February 2018

Environmental Assessment and Finding of No Significant Impact

2018: L-29 CANAL AND G-3273 CONSTRAINT RELAXATION INCLUDING THE NORTHERN DETENTION AREA (REVISED OPERATIONAL STRATEGY INCREMENT 2)

Miami-Dade County, Florida

US Army Corps of Engineers ®
Jacksonville District

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DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
701 San Marco Boulevard
JACKSONVILLE, FLORIDA 32207-8175

REPLY TO

FINDING OF NO SIGNIFICANT IMPACT
2018: L-29 CANAL AND G-3273 CONSTRAINT RELAXATION INCLUDING THE NORTHERN DETENTION AREA (REVISED OPERATIONAL STRATEGY INCREMENT 2) MIAMI-DADE COUNTY, FLORIDA

I have reviewed the Environmental Assessment (EA) for the Proposed Action. Operations in the project area are currently governed by Increment 1.1 and Increment 1.2 for the operation of water management infrastructure connected to the Modified Water Deliveries (MWD) to Everglades National Park (ENP) and Canal 111 (C-111) South Dade Projects and subsequently approved deviations to include the June 2017 Water Conservation Area (WCA) 3A Planned Temporary Deviation, the July WCA 2A Planned Temporary Deviation and the September 2017 WCA 3A Emergency and Planned Temporary Deviation Post Hurricane Irma. Increment 1.1 and 1.2 is a deviation to the WCAs, ENP, and ENP to South Dade Conveyance System (SDCS) Water Control Plan (hereafter referred to as the 2012 Water Control Plan). National Environmental Policy Act (NEPA) documentation for Increment 1.1 and 1.2 was completed on February 16, 2017 with signing of a Finding No Significant Impact (FONSI) incorporating an EA. The U.S. Army Corps of Engineers, Jacksonville District (Corps), is proposing to modify the Operational Strategy currently defined in the February 2017 Increment 1.1 and Increment 1.2 EA to increase restoration flows to Northeast Shark River Slough (NESRS) in ENP, while continuing to ensure flood mitigation within 8.5 Square Mile Area (SMA). The Increment 2 field test is being conducted as part of a series of related, sequential efforts that will result in a comprehensive integrated water control plan, referred to as the Combined Operational Plan (COP), for the operation of water management infrastructure connected to the MWD to ENP and C-111 South Dade Projects. Increment 2 is a deviation to 2012 Water Control Plan Water Control Plan and its implementation is a mandated requirement of the July 22, 2016 Everglades Restoration Transition Plan Biological Opinion.

The Corps is proposing to raise the maximum operating limit in the L-29 Canal up to 8.5 feet National Geodetic Vertical Datum of 1929 (NGVD), while replacing the G-3273 stage constraint for S-333 inflows to NESRS with local gages that trigger flood mitigation actions in 8.5 SMA and continuing to utilize S-356 for control of seepage into the L-31N Canal. The L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based upon coordination with the Florida Department of Transportation (FDOT) regarding implementation of the “Contract between the United States of America and the FDOT for Relocation, Rearrangement, or Alteration of Facilities Modified Water Deliveries to Everglades National Park Project”. Water management operations will likely result in increased seepage to the L-31N Canal as increased flow into NESRS will likely increase stages along the west side of L-31N. This increase is expected to be fully manageable with operation of the C-111 South Dade Project North Detention Area.

However, since Increment 2 will be the initial opportunity to gain operational experience with this feature, additional operational flexibility has been included to maintain flood risk management for southeastern Miami Dade County.

The Preferred Alternative (Alternative B) is expected to benefit ENP by increasing flows to NESRS. Alternative B best accomplishes this objective while meeting project constraints. Alternative C is expected to improve hydrologic conditions in NESRS; however uncertainty exists regarding the ability of Alternative C to ensure the stability and safety of Tamiami Trail (U.S. 41) Highway between S-333 and S-334 and to maintain existing flood mitigation performance for the 8.5 SMA. Operational criteria for Alternative C are identical to that described for Alternative B, except that Alternative B includes constraints for the L-29 Canal based upon coordination with the FDOT concerning implementation of Section 6.1.3 of the 2008 Tamiami Trail Limited Re-evaluation Report (LRR) as well as the Relocation Agreement dated September 25, 2008. Alternative C would ensure compliance with the LRR and Relocation Agreement but would relax the additional coordinated constraints. Implementation of Alternative C would not occur without: (1) written approval from FDOT to remove the L-29 Canal constraint identified in Appendix A, Part 1 (*i.e.* limited duration of L-29 Canal stages near 8.5 feet, NGVD to a maximum period of 90 consecutive or cumulative days) based on a joint evaluation of monitoring data by the Corps and the FDOT; and (2) demonstration of the capability of the completed MWD Project components (including S-357N) to maintain flood mitigation requirements for the 8.5 SMA under the raised L-29 Canal maximum operating limit of up to 8.5 feet, NGVD. If the above conditions were met the Corps would prepare a revised FONSI to implement Alternative C in place of Alternative B. This may result in realization of additional benefits closer to those characterized for Alternative C as described in the EA. The implementation of the Proposed Action will extend until the implementation of COP currently anticipated in January 1, 2020. The implementation of COP would supersede the implementation of Increment 2.

This Finding incorporates by reference all discussions and conclusions contained in the EA enclosed hereto. Based on information analyzed in the EA, reflecting pertinent information obtained from agencies having jurisdiction by law and/or special expertise, I conclude that the Proposed Action will not significantly affect the quality of the human environment and does not require an Environmental Impact Statement. Reasons for this conclusion are in summary:

a. The Proposed Action is in full compliance with the Endangered Species Act and the Fish and Wildlife Coordination Act. The Proposed Action would not adversely affect protected species. Measures have been incorporated into the monitoring plan to avoid or minimize adverse effects to any listed endangered, threatened, or species of special concern that may be present. The U.S. Fish and Wildlife Service has concurred with the Corps species effects determinations for federally listed species within the project area as a result of the Proposed Action in correspondence dated November 15, 2017. The Corps agrees to maintain open and cooperative communication with the U.S. Fish and Wildlife Service and Florida Fish and Wildlife Conservation Commission during operations.

b. The Corps has coordinated a consistency determination pursuant to the Coastal Zone Management Act through the circulation of this EA. The Corps has determined that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of Florida's approved Coastal Zone Management Program. The Florida State Clearinghouse has reviewed the Proposed Action in correspondence dated January 10, 2018 and has stated that the State has no objection to the Proposed Action. Final concurrence of consistency with the CZMP will be determined during environmental permitting processes, as applicable.

c. The Proposed Action has been coordinated with the Florida State Historic Preservation Officer (SHPO) and the appropriate Federally-recognized Tribes in accordance with the National Historic Preservation Act and consideration given under the National Environmental Policy Act. The Corps has determined that the Proposed Action will have no adverse effect on historic properties eligible or potentially eligible for listing in the National Register of Historic Places. The SHPO concurred with the Corps' determination of no adverse effects and the Seminole Tribe of Florida "have no objections to the project at this time."

d. The Proposed Action will not adversely affect water quality and will be in compliance with the appropriate conditions in the Everglades Forever Act Permit (File No. 0246512-10) and consistent with the Clean Water Act.

e. The Proposed Action will maintain the authorized purposes of the Central and Southern Florida Project, which include flood control; water supply for agricultural irrigation, municipalities and industry, and ENP; regional groundwater control and prevention of saltwater intrusion; enhancement of fish and wildlife; and recreation.

In view of the above and the attached EA, and after consideration of public and agency comments received on the project, I conclude that the Proposed Action would not result in a significant effect on the human environment. This FONSI incorporates by reference all discussions and conclusions contained in the EA enclosed herewith.

HOGEBOOM.CHARLES.PATRICK.IV.1047421752

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C. PATRICK HOGEBOOM IV
COL, EN
Acting Commander

21 February 2018
Date

ENVIRONMENTAL ASSESSMENT ON 2018: L-29 CANAL AND G-3273 CONSTRAINT RELAXATION INCLUDING THE NORTHERN DETENTION AREA (REVISED OPERATIONAL STRATEGY INCREMENT 2) MIAMI-DADE COUNTY, FLORIDA

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ENVIRONMENTAL ASSESSMENT ON 2018: L-29 CANAL AND G-3273 CONSTRAINT RELAXATION INCLUDING THE NORTHERN DETENTION AREA (REVISED OPERATIONAL STRATEGY INCREMENT 2) MIAMI-DADE COUNTY, FLORIDA

1 PROJECT PURPOSE AND NEED

1.1 PROJECT AUTHORITY

The Everglades National Park (ENP) Protection and Expansion Act, (Public Law 01-229, Section 104), authorized the Secretary of the Army to undertake certain actions to improve water deliveries from the Central & Southern Florida (C&SF) Project to ENP.

Section 104 (a) (1)-(3) of the Act directed the U.S. Army Corps of Engineers (Corps) to address restoration of water deliveries and natural hydrological conditions. The Act states:

> *(a)(1) Upon completion of a final report by the Chief of the Army Corps of Engineers, the Secretary of the Army, in consultation with the Secretary, is authorized and directed 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.*
>
> *(2) Such modifications shall be based upon the findings of the Secretary's experimental program authorized in Section 1302 of the 1984 Supplemental Appropriations Act (97 Stat. 1292) and generally as set forth in a General Design Memorandum to be prepared by the Jacksonville District entitled "Modified Water Deliveries to Everglades National Park". The Draft of such Memorandum and the Final Memorandum, as prepared by the Jacksonville District, shall be submitted as promptly as practicable to the Committee on Energy and Natural Resources and the Committee on Environment and Public Works of the United States Senate and the Committee on Interior and Insular Affairs and the Committee on Public Works and Transportation of the United States House of Representatives.*
>
> *(3) Construction of project modifications authorized in this subsection and flood protection systems authorized in subsections (c) and (d) are justified by the environmental benefits to be derived by the Everglades ecosystem in general and by the park in particular and shall not require further economic justification.*
>
> *(4) Nothing in this section shall be construed to limit the operation of project facilities to achieve their design objectives, as set forth in the Congressional authorizations and any modification thereof.*

Public Law 101-229 was amended by Public Law 108-7 (Appropriations Act, 2003). This authorization bill identified Alternative 6D (the Selected Alternative in the July 2000 Central and Southern Florida Project, Modified Water Deliveries to Everglades National Park, Florida 8.5 Square Mile Area General Reevaluation Report [GRR] and Final Supplemental Environmental

Impact Statement as the plan to be built, authorized relocation of residents, and other provisions (USACE 2000). Tamiami Trail Modifications (TTM) are described in the TTM Final Limited Reevaluation Report (LRR) and Environmental Assessment (EA) and its addendum (USACE 2008).

1.2 PROJECT LOCATION

The water management operating criteria relating to the 2012 Water Conservation Areas (WCAs), ENP, and ENP to South Dade Conveyance System (SDCS) Water Control Plan affects an area within the C&SF Project located in south Florida and includes portions of several counties, as well as WCA 3, ENP, Big Cypress National Preserve (BCNP), and adjacent areas. The Modified Water Deliveries (MWD) Project is a modification of the C&SF Project. Features of the MWD Project are located in Miami-Dade County, including portions of ENP and adjacent areas (**FIGURE 1-1**). The 1992 MWD General Design Memorandum (GDM) and Final EIS defines the project boundary as Shark River Slough (SRS) and that portion of the C&SF Project north of structure 331 (S-331) to include WCA 3.

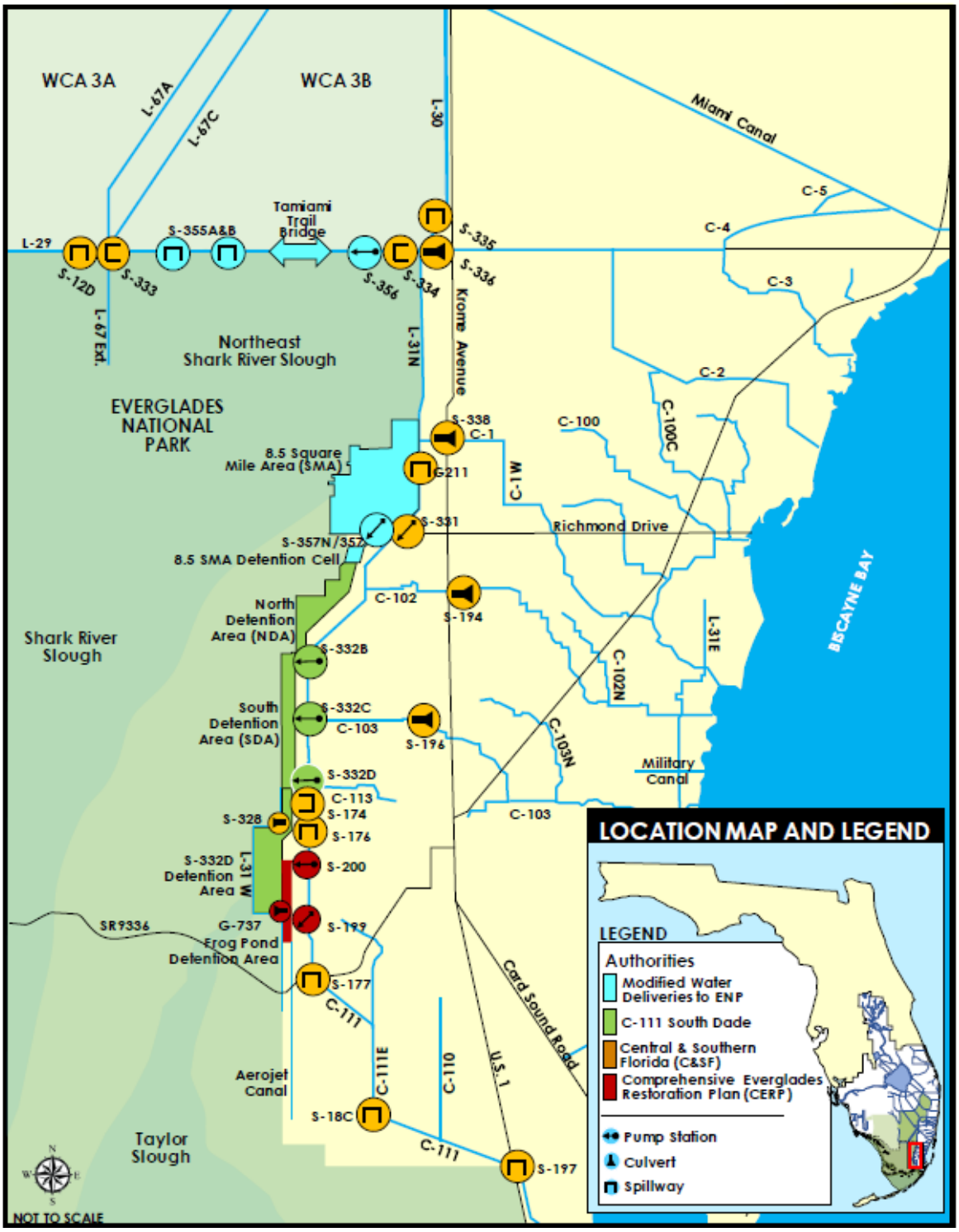

FIGURE 1-1. PROJECT LOCATION AND RELEVANT C&SF PROJECT FEATURES OF THE MWD PROJECT AND C-111 PROJECTS

1.3 PROJECT BACKGROUND

The C&SF Project currently functions and was originally authorized to function as a multi-purpose water management system. The authorized project purposes include flood control; water supply for agricultural irrigation, municipalities and industry, and ENP; regional groundwater control and prevention of saltwater intrusion; enhancement of fish and wildlife; and recreation. The following sections explain key project and water control plan changes that are relevant to Proposed Action.

1.3.1 MODIFIED WATER DELIVERIES PROJECT

The MWD Project includes modifications to the C&SF Project to provide a system of water deliveries to ENP across the full width of the historic SRS flow way and consists of four main components: (1) conveyance and seepage control features to facilitate flow through the system from WCA 3A to WCA 3B and to limit seepage eastward from WCA 3B and ENP; (2) modifications to Tamiami Trail to facilitate flow under the road to SRS; (3) flood mitigation for the developed East Everglades area (also referred to as the 8.5 SMA); and (4) project implementation support, which includes monitoring and operational changes. The MWD GDM and Final EIS (USACE 1992) includes a discussion of the location, capacity, and environmental impacts for the proposed structural modifications, which included structures S-345A, B and C; S-349A, B and C; S-355A and B; S-334 modification; removal of the L-67 Extension Levee and borrow canal filling; and a levee and canal system for flood mitigation in 8.5 SMA. The GDM 8.5 SMA levee and canal system included two pumping stations, S-356 and S-357 (**FIGURE 1-1**).

The 8.5 SMA features were constructed to provide flood mitigation to the privately-owned lands in the Las Palmas Community located east of ENP, in order to prevent seepage impacts from higher stages within Northeast Shark River Slough (NESRS) resulting from the implementation of MWD. A GRR and Final Supplemental EIS for the 8.5 SMA were completed in July 2000 (USACE 2000). The GRR recommended Alternative 6D, consisting of a perimeter levee (Levee 357W [L-357W]), internal levees, an interior seepage collection canal (C-357), a new pump station (S-357), and a detention area that would discharge into the proposed C-111 South Dade Northern Detention Area (NDA) (**FIGURE 1-1**). A design refinement for the 8.5 SMA and EA was completed in August of 2012 (USACE 2012a). An operational test conducted in 2009 indicated that the S-357 pump station and other 8.5 SMA features may not adequately mitigate impacts from increased flows to the southwest corner of the 8.5 SMA. To ensure capability to use the S-357 pump station at maximum design capacity following completion of the NDA, new hydrologic modeling identified an additional east-west seepage collection canal (C-358) was needed to properly mitigate groundwater stages in the southwest corner (east of L-357W). A gated control structure (S-357N), currently planned to be constructed by February 2018, will connect the C-358 seepage collection canal to the existing C-357 Canal, upstream of S-357. The 2012 Design Refinement for the 8.5 SMA EA did not address water management operating criteria for S-357N or C-358 and stated that all gates would be in the closed position until a new operational protocol is developed for the MWD Project (USACE 2012a).

With regard to the TTM component, the original 1992 MWD GDM/EIS plan did not include modifications to provide full conveyance capacity under Tamiami Trail for the additional flow volumes of up to 4,000 cubic feet per second anticipated during the rainy season. By 2000, it was known that additional modifications to Tamiami Trail would be required to prevent damage to the

road from increased flows and higher water levels to NESRS. Following an extensive evaluation of a full range of alternatives for Tamiami Trail, the 2008 TTM LRR and EA recommended construction of a one mile bridge in the eastern segment of the roadway, raising the operational water level constraint in the L-29 Canal from 7.5 to 8.5 feet National Geodetic Vertical Datum 1929 (NGVD), and reinforcing the roadway in that area to meet Florida Department of Transportation standards (FDOT). The TTM construction was completed in 2013.

Much of the MWD Project has been completed, including the majority of the 8.5 SMA Project, construction of S-355A and S-355B, S-333 and S-334 modifications, S-356, Tiger Tail camp raising, removal of four miles of the L-67 Extension Levee, and Tamiami Trail modifications. However, some features originally included in the 1992 MWD GDM and Final EIS, including features to provide hydrologic connectivity between WCA 3A and WCA 3B and complete degradation of the L-67 Extension Levee and adjacent canal, have not been completed for various reasons, including operational (water levels) constraints within WCA 3B, lowered MWD maximum operational stages for the L-29 Canal (9.7 feet, NGVD) was assumed with the 1992 MWD GDM and Final EIS), and potential water quality concerns. In coordination with the Department of the Interior (DOI) and South Florida Water Management District (SFWMD), the Corps 2015 Technical Analysis determined that the previously constructed MWD features and the MWD features currently under construction (C-358 and S-357N), along with the acquisition of remaining real estate interests and completion of a project Water Control Plan and Operations, Maintenance, Repair, Replacement and Rehabilitation (OMRR&R) Manual, will achieve the statutory charge to improve water deliveries into the ENP and, to the extent practicable, to restore the natural hydrological conditions within the ENP.

NEPA documentation for removal of unconstructed conveyance and seepage control features for the MWD Project was completed on May 2, 2017 with signing of a FONSI incorporating an EA (USACE 2017e). Specifically, the components to be removed from the MWD authorized project and associated Project Cooperation Agreement (PCA) include: (1) gated culvert structures S-345 A, B, and C through the L-67A; (2) gated concrete headwall structures S-349A, B, and C in the L-67 Borrow Canal; and (3) degradation of the remaining 5.5 miles of the L-67A Extension.

1.3.2 C-111 SOUTH DADE PROJECT

The C-111 South Dade Project is part of the C&SF Project authorized by Section 203 of the Flood Control Act of 1948 (Public Law 80-858), as modified by Section 203 of the Flood Control Act of 1968 (Public Law 90-483). The C-111 South Dade Integrated GRR and EIS were published in May 1994 (USACE 1994). The 1994 report described a plan to construct five pump stations and a levee-bounded retention/detention area to be built west of the L-31N Canal, between the 8.5 SMA and the Frog Pond Area (south of S-332D), to control seepage out of ENP and reduce damaging freshwater discharges to Manatee Bay/Barnes Sound while maintaining flood protection to agricultural lands east of C-111 Canal. The 1994 GRR plan also proposed a spreader canal, plugs in the C-109 and C-110 Canals, and degradation of the spoil mound south of the C-111 Canal to provide overland flow into the ENP Eastern Panhandle towards northeast Florida Bay. The existing and proposed configuration of these structural features are described in detail in the 2006 Interim Operational Plan (IOP) for Protection of the Cape Sable Seaside Sparrow (CSSS) Final Supplemental EIS (USACE 2006), the 2012 EA for the expansion of the C-111 South Dade NDA (USACE 2012b), the 2016 EA and FONSI for modifications to the C-111 South Dade North and

South Detention Areas and associated features (USACE 2016a), and the 2016 C-111 South Dade Final Limited Reevaluation Report (LRR), as depicted in **FIGURE 1-2**.

The remaining features of the C-111 South Dade Project recently constructed and/or currently under construction include but are not limited to: the NDA which will link the C-111 South Dade Project to the MWD Project 8.5 SMA detention area; two internal flow-way berms (L-360E and L-360W) inside the 8.5 SMA Detention Cell; L-357W Levee crossing at Richmond Drive; modification of the outlet weirs (S-360E and S-360W) for the 8.5 SMA detention area. The C-111 NDA will be created by extending the existing L-315 north levee (NDA western perimeter levee) and realigning and extending the L-316 levee (NDA eastern perimeter levee), with both levees connected to the 8.5 SMA detention area perimeter levees. Earthen flow-way berms will also be constructed within the interior of both the NDA (L-318) and SDA (L-321), with the intention of creating a narrow interior flow-way to maintain the hydraulic ridge during periods of limited water availability.

Construction of the two internal flow way berms (L-360E and L-360W) inside the 8.5 SMA Detention Cell were completed in May 2017. 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 significantly completed in July 2017. Extension of the existing L-315 north levee (NDA western perimeter levee) was significantly completed in August 2017, although placement of additional caprock material is still required to complete the southern segment of the L-315 Levee. The earthen flow-way berms within the interior of the NDA (L-318) is nearly complete and was anticipated to be completed in September of 2017, prior to interruption of the construction schedule by Hurricane Irma. Modification of the western outlet weir (S-360W 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 September 16 through September 23, 2017, a 140-foot section of the L-359 north levee adjacent to S-360W was removed by both the Corps' South Florida Operations Office (SFOO) (initial 70-foot length removed) and the C-111 South Dade Contract 8A contractor to allow S-357 discharges to flow into the NDA in association with the September 2017 Emergency Deviation Post Hurricane Irma (**Section 1.3.8**). 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. 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 South Dade NDA was an established prerequisite for raising the L-29 Canal maximum operating limit above 7.8 feet, NGVD (the limit for MWD Increment 1.2). As of October 2017, the NDA is functional but not 100% complete. Following direct impacts to the NDA active construction site related to Hurricane Irma and the pursuant September 2017 Emergency Deviation, Termination for Convenience was issued to the contractor for the NDA (*i.e.* Contract 8) and became effective on September 20, 2017. The Corps is currently investigating alternate means to complete the remaining portions of the NDA construction and any additional repairs required following Hurricane Irma, with the construction schedule to be determined following subsidence of the current Emergency Deviation conditions.

An EA and FONSI dated December 7, 2016 for additional modifications to the C-111 South Dade Project, other than those noted above, evaluates options for backfill and/or placement of plugs within the existing L-31W Canal and modifying 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 ENP, flows 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-31 W, along with modifications to the L-31W levee gap, are 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 South Dade features was included with the 1994 GRR, the GRR identified a need for a refined operation plan to be developed in coordination with ENP, the U.S. Fish and Wildlife Service (USFWS), the South Florida Water Management District (SFWMD) and other agencies prior to completion of project construction. The future Combined Operational Plan (COP) study will result in a comprehensive integrated water control plan for the operation of the water management infrastructure associated with the MWD and C-111 South Dade Projects, including integration of the modified design components which have been constructed as generally described in the December 2016 C-111 South Dade LRR.

1.3.3 C-111 Spreader Canal Western Project

The WRDA of 2000 (Public Law 106-541), Section 601(b)(1)(A) approved the Comprehensive Everglades Restoration Plan (CERP) as a framework for modifications to the C&SF Project that are needed to restore, preserve, and protect the south Florida ecosystem while providing for other water-related needs of the region, including water supply and flood protection. The C-111 Spreader Canal Western Project is one of the projects that make up the CERP. The C-111 Spreader Canal Western Project Final Integrated Project Implementation Report (PIR) and EIS were published in January 2011 (USACE 2011a). The project was authorized in the Water Resources Reform and Development Act (WRRDA) of 2014 (Public Law 113-121). The C-111 Spreader Canal Western Project is located in southern Miami-Dade County, in an area bounded by ENP, the Florida City-Homestead area, and Manatee Bay. Components of the project include construction of a six-mile hydraulic ridge between Taylor Slough and the C-111 Canal to reduce seepage loss from Taylor Slough and its headwaters. Implementation of the project is expected to improve the quantity, timing and distribution of water delivered to Florida Bay via Taylor Slough; improve hydroperiods and hydropatterns in the Southern Glades and Model Lands; and return coastal salinities to historical recorded conditions through the redistribution of water that is currently discharged to the Atlantic Ocean and Gulf of Mexico. The hydraulic ridge has been created by constructing a 590-acre above-ground detention area in the Frog Pond area (south of S-332D) and by installing two 225 cubic feet per second (cfs) pump stations (S-199 and S-200), and integrating other C-111 Spreader Canal Western Project features (**FIGURE 1-1**). The completed project will also begin restoration of the Southern Glades and Model Lands with an operable structure in the lower C-111 Canal (S-198), incremental operational changes to increase stages upstream of the S-18C structure, a plug just south of the location of structure S-20A within the L-31E Canal, operational changes at the S-20 structure, and construction of earthen plugs at the C-110 Canal.

The SFWMD has implemented features of the C-111 Spreader Canal Western Project under the State Expedited Construction program (*i.e.* Accelerate Everglades Restoration Project [Acceler8])

for the purpose of expediting design and construction of a number of critical restoration projects consistent with the CERP. A Department of Army permit (SAJ-2005-9856 [IP-AAZ]) was issued to the SFWMD on October 14, 2009 for the construction and operation of the project. Initial construction of the C-111 Spreader Canal Western Project was completed in January 2012 with completion of the Frog Pond Detention Area, partial Aerojet Canal features, plugs in the C-110 Canal, and a plug at S-20A. Construction of the remaining two southern weirs along the Aerojet Canal began in November 2014 and was completed in early 2015. Construction of a new water control structure in the lower C-111 Canal (*i.e.* S-198, which would be located south of S-18C) and incremental increases in the open/close stage triggers at S-18C have not yet been implemented.

The SFWMD initiated operation of the C-111 Spreader Canal Western Project constructed components in June 2012, in accordance with the Project Operating Manual (POM) developed with the PIR. At the request of SFWMD, a revised POM was approved in June 2016. Steps will be taken in the future to incorporate the project into the federally authorized C&SF Project once the project's consistency with the 2014 WRRDA authorized project has been documented and approved by the Corps, and a Project Partnership Agreement (PPA) between the Corps and SFWMD has been executed. Pending execution of the PPA, operation of the C-111 Spreader Canal Western Project is not included as part of the 2012 WCAs, ENP, and ENP to SDCS Water Control Plan (hereafter referred to as the 2012 Water Control Plan) (USACE 2012c) or within the MWD incremental field tests. Concurrent with the MWD Increment 1.1 and 1.2 and the proposed Increment 2 field test, the SFWMD will continue to operate their expedited C-111 Spreader Canal Western Project. Consistent with the requirements of the February 2017 re-issued C-111 Spreader Canal regulatory permit from the Corps, the SFWMD is continuing to assess south Miami-Dade water conditions and existing operations, including those of the C-111 Spreader Canal Western Project, on a quarterly basis for a minimum of five years to ensure project features are constructed and operated not to adversely affect adjacent lands outside and within the C-111 Spreader Canal Western Project boundary with regards to water quantity, water quality, and/or flooding. The purpose of the assessment and quarterly reports are to ensure the SFWMD has the best available information to determine what operational system changes, if any, are necessary to avoid adverse water levels on adjacent lands. The enhanced reporting by SFWMD will also benefit the monitoring objectives of the current Increment 1.1 and 1.2 field test and the future Increment 2 field test. It is presently anticipated that additional information generated from the ongoing SFWMD monitoring within the C-111 Spreader Canal Western Project area will be considered during development of the COP.

The SFWMD is implementing modifications to the C-111 Spreader Canal Western Project which include increasing the installed pump capacity at S-199 and S-200 by installing an additional 75 cfs electric pump in each of the existing vacant bays (1 per pump station), and connecting the C-200 Header Channel to the L-31W Canal (via the G-737 culvert). Both of these modifications are intended to increase the quantity of fresh water delivered to Florida Bay via Taylor Slough. The G-737 culvert was completed and operational in July 2017. The increased capacity at S-199 and S-200 is currently planned for completion by SFWMD in early 2018.

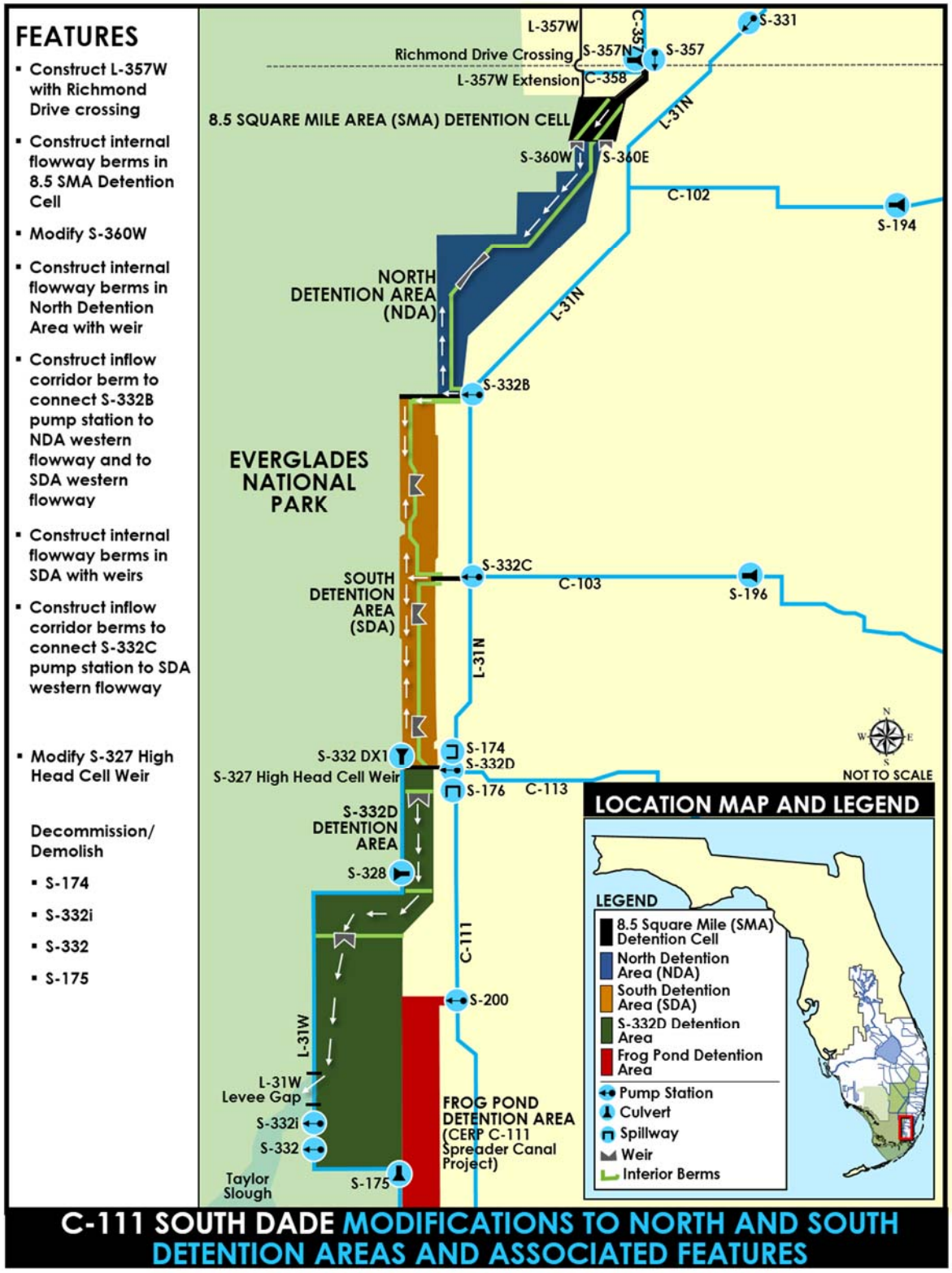

FIGURE 1-2. C-111 SOUTH DADE PROJECT FEATURES THAT ARE BUILT OR CURRENTLY UNDER CONSTRUCTION

1.3.4 INCREMENT 1 FIELD TEST

The Corps initiated the Increment 1 field test under the authority of the MWD Project, to evaluate raising or removing the existing G-3273 stage constraint for inflow into NESRS and operate the S-356 pump station for control of seepage into the L-31N Canal in October of 2015. The field test was the first increment in a series of related, sequential efforts that will result in a comprehensive integrated water control plan, referred to as the COP, for the operation of the water management infrastructure associated with the MWD and C-111 South Dade Projects. G-3273 lies within eastern ENP, approximately 9.0 miles south of the L-29 Canal and 2.5 miles west of the 8.5 SMA (**FIGURE 1-1**). The G-3273 constraint of 6.8 feet, NGVD was originally established as a flood protection measure. Prior to implementation of the Increment 1 field test, a stage of 6.8 feet, NGVD at this gage had been used since 1985 as a trigger to cease S-333 discharges from flowing south into NESRS as a protective measure for residential areas to the east, particularly the 8.5 SMA.

The Increment 1 field test was a planned deviation from the 2012 Water Control Plan (USACE 2012c). The 2012 Water Control Plan, which includes the WCA 3A Regulation Schedule, Rainfall Plan, and the Interim Operating Criteria for the 8.5 SMA Project continued to govern water management operations during Increment 1, with the exception of operating criteria for S-333, S-334, S-356, S-197, and S-357N (USACE 2015). Increment 1, which was initiated on October 15, 2015, maintained the 2012 Water Control Plan stage maximum operating limit of 7.5 feet, NGVD in the L-29 Canal, while relaxing the G-3273 stage constraint and utilized S-356 for the control of seepage to the L-31N Canal. During Increment 1, it was anticipated that the combined flows to NESRS through S-333 and S-356 would be more than what would have otherwise been discharged through S-333 under the 2012 Water Control Plan. Additionally, it was anticipated that during implementation of water management operations associated with the Increment 1 field test, under typical hydro-meteorological conditions, the combined flows through S-173 and S-331 to the C-111 Basin would be less than what would have been discharged through these features under the 2012 Water Control Plan. Increment 1 also included a testing protocol to assist in defining operating criteria for the new 8.5 SMA S-357N water control structure following completion of construction. Construction of S-357N has not yet been completed.

NEPA documentation for Increment 1 was completed on May 27, 2015 with signing of a FONSI incorporating an EA. Increment 1 duration was planned for approximately two years, with a minimum duration of one year. Implementation of Increment 1 was limited from October 15, 2015 to December 1, 2015, after which the Corps began to proceed with pre-storm drawdown and flood control operations due to very strong El Niño conditions experienced in the WCAs during the 2015-2016 dry season. The pre-storm drawdown and flood control operations were conducted in accordance with the 2012 Water Control Plan, independent of the Increment 1 field test. Regional water management operations next transitioned into a temporary emergency deviation to alleviate high water levels within WCA 3 (hereafter referred to as the 2016 Temporary Emergency Deviation). When the Increment 1 EA and FONSI was completed on May 27, 2015, completion of S-357N was anticipated by April 2015, prior to the initiation of Increment 1 operations. The Corps currently anticipates completion of S-357N by February 2018.

A timeline for Increment 1 operations is depicted in **TABLE 1-1**. **TABLE 1-1** also provides information on timelines for operations conducted under the authority of the MWD Project as well

as temporary and emergency deviations from the 2012 Water Control Plan relevant to the project area conducted during 2016 and 2017. Reference **Sections 1.3.5**, **1.3.7**, and 1**.3.8** for information related to the operations listed within the table.

TABLE 1-1. TIMELINE FOR MWD PROJECT OPERATIONAL FIELD TESTS (INCREMENT 1, INCREMENT 1.1 AND 1.2) AND RELATED DEVIATIONS TO THE 2012 WATER CONTROL PLAN

Action/Operation	Begin Date	End Date	Reference Section	NEPA Documentation
Increment 1 Operations Planned Deviation	October 15, 2015	December 1, 2015	Section 1.3.4	May 27, 2015
Pre-Storm Drawdown & Flood Control Operations	December 1, 2015	December 22, 2015		
Transitioning Back to Increment 1 Operations Planned Deviation	December 22, 2015	February 12, 2016		
L-29 Canal Temporary Emergency Deviation Implementation	February 15, 2016	May 11, 2016	Section 1.3.5	February 12, 2016 and May 10, 2016
L-29 Canal Temporary Emergency Deviation Recovery Period	May 12, 2016	July 10, 2016		
L-29 Canal Temporary Emergency Deviation Extension of Recovery Period	July 11, 2016	November 30, 2016		
S-344 Temporary Emergency Deviation Implementation	May 19, 2016	July 14, 2016		April 14, 2016
Increment 1 Operations	December 1, 2016	February 21, 2018	Section 1.3.4	May 27, 2015

Increment 1.1 and 1.2	February 21, 2017	February 28, 2018	Section 1.3.7	February 16, 2017
2017 Planned Temporary Deviation WCA 3A	June 28, 2017	In effect until WCA3A 3-station gauge average falls below Zone A of the WCA 3A Regulation Schedule	Section 1.3.8	June 28, 2017
2017 Planned Temporary Deviation WCA 2A	August 1, 2017	April 30, 2018		July 31, 2017
2017 Emergency Deviation Post Hurricane Irma	September 8, 2017	In effect until WCA3A 3-station gauge average reaches the bottom of Zone A of the WCA 3A Regulation Schedule	Section 1.3.8	October 7, 2017
2017 Planned Temporary Deviation WCA 3A Post Hurricane Irma	October 7, 2017	In effect until the WCA 3A 3-station gauge average falls below the MWD Increment 1 Action Line or January 1, 2018 whichever comes first		

1.3.5 2016 TEMPORARY EMERGENCY DEVIATION TO ALLEVIATE HIGH WATER LEVELS IN WATER CONSERVATION AREA 3

Due to the very strong El Niño during the 2015 to 2016 dry season, WCA 3A experienced unseasonable high water levels. To protect natural resources within WCA 3A, the Corps initiated a temporary emergency deviation to the stage maximum operating limit of 7.5 feet, NGVD in the L-29 Canal on February 15, 2016. The 2016 Temporary Emergency Deviation mediated high water levels within WCA 3A by allowing for the full discharge capacity through S-333 into the L-29 Canal and the use of additional WCA 3A discharge structures such as S-152. The 2016 Temporary Emergency Deviation included additional operational flexibility by raising the L-29 constraint up to 8.5 feet, NGVD with corresponding lowering of 8.5 SMA (C-357 and C-358,

FIGURE 1-2), L-31N, and C-111 Canals to compensate for the resulting higher stages and increased groundwater seepage along the eastern boundary of ENP and further expanded utilization of Column 2 operations to convey WCA 3A releases to the SDCS. NEPA documentation to support the 2016 Temporary Emergency Deviation was completed on February 12, 2016 with signing of a FONSI, incorporating an EA (USACE 2016c). A Supplemental EA and FONSI were completed on May 10, 2016 (USACE 2016d).

Residents within the 8.5 SMA expressed concern during implementation of the 2016 Temporary Emergency Deviation due to observed increases in ground and surface water. In response to these concerns, the SFWMD constructed temporary measures including the use of temporary pumps and an open channel connection between the C-358 Canal and the C-357 Canal prior to construction of S-357N to maintain flood mitigation requirements for the 8.5 SMA. The SFWMD also constructed temporary plugs in the drainage swales located north and south of Richmond Drive (SW 168th Street), and a berm around the western end of the C-358 Canal, consistent with design refinements associated with the C-111 South Dade Project (**Section 1.3.2**). Design refinements associated with the C-111 South Dade Project, which were still under construction in 2016, included the extension of the L-357 W Levee from the 8.5 SMA Detention Cell to the southern limits of Richmond Drive and the completion of the remaining levee segment to cross Richmond Drive, including construction of a ramp over the new levee segment to maintain western access to ENP. Since the 2016 Temporary Emergency Deviation, these features were constructed under the Contract 8 and Contract 8A of the C-111 South Dade Project. The SFWMD also installed temporary culverts (subsequently removed) in the southern levee of the 8.5 SMA Detention Cell in an area where the planned degrading of the S-360W weir was anticipated to take place to connect the 8.5 SMA Detention Cell to the future C-111 South Dade NDA under modifications to the C-111 South Dade Project (USACE 2016a). This effort was undertaken by the SFWMD in order to limit the increase in water depth in the 8.5 SMA Detention Cell resultant from the additional S-357 pumping coincident with the connection of the C-358 Canal to the C-357 Canal.

Due to the critical nature of elevated water levels in WCA 3A, a second emergency NEPA document was prepared to deviate from the 2012 Water Control Plan for S-344 on the L-28 Levee (USACE 2012c, **FIGURE 1-1**). The purpose of S-344 and associated features located along the L-28 Levee and Borrow Canal are to: restore overland flow to an area of BCNP just south of the L-28 Tieback; prevent over drainage of the eastern BCNP under dry conditions; and provide a means of making regulatory releases from WCA 3A into BCNP. The operational criteria during the 2016 deviation included full operational flexibility, subject to downstream constraints, to partially or completely open S-344, allowing up to approximately 200 cfs to be released from WCA 3A into BCNP and the L-28 Canal. The EA and FONSI for that action is dated April 14, 2016 (USACE 2016e).

The 2016 Temporary Emergency Deviation included the relaxation of the L-29 Canal stage maximum operating limit up to 8.5 feet, NGVD for a period of 90 days. The temporary emergency deviation also included a 60-day recovery period. The 60-day recovery period was initiated on May 12, 2016 once the L-29 Canal constraint was returned to 7.5 feet, NGVD. In June of 2016, the Corps anticipated the likelihood of above average conditions/flows through most of the 2016 wet season. With flora and fauna still recovering from the high water event during the typical dry season months, it was important to prevent, to the extent practicable, another high water event

during the 2016 wet season. Therefore the Corps proposed to extend the 60-day recovery period for purposes of maintaining lower canal levels along the L-31N and C-111 Canals, as well as to maintain flexibility to address potential 8.5 SMA flood mitigation issues. The lower L-31N Canal levels, increased pumping at S-331, and reduced pumping at S-357 into the 8.5 SMA Detention Cell were also expected to benefit and facilitate the continued contractor progress with ongoing construction of the C-111 South Dade Project features following weather delays and site-related construction challenges throughout the 2015-2016 El Niño event. The 60-day recovery period was extended on July 11, 2016 and expired on November 30, 2016. A memorandum for record documenting NEPA compliance for the extension of the recovery period was completed on July 8, 2016.

1.3.6 EVERGLADES RESTORATION TRANSITION PLAN

The Everglades Restoration Transition Plan (ERTP) was implemented in October 2012 through the Water Control Plan (USACE 2012c) and included operational guidance for the constructed features of the MWD and C-111 South Dade Projects until those projects are fully completed and COP is implemented (USACE 2011). The Corps reinitiated Endangered Species Act (ESA) consultation on ERTP on November 17, 2014 as a result of an exceedance of an Incidental Take Reinitiation Trigger from the November 17, 2010 ERTP Biological Opinion (BO) for the CSSS. A BO states the opinion of the U.S. Fish and Wildlife Service (USFWS) as to whether a federal action is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of designated critical habitat. USFWS issued a new BO for ERTP on July 22, 2016, developed in formal ESA consultation with the Corps (USFWS 2016). As a result of this consultation, USFWS determined that current conditions within CSSS habitat threaten the survival of the sparrow, and as a result, USFWS issued a "jeopardy" BO which explains that unless alternatives to current water operational practices (which then included the 2012 Water Control Plan) are explored and implemented, continued implementation of ERTP is likely to jeopardize the continued existence of the CSSS. The revised BO, issued July 22, 2016 presented a Reasonable and Prudent Alternative (RPA) that would avoid jeopardizing the CSSS. The RPA identifies operational modifications and expediting restoration initiatives for some of the structures in the southern portion of the Everglades ecosystem to provide suitable nesting habitat for the endangered CSSS. Main elements of the RPA include: habitat performance targets; actions to move water east; surveys and studies; and adaptive management. These RPA actions include additional seasonal closures to outlet structures within WCA 3A (S-12A, S-12B, S-343A, S-343B, S-344), with the flexibility to open under high water conditions between October and November, and adjustments in operations in the SDCS that will enable additional flows to Biscayne Bay during the dry season as well as increased flows toward eastern ENP to extend hydroperiods during the early dry season. In response to the BO, the Corps committed to taking specific actions to comply with the BO terms and conditions and implementing the RPA.

The 2016 ERTP BO states that the S-12A/S-12B and associated structures currently direct water flows to the north of CSSS-A, resulting in increased hydroperiods within this area. A delay in opening and implementing early closure of the S-12A, S-12B, S-343A, S-343B, and S-344 structures beyond their restrictions under ERTP is needed to limit flow into western SRS and provide drier conditions for this region. Structural closings for S-12A, S-12B, S-343A, S-343B, and S-344 under ERTP were retained under Increment 1 (USACE 2015); however the Increment 1 Operational Strategy was modified to address the mandated RPA of the July 22, 2016 ERTP BO,

to include expanded closure periods for the S-12A, S-12B, S-343A, S-343B, and S-344 structures (**Section 1.3.7**) under Increment1.1 and 1.2 (USACE 2017a). Increment 2 will maintain the required closure periods for these structures and will analyze a set of alternatives to address the mandated RPA of the 2016 ERTP BO to raise the maximum operating limit in the L-29 Canal up to a maximum of 8.5 feet, NGVD.

The BO issued July 22, 2016 may be accessed at the following website:

http://www.saj.usace.army.mil/Missions/Environmental/Ecosystem-Restoration/G-3273-and-S-356-Pump-Station-Field-Test/.

1.3.7 INCREMENT 1 PLUS (INCREMENT 1.1 AND 1.2)

Upon review of monitoring data associated with Increment 1 and the 2016 Temporary Emergency Deviation, it became apparent that modifications were necessary to the Increment 1 Operational Strategy to maintain the Congressionally-authorized flood mitigation requirements within the 8.5 SMA and to facilitate completion of ongoing construction of the MWD and C-111 South Dade Projects. During Increment 1 and the 2016 Temporary Emergency Deviation, the Corps learned information with respect to how 8.5 SMA and the SDCS responded to increased water levels in NESRS prior to the full build out of MWD and C-111 South Dade Project features.

The Operational Strategy for Increment 1 was developed between July 2014 and February 2015. Hence operational flexibility to facilitate the construction of associated features of the C-111 South Dade Project was not included within the Increment 1 Operational Strategy as construction schedules were not available at the time. Furthermore, at the time, a typical wet season was anticipated for 2015, not the extended drought conditions which delayed the initiation of Increment 1 until October 2015, which was then followed by a very strong El Niño during the 2015 to 2016 dry season in which WCA 3A experienced unseasonable high water levels.

The 2016 Temporary Emergency Deviation provided additional operational flexibility to increase WCA 3A discharge by raising the L-29 Canal constraint up to 8.5 feet, NGVD with corresponding lowering of the 8.5 SMA (C-357 and C-358), L-31N, and C-111 Canals to compensate for the resulting higher stages and increased groundwater seepage along the eastern boundary of ENP and further expanded utilization of Column 2 operations to convey WCA 3A releases to the SDCS (Reference **Section 1.3.5**). During the 2016 Temporary Emergency Deviation, residents within 8.5 SMA expressed concern due to observed increases in ground and surface water. In response to these concerns, the SFWMD installed several mitigation measures to address conditions related to the deviation. Experience with sustained lower operational ranges from pre-storm operations during Increment 1 and the recent 2016 Temporary Emergency Deviation and extended recovery period which followed, showed that with the existing infrastructure, additional operational constraints were necessary to continue increased inflows to ENP while maintaining the authorized flood mitigation for the 8.5 SMA and to facilitate ongoing construction efforts.

Furthermore, the Corps continued to receive support from Federal and state agencies and members of the general public to continue planning to raise the L-29 Canal above 7.5 feet, NGVD and to expeditiously move restoration efforts forward. Aided by new information collected under the 2016 Temporary Emergency Deviation, the Corps proposed to modify the Operational Strategy

defined within the previous May 2015 Increment 1 EA to ensure continued flood mitigation within 8.5 SMA and to be able to continue construction of the MWD and C-111 South Dade Project features in order to achieve the needed capacity to deliver restoration flows to NESRS.

The Corps proposed to include additional operational flexibility within the revised Increment 1 Plus Operational Strategy (hereafter referenced as Increment 1.1 and 1.2) to operate the L-29 Canal to a maximum of 7.8 feet, NGVD subject to downstream constraints. The Corps also modified the Increment 1 Operational Strategy to address the mandated terms and conditions of the July 22, 2016 ERTP BO, which included expanded closure periods for S-12A, S-12B, S-343A, S-343B, and S-344 as mandated by the RPA (Reference **Section 1.3.2**). NEPA documentation for Increment 1.1 and 1.2 was completed on February 16, 2017 with signing of a FONSI incorporating an EA (USACE 2017a). During implementation of Increment 1.1 and 1.2, the 2012 Water Control Plan, including the WCA 3A Regulation Schedule and Rainfall Plan, continued to govern water management operations with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S-355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177 and S-197. Similar to Increment 1, under Increment 1.1 and 1.2 the water level constraint at G-3273 was not a pre-determined constraint, allowing NESRS to receive more water, relative to the 2012 Water Control Plan. S-356 is also utilized for control of seepage to the L-29 Canal. Under Increment 1.1 and 1.2 the ability to raise the L-29 Canal maximum operating limit from 7.5 up to 7.8 feet, NGVD, is contingent upon compliance with downstream constraints including: (1) acquisition of required real estate interest and any associated improvements for the private ownership along Tamiami Trail and receipt of Tamiami Trail Bridge and roadway channel and flowage easements from the FDOT; (2) completion of the C-358 Canal (Richmond Drive Seepage Collection Canal) and installation of S-357N (C-358 control structure); and (3) completion of sufficient portions of Contract 8 (construction of the C-111 NDA L-315 western levee, the L-357W Extension Levee between Richmond Drive and the 8.5 SMA Detention Cell) and completion of the Contract 8A berms inside the 8.5 SMA Detention Cell. Prior to construction completion and operation of the NDA, these constructed features of the MWD and C-111 South Dade Projects were deemed necessary in order to raise the L-29 Canal maximum operating limit up to 7.8 feet, NGVD while maintaining required water levels in the residential and agricultural areas in southeastern Miami-Dade County.

The combined duration of Increment 1 and Increment 1.1 and 1.2 was anticipated to extend beyond the two calendar years initially envisioned for Increment 1 to compensate for the temporary suspension of the Increment 1 field test during the 2016 Temporary Emergency Deviation and extended recovery period (February-November 2016). Extension of Increment 1 and Increment 1.1. and 1.2 for up to three years was proposed to allow for sufficient time to complete the C-111 South Dade construction components needed to operate the C-111 NDA during subsequent operational field tests of the MWD Project (*i.e.* Increment 2).

Implementation of Increment 1.1 was implemented from February 21, 2017 to June 27, 2017 after which the Corps began to proceed with the 2017 Planned Temporary Deviation from the 2012 Water Control Plan in order to provide relief from high water stages within the WCAs (Reference **Section 1.3.8**). As detailed in **Section 1.3.8**, the June 2017 Planned Temporary Deviation principally provided for increased discharges from WCA 3A. Aside from the allowance for WCA

3A regulatory releases to the SDCS outside of the S-12A seasonal closure period, the operational criteria for the SDCS canals were not otherwise modified for the June 2017 Planned Temporary Deviation.

1.3.8 2017 PLANNED AND EMERGENCY TEMPORARY DEVIATIONS TO ALLEVIATE HIGH WATER LEVELS

The Corps initiated a planned temporary deviation on June 28, 2017 with completion of an EA and FONSI (USACE 2017b) for WCA 3A (**TABLE 1-1**) in response to a series of early wet season storms that occurred in June of 2017 that caused hydrologic conditions within the C&SF Project to change rapidly from very dry conditions to very wet conditions. Immediate action was deemed necessary to deviate from permitted water management practices to move flood water out of the WCAs and mitigate for severe ecologic and economic losses that could result from prolonged high water levels. The 2017 EA consisted of four major components including: (1) opening of S-12A, S-12B, S-343A, S-343B and S-344 structures prior to the official opening date of July 15, 2017; (2) opening of S-152 to discharge water from WCA 3A to WCA 3B; (3) increasing discharges at S-332D from 250 cfs to 500 cfs to increase discharge from WCA 3A to the SDCS using S-333 and S-334, if needed; and (4) increasing discharge at S-197 from 400 cfs to 2,400 cfs to accommodate additional flows from WCA 3A to the SDCS while retaining capacity to manage local basin run off. This deviation is anticipated to remain in effect until the WCA 3A 3-station gage average falls below Zone A of the regulation schedule.

