CENTRAL AND SOUTHERN FLORIDA PROJECT

CANAL 111 (C-111) South Dade Project

REPLACEMENT OF INTERIM PUMP STATIONS S-332B AND S-332C

DRAFT INTEGRATED GENERAL RE-EVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT

U.S. Army Corps of Engineers
January 2020

US Army Corps of Engineers
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SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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PROPOSED FINDING OF NO SIGNIFICANT IMPACT

CANAL 111 (C-111) SOUTH DADE PROJECT
REPLACEMENT OF INTERIM PUMP STATIONS S-332B AND S-332C
DRAFT INTEGRATED GENERAL RE-EVALUATION REPORT AND ENVIRONMENTAL ASSESSMENT
MIAMI-DADE COUNTY, FLORIDA

The U.S. Army Corps of Engineers (USACE), Jacksonville District, has conducted an environmental analysis in accordance with the National Environmental Policy Act (NEPA) of 1969, as amended. The Canal 111 South Dade (C-111 SD) Project, Replacement Of Interim Pump Stations S-332B and S-332C Draft Integrated General Re-evaluation Report (GRR) and Environmental Assessment (EA) dated January 2020 addresses pump reliability and vulnerability to storm damage while simultaneously serving ecological goals, opportunities and feasibility in Miami-Dade County, Florida.

The Draft GRR/EA, incorporated herein by reference, evaluated various alternative designs that would support the replacement of two interim pump stations that were constructed under the 1996 project authorization and in response to the 1999 Jeopardy Biological Opinion on the Cape Sable Seaside Sparrow (CSSS) in the study area. The Tentatively Selected Plan (TSP) includes:

- A construction footprint of approximately 38 acres that includes the following features: a new concrete lined discharge channel that will replace the existing corrugated metal pipes to connect the S-332B and S-332C pump station releases to the South Detention Area (SDA) by a parallel weir; construction of a new culvert to maintain the connection from S-332B that allows flows from the SDA to the North Detention Area (NDA); removal of the existing underground corrugated metal pipes at S-332B and S-332C and a removal to grade for the existing overburden material; and the construction of a new levee to expand the wetland footprint of the NDA southward by approximately 7.1 acres following removal of the existing S-332B discharge pipes. The replacement pumps will be located approximately 300 feet south and 300 feet west of the current interim pump station locations.

In addition to a “no action” plan, two alternatives were evaluated. The alternatives included the preferred alternative (TSP) listed above, and a second alternative (Alternative 2), including the replacement of the S-332B and S-332C existing interim pump stations with new permanent pump stations at an offset of approximately 300 feet south and 300 feet west from their current locations along the L-31N canal and an extended concrete lined discharge channel (3,165 feet) from S-332B with connection to and extension of the existing NDA by 7.1 acres. Alternative 2 would permanently impact an additional 6.0 acres of wetland compared to the TSP and have greater cost. Evaluation of Environmental Effects can be found in Section 4 of the GRR/EA.

SUMMARY OF POTENTIAL EFFECTS:

For all alternatives, the potential effects were evaluated, as appropriate. A summary assessment of the potential effects of the TSP are listed in Table 1:

Table 1: Summary of Potential Effects of the TSP

	Insignificant effects	Insignificant effects as a result of mitigation*	Resource unaffected by action
Aesthetics	☐	☐	☒
Air quality	☒	☐	☐
Aquatic resources/wetlands	☐	☒	☐
Invasive species	☒	☐	☐
Fish and wildlife habitat	☒	☐	☐
Threatened/Endangered species/critical habitat	☒	☐	☐
Historic properties	☐	☐	☒
Other cultural resources	☐	☐	☒
Floodplains	☐	☐	☒
Hazardous, toxic & radioactive waste	☐	☐	☒
Hydrology	☒	☐	☐
Land use	☒	☐	☐
Navigation	☐	☐	☒
Noise levels	☒	☐	☐
Public infrastructure	☐	☐	☒
Socio-economics	☐	☐	☒
Environmental justice	☐	☐	☒
Soils	☒	☐	☐
Tribal trust resources	☐	☐	☒
Water quality	☒	☐	☐
Climate change	☐	☐	☒

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the TSP. Best management practices (BMPs) as detailed in the GRR/EA will be implemented, if appropriate, to minimize impacts. The USACE, the non-federal sponsor (the South Florida Water Management District (SFWMD)), and contractors commit to avoiding and minimizing adverse effects during construction activities. A list of minimization measures can be found in Section 4.3.6 of the GRR/EA.

COMPENSATORY MITIGATION:

No compensatory mitigation is required as part of the TSP. However, expansion of the NDA by 7.1 acres in addition to the availability of 4.7 acres of current NDA area previously used by the C-111 SD Project will enhance approximately 11.8 acres of wetland habitat. Wetland effects are described in Section 4.3 of the GRR/EA.

PUBLIC REVIEW:

The draft GRR/EA and Proposed FONSI have been prepared and coordinated for public, state, and Federal agency review. All comments submitted during the public review period will be responded to in the final GRR/EA.

OTHER ENVIRONMENTAL AND CULTURAL COMPLIANCE REQUIREMENTS:

ENDANGERED SPECIES ACT

Pursuant to Section 7 of the Endangered Species Act of 1973, as amended, the USACE determined that the TSP may affect but is not likely to adversely affect the following federally listed species: Eastern indigo snake. The USACE determined that the TSP will have no effect on any other federally listed species or their designated critical habitat. Determinations for all federally listed species can be found in Table 4-5 in Section 4.3 of the GRR/EA. Consultation with the U.S. Fish and Wildlife Service (FWS)U.S. Fish and Wildlife Service (FWS) is ongoing and the TSP will be in compliance with the Act.

NATIONAL HISTORIC PRESERVATION ACT

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the USACE determined that historic properties would not be adversely affected by the TSP. The State Historic Preservation Officer (SHPO) concurred with the determination on 15 February 201915 February 2019.

CLEAN WATER ACT SECTION 404(B) (1) COMPLIANCE

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the TSP has been found to be compliant with Section 404(b) (1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b) (1) Guidelines evaluation is found in Appendix B of the GRR/EA.

CLEAN WATER ACT SECTION 401 COMPLIANCE

A Water Quality Certification pursuant to section 401 of the Clean Water Act will be obtained from the State of Florida prior to construction. Full compliance with this Act will be achieved upon the issuance of a Section 401 WQC by the State. All conditions of the WQC will be implemented in order to minimize adverse impacts to water quality.

COASTAL ZONE MANAGEMENT ACT

Concurrence of consistency with the Florida Coastal Zone Management program pursuant to the Coastal Zone Management Act of 1972 will be obtained from the Florida State Clearinghouse prior to construction. The State's consistency review for this project is performed during the coordination of the draft EA. All conditions of the consistency determination shall be implemented in order to minimize adverse impacts to the coastal zone.

FINDING

Technical, environmental, and cost effectivenessand cost effectiveness criteria were used in the formulation and evaluation of alternative plans. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the TSP would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

Date

Andrew D. Kelly, Jr.
Colonel, Corps of Engineers
District Commander

Table of Contents

Appendices

Appendix A – The Florida Coastal Zone Management Act (CZMA)*

Appendix B – Clean Water Act 404(b) (1) Evaluation*

Appendix C – Pertinent Correspondence*

Appendix D – Preliminary Seepage Evaluation of Proposed Discharges from Pump Stations S-332B and S-332C

Appendix E – Application of a Computational Fluid Dynamics Model to the Preliminary Hydraulic Design of Pump Stations S-332B and S-332C

Appendix F – Preliminary Hydraulic Design of the Discharge Canals for Pump Stations S-332B & S-332C (Alternative 2 - Extended Concrete Channel)

Appendix G – Preliminary Design of the S-332B&C Aboveground Channels (Alternative 3 – Short Concrete Channel)

Appendix H – Cost Appendix

Appendix I - Cost Certification (to be included in the final report)

"Elements marked with an asterisk (*) provide further detail on sections required for National Environmental Policy Act compliance."

List of Tables

List of Figures

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EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers (USACE), Jacksonville District, in cooperation with its cost-sharing partner, the South Florida Water Management District (SFWMD), has prepared a 2020 General Re-evaluation Report (GRR), Environmental Assessment (EA) and Proposed Finding of No Significant Impact (FONSI) for the Canal 111 South Dade (C-111 SD) Project, located in Miami-Dade County, Florida. The Tentatively Selected Plan (TSP) – Alternative 3, an alternative for replacing two pump stations that were constructed as interim structures rather than permanent, is described in this report.

The C-111 SD Project reduces flooding in South Miami-Dade County, prevents over drainage, prevents saltwater intrusion, and conveys water to Everglades National Park (ENP) when runoff is available. A hydraulic ridge is formed by combination of the Modified Water Deliveries (MWD) to the ENP project, along with C-111 SD components including the North Detention Area (NDA), South Detention Area (SDA) and the S-332D Detention Area that extend from the MWD 8.5 Square Mile Area (SMA) to Taylor Slough, reducing groundwater seepage losses from ENP, while maintaining the authorized level of flood damage reduction for the C-111 Basin. The C-111 SD features will be operated as established by the Combined Operational Plan (COP). The COP is a parallel effort that will provide guidance on how to operate the project while achieving the C-111 SD benefits identified in the 1994 GRR. The anticipated benefits of the 1994 GRR/Environmental Impact Statement (EIS) will not undergo re-evaluation for the purpose of this 2020 GRR/EA, as it has been established that the proposed changes and sea level rise will have no effect on achieving the project benefits. By continuing the pump station function to rehydrate ENP and reduce groundwater seepage losses from ENP, the TSP will continue to provide appropriate hydrology for the Cape Sable Seaside Sparrow (CSSS) in accordance with the current Everglades Restoration Transition Plan (ERTP) in March 2012. Under the TSP, the existing interim pump stations S-332B and S-332C will not be taken offline and will continue to operate until construction is completed for the new proposed permanent pump stations. The replacement structures will not exceed the current design capacity of 575 cubic feet per second (cfs).

This report has been prepared in accordance with the requirements of Section 316 of the Water Resources Development Act of 1996 (WRDA 1996) and the 29 Apr 2014 memorandum issued by the Assistant Secretary of the Army for Civil Works (ASA (CW)) Darcy.

Project Problem

Two pump stations, S-332B and S-332C, were quickly built in response to a 1999 U.S. Fish and Wildlife Service (USFWS) Jeopardy Biological Opinion (BO) on the endangered CSSS. The interim pump stations have been used successfully for almost 20 years. However, because the interim pump stations have required extensive repairs, there is a risk of sustaining catastrophic damages if a severe weather event were to occur. Therefore, the pump stations must be replaced and constructed as permanent pump stations with hardened outer structures, providing additional protection during hurricanes.

Project Location

The C-111 SD Project is located west of the C-111 Canal in southern Miami-Dade County in southeastern Florida and is an integral part of the overall Central and Southern Florida (C&SF) Project. The area of primary focus for this C-111 SD 2020 GRR/EA is where S-332B and S-332C are located as shown in **Figure 1**.

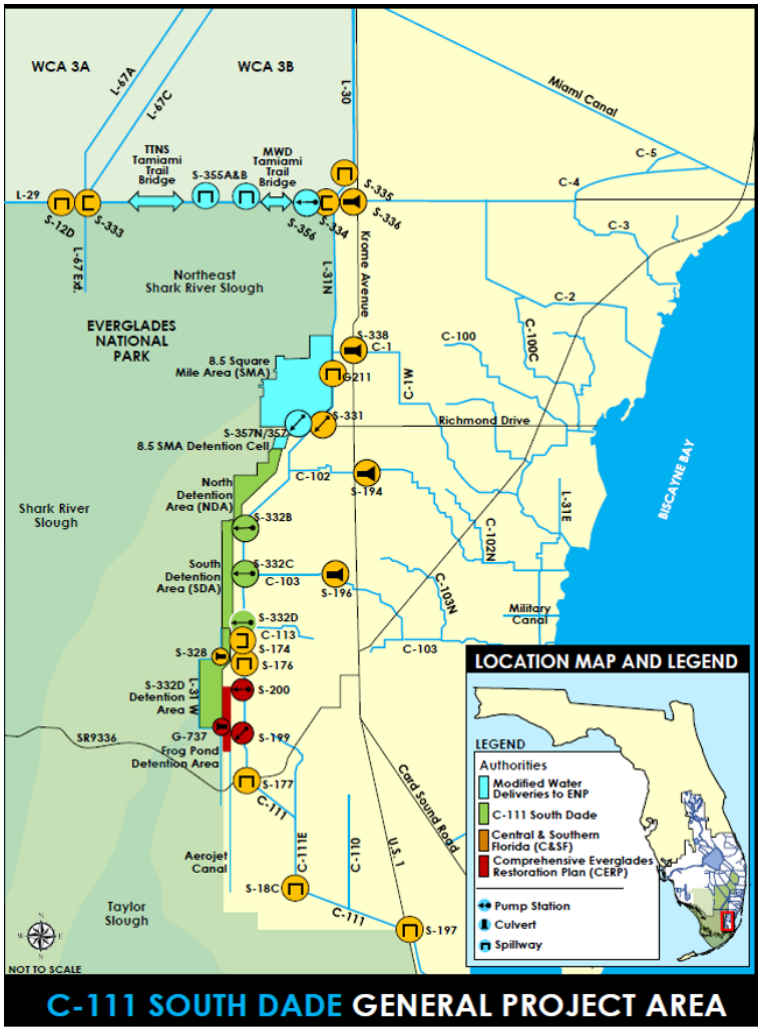

Figure 1. Project area location

Evaluation and Selection of Alternatives

This 2020 GRR/EA for the C-111 SD Project does not require any project reformulation. The project will use the same design and construction techniques that have been used in earlier stages of this project. The construction processes (paving, grading, storm water, pump installation, etc.) for the proposed pump stations will be similar to the techniques utilized in the construction of the interim pump stations S-332B & S-332C. The material, equipment, and design techniques for the updated project design will be for a 50-year design life. It is necessary to validate that the previously approved project features remain appropriate to meet current project needs as well as obtain the benefits anticipated in the 1994 GRR/EIS, with focus on verification that 575 cfs pump capacities will be sufficient.

After consolidation and screening of alternative plans, a final array of three plans was evaluated.

1. Alternative 1 -The future without-project condition or “no action” alternative. Under this alternative, there would be a continued use of the existing interim pump stations which are currently reaching their failure points. Expected future failures and increased pump maintenance could potentially cause loss of the ability to hydrate marshes within the adjacent

ENP. Potential flood risks could also result from failure of the existing pumps that were constructed without long term infrastructure for protection against storm damages, discharge flow-ways that are not hardened, and the aging corrugated metal pipes leading to the NDA and SDA.

2. Alternative 2- The extended concrete channel alternative. This alternative would consist of constructing new permanent, hardened structures including two pump stations in an offset of approximately 300 feet south and 300 feet west from the existing S-332B and S-332C interim pump station locations along L-31N canal and an extended concrete lined discharge channel with an expanded NDA connection. The NDA southern levee would be relocated south in direction of the offset, resulting in an expansion of approximately 7.1 acres. The extended concrete lined discharge channel would replace the existing corrugated metal pipes to connect the pump station releases to the SDA. Each of the permanent pump stations would have a maximum design capacity of 575 cfs, consisting of four diesel units (125 cfs each) and one electric unit (75 cfs), with an additional electric unit (75 cfs) provided as backup for operational flexibility. The proposed channels would extend approximately 3600 feet and 3400 feet from pump stations S-332B and S-332C, respectively, to the SDA in the east-west direction.
3. Alternative 3- The short concrete channel alternative. This alternative would consist of constructing new permanent, hardened structures including two pump stations in an offset of approximately 300 feet south and 300 feet west from the existing S-332B and S-332C interim pump station locations along L-31N canal and a short concrete lined discharge channel with an expanded NDA connection that would be connected to the existing SDA S-332B inflow corridor by a parallel weir. The NDA southern levee would be relocated south in direction of the offset, resulting in an expansion of approximately 7.1 acres. The short concrete lined discharge channel would replace the existing corrugated metal pipes to connect the pump station releases to the SDA by a parallel weir. Each of the permanent pump stations would have a maximum design capacity of 575 cfs, consisting of four diesel units (125 cfs each) and one electric unit (75 cfs), with an additional electric unit (75 cfs) provided as backup for operational flexibility. Each of the proposed channels extends approximately 1900 feet from the pump station to the existing inflow corridor.

Table 1 shows the total construction costs and average annual costs of the alternatives. As a result of the analysis based on the lowest annual cost, Alternative 3 was identified as the TSP.

Table 1. Total Construction and Annual Cost Comparison for the Alternatives

Costs	Alternative 1 – No action	Alternative 2 - Extended Concrete Channel	Alternative 3 – Short Concrete Channel with Parallel Weir (Tentatively Selected Plan)
Total Construction Cost	$0	$97,494,000	$92,603,000
Annualized First Cost*	$0	$3,699,711	$3,514,107
Depreciation	$4,148,415	$0	$0
O&M Cost, annual	$1,700,000**	$665,554	$665,554
Additional O&M Cost for seepage difference, annual	$0	$0	$39,400
Total Annual Cost	$5,848,415	$4,365,265	$4,219,061

*Average annual cost, FY2019, 2.875%, 50 years.
**Estimated O&M cost for Alternative 1 is an average based on the last 3 years (2017, 2018 and 2019).

Alternatives 2 and 3 both will maintain the continuous hydraulic ridge to disperse flows into the NDA and SDA, preserve ecosystem restoration by keeping water in ENP, and maintain the same level of flood protection as the project currently provides. Alternative 3 has a lower annual cost than Alternative 2 and therefore is the TSP. Alternative 3 also has fewer wetland impacts than Alternative 2. Alternative 1 is not recommended because the temporarily placed pump stations that have been successfully used for approximately 20 years have reached the end of their life cycles. Also, because the pump stations have required extensive repairs, there is a risk of sustaining catastrophic damages if a severe weather event were to occur.

Description of the Tentatively Selected Plan

The TSP refers to the plan put forward for implementation in this 2020 GRR/EA, which is the same as the "preferred alternative" under National Environmental Policy Act (NEPA) guidelines.

The TSP includes the following features that are further described in Section 3: a new concrete lined discharge channel that will replace the existing corrugated metal pipes to connect the S-332B and S-332C pump station releases to the SDA by a parallel weir; construction of a new culvert to maintain the connection from the NDA to the flow way ; removal of the existing underground corrugated metal pipes at S-332B and S-332C and a removal to grade for the existing overburden material; and the construction of a new levee to expand the wetland footprint of the NDA following removal of the existing S-332B discharge pipes. Each of the new permanent pump stations will have a maximum design capacity of 575 cfs, consisting of four diesel units (125 cfs each) and one electric unit (75 cfs). In addition to the normal pump station operational capacity of 575 cfs, both the S-332B and S-332C pump stations will have one additional 75 cfs electric pump unit to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities. Also, the additional 75 cfs electric unit will be considered as a backup unit to maintain operational flexibility during periods when one or more pump units are offline for maintenance or repairs. The diesel pumps will be located in the center and the electric pumps will be placed on each end. The S-332B pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA (the existing interim pump station culvert discharges limit the maximum discharge to the SDA to 325 cfs). Consistent with the

existing NDA design for the interim S-332B pump station, the pump station discharge channel design will allow up to 250 cfs to be redirected to the NDA. The S-332C pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA.

The benefits of the C-111 SD Project include restoring the natural hydrological conditions within eastern ENP and improving habitat for the endangered CSSS. Ecosystem restoration in Taylor Slough and the eastern panhandle of ENP is also achieved while preserving the authorized level of flood protection for adjacent agricultural areas in the C-111 Basin.

This 2020 GRR/EA does not change the operations of S-332B and S-332C, as the purpose of this GRR is to authorize replacement of the pump stations. Current operational criteria for the S-332B and S-332C pump stations are governed under the 2012 ERTP and the 2017 MWD Increment 2 field test temporary planned deviation, with the field test operations expected to extend through implementation of the COP anticipated in August 2020.

1 INTRODUCTION

The United States Army Corps of Engineers (USACE), Jacksonville District and the South Florida Water Management District (SFWMD) are cooperating in the Central and Southern Florida (C&SF) Project Canal 111 South Dade (C-111 SD) Project, Replacement of Interim Pump Stations S-332B and S-332C Draft Integrated General Re-evaluation Report (GRR) and Environmental Assessment (EA). The intent of the project is to replace the existing interim pump stations that are currently reaching their failure points with permanent pump stations with hardened structures that were envisioned in the original authorization.

1.1 Study Authority

In accordance with the 29 April 2014 memorandum issued by the Assistant Secretary of the Army for Civil Works (ASA (CW)), USACE was directed to develop a Post Authorization Change Report (PACR) to examine replacing the pumps, possible alternative measures, cost sharing, depreciation payments, work-in-kind, and the overall schedule. On 14 August 2014, USACE and SFWMD executed an amendment to the 1995 Project Cooperation Agreement (PCA). Article M of the amendment provided further clarification on the associated requirements:

> The Government and the Non-Federal Sponsor agree to enter into an agreement for equal cost sharing for preparation of a PACR to evaluate various alternatives to replace pump stations S-332B and S-332C and associated discharge pipes including an alternative with pump stations with hardened outer structures for additional protection during hurricanes and concrete-lined conveyance canals. The PACR shall consider seeking authorization for cost sharing of recommended features in accordance with Section 316 of the Water Resources Development Act of 1996; appropriate cost sharing for the operation, maintenance, repair, replacement and rehabilitation of project features; and the provision of credit for proportional depreciation payments made by the Government to the Non-Federal Sponsor under Article Vll.A.1.a of this Agreement for Pump Stations S-332B and S-332C toward the Federal share of the replacement costs for S-332B and S-332C.

