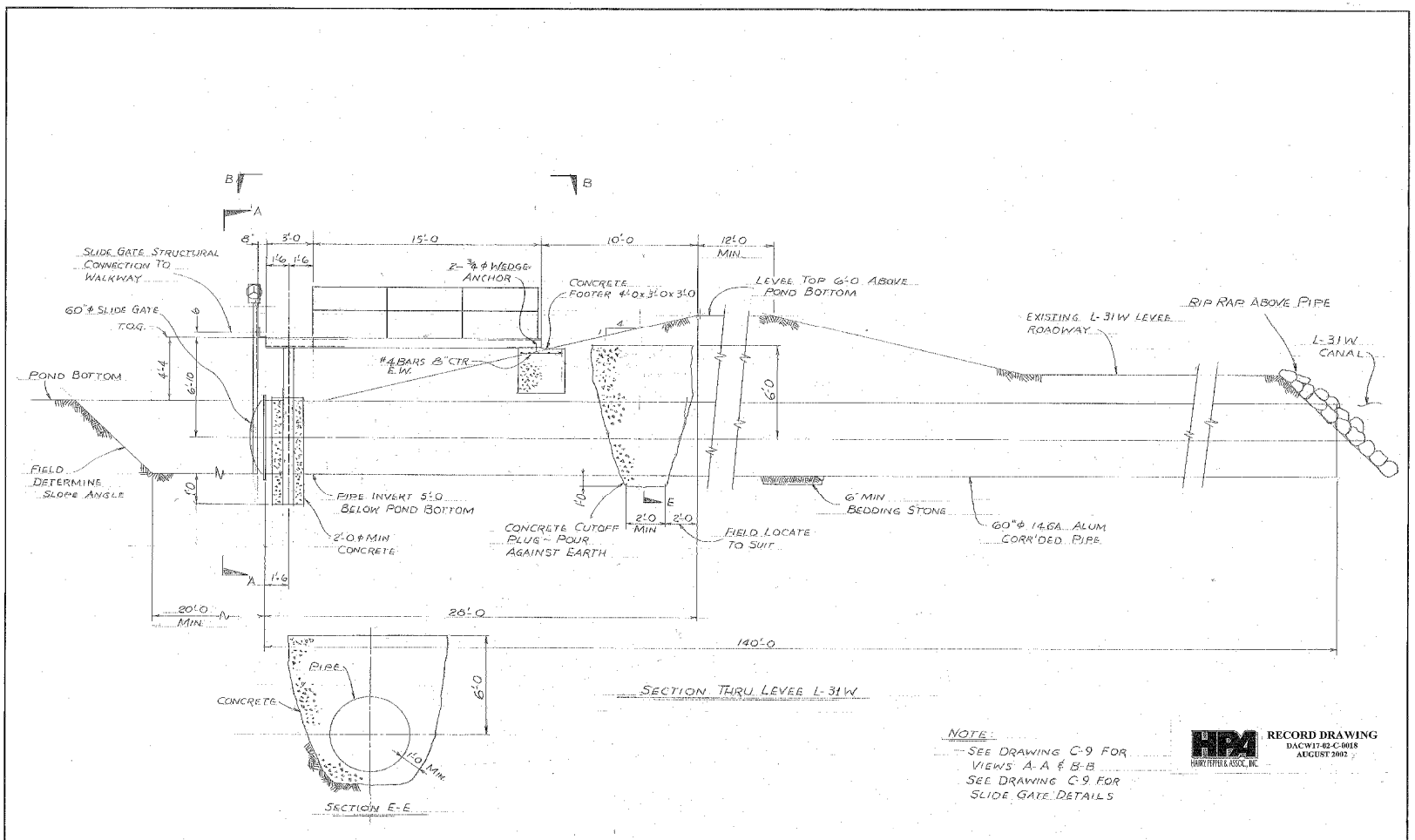
Discharge	500	cfs
Headwater Elevation	6.5	ft (High Head Cell)
Tailwater Elevation	6	ft (C-111 SDA)

Normal Conditions (Flow North)

Headwater Elevation	8.1 to 8.6	ft (High Head Cell)
Tailwater Elevation	6 to 8	ft (C-111 SDA)

Maximum Head Difference

Headwater Elevation	8.6	ft (High Head Cell)
Tailwater Elevation	10	ft (C-111 SDA)



NO.	DATE	BY	REVISION
1	4-12	JWG	AS BUILT

PROJECT HPA 919
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

60"φ SLIDE GATE CULVERTS FOR L-31W LEVEE

SCALE N/A
DATE 5-1-02
SHEET C8 OF

ORIGINAL

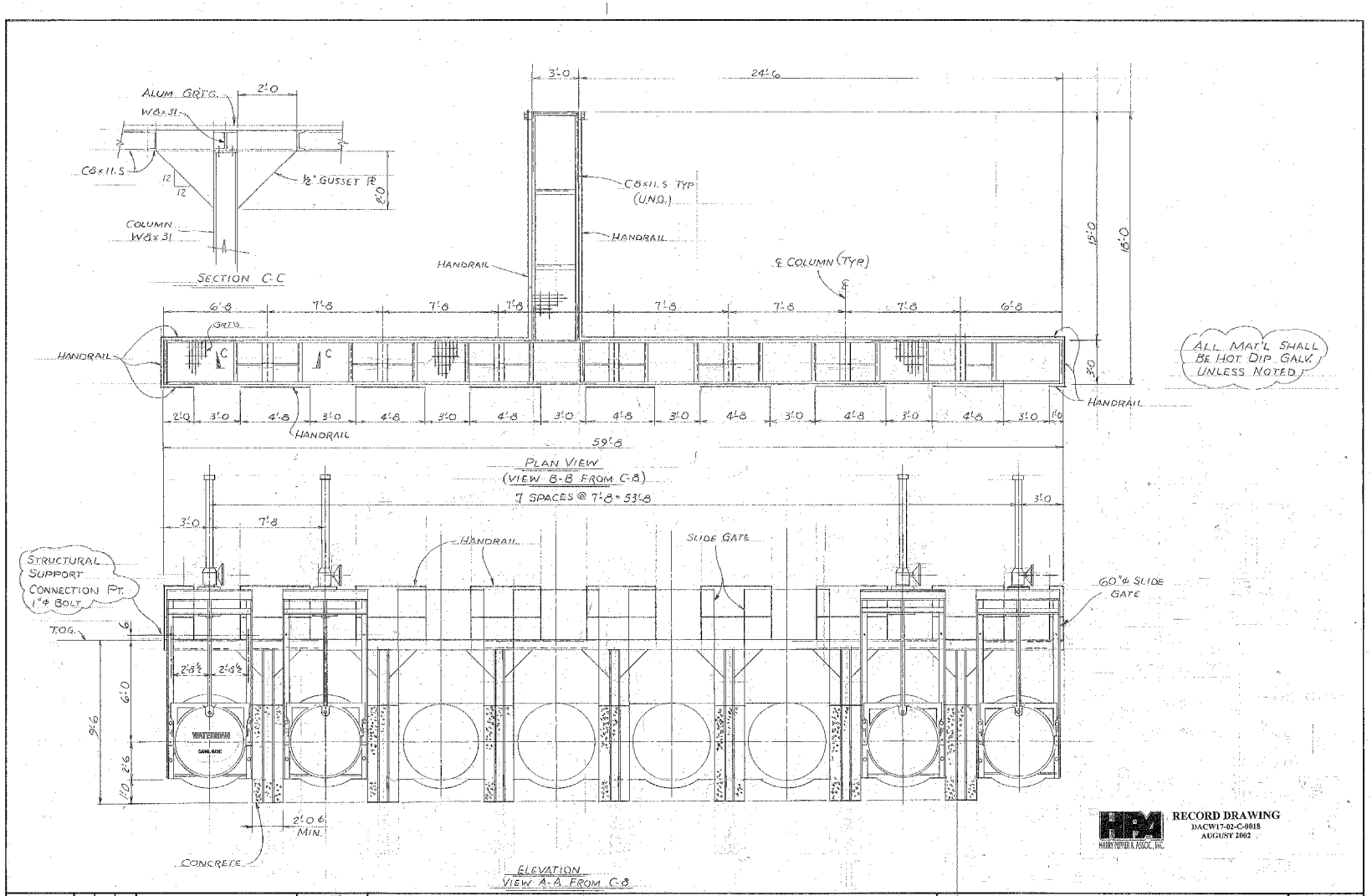
US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files: Figure20_EDR.DGN
File name:

C-111 Engineering Documentation Report
FROG POND CELL 1 CULVERT AS-BUILT CROSS SECTION

Figure 20



NO.	DATE	BY	REVISION
1	9-12	JWG	AS BUILT

PROJECT HPA719
DESIGN J. GATES
DRAWN J. GATES
CHECKED

HARRY PEPPER AND ASSOCIATES INC.
ENGINEERING AND CONSTRUCTION JACKSONVILLE, FLORIDA

60" ϕ SLIDE GATE CULVERT AND PLATFORM DETAILS FOR L-31W LEVEE

SCALE N/A
DATE 5-1-02
SHEET C9 OF

ORIGINAL

US Army Corps of Engineers
Jacksonville District

Designed by: G.J.N.
Ckd by: G.J.N.
DWN by: G.J.N.

brdr ANSI_E.DGN
Reference files: Figure21_EDR.DGN
File name:

C-111 Engineering Documentation Report
FROG POND CELL 1 CULVERT
AS-BUILT PLAN AND PROFILE

Figure 21

pipe is made of corrugated aluminum and is placed on 6 inches of bedding stone. To prevent seepage through the levee at the culvert, a concrete cutoff plug was poured with earthen supports.

1.10.1.5.12 Frog Pond Cell 2 Weir

Purpose
Constructed during the 2002 CSSS Emergency contract to maintain stages within Cell 2 at a minimum depth of 1 foot.

Physical Feature (Table 23)
Outfall structure is a 1,900-foot concrete broad crested weir with a crest elevation approximately 1.0 foot above grade and a width of 12-feet, that discharges into Cell 3.

1.10.1.5.13 Frog Pond Discharge Structure

Purpose
During the 2002 CSSS Emergency Contract, a 2,000 foot reach of L-31W was degraded to grade (approximate elevation 4 feet, NGVD29) to allow water flowing through the Frog Pond Detention System to be delivered to Taylor Slough. To make the flowway area a more functional part of the detention system and augment the delivery of water to Taylor Slough, this gap will be closed and replaced with a levee and concrete overflow weir.

Physical Feature (Table 24)
L-31W will be re-constructed through the 2,000 foot gap using material from the C-111 Spoil Mound disposal area. A 764-foot concrete overflow weir will be constructed with nine v-notches in it to increment the delivery of water to Taylor Slough (see Figure 22). Six of the v-notches will have inverts of 6.0 feet, three will have inverts of 5.5 feet, and all remaining portions of the overflow weir will have an elevation of 7.3 feet.

1.10.1.5.14 Frog Pond Seepage Management Flowway Overflow Weir

Purpose
The purpose of this simple overflow weir is to increase the stage within the flowway area during low flows and startup operations to prevent excessive velocities from eroding the toe of the levee.

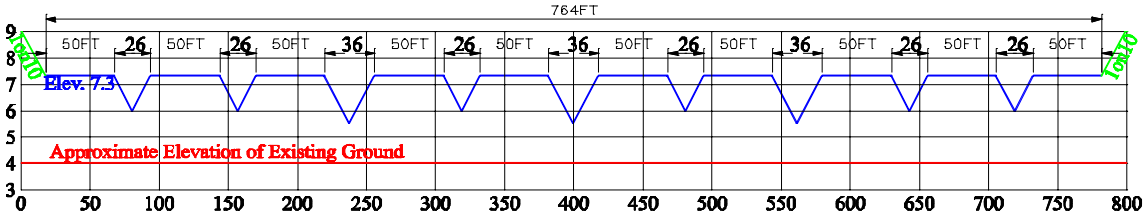
Location
This structure is located on the western end of the Frog Pond Seepage Management Flowway, approximately 1,000 feet west of pump station S-332B.

Table 23
Engineering Documentation Report (EDR)
C-111 Frog Pond Cell 2 Weir

Weir Type	Concrete-Broadcrested	
Weir Length	1,900 ft	
Crest Width	12 ft	
Crest Elevation	5.0 ft	(Approximately 3 feet above grade)
Side Slopes	1 on 4	V to H, US and DS
Slab Thickness		
Crest	0.5 ft	
Side Slopes	0.333 ft	
Design Condition		
Discharge	500	cfs
Headwater Elevation	5.25 ft	
Tailwater Elevation	No influence	

Table 24
Engineering Documentation Report (EDR)
Frog Pond Discharge Structure

Purpose: This structure is at the southern terminus of the Frog Pond Detention Area (FDA) and is designed in order to perform the following functions:
1) Prevent backflow from Taylor Slough back into the Frog Pond area.
2) Develop longer retention times within the FDA.
3) Notches allow for a more gradual increase and decrease of flows into Taylor



Weir Length (Total) =	764	
Total Number of Notches =	9	
3 notches at elevation	5.5	ft, NGVD 1929
6 notches at elevation	6	ft, NGVD 1929

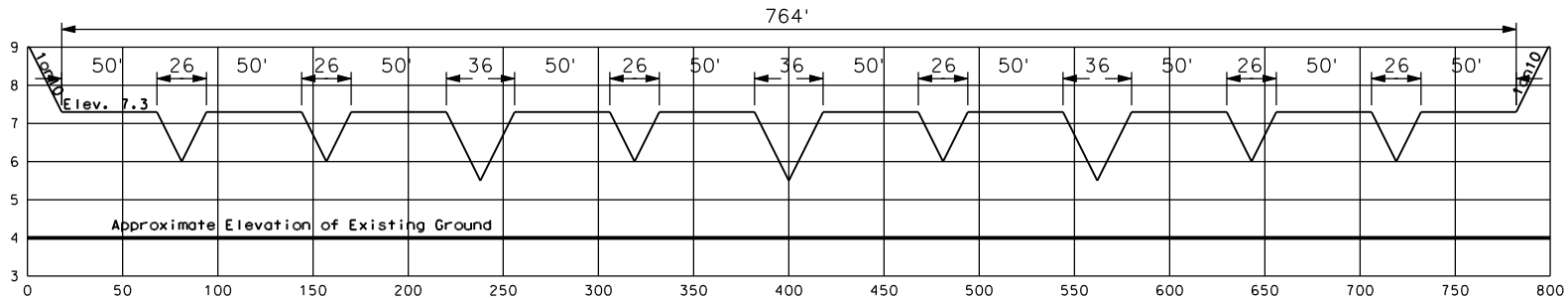
To construct the Flowway weir the 2,000 foot levee/berm degraded during the 2002 IOP Emergency Contract, will need to reconstruct the levee portion. Material will be obtained from the C-111 Spoil Mound Material (approximately 8,000 feet one way haul).