The Corps initiated a second planned temporary deviation on August 1, 2017 with completion of an EA and FONSI (USACE 2017c) for WCA 2A (**TABLE 1-1**). The 2017 EA for WCA 2A consisted of a deviation from the 1988 Regulation Schedule for WCA 2A to provide additional flexibility in managing the current and expected high water levels in WCA 3A by holding water higher in WCA 2A. The deviation raised the regulation schedule of WCA 2A to accommodate additional storage therefore reducing inflows into WCA 3A through the S-11 structures. This deviation is anticipated to remain in effect until WCA 3A falls below Zone A of the WCA 3A Regulation Schedule, at which point a recovery period would be initiated to reduce the WCA 2A stage to the pre-deviation regulation schedule (normal operations). The deviation, including the recovery period, is currently approved through April 30, 2018.

Hurricane Irma developed on August 30, 2017 off the Cape Verde Islands and rapidly intensified as it moved west across the Caribbean. The storm caused catastrophic damage on several of the Leeward Islands, and made landfall in Florida on September 10, 2017. In response, the Corps initiated an Emergency Deviation from the 2012 Water Control Plan and Increment 1.1 and 1.2 on September 15, 2017 in order to provide relief from high water stages within WCA 3A and the SDCS due to Hurricane Irma. Emergency water management activities that were implemented included: (1) raising the current 7.5 feet, NGVD maximum operating limit in the L-29 Canal up to 8.5 feet, NGVD until the WCA 3A 3-gage average stage falls below Zone A of the WCA 3A Regulation Schedule; (2) use of S-356 (up to 500 cfs) to provide flood relief along L-31N Canal between structures S-335 and G-211 along the eastern side of ENP; (3) use of S-357 (up to 575 cfs) to provide flood mitigation to 8.5 SMA due to excessive seepage from high water levels within NESRS; (4) continued implementation of the June 2017 WCA 3A Planned Temporary Deviation (on-going); and (5) continued implementation of the July 2017 WCA 2A Planned Temporary Deviation (on-going). In addition, the Corps also proposed to initiate a planned temporary

deviation to further mitigate for stages within WCA 3A. The planned temporary deviation includes delayed closure of the S-12A and S-12B structures and reopening of the S-343A, S-43B, and S-344 structures until the WCA 3A 3-gage average falls below the MWD Project Increment Action Line or January 1, 2018, whichever comes first. NEPA documentation for the 2017 Emergency Deviation and 2017 Planned Temporary Deviation for S-12A, S-12B, S-343A, S-343B, and S-344 was completed on October 7, 2017 with signing of a FONSI incorporating an EA (USACE 2017d).

1.4 PROJECT NEED OR OPPORTUNITY

The overarching project need for the MWD Project operational field tests is to increase the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS, to the maximum extent practicable, for the benefit of natural resources. Releases from S-333 are part of a regulation schedule for WCA 3A and are typically dependent on the Rainfall Formula for Rain-Driven Water Deliveries to ENP via NESRS (collectively referred to as the Rainfall Plan) outlined in the 2012 Water Control Plan (USACE 2012c). This Rainfall Plan consists of a rainfall-based (non-regulatory) component and a supplemental regulatory component that specifies the amount of water to be delivered to ENP in weekly volumes through the S-333 and S-12s. Under current ERTP water management practice, which were unchanged with Increment 1 and Increment 1.1 and 1.2, discharge capacity from S-333 into the L-29 Canal and NESRS is maximized prior to utilization of the S-12 structures, in order to limit potential effects from WCA 3A discharges on the CSSS western subpopulation (CSSS-A). When flows through the S-12 structures are determined necessary by the WCA 3A Regulation Schedule and the Rainfall Plan, water managers prioritize flow through the easternmost S-12 structures as capacity allows, in order to minimize flow through the S-12A and S-12B structures. The historical operational target flow distribution of 55% through S-333 into NESRS and 45% through the S-12 structures into ENP west of the L-67 Extension is no longer used as a constraint governing water management operations of WCA 3A and northern ENP under ERTP. Weekly WCA 3A water management release decisions are coordinated with ENP. Releases through S-333 were limited under the 2012 Water Control Plan (USACE 2012c) by the G-3273 stage constraint. Continued implementation of the MWD Increment 1.1 and 1.2 field test will continue to maintain the current operating limit constraint between 7.5-7.8 feet, NGVD in the L-29 Canal, while relaxing the G-3273 stage constraint and utilizing S-356 for control of seepage to the L-31N Canal. If the maximum operating limit for the L-29 Canal is reached or exceeded during the S-12A seasonal closure window (01 October, or initial S-12A closure date through 15 July), S-334 may be used to pass all or partial S-333 flows to the SDCS when S-12C and S-12D are fully open.

Many of the MWD and C-111 South Dade Project features have been built (Reference **Section 1.3.1** and **1.3.2** and **FIGURE 1-3**), and/or are nearing completion, including the required infrastructure identified within the February 2017 Increment 1.1 and 1.2 EA and FONSI required to raise the maximum operating limit of the L-29 Canal up to 7.8 feet, NGVD [completion of the C-358 Canal and installation of S-357N; completion of sufficient portions of Contract 8 (construction of the C-111 NDA L-315 western levee and the L-357W extension levee between Richmond Drive and the 8.5 SMA Detention Cell), and completion of the Contract 8A berms inside the 8.5 SMA Detention Cell]. The NDA, the operation of which is a prerequisite to implementation of Increment 2, is functional but not 100% complete. Acquisition of required real estate interest and any associated improvements for the private interests along Tamiami Trail, including receipt of Tamiami Trail Bridge and roadway channel and flowage easements from the

FDOT, was completed between June and August 2017. More opportunities now exist to remove the G-3273 constraint and raise the maximum operating limit in the L-29 Canal up to a maximum of 8.5 feet, NGVD consistent with the 2008 MWD Tamiami Trail Modifications LRR and Final EIS (USACE 2008), subject to water availability within WCA 3A and identified downstream constraints.

The Corps is proposing to modify the Operational Strategy currently defined in the February 2017 Increment 1.1 and 1.2 EA and FONSI to increase restoration flows to NESRS by way of raising the maximum operating limit in the L-29 Canal up to 8.5 feet, NGVD while ensuring continued flood mitigation within 8.5 SMA. The Corps is evaluating further relaxation or potential removal of the G-3273 stage constraint, and modifications to structural operations that direct more flow to ENP. This allows for an increase in deliveries from WCA 3A into NESRS for the benefit of natural resources and anticipated further reductions to the frequency and duration of Column 2 operations implemented under the 2012 Water Control Plan. Additionally, operational flexibility is necessary to facilitate completion of construction of the MWD and C-111 South Dade Project features in a similar manner to Increment 1.1 and 1.2. Increment 2 seeks to increase flow to NESRS while providing operational flexibility needed to: (1) maintain operating limits in the L-29 Canal that ensure the stability and safety of the Tamiami Trail (U.S. 41 Highway) between S-333 and S-334; (2) support MWD Project construction for the installation of S-357N, if needed; (3) facilitate the remaining SDA construction of C-111 South Dade Contract 8A and any remaining construction components of the NDA Contract 8; (4) maintain authorized flood mitigation for 8.5 SMA; (5) maintain pre-existing flood protection along the L-31N and C-111 Canals; (6) provide supplemental flows to Taylor Slough; and (7) provide operational flexibilities for prescribed extreme high water conditions in WCA 3A.

Information and operational criteria identified from Increment 1, Increment 1.1 and 1.2, and Increment 2 will be used to develop the third increment which is development of COP. COP will incorporate constructed features of the MWD and C-111 South Dade Projects into the 2012 Water Control Plan. The incremental approach to the development of COP will: (1) allow interim benefits towards restoration of the natural systems; (2) reduce uncertainty of operating the components of the MWD and C-111 South Dade Projects; and (3) provide information to complete COP efficiently. The 2016 ERTP BO acknowledges the above planning efforts by the Corps to increase flows into NESRS under the MWD Project and requires the Corps to proceed as scheduled, and as allowable by law, for completing NEPA analysis on Increment 2 prior to March 1, 2018, and COP in 2019.

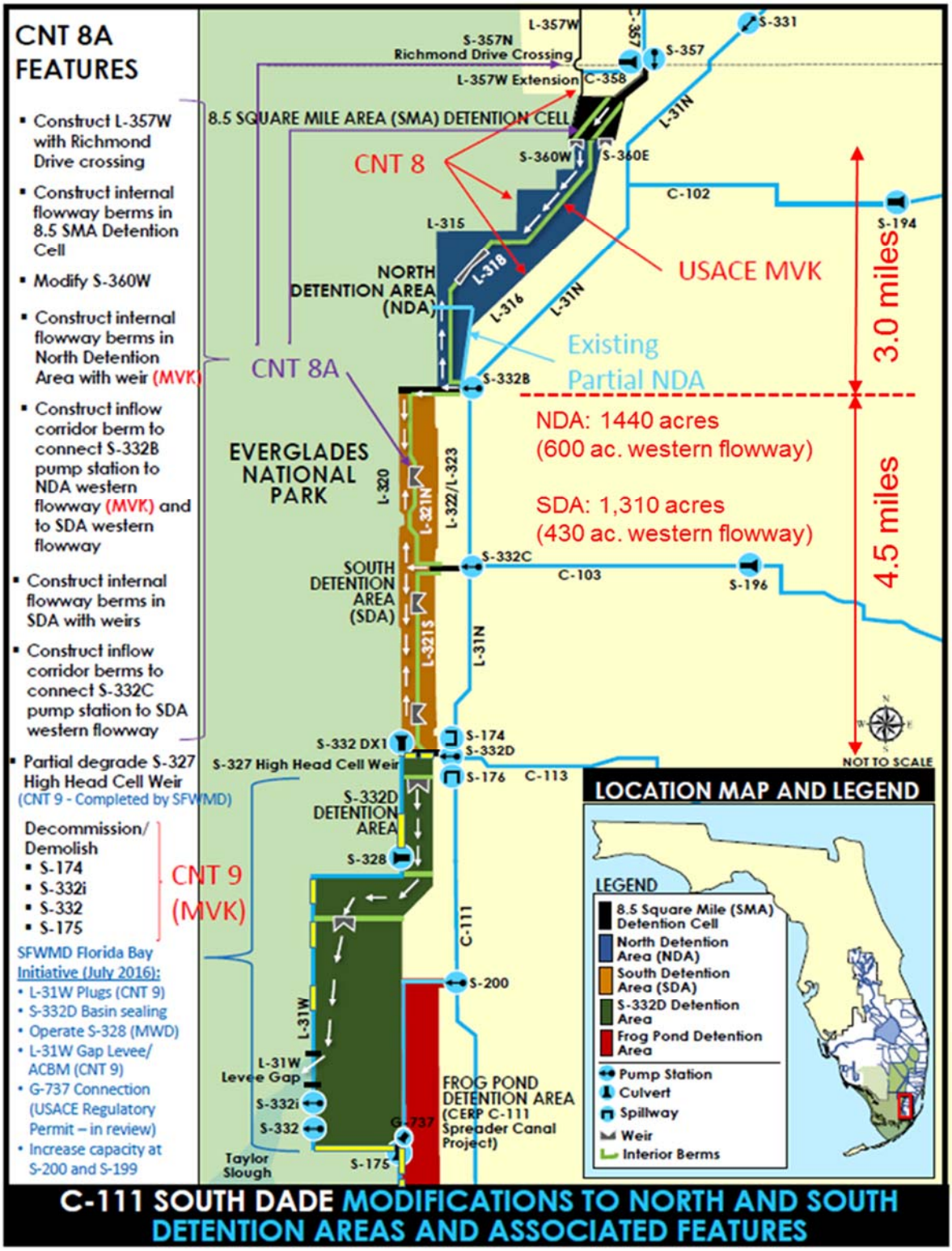

FIGURE 1-3. C-111 SOUTH DADE PROJECT FEATURES (CONTRACTS 8, 8A, 9).

1.5 AGENCY GOALS AND OBJECTIVES

Objectives of the Proposed Action remain consistent with those defined in the May 2015 Increment 1 EA and FONSI and the February 2017 Increment1.1 and 1.2 EA and FONSI:

A. Improve hydrological conditions in NESRS through the relaxation of both the G-3273 stage constraint and L-29 Canal maximum operating limit to increase water deliveries from WCA 3A to NESRS, while maintaining other C&SF Project authorized purposes.

B. Continue use of the S-356 pump station to manage seepage from NESRS to the L-31N Canal resulting from the relaxation of the G-3273 stage constraint and L-29 Canal maximum operating limit, in conjunction with increased flows through the S-333 structure (gated spillway) to NESRS via the L-29 Canal.

C. Improve hydrological conditions in NESRS by maximizing the flexibility and efficiency of the existing infrastructure, including use of S-356, the completed 8.5 SMA project and completed C-111 South Dade project features to complement inflows to NESRS from WCA 3A.

D. Improve hydrologic conditions in Taylor Slough, Rocky Glades, and the eastern panhandle of ENP, including use of the completed 8.5 SMA project and completed C-111 South Dade Project features to maintain a continuous hydraulic ridge that reduces groundwater seepage losses from eastern ENP between the 8.5 SMA and Taylor Slough.

E. Gather and analyze infrastructure performance, ecologic, hydrologic and water quality data sufficient to support Increment 3 (COP), resulting in the following:

   i. Data gathering sufficient to support water quality certification

   ii. Refined operational criteria for the MWD and C-111 South Dade Projects

   iii. Updates to the 2012 Water Control Plan (in the form of Volume 4, Chapter 7 of the System Operations Manual (SOM) in which COP will be a portion of the SOM contents)

As stated in **Section 1.4**, the Corps is proposing to modify the Increment 1.1 and 1.2 Operational Strategy to address the mandated RPA of the July 22, 2016 ERTP BO to raise the maximum operating limit in the L-29 canal up to a maximum of 8.5 feet, NGVD.

1.6 OPERATIONAL CONSTRAINTS

Operational constraints as defined for Increment 2 are as follows:

A. L-29 Canal maximum operating limit of 8.5 feet, NGVD to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334. All inflows to the L-29 Canal shall also be discontinued in advance of certain stage and weather events, as previously coordinated with the Florida Department of Transportation (FDOT) and

prescribed in the 2008 Tamiami Trail Limited Re-evaluation Report for the final operating plan with the maximum L-29 Canal limit up to 8.5 feet, NGVD.

B. Maintain the authorized purposes of the C&SF Project modified to include:

   i. MWD Project
   ii. C-111 South Dade Project
   iii. CERP

C. No reduction in current flood protection or mitigation.

D. Maintain the current multi-species objectives of the 2012 Water Control Plan and comply with the requirements of the applicable BO from USFWS, to include the ERTP and the CERP C-111 Spreader Canal Western Project.

The 2008 Tamiami Trail LRR included recommendations to build a one mile long bridge in the project area's eastern segment and raise the headwater stage constraints in the L-29 Borrow Canal by one foot from 7.5 feet, NGVD to 8.5 feet, NGVD; which required road mitigation on parts of Tamiami Trail (U.S. Highway 41) in the action area, located between S-333 on the west and S-334 on the east. To ensure the safety and stability of the roadway subbase infrastructure along this segment of Tamiami Trail (U.S. Highway 41), operational constraints [referenced within Section 6 (Recommended Plan) of the 2008 Tamiami Trail LRR] were set forth within the Contract Between the United States of America and Florida Department of Transportation for Relocation, Rearrangement, or Alteration of Facilities Modified Water Deliveries to Everglades National Park Project (Relocation Agreement) dated September 25, 2008. FDOT allowed the Corps to use a new standard for the Tamiami Trail roadway (adopted in the March 2008 FDOT Flexible Pavement Design Manual) thereby reducing the required separation (Design Base Highwater Clearance) between the Design High Water (DHW) and the bottom of the road base. DHW (also referred to as Base Clearance Water Elevation) is defined as the average October wet season elevation plus the rainfall from a specific design storm even (10-year frequency, with duration (1hour, 8hour, or 24 hour) producing the highest stage and drawing down within a specific period). The previous FDOT standard required either a higher base or a lower DHW. Operational constraints as outlined within the Relocation Agreement dated September 25, 2008 are minimum protective standards that will be included in the Increment 2 Operational Strategy. In coordination with FDOT, the Corps has implemented additional constraints that are not explicitly spelled out in the Relocation Agreement. Out of concern that the these additional constraints reduce the ability to meet field test goals and objectives of maximizing flows to NESRS, the Corps is currently working with technical staff from the FDOT to further refine the restrictions as described within the Operational Strategy (**Appendix A, Part 1**) and will implement expanded hydrologic monitoring of water levels along this section of Tamiami Trail. Data collected in accordance with the Increment 2 monitoring plan developed in consultation with the FDOT will help to inform L-29 Canal operations to be developed for COP.

1.7 RELATED ENVIRONMENTAL DOCUMENTS

The Corps has documented a number of environmental documents relevant to the Proposed Action:

- *General Design Memorandum and Environmental Impact Statement, Modified Water Deliveries to Everglades National Park*, U.S. Army Corps of Engineers, Jacksonville District, June 1992
- *C-111, Central and Southern Florida Project for Flood Control and Other Purposes, Final General Reevaluation Report and Environmental Impact Statement,* U.S. Army Corps of Engineers, Jacksonville District 1994
- *1998 Emergency Deviation from Test 7 of the Environmental Program of Water Deliveries to Everglades National Park to Protect the Cape Sable Seaside Sparrow, Central and Southern Florida Project for Flood Control and Other Purposes, Final Environmental Assessment,* U.S. Army Corps of Engineers, Jacksonville District, 1999
- *Jeopardy and Adverse Modification Biological Opinion on the Modified Water Delivery to Everglades National Park Experimental Program to Everglades National Park and Canal-111 South Dade Projects,* U.S. Fish and Wildlife Service, Vero Beach, Florida 1999
- *Comprehensive Review Study of the Central and Southern Florida Project, Comprehensive Everglades Restoration Plan Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* , U.S. Army Corps of Engineers, Jacksonville District 1999
- *General Reevaluation Report and Final Supplemental Environmental Impact Statement, 8.5 Square Mile Area*, U.S. Army Corps of Engineers, Jacksonville District, July 2000
- *Central and Southern Florida Project for Flood Control and Other Purposes, Interim Structural and Operational Plan, Emergency Deviation from Test 7 of the Experimental Program of Water Deliveries to Everglades National Park for Protection of the Cape Sable Seaside Sparrow Final Environmental Assessment,* U.S. Army Corps of Engineers, Jacksonville District, 2000
- *Interim Operating Plan for the Protection of the Cape Sable Seaside Sparrow Final Supplemental Environmental Impact Statement,* U.S. Army Corps of Engineers, Jacksonville District, 2002
- *Biological Opinion, Final Interim Operating Plan,* U.S. Fish and Wildlife Service, Vero Beach, Florida, November 17, 2006
- *Interim Operational Plan for the Protection of the Cape Sable Seaside Sparrow Final Supplemental Environmental Impact Statement,* U.S. Army Corps of Engineers, Jacksonville District, December 2006
- *C-111 Engineering Documentation Report*, U.S. Army Corps of Engineers, Jacksonville District, May 2007
- *Draft Environmental Assessment; Design Modifications for the Canal 111 Project,* U.S. Army Corps of Engineers, Jacksonville District, June 2007
- *Modified Water Deliveries to Everglades National Park Tamiami Trail Modifications Final Limited Reevaluation Report and Environmental Assessment*, U.S. Army Corps of Engineers, Jacksonville District, June 2008
- *Draft Environmental Assessment; Proposed Interim Operating Criteria for 8.5 Square Mile Area Project,* U.S. Army Corps of Engineers, Jacksonville District, November 2008
- *Revised Draft Environmental Assessment; Proposed Interim Operating Criteria for 8.5 Square Mile Area Project,* U.S. Army Corps of Engineers, Jacksonville District, April 2009

- *Canal-111 Spreader Canal Project Implementation Report,* U.S. Army Corps of Engineers, Jacksonville District, 2009
- *Biological Opinion, Canal-111 Spreader Canal,* U.S. Fish and Wildlife Service, Vero Beach, Florida, August 25, 2009
- *Biological Opinion, Everglades Restoration Transition Plan,* U.S. Fish and Wildlife Service, Vero Beach, Florida, November 17, 2010
- *Central and Southern Florida Project Comprehensive Everglades Restoration Plan C-111 Spreader Canal Western Project Final Integrated Project Implementation Report and Environmental Impact Statement*, U.S. Army Corps of Engineers, Jacksonville District, January 2011
- *Environmental Assessment; Proposed Interim Operation Criteria for 8.5 Square Mile Area Project,* U.S. Army Corps of Engineers, Jacksonville District, June 2011
- *Environmental Assessment; Design Refinement for the 8.5 Square Mile Area,* U.S. Army Corps of Engineers, Jacksonville District, August 2012
- *Environmental Assessment for Expansion of C-111 Detention Area and Associated Features South Miami-Dade County,* U.S. Army Corps of Engineers, Jacksonville District, May 2012
- *Everglades Restoration Transition Plan Final Environmental Impact Statement*, U.S. Army Corps of Engineers, Jacksonville District, October 19, 2012
- *Environmental Assessment; G-3273 Constraint Relaxation/S-356 Field Test and S-357N Operational Strategy,* U.S. Army Corps of Engineers, Jacksonville District, May 2015.
- *Environmental Assessment and Finding of No Significant Impact; Modifications to the C-111 South Dade North and South Detention Areas and Associated Features,* U.S. Army Corps of Engineers, Jacksonville District, December 2016.
- *Environmental Assessment; Modifications to the C-111 South Dade Project, L-31W,* U.S. Army Corps of Engineers, Jacksonville District, December 2016.
- *Canal 111 (C-111) South Dade County, Florida: Final Limited Reevaluation Report, U.S.* Army Corps of Engineers, Jacksonville District, December 2016.
- *Environmental Assessment; L-29 Canal and South Dade Conveyance System Temporary Emergency Deviation to Affect Relief of High Water Levels within Water Conservation Area 3A*, U.S. Army Corps of Engineers, Jacksonville District, February 2016
- *Supplemental Environmental Assessment; L-29 Canal and South Dade Conveyance System Temporary Emergency Deviation to Alleviate High Water Levels in Water Conservation Area 3A,* U.S. Army Corps of Engineers, Jacksonville District, May 2016.
- *Environmental Assessment Temporary Emergency Deviation to Alleviate High Water Levels in Water Conservation Area 3A (S-344 Deviation),* U.S. Army Corps of Engineers, Jacksonville District, April 2016.
- *Environmental Assessment Temporary Emergency Deviation to Alleviate High Water Levels in Water Conservation Area 3A (S-344 Deviation),* U.S. Army Corps of Engineers, Jacksonville District, February 2016.
- *Supplemental Environmental Assessment; G-3273 Constraint Relaxation/S-356 Field Test and S-357N Revised Operational Strategy: Increment 1 Plus (Increment 1.1 and 1.2),* U.S. Army Corps of Engineers, Jacksonville District, February 2017.

- *Environmental Assessment; Modified Water Deliveries to Everglades National Park Project: Removal of Unconstructed Conveyance and Seepage Control Features,* U.S. Army Corps of Engineers, Jacksonville District, May 2017.
- *Environmental Assessment; Planned Temporary Deviation to Affect Relief of High Water Levels within Water Conservation Area 3A,* U.S. Army Corps of Engineers, Jacksonville District, June 2017.
- *Environmental Assessment; Planned Temporary Deviation from the 2012 Water Control Plan for Water Conservation Area 2A,* U.S. Army Corps of Engineers, Jacksonville District, July 2017.
- *Environmental Assessment: Emergency Deviation to Affect Relief of High Water Levels within Water Conservation Area 3A and the South Dade Conveyance System Post Hurricane Irma and Planned Deviation to Affect Relief of High Water Levels within Water Conservation Area 3A*¸U.S. Army Corps of Engineers, Jacksonville District, October 2017.

Information contained within the previous NEPA documents listed above, as well as others described later, is incorporated by reference into this EA.

1.8 DECISIONS TO BE MADE

The selection of an alternative is the primary decision that must be made. Reference **Section 1.5** for agency goals and objectives.

1.9 SCOPING AND ISSUES

Reference Appendix D of the May 2015 Increment 1 EA and FONSI and Appendix D of the February 2017 Increment1.1 and 1.2 EA and FONSI for pertinent correspondence related to the MWD Project operational field tests.

1.10 PERMITS, LICENSES, AND ENTITLEMENTS

Information regarding Increment 1 has been submitted to FDEP per specific condition 18 of the Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) permit number 0246512-003. FDEP has issued a testing approval for a one year extension to Increment 1 testing operations associated with the S-356 pump station under the test authorization provision (specific condition no. 22 of CEPRA permit number 0246512-003). Operational authorization for S-356 has been turned over to the SFWMD; SFWMD obtained Permit No. 0317422-004 for operations of S-356.

Coastal Zone Management Act coordination may involve modifications to the following, subject to further coordination with the SFWMD and FDEP:

1. Modification to File No. 0306639-003, S-197 Control Structure Project, Environmental Resource Permit: SFWMD permit
2. Modification to File No. 0246512-0004, Modified Water Deliveries to the Everglades National Park Project, CERPRA permit: SFWMD permit
3. Modification to File No. 0317442-003, 8.5 SMA S-357 Pump Station Project, CERPRA permit: SFWMD permit
4. Modification to File No. 0246512-012, C-111 South Dade and Modified Water Deliveries to Everglades National Park Project: Corps permit

5. Modification, if deemed necessary by FDEP for revised operations to S-333 S-335, S-337,S-343A, S-343B and S-344 to the Non Everglades Construction Everglades Forever Act Permit File No. 0237803-001: SFWMD permit
6. Modification to the C-111 South Dade Emergency Order No. 9 may be required to adjust the operations for S-332B/C/D and S-328. Under evaluation by FDEP. Acquisition of the required FDEP authorization for the EO 9 structures is not expected to delay implementation of Increment 2.
7. A gated control structure (S-357N), as per Increment 1 Test Authorization, currently planned to be constructed by February 2018, will connect the C-358 seepage collection canal to the existing C 357 Canal, upstream of S-357.

The Corps will coordinate a consistency determination pursuant to the Coastal Zone Management Act through the circulation of this EA. The Corps has determined that the Proposed Action is consistent to the maximum extent practicable with the Coastal Zone Management Program (CZMP). Final concurrence of consistency with the CZMP will be determined during consultation with the State Clearinghouse.

2 ALTERNATIVES

2.1 DESCRIPTION OF ALTERNATIVES

Each of the following alternatives described below in **Sections 2.1.2** through **2.1.6** were considered and evaluated as the Operational Strategy for Increment 2 was developed. Increment 2 alternatives differ based on: (1) the degree of relaxation of the L-29 Canal stage maximum operating limit; (2) operational modifications to ensure flood mitigation within 8.5 SMA; (3) use of Column 2 operations as defined in the 2012 Water Control Plan (USACE 2012c); (4) inclusion of operational changes to C-111 Canal structure S-197; and (5) additional operational flexibilities during high water conditions in WCA 3A. An overview of alternative descriptions is provided in **TABLE 2-1**.

TABLE 2-1. ALTERNATIVE DESCRIPTIONS.

ALTERNATIVE	G-3273 STAGE CONSTRAINT	L-29 CANAL CONSTRAINT	FDOT CONSTRAINT	C&SF OPERATIONAL CHANGES	COLUMN 2 OPERATIONS	ADDTIONAL FLEXIBILITIES DURING HIGH WATER CONDITIONS
A (NO ACTION)	NO	Up to 7.8 feet, NGVD	NO	Structures are listed for those whose operational criteria deviate from the 2012 WATER CONTROL PLAN: S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S-355B, S-356, S-357, S-357N*, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177, S-197 * under construction	Limited Column 2 operations during S-12 seasonal closure period	NO
B	NO	Up to 8.5 feet, NGVD	YES - The L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based on coordination with the FDOT on implementation of the September 25, 2008 Relocation Agreement. The Operational Strategy included in **Appendix A, Part 1** and expanded monitoring requirements in **Appendix C** were coordinated with FDOT during development.	Structures are listed for those whose operational criteria deviate from the NO ACTION ALTERNATIVE: S-328, S-333, S-334, S-356, S-357, S-357N*, S-332B, S-332C, S-332D, S-194, S-196, S-197 *under construction	Further Limited Column 2 operations during S-12 seasonal closure period.	YES - Additional operational flexibility to allow for rapid response to extreme high water levels in WCA 3A; allow increased discharges at S-197 when flow through S-334 and S-176 exceeds the established criteria.
C	NO	Up to 8.5 feet, NGVD	NO	Same as B	Same as B	Same as B
D	NO	Same as B	Same as B	Same as B	Elimination of Column 2 Operations	Same as B
E	NO	Same as B	Same as B	Same as B except for operating criteria for S-331 and S-357	Same as B	Same as B
F	NO	Same as B	Same as B	Same as B except for operating criteria for S-197. The operation of S-197 would be consistent with the 2012 Water Control Plan.	Same as B	Same as B
G	NO	Same as B	Same as B	Same as B	Same as B	NO

2.1.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

The No Action Alternative would continue C&SF water management operations as defined in the February 2017 Increment 1.1 and 1.2 EA and FONSI for the operation of the water management infrastructure connected to the MWD and C-111 South Dade Projects (USACE 2017a). The No Action Alternative also includes subsequently approved deviations to the 2012 Water Control Plan to include the June 2017 WCA 3A Planned Temporary Deviation (USACE 2017b), the July 2017 WCA 2A Planned Temporary Deviation (USACE 2017c), and the October 2017 WCA 3A Emergency and Planned Temporary Deviation Post Hurricane Irma (2017d); however, these actions are not anticipated to be in effect past the first quarter of 2018 as described in **Section 1.3.8**. Increment 1.1 and 1.2 is a deviation to the 2012 Water Control Plan. Under the No Action Alternative, the 2012 Water Control Plan, including the WCA 3A Regulation Schedule and Rainfall Plan, will continue to govern water management operations with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S-355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177 and S-197. Water management operations for Increment 1.1 and 1.2 are further defined in Appendix A of the February 2017 EA and FONSI (USACE 2017a) and briefly summarized in **Section 1.3.7**.

2.1.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD

The 2012 Water Control Plan will continue to govern water management operations during implementation of Alternative B with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S- 355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177, and S-197. Similar to the No Action Alternative, the water level constraint at G-3273 will not be a pre-determined constraint, allowing NESRS to receive more water pursuant to the WCA 3A Regulation Schedule and Rainfall Plan relative to the 2012 Water Control Plan. G-3273 will be used as an indicator to define when NESRS is experiencing low, moderate, and high water levels. Alternative B will utilize local gages (Angels and LPG-2) that trigger flood mitigation actions for the 8.5 SMA (S-357 and S-331) and continue to utilize S-356 for the control of the seepage to the L-31N Canal. The WCA 3A water level (as measured using the average of monitoring gauges/sites 63, 64, and 65) will be utilized to define the priority of releases from S-333 and S-356 to the L-29 Canal and NESRS consistent with water management operations previously prescribed under the No Action Alternative. Specifically, when the WCA 3A stage is above the Action Line (**FIGURE 2-1**) during the S-12A closure period, all of the available L-29 capacity will be dedicated to lowering WCA 3A.

The maximum operating limit in the L-29 Canal will be raised up to 8.5 feet, NGVD under Alternative B relative to the maximum operating limit of up to 7.8 feet, NGVD under the No Action Alternative, as described in **Appendix A, Part 1**. The L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based on coordination with the FDOT regarding implementation of the Relocation Agreement dated September 25, 2008. In accordance with Table 1 in **Appendix A**, **Part 1**, the L-29 Canal inflow structures (S-333, S-355A/B, and S-356) will be operated with the intention of limiting event durations with L-29 Canal stages above 8.5 feet NGVD to a target maximum duration of 72 hours. Once the stage in the L-29 Canal reaches a stage of 8.5 feet, NGVD, input from all

structures that discharge into the canal (S-333, S-355A/B, and S-356) shall be stopped until the level in the L-29 Canal recedes below 8.5 feet, NGVD. For each water year (May through April), the L-29 Canal inflow structures will be managed to limit the duration of L-29 Canal stages near 8.5 feet (as measured at the S-333 tailwater [TW]), NGVD to 90 cumulative days or to a maximum of 90 consecutive days. The number of either cumulative or consecutive days in each period (only one period per water year) will be measured when L-29 stages exceed 8.3 feet, NGVD. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages at 8.5 feet, NGVD for longer than 90 days will require written approval from the FDOT. The L-29 stage will be maintained at or below 8.5 feet, NGVD by ceasing inflow into L-29 when the L-29 stage rises above 8.5 feet, NGVD. Event driven criteria will be followed in accordance with Table 1 of **Appendix A, Part 1**. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages above 8.3 feet for longer than 90 days will require written approval from the FDOT, given evaluation of the monitoring data by FDOT.

It is anticipated that during implementation of Alternative B, the combined flows through S-333 and S-356 will be more than what would have been discharged through these features under the No Action Alternative. Along the L-31N Canal, S-173 releases and pumping with S-331 have previously been used to: (1) maintain target L-31N Canal stages; (2) provide flood mitigation to the 8.5 SMA eastern areas and assist S-357 in maintaining flood mitigation for the 8.5 SMA when S-357 operational capacity is limited; and (3) convey WCA 3A regulatory releases to the SDCS from S-334 during Column 2 operations. With Alternative B, 8.5 SMA flood mitigation requirements are shifted to an increased reliance on S-357 given full operability of the NDA and a reduced dependency of 8.5 SMA on S-331. The frequency and duration of Column 2 operations which convey WCA 3A regulatory discharges to the SDCS are also generally reduced. Alternative B assumes flood mitigation and seepage management features envisioned in the MWD and C-111 South Dade Projects, described in **Section 1.3.2**, have been constructed and are fully operational. Alternative B defines the start of the testing protocol for S-357N operating criteria following completion of the C-358 seepage collection canal and the associated S-357N gated control structure. In the event that the S-357N structure (8.5 SMA) remains incomplete due to construction delays (current schedule will complete S-357N by February 2018), the previously installed temporary bypass culverts will continue to be used (Reference **Section 1.3.5**).

Following construction completion and operation of the NDA, the need to maintain flood mitigation for 8.5 SMA while facilitating completion of S-357N (C-358 control structure) and incrementally raising the L-29 Canal maximum operating limit up to 8.5 feet, NGVD have warranted operational changes relative to the No Action Alternative. The MWD 8.5 SMA features and the C-111 South Dade Project NDA components will be operated to accommodate increased flow to NESRS while evaluating whether the operational criteria meet the field test objectives and constraints, most notably no reduction in flood mitigation for the 8.5 SMA. The operational criteria for S-357 under Alternative B as compared to the Alternative A modified the operational reference gage from primary reliance on LPG2 to Angels Well, as well as modified the associated operational stages that correlate to the gage location change. Specifically, Alternative B provides criteria to allow for operations that maintain C-357 as low as 3.5 feet, NGVD but not below 3.0 feet, NGVD in order to ensure flood mitigation for 8.5 SMA as provided for in the No Action Alternative. Overall the level of flood mitigation provided under Alternative B remains unchanged from that provided under the No Action. The Operational Strategy also specifies short duration or limited

use of S-332C and/or S-332DX1 during Contract 8A construction completion because these structures discharge near the southern extent of the Contract 8A work, and operations at these two structures will default to those coordinated under Increment 1.1 and 1.2 should construction activity not be complete prior to implementation of Alternative B. Testing operations for S-357N remain unchanged from those defined in Alternative B as compared to Alternative A.

Water management operations to raise the L-29 Canal maximum operating limit will result in increased seepage to the L-31N Canal as increased flow into NESRS will likely increase stages along the west side of L-31N. This increase is expected to be fully manageable with operation of the C-111 South Dade Project NDA. However, since this will be the initial opportunity to gain operational experience with the NDA, Alternative B will continue to retain the operating criteria for S-197 as provided in the No Action Alternative. This provides flexibility to maintain flood risk management for southeastern Miami Dade County if needed. It is the intention of the Corps that the operating criteria for S-197 will revert to the 2012 Water Control Plan under COP once all features of the C-111 South Dade and MWD Projects are constructed, operational, and tested, if supported by the analysis of the data collected after the field tests.

SDCS operations are intended to utilize the C-111 South Dade NDA, SDA and the S332D Detention Area to maintain canal stage targets in the lower L-31N and C-111 canals while increasing flows through NESRS in ENP, consistent with targets defined in the No Action Alternative for conditions following completion of the 8.5 SMA and C-111 NDA construction. In Alternative B, S-176, S-177 and S-18C will be used to pass water to the marsh downstream of S-18C and utilize S-197 only as needed. Prolonged use of the C-111 South Dade detention areas, particularly following significant rain events, has the tendency to set up a large stage difference between the marsh to the west and the canal stage in the lower L31N and C-111. This is expected and is how the system is designed to work, as it is the water level in the detention areas that provides the hydraulic ridge that supports this stage difference. However, after the rain event has passed through the system, the hydraulic ridge can dissipate quickly following an abrupt cessation of pumping. This abrupt cessation can lead to a rapid drainage of the marsh. To mitigate for this potential rapid drainage of the marsh, Alternative B will include the operational flexibility for water managers to convey up to 250 cfs from WCA 3A to avoid ecologically harmful rapid recession of the ENP marsh to the west of the detention areas. Supplemental water deliveries from WCA-3A will be limited to conditions when WCA 3A is above its floor elevation of 8.0 feet, NGVD. These deliveries, if provided under Increment 2 operations, will be conducted in coordination with ENP and the Corps to provide ecological benefits to Taylor Slough. This flow limit will be measured at S-334 or S-337. Measurements are made at these locations to tie back to WCA 3A stage. This operation is intended to support gradual recession rates in the marsh by providing additional water to the S332D pump station, or maintain a canal stage in a range conducive to gradual recession rates. Data collected during the incremental test will be assessed to evaluate the effectiveness of this operation as we move forward with the COP. The effects of supplemental water deliveries will be discussed among the Corps and SFWMD during monthly meetings and prior to initiation of flows. Additional deliveries to Taylor Slough above those accommodated by Increment 2, if required, may be provided by SFWMD under the existing water supply authority of the SFWMD. Under the No Action Alternative, supplemental water deliveries were limited to conditions when WCA 3A was above the floor elevation of 8.0 feet, NGVD in April and May and above 8.5 feet, NGVD in all other months; the operation was also limited to 8

weeks per year when the 3-gage average was below the historical median stage of WCA 3A. Furthermore, similar to the No Action Alternative, implementation of Alternative B includes operation of S-328. S-328 (eight 60 inch diameter CMP with gates) is located in the southwest corner of Cell 1 of the S-332D Detention Area and may be used to increase deliveries to Taylor Slough up to 250 cfs provided that an average water depth of at least six inches is maintained in Cell 1.

Similar to the No Action Alternative, Alternative B will retain the required closure period for S-12A, S-12B, S-343A, S-343B, and S-344 starting 01 October through 15 July consistent with the 2016 ERTP BO RPA and the No Action Alternative. Alternative B will also retain the 'high water strategy' criteria developed by the Corps during the ERTP 2016 ESA consultation to mitigate for the increased frequency and duration of WCA 3A high water stages in excess of the 90th percentile of historical water stages (compared to the 2012 Water Control Plan) associated with the expanded closure periods. The 90th percentile water level varies seasonally and reaches a maximum of 11.5 feet, NGVD during the month of October. Levee safety concerns and the risk of overtopping to the perimeter levees are exacerbated with higher water levels in WCA 3A and are most vulnerable during the later parts of the wet season (July, August, September and early October), which coincides with the height of the hurricane season. Therefore, a conditions based scenario that varies the closing dates of the S-12A and S-12B structures within October and November depending on measured conditions within WCA 3A was developed during the 2016 ERTP ESA consultation, rather than prescriptive close dates. This conditions based approach to the operation of S-12A and S-12 B will be maintained in Alternative B, similar to the No Action Alternative, to retain critical flexibility during WCA 3A high water conditions while also ensuring that the structures are operated optimally for CSSS habitat during normal and low water conditions. The 'high water strategy' criteria are included within **Appendix A** of the February 2017 Increment 1.1 and 1.2 EA and FONSI.

It should be noted that the 2016 ERTP BO RPA provided performance targets for the CSSS eastern subpopulations; however specific SDCS operational changes (the S-12A and S-12B conditional extended closure periods are specified within the RPA) were not prescribed within the RPA. Regional modeling conducted in support of the ERTP 2016 ESA consultation for SDCS operations and for the protection of the eastern marl prairie and CSSS subpopulations were adjusted under the No Action Alternative (Increment 1.1 and 1.2) to provide sufficient flexibility for the Corps and SFWMD water managers to achieve the intended performance from the RPA while taking into account the multiple purposes of the C&SF Project. **TABLE 2-8** presents a cross walk of SDCS operational criteria for the RPA and Alternative B. The operational ranges for Alternative B are consistent with the No Action Alternative and what was modeled for the RPA.

A brief summary of operational criteria for Alternative B is described below. Consistent with the No Action Alternative, operational conditions (*i.e.* Conditions 1-4) have been prescribed to provide guidance throughout the implementation of Alternative B. To allow for adaptive management during under high water conditions similar to those experienced during 2016 and 2017, additional operational flexibility has been included within Alternative B to allow for a rapid response to extreme high water levels in WCA 3A. Reference **Section 5.7** of **Appendix A, Part 1.** In the event remaining construction components of C-111 South Dade Contract 8 are incomplete prior to March 1, 2018 and preclude operation of the NDA as required for full implementation of

Alternative B, the operating criteria previously established under Increment 1.1 and 1.2 will govern the following structures that are affected by the construction activity (L-29 Canal, including S-333, S-355A, S-355B, and S-356; S-331; S-357; S-357N; L-31N Canal, including S-332BN, S-332BW, S-332C, S-332D, S-194, S-196, and S-176). Once construction of the NDA is verified as functionally complete, all operations developed under Alternative B will be implemented. Reference **Appendix A**, **Part 1** for a complete description of Alternative B. A comparison table of operational criteria for Alternative B relative to the No Action Alternative can be found in **Appendix A, Part 2**.

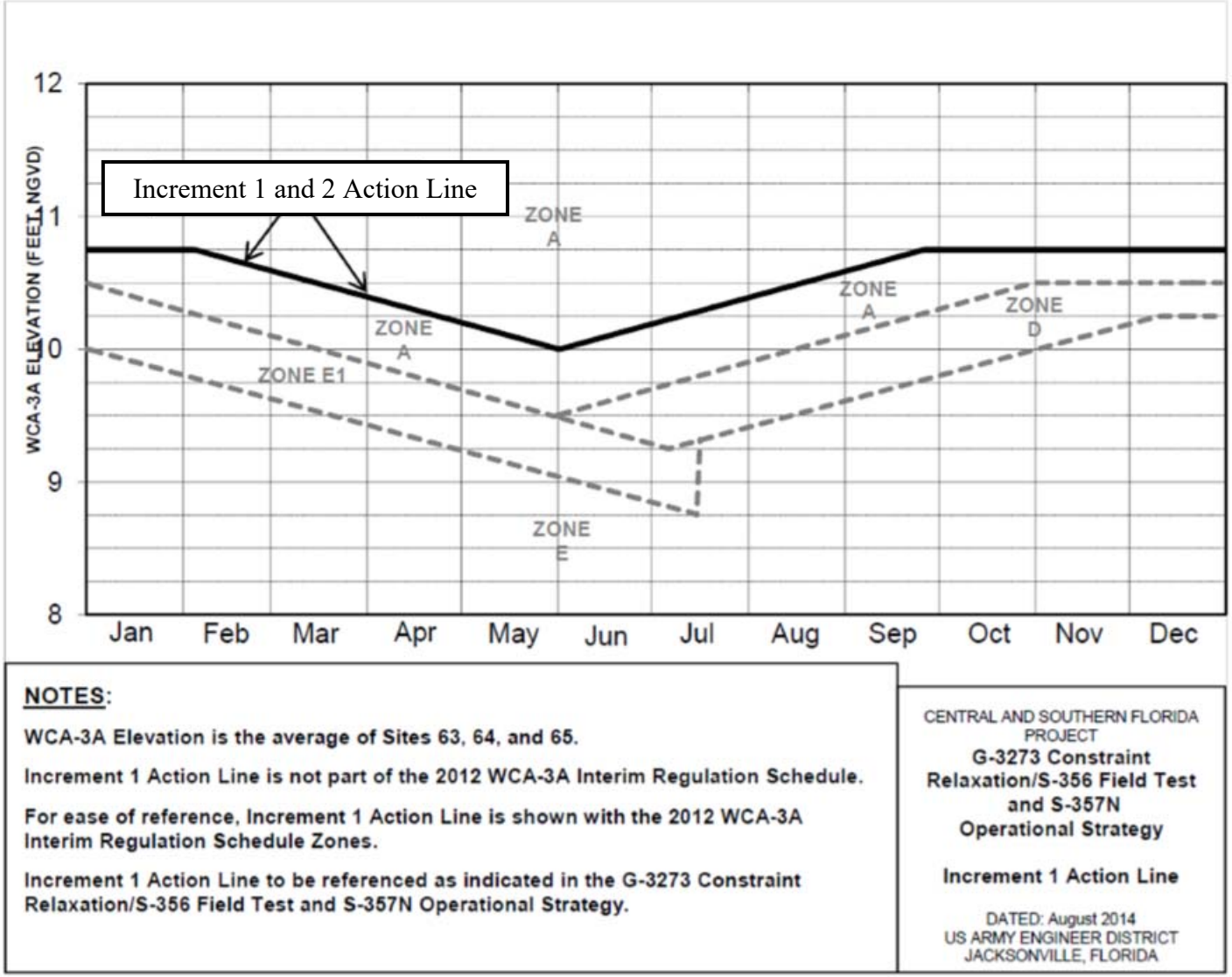

FIGURE 2-1. WATER CONSERVATION AREA 3 SCHEDULE WITH ACTION LINE

UNVARYING CONDITIONS OF THE OPERATIONAL STRATEGY

a) WCA 3A Zone A Operations. When the WCA 3A 3-gage average is in Zone A of the regulation schedule maximum discharges will be made through the S-12A/B/C/D and S-333 to the NESRS in accordance with the Rainfall Plan subject to downstream constraints and the 2016 ERTP BO closure dates. S-151 discharges may also be maximized to WCA 3B and to tide subject to downstream constraints. S-343A, S-343B and S-344 discharges may also be maximized subject to the 2016 ERTP BO closure dates.

b) L-29 Canal. The L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based upon coordination with the FDOT concerning implementation of the Relocation Agreement dated September 25, 2008. In accordance with **Appendix A, Part 1**, the L-29 Canal inflow structures (S-333, S-355A/B, and S-356) will be operated with the intention of limiting event durations with L-29 Canal stages above 8.5 feet, NGVD to a target maximum duration of 72 hours. Once the stage in the L-29 Canal reaches a stage of 8.5 feet, NGVD, input from all structures that discharge into the canal (S-333, S-355A/B, and S-356) shall be stopped until the level in the L-29 Canal recedes below 8.5 feet, NGVD. For each water year (May through April), the L-29 Canal inflow structures will be managed to limit the duration of L-29 Canal stages near 8.5 feet (as measured at the S-333 tailwater[TW]), NGVD to 90 cumulative days or to a maximum of 90 consecutive days. The number of either cumulative or consecutive days in each period (only one period per water year) will be measured when L-29 stages exceed 8.3 feet, NGVD. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages at 8.5 feet, NGVD for longer than 90 days will require written approval from the FDOT. The L-29 stage will be maintained at or below 8.5 feet, NGVD by ceasing inflow into L-29 when the L-29 stage rises above 8.5 feet, NGVD. Event driven criteria will be followed in accordance with Table 1 in **Appendix A**, **Part 1**. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages above 8.3 feet, NGVD for longer than 90 days will require written approval from the FDOT, given evaluation of the monitoring data by FDOT.

c) S-151, S-337, S-335 and S-356. S-356 may be used to send water from WCA 3A to the NESRS by way of the S-151, S-337 and S-335 structures subject to L-29 Canal constraints if agreed upon by the SFWMD, ENP and the Corps. These deliveries are in addition to the Rainfall Plan target deliveries to NESRS. These operations are intended to be secondary to S-356's primary purpose of controlling the stage in L-31N.

d) S-333, S-355A, S-355B, S-356 and S-334 for the L-29 Canal if stage exceeds 8.5 feet, NGVD. All inflows to the L-29 Canal which include S-333, S-355A, S-355B and S-356 will be secured in order to allow the canal to recede below 8.5 feet, NGVD. S-334 may be used to maintain the L-29 Canal stage at or below the FDOT constraint of 8.5 feet, NGVD to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based upon coordination with the FDOT concerning implementation of the Relocation Agreement dated September 25, 2008. As soon as 8.3 feet, NGVD in L-29 is reached following the post-event recession, S-334 is closed. The S-334 discharges will be as follows:

i) When the daily average stage in L-31N using the HW of S-332B, S-332C, and S-332D can be maintained below 4.4 feet, NGVD the S-334 may discharge as necessary to maintain the L-29 Canal constraints defined in **Appendix A, Part 1** as long as the other L-31N canal reaches are maintained within their respective ranges.
ii) When the average stage in L-31N at the HW of S-332B, S-332C, and S-332D cannot be maintained below 4.4 feet, NGVD then:
   a) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,125 cfs, S-334 may be utilized up to a maximum flow rate of 250 cfs.
   b) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,000 cfs (increased storage capacity may be available within the SDCS), S-334 may be utilized up to 400 cfs.

It is expected that during drier times the need to deliver supplemental flow to Taylor Slough would diminish the use of S-356 compared to Increment 1 if water was delivered through S-334. Water may be delivered through the S-151, S-337, S-335 route to reduce this conflict. During the wet season it is expected that supplemental deliveries will be relatively small and occurring during dry periods. At the end of the wet season it is expected that the supplemental deliveries be larger and more persistent. Deliveries through S-332D/S-332DX1 will still comply with the seasonal discharge limits for nesting of the CSSS.

e) <u>S-357 and S-331 for the 8.5 SMA</u>. To help maintain 8.5 SMA flood mitigation, S-357 will conditionally operate up to its full capacity according to **Appendix A, Part 1**. S-331 will be operated as described in **Appendix A, Part 1**. Construction of the 8.5 SMA features and C-111 South Dade Contracts 8 and 8A will be considered functionally complete when the Corps construction manager with input from the Corps water managers and Corps Engineering Division formally communicate it to the SFWMD project manager and water managers. Once functionally complete, such that construction conflicts with water management of canal levels are resolved, the S-331 HW range specified in **Appendix A, Part 1** may be raised by up to 0.5 feet and the S-357 HW range may be evaluated with the effects of this change.

f) <u>L-31N Canal Reach from S-331 to S-176.</u> S-332B, S-332C, S-332D, S-176, S-194, and S-196 will be operated to maintain the L-31N Canal reach between S-331 and S-176 in accordance with **Appendix A, Part 1** except during hydraulic testing of the NDA and SDA. The S-328 structure (eight 60 inch diameter CMP with gates) located in the southwest corner of Cell 1 of the S-332D Detention Area may be used to increase deliveries to Taylor Slough up to 250 cfs provided that an average water depth of at least six inches is maintained in Cell 1 or in accordance with the correlation between S-332D TW/S-332DX1 HW and S-328 HW to be determined once data becomes available. Prior to initial operation of S-328 in September 2017, construction of the three L-31W Canal plugs proposed between S-328 and the L-31W gap were completed as components of the SFWMD proposal to move more water to Taylor Slough and Florida Bay.

g) <u>C-111 Canal Reach from S-176 to S-177.</u> Operating Range for S-177 is from 3.6 to 4.2 feet, NGVD. If the rainfall over the last 14 days exceeds 5.5 inches, or if water is being released through S-334 into L-31N and being passed through S-331, then S-177 may be

opened to lower S-177 HW down to 3.3 feet, NGVD. When flows at S-332B/C/D are reduced to achieve the CSSS habitat or nesting conditions, up to 200 cfs may be through S-177 when S-177 HW is below its operational range. It is not the intent of these operations to trigger a S-197 release greater than 400 cfs.

h) Supplemental Water Deliveries to Florida Bay via Taylor Slough. SDCS operations for Alternative B will utilize the C-111 South Dade SDA and the S-332D Detention Area to maintain canal stage targets in the lower L-31N and C-111 canals. Supplemental water deliveries of up to 250 cfs from WCA-3A will be limited to conditions when WCA-3A is above its floor elevation of 8.0 feet, NGVD. S-176, S-177 and S-18C will be used to pass water to the marsh downstream of S-18C and utilize S-197 as needed.

OPERATIONAL STRATEGY CONDITIONS:

CONDITION 1. YEAR-ROUND WHEN STAGE AT G-3273 IS BELOW 6.6 FEET, NGVD AND WCA 3A STAGE IS BELOW THE INCREMENT 1 AND INCREMENT 2 ACTION LINE (S-333 HAS PRIORITY; S-356 USE IS SECONDARY TO S-333 BUT S-356 CAN AND SHOULD BE USED SUBJECT TO L-29 STAGE LIMITATIONS):

a) S-333 and S-334. S-333 will be used to release up to the full rate prescribed by WCA-3A Regulation Schedule and the Rainfall Plan into NESRS subject only to the L-29 adjusted constraint. The combined flow from the S-333, S-12A, S-12B, S-12C, and S-12D should not exceed the total prescribed by the Rainfall Plan except as allowed by the 2012 Water Control Plan and constrained by the ERTP BO's stage and recession limits. The latitude to deliver water from WCA 3A via S-333/S-334 to supply water to Taylor Slough remains as long as WCA 3A's stage is above 8.0 feet, NGVD. Deliveries through S-332D will still comply with the seasonal discharge limits for nesting of the CSSS Sub Population C. This supplemental delivery from WCA-3A will only occur when it does not conflict with the ability to maintain canal stages within their operational ranges and is expected to occur during relatively drier conditions at which time this magnitude of flow will become important as it will help sustain the hydraulic ridge at S-332C and S-332D.

b) S-356. S-356 may be used to control the stage in L-31N between 5.5 and 5.8 feet, NGVD to the extent there is capacity in L-29. Compliance with the range limits is based on the daily average stage at S-356/S-336 headwaters. The operator of S-356 may operate the pumps within this range. Using S-356 to maintain the L-31N Canal range to 5.5 to 5.8 feet, NGVD allows the flexibility to keep G-211 and S-338 closed or reduce G-211 and S-338 discharge if conditions make this desirable.

c) L-30 Canal and S-335. Excess flow from L-30 through S-335 may be diverted into NESRS using S-356. Delivery of water from WCA 3A (through S-151, S-337, and S-335) is allowed. When S-335 HW is above 6.5 feet, NGVD, the SFWMD has full latitude to make the S-335 discharge required to maintain the desired stage in the L-30 Canal and also provide S-335 discharge to reduce pump unit cycling at S-356 or S-331 (by releasing the flow required to maintain steady pumping at S-331 through G-211) or both. S-335 releases are still dependent on having available downstream capacity.

d) S-197. For Increment 2, additional S-197 flexibility will be allowed to achieve the objectives. S-197 will be operated based upon S-18C HW or S-177 HW stage as prescribed below in Condition 2 (**TABLE 2-2** and **TABLE 2-3**). These additional S-197 operating criteria do not change the existing S-197 operating criteria for openings prescribed by the conditions at S-177. The flexibility at S-197 is expected to be used when the available upstream capacity is insufficient to keep S-176 and S-177 closed. However, S-197 is not intended to be opened greater than 400 cfs when S-18C HW is below 2.8 feet, NGVD or when S-177 HW is above 4.1 feet, NGVD.