1.2 C-111 South Dade Project Background

The C-111 SD Project is part of the larger C&SF Project. The purpose of the C&SF Project, first authorized in 1948, includes flood control, agricultural water supply, municipal and industrial water supply, preservation of fish and wildlife, water supply to Everglades National Park (ENP), preservation of ENP, prevention of saltwater intrusion, drainage and water control, groundwater recharge, recreation, and navigation.

Modifications to the C&SF Project in southern Dade County were authorized by the Flood Control Act of 1962 (Public Law 87-874). Congress recognized “the need to improve the supply, distribution and conservation of water resources in Central and Southern Florida to meet growing urban and agricultural needs and to provide sufficient flow to preserve Everglades National Park”. This authorization was further modified by the Flood Control Act of 1968 (Public Law 90-483) as the ENP-South Dade Conveyance System (SDCS) Project. The Act authorized modifications to the existing C&SF Flood Control Projects in the interest of improved conservation and distribution of available water and extended flood protection.

The 1989 ENP Protection and Expansion Act added 109,000 acres of wetlands and former agricultural lands to the Park and expanded ENP’s former eastern boundaries from approximately the location of the L-67 extension canal eastward to the current ENP boundary. When Congress authorized expansion of ENP lands,

the C-111 Canal needed modifications so that it would no longer draw groundwater out of the new addition to ENP.

USACE and SFWMD developed the 1994 Final Integrated GRR and Environmental Impact Statement (EIS), C-111, South Dade County, Florida. The 1994 GRR/EIS addressed restoration of the ecosystem in Taylor Slough and the eastern panhandle of ENP which were affected by the C&SF flood control project in the C-111 Basin. The 1994 GRR/EIS also focused on maintaining flood protection for the agricultural activities on adjacent lands. The 1994 GRR/EIS described a conceptual plan for five pump stations and levee-bounded water retention areas to be built west of the L-31N Borrow Canal between the 8.5 Square Mile Area (SMA) and the Frog Pond Detention Area to its south. These features were designed to reduce seepage out of ENP by operating the inflow pump stations to maintain target L-31N Canal stages in order to maintain the authorized flood protection (40% removal of Standard Project Flood flows) to agricultural lands east of the L-31N Canal. The 1994 GRR/EIS plan provided the operational capability and flexibility to assist in restoring the ecological integrity of Taylor Slough and the eastern panhandle area of the Everglades and flood protection to the agricultural interests adjacent to the C-111 Canal.

The modifications in the 1994 GRR/EIS were authorized by Section 316 of the Water Resources Development Act (WRDA) of 1996 (Public Law 303, 104th Congress), 110 Stat. 3715, October 12, 1996.

> '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 area 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.'

In order to provide a timely solution to address environmental problems in Taylor Slough and Florida Bay, the features described in the 1994 C-111 SD GRR/EIS would be implemented in two stages: (1) the facilities planning stage; and (2) the operation planning stage. The facilities planning stage included identifying locations and capacities of pumps, canals, levees and required appurtenances as described in the 1994 GRR/EIS. The C-111 SD operations planning stage was intended to be combined with the development of the operational plan for the Modified Water Deliveries (MWD) to ENP Project. This strategy would optimize environmental benefits of the recommended plans identified for both projects.

While a preliminary operational plan for the then-proposed C-111 SD project was included in the 1994 GRR/EIS, it further identified the need for a refined operation plan to be developed in coordination with ENP, the U.S. Fish and Wildlife Service (USFWS), the SFWMD and other agencies prior to completion of project construction. For operational planning, the purposes of the MWD and C-111 SD projects are complementary. The purpose of the MWD project was to improve water deliveries into ENP, and to the extent practicable, restore the natural hydrological conditions within ENP. The purposes of the C-111 SD project included ecosystem restoration in Taylor Slough and the eastern panhandle of ENP, while preserving the authorized level of flood protection for agricultural areas in the C-111 Basin. Combined with the MWD project, the North Detention Area (NDA), South Detention Area (SDA), and the S-332D Detention Area features of the C-111 SD Project currently form a hydraulic ridge that extends from the 8.5 SMA to Taylor Slough for the combined purposes of reducing groundwater seepage losses from ENP while maintaining flood protection for adjacent agricultural lands. The Combined Operational Plan (COP) study, which is currently ongoing and scheduled for completion in August 2020, will result in a comprehensive integrated water control plan for the operation of the water management infrastructure associated with the MWD and C-111 SD Projects.

A 2016 Limited Reevaluation Report (LRR) served as the PACR that documented prior design refinements to the 1994 GRR/EIS plan that were incorporated into the project construction (Contracts 1 through 8) as well as features proposed for future construction (Contract 9), as coordinated with the USACE South Atlantic Division (SAD). C-111 SD features already constructed were addressed in previous National Environmental Policy Act (NEPA) documents. The “2016 C-111 SD Modifications to the North and South Detention Area and Associated Features EA” evaluated features proposed in the 2016 LRR – options for connecting the MWD Project 8.5 SMA to the C-111 SD Project, and flow ways through the 8.5 SMA Detention Cell and the NDA and SDA of the C-111 Project, to better maintain a continuous hydrologic ridge along the eastern boundary of ENP that extends from the 8.5 SMA to Taylor Slough. As of July 2019, construction of the C-111 SD project is functionally complete.

1.3 Project Purpose and Need

In 1999, as the C-111 SD project was beginning to be implemented, the U.S. Fish and Wildlife Service issued a Jeopardy Biological Opinion (BO) on the Experimental Program, MWD and C-111 SD Projects for the benefit of the endangered Cape Sable Seaside Sparrow (CSSS). In response to this BO, construction was expedited on the S-332B interim pump station in 2000. The S-332C interim pump station was constructed in 2003, also in response to the 1999 Jeopardy BO and subsequent development of the 2002 Interim Operational Plan (IOP) for Protection of the CSSS. The pump station capacities were increased, compared to the 1994 C-111 SD GRR/EIS, primarily to provide additional capacity in conjunction with the elimination of the S-332A pump station following the MWD 8.5 SMA modifications approved in the 2000 8.5 SMA GRR and to create more favorable hydro periods in sparrow habitat in ENP as part of the IOP. The 2016 LRR approved the increase in capacity and codified all the design modifications subsequent to the 1994 GRR/EIS.

The two aging interim pump stations are currently showing signs of stress, require extensive repairs and have reliability concerns. The interim pump stations are poorly protected from storm damages and are at a high risk of sustaining catastrophic damages. Now, the permanent pump stations that were envisioned in the original authorization need to be constructed.

1.4 Scope of Study

The scope of this 2020 GRR/EA will focus on replacing the interim S-332B and S-332C pump stations with permanent, hardened structures and the permanent reconfiguration of intake and discharge structures. No project reformulation is needed.

The study will address the items listed below:

- Identification and evaluation of alternatives for replacing the existing interim pump stations S-332B and S-332C and associated discharge pipes, including an alternative with hardened outer structures for additional protection during hurricanes and concrete-lined conveyance channels;
- Appropriate cost sharing for the operation, maintenance, repair, replacement and rehabilitation of project features; and
- Provision of credit for proportional depreciation payments made by the Government to the Non-Federal Sponsor under Article VII.A.I.a of the Project Cooperation Agreement, as amended, for Pump Stations S-332B and S-332C toward the Federal share of the replacement costs for S-332B and S-332C.

This 2020 GRR/EA will focus on technical comparisons of current structure conditions, life expectancy, and cost, while assessing whether the previous S-332B and S-332C pump station infrastructure design capacities continue to be appropriate to meet the needs for ecosystem restoration and flood risk management.

Reformulation for increased ecosystem benefits or reduced flood risks is not part of this study. Changes to operations of the pump stations are not part of this study. Operational criteria for the S-332B and S-332C pump stations will continue to be governed under the 2012 Everglades Restoration Transition Plan (ERTP) and the 2017 MWD Increment 2 field test temporary planned deviation, with the field test operations expected to extend through implementation of the COP anticipated in August 2020.

Appropriate seepage and hydraulic design modeling and assessments to evaluate the pumping capacity and location of pump stations (with affiliated structure/features) were conducted in support of this 2020 GRR/EA. These assessments are further discussed in **Section 3**.

A GRR/EA for the C-111 SD Project is needed to address the replacement of the S-332B and S-332C interim pump stations. The findings of this study are documented in this 2020 GRR/EA and Finding of No Significant Impact (FONSI) to be submitted to Congress for authorization. The C-111 SD 2020 GRR/EA is planned to be submitted to Congress for authorization of replacement pump stations and the appropriate cost sharing of the operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) of recommended features in accordance with Section 316 of the WRDA of 1996.

1.5 Project and Study Area

The C-111 SD Project is located west of portions of the L-31N and C-111 Canals in southern Miami-Dade County in southeastern Florida and is an integral part of the overall C&SF Project. The project is situated within the C-111 Basin adjacent to ENP. The C-111 Basin consists of both natural wetlands, agricultural lands, and residential lands in the Homestead/Florida City area. The area of primary focus for the C-111 SD 2020 GRR/EA is where S-332B and S-332C are located as shown in **Figure 1-1**.

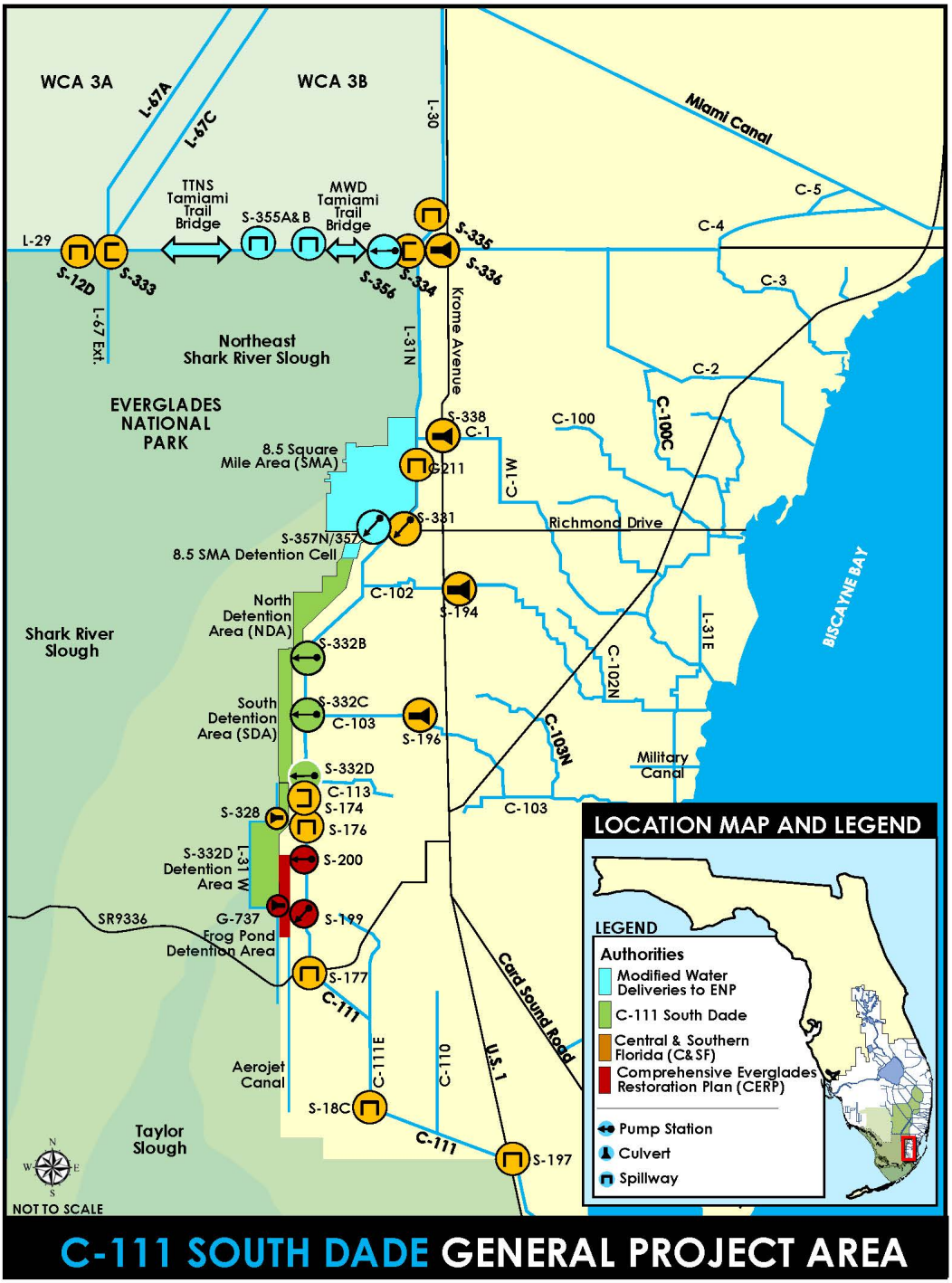

Figure 1-1. Project Location

1.6 Problems and Opportunities

The USACE, Jacksonville District, quickly built interim pump stations S-332B and S-332C in response to a USFWS 1999 Jeopardy BO on the endangered CSSS. The interim pump stations were constructed between 2000 and 2003. Presently, these interim pump stations require extensive repairs and have reliability concerns. Because they are poorly protected from storm damages, these interim pump stations are currently at risk of sustaining catastrophic damages.

This 2020 GRR/EA focuses on replacement of the interim pump stations for use under existing operational criteria. Additional analysis may be required for future planning or operational studies. The ongoing operational study, the 2020 COP for MWD to ENP and C-111 SD projects, will establish the next regional operations plan for deliveries to ENP and operation of the MWD 8.5 SMA and the SDCS canals, including operational criteria for the C-111 SD NDA and SDA to maintain a continuous hydraulic ridge between ENP and the L-31N and C-111 Canals. A 2014 Draft Project Operating Manual (POM) is also available for the Comprehensive Everglades Restoration Project (CERP) Central Everglades Planning Project (CEPP) feasibility study, providing a general conceptual framework for both potential restoration stages in eastern ENP and adjacent SDCS operational criteria with these CERP components planned for completion by 2027. Therefore, the replacement pump stations need to manage the increased hydraulic head differential between ENP stages and the adjacent L-31N and C-111 Canals associated with these likely near-term restoration initiatives.

1.7 Goals and Objectives

The goal of this action is to increase the reliability of the pump stations by replacing them with permanent pump stations, thereby reducing their vulnerability to storm induced damages. The permanent pump stations must be able to manage the seepage resultant from the MWD and C-111 SD ecosystem restoration projects, while addressing flood risks. Additionally, OMRR&R costs should be reduced through a more robust design process and by reducing the risks of storm damages.

Consistent with the C-111 SD project objectives, the USACE will maintain the authorized level of flood protection for the C-111 Basin. Flood risk management is achieved by managing seepage from ENP and local basin runoff through operation of the S-332B and S-332C pumps (in tandem with other water control structures, including S-332D, S-194, S-196, and S-176) that help to maintain stages in the L-31N within its prescribed operating ranges.

1.8 Constraints

Operational constraints applicable to the pump stations, if any, will be identified and included in the planned COP and/or subsequent updates to the POMs developed during CERP implementation. For example, the COP may include maximum depth limits within the NDA and/or SDA and criteria to meet the CSSS requirements which may affect the timing of S-332B and S-332C operations.

Current operational criteria for the S-332B and S-332C pump stations are governed under the 2012 ERTP and the 2017 MWD Increment 2 field test temporary planned deviation. The field test operations are expected to extend through implementation of the COP anticipated in August 2020. The COP operational criteria are under development to provide more natural hydro periods to include protection of the natural ecological values associated with the ENP, while maintaining the authorized level of service for flood risk management within the C-111 Basin. Additionally, the existing S-332B and S-333C pump stations must

continuously operate during construction of the new pump stations until the new pump stations are ready to be turned on.

1.9 Decision to be made

The selection of the Preferred Alternative (also called the Tentatively Selected Plan) for the replacement of the interim pump stations is the primary decision that must be made.

2 EXISTING CONDITIONS

This chapter describes the relevant resources of the areas that would be affected by construction of the alternatives described in Section 3 (Description of Alternatives) and evaluated in Section 4 (Evaluation of Alternatives and Environmental Effects). A complete description of the affected environment with respect to the Canal-111 South Dade (C-111 SD) project is discussed within the "2016 C-111 SD Modifications to the North and South Detention Area and Associated Features EA," has minimally changed (Dade County: https://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/) and is hereby incorporated by reference. The following describes relevant resources likely to be affected by replacement of the S-332B and S-332C pump stations and provides a summary of completed construction efforts associated with the C-111 SD Project since completion of the 2016 C-111 SD Environmental Assessment (EA).

Structures S-332B and S-332C were part of the authorized 1994 General Reevaluation Report (GRR)/Environmental Impact Statement (EIS) for the C-111 SD Project. The U.S Army Corps of Engineers (USACE) quickly built these 575 cubic feet per second (cfs) interim pump stations in response to a U.S Fish and Wildlife Service (USFWS) 1999 Jeopardy Biological Opinion (BO) on the endangered Cape Sable Seaside Sparrow (CSSS). Construction of the interim pump stations occurred between 2000 and 2003. USACE then transferred the pump stations to the South Florida Water Management District (SFWMD) in 2010 for Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). The interim S-332B pump station discharges a maximum capacity of 250 cfs to the North Detention Area (NDA) and 325 cfs to the South Detention Area (SDA). The interim S-332C pump station discharges a maximum capacity of 575 cfs to the SDA.

Currently, the interim pump stations require extensive repairs and have reliability concerns. Inspections performed on the existing pump stations have shown problems in the current structures, such as potential vibration issues, strong vortices and swirls induced by imbalanced approaching inflow at pump intake, and frequent maintenance requirements. Although the existing conditions in the project area described in the previous "2016 C-111 SD Modifications to the North and South Detention Area and Associated Features EA" have minimally changed (Dade County: https://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/), there are some components that were constructed since then. These features are mentioned below.

Construction of the two internal flow way berms (L-360E and L-360W) inside the 8.5 Square Mile Area (SMA) Detention Cell were completed in May 2017, and the berms were subsequently repaired and raised by SFWMD during February to April 2018 following Hurricane Irma. Construction of the L-357W Levee crossing at Richmond Drive was also completed in May 2017. Realignment and extension of the L-316 levee (NDA eastern perimeter levee) was completed in July 2017. Extension of the existing L-315 north levee (NDA western perimeter levee) was completed in July 2017, although additional repairs to the levee section were required following Hurricane Irma. The earthen flow way berms within the interior of the NDA (L-318) were nearly completed in September of 2017, but additional repairs to the berm were required following Hurricane Irma.

Modification of the western outlet weir (S-360W weir and an adjacent section of the L-359 levee) for the 8.5 SMA detention area was also scheduled for completion in September 2017; however, between 16 September through 23 September 2017, a section of the L-359 north levee adjacent to S-360W was removed by both the USACE South Florida Operations Office (SFOO) and the USACE contractor to allow S-

357 discharges to flow into the NDA in association with the September 2017 Emergency Deviation Post Hurricane Irma. This action was needed to move water out of the 8.5 SMA Detention Cell, minimize return seepage north into the 8.5 SMA interior, and allow a more efficient open channel flow from the S-357 pump station to the NDA. The temporary gap in the L-359 Levee was closed in February 2018, to facilitate completion of the post-Hurricane repairs to L-315 and L-318 and for completion of the interior scraping within the NDA. Prior to this Emergency Deviation action, completion of this direct hydraulic connection between the 8.5 SMA S-357 pump station and the C-111 SD NDA was an established prerequisite for raising the L-29 Canal maximum operating limit above 7.8 feet, National Geodetic Vertical Datum (NGVD) (the limit for Modified Water Deliveries (MWD) Increment 1.2). Following a contract suspension period immediately following Hurricane Irma, the SDA interior berm construction was completed in early August 2018. As of August 2018, the NDA and SDA were both fully functional, and the significant completion status allowed for the L-29 Canal maximum operating stage limit to be raised from 8.0 up to 8.5 feet NGVD according to the MWD Increment 2 field test criteria.

An EA and Finding of No Significant Impact (FONSI) dated 7 December 2016 for additional modifications to the C-111 SD Project, other than those noted above, evaluated options for backfill and/or placement of plugs within the existing L-31W Canal and modified existing features, including the gap in the L-31W levee (USACE 2016b). Water drained into the L-31W borrow canal, which is immediately adjacent to Everglades National Park (ENP), flowed as groundwater and surface water to the south and east, raising groundwater and C-111 levels and impeding drainage of lands east of C-111. Fill or plugging in L-31W, along with modifications to the L-31W levee gap, were expected to provide additional rehydration benefits to lands in eastern ENP, in addition to the expansion of the NDA and construction of flow ways in both the NDA and SDA (USACE 2016b). The L-31W borrow canal modifications were completed by the SFWMD between January and September of 2017.

While a preliminary operational plan for the then-proposed C-111 SD features was included in the 1994 GRR/EIS, the 1994 GRR/EIS identified a need for a refined operation plan to be developed in coordination with ENP, USFWS, SFWMD and other agencies prior to completion of project construction. The future Combined Operational Plan (COP) will result in a comprehensive integrated Water Control Plan (WCP) for the operation of the water management infrastructure associated with the MWD and C-111 SD Projects, including integration of the modified design components which have been constructed as generally described in the December 2016 C-111 SD Limited Re-evaluation Report (LRR). A separate National Environmental Policy Act (NEPA) document will address operational changes due to the COP or a subsequent operational plan.