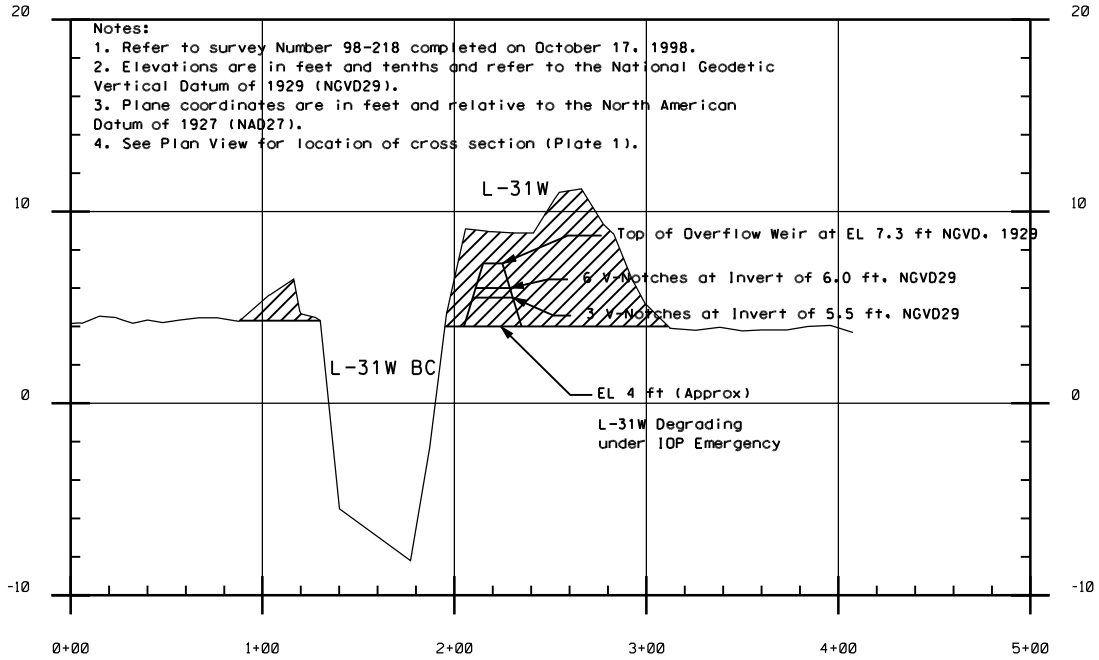
Top Width =	12	ft
Assumed Average Ground =	4	ft
Side Slopes 1 on	3	V to H

Station	Elevation (ft, NGVD29)	Incr. Length (ft)	Area (sq ft)	End Area Volume (cu yds)
0+00	10.0	0	180	0
5+91	10.0	591	180	3940
6+18	7.3	27	72.27	126
6+68	7.3	50	72.27	134
6+81	6.0	13	36	26
6+94	7.3	13	72.27	26
7+44	7.3	50	72.27	134
7+57	6.0	13	36	26
7+70	7.3	13	72.27	26
8+20	7.3	50	72.27	134
8+38	5.5	18	24.75	32
8+56	7.3	18	72.27	32
9+06	7.3	50	72.27	134
9+19	6.0	13	36	26
9+32	7.3	13	72.27	26
9+82	7.3	50	72.27	134
10+00	5.5	18	24.75	32

Station	Elevation (ft, NGVD29)	Incr. Length (sq ft)	Area (ft^2)	End Area Volume (cu yds)
10+18	7.3	18	72.27	48
10+68	7.3	50	72.27	134
10+81	6.0	13	36	26
10+94	7.3	13	72.27	26
11+44	7.3	50	72.27	134
11+62	5.5	18	24.75	32
11+80	7.3	18	72.27	32
12+30	7.3	50	72.27	134
12+43	6.0	13	36	26
12+56	7.3	13	72.27	26
13+06	7.3	50	72.27	134
13+19	6.0	13	36	26
13+32	7.3	13	72.27	26
13+82	7.3	50	72.27	134
14+09	10	27	180	126
20+00	10	591	180	3940
Total Volume of Levee Material (cu yds) =				10,000

Total Length of Concrete =	818	ft
Side Slopes 1 on	3	V to H
Thickness of concrete overflow Weir =	0.5	ft
General Cross Sectional Area =	20.0	sq ft (concrete per foot of weir)
Total Volume of Concrete =	606	cubic yards





US Army Corps of Engineers
Jacksonville District

Ckd by: G.J.N.
Designed by: T.L.F.
DWN by: T.L.F.

Frogpond_Flowway_Wer.DGN
brdr ANSI_E.DGN
Reference files:
Figure22_EDR.DGN
File name:

C-111 Engineering Documentation Report
FROG POND DISCHARGE
STRUCTURE PROFILE & SECTION

Figure
22

Physical Feature (Table 25)
Two possible construction techniques are being investigated (decisions will be made during detail design):

1.10.1.5.14.1 Option 1: Concrete Curb
The existing overburden should already be removed as part of the scraping for perimeter levee construction. A six-inch deep trench should be excavated for the toe of the curb. A curbing machine should be used to place a concrete curb within the trench that will have a height and width of 2 feet, giving an elevation of 1.5 feet above grade.

1.10.1.5.14.2 Option 2: Pre-Cast Piles
Placing pre-cast concrete piles end on end for the total length. Piles would be cast in 50 foot segments (890 piles). Piles will be placed into a trench that would be cut approximately 6 inches into the rock. In addition, a poly-ethylene seal will be placed at the ends of all piles. The Frog Pond Seepage Management Flowway Over Flow Weir is being deferred to the CERP C-111 Spreader Canal Project.

1.10.1.5.15 500 foot Flowway System

Purpose
A 500 foot wide flowway system will be constructed within the C-111 NDA (20,000 feet) and the C-111 SDA (25,500 feet). This area will hold approximately the first 1.5 feet of water before overflow is allowed. The system will parallel the eastern levee (S-332D Tieback Levee). This will allow the hydraulic ridge to be kept further east, away from Everglades National Park boundary, during dry periods.

Physical Feature (Table 26)
Two possible construction techniques are being investigated:

1.10.1.5.15.1 Option 1: Concrete Curb

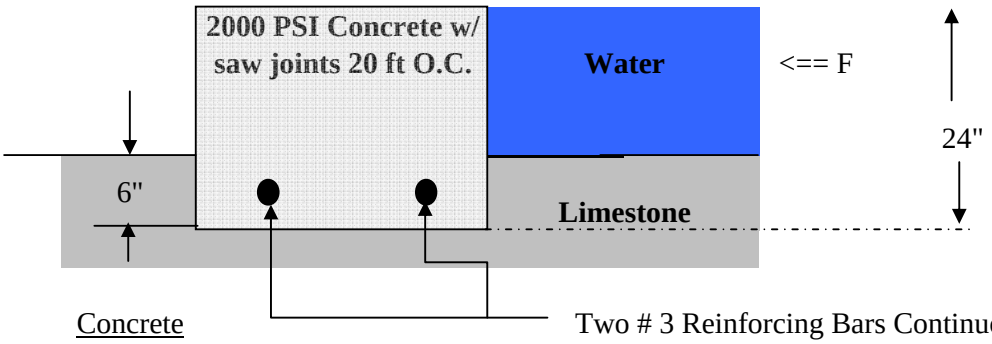
The existing overburden should already be removed as part of the scraping for perimeter levee construction. A six-inch deep trench should be excavated for the toe of the curb. A curbing machine should be used to place a concrete curb within the trench that will have a height and width of 2 feet, giving an elevation of 1.5 feet above grade.

1.10.1.5.15.2 Option 2: Pre-Cast Piles

Placing pre-cast concrete piles end on end for the total length. Piles would be cast in 50-foot segments (890 piles). Piles will be placed in a trench that would be cut approximately 6 inches into the rock. In addition a poly-ethylene seal will be placed at the ends of all the piles.

Table 25
Engineering Documentation Report (EDR)
Frog Pond Seepage Management Flowway Overflow Weir

A) Option 1 -- Concrete Curb

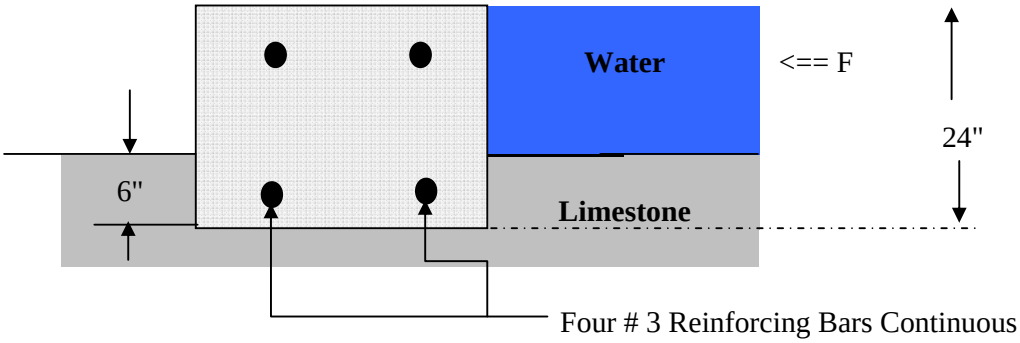


Two # 3 Reinforcing Bars Continuous

<u>Concrete</u>		
Total length =	500	ft
Width =	2	ft
Height =	2	ft
Area =	4	sq ft (per foot of curb)
Volume =	81	cyd's of concrete (Added an additional 10%)
<u>Rock Excavation</u>		
Width =	2.25	ft
Depth =	0.5	ft
Area =	1.125	sq ft (per foot of curb)
Volume =	21	cubic yards of rock Excavation
<u>Formwork</u>		
Number of sides =	2	
Height =	2	ft
Area =	2,000	sq ft
<u>Rebar</u>		
Number of Bars =	2	
Diameter =	0.375	inches
Weight =	0.375	lbs/ft
Lbs of Steel =	375	lbs
Lap Splice & supports =	7.50%	28 lbs
Total Steel Quantity =	403	lbs

Table 25 (Continued)
C-111 Detention Area Flowway Berms (Curb)
Table 32 (Continued)

B) Option 2 Pre-Cast Pile

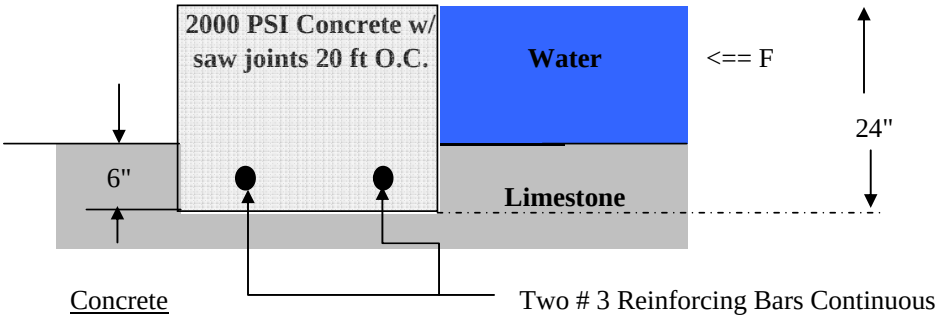


Concrete		
Total length	500	ft
Width =	2	ft
Height =	2	ft
Area =	4	sq ft (per foot of curb)
Volume =	81	cyd's of concrete (Added an additional 10%)
Rock Excavation		
Width =	2.25	ft
Depth =	0.5	ft
Area =	1.125	sq ft (per foot of curb)
Volume =	21	cubic yards of rock Excavation
Rebar		
Number of Bars =	4	
Diameter =	3/8	inches
Weight =	0.375	lbs/ft
Tons of Steel =	750	lbs
Length of Pre-Stressed Piles =	50	ft
Number of Piles =	10	
Poly-Ethylene Seals =	9	

Table 26
Engineering Documentation Report (EDR)
C-111 NDA and SDA Flowway Berms (Curb)
Two Construction Techniques

Purpose: The divide berm is designed to create the hydraulic ridge on the eastern side of the detention area first. Once stage increase over 1.5 feet then flow will utilize the entire area. This allows in times of low flow the ability to maintain a hydraulic ridge on the eastern side of the detention area. In addition it puts the hydraulic ridge further away from the park boundary during these times.