* Note: For the time period from January 1st through near the end of May that a stage of 6.6 at G-3273 reflect a very wet (above median and near P75). For the period from mid-May through December 6.6 is near (+/- 0.2 feet) median (P50) conditions.

CONDITION 2. YEAR-ROUND WHEN STAGE AT G-3273 IS ABOVE 6.6 FEET, NGVD * AND THE WCA 3A STAGE IS BELOW THE INCREMENT 1 AND 2 ACTION LINE (S-356 HAS LIMITED PRIORITY OVER S-333):

The following criteria will be triggered when G-3273 rises above 6.6 feet, NGVD for more than 24 hours and will remain in effect until G-3273 declines to 6.5 feet, NGVD.

a. S-333 and S-334. S 333 will be used to release up to the full rate prescribed by the WCA 3A Regulation Schedule and the Rainfall Plan into NESRS subject to the L 29 adjusted constraint and an assured minimum available capacity of three units at S-356 (375 cfs) when the L-29 constraint is up to 8.5 feet, NGVD. If the assured minimum available capacity indicated at S-356 is not possible due to the L-29 constraint, then S-333 releases will be reduced to allow S-356 to achieve the specified minimum available capacity.

b. S-356. S 356 may be used to control the stage in L 31N between 5.5 and 5.8 feet, NGVD with an assured minimum available capacity of 3 units (375 cfs) when the L-29 constraint is up to 8.5 feet, NGVD. Compliance with the range limits is based on the daily average stage at S-356/S-336 headwater. The operator of S-356 may operate the pumps within this range. Using S-356 to maintain the L-31N Canal between 5.5 and 5.8 feet, NGVD, allows the flexibility to keep G-211 and S-338 closed or reduce G-211 and S-338 discharge if conditions make this desirable.

c. L-30 Canal and S-335. Excess flow from L 30 through S 335 may be diverted into NESRS using S 356. Delivery of water from WCA-3A (through S-151, S-337, and S-335) is allowed. When S-335 HW is above 6.5 feet, NGVD, the SFWMD has full latitude to make the S-335 discharge required to maintain the desired stage in the L-30 Canal and also provide S 335 discharge to reduce pump unit cycling at S-356 or S-331 (by releasing the flow required to maintain steady pumping at S-331 through G-211) or both. S-335 releases are still dependent on having available downstream capacity.

d. S-18C. S-18C will be operated in accordance with the Column 1 (operating range of 2.3 to 2.6 feet, NGVD) of the 2012 Water Control Plan.

e. S-197. For Increment 2, additional S-197 flexibility will be allowed to achieve the objectives. S-197 will be operated based upon S-18C HW or S-177 HW stage as prescribed below (**TABLE 2-2** and **TABLE 2-3**). These additional S-197 operating criteria do not change the existing S-197 operating criteria for openings prescribed by the conditions at S-177. The flexibility at S-197 is expected to be used when the available upstream capacity is insufficient to keep S-176 and S-177 closed. However, S-197 is not intended to be opened greater than 400 cfs when S-18C is below 2.8 feet, NGVD or when S-177 HW is above 4.1 feet, NGVD.

* Note: For the time period from January 1st through near the end of May a stage of 6.6 at G-3273 reflects a very wet (above median and near P75) condition. For the period from mid-May through December 6.6 is near (+/- 0.2 feet) median (P50) conditions.

TABLE 2-2. S-197 OPERATING CRITERIA

S-18C HW (feet, NGVD)	or	S-177 HW (feet, NGVD)	Maximum S-197 Flow (cfs) (daily time-weighted average)
> 3.3		> 4.3	2,400 (full)
> 3.1		> 4.2	1,600 (two-thirds)
> 2.8		> 4.1	500
> **TABLE** 2B		NA	minimum(S-176+100, S-177+100, 300)
< **TABLE** 2B		NA	minimum(S-176+50, S-177+50, 250)
The criteria for S-177 and S-18C only applies when gate is fully open (or gates out of the water) for 24 hours.			

TABLE 2-3. MONTHLY MEDIAN S-18C HW STAGES (POR1978-2015)

Month	Monthly Median S-18C HW Stage
January	2.2 feet, NGVD
February	2.0 feet, NGVD
March	2.0 feet, NGVD
April	1.8 feet, NGVD
May	2.0 feet, NGVD
June	2.3 feet, NGVD
July	2.4 feet, NGVD
August	2.4 feet, NGVD
September	2.5 feet, NGVD
October	2.5 feet, NGVD
November	2.3 feet, NGVD
December	2.2 feet, NGVD

CONDITION 3. WHEN WCA 3A STAGE IS ABOVE THE INCREMENT 1 AND 2 ACTION LINE DURING S-12A SEASONAL CLOSURE WINDOW FROM 01 OCTOBER (OR INITIAL S-12A CLOSURE DATE) THROUGH 14 JULY * (S-333 HAS PRIORITY; S-356 USE IS SECONDARY TO S-333 BUT S-356 CAN AND SHOULD BE USED SUBJECT TO L-29 STAGE LIMITATIONS)

The following criteria will be triggered when the WCA 3A 3-gage average exceeds the Increment 1 and 2 Action Line for more than 24 hours and will remain in effect the 3-gage average declines to 0.1 feet below the Increment 1 and 2 Action line for 48 hours.

a) S-356. S-356 may be used to control the stage in L-31N between 5.5 and 5.8 feet, NGVD to the extent there is capacity in L-29. S-333 releases have priority over S-356 pumping. Compliance with the range limits is based on the daily average stage at -S-356/S-336 headwaters. The operator of S-356 may turn pump units on and off within this range. Using S-356 to maintain the L-31N Canal range to 5.5 to 5.8 feet, NGVD allows the flexibility to keep G-211 and S-338 closed or reduce G-211 and S-338 discharge if conditions make this desirable.

b) S-333 and S-334. S-333 makes maximum releases to NESRS subject to the L-29 constraint. When the L-29 canal is below 7.8 feet, NGVD (operations are comparable to conditions under Increment 1.1 and Increment 1.2) and is reached or exceeded, S-334 may be used to maintain the L-29 Canal stage at or below the adjusted constraint by delivering a portion of the WCA-3A regulatory releases to the SDCS (including the use of pumping stations S-331, S-332B, S-332C, and S-332D) when the following conditions (i, ii, and iii) are met:
   i) S-12C and S-12D are full open.
   ii) The discharge to tide from all of the WCAs are maximized to the extent that downstream conditions allow.
   iii) The SDCS has available capacity (as defined in paragraph "iv)" below) while maintaining L-31N canal stage between S-335 and G-211 below 4.6 feet, NGVD. Under these conditions (i, ii, and iii), the following criteria (iv, v, and vi) will govern S-334 operation, including maximum discharge limits:
   iii) When the daily average stage in L-31N using the HW of S-332B, S-332C, and S-332D can be maintained below 4.4 feet, NGVD then there is no limit on the S-334 discharge as long as the other L-31N canal reaches are maintained within their respective ranges.
   iv) S-334 will not be operated when L-29 is above 7.8 feet, NGVD (subject to L-29 lowering operations per FDOT constraint and Additional Operational Flexibility, for Extreme High Water Levels in WCA 3A). When L-29 is below 7.8 feet, NGVD the below constraints established under Increment 1.1 and 1.2 will be followed:
      (1) When the average stage in L-31N at the HW of S-332B, S-332C, and S-332D cannot be maintained below 4.4 feet, NGVD then:
         (a) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,125 cfs, S-334 may be utilized up to a maximum flow rate of 250 cfs.

(b) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,000 cfs (increased storage capacity may be available within the SDCS), S-334 may be utilized up to 400 cfs.

v) S-334 flows will not be constrained by S-333 flows, and there is no constraint to require matching S-333 and S-334 flows.

* The use of S-334 based on criteria "i)" through "v)" may continue long enough past the end of the S-12A and S-12B closure period (14 July) to release the volume of water that would have been released, according to the WCA 3A Regulation Schedule, had the S-12s been allowed to be open, but in no case beyond August 15th. The determination of the extent to which the S-12 closures cause water to be retained in WCA 3A beyond that expected during the pre-ISOP schedule for WCA 3A (1993 Experimental Program, including no seasonal closure of the S-12s) will be computed monthly by Corps water managers and reported annually by the Corps for the period from 1 October through 14 July. When the combined WCA 3A releases from the S-12s and S-333 are less than the releases computed for the pre-ISOP schedule, a WCA-3A "discharge deficit" resulting in additional accumulation of water in WCA 3A is indicated for the period from 1 October through 14 July. For this WCA 3A accounting computation, S-333 discharges to NESRS computed under the pre-ISOP schedule will be based on inclusion of the G-3273 constraint of 6.8 feet, NGVD. S-334 deliveries will be discontinued when S-334 capacity is no longer required to meet the discharge prescribed by the Rainfall Plan and the WCA-3A storage volume accumulated due to the discharge deficit (the balance) is discharged but in no case beyond August 15th. S-334 discharges to the SDCS under all conditions and S-333 deliveries to NESRS when G-3273 (S-333 flows greater than S-334 flows) will both count as flows to be subtracted from the WCA 3A balance computed through 14 July.

I. S-334 will not be used after 14 July during periods when the WCA-3A stage is below the Increment 1 and 2 Action Line. S-334 may be used to discharge accumulated water from 15 July through 14 August if WCA-3A stage is above the Increment 1 and 2 Action Line. Regardless of conditions within WCA-3A or any residual WCA-3A storage deficit balance, the use of S-334 to deliver a portion of WCA-3A regulatory releases to the SDCS will be discontinued on 15 August. The WCA-3A storage deficit balance resultant from the S-12 closures, if applicable for the prior period from 1 November through 14 July, will zero-out on 15 August and will preclude a balance carryover into the next year.

II. If more water was released from WCA-3A under Increment 2 than computed for the pre-ISOP schedule, a WCA-3A "discharge surplus" balance is indicated for the period from 1 November through 14 July, and S-334 will not be utilized for WCA-3A regulatory releases to the SDCS during the period from 15 July through start of S-12A Seasonal Closure window on 30 September.

e) L-30 Canal. Delivery of water from WCA-3A (through S-151, S-337, and S-335) is allowed. Net flow from the L-30 Canal should be minimized with the corresponding lowering of the C-4 Canal (opening G-119 and S-380) if downstream conditions allow. When S-335 HW is above 7.0 feet, NGVD, the SFWMD has full latitude to make the S-335 discharge required to maintain the desired stage in the L-30 Canal below 7.5 feet, NGVD if there is capacity available downstream. When S-335 HW is above 7.0 feet, NGVD discharge from the L-30 canal through S-335 may be used to reduce pump unit cycling at S-331 (by releasing the flow required to maintain steady pumping at S-331 through G-211). Delivery of water from WCA-3A through S-151, S-337, and S-335 is allowed.

f) S-18C. Operation of S-18C will be in accordance with the Column 2 of the 2012 WCP with an operating range from 2.0 to 2.25 Feet, NGVD.

g) S-197. S-197 will be operated based upon S-18C HW or S-177 HW stage as described below. These additional S-197 operating criteria do not change the existing S-197 operating criteria based on conditions at S-177 and contained in the 2012 Water Control Plan.

TABLE 2-4. S-197 OPERATING CRITERIA

S-18C HW (feet, NGVD)	or	S-177 HW (feet, NGVD)	Maximum S-197 Flow (cfs) (daily time-weighted average)
> 3.3		> 4.3	2,400 (full)
> 3.1		> 4.2	1,600 (two-thirds)
> 2.8		> 4.1	500
> **TABLE** 3B		NA	minimum(S-176+200, S-177+200, 400)
< **TABLE** 3B		NA	minimum(S-176+100, S-177+100, 300)
The criteria for S-177 and S-18C only applies when gate is fully open (or gates out of the water) for 24 hours.			

TABLE 2-5. MONTHLY MEDIAN S-18C HW STAGES (POR 1978-2015)

Month	Monthly Median S-18C HW Stage
January	2.2 feet, NGVD
February	2.0 feet, NGVD
March	2.0 feet, NGVD
April	1.8 feet, NGVD
May	2.0 feet, NGVD
June	2.3 feet, NGVD
July	2.4 feet, NGVD
August	2.4 feet, NGVD
September	2.5 feet, NGVD
October	2.5 feet, NGVD
November	2.3 feet, NGVD
December	2.2 feet, NGVD

Within these operational ranges, S-197 gates may be adjusted to maintain the daily average flow rates and stages within the appropriate and corresponding ranges. If a flow or stage is outside of the corresponding range for more than one day (24 hour average) then the appropriate gate change will be made no later than the next working day.

Water managers may use any or all of the four gates at S-197 to achieve the daily average flows prescribed by the stage ranges while, when possible keeping gate openings small enough to prevent manatee movement.

CONDITION 4. WHEN WCA 3A STAGE IS ABOVE THE INCREMENT 1 AND 2 ACTION LINE FROM 15 JULY THROUGH START OF S-12A SEASONAL CLOSURE WINDOW ON 30 SEPTEMBER (OR INITIAL S-12A CLOSURE DATE) (S-333 HAS PRIORITY; S-356 USE IS SECONDARY TO S-333 BUT S-356 CAN AND SHOULD BE USED SUBJECT TO l-29 STAGE LIMITATIONS AND NO USE OF S-334):

The following criteria will be triggered when WCA 3A 3-gage average exceeds the Increment 1 and 2 Action Line for more than 24 hours and will remain in effect until the 3-gage average declines to 0.1 feet below the Action line for 48 hours.

a) S-356. S-356 may be used to control the stage in L-31N between 5.5 and 5.8 feet, NGVD to the extent there is capacity in L-29. S-333 releases have priority over S-356 pumping. Compliance with the range limits is based on the daily average stage at S-356/-S-336 headwaters. The operator of S-356 may turn pump units on and off within this range. Using S-356 to maintain the L-31N Canal range to 5.5 to 5.8 feet, NGVD allows the flexibility to keep G-211 and S-338 closed or reduce G-211 and S-338 discharge if conditions make this desirable.S-334 remains closed.

a) S-333. S-333 makes maximum releases to NESRS subject only to the L-29 constraint.

b) L-30 Canal. Delivery of water from WCA-3A (through S-151, S-337, and S-335) is allowed. Net flow from the L-30 Canal should be minimized with the corresponding lowering of the C-4 Canal (opening G-119 and S-380) if downstream conditions allow. When S-335 HW is above 7.0 feet, NGVD, the SFWMD has full latitude to make the S-335 discharge required to maintain the desired stage in the L-30 Canal below 7.5 feet, NGVD, if there is capacity available downstream. When S-335 HW is above 7.0 feet, NGVD, discharge from the L-30 canal through S-335 may be used to reduce pump unit cycling at S-331 (by releasing the flow required to maintain steady pumping at S-331 through G-211) or both if the flow at S-334 is insufficient.

e) S-18C. Operation of S-18C will be in accordance with the Column 2 of the 2012 Water Control Plan.

f) S-197. S-197 will be operated based upon S-18C HW or S-177 HW stage as described below. These additional S-197 operating criteria do not change the existing S-197 operating criteria based on conditions at S-177, and contained in the 2012 Water Control Plan.

TABLE 2-6. S-197 OPERATING CRITERIA

S-18C HW (feet, NGVD)	or	S-177 HW (feet, NGVD)	Maximum S-197 Flow (cfs) (daily time-weighted average)
> 3.3		> 4.3	2,400 (full)
> 3.1		> 4.2	1,600 (two-thirds)
> 2.8		> 4.1	500
> **TABLE** 4B		NA	minimum(S-176+200, S-177+200, 400)
< **TABLE** 4B		NA	minimum(S-176+100, S-177+100, 300)
The criteria for S-177 and S-18C only applies when gate is fully open (or gates out of the water) for 24 hours.			

TABLE 2-7. MONTHLY MEDIAN S18C HW STATEGS (POR) 1978-2015

Month	Monthly Median S-18 HW Stage
January	2.2 feet, NGVD
February	2.0 feet, NGVD
March	2.0 feet, NGVD
April	1.8 feet, NGVD
May	2.0 feet, NGVD
June	2.3 feet, NGVD
July	2.4 feet, NGVD
August	2.4 feet, NGVD
September	2.5 feet, NGVD
October	2.5 feet, NGVD
November	2.3 feet, NGVD
December	2.2 feet, NGVD

Within these operational ranges, S-197 gates may be adjusted to maintain the daily average flow rates and stages within the appropriate and corresponding ranges. If a flow or stage is outside of the corresponding range for more than one day (24 hour average) then the appropriate gate change will be made no later than the next working day.

Water managers may use any or all of the four gates at S-197 to achieve the daily average flows prescribed by the stage ranges while, when possible keeping gate openings small enough to prevent manatee movement.

ADDITIONAL OPERATIONAL FLEXIBILITY FOR EXTREME HIGH WATER LEVELS IN WCA 3A:

Extreme high water levels in WCA 3A is defined as when either of the following two conditions are met:

1. WCA-3A is above the Extreme High Water Action Line (**FIGURE 2-2**).
2. SFWMD position analysis (monthly, semi-monthly) shows at least a 10 percent probability of WCA 3A, 3-station average exceeding 12.7 feet, NGVD along with other forecast information prior to September 15th.

Alternative B will include the following additional operational flexibility for the extreme high water condition:

a) WCA 3A. WCA 3A discharges through the SDCS may continue beyond the date at which the deficit due to S-12 closures has been met or past the cutoff date of 15 August.

b) L-29. When L-29 is maintained above 7.8 feet, NGVD, and either extreme high-water condition is likely, S-334 will not be constrained to the closure period window. S-334 discharges will be subject to the following downstream conditions:
   1. When the daily average stage in L-31N using the HW of S-332B, S-332C, and S-332D can be maintained below 4.4 feet, NGVD then there is no limit on the S-334 discharge as long as the other L-31N canal reaches are maintained within their respective ranges.
   2. When the average stage in L-31N at the HW of S-332B, S-332C, and S-332D cannot be maintained below 4.4 feet, NGVD then:
      a) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,125 cfs, S-334 may be utilized up to a maximum flow rate of 250 cfs;
      b) When daily combined pumping at S-332B, S-332C, and S-332D is less than 1,000 cfs (increased storage capacity may be available within the SDCS), S-334 may be utilized up to 400 cfs.

c) S-197 discharges may increase up to 1200 cfs when the flow through S-334 exceeds 600 cfs and the flow through S-176 exceeds 300 cfs to handle up to maximum discharges from WCA 3A to the SDCS using S-333/S-334 while retaining capacity to manage local basin runoff. For flows at S-197 exceeding 600 cfs the expectation is to maximize upstream discharges including S-194 and S-196 to the extent practicable in 24 hrs. Available capacity at S-197 will decrease to 600 cfs when S-18C HW falls below median elevation provided in **TABLE 2-3.**

d) **TABLE 2-7**. S-199 and S-200 available capacities are subject to CSSS criteria. When L-29 is maintained above 7.8 feet, NGVD and a forecast of one of the extreme high water level conditions are expected, S-197 may be increased up to 2400 cfs.

Additional operational flexibility for extreme high water levels in WCA 3A will be ceased when the WCA 3A 3-gage average is at least 0.1 feet below the Extreme High Water Action Line and not projected to rise above the line based on forecasts.

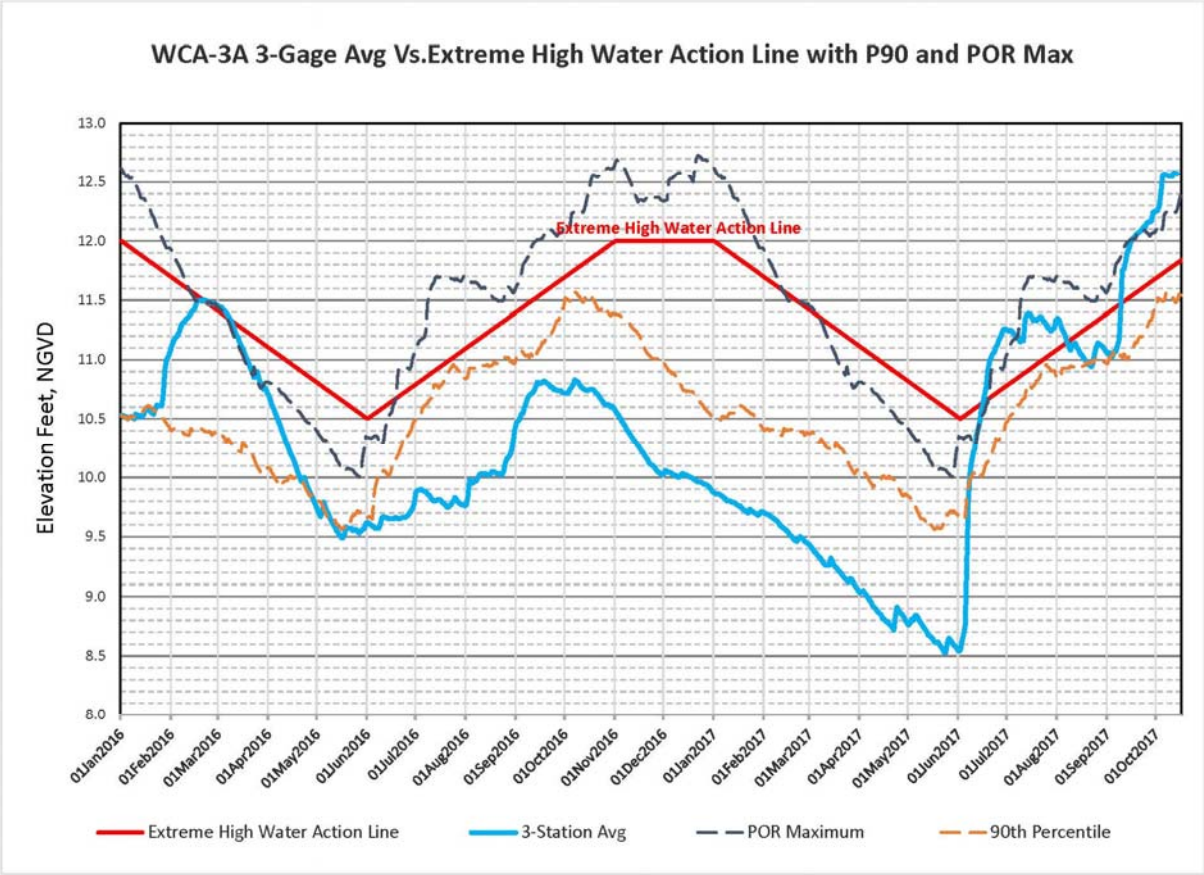

FIGURE 2-2. WCA 3A 3 GAGE AVERAGE WITH EXTREME HIGH WATER ACTION LINE

OPERATIONAL FLEXIBILITY (ALL FOUR OPERATIONAL CONDITIONS)

The following areas have been identified to have some uncertainties which may require some additional operational flexibilities:

- Operational range of L-30 may be adjusted by +/- 0.5 feet
- Operational range for S-338 may be adjusted by +/- 0.5 feet
- Operational range for S-194 may be adjusted +/- 0.5 feet
- Operational range for S-196 may be adjusted +/- 0.5 feet
- During the period when pumping at S-332B, S-332C, S-332D combined is restricted to less than 1,125 cfs total due to the operational restrictions associated with the RPA targets of the 2016 ERTP BO or maintenance/repair issues which result in reduced pump capacity or a combination of both, the operational range for S-176 may be lowered 0.5 feet from the operating range of 4.75 to 5.0 feet, NGVD.
- During the period when pumping at S-199 and S-200 combined is restricted to less than 300 cfs total due to the operational restrictions associated with the RPA targets of the 2009 C-111 Spreader Canal Western Project BO and/or 2016 ERTP BO or maintenance/repair issues which result in reduced pump capacity, the operational range for S-177 may be lowered 0.2 feet from the operating range of 3.6 to 4.2 feet, NGVD (the adjusted lower limit of S-177 HW is 3.4 feet, NGVD).
- Operational flexibility for S-357 and S-357N is included within the 8.5 SMA test operations which includes adjustments up to +/- 0.5 feet after the initial + 0.5 feet change. S-357 will not be operated below 3.0 feet, NGVD.

TABLE 2-8. SDCS OPERATIONAL CRITERIA FOR ALTERNATIVE B. COMPARISON IS BEING MADE RELATIVE TO SIMULATION R2H SOUTH DADE OPERATIONS FROM THE 2016 ERTP BO.

Structure	ERTP B.O modeling (R2H for SDCS) Operating Range		Increment 2 Operational Strategy Range		Increment 2 Changes from Increment 1.1/1.2 (included 2016 B.O)?
(Influence on Eastern CSSS)	CSSS-A nesting period (15Feb-31July)	Outside CSSS-A nesting period (01Aug-31Dec)	CSSS-A nesting period (15Feb-31July)	Outside CSSS-A nesting period (01Aug-31Dec)	
S-356	5.5-5.8	No change	5.5-5.8	No change	Minor (added Condition 3 and 4)
S-338	4.9-5.3	Column 1: 5.5-5.8; Column 2: 5.0-5.4	5.5-5.8	No change	No
S-357	5.7-6.2*	No change	5.0-6.0 (5.5-6.0 for dry conditions) Angel's > 6.4: 4.5-5.5 Angel's > 6.7/LPG-2 > 6.6: 4.0-5.0 Angel's > 7.6/LPG-2 > 6.6: 3.5-4.5	No change	Yes (revisions required to support raising of the L-29 Canal constraint and functional completion of the C-111 South Dade NDA)
S-331 HW: High Range Intermed. Range Low Range Add'l Criteria	No Limit* 4.5-5.0 4.0-4.5 4.5-5.0 (Low Range Adjustment if S-357 not limited)	No change	5.0-6.0 4.5-5.0 4.0-4.5 3.5-4.0 (LPG-2 > 6.6 ft NGVD)	No change	Yes (revisions required to support raising of the L-29 Canal constraint and functional completion of the C-111 South Dade NDA)
S-332B/C	4.5-5.0*	4.0-4.5 (Aug-Dec)	4.2-4.8	No change	No
S-332D	4.5-4.85* (includes CSSS seasonal limits)	4.0-4.35 (Aug-Dec)	4.2-4.8	No change	No
S-194 and S-196	4.0-4.5 (15Feb-15May); 4.3-4.8(01Jun-31Jul)	Column 1: 5.5-5.8; Column 2: 5.0-5.4	4.2-4.8	No change	No
S-176 HW	Column 1: 4.75-5.0*; Column 2: 4.7-4.9*	Column 1: 4.75-5.0*; Column 2: 4.7-4.9* Up to 200 cfs: 4.55-4.8 (Sep-Dec)	4.75-5.0**	No change Up to 200 cfs: 4.5-4.8 (Aug-Feb)	Minor (200 cfs supplemental releases allowed if upstream CSSS constraints limit discharges at S-332B/C/D).
S-177 HW	Normal: 3.6-4.2* Dry Season, high rainfall: 3.1-3.7 high rainfall) Wet Season, med.-high rainfall: 3.1-3.7 Wet Season, high rainfall: 2.6-3.2	No change Up to 200 cfs: 3.2-3.9 (Sep-Dec)	3.6-4.2* 14-day rainfall > 5.5 inches: 3.3-4.2	No change	Minor (200 cfs supplemental releases allowed if upstream CSSS constraints limit discharges at S-332B/C/D).

NOTE: All operating criteria are in feet, NGVD 1929
* = Consistent with 2012 WCP
** = Canal stages also effected by SFWMD C-111SC POM (S-199: 3.4-3.8; S-200: 3.6-4.0)

2.1.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT CONSTRAINT

Operational criteria for Alternative C are identical to those described for Alternative B, except for operational constraints for the L-29 Canal identified in **Appendix A, Part 1**. Under Alternative B, the L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based upon coordination with the FDOT concerning implementation of the Relocation Agreement dated September 25, 2008. The maximum operating limit in the L-29 Canal will be raised up to 8.5 feet, NGVD under Alternative B relative to the maximum operating limit of up to 7.8 feet, NGVD under the No Action Alternative, as described in **Appendix A, Part 1**. The L-29 Canal will be operated to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, based on coordination with the FDOT regarding implementation of the Relocation Agreement dated September 25, 2008. In accordance with Table 1 in **Appendix A**, **Part 1**, the L-29 Canal inflow structures (S-333, S-355A/B, and S-356) will be operated with the intention of limiting event durations with L-29 Canal stages above 8.5 feet NGVD to a target maximum duration of 72 hours. Once the stage in the L-29 Canal reaches a stage of 8.5 feet, NGVD, input from all structures that discharge into the canal (S-333, S-355A/B, and S-356) shall be stopped until the level in the L-29 Canal recedes below 8.5 feet, NGVD. For each water year (May through April), the L-29 Canal inflow structures will be managed to limit the duration of L-29 Canal stages near 8.5 feet (as measured at the S-333 TW), NGVD to 90 cumulative days or to a maximum of 90 consecutive days. The number of either cumulative or consecutive days in each period (only one period per water year) will be measured when L-29 stages exceed 8.3 feet, NGVD. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages at 8.5 feet, NGVD for longer than 90 days will require written approval from the FDOT under Alternative B. Under Alternative B, the L-29 stage will be maintained at or below 8.5 feet, NGVD by ceasing inflow into L-29 when the L-29 stage rises above 8.5 feet, NGVD. Event driven criteria will be followed in accordance with Table 1 of **Appendix A, Part 1**. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages above 8.3 feet for longer than 90 days will require written approval from the FDOT, given evaluation of the monitoring data by FDOT.

Under Alternative C, this operational constraint would be eliminated. The ability to freely raise the maximum operating limit in the L-29 Canal up to a maximum of 8.5 feet, NGVD would be unrestricted. Alternative C also includes no restriction on inflows to NESRS based on flood mitigation performance within the 8.5 SMA.

Based on preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO, current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance), regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months. The relatively coarse resolution of the hydrologic modeling tools used in support of the July 2016 ERTP BO is not sufficient to effectively assess effects within the 8.5 SMA.

2.1.4 ALTENATIVE D: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT COLUMN 2 OPERATIONS

Operational criteria for Alternative D are identical to that described for Alternative B above, except for those criteria and related water management structures utilized to define Column 2 operations. Column 2 is the condition when regulatory releases from WCA 3A are made via S-333 to the L-29 Canal and via S-334 to the L-31N Canal and the SDCS to address the reduction of WCA 3A releases due to the CSSS sub-population A structure closure period (*i.e.* S-12A/B, S-343A/B and S-344). Column 2 operations generally require the increased use of pumping stations S-331, S-332B, S-332C, and S-332D. During Column 2 operations, the control stages along the L-31N and C-111 Canals are also lowered to help maintain the existing flood risk management along the SDCS and also to provide the necessary downstream gradient for the S-334 releases to reach S-332B, S-332C, and S-332D pump stations. Under Alternative D, regulatory releases from WCA 3A to the SDCS are discontinued with the elimination of Column 2 operations. For this alternative, releases from S-334 will be limited to dry season water supply deliveries to Taylor Slough (up to 250 cfs) and to maintain the L-29 Canal FDOT stage constraints necessary to ensure the stability and safety of the Tamiami Trail. The SDCS Canals will be maintained at the same levels as those identified in the No Action Alternative for the prescribed Column 1 operating ranges S-334 would not be operated to discharge regulatory releases from WCA 3A at S-333 to the SDCS under any conditions except to provide dry season water supply deliveries to Taylor Slough or to maintain L-29 Canal stages in accordance with the FDOT criteria; during these limited operations, the SDCS Canals will be maintained at the same levels as those identified in the No Action Alternative for the prescribed Column 2 operating ranges. Reliance on Column 2 (S-334) operations as a water management tool for WCA 3A would be eliminated.

According to the 1994 C-111 South Dade GRR (Section 7.10), consistent with the original design of the South Dade County Flood control features and subsequent modifications to the system, the design of all GRR alternatives utilized S-173/S-331 as a divide structure between the L-31N Canal and the C-111 Canal under flood conditions. During normal (non-flood) periods, however, a potential for the structural features of both projects to be operated for mutual benefits was identified. A portion of the water to be returned to NESRS via S-356 as a part of the MWD Project could be discharged southward under some conditions. Such discharges could be made only when there would be no potential increase in flood risk in the C-111 basin. The C-111 GRR (Section 6.18.1) stated, "The Modified Water Deliveries to Everglades National Park Project may permit a restoration of the historic link between the waters of the two project areas, to the benefit of the wide-ranging species that used both basins in historic times. During non-flood conditions, excess seepage water from Shark River Slough collected in L-31 N borrow canal could be passed to the C-111 system for enhanced hydrologic restoration of Taylor Slough." Operating studies were planned to include an evaluation of the need for, and availability of, supplemental water supplies for the C-111 basin. The future COP study will explore opportunities to eliminate regulatory discharges from WCA 3A to the SDCS, consistent with the intent of Alternative D.

2.1.5 ALTERNATIVE E: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD; MODIFIED OPERATIONS OF S-331/S-357

Operational criteria for Alternative E are identical to that described for Alternative B above, except for those criteria utilized to define operations for structures S-331 and S-357. Alternative E includes operational criteria for S-357 and S-331 as previously coordinated under the interagency

Combined Structural and Operational Plan (CSOP) effort between 2002 and 2006. Although many assumptions applied during CSOP have changed, the previous hydrologic modeling conducted under the CSOP study included more than 70 combined alternative scenarios and sensitivity runs which may provide information helpful to predicting performance trends in response to operational changes considered during future development of the COP. Similar to the current COP, the prior CSOP operational planning effort was conducted to develop the next regional operational plan that would replace the then-current regional operational plan (2002 Interim Operational Plan, or IOP) and allow for integration of the MWD and C-111 South Dade Project features. Although the CSOP study identified a tentatively selected plan (TSP) in 2006, efforts to document the CSOP interagency formulation efforts and TSP recommendation through a NEPA process were subsequently stopped primarily due to the direction to reassess the Tamiami Trail alternatives. The recommended plan identified in the 2005 Tamiami Trail Revised GRR, was assumed in place for all CSOP alternatives, and the resulting 2008 Tamiami Trail LRR identified a significantly different bridge and roadway-raising design. Based on the revised Tamiami Trail roadway configuration, the CSOP TSP operational plan was no longer implementable since the Tamiami Trail configuration does impact the volume and location of water conveyance across Tamiami Trail, which in-turn affects hydrologic conditions within WCA 3A, WCA 3B, ENP, and the SDCS. The Tamiami Trail LRR one-mile bridge and roadway modifications were completed in December 2013, and the ERTP replaced the IOP as the next regional operations plan in October 2012.

For Alternative E, the operational plan for the 8.5 SMA S 357 pump station provides for the collection of seepage within the project area east of the perimeter levee in accordance with 8.5 SMA design identified in the 2000 8.5 SMA GRR. Alternative E specifies wet-season and dry-season operations for the 500 cfs capacity S-357 pump station as indicated below:

Wet- Season On/Off Criteria (feet, NGVD)	Dry Season On/Off Criteria (feet, NGVD)
Pumps 1 & 2 (250 cfs) 5.2/4.9	Pumps 1 & 2 (250 cfs) 5.7/5.4
Pumps 3 & 4 (250 cfs) 5.5/5.2	Pumps 3 & 4 (250 cfs) 6.0/5.7

Per the formulation conducted under CSOP, these operations represent an adjustment to operations specified in the 8.5 SMA GRR for the S-357 pump station (6.0 on/5.7 off) necessary to integrate the project with operations of the ENP-South Dade Conveyance System and C-111 Project modifications. The implementation of the 8.5 SMA project protection levee and C-357 seepage collection system requires integration with G-211/S-331 operations, which were based on Angels Well under IOP. Since Angels Well is located west of the 8.5 SMA protection levee and within an area of ENP to be restored by the MWD Project, adjustments to the G-211 and S-331 operations are also included for Alternative E. G-211 and S-331 operational criteria are consistent with the design for the C-111 South Dade Project from the 1994 GRR in which the structural features of the C-111 Project (detention areas and S-332B/S-332C/S-332D pump stations) were designed to convey runoff from the C-111 basin without inflows from S-331/S-173 during a design storm; during non-flood conditions, S-331 could pass flows into the C-111 basin. G-211 would serve as the hydrologic basin divide during flood management conditions in lieu of the S-331 structure. The first pump at S-331 (387 cfs design capacity) initiates if the S-331 headwater is greater than 5.3 feet, thereby preserving flood protection for areas surrounding this reach of the L-31N canal. The second and third pump units at S-331 (combined 774 cfs design capacity) are triggered for local flood risk management operations for conditions when the S-331 headwater stage exceeds

6.0 and 6.5 feet, NGVD, respectively. These operations are also intended to ensure use of the downstream C-111 detention area for management of seepage into the C-111 basin, collection of design storm basin runoff, and the reduction of damaging discharges through S-176 to Barnes Sound in accordance with C-111 South Dade Project purposes. Discharges from the L-31N Canal upstream of S-331 would be limited to gravity flow through S-173 and are constrained to conditions in the lower reach of the L-31N canal when the S-176 headwater stage is less than 4.5 feet. Use of the S-173 gravity structure is to be maximized in conjunction with the wet-season canal triggers at S-357 to move water south from this reach of the L-31N canal before the first pump at S-331 is turned on.

Similar to Increment 2, the CSOP operations included the S-357 pump station discharging into the C-111 South Dade NDA. However, CSOP also included no seasonal closures of the S-12s, new hydraulic connections between WCA 3A and WCA 3B and between WCA 3B and the L-29 Canal, no stage constraint for the L-29 Canal, an additional 450 cfs pump station to supplement the existing 500 cfs S-356 pump station, and no seepage cutoff wall along the L-31N canal. The 8.5 SMA project features have also been subsequently modified to include the C-358 seepage collection canal and S-357N gated control structure, which were not included in the CSOP evaluations.

2.1.6 ALTERNATIVE F: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT OPERATIONAL CRITERIA CHANGES AT S-197

Operational criteria for Alternative F are identical to that described for Alternative B above, but exclude the revisions to the operational criteria for S-197. Under Alternative F, S-197 would revert to the operational criteria defined in the 2012 Water Control Plan (USACE 2012c). S-197 operational criteria were adjusted during the Increment 1 and Increment 1.1 and 1.2 field tests to ensure compliance with the flood protection constraints within the C-111 basin prior to completion and operational testing of the NDA. In Alternative B, the objective of the field test operations at S-197 are developed with the objective of determining whether Increment 2 operational changes at S-197 ensure existing levels of flood are maintained within the C-111 Basin (south of S-176). The evaluation would also include an assessment of the low level trigger criteria used for S-197 gate openings and their effects on Manatee Bay. In Alternative F, there would be no consideration for the system-wide changes post-construction and no refinement to operations to ensure adequate flood protection while continuing to maintain the beneficial flows to Manatee Bay.

2.1.7 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Operational criteria for Alternative G are identical to that described for Alternative B above, except for the exclusion of additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A (*i.e.* Section 5.7 in **Appendix A, Part 1**). Under Alternative G, this additional operational flexibility would not be implemented.

2.2 ISSUES AND BASIS FOR CHOICE

The overarching project need for Increment 2, consistent with the May 2015 Increment 1 EA and FONSI and February 2017 Increment 1.1 and 1.2 EA and FONSI is to increase the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS, to the maximum extent practicable, for the benefit of natural resources. The alternatives described in **Section 2.0** were formulated, considered, and evaluated based on achievement of project objectives (**Section 1.5**) and compliance with project constraints (**Section 1.6**). Potential effects to the human environment were also evaluated (**Section 4.0**). **TABLE 2-9** provides a summary of the issues and basis for choice for the Preferred Alternative, Alternative B.

The Preferred Alternative is expected to benefit ENP by increasing flows to NESRS. Alternative B best accomplishes this objective while meeting project constraints. Alternative C is expected to improve hydrologic conditions in NESRS; however uncertainty exists regarding the ability of Alternative C to ensure the stability and safety of Tamiami Trail (U.S. 41) Highway between S-333 and S-334 and to maintain existing flood mitigation performance for the 8.5 SMA (**TABLE 2-9**). Alternative B includes constraints for the L-29 Canal based upon coordination with FDOT concerning implementation of Section 6.1.3 of the 2008 Tamiami Trail LRR as well as the Relocation Agreement dated September 25, 2008. Operational criteria for Alternative C are identical to that described for Alternative B, except that Alternative B includes constraints beyond those explicitly stated in the Relocation Agreement. Alternative C would ensure compliance with the LRR and Relocation Agreement but would relax the additional coordinated constraints. Alternative C was carried forward through the environmental effects analysis within **Section 4.0** in the event the following criteria are met: (1) written approval from FDOT to remove the L-29 Canal constraint identified in **Appendix A**, **Part 1** (*i.e.* limited duration of L-29 Canal stages near 8.5 feet, NGVD to a maximum period of 90 consecutive or cumulative days) based on a joint evaluation of monitoring data by the Corps and the FDOT; and (2) demonstration of the capability of the completed MWD Project components (including S-357N) to maintain flood mitigation requirements for the 8.5 SMA under the raised L-29 Canal maximum operating limit of up to 8.5 feet, NGVD.

Operational criteria for Alternative D are identical to that described for Alternative B, except for those criteria and related water management structures utilized to defined Column 2 operations. Uncertainty exists regarding the ability of Alternative D to ensure no reduction in current flood protection or mitigation (**TABLE 2-9**), including WCA 3A. There are three distinct modes of water management operations specified in the 2012 Water Control Plan (USACE 2012c): Column 1 (normal operations), Column 2 (high water operations), and water supply. These three modes were retained for Increment 1 and Increment 1.1 and 1.2. As initially defined in the 2002 Interim Operational Plan (IOP) for the Protection of the CSSS (IOP 2002 and IOP Supplement 2006) and retained through the 2012 Water Control Plan (USACE 2012c), Column 1 is the condition when regulatory releases from WCA 3A can be met by normal operation of the WCA 3A regulatory outlets (S-12s, S-333, S-344, S-343s, S-151). Column 2 is the condition when regulatory releases from WCA 3A are made via S-333 to the L-29 Canal and via S-334 to the L-31N Canal and the SDCS to address the reduction of WCA 3A releases due to the CSSS sub-population A closure period (*i.e.* S-12A/B, S-343A/B and S-344). Column 2 operations generally require the increased use of pumping stations S-331, S-332B, S-332C, and S-332D. During Column 2 operations, the control stages along the L-31N Canal are also lowered to help maintain existing flood risk

management along the SDCS and also to provide the necessary downstream gradient for the S-334 releases to reach the S-332B, S-332C, and S-332D pump stations. Column 2 operations were established under IOP 2002 to mitigate for potential adverse effects on WCA 3A related to actions taken to protect CSSS Sub-population A within western ENP and the native vegetation of the western marl prairie, including the seasonal closure of the S-12A, S-12B, S-12C, S-343A, S-343B, and S-344 regulatory outlets under IOP.

The 2012 Water Control Plan (USACE 2012c), which includes the operational guidance for ERTP, modified the WCA 3A Regulation Schedule from IOP, including the lowering of the top zone (Zone A) of the Regulation Schedule, the expansion of Zone E1, and removal of the seasonal closure of S-12C. These changes were expected to reduce the need for S-334 releases from WCA 3A to the SDCS during Column 2 operations. Implementation of Increment 1 and Increment 1.1 and 1.2 further decreased reliance on Column 2 (S-334) operations as a water management tool for WCA 3A, consistent with the evaluations of environmental effects documented within the May 2015 Increment 1 EA and FONSI and the February 2017 Increment 1.1 and 1.2 EA and FONSI, respectively. Alternatives considered under Increment 2 have been developed to incorporate additional limitations on the conditions under which Column 2 operations discharging WCA 3A releases through S-334 to the SDCS may be used. One of the questions that these field tests should help answer is what are the required seasonal operational canal ranges within the SDCS to best manage ENP water levels while maintaining flood protection to nearby private properties. Until such time that the system can be operated post-construction with full project build-out of the C-111 NDA and SDAs and with increased L-29 Canal stages, Column 2 operations must be retained in order to maintain current flood protection levels within WCA 3A, to ensure an adequate level of flood mitigation for 8.5 SMA and to ensure the safety and stability of Tamiami Trail (U.S. 41) Highway. Alternative D was eliminated from detailed evaluation.

Operational criteria for Alternative E are identical to that described for Alternative B, except for those criteria utilized to define operations for structures S-331 and S-357. Alternative E includes operational criteria for S-357 and S-331 as previously determined under the interagency CSOP effort. Assumptions applied during previous modeling efforts to support the CSOP TSP are inconsistent with constructed features of the MWD Project including 8.5 SMA. The CSOP TSP operational plan was not implementable as a result of modifications identified in the 2008 Tamiami Trail LRR which affected hydrologic conditions within ENP and the SDCS. Furthermore, 8.5 SMA operations evaluated within the CSOP TSP operational plan also included no seasonal closures of the S-12s, new hydraulic connections between WCA 3A and WCA 3B and between WCA 3B and the L-29 Canal, no stage constraint for the L-29 Canal, an additional 450 cfs pump station to supplement the existing 500 cfs S-356 pump station, and no seepage cutoff wall along the L-31N canal. Reference **Section 2.1.2**. Uncertainty exists regarding the ability of Alternative E to meet field test constraints, ensuring no reduction in current flood protection or mitigation for 8.5 SMA; therefore Alternative E was eliminated from detailed evaluation (**TABLE 2-9**).

A stated goal of the 1994 C-111 South Dade GRR and EIS includes the reduction of damaging freshwater discharges to Manatee Bay and Barnes Sound while maintaining flood protection to agricultural lands east of the C-111 Canal (USACE 1994). Goals also include the extension of hydroperiods within the ENP Eastern Panhandle, and the promotion of additional overland flows across the ENP Eastern Panhandle towards northeast Florida Bay. Under Alternative F, S-197

would revert to the operational criteria as defined in the 2012 Water Control Plan (USACE 2012c). Side-cast spoil material (from canal construction) on the southern side of the C-111 Canal between S-18C and S-197 has been degraded to improve sheetflow of freshwater from S-18C to ENP and Florida Bay, as well as to moderate the frequency of S-197 gate openings under the 1994 C-111 South Dade GRR and EIS (USACE 1994). S-197 maintains optimum water control stages in the C-111 Canal and prevents saltwater intrusion during high tides. S-197 is typically closed, diverting discharge from S-18C overland to the Eastern Panhandle of ENP. Releases through the structure typically only occur during flood conditions. Under Alternatives B, C, E and G, the prescribed operational criteria for S-197are expected to shift some water flow from the ENP panhandle to Manatee Bay and Barnes Sound and lower stages in the C-111 Canal (upstream of both S-18C and S-197). This is expected to occur during normal to wet hydrologic conditions. Consistent with the No Action Alternative, these additional S-197 operating criteria reduce how much S-197 is opened for the first level (normally under the 2012 WCP, S-197 is initially opened to one third of S-197 capacity) while leaving the criteria for the second level (two thirds open) and third level (full open) unchanged. The reduction in discharge for level one opening of S-197 is from approximately 800 cfs under the 2012 Water Control Plan to 500 cfs. Alternatives B, C, E, and G may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound relative to Alternative F. Low volume releases at S-197 have the potential to decrease flows to Taylor Slough, and subsequently Florida Bay. However these alternatives are expected to provide an overall benefit to ENP and Taylor Slough with increased storage availability in NESRS and reduced reliance on Column 2 operations. Taylor Slough is a major source of freshwater for Florida Bay. Potential minor adverse impacts associated with salinity fluctuations as a result of low volume S-197 discharges would be temporary and spatially limited to nearshore areas within the southern estuaries. Significant negative effects within the southern estuaries are not anticipated with Alternative B.

Increment 1 was implemented for a limited cumulative duration of approximately 4.5 months (October-December 2015, and December 2016 through February 2017). Increment 1.1 has governed operations for approximately 4 months (March-June 2017). Due to the necessity of prolonged water management deviations from normal operations during both 2016 and 2017, insufficient historical data is available to quantify the degree to which long-term reductions to WCA 3A regulatory releases to the SDCS anticipated under Increment 1 and Increment 1.1 and 1.2 have occurred. Increased flood control releases from S-197 were included within the operational strategies for Increment 1, 1.1 and 1.2 to mitigate for potential risks to flood protection for areas within South Miami-Dade County, which may be affected during the field tests by increased seepage to the L-31N Canal south of the S-331 pump station, prior to the construction and operation of the C-111 South Dade Project NDA. This increased seepage is expected to be fully manageable with operation of the C-111 South Dade Project NDA. However, since Increment 2 will be the initial opportunity to gain operational experience with the NDA, Increment 2 will continue to retain the management operating criteria for S-197 as provided in the No Action Alternative. This provides flexibility to maintain flood risk management for southeastern Miami Dade County, if needed. Relative to the No Action Alternative, Alternative B has expanded the use of low-volume S-197 operations to include drier periods under Condition 1 when the stage at G-3273 is below 6.6 feet, NGVD and the WCA 3A stage is below the Increment 1 and 2 Action Line; the No Action Alternative criteria for S-197 were consistent with the 2012 Water Control Plan, with level 1 gate openings starting at 800 cfs. Alternative F was eliminated from detailed

evaluation as uncertainty exists regarding the ability of Alternative F to ensure no reduction in current flood protection or mitigation. It is the intention of the Corps that the operating criteria for S-197 will revert to the 2012 Water Control Plan under COP once all features of the C-111 South Dade and MWD Projects are constructed, operational, and tested, if supported by the analysis of the data collected after the field tests.

It should be noted that Alternatives B, C, D, and E include additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A (**FIGURE 2-2**). Under this condition, discharges at S-197 may be increased up to a maximum of 2,400 cfs as summarized in **Section 2.1.2** and detailed in **Appendix A, Part 1**. However, these operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years with an average duration of 51 days (**TABLE 4-1**).

Alternative B best accomplishes the objective of benefiting natural resources within ENP while meeting project constraints. Alternative B is expected to provide minor beneficial effects on wetland vegetation and fish and wildlife resources through improved hydroperiods and increases in forage prey availability. Vegetation and fish and wildlife resources within WCA 3A would not be expected to significantly change with implementation of Alternative B; however, Alternative B includes additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. Prolonged periods of inundation are of particular concern for tree islands within WCA 3A and eliminate foraging and nesting opportunities for wading birds. Prolonged periods of inundation also presents concerns for mammals dependent on upland habitat. Exclusion of this action line from the operational schedule will result in slower operational responses to extreme wet conditions in WCA 3A. Alternative B is the Preferred Alternative.

Based on evaluation of the regional modeling conducted in support of the ERTP 2016 ESA consultation, components from the BO modeling which require modifications to the 2012 Water Control Plan were previously included in the operational criteria governing Increment 1.1 and 1.2, consistent with the requirements of the RPA, and these components remain unaltered within Increment 2. Annex 1 of Appendix A of the February 2017 EA and FONSI for Increment 1.1 and 1.2 provides criteria that must be adhered to during operations to remain in compliance with the 2016 USFWS ERTP BO (USACE 2017a). The intent of this criteria remains applicable to operational criteria defined under Alternative B. Alternative B addresses the mandated RPA of the 2016 ERTP BO to raise the maximum operating limit in the L-29 canal up to a maximum of 8.5 feet, NGVD. The RPA specifies that the Corps shall proceed as scheduled for completing NEPA analysis on Increment 2 and, as allowable by law, raising L-29 Canal levels up to 8.5 feet, NGVD prior to March 1, 2018.

TABLE 2-9. ISSUES AND BASIS FOR CHOICE: SELECTION OF THE PREFERRED ALTERNATIVE (ALTERNATIVE B)

ALTERNATIVE	MEETS FIELD TEST OBJECTIVES	MEETS FIELD TEST CONSTRAINTS				ENVIRONMENTAL EFFECTS				
		L-29 Canal maximum operating limit of 8.5 feet, NGVD to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334.	Maintain the authorized purposes of the C&SF Project modified to include: MWD Project C-111 South Dade Project CERP	No reduction in current flood protection or mitigation	Consistency with applicable Biological Opinions	WCA 3A*	NESRS	TAYLOR SLOUGH	MANATEE BAY AND BARNES SOUND*	REDUCTION IN FLOWS TO SDCS FROM WCA 3A*
A (NO ACTION)	NO	NO	YES	YES	YES	0	0	0	0	0
B (PREFERRED)	YES	YES	YES	YES	YES	++*	++	++	-	+
C	YES	UNCERTAIN	YES	YES	YES	+++*	+++	+++	0	++
D	YES	YES	YES	UNCERTAIN	YES	+*	++	++	-	+++
E	YES	YES	YES	NO	YES	++*	++	++	--	+
F	YES	YES	YES	UNCERTAIN	YES	++*	++	++	+	+

G	YES	YES	YES	YES	YES	++	++	++	-	+

- NEGATIVE, + POSITIVE, 0 NEUTRAL (NO CHANGE FROM EXISTING CONDITIONS/ALTERNATIVE A)

* - NEGATIVE, + POSITIVE, 0 NEUTRAL REPRESENTS ADDITIONAL INCREASE IN FLOWS TO NESRS AS A RESULT OF INCREASING THE MAXIMUM OPERATING LIMIT OF THE L-29 CANAL. THE TABLE DOES NOT REFLECT ADDITIONAL BENEFITS OR IMPACTS EXPECTED UNDER ALTERNATIVES B, C, D, E, AND F AS A RESULT OF ADDITIONAL OPERATIONAL FLEXIBILITY TO ALLOW FOR RAPID RESPONSE TO EXTREME HIGH WATER LEVELS IN WCA 3A.