According to the jurisdictional determination in the 2018 S332 B and C Pumps Site Biological Conditions Report prepared by SFWMD, the wetland habitat in the project area was concluded to be non-forested freshwater marl prairie wetlands, seasonally inundated to a depth of 20-25 centimeters. The NDA and C-111 buffer lands contain previously scraped cropland that has been recolonized by weedy species. These wetland areas are not high quality or pristine, and would benefit from rehydration. The affected environment is home to several federally listed threatened and endangered species. Communication between USACE and USFWS confirmed the presence of federally listed species within the project area, listed in **Table 2-1** (see Appendix C for correspondence).

Table 2-1. List of Federally Threatened and Endangered Species within the project area (E: Endangered, T: Threatened, SA: Similarity of Appearance, CH: Critical Habitat, C: Candidate Species; PT: Proposed Threatened; PE: Proposed Endangered; NE: No Effect; MANLAA)

Common Name	Scientific Name	Status
Mammals		
Florida panther	*Puma concolor coryi*	E
West Indian manatee	*Trichechus manatus latirostris*	T, CH
Florida bonneted bat	*Eumops floridanus*	E
Birds		
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH
Piping plover	*Charadrius melodus*	T
Red-cockaded woodpecker	*Picoides borealis*	E
Roseate tern	*Sterna dougallii dougallii*	T
Wood stork	*Mycteria Americana*	T
Reptiles		
American Alligator	*Alligator mississippiensis*	T, SA
American crocodile	*Crocodylus acutus*	T, CH
Eastern indigo snake	*Drymarchon corais couperi*	T
Gopher tortoise	*Gopherus polyphemus*	C
Green sea turtle*	*Chelonia mydas*	E
Hawksbill sea turtle*	*Eretmochelys imbricata*	E
Kemp's Ridley sea turtle*	*Lipodochelys kempii*	E
Leatherback sea turtle*	*Dermochelys coriacea*	E
Loggerhead sea turtle*	*Caretta caretta*	T
Fish		
Smalltooth sawfish*	*Pristis pectinata*	E
Invertebrates		
Bartram's hairstreak butterfly	*Strymon acis bartrami*	E
Elkhorn coral*	*Acropora palmata*	T, CH
Florida leafwing butterfly	*Anaea troglodyta floridalis*	E
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E
Staghorn coral*	*Acropora cervicornis*	T, CH

Common Name	Scientific Name	Status
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	T
Plants		
Crenulate lead plant	*Amorpha crenulata*	E
Deltoid spurge	*Chamaesyce deltoidea spp. deltoidea*	E
Garber's spurge	*Chamaesyce garberi*	T
Johnson's seagrass*	*Halophila johnsonii*	T, CH
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeenis*	E
Small's milkpea	*Galactia smallii*	E
Tiny polygala	*Polygala smallii*	E
Big pine partridge pea	*Chamaecrista lineata* var. *keyensis*	E
Blodgett's silverbush	*Argythamnia blodgettii*	T
Cape Sable thoroughwort	*Chromolaena frustrata*	E, CH
Carter's small-flowered flax	*Linum carteri* var. *carteri*	E, CH
Everglades bully	*Sideroxylon reclinatum spp. austrofloridense*	T
Florida brickell-bush	*Brickellia mosieri*	E, CH
Florida bristle fern	*Trichomanes punctatum* spp. *floridanum*	E
Florida semaphore cactus	*Consolea corallicola*	E, CH
Sand flax	*Linum arenicola*	E
Florida pineland crabgrass	*Digitaria pauciflora*	T
Florida pineland sandmat	*Chaemaesyce deltoidea pinetorum*	T
Florida prairie clover	*Dalea carthagenesis floridana*	E

* Marine species under the purview of National Marine Fisheries Service (NMFS), the USACE will conduct separate consultation with NMFS. .

3 DESCRIPTION OF ALTERNATIVES

The following section provides a description of alternatives considered, including the No Action Alternative. Each of the action alternatives will include replacing both S-332B and S-332C pump stations with permanent, hardened structures in an offset location approximately 300 feet south and 300 feet west along the L-31N Canal and with the same 575 cubic feet per second (cfs) maximum capacity as the two existing interim pump stations. Alternatives were evaluated based on the resources described in **Section 2** (**Existing Conditions**) and are evaluated in **Section 4** (**Evaluation of Alternatives and Environmental Effects**) based on the achievement of project goals, objectives, and constraints. Potential effects to the human environment were also evaluated and the location of where the discharges will connect to the South Detention Area (SDA).

3.1 Initial Measures and Screening

To reduce planning risks, seepage and hydraulic design analyses were conducted to evaluate the existing pumps' capacities and their locations. The seepage analysis evaluated three pumping conditions along the L-31N intake canal (lower canal stages, highest Everglades National Park (ENP) stages, and current Water Control Plan (WCP) to provide an initial assessment of any changes in return flows through ground water to the L-31N borrow canal resulting from potential changes in water levels in eastern ENP and South Dade Conveyance System (SDCS) operations (noting that the Combined Operational Plan (COP) development was conducted in parallel). The Computational Fluid Dynamic (CFD) analysis evaluated the hydraulic design considerations including the L-31N Canal intake at the two pump locations and internal pump unit alignments. Both modeling analyses were conducted concurrently.

3.1.1 Pump Size

The S-332B and S-332C existing interim pump stations each have 575 cfs capacity. It is important to determine whether or not the constructed interim pump stations are of a sufficient capacity to manage the anticipated additional seepage from planned restoration flows to eastern ENP, including pre-Comprehensive Everglades Restoration Project (CERP) Foundation Projects (Modified Water Deliveries (MWD) and C-111 SD) and the CERP. To evaluate this, a seepage analysis was completed by the South Florida Water Management District (SFWMD) and U.S. Army Corps of Engineers (USACE) to provide an initial assessment of any changes in return flows through ground water to the L-31N Canal resulting from changes in water levels due to increased pumping along with potential modifications to water management plans. Prior studies indicate that hydraulic properties of the Biscayne aquifer are highly heterogeneous and anisotropic, and that ground water flow occurs primarily within localized preferential flow zones within the limestone layers.

A detailed report for the "Preliminary Seepage Evaluation of Proposed Discharges from Pump Stations S-332B and S-332C" (SFWMD, November 2018) is provided as **Appendix D.** In addition to describing the analysis methods, model development and calibration, results, recommendations for the site-specific seepage analyses, and an overview of the project area hydrogeology is provided in **Appendix D**, pages 4 through 10. The western and eastern spatial extents of the cross-section model (developed using AnAqSim software) was set in the ENP at approximately 500 feet west of the SDA and approximately 1000 feet east of the L-31N borrow canal, respectively. The calibrated model was used to obtain estimates of seepage from the SDA for two operation plans that bracket the range of hydrologic and hydraulic conditions that could prevail in and around the SDA when late wet season discharges from both pump stations occur. The

first operational plan depicts a base condition resulting from Increment 2 of the MWD incremental field test. The second operational scenario pertains to the CERP Central Everglades Planning Project (CEPP) and is expected to result in higher water levels in the project area. Based on the seepage model analysis, over the ranges of ENP, SDA and L-31N water levels examined, roughly half of the seepage out of the bottom of the SDA returns to the L-31N borrow canal. SDA seepage rates for potential future CEPP conditions were indicated as 2 – 3 percent lower than the seepage rates under pre-CEPP conditions due to the higher stage difference inherent to the latter operational scenario, but an additional 6 – 8 percent is estimated as returning to the L-31N Canal under these conditions. Additionally, increasing the L-31N stage from the lower limit of the Everglades Restoration Transition Plan (ERTP) Increment 2 range (4.2 feet National Geodetic Vertical Datum (NGVD) to the upper limit of 4.8 feet NGVD) reduces the return seepage rate to the L-31N borrow canal about 14% under CEPP operational conditions and about 15% under pre-CEPP conditions. The preliminary COP plan would continue to maintain the L-31N Canal adjacent to the SDA within the same 4.2 to 4.8 feet NGVD operating range based on the criteria for the S-332B and S-332C pump stations.

Seepage rates computed by the cross-section model are highly unclear due to uncertainties inherent to both the conceptual hydrostratigraphic model and the model parameters. As recognized in the SFWMD seepage analysis report, the model is currently only suitable for providing the order-of-magnitude estimates of seepage needed for cost estimating purposes. If the engineering design team recommends further seepage analyses for future phases of design, the surficial aquifer within the study area should be characterized in additional detail using the techniques previously employed by the U.S. Geological Survey (USGS) in the Lake Belt mining area of Miami-Dade County. Further seepage modeling efforts may also be assisted through incorporation of additional survey data for the L-31N canal and improved surface water monitoring within the ENP, including consideration of data collected from the C-111 SD North Detention Area (NDA) and SDA interior monitoring wells that have been installed and will begin water level recording in the spring 2020 dry season.

Based on the preliminary seepage modeling results, seepage return rates from the C-111 SD NDA and SDA to the L-31N Canal may increase by about 18 cfs per mile after SDA operations evolve from pre-CEPP to CEPP conditions. For the L-31N reach located along the length of the SDA (approximately 4.7 miles), this translates to about 85 cfs of additional seepage under the conditions examined or approximately 43 cfs per pump station. A safety factor of 2 applied to the computed seepage rates would then suggest that each pump station should have its capacity increased by slightly more than 80 cfs to accommodate increases in seepage rates to the L-31N borrow canal. Full implementation of CEPP project components and the resulting increases to stages within eastern ENP are not anticipated prior to 2027. The seepage analysis in support of this 2020 General Re-evaluation Report (GRR)/Environmental Assessment (EA) demonstrated that the 575 cfs maximum design capacity would be sufficient to maintain the hydraulic ridge under CEPP conditions.

The new S-332B and S-332C pump stations will consist of four 125 cfs diesel pump units and one 75 cfs electric pump unit, with a total maximum design capacity of 575 cfs each. In addition to the maximum design capacity, a backup electric pump unit of 75 cfs is also recommended to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities and address hydro period and recession rates considerations for the adjacent Cape Sable Seaside Sparrow (CSSS) sub-population F, as required by the 2016 U.S. Fish and Wildlife Service (USFWS) Biological Opinion (BO). Also, the backup electric pump provides operational flexibility during periods when one or more pump units are offline for maintenance or repairs.

The design of the two pump stations will require a full geotechnical investigation to include the following: shallow and deep borings at each pump station and discharge channel, core borings, percolation tests, seepage testing, piezometers, and seepage modeling. This information will be used during Pre-Construction, Engineering, and Design (PED) to confirm the assumptions and may be used to revise the design, if warranted. Additional formulation considerations for the Final Alternatives are discussed in **Section 3.2**.

Based on consideration of the seepage modeling results, the hydraulic design modeling for the replacement pump stations, which is further detailed in **Section 3.1.3**, included two operation scenarios for the proposed pump stations: (a) Scenario 1: all pump units are on (including backup electric pump); and (b) Scenario 2: one of the electric pump units is off. The flow fields in the approach channel and in each individual pump column for both Scenario 1 and 2 were similar. The proposed operational plan for the COP assumes that the maximum design capacity of the S-332B and S-332C (either existing or replacement pump stations) will remain at 575 cfs, consistent with the hydraulic design criteria used for the downstream interior flow way levees within the C-111 SD NDA and SDA. Additional levee modifications within the NDA and/or SDA may be required if the pump station maximum design capacity of 575 cfs is increased through future operational planning studies.

3.1.2 **Pump Station Location**

New pump station locations were evaluated because of 3 issues: 1) interim pump stations are at a 90 degree angle to the L-31N canal and have ongoing vibration issues, 2) the S-332B pump station needs to be located to the south to avoid the bend in L-31N canal, and 3) to ensure the interim pump stations can continue to operate during construction of new pump stations. Offsetting the new pump station locations south and west of existing S-332B and S-332C will allow for continued operation of the existing pump stations during construction of the replacement pump stations.

Placement of the new pump stations will be on wetlands in close proximity to the existing S-332B and S-332C interim structures located along the L-31N Canal. The analyses made with the CFD (**Appendix E**) demonstrated the imbalanced flow issues observed under current SFWMD operations of the interim pump stations and focused on the evaluation of different design scenarios in order to identify recommendations to improve the flow fields and hydrodynamic performance of the approaching canal and pump unit intake bays.

Based on the CFD simulations, the recommended location of the new S-332B and S-332C pump stations is approximately 300 feet south along L-31N canal and 300 feet further west from their respective current locations, with four diesel units (125 cfs each) in the center and two electric units (75 cfs each) placed on each end. The engineering design team has communicated that the final offset may be adjusted slightly (less than 300 foot offset) during the detailed design phase during review of project components and construction costs. The relocation is also desired to ensure the main flow has enough space to readjust itself to be fully developed and evenly distributed in the intake canal as the flow approaches the pump intake after a 90-degree channel bend. Relocation will also allow for sufficient space for installation of the flow guide vanes. Additional discussion of the hydraulic design analysis is detailed in **Section 3.1.3**. The analysis focused on developing the preliminary design requirements for the pump station intake channels.

3.1.3 Pump Station Intake Channels

During the Operation and Maintenance (O&M) of existing S-332B and S-332C interim pump stations by the SFWMD, some design limitations became apparent over time. According to the "Structure Inspection Report as part of the Structure Inspection Program (2013)", the construction of S-332B and S-332C did not adhere to USACE standards for permanent pump stations. The interim pump stations were quickly built in response to a 1999 Jeopardy BO and therefore were not constructed with permanent, hardened structures as envisioned in the original authorization. Additionally, the inflow channel for each structure is oriented at 90^{o} to the pump intakes, causing the inflow field to be biased towards one side of the intake pipes. The imbalance of the flow field not only decreases pump efficiency but also causes potential vibration issues. Moreover, biased inflows can cause formation of vortices and swirls that can lead to mechanical failure of pump components. As a result of these factors, SFWMD staff has performed frequent repairs and maintenance to address abnormal pump noise, worn bearings, leaking seals and high levels of corrosion. The S-332B and S-332C replacement project will relocate the pump stations to ensure a balanced flow field at the pump intake, acceptable hydraulic efficiencies, and the minimization of potential vibration and noise issues.

To evaluate these issues, a hydraulic design analysis was completed by the SFWMD and USACE and was performed to develop a preliminary pump station alignment and arrangement of individual pump units for both the S-332B and S-332C locations. The CFD model was used for these analyses as previously described in **Section 3.1** and **Section 3.1.2**. A detailed report for the "Application of a Computational Fluid Dynamics Model to the Preliminary Hydraulic Design of Pump Stations S-332B and S-332C" (SFWMD, January 2019) is provided as **Appendix F.** In addition to describing the analysis methods, model development, results, and recommendations for the hydraulic design analyses, an overview of the CFD software is provided in **Appendix F**, pages 9 through 12.

The location of the Pump Station Intake Channels followed the same hydraulic analysis conducted for the Pump Station Location as described in **Section 3.1.2**. Flow separating vanes and a trash rake are recommended to ensure evenly-distributed approach flow distributions, even velocity distributions at the throat of pump suction bells, and minimal flow pre-swirl in the pump intake column. The directional vanes are shown in **Figure 3-1** below.

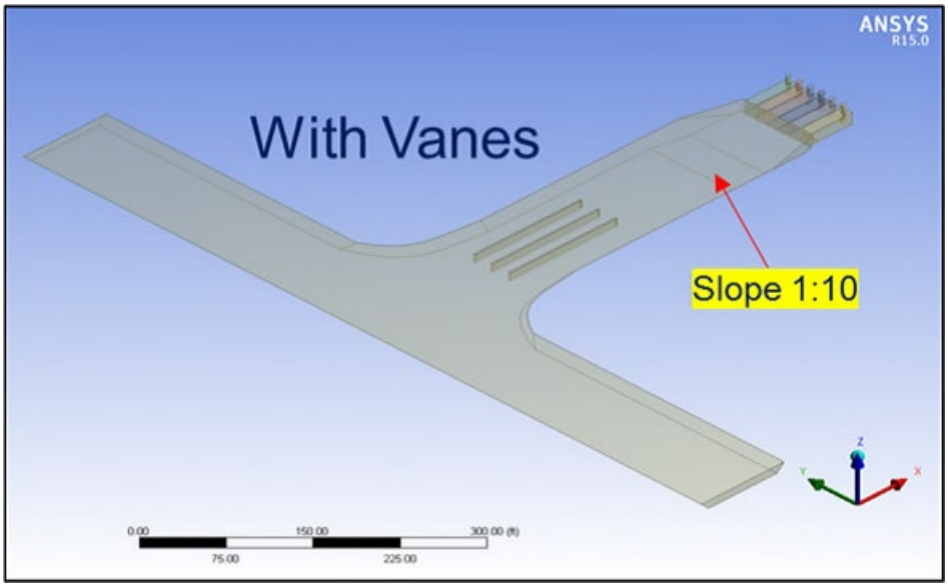

Figure 3-1. Vanes included in the intake channels for flow equalization.

In order to convey each pump station's discharge of 575 cfs from its proposed location to the SDA, an aboveground concrete lined channel connecting each pump station to the respective SDA pump station inflow corridors will be constructed. Refer to **Section 3.1.5** for more information about the above-ground concrete lined channel.

3.1.4 North Detention Area Expansion

The existing project allows discharges from S-332B to be directed to both the NDA and the SDA. To facilitate the connection of the proposed new discharge channel (see **Section 3.1.5**) to the NDA, the NDA would be extended southward to reduce the distance to the NDA. This would also increase the NDA by approximately 7.1 acres of potential wetland habitat. **Figure 3-2** shows the new levee segments that would be constructed and the existing levee segments that would be degraded. The length of overburden to be degraded at S-332B is 2,000 feet and 2,100 feet at S-332C. The existing discharge culverts would be demolished and replaced with approximately 100 feet of new discharge culvert at the southern end of the NDA expansion. A vertical lift slide gate will be installed to control the flow from the concrete channel to the NDA reservoir. Based on the preliminary hydraulic design, the discharge culvert to the NDA will be a gated box culvert with 2 barrels, with a 5.8 feet span by 6-feet rise.

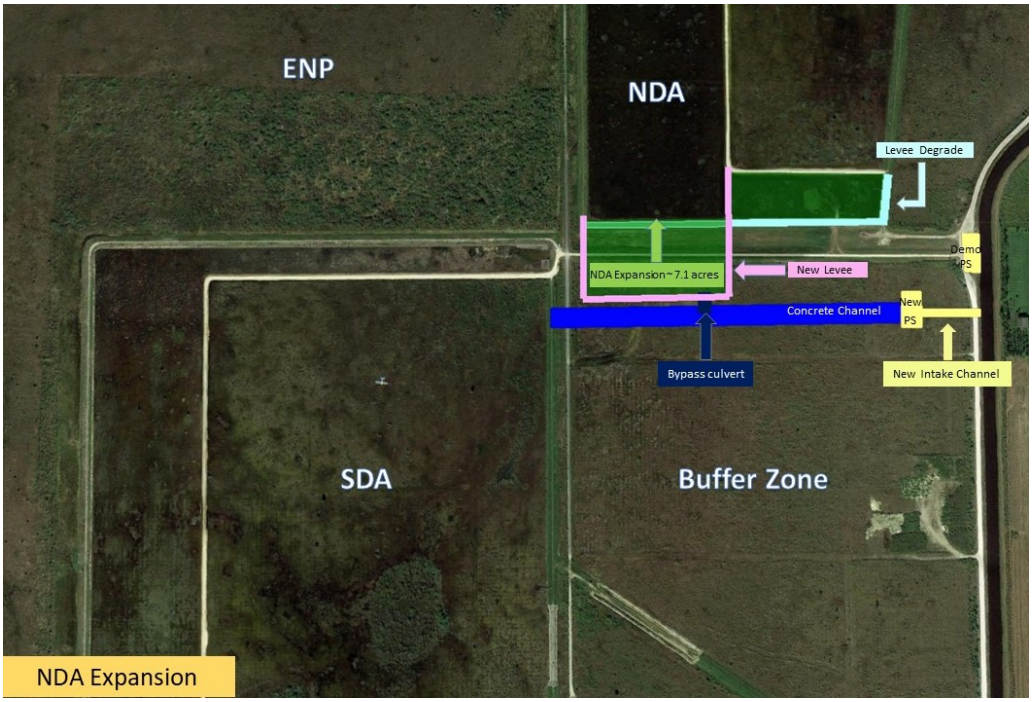

Figure 3-2. NDA Expansion

3.1.5 Pump Station Discharge Channels

In order to convey each pump station's discharge of 575 cfs from its proposed location to the SDA, an above-ground channel connecting each pump station to the SDA is proposed extending from the pump station to the eastern levee of the C-111 SD SDA. The new above-ground channel will be lined with concrete to reduce seepage losses and ensure water connection to the SDA. Concrete-lined channels are preferred to reduce long-term O&M costs compared to the buried pipes that were used to construct the interim pump stations. The buried pipes (overburden material previously referenced in this 2020 GRR/EA) were able to be expeditiously constructed to support the interim pump station construction schedule, and removal of the buried pipes is separately discussed for Alternative 2 and Alternative 3 in **Section 3.2.2** and **Section 3.2.3**, respectively.

A hydraulic design analysis was completed by the USACE and SFWMD to develop conceptual designs of the required components of the pump station discharge channels needed to pass the design discharge of 575 cfs to the SDA while satisfying the design constraints.

The following preliminary design constraints were established by the hydraulic design team:

1. A maximum headwater stage of 12.0 feet NGVD is allowed at the upstream end of both channels. The design tail water stage in the SDA is 8.5 feet NGVD.

2. The maximum flow velocity in each channel is 4.5 feet/sec.

3. Additionally, for the S-332B discharge channel, a minimum headwater stage of 9.0 feet NGVD must be maintained at the weir to provide sufficient head for diverting 250 cfs to the NDA through the proposed gated culverts. For the proposed diversion culverts, the tail water stage at the intake channel of the NDA is taken to be 8.5 feet NGVD.