A) Option 1 -- Concrete Curb



Concrete

Total length =	44,500	ft
Width =	2	ft
Height =	2	ft
Area =	4	sq ft (per foot of curb)
Volume =	7,252	cubic yards of concrete (Added an additional 10%)

Rock Excavation

Width =	2.25	ft
Depth =	0.5	ft
Area =	1.125	sq ft (per foot of curb)
Volume =	1,854	cubic yards of rock Excavation

Formwork

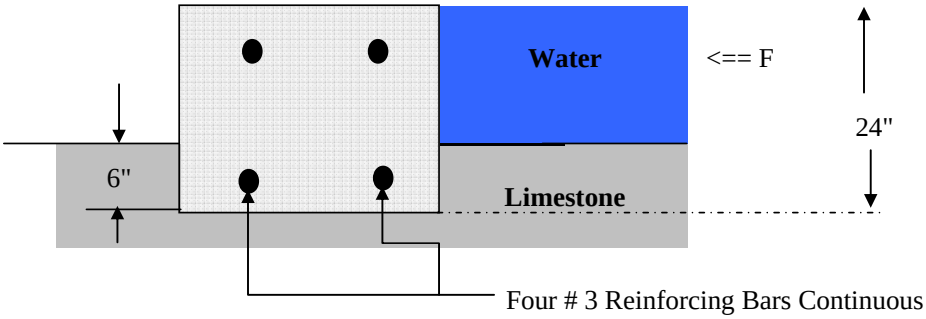
Number of sides =	2	
Height =	2	ft
Area =	178,000	sq ft

Rebar

Number of Bars =	2			
Diameter =	0.375	inches		
Weight =	0.375	lbs/ft		
Lbs of Steel =	33,375	lbs		
Lap Splice & supports =	7.50%		2,503	lbs
Total Steel Quantity =	35,878	lbs		

Table 26 (Continued)
C-111 Detention Area Flowway Berms (Curb)
Two Construction Techniques

B) Option 2 Pre-Cast Pile



Concrete Total length	44,500 ft	
Width =	2 ft	
Height =	2 ft	
Area =	4	sq ft (per foot of curb)
Volume =	7,252	cubic yards of concrete (Added an additional 10%)
Rock Excavation		
Width =	2.25 ft	
Depth =	0.5 ft	
Area =	1.125	sq ft (per foot of curb)
Volume =	1,854	cubic yards of rock Excavation
Rebar		
Number of Bars =	4	
Diameter =	3/8	inches
Weight =	0.375	lbs/ft
Tons of Steel =	66,750	lbs
Length of Pre-Stressed Piles =	50 ft	
Number of Piles =	890	
Poly-Ethylene Seals =	889	

1.10.1.5.16 C-111 NDA Southern Divide Berm Weirs

Purpose

These two weirs are designed to start passing water into this portion of the detention area when stages exceed 2.75 feet above average ground. The weirs allow for water to equalize across the berm between the two areas so that scour problems do not occur.

Physical Feature (Table 27)

Two 100-foot concrete overflow weirs with crest elevation set 2.75 feet above grade with a 12-foot top width and 1 on 3 (V:H) side slopes. Construction will be similar to that performed during the 2002 CSSS Emergency Contract.

1.10.1.6 Demolition

1.10.1.6.1 S-332 B Temporary Pump Station

Purpose

The S-332B Pump Station was only intended to be a temporary pump station and was installed under IOP. The pumps were off-the-shelf and the station itself is just a platform with housing. The Pump Station should be replaced with a permanent structure.

Physical Feature

Demolish temporary pump station S-332B once the permanent S-332B is in operation. The removal will include all piping and head walls to the S-332B West and S-332B North Detention Area.

1.10.1.6.2 S-332C Temporary Pump Station

Purpose

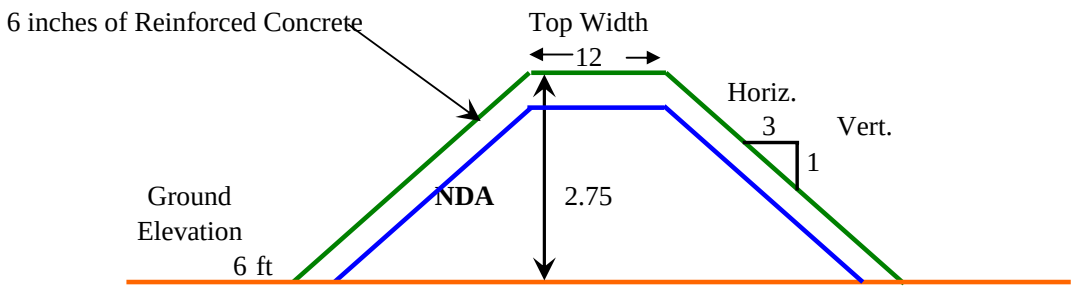
The S-332C Pump Station was only intended to be a temporary pump station and was installed under IOP. The pumps were off-the-shelf and the station itself is just a platform with housing. The Pump Station should be replaced with a permanent structure.

Physical Feature

Demolish temporary pump station S-332C once the permanent pump station S-332C is in operation. The removal will include all piping and head wall to the S-332C Detention Area.

Table 27
Engineering Documentation Report (EDR)
C-111 NDA Southern Interior Over Flow Weirs

Number of Structures	2	(two in the NDA and two in the SDA)
Weir Length	100	ft, each
Crest Elevation	8.75	ft, NGVD29



Individual Weirs

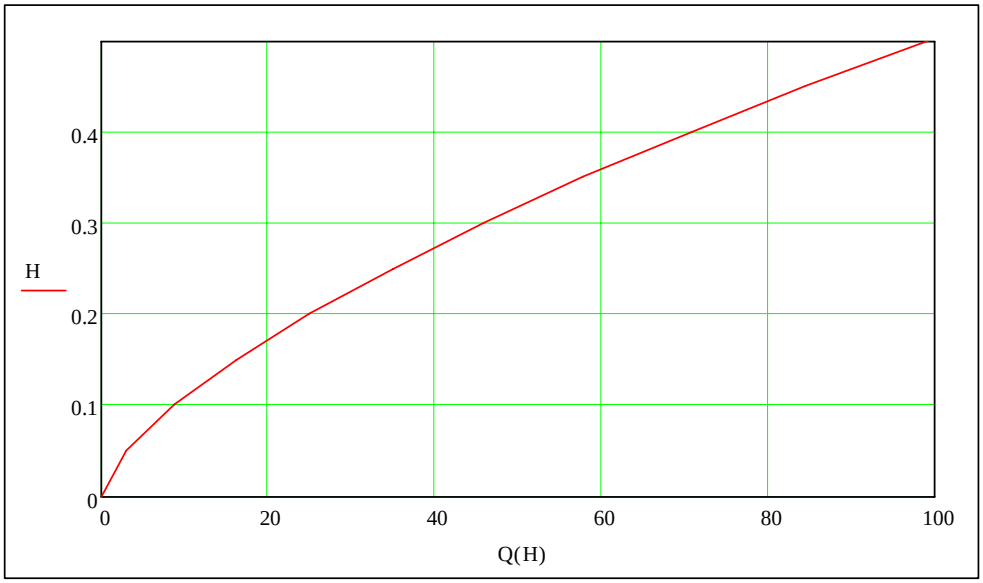
Total Length of Concrete =	105	ft (includes 1 on 10 ramps from levee crest)
Thickness of concrete overflow Weir =	0.5	ft
General Cross Sectional Area =	10	sq ft (concrete per foot of weir)
Total Volume of Concrete =	39	cubic yards per location
Wire Mesh Reinforcement =	3086	sq ft (6-6-10 wire)

Hydraulic Design

Design Condition

Discharge	35	cfs
Headwater Elevation	9	ft
Tailwater Elevation	---	ft, assumed no tailwater influence

Discharge Rating Curve



1.10.1.6.3 S-332I

Purpose
The S-332I pump station is part of the S-332 pump station system. S-332I and S-332 were to have a canal connecting them to C-111 to pump water to the West. With the filling in of the L-31W canal, this is no longer a viable option.

Recommendation
This structure should be de-authorized. Then the pumps can be removed to prevent operation or the entire station can be demolished.

1.10.1.6.4 S-332

Purpose
S-332 was originally to have a canal connecting it to C-111 to pump water to the West. With the filling in of the L-31W canal, this is no longer a viable option.

Recommendation
This structure needs to be de-authorized. Then the pumps can be removed to prevent operation or the entire station can be demolished.

1.10.1.6.5 S-175

Purpose
S-175 will no longer be able to operate when L-31W is filled.

Recommendation
This structure needs to be de-authorized. Then the gates can be removed to prevent operation or the entire structure can be demolished.

1.10.2 CONTRACTS

To date several features of the C-111 Project have already been completed under the Taylor Slough Bridge contract, IOP and ISOP. The remaining features to be constructed are divided into contracts and have contract numbers. Table 28 gives the details on which features and length of the features to be constructed and includes the Contract Number.

1.11 CHANGES IN PROJECT BENEFITS

Paragraph G-16.a(10) of ER 1105-2-100 requires a table showing a comparison of the benefits given in the project document, the benefits last reported to Congress, and the benefits based on reevaluations which have been done to support the recommended changes to the project.

TABLE 28
C-111 REMAINING CONTRACTS

Description	Project	Contract No.	Unit of Measure	Quantity
S-331 and Controls for Pump Stations	C-111	6	LS	1
S-332B Temporary Housing	C-111	6	LS	1
S-332C Temporary Housing	C-111	6	LS	1
S-356 Temporary Housing	MWD	6	LS	1
Controls for Pump Station S-357	MWD	6	LS	1
L-31W Tieback Levee (C-111 SDA Western Levee)	C-111	7	***Total***	***21,542***
North of Existing Temp S-332C Detention Area			ft	13,133
South of Existing Temp S-332C Detention Area			ft	8,409
S-332D Tieback Levee (C-111 SDA Eastern Levee)	C-111	7	***Total***	***11,190***
North of Existing Temp S-332C Detention Area			ft	2,850
South of Existing Temp S-332C Detention Area			ft	8,340
S-332 B to C Partial Connector Levee			ft	2,850
Levee Degrades (Demo)	C-111	7	***Total***	***15,340***
Degrade the north levee of temp S-332B West Det Area			ft	2,530
Degrade the west levee of temp S-332B West Det Area			ft	2,580
Degrade the south levee of temp S-332B West Det Area			ft	3,000
Degrade northern east-west levee of temp S-332C Det Area			ft	2,500
Degrade southern east-west levee of temp S-332C Det Area			ft	2,700
Degrade east-west levees of northern partial connector			ft	1,010
Degrade east-west levees of southern partial connector			ft	1,020
Construct S-332DX1	C-111	7	4 - 5ft Dia	
Partial Backfilling of L-31 West	C-111	7	ft	2,000
L-31W Tieback Levee (C-111 NDA Western Levee)	C-111	8	ft	21,730
S-332D Tieback Levee (C-111 NDA Eastern Levee)	C-111	8	ft	16,178
SDA (2) and NDA (2) Western Emergency Overflow Weirs	C-111	8	# - ft each	4 - 240 ft
SDA and NDA Flowway Berms	C-111	8	ft	44,500
Degrade portion of S-332B Temp Detention Area Levee (east-west and part of eastern)		8	ft	3,600
Plug Areojet Canal	C-111	9	# of plugs	5
Backfill L-31W	C-111	9	complete/partial	25,800 ft / 19,230 ft
Frogpond Flowway Weir	C-111	9		
Weir			ft	764
V Reconstruction from Gap during IOP (Includes length beneath weir.)			ft	2,000
Structure Demolishing (De-authorize structures)				
Pull S-175	C-111	9		
Demolish S-332 and S-332i	C-111	9		
S-332B Permanent Pump Station	C-111	10		4-125D and 1-75E
S-332B Flowway (Levee Construction)	C-111	10	ft	3,100
S-332 B Control Structure	C-111	10	2 Struct	ox Culverts Each (3x6)
Northern Detention Area Southern Divide Berm	C-111	10	ft	3,250
NDA Southern Interior Over Flow Weirs	C-111	10	#	2
Demolition				
S-332B Temporary Pump Station				4-125D and 1-75E
S-332B Discharges Pipe/Berm			ft	
S-332C Permanent Pump Station	C-111	11		4-125D and 1-75E
S-332C Flowway	C-111	11	ft	5,000
S-332C Control Structure	C-111	11	ft	500
Demolition				
S-332C Temporary Pump Station				4-125D and 1-75E
S-332C Discharges Pipe/Berm				

Note:
1. For the Pump Stations D represents Deseil and E represent Electric Motors for the Pumps.
2. Contract 6: S-331 costs is being shared by Modified Water Deliveries.

The C-111 Project modifications to the C&SF Project did not identify National Economic Development (NED) or National Ecosystem Restoration (NER) benefits or plans. It presented "an environmental restoration plan", which "maintains flood damage prevention for the study area." The 1994 C-111 GRR ecological evaluations scored the alternative plans based upon hydrohabitat units and species compatibility scores. In addition, all alternatives were formulated based on the premise that they would maintain the existing level of service for flood damage reduction in the basin. The 1994 C-111 GRR determined that all of its alternative plans provide an increased and similar level of service for flood damage reduction when compared to the existing project operated at optimum design canal levels. Therefore, the 1994 C-111 GRR quantified the flood damage reduction benefit of all plans using its Alternative 1A, with an annual benefit of $3,179,000 and benefit to cost ratio of 1.05 to 1.0 (in 1994 price levels). Benefits last reported to Congress would be those included in the 1994 C-111 GRR.

Evaluations performed for CSOP are referenced to support this EDR's recommended structural design refinements. These evaluations include (1) a comparison of habitat units provided by the CSOP Tentatively Selected Plan[5] (TSP) and the "No Action" planning condition[6], and (2) level of service for flood damage reduction provided by the CSOP TSP compared to the 1994 C-111 GRR planning condition to ensure authorized level of service of flood damage reduction in the C-111 basin is maintained. As shown in Table 29 below, the potential annual equivalent flood damages for the CSOP TSP, which includes the C-111 structural design refinements discussed in this EDR, are less than the CSOP No Action and the 1994 C-111 Planning Conditions, indicating the level of service for the 1994 C-111 GRR is maintained.

Table 29
Benefits—C-111 Project Modifications to the C&SF Project

Benefit	CSOP TSP[2]	CSOP No Action Planning Condition	1994 C-111 GRR CSOP Planning Condition
Ecological -- Habitat Units	1,278,000 acres	834,000 acres	N/A
Potential Annual Equivalent Flood Damages	$134,409,000	$139,811,000	$137,925,000

[5] The CSOP TSP includes all of the structural design refinements provided in Section 1.10.1 (C-111 Project Design Refinements to 1994 C-111 Recommended Plan)
[6] Represents MWD to ENP Project and C-111 Project modifications to the C&SF Project implemented.

1.12 CHANGES IN BENEFIT TO COST RATIO

Paragraph G-16.a(11) of ER 1105-2-100 requires the Benefit to Cost (B/C) Ratio for the recommended project and the authorized project, along with interest rate used. As stated above, the 1994 C-111 GRR did not identify an NED plan or calculate a B/C ratio for use in selecting its recommended plan. Neither did CSOP. The 1994 C-111 GRR quantified the flood damage reduction benefit of all of its alternative plans using Alternative 1A, with an annual benefit of $3,179,000 and benefit to cost ratio of 1.05 to 1.0 (May 1993 price level and 8 percent interest rate).