CHART REQUIRES INTERPRETATION. ADDITIONAL JUSTIFICATION WITH RESPECT TO ENVIRONMENTAL EFFECTS IS FOUND IN **SECTION 4.0**.
COMPARISON OF THE NO ACTION ALTERNATIVE WITHIN **SECTION 4.0** (*I.E.* INCREMENT 1.1 AND 1.2) IS RELATIVE TO INCREMENT 1.

2.3 ALTERNATIVES ELIMINATED FROM DETAILED EVALUATION

Alternatives D, E, and F were eliminated from detailed evaluation for the reasons outlined in **Section 2.2**. Uncertainty exists regarding the ability of these Action Alternatives to meet field test constraints, specifically the capability to maintain the flood risk management constraints for WCA 3A, 8.5 SMA, and southeastern Miami Dade County.

2.4 PREFERRED ALTERNATIVE

Based upon the impact analysis conducted within this EA, Alternative B with a transition to Alternative C, if and when conditions are met, is the Preferred Alternative. This plan is expected to best meet the objectives and constraints identified in **Sections 1.5** and **1.6**. Summary details of the Preferred Alternative are listed below:

- The 2012 Water Control Plan will continue to govern water management operations during Increment 2 with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S- 355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177, and S-197 as contained in the Operational Strategy. The water level constraint at G-3273 will not be a pre-determined constraint, allowing NESRS to receive more water pursuant to the WCA 3A Regulation Schedule and Rainfall Plan relative to the 2012 Water Control Plan. G-3273 will be used as an indicator to define when NESRS is experiencing low, moderate, and high water levels. The WCA 3A water level (as measured using the average of monitoring gauges/sites 63, 64, and 65) will be utilized to define the priority of releases from S-333 and S-356 to the L-29 Canal and NESRS. The L-29 Canal inflow structures (S-333, S-355A/B, and S-356) will be operated with the intention of limiting event durations with L-29 Canal stages above 8.5 feet NGVD to a target maximum duration of 72 hours. Once the stage in the L-29 Canal reaches a stage of 8.5 feet, NGVD, input from all structures that discharge into the canal (S-333, S-355A/B, and S-356) shall be stopped until the level in the L-29 Canal recedes below 8.5 feet, NGVD. For each water year (May through April), the L-29 Canal inflow structures will be managed to limit the duration of L-29 Canal stages near 8.5 feet (as measured at the S-333 TW), NGVD to 90 cumulative days or to a maximum of 90 consecutive days. The number of either cumulative or consecutive days in each period (only one period per water year) will be measured when L-29 stages exceed 8.3 feet, NGVD. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages at 8.5 feet, NGVD for longer than 90 days will require written approval from the FDOT. The L-29 stage will be maintained at or below 8.5 feet, NGVD by ceasing inflow into L-29 when the L-29 stage rises above 8.5 feet, NGVD. Event driven criteria will be followed in accordance with Table 1 of **Appendix A, Part 1**. Continued L-29 structure inflows which result in consecutive durations with L-29 Canal stages above 8.3 feet for longer than 90 days will require written approval from the FDOT, given evaluation of the monitoring data by FDOT.
- The MWD 8.5 SMA features and the C-111 South Dade Project NDA components will be operated to accommodate increased flow to NESRS while evaluating whether the operational criteria meet the field test objectives and constraints, most notably no reduction in current flood mitigation for the 8.5 SMA.

- Water management operations will likely result in increased seepage to the L-31N Canal as increased flow into NESRS will likely increase stages along the west side of L-31N. This increase is expected to be fully manageable with operation of the C-111 South Dade Project NDA. However, since Increment 2 will be the initial opportunity to gain operational experience with the NDA, Increment 2 will continue to retain the management operating criteria for S-197 as provided in Increment 1.1 and 1.2. This provides flexibility to maintain flood risk management for southeastern Miami Dade County if needed. It is the intention of the Corps that the operating criteria for S-197 will revert to the 2012 Water Control Plan once all features of the C-111 South Dade and MWD Projects are constructed and operational, if supported by the analysis of the data collected after the field test. S-173 releases and pumping with S-331 have previously been used : (1) maintain target L-31N Canal stages; (2) provide flood mitigation to the 8.5 SMA eastern areas and assist S-357 in maintaining flood mitigation for the 8.5 SMA when S-357 operational capacity is limited; and (3) convey WCA 3A regulatory releases to the SDCS from S-334 during Column 2 operations. With Increment 2, 8.5 SMA flood mitigation requirements are shifted to an increased reliance on S-357 given full operability of the NDA and a reduced dependency of 8.5 SMA on S-331. Column 2 operations are also generally reduced.
- In the event remaining construction components of C-111 South Dade Contract 8 are incomplete prior to March 1, 2018 and preclude operation of the NDA as required for full implementation of Increment 2, the operating criteria previously established under Increment 1.1 and 1.2 will govern the following structures that are affected by the construction activity (L-29 Canal, including S-333, S-355A, S-355B, S-356, S-331, S-357, S-357N; L-31N Canal, including S-332BN, S-332BW, S-332C, S-332D, S-194, S-196, and S-176). Once construction of the NDA is verified as functionally complete, all operations developed under this Increment 2 Operational Strategy will be implemented.
- Additional operational flexibility has been included within Increment 2 to allow for a rapid response to extreme high water levels in WCA 3A. Extreme high water levels in WCAs is defined as when any of these two conditions are met: (1) WCA 3A is above the Extreme High Water Action Line; and (2) the SFWMD monthly position analysis (monthly, semi-monthly) shows at least a 10 percent probability of WCA 3A, 3 station average exceeding 12.7 feet, NGVD along with other forecast information prior to September 15.
- Increment 2 will extend until implementation of COP anticipated January 1, 2020.
- Multiple purposes of the C&SF Project to provide flood control, water supply for municipal, industrial, and agricultural uses, prevention of saltwater intrusion, water supply for ENP and protection of fish and wildlife will be maintained. A Monitoring Plan has been developed for Increment 2. Existing monitoring currently being funded by the Corps and/or other Federal and state agencies is noted in **Appendix C**. Roles and responsibilities are also identified within the Monitoring Plan.

The Preferred Alternative (Alternative B) is expected to benefit ENP by increasing flows to NESRS. Alternative B best accomplishes this objective while meeting project constraints. Alternative C is expected to improve hydrologic conditions in NESRS; however uncertainty exists regarding the ability of Alternative C to ensure the stability and safety of Tamiami Trail (U.S. 41) Highway between S-333 and S-334 and to maintain existing flood mitigation performance for the 8.5 SMA. Operational criteria for Alternative C are identical to that described for Alternative B, except that Alternative B includes constraints based upon coordination with FDOT under the

Relocation Agreement. The Corps has coordinated with FDOT on implementation of the Relocation Agreement to apply constraints for the L-29 Canal in accordance with Section 6.1.3 of the 2008 Tamiami Trail LRR as well as the Relocation Agreement dated September 25, 2008. Alternative C would relax the coordinated constraints that go beyond explicit constraints in the Relocation Agreement and would not occur without: (1) written approval from FDOT to remove the L-29 Canal constraint identified in Appendix A, Part 1 (*i.e.* limited duration of L-29 Canal stages near 8.5 feet, NGVD to a maximum period of 90 days) based on a joint evaluation of monitoring data by the Corps and the FDOT; and (2) demonstration of the capability of the completed MWD Project components (including S-357N) to maintain flood mitigation requirements for the 8.5 SMA under the raised L-29 Canal maximum operating limit of up to 8.5 feet, NGVD. If the above conditions were met the Corps would prepare a revised FONSI to implement Alternative C in place of Alternative B. This may result in realization of additional benefits closer to those characterized for Alternative C under **Section 4.0**. The implementation of the Proposed Action will extend until the implementation of COP currently anticipated in January 1, 2020. The implementation of COP would supersede the implementation of Increment 2.

3 AFFECTED ENVIRONMENT

3.1 GENERAL ENVIRONMENTAL SETTING

The remaining portion of the Greater Everglades wetlands includes a mosaic of interconnected freshwater wetlands and estuaries located primarily south of the Everglades Agricultural Area (EAA). A ridge and slough system of patterned, freshwater peat lands extends throughout the WCAs into SRS in ENP. The ridge and slough wetlands drain into tidal rivers that flow through mangrove estuaries into the Gulf of Mexico. Higher elevation wetlands that flank either side of SRS are characterized by marl substrates and exposed limestone bedrock. Those wetland areas located to the east of SRS include the drainage basin for Taylor Slough, which flows through an estuary of dwarf mangrove forests into northeast Florida Bay. The Everglades wetlands merge with the forested wetlands of Big Cypress National Preserve (BCNP) to the west of WCA 3.

Declines in ecological function of the Everglades have been well documented. Construction of canals and levees by the C&SF Project has resulted in the creation of artificial impoundments and has altered hydroperiods and depths within the project area. The result has been substantially altered plant community structures, reduced abundance and diversity of animals and spread of non-native vegetation.

A complete description of the affected environment with respect to the MWD Project operational field tests (*i.e.* Increment 1 and Increment 1.1/1.2) is discussed within the 2015 AND 2017 EAs, respectively (USACE 2015 and USACE 2017a). Further information regarding 8.5 SMA can be found within the July 2000 8.5 SMA GRR/FSEIS (USACE 2000), 2011 Proposed Interim Operating Criteria for 8.5 SMA EA (USACE 2011), and 2012 design refinement for the 8.5 SMA EA (USACE 2012a).

3.2 CLIMATE

The climate of south Florida is subtropical. Seasonal rainfall patterns in south Florida resemble the wet and dry season patterns of the humid tropics more than the winter and summer patterns of temperate latitudes. Of the 53 inches of rain that south Florida receives on average annually, 75% falls during the wet season months of May through October. Tropical storms and hurricanes also provide major contributions to wet season rainfall. During the dry season (November through April), rainfall is governed by large-scale winter weather fronts that pass through the region approximately weekly. However, due to the variability of climate patterns (La Niña and El Niño), dry periods may occur during the wet season and wet periods may occur during the dry season. High evapotranspiration rates in south Florida roughly equal annual precipitation. Mean annual temperature for the south Florida ecosystem ranges from 72 ° Fahrenheit (F) (22 ° Celsius [C]) in the northern Everglades to 76 ° F (24 °C) in the southern Everglades (Thomas 1974). There is now evidence of anthropogenic changes to global climate patterns that will likely have an impact on south Florida in terms of rainfall, evapotranspiration, and temperature.

3.3 GEOLOGY AND SOILS

The geology and soils of South Florida represent many of the opportunities, constraints, and impacts of regional water management. The high transmissivity of the Biscayne Aquifer allows rapid recharge of lower east coast well fields while it sets the stage for water competition between

the Everglades and Biscayne Bay regarding the issue of seepage control. The loss of peat soils of the Everglades provides an indicator of ecosystem change due to drainage activities. Peat soils predominate in previously flooded areas. Peat soils have subsided as a result of oxidation due to drainage, which has affected local topography and hydroperiods.

The lower east coast on the Atlantic Coastal Ridge is mostly underlain by thin sand and Miami Limestone that are highly permeable and moderately to well-drained. To the west of the coastal ridge, soils of the lower east coast contain fine sand and loamy material and have poor drainage. Rockland areas on the coastal ridge in Miami-Dade County are characterized by weathered limestone surfaces and karst features such as solution holes and sinkholes. Higher elevation marshes of the southern Everglades on either side of SRS are characterized by calcitic marl soils deposited by calcareous algal mats and exposed lime rock surfaces with karst features such as solution pits and sinkholes.

3.4 STUDY AREA LAND USE

The existing land use within the study area varies widely from agricultural to high-density multi-family and industrial urban uses. Much of the land use/cover change occurring in south Florida over the past several years can be categorized as either the creation of new developments in previously natural or agricultural areas, or the change in the types of agriculture practiced. Generally, urban development is concentrated along the Lower East Coast (LEC) from Palm Beach County to Miami-Dade County. WCA 3, located directly north of ENP, is part of the Everglades Complex of Wildlife Management Areas and are managed by the Florida Fish and Wildlife Conservation Commission (FWC).

3.5 HYDROLOGY

The major characteristics of south Florida's hydrology are: (1) local rainfall; (2) evapotranspiration; (3) canals and water control structures; (4) flat topography; and (5) the highly permeable surficial aquifer along a thirty to forty mile-wide coastal strip. Local rainfall is the source of all of south Florida's fresh water. The surface water that is not removed from the land by evapotranspiration and seepage to the underlying aquifer is drained to the Atlantic Ocean, Florida Bay, or the Gulf of Mexico by very slow, shallow sheetflow through wetlands or relatively quickly through man-made canals.

Levees and canals constructed during the last 60 years under the C&SF Project have divided the former Everglades into areas designated for development and areas for fish and wildlife benefits, natural system preservation, and water storage. The natural areas consist of the three WCAs located north of Tamiami Trail. ENP is located south of Tamiami Trail. The WCAs provide detention storage for water from Lake Okeechobee, the EAA, and parts of the east coast region. Detention of water helps prevent floodwaters from inundating the east coast urban areas; provides water supply and detention for east coast urban and agricultural areas and ENP; improves the water supply for east coast communities by recharging underground freshwater aquifers; reduces seepage; and provides control for saltwater intrusion in coastal aquifers. While the WCAs may reduce the severity of the drainage of the Everglades caused by the major canal systems, thus reducing impacts to fish and wildlife caused by the major drainage systems, the levees surrounding the WCAs still function to impound the Everglades, precluding the historic flow patterns. The C&SF Project infrastructure, combined with operational constraints, makes it difficult to provide

natural timing, volume and distribution. In wet periods, water is impounded in the WCAs and then discharged to ENP or coastal canals for eventual release to tide. During dry periods, water can flow through the canals to coastal areas and bypass the ENP wetlands.

3.5.1 WATER CONSERVATION AREAS 3A AND 3B

The largest WCA is WCA 3, which is divided into two parts, 3A and 3B. It is approximately 40 miles long from north to south and covers approximately 915 square miles. Ground elevations slope southeasterly one to three feet in ten miles ranging from 13 feet, NGVD in northwest WCA 3A to 6 feet, NGVD in southeast WCA 3B. The area is enclosed by approximately 111 miles of levees, of which 15 miles are common to WCA 2. An interior levee system across the southeastern corner of the area reduces seepage into an extremely pervious aquifer.

The upper pool, WCA 3A, provides an area of approximately 752 square miles for storage of excess water from the following sources: regulatory releases from WCA 2A; rainfall excess from approximately 750 square miles in Collier and Hendry counties (through Mullet Slough); flood control inflows from 71 square miles of the former Davie agricultural area lying east of pump station S-9 in Broward County; and excess water from a 208 square mile agricultural drainage area of the Miami Canal and other adjacent EAA areas to the north. WCA 3A provides water supply to the LEC, as well as the SDCS, in accordance with the WCA 3A Regulation Schedule, and WCA 3A provides water deliveries to ENP in accordance with the Rainfall Formula and the WCA 3A Regulation Schedule, collectively referred to as the Rainfall Plan (USACE 2006). Due to its limited discharge capacity compared to the spatial extent of the watershed from which it receives water, consecutive rainfall events have the potential to quickly utilize potential storage within WCA 3A and result in discharges from WCA 3A to SRS and/or the SDCS via the S-12 structures and/or S-333 and S-334.

South of WCA 3 and within ENP, the northern portion of SRS is also partially divided by the remaining 5.5 miles of the L-67 Extension Levee, which extends south from the southern terminus of L-67A at Tamiami Trail. Outflows from WCA 3A to ENP are regulated according to the WCA 3A Regulation Schedule, with some additional WCA 3A outflows to ENP from groundwater seepage across Tamiami Trail and seasonal surface water flows through the L-28 gaps, which then continue south along the L-28 borrow canal towards the Tamiami Trail bridges west of S-12A.

Stage variability within WCA 3 typically follows an annual cycle; the levels vary from high stages in the late fall and early winter to low stages at the beginning of the wet season (typically late May or early June). Water stages within WCA 3A typically exceed the top of the WCA 3A Regulation Schedule during the months of August through October, with this duration extended to earlier in the wet season (May) and/or later into the dry season (November and December) during wet years. Above-normal rainfall patterns associated with El Niño conditions during the dry season months (November through May) may also result in water stages which exceed the top of the Regulation Schedule. Overall, water stage decreases from northwest to southeast within WCA 3, consistent with the general direction of surface water flow and prevailing topography within WCA 3. Water depth is typically between one to two and a half feet, with the shallower waters in the higher elevation northwestern portion of WCA 3. Water stages and depths in WCA 3B are typically much lower than water stages and depths in WCA 3A, due to limited surface water inflows into WCA 3B and the reduction of seepage from WCA 3A to WCA 3B consistent with the design purpose of

the L-67A and L-67C levees. Water levels in WCA 3B are affected by seepage losses to the east towards the L-30 borrow canal and seepage losses to the south towards the L-29 Canal.

Water supply deliveries from the C&SF Project (also known as the Regional system) to coastal canals are utilized to recharge coastal well fields and to prevent saltwater intrusion into the Biscayne aquifer. When canal levels drop below adequate recharge levels due to a combination of well field drawdowns, evaporation, and lack of rainfall, water supply deliveries are typically made from the Regional system. When canal levels drop in Miami-Dade County, regional water supply is delivered from WCA 3A through one of two delivery routes. Depending on system conditions, both routes may be utilized concurrently. For the northern delivery route from WCA 3A, water supply deliveries are either released from S-151 to the Miami Canal within WCA 3B (C-304), followed by downstream releases to either Miami-Dade County's SDCS by utilizing S-337 and/or by utilizing S-31 to release into the C-6 Canal. For the southern delivery route from WCA 3A, water supply deliveries are released from S-333 (from the upstream L-67A Canal), passed through the L-29 Canal, and are released to the SDCS by utilizing S-334.

The most important component of the groundwater system within the study area is the Biscayne aquifer, an unconfined aquifer unit underlying an area of approximately 3,000 square miles in southeast Florida, from southern Palm Beach County southward through Broward County to South Miami-Dade County. Groundwater in WCA 3 generally flows from the northwest to the southeast, with extensive seepage across the eastern and southern levees, L-30 (southeast corner of WCA 3B) in particular. However, the direction of groundwater flow may be locally influenced by rainfall, drainage canals, or well fields. Fluctuations in groundwater levels are seasonal. Groundwater levels within WCA 3 are influenced by water levels in adjacent canals. Where there is no impermeable formation above the aquifer, surface water recharges the system and the groundwater level can rise freely. In times of heavy rainfall, the aquifer fills and the water table rises above the land surface, contributing to seasonal inundation patterns throughout the area.

3.5.2 NORTHEAST SHARK RIVER SLOUGH

NESRS is a complex area located in the northeast corner of ENP. It is currently the northern terminus of SRS, which is aligned from the northeast to southwest across ENP. Tamiami Trail is the northern boundary, the L-31N Canal the eastern boundary, and the L-67 Extension Canal the western boundary of the NESRS. Prior to construction and operation of the C&SF Project, NESRS would have been characterized as wet most of the year, but regional developments have impacted historic freshwater routes into the area. In addition, if historic levels are not maintained through the end of the wet season, significant reductions in surface water can occur during the dry season below historic dry season levels.

Water enters NESRS primarily from WCA 3A via S-333, and then to the L-29 Borrow Canal and subsequent passage through several sets of culverts and the one-mile Tamiami Trail bridge (completed as part of the MWD Project in 2013) under Tamiami Trail. S-355A and S-355B may also be used to deliver water from WCA 3B to the L-29 Canal for subsequent passage through the culverts to NESRS. The discharges made from WCA 3A through the S-12 structures and S-333 are target flows determined from the Rainfall Plan (USACE 2012a). Under the Rainfall Plan, water deliveries would be computed and operations adjusted weekly, if necessary based on the sum of two components: a rainfall response component and a WCA 3A regulatory component.

When flows through the S-12 structures are determined necessary by the WCA 3A Regulation Schedule and the Rainfall Plan, water managers prioritize flow through the easternmost S-12 structures as capacity allows, in order to minimize flow through the S-12A and S-12B structures. The historical operational target flow distribution of 55% through S-333 into NESRS and 45% through the S-12 structures into ENP west of the L-67 Extension is no longer used as a constraint governing water management operations of WCA 3A and northern ENP under ERTP. Weekly WCA 3A water management release decisions are coordinated with ENP. Eastern portions of the ENP are also influenced by the system of canals and structures that provide flood control and water supply for the LEC urban and agricultural areas.

3.5.3 WESTERN SHARK RIVER SLOUGH

Western SRS located to the west of L-67 Extension Levee and bounded on the north by Tamiami Trail, is primarily influenced by rainfall and water management operations at the S-12 structures (A, B, C and D). Under the ERTP, the utilization of the S-12 structures and the seasonal sequential closure periods beginning from the west at S-12A (November 1 through July 15) and S-12B (January 1 through July 15) is meant to move water from WCA 3A into SRS while providing conditions for Cape Sable seaside sparrow Subpopulation-A (CSSS-A) nesting and breeding. Releases from WCA 3A are specified by the Rainfall Plan, which includes the regulation schedule for WCA 3A and the Rainfall Formula. This Rainfall Based Management Plan consists of a rainfall-based delivery target and a supplemental regulatory component that specifies the total amount of water to be delivered to ENP in weekly volumes through the S-333 and S-12 structures; additional details for the Rainfall Plan are provided in Section 3.6.

3.5.4 TAYLOR SLOUGH

Taylor Slough is in the southeast quadrant of ENP. The area through the Rocky Glades and Taylor Slough is higher in elevation compared to ground levels north, south, or west. Because of this characteristic, the area is normally drier than other areas in the ENP. The Rocky Glades and Taylor Slough are somewhat like an island or a peninsula extending from the canals into the ENP. Under ERTP, specified C-111 basin canal water levels/ranges and S-332D pump station operations have resulted in Taylor Slough being provided water from the C-111 Basin mainly during the wet season. During the dry season, under ERTP, water deliveries to Taylor Slough were limited to provide conditions conducive to CSSS Sub-population C nesting (325 cfs from December 1 – January 31; 250 cfs from February 1 – July 14).

Since completion of the S-332D Detention Area in 2003, maximum surface water flows observed at the Taylor Slough Bridge (approximately 1.8 miles downstream of the existing L-31W gap and the remnant S-332/S-332I pump stations) typically range between 250 and 550 cfs during the wet season months of June to October. The flow at Taylor Slough includes contributions from the S-332D Detention Area and flow-way, southerly flow within the remnant L-31W Canal (including significant seepage inflows from the S-332D Detention Area), and drainage from the adjacent ENP wetlands. The S-332D Detention Area includes the High Head Cell (a portion of the S-327 weir was degraded by SFWMD in August 2016, as part of the C-111 South Dade Project), the Cell 1 detention area, the Cell 2 detention area, and the flow-way cell. **FIGURE** 3-1 and **FIGURE** 3-2 provide an overview of the S-332D Detention Area and the northern reaches of the L-31W Canal, including prevalent surface water flow pathways (indicated by green arrows) and seepage/groundwater flow pathways (indicated by blue arrows). Backfill and/or plugs within the

remnant segments of the L-31W Canal will reduce seepage losses from the S-332D Detention Area to the L-31W Canal, reduce drainage of the adjacent ENP wetlands by the L-31W Canal, and promote increased sheetflow to Taylor Slough. Additional plugs along the L-31W Canal were constructed between June and September 2017 by the SFWMD as part of the C-111 South Dade Project (Reference **Section 1.3.2**).

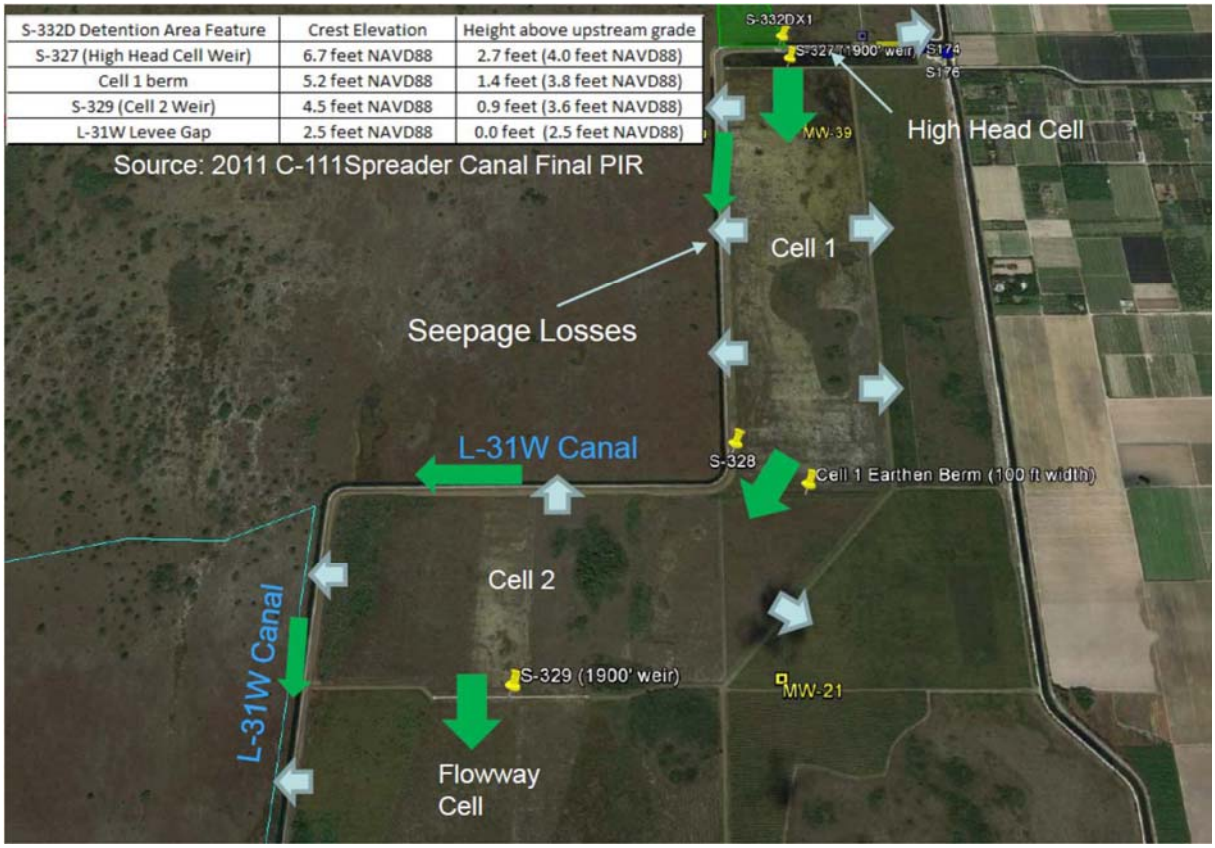

FIGURE 3-1. NORTHERN S-332D DETENTION AREA.

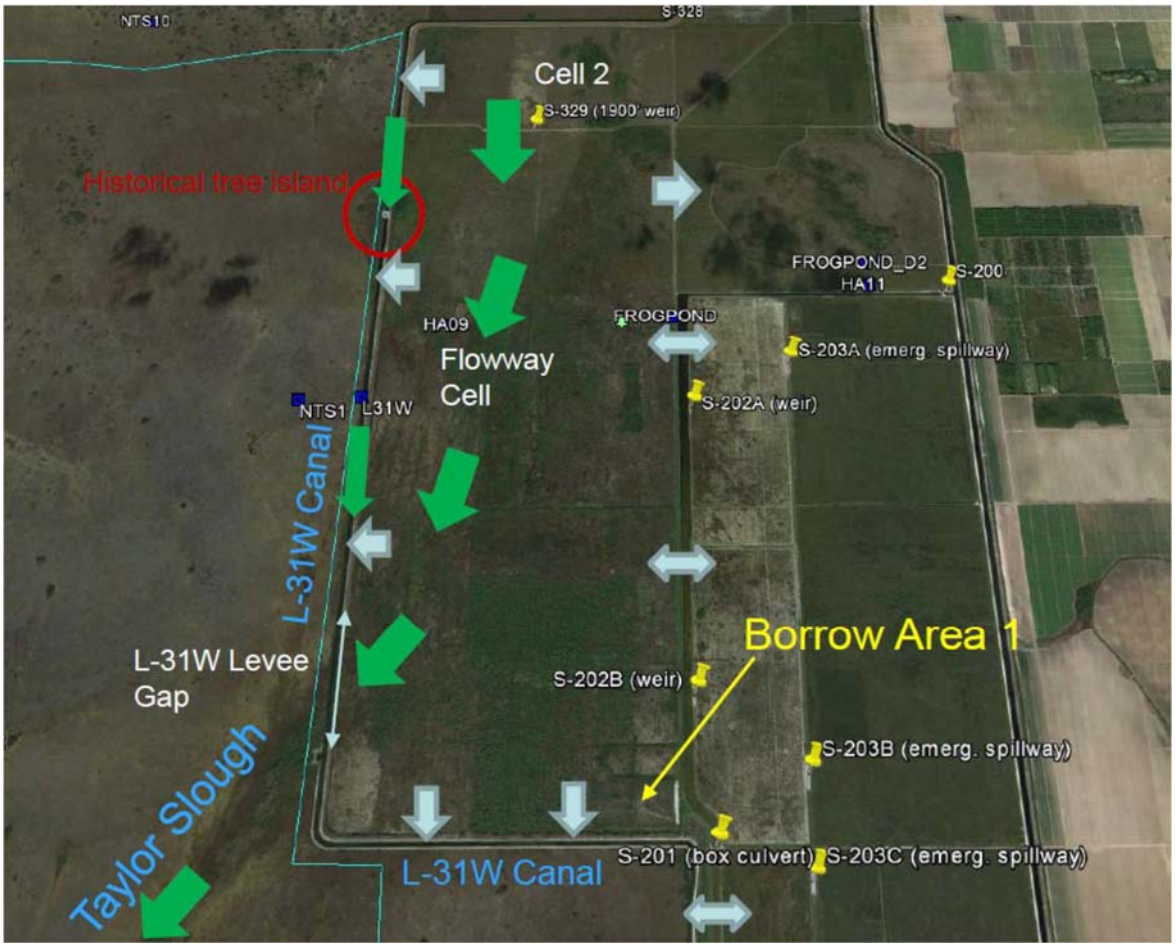

FIGURE 3-2. SOUTHERN S-332D DETENTION AREA

3.5.5 LOWER EAST COAST AREA

The LEC area is located to the east of the L-31N, L-31W, and C-111 canals. Under ERTP, specified canal water levels/ranges are meant to provide flood protection, water supply, and prevention of saltwater intrusion for the LEC. The LEC can be provided water supply from WCA 3A and Lake Okeechobee according to their respective regulation schedules. In wet conditions, the excess water from the LEC is discharged to tide.

3.5.6 8.5 SQUARE MILE AREA

The 8.5 SMA is a primarily residential area adjacent to, but west of, the L-31N Canal. The 8.5 SMA, which is also known as the Las Palmas community, is bordered on both the west and north by NESRS. In 2000, the Corps prepared the MWD General Reevaluation Report (GRR) and a Final Supplemental Environmental Impact Statement (SEIS) to assist in the selection of a Recommended Plan for providing flood mitigation to the 8.5 SMA while allowing for restoration of the NESRS as authorized by the MWD Project. Consistent with the 1992 GDM analysis, it was a requirement of the reevaluation to analyze alternatives that provided no increase in flooding above and beyond what existed prior to the authorization of the MWD Project. As a result of the Corps implementing the 8.5 SMA flood mitigation project, the Las Palmas community has water

management infrastructure consisting of a perimeter levee, a seepage collection canal, a pump station (S-357), and a southern detention area meant to collectively provide flood mitigation as part of the MWD Project (USACE 2000). An additional seepage collection canal along Richmond Drive (C-358) has been operational since April 2016 to manage water stages within the southwest corner of the 8.5 SMA. A new gated water control structure (S-357N) at the junction of the C-358 and C-357 canals, presently planned for completion in February 2018, will replace the current temporary by-pass culverts to allow operational control to manage C-358 stages higher than C-357 when flood mitigation is provided for the southwest corner of the 8.5 SMA.

The GRR/SEIS presented hydrologic modeling simulations, social impact assessments, policy analysis, real estate information, engineering design and cost analysis, environmental impact assessment, economics calculations and review of public concerns. The Record of Decision (ROD) for the 8.5 SMA GRR/SEIS stated that it would be implemented with added assurances and conditions described therein. One of those assurances and conditions required by the ROD is that "periodic flooding of landowners east of the proposed levee, before and after project implementation, will remain unchanged from conditions in existence prior to implementation of the MWD Project except where flowage easements are required." The ROD further prescribed that: "Implementation of the Recommended Plan should not adversely impact the restoration levels of Everglades National Park's hydrology greater than that simulated through modeling of Alternative 6D" (the GRR Recommended Plan); "A monitoring, evaluation, and reporting program shall be implemented to ensure operations are consistent with these levels"; and "No deviations are intended from the operations specified in the Manual (*i.e.*, increased pumping in the seepage canal or the inclusion of additional pumps) due to anticipated public demand for increased flood relief inside the perimeter levee of the 8.5 SMA Project." The Hydraulic and Hydrogeologic Model Report (Appendix A) for the 2000 GRR also recognized that the final operation of the C-111SD pump stations and detention areas would require further study beyond the scope of the GRR effort, while also including recognition that the C-111SD components represented a large change in the local flow regime which could affect the study area.

The 8.5 SMA, when fully constructed and operational, will provide mitigation for the increased water levels that will occur once the MWD project is fully implemented and the associated MWD additional water flows are delivered to ENP. The 8.5 SMA flood mitigation features do not work independently, as full mitigation is dependent on both the MWD 8.5 SMA features and the C-111 South Dade project features. The MWD project and the C-111 South Dade project work together, and more water deliveries (out of WCA 3A and into the ENP) cannot occur without adversely impacting private property within the 8.5 SMA until the C-111 South Dade NDA is constructed, operational, and connected to the 8.5 SMA Detention Cell. The hydraulic connection between the 8.5 SMA and the NDA, which was envisioned by the 2000 MWD GRR/EIS for the 8.5 SMA, creates an interdependency between MWD and C-111SD project operations which affects the flood mitigation performance for the MWD 8.5 SMA components, the flood protection performance of the C-111SD project components, and the hydrologic/ecological benefits for both the MWD and C-111SD projects. Completion of NDA components and the levee components adjacent to the 8.5 SMA included in the C-111 South Dade ongoing construction contracts is integral to allowing more water to flow south into the ENP, and to ensure the 8.5 SMA features provide the flood mitigation required for the MWD project.

The full implementation of the MWD Project cannot occur until flood mitigation is provided to the 8.5 SMA. Throughout all phases of the MWD field test, the Corps operations within the L-29 Canal and NESRS cannot cause the 8.5 SMA to endure a greater duration of high water than they would have experienced prior to construction of the MWD project and prior to MWD implementation of increased flows to ENP. The COP development during 2018-2019 will utilize regional hydrologic modeling in order to balance the ecological restoration objectives of the MWD and C-111SD projects while demonstrating compliance with the project constraints, which will include requirements to maintain the seepage mitigation for project in the 8.5 SMA and to maintain the level of flood damage reduction associated with the 1994 C-111 GRR Recommended Plan. The results from the future COP development will be used to update the flood mitigation analysis for the MWD 8.5 SMA GRR and to update the flood risk management analysis from the 1994 C-111 South Dade GRR, which did not then identify inter-basin transfer of water from the MWD 8.5 SMA to the C-111SD Project lands. Development of the COP will be informed by the MWD Increment 1, Increment 1.1 and 1.2, and Increment 2 field tests. Constraints included in the monitoring plans for the field tests may result in discontinuation of the field tests if adverse impacts to flood damage reduction are indicated as a result of the field test operations.

Prior to completion of the regional hydrologic modeling under the COP, and prior to further raising the maximum operating stage limit for the L-29 Canal, the hydrologic monitoring for the Increment 1.1 and 1.2 field test and the proposed Increment 2 field test will continue to conduct real-time monitoring of 8.5 SMA flood mitigation performance. Hydrologic response from increased stages in NESRS and the observed effects within the 8.5 SMA are continually analyzed across a wide range of temporal scales, including daily (early detection metrics), weekly, monthly, seasonal, and annual (water year) periods to inform real-time operations and identify potential performance limitations of the current 8.5 SMA and C-111 South Dade infrastructure configuration. Complete details regarding the ongoing flood mitigation assessment methodology for the 8.5 SMA, continued from Increment 1.1 and 1.2, is provided in the Increment 2 monitoring plan (**Appendix C**, **Part 1**, **Annex 2**).

3.5.7 BISCAYNE BAY

Biscayne Bay is a shallow, tidal sound located near the extreme southeastern part of Florida. Biscayne Bay, its tributaries, and Card Sound are designated by the State of Florida as aquatic preserves, while Card and Barnes Sounds are part of the Florida Keys National Marine Sanctuary. A significant portion of the central and southern portions of Biscayne Bay comprise Biscayne National Park. Under ERTP, specified canal water levels/ranges are meant to provide flood protection for the portions of the LEC and Miami-Dade County, which may result in discharges to Biscayne Bay.

3.5.8 FLORIDA BAY

Florida Bay and the Ten Thousand Islands comprise approximately 1,500 square miles of ENP. The bay is shallow, with an average depth of less than three feet. To the north is the Florida mainland and to the south lie the Florida Keys. Sheet flow across the marl prairies of the southern Everglades and 20 creek systems fed by Taylor Slough and the C-111 Canal provide direct inflow of freshwater to the bay. Surface water from SRS flows into Whitewater Bay and these flows may also provide essential recharge for central and western Florida Bay. Exchange with Florida Bay

occurs when this lower salinity water mass flows around Cape Sable into the western sub-region of the bay.

3.6 REGIONAL WATER MANAGEMENT (OPERATIONS)

The C&SF Project contains multiple water bodies created by the existing C&SF levee infrastructure and implementation of the water management operating criteria, including WCA 1, WCA 2, and WCA 3. Associated with the inflow to and discharge from the water bodies is an infrastructure of structures and canals that are managed by the implementation of water management operating criteria that can include specified water levels or ranges. The WCA 3A Interim Regulation Schedule, which was implemented with ERTP, is a compilation of water management operating criteria, guidelines, rule curves, and specifications that govern storage and release functions. Typically, a regulation schedule has water level thresholds which vary with the time of year and result in discharges. The threshold lines of regulation schedules define the discharge zones and are traditionally displayed graphically. Additionally, a corresponding table is typically used to identify the structure discharge rules for the zones. As with most regulation schedules, the WCA 1, WCA 2, and WCA 3A regulation schedules must take into account various, and often conflicting, project purposes. The WCAs are regulated for the Congressionally-authorized C&SF Project purposes to provide: flood control; water supply for agricultural irrigation, municipalities and industry, and ENP; regional groundwater control and prevention of saltwater intrusion; enhancement of fish and wildlife; and recreation. An important component of flood control is the maintenance of marsh vegetation in the WCAs, which provide a dampening effect on hurricane-induced wind tides that have the potential to affect residential areas to the east of the WCAs. The marsh vegetation, along with the east coast protection levee, also prevents floodwaters that historically flowed eastward from the Everglades from flowing into the developed areas along the southeast coast of Florida.

Besides releases from WCA 2A via the S-11 structures, WCA 3A receives inflow from pumping stations S-8, S-9, and S-140. The S-9 pump station removes runoff in the area west of Ft. Lauderdale known as Western C-11. The S-9A pump station, located adjacent to the S-9 pump station, returns seepage water from WCA 3A and WCA3B collected in the L-37, L-33 and the US 27 borrow canals. The S-140 pump station serves the 110 square mile area north and east of the interceptor canal and west of L-28. S-140 is used to maintain canal levels below 10.5 feet, NGVD unless gravity flow into WCA 3A is possible at an adequate rate. Water also enters northeastern WCA 3A by gravity through the S-150 gated culvert. Discharges at S-142 are made from WCA 3A into the North New River Canal. The SFWMD can pump runoff from the North New River Canal and the C-13 Canal into WCA 3A through S-142 by operating their pump station, G-123.

Water levels in WCA 3A are managed primarily by five gated spillways: the S-12 structures (S-12A, S-12B, S-12C, and S-12D) and S-333. Additionally, the S-151, S-343A, S-343B and S-344 gated culvert structures can be utilized to discharge from WCA 3A. From July 2002 through October 2012, WCA 3A was regulated according to a seasonally varying 8.75 to 10.75 feet, NGVD regulation schedule and the Rainfall Plan (initiated in 1985), as per IOP (2002 IOP EIS and 2006 IOP Final Supplemental EIS). In October 2012, the WCA 3A Regulation Schedule was revised with implementation of the ERTP recommended plan through the 2012 Water Control Plan. Revisions to the WCA 3A Regulation Schedule included incorporation of the WCA 3A 1960 9.5 to 10.5 feet, NGVD Zone A, along with expansion of Zone D forward to December 31 and

expansion of Zone E1 backwards to January 1. The discharges made from WCA 3A through the S-12s and S-333 are target flows determined from the Rainfall Plan; when WCA 3A is in Zone A, these target flows are the maximum flow possible based on structure design capacities and consideration of downstream operational constraints. Under the Rainfall Plan, water deliveries are computed and operations adjusted weekly, if necessary based on the sum of two components: a rainfall response component and a WCA 3A supplemental regulatory component. The Rainfall Plan provides for the rainfall response component within all zones of the WCA 3A Regulation Schedule, with the additional regulatory release requirement added when the WCA 3A water levels fall within the higher regulation schedule zones above Zone E, including Zone E1. Under current ERTP water management practice, which were unchanged with Increment 1, discharge capacity from S-333 into the L-29 Canal and NESRS is maximized prior to utilization of the S-12 structures, in order to limit potential effects from WCA 3A discharges on the CSSS western subpopulation (CSSS-A). When flows through the S-12 structures are determined necessary by the WCA 3A Regulation Schedule and the Rainfall Plan, water managers prioritize flow through the easternmost S-12 structures as capacity allows, in order to minimize flow through the S-12A and S-12B structures. The historical operational target flow distribution of 55% through S-333 into NESRS and 45% through the S-12 structures into ENP west of the L-67 Extension is no longer used as a constraint governing water management operations of WCA 3A and northern ENP under ERTP. Weekly WCA 3A water management release decisions are coordinated with ENP. ERTP specifies seasonal closure of the S-343A, S-343B, S-344, S-12A and S-12B structures, with the following rigid closure periods: November 1 through July 14 for S-343A, S-343B, S-344, and S-12A; and January 1 through July 14 for S-12B. There are no prescribed closure periods for S-12C or D, although either or both of these structures may be closed when Rainfall Plan target releases are achieved through S-333.

Water deliveries to eastern ENP (NESRS) are controlled by the stage in L-29 Canal, as pressure from the water within the canal (hydraulic head), is required to force water through the Tamiami Trail culverts and the one mile bridge and into ENP. As the L-29 Canal stage increases, more water is forced beneath the road through 17 sets of culverts (49 total culverts, three culverts per set in most locations) and the one mile bridge. The L-29 Canal maximum operating stage has been limited under ERTP and previous regional operating plans due to concerns regarding: (1) potential flooding and seepage effects within residential or agricultural areas of Miami-Dade County; (2) potential damage to the Tamiami Trail roadway sub-base; and (3) potential flooding effects to privately-owned real estate adjacent to Tamiami Trail and within eastern ENP. The MWD Tamiami Trail Modifications (TTM) Project, which was completed in December 2013, included construction of the one mile bridge and Tamiami Trail roadway reconstruction/resurfacing to allow for the maximum operating stage in the L-29 Canal to be raised from 7.5 feet to 8.5 feet, NGVD following the acquisition of the required real estate interests by the Corps and ENP. Following completion of the MWD TTM Project, the current ERTP water management operating criteria for the L-29 Canal between S-333 and S-334 is meant to limit the L-29 Canal stage to no more than 7.5 feet, NGVD in response to potential flooding effects to privately-owned real estate adjacent to Tamiami Trail and within eastern ENP which may result from extended durations with higher operating stages in the L-29 Canal (above 7.5 feet, NGVD). ERTP also included an additional operational constraint for the L-29 Canal water level related to potential flooding and seepage effects within residential and/or agricultural areas of Miami-Dade County; this constraint, which is removed during implementation of the Increment 1 planned deviation, required S-333 discharges

to NESRS will be discontinued when the G-3273 water level within NESRS reaches 6.8 feet, NGVD during the normal Column 1 mode of operations, or S-333 discharges into the L-29 Canal to be matched with S-334 discharges out of the L-29 Canal when operating under the Column 2 mode of operations.

When WCA 3A water levels are in Zone A of the WCA 3A Interim Regulation Schedule, S-343A, S-343B, and S-344 can be utilized to discharge from WCA 3A into BCNP outside of the prescribed closure period for these gated culvert structures. Discharges can also be made through S-343A, S-343B and S-344 when agreed to by SFWMD, Corps, and NPS to extend hydroperiods within BCNP. The S-151 gated culvert structure is located along the Miami Canal and operated according to the WCA 3A Interim Regulation Schedule (USACE 2012a). S-151 discharges into the Miami Canal (C-304) in WCA 3B for flood diversion and for the purpose of providing water supply to LEC canals and the SDCS. Under existing conditions, water does not flow directly from WCA 3B into the L-29 Borrow canal. There are two discharge structures, gated spillways S-355A and S-355B, along L-29 south of WCA 3B that are designed to move water from WCA 3B into the L-29 Canal. The S-355 structures are completed components of the MWD Project, intended to function in concert with the proposed MWD S-345 structures along L-67A/L-67C to address the MWD Project objective of restoring WCA 3B as a functioning component of the Everglades hydrologic system and restoration of water deliveries to NESRS.

There are three distinct modes of water management operations for ERTP, which are consistent with the previous IOP (2002 EIS; 2006 Supplemental EIS): Column 1, Column 2, and water supply. Column 1 refers to the condition when regulatory releases from WCA 3A can be met by normal operation of the WCA 3A regulatory outlets (the S-12 structures, S-333, S-151, S-343A, S-343B, and/or S-344). Column 2 refers to the condition when regulatory releases from WCA 3A are made via S-333 to the L-29 Canal and via S-334 to the L-31N Canal and the SDCS; Column 2 operations generally require the use of pump stations S-331, S-332B, S-332C, and S-332D. During Column 2 operations, the control stages along the L-31N Canal are also lowered to minimize potential flood impacts to the SDCS and also to provide the necessary downstream gradient for the S-334 releases to reach S-332B, S-332C, and S-332D pump stations. Column 2 operations are used to offset or mitigate for potential adverse effects on WCA 3A related to actions taken to protect CSSS sub-population A within western ENP, including seasonal closure of the S-12A and S-12B regulatory outlets under ERTP (S-12C seasonal closure criteria were additionally included with IOP). The IOP/ERTP generally prescribed that the Column 2 mode of operation would be used when any S-12 structure is closed in order to protect the CSSS (November 1 through July 14, under ERTP), although Column 1 operations would continue until the capacity of the S-12 structures that remain open is insufficient to handle the discharge from WCA 3A. Similarly, the IOP/ERTP generally prescribed that Column 2 operations may continue past re-opening of the S-12 structures (July 15) to mitigate for adverse effects on WCA 3A stage levels resulting from the ERTP closures of S-12A, S-12B, S-343A, S-343B, and S-344, based on comparison to WCA stage levels that would have been expected under the WCA 3A Regulation Schedule in place prior to the 2000 Interim Structural and Operational Plan (ISOP; the predecessor of IOP 2002); the cited 1985 WCA 3A Regulation Schedule was first incorporated the Rainfall Plan and included no seasonal closures for the S-12s. Under historical IOP and ERTP operations, the Column 2 mode of operations has also been used as an additional water management tool for WCA 3A high water conditions. Beginning in 2014, the Corps and SFWMD are applying a WCA 3A water budget

accounting tool to track the expected effect on WCA 3A stage levels resulting from the ERTP closures of S-12A, S-12B, S-343A, S-343B, and S-344.

During implementation of Increment 1.1 and 1.2, the 2012 Water Control Plan, including the WCA 3A Regulation Schedule and Rainfall Plan, continued to govern water management operations with the exception of operating criteria for S-12A, S-12B, S-328, S-151, S-331, S-333, S-334, S-335, S-337, S-338, S-343A, S-343B, S-344, S-355A, S-355B, S-356, S-357, S-357N, S-332B, S-332C, S-332D, S-194, S-196, S-176, S-177 and S-197. Similar to Increment 1, under Increment 1.1 and 1.2 the water level constraint at G-3273 was not a pre-determined constraint, allowing NESRS to receive more water, relative to the 2012 Water Control Plan. S-356 was also utilized for control of seepage to the L-29 Canal. Under Increment 1.1 and 1.2 the ability to raise the L-29 Canal maximum operating limit from 7.5 up to 7.8 feet, NGVD, was contingent upon compliance with downstream constraints including: (1) acquisition of required real estate interest and any associated improvements for the private ownership along Tamiami Trail including receipt of Tamiami Trail Bridge and roadway channel and flowage easements from the FDOT; (2) completion of the C-358 Canal (Richmond Drive Seepage Collection Canal) and installation of S-357N (C-358 control structure); (3) completion of sufficient portions of Contract 8 (construction of the C-111 NDA L-315 western levee and the L-357W Extension Levee between Richmond Drive and the 8.5 SMA Detention Cell) and completion of the Contract 8A berms inside the 8.5 SMA Detention Cell. These constructed features of the MWD and C-111 South Dade Projects were deemed necessary in order to raise the L-29 Canal maximum operating limit up to 7.8 feet, NGVD while maintaining required water levels in the residential and agricultural areas in southeastern Miami-Dade County. The Increment 1.1 and 1.2 Operational Strategy was also modified to address the mandated RPA of the July 2016 ERTP BO to include expanded closure periods for S-12A, S-12B, S-343A, S-343B, and S-344 structures. Reference **Section 1.7**.

3.7 FLOOD CONTROL

Water management and flood control is achieved in south Florida through a variety of canals, levees, pumping stations, and control structures within the WCAs, ENP, and SDCS. The WCAs provide a detention reservoir for rainfall over the WCAs, excess water from the EAA and parts of the east coast region, and for flood discharge from Lake Okeechobee to tide. The WCAs provide levees to prevent the Everglades floodwaters from inundating the east coast urban areas; provide a water supply for the east coast areas and ENP; improve water supply for east coast communities by recharging underground freshwater aquifers reduce seepage; ameliorate salt-water intrusion in coastal well fields; and provide mixed quality habitat for fish and wildlife in the Everglades.

The East Coast Canals are flood control and outlet works that extend from St. Lucie County southward through Martin, Palm Beach, and Broward Counties to Miami-Dade County. The East Coast Canal watersheds encompass the primary canals and water control structures located along the LEC and their hydrologic basins. The main design functions of the project canals and structures in the East Coast Canal area are to protect the adjacent coastal areas against flooding; store water in conservation areas west of the levees; control water elevations in adjacent areas; prevent salt-water intrusion and over-drainage; provide freshwater to Biscayne Bay; and provide for water conservation and public consumption. The East Coast Canals consist of 40 independently operated canals, one levee, and 50 operating structures, consisting of 35 spillways,

14 culverts, and one pump station. The project operates to prevent major flood damage; however, due to urbanization, the existing surface water management system now has to handle greater peak flows than in the past. The SDCS provides a way to deliver water to areas of south Miami-Dade County. This canal system was overlaid on the existing flood control system. Many of these canals are used to remove water from interior areas to tide in times of excess water.

The C-111 South Dade Project was authorized to remove 40 percent of the Standard Project Flood (SPF) flows. This purpose remains an important objective because of the remaining agriculture within the basin. The South-Dade County Basin (south of the S-331 pump station) is provided flood protection by operation of the S-332B/S-332C/S-332D pump stations completed under the C-111 South Dade Project and through operation of the L-31N and C-111 Canal control structures (S-176, S-177, S-18C, and S-197). The South-Dade County basin may also receive inflows from upstream basin drainage through the S-331 pump station and the adjacent S-173 gated culvert structure. Under the current 2012 Water Control Plan, S-331/S-173 releases are the result of water management operations to: (1) maintain target L-31N Canal stages; (2) provide flood mitigation to the 8.5 SMA eastern areas when sufficient capacity is available at S-357 and maintain flood mitigation for the 8.5 SMA when S-357 operational capacity is limited; and (3) WCA 3A regulatory releases to the SDCS from S-334 during ERTP Column 2 operations. The COP will include regional hydrologic modeling in order to balance the ecological restoration objectives of the MWD and C-111 South Dade projects while demonstrating compliance with the project constraints. This will include flood mitigation requirements to prevent potential MWD project-induced flood damages in the 8.5 SMA and to maintain the level of flood damage reduction associated with the 1994 C-111 GRR-EIS Recommended Plan. The performance of the C-111 South Dade Project features, 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 WCA 3A, ENP (including the L-29 Canal), and the 8.5 SMA.

3.8 VEGETATIVE COMMUNITIES

The Everglades landscape is dominated by a complex of freshwater wetland communities that includes open water sloughs and marshes, dense grass- and sedge-dominated marshes, forested islands, and wet marl prairies. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrological regime (USFWS 1999). These communities generally occur along a hydrological gradient with the slough/open water marsh communities occupying the wettest areas (flooded more than nine months per year), followed by sawgrass marshes (flooded six to nine months per year), and wet marl prairie communities (flooded less than six months per year) (USFWS 1999). The Everglades freshwater wetlands eventually grade into intertidal mangrove wetlands and sub tidal seagrass beds in the estuarine waters of Florida Bay. Development and drainage over the last century have dramatically reduced the overall spatial extent of freshwater wetlands within the Everglades, with approximately half of the pre-drainage 2.96 million acres of wetlands being converted for development and agriculture (Davis and Ogden 1997). Alteration of the normal flow of freshwater through the Everglades has also contributed to conversions between community types, invasion by exotic species, and a general loss of community diversity and heterogeneity.