4. The invert elevation of the discharge channel and all diversion conduits is constant and equal to 6 feet NGVD (near land surface).

An additional design objective of the S-332B discharge channel is that it must be able to supply a diverted discharge of 250 cfs to the NDA when S-332B is discharging at capacity, consistent with the current functionality of the S-332B interim pump station to maintain the hydraulic ridge within the NDA. Therefore, it will be necessary to maintain a certain range of stages in the channel along its reach where the diversions occur in order to enable 250 cfs to flow by gravity to the NDA without exceeding a channel headwater stage of 12.0 feet NGVD at its eastern end. A weir is proposed at the downstream end of the S-332B discharge channel to achieve this objective. For the S-332B discharge channel, lateral diversion culverts were sized to divert 250 cfs by gravity into the NDA. The NDA will be extended southward, encompassing approximately 7.1 additional acres of potential wetland habitat to the NDA. These culverts, at approximately 100 feet in length, connect from the concrete channel to the NDA, and about 320 feet west of the S-332B replacement pump station, with inverts set at the same elevation as the channel invert elevation. Based on the preliminary hydraulic design, the discharge culvert to the NDA will be a vertical lift gate box culvert with 2 barrels, with a 5.8 feet span by 6-feet rise.

The hydraulic design analysis for an extended discharge lined channel was performed for both pump stations. These analyses were conducted by SFWMD using the direct step method to compute the backwater water surface profile within the discharge channel, and weir sizing was computed using SFWMD design guidelines (note: SFWMD determined that a more expansive analysis using Hydrologic Engineering Center's River Analysis System (HEC-RAS) would not provide much additional information because the channel downstream of the weir is short and wide with almost a flat water surface profile). A technical report detailing the results for the “Preliminary Hydraulic Design of the Discharge Canals for Pump Stations S-332B & S-332C” is provided in **Appendix F**. This design was included as part of Alternative 2 – Extended Concrete Channel further discussed in **Section 3.2.2**.

Additional hydraulic design analysis was conducted by SFWMD for a parallel weir option that did not require an extended concrete lined discharge channel within the interior of the SDA. A technical report detailing the results for the “Preliminary Design of the S-332B&C Aboveground Channels” is provided in **Appendix G**. HEC-RAS 1D and 2D were used to model the proposed designs. This design was included as part of Alternative 3 – Short Concrete Channel further discussed in **Section 3.2.3**.

For both S-332B and S-332C, the proposed design is comprised of a trapezoidal channel with a bottom width of 15 feet and 4H: 1V side slopes (based on maintenance and safety considerations). Additionally, a trapezoidal broad crested weir with 2H:1V side slopes and a fixed crest elevation of 8.2 feet NGVD is proposed near the downstream end of the channels, about 100 feet upstream of the SDA. Since the required weir length was larger than the channel width at the weir crest elevation, a channel transition is also included in the preliminary design for each alternative. Although a lateral diversion is not needed for the S-332C discharge channel (S-332B must provide inflows to the NDA), the hydraulic design analysis included in **Appendix F** documents that inclusion of a weir for the S-332C discharge channel will result in cost savings from a reduced channel width needed to maintain the target design velocity within the discharge channel. The weirs were therefore retained for the hydraulic design analysis of the parallel weir option in **Appendix G**.

Based on the hydraulic modeling, since the maximum velocity below the S-332B and S-332C weirs is predicted to exceed 4.5 feet/second, additional erosion protection measures will be needed on the downstream side of the weir and for a short distance downstream along the discharge channel. The

maximum velocity computed here is not indicative of any potential erosion problems further downstream in the SDA since the approach velocity in the SDA is low. Erosion protection measures at the weirs will be designed during the PED phase of the project.

The hydraulic design analysis demonstrated that cost savings in the current preliminary design can be achieved if the design head water stage for each channel is increased above 10 feet NGVD (refer to **Appendix F**). Consequently, for cost comparison purposes, alternative design criteria were considered in addition to the original design criteria mentioned above. These "Option 1" design criteria are essentially the same as the original design criteria except that the maximum allowable headwater stage for the discharge channel is 12.0 feet. An analysis of these alternative design criteria revealed that a channel bottom width of only 15 feet would be needed to pass the design discharge of 575 cfs while the weir length was reduced if its crest was set at 9.2 feet NGVD.

The preliminary designs developed as part of this effort should be considered conceptual and preliminary, as these designs were intended to be used for cost estimating purposes only. The preliminary design for the concrete lined discharge channel are as follows: 15-feet wide channel bottom with 4H to 1V side slopes, crown at 6-feet above the surrounding grade and 8-inches thick concrete liner. Additional hydraulic design analyses of the proposed facilities will be needed prior to the next design phase. Additional design phases must be completed prior to construction. Future design efforts will require a full geotechnical investigation to include the following: shallow and deep borings at each pump station and discharge channel, core borings, percolation tests, seepage testing, piezometers, and seepage modeling. This information will be used during PED to confirm the assumptions and may be used to revise the design, if warranted.

3.2 Final Alternatives

All action alternatives will include replacing S-332B and S-332C interim pump stations with permanent pump stations with hardened structures. The permanent pump stations will be located approximately 300 feet south and 300 feet west of the existing S-332B and S-332C interim structures along the L-31N Canal. The design capacity of the permanent pump stations will be 575 cfs, which is the same as the two existing interim pump stations and the same design capacity assumed for the COP development. As detailed in **Section 3.1.1**, the total design capacity for the new S-332B and S-332C pump stations will consist of four 125 cfs diesel pump units and one 75 cfs electric pump unit. In addition to the pump units necessary to provide the design capacity for normal pump station operations, a backup electric pump unit of 75 cfs will also be provided at both S-332B and S-332C to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities and address hydro period and recession rates considerations for the adjacent CSSS sub-population F. Also, the backup electric pump provides operational flexibility during periods when one or more pump units are offline for maintenance or repairs.

Both alternatives also include expansion of the NDA by approximately 7.1 acres with removal of the interim pump stations and overburden as described above. Alternatives will differ in the types and lengths of the discharge conveyance channels and structures to potentially increase flexibility of pump station operations to further improve ecosystem conditions, while maintaining the authorized level of flood protection. Operations of the project will be in accordance of the COP project and other future restoration projects. Refer to **Section 4.2.2** for more information.

The final alternatives include Alternative 1 No action, Alternative 2 Extended Concrete Channel, and Alternative 3 Short Concrete Channel.

3.2.1 **Alternative 1 - No Action**

This alternative would result in the continued use of the existing interim pump stations that were installed as part of the authorized project and are currently reaching their failure points, as expected. The interim S-332B pump station discharges a maximum capacity of 250 cfs to the NDA and 325 cfs to the SDA. The interim S-332C pump station discharges a maximum capacity of 575 cfs to the SDA. Under this alternative, future failures and increased pump maintenance would be expected, potentially causing loss of ability to hydrate marshes within the ENP. As a result of the existing pumps being interim, abutments and outer structure features were not hardened for long-term use and protection during hurricanes. In addition, the corrugated metal discharge pipes are aging and discharge flow-ways are not hardened, but are vegetated conveyance channels, requiring regular maintenance.

Operation of the existing pumps by the Non-Federal Sponsor (NFS) has demonstrated design weaknesses, whereby vibrations of pumps is introduced by the 90 degree inflow causing a movement of water (flow-field) imbalance to one side from L-31N canal to the pump stations. Adverse hydraulic conditions have been identified that include: turbulence / unsteadiness of approaching flow, vortex, swirl, non-uniform velocity profiles, which may cause decreased hydraulic efficiency, abnormal pump noise and vibration, and uneven loadings that can lead to mechanical failure of pump components.

The No Action Alternative would present as high risk for failure of existing pumps and pipes leading to the NDA and SDA resulting in potential flood risk. It does not address the identified problems and would be inconsistent with the intent of the project if the features failed.

3.2.2 **Alternative 2 – Extended Concrete Channel**

This alternative consists of replacing the S-332B and S-332C existing interim pump stations with new permanent pump stations at an offset of approximately 300 feet south and 300 feet west from their current location along L-31N canal and an extended concrete lined discharge channel with an extension and connection to the existing NDA as depicted in **Figure 3-3**. The S-332B pump station location features include demolition of the existing interim pump station and connecting features, pump offset of approximately 300 feet south and 300 feet west from current location along L-31N canal, concrete intake channel, concrete lined discharge channel to the eastern SDA perimeter levee, extended concrete lined discharge channel within the interior of the SDA, bypass culvert, and an expansion of the NDA of approximately 7.1 acres by degrading a section of NDA levee. Based on the preliminary hydraulic design, the discharge culvert to the NDA will be a vertical lift gate box culvert with 2 barrels, with a 5.8 feet span by 6-feet rise, and approximately 100 feet in length. The S-332C pump station location features include demolition of the existing interim pump station and connecting features, pump offset, concrete intake channel, concrete lined discharge channel to the eastern SDA perimeter levee, and extended concrete lined discharge channel within the interior of the SDA. The permanent pump stations will have a maximum design capacity of 575 cfs, consisting of four diesel units (125 cfs each) and one electric unit (75 cfs). In addition to the normal pump station operational capacity of 575 cfs, both the S-332B and S-332C pump stations will have one additional 75 cfs electric pump to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities. Also, the additional 75 cfs electric unit will be considered as a backup unit to maintain operational flexibility during periods when one or more pump units are offline for maintenance or repairs. The diesel pumps will be located in the center and the electric pumps will be placed on each end. The S-332B pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA (the existing interim pump station culvert discharges limit the maximum discharge to the SDA to 325 cfs). Consistent with the existing NDA design for the interim

S-332B pump station, the pump station discharge channel design will allow up to 250 cfs to be redirected to the NDA. The S-332C pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA.

A new above-ground channel will replace the existing underground corrugated metal pipes to connect the pump station releases to the SDA. This new above-ground channel will be lined with concrete to reduce seepage losses, minimize the maintenance of an unlined channel, and ensure water connection to the SDA. These proposed channels extend approximately 3600 feet and 3400 feet from pump stations S-332B and S-332C, respectively, to the SDA in the east-west direction. The design head water stage for each channel at its eastern end is 10.0 feet NGVD while the design tail water stage at the SDA is 8.5 feet NGVD. The existing underground corrugated metal pipes and overburden material will be removed and will be leveled to grade.

The operations of the existing pump stations would continue through construction while decreasing the amount of over-drying within this region (without operation of the hydraulic ridge) and providing appropriate hydrology for CSSS habitat in accordance with the 1999 USFWS Jeopardy BO. Once the new pump stations are operational, the existing interim pump stations would be removed.

Refer to **Section 3.1** for further details about the management measures proposed under this alternative.

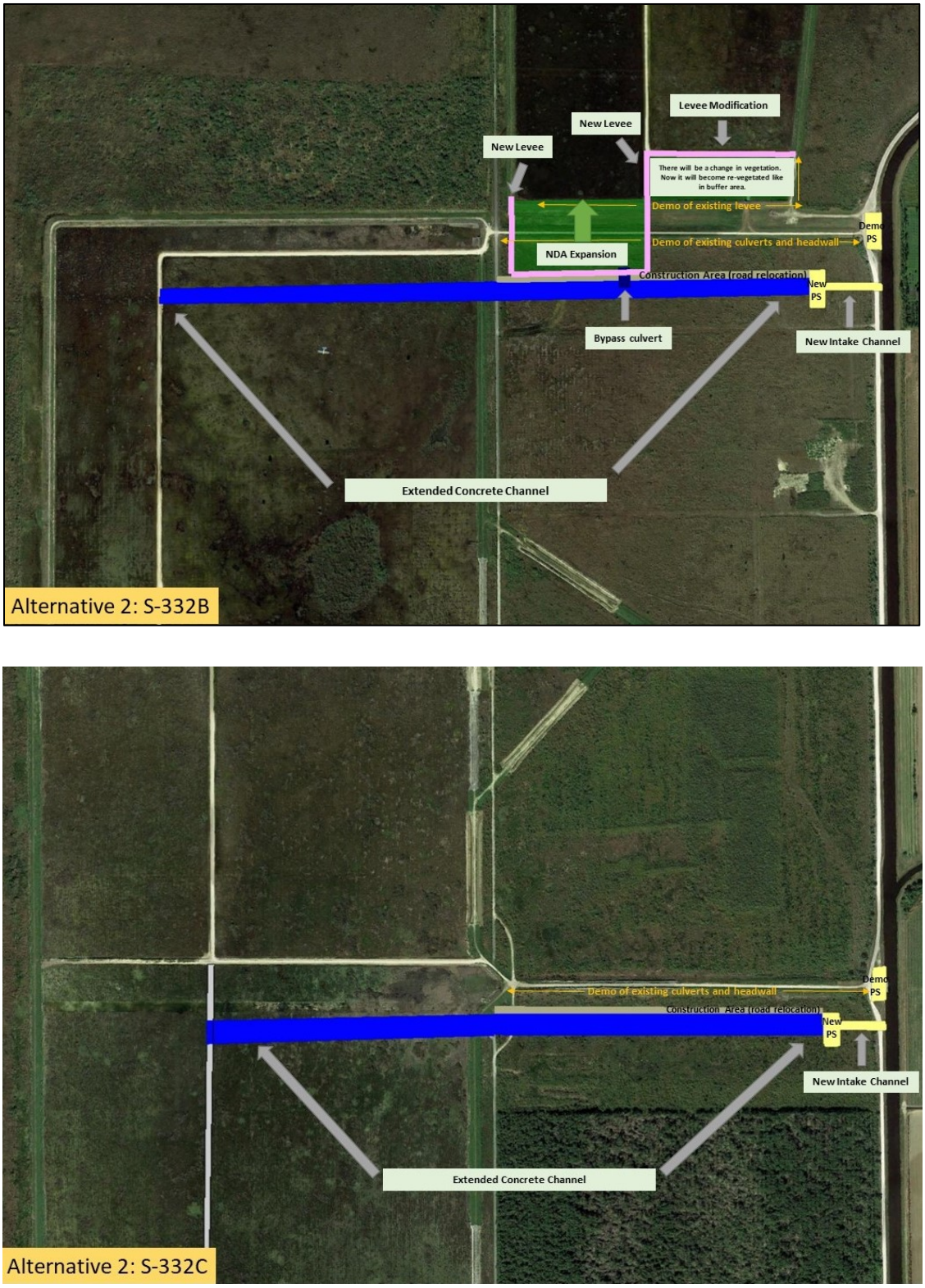

Figure 3-3. Alternative 2 Extended Concrete Channel project footprint.

3.2.3 **Alternative 3 – Short Concrete Channel**

This alternative would consist of replacing the existing S-332B and S-332C interim pump stations with new permanent pump stations at an offset of approximately 300 feet south and 300 feet west from their current location along L-31N canal and a short concrete lined discharge channel with a NDA connect as depicted in **Figure 3-4**. The S-332B pump station location features include demolition of the existing interim pump station and connecting features, pump offset, concrete intake channel, short concrete lined discharge channel (extending slightly west of the eastern SDA perimeter levee), parallel weir to tie into the existing S-332B SDA inflow corridor, bypass culvert, and expansion of the NDA by approximately 7.1 acres by degrading a section of NDA levee. Based on the preliminary hydraulic design, the discharge culvert to the NDA will be a vertical lift gate box culvert with 2 barrels, with a 5.8 feet span by 6-feet rise, and approximately 100 feet in length. The S-332C pump station location features include demolition of the existing interim pump station and connecting features, pump offset, concrete intake channel, short concrete lined discharge channel (extending slightly west of the eastern SDA perimeter levee), and a parallel weir to tie into the existing S-332C SDA inflow corridor. Each of the permanent pump stations will have a maximum design capacity of 575 cfs, consisting of four diesel units (125 cfs each) and one electric unit (75 cfs). In addition to the normal pump station operational capacity of 575 cfs, both the S-332B and S-332C pump stations will have one additional 75 cfs electric pump unit to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities. Also, the additional 75 cfs electric unit will be considered as a backup unit to maintain operational flexibility during periods when one or more pump units are offline for maintenance or repairs. The diesel pumps will be located in the center and the electric pumps will be placed on each end. The S-332B pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA (the existing interim pump station culvert discharges limit the maximum discharge to the SDA to 325 cfs). Consistent with the existing NDA design for the interim S-332B pump station, the pump station discharge channel design will allow up to 250 cfs to be redirected to the NDA. The S-332C pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA.

A new above-ground channel will replace the existing underground corrugated metal pipes to connect pump station discharges to the SDA by a parallel weir. This new above-ground channel will be lined with concrete to reduce seepage losses, minimize the maintenance of an unlined channel, and ensure water connection to the SDA. Each of the proposed channels extends approximately 1900 feet from the pump station to the existing flow-way. The design head water stage for each channel at its eastern end (i.e. the west end of the pump station tail water pool) is 12.0 feet NGVD. The existing underground corrugated metal pipes and overburden material will be removed and will be leveled to grade.

Once the new pump stations are operational, the existing interim pump stations would be removed. The operations of the existing pump stations would continue through construction while decreasing the amount of over-drying within this region (without operation of the hydraulic ridge) and providing appropriate hydrology for CSSS habitat in accordance with the 1999 Jeopardy BO.

Refer to **Section 3.1** for further details about the management measures proposed under this alternative.

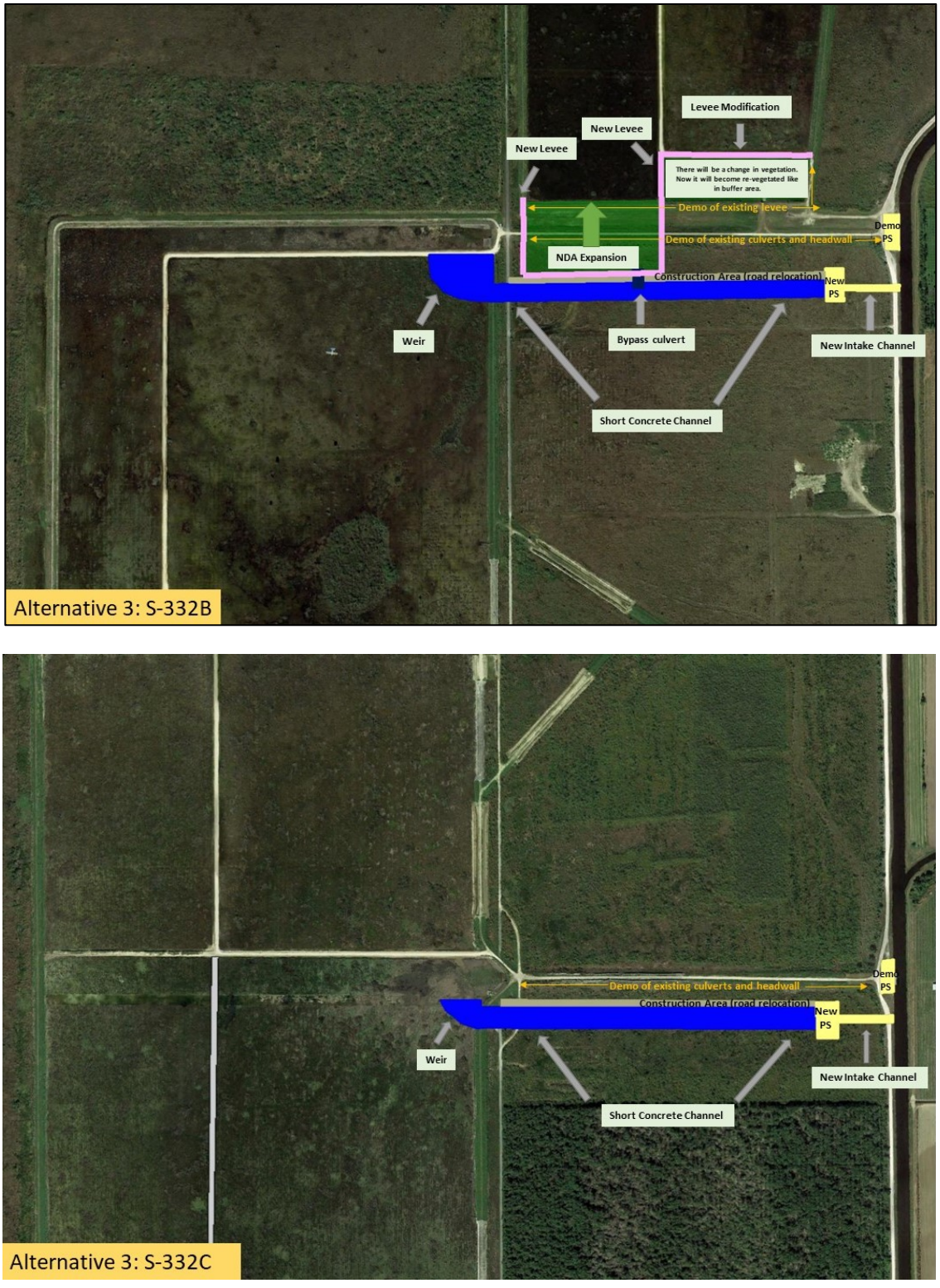

Figure 3-4. Alternative 3 Short Concrete Channel project footprint.

4 EVALUATION OF ALTERNATIVES AND ENVIRONMENTAL EFFECTS

Ecosystem restoration benefits and flood risk management performance were evaluated and were the basis for selecting the Tentatively Selected Plan (TSP) in the 1994 General Reevaluation Report (GRR)/Environmental Impact Statement (EIS). The alternatives in this 2020 GRR/Environmental Assessment (EA) are evaluated based on lowest average annual cost while maintaining project requirements. U.S. Army Corps of Engineers (USACE) and National Environmental Policy Act (NEPA) regulations also require consideration of environmental effects. **Section 4.1** describes the primary decision criteria, how the alternatives meet the authorized project performance, and the cost estimates of the alternatives. **Section 4.2** describes additional performance considerations. **Section 4.3** describes the environmental effects.