1.13 COST ESTIMATE

Paragraph G-16.a(9) of ER 1105-2-100 requires a table comparing the estimated cost for the project being recommended, the project as authorized by Congress, the authorized project updated to current price levels, and the project last presented to Congress. Table 30 provides a comparison of the estimated cost for:

C-111 Project as *Authorized* by Congress,
Authorized project cost updated to *Current* price levels,
Authorized project cost *Escalated* to February 2007 price levels,
Project *Last Presented to Congress*, and
***Fully Funded* cost as of October 2007.**

Discussion of C-111 cost changes since authorization are included in Section 1.13.3, Changes in Total Project First Costs.

Table 30
Costs -- C-111 Project Modifications to the C&SF Project

Project Cost Estimate			Price Level
Authorized (1)		**$121,400,000**	May-93
Current (2)		**$372,997,000**	May-07
EDR Recommended Design Refinements	**$90,984,300**		
Remaining Features to construct	$ 67,737,700 (8)		
Remaining Real Estate	$132,227,000 (5)(6)		
Expenditures to Date (through 30 Sep 06)	$82,048,000		
Authorized Project Escalated to Feb 2007 (7)		**$192,559,200**	Feb-07
Last Presented to Congress		**$370,100,000**	Oct-06
Fully Funded as of October 2007		**$373,400,000 (3)(4)**	Oct-07

(1) Cost from the authorizing document: C-111 1994 GRR.
(2) Current costs are costs in today's price level for construction of EDR recommended design refinements and remaining features, plus remaining real estate and expenditures to date.
(3) Fully funded costs for C-111 are total project cost at completion of construction based upon the current construction schedule.

[4] Fully funded cost estimate price level is October 2007 per the PB3 with OMB October 2007 inflation rates.
[5] Includes $106,039,000 non-Federal expenditures to date awaiting crediting following execution of an amended Project Cooperation Agreement addressing cost sharing pursuant to WRDA 1996. Remaining real estate cost estimate is $26,063,000.
[6] Includes estimated real estate costs of $125,000 for S-332E and C-111N canal.
[7] See Appendix C for the escalated costs associated with the authorized project cost.
[8] Escalated up from the 1994 GDM.

1.13.1 Recommended Design Refinements

The C-111 EDR Recommended Design Refinements cost estimate is a complete reprice. The costs are based on provided engineering data. See Appendix B for a detailed description on how costs were obtained. See Appendix D for Recommended Design Refinement Costs.

1.13.2 Authorized Project Cost Escalated to February 2007

The 1994 C-111 GRR cost estimate was updated in 2003 using the latest Civil Works Construction Cost Index System (CWCCIS). The estimate was then updated from 2003 to 2007 using CWCCIS tables (last revised 30 September 2006). The composite index (weighted average) was used. The table indexes were 525.26 (12/31/2003) to 658.51 (4/15/2007) and calculated as 25.43%. The escalation is applied to the total contractor cost. See Appendix C for the escalated costs associated with the original Project Cost.

1.13.3 Changes in Total Project First Costs

The Section 902 (WRDA 1986) limit for project costs does not apply to the C-111 Project modifications to the C&SF Project. Section 902 of WRDA of 1986 only applies to projects authorized in WRDA 1986 or subsequent legislation *in which a total project cost of a project is set forth in law.* The C-111 Project was authorized as an addition to the C&SF Project by the Flood Control Act of 1962, and is therefore not subject to Section 902 of WRDA 1986. The Administrative 902 limit for the C-111 Project modifications to the C&SF Project is $190,181,000.

C-111 Project cost changes since authorization:

<u>1993 – 1994</u>
1994 GRR (dated July 1994) cost of $121,413,000 at 1993 price level increased to $139,370,000 in December 1994 at October 1994 price levels.

<u>Increase due to:</u>	**$17,062,000**	**price level changes**
	$ 895,000	**addition of S-26 Stilling Basin**

<u>1994 – 1995</u>
FY 94 project cost at $139,370,000 increased to FY95 project cost at $147,345,000.
<u>Increase due to:</u> $4,130,000 price level changes
$3,845,000 scope changes
The $3,845,000 scope change was due to increase in cost to the Florida Bay Study.
C-109 was combined with C-111 Spoil Removal.

<u>1995 – 1996</u>
FY95 project cost at $147,345,000 to FY96 project cost at $149,378,000.
<u>Increase due to:</u> New MCACES was completed 5/1/96 at May 1996 price levels.
The new MCACES included the following additional features:

- **Lands: Structure 332E $ 3,000**
- **PED: FDM1B $293,000**

<u>Change in cost due to following schedule changes:</u>

- **Taylor Slough Bridge start date slipped from August 1996 to September 1997**
- **C-111N start date slipped two years**
- **S-332D start date expedited from February 1999 to October 1996**

<u>1996 – 1997</u>
FY96 project cost at $149,378,000 to FY97 project cost at $156,445,000.
<u>Increase due to:</u> $9,100,000 price level changes
($2,033,000) scope changes
Contract for Canal C-111 Spoil Removal and S-332D awarded below original estimate. Adjustments were made to reduce cost estimates to award price. In feature "09"- Channels, L-31 Borrow Canal S-332D was removed as a separate line item and combined with S-332D.
<u>Changes in cost due to following schedule changes:</u>

- **Land purchases slipped from October 1996 through September 1999 to October 2000 through May 2002**
- **C-109, C-110, and C-111N start date slipped from October 1998 to October 2000**
- **S-332B start date slipped from April 1998 to October 1999**

<u>1997 – 1998</u>
FY97 project cost at $156,445,000 to FY98 project cost at $159,429,000.
<u>Increase due to:</u> $9,983,000 price level changes
($6,999,000) scope changes
Contracts Canal C-111 Spoil Removal and S-332D were completed and the cost estimate was adjusted to reflect final construction costs.
C-109 construction completed by FDOT.
<u>The following schedule changes were made:</u>

- **332-A and 332-C start dates were slipped from April 2000 to October 2001**
- **332-B start date was slipped from October 1999 to November 2000**
- **332-D completion date was extended from November 1997 to August 1998**

<u>1998 – 1999</u>
FY98 project cost at $159,429,000 to FY99 Fully Funded cost of $161,293,000.
<u>Increase due to:</u> $3,072,000 price level changes
$(1,208,000) Cost adjusted per the 1996 MCASES for all construction items.

<u>1999 – 2000</u>
FY99 project cost at $161,293,000 to FY00 Fully Funded Cost of $154,917,000.
<u>Decrease due to:</u> $8,688,000 price level changes
$(2,312,000) Adjusted to S-332D award cost.
Reduction in Pumping Plant costs based on the actual award of S-332D.

<u>2000-2001</u>
FY00 project cost at $154,917,000 to FY01 Fully Funded Cost of $157,700,000.
<u>Increase due to</u>: $8,512,000 price level changes
$(5,729,000) Adjustment for Taylor Slough Bridge Award and Completed cost on S-332D pump Station and C-111 spoil mound removal.

<u>2001-2002</u>
FY01 project cost at $157,700,000 to FY02 Fully Funded Cost of $283,000,000.
<u>Increase due to</u>: $21,322,000 price level changes
$103,978,000 scope changes
The cost increases came from the May 2000 MCASES that included cost for the Interim Operational Plan (IOP) for releasing the Corps from the Cape Sable Seaside Sparrow jeopardy opinion from the Fish and Wildlife service. This included providing two temporary pump stations S-332B and S-332C and detention areas for each.

<u>2002-2003</u>
FY02 project cost at $283,000,000 to FY03 Fully Funded Cost of $268,200,000.
<u>Decrease due to:</u> $(14,800,000) cost was adjusted due to actual cost of the IOP construction.

<u>2003-2004</u>
FY03 project cost at $268,200,000 to FY04 Fully Funded Cost of $266,800,000.
<u>Decrease due to:</u> $6,408,000 price level changes
$(7,808,000) adjusted for all items due to 2003 MCASES.

<u>2004-2005</u>
FY04 project cost at $266,800,000 to FY05 Fully Funded Cost of $274,670,000.
<u>Increase due to:</u> $7,870,000 price level changes

<u>2005-2006</u>
FY05 project cost at $274,670,000 to FY06 Fully Funded Cost of $282,900,000.
<u>Increase due to:</u> $8,230,000 price level changes

2006-2007
FY06 project cost at $282,900,000 to FY07 Fully Funded Cost of $287,600,000.
Increase due to: $4,700,000 price level changes

2007-2008
FY07 project cost at $287,600,000 to FY08 Fully Funded Cost of $373,400,000.
Increase due to: $3,327,000 price level changes
$82,473,000 2007 MCASES update on EDR cost. The increase is due to the rising cost of concrete, steel, and gas. It is also based on the latest schedule to complete.

1.14 OPERATIONS AND MAINTENANCE (O&M) COSTS

Table 31 provides estimated annual O&M costs for features of the recommended plan. Additional information on O&M costs are included in Appendix E.

Table 31
Annual Operations and Maintenance Costs

Feature	Amount
Pump Stations	$1,120,000
Culverts	$ 40,000
Weirs	$ 100,000
Mowing	$ 31,950
Erosion Control	$ 142,633
Invasive Species Control – Floating Vegetation	$ 105,149
Invasive Species Control – Submerged Vegetation	$ 145,806
Supervision and Inspection	$ 550,781
Total	$2,236,319

1.15 CHANGES IN COST ALLOCATION

The C&SF Project purposes (e.g. water supply and flood damage reduction) are intricately related. To allocate costs of certain features to one project purpose or another for determination of the most appropriate cost sharing would be a complex endeavor. Therefore, cost sharing for the C-111 Project modifications to the C&SF Project is not determined pursuant to project purposes, but is determined by specific authorizations or other binding legal agreements. There is no change in cost allocation.

1.16 CHANGES IN COST APPORTIONMENT (COST SHARING)

One of the purposes of this EDR is to serve as the decision document supporting the Project Cooperation Agreement amendment needed to address cost-sharing changes pursuant to Section 316 of WRDA of 1996. Pursuant to ER 1105-2-100, paragraph

G-16.a.(13), changes in cost apportionment for the authorized project and the recommended project are provided in Table 32. Tables 33a and 33b provide Federal and non-Federal costs of the authorized project in the 1994 C-111 GRR (February 2007 price level) and the recommended project (May 2007 price level). Table 34 provides the Federal and non-Federal costs for Operations and Maintenance for the project recommended in this EDR.

Table 32
C-111 Project Changes in Cost Apportionment (Cost Sharing)

Activity	**Current**	**Change Pursuant to Section 316 of WRDA of 1996**
Construction	80% Federal / 20% Non-Federal	50% Federal / 50% Non-Federal
OMRR&R	100% Non-Federal except for pump stations. Pump stations is 60% Federal / 40% Non-Federal	No Change
Land Acquisition	ENP Protection and Expansion Act of 1989 (PL 101-229), as amended by PL 103-219 (March 9, 1994), authorized DOI to contribute 25% of Federal funding toward purchase of Rocky Glades and Frog Pond.	50% Federal / 50% Non-Federal DOI is still authorized to contribute 25% of Federal fundings toward purchase of Rocky Glades and Frog Pond and any funds contributed by DOI are part of Federal cost share

Table 33 a
Cost Apportionment (Cost Sharing) of Authorized Project

Item	**Total**	**Federal (USACE)**	**Non-Federal (SFWMD)**
1994 C-111 GRR Escalated to February 2007 price level (see Table 30)	**$192,559,200**	**$154,047,360 (80%)**	**$38,511,840 (20%)**

Table 33 b
Cost Apportionment (Cost Sharing) of Recommended Project

Item	Total	Federal (USACE & DOI)	Non-Federal (SFWMD)
Construction Management , PED, Construction Costs Expended	$82,048,000	$77,611,000	$ 4,437,000
Remaining Costs to Construct (Construction Management, PED, Construction Costs)	$158,722,000	$97,319,500	$61,402,500
Lands & Damages	$132,227,000	$11,568,000	$120,659,000
TOTALS	$372,997,000	$186,498,500 50 %	$186,498,500 50 %

Table 34
Cost Apportionment (Cost Sharing) of O&M for Recommended Project

Item	Total	Federal (USACE)	Non-Federal (SFWMD)
Pump Stations	$1,120,000	$672,000 (60%)	$ 448,000 (40%)
Remaining Project	$1,116,319	$0 (0%)	$1,116,319 (100%)
TOTALS	$2,236,319	$672,000	$1,564,319

1.17 ENVIRONMENTAL ASSESSMENT

A Draft Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) (attached) have been prepared in accordance with the National Environmental Policy Act to address the project modifications presented in this EDR. The draft EA and FONSI will be circulated for a minimum 30-day review to concerned agencies, organizations and the interested public.

1.17.1 Public Involvement

Public involvement is addressed in the draft EA.

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APPENDIX A

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UP-DATED REAL ESTATE PLAN
C-111 (SOUTH DADE) PROJECT

This update of the 1994 Real Estate Design Memorandum is tentative in nature only. The purpose is to update the cost estimates for lands required for the C-111 (South Dade) project and address the changes that have occurred in the cost sharing applicable to the project as a result of Section 316 of the Water Resources Development Act of 1996 (WRDA) (P.L. 104-303).

A General Reevaluation Report (1994 C-111 GRR) was prepared in May 1994 (approved July 1994) which examined restoration of the ecosystem that was affected by construction of Central and Southern Florida (C&SF) Project features in the Canal 111 basin (1994 C-111 GRR). The document recommended project modifications which would maintain existing flood protection and other project benefits for lands located east of Levee 31 North (L-31N) and Canal 111 (C-111) while restoring natural hydrologic conditions within Everglades National Park (ENP).

An REDM was completed in November 1994 and approved by HQUSACE on 2 April 1996. The 1994 REDM discussed the land requirements in the Rocky Glades (estimated 5,322 acres), in the Southern Glades (estimated 250.5 acres), and in the Frog Pond (estimated 5,215 acres) areas of the project and provided estimated land costs and estimated associated incidental costs. The estimated land costs were based on a Gross Appraisal (October 1993) and revised Gross Appraisal (April 1994). The revision to the Gross Appraisal was approved by HQUSACE for planning purposes on 6 May 1994. The approval by HQUSACE recommended a 25% contingency and that the Gross Appraisal "be updated to the appropriate date of value in order to be used for credit purposes." In 1994, when the original (October 1993), revised (April 1994) Gross Appraisal and 1994 REDM were written and on the dates the respective documents were approved, the Non-Federal Sponsor was required by law to furnish the lands, easements, and rights of way necessary for the construction of the project, free of cost to the United States. In the 1994 REDM, fee title was the approved estate for all lands in the Frog Pond and Rocky Glades areas of the Project.