Vegetative communities of the WCAs have suffered from both over-drainage and prolonged periods of inundation associated with the stabilization of water levels (USACE 1999). Many areas

of WCA 3A still contain relatively good wetland habitat consisting of a complex of tree islands, sawgrass marshes, wet prairies, and aquatic sloughs. However, the northern portion of WCA 3A has been over-drained, resulting in increased fire frequency and the associated loss of tree islands, wet prairie, and aquatic slough habitat. Northern WCA 3A is currently dominated largely by mono-specific sawgrass stands and lacks the diversity of communities that exists in southern WCA 3A. In southern WCA 3A, Wood and Tanner (1990) first documented the trend toward deep water lily dominated sloughs due to impoundment. In approximately 1991, the hydrology of southern WCA 3A shifted to deeper water and extended hydroperiods resulting in corresponding shifts in vegetation communities (Zweig and Kitchens 2008). Typical Everglades vegetation, including tree islands, wet prairies, sawgrass marshes, and aquatic sloughs is contained in WCA 3B. However, within WCA 3B, the ridge and slough landscape has been severely degraded by the virtual elimination of overland sheetflow due to the L-67 Canal and Levee system. WCA 3B experiences very little overland flow and has become primarily a rain-fed system pre-dominated by shorter hydroperiod sawgrass marshes with relatively few sloughs or tree islands remaining. Water levels in WCA 3B are also too low and do not vary seasonally, contributing to poor ridge and slough patterning. Loss of sheetflow to WCA 3B has also accelerated soil loss reducing elevations of the remaining tree islands in WCA 3B and making them vulnerable to high water stages.

Vegetative trends in ENP have included a substantial shift from the longer hydroperiod slough/open water marsh communities to shorter hydroperiod sawgrass marshes (Davis and Ogden 1997; Armentano et al. 2006). In addition, invasion of sawgrass marshes and wet prairies by exotic woody species has led to the conversion of some marsh communities to forested wetlands (Gunderson et al. 1997).

The estuarine communities of Florida Bay have also been affected by upstream changes in freshwater flows through the Everglades. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (USFWS 1999). Mangrove communities along Biscayne Bay have also seen a reduction in freshwater inflows and a reduction in historic habitat range by urban and agricultural development leaving only a remnant ribbon of suitable habitat immediately adjacent to the bay. Both bays experiences salinities in excess of 40 practical salinity units (psu) on a seasonal basis. Manatee Bay and Barnes Sound are presently characterized by extended periods with little or no freshwater input, interspersed with erratic large volume discharges from the C-111 Canal, which is presently the major source of freshwater flows.

In contrast to the vast extent of wetland communities, upland communities comprise a relatively small component of the Everglades landscape and are largely restricted to Long Pine Key, the northern shores of Florida Bay, and the many tree islands scattered throughout the region. Vegetative communities of Long Pine Key include rockland pine forest and tropical hardwood forest. In addition, substantial areas of tropical hardwood hammock occur along the northern shores of Florida Bay and on elevated portions of some forested islands.

The vast majority of wetland features within the 8.5 SMA have undergone varying degrees of disturbance related to land clearing for agricultural or residential improvements and invasion by exotic species. Generally, wetlands with the least amount of disturbance are located in the western

areas of the 8.5 SMA. The developed (eastern) portion of the 8.5 SMA, except the Federal Aviation Administration (FAA) radar facility, is virtually devoid of wetlands, whereas a zone extending down the central portion is dotted by wetlands intermixed within agricultural and residential land uses. Many of the wetland communities include varying densities of exotics including: Brazilian pepper (*Schinus terebinthifolius*), Australian pine (*Casuarina equisetifolia* L.), and melaleuca (*Melaleuca quinquenervia*). The 8.5 SMA includes an Australian pine forest that is very dense, supporting a sparsely vegetated understory and ground cover. A prevalent ground cover species is sawgrass, growing within a thick layer of duff comprised entirely of pine needles. Australian pine can be found in monotypic stands, along marsh and prairie edges, and in abandoned fields. Brazilian pepper is common along roadsides and also forms dense wooded plots throughout the 8.5 SMA (USACE 2012a).

3.9 FISH AND WILDLIFE RESOURCES

Aquatic macro invertebrates form a vital link between the algal and detrital food web base of freshwater wetlands and the fishes, amphibians, reptiles, and wading birds that feed upon them. Important macro invertebrates of the freshwater aquatic community include crayfish (*Procambarus alleni*), riverine grass shrimp (*Palaemonetes paludosus*), amphipods (*Hyallela aztecus*), Florida apple snail (*Pomacea paludosa*), Seminole ramshorn (*Planorbella duryi*), and numerous species of aquatic insects (USACE 1999).

Small freshwater marsh fishes are also important processors of algae, plankton, macrophytes, and macro invertebrates. Marsh fishes provide an important food source for wading birds, amphibians, and reptiles. Common small freshwater marsh species include the native and introduced golden topminnow (*Fundulus chrysotus*), least killifish (*Heterandria formosa*), Florida flagfish (*Jordenella floridae*), golden shiner (*Notemigonus crysoleucas*), sailfin molly (*Poecilia latipinna*), bluefin killifish (*Lucania goodei*), oscar (*Astronotus ocellatus*), eastern mosquitofish (*Gambusia holbrookii*), and small sunfishes (*Lepomis* spp.) (USACE 1999).

Within the Greater Everglades, numerous sport and larger predatory fishes occur in deeper canals and sloughs. Common species include largemouth bass (*Micropterus salmoides*), bluegill (*Lepomis macrochirus*), redear sunfish (*Lepomis microlophus*), black crappie (*Pomoxis nigromaculatus*), Florida gar (*Lepisosteus platyrhincus*), threadfin shad (*Dorosoma petenense*), gizzard shad (*Dorosoma cepedianum*), yellow bullhead (*Ameiurus natilis*), white catfish (*Ameiurus catus*), bowfin (*Amia calva*), and tilapia (*Tilapia* spp.) (USACE 1999). Larger fishes are an important food source for wading birds, alligators, otters, raccoons, and mink.

The freshwater wetland complex supports a diverse assemblage of reptiles and amphibians. Common amphibians include the greater siren (*Siren lacertina*), Everglades dwarf siren (*Pseudobranchus striatus*), two-toed amphiuma (*Amphiuma means*), pig frog (*Rana grylio*), southern leopard frog (*Rana sphenocephala*), Florida cricket frog (*Acris gryllus*), southern chorus frog (*Pseudacris nigrita*), squirrel tree frog (*Hyla squirela*), and green tree frog (*Hyla cinerea*) (USACE 1999). Amphibians also represent an important forage base for wading birds, alligators, and larger predatory fishes (USACE 1999).

Common reptiles of freshwater wetlands include the American alligator (*Alligator mississippiensis*), snapping turtle (*Chelydra serpentina*), striped mud turtle (*Kinosternon bauri*),

mud turtle (*Kinosternon subrubrum*), cooter (*Chrysemys floridana*), Florida chicken turtle (*Deirochelys reticularia*), Florida softshell turtle (*Trionys ferox*), water snake (*Natrix sipidon*), green water snake (*Natrix cyclopion*), mud snake (*Francia abacura*), and Florida cottonmouth (*Agkistrodon piscivorus*) (USACE 1999).

The freshwater wetlands of the Everglades are noted for their abundance and diversity of colonial wading birds. Common wading birds include the white ibis (*Eudocimus albus*), glossy ibis (*Plegadus falcenellus*), great egret (*Casmerodius albus*), great blue heron (*Ardea herodius*), little blue heron (*Egretta caerulea*), tricolored heron (*Egretta tricolor*), snowy egret (*Egretta thula*), green-backed heron (*Butorides striatus*), cattle egret (*Bubulcus ibis*), black-crowned night heron (*Nycticorax nycticorax*), yellow-crowned night heron (*Nycticorax violacea*), roseate spoonbill (*Ajaia ajaja*), and wood stork (*Mycteria americana*) (USACE 1999).

Mammals that are well-adapted to the aquatic and wetland conditions of the freshwater marsh complex include the rice rat (*Oryzomys palustris natator*), round-tailed muskrat (*Neofiber alleni*), and river otter (*Lutra canadensis*). Additional mammals that may utilize freshwater wetlands on a temporary basis include the white-tailed deer (*Odocoileus virginianus*), Florida panther (*Puma concolor coryi*), bobcat (*Lynx rufus*), and raccoon (*Procyon lotor*).

Conditions within the 8.5 SMA provide important resources for opportunistic small animals including raccoons, rabbits, squirrels, songbirds, hawks, kestrels, crows, turkey vultures, frogs, and various reptiles. White-tailed deer have been observed. On-site surveys have found the greatest degree of species richness within the forested wetland systems within the ENP lands to the west of the 8.5 SMA, whereas species richness was lowest in wetlands on higher elevations (7.0-8.0 feet, NGVD) in the eastern regions of the 8.5 SMA, in close proximity to L-31N (USACE 2011). This eastern region of the 8.5 SMA is dedicated to agricultural and residential land uses, and provides only marginal benefits to resident wildlife (USACE 2012a).

The change in fish and wildlife diversity and wetland function between the western and eastern portions of the 8.5 SMA correlates with an elevation gradient (increasing elevations from west to east) and land use. Both elevation and land use are interdependent co-variables as lower elevations correlate with frequent flooding that limits the extent and type of land use. Higher elevations are more compatible with agricultural, commercial, and residential land uses. A recent overview of wildlife observed within the 8.5 SMA can be found in the 2011 Proposed Interim Operating Criteria for 8.5 SMA EA (USACE 2011), and 2012 design refinement for the 8.5 SMA EA (USACE 2012a).

3.10 THREATENED AND ENDANGERED SPECIES

3.10.1 FEDERALLY PROTECTED SPECIES

The Corps has coordinated with USFWS, in accordance with Section 7 of the ESA, to determine federally-listed threatened and endangered species that are either known to occur or are likely to occur within the project area (**TABLE 3-1**). The Corps requested written confirmation of federally listed threatened and endangered species that are either known to occur or are likely to occur within the project area from the USFWS by correspondence dated July 17, 2017. A revised species list was provided by the USFWS through correspondence dated July 25, 2017 (**TABLE 3-1**).

TABLE 3-1. FEDERALLY THREATENED AND ENDANGERED SPECIES WITHIN THE PROJECT AREA

Common Name	Scientific Name	Status
Mammals		
Florida panther	*Puma concolor coryi*	E
Florida manatee	*Trichechus manatus latirostris*	E, 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*	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 imbricate*	E
Kemp's Ridley sea turtle	*Lipodochelys kempii*	E
Leatherback sea turtle	*Dermochelys coriacea*	E
Loggerhead sea turtle	*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

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*	E, 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*	C
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*	PT
Florida pineland sandmat	*Chaemaesyce deltoidea pinetorium*	PT
Florida prairie clover	*Dalea carthagenesis floridana*	PE

E=Endangered; T=Threatened; CH=Critical Habitat; Candidate Species; PT=Proposed Threatened; PE=Proposed Endangered

3.10.2 STATE LISTED SPECIES

The project area also provides habitat for several state listed species (**TABLE 3-2**).

TABLE 3-2. STATE LISTED SPECIES WITHIN THE PROJECT AREA

Common Name	Scientific Name	Status
Mammals		
Everglades mink	*Mustela vison evergladensis*	T
Birds		
Snowy plover	*Charadrius nivosus*	T
American oystercatcher	*Haematopus palliates*	T
Black skimmer	*Rynchops niger*	T
Least tern	*Sterna antillarium*	T
White-crowned pigeon	*Patagioenas leucocephalus*	T
Little blue heron	*Egretta caerulea*	T
Tricolored heron	*Egretta tricolor*	T
Reddish egret	*Egretta rufescens*	T
Roseate spoonbill	*Platalea ajaja*	T
Florida sandhill crane	*Antigone canadensis pratensis*	T
Southeastern American kestrel	*Falco sparverius paulus*	T
Reptiles		
Rim rock crowned snake	*Tantilla oolitica*	T
Plants		
Pine-pink orchid	*Bletia purpurea*	T
Lattace vein fern	*Thelypteris reticulate*	E
Eatons spikemoss	*Selaginella eatonii*	E
Wright's flowering fern	*Anemia wrightii*	E
Tropical fern	*Schizaea pennula*	E
Mexican vanilla	*Manilla mexicana*	E

E=Endangered; T=Threatened

3.11 ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act, 16USC 1801 et seq. reflects the Secretary of Commerce and Fishery Management Council authority and responsibilities for the protection of essential fish habitat (EFH). The southern estuaries comprise Biscayne National Park and a large portion of ENP and are a shallow estuarine system (average depth less than 3 feet). Florida Bay is the main receiving water of the greater Everglades. The southern estuaries contain essential fish habitat for corals; coral reef and live bottom habitat; red drum (*Sciaenops ocellatus*); penaeid shrimps; spiny lobster (*Panulirus argus*); other coastal migratory pelagic species and the snapper-grouper complex. Essential fish habitat in the southern estuaries is comprised of seagrasses, estuarine mangroves, intertidal flats, the estuarine water column, live/hard bottoms, and coral reefs.

3.12 WATER QUALITY

Water quality in the study area is significantly influenced by development. The C&SF Project led to significant changes in the landscape by opening large land tracts for urban development and agricultural uses, and by the construction of extensive drainage networks. Natural drainage

patterns in the region have been disrupted by the extensive array of levees and canals which has resulted in further water quality degradation. Since the bypass of the STA's has been essentially eliminated (except under extreme environmental conditions), the water quality of the project area is primarily influenced by legacy loading, untreated discharges from the S-9 and weather conditions/rainfall patterns. Dry out conditions in marsh/urban areas served by the S-9 and within the WCA's followed by high rainfall events are very likely associated with release of nutrients into the water column from sediments/vegetation. The northern WCAs are fed from Lake Okeechobee as well as runoff from the EAA. Typically under normal conditions all water from Lake Okeechobee and the EAA is routed through the Stormwater Treatment Areas (STAs). The STA's were constructed to reduce total phosphorus from surface water runoff releases from Lake Okeechobee. Water quality delivered to the WCA's from Lake Okeechobee/EAA source water treated by STA's has significantly improved (lower nutrient loading/concentrations). Water quality impairment within the study area can generally be attributed to nutrients and bioavailable forms of mercury. A short discussion of each of these water pollutants is provided below followed by a review of water quality within the project area.

3.12.1 NUTRIENTS

Nutrients such as phosphorus and nitrogen compounds are a concern in the estuaries, WCAs, ENP, and Lake Okeechobee since they result in an imbalance of flora and fauna. To address nutrient discharges the FDEP has recently established surface water quality numeric nutrient criteria for all Florida water bodies and developed National Pollution Discharge Elimination (NPDES) Total Maximum Daily Loads (TMDLs) for many watersheds with excessive nutrient pollution. TMDLs for phosphorus and/or nitrogen currently exist for Lake Okeechobee. Additional information on the status and implementation of TMDLs within the study area can be found at http://www.dep.state.fl.us/water/tmdl/.) Within the Everglades Protection Area (EPA), phosphorus concentrations are regulated by the "Phosphorus Rule" 62-302.540 F.A.C. and are subject to the terms of the 1992 Consent Decree in United States v. South Florida Water Management. District (S.D. Fla No. 88-1886-CIV-MORENO).

Total phosphorus is the primary nutrient of concern within WCA 3 and NESRS. Shark River Slough (SRS) compliance for Water Year (WY) 2016 (Oct 1, 2015-Sept 30, 2016) was calculated using two methods. One method included S-356 flows and the other did not. SRS was in compliance using both methods with annual Flow Weighted Mean (FWM) of 7.2 parts per billion (ppb) as the result for both methods. The WY 2016 long term limit for SRS using both methods was 7.6ppb

Due to the unusual record high rainfall events during June 2017, that followed a prolonged dry period in the WCAs, resulted in high SRS flows with high phosphorus concentrations during June and subsequent months. Typically the marsh and upstream rehydration occurs more gradually without the very high flows into SRS at the very beginning of the transition of dry season conditions to wet season conditions that occurred during WY 2017. The gradual rehydration of the upstream marshes allow marsh ability to uptake nutrients to recover before the higher flows that normally occur later in the wet season. The highest nutrient concentrations delivered to SRS normally occur during the transition from dry season to wet season conditions and normally the flows are not high (relative to the rest of the wet season) during this transition period. Due to the

flows/concentrations during June 2017, the preliminary SRS FWM for WY 2017 exceeded the SRS long term limit by 2.1 ppb.

3.13 NATIVE AMERICANS

There are two federally recognized tribes (Miccosukee Tribe of Indians of Florida and the Seminole Tribe of Florida) that are located within and adjacent to the project area (**FIGURE 3-3**). Both tribes maintain a strong connection to the project area through continued use and regard the indigenous populations of Florida as their ancestors. The project area includes a large segment of the Miccosukee Tribe's Alligator Alley Reservation which spans portions of WCA 3A, the Tamiami Trail Reservation Area which consists of three parcels of land used for commercial services, and the Miccosukee Reserved Area which is the center of the Miccosukee Indian population. In addition, both tribes have leases and easements within WCA 3A and have historically recognized rights within ENP that stems from the Native Americans who lived within the ENP boundary prior to the parks creation.

The Miccosukee Tribe of Indians of Florida and Seminole Tribe of Florida have a long history of living within the project area. Both tribes moved into the region during the eighteenth and nineteenth centuries from Georgia and Alabama. Fleeing the U.S. Army and the forced relocation policies of the Indian Removal Act (1830), the Miccosukee and Seminoles were part of Native American groups commonly referred to as Seminoles; however, there are references to some of the groups involved in the conflict as Mikasuki, which supports the subsequent separation of the two groups (Weisman 1999). Many of these groups fled into the swamp areas of south Florida and made their homes within the Everglades and other remote areas of region. The coming of the Civil War led to the abandonment of the removal efforts and the various Native American groups were largely left alone until the late nineteenth century. In 1928 the Tamiami Trail opened, cutting through the Everglades and bringing along with it tourists and explorers into the region, and, for the first time, bringing complete access for the various tribes to participate in the larger economy that was growing in south Florida.

As early as 1894, the Federal governmental and later the State of Florida started to acquire lands within the Big Cypress area. However, initial attempts to relocate tribal members to these areas failed as there were simply no incentives to abandon traditionally occupied areas in favor of the new lands (Weisman 1999). "The Indian New Deal changed that, and for the first time, services, programs, and land were brought together…at Big Cypress" (Weisman 1999:125). In the 1930s, the Federal Government started to bring services to the various Seminole groups. Some of the groups relocated and started to receive Federal aid, while some groups resisted government intrusion into their lives and remained in various traditional areas that now included sites along Tamiami Trail (Weisman 1999). Throughout the next two decades the Federal Government instituted various aid programs to assist the Native American groups living within the reservations until the early 1950s. In the early 1950s, the Federal Government's policies radically changed, as it was felt that native groups should now join "mainstream society" and that Federal aid should come to an end (Weisman 1999:131). Being faced with a reduction in support and possible termination of recognition as a group by the government, various Native American groups on these reservations began to organize and form their own tribal governments to assist in the protection of their interests. In 1957, the Seminole Tribe of Florida received Federal recognition. However, wishing to remain separate and to maintain their own identity, many of the groups along the

Tamiami Trail refused to join and instead held out to form their own government that would be federally recognized in 1962 as the Miccosukee Tribes of Indians of Florida.

Today most of the Miccosukee Tribe lives within the confines of the reservation located along the forty mile bend of Tamiami Trail, while many of the Seminoles Tribal members live on various reservations properties with the largest being those of Big Cypress, Hollywood, and Brighton Reservations. In addition to the Federal reservation, the Miccosukee Tribe has also established a perpetual lease to large portions of the WCA 3A area while the Seminole Tribe has a lease within the northwestern portion of WCA 3A. The members of both groups maintain a traditional life style that is intricately connected to the Everglades. Traditional practices of hunting, fishing and general living are still maintained, along with modern entrepreneurship through various enterprises such as cattle ranching and with tourism related businesses along Tamiami Trail. Today, both tribes have vibrant, thriving cultures based within the Everglades region. These practices continue to tie the Tribes to the Everglades is such a way that careful consideration of effects is warranted.

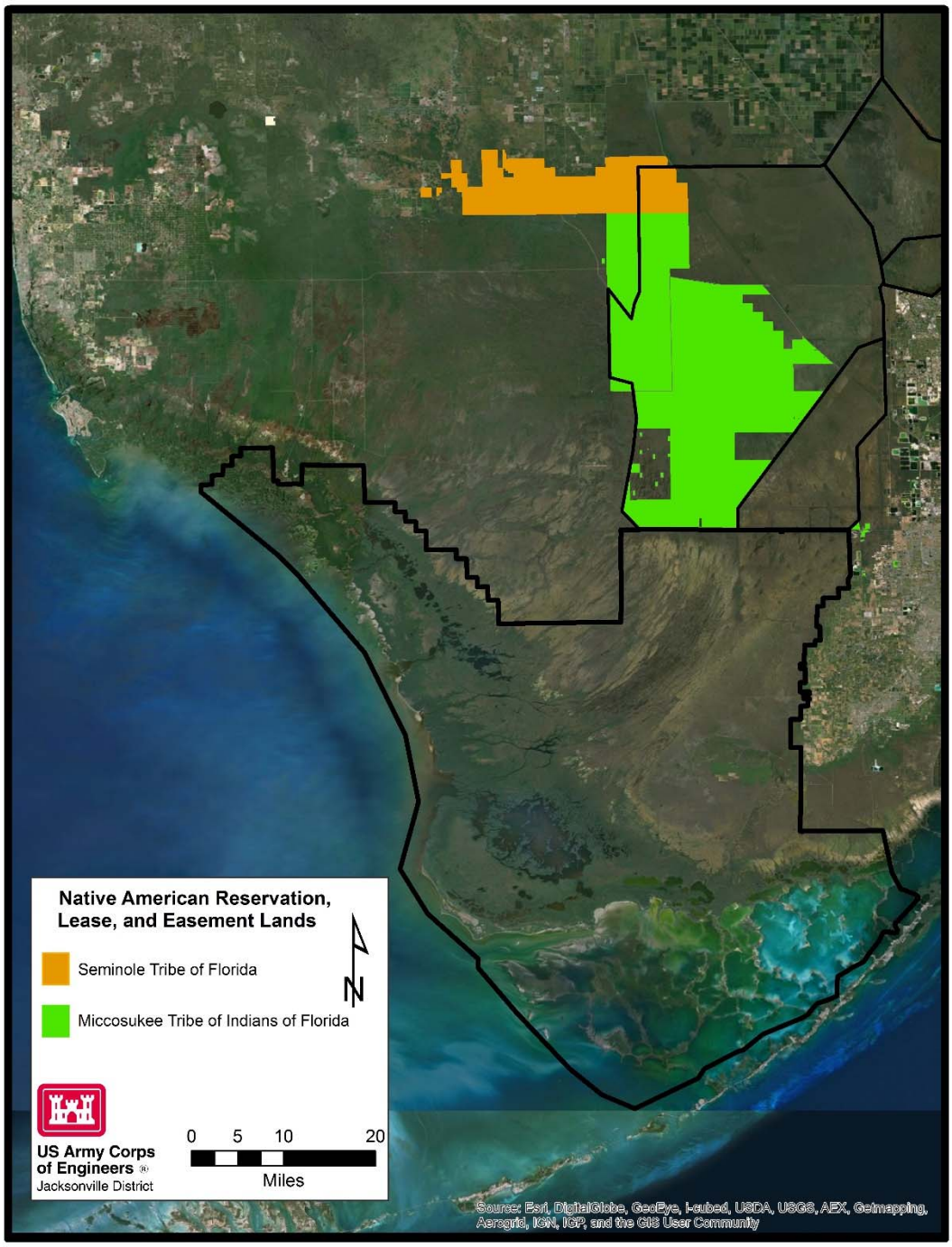

FIGURE 3-3. MAP OUTLINING THE LOCATION OF TRIBAL RESERVATION, LEASED AND EASEMENT LANDS

3.14 CULTURAL RESOURCES

Within the larger region that includes ENP and WCA3, there are numerous recorded archeological sites indicative of Native American habitation. Prior to European contact, the Everglades were a heavily populated area. Native Americans traveled via canoe and on foot through the saw grass

and inhabited many of the tree islands that dot the landscape. The earliest known habitation sites date to the Early Archaic period (7500 BC) when the Everglades were much drier. However, within the larger area of south Florida, evidence of Paleo-Indian (12,000 to 7500 BC) habitation has also been recorded (*i.e.* Warm Mineral Springs (8SO18) and Little Salt Spring (8SO79) (Griffin 1988). Some of the Early Archaic habitation sites have only recently been rediscovered as the result of managed drainage programs in south Florida. As the climate warmed and sea level rose, many Native Americans abandoned the lowest of the tree islands as they became submerged. This process continued through what is known as the Middle Archaic, until climate conditions stabilized around 300 BC at the start of the Late Archaic. Today many sites from both the Early and Middle Archaic periods are no longer submerged and may have more modern Native American use.

After the Archaic period, the region became incorporated into what is known as the Glades region and remained inhabited until European contact, when Old World diseases and slave raiding heavily reduced the Native populations during the late 1500s-1700s. Many of the tree islands through this portion of the Everglades have sites associated to the Glades period. This period has been broken down into successive stages starting with Glades I, which dates from 500 BC to 750 AD, Glades Period II dating from 750 to 1200 AD, and Glades Period III dating from 1200 AD to European contact in the 1500s. Typical habitation sites through this region are commonly referred to as middens, which are the accumulation of daily life activities on these tree islands. Material remains can stretch from the surface to well over one meter below the surface on certain islands. Native American burials can also be found among these habitation sites.

After European contact, Native American populations in the region continuously declined and remained at low levels until Miccosukee and Seminole tribal groups moved into the area while fleeing the U.S. Army and U.S. Governments' forced relocation program. Many sites associated with both the Miccosukee and Seminole tribes are known to exist throughout the region.

The broad region of ENP and WCA3 has been subject to numerous cultural resource investigations and have been found to contain a wide variety of cultural resources that vary within their significance. There are archaeological resources associated with some of the earliest habitation sequences within south Florida and relatively recent sites directly associated with modern Native American tribes who were removed from ENP shortly after its creation.

Approximately 277 cultural resources, as identified in the Florida Master Site File, are located within the project area. Of these resources, 121 sites are located within WCA 3 north of the L-29 canal. The majority of these sites were identified based on a 1987 aerial analysis of the WCA and the presence of archaeological materials was not ground-truthed (Taylor 1987). Only approximately 25 sites within WCA 3 have been identified based on a physical archaeological investigation. A total of 8 cultural resources within WCA3 have been listed or determined eligible for listing in the National Register of Historic Places (NRHP), including Mack's Fish Camp Historical District.

The southern portion of the project area, south of the L-29 Canal, is located entirely within ENP. ENP has been subject to many archaeological investigations that have identified approximately 156 cultural resources within the project area. Of these resources, 40 have been listed or

determined eligible for listing in the NRHP, including two archaeological districts. A small portion of Ten Thousand Islands Archaeological District is located on the western edge of the project area and the SRS Archaeological District in contained entirely within the project area. The SRS Archaeological District contains no less than 63 archaeological resources, 39 of which are contributing resources to the district (Schwandron 1996). Sites typically found within the SRS are described as earth middens; however, multi-occupation sites such as Tiger Hammock (8DA11) which is associated with Glades II and III and Seminole occupations have also been identified.

3.15 AIR QUALITY

Air monitoring reports are prepared annually by FDEP to inform the public of the air pollutant levels throughout the State of Florida. All areas within the state are designated with respect to each of the six pollutants (carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particle pollution (10 microns or less in diameter (PM_{10}), and 2.5 microns or less in diameter ($PM_{2.5}$), and sulfur dioxide (SO_2)) as attainment (*i.e.*, in compliance with the standards); non-attainment (*i.e.*, not in compliance with the standards); or unclassifiable (*i.e.*, insufficient data to classify). Attainment areas can be further classified as maintenance areas. Maintenance areas are areas previously classified as non-attainment which have successfully reduced air pollutant concentrations to below the standard. Southeast Florida including Miami-Dade County continues to be classified by the USEPA as an attainment/maintenance area for ozone. Florida remains designated as unclassifiable for PM_{10}. Although sufficient data have been collected for attainment determinations, USEPA has not considered PM_{10} for attainment determinations in Florida yet.

3.16 HAZARDOUS, TOXIC OR RADIOACTIVE WASTES

Along the southern boundary of WCA 3A and WCA 3B there are levees and canals constructed in the 1950s and 1960s that limit vehicle access to the interior. Activity within the WCA is generally limited to fishing, hunting, and birding though there may be some illegal dumping of solid wastes along the perimeter. No soil testing for residual contaminants has been conducted within the WCA 3A and WCA 3B as part of this project since the lands have no history of prior agricultural or industrial use that would cause such contamination.

A search of FDEP petroleum spill and storage sites database done in October of 2014 identified six petroleum storage sites and one spill site along Tamiami Trail between S-333 and S-356. Petroleum storage at Everglades Safari site was closed in 2005; however, a petroleum spill at this site is listed as ongoing as of October 2014. Petroleum storage facilities operated by the SFWMD are located at the S-333 and S-356 structures.

A search of FDEP's databases of contamination sites and petroleum storage facilities identified five spill sites and 15 petroleum storage facilities located along the canal or within the 8.5 SMA. The SFWMD is listed as the permit holder for storage facilities at the S-357 and S-331 pump stations. The spill at the SFWMD's S-331 pump station has been completed. A spill at the General Portland, Inc. facility west of the canal is listed as ongoing. Three non-petroleum cleanup sites are located along the L-31N Canal. Two of the sites are located along the L-31N Canal buffer trail and one is located within the 8.5 SMA.

3.17 NOISE

Noise levels are associated with surrounding land use. Within the major natural areas of south Florida, external sources of noise are limited and of low occurrence. Existing sources of noise are limited to vehicular traffic travelling on roads adjacent to and cutting through the project area. Other sources of noise which may occur within these natural areas include air boats, off road vehicles, swamp buggies, motor boats, and occasional air traffic. Sources of noise in rural, areas include noise associated with agricultural production such as the processing and transportation of agricultural produce. Within the rural municipalities and urban areas, sound levels would be expected to be of greater intensity, frequency, and duration. Noise associated with transportation arteries, such as highways, railroads, primary and secondary roads, airports, operations at commercial and industrial facilities etc., inherent in areas of higher population would be significant and probably override those sounds associated with natural emissions.

3.18 AESTHETICS

The visual characteristics of south Florida can be described according to the three dominant land use categories: natural areas, agricultural lands, and urban areas. The natural areas consist of a variety of upland and wetland ecosystems, including lakes, ponds, vast expanses of marsh and wet prairie, with varying vegetative components. Uplands are often dominated by pine, although other sub-tropical and tropical hardwoods do occur. Overall, the land is extremely flat, with few natural topographic features such as hills or other undulations. Much of the visible topographic features within the natural areas are man-made. Generally, urban development is concentrated along the LEC. Development is typically immediately adjacent to or nearby protected natural areas.

3.19 SOCIOECONOMICS

Florida's economy is characterized by strong wholesale and retail trade, government, and service sectors. The economy of south Florida is based on services, agriculture, and tourism. The three counties that comprise the LEC are heavily populated. Much of the land within the area potentially impacted is within ENP and is publicly owned. However, a number of privately owned parcels still exist within this region. Several private entities previously owned real estate within the project area adjacent to Tamiami Trail and within ENP (**FIGURE 3-4**). Property owners included three airboat concessionaires, the Airboat Association of Florida, Florida Power and Light, Lincoln Financial Media, and Salem Communications, which continue to operate under agreements with the Federal Government. Efforts by the Corps and DOI/ENP to acquire real estate interests for all privately owned properties and the channel and flowage easements for the Tamiami Trail Bridge and roadway to allow raising of the L-29 Canal maximum operating limit above 7.5 feet, NGVD were completed by August 2017.

The Miccosukee Indian Tribe of Florida currently lease two areas adjacent to Tamiami Trail (Osceola and Tigertail Camps) and have several businesses adjacent to Tamiami Trail west of S-333 including the Miccosukee Indian Village, Restaurant and airboat concessionaires.

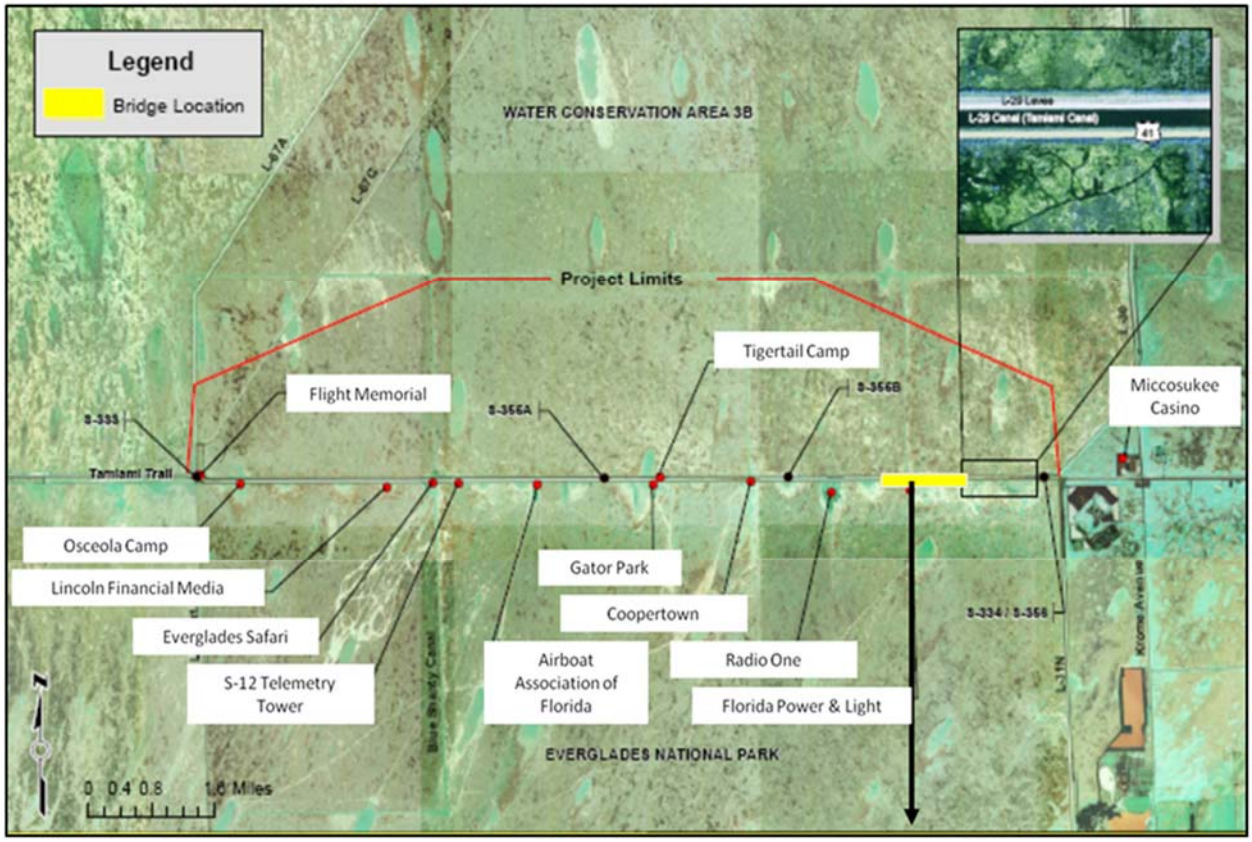

FIGURE 3-4. LOCATIONS OF PRIVATELY OWNED REAL ESTATE WITHIN THE PROJECT AREA

The 8.5 SMA is located in the East Everglades, approximately 20 miles southwest of Miami, ten miles north of Homestead, and 6.6 miles south of U.S. Highway 41. It is bounded on the east by L-31N, on the west by NESRS (part of ENP), on the north by SW 104th Street, and on the south by SW 168th (Richmond Drive) Street. The 8.5 SMA presently encompasses approximately ten square miles of mixed use development. Approximately 42 percent (2,699 acres) of the 8.5 SMA is classified as wetlands, one percent (65 acres) as uplands, and 57 percent (3,646 acres) as residential and/or agricultural lands based on a Wetland Rapid Assessment Procedure (WRAP) performed for the 2000 GRR/FSEIS (USACE 2000). The eastern region of the 8.5 SMA is dedicated to agricultural and residential land uses (USACE 2012a).

3.20 AGRICULTURE

The Miami-Dade County agricultural industry is unique in both the types of commodities produced and the method of cultivation. The majority of agricultural activities in the county are located south of Tamiami Trail and east of ENP. A variety of vegetables, fruits, and ornamentals are grown within this region and include many tropical and subtropical crops, which are grown year-round. The most active growing season is between September and May. Because of the wet and dry rainy seasons in the area, planting times are controlled by the elevation of ground water. Soils in these agricultural areas are rocky soils and marl soils.

3.21 RECREATION

There are many recreational opportunities throughout south Florida. WCA 3 has been used for recreational activities including hunting, fishing, frogging, boating, camping, and off-road vehicle use. Private camps are located throughout WCA 3. A variety of other nature-based recreational opportunities are also provided to the public within WCA 3. These activities include wildlife viewing and nature photography. Hiking and bicycling are also permitted on existing levees within the project area where appropriate. There are also several recreation areas at locations along the boundary of WCA 3. Similar recreational opportunities are provided in ENP.

4 ENVIRONMENTAL EFFECTS

4.1 GENERAL ENVIRONMENTAL EFFECTS

The following includes anticipated changes to the existing environment including direct, indirect, and cumulative effects. Environmental effects are expected to be spatially limited and small in magnitude given the short duration of the Proposed Action. Potential environmental effects of current water management operations (No Action Alternative) are thoroughly evaluated within the February 2017 Increment 1.1 and 1.2 EA (USACE 2017a), the June 2017 WCA 3A Planned Temporary Deviation EA (USACE 2017b), the July 2017 WCA 2A Planned Temporary Deviation (USACE 2017c) EA and the September 2017 WCA 3A Emergency and Planned Temporary Deviation EA implemented post Hurricane Irma (2017d) and are hereby incorporated by reference. Water management actions taken in 2017 for WCA 2A and WCA 3A are not anticipated to be in effect past the first quarter of 2018 as described in **Section 1.3.8**. Please refer to the cited documents for additional information (http://www.saj.usace.army.mil/About/Divisions-Offices/Planning/Environmental-Branch/Environmental-Documents/).

4.2 CLIMATE

Implementation of the No Action Alternative and Action Alternatives would not result in significant impacts to the climate of south Florida.

The impact of current or projected effects of climate change on C&SF operations is difficult to estimate given the uncertainty in predictions of future weather patterns and water management strategies. Higher average ambient temperatures are expected to result in increased evapotranspiration. Rainfall events are expected to become less frequent but larger in magnitude. As a peat soil ecosystem, increasing drought would reduce available water to keep the soils wet, resulting in higher peat oxidation and loss of soil elevations in freshwater wetlands. Regional surface water storage systems (*i.e.* canals) will most likely experience more rapid water loss when compared to current water levels, ultimately impacting availability of water supplies. Sea level change is one of the more certain consequences of climate change, and because it affects the land/ocean interface, it has the potential for environmental impacts on coastal areas. Future rates of sea level change are expected to result in significant impacts on coastal canals and communities, with loss of flood protection and increased saltwater intrusion being the primary effects. Additionally, coastal ecosystems and estuaries are expected to be adversely affected and require additional deliveries of freshwater to maintain desirable salinity patterns and healthy ecosystems.

The influence of climate change is not anticipated to alter the severity or nature of impacts resulting from the Proposed Action. The overarching project need for Increment 2 is to increase the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of natural resources. Potential benefits (*i.e.* improved hydroperiods) expected from implementation of the Proposed Action may be reduced as a result of climate change and the potential for increased evapotranspiration; however general environmental effects of the Proposed Action are expected to be of short duration as Increment 2 will extend until implementation of COP anticipated January 1, 2020.

4.3 GEOLOGY AND SOILS

4.3.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

The No Action Alternative does not include construction of permanent structures or structural modifications to existing C&SF Project features. Geologic impacts resulting from removal of surface cover (*i.e.* vegetation and soil), or removal of caprock from blasting and/or removal of limestone would not occur under continued implementation of Increment 1.1 and 1.2. As described in the February 2017 Increment 1.1 and 1.2 EA, the duration at which water stages within the L-29 Canal approach 7.8 feet, NGVD is expected to be greater under Increment 1.1 and 1.2 relative to the 2012 Water Control Plan (USACE 2017a), increasing the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of natural resources. Improved hydroperiods within NESRS has the potential to reduce soil oxidation, and promote peat accretion. A potential decrease in drying event severity relative to prior water management operations has the potential for reduced fire incidence within NESRS; however the frequency of muck fires are primarily controlled by weather patterns within the area. Hydrologic modeling was completed to support the July 2016 ERTP BO. Model simulation INCR1B corresponds to the No Action Alternative in this EA (for WCA 3A and ENP), without the simulation of the WCA 3A high water strategy to limit additional S-12A and/or S-12B closures during late wet season high water conditions. Modeling results indicated that operations may result in slightly higher WCA 3A stages (**FIGURE 4-1**) and improved hydroperiods along the eastern perimeter of NESRS (**FIGURE 4-11**) and decreased hydroperiods within western SRS, downstream of S-12D in comparison to the May 2015 Increment 1 EA and FONSI. Reference **Section 4.5.1**.

4.3.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

Implementation of Alternative B would result in similar effects as discussed under the No Action Alternative within WCA 3 and ENP. Alternative B has the ability to raise the L-29 Canal stage operating limit up to 8.5 feet, NGVD. Under the implementation of Alternative B, hydrologic benefits within NESRS will be greater than the No Action Alternative but less than Alternative C. Since Alternative B maintains the L-29 Canal stage higher than the No Action Alternative, Alternative B would likely show a slightly higher beneficial effect on geology and soils within ENP due to improved hydroperiods. Soils within ENP have previously been adversely affected by C&SF infrastructure that lead to over drying of NESRS. Potential effects to geology and soils within WCA 3 is not expected as Alternative B does not alter the duration of dry downs which often results in increased oxidation, subsidence and peat fires. **FIGURE 4-11** illustrates average annual hydroperiod distributions for the No Action Alternative (INCR1B) and Alternative C (INCR2B). Increases in hydroperiods are anticipated under implementation of Alternative B within the range depicted in **FIGURE 4-11** for NESRS. Alternative C is anticipated to result in a moderate stage reduction of less than 0.25 feet for WCA 3A compared to the No Action Alternative. Depending on the extent to which the FDOT constraint and the 8.5 SMA flood mitigation constraints accommodate prolonged increased stages within the L-29 Canal, under Alternative B, a minor stage reduction between 0 and 0.25 feet is anticipated for Alternative B. Alternative C is anticipated to result in a moderate stage reduction of less than 0.25 feet for WCA 3A compared to the No Action Alternative. Depending on the extent to which the FDOT constraint and the 8.5 SMA flood mitigation constraints accommodate prolonged increased stages within the

L-29 Canal, under Alternative B, a minor stage reduction in WCA 3A between 0 and 0.25 feet is anticipated for Alternative B.

4.3.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

Implementation of Alternative C would result in similar effects as discussed under Alternative B. Since Alternative C has the ability to raise the L-29 Canal stage operating limit up to 8.5 feet, NGVD and is not subject to a limited duration at which this stage can be maintained (**Appendix A, Part 1**), Alternative C would likely show a slightly higher beneficial effect on geology and soils within ENP due to improved hydroperiods. Alternative C is anticipated to result in a moderate stage reduction of less than 0.25 feet for WCA 3A compared to the No Action Alternative.

4.3.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Implementation of Alternatives G would result in similar effects as discussed under Alternative B.

4.4 STUDY AREA LAND USE

Implementation of the No Action Alternative and Action Alternatives would not result in significant impacts to study area land use.

4.5 HYDROLOGY

4.5.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

4.5.1.1 WCA 3A, WCA3B, AND ENP SHARK RIVER SLOUGH

Under the continued implementation of Increment 1.1 and 1.2, durations at which water stages within the L-29 Canal approach 7.8 feet, NGVD is expected to be greater relative to the 2012 Water Control Plan (USACE 2017a), increasing the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of natural resources.

<u>WCA 3A</u>

The Corps reinitiated consultation with USFWS under the ESA on ERTP on November 17, 2014 as a result of an exceedance of an Incidental Take Reinitiation Trigger from the November 17, 2010 ERTP BO (Reference **Section 1.3.6**). During ESA consultation, USFWS indicated that extended closure periods for the S-12A, S-12B, S-343A, S-343B and S-344 structures may be required to achieve performance targets for the CSSS. The Corps expressed reservations with the extended closure periods for S-12A and S-12B prior to completing the Baseline and Modification Model (BAMM) regional flood routing study for the WCAs, due to the concerns about levee safety and other risks in WCA 3A. To effectively evaluate the conflicting recommendations identified by the USFWS and the Corps, model simulations were conducted to evaluate the additional closure periods. The effort focused on refinement of the base condition model (*i.e.* ERTP) to replicate current system configuration and operational protocols, and explored potential operational

scenarios to enhance system performance for the CSSS while balancing WCA 3A high water concerns. Since ESA consultation was conducted based on the current approved 2012 Water Control Plan (ERTP) and since the Corps was operating under Increment 1when the modeling analysis was completed in May-June 2016, both base conditions were referenced during the ESA consultation. For the 2016 hydrologic modeling, simulation scenarios were evaluated which are comparable to conditions expected under the Increment 1 field test (INCR1R) and the Increment 1.1 and 1.2 field test (INCR1B). An additional base condition model was also prepared with Increment 2 placeholder operations, which included raising the L-29 Canal stage maximum operating limit up to 8.5 feet, NGVD, given recognition that Increment 2 operations were expected to be implemented during the time period covered by the 2016 ERTP BO. Hydrologic modeling was not completed to support the May 2015 Increment 1 EA and FONSI but the base condition models developed for the ESA consultation are consistent with the hydrologic effects for Increment 1 as summarized in the May 2015 Increment 1 EA and FONSI.

The hydrologic effects for Increment 1.1 for WCA 3A and western SRS, compared to Increment 1 are affected by the modified closure regime for the S-12A and S-12B structures. The modeling conducted for the ESA consultation assumed that these structures, in addition to the S-343A, S-343B, and S-344, would be closed between 01 October and 14 July during all years. However, the 2016 ERTP BO RPA and the Operational Strategy for Increment 1.1 and 1.2 both recognize that the modified closure period for S-12A and S-12B would be accompanied by a high-water strategy for October and November that was developed by the Corps to limit the duration of WCA 3A high water stages during the late wet season.

To evaluate the effects of the operational changes on WCA 3A, intra-annual stage hydrographs were generated for the February 2017 Increment 1.1 and 1.2 EA and FONSI (USACE 2017a) using the average daily stage of each of the 41 years within the simulation period of record, for each day of the year. The INCR1B simulation corresponds to the No Action Alternative for this EA, without the WCA 3A high water strategy to limit additional S-12A and/or S-12B closures during late wet season high water conditions; the INCR2B simulation corresponds to Alternative C within this EA, without the WCA 3A high water strategy and with the L-29 Canal maximum operating limit raised up to 8.5 feet, NGVD (previous surrogate placeholder for MWD Increment 2). As presented in **FIGURE 4-1** and Section 4.5.3.1 of the February 2017 Increment 1.1 and 1.2 EA and FONSI, the modeling results indicated that Increment 1.1 operations (INCR1R) may result in slightly higher WCA 3A stages than Increment 1 operations (INCR1B), and characterized the effects of the No Action Alternative on WCA 3A water levels, compared to Increment 1 as below:

- Average water levels across WCA 3A are increased by 0.0-0.1 feet during the months of January through September and December (**FIGURE 4-1**);
- Average water levels across WCA 3A are increased by 0.20-0.25 feet during the months of October and November, without consideration of the WCA 3A high water criteria that are included in the Increment 1.1 and 1.2 Operational Strategy (**FIGURE 4-1**);
- During moderate wet hydrologic conditions (characterized by the 75th percentile intraannual stage hydrographs), water levels across WCA 3A are increased by 0.0-0.1 feet during the months of January through September (USACE 2017a);
- During moderate wet hydrologic conditions, water levels across WCA 3A are increased by 0.2-0.5 feet during the months of October through December, without consideration of the

WCA 3A high water criteria that are included in the Increment 1.1 and 1.2 Operational Strategy (USACE 2017a);

Because of the unusually wet conditions in the project area (See **FIGURE 4-2** for a comparison of recently observed stages against the historical stages), it was not possible to run the system per the intent of the Increment 1.1 Operational Strategy for sustained periods. With the implementation of Condition 3 and 4 Action Lines, the No Action Alternative is expected to help alleviate the negative impacts of extreme high water conditions in the WCA 3A relative to the 2012 Water Control Plan (USACE 2012c).

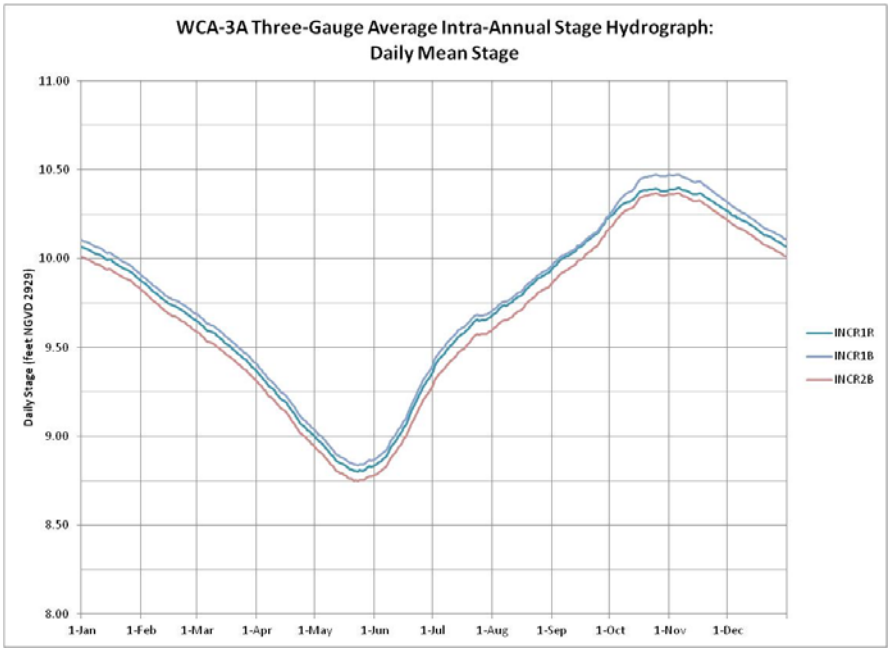

FIGURE 4-1: WCA 3A THREE-GAUGE AVERAGE INTRA-ANNUAL STAGE HYDROGRAPH FOR AVERAGE HYDROLOGIC CONDITIONS, FOR THE NO ACTION ALTERNATIVE (INCR1B), INCREMENT 1 (INCR1R) AND ALTERNATIVE C (INCR2B).

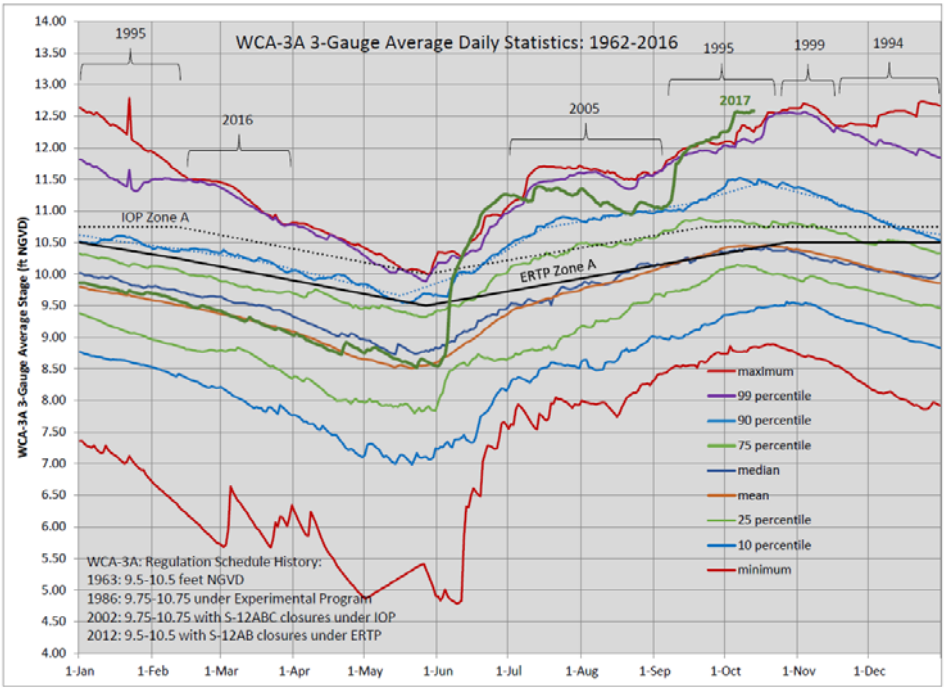

FIGURE 4-2: WATER CONSERVATION AREA 3A (WCA 3A) ANNUAL AVERAGE STAGE HYDROGRAPH FOR THE THREE-STATION AVERAGE, 1962-2016.

WCA 3B

Water enters NESRS primarily from WCA 3A via S-333, and then to the L-29 Borrow Canal and subsequently passes through several sets of culverts and the one-mile Tamiami Trail bridge, under the Tamiami Trail. In addition to this primary route, S-355A and S-355B may also be used to deliver water from WCA 3B to the L-29 Canal for subsequent passage through the culverts to NESRS. The S-152 culvert structure can be used to deliver water from WCA 3A to WCA 3B when a set of hydrologic and water quality criteria listed in the operational plan for the Decomp Physical Model (DPM) is satisfied. Even though it is not a part of the Modified Water Deliveries Project, S-152 operations under the No Action Alternative may result in increased water deliveries to the ENP by increasing the head difference across S-355A and S-355B. Since the beginning of operations of the DPM in November 2013, there have been five flow events during which the S-152 structure was used to convey water from WCA 3A to WCA 3B (**FIGURE 4-3**). If year-around operational criteria for the S-152 structure is implemented during Increment 2 (USACE, 2017f), it is expected that more favorable head differences for flow through S-355A and S-355B will be possible. After implementation of Increment 1.1 and 1.2 in February 2017, the Corps prepared a Supplemental EA and Proposed FONSI in June of 2017 to continue operational testing under the DPM year round, with the potential for additional years of testing through the year 2021 (USACE 2017f). Recent unusually wet conditions in the project area resulted in high stages in WCA 3B exceeding the 8.5 feet, NGVD threshold for Site 71 (**FIGURE 4-4**). The continued implementation of No Action Alternative is not expected to create adverse effects on WCA 3B, and, with the Conditions 3 and 4 Action Lines, is expected to help reduce the negative impacts caused by extreme high water conditions in WCA 3B.