The alternative with the lowest average annual cost in operating for the required pump capacity of 575 cubic feet per second (cfs) for each permanent pump station that meets the project objectives has been selected as the TSP. The tentatively selected alternative is independent of the final cost share for Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R). Current operational criteria for the S-332B and S-332C pump stations are governed under the 2012 Everglades Restoration Transition Plan (ERTP) and the 2017 Modified Water Deliveries (MWD) Increment 2 field test temporary planned deviation. The Combined Operational Plan (COP) will determine the next increment of operating criteria for the current completed water management infrastructure, including S-332B and S-332C.

4.1 Performance

The replacement pump stations are necessary for the MWD and Canal-111 South Dade (C-111 SD) projects in order for these projects to provide ecosystem and flood risk management protection benefits. A relative environmental effects comparison for the alternatives can be found in **Section 4.3** of this report. Ecosystem restoration, wetland impacts, and flood risk would all be negatively impacted by the no action plan.

4.1.1 Ecosystem Restoration

Both Alternatives 2 and 3 will perform in maintaining a hydraulic ridge along the flow way to disperse water into the North Detention Area (NDA) and South Detention Area (SDA) and continue restoration of hydro periods in eastern Everglades National Park (ENP) to meet the ecosystem restoration objective. Restoration targets are not expected to change from the 1994 GRR/EIS report, consistent with the 2016 Limited Re-evaluation Report (LRR). The performance of the C-111 SD project features (including S-332B and S-332C pump stations), with respect to both project objectives and constraints, is dependent on the outcome of the future COP. The project is not expected to adversely affect existing fish and wildlife habitat or cultural resources.

4.1.2 Flood Risk

The risk of flooding is minimal for this project as it is primarily focused on ecosystem restoration while maintaining the authorized level of flood protection. The project features covered in this current GRR/EA are focused on routing flow along the western edge of the C-111 Basin. There will be no major impacts to nearby communities since the interim pump station 575 cfs capacity will be maintained with the replacement pump stations. Significant adverse impacts to flood risk management may be realized if the interim pump stations were to be deemed inoperable prior to completion of the replacement pump stations, for example, if one or both of the interim pump stations were damaged during an extreme weather event. Temporary loss of the pump station capacity would require increased releases to the C-111 Canal through the S-176 spillway, which would result in increased freshwater discharges from the S-197

gated culvert into Barnes Sound and Manatee Bay; the rate of removal is more limited with reliance on the gravity drainage along the C-111 Canal compared to the S-332B and S-332C pump stations, and the potential flood event duration associated with the L-31N Canal levels operated outside of the normal operating range would be extended under this condition.

4.1.3 **Cost Estimates**

The cost developed for this C-111 SD GRR/EA is preliminary and subject to change. The design information used for the estimates is preliminary and will be revised in the next phase of this study.

Table 4-1. C-111 SD 2019 GRR/EA Construction Cost Estimate

Project Feature	Alternative 1 – No Action	Alternative 2 – Extended Concrete Channel	Alternative 3 – Short Concrete Channel
S-332B Demolition (existing pump station, discharge pipes, outlet, etc.)	$0	$1,674,000	$1,674,000
S-332B New Pump Station	$0	$40,500,000	$40,500,000
S-332B New Channel	$0	$3,169,000	$3,169,000
S-332B New Additional (Extended) Channel	$0	$2,542,000	$0
S-332B New Lateral Culvert	$0	$280,000	$280,000
S-332B New Outfall Weir	$0	$694,000	$0
S-332B New Outfall Parallel Weir	$0	$0	$696,000
S-332B New Levee	$0	$341,000	$341,000
S-332B Degrade Levee	$0	$157,000	$157,000
S-332C Demolition (existing pump station, discharge pipes, outlet, etc.)	$0	$1,578,000	$1,578,000
S-332C New Pump Station	$0	$40,500,000	$40,500,000
S-332C New Channel	$0	$3,012,000	$3,012,000
S-332C New Additional (Extended) Channel	$0	$2,353,000	$0
S-332C New Outfall Weir	$0	$694,000	$0
S-332C New Outfall Parallel Weir	$0	$0	$696,000
TOTAL	**$0**	**$97,494,000**	**$92,603,000**

Annualized maintenance costs were jointly developed between South Florida Water Management District (SFWMD) and the USACE using historical data from nearby pump stations, such as S-332D.

The OMRR&R for this project is expected to be $332,777 per pump station, resulting in a total cost per alternative of approximately $665,554 per year at 2020 costs. Compared to Alternative 2, there is a minor expected increase in OMRR&R cost due to the parallel weir feature associated with increased fuel cost to return the incremental increase in return seepage due to the un-lined SDA pump station inflow corridors at S-332B and S-332C. The annual expected incremental fuel cost increase of the parallel weir alternative is $39,400. **Table 4-2** shows the annualized costs associated with each of the alternatives.

Table 4-2. Total Annual Cost Comparison for the Alternatives

Annual Costs	Alternative 1 – No action	Alternative 2 - Extended Concrete Channel	Alternative 3 – Short Concrete Channel with Parallel Weir
Construction Cost*	$0	$3,699,711	$3,514,107
O&M Cost	$1,700,000**	$665,554	$665,554
Depreciation	$4,148,415	$0	$0
Additional O&M Cost	$0	$0	$39,400
O&M subtotal	$1,700,000*	$665,554	$704,954
Total Annual Cost	$5,848,415	$4,365,265	$4,219,061

*Average annual cost, FY2019, 2.875%, 50 years.
**Estimated O&M cost for Alternative 1 is an average based on the last 3 years (2017, 2018 and 2019).

4.2 Other Considerations

The following sections describe the lands required for the permanent pump stations, potential impact to future restoration projects, climate change considerations and potential impact to cultural resources.

4.2.1 Real Estate

The Lands required for the construction of the Interim Pump Stations S-332B and S-332C would be the same lands for the construction of the proposed permanent pump stations S-332B and S-332C, as depicted on the projected project maps marked as **Figure 4-1** below.

Figure 4-1. Potential Real Estate Construction Limits.

SFWMD, the Non-Federal Sponsor (NFS), submitted the Certification of Lands dated February 15, 2000, for the life of the project. Parcels which will be directly impacted by the proposed construction of the S-332B permanent pump station, consist of Parcel Nos. 30-6819-000-0010, 30-6819-000-0900, 30-6819-000-0100, 30-6819-000-0120, 30-6819-000-0110, 30-6819-000-0080, 30-6818-000-0060 and 30-6818-000-0065, containing approximately 260.29 total acres. Lands directly impacted for the construction of the permanent pump station S-332C are Parcel Nos. 30-6831-000-0060 and 30-6831-000-0010 containing approximately 387.28 acres, were certified by SFWMD on March 1, 2002.

4.2.2 **Future restoration projects**

The S-332B and S-332C pump station operational ranges for the preliminary design evaluations in this 2020 GRR/EA were constrained by three different existing coordinated documents: the 2012 Water Control Plan (WCP), Increment 2 Operating Strategy, and Historical operating stages less outliers. The 2012 WCP L-31N Canal operating criteria, which were unchanged from the preceding Interim Operational Plan (IOP) criteria, governed historical S-332B and S-332C pump station operations from 2002 through September 2015 with prescribed operating ranges of 4.5-5.0 feet National Geodetic Vertical Datum (NGVD) for the L-31N Canal (S-332B and S-332C pump station headwater elevation). The operating criteria identified in the Increment 2 field test, a temporary planned deviation to the 2012 WCP initiated in February 2018, presently governs S-332B and S-332C pump station operations extending through the future COP; prescribed operating ranges are 3.8-4.8 feet NGVD for the L-31N Canal.

The future COP study will result in a comprehensive integrated WCP for the operation of the water management infrastructure associated with the MWD and C-111 SD Projects. The COP Draft EIS, which will document the environmental effects with the operational criteria proposed under the COP (including the C-111 SD project area), is scheduled for release in February 2020, with implementation of the COP presently anticipated in August 2020. The COP EIS will describe regional hydrologic modeling conducted in order to balance the ecological restoration objectives of the MWD and C-111 SD projects while demonstrating compliance with the project constraints. The COP project constraints will include flood mitigation requirements to prevent potential project-induced flood damages in the 8.5 Square Mile Area (SMA) and to maintain the level of flood damage reduction associated with the 1994 C-111 SD GRR/EIS Recommended Plan. The performance of the C-111 SD project features (including S-332B and S-332C pump stations), with respect to both project objectives and constraints, is dependent on the outcome of the COP, including

details of the operational plans and operational constraints within Water Conservation Area (WCA)-3A, ENP, and the 8.5 SMA. The current draft of the COP Recommended Plan prescribes operating ranges between 3.8-4.8 feet NGVD, within the ranges evaluated for the preliminary S-332B and S-332C pump station design evaluations.

The expectation is that the COP implementation will deliver more water to ENP than the amount of water being delivered under the 2012 WCP, with greater seepage rates as a result of restoration flows and increased stages within eastern ENP as a result of the MWD to ENP project. The COP will utilize C-111 SD constructed features to establish a water management plan for the southern end of the system. The COP analysis is showing that the existing 575 cfs capacities at S-332B and S-332C are sufficient.

The scheduled 2020 finalized COP will define the next increment of operations of the S-332B and S-332C pump stations. The COP will define operations for the existing infrastructure into a WCP/Systems Operations Manual (SOM).

The seepage analysis results discussed in **Section 3.1** indicated that the proposed 575 cfs pump station replacements are compatible to maintain ecosystem restoration and flood risk management benefits with the future planned Central Everglades Planning Project (CEPP) implementation. During screening, the seepage analysis results were considered by the formulation team to provide technical justification for designing the S-332B and S-332C replacement pump stations with an additional 75 cfs capacity at each location as backup for operational flexibility during periods when one or more pump units are offline for maintenance or repairs. The 75 cfs backup electric pump unit will also provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities. Once CEPP and future projects come on board, the WCP/SOM will be updated accordingly.

4.2.3 **Climate Change**

Subsequent to C-111 SD Pump Stations S-332B and S-332C being completed and transferred to the NFS in December 2010, the USACE established an overarching USACE Climate Change Adaptation Policy Statement to support climate preparedness and resilience in 2011. In 2014, the policy was updated and the Climate Preparedness and Resilience (CPR) Community of Practice was established. CPR policy states that climate change assessments are to be considered for all phases of the project life cycle, for both existing and proposed projects. As a result, in order to determine the risk and resiliency of the project to climate change, the C-111 SD project was evaluated in accordance with USACE climate guidance. The commencement of the replacement of S-332B and S-332C pump stations is anticipated in 2021.

The C-111 SD project purpose is to act as a hydraulic ridge between the ENP and private lands to the east of the L-31N borrow canal – essentially serving as an above-ground water impoundment while reducing ENP groundwater seepage flow to the east. It is a highly managed system (i.e. water is pumped into the C-111 detention areas project from the adjacent L-31N borrow canal) in order to develop a hydraulic head that will reduce the groundwater gradient (and thus groundwater seepage flow) towards the east. Water enters the C-111 SD project primarily through direct rainfall, pumping from the MWD 8.5 SMA, S-357, S-332B, S-332C, S-332D, and groundwater seepage from the adjacent ENP. The purpose of this C-111 SD study is to support the replacement of the two interim pump stations (S-332B and S-332C) that were constructed under the approved project authorization and in response to the 1999 Jeopardy Biological Opinion (BO) on the Cape Sable Seaside Sparrow (CSSS).

In addition to potential impacts from inland hydrology (precipitation, air temperature, stream flow) climate change, the C-111 SD project may also be impacted by sea level change (SLC) from the south. For this reason, the project was evaluated for both inland hydrology and SLC.

4.2.3.1 Sea Level Change

The climate assessment for SLC follows the USACE guidance of Engineer Regulation (ER) 1100-2-8162, Incorporating SLC in Civil Works Programs and Engineer Technical Letter (ETL) 1100-2-1, Procedures to Evaluate SLC: Impacts, Responses, and Adaptation. ER 1100-2-8162 and ETL 1100-2-1 provide guidance for incorporating the direct and indirect physical effects of projected future sea level change across the project life cycle in managing, planning, engineering, designing, constructing, operating, and maintaining USACE projects and systems of projects.

The C-111 SD project is located inland from the eastern and southern coasts of Florida but is potentially vulnerable to increases in sea levels in Florida Bay to the south because there are not any existing infrastructure and water management features in ENP located between the Florida Bay (north of the Florida Keys) and the C-111 SD project. The C-111 SD project is protected from SLC to the east at the Atlantic Ocean because of the South Dade Conveyance System's (SDCS) water control structures located between the C-111 SD project and the east coast of Florida. Because of this protection, existing or future sea levels to the east are not expected to impact the hydrologic boundaries, including coastal surge and groundwater impacts, governing the performance and operation of the S-332B and S-332C pump stations.

To assess the vulnerability of the C-111 SD project to future SLC, the web-based USACE Sea Level Change Curve Calculator was used at National Oceanographic and Atmospheric Administration (NOAA) tidal gauge 8724580 in Key West for the following three SLC scenarios:

- Baseline (or "low") estimate, which is based on historic sea level rise (SLR) and represents the minimum expected SLC.
- Intermediate estimate.
- High estimate, representing the maximum expected SLC.

Analysis of C-111 SD project area in relationship with the Key West NOAA gauge can be found in **Figure 4-2**. The figure shows that the following future SLC elevations are projected for the low, intermediate and high SLC projected curves in 2071 (end of 50-year life cycle of S-332B and S-332C replacement pump stations, assuming replacement in 2021):

- Low curve: -0.29 ft. NAVD88 (after the 50-year project life cycle, assuming the project life cycle starts when the project is operational in 2021)
- Intermediate Curve: 0.27 ft. NAVD88
- High Curve: 2.02 ft. NAVD88

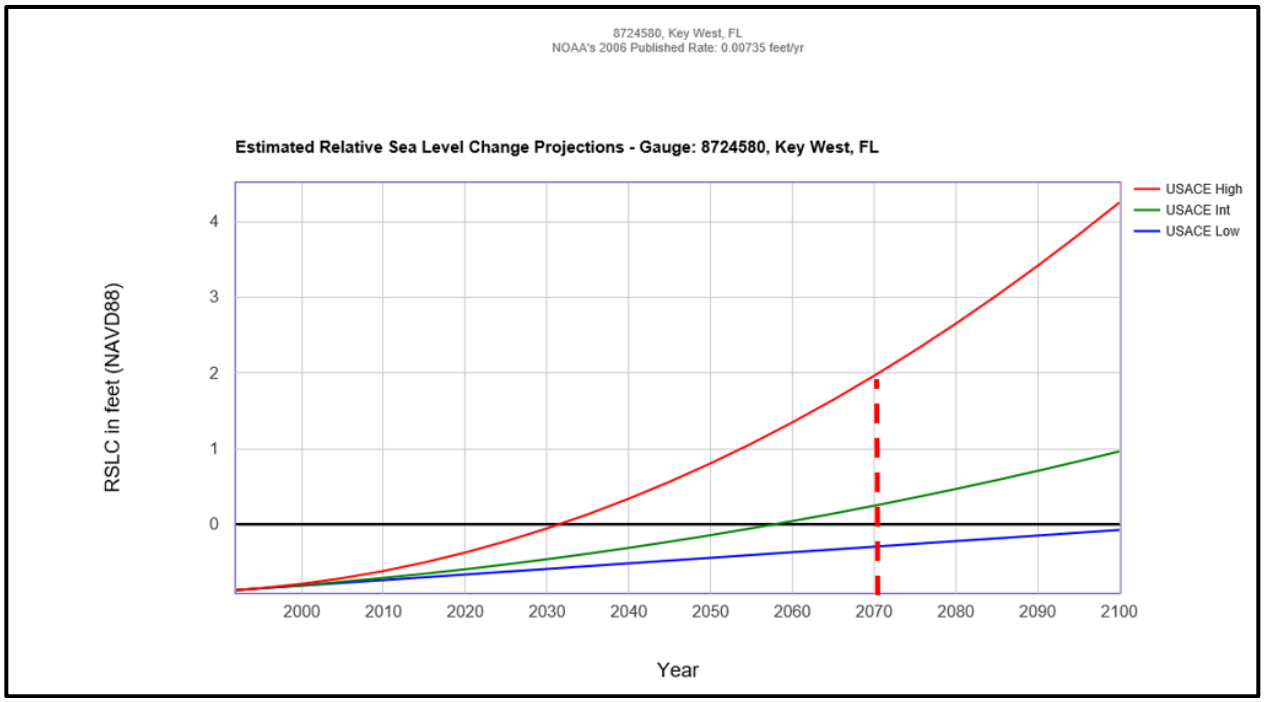

Figure 4-2. SLC Curves at Key West, FL (http://corpsmapu.usace.army.mil/rccinfo/slc/slcc_calc.html)

In lieu of identifying a critical elevation at which SLC impacts the performance or operation of the C-111 SD project, the future SLC elevations were mapped on a regional terrain dataset of south Florida to determine if the inundation footprint due to SLC would encroach on the C-111 SD project footprint during the 50-year life cycle of the S-332B and S-332C pump stations. Based on the inundation of the high curve shown in **Figure 4-3**, the SLC from the Florida Bay is very unlikely to impact the C-111 SD project for the USACE low, intermediate, and high SLC projections. The risk of high tide Mean Higher High Water (MHHW) impacts were also evaluated by assessing the SLC inundation footprint with a MHHW of 0.04 ft. The MHHW elevation was obtained from the tidal datums reported at the NOAA Key West gauge as shown in **Figure 4-4**. Because the difference between NAVD88 and MHHW vertical datums is very small, the resulting differences in inundation footprints between NAVD88 and MHHW were also negligible.

While SLC does not appear to impact the C-111 SD project directly, future resiliency and adaptive management measures for the C-111 SD project may be considered as part of the larger COP and/or through future Central Everglades Restoration Project (CERP) studies. Operational considerations for the COP, of which the C-111 SD project is a component of, may preliminarily be considered with high SLC projections potentially impacting water control structures to the east. Since the COP is expected to govern operations within the SDCS primary canal network for only between 5 to 10 years, prior to the steeper ascension of the SLC High Curve, subsequent operational studies with CERP will require more expansive evaluations for potential SLC impacts.

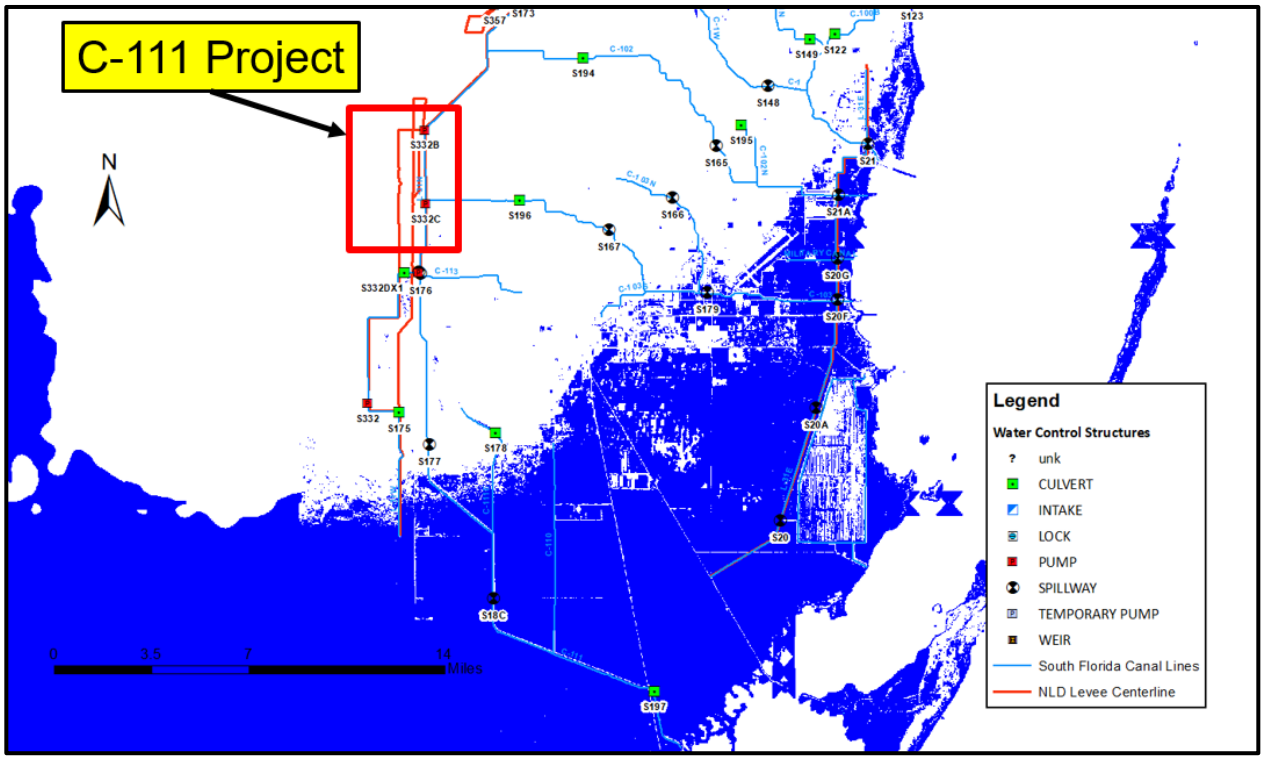

Figure 4-3. SLC Inundation in 2071 – USACE High Curve (End of 50-yr life cycle of S-332B and S-332C pump stations)

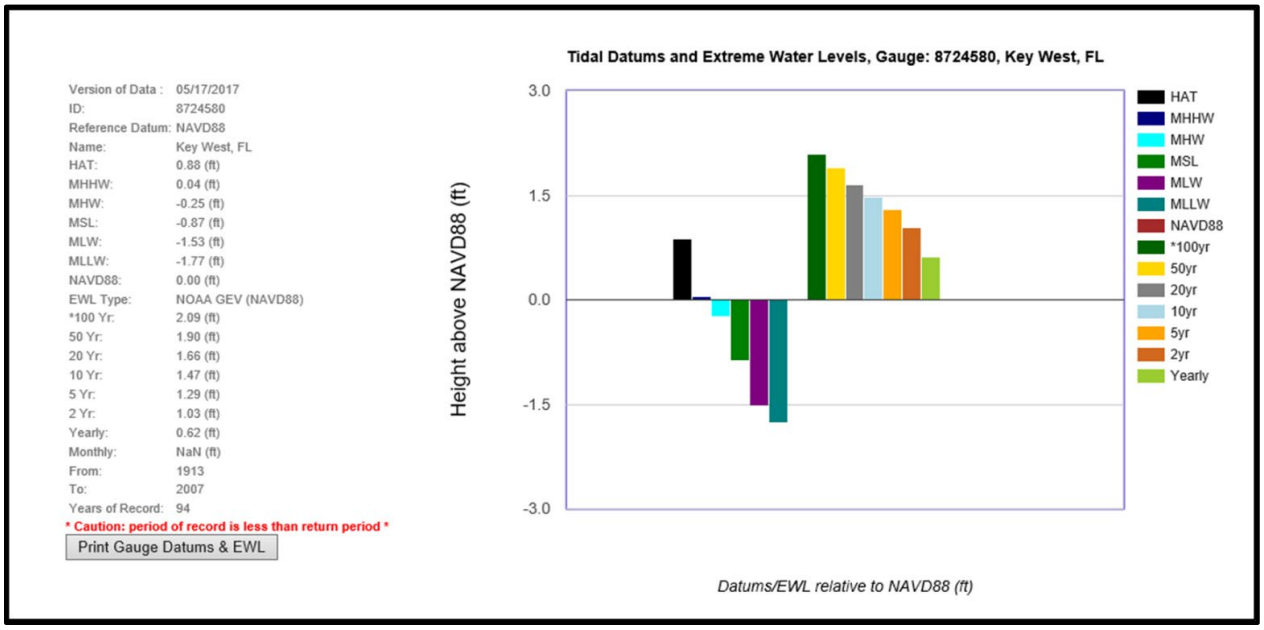

Figure 4-4. Key West Tidal Datum (http://corpsmapu.usace.army.mil/rccinfo/slc/slcc_calc.html)

4.2.3.2 Inland Hydrology

The climate assessment for inland hydrology follows the USACE guidance of Engineering and Construction Bulletin (ECB) 2018-14, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects. ECB 2018-14 provides guidance for incorporating climate change information in the hydrologic analyses in accordance with the USACE climate preparedness and resilience policy and ER 1105-2-101, Risk Assessment for Flood Risk Management Studies.