On October 12, 1996, the Water Resources Development Act of 1996 (P.L. 104-303) prescribed changes in the cost sharing for the Canal 111 Project. Section 316 of WRDA 96 is quoted as follows:

SEC. 316. CENTRAL AND SOUTHERN FLORIDA, CANAL 111.

(a) IN GENERAL.-The project for Central and Southern Florida,

authorized by section 203 of the Flood Control Act of 1948 (62 Stat. 1176) and modified by section 203 of the Flood Control Act of 1968 (82 Stat. 740-741), is modified to authorize the Secretary to implement the recommended plan of improvement contained in a report entitled "Central and Southern Florida Project, Final Integrated General Reevaluation Report and Environmental Impact Statement, Canal 111 (C-111), South Dade County, Florida", dated May 1994, including acquisition by non-Federal interests of such portions of the Frog Pond and Rocky Glades areas as are needed for the project.

(b) COST SHARING.-

(1) FEDERAL SHARE.-The Federal share of the cost of implementing the plan of improvement shall be 50 percent.

(2) SECRETARY OF INTERIOR RESPONSIBILITY.-The Secretary of the Interior shall pay 25 percent of the cost of acquiring such portions of the Frog Pond and Rocky Glades areas as are needed for the project. The amount paid by the Secretary of the Interior shall be included as part of the Federal share of the cost of implementing the plan.

(3) OPERATION AND MAINTENANCE.-The non-Federal share of operation and maintenance costs of the improvements undertaken pursuant to this section shall be 100 percent; except that the Federal Government shall reimburse the non-Federal interest with respect to the project 60 percent of the costs of operating and maintaining pump stations that pump water into Taylor Slough in the Everglades National Park.

The law provides that the Federal share of implementing the plan contained in this supplement is to be 50 percent with the Department of Interior contributing 25 percent of the cost of acquiring such portions of the Frog Pond and Rocky Glades as are needed for the project. Therefore lands acquired by either the SFWMD or the National Park Service, Department of Interior have been included in the estimated real estate costs for the project.

ROCKY GLADES AREA-In the 1994 REDM, it was estimated the 5,322 acres would be acquired by SFWMD and that the Everglades National Park would acquire and provide approximately 1,078 acres of land within the boundaries of Everglades National Park for the project. The 1994 REDM provided an estimate of value of $25,335,000 for the 5,322 acres within the Rocky Glades to be acquired by SFWMD. Residential

improvements valued at $149,300. Based on more updated mapping by SFWMD, the number of acres of land within the Rocky Glades portion of the project to be acquired by SFWMD is 4,957 acres exclusive of the lands acquired by the Everglades National Park. Between 1994 and 2006, SFWMD has acquired 4,767 acres at a land acquisition cost of $55,142,464, exclusive of administrative costs. SFWMD has acquired 150 parcels of land. For the remaining approximately 192 acres yet to be acquired, the estimated land cost of these 66 parcels is estimated at $15,480,000, including a contingency, but exclusive of Non-Federal and Federal acquisition/administrative costs and contingency. It is expected that all land acquisition of these remaining 192 acres will be completed by July 2008. SFWMD's acquisition/administrative costs for the parcels acquired is $3,298,000, which includes recording costs, title costs, appraisal costs, risk assessment costs, relocation costs, professional fees and staff costs. For the 66 parcels to be acquired, SFWMD's acquisition/administrative costs are estimated to be $3,000,000, including contingency. USACE Federal Administrative costs to review the SFWMD acquisition of the 216 parcels are estimated at $2,463,000, including contingency.

Based on proposed modifications to the project in the Rocky Glades, it was determined that 1,056 acres of land within the boundaries of the Everglades National Park were required for the project. The National Park Service acquired all of these lands either by direct purchase or by Declaration of Taking. Everglades National Park Expansion area land is included in the total project acreage. As Section 316 of WRDA 96 changed the cost sharing to a 50 percent Federal cost share, the land is valued at $1,276,430, according to 9 individual tract appraisals performed by the National Park Service with a contingency of 35 percent added to as most of the tracts are still in condemnation for a total of $1,723,180. Improvements on the properties were valued by DOI at $156,000 and a contingency of 25 percent is added as most of the parcels containing improvements are in condemnation, total value is therefore estimated at $195,000. The estimated DOI administrative costs, including a 25 percent contingency are estimated at $229,400. The value of the National Park Service land is included in the cost estimate as WRDA 96 changes the cost sharing to 50% Federal and these costs will be included in the Federal share. These lands have been transferred by the National Park Service to the SFWMD, pursuant to Public Law 108-423 enacted December 23, 2004, which provides as follows:

> *SECTION 1. EVERGLADES NATIONAL PARK.*
> *Section 102 of the Everglades National Park Protection and Expansion Act of 1989 (16 U.S.C. 410r–6) is amended—*
> *(2) by adding at the end the following:*
> *''(h) LAND EXCHANGES.—*
> *''(1) DEFINITIONS.—In this subsection:*
> *''(A) ADMINISTRATOR.—The term 'Administrator' means the Administrator of General Services.*
> *''(B) COUNTY.—The term 'County' means Miami-Dade County, Florida.*

"(C) COUNTY LAND.—The term 'County land' means the 2 parcels of land owned by the County totaling approximately 152.93 acres that are designated as 'Tract 605–01' and 'Tract 605–03'.

"(D) DISTRICT.—The term 'District' means the South Florida Water Management District.

"(E) DISTRICT LAND.—The term 'District land' means the approximately 1,054 acres of District land located in the Southern Glades Wildlife and Environmental Area and identified on the map as 'South Florida Water Management District Exchange Lands'.

Florida.

"(F) GENERAL SERVICES ADMINISTRATION LAND.—The term 'General Services Administration land' means the approximately 595.28 acres of land designated as 'Site Alpha' that is declared by the Department of the Navy to be excess land.

"(G) MAP.—The term 'map' means the map entitled 'Boundary Modification for C–111 Project, Everglades National Park', numbered 160/80,007A, and dated May 18, 2004.

"(H) NATIONAL PARK SERVICE LAND.—The term 'National Park Service land' means the approximately 1,054 acres of land located in the Rocky Glades area of the park and identified on the map as 'NPS Exchange Lands'.

"(2) EXCHANGE OF GENERAL SERVICES ADMINISTRATION LAND AND COUNTY LAND.—The Administrator shall convey to the County fee title to the General Services Administration land in exchange for the conveyance by the County to the Secretary of fee title to the County land.

"(3) EXCHANGE OF NATIONAL PARK SERVICE LAND AND DISTRICT LAND.—

"(A) IN GENERAL.—As soon as practicable after the completion of the exchange under paragraph (2), the Secretary shall convey to the District fee title to the National Park Service land in exchange for fee title to the District land.

''(B) USE OF NATIONAL PARK SERVICE LAND.—The National Park Service land conveyed to the District shall be used by the District for the purposes of the C–111 project, including restoration of the Everglades natural system.

''(C) BOUNDARY ADJUSTMENT.—On completion of the land exchange under subparagraph (A), the Secretary shall modify the boundary of the park to reflect the exchange of the National Park Service land and the District land.

''(4) AVAILABILITY OF MAP.—The map shall be on file and available for public inspection in the appropriate offices of the National Park Service.''.

FROG POND-The Frog Pond acreage consisting of 5,215 acres was acquired by the South Florida Water Management District in April 1996.

DOI through a Grant with the SFWMD has reimbursed SFWMD $4,700,000 as a portion of its 25 percent contribution for the acquisition of the Frog Pond lands by the SFWMD. The SFWMD has the option of requesting that DOI reimburse them for their acquisition of the lands in the Rocky Glades and the balance of lands in the Frog Pond if not covered by the $4,700,000 already reimbursed. This would be for a total of $17,702,355, which would then be credited to the Federal share of the project.

The Frog Pond ownership consists of approximately 5,215 acres, of which approximately 389 acres are protected tree islands and sloughs. The remainder of the Frog Pond area is productive agricultural land. This area was valued in fee at

$11,994,500 in the Gross Appraisal dated October 1993; revised April 1994. In December 1994, South Florida Water Management District instituted eminent domain proceedings to acquire the western 3 sections of the Frog Pond. In February 1995, South Florida Water Management District converted the action to a quick take proceeding and amended the action to include the entire Frog Pond (5,215 acres). On 11 April 1996, a Stipulated Final Judgment was entered into in which the South Florida Water Management District agreed to settle the case and to pay the sum of $43,000,000 to the landowners. The South Florida Water Management District paid $34,500,000 for the land; $500,000 for 500,000 cubic yards of fill material on the land; interest as required by State law in the amount of $2,264,794.52; attorney's fees in accordance with State law in the amount of $4,810,000; and landowner costs in accordance with State law in the amount of $925,205.48. This amount has been approved by the USACE. The Department of Interior by Grant Agreement dated 12 October 2000 has contributed $4,700,000 as a portion of its 25 percent share toward the land acquisition costs of the Frog Pond. For the Frog Pond which has already been acquired, the actual Non-Federal acquisition/administrative costs are $914,000, while the Federal acquisition/administrative costs are estimated, in the amount of $475,200, including contingency. Included in the Federal acquisition/administrative cost ($356,400) and in the Non-Federal acquisition/administrative costs ($148,600) are costs related to a damage claim paid to a lessee of the SFWMD. During construction of the Frog Pond detention area, the Corps' contractor damaged crops on lands that had not been certified to the Corps.

SOUTHERN GLADES

In the approved 1994 REDM, the recommended/approved plan for the Southern Glades area, includes construction of a Spreader canal (C-111N), a 50 cfs pump station (S-332E), plugging of C-109 and C-110, and degrading the spoil mounds along the south side of C-111 (portion running southeast to Barnes Sound). These improvements are designed to provide overland flow through the Southern Glades into the eastern panhandle of the Everglades National Park and reduced flood discharges to Manatee Bay/Barnes Sound. The 1994 REDM also stated that the features lie predominantly within one large wetland tract owned by South Florida Water Management District. This land was valued in fee at a cost of $250,500 or $1,000 per acre.

For the Southern Glades, the SFWMD will provide 250.5 acres for the C-111N spreader canal at an estimated cost of $125,000, with estimated non-Federal administrative costs of $33,000 and estimated Federal administrative costs of $14,000. The actual acquisition cost per acre value for this land is estimated to be $310 per acre and will only require approximately 4 parcels. Because the lands were acquired in the 1980's and early 1990's, Non-Federal administrative costs are estimated. SFWMD may not have records to validate the estimates.

ADMINISTRATIVE COSTS

FROG POND
Federal Acquisition/Administrative Cost Estimate:
5 parcels -5,215 acres

Project Planning	$50,000
Review of Appraisals (5 @ $3,000 ea)	$15,000
Review of Condemnations (1 @ $15,000 ea)	$15,000
Review of Temporary Permits (Rights-of-Entry)	$15,000
Subtotal Federal Acquisition/Administrative Cost (RD):	$95,000
Contingency (25%) (RD) on $95,000	$23,800
Subtotal Federal Acquisition/Administrative Cost (RD):	$118,800
Damage Claim	$356,400
Total Federal Acquisition/Administrative Cost (RD):	**$475,200**

FROG POND
Non-Federal Acquisition/Administrative Cost Estimate:
5 parcels – 5,215 acres

Condemnation: (1 tract): (RD)	
Title Insurance Cost	$88,610
Survey Fees	$49,777
Salaries-SFWMD	$78,483
Environmental Audit Fees	$61,665
Expert Witness	$238,260
Outside attorney fees	$189,805
Appraisals-Contractor Appraisal Fees (RD)	$53,760
Temporary Permits (Rights-of-Entry)	$5,000
Subtotal Non-Federal Acquisition/Administrative Cost (RD):	$765,400
Damage Claim	$148,600
TOTAL NON-FEDERAL ACQUISITION/ADMINISTRATIVE COSTS	**$914,000**

ROCKY GLADES
Federal Acquisition/Administrative Cost Estimate **(USACE):**
216 parcels **-** 4,957 acres

Project Planning	$300,000
Review of Acquisitions	$600,000
Review of Appraisals	$600,000
Review of Condemnations	$300,000
Review of PL 91-646	$150,000
Review of Temporary Permits	$15,000
Draft PCA Review by Real Estate	$5,000
Subtotal Federal Acquisition/Administrative Cost (RD):	$1,970,000
Contingency (25%) (RD)	$ 493,000
Total Federal Acquisition/Administrative Cost (RD):	**$2,463,000**

ROCKY GLADES
Federal Acquisition/Administrative Cost Estimate **(National Park Service):**
9 parcels - 1,058 acres

Acquisitions (9 @ $4,000 ea)	$ 36,000
Appraisals (9 @ $2,500 ea)	$ 22,500
Condemnations (5 @ $20,000 ea)	$100,000
Temporary Permits (1 Right-of-Entry @ $25000)	$25,000
Subtotal Federal Acquisition/Administrative Cost (RD):	$183,500
Contingency (25%) (RD)	$ 45,900
Total Federal Acquisition/Administrative Cost (RD):	**$229,400**

ROCKY GLADES
Non-Federal Acquisition/Administrative Cost Estimate For acquired Lands:
150 parcels **-** 4,767 acres

Acquisitions includes staff costs, recording costs, title cost, professional fees, and risk assessment costs	$ 2,714,667
Appraisals	$ 582,943
Total Non-Federal Acquisition/Administrative Cost for acquired lands (RD)	**$3,298,000**

ROCKY GLADES
Non-Federal Acquisition/Administrative Cost Estimate for Lands to be acquired:
66 parcels **-** 192 acres

Acquisitions and Appraisals	$ 1,150,000
Condemnations	$920,000
PL 91-646 Assistance	$300,000
Temporary Permits	$15,000
Damage Claims	$15,000
Subtotal Non-Federal Acquisition/Administrative Cost:	$ 2,400,000
Contingency (25%) (RD)	$600,000
Total Non-Federal Acquisition/Administrative Cost (RD):	**$3,000,000**