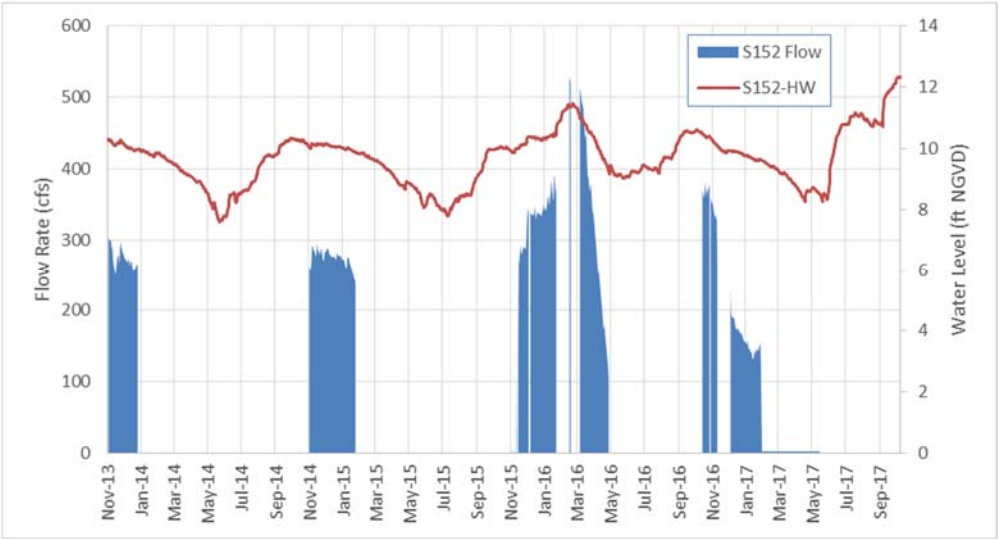

FIGURE 4-3: S-152 FLOW RATE AND HEADWATER STAGE SINCE THE START OF STRUCTURE OPERATIONS IN NOVEMBER 2013.

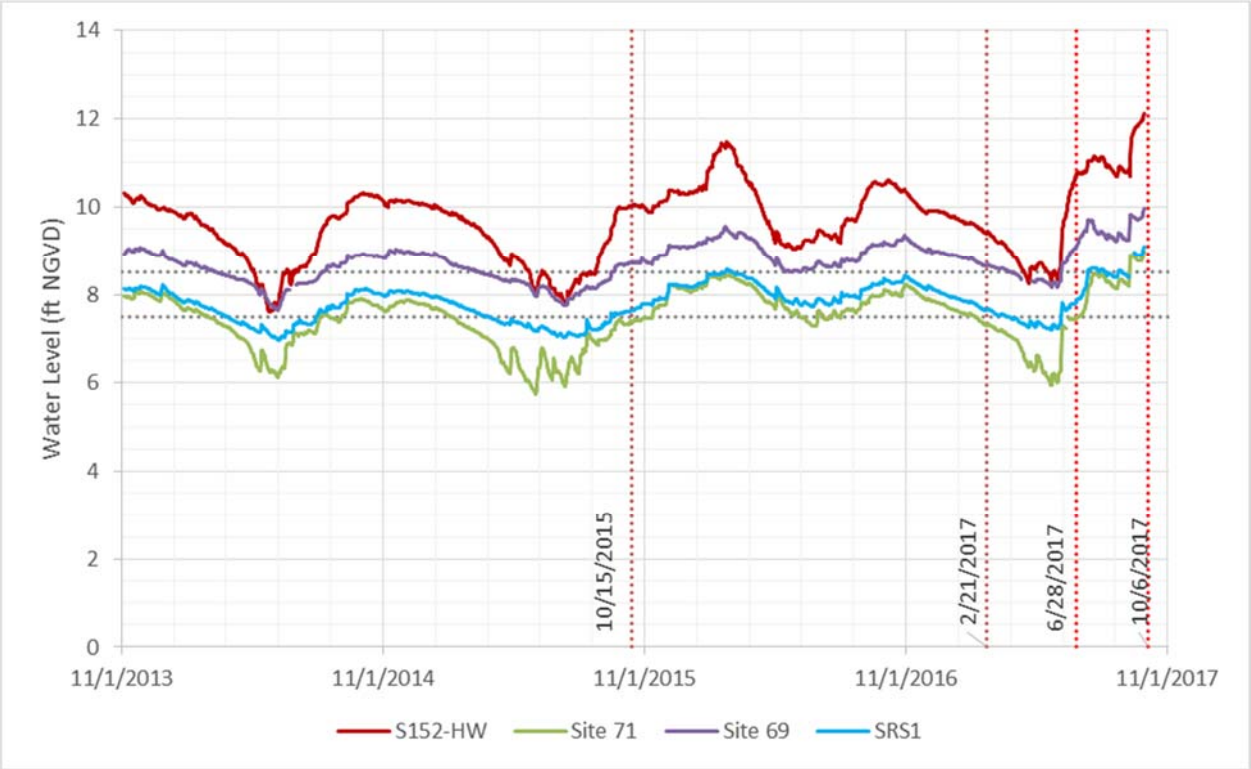

FIGURE 4-4: WCA-3B STAGES BEFORE AND AFTER THE START OF INCREMENTAL TESTS IN OCTOBER 2015.

ENP Shark River Slough

The continued implementation of Increment 1.1 and 1.2 is expected to provide beneficial effects for NESRS by increasing flows from the WCA 3A relative to the 2012 Water Control Plan (USACE 2012c). As described in the February 2017 Increment 1.1 and 1.2 EA and FONSI (USACE 2017a), the duration at which water stages within the L-29 Canal approach 7.5-7.8 feet, NGVD is expected to be greater under Increment 1.1 and 1.2 relative to the 2012 Water Control Plan (USACE 2017a), increasing the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of improved hydroperiods. Although the L-29 Canal maximum operating limit (7.5 feet, NGVD) and the relaxation of the G-3273 constraint are the same between Increment 1 and Increment 1.1, the stage duration curves for the L-29 Canal and G-3273 gage and the hydroperiod changes within Shark River Slough demonstrated a minor improvement to NESRS and Western Shark River Slough compared to the precursor field test increment (Increment 1):

- Average annual stage increase of approximately 0.1-0.2 feet for the L-29 Canal for hydrologic conditions ranging from normal to moderate dry, with no significant change to the frequency of wet, extreme wet or extreme dry stages (**FIGURE 4-5)**;
- Average annual stage increase of approximately 0.1 feet for G-3273 for hydrologic conditions ranging from moderate wet to moderate dry, with no significant change to the frequency of extreme wet or extreme dry stages (**FIGURE 4-6**);
- Increase hydroperiods by 5 to 15 days along the eastern perimeter of NESRS;
- Additional minor to moderate increases in NESRS hydroperiods are expected with implementation of Increment 1.2, which provides the ability to raise the L-29 Canal stage maximum operating limit from 7.5 up to 7.8 feet, NGVD contingent upon completion of sufficient portions of Contract 8 (construction of the C-111 NDA L-315 western levee and the L-357W Extension Levee between Richmond Drive and the 8.5 SMA Detention Cell), completion of the Contract 8A berms inside the 8.5 SMA Detention Cell, and continued compliance with the 8.5 SMA flood mitigation constraints;
- Decrease hydroperiods by 10 to 15 days within Western SRS, downstream of S-12D;
- Decrease hydroperiods within northern CSSS-A habitat in Western SRS by 5 to 30 days and decrease hydroperiods within southern CSSS-A habitat in Western SRS by 0 to 5 days (expected Increment 1.1 hydroperiods are shown in **FIGURE 4-7**, see USACE 2017a for the comparison of modeling results).

Consistent with the 2012 Water Control Plan, under the No Action Alternative, the DOI will continue to sandbag or otherwise block the culverts under Tram Road by February 1 if necessary. The effect of blocking the Tram Road culverts would be to prevent westward flow of water from S-12C into the western marl prairies and CSSS-A. In addition, to further prevent westward flow of water from the borrow canal associated with the old Tamiami Trail road, the DOI may elect to purchase, install, monitor and maintain a removable stopper in this borrow canal between S-12C and S-12B, at the junction with the Shark Valley Tram Road; the environmental effects were previously evaluated by ENP, and this assessment was incorporated within the 2011 ERTP FEIS (Appendix I) at the request of the DOI. Authority to purchase, install, monitor and maintain this feature resides with the DOI. Due to potential effects on the WCA 3A discharge capacity (most notably during high water conditions) and concerns previously indicated by the Miccosukee Tribe,

this action will be closely coordinated by DOI with the Corps. If DOI decides that they want to install this structure (in coordination with the Corps), it would be compatible with the currently proposed operational plan. However, the Corps would have authority to remove this stopper in the event that increased conveyance capacity is required to remove water from WCA3A due to high water concerns. The 2014 CERP Central Everglades Planning Project (CEPP) includes a proposal to remove approximately 6 miles of Old Tamiami Trail between the Shark Valley Entrance Road and the L-67 extension levee. DOI is currently conducting a tiered NEPA analysis, following from the CEPP Project Implementation Report and EIS, to further assess site-specific impacts on hydrologic sheetflow, the Old Tamiami Trail, and other resources from a range of alternatives that would remove different amounts of the roadway.

The hydrologic effects for Increment 1.1 for WCA 3A and western SRS, compared to Increment 1.0, are affected by the modified closure regime for the S-12A and S-12B structures. The modeling conducted for the ESA consultation each assumed that these structures, in addition to the S-343A, S-343B, and S-344, would be closed between 01 October and 14 July during all years.

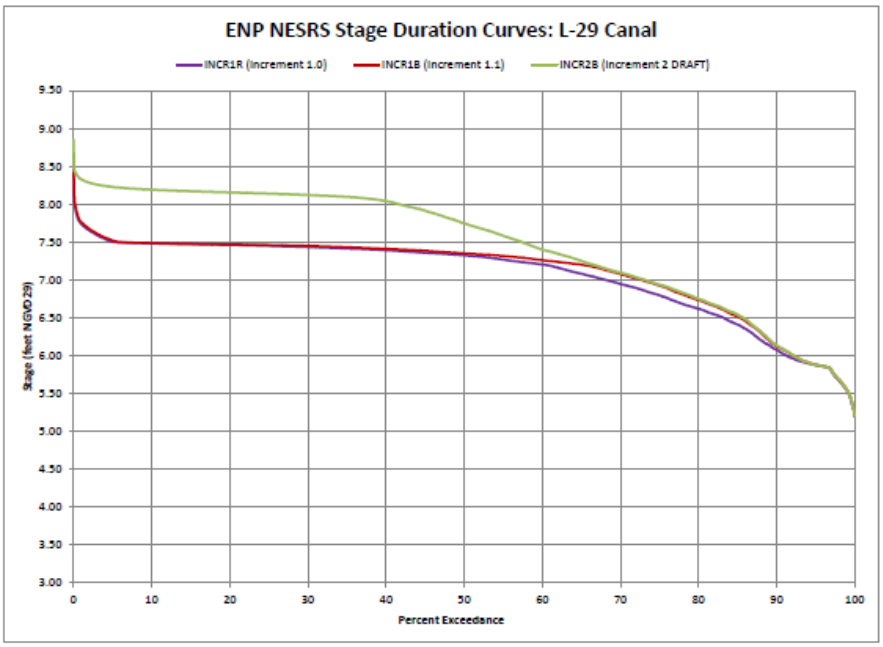

FIGURE 4-5: SIMULATED L-29 CANAL STAGE DURATION CURVES, INCLUDING COMPARISON BETWEEN NO ACTION ALTERNATIVE (INCR1B), INCREMENT 1 (INCR1R) AND ALTERNATIVE C (INCR2B).

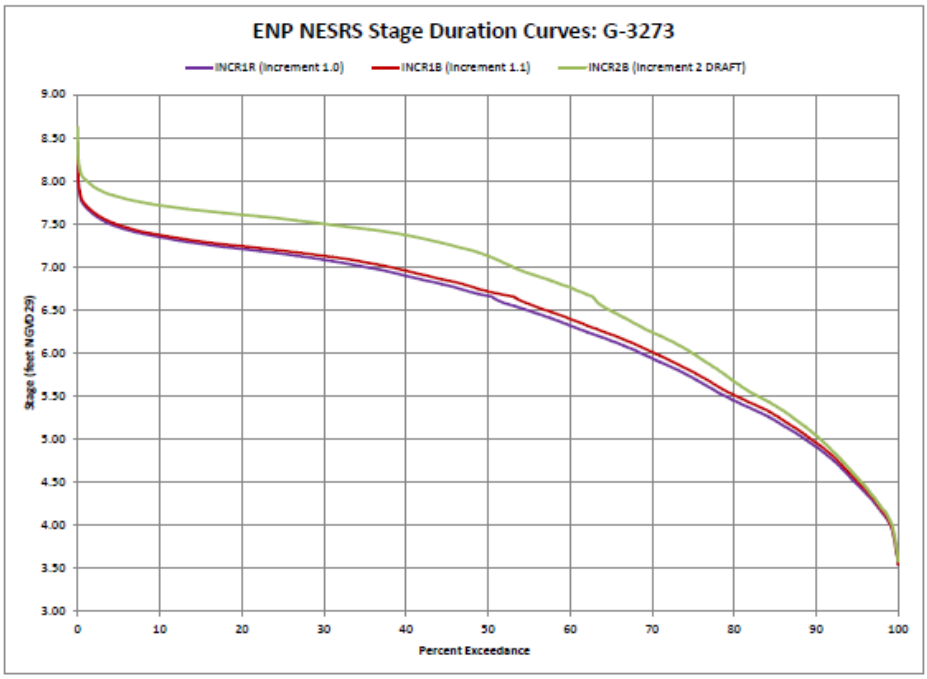

FIGURE 4-6: SIMULATED G-3273 STAGE DURATION CURVES, INCLUDING COMPARISON BETWEEN NO ACTION ALTERNATIVE (INCR1B), INCREMENT 1 (INCR1R) AND ALTERNATIVE C (INCR2B)

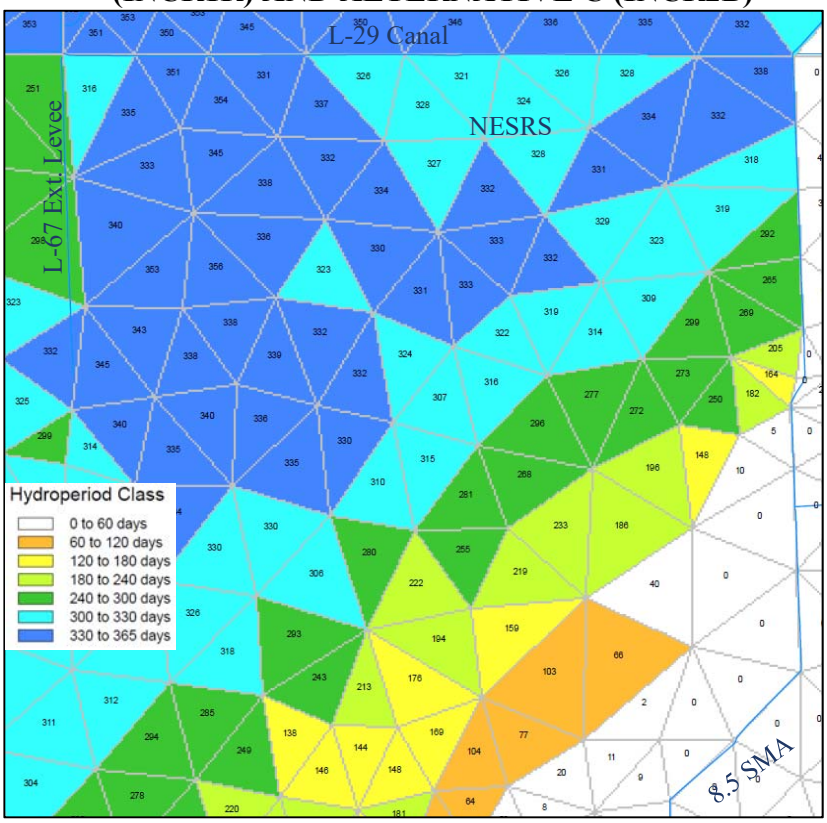

FIGURE 4-7: AVERAGE ANNUAL HYDROPERIOD DISTRIBUTION FOR THE NO ACTION ALTERNATIVE (INCR1B).

4.5.1.2 ENP EASTERN PANHANDLE AND MANATEE BAY/BARNES SOUND

Continued implementation of Increment 1.1 and 1.2 is expected to result in potential impacts to ENP eastern Panhandle, Manatee Bay and Barnes Sound as a result of expected increases in the frequency and duration of low volume discharges from S-197 relative to the 2012 Water Control Plan (USACE 2015). Since the 2016 ERTP BO and RPA provides performance targets for the CSSS eastern subpopulations and does not prescribe specific SDCS operational changes, the Corps advocated to provide sufficient flexibility within the Increment 1.1 and 1.2 Operational Strategy to allow the Corps and SFWMD water managers to achieve the intended performance from the RPA proposed operational condition. Not all flood mitigation and seepage management features envisioned in the MWD and C-111 South Dade Projects have been constructed. The May 2015 Increment 1 EA and FONSI specified that S-197 would be operated consistent with the 2012 Water Control Plan during Condition 1 and Condition 2, when the WCA 3A stage was below the Increment 1 Action Line. Under Condition 3 and Condition 4, when the WCA 3A stage was above the Increment 1 Action Line, additional criteria were used which prescribed small discharges expected to assist in moderating high stages within the C-111 Canal through use of S-197 discharges. The additional S-197 gate openings ranged from 50 to 200 cfs based upon S-178 TW stage between 2.5-2.9 feet, NGVD (These stages correspond to approximately 2.4-2.8 feet, NGVD at the S-18C headwater) when the S-18C gates are out of the water. These additional S-197 operating criteria did not change the existing S-197 operating criteria for opening prescribed by the conditions at S-177 headwater. These additional S-197 operating criteria reduced how much S-197 is opened for the first level (normally S-197 opened to one third of S-197 capacity, or 800 cfs) while leaving the criteria for the second level (two thirds open) and third level (full open) unchanged. The reduction in discharge for level one openings of S-197 was from approximately 800 cfs to 500 cfs.

Increment 1.1 retained from Increment 1 a requirement for additional water management operating criteria for features of the SDCS including S-197 (in addition to the S-197 operating criteria defined in the 2012 Water Control Plan). However, additional S-197 operating criteria were included in both Increment 1, and Increment 1.1 and 1.2 under all conditions where implementation of increased stages within NESRS may result in increased seepage inflows into the SDCS, including Condition 2 (when G-3273 stage is above 6.6 feet, NGVD) and Conditions 3 and 4 (when the WCA 3A stage was above the Increment 1 Action Line). Based on the modeling analysis conducted in support of the 2016 ERTP BO and RPA, the Increment 1.1 and 1.2 Operational Strategy was expanded to include the following new operations for S-176 and S-177: (1) from 01 August through 14 February (outside of CSSS nesting period), S-176 may release up to an additional 200 cfs discharge to Manatee Bay while maintaining C-111 Canal stages at S-176 HW above 4.2 feet, NGVD; and (2) during the period from 01 August through 14 February, S-177 may release up to an additional 200 cfs water supply delivery to Manatee Bay while maintaining C-111 Canal stages at S-177 HW above 3.2 feet, NGVD (normal operating range is from 3.6-4.2 feet, NGVD). In order to limit the necessity for second level or third level S-197 gate openings, given recognition of these potential increased flows being transferred south from S-176 and S-177, the Increment 1.1 and 1.2 operational strategy accommodated limited S-197 gate openings, which may range from 50 to 400 cfs, for conditions when the S-18C headwater stage is above the historical average for the month (refer to **Appendix A, Part 2**).

The hydrologic modeling conducted for the ESA consultation did not account for the effects of the operational flexibility added to the Increment 1.1 and 1.2 Operational Strategy to allow the Corps and SFWMD water managers to achieve the intended performance from the RPA proposed operational condition; however, the comparison between Increment 1 (model simulation INCR1R) and the modified SDCS operations initially evaluated for the Biological Opinion (model simulation INCR1H) notably predicted a moderate reduction in southward flows from S-176 (average annual discharge volume reduced from 51,000 acre-feet to 41,000 acre-feet) and a corresponding moderate reduction at S-197 (average annual discharge volume reduced from 16,600 acre-feet to 13,600 acre-feet, associated principally with increased operation of the S-332B/C/D pump stations (average annual discharge volume increased from 292,000 acre-feet to 339,000 acre-feet).

For the No Action Alternative, the frequency of opening S-197 will be highly dependent on: (1) upstream conditions necessary to facilitate completion of the C-111 South Dade construction needed prior to MWD Increment 2; and (2) operational modifications required to provide the necessary suitable hydrologic conditions for the eastern CSSS sub-populations. Compared to the precursor Increment 1 field test, based on qualitative assessment of the S-197 criteria described in the Increment 1.1 operational strategy, the No Action Alternative may result in the following hydrologic effects within the ENP Eastern Panhandle and Manatee Bay/Barnes Sound:

- Minor to moderate increase in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay/Barnes Sound;
- No significant change to the timing of S-197 operations (July to October / wet season);
- Minor increase to flood control releases from S-18C and S-197 to mitigate for increased discharges from S-331 for 8.5 SMA flood mitigation;
- Minor increase to flood control releases from S-18C and S-197 to mitigate for increased operation of the S-332D pump station and/or the C-111 South Dade SDA, to manage L-31N Canal stages and facilitate completion of the C-111 South Dade construction needed prior to MWD Increment 2.

4.5.1.3 ENP TAYLOR SLOUGH

The Operational Strategy for Increment 1.1 and 1.2 incorporated changes to the operation of S-332D and prescribed operational criteria for the S-328 gated culvert (refer to map on **FIGURE 3-1**). A general indication of potential increased inflows to Taylor Slough was provided in the February 2017 Increment 1.1 and 1.2 EA and FONSI using the hydrologic modeling conducted for the ESA consultation, although the hydrologic modeling does not effectively account for the effects of the operational flexibility added to the Increment 1.1 and 1.2 Operational Strategy to allow the Corps and SFWMD water managers to achieve the intended performance from the RPA proposed operational condition. The comparison indicated that increased operation of the S-332D pump stations may result in up to a 17 percent increases towards Taylor Slough (average annual discharge volume increased from 103,000 acre-feet to 121,000 acre-feet).

During development of the Operational Strategy for Increment 1.1 and 1.2, operational modifications to provide supplemental flows to Taylor Slough were advocated by the SFWMD to help facilitate the recovery of Florida Bay from the 2015 extreme hyper-salinity event. The SFWMD plan, presented at the July 14, 2016 SFWMD Governing Board, is expected to increase

the flow of water directly into Taylor Slough in ENP, a major source of fresh water for the bay. Components of this plan include, but are not limited to, sending additional water through the S-328 water control structure into the L-31 West Canal to reach Taylor Slough. The S-328 gated culvert is located in the southwest corner of Cell 1 of the S-332D Detention Area and provides an ability to discharge up to 500 cfs from Cell 1 into the L-31W Canal to short-circuit the southern portion of the S-332D Detention Area if necessary to ensure water deliveries reach Taylor Slough.

Conditional operations for the S-328 gated culvert were included within the Operational Strategy for Increment 1.1 and 1.2 in order to collect additional information needed to inform whether S-328 operations warrant inclusion within Water Control Plan updates following completion of the Increment 1.1 and 1.2 field test and/or inclusion for additional testing during Increment 2. The S-328 may be used to increase deliveries to Taylor Slough up to 250 cfs (restricted to half of the structure design capacity) as measured at S-332D provided that an average water depth of at least six inches is maintained in Cell 1. Prior to initial operation of S-328, construction of the three L-31W Canal plugs proposed between S-328 and the L-31W gap needed to be completed. The L-31W Canal plugs were identified in the 2016 C-111 South Dade Contract 9 EA; these features were constructed by the SFWMD between January and September 2017. Continued monitoring will need to be conducted to characterize the water quality of these new discharges into the ENP to determine if the current compliance monitoring point (S-332D) needs to be shifted to or include the S-328 flows.

The Increment 1.1 and 1.2 Operational Strategy also includes provisions for supplemental flows to Taylor Slough to help facilitate the recovery of Florida Bay from the 2015 extreme Hyper-Salinity event. When conditions allow, the Increment 1.1 and 1.2 Operational Strategy includes flexibility to enable the distribution of flows along the L-31N Canal to be changed to move water away from the C-111 South Dade Contracts 8 and 8A construction area during the time period when this is likely to help facilitate continued construction progress for Contract 8 and expedite construction for Contract 8A. Some short-term loss of effectiveness of the hydraulic ridge is expected with the corresponding increase in use of the downstream facilities. To offset the potential for reduced flows to Taylor Slough, up to 250 cfs of supplemental flows may be supplied to S-332D (and/or the SFWMD proposed connection from S-200 to Taylor Slough) as long as WCA 3A is above its floor elevation of 7.5 feet, NGVD by 0.5 feet (8.0 feet, NGVD) in April and May and above 8.5 feet, NGVD (1.0 foot above the water supply floor) in all other months. For the No Action Alternative, this operation will be limited to 8 weeks per year when the 3-gage average is below the historical median of WCA 3A; there will be no time limit while the 3-gage average is above the median stage.

The hydrographs included in
FIGURE 4-8 show the variation in stages and flow rates relevant to the Taylor Slough hydrology since October 2015. In addition to the variation driven by the regional rainfall, NP-TSB stages in the Taylor Slough appear to be influenced by the structure flows; however, longer period of record is needed to demonstrate the statistically significant dependency. Continued implementation of No Action Alternative is expected to result in improved hydrological conditions in the Taylor Slough relative to the 2012 Water Control Plan.

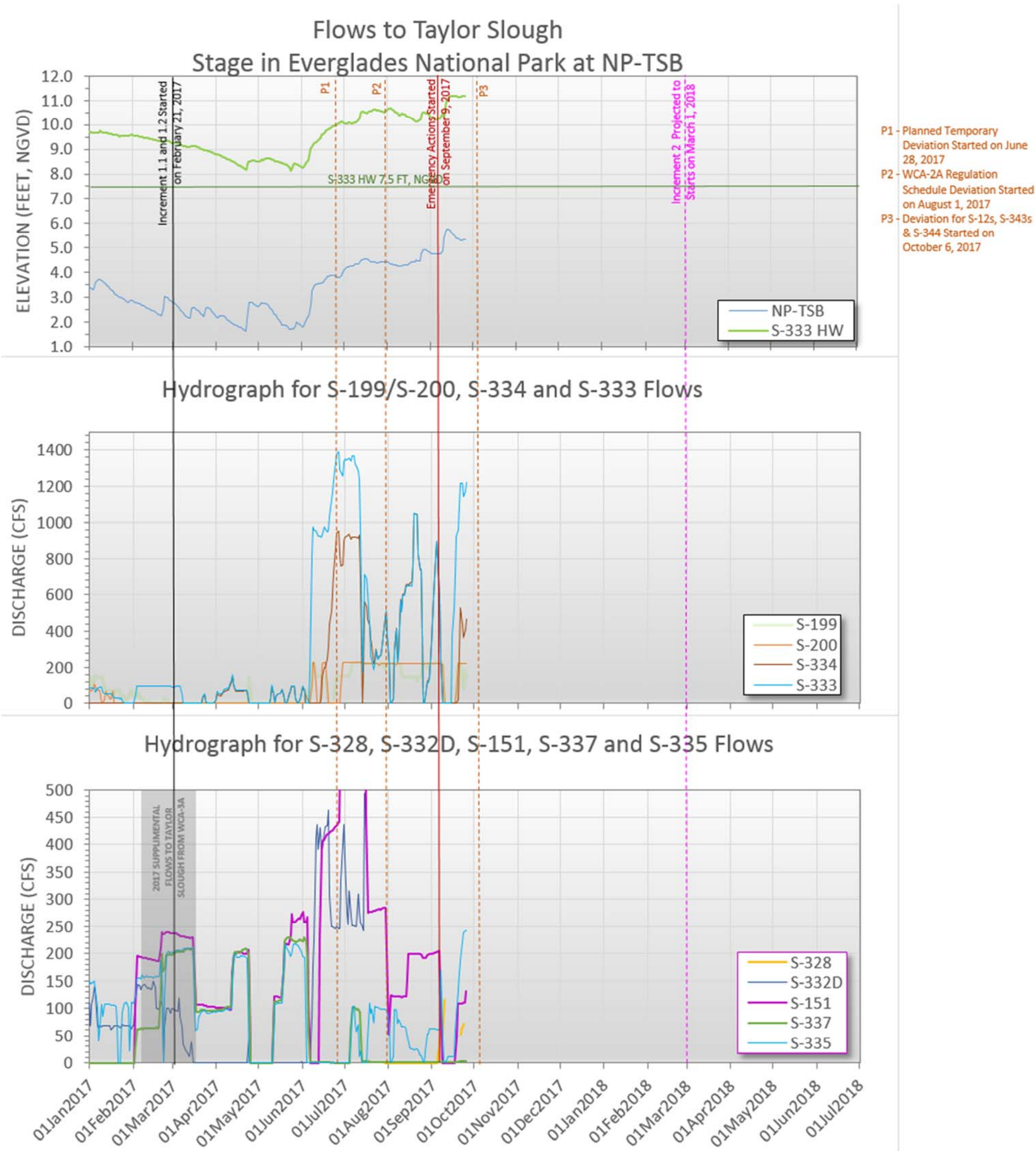

FIGURE 4-8: FLOWS TO TAYLOR SLOUGH FOLLOWING IMPLEMENTATION OF INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

4.5.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

4.5.2.1 WCA 3A, WCA 3B, AND ENP SHARK RIVER SLOUGH

Based on preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO, current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance), regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months (**FIGURE 4-10**). Consistent with the objectives and constraints of Increment 1, with Alternative B the Corps will continue to pursue opportunities to increase deliveries from WCA 3A to NESRS to the maximum extent practicable during Increment 2.

Increment 2 of the MWD Project is dependent on construction completion and operation of the C-111 South Dade NDA. The NDA is functional but not 100 percent complete. Termination for Convenience was issued from the Corps to the C-111 South Dade Contract 8 contractor for the NDA and became effective on September 20, 2017. The Corps is currently investigating alternate means to complete the remaining portions of the Contract 8 NDA construction following subsidence of the current Emergency Deviation conditions. Prior to operation of the C-111 South Dade NDA, the capability of the S-357 pump station to maintain flood mitigation requirements for 8.5 SMA is expected to limit the ability to raise the L-29 Canal stage above 7.5 feet, NGVD, most notably during the wet season months of June to October when approximately two-thirds of the average annual rainfall total is accumulated across South Florida. During the dry season months, limited water availability within WCA 3A may also limit the opportunity to raise the L-29 Canal stage above 7.5 feet, NGVD. Prior to operation of the NDA, the opportunity to raise the L-29 Canal above 7.5 feet, NGVD may be restricted to late in the wet season (September-October) and during the early dry season (November-December) when excess water storage remains within WCA 3A to facilitate continued regulatory releases in accordance with the Rainfall Plan and the limited operations at S-357 and operations at S-331 are effective to maintain 8.5 SMA flood mitigation requirements. Limited information is currently available to fully assess the effectiveness of the NDA to support prolonged operation of the L-29 Canal above 7.8 feet, NGVD while maintaining flood mitigation requirements for the 8.5 SMA, and this information is continuing to be assessed during the October 2017 deviation actions.

The unusually wet conditions in 2017 wet season resulted in emergency actions that raised the stages in L-29 Canal to the range proposed under Alternative B. Due to the limited duration of increment operations caused by unusually wet conditions, not enough data has been collected to establish the relationship between the L-29 canal stages and the deliveries to the NESRS. As shown in the hydrographs of
FIGURE 4-9, operational decision during the deviations resulted in lower net deliveries to the NESRS, than the deliveries made during Increment 1. Under the implementation of Alternative B, hydrologic benefits within WCA 3A, WCA 3B, NESRS, and Western SRS is expected to be greater than Alternative A but less than Alternative C, which are detailed in **Sections 4.5.1.1** and

4.5.3.1, respectively. The level of this expected improvement is expected to be quantified as the more data is collected under Increment 1.1, 1.2, and 2 operations. Alternative B has the ability to raise the L-29 Canal Stage maximum operation limit from 7.8 feet, NGVD to 8.5 feet, NGVD given the completion of the C-111 South Dade NDA and adherence to the 8.5 SMA flood mitigation constraints. Alternative C is expected to provide a greater magnitude of increased inflows to NESRS relative to Alternative B since it would not be subject to the FDOT/LRR Constraints along the Tamiami Trail roadway.

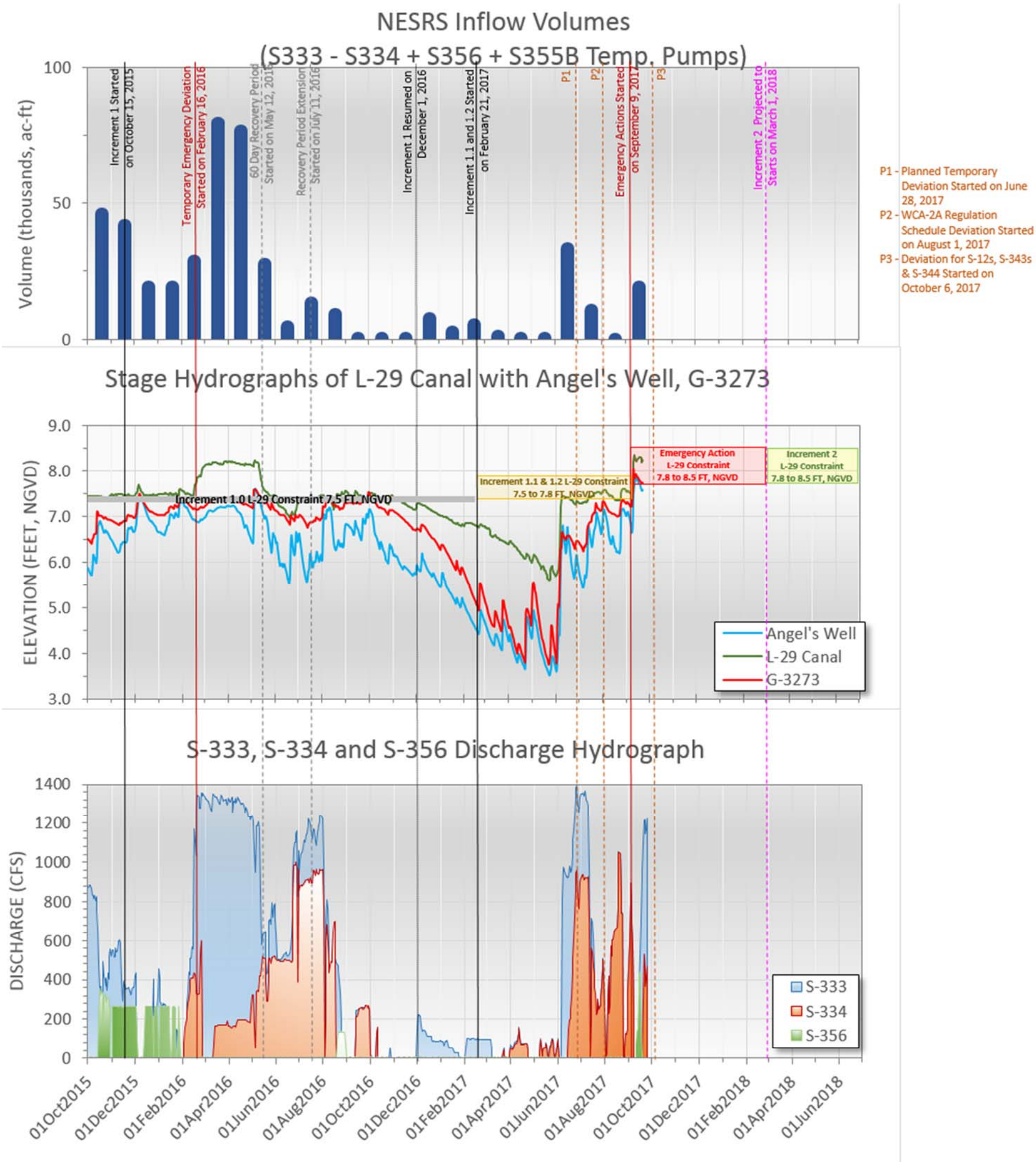

FIGURE 4-9: ESTIMATED WATER DELIVERIES TO NESRS ALONG WITH A STAGE COMPARISON IN THE L-29 CANAL FOLLOWING INITIATION OF MWD INCREMENT 1 AND INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

4.5.2.2 ENP EASTERN PANHANDLE AND MANATEE BAY/BARNES SOUND

Implementation of Alternative B is expected to result in minor improvement to the hydrology of the ENP Eastern Panhandle and Manatee Bay/Barnes Sound relative to the No Action Alternative with efforts to reduce the Column 2 discharges. Although the general criteria for limited use of Column 2 discharges (Condition 3 of the Operational Strategy) were not changed from the No Action Alternative, increased available storage within NESRS may result in increased seepage into the SDCS and reduce the frequency and duration for regulatory releases from WCA 3A to the SDCS. Alternative B also allows limited use of S-334 discharges to maintain the L-29 Canal stage at or below the FDOT constraint of 8.5 feet, NGVD to ensure the stability and safety of the Tamiami Trail (U.S. 41) Highway between S-333 and S-334, in accordance with the 2017 coordination with the FDOT; as soon as 8.3 feet, NGVD in L-29 is reached following the post-event recession, S-334 is closed. Relative to the No Action Alternative, Alternative B has expanded the use of low-volume S-197 operations to include drier periods under Condition 1 when the stage at G-3273 is below 6.6 feet, NGVD and the WCA 3A stage is below the Increment 1 and 2 Action Line; the No Action Alternative criteria for S-197 were consistent with the 2012 WCP, with level 1 gate openings starting at 800 cfs.

Operation of the completed NDA and SDA are expected to mitigate any effects to C-111 South Dade groundwater levels, associated with increased groundwater inflows from NESRS. The modified operational criteria for S-331, as included to maintain flood mitigation in the 8.5 SMA, may result in increased discharges through S-176, S-177, S-18C, and potentially S-197. The net effect of reduced WCA 3A regulatory discharges to the SDCS combined with increased flood control releases from S-331/S-173 and increased groundwater seepage to the L-31N Canal south of S-331 is not able to be quantified prior to completion of the field test and associated hydrologic monitoring, as identified prior to Increment 1. Insufficient data has been collected under Increment 1 and Increment 1.1 and 1.2 due to the repeated temporary and emergency deviations to the established field test operational criteria.

4.5.2.3 ENP TAYLOR SLOUGH

Implementation of Alternative B is expected to improve the hydrology of the ENP Taylor Slough relative to the 2012 Water Control Plan (USACE 2012c). In addition to the expected improvements of the No Action Alternative summarized in **Section 4.5.1.3**, Alternative B will be expanding durations for supplemental flows to Taylor Slough. To mitigate for this potential rapid drainage of the marsh, Increment 2 will include the operational flexibility for water managers to convey water from WCA 3A to avoid excessive drainage of the marsh to the west of the detention areas. Supplemental water deliveries of up to 250 cfs from WCA 3A will be limited to conditions when WCA 3A is above its floor elevation of 8.0 feet, NGVD. These deliveries, if provided under Increment 2 operations, will be conducted in coordination with ENP and the Corps to provide ecological benefits to Taylor Slough. This flow limit will be measured at S-334 or S-337. Measurements are made at these locations to tie back to WCA 3A stage. This operation is intended to support gradual recession rates in the marsh by providing additional water to the S-332D pump station, or maintain a canal stage in a range conducive to gradual recession rates. Data collected during the incremental test will be assessed to evaluate the effectiveness of this operation as we move forward with a the COP. The effects of supplemental water deliveries will be discussed

among the Corps and SFWMD during monthly meetings and prior to initiation of flows. Additional deliveries to Taylor Slough above those accommodated by Increment 2, if required, may be provided by SFWMD under the existing water supply authority of the SFWMD.

Under the No Action Alternative, supplemental water deliveries were limited to conditions when WCA 3A was above the floor elevation of 8.0 feet, NGVD in April and May and above 8.5 feet, NGVD in all other months. The operation was also limited to 8 weeks per year when the 3-gage average was below the historical median stage, which will be eliminated for Alternative B. Furthermore, similar to the No Action Alternative, implementation of Alternative B includes operation of S-328. S-328 may be used to increase deliveries to Taylor Slough up to 250 cfs provided that an average water depth of at least six inches is maintained in Cell 1 of the S-332D Detention Area.

4.5.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

4.5.3.1 WCA 3A, WCA 3B, AND ENP SHARK RIVER SLOUGH

Implementation of Alternative C is expected to result in improved effects on WCA 3A, WCA 3B and Shark River Slough relative to the No Action Alternative. Alternative C has the ability to raise the L-29 Canal maximum stage operating limit up to 8.5 feet, NGVD and is not subject to a limited duration at which this stage can be maintained (**Appendix A, Part 1**). Alternative C would likely show a slightly higher beneficial effect on discharges to the NESRS. Based on the results of the preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO, current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance), regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months **(FIGURE 4-10)**. The Critical Flows Report, summarizing the simulation results for cumulative flow volumes estimated to pass through the water control structures, indicated that, relative to No Action Alternative, Alternative C will result in 400 kac-ft increase in deliveries to the NESRS, calculated as the residual of the water budget for structure flows (S333+S355A+S355B+S356-S334). The ratio of deliveries to the NESRS as a percentage of total deliveries from the WCA 3A to ENP (including S12s) will increase from 29% under Alternative A to 63% under Alternative C. The exceedance curves for the simulated G-3273 stages (**FIGURE 4-6**) showed that water levels in the NESRS will increase for more than 0.5 ft for the Alternative C, relative to No Action alternative. Similarly, the stages in the L-29 Canal is expected to increase up to 0.8 feet (**FIGURE 4-5)**, while the WCA 3A stages will decrease up to 0.25 feet. The side-by-side comparison of the simulated annual hydroperiod distribution for Alternative C and the No Action Alternative presented in **FIGURE 4-11** shows that the improvement in hydroperiods become more pronounced with distance from the canals. For example, while the model cell including NESRS3 indicates only 1 day of increase in hydroperiod, the model cell hosting G-3272 gage experiences an increase of 35 days. The approximate locations for the gauges are marked in **FIGURE 4-5.** The other two NESRS gauges

shown in the figure, NESRS1 and NESRS2, are also expected to have minor improvements in hydroperiods (1-2 days) under the implementation of Alternative C relative to No Action Alternative.

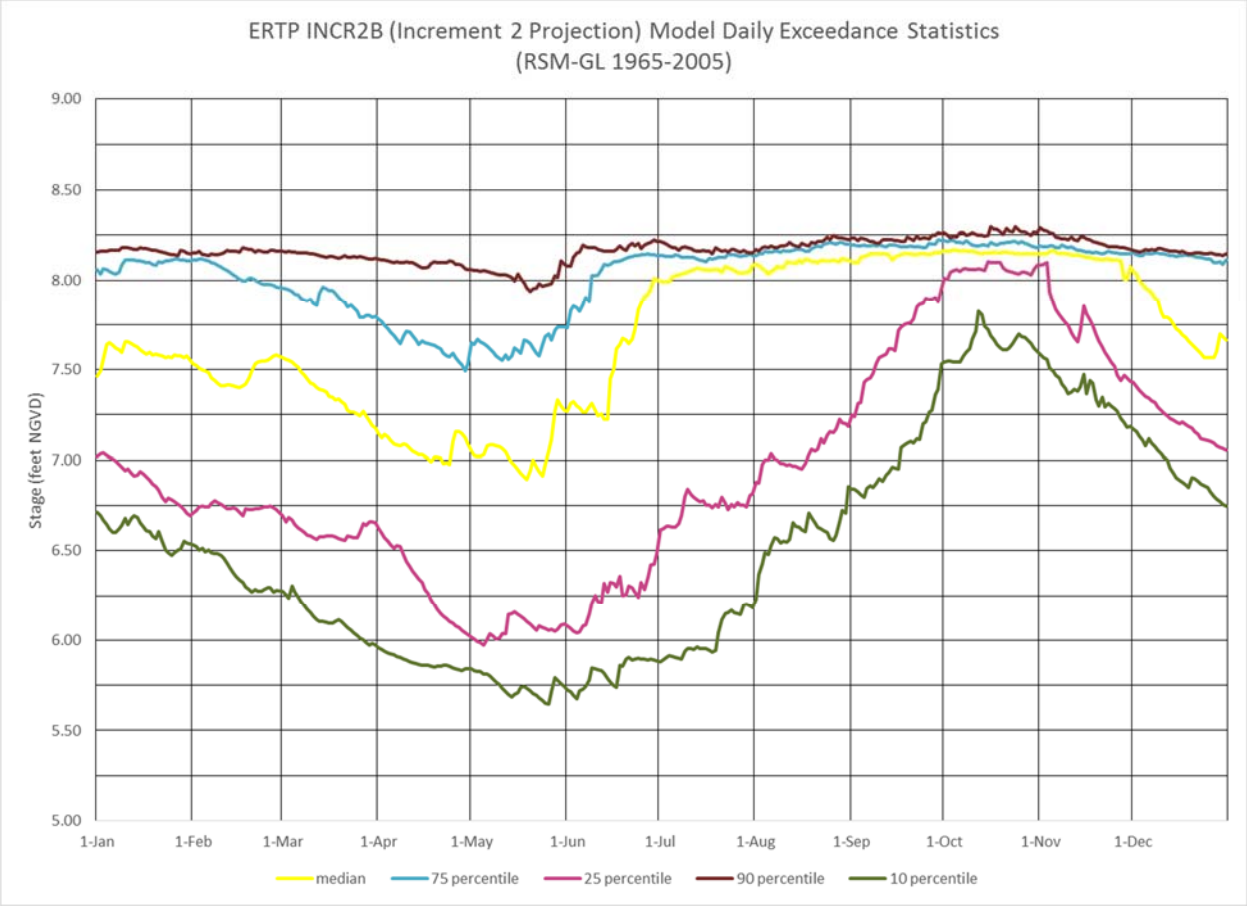

FIGURE 4-10: SIMULATED L-29 CANAL STAGE DAILY EXCEEDANCE STATISTICS FOR ERTP INCR2B SIMULATION.

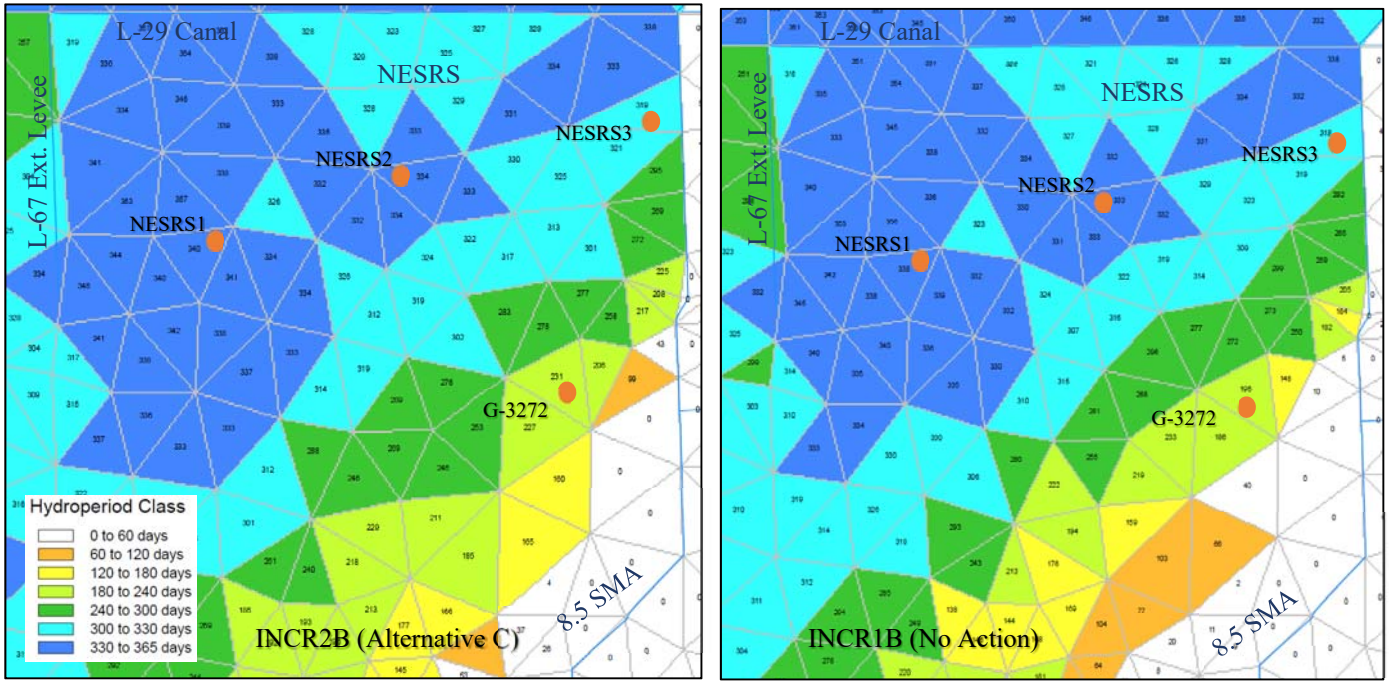

FIGURE 4-11: AVERAGE ANNUAL HYDROPERIOD DISTRIBUTION FOR THE ALTERNATIVE C (INCR2B) AND NO ACTION ALTERNATIVE (INCR1B).

4.5.3.2 ENP EASTERN PANHANDLE AND MANATEE BAY/BARNES SOUND

Relative to Alternative B, implementation of Alternative C would result in slightly more beneficial hydrologic conditions in ENP eastern Panhandle, Manatee Bay, and Barnes Sound with efforts to increase available storage within NESRS and significantly reduce the frequency and duration for Column 2 discharges. However, temporary impacts to Manatee Bay and Barnes Sound have the potential to continue to occur under Alternative C as a result of the minor to moderate increases in the frequency and duration of low volume (less than 500 cfs) S-197 discharges consistent with the No Action Alternative and Alternative B.

4.5.3.3 ENP TAYLOR SLOUGH

The hydrologic effects of Alternative C operations on the ENP Taylor Slough is expected to be slightly improved compared to the hydrologic effects for Alternative B, which are detailed in Section **4.5.2.3**. Increased opportunity for WCA 3A discharges to be delivered to NESRS will moderately reduce the likelihood for regulatory discharges to be conveyed from WCA 3A to the SDCS, including the NDA, SDA, and Taylor Slough, during moderate to dry hydrologic conditions when flows to Taylor Slough would historically have been driven by regional groundwater and the hydrologic connection to NESRS.

4.5.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

4.5.4.1 WCA 3A, WCA 3B, AND ENP SHARK RIVER SLOUGH

Under Alternative G, the hydrologic effects within WCA 3A, WCA 3B, and NESRS will be slightly different from the hydrologic effects for Alternative B, which are detailed in **Section 4.5.2.1**. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the 3-gage average, previously defined under the May 2015 Increment 1 EA and FONSI and the February 2017 Increment 1.1 and 1.2 EA and FONSI, to define the priority of releases from S-333 and S-356 to the L-29 Canal and NESRS. Implementation of the Action Line (*i.e.* Condition 3 and 4) to manage high water conditions in WCA 3A, would help to prevent conditions of extreme high water levels and prolonged inundation periods within WCA 3A. Furthermore, Alternative B includes additional operational flexibility by inclusion of a second action line for extreme high water conditions **(FIGURE 4-12)** to further allow for a rapid response in WCA 3A. The hydrograph of the historical stages shown in **Appendix A, Part 1** – **FIGURE 3** and **TABLE 4-1** indicate that the Action Line would have been exceeded five times during the last 15 years (since implementation of the IOP in 2002) if it was in effect, with an average duration of 51 days. Since Alternative G excludes this additional operational flexibility, higher WCA 3A stages relative to Alternative B may be observed if this alternative is implemented. The effects of this alternative on the inflows and the stages of the NESRS will be slightly worse than those of No Action alternative. However, since the extreme high water conditions are expected to occur infrequently, only slight differences can be expected between the implementation of this alternative and Alternative B.

TABLE 4-1. EXTREME HIGH WATER ACTION LINE EXCEEDANCE

Extreme High Water Action Line Exceedance During Last 15 Years		
Year	Exceedance Period	Number of Days
2005	29 JUN – 14 SEP	78
2008	28 AUG – 18 OCT	52
2013	15 JUL – 19 AUG	36
2016	21 FEB – 8 MAR	17
2017	17 JUN – 1 OCT	73

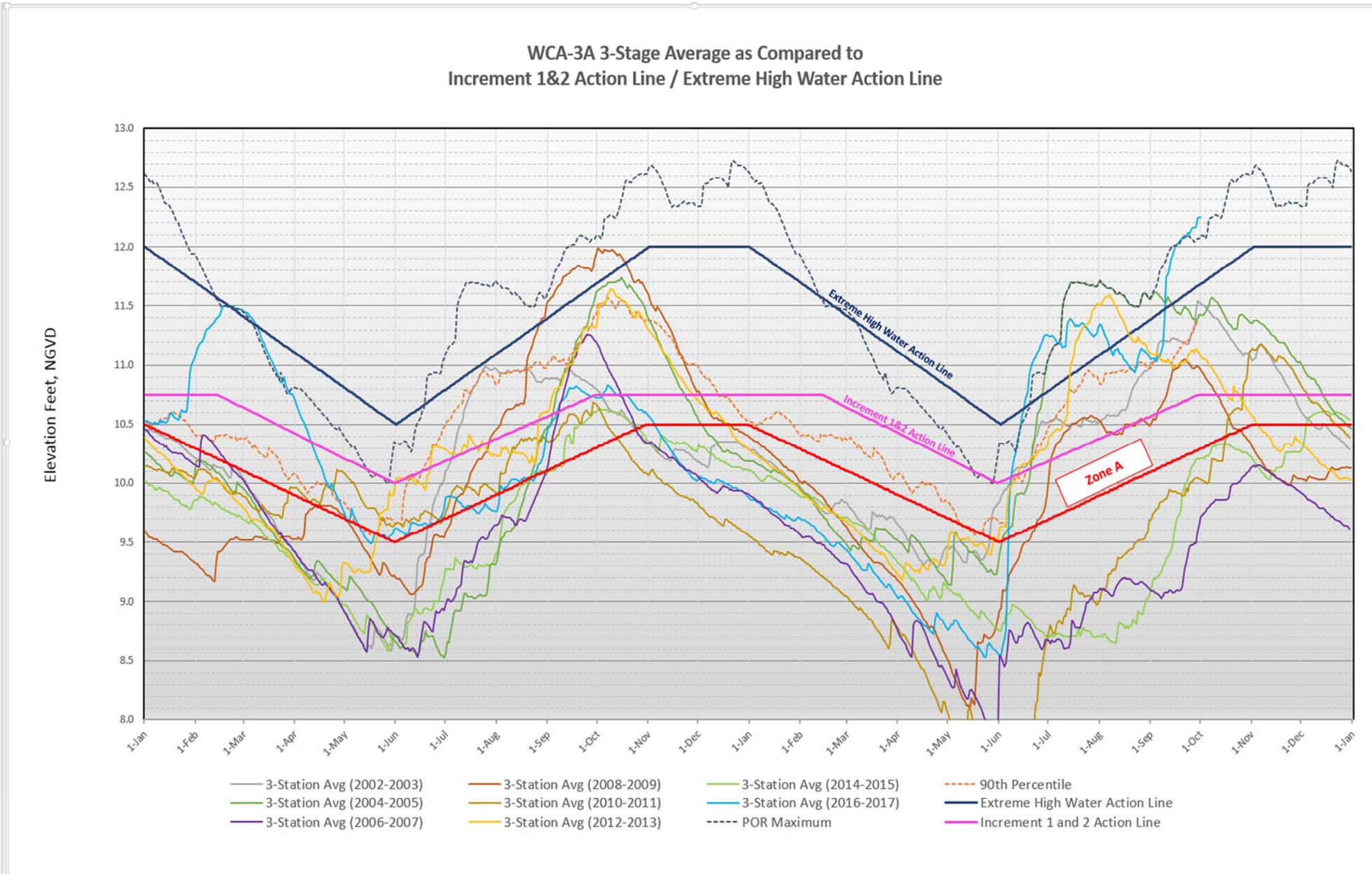

FIGURE 4-12. EXTREME HIGHWATER ACTION VS HISTORICAL WCA 3A STAGES.