The vulnerability and risk to this project associated with inland hydrology climate change was assessed qualitatively as outlined in ECB 2018-14. In general, projects addressing climate change during the GRR phase of the project life cycle are less comprehensive than projects evaluated at the Pre-construction Engineering and Design (PED) phase.

The vulnerability assessment includes a literature review and an application of climate tools to evaluate observed and projected climate trends.

The literature review includes the following sources specific to Florida and the surrounding region:

1) *Recent US Climate Change and Hydrology Literature Applicable to US Army Corps of Engineers Missions – South Atlantic-Gulf Region 03* (USACE, 2015a)
2) *Climate Change Indicators in the United States* (EPA, 2016)
3) *Climate Science Special Report: Fourth National Climate Assessment, Volume I* (USGCRP, 2017) *and II* (USGCRP, 2018)
4) *NOAA State Climate Summaries* (Runkle et al., 2017)
5) *USACE Jacksonville District Report on Climate Change*, *Comprehensive Everglades Restoration Plan Central Everglades Planning Project Final Integrated Project Implementation Report and Environmental Impact Statement* (USACE, 2014)

The vulnerability assessment includes a literature review and an application of climate tools to evaluate observed and projected climate trends. The following USACE CPR web-based tools were used in the analysis:

1. Climate Hydrology Assessment Tool (CHAT) – evaluate historic and projected climate trends.
2. Nonstationarity Detection Tool (NSD) – evaluate historic climate trends.
3. Vulnerability Assessment Tool (VA) – provide qualitative information on projected climate conditions.

The CHAT and NSD analyses was performed using data from U.S. Geological Survey (USGS) gauge 2256500 Fisheating Creek at Palmdale, Florida.

4.2.3.3 Risk Assessment

The increases in extreme storm frequency and intensity and increases in temperatures indicated by the literature review present risks to the project features. The literature and statistical analysis show little evidence that indicates change in stream flow. Despite there being no consensus in the literature regarding trends in either observed or projected stream flow, it can reasonably be expected that increased extreme precipitation may lead to increased flows and larger flood volumes and potential risk to the project's levees

and pump stations. In addition, increased temperatures may lead to decreased flows and increases in drought severity and frequency.

The Phase II VA results indicate that the project is located in a relatively vulnerable watershed for the USACE flood risk management business line. The watershed is most vulnerable to increases in extreme storm frequency and intensity, and increases in air temperature. Per guidance in ECB 2018-14, **Table 4-3** identifies risk resulting from changed climate conditions in the future. The table shows the major project feature, the trigger event (climate variable that causes the risk), the hazard (resulting dangerous environmental condition), the harms (potential damage to the project or changed project output), and qualitative assessment of the likelihood and uncertainty of this harm. Note that not all impacts of climate change will result in increased risk, as there may be project benefits.

Because there is not substantial evidence within the observed stream flow record and the literature that inflows to the study area are presently increasing, climate change and resilience should be accounted for by incorporation into the project's risk register. The impacts of climate change are appropriately captured within the uncertainty bounds already incorporated into the preliminary project design identified in this 2020 GRR/EA. Based on the vulnerability assessment (literature review results indicate a high potential for increases in temperature and extreme precipitation and increases in the projections of annual maximum monthly stream flow), it would be beneficial for the project to account for risk due to climate change by developing a strategy for adaptive management of the project. Adaptive management could be used as a means of ensuring that the project is resilient to the impact of climate change for the duration of the project life cycle. This includes ensuring that the design of the project and prescribed operations can easily be adapted to handle extreme wet and dry conditions, including floods and droughts. This will ensure that the plan selected is robust enough to accommodate changing climatic conditions.

If SLR trends increase significantly, or if an increase in the frequency of extreme storm events increases the project design event, or if drought conditions increase, then future resiliency and adaptation measures to the area served by the project could include:

a) Operations of project structures, especially during the wet/dry season.

b) Additional water control structures/pump stations may be added to provide increased pump capacity

In general, all project features were designed for robustness and to adequately handle the 575 cfs design capacity for each replacement pump station.

Table 4-3. Risk Assessment

Feature or Measure	Trigger	Hazard	Harm	Qualitative Likelihood
NDA/SDA Storage Reservoir, C-111	Increased extreme precipitation may occur from increased tropical storm activity.	Future flood volumes may be larger than present.	Flood waters may remain on the levee for longer durations, and more frequently, potentially damaging the NDA or SDA perimeter levees. Larger flood volumes may not be adequately captured and have to bypass to the downstream SFWMD C-111 Spreader Canal detention areas and/or the Estuary.	Somewhat Likely
NDA/SDA Storage Reservoir, C-111	Increased temperatures	Increased evapotranspiration or drought	Decrease in flows may result in lower reservoir stages, resulting in reduced effectiveness for seepage management, resulting in loss of habitat and vegetation and reducing project benefits.	Likely
Water Control Structures and Pump Stations	Increased extreme precipitation may occur from increased tropical storm activity.	Future flood volumes may be larger than present.	Increase in flows resulting in structure under-performing during high flow events	Somewhat Likely
Water Control Structures and Pump Stations	Increased Sea Level	Future sea level elevation may be larger than present.	Increased SLR may limit discharge capacities of water control structures near the coast with current headwater conditions, increasing the frequency of C-111 South Dade pump operations.	Likely

4.2.4 **Cultural Resources**

Two modern interim water control structures (S-332C and S-332C pump stations) are located within the project area. These modern, interim structures were constructed following standardized construction design plans, and do not embody distinctive characteristics of a type, period, or method of construction, and are not historic properties considered eligible for inclusion in the National Register of Historic Places (NRHP). Consultation in accordance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended, is implementing regulations in 36 CFR Part 800: Protection of Historic Properties has been coordinated with the Florida State Historic Preservation Office (SHPO), within the Division of Historical Resources, Florida Department of State, regarding these project components. The current project footprint has been surveyed for cultural resources (DHR# 2006-04979). No recorded archaeological sites exist along

the L-31N Canal or in its bed. The entire project footprint has been previously disturbed by construction of the SDCS. The USACE has determined that project design modifications to the C-111 SD S-332B and S-332C interim pump stations and associated features would have no effect on historic properties. The SHPO has concurred with the determination of no effect in a letter dated 5 August 2019 (DHR# 2019-0299).

4.3 Environmental Effects

The Alternatives analyzed in this section are the No Action Alternative, Alternative 2, and Alternative 3 (the preferred alternative). The features of the alternatives are fully described in **Section 3** of this document.

Construction of any of the alternatives is not expected to cause significant adverse or differing effects between alternatives on the listed resources that are typically described fully within the Jacksonville District's C-111 SD EAs (climate change, geology and soils, endangered species, air quality, noise, aesthetics, land use, or hazardous materials and toxic waste (HTRW), and hydrology). Most effects would be construction-related and temporary and lasting only for the duration of construction, with the exception of the permanent impact of pump station and discharge channel locations. Such construction-related effects could include release of dust, vehicle exhaust, noise generated by construction machinery, human activity, vibrations, etc. Minimal effects are expected to occur to threatened or endangered species due to this project, and those effects are discussed below and are being coordinated with the United States Fish and Wildlife Service (USFWS). All standard construction measures would be followed to ensure no harm to endangered species occurs during construction.

Resources discussed in more detail below would have differing effects between the No Action, Alternative 2 and Alternative 3 – preferred alternative.

Table 4-4. Evaluation of effects between Alternatives.

Resource	No Action	Alternative 2 – Extended Concrete Channel	Alternative 3 – Short Concrete Channel (Tentatively Selected Plan)
Water Quality	The water quality in the C-111 Basin will remain as indicated in the 2016 NDA EA under the No Action Alternative. No additional effects on groundwater or surface water quality are expected with this alternative.	Water quality would not be expected to change due to operation of the new pump station locations. All Water Quality Certifications (WQCs) and permits would be acquired prior to construction.	Water quality would not be expected to change due to operation of the new pump station locations. All WQCs and permits would be acquired prior to construction.
Wetlands	No wetland impact is expected with the No Action Alternative. Wetland impacts that resulted from the prior C-111 SD project implementation have been discussed in previous National Environmental Policy Act (NEPA)	There would likely be approximately 21.8 acres of permanent wetland impacts through functional loss as a direct result of construction of the new pump stations, intake channels, and concrete discharge channels. Construction of the new pump stations S-	There would likely be approximately 15.8 acres of permanent wetland impacts through functional loss as a direct result of construction of the new pump stations, intake channels, and discharge weirs. Construction of the new pump stations S-332 B

Resource	No Action	Alternative 2 – Extended Concrete Channel	Alternative 3 – Short Concrete Channel (Tentatively Selected Plan)
	documents and wetland assessments (1994 GRR/EIS, 2006 Interim Operational Plan (IOP) Final Environmental Impact Statement (FEIS), 2012 8.5 SMA, 2012 NDA EA, 2016 NDA and Associated Features EA/Finding of No Significant Impact (FONSI).	332 B and S-332 C, new channels in the C-111 buffer lands, and levee modifications in and around the NDA will result in approximately 13.3 acres of permanent impacts. Construction of the extended channel from S-332 B would irreversibly impact approximately 4.2 acres of marl prairie within the SDA, and construction of the extended concrete channel from S-332 C within the SDA would irreversibly impact approximately 4.3 acres of marl prairie within the SDA. Demolition of interim pump stations and existing channels along with the construction area in the C-111 buffer lands along the new channels will result in temporary impacts to 10.1 acres of wetland area during the construction phase. Expansion of the NDA by 7.1 acres in addition to 4.7 acres of current NDA area that will no longer be used directly for project purposes uses will allow for the enhancement of 11.8 acres of wetland habitat.	and S-332 C, new channels in the C-111 buffer lands, and levee modifications in and around the NDA will result in approximately 13.3 acres of permanent impacts. The discharge weir for pump S-332 B constructed in the SDA would impact approximately 2.0 acres of marl prairie, and the discharge weir for pump S-332 C would impact approximately 0.5 acres of marl prairie within the SDA. Demolition of interim pump stations and existing channels along with the construction area in the C-111 buffer lands along the new channels will result in temporary impacts to 10.1 acres of wetland area during the construction phase. Expansion of the NDA by 7.1 acres and release of 4.7 acres of current NDA area from project uses will allow for the enhancement of 11.8 acres of wetland habitat. The impacted acreage will be assessed and verified prior to the WQC.
Cultural Resources	Selection of the No Action Alternative would have no effect on cultural resources.	There are no known resources within the proposed pump station project areas. These areas have been previously subjected to cultural resources surveys. Project associated impacts to these areas will have no effect on historic resources.	There are no known resources within the proposed pump station project areas. These areas have been previously subjected to cultural resources surveys. Project associated impacts to these areas will have no effect on historic resources.

Resource	No Action	Alternative 2 – Extended Concrete Channel	Alternative 3 – Short Concrete Channel (Tentatively Selected Plan)
Threatened and Endangered Species	No Effect from continued pump station operations.	May Affect, Not Likely to Adversely Affect eastern indigo snake due to potential construction impacts. All standard procedure construction measures would be followed to minimize and avoid effects to listed species.	May Affect, Not Likely to Adversely Affect eastern indigo snake due to potential construction impacts. All standard procedure construction measures would be followed to minimize and avoid effects to listed species.

As this project is an in-kind replacement of S-332B and S-332C, potential effects to federally listed threatened and endangered species would be construction-related and temporary, lasting only for the duration of construction, with the exception of the permanent impact of pump station and discharge channel locations. Such construction-related effects could include release of dust, vehicle exhaust, noise generated by construction machinery, human activity, vibrations, etc. Minimal effects are expected to occur to threatened or endangered species due to this project. The USACE requested written confirmation of federally listed threatened and endangered species that are either known to occur or are likely to occur within the study area from USFWS by correspondence dated 5 March 2019. The FWS provided concurrence on the revised list on 20 March 2019 (see **Appendix C**). The USACE has determined that there will be No Effect to the listed species in **Table 4-5** apart from the Eastern Indigo Snake, which the USACE has concluded the determination May Affect, Not Likely To Adversely Affect (MANLAA) due to potential, temporary construction impacts.

The Eastern indigo snake prefers drier habitats, but may be found in a variety of habitats including pine flat woods, scrubby flat woods, floodplain edges, sand ridges, dry glades, tropical hammocks, edges of freshwater marshes, muck land fields, coastal dunes, cabbage palm hammocks, and xeric sand hill communities. Since Eastern indigo snakes occur primarily in upland areas, their presence within the Everglades is somewhat limited, except within existing levees throughout the project area. The proposed action would result in approximately 15.8 acres of permanent wetland impacts. The construction of the new channels and parallel weirs within the footprint of the SDA is expected to impact non-forested wetland habitat, and there would likely be permanent wetland effects with placement of the concrete lined channels. However, the pump station locations likely would not affect any wetland areas but would still have proximal construction impacts. All standard procedure construction measures would be followed to minimize and avoid effects to listed species.

Table 4-5. List of Federally Threatened and Endangered Species within the project area (E: Endangered, T: Threatened, SA: Similarity of Appearance, CH: Critical Habitat, C: Candidate Species; PT: Proposed Threatened; PE: Proposed Endangered; NE: No Effect; MANLAA)

Common Name	Scientific Name	Status	Determination
Mammals			
Florida panther	*Puma concolor coryi*	E	NE
West Indian manatee	*Trichechus manatus latirostris*	T, CH	NE
Florida bonneted bat	*Eumops floridanus*	E	NE
Birds			
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH	NE
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH	NE
Piping plover	*Charadrius melodus*	T	NE
Red-cockaded woodpecker	*Picoides borealis*	E	NE
Roseate tern	*Sterna dougallii dougallii*	T	NE
Wood stork	*Mycteria Americana*	T	NE
Reptiles			
American Alligator	*Alligator mississippiensis*	T, SA	NE
American crocodile	*Crocodylus acutus*	T, CH	NE
Eastern indigo snake	*Drymarchon corais couperi*	T	MANLAA
Gopher tortoise	*Gopherus polyphemus*	C	NE
Green sea turtle*	*Chelonia mydas*	E	NE
Hawksbill sea turtle*	*Eretmochelys imbricata*	E	NE
Kemp's Ridley sea turtle*	*Lipodochelys kempii*	E	NE
Leatherback sea turtle*	*Dermochelys coriacea*	E	NE
Loggerhead sea turtle*	*Caretta carretta*	T	NE
Fish			
Smalltooth sawfish*	*Pristis pectinata*	E	NE
Invertebrates			
Bartram's hairstreak butterfly	*Strymon acis bartrami*	E	NE
Elkhorn coral*	*Acropora palmata*	T, CH	NE
Florida leafwing butterfly	*Anaea troglodyta floridalis*	E	NE
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E	NE
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E	NE
Staghorn coral*	*Acropora cervicornis*	T, CH	NE

Common Name	Scientific Name	Status	Determination
Invertebrates			
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	T	NE
Plants			
Crenulate lead plant	*Amorpha crenulata*	E	NE
Deltoid spurge	*Chamaesyce deltoidea spp. deltoidea*	E	NE
Garber's spurge	*Chamaesyce garberi*	T	NE
Johnson's seagrass*	*Halophila johnsonii*	T, CH	NE
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeenis*	E	NE
Small's milkpea	*Galactia smallii*	E	NE
Tiny polygala	*Polygala smallii*	E	NE
Big pine partridge pea	*Chamaecrista lineata* var. *keyensis*	E	NE
Blodgett's silverbush	*Argythamnia blodgettii*	T	NE
Cape Sable thoroughwort	*Chromolaena frustrata*	E, CH	NE
Carter's small-flowered flax	*Linum carteri* var. *carteri*	E, CH	NE
Everglades bully	*Sideroxylon reclinatum spp. austrofloridense*	T	NE
Florida brickell-bush	*Brickellia mosieri*	E, CH	NE
Florida bristle fern	*Trichomanes punctatum* spp. f*loridanum*	E	NE
Florida semaphore cactus	*Consolea corallicola*	E, CH	NE
Sand flax	*Linum arenicola*	E	NE
Florida pineland crabgrass	*Digitaria pauciflora*	T	NE
Florida pineland sandmat	*Chaemaesyce deltoidea pinetorum*	T	NE
Florida prairie clover	*Dalea carthagenesis floridana*	E	NE

* Marine species under the purview of National Marine Fisheries Service (NMFS), the USACE will conduct separate consultation with NMFS.

4.3.1 **Wetlands Impacts**

Under both action alternatives, the construction of the new pump stations and concrete intake channels within the C-111 buffer zone is expected to impact non-forested wetland habitat. The concrete lined channels within the interior of the C-111 buffer zone will permanently impact wetland areas. The proposed pump station locations, at an offset of approximately 300 feet south and 300 feet west from existing pump station locations, are located in reverted freshwater marl prairie wetland areas and will likely not impact any pristine wetland areas. The local benefits of pump relocation and NDA expansion of 7.1 acres are expected to improve wetland quality and allow for natural enhancement of wetland

habitat. By expanding the NDA, the local surficial hydrology of the wetland area is expected to improve. Regionally, the C-111 SD Project as a whole was expected to provide benefit to 739,200 acres of wetlands in ENP, including 81,920 acres in Taylor Slough and 657,280 acres in Shark River Slough (USACE 1994). Wetlands within ENP are currently benefiting from the restoration of more natural hydro periods due to implementation of the project including the S-332B and S-332C pump stations that hydrate detention areas and keep water in ENP. Restoration of the natural hydro periods and burning patterns will result in more historic vegetation within these wetlands. The potential wetland effects will be confirmed during the PED phase of the project through the WQC process. The alternatives were evaluated and summarized in Section 4.

The impacted acreages for all alternatives can be found in **Table 4-6**. The No Action Alternative will have no permanent impacts to wetland habitat, but also will not provide any wetland enhancement or increase regional benefits. For Alternative 2, construction of new project features (including the extended concrete channels, parallel weirs, and replacement pump stations) will result in permanent impacts to 21.8 acres of disturbed wetlands and will be offset by removing the 0.8 acre existing pump stations, by hydrologic improvements to 11.8 acres of disturbed wetlands, including the 7.1 acre NDA expansion, and by continuing to be able to operate the C-111 SD Project to provide local and regional wetland benefits. For both Alternatives 2 and 3, construction of the new pump stations S-332B and S-332C, new concrete channels in the C-111 buffer lands, and levee modifications in and around the NDA will result in approximately 13.3 acres of permanent impacts. The permanent impacts in the SDA differ between these two alternatives, as explained in **Table 4-4**. Both alternatives will also have 10.1 acres of temporary impacts during the construction phase. For Alternative 3, construction of new project features (including the concrete channels, parallel weirs, and replacement pump stations) will result in permanent impacts to 15.8 acres of disturbed wetlands and will be offset by removing the 0.8 acre existing pump stations, by hydrologic improvements to 11.8 acres of disturbed wetlands, including the 7.1 acre NDA expansion, and by continuing to be able to operate the C-111 SD Project to provide local and regional wetland benefits. Alternative 3 will permanently impact approximately 6.1 fewer acres of wetlands than Alternative 2. While there will be impacts to wetlands from either alternative, replacing and continuing the S-332B & S-332C pump stations' wetland rehydration function will benefit a far greater amount of wetlands in ENP.