SOUTHERN GLADES
Federal Acquisition/Administrative Cost Estimate:

Project Planning	$ 20,000	
Review of Acquisitions (4 @ $1,000 ea)	$4,000	
Review of Appraisals (4 @ $1,000 ea)	$4,000	
Review of Condemnations (0 @ $3,500 ea)	$0	
Review of Temporary Permits (1 @ $1,000)	$1,000	
Subtotal Federal Acquisition/Administrative Cost (RD):	$29,000	
Contingency (15%) (RD):	$4,000	
Total Federal Acquisition/Administrative Cost (RD):		$33,000

SOUTHERN GLADES
Non-Federal Acquisition/Administrative Cost Estimate:

Acquisitions	$5,000	
Appraisals	$7,000	
Temporary Permits (Rights-of-Entry)	$1,000	
Subtotal Non-Federal Acquisition/Administrative Cost:	$12,000	
Contingency (15%) (RD)	$2,000	
Total Non-Federal Acquisition/Administrative Cost: (RD)		$14,000

TOTAL ACQUISITION/ADMINISTRATIVE COSTS (RD) **$10,447,000**

25. SUMMARY OF ESTIMATED PROJECT REAL ESTATE COSTS (Lands and Damages)

FROG POND LANDS

Fee Simple: 5,215 acres		$34,500,000	
Fill Material (500,00 cubic yds)		$500,000	
Interest (State Law)		$2,264.795	
Landowner Attorney Fees (State law)		$4,810,000	
Landowner Costs (State law)		$925,205	
	Subtotal	$43,000,000	
Acquisition/Administrative Costs			
Federal with Contingency		$475,200	
Non-Federal without Contingency		$914,000	
	Subtotal	$1,389,200	
	TOTAL		**$44,389,200**

ROCKY GLADES LANDS

SFWMD fee simple acquired	$ 55,142,464	
SFWMD to be acquired with 25% contingency	$ 15,480,000	
ENP Lands: 1,056 acres with contingency (35%) on DOI lands in condemnation	$1,723,180	
Subtotal (RD)	$72,346,000	
91-646 National Park Service with 25 % contingency	$195,000	
Severance Damages:	-0-	
Minerals:	-0-	
Subtotal (Rounded)	$72,541,000	
Acquisition/Administrative Costs		
Federal with Contingency (USACE)	$2,463,000	
Federal with Contingency (National Park Service)	$229,400	
Non-Federal with Contingency (Rounded) acquired	$ 3,298,000	
Non-Federal with Contingency (Rounded) to be acquired	$3,000,000	
Subtotal	$8,990,400	
TOTAL		**$81,531,400**

ROCKY GLADES LANDS

Demolition and Removal of Structures (expended)	$1,181,100	
Demolition and Removal of Structures (estimated)	$5,000,000	
TOTAL		**$6,181,100**

SOUTHERN GLADES LANDS (250.5 acres total)

Fee Simple Acquired: 250.5 acres at $310 per acre	$78,000	
Improvements:	-0-	
Severance Damages:	-0-	
Minerals:	-0-	
Subtotal (Rounded)	$78,000	
Acquisition/Administrative Costs		
Federal with Contingency:	$33,000	
Non-Federal with contingency:	$14,000	
Public Law 91-646 Payments	-0-	
Subtotal	$47,000	
TOTAL		**$125,000**

TOTAL ESTIMATED REAL ESTATE COSTS (ROUNDED) **$132,227,000**

*Contingency on the various segments of costs are estimated to cover uncertainties associated with such elements as valuation variance, negotiation latitude, condemnation awards and interest, and refinement of boundary lines during ownership verification.

CHART OF ACCOUNTS

1	LANDS AND DAMAGES	
DATE	MAY-07	
01A00	PROJECT PLANNING with contingency added	$460,500
01B--	ACQUISITIONS	
01B10	BY GOVT WITH CONTINGENCY (DOI-NPS)	$45,000
01B20	BY LOCAL SPONSOR (LS) with contingency	$4,157,167
01B40	REVIEW OF LS with contingency	$754,500
01C--	CONDEMNATIONS	
01C10	BY GOVT (with contingency) (DOI-NPS)	$125,000
01C20	BY LS (NOTE 2)	$1,910,400
01C40	REVIEW OF LS with contingency	$393,750
01E--	APPRAISALS	
1E+20	BY GOVT (CONTRACT) with contingency (DOI NPS)	$28,125
1E+30	BY LS with contingency	$589,943
1E+50	REVIEW OF LS with contingency	$773,250
01F--	PL 91-646 ASSISTANCE	
01F20	BY LS with contingency	$375,000
01F40	REVIEW OF LS with contingency	$187,500
01G--	TEMPORARY PERMITS/LICENSES/RIGHTS-OF-ENTRY	
01G10	BY GOVT with contingency (DOI-NPS)	$31,250
01G20	BY LS with contingency	$26,200
01G40	REVIEW OF LS with contingency	$38,500
01G60	DAMAGE CLAIMS with contingency	$523,750
01M00	PROJECT RELATED ADMINISTRATION with contingency	
	REAL ESTATE REVIEW OF PCA	$6,250
01R--	REAL ESTATE PAYMENTS	
01R10	LAND PAYMENTS	
01R1A	BY GOVT (with contingency) (DOI-NPS)	$1,918,180
01R1B	BY LS with contingency	$113,622,464
	Demolition and Removal of Structures	$6,181,100
	TOTAL PROJECT REAL ESTATE COST (RD)	$132,227,000

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APPENDIX B

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APPENDIX B

COST ESTIMATES

B.1 COST ENGINEERING

Construction cost estimates for the various alternatives were made in the MII cost software version 2.2.2. The basis of the cost estimates was the scope of work provided by the engineering technical lead person. The scope of works may provide a layout of the plan features, a description of the major feature's special considerations, quantity calculations, and specific reference to particular structures. Cost estimates for spillways, culvert structures, and pump plants were produced in cost models from quantities provided.

B.2 EARTHWORK COST ESTIMATES

The earthwork structures levees, canals, berms, swales and other general earthwork employed standard construction techniques and standard equipment. The cost estimates for this work relied on equipment manufactures' data. The haul distances for trucking operations were approximations based on general assumption about the location of borrow areas. The cost estimates relied on data provided by designers for quantity estimates of cut and fill, suitable and unsuitable material, rock and overburden, and swell and compaction factors.

B.3 PUMP PLANT COST ESTIMATES

Pump plant cost estimates were produced by incorporating data provided by designers relating to pump capacity, number of pumps, concrete quantity, station dimensions and dewatering plan. The data provided served as the basis for modifying a standard cost estimate for a pump plant of the same type. The particular standard pump plant cost estimate was derived from the government estimate of cost and the contract cost for a pump plant under construction or recently completed.

B.4 PLANNING ENGINEERING AND DESIGN

Planning, engineering and design cost were estimated by the various engineering functions and provided for inclusion in the cost estimate.

B.5 CONSTRUCTION MANAGEMENT

Construction management costs were estimated by the Construction Operations division.

B.6 CONTINGENCY

A construction contingency cost of 25% of construction cost was used for all construction. No statistical analysis of cost risk was performed. The major factors influencing the construction contingency cost are:

1. The estimate of rock quantity and usable material percentage. The rock elevations were provided and were based on available borings data. Normal variations are expected as the subsurface investigations are made.

2. Haul distances for trucking operations. Haul distances were analyzed inasmuch as identifying reasonable areas with the required carrying capacity. Normal variances are expected in routing.

3. The structure construction quantities. The structure quantities were calculated from standard designs. Normal variations are expected in site-specific designs.

4. The levee and canal alignments and cross sections. A change that would affect quantity is not anticipated. Normal design variances are expected as more specific site data is acquired.

B.7 CONTRACTOR COST

A contractor cost was determined as percentages using industry averages and normal contracting arrangements. The contractor cost was modeled after recent construction projects in progress.

B.8 EQUIPMENT COST

All equipment costs are from EP 1110-1-8 Construction Equipment Ownership and operating Expense Schedule.

B.9 LABOR RATES

Labor rates are derived using a national labor rates database.

APPENDIX C

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GRR Estimate for C-111 - Alt 6A
South Dade Co., Florida
May 1993 Price Level
Escalated to FY07 Level
Feb 2007

Designed By: Jacksonville District Office
Estimated By: D Cowdrey

Prepared By: M. Fascher

Preparation Date: 05/08/93
Effective Date of Pricing: 05/08/93

Sales Tax: 6.00%

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Release 5.31

Currency in DOLLARS

This estimate is for C-111 GRR. The object of this project is to increase water flow to ENP. Notes under the detail items explain method and general assumptions made for this estimate. Mechanical and electrical costs were provided by Mechanical and Electrical Section and their backup for these costs is available for review.

E&D and S&I costs are based on percentages provided by Project Management. E&D is 8% and S&I is 10%.

Real Estate costs were provided by Real Estate Division.

Contingencies: With the limited design information and lack of surveys and geotechnical information, contingencies of 25% were determined to be reasonable.

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** PROJECT OWNER SUMMARY - Contract (Rounded to 100's) **

		QUANTITY UOM	CONTRACT	ESCALATN	CONTING	TOTAL COST	UNIT COST
05	3-84" CMP w/Flap Gates		645,800	347,200	248,300	1,241,300	
07	24 36" Culverts with Risers		3,923,200	2,109,200	1,508,100	7,540,400	
08	Structure 332A (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
09	Structure 332B (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
10	Structure 332C (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
11	Structure 332D (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
12	State Road 9336 (Bridge)		3,482,800	1,872,400	1,338,800	6,693,900	
13	Connector Canal from C-111		2,092,200	1,124,800	804,300	4,021,300	
14	Connector Canal @ S-332B		2,092,200	1,124,800	804,300	4,021,300	
15	Connector Canal @ S-332C		2,092,200	1,124,800	804,300	4,021,300	
16	Canal L-31W (filled in) fr S-332		3,024,100	1,625,800	1,162,500	5,812,400	
17	C-111 North		1,246,800	670,300	479,300	2,396,300	
18	Canal C-109		214,700	115,400	82,500	412,600	
19	Canal C-110		220,000	118,300	84,600	422,800	
20	Canal C-111		8,379,100	4,504,800	3,221,000	16,104,800	
21	Connector Canal from C-332A		2,092,200	1,124,800	804,300	4,021,300	
22	Existing L-31W Borrow Cl-S332D		2,010,900	1,081,100	773,000	3,865,000	
26	L-31W Tieback Levee		1,327,900	713,900	510,500	2,552,300	
28	Structure 332E (50 cfs)		1,043,100	560,800	401,000	2,004,900	
29	300' Spillway (Weir)		92,800	49,900	35,700	178,300	
30	S-332D Tieback Levee		615,400	330,900	236,600	1,182,900	
40	Lands and Damages for C-111		40,552,000	21,801,600	15,588,400	77,942,000	
41	Required Hydro & Bio Monitoring		6,400,000	3,440,800	2,460,200	12,301,000	
TOTAL	GRR Estimate for C-111 - Alt 6A		100,185,600	53,861,800	38,511,800	192,559,200	

** PROJECT OWNER SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	CONTRACT	ESCALATN	CONTING	TOTAL COST	UNIT COST
05 3-84" CMP w/Flap Gates						
05- A Construction Cost		547,300	294,300	210,400	1,052,000	
05- B Non-Construction Cost		98,500	53,000	37,900	189,300	
TOTAL 3-84" CMP w/Flap Gates		645,800	347,200	248,300	1,241,300	
07 24 36" Culverts with Risers						
07- A Construction Cost		3,324,700	1,787,400	1,278,000	6,390,200	
07- B Non-Construction Cost		598,500	321,700	230,000	1,150,200	
TOTAL 24 36" Culverts with Risers		3,923,200	2,109,200	1,508,100	7,540,400	
08 Structure 332A (300 cfs)						
08- A Construction Cost		3,948,800	2,122,900	1,517,900	7,589,600	
08- B Non-Construction Cost		710,800	382,100	273,200	1,366,100	
TOTAL Structure 332A (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
09 Structure 332B (300 cfs)						
09- A Construction Cost		3,948,800	2,122,900	1,517,900	7,589,600	
09- B Non-Construction Cost		710,800	382,100	273,200	1,366,100	
TOTAL Structure 332B (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
10 Structure 332C (300 cfs)						
10- A Construction Cost		3,948,800	2,122,900	1,517,900	7,589,600	
10- B Non-Construction Cost		710,800	382,100	273,200	1,366,100	
TOTAL Structure 332C (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
11 Structure 332D (300 cfs)						
11- A Construction Cost		3,948,800	2,122,900	1,517,900	7,589,600	
11- B Non-Construction Cost		710,800	382,100	273,200	1,366,100	
TOTAL Structure 332D (300 cfs)		4,659,500	2,505,100	1,791,100	8,955,700	
12 State Road 9336 (Bridge)						

** PROJECT OWNER SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	CONTRACT	ESCALATN	CONTING	TOTAL COST	UNIT COST
12- A Construction Costs		2,951,500	1,586,800	1,134,600	5,672,800	
12- B Non-Construction Cost		531,300	285,600	204,200	1,021,100	
TOTAL State Road 9336 (Bridge)		3,482,800	1,872,400	1,338,800	6,693,900	
13 Connector Canal from C-111						
13- A Construction Cost		1,773,100	953,200	681,600	3,407,900	
13- B Non-Construction Cost		319,200	171,600	122,700	613,400	
TOTAL Connector Canal from C-111		2,092,200	1,124,800	804,300	4,021,300	
14 Connector Canal @ S-332B						
14- A Construction Cost		1,773,100	953,200	681,600	3,407,900	
14- B Non-Construction Cost		319,200	171,600	122,700	613,400	
TOTAL Connector Canal @ S-332B		2,092,200	1,124,800	804,300	4,021,300	
15 Connector Canal @ S-332C						
15- A Construction Cost		1,773,100	953,200	681,600	3,407,900	
15- B Non-Construction Cost		319,200	171,600	122,700	613,400	
TOTAL Connector Canal @ S-332C		2,092,200	1,124,800	804,300	4,021,300	
16 Canal L-31W (filled in) fr S-332						
16- A Construction Cost		2,562,800	1,377,800	985,200	4,925,800	
16- B Non-Construction Cost		461,300	248,000	177,300	886,600	
TOTAL Canal L-31W (filled in) fr S-332		3,024,100	1,625,800	1,162,500	5,812,400	
17 C-111 North						
17- A Construction Cost		1,056,600	568,000	406,200	2,030,800	
17- B Non-Construction Cost		190,200	102,200	73,100	365,500	
TOTAL C-111 North		1,246,800	670,300	479,300	2,396,300	
18 Canal C-109						
18- A Construction Cost		182,000	97,800	69,900	349,700	
18- B Non-Construction Cost		32,700	17,600	12,600	62,900	