4.5.4.2 ENP EASTERN PANHANDLE AND MANATEE BAY/BARNES SOUND

Similar to Alternative B, implementation of Alternative G would result in a minor hydrologic benefit for the ENP Eastern Panhandle and Manatee Bay/Barnes Sound relative to the 2012 Water Control Plan (USACE 2012c) with efforts to increase available storage in NESRS and reduce Column 2 discharges. However, temporary impacts to Manatee Bay and Barnes Sound have the potential to continue to occur under Alternative G as a result of the increases in the frequency and duration of low volume (less than 500 cfs) S-197 discharges consistent with the No Action Alternative, Alternative B, and Alternative C. The hydrological conditions during the current wet season is a good example of the extreme high water conditions described by the Action Line in **FIGURE 4-12**. A hydrograph of S-197 headwater stage and flow rates following since the beginning of implementation of increments is provided in **FIGURE 4-13**. Relative to Alternative B, reduced discharges from S-197 would be anticipated to occur during the years when the Extreme High Water Action Line is exceeded; discharges would be reduced approximately once every three years, for an average duration of 51 days. As shown in the figure the operational actions taken as a response to extreme high water conditions resulted in high flow rates through the S-197 structure. Exclusion of this action line from the operational schedule will result in slower responses to extreme wet conditions in WCA 3A. The exclusion of this additional operational flexibility for extreme high water levels in WCA 3A under Alternative G would exclude the additional operational criteria for high volume discharges at S-197 as described in **Appendix A, Part 1**.

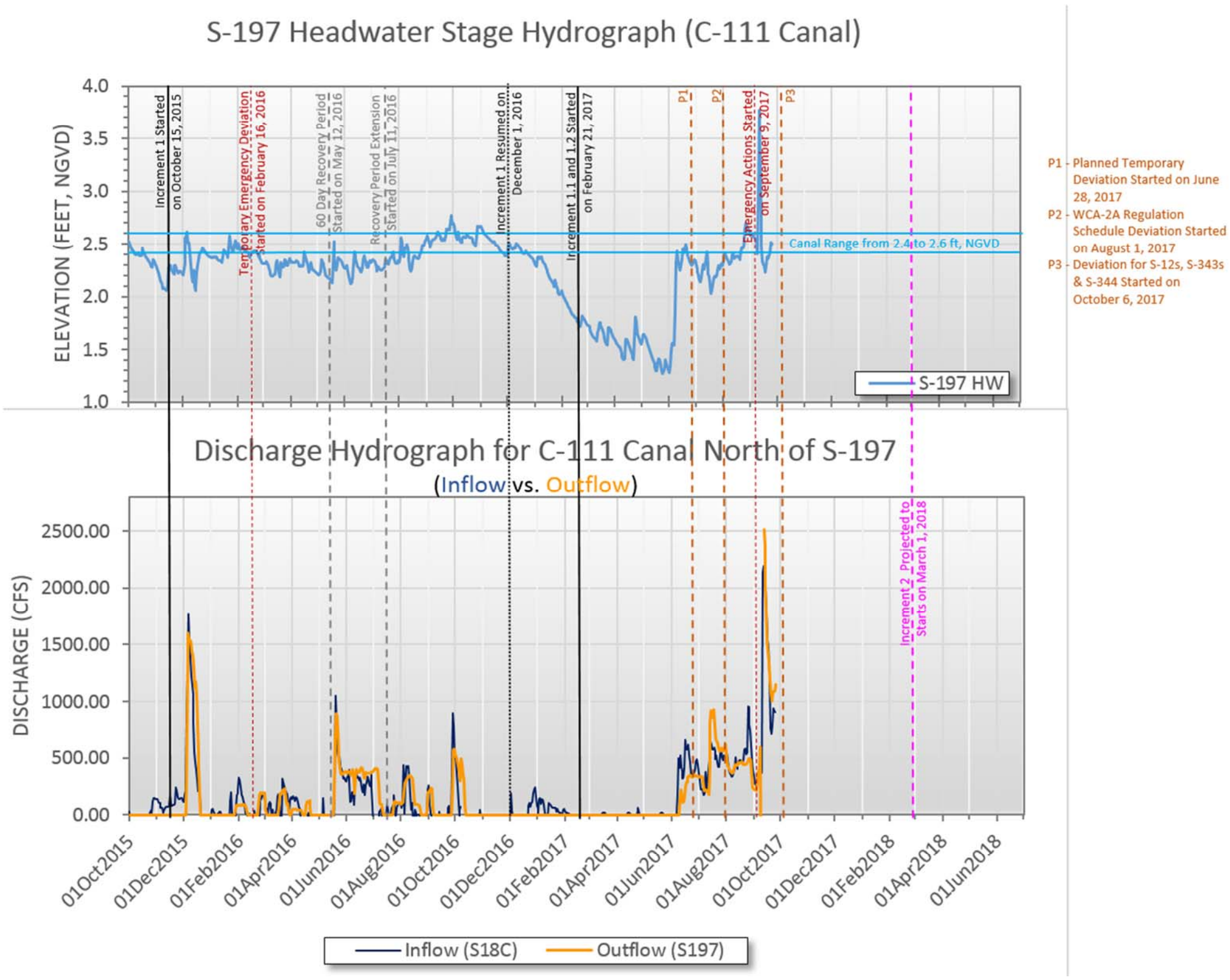

FIGURE 4-13. S-197 HEADWATER STAGE AND DISCHARGE HYDROGRAPH DURING FOLLOWING INITIATION OF MWD INCREMENT 1 THROUGH INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

4.5.4.3 ENP TAYLOR SLOUGH

The effects of Alternative G operations on the ENP Taylor Slough will be similar to those of Alternative B and C, except the potential increase in deliveries due to the inclusion of Extreme High Water Action Line in **Appendix A, Part 1**. The trigger of these action line may result in increased discharges through S-334. The historical stages for WCA 3A indicate that the action line would have been exceeded five times during the last 15 years if it was in effect, with an average duration of 51 days (**TABLE 4-1**). The exclusion of this additional operational flexibility for extreme high water levels in WCA 3A under Alternative G may eliminate the potential of increased inflows to Taylor Slough due to additional S-334 releases that may occur when the extreme high water action line is triggered under Alternative B and Alternative C.

4.6 FLOOD RISK MANAGEMENT

4.6.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

4.6.1.1 WCA 3A High Water Conditions and SDCS Column 2 Operations

Section 4.5.1 provides a detailed review of the hydrologic effects for WCA 3A resultant from the modified closure regime for the S-12A and S-12B structures under Increment 1.1 and 1.2, as compared to the predecessor Increment 1 field test. The modeling conducted for ESA consultation assumed that these structures, in addition to the S-343A, S-343B, and S-344, would be closed between 01 October and 14 July during all years. However, the 2016 ERTP BO RPA and the Operational Strategy for Increment 1.1 and 1.2 both recognize that the modified closure period for S-12A and S-12B would be accompanied by a high water strategy for October and November that was developed by the Corps to limit the duration of WCA 3A high water stages during the late wet season. The conditions-based approach to the operation of S-12A and S-12 B retains critical flexibility during WCA 3A high water conditions while also ensuring that the structures are operated optimally for CSSS habitat during normal and low water conditions.

Continued implementation of Increment 1.1 and 1.2 will maintain the incremental reduction in WCA 3A regulatory releases to the SDCS that was projected with implementation of Increment 1. As described in the May 2015 Increment 1 EA and FONSI, significant effects to South Dade County are not expected due to the significant reduction in WCA 3A regulatory releases to the SDCS and inclusion of increased flood control releases from S-18C and S-197 to mitigate for increased risk to flood protection for South Dade areas which may be conditionally affected by the field test (USACE 2015). Based on an assessment of the historical hydrological conditions experienced during IOP/ERTP (July 2002 through June 2015), Increment 1 was anticipated to provide the following flood control effects within WCA 3A and the SDCS relative to the 2012 Water Control Plan:

- Reduce the total duration of WCA 3A regulatory releases to the SDCS by an estimated 832 days (81% reduction; frequency reduced from 23.5 % to 4.5 percent of the assessment period);
- Reduce the accumulated volume of WCA 3A regulatory releases to the SDCS by an estimated 85% (735 thousand acre feet (kAF) under IOP/ERTP to 112 kAF);
- Increased use of Column 2 operational criteria for the SDCS Canals during the wet season months of July through October, which provide increased canal storage for management of local basin runoff and potential increased seepage from NESRS

Reference Section 4.6 of the May 2015 Increment 1 EA and FONSI for the assumptions used for the Increment 1 analysis. As indicated in **TABLE 1-1**, Increment 1 was implemented for a limited cumulative duration of approximately 4.5 months (October-December 2015, and December 2016 through February 2017), and Increment 1.1 has governed operations for approximately 4 months (March-June 2017). Due to the prolonged water management deviations from normal operations during both 2016 and 2017, insufficient historical data is available to quantify the degree to which long-term reductions to WCA 3A regulatory releases to the SDCS anticipated under Increment 1. and Increment 1.1 and 1.2 have occurred.

4.6.1.2 8.5 Square Mile Area

Since many of the MWD features have been built, including the seepage collection canals, pump station and protective levee around 8.5 SMA and the Tamiami Trail roadway modifications, the May 2015 Increment 1 EA and FONSI and subsequent updated February 2017 Increment 1.1 and 1.2 EA and FONSI recognized there are more opportunities to begin relaxation of the G-3273 constraint and associated increased water deliveries from WCA 3A into NESRS.

For the No Action Alternative, the S-357 pump station will continue to be operated for the purpose of providing flood mitigation for the 8.5 SMA. The hydraulic connection between the 8.5 SMA Detention Cell and the C-111 South Dade NDA, which remains a prerequisite for MWD Increment 2, will enable the S-357 pump station to move water further away from the protected portion of the 8.5 SMA, thereby reducing the frequency of operational restrictions on the S-357 pump station caused by storing water within the 8.5 SMA detention cell. By not allowing significant water storage depths within the 8.5 SMA Detention Cell and by constructing the internal flow-way to convey water through the 8.5 SMA Detention Cell more efficiently, the potential for backwater drainage effects on the southwest corner of the 8.5 SMA caused by retardation of the regional groundwater flow to the southeast will also be significantly reduced. The temporary by-pass connection between the C-358 Canal and the C-357 Canal, upstream of the S-357 pump station that was constructed by the Corps in July 2016 will remain operational pending completion of the S-357N gated control structure. Continued monitoring and data assessment is needed to verify the effectiveness of the 8.5 SMA flood mitigation system for the entire protected area of the 8.5 SMA.

During the 2016 Temporary Emergency Deviation and the subsequent recovery transition period, L-29 Canal stages were raised up to approximately 8.3 feet, NGVD and the G-3273 stage remained above 7.1 feet, NGVD for nearly 4 months (maximum stage 7.6 feet, NGVD); refer to **FIGURE 4-9**. In response to concerns expressed by residents within the Las Palmas community during the 2016 Temporary Emergency Deviation, the SFWMD constructed temporary measures including: the use of temporary pumps (subsequently removed) and an open channel connection between the C-358 Canal and the C-357 Canal prior to construction of S-357N to maintain flood mitigation requirements for the 8.5 SMA; temporary plugs in the drainage swales located north and south of Richmond Drive (SW 168th Street); a berm around the western end of the C-358 Canal; and temporary culverts in the southern levee of the 8.5 SMA Detention Cell. Based on the demonstrated ability of these measures to maintain flood mitigation requirements for the 8.5 SMA, the Corps completed construction of the temporary by-pass connection between the C-358 Canal and the C-357 Canal in July 2016 in order to maintain this level of service during construction of S-357N. With one of the stated objectives of the Increment 1 field test being to improve hydrological conditions in NESRS through the relaxation of the G-3273 stage criteria to increase

water deliveries from WCA 3A to NESRS, subject to constraints which include to maintain the authorized purposes of the MWD Project and no reduction in current flood protection and mitigation, during development of Increment 1.1 and 1.2 the Corps extensively reviewed the 8.5 SMA performance which resulted from revised operational criteria used during the 2016 Temporary Emergency Deviation and subsequent recovery period; as a result of this review, revised 8.5 SMA operations for the C-357 Canal targets for the S-357 pump station were included within the Increment 1.1 and 1.2 Operational Strategy.

For the No Action Alternative, S-357 will continue to be operated to maintain an average-daily water level in C-357 at LPG-1 or S-357 headwater between 5.0 to 5.5 feet, NGVD. When drier conditions allow reduced pumping at S-357, canal range of 5.5 to 6.0 feet, NGVD may be utilized. The ground surface elevation along the western perimeter of 8.5 SMA is approximately 6.7 feet, NGVD at the LPG-2 monitoring gauge and approximately 6.6 at the LPG-1 monitoring gauge. The Increment 1.1 and 1.2 Operational Strategy specifies a pump sequence that first leverages the operational capability of S-331, prior to incrementally increasing operations at S-357.

As of October 2017, the NDA is functional but not 100% complete. Following direct impacts to the NDA active construction site related to Hurricane Irma and the pursuant October 2017 Emergency Deviation, Termination for Convenience was issued to the Contract 8 contractor for the NDA and became effective on September 20, 2017. The Corps is currently investigating alternate means to complete the remaining portions of the Contract 8 NDA construction and any additional repairs required following Hurricane Irma, with the construction schedule to be determined following subsidence of the current Emergency Deviation conditions. When the completed C-111 South Dade NDA is fully-functional and available for Increment 2, S-357 operations would no longer to be constrained to two pump units (this condition was specified within the Increment 1.1 and 1.2 operational strategy), and the need to use S-331 to provide flood mitigation for the Las Palmas Community (8.5 SMA) would be reduced. If the stage at LPG2 rises above 6.6 feet, NGVD then the No Action Alternative allows a canal range of 3.5-4.0 to be used at S-331 until the stage at LPG-2 falls below 6.5 feet, NGVD.

Since Increment 1.1 limits the maximum operating stage in the L-29 Canal to 7.5 feet, NGVD, the Increment 1.1 Operational Strategy does not require and therefore did not include the ability to lower C-357 and/or C-358 to the 3.0-4.0 feet, NGVD range that was determined necessary to provide 8.5 SMA flood mitigation during the 2016 Temporary Emergency Deviation and extended recovery period. Section 12.0 of the Operational Strategy for Increment 1.1 includes the following additional flexibility to ensure continued maintenance of 8.5 flood mitigation, if necessary during future Increment 1.1 operations: (1) during the period when pumping at S-357 is limited to 250 cfs due to construction within the 8.5 SMA Detention Cell (Contract 8A): the operational range for L-31N may be lowered by 0.2 feet; S-197 may be used per the criteria in **TABLE 3A** regardless of the current operational condition; and G-3273 stages within NESRS will be constrained to 7.0 feet, NGVD by limiting inflows from WCA 3A to the L-29 Canal; and (2) operational flexibility for S-357 and S-357N is included within the 8.5 SMA test operations which includes adjustments from +/- 0.2 to +/- 0.5 feet (to a minimum C-357 Canal range 4.5-5.0 feet, NGVD) after the initial + 0.5 feet change. S-331 pump station operations under Increment 1.1 maintain the L-31N Canal target stages that were used during the extended recovery period following the 2016 Temporary Emergency Deviation as illustrated in **FIGURE 4-15**.

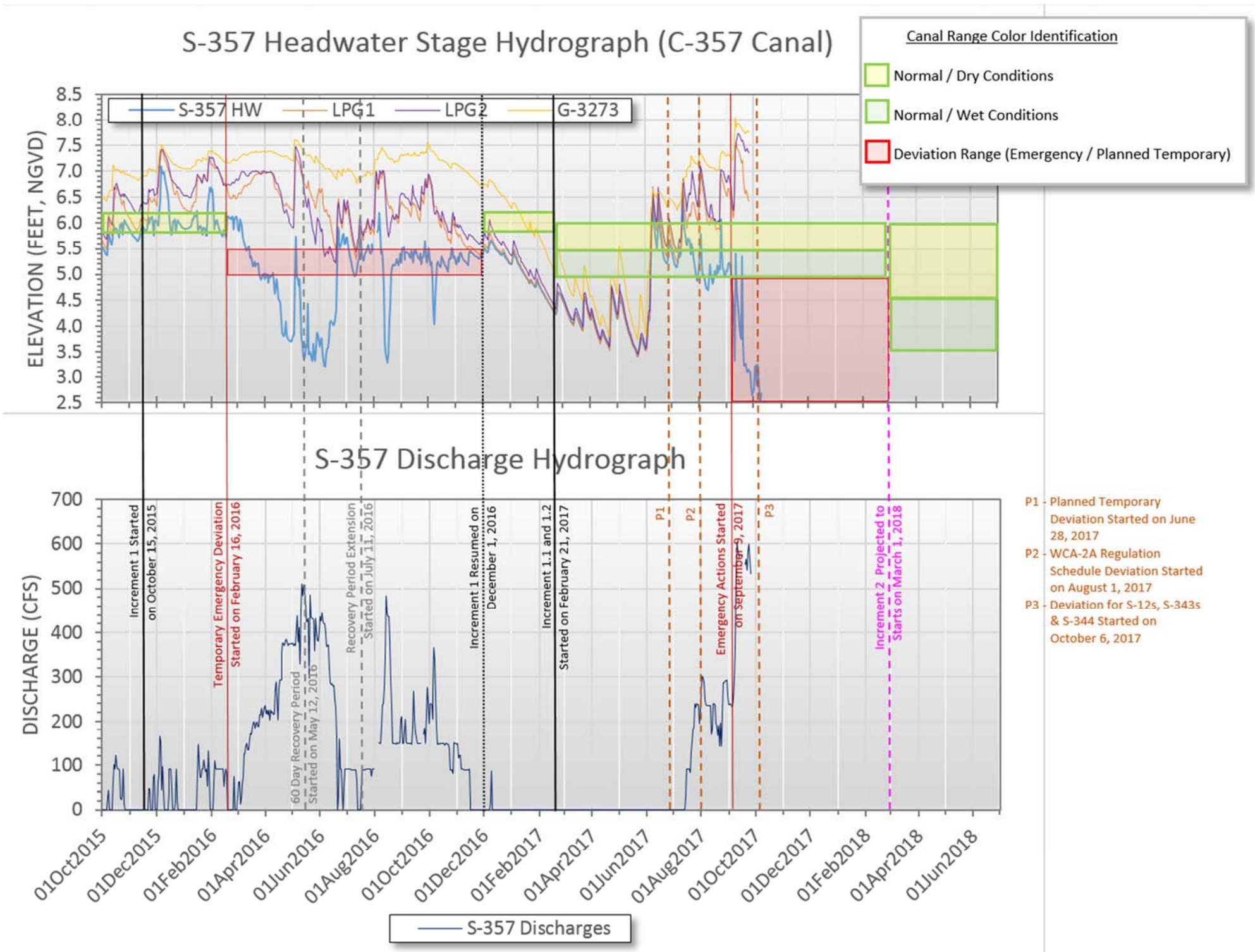

FIGURE 4-14. S-357 HEADWATER, LPG-1, LPG-2, AND G-3273 STAGE HYDROGRAPHS AND S-357 DISCHARGE HYDROGRAPH FOLLOWING INITIATION OF MWD INCREMENT 1 AND INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

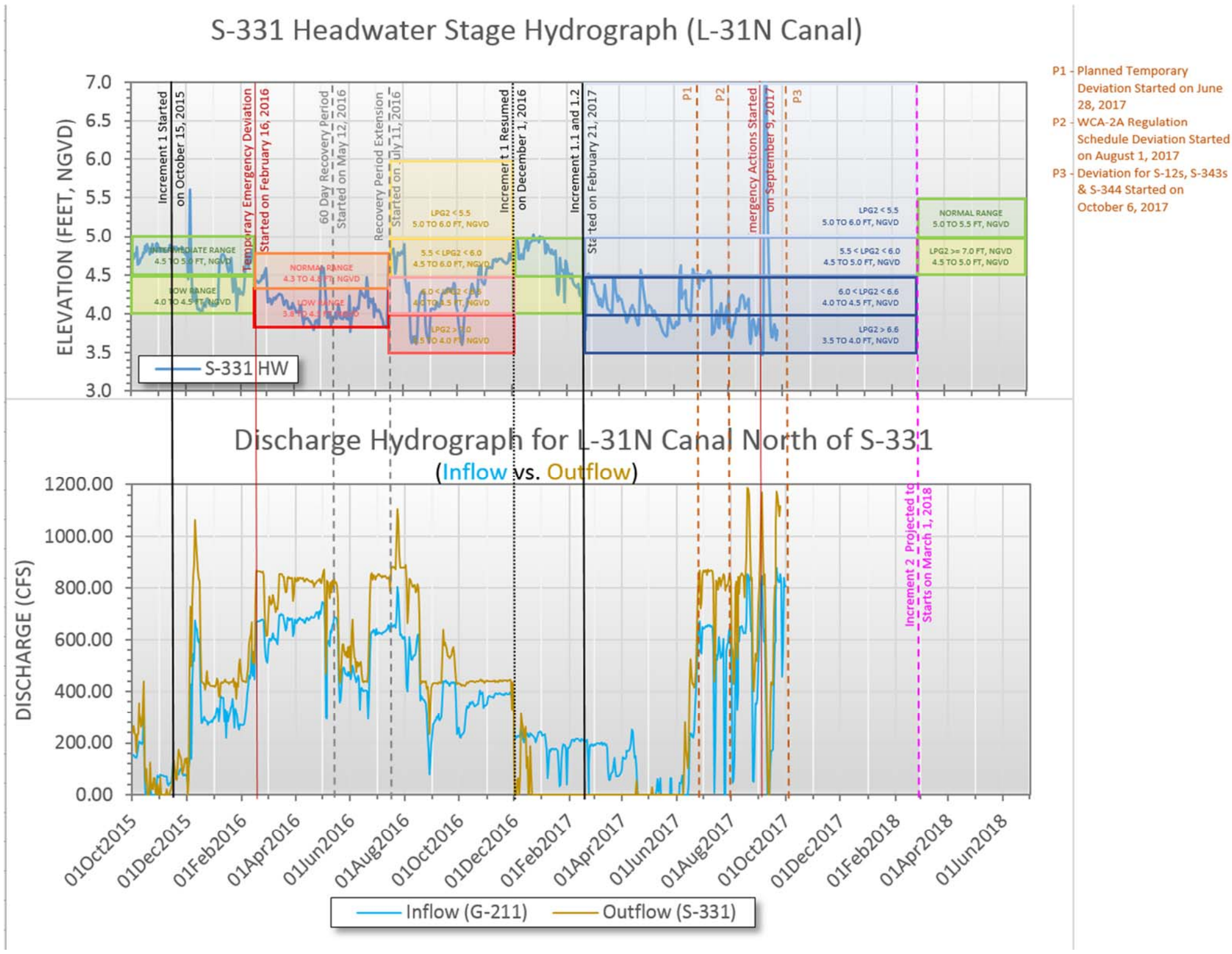

FIGURE 4-15. S-331 HEADWATER STAGE HYDROGRAPH AND DISCHARGE HYDROGRAPH FOLLOWING INITIATION OF MWD INCREMENT 1 AND INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

4.6.1.3 South-Dade County Flood Risk Management

The net effect of reduced WCA 3A regulatory discharges to NESRS combined with increased flood control releases from S-331/S-173 and increased seepage to the L-31N Canal south of S- 331 is not able to be quantified prior to completion of the field test and associated hydrologic monitoring. The field test hydrologic monitoring will aid in quantifying both long-term and intra-annual/seasonal effects of increased stages within NESRS. Additional inflow volumes to L-31N Canal, if resultant from the field test, are expected to be primarily managed with the C-111 South Detention Area using S-332 B, S-332C, and S-332D, given the significant reduction in WCA 3A regulatory releases to the SDCS. As indicated in **TABLE 1-1**, Increment 1 was implemented for a limited cumulative duration of approximately 4.5 months (October-December 2015, and December 2016 through February 2017), and Increment 1.1 has governed operations for approximately 4 months (March-June 2017). Due to the necessity of prolonged water management deviations from normal operations during both 2016 and 2017, insufficient historical data is available to quantify the degree to which the long-term reductions to WCA 3A regulatory releases to the SDCS anticipated under Increment 1.0 and Increment 1.1 and 1.2 have occurred.

The C-111 Spreader Canal Western Project will continue to be operated by SFWMD and provide flows to Taylor Slough. The SFWMD efforts to monitor the impacts of the project operation and ensure protection of privately-owned lands in the vicinity of the C-111 Spreader Canal Western Project area remain ongoing and inconclusive based on the limited period of monitoring data collected since June 2012. To mitigate for potential increased risk to flood protection in south Miami-Dade County areas, which may be affected by increased water levels in NESRS and associated water management operations within south Miami-Dade County during the field test, low volume releases from S-197 are included as components of the No Action Alternative. The MWD field tests will continue to include assessment of the combined effects of increased seepage east resultant from increased stage levels in NESRS and will incorporate the ongoing SFWMD operations, monitoring, and performance assessments conducted as part of the C 111 Spreader Canal Western Project. Consistent with the requirements of the February 2017 re-issued C-111 Spreader Canal regulatory permit from the Corps, the SFWMD is continuing to assess south Miami-Dade water conditions and existing operations, including those of the C-111 Spreader Canal Project, on a quarterly basis for a minimum of five years to ensure project features are constructed and operated not to adversely affect adjacent lands outside and within the C-111 Spreader Canal Western Project boundary with regards to water quantity, water quality, and/or flooding. The purpose of the assessment and quarterly reports are to ensure the SFWMD has the best available information to determine what operational system changes, if any, are necessary to avoid adverse water levels on adjacent lands. The enhanced reporting by SFWMD will also benefit the monitoring objectives of the MWD Project operational field tests.

4.6.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

4.6.2.1 WCA 3A High Water Conditions and SDCS Column 2 Operations

Consistent with the hydrologic effects characterized in **Section 4.5.3.1** and below in **Section 4.6.3**, Alternative C is anticipated to result in a moderate stage reduction of less than 0.25 feet is expected for WCA3A compared to the No Action Alternative. Depending on the extent to which the FDOT/LRR constraints and the 8.5 SMA flood mitigation constraints accommodate prolonged

increased stages within the L-29 Canal under Alternative B, a minor stage reduction between 0.0 and 0.25 feet is anticipated for Alternative B. A minor to moderate reduction in WCA 3A regulatory releases to the SDCS is similarly anticipated within increased water deliveries to NESRS.

Consistent with the objectives and constraints of Increment, the Corps will continue to pursue opportunities to increase deliveries from WCA 3A to NESRS to the maximum extent practicable during Increment 1.1 and 1.2.

4.6.2.2 8.5 Square Mile Area

Based on the stated constraints of the Increment 2 field test to maintain the authorized purposes of the MWD Project, which includes the authorized flood mitigation requirements, water levels within the L-29 Canal and NESRS will not be raised above 7.5 feet, NGVD except under conditions that ensure adherence with the flood mitigation requirements for the 8.5 SMA. Increment 2 of the MWD Project is also dependent on construction completion and operation of the C-111 South Dade NDA. The real-time assessment of 8.5 SMA flood mitigation requires recognition of the hydrologic relationships observed between the L-29 Canal, stages within NESRS proximal to the 8.5 SMA (G-3273 is used for this analysis, given its historical utilization as a constraint for inflows to NESRS), and stages observed within the 8.5 SMA protected area.

During the development of Increment 1.1 and 1.2, the Corps extensively reviewed the hydrologic conditions proximal to the C-111 South Dade NDA which resulted from revised SDCS operational criteria used during the 2016 Temporary Emergency Deviation and subsequent recovery period. As detailed in Section 4.6.2.3 of the February 2017 Increment 1 Plus EA, water stages within the NDA construction footprint were shown to be generally influenced by a combination of factors which include: direct rainfall; 8.5 SMA operations at S-357 and resulting water stages within the 8.5 SMA Detention Cell (LP-DC1 gauge); water stages within NESRS, south of G-3273 and west of the NDA footprint; SDCS operations at S-332B and resulting water stages within the partial NDA; and operational levels within the L-31N Canal, 0.5 miles east of the NDA footprint. During the 2016 Temporary Emergency Deviation, direct precipitation for the area of the 8.5 SMA and NDA footprint was less than 3.6 inches combined during February-April 2016, and no significant rainfall was observed until the first week of May 2016. A scatter plot demonstrating the correlation between historical water levels in the L-29 Canal and G-3273 (located approximately 9 miles south of the L-29 Canal, with NESRS) during S-333 operations is provided in **FIGURE 4-16**, further updated from the Increment 1 Plus EA to include the recent operations under Increment 1.1 and the 2017 water management deviation actions. This figure includes daily observed water levels for the period corresponding to IOP, ERTP (implemented October 2012), Increment 1, the 2016 Temporary Emergency Deviation and subsequent recovery period, Increment 1.1, and the 2017 water management deviation actions, extending from July 2002 through September 2017. Since the L-29 Canal maximum operating limit was maintained at 7.5 feet, NGVD with the G-3273 constraint of 6.8 feet, NGVD during both IOP and ERTP, these historical data points prior to the MWD field tests are combined (light blue data points on the figure), and also displayed for the wet season period only (June through October; dark blue data points). The observations collected during the 2016 Temporary Emergency Deviation (purple data points), the 60-day recovery period (orange data points), the 2016 recovery period extension (yellow data points), and the September 2017 Emergency Deviation each indicate an increased slope compared to the IOP/ERTP base

condition. The increased slope observed during the 2016 Temporary Emergency Deviation and shown in the limited data for the 2017 Emergency Deviation is indicative that the NESRS marsh vegetation results in a 1-2 week lag time before the influence of the L-29 Canal stages is observed at G-3273, and the observed dynamic temporal trends may also demonstrate the effects from the completion of the 1-mile MWD eastern bridge in December 2013 and/or Phase 2 of the L-31N seepage barrier construction in the spring of 2016. The combined influence of increased pumping at S-357, lowered C-357 Canal stages, and lowered L-31N Canal stages during the 2016 Temporary Emergency Deviation and extended recovery period and during the 2017 Emergency Deviation is also potentially influencing the observed data at G-3273 (located 2 miles west of the 8.5 SMA). Due to large number of variables changing throughout the first two years following implementation of the MWD Increment 1 field test (starting October 2015), additional monitoring and data analysis is still needed to further assess the cause and effect relationships and ultimately to inform the development of the COP.

Implementation of lowered L-31N Canal levels during the initial 60-day recovery period and the subsequent extended recovery period in 2016, when combined with limited pumping at S-357 and reduced deliveries into NESRS (compared to the 2016 Temporary Emergency Deviation), demonstrated an improved ability for water managers to maintain site conditions favorable to completion of the NDA levees. The hydrologic response observed at G-3628 (located immediately south of the 8.5 SMA Detention Cell) and G-3437 (located immediately northwest of the Partial NDA) during the first year following implementation of Increment 1 were previously discussed in the Increment 1.1 and 1.2 EA, respectively. Refer to the Operational Strategy for the location of these monitoring gauges. Based on the demonstrated ability of these measures to facilitate continued construction progress for the NDA construction footprint, revised S-332B/C/D pump station operations for the L-31N Canal stage targets were included within the Increment 1.1 and 1.2 Operational Strategy (**Appendix A, Part 1**). The S-332B, S-332C, and S-332D pump stations, along with the S-176 gated spillway, are operated to maintain an operating range within the L-31N Canal between 4.2-4.8 feet, NGVD during the CSSS nesting window (15 February through 31 August) and between 4.0-4.6 feet, NGVD outside the CSSS nesting window (01 August through 14 February) (**Figure 4-18**). Once the NDA and 8.5 SMA features are functionally complete, prior to full implementation of Increment 2 and raising of the L-29 Canal maximum operating limit up to 8.5 feet NGVD, the operational range for the L-31N will be raised 0.2 feet to 4.2-4.8 feet, NGVD throughout the year. The normal management of water will be to fully maintain the hydraulic ridge and deliver water to eastern ENP using the full available capacity of S-332B, S-332C, and S-332D. If the capacity available at S-332B, S-332C, and S-332D is unable to maintain the operational range then S-194/S-196/S-197 may be additionally used (low flow discharges through S 197 available for conditions 2, 3, and 4). To facilitate management of hydroperiods along the eastern boundary of ENP to better meet habitat and nesting targets specified in the 2016 ERTP BO RPA, up to one pump may be run at S-332BN, S-332B, and S-332C and up to two pumps at S-332D may be run within an operating range from 3.8 to 4.2 feet, NGVD (highest stage at which water supply is usually initiated).

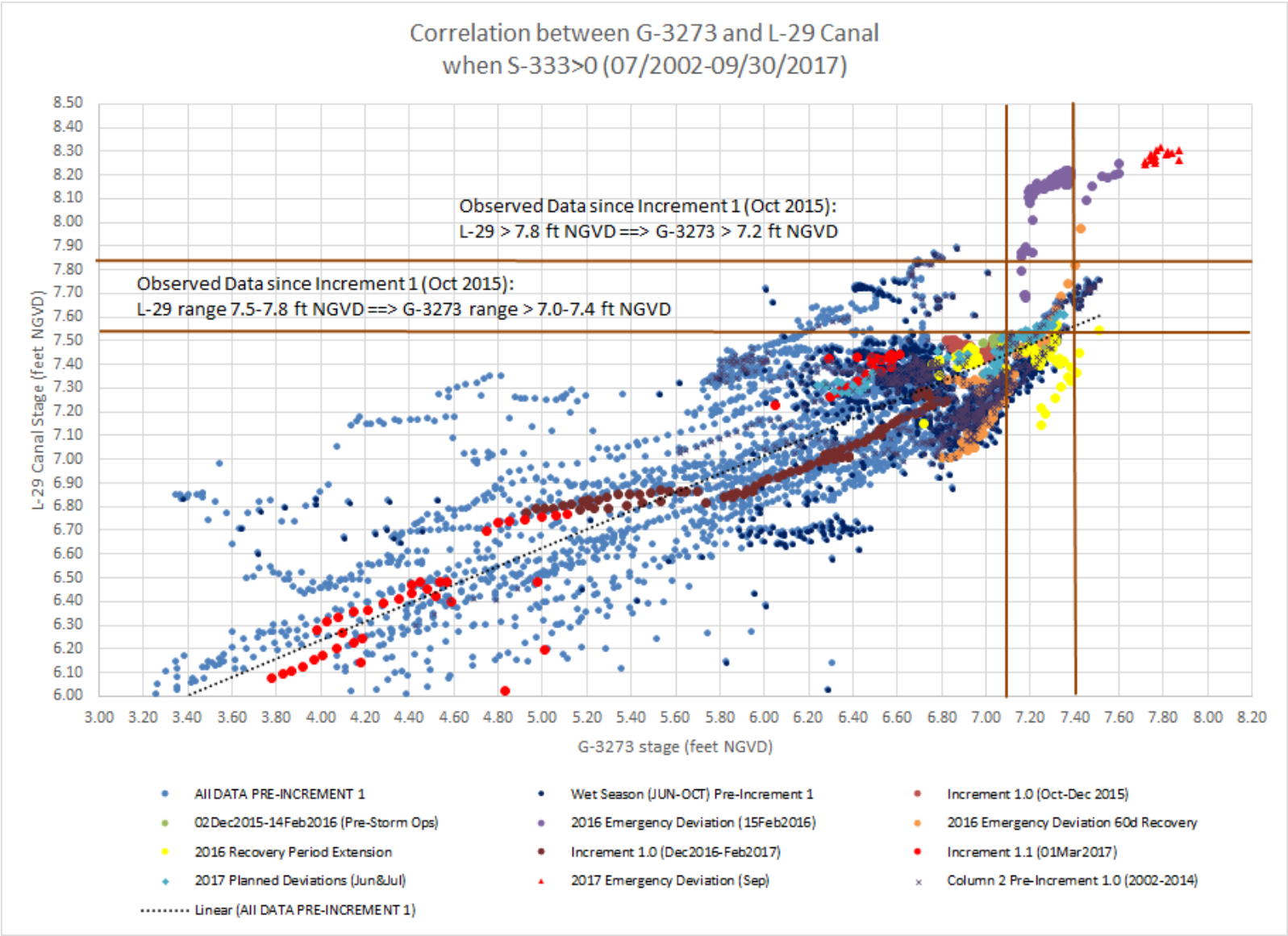

FIGURE 4-16. HISTORICAL CORRELATION BETWEEN L-29 CANAL STAGES AND G-3272 STAGES (2002-2017)

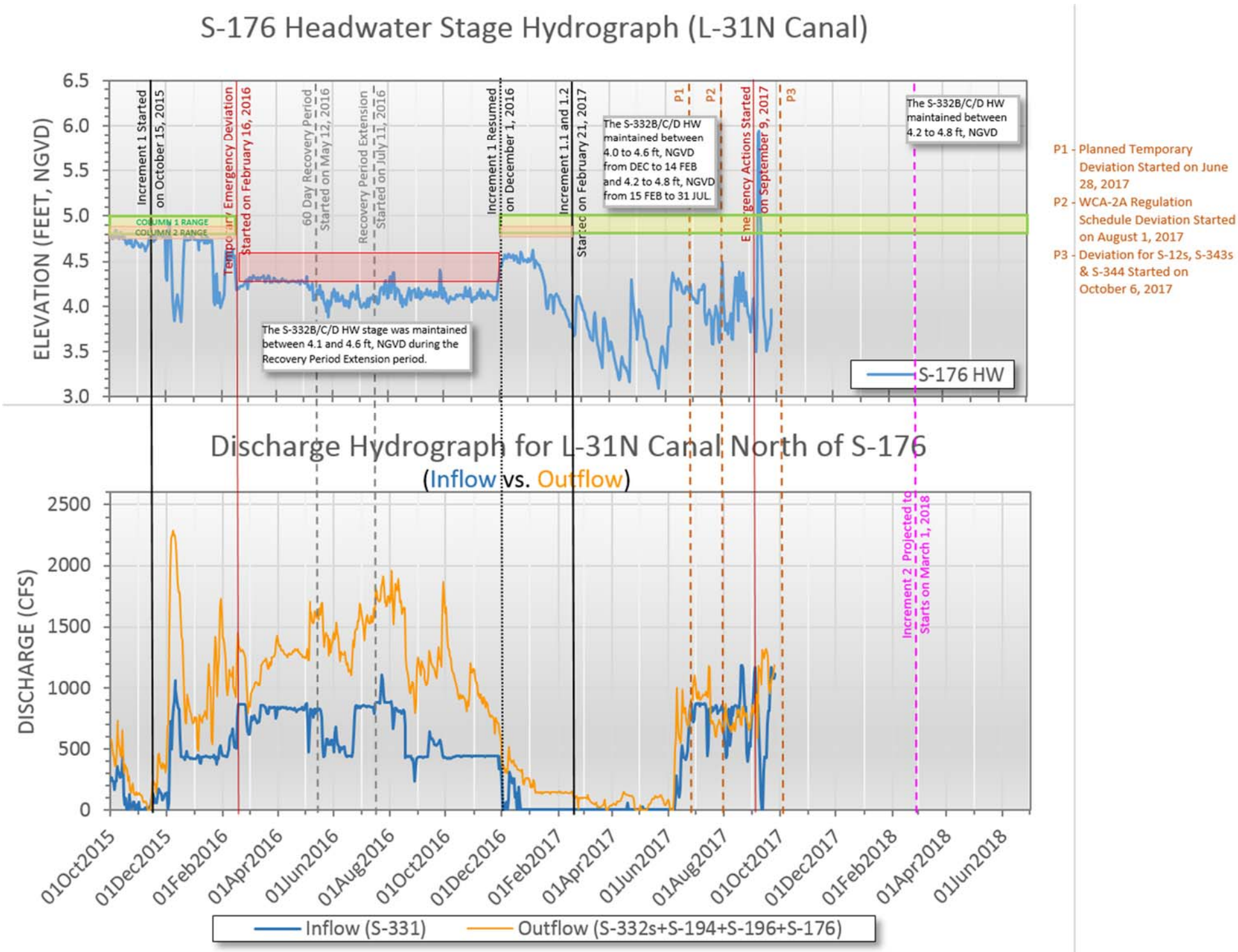

FIGURE 4-17. S-176 HEADWATER STAGE HYDROGRAPH AND L-31N DISCHARGE HYDROGRAPHS FOLLOWING INITIATION OF MWD INCREMENT 1 AND INCREMENT 1.1 AND 1.2 (OCTOBER 2015-SEPTEMBER 2017)

Increment 1.1 maintains a maximum operating limit of 7.5 feet, NGVD for the L-29 Canal. Prior to Hurricane Irma's impacts to South Florida on 10-11 September 2017, the Increment 1.1 field test effectively provided flood mitigation to the 8.5 SMA while maintaining the C-357 Canal and C-358 Canal between 5.0-6.0 feet, NGVD, as summarized below and shown in **FIGURE 4-18** and **FIGURE 4-19**:

- Following the accumulation of approximately 15 inches of rainfall on the 8.5 SMA during June 2017 (as recorded as the adjacent S-331 pump station), no significant hydroperiods (duration with water stages above the local ground elevation) were observed for the LPG-1 and LPG-2 monitoring locations along the western perimeter of the 8.5 SMA.
- Following the accumulation of an additional approximately 13 inches of rainfall on the 8.5 SMA during July 2017, a 3-day hydroperiod was observed at both the LPG-1 and the LPG-2 monitoring locations; observed average recession rates during this hydroperiod event were approximately 1.4 inches per day.
- Following the accumulation of more than 6 inches on 01 August, a 4-day hydroperiod was observed at both the LPG-1 and the LPG-2 monitoring locations during 02-08 August; observed average recession rates during this hydroperiod event were approximately 1.6 and 1.3 inches per day, respectively, at LPG-1 and LPG-2.
- Following the accumulation of an additional approximately 9 inches of rainfall on the 8.5 SMA during the remainder of August and the first week of September 2017, an 8-day hydroperiod and a 12-day hydroperiod, respectively, was observed at the LPG-1 and the LPG-2 monitoring locations starting 25 August and extending through 8 September (for LPG-2); observed average recession rates during this hydroperiod event were limited to 0.5 inches per day at both LPG-1 and LPG-2.

Prior to Hurricane Irma, the SFWMD initiated pre-storm drawdown operations for the C-357 Canal, and headwater stages at S-357 were lowered to approximately 3.5 feet, NGVD. With the accumulation of another 9-10 inches of direct rainfall on the 8.5 SMA, water depths at LPG-1 and LPG-2 both approached 0.9-1.0 feet above the local ground elevation immediately following the event. The Jacksonville District Corps received approval from the Corps' South Atlantic Division (SAD) on September 9 to use all available pumps at S-357 to maintain a canal operating range from 3.0 to 5.0 feet, NGVD to provide flood mitigation to 8.5 SMA due to excessive seepage from high water levels in NESRS as a direct result of the L-29 Canal stage increase above the constraint level of 7.5 feet, NGVD. On September 11, 2017 SAD approved utilization of all available pumps at S-356 in order to provide flood relief along the L-31N canal. Four days later, on September 15 2017, SAD approved a deviation to raise the L-29 canal maximum operating limit from 7.5 to 8.5 feet, NGVD until the WCA 3A 3-gage average falls below Zone A of its regulation schedule. The Corps sought and received approval for an additional deviation from the Increment 1.1 and 1.2 operational strategy to allow the operating level of the S-357 pump station to be lowered to 2.5 feet, NGVD on September 27, 2017. The stage and recession rate of 8.5 SMA gages will be reviewed throughout the deviation duration, and, if the S-357 operation ranges are consistently providing drainage that exceeds the authorized flood mitigation, the ranges will be raised by increments of up to 0.5 feet. The Corps also received approval on October 6, 2017 to utilize all available pumps at S-331 to maintain a headwater range between 3.0 and 5.0 feet, NGVD, in order to allow additional operational flexibility to help improve flood mitigation efforts and reduce

impacts to 8.5 SMA residents. This deviation will be in effect until LPG2 is below 6.5 feet, NGVD.

With all units pumping at S-357 (575 cfs design capacity) into the 8.5 SMA Detention Cell, water within the cell exceeded 4 feet depth and was overtopping the S-360E southern weir directly into the C-111 South Dade NDA construction site. On September 16, 2017 the Corps' SFOO began the removal of a section of the L-359 Levee (approximately 70-foot length adjacent to the S-360W weir) ahead of the C-111 South Dade construction contract schedule to allow S-357 discharges to flow into the NDA. SFOO completed partial degradation of the L-359 Levee section on September 17, 2017, and the remaining segment (combined total L-359 removal length of 140 feet) was completed by the C-111 South Dade Contract 8A contractor on September 23, 2017. 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. Prior to this requested Emergency Deviation, completion of this direct hydraulic connection between the 8.5 SMA S-357 pump station and the C-111 South Dade NDA was an established prerequisite for raising the L-29 Canal maximum operating limit above 7.8 feet, NGVD. The NDA is functional but not 100 percent complete. Termination for Convenience was issued from the Corps to the C-111 South Dade Contract 8 contractor for the NDA and became effective on September 20, 2017. The Corps is currently investigating alternate means to complete the remaining portions of the Contract 8 NDA construction following subsidence of the current Emergency Deviation conditions.

Despite implementation of the described emergency measures, the combined effects from the Hurricane Irma rainfall and nearly one week of elevated L-29 Canal stages with concurrent elevated stages in the 8.5 SMA Detention Cell prior to enabling discharges into the NDA have resulted in a continuous and still-ongoing inundation period of 28 days for LPG-2 through October 7, 2017 (time of report preparation; refer to **FIGURE 4-18** and **FIGURE 4-19**). Based on comprehensive review of historical conditions observed within the 8.5 SMA prior to construction of the 8.5 SMA Project, the Corps established an initial hydroperiod target of 40 days (based on recurrent wet season rainfall accumulation and hydroperiod response, estimated at 2 days of hydroperiod per 1-inch of direct rainfall) with an upper limit of 60 days (based on historical pre-MWD events with comparable 60-day rainfall accumulations as observed in 2017) for the post-Irma hydroperiod event at LPG-2; as additional rainfall accumulates post-Irma (not available at time of report preparation), the hydroperiod target will continue to be adjusted consistent with the evaluation methodology detailed in **Annex 2**, if needed. If recession rates are not projected to result in water levels receding below the local LPG-2 ground elevation prior to the target duration (initially estimated at 40 days), additional water management measures may be required including, but not limited to, restricting the maximum operating limit of the L-29 Canal below the 8.5 limit initially approved for the Emergency Deviation.

Refer to **Annex 2** of the Monitoring Plan (**Appendix C**) for a complete discussion of the evaluation methodology established by the Corps to support real-time evaluations of 8.5 SMA flood mitigation requirements during the Increment 1.1 and 1.2 and Increment 2 field tests.

Based on review and consideration of the 2016 and 2017 operations for the 8.5 SMA, the Increment 2 operational strategy in **Appendix A, Part 1** proposes a tiered set of criteria for operating S-357

based on the stage at Angel's Well (0.25 miles west of LPG-2), the stage at LPG-2, and the duration of stages above the local ground elevation at LPG-2. Generally, as the stage at Angel's Well continues to rise and increase the stage gradient towards the 8.5 SMA, or as LPG-2 hydroperiod durations continue to increase, the tiered operations allow continued, gradual lowering of the C-357 operational level in order to ensure flood mitigation is maintained for the 8.5 SMA. As detailed in the Increment 2 operational strategy (**Appendix A, Part 1**), the C-357 Canal will generally be maintained between 4.0-6.0 feet, NGVD. Under the following two conditions, C-357 may be temporarily maintained within a range of 3.5-4.5 feet, NGVD: (1) If Angel's > 7.19 feet and LPG-2 > 6.59 feet, NGVD for 7 days or longer; or (2) If LPG-2 > 6.99 feet, NGVD for longer than 24 hours. The stage and recession rate of 8.5 SMA gages will be reviewed based on conditions and if necessary the range may be lowered by 0.5 feet increments to meet flood mitigation requirements. Similar to conditions experienced following Hurricane Irma in 2017, the Increment 2 Operational Strategy also specifies that if the condition exists whereby all available pumps at S-357 and S-331 are operating below 4.0 feet, NGVD for over two weeks and the 8.5 SMA flood mitigation criteria is not being met at LPG2 or LPG1, WCA 3A discharges through S-333 structure to NESRS will be incrementally reduced until the mitigation targets at either LPG2 or LPG1 are met.