Table 4-6. Acreages of Wetland Types Gained/Loss/Net

Impact Level	Alternative 1- No Action	Alternative 2- Extended Concrete Channel	Alternative 3- Short Concrete Channel
Permanent	**0**	**21.8**	**15.8**
Temporary	**0**	**10.1**	**10.1**
Enhancement	**0**	**11.8**	**11.8**

4.3.2 Irreversible and Irretrievable Commitment of Resources

An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to enjoy the resources as they presently exist are lost for a period of time. Construction of the Preferred Alternative will include features considered to be permanent as well as modifications to existing Central and Southern Florida (C&SF) Project features

which may be deemed irreversible. Resources to be committed if the project is approved include expenditure of funding, labor, energy, and project materials to build the proposed structures.

4.3.3 Unavoidable Adverse Environmental Effects

As discussed in **Table 4-4,** adverse effects associated with implementing the Preferred Alternative are expected to be minimal. Potential environmental effects would be limited in spatial extent to the immediate areas of construction. Unavoidable potentially adverse impacts that would result from implementation of the Preferred Alternative include 15.8 acres of permanent impacts to wetlands associated with construction of project features.

4.3.4 Cumulative effects

The project area has been subject to Federal involvement for many years. The need for flood damage reduction, water supply, recreation, and fish and wildlife enhancement has provided a difficult task of balancing various and sometimes-conflicting needs for the region. In the early years of the C&SF Project, flood control was the overriding goal, and eventually the need for additional water supplies for south Florida required additional modification to the project. The ENP Protection and Expansion Act of 1989 directed the USACE:

> *"to construct modifications to the Central and Southern Florida Project to improve water deliveries into the park and shall, to the extent practicable, take steps to restore the natural hydrological conditions within the park."*

Since that time, a number of Federal actions have been authorized and implemented that have attempted to improve the flow of water to the ENP without compromising the other needs of the region (i.e., flood control, water supply). The cumulative effects of these actions have been mostly positive. However, some adverse effects have occurred. The CERP (USACE 1999) has already addressed cumulative effects of lost agricultural land use with the expansion of publicly owned lands in the region.

Cumulative impacts in terms of hydrology, water quality, and natural resources have occurred with the many Federal projects implemented over the years. However, this proposed action, coupled with other recent and future projects, should eventually restore the hydrology of the ENP to a more historic natural condition while maintaining flood risk management. The following summarizes past, present, and projected USACE efforts that cumulatively affect the regional environment of south Florida (**Table 4-7**).

Table 4-7. Past, present, and reasonably foreseeable actions and plans affecting the project area.

-	Past Actions and Authorized Plans	Current Actions and Operating Plans	Reasonably Foreseeable Future Actions and Plans
Status of Non-CERP Projects	- C&SF Project (1948) - ENP Protection and Expansion Act (1989) - MWD GDM and Final EIS (1992) - C-111 South Dade GRR (1994)	- MWD 8.5 SMA GRR (2000) - MWD Tamiami Trail Modifications Limited Re-evaluation Report (2008) - C&SF C-51 West End Flood Control Project - Kissimmee River Restoration - Seepage Barrier near the L-31 N Levee (Miami-Dade Limestone Products Association) - Tamiami Trail Modifications Next Steps (TTMNS) Project - SFWMD Florida Bay Initiatives - C-111 South Dade Project (Contracts 8, 8A, and 9)	- SFWMD Restoration Strategies Project - MWD Closeout
Operations Plan for Lake Okeechobee, WCA 3A, ENP and the SDCS	- Water Supply and Environment (WSE) Lake Okeechobee Regulation Schedule (2000) - IOP 2002 to Present	- Lake Okeechobee Regulation Schedule (LORS 2008) - SFWMD LEC Regional Water Supply Plan - Everglades Restoration Transition Plan (ERTP) October 2012 to present; deviation includes Increment 1 and Increment 1.1 and 1.2 and 2 Operational Strategies - Herbert Hoover Dike Dam Safety Modification Study (HHD DSMS) risk reduction measures (2011 through 2025) - ERTP to be replaced by COP.	- LORS 2008 to be replaced by revised Lake Okeechobee Regulation Schedule by 2022 - SFWMD periodically revises the LEC Regional Water Supply Interim Plan

-	Past Actions and Authorized Plans	Current Actions and Operating Plans	Reasonably Foreseeable Future Actions and Plans
CERP Projects		Congressional Authorization Received: - Broward County Water Preserve Areas Project - Caloosahatchee River (C-43) West Basin Storage Reservoir - Central Everglades Planning Projects Congressional Authorization Received and Construction in Progress: - Indian River Lagoon-South Project - Picayune Strand Restoration Project - Site 1 Impoundment Project - Biscayne Bay Coastal Wetlands Project - C-111 Spreader Canal Western Project (operated by SFWMD)	- Future CERP Projects (Lake Okeechobee Watershed Restoration Project, Western Everglades Restoration Project - DOI removal of portions of the old Tamiami Trail roadway and SFWMD construction of the increased S-333 structure - SFWMD Section 203 EAA Southern Reservoir Project

4.3.5 **Compatibility with Federal, State, and Local Objectives**

The USACE has partnered with the SFWMD on this project. The proposed action is consistent with the overall goals and objectives of the C-111 SD Project. It is expected that the proposed action will be consistent with Federal, State, and local plans and objectives as discussed in the completed 2016 NDA and Associated Features EA/FONSI. The only difference in this proposed project is moving the location of the pump stations and associated channels. Wetlands will be quantified and assessed prior to WQC.

4.3.6 **Compliance with Environmental Requirements**

The following sections describe the environmental requirements to be compliant with the NEPA.

4.3.6.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and this EA has been prepared in compliance with NEPA. Full compliance with the Act will be achieved when public and agency coordination is completed.

4.3.6.2 Endangered Species Act of 1973, Section 7

USACE requested written confirmation of federally listed threatened and endangered species that are either known to occur or are likely to occur within the study area from USFWS by correspondence dated 5 March 2019. On 20 March 2019, USFWS concurred with the list of threatened and endangered species located within the project area. Coordination on species effects determinations is still ongoing. The pertinent correspondence (**Appendix C**) includes communication between USACE and USFWS confirming listed species within the project area. A letter conveying the USACE effects determinations will be sent directly prior to the release of this EA. The Proposed Action will be fully coordinated under the Endangered Species Act (ESA) and will be in full compliance with the Act.

4.3.6.3 Fish and Wildlife Coordination Act of 1958

The C-111 SD Project has been extensively coordinated with the USFWS. Fish and Wildlife Coordination Act (FWCA) reports were submitted by the USFWS for the 1994 GRR/EIS, 2002 IOP EIS, and the 2006 IOP FEIS. A letter of concurrence was received on the 2012 NDA USFWS coordination. This project is in compliance with the Act.

4.3.6.4 National Historic Preservation Act of 1966 (Inter Alia), (PL 89-665, the Archeology and Historic Preservation Act (PL 93-291), and Executive Order (E.O.) 11593)

The Proposed Action is in compliance with Section 106 of the NHPA, as amended (PL 89-665). As part of the requirements and consultation process contained within the NHPA implementing regulations of 36 CFR 800, this project is also in compliance through ongoing consultation with the Archaeological and Historic Preservation Act, as amended (PL 93-29), Archeological Resources Protection Act (PL 96-95), American Indian Religious Freedom Act (PL 95-341), Native American Graves Protection and Repatriation Act (NAGPRA) (PL 101-601), Executive Order (E.O.) 11593, 13007, and 13175, the Presidential Memo of 1994 on Government to Government Relations and appropriate Florida Statutes. Consultation with the Florida SHPO, appropriate federally recognized tribes, and other interested parties is complete; the USACE determination that the project poses no effect to historic properties listed or eligible for listing in the NRHP received concurrence from SHPO on 15 February 2019 and can be found in the Pertinent Correspondence Appendix. The Preferred Alternative will be in compliance with the goals of this Act prior to implementation of any portion of this project and upon completion of coordination as stated above.

4.3.6.5 Clean Water Act of 1972

A 404(b) (1) Evaluation has been prepared (**Appendix B**) and has been coordinated along with this 2020 GRR/EA. Full compliance with this Act will be achieved upon the issuance of a Section 401 WQC by the State of Florida during PED.

4.3.6.6 Clean Air Act of 1972

Full compliance with this Act will be achieved through the coordination and review of this EA with the Environmental Protection Agency and the issuance of any required permits. No air permit will be required for the replacement of both pump stations or expansion of the NDA. Though not anticipated, if the contractor has to perform any onsite burning activity associated with the clearing and grubbing activity, any required permits will be obtained by the contractor.

4.3.6.7 Coastal Zone Management Act of 1972

A Federal consistency determination evaluation in accordance with 15 CFR 930 Subpart C is included in this EA as **Appendix A**. The State's consistency review for this project is performed during the coordination of this EA. The Florida State Clearinghouse will review and determine if the project is in conditional compliance at this time. Full compliance will occur with the issuance of the WQC by the State of Florida.

4.3.6.8 Farmland Protection Policy Act of 1981

The USACE consulted with the Natural Resource Conservation Service (NRCS) in 2012 to determine whether prime or unique farmland would be impacted by implementation of this project. The project area for relocation of pumps S-332B and S-332C was coordinated with NRCS in 2012 as part of C-111 SD Project coordination. This project is in compliance with the Act, and the proposed construction impacts and footprint will not impact designated prime or unique farmland.

4.3.6.9 Wild and Scenic River Act of 1968

No designated Wild and Scenic river reaches would be affected by project related activities. This Act is not applicable.

4.3.6.10 Marine Mammal Protection Act of 1972

The West Indian manatee and other protected marine mammals are not believed to occur in the project area, although it is in Barnes Sound and Florida Bay. Incorporation of the safeguards used to protect threatened and endangered species during construction would protect any marine mammals in the area. Coordination with USFWS will continue as construction and operational guidelines are incorporated to avoid impacts to this species. No work is being completed in the canals. The project is in full compliance with the Marine Mammal Protection Act (MMPA).

4.3.6.11 Estuary Protection Act of 1968

No designated estuary would be affected by project construction activities, however, operations of the project may benefit Florida Bay by improving timing of deliveries. The project is in full compliance of this Act upon review of this EA by the NMFS.

4.3.6.12 Federal Water Project Recreation Act

Recreation features were included in the previous construction of project features and were not addressed in this study. Therefore, this project is in compliance with this Act.

4.3.6.13 NMFS Submerged Lands Act of 1953

The project would not occur on submerged lands of the State of Florida. This Act does not apply.

4.3.6.14 Coastal Barrier Resources Act and Coastal Barrier Improvement Act of 1990

There are no designated coastal barrier resources in the project area that would be affected by this project. These Acts are not applicable.

4.3.6.15 Rivers and Harbors Act of 1899

The proposed work would not obstruct navigable waters of the United States. The project is in full compliance.

4.3.6.16 Anadromous Fish Conservation Act

Anadromous fish species would not be affected by this project. This Act is not applicable.

4.3.6.17 Gold and Bald Eagle Protection Act

During Section 7 consultation with the USFWS for the IOP, the USFWS concurred with the USACE determination that construction and operation of the project was not likely to adversely affect the Gold Eagle or Bald Eagle. This was re-coordinated through the USFWS for the features described within the 2012 NDA EA and for this EA. This fulfills the USACE commitments under the Gold and Bald Eagle Protection Act. The project is in compliance with the Act. Gold or Bald eagles have not been found in the area and are unlikely to occur within the direct footprint of construction.

4.3.6.18 Migratory Bird Treaty Act and Migratory Bird Conservation Act

No migratory birds would be adversely affected by project activities. Contract specifications require wildlife surveys be conducted prior to start of construction. Construction will be monitored and all activities kept under surveillance to prevent impacts to migratory birds and their nests, should they occur within the project area. The project will comply with these Acts.

4.3.6.19 Magnuson-Stevens Fishery Conservation and Management Act

This project is inland and not expected to adversely affect Essential Fish Habitat (EFH) due to the large distance between EFH and this project. EFH in Florida Bay is comprised of sea grasses, estuarine mangroves, intertidal flats, the estuarine water column, live/hard bottoms, and coral reefs. Project construction activities should have no effect on the near shore communities or EFH downstream of the project area. However, as a component of the CERP and MWD, this project is expected to have a beneficial indirect effect by increasing overland flow into Florida Bay through Taylor Slough and by improving the timing of water deliveries. The increased flow is anticipated to stabilize the water quality and salinities required to improve and sustain near shore biological communities. The project is in full compliance with the Act.

4.3.6.20 Marine Protection, Research and Sanctuaries Act (MPRSA)

The term “dumping” as defined in the Act (3[33 USC. 1402] (f)) does not apply to this project. Therefore, the Marine Protection, Research and Sanctuaries Act (MPRSA) does not apply.

4.3.6.21 Resource Conservation and Recovery Act (RCRA), Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Toxic Substances Control Act of 1976

A preliminary Phase I HTRW assessment was conducted in 2009 to address the potential for the occurrence of HTRW on lands within the full scope of the C&SF project in the study area. No specific sites were identified within the footprint of the structures. Lands related to the C-111 SD project were

also surveyed for HTRW by SFWMD prior to that agency's transfer and certification of lands to the Federal Government. The project is in compliance with these Acts.

4.3.6.22 E.O. 11988, Flood Plain Management

Guidance on compliance with this Executive Order (E.O.) requires an eight step process. Management of the floodplain is shared among the Federal Emergency Management Agency, the County of Miami-Dade (secondary canals), the USACE and the SFWMD:

1. Is the proposed activity located in the base flood plain? **Yes, The C-111 Canal, a mixed flood mitigation and habitat improvement project, is located in the base flood plain.** Actions (construction) evaluated in this EA are improvements to the function of a pre-existing project.
2. Public review of this 2020 GRR/EA is being conducted with a 30 day review period.
3. Offsetting pump station location to construct new permanent pump stations requires project to stay within the existing floodplain. The proposed project needs to remain in the floodplain, as the system is already operating along with connecting projects and features, including MWD, to maintain current flood control protection that the project provides today.
4. Impacts or effects of the proposed construction include: maintained wet-season flood mitigation for existing land uses: agriculture, residences and businesses; continued groundwater retention in ENP due to the creation of a hydraulic ridge in the Detention Areas that will retard ground water seepage out of ENP; continued avoidance of over-drainage of the eastern boundary lands inside ENP, including CSSS critical habitat.
5. Measures available to minimize adverse effects on natural or beneficial flood plain values: The hydraulic ridge generated by constraining pumped water to the western side of the NDA and SDA flow ways will maintain authorized flood risk management in lands adjacent to the L-31N levee and in the C-111 Canal.
6. Modification or re-evaluation of alternatives to avoid impacts to the floodplain: The construction features on this project were modified as documented in this 2020 GRR/EA to better balance the habitat improvement and flood mitigation purposes. The location of the project remains the same because it must be located along the C-111 SD Canal, but will be offset approximately 300 feet south and 300 feet west of the existing pump station location along the L-31N canal. The Tentatively Selected Plan (or preferred alternative) best provides the authorized benefits without inducing further development.
7. Conclusion: Adverse effects, described elsewhere in this EA, would include irreversible loss of wetlands due to addition of concrete lined channels. The areas to be modified under Water Resources Development Act (WRDA) 1996 authorization within the C-111 SD project are part of the base floodplain. The purpose of the E.O. is to discourage federally induced development in floodplains. The C-111 SD Project is part of the C&SF Project for Flood Control and other Purposes. Commitment of lands to the C-111 SD Project occurred many years ago. This project is in compliance with the intent of this E.O. as the major purpose of the C-111 SD project is to build and maintain a hydraulic ridge that can reduce groundwater seepage out of the eastern ENP lands, improving their value as natural habitats. The proposed construction is being coordinated with the public and agencies during a 30 day period.
8. Implement action after allowing for public response.

4.3.6.23 E.O. 11990, Protection of Wetlands

This E.O. directs Federal agencies to avoid developing or siting projects in wetlands. The nature of this project is that it involves work in wetlands, and no practicable alternative to working in wetlands exists. The project would reduce seepage of groundwater away from wetlands along the eastern boundary of the ENP. Regionally, the C-111 SD Project as a whole was expected to provide benefits to wetlands in ENP, including Taylor Slough and Shark River Slough, as described in **Section 4.3.1.**The project will be in compliance with the intent of this E.O.

4.3.6.24 E.O. 12898, Environmental Justice

This E.O. directs Federal agencies to provide for full participation of minorities and low-income populations in the Federal decision-making process and further directs agencies to fully disclose any adverse effects of plans and proposals on minority and low-income populations. This project would benefit all population groups of southern Miami-Dade County by providing flood damage reduction, drinking water supply protection, and restoration of wetlands and other natural resources inside and outside of the ENP. The project would not result in disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. The project is in compliance with this E.O.

4.3.6.25 E.O. 13045, Protection of Children

E.O. 13045, requires each Federal agency to "identify and assess environmental risks and safety risks [that] may disproportionately affect children" and ensure that its "policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks." This project has no environmental or safety risks that may disproportionately affect children. The project is in compliance.

4.3.6.26 E.O. 13089, Coral Reef Protection

No coral reefs will be impacted by this project due to the large distance between coral reefs and this project. This E.O. does not apply.

4.3.6.27 E.O. 13112, Invasive Species

The project will help reduce the abundance and variety of invasive plant species in the project area. Best management practices (BMPs) will be implemented during the construction phase to preclude the introduction of additional invasive species. Both management agencies, SFWMD and ENP, have invasive species control programs on their respective lands. The project is in compliance with this E.O.

4.3.6.28 E.O. 13186 Responsibilities of Federal Agencies to Protect Migratory Birds

The project will be coordinated with the USFWS concerning migratory birds. The project is expected to benefit migratory birds by improved habitat and increased availability of forage species (amphibians, fish, aquatic invertebrates) for wading birds. The project is in compliance with this E.O.

4.3.7 **Environmental Commitments**

The USACE, the non-federal sponsor (SFWMD), and contractors commit to avoiding, minimizing, or mitigating for adverse effects during construction activities by taking the following actions:

1. Employ BMP practices with regard to erosion and turbidity control. Prior to construction, the construction team should examine all areas of proposed erosion/turbidity control in the field, and make adjustments to the plan specified in the plan control device as warranted by actual field conditions at the time of construction.
2. The contract specifications will prohibit the contractor from dumping oil, fuel, or hazardous wastes in the work area and will require that the contractor adopt safe and sanitary measures for the disposal of solid wastes. The contractor will be required to prepare a spill prevention plan.
3. Demolition debris would be transported to a landfill or otherwise disposed of in accordance with Federal, State, and local requirements. Concrete or paving materials would be disposed of in accordance with Federal, State, and local requirements.
4. Inform contractor personnel of the potential presence of threatened and endangered species in the project area, the need for precautionary measures and the ESA prohibition on taking listed species. A wildlife observer/monitor will be required to be present during all construction.
5. Incorporate any commitments required by the appropriate regulatory agencies identified during the NEPA and ESA process.
6. The contractor will prepare an environmental protection plan for listed species onsite.
7. Construction activities will avoid impacting existing tree islands, if applicable.

5 TENTATIVELY SELECTED PLAN

Alternative 3 - Short Concrete Channel is the Tentatively Selected Plan (TSP)/Preferred Alternative and was selected based on the evaluation criteria resulting in Alternative 3 having the lowest average annual cost, as compared to Alternative 2. Alternative 3 also had the least acreage of wetland impacts. All other evaluation criteria considered was the same for both action alternatives. The following sections explain the project features, operations, cost certification, cost share and preliminary construction schedule for the TSP.

5.1 Project Features

The S-332B pump station location features include demolition of the existing interim pump station and connecting features, new concrete intake channel, short concrete lined discharge channel (extending slightly west of the eastern Southern Detention Area (SDA) perimeter levee), parallel weir to tie into the existing S-332B SDA inflow corridor, and expansion of the North Detention Area (NDA) by approximately 7.1 acres as a result of degrading a section of NDA levee. Based on the preliminary hydraulic design, the discharge culvert to the NDA will be a vertical lift gate box culvert with 2 barrels, with a 5.8 feet span by 6-feet rise, and approximately 100 feet in length. The S-332C pump station location features include demolition of the existing interim pump station and connecting features, new concrete intake channel, short concrete lined discharge channel (extending slightly west of the eastern SDA perimeter levee), and a parallel weir to tie into the existing S-332C SDA inflow corridor. The recommended locations of the new S-332B and S-332C pump stations are approximately 300 feet south along the L-31N Canal and approximately 300 feet further west from their respective current interim pump station locations.