** PROJECT OWNER SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	CONTRACT	ESCALATN	CONTING	TOTAL COST	UNIT COST
TOTAL Canal C-109		214,700	115,400	82,500	412,600	
19 Canal C-110						
19- A Construction Cost		186,400	100,200	71,700	358,400	
19- B Non-Construction Cost		33,600	18,000	12,900	64,500	
TOTAL Canal C-110		220,000	118,300	84,600	422,800	
20 Canal C-111						
20- A Construction Cost		7,067,100	3,799,400	2,716,600	13,583,100	
20- B Non-Construction Cost		1,312,000	705,400	504,300	2,521,700	
TOTAL Canal C-111		8,379,100	4,504,800	3,221,000	16,104,800	
21 Connector Canal from C-332A						
21- A Construction Cost		1,773,100	953,200	681,600	3,407,900	
21- B Non-Construction Cost		319,200	171,600	122,700	613,400	
TOTAL Connector Canal from C-332A		2,092,200	1,124,800	804,300	4,021,300	
22 Existing L-31W Borrow Cl-S332D						
22- A Construction Cost		1,704,100	916,200	655,100	3,275,400	
22- B Non-Construction Cost		306,700	164,900	117,900	589,600	
TOTAL Existing L-31W Borrow Cl-S332D		2,010,900	1,081,100	773,000	3,865,000	
26 L-31W Tieback Levee						
26- A Construction Cost		1,125,400	605,000	432,600	2,163,000	
26- B Non-Construction Cost		202,600	108,900	77,900	389,300	
TOTAL L-31W Tieback Levee		1,327,900	713,900	510,500	2,552,300	
28 Structure 332E (50 cfs)						
28- A Construction Cost		881,900	474,100	339,000	1,695,000	
28- B Non-Construction Cost		161,200	86,700	62,000	309,900	
TOTAL Structure 332E (50 cfs)		1,043,100	560,800	401,000	2,004,900	

** PROJECT OWNER SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	CONTRACT	ESCALATN	CONTING	TOTAL COST	UNIT COST
29 300' Spillway (Weir)						
29- A Construction Cost		78,700	42,300	30,300	151,300	
29- B Non-Construction Cost		14,100	7,600	5,400	27,100	
TOTAL 300' Spillway (Weir)		92,800	49,900	35,700	178,300	
30 S-332D Tieback Levee						
30- A Construction Cost		521,600	280,400	200,500	1,002,400	
30- B Non-Construction Cost		93,900	50,500	36,100	180,500	
TOTAL S-332D Tieback Levee		615,400	330,900	236,600	1,182,900	
40 Lands and Damages for C-111						
40- B Non-Construction Cost		40,552,000	21,801,600	15,588,400	77,942,000	
TOTAL Lands and Damages for C-111		40,552,000	21,801,600	15,588,400	77,942,000	
41 Reguired Hydro & Bio Monitoring						
41- B Non-Construction Cost		6,400,000	3,440,800	2,460,200	12,301,000	
TOTAL Reguired Hydro & Bio Monitoring		6,400,000	3,440,800	2,460,200	12,301,000	
TOTAL GRR Estimate for C-111 - Alt 6A		100,185,600	53,861,800	38,511,800	192,559,200	

** PROJECT INDIRECT SUMMARY - Contract (Rounded to 100's) **

		QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
05	3-84" CMP w/Fla		526,900	42,800	21,400	49,300	5,400	645,800	
07	24 36" Culverts		3,200,700	260,200	130,100	299,300	32,900	3,923,200	
08	Structure 332A		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
09	Structure 332B		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
10	Structure 332C		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
11	Structure 332D		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
12	State Road 9336		2,841,400	231,000	115,500	265,700	29,200	3,482,800	
13	Connector Canal		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
14	Connector Canal		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
15	Connector Canal		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
16	Canal L-31W (fi		2,467,200	200,600	100,300	230,700	25,400	3,024,100	
17	C-111 North		1,017,200	82,700	41,300	95,100	10,500	1,246,800	
18	Canal C-109		175,200	14,200	7,100	16,400	1,800	214,700	
19	Canal C-110		179,500	14,600	7,300	16,800	1,800	220,000	
20	Canal C-111		6,843,300	553,100	276,600	636,100	70,000	8,379,100	
21	Connector Canal		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
22	Existing L-31W		1,640,500	133,400	66,700	153,400	16,900	2,010,900	
26	L-31W Tieback L		1,083,400	88,100	44,000	101,300	11,100	1,327,900	
28	Structure 332E		851,500	69,000	34,500	79,400	8,700	1,043,100	
29	300' Spillway (		75,700	6,200	3,100	7,100	800	92,800	
30	S-332D Tieback		502,100	40,800	20,400	46,900	5,200	615,400	
40	Lands and Damag		40,552,000	0	0	0	0	40,552,000	
41	Required Hydro		6,400,000	0	0	0	0	6,400,000	
	GRR Estimate fo		90,389,700	3,528,100	1,764,100	4,057,400	446,300	100,185,600	

	53,861,800
SUBTOTAL	154,047,400
CONTING	38,511,800
TOTAL INCL OWNER COSTS	192,559,200

** PROJECT INDIRECT SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
05 3-84" CMP w/Fla								
05- A Construction		428,400	42,800	21,400	49,300	5,400	547,300	
05- B Non-Construc		98,500	0	0	0	0	98,500	
TOTAL 3-84" CMP w/		526,900	42,800	21,400	49,300	5,400	645,800	
07 24 36" Culverts								
07- A Construction		2,602,200	260,200	130,100	299,300	32,900	3,324,700	
07- B Non-Construc		598,500	0	0	0	0	598,500	
TOTAL 24 36" Culve		3,200,700	260,200	130,100	299,300	32,900	3,923,200	
08 Structure 332A								
08- A Construction		3,090,600	309,100	154,500	355,400	39,100	3,948,800	
08- B Non-Construc		710,800	0	0	0	0	710,800	
TOTAL Structure 33		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
09 Structure 332B								
09- A Construction		3,090,600	309,100	154,500	355,400	39,100	3,948,800	
09- B Non-Construc		710,800	0	0	0	0	710,800	
TOTAL Structure 33		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
10 Structure 332C								
10- A Construction		3,090,600	309,100	154,500	355,400	39,100	3,948,800	
10- B Non-Construc		710,800	0	0	0	0	710,800	
TOTAL Structure 33		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
11 Structure 332D								
11- A Construction		3,090,600	309,100	154,500	355,400	39,100	3,948,800	
11- B Non-Construc		710,800	0	0	0	0	710,800	
TOTAL Structure 33		3,801,400	309,100	154,500	355,400	39,100	4,659,500	
12 State Road 9336								

** PROJECT INDIRECT SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
12- A Construction		2,310,100	231,000	115,500	265,700	29,200	2,951,500	
12- B Non-Construc		531,300	0	0	0	0	531,300	
TOTAL State Road 9		2,841,400	231,000	115,500	265,700	29,200	3,482,800	
13 Connector Canal								
13- A Construction		1,387,800	138,800	69,400	159,600	17,600	1,773,100	
13- B Non-Construc		319,200	0	0	0	0	319,200	
TOTAL Connector Ca		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
14 Connector Canal								
14- A Construction		1,387,800	138,800	69,400	159,600	17,600	1,773,100	
14- B Non-Construc		319,200	0	0	0	0	319,200	
TOTAL Connector Ca		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
15 Connector Canal								
15- A Construction		1,387,800	138,800	69,400	159,600	17,600	1,773,100	
15- B Non-Construc		319,200	0	0	0	0	319,200	
TOTAL Connector Ca		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
16 Canal L-31W (fi								
16- A Construction		2,005,900	200,600	100,300	230,700	25,400	2,562,800	
16- B Non-Construc		461,300	0	0	0	0	461,300	
TOTAL Canal L-31W		2,467,200	200,600	100,300	230,700	25,400	3,024,100	
17 C-111 North								
17- A Construction		827,000	82,700	41,300	95,100	10,500	1,056,600	
17- B Non-Construc		190,200	0	0	0	0	190,200	
TOTAL C-111 North		1,017,200	82,700	41,300	95,100	10,500	1,246,800	
18 Canal C-109								
18- A Construction		142,400	14,200	7,100	16,400	1,800	182,000	
18- B Non-Construc		32,700	0	0	0	0	32,700	

** PROJECT INDIRECT SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
TOTAL Canal C-109		175,200	14,200	7,100	16,400	1,800	214,700	
19 Canal C-110								
19- A Construction		145,900	14,600	7,300	16,800	1,800	186,400	
19- B Non-Construc		33,600	0	0	0	0	33,600	
TOTAL Canal C-110		179,500	14,600	7,300	16,800	1,800	220,000	
20 Canal C-111								
20- A Construction		5,531,300	553,100	276,600	636,100	70,000	7,067,100	
20- B Non-Construc		1,312,000	0	0	0	0	1,312,000	
TOTAL Canal C-111		6,843,300	553,100	276,600	636,100	70,000	8,379,100	
21 Connector Canal								
21- A Construction		1,387,800	138,800	69,400	159,600	17,600	1,773,100	
21- B Non-Construc		319,200	0	0	0	0	319,200	
TOTAL Connector Ca		1,706,900	138,800	69,400	159,600	17,600	2,092,200	
22 Existing L-31W								
22- A Construction		1,333,800	133,400	66,700	153,400	16,900	1,704,100	
22- B Non-Construc		306,700	0	0	0	0	306,700	
TOTAL Existing L-3		1,640,500	133,400	66,700	153,400	16,900	2,010,900	
26 L-31W Tieback L								
26- A Construction		880,800	88,100	44,000	101,300	11,100	1,125,400	
26- B Non-Construc		202,600	0	0	0	0	202,600	
TOTAL L-31W Tiebac		1,083,400	88,100	44,000	101,300	11,100	1,327,900	
28 Structure 332E								
28- A Construction		690,200	69,000	34,500	79,400	8,700	881,900	
28- B Non-Construc		161,200	0	0	0	0	161,200	
TOTAL Structure 33		851,500	69,000	34,500	79,400	8,700	1,043,100	

** PROJECT INDIRECT SUMMARY - Level 2 (Rounded to 100's) **

	QUANTITY UOM	DIRECT	OVERHEAD	HOME OFC	PROFIT	BOND	TOTAL COST	UNIT COST
29 300' Spillway (								
29- A Construction		61,600	6,200	3,100	7,100	800	78,700	
29- B Non-Construc		14,100	0	0	0	0	14,100	
TOTAL 300' Spillwa		75,700	6,200	3,100	7,100	800	92,800	
30 S-332D Tieback								
30- A Construction		408,200	40,800	20,400	46,900	5,200	521,600	
30- B Non-Construc		93,900	0	0	0	0	93,900	
TOTAL S-332D Tieba		502,100	40,800	20,400	46,900	5,200	615,400	
40 Lands and Damag								
40- B Non-Construc		40,552,000	0	0	0	0	40,552,000	
TOTAL Lands and Da		40,552,000	0	0	0	0	40,552,000	
41 Required Hydro								
41- B Non-Construc		6,400,000	0	0	0	0	6,400,000	
TOTAL Required Hyd		6,400,000	0	0	0	0	6,400,000	
TOTAL GRR Estimate		90,389,700	3,528,100	1,764,100	4,057,400	446,300	100,185,600	
							53,861,800	
SUBTOTAL							154,047,400	
CONTING							38,511,800	
TOTAL INCL OWNER COSTS							192,559,200	

APPENDIX D

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C111_PRELIM_612
Preliminary Concept Cost Estimate

Estimated by	W Dailey
Designed by	USACE
Prepared by	W Dailey
Preparation Date	2/22/2007
Effective Date of Pricing	2/22/2007
Estimated Construction Time	Days

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Description	UOM	Quantity	Escalation	Contingency	ContractCost	ProjectCost
Project Costs			**11,809,990.70**	**19,940,513.19**	**103,001,337.44**	**155,616,134.01**
Contract 6	**EA**	**1.0000**	**550,593.49**	**0.00**	*10,226,446.0000* **10,226,446.00**	*11,926,492.0193* **11,926,492.02**
S-331 Command & Control Center	**EA**	**1.0000**	**550,593.49**	**0.00**	*10,226,446.0000* **10,226,446.00**	*11,926,492.0193* **11,926,492.02**
Contract 7	**EA**	**1.0000**	**504,231.62**	**813,302.42**	*16,266,048.3714* **16,266,048.37**	*19,318,844.4541* **19,318,844.45**
L-31 W Tieback Levee	**EA**	**1.0000**	**232,404.20**	**374,857.28**	*7,497,145.6626* **7,497,145.66**	*8,904,202.6434* **8,904,202.64**
Levees and Floodwalls	**EA**	**1.0000**	**232,404.20**	**374,857.28**	*7,497,145.6626* **7,497,145.66**	*8,904,202.6434* **8,904,202.64**
S-332D Tieback Levee	**EA**	**1.0000**	**128,513.97**	**207,287.12**	*4,145,742.4466* **4,145,742.45**	*4,923,811.3427* **4,923,811.34**
Levees and Floodwalls	**EA**	**1.0000**	**128,513.97**	**207,287.12**	*4,145,742.4466* **4,145,742.45**	*4,923,811.3427* **4,923,811.34**
S-332B to C Partial Connector Levee	**EA**	**1.0000**	**47,000.62**	**75,809.84**	*1,516,196.8946* **1,516,196.89**	*1,800,755.2480* **1,800,755.25**
Levees and Floodwalls	**EA**	**1.0000**	**47,000.62**	**75,809.84**	*1,516,196.8946* **1,516,196.89**	*1,800,755.2480* **1,800,755.25**
Levee Degrades	**EA**	**1.0000**	**22,206.76**	**35,818.49**	*716,369.7547* **716,369.75**	*850,817.3311* **850,817.33**
Levees and Floodwalls	**EA**	**1.0000**	**22,206.76**	**35,818.49**	*716,369.7547* **716,369.75**	*850,817.3311* **850,817.33**
Structure S-332DX1	**EA**	**1.0000**	**31,288.82**	**50,467.43**	*1,009,348.5232* **1,009,348.52**	*1,198,782.0689* **1,198,782.07**
Floodway Control-Diversion Struc	**EA**	**1.0000**	**31,288.82**	**50,467.43**	*1,009,348.5232* **1,009,348.52**	*1,198,782.0689* **1,198,782.07**
L-31W Borrow Canal Backfill	**EA**	**1.0000**	**42,817.25**	**69,062.25**	*1,381,245.0897* **1,381,245.09**	*1,640,475.8201* **1,640,475.82**
Channels and Canals	**EA**	**1.0000**	**42,817.25**	**69,062.25**	*1,381,245.0897* **1,381,245.09**	*1,640,475.8201* **1,640,475.82**
Contract 8	**EA**	**1.0000**	**1,070,296.89**	**3,698,535.74**	*14,794,142.9782* **14,794,142.98**	*23,039,599.2122* **23,039,599.21**
L-31 W Tieback Levee	**EA**	**1.0000**	**543,386.89**	**1,890,067.64**	*7,560,270.5693* **7,560,270.57**	*11,770,388.6823* **11,770,388.68**