The design capacity of the permanent pump stations will be 575 cubic feet per second (cfs), which is the same as the two existing interim pump stations and the same design capacity assumed for the Combined Operational Plan (COP) development. As detailed in **section 3.1.1**, the total design capacity for the new S-332B and S-332C pump stations will consist of four 125 cfs diesel pump units and one 75 electric pump unit. In addition to the pump units necessary to provide the design capacity for normal pump station operations, a backup electric pump unit of 75 cfs will also be provided at both S-332B and S-332C to provide further operational flexibility to manage the NDA and SDA stages by allowing for additional combinations of pump capacities. Also, the additional 75 cfs electric unit will be considered as a backup unit to maintain operational flexibility during periods when one or more pump units are offline for maintenance or repairs. The diesel pumps will be located in the center and the electric pumps will be placed on each end. Flow separating vanes and trash rake will be constructed in the intake channels from the L-31N Canal to the pump station intake structures. The intake channels and flow separating vanes are proposed to ensure even approach flow distributions, even velocity distributions at the throat of pump suction bells, and minimal flow pre-swirl in the pump column. After review of the seepage modeling utilized for the design of the permanent pump stations, the existing 575 cfs capacity of the pumps for each of the pump stations have been confirmed as adequate for designing the permanent pump stations. The S-332B pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA (the existing interim pump station culvert discharges limit the maximum discharge to the SDA to 325 cfs). Consistent with the existing NDA design for the interim S-332B pump station, the pump station discharge channel design will allow up to 250 cfs to be redirected to the NDA. The S-332C pump station discharge channel design will allow the full pump capacity of 575 cfs to be directed to the SDA. Each of the proposed discharge channels extends approximately 1900 feet from the pump station to the existing flow way. The design head water stage for each channel at its eastern end (i.e. the west end of the pump station tail water pool) is 12.0 feet National Geodetic Vertical

Datum (NGVD). Furthermore, each channel widens as it turns 90 degrees to the north and discharges over a trapezoidal weir. The downstream toe of this weir is connected in an open-channel fashion to the existing inflow corridor through approximately 130 feet of concrete channel. The expanded channel reach functions as a head water pool for the weir. Based on preliminary hydraulic design analysis, the following initial channel and weir design dimensions were identified: (a) the pump station discharge channels at both S-332B and S-332C will require an estimated bottom width of 15 feet, based on the indicated maximum stage of 12.0 feet NGVD; (b) the concrete broad-crested weirs which provide a lateral outflow (parallel weir) from both the S-332B and S-332C discharge channels will have an estimated top length of 192 feet and width of 15 feet. Following completion of a full geotechnical investigation during the future Pre-Construction, Engineering, and Design (PED) phase, including additional seepage modeling, the hydraulic design assumptions will be revisited and the preliminary design parameters may be adjusted.

The preliminary designs developed as part of this effort should be considered conceptual and preliminary, as these designs were intended to be used for cost estimating purposes only. Additional hydraulic design analyses of the proposed facilities will be needed prior to the next design phase, including potential adjustments to shift the locations closer to the existing pump stations to minimize costs of the parallel weir connections to the existing pump station inflow corridors. Additional design phases must be completed prior to construction, including coordination between the U.S. Army Corps of Engineers (USACE) and South Florida Water Management District (SFWMD).

5.1.1 **Future Modeling and Design Considerations**

Proposed features for the two new pump stations are anticipated to include pump station buildings designed to withstand Hurricane Category 5 force winds, inclusive of pipe gallery, pump equipment room, fan room, workshop, break room, truck bay, access bridge, service bridge, bridge crane, fuel tank area, telemetry, turning vanes, trash rake, backup generator, headwater/tail water stilling well platforms, intake bay from L-31N, discharging to a concrete lined channel and weir. The diesel pumps will be compliant to latest air permit requirements. A shelter building with replacement microwave equipment at the S-332B microwave tower and new fiber optic cable at S-332B and S-332C pump stations will be necessary. The permanent S-332B pump station will also include a 250 cfs vertical lift gate box culvert structure with telemetry including headwater/tail water stilling well platforms. The old pump stations will be demolished upon construction completion and commencement of operation of the new S-332B and S-332C pump stations. The design of the two new pump stations will require a full geotechnical investigation to include the following: shallow and deep borings at each pump station and discharge channel, core borings, percolation tests, seepage testing, piezometers, and seepage modeling. The two pump stations will be designed per SFWMD and USACE design guidelines. There will be more detailed hydraulic modeling of the pump stations, intake canals, and the concrete lined discharge channels. A physical model will be required for each pump station to evaluate the proposed hydraulic design, including the intake channel, and to adjust it as necessary.

5.2 Operations

Current operational criteria for the S-332B and S-332C interim pump stations are governed under the 2012 Everglades Restoration Transition Plan (ERTP) and the 2017 Modified Water Deliveries (MWD) Increment 2 field test temporary planned deviation, with the field test operations anticipated to extend through implementation of the COP planned for August 2020. The Canal-111 South Dade (C-111 SD) features, including the permanent pump stations, will be operated as established by the COP. The COP is

a parallel effort that will provide guidance on how to operate the project while achieving the C-111 SD project objectives determined in the 1994 General Re-evaluation Report (GRR)/Environmental Impact Statement (EIS). Additionally, the existing S-332B and S-333C pump stations must continuously operate during construction of the new pump stations until the new pump stations are operable.

5.3 Cost Estimates

The cost estimate has been revised to reflect design modifications to the NDA/SDA connection. The changes apply to both Alternatives 2 and 3 and subsequently does not alter selection of Alternative 3 as the TSP. Design modifications include: added gates to the culverts for flow control; elevation of existing levee raised to meet required height consistent with adjacent levees; excavation to bury culvert; and better understanding of risk for overall project increased the contingency.

5.3.1 First Costs

Table 5-1 shows the construction costs for pump stations S-332B and S-332C and their associated features. Lands & Damages, PED, and construction management costs are provided to show the total project first cost. The project first cost includes a risk based contingency of 34%. Refer to Appendix H for additional detail on how project cost was developed.

Table 5-1. C-111 SD 2020 GRR/EA Project First Cost Estimate

Project Feature	Alternative 3 – Short Concrete Channel
S-332B Demolition (existing pump station, discharge pipes, outlet, etc.)	$1,852,043
S-332B New Pump Station	$44,354,000
S-332B New Channel	$3,682,655
New Levee	$1,079,618
S-332B New Lateral Culvert + Vertical Slide	$6,358,499
Degrade Levee	$204,847
Levee Modification	$422,528
S-332B New Outfall Parallel Weir	$781,716
S-332C Demolition (existing pump station, discharge pipes, outlet, etc.)	$1,745,083
S-332C New Pump Station	$43,416,000
S-332C New Channel	$3,496,203
S-332C New Outfall Parallel Weir	$781,716
CONSTRUCTION SUBTOTAL	$108,174,907
Lands and Damages	$0
Planning, Engineering & Design	$18,931,000
Construction Management	$12,981,000
TOTAL PROJECT FIRST COST	$140,086,907

Cost certification by the USACE Mandatory Center of Expertise (MCX) Walla Walla will be included in the final report.

5.3.2 **Operations**

Annualized maintenance costs were jointly developed between the SFWMD and the USACE using historical data from nearby pump stations, such as S-332D. The estimated total annual cost of Operation, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) of the new pump stations, concrete intake and discharge channels, and NDA diversion culvert for S-332B is $704,954.

5.4 Cost Share

5.4.1 **Cost Sharing of First Costs**

Recommended cost sharing for construction of replacement pump stations is 50% federal and 50% non-federal. Pursuant to the PCA amendment, the USACE made depreciation payment to SFWMD intended for construction of replacement of interim pump stations by SFWMD. Construction for the replacement of pump stations has not yet occurred. Since this report is recommending cost shared construction of

new replacement pump stations, this depreciation payment made by USACE is to be credited to the federal share of construction cost.

5.4.2 **Cost Sharing of OMRR&R**

a. The C-111 SD Project involves pumping water to a retention/detention zone which discharges water directly to Everglades National Park (ENP), and preserves the level of flood protection for the urban and agricultural interests in the C-111 Basin. As described in Section 7.7.1 of the 1994 GRR and consistent with the 1968 authorization for the C-111 SD Project, as amended in Section 316 of the Water Resources Development Act (WRDA) of 1996, the current cost share with the non-Federal Sponsor is as follows.

i. The non-Federal sponsor is required to contribute 50 percent of the total project costs to implement the project. The operation and maintenance (O&M) cost of the project is a local responsibility, however, the annual pumping costs, including fuel, lubricants, proportional depreciation and repairs, and operating labor for the pump stations are cost shared 60 percent Federal and 40 percent non-Federal. The 1968 GRR states that the Federal Government should share in the major pumping costs for water supplies on the basis of 60 percent Federal and 40 percent non-Federal, which approximates the ratio of pumped water to the ENP and to non-park users. Section 316 states 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 ENP. The pump stations that pump water into Taylor Slough in the ENP are S-332B, S-332C, and S-332D.

ii. Amendment No.1 of Project Cooperation Agreement (PCA), dated 14 August 2014, requires that the Post Authorization Change Report (PACR) shall consider seeking authorization for cost sharing of recommended features in accordance with Section 316 of the Water Resources Development Act (WRDA) of 1996; appropriate cost sharing for the operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of project features; and the provision of credit for proportional depreciation payments made by the Government to the Non-Federal Sponsor under Article VII.A.1.a of this Agreement for Pump Stations S-332B and S-332C toward the Federal share of the replacement costs for S-332B and S-332C.

b. The proposed cost share for the replacement of the existing, interim S-332B and S-332C structures is 50 percent federal and 50 percent non-federal, consistent with the existing construction cost share authority in Section 316 of WRDA 1996. Cost share for O&M phase activities is under development, and the Assistant Secretary of the Army for Civil Works (ASA (CW)) will make the final determination of the cost share percentages for O&M phase activities that will be included in the final integrated GRR and Environmental Assessment (EA) that is submitted to Congress for authorization. The cost share percentages for O&M phase activities are anticipated to be within the range of 0% Federal to 60% Federal.

Based on this proposed language, cost sharing of the replacement pump stations and associated facilities and operations is shown in Table 5-2.

Table 5-2. Cost Share

Item	Federal Cost	Non-Federal Cost	Total[1]
Ecosystem Restoration (ER)			
Restoration Construction[1]	**$49,939,039**	**$54,087,454**	**$108,174,907**
Credit for Depreciation Payment	**$4,148,415**		
PED[1]	**$9,465,500**	**$9,465,500**	**$18,931,000**
Construction Management	**$6,490,500**	**$6,490,500**	**$12,981,000**
LER&R	**$0**	**$0**	**$0**
Total Project First Cost[2]	**$70,043,454**	**$70,043,454**	**$140,086,907**
Average Annual Costs			
Annualized First Cost	**$2,023,149**	**$2,023,149**	**$4,046,298**
OMRR&R - C-111 SD pump stations, concrete conveyance channels, NDA diversion culvert for S-332B. (60% federal, 40% non-federal)	**0% - 60%**	**40% - 100%**	**$704,954**

1 Construction cost totals are Oct 2019 (FY20) costs and include 34% contingency
*Average annual cost, FY2020, 2.75%, 50 years.

5.5 Project Implementation

This 2020 GRR/EA is seeking Congressional Authorization to construct replacement pump stations S-332B and S-332C with respective conveyance channels. The SFWMD is seeking execution of an In-Kind Memorandum of Understanding (MOU) under Section 221 of the Flood Control Act of 1970, as amended, so that it can preserve the opportunity for credit for construction of permanent structures S-332B and S-332C prior to authorization and PCA Amendment.

After execution of the MOU, the SFWMD may initiate design and construction of the TSP while maintaining eligibility to receive in-kind credit for this early work. Credit may be afforded under the terms of the PCA upon Congressional authorization of this 2020 GRR/EA, a PCA Amendment and a determination that the work SFWMD performed is integral to the C-111 SD Project.

The estimated time for PED is 18 months and construction is 40 months. Should the SFWMD pursue an alternative design other than the TSP design during PED, such as alternative 2, additional USACE review and associated National Environmental Policy Act (NEPA) will be required to ensure additional environmental effects are fully addressed.

6 DISTRICT ENGINEER'S RECOMMENDATION

The Canal 111 South Dade (C-111 SD) replacement of interim pump stations S-332B and S-332C is a component of the larger existing C-111 SD project. In addition to increasing the reliability of pumps, the new permanent pump stations will allow for long term operations of the larger existing project and its features. The C-111 SD project will reduce flooding in South Miami-Dade County, prevent over drainage, prevent saltwater intrusion, and convey water to Everglades National Park (ENP) when runoff is available. A hydraulic ridge will be maintained through combination of the Modified Water Deliveries (MWD) with existing C-111 SD project features including the North Detention Area (NDA), South Detention Area (SDA) and the S-332D Detention Area, all which extend from the MWD 8.5 Square Mile Area (SMA) to Taylor Slough. Maintaining the existing hydraulic ridge will allow for continuation of reducing ground water seepage losses from ENP and sustaining the authorized level of flood protection for adjacent agricultural areas in the C-111 Basin. The new permanent pump stations will improve operational flexibility and allow for improvement of hydro periods and hydro patterns within the Cape Sable Seaside Sparrow (CSSS) habitat. Replacement needs of existing interim pump stations will be addressed in this 2020 GRR/EA and pumps will be reconfigured to permanent, hardened structures that were envisioned in the original authorization.

The C-111 SD project features will continue to be operated in order to achieve the C-111 SD benefits previously identified in the 1994 GRR while using the same 575 cubic feet per second (cfs) design capacity as existing pumps. Operational criteria will be established by an ongoing effort, the Combined Operational Plan (COP), which anticipates completion in August 2020.

The C-111 SD project plan includes the features described below:

New pump station S-332B features: a 575 cfs capacity pump station with permanent, hardened structures located at approximately 300 feet west and 300 feet south from the existing pump station location along the L-31N Canal; new concrete intake channel; short concrete lined discharge channel (extending slightly west of the eastern SDA perimeter levee); parallel weir to tie into the existing S-332B SDA inflow corridor; expansion of the NDA by approximately 7.1 acres as a result of degrading a section of NDA levee; a gated culvert connecting the concrete discharge channel with the NDA, and demolition of the existing interim pump station and connecting features.

New pump station S-332C features: a 575 cfs capacity pump station with permanent, hardened structures located at approximately 300 feet west and 300 feet south from the existing pump station location along the L-31N Canal; new concrete intake channel; short concrete lined discharge channel (extending slightly west of the eastern SDA perimeter levee); parallel weir to tie into the existing S-332C SDA inflow corridor, and demolition of the existing interim pump station and connecting features.

The Project Cooperation Agreement (PCA) Amendment requires that the Post Authorization Change Report (PACR) shall consider seeking authorization for cost sharing of recommended features in accordance with Section 316 of the Water Resources Development Act (WRDA) of 1996; appropriate cost sharing for the operation, maintenance, repair, replacement and rehabilitation (OMRR&R) of project features; and the provision of credit for proportional depreciation payments made by the Government to the Non-Federal Sponsor under Article VII.A.1.a of this Agreement for Pump Stations S-332B and S-332C toward the Federal share of the replacement costs for S-332B and S-332C.

Therefore, I recommend that the C-111 SD replacement of pump stations as described in the section of the report entitled "The Tentatively Selected Plan," with such modifications that may be deemed advisable at the discretion of the Chief of Engineers, be authorized for construction. The total estimated first cost for the C-111 SD project is $140,086,907 (October 2019 price level), with an estimated federal cost of $70,043,454 and an estimated non-federal cost of $70,043,454. The depreciation payment of $4,148,415 made by the USACE will be credited to the federal share of cost for construction of the replacement pump stations. The estimated total annual cost of operation, maintenance, repair, replacement, and rehabilitation (OMRR&R) is $704,954 with an estimated federal annual OMRR&R cost ranging from $0 to $422,972.40 and an estimated non-federal OMRR&R cost ranging from $281,981.60 to $704,954.

6.1 Recommendation for Congressional Authorization

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for authorization and implementation funding. However, prior to transmittal to the Congress, the sponsor, the state, interested federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

Andrew D. Kelly, Jr.
Colonel, U.S. Army
District Commander

7 LIST OF RECIPIENTS

The following agencies, groups, and individuals were sent copies of this EA and FONSI:

Native American Tribes
Miccosukee Tribe of Indians of Florida
Seminole Tribe of Florida

Federal Agencies
Federal Emergency Management Agency
US Environmental Protection Agency
US Department of Agriculture
Forest Service
Natural Resources Conservation Service
US Department of Commerce
National Oceanic and Atmospheric Administration
Florida Keys National Marine Sanctuary
National Marine Fisheries Service
US Department of Housing and Urban Development
US Department of the Interior
Bureau of Indian Affairs
US Fish and Wildlife Service
US Geological Survey
National Park Service
Office of Environmental Policy and Compliance
US Coast Guard
US Department of Transportation
Federal Highway Administration
US Public Health Service

State Agencies
Florida Department of Agriculture and Consumer Services
Florida Department of Community Affairs
Florida Department of Environmental Protection
Florida State Clearinghouse
Florida Fish and Wildlife Conservation Commission
Florida Department of Transportation
Florida Division of Historical Resources - SHPO
South Florida Water Management District

Regional Governments
South Florida Regional Planning Council

County Governments
Miami-Dade County

Municipalities
Miami, Florida
Florida City, Florida
Homestead, Florida

Groups
Audubon Society of the Everglades
Biodiversity Legal Foundation
Miami-Dade County Farm Bureau
Dairy Farmers, Inc.
Defenders of Wildlife
Environmental Coalition of Broward County
Environmental Defense Fund
Everglades Coordinating Council
Everglades Foundation
Florida Audubon Society
Florida Biodiversity Project
Florida Defenders of the Environment
Florida League of Anglers, Inc.
Florida Power and Light Company
Florida Sportsman Conservation Association
Florida Wetlands
Florida Wildlife Federation
Friends of Florida
Friends of the Everglades
Lake Worth Drainage District
National Audubon Society
National Parks and Conservation Association
National Resources Defense Council
National Sierra Club
National Parks Conservation Association
National Wildlife Federation

Save the Manatee Club
Sierra Club, Florida Chapter
South Florida Agricultural Council
South Florida Anglers for Everglades Restoration, Inc.
The Environmental Coalition
The Nature Conservancy
The Wilderness Society
Tropical Audubon Society
Trust for Public Lands
World Wildlife Fund

Individuals

A complete list of individuals who received the EA and FONSI is on file in the Jacksonville District of the Corps.

8 REFERENCES

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U.S. Fish and Wildlife Service. 2006, 2010, Suppl. 2012. Biological Opinion, Interim Operational Plan for the Protection of the Cape Sable Seaside Sparrow (November 17, 2006); Everglades Restoration Transition Plan, 2010, 2012.

Ware, John A. 1989 Archeological Inundation Studies: Manual for Reservoir Managers, Contract Report EL-89-4, US Army Engineer Waterways Experiment Station, Vicksburg, MS.

9 LIST OF ACRONYMS

A	
ASA (CW)	Assistant Secretary of the Army for Civil Works
B	
BO	Biological Opinion
C	
C-111 SD	Canal 111 South Dade
CEPP	Central Everglades Planning Project
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERP	Comprehensive Everglades Restoration Project
CFD	Computational Fluid Dynamics
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CHAT	Climate Hydrology Assessment Tool
COE	Corps of Engineers
COP	Combined Operational Plan
CPR	Climate Preparedness Resilience
C&SF	Central and Southern Florida
CSSS	Cape Sable Seaside Sparrow
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
E	
EA	Environmental Assessment
ECB	Engineering and Construction Bulletin
EFH	Essential Fish Habitat

EIS	Environmental Impact Statement
ENP	Everglades National Park
E.O.	Executive Order
EPA	Environmental Protection Agency
ER	Engineer Regulation
ERTP	Everglades Restoration Transition Plan
ESA	Endangered Species Act
ETL	Engineer Technical Letter
F	
FCSA	Feasibility Cost Sharing Agreement
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
FEMA	Federal Emergency Management Agency
FLUCCS	Florida Land Use, Cover, and Forms Classification System
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
G	
GRR	General Reevaluation Report
H	
HEC-RAS	Hydrologic Engineering Center's River Analysis System
HDPE	High-density Polyethylene
HTRW	Hazardous, Toxic and Radioactive Waste
I	
IOP	Interim Operational Plan

L

LRR	Limited Reevaluation Report

M

MANLAA	May Affect, Not Likely To Adversely Affect
MCX	Mandatory Center of Expertise
MHHW	Mean Higher High Water
MOU	Memorandum of Understanding
MPRSA	Marine Protection, Research and Sanctuaries Act
MWD	Modified Water Deliveries

N

NAGPRA	Native American Graves Protection and Repatriation Act
NDA	North Detention Area
NEPA	National Environmental Policy Act
NFS	Non-Federal Sponsor
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanographic and Atmospheric Administration
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NSD	Nonstationarity Detection Tool

O

O&M	Operation and Maintenance

OMRR&R	Operation, Maintenance, Repair, Replacement and Rehabilitation
P	
PACR	Post Authorization Change Report
PCA	Project Cooperation Agreement
PED	Pre-Construction Engineering and Design
POM	Project Operating Manual
PPA	Project Partnership Agreement
PPCA	Pre-Partnership Credit Agreement
Q	
QTD	Quantity, Timing and Distribution
R	
RCRA	Resource Conservation and Recovery Act
S	
S&A	Supervision and Administration
SAD	South Atlantic Division
SDA	South Detention Area
SDCS	South Dade Conveyance System
SFOO	South Florida Operations Office
SFWMD	South Florida Water Management District
SHPO	State Historic Preservation Office (r)
SLC	Sea Level Change
SLR	Sea Level Rise
SMA	Square Mile Area
SOM	Systems Operations Manual

T

TSP	Tentatively Selected Plan

U

USACE	U.S. Army Corps of Engineers
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service

V

VA	Vulnerability Assessment Tool

W

WCA	Water Conservation Area
WCP	Water Control Plan
WQC	Water Quality Certification
WRDA	Water Resources Development Act