Description	UOM	Quantity	Escalation	Contingency	ContractCost	ProjectCost
Levees and Floodwalls	EA	1.0000	543,386.89	1,890,067.64	*7,560,270.5693* 7,560,270.57	*11,770,388.6823* 11,770,388.68
S-332D Tieback Levee	EA	1.0000	400,167.12	1,391,905.01	*5,567,620.0581* 5,567,620.06	*8,668,082.9104* 8,668,082.91
Levees and Floodwalls	EA	1.0000	400,167.12	1,391,905.01	*5,567,620.0581* 5,567,620.06	*8,668,082.9104* 8,668,082.91
NDA Southern Interior Overflow Weir	EA	1.0000	14,577.28	26,416.44	*105,665.7533* 105,665.75	*171,490.9211* 171,490.92
Levees and Floodwalls	EA	1.0000	14,577.28	26,416.44	*105,665.7533* 105,665.75	*171,490.9211* 171,490.92
SDA/NDA - Western Emer Overflow Weirs	EA	1.0000	29,454.29	102,451.13	*409,804.5280* 409,804.53	*638,014.0147* 638,014.01
Channels and Canals	EA	1.0000	26,748.09	93,038.13	*372,152.5222* 372,152.52	*579,394.5859* 579,394.59
Levees and Floodwalls	EA	1.0000	2,706.20	9,413.00	*37,652.0058* 37,652.01	*58,619.4288* 58,619.43
SDA and NDA Flowway Berms	EA	1.0000	62,581.53	217,677.91	*870,711.6384* 870,711.64	*1,355,588.3113* 1,355,588.31
Floodway Control-Diversion Struc	EA	1.0000	62,581.53	217,677.91	*870,711.6384* 870,711.64	*1,355,588.3113* 1,355,588.31
S-332B TDA degrade	EA	1.0000	20,129.78	70,017.61	*280,070.4311* 280,070.43	*436,034.3724* 436,034.37
Levees and Floodwalls	EA	1.0000	20,129.78	70,017.61	*280,070.4311* 280,070.43	*436,034.3724* 436,034.37
Contract 9	EA	1.0000	2,619,273.95	6,263,568.33	*25,054,273.3398* 25,054,273.34	*39,824,869.8617* 39,824,869.86
Aerojet Canal Plugs	EA	1.0000	366,689.93	876,879.43	*3,507,517.7175* 3,507,517.72	*5,575,353.7427* 5,575,353.74
Channels and Canals	EA	1.0000	366,689.93	876,879.43	*3,507,517.7175* 3,507,517.72	*5,575,353.7427* 5,575,353.74
L-31W Borrow Canal Backfill	EA	1.0000	2,137,700.03	5,111,962.50	*20,447,849.9820* 20,447,849.98	*32,502,757.2519* 32,502,757.25
Channels and Canals	EA	1.0000	2,137,700.03	5,111,962.50	*20,447,849.9820* 20,447,849.98	*32,502,757.2519* 32,502,757.25
Frogpond Flowway Weir	EA	1.0000	63,040.53	150,751.20	*603,004.7834* 603,004.78	*958,502.6354* 958,502.64

Description	UOM	Quantity	Escalation	Contingency	ContractCost	ProjectCost
Levees and Floodwalls	EA	1.0000	63,040.53	150,751.20	*603,004.7834* 603,004.78	*958,502.6354* 958,502.64
Structure Demolishing	EA	1.0000	51,843.46	123,975.21	*495,900.8569* 495,900.86	*788,256.2317* 788,256.23
Floodway Control-Diversion Struc	EA	1.0000	51,843.46	123,975.21	*495,900.8569* 495,900.86	*788,256.2317* 788,256.23
Contract 10	EA	1.0000	2,553,945.04	4,628,170.91	*18,512,683.6534* 18,512,683.65	*30,045,280.2677* 30,045,280.27
S-332B Pumping Plant	EA	1.0000	1,733,250.98	3,140,937.50	*12,563,750.0000* 12,563,750.00	*20,390,419.7269* 20,390,419.73
Pumping Plant	EA	1.0000	1,733,250.98	3,140,937.50	*12,563,750.0000* 12,563,750.00	*20,390,419.7269* 20,390,419.73
S-332B Flowway Levee	EA	1.0000	167,807.59	304,095.10	*1,216,380.4191* 1,216,380.42	*1,974,132.5077* 1,974,132.51
Levees and Floodwalls	EA	1.0000	167,807.59	304,095.10	*1,216,380.4191* 1,216,380.42	*1,974,132.5077* 1,974,132.51
S-332B Control Structure	EA	1.0000	326,236.35	591,194.24	*2,364,776.9561* 2,364,776.96	*3,837,930.1319* 3,837,930.13
Floodway Control-Diversion Struc	EA	1.0000	326,236.35	591,194.24	*2,364,776.9561* 2,364,776.96	*3,837,930.1319* 3,837,930.13
S332B Control Structure West	EA	1.0000	168,237.53	304,874.23	*1,219,496.9373* 1,219,496.94	*1,979,190.4811* 1,979,190.48
Levees and Floodwalls	EA	1.0000	168,237.53	304,874.23	*1,219,496.9373* 1,219,496.94	*1,979,190.4811* 1,979,190.48
Demolition	EA	1.0000	158,412.60	287,069.84	*1,148,279.3409* 1,148,279.34	*1,863,607.4201* 1,863,607.42
Temporary Pump Station	EA	1.0000	158,412.60	287,069.84	*1,148,279.3409* 1,148,279.34	*1,863,607.4201* 1,863,607.42
Contract 11	EA	1.0000	2,754,678.29	4,004,754.36	*16,019,017.4216* 16,019,017.42	*26,542,919.1640* 26,542,919.16
S-332C Pumping Plant	EA	1.0000	2,160,500.14	3,140,937.50	*12,563,750.0000* 12,563,750.00	*20,817,668.8913* 20,817,668.89
Pumping Plant	EA	1.0000	2,160,500.14	3,140,937.50	*12,563,750.0000* 12,563,750.00	*20,817,668.8913* 20,817,668.89
S-332C Flowway Levee	EA	1.0000	334,587.10	486,423.10	*1,945,692.3809* 1,945,692.38	*3,223,940.2845* 3,223,940.28

Description	UOM	Quantity	Escalation	Contingency	ContractCost	ProjectCost
Levees and Floodwalls	EA	1.0000	334,587.10	486,423.10	*1,945,692.3809* **1,945,692.38**	*3,223,940.2845* **3,223,940.28**
S-332C Control Structure	EA	1.0000	69,693.00	101,319.76	*405,279.0274* **405,279.03**	*671,532.3531* **671,532.35**
Floodway Control-Diversion Struc	EA	1.0000	69,693.00	101,319.76	*405,279.0274* **405,279.03**	*671,532.3531* **671,532.35**
Demolition	EA	1.0000	189,898.06	276,074.00	*1,104,296.0133* **1,104,296.01**	*1,829,777.6351* **1,829,777.64**
Temporary Pump Station	EA	1.0000	189,898.06	276,074.00	*1,104,296.0133* **1,104,296.01**	*1,829,777.6351* **1,829,777.64**
Spreader Canal	EA	1.0000	1,756,971.41	532,181.42	*2,128,725.6737* **2,128,725.67**	*4,918,129.0336* **4,918,129.03**
S332E Pumping Plant	EA	1.0000	727,908.87	220,481.43	*881,925.7294* **881,925.73**	*2,037,568.5739* **2,037,568.57**
Mob & Demob	EA	1.0000	30,620.97	9,275.00	*37,099.9984* **37,100.00**	*85,714.4635* **85,714.46**
Care & Diversion of Water	EA	1.0000	90,624.85	27,450.00	*109,799.9952* **109,800.00**	*253,677.8463* **253,677.85**
Earthwork for Structures	EA	1.0000	47,387.56	14,353.55	*57,414.2047* **57,414.20**	*132,647.6543* **132,647.65**
Foundation Work	EA	1.0000	34,834.37	10,551.23	*42,204.9028* **42,204.90**	*97,508.6459* **97,508.65**
Pumping Plant Substructure	EA	1.0000	196,856.16	59,627.15	*238,508.5881* **238,508.59**	*551,041.4171* **551,041.42**
Pumping Plant Superstructure	EA	1.0000	24,760.89	7,500.00	*29,999.9979* **30,000.00**	*69,310.8852* **69,310.89**
Pumping Machinery & Appurtenances	EA	1.0000	212,035.76	64,225.00	*256,900.0086* **256,900.01**	*593,532.2746* **593,532.27**
Associated General Items	EA	1.0000	90,788.31	27,499.51	*109,998.0336* **109,998.03**	*254,135.3869* **254,135.39**
C-111North	EA	1.0000	1,029,062.54	311,699.99	*1,246,799.9443* **1,246,799.94**	*2,880,560.4598* **2,880,560.46**

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APPENDIX E

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C-111 Estimated O&M

C-111 Features	**Amount**
C-111 Pump Station O&M	1,120,000
C-111 Culvert O&M	40,000
C-111 Weir O&M	100,000
C-111 Mowing Cost	31,950
C-111 Erosion Control Cost	142,633
C-111 Invasive Species Control	
Floating Vegetation	105,149
Submerged Vegetation	145,806
C-111 Supervision & Inspection	550,781
C-111 O&M	2,236,318

C-111 Estimated O&M

Project Levees
C-111

	CSOP Line Item	Length	Top Width	Slope	Levee Height	Overall Width	Acres	Mowing Cost	Erosion Control Cost
L-31W Tieback Levee (C-111 SDA Western Levee)									
North of Existing Temp S-332C Detention Area	12	13,133	15	1:4	6	63	19	5,318	23,743
South of Existing Temp S-332 Detention Area	12	8,409	15	1:4	6	63	12	3,405	15,202
S-332 D Tieback Levee (C-111 SDA Eastern Levee)									
North of Existing Temp S-332C Detention Area	13	2,850	15	1:4	6.5	67	4	1,227	5,480
South of Existing Temp S-332 Detention Area	13	8,340	15	1:4	6.5	67	13	3,592	16,035
S-332 B to C Partial Connector Levee	14	2,850	15	1:4	6.5	67	4	1,227	5,480
Frog Pond Seepage Management Levee	15	32,950	15	1:4	6.5	67	51	14,191	63,351
S-332 B Flowway	16	3,100	15	1:4	7.5	75	5	1,494	6,672
S-332 C Flowway	16	3,100	15	1:4	7.5	75	5	1,494	6,672
							C-111 Sub-Total	31,950	142,633

C-111 Estimated O&M

Project Features

Water Management Areas	Surface Acres	Average Depth	Average Time Flooded	Floating Vegetation Management Cost	Sumberged Vegetation Management Cost
C-111 North Detention Area	1,482	4	30%	27,797	38,545
C-111 South Detention Area	1,351	4	30%	25,331	35,126
Connector Levee Area	220	4	30%	4,128	5,725
Flowways	54	1.5	30%	1,018	1,411
Frog Pond	2,500			46,875	65,000
			C-111 Sub-Total	105,149	145,806

C-111 Estimated O&M

C-111 Project Features

C-111 Pump Stations

	Pump Type	Pump Size (cfs)	Quantity	Annual O&M
S-332B Permanent Pump Station	Diesel	125	4	340,000
	Electric	75	1	120,000
	Total cfs	575		460,000
S-3332 C Pump Station	Diesel	125	4	340,000
	Electric	75	1	120,000
Frog Pond Seepage Mgt. Pump Station	Electric	50	4	200,000
	Total cfs	775		660,000

C-111 Culverts

	Size	Quantity	
S-332 B Control Structure (Box Culverts)	3'x6'	4	5,000
S-332 DX1 Culvert	5'		5,000
S-332 C Control Structure	500		30,000
			40,000

C-111 Weirs

	Size	Quantity	
NDA Southern Interior Overflow Weirs		2	20,000
SDA (2) Western Emergency Overflow Weir		2	20,000
NDA Western Emergency Overflow Weir		2	20,000
Frogpond Flowway Weir		1	10,000
Frogpond Seepage Mgt. Flowway Overflow Weir	500		30,000
			100,000
		C-111 Sub-Total	1,260,000

Floating Vegetation	
Percent Coverage	15.00%
Treatments Per Year	1
Cost Per Acre	125
Submerged Vegetation	
Percent Coverage	8.00%
Treatments Per Year	1
Cost Per Acre	325
Mowing	
Number of Mowings Per Year	8
Cost Per Acre	35
Erosion Control	
% Repair Per Year	10%
Cost Per Acre	12,500
Exotic Terrestrial Plant Control	
% Coverage	10%
Treatment Cost	400

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