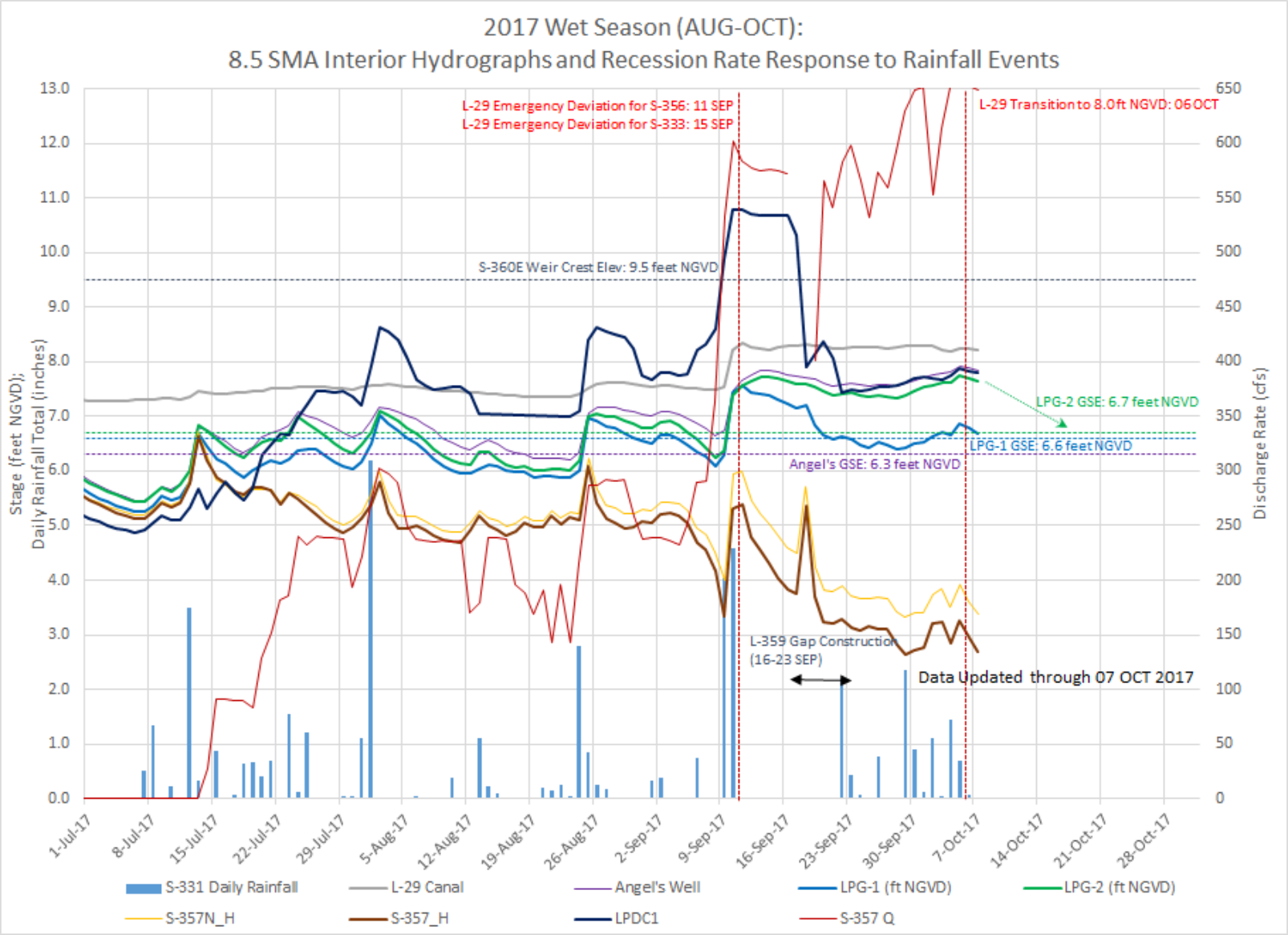

FIGURE 4-18. 8.5 SMA Interior Hydrographs and Recession Rate Response to Rainfall Events, 2017 Wet Season

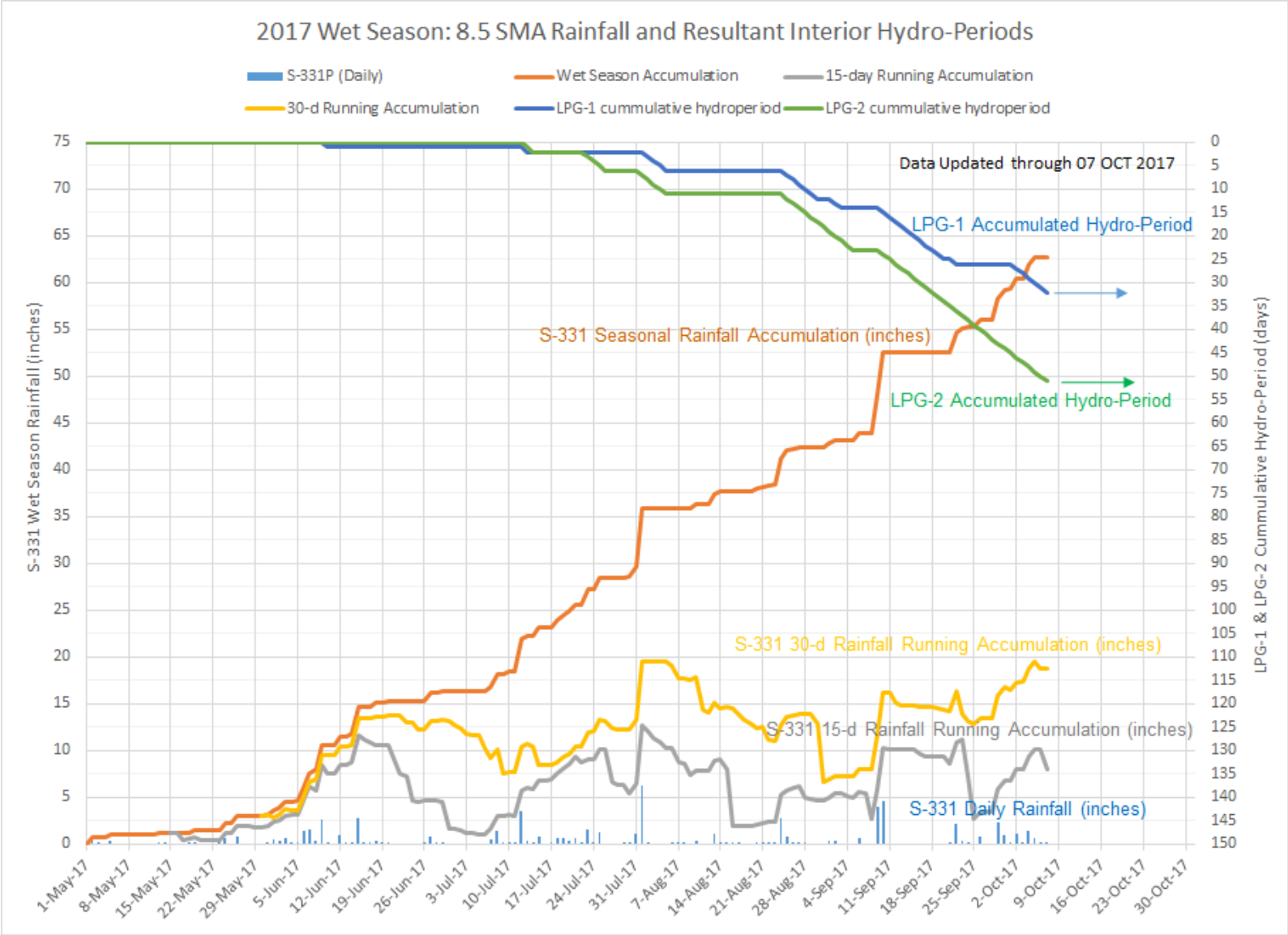

FIGURE 4-19. 8.5 SMA RAINFALL AND RESULTANT INTERIOR HYDRO-PERIODS, 2017 WET SEASON

4.6.2.3 South-Dade County Flood Risk Management

The net effect of reduced WCA 3A regulatory discharges to NESRS combined with increased flood control releases from S-331/S-173 and increased seepage to the L-31N Canal south of S-331 is not able to be quantified prior to completion of the field test and associated hydrologic monitoring. The field test hydrologic monitoring will aid in quantifying both long-term and intra annual/seasonal effects of increased stages within NESRS. Additional inflow volumes to L-31N Canal, if resultant from the field test, are expected to be primarily managed with the C- 111 South Detention Area using S-332 B, S-332C, and S-332D, given the significant reduction in WCA 3A regulatory releases to the SDCS.

The Increment 2 Operational Strategy proposes to retain the target operational ranges for the SDCS L-31N Canal compared to the No Action Alternative. A moderate reduction in WCA 3A regulatory discharges to the SDCS will be realized with increased utilization of the storage within NESRS, given no changes to the WCA 3A Regulation Schedule, which is anticipated to provide a minor improvement in the flood protection for areas adjacent to the L-3N Canal, north of S-176.

The C-111 Spreader Canal Western Project will continue to be operated by SFWMD and provide flows to Taylor Slough. The SFWMD efforts to monitor the impacts of the project operation and ensure protection of privately-owned lands in the vicinity of the C-111 Spreader Canal Western Project area remain ongoing and inconclusive based on the limited period of monitoring data collected since June 2012. To mitigate for potential increased risk to flood protection in south Miami-Dade County areas, which may be affected by increased water levels in NESRS and associated water management operations within south Miami-Dade County during the field test, low volume releases from S-197 are included as components of Alternative B. Compared to the No Action Alternative, the increased utilization of low-volume discharges from S-197 under all operational conditions (Conditions 1 through 4), in an effort to avoid the need for higher-magnitude and potentially harmful discharges, will not change the flood protection along the lower C-111 Canal. The field test will continue to include assessment of the combined effects of increased seepage east resultant from increased stage levels in NESRS and will incorporate the ongoing SFWMD operations, monitoring, and performance assessments conducted as part of the C 111 Spreader Canal Western Project. Consistent with the requirements of the February 2017 re-issued C-111 Spreader Canal regulatory permit from the Corps, the SFWMD is continuing to assess south Miami-Dade water conditions and existing operations, including those of the C-111 Spreader Canal Project, on a quarterly basis for a minimum of five years to ensure project features are constructed and operated not to adversely affect adjacent lands outside and within the C-111 Spreader Canal Western Project boundary with regards to water quantity, water quality, and/or flooding. The purpose of the assessment and quarterly reports are to ensure the SFWMD has the best available information to determine what operational system changes, if any, are necessary to avoid adverse water levels on adjacent lands.

The inclusion of the Additional Operational Flexibility for Extreme High Water Levels in WCA 3A (refer to Section 5.7 of the Operational Strategy in **Appendix A**) will not result in increased discharged to the SDCS if canal stages are unable to be maintained within the specified operational ranges. Inclusion of these criteria will therefore not alter the level of flood protection within South Dade, compared to the levels identified for the No Action Alternative.

4.6.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

4.6.3.1 WCA 3A High Water Conditions and SDCS Column 2 Operations

Consistent with the hydrologic effects characterized in **Section 4.5.3**, a moderate stage reduction of less than 0.25 feet is expected for WCA 3A compared to the No Action Alternative. Based on the hydrologic modeling conducted for the ERTP ESA consultation, the need for WCA 3A regulatory discharges to the SDCS will be nearly eliminated with Alternative C.

4.6.3.2 8.5 Square Mile Area

The hydrologic effects within the 8.5 SMA will be similar to the hydrologic effects for Alternative B, which are detailed in **Section 4.6.2.2**. Flood mitigation requirements for the 8.5 SMA may more frequently trigger reduced inflows to NESRS from WCA 3A.

4.6.3.3 South-Dade County Flood Risk Management

The hydrologic effects within the C-111 South Dade Basin will be similar to the hydrologic effects for Alternative B, which are detailed in **Section 4.6.2.3**. With the completion of the C-111 South Dade NDA, no significant effects from NESRS stages are anticipated within the C-111 South Dade Basin given no change to the operational criteria for the SDCS Canal network.

4.6.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

4.6.4.1 WCA 3A High Water Conditions and SDCS Column 2 Operations

The hydrologic effects within the WCA 3A and the SDCS will be similar to the hydrologic effects for Alternative B, which are detailed in **Section 4.6.2.1**.

4.6.4.2 8.5 Square Mile Area

The hydrologic effects within the 8.5 SMA will be similar to the hydrologic effects for Alternative B, which are detailed in **Section 4.6.2.2**.

4.6.4.3 South-Dade County Flood Risk Management

The hydrologic effects within the C-111 South Dade Basin will be similar to the hydrologic effects for Alternative B, which are detailed in **Section 4.6.2.3**. With the completion of the C-111 South Dade NDA, no significant effects from NESRS stages are anticipated within the C-111 South Dade Basin given no change to the operational criteria for the SDCS Canal network.

The exclusion of the Additional Operational Flexibility for Extreme High Water Levels in WCA 3A (refer to Section 5.7 of the Operational Strategy in **Appendix A**) would be anticipated to reduce discharges to the SDCS compared to Alternative B. However, since WCA 3A regulatory discharges to the SDCS are not available if canal stages are unable to be maintained within the specified operational ranges, no change to flood risk management would result compared to Alternative B.

4.7 VEGETATIVE COMMUNITIES

4.7.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

The continued implementation of Increment 1.1 and 1.2 has the potential for minor beneficial effects on wetland vegetation within ENP by increasing flows to NESRS relative to the 2012 Water Control Plan (USACE 2012c). As described in the February 2017 Increment 1.1 and 1.2 EA, the duration at which water stages within the L-29 Canal approach 7.8 feet, NGVD is expected to be greater under Increment 1.1 and 1.2 relative to the 2012 Water Control Plan (USACE 2017a), increasing the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of wetland vegetation due to improved hydroperiods. Hydrologic modeling was completed to support the July 2016 ERTP BO. Model simulation INCR1B corresponds to the No Action Alternative in this EA, without the WCA 3A high water strategy to limit additional S-12A and/or S-12B closures during late wet season high water conditions. Modeling results indicated that operations may result in slightly higher WCA 3A stages (**FIGURE 4-1**) with improved hydroperiods along the eastern perimeter of NESRS (**FIGURE 4-11**) and decreased hydroperiods within western SRS, downstream of S-12D in comparison to the May 2015 Increment 1 EA and FONSI. Continued implementation of Increment 1.1 and 1.2 may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound. Reference **Section 4.5.1**.

4.7.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

4.7.2.1 WCA 3A AND ENP SHARK RIVER SLOUGH

Deep slough communities formerly occurred throughout the pre-drainage Ridge and Slough region of the Everglades (McVoy et al. 2011). Sloughs within the Greater Everglades have been degraded by compartmentalization resulting in reduced sheetflow, depths and inundation durations, and alteration of vegetation communities. The primary factors influencing the distribution of dominant freshwater wetland plant species of the Everglades are soil type, soil depth, and hydrological regime (USFWS 1999). Alternative B is expected to provide minor beneficial effects on wetland vegetation within ENP by increasing flows to NESRS. Alternative B is expected to provide a greater magnitude increase relative to the No Action Alternative as Alternative B has the ability to raise the L-29 Canal stage maximum operating limit from 7.8 feet, NGVD to 8.5 feet, NGVD contingent upon constraints identified in **Appendix A, Part 1**.

Hydrologic modeling was completed to support the July 2016 ERTP BO. Model simulation INCR2B corresponds to Alternative C in this EA, without the WCA 3A high water strategy and with the L-29 Canal maximum operating limit raised to 8.5 feet, NGVD (surrogate placeholder for Increment 2). Under the implementation of Alternative B, hydrologic benefits within NESRS will be greater than the No Action Alternative but less than Alternative C. Simulated stage duration curves for the L-29 Canal and G-3273 are illustrated in **FIGURE 4-5** and **FIGURE 4-6**, respectively, for the No Action Alternative (INCR1B) and Alternative C (INCR2B). Average annual stage increases for the L-29 Canal and G-3273 are anticipated under implementation of Alternative B within the range depicted in **FIGURE 4-5** and **FIGURE 4-6**. Based on preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO, current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum

operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance), regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months (**FIGURE 4-10**). Improved hydroperiods within NESRS and ENP have the potential to reduce soil oxidation, which is expected to promote peat accretion. A potential decease in drying event severity, if achieved under Alternative B would aid in the restoration of historic wetland vegetation communities. **FIGURE 4-11** illustrates average annual hydroperiod distributions for the No Action Alternative (INCR1B) and Alternative C (INCR2B). Increases in hydroperiods are anticipated under implementation of Alternative B within the range depicted in **FIGURE 4-11**.

Alternative B, consistent with the No Action Alternative, includes increasing flows through S-333. With an increase in S-333 flow, there is an increased likelihood of higher total phosphorus (TP) concentrations in the water delivered to the NESRS. The Everglades, a phosphorus-limited system, historically received most inputs of phosphorus through rainfall, with average TP concentrations of less than 0.01 mg/L (McCormick et al. 1996, Newman et al. 2004). However, more recently, areas within ENP, including NESRS, have been exposed to TP concentrations at or in excess of 0.10 mg/L (SFWMD 2010). Vegetation that can assimilate nutrients directly from the water column appears to be the most sensitive to nutrient enrichment and include periphyton and floating-leaved plants, such as spatterdock and water lily (Chaing et al. 2000; Newman et al. 2004). Potential effects to vegetation and species composition within NESRS and ENP as a result of changes in water quality cannot be fully determined at this time.

The hydrologic effects for western SRS are affected by the closure regime for the S-12A, S-12B, S-343A, S-343B, and S-344 structures under current water management practices. Alternative B will retain the required closure period for S-12A, S-12B, S-343A, S-343B, and S-344 starting 01 October through 15 July consistent with the 2016 ERTP BO RPA and the No Action Alternative. A potential decrease in hydroperiod within the vicinity of CSSS-A within NESRS may be beneficial in terms of achieving the desired vegetation and performance measure targets defined by the USFWS in the 2016 ERTP BO. This area has been identified by USFWS as being too wet. An average annual discontinuous hydroperiod of between 90 and 210 days is required to maintain suitable marl prairie habitat for the CSSS. If the number of days with surface water is consistently more than 210 days, the habitat will convert to sawgrass. If it is consistently too dry (less than 90 days) woody vegetation encroaches on the habitat and there is an increased risk of fire and predation on CSSS from aerial predators (raptors).

Vegetation within WCA 3A would not be expected to significantly change from current conditions with implementation of Alternative B. Alternative C is anticipated to result in a moderate stage reduction of less than 0.25 feet for WCA 3A compared to the No Action Alternative. Depending on the extent to which the FDOT constraint and the 8.5 SMA flood mitigation constraints accommodate prolonged increased stages within the L-29 Canal, under Alternative B, a minor stage reduction between 0 and 0.25 feet is anticipated for Alternative B. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75

feet, NGVD, as measured by the 3-gage average, previously defined under the May 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a), to define the priority of releases from S-333 and S-356 to the L-29 Canal and NESRS. Implementation of the Action Line (*i.e.* Condition 3 and 4; **FIGURE 2-1**) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A that result in negative impacts to its natural communities. Furthermore, Alternative B includes additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**) to further allow for a rapid response to extreme high water levels in WCA 3A. Prolonged periods of inundation are of particular concern for tree islands within WCA 3A. ERTP tree island performance measures strive to keep high water peaks less than 10.8 feet, NGVD, and strive to reach water levels less than 10.3 feet, NGVD by December 31. The operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

4.7.2.2 ENP EASTERN PANHANDLE AND MANATEE BAY/BARNES SOUND

The estuarine communities of Florida and Biscayne Bays have been affected by upstream changes in freshwater flows through the Everglades and eastward across the Miami Rock Ridge. The estuarine communities of Biscayne Bay have been further affected by agricultural and urban development of the areas east of the current boundaries of ENP. A reduction in freshwater inflows into Florida Bay and alterations of the normal salinity balance have affected mangrove community composition and may have contributed to a large-scale die-off of seagrass beds (USFWS 1999). Mangrove communities along Biscayne Bay have also seen a reduction in freshwater inflows and a reduction in historic habitat range by urban and agricultural development leaving only a remnant ribbon of suitable habitat immediately adjacent to the bay. Both bays experiences salinities in excess of 40 psu on a seasonal basis. Manatee Bay and Barnes Sound are presently characterized by extended periods with little or no freshwater input, interspersed with erratic large volume discharges from the C-111 Canal, which is presently the major source of freshwater flows. The timing and quantity of these flows however cause abrupt, major reductions in salinity that may persist for periods of days to weeks, followed by a return to moderate-to-high salinities.

Implementation of Alternative B is expected to improve the hydrology of the ENP Eastern Panhandle and Manatee Bay and Barnes Sound relative to the No Action Alternative with efforts to reduce Column 2 discharges. Reference **Section 4.5.3.2** and **4.5.3.3**. Increased available storage within NESRS should reduce the frequency and duration for regulatory releases from WCA 3A to the SDCS. However, temporary impacts to Manatee Bay and Barnes Sound have the potential to continue to occur under Alternative B. Water management operations to raise the L-29 Canal maximum operating limit will result in increased seepage to the L-31N Canal as increased flow into NESRS will likely increase stages along the west side of L-31N. This increase is expected to be fully manageable with operation of the C-111 South Dade Project NDA. However, since this will be the initial opportunity to gain operational experience with the NDA, Alternative B will continue to retain the management operating criteria for S-197 as provided in the No Action Alternative. Relative to the No Action Alternative, Alternative B has expanded the use of low-volume S-197 operations to include drier periods under Condition 1 when the stage at G-3273 is below 6.6 feet, NGVD and the WCA 3A stage is below the Increment 1 and 2 Action Line; the No

Action Alternative criteria for S-197 were consistent with the 2012 Water Control Plan, with level 1 gate openings starting at 800 cfs. Alternative B may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound consistent with the No Action Alternative. Potential minor adverse impacts associated with salinity fluctuations under Alternative B, would be temporary and spatially limited to nearshore areas within the southern estuaries. Manatee Bay and Barnes Sound are relatively large bodies of water with open connections to Card Sound and the Atlantic Ocean. Waters within Manatee Bay and Barnes Sound have been documented to have shorter residence times and experience more tidal flushing relative to northeastern Florida Bay (Marshall 2014).

Implementation of Alternative B is expected to improve the hydrology of ENP Taylor Slough. Reference **Section 4.5.2.3**. The S-328 gated culvert provides an ability to discharge up to 500 cfs from Cell 1 of the S-332 Detention Area into the L-31W Canal to short-circuit the southern portion of the S-332D Detention Area to ensure water deliveries reach Taylor Slough. Under Alternative B, S-328 will continue to be used to increase deliveries to Taylor Slough up to 250 cfs. This is consistent with the No Action Alternative. Under the No Action Alternative, supplemental water deliveries were limited to conditions when WCA 3A was above the floor elevation of 8.0 feet, NGVD in April and May and above 8.5 feet, NGVD in all other months. The operation was also limited to 8 weeks per year when the 3-gage average was below the historical median stage, which will be eliminated for Alternative B. Alternative B will expand the duration of supplemental flows by removing restrictions Supplemental flows may be useful in providing potential benefits to Taylor Slough and northeastern areas of Florida Bay, by potentially reducing hyper saline events in those areas directly influenced by Taylor Slough inflows.

Experimentation with surface water flow to Taylor Slough and its effect on the vegetation within and adjacent to the slough has been well studied (Armentano et al. 2000, 2006, Nott et al. 1998, Olmstead et al. 1980, Van Lent et al. 1993, 1999). From 1980-1999, as part of the C&SF Project, various amounts of overland flow were discharged through the now decommissioned S-332 pump station which was located in the south western corner of L-31W. Rapid vegetation changes were observed where habitats dominated by short hydroperiod species such as *Muhlenbergia* were replaced by sawgrass and where sawgrass dominated habitats were replaced by more aquatic species such as *Eleocharis*. Cattail also became established near the pumping station potentially due to increased phosphorus loading. Additional supplemental water supply to Taylor Slough under Alternative B, is not expected to have significant effects on vegetative communities as a result of the limited duration and spatial extent of the operational changes being considered. Three plugs in the L-31W canal between S-328 and the L-31W gap have been constructed as part of the C-111 South Dade Project. Construction of these plugs reduce the potential for increased nutrient load into Taylor Slough as a longer residence time within the L-31W Canal may provide increased opportunity for nutrient uptake. The L-31W Canal plugs were identified in the 2016 C-111 South Dade Contract 9 EA. Water drained into the L-31W borrow canal, which is immediately adjacent to ENP, flows 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-31 W, along with modifications to the L-31W levee gap, are 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 2016a).

Alternative B is not expected to have significant effects on vegetative communities within Taylor Slough and the coastal estuaries as a result of the limited duration and limited extent of operational changes being considered for the southern estuaries under this field test.

4.7.2.3 Slough/Open Water Marsh

Flows through NESRS under current system compartmentalization and water management practices are greatly reduced when compared with pre-drainage conditions. The result has been lower wet season depths and more frequent and severe dry downs in sloughs and reduction in extent of shallow water edges. Over-drainage within ENP has resulted in the conversion of slough/open-water marsh communities to shorter hydroperiod sawgrass marshes and wet prairies (Davis et al. 1994, Davis and Ogden 1997; Armentano et al. 2006; McVoy et al. 2011). Shorter hydroperiod sawgrass marshes may transition to wet prairie and slough/open water marsh communities with improved hydroperiods under Alternative B. Shifts from one vegetation type to another may occur in a relatively short time frame (1 to 4 years) following hydrological alteration (Armentano et al. 2006, Zweig 2008, Zweig and Kitchens 2008, Sah et al. 2008). Alternative B may have a temporary minor beneficial effect on slough/open water marsh communities within NESRS. However, due to the short duration of this test, significant vegetation changes are not anticipated.

4.7.2.4 Sawgrass Marsh

As a result of increased durations under Alternative B, it is expected that shorter hydroperiod sawgrass marshes within ENP may transition to wet prairie, except where there is deep water that will transition to slough.

4.7.2.5 Wet Marl Prairies

Areas within the eastern marl prairies along the boundary of ENP suffer from over-drainage, reduced water flow, exotic tree invasion and frequent human-induced fires (Lockwood et al. 2003; Ross et al. 2006). To alleviate the perpetually drier conditions and associated problems, increased water flows within this area are required. Increased hydroperiods within the eastern marl prairies may act to alleviate some of the problems associated with drier conditions and promote a shift in species community composition to benefit native vegetation and provide a temporary minor beneficial effect.

4.7.2.6 Rockland Pine Forest

Pine rocklands within the action area occur on the Miami Rock Ridge and extend into the Everglades as Long Pine Key. The pine rocklands, also called the pinelands, have a hard rocky ground, made up of limestone. The pinelands, like the hardwood hammock are found on higher ground, making it a dry habitat. Significant impacts are not predicted within rockland pine forest with implementation of Alternative B.

4.7.2.7 Tropical Hardwood Hammock

Tropical hardwood hammocks on the Miami Rock Ridge have been affected by a lowered water table associated with the reduction of freshwater flow through the Everglades. Tropical hardwood hammocks within the action area occur on the Miami Rock Ridge, along the northern shores of

Florida Bay, and on elevated outcrops on the upstream side of tree islands. Significant impacts are not predicted within tropical hardwood hammock with implementation of Alternative B.

4.7.2.8 Tree Islands

Tree islands in SRS rise above the surrounding marsh. Potential for flooding stress is low with implementation of Alternative B. Since 1942, a 55 percent decline in the extent and number of tree islands in SRS has been observed due to intensive fires that migrate across the marshes and burn tree island peat soils leaving rocky outcroppings. Tree islands are connected to the surrounding marsh via the roots of the trees. When the water table drops below these roots, tree islands often become too dry and can burn. Under Alternative B, the duration of water above the marsh surface is expected to improve. Alternative B may have a temporary minor beneficial effect on tree islands within ENP by reducing the potential for devastating fires. Reference **Section 4.13.2** for additional information regarding tree islands and the potential for overtopping as a result of Alternative B.

Prolonged periods of inundation are of particular concern for tree islands within WCA 3A. ERTP tree island performance measures strive to keep high water peaks less than 10.8 feet, NGVD, and strive to reach water levels less than 10.3 feet, NGVD by December 31. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the 3-gage average, previously defined under the 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a). Implementation of the Action Line (*i.e.* Condition 3 and 4; **FIGURE 2-1**) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A. Furthermore, Alternative B includes additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**) to further allow for a rapid response to extreme high water levels in WCA 3A. This would assist in mitigating potential negative impacts to tree islands as a result of high water events. The operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

Vegetation within WCA 3A would not be expected to significantly change from current conditions with implementation of Alternative B. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the 3-gage average, previously defined under the May 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a), to define the priority of releases from S-333 and S 356 to the L-29 Canal and NESRS. Implementation of the Action Line (*i.e.* Condition 3 and 4; **FIGURE 2-1**) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A that result in negative impacts to its natural communities. Furthermore, Alternative B includes additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-1**) to further allow for a rapid response to extreme high water levels in WCA 3A. Prolonged periods of inundation are of particular concern for tree islands within WCA 3A. ERTP tree island performance measures strive to keep high water peaks less than 10.8 feet, NGVD, and strive to reach water levels less than 10.3 feet, NGVD by December 31. The operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical

WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

4.7.2.9 Mangroves

Mangrove communities occur within a range of salinities from 0 to 40 psu. Jiang et al. (2012) developed a model to estimate the resilience of a system against a regime shift. Their model was applied to a halophytic mangrove and glycophytic hardwood hammock ecotone to measure its resilience to storm surge. The boundary between these two vegetative types is typically distinct, with only slight changes in topography. The authors noted that a disturbance, such as an input of salinity to the soil from a storm event, could upset this ecotone boundary. This could possibly cause salinity-tolerant vegetation to migrate inland. For the model developed in this study, the authors found a pulse disturbance was not sufficient to cause a regime shift in the vegetative boundary. Any change in salinity would have to be held at a high level for some time for this type of boundary shift to occur (Jiang et al., 2012). Alternative B will continue to retain the management operating criteria for S-197 as provided in the No Action Alternative. Alternative B may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound. No significant changes to the timing of S-197 operations (July to October/wet season) are anticipated to occur relative to the No Action Alternative (Reference **Section 4.5.3.2)**. Although the above referenced study by Jiang et al. (2012) provides only limited data on how mangrove habitats respond to salinity variations, it suggests that low volume freshwater releases *(i.e.* less than 500 cfs) from S-197 under Alternative B would not be sufficient to affect mangrove habitats within the coastal estuaries.

Alternative B does include additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**). Under this condition discharges at S-197 may be increased up to a maximum of 2400 cfs as summarized in **Section 4.3.2** and detailed in **Appendix A**, **Part 1**. However these operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

4.7.2.10 Seagrass Beds

Nearshore salinity conditions within the coastal estuaries are elevated much of the year as a result of the less than adequate freshwater flow deliveries. Alternative B may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound. No significant changes to the timing of S-197 operations (July to October/wet season) are anticipated to occur relative to the No Action Alternative (Reference **Section 4.5.3.2**). Overland flow of freshwater into coastal estuaries is preferred as compared with transfers through the S-197 structure, however low volume releases to Manatee Bay and Barnes Sound through this structure are considered preferential to high volume releases which result in increased incidence of large salinity swings as well as high nutrient load delivery. Extreme salinity fluctuations associated with high volume discharges are not expected under Alternative B, as additional S-197 releases are anticipated to be less than 500 cfs. Scouring of bottom sediments and significant increases in turbidity resulting in diminished light penetrations through the water column is not expected. Significant impacts to seagrass beds within the coastal estuaries are not expected due to the limited duration and limited extent of operational changes at S-197 being

considered. Seagrasses have an optimum salinity range of 24 to 35 psu, but can tolerate considerable short-term salinity fluctuations.

Alternative B does include additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**). Under this condition discharges at S-197 may be increased up to a maximum of 2400 cfs as summarized in **Section 4.3.2** and detailed in **Appendix A, Part 1**. However these operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

4.7.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

Implementation of Alternative C would result in similar effects as discussed under Alternative B. Alternative C is expected to provide a greater magnitude of increase relative to Alternative B as Alternative C has the ability to raise the L-29 Canal stage operating limit up to 8.5 feet, NGVD and is not subject to a limited duration at which this stage can be maintained (**Appendix A**, **Part 1**). Alternative C would likely show a slightly higher beneficial effect on wetland vegetation within ENP. Relative to Alternative B, implementation of Alternative C would result in slightly more beneficial hydrologic conditions in ENP eastern Panhandle, Manatee Bay and Barnes Sound with efforts to increase available storage within NESRS and significantly reduce the frequency and duration for Column 2 discharges. Potential effects to mangrove habitats and seagrass beds within the coastal estuaries under Alternative C would be similar to that as discussed under Alternative B as a result of the minor to moderate increases in the frequency and duration of low volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound. Potential temporary adverse effects to Manatee Bay and Barnes Sound associated with salinity fluctuations are anticipated with continued S-197 utilization. Significant impacts to vegetation communities as a result of implementation of the Alternative C would not expected due to the short duration of the operational modifications being considered.

4.7.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Implementation of Alternative G would result in similar effects as discussed under Alternative B. Operational criteria for Alternative G are identical to that described for Alternative B, except for the exclusion of additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. Exclusion of additional operational flexibility for extreme high water levels in WCA 3A has the potential for negative impacts to occur on vegetation communities. Prolonged periods of inundation are of particular concern for tree islands within WCA 3A. Exclusion of this action line from the operational schedule will result in slower responses to extreme wet conditions in WCA 3A. The potential for increased additional discharges up to 2400 cfs at S-197 as summarized in **Section 4.3.2** and detailed in **Appendix A, Part 1** would also not be implemented.

4.8 FISH AND WILDLIFE RESOURCES

4.8.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

The continued implementation of Increment 1.1 and 1.2 has the potential for minor beneficial effects on fish and wildlife resources within ENP by increasing flows to NESRS relative to the 2012 Water Control Plan (USACE 2012c). As described in the February 2017 Increment 1.1 and 1.2 EA, the duration at which water stages within the L-29 Canal approach 7.8 feet, NGVD is expected to be greater under Increment 1.1 and 1.2 relative to the 2012 Water Control Plan (USACE 2017a), increasing the availability of S-333 for water deliveries from WCA 3A to ENP through NESRS for the benefit of fish and wildlife resources due to improved hydroperiods. Hydrologic modeling was completed to support the July 2016 ERTP BO. Model simulation INCR1B corresponds to the No Action Alternative in this EA, without the WCA 3A high water strategy to limit additional S-12A and/or S-12B closures during late wet season high water conditions. Modeling results indicated that operations may result in slightly higher WCA 3A stages (**FIGURE 4-1**) with improved hydroperiods along the eastern perimeter of NESRS (**FIGURE 4-11**) and decreased hydroperiods within western SRS, downstream of S-12D in comparison to the May 2015 Increment 1 EA and FONSI. Continued implementation of Increment 1.1 and 1.2 may result in minor to moderate increases in the frequency and duration of low-volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound (Reference **Section 4.5.1)**.

4.8.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

Alternative B is expected to provide minor beneficial effects on fish and wildlife resources within ENP by increasing flows to NESRS. Moving water south, through ENP will also have the added ecological benefit of improving salinity conditions of Florida Bay. Alternative B is expected to provide a greater magnitude increase relative to the No Action Alternative as Alternative B has the ability to raise the L-29 Canal stage maximum operating limit from 7.8 feet, NGVD to 8.5 feet, NGVD contingent upon constraints identified in **Appendix A, Part 1**. Hydrologic modeling was completed to support the July 2016 ERTP BO. Model simulation INCR2B corresponds to Alternative C in this EA, without the WCA 3A high water strategy and with the L-29 Canal maximum operating limit raised to 8.5 feet, NGVD (surrogate placeholder for Increment 2). Under the implementation of Alternative B, hydrologic benefits within NESRS will be greater than the No Action Alternative but less than Alternative C. Simulated stage duration curves for the L-29 Canal and G-3273 are illustrated in **FIGURE 4-5** and **FIGURE 4-6**, respectively, for the No Action Alternative (INCR1B) and Alternative C (INCR2B). Average annual stage increases for the L-29 Canal and G-3273 are anticipated under implementation of Alternative B within the range depicted in **FIGURE 4-5** and **FIGURE 4-6**. Based on preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance), regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months (**FIGURE 4-10**). Reference **Section 4.5.2.1**.

Improved hydroperiods would increase forage prey availability (*i.e.* crayfish and other invertebrates, fish), providing a direct benefit for amphibian, reptile, small mammal and wading bird species, including the threatened wood stork, within ENP. **FIGURE 4-11** illustrates average annual hydroperiod distributions for the No Action Alternative (INCR1B) and Alternative C (INCR2B). Increased hydroperiods are anticipated under implementation of Alternative B within the range depicted in **FIGURE 4-11**.

Flows through NESRS under current system compartmentalization and water management practices are greatly reduced when compared with pre-drainage conditions. The result has been lower wet season depths and more frequent and severe dry downs in sloughs and reduction in extent of shallow water edges. Improved hydroperiods would directly benefit aquatic invertebrates within the project area. Shorter hydroperiod sawgrass marshes may transition to wet prairie and slough/open water marsh communities with improved hydroperiods under Alternative B. Shifts from one vegetation type to another may occur in a relatively short time frame (1 to 4 years) following hydrological alteration (Armentano et al. 2006, Zweig 2008, Zweig and Kitchens 2008, Sah et al. 2008). Submerged aquatic plants are commonly associated with sloughs providing structure for growth of periphyton, the main source of primary production within the freshwater Everglades (Gunderson 1994; Powers 2005) and a primary component of invertebrate diets. Periphyton is of particular importance for the Florida apple snail which is the primary constituent of the endangered Everglade snail kite's diet.

Crayfish are important components within the Everglades food web, serving as primary dietary components of higher trophic level species including fish, amphibians, alligators, wading birds and mammals such as raccoons and river otters (Kashan and Kushlan 1979). Crayfish species composition and abundance within the Greater Everglades are linked to hydroperiod. Increases in hydroperiod associated with implementation of Alternative B may provide temporary, minor beneficial effects to crayfishes within areas of NESRS as well as Taylor Slough, as a result of operational modifications to provide supplemental flows to this area.

Increases in forage prey availability (*i.e.* crayfish and other invertebrates, fish) resulting from improved hydroperiods would in turn provide beneficial effects for amphibian, reptile, small mammal, and wading bird species. Abrupt increases in water levels during nesting, termed reversals, may cause wading bird nest abandonment, re-nesting, late nest initiation, and poor fledging success. Potential wading bird colony abandonment due to artificial reversals at the end of the dry season/start of the wet season is not anticipated as a result of Alternative B.

Fish and wildlife resources within WCA 3A would not be expected to be significantly affected with implementation of Alternative B. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the 3-gage average, previously defined under the 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a), to define the priority of releases from S-333 and S 356 to the L-29 Canal and NESRS. Implementation of the Action Line (*i.e.* Condition 3 and 4; **FIGURE 2-1**) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A that result in negative impacts to its natural communities. Furthermore, Alternative B includes additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**) to further allow for a rapid response to extreme high water

levels in WCA 3A. The additional operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A 3-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days (**TABLE 4-1**).

Potential effects to fish and wildlife resources inhabiting mangrove habitats and seagrass beds within the coastal estuaries under Alternative B would be similar to the No Action Alternative as a result of the minor to moderate increases in the frequency and duration of low volume (less than 500 cfs) S-197 discharges to Manatee Bay/Barnes Sound. Mangrove habitats provide food and refuge to a large variety of species. Seagrass habitats are heavily utilized by both juvenile and adult fishes and invertebrates for feeding and shelter. Low volume freshwater releases from S-197 (less than 500 cfs) and potential increases in structural discharges from the L-31N Canal considered under Alternative B would not be sufficient to affect mangrove and seagrass habitats within the coastal estuaries (Reference **Section 4.7.2.9** and **4.7.2.10)**. Potential minor adverse impacts associated with salinity fluctuations would be temporary and spatially limited to nearshore areas within the southern estuaries. Significant effects to fish and wildlife resources with eastern Florida Bay, Biscayne Bay, and Manatee Bay and Barnes Sound are not anticipated as a result of the test.

Alternative B does include additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-2**). Under this condition discharges at S-197 may be increased up to a maximum of 2400 cfs as summarized in **Section 4.3.2** and detailed in **Appendix A**, **Part 1**. However, as previously stated these operational flexibilities are not expected to be triggered frequently (**TABLE 4-1**).

4.8.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

Implementation of Alternative C would result in similar effects as discussed under Alternative B. Since Alternative C has the ability to raise the L-29 Canal stage operating limit up to 8.5 feet, NGVD and is not subject to a limited duration at which this stage can be maintained (**Appendix A, Part 1**), Alternative C would likely show a slightly higher beneficial effect on fish and wildlife resources within the project area due to improved hydroperiods within ENP. Relative to Alternative B, implementation of Alternative C would result in slightly more beneficial hydrologic conditions in ENP eastern Panhandle, Manatee Bay and Barnes Sound with efforts to increase available storage within NESRS and significantly reduce the frequency and duration for Column 2 discharges. Potential effects to fish and wildlife resources inhabiting mangrove habitats and seagrass beds within the coastal estuaries under Alternative C would be similar to that as discussed under Alternative B as a result of the minor to moderate increases in the frequency and duration of low volume (less than 500 cfs) S-197 discharges to Manatee Bay and Barnes Sound. Significant impacts to fish and wildlife resources as a result of implementation of the Proposed Action are not expected due to the short duration of the operational modifications being considered.

4.8.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Implementation of Alternative G would result in similar effects as discussed under Alternative B. Operational criteria for Alternative G are identical to that described for Alternative B, except for the exclusion of additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. Exclusion of additional operational flexibility for extreme high water levels in WCA 3A has the potential for negative impacts to occur on fish and wildlife resources. Prolonged periods of flooding eliminates foraging and nesting opportunities for wading birds. Several species of wading birds nest during the dry season and rely on drying wetlands to concentrate prey items. However, frequent heavy rains during nesting can cause water levels to increase rapidly, reducing foraging opportunities. Abrupt increases in water levels during nesting, termed reversals, may cause wading bird nest abandonment, re-nesting, late nest initiation, and poor fledgling success. Prolonged inundation periods are also of particular concern for mammals dependent on upland habitat, particularly for deer populations within northern WCA 3A that utilize tree islands for refugia. Exclusion of this action line from the operational schedule will result in slower responses to extreme wet conditions in WCA 3A. The potential for increased additional discharges up to 2400 cfs at S-197 as summarized in **Section 4.3.2** and detailed in **Appendix A, Part 1** would also not be implemented.

4.9 THREATENED AND ENDANGERED SPECIES

4.9.1 FEDERALLY PROTECTED SPECIES

Effects determinations for federally threatened and endangered species within the project area for all Action Alternatives are listed in **TABLE 4-2.** The Corps reinitiated ESA consultation on ERTP on November 17, 2014 as a result of an exceedance of an Incidental Take Reinitiation Trigger from the November 17, 2010 ERTP BO for the CSSS (Reference **Section 1.3.6**). USFWS issued a Jeopardy BO for ERTP on July 22, 2016, developed in formal ESA consultation with the Corps. The RPA specifies that the Corps shall proceed as scheduled for completing NEPA analysis on Increment 2 prior to March 1, 2018. There has been no change in the operational intent of the Proposed Action that would require the need to re-initiate consultation with the USFWS since the completion of prior resource agency consultation under ERTP. Increment 2 meets the intent of the RPA. Correspondence dated October 18, 2017 has been provided to the USFWS requesting concurrence on species determinations listed in **TABLE 4-2**, noting that the conclusion of ESA consultation on the Proposed Action presented within this EA is previously covered under the 2016 ERTP BO. The USFWS concurred with this assessment by correspondence dated November 15, 2017. Reference **Appendix D** for pertinent correspondence. Upon completion of an assessment for species under NMFS purview it was determined that the Proposed Action would have no effect on these species; therefore, consultation with NMFS was not necessary.

TABLE 4-2. FEDERALLY THREATENED AND ENDANGERED SPECIES WITHIN THE PROJECT AREA AND SPECIES DETERMINATION FOR THE PROPOSED ACTION

Common Name	Scientific Name	Status	May Affect, Likely to Adversely Effect	May Affect, Not Likely to Adversely Effect	No Effect
Mammals					
Florida panther	*Puma concolor coryi*	E			X
Florida manatee	*Trichechus manatus latirostris*	E, CH			X
Florida bonneted bat	*Eumops floridanus*	E		X	
Birds					
Cape Sable seaside sparrow	*Ammodramus maritimus mirabilis*	E, CH		X	
Everglade snail kite	*Rostrhamus sociabilis plumbeus*	E, CH		X	
Piping plover	*Charadrius melodus*	T			X
Red-cockaded woodpecker	*Picoides borealis*	E			X
Roseate tern	*Sterna dougallii*	T			X
Wood stork	*Mycteria Americana*	T		X	
Reptiles					
American Alligator	*Alligator mississippiensis*	T, SA			X
American crocodile	*Crocodylus acutus*	T, CH			X
Eastern indigo snake	*Drymarchon corais couperi*	T			X
Gopher tortoise*	*Gopherus polyphemus*	C			X
Green sea turtle*	*Chelonia mydas*	E			X
Hawksbill sea turtle*	*Eretmochelys imbricate*	E			X
Kemp's Ridley sea turtle*	*Lipodochelys kempii*	E			X
Leatherback sea turtle*	*Dermochelys coriacea*	E			X
Loggerhead sea turtle*	*Caretta*	T			X
Fish					
Smalltooth sawfish*	*Pristis pectinata*	E			X
Invertebrates					

Bartram's hairstreak butterfly	*Strymon acis bartrami*	E			X
Elkhorn coral*	*Acropora palmata*	T, CH			X
Florida leafwing butterfly	*Anaea troglodyta floridalis*	E			X
Miami blue butterfly	*Cyclargus thomasi bethunebakeri*	E			X
Schaus swallowtail butterfly	*Heraclides aristodemus ponceanus*	E			X
Staghorn coral*	*Acropora cervicornis*	T, CH			X
Stock Island tree snail	*Orthalicus reses* (not incl. *nesodryas*)	T			X
Plants					
Crenulate lead plant	*Amorpha crenulata*	E			X
Deltoid spurge	*Chamaesyce deltoidea spp. deltoidea*	E		X	
Garber's spurge	*Chamaesyce garberi*	T		X	
Johnson's seagrass*	*Halophila johnsonii*	E, CH			X
Okeechobee gourd	*Cucurbita okeechobeensis* ssp. *okeechobeenis*	E			X
Small's milkpea	*Galactia smallii*	E		X	
Tiny polygala	*Polygala smallii*	E		X	
Big pine partridge pea	*Chamaecrista lineata* var. *keyensis*	E			X
Blodgett's silverbush	*Argythamnia blodgettii*	T			X
Cape Sable thoroughwort	*Chromolaena frustrata*	E, CH			X
Carter's small-flowered flax	*Linum carteri* var. *carteri*	E, CH			X
Everglades bully	*Sideroxylon reclinatum spp. austrofloridense*	T			X
Florida brickell-bush	*Brickellia mosieri*	E, CH			X
Florida bristle fern	*Trichomanes punctatum* spp. *floridanum*	E			X
Florida semaphore cactus	*Consolea corallicola*	E, CH			X
Sand flax	*Linum arenicola*	E			X
Florida pineland crabgrass	*Digitaria pauciflora*	T			X

Florida pineland sandmat	*Chaemaesyce deltoidea pinetorium*	T			X
Florida prairie clover	*Dalea carthagenesis floridana*	E			X

E=Endangered; T=Threatened; CH=Critical Habitat; Candidate Species

4.9.2 STATE LISTED SPECIES

Implementation of the Proposed Action would not result in significant impacts to state listed species (**TABLE 4-3**). Impacts to state listed species would be similar to those outlined for fish and wildlife resources in **Section 4.8**.

TABLE 4-3. STATE LISTED SPECIES WITHIN THE PROJECT AREA AND SPECIES DETERMINATION FOR THE PROPOSED ACTION

Common Name	Scientific Name	Status	May Affect, Likely to Adversely Effect	May Affect, Not Likely to Adversely Effect	No Effect
Mammals					
Everglades mink	*Mustela vison evergladensis*	T			X
Birds					
Snowy plover	*Charadrius nivosus*	T			X
American oystercatcher	*Haematopus palliates*	T			X
Black skimmer	*Rynchops niger*	T			X
Least tern	*Sterna antillarium*	T			X
White-crowned pigeon	*Patagioenas leucocephalus*	T			X
Little blue heron	*Egretta caerulea*	T		X	
Tricolored heron	*Egretta tricolor*	T		X	
Reddish egret	*Egretta rufescens*	T		X	
Roseate spoonbill	*Platalea ajaja*	T			X
Florida sandhill crane	*Antigone canadensis pratensis*	T			X
Southeastern American kestrel	*Falco sparverius paulus*	T			X
Reptiles					
Rim rock crowned snake	*Tantilla oolitica*	T			X
Plants					
Pine-pink orchid	*Bletia purpurea*	T			X
Lattace vein fern	*Thelypteris reticulate*	E			X

Eatons spikemoss	*Selaginella eatonii*	E			X
Wright's flowering fern	*Anemia wrightii*	E			X
Tropical fern	*Schizaea pennula*	E			X
Mexican vanilla	*Manilla mexicana*	E			X

E=Endangered; T=Threatened

4.10 ESSENTIAL FISH HABITAT

Implementation of the No Action and Action Alternatives are not expected to adversely affect Essential Fish Habitat. Mangrove habitats provide food and refuge to a large variety of species (SAFM 1998). These species include: spiny lobsters, pink shrimp, snook (*Centropomus undecimalis*), goliath grouper (*Epinephelus itajara*), tripletail (*Lobotes surinamensis*), leatherjack (*Oligoplites saurus*), gray snapper (*Lutjanus griseus*), dog snapper (*L. jocu*), sailor's choice (*Haemulon parra*), bluestriped grunt (*H. sciurus*), sheepshead (*Archosargus probatocephalus*), black drum (*Pogonias cromis*) and red drum (SAFM 1998). Low volume freshwater releases from S-197 considered under the No Action Alternative, and Alternatives B, C, and G would not be sufficient to affect mangrove habitats within the coastal estuaries (**Section 4.7**) due to the limited duration and limited extent of operational changes at S-197 being considered.

Seagrass habitats are heavily utilized by both juvenile and adult fishes and invertebrates for feeding and shelter (SAFM 1998). Species that depend on seagrass habitats include the penaeid pink and brown shrimp, and spiny lobster (SAFM 1998). Seagrass performs as an important nursery habitat for red drum, snook (*Centropomus undecimalis*), bonefish (*Albula vulpes*), tarpon (*Megalops atlanticus*) and several species of snapper and grouper, and is critical to the health of a number of commercial and recreational fisheries (SAFM 1998). Significant impacts to seagrass beds within the coastal estuaries are not expected due to the limited duration and limited extent of operational changes at S-197 being considered under the No Action Alternative and Alternatives B, C, and G. Seagrasses have an optimum salinity range of 24 to 35 psu, but can tolerate considerable short-term salinity fluctuations (**Section 4.7**).

There are no coral reefs or hard bottom communities located within the proposed project area or the nearshore waters affected by the project. Corals found within Florida Bay and Biscayne Bay are outside the area of potential effect.

4.11 WATER QUALITY

The exact mechanism for the nutrient pulses that occur at the S-333 after drought conditions in the WCA's followed by wet season conditions is not completely understood at this time. The dried out marsh soils/vegetation in the WCA's upstream of the S-333 after drought conditions/marsh rehydration is apparently part of the nutrient pulse loading that is delivered to the S-333. Data collected at the S-12's does not closely track with the nutrient spikes at the S-333 observed after drought conditions followed by rehydration/wet season conditions. That may indicate that the area most proximate to the S-12's have recovered nutrient assimilation function more quickly than areas further upstream of the S-12's/S-333. Untreated canal water deliveries from S-9 and sediments accumulated in the canal system upstream of the S-333 are the other two most likely primary sources for the dry season/wet season transition nutrient pulses observed at

the S-333. It has been observed in the Corps PSTA mescosm study that nutrients spikes were observed after dry conditions were followed by rehydration before the marsh cell being studied recovered nutrient uptake function. It is assumed that something similar is happening in the WCA's, particullary in Northern 3A which typically experiences dry out conditions more consistently as compared to the rest of the WCA. A similar short term nutrient spike was observed in the S-332D detention area following effective rehydration of cells within the S-332D detention area. If the marsh dry out conditions in the northern portion of WCA 3A could be reduced, the peak of the nutrient pulses during the dry season to wet season condition, could also be reduced at the S-333. That action is dependent on water availability and efforts are currently made to minimize northern WCA 3A drought conditions with available water not allocated to other uses. Until more water is available during dry season conditions, the dry out duration periods in northern 3A (possible contributing factor in S-333 nutrient pulses) will not be decreased.

4.11.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

The No Action Alternative is expected to have no changes to water quality conditions as there are no changes in flows or routing of flows. Water deliveries to ENP and NESRS are subject to the water quality limit for TP contained in Appendix A of the 1991 Everglades Settlement Agreement. Appendix A compliance is currently assessed by comparing the long term limit (LTL) against the 12-month flow weighted mean concentration (FWMC) TP concentration in ppb, calculated using the measured total annual flows from the S-12A, S-12B, S-12C, S-12D, and S-333 (S-333 flows expressed as S-333 minus S-334) structures that distribute flows from WCA 3A into SRS. The LTL equation from the Appendix A has an inverse relationship with flow: as flow into SRS increases, the LTL gradually falls until reaching 7.6 ppb for flow volumes equal or greater than 1,061x103 AF per year. Although the effect of Increment 2 is largely to redistribute existing flows, with respect to the Appendix A LTL, operations are expected to result in higher flow volumes through the S-333 structure, lower flow volumes through the S-334 structure, and moderately lower flow volumes through the S-12D structure. Under specific limited operational conditions under increment operations, there may be a short-term increase in TP concentrations at S-333 with more water being routed through this structure, but that may not result in the annual FWMC exceeding the LTL (for example WY2015). Settlement agreement requires that new sources to the SRS must be considered in the SRS compliance calculation. At present, TP concentrations/flows measured at the S-356 pump station, a new SRS source, are not included in the Appendix A calculation. However, the TOC is continuing to determine how this structure will be incorporated in future Appendix A calculations. Currently it will be reported provisionally until the exact method is determined. For the first year of testing as part of the process to incorporate the S-356 flows into the SRS FWMC compliance evaluation, the FWMC and LTL was calculated with and without the S356 flows.

For WY 2016, each calculation method yielded the same FWMC and LTL (7.2ppb/7.6 ppb respectively). S-356 flows/concentrations are in compliance with the FDEP/SFWMD proposed annual guidelines for the first year of testing and are likely to be in compliance with the multi-year compliance assessment methodology for flows entering ENP, an Outstanding Florida Water (OFW). The proposed S-356 OFW compliance criteria are FWM TP concentration no greater than 11 parts per billion (ppb) on an annual basis and no greater than 9 ppb on a three-year average annual basis. The February 2017 Increment 1.1 and 1.2 EA and FONSI estimated a 10 to 20 percent

increase in the frequency of exceedance of the Appendix A LTL for flows entering ENP at the L-29 Canal compared to the 2012 Water Control Plan (USACE 2015). No adverse impact to water quality conditions in WCA 3A, WCA 3B, the L-30 Canal, L-31N Canal, or C-111 Basins were predicted with Increment 1.1 and 1.2. Significant changes in the potential for mercury methylation or bioaccumulation of mercury by aquatic species in ENP or WCA 3A and WCA 3B were not expected.

Water quality monitoring and analyses during Increment 2 testing will be used to help identify potential changes to the operating rules that could increase the probability of water quality compliance for additional flows entering NESRS. A water quality assessment will be evaluated at the S-356 pump station in accordance with the FDEP test authorization to conduct Increment 2 testing. Concurrently, compliance with the LTL will be determined in accordance with the Settlement Agreement Appendix A requirements on an annual basis during Increment 2 testing and S-356 flows will be evaluated for Settlement Agreement compliance. Operating plan changes resulting from the S-356 water quality assessment, if needed because of Increment 1 operations, would be implemented only after the conclusion of the Increment 2test period. During Increment 2 test operations the Corps does not plan to impose operational constraints for water quality that could restrict or otherwise limit inflows to NESRS. Water quality conditions in the vicinity of the L-29 Canal and L-31N Canal might be affected by implementation of the project.

4.11.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

Implementation of Alternative B would allow greater deliveries to SRS due to the higher L-29 stages and will result in somewhat reduced flows through S-12D. This alternative is basically an amplification of Increment 1.1 and 1.2. Dependent on rainfall conditions this alternative could result in a LTL declining to the minimum of 7.6 ppb more frequently as compared to the No Action Alternative as higher flows into the SRS are likely to result for similar rainfall patterns for a given year. The impacts to the FWM will be more strongly impacted by the rainfall pattern than from the implementation of this alternative. Higher flows will be allowed via the S-333 allowed by L-29 being raised to 8.5 feet, NGVD. If high flows through the S-333 occur while water levels are low at the headwater to the S-333 structure and the annual pattern of higher phosphorous concentrations at the drys season is evident, more high concentration water will be routed into the SRS. This pattern can result in higher short term TP concentrations as the S-333, but that may not result in the annual FWMC exceeding the LTL (for example WY 2015).).

4.11.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

Implementation of Alternative C would result in similar effects to Alternative B as discussed above.

4.11.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Implementation of Alternative G would result in similar effects to Alternative B as discussed above.

4.12 NATIVE AMERICANS

As part of the development of this project consultation has occurred and is ongoing between the Corps and the two Federally-recognized tribes within the immediate area of potential effects. Letters requesting government-to-government consultation were sent to both the Miccosukee and Seminole Chairmen on July 28, 2017 (**Appendix D**). In addition, presentations and face-to-face meetings were conducted as well as email and phone correspondence with tribal government staff to brief them on the project development and to discuss issues of concern. The following evaluations are designed to assess potential impacts to Native American lands discussed in Section 3.13. The reader should note that Native American concerns extend beyond physical impacts to their lands and, as such, considerations have taken into account discussions and consultations that have occurred with Federally-recognized tribes. This includes letters requesting government-to-government consultation on ERTP dated February 24, 2016.

4.12.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

Continued implementation of Increment 1.1 and 1.2 will have no effect on Tribal properties. Affiliated non-Federally recognized tribes located along Tamiami Trail are of sufficient elevation that increased water flows will have no effect as described in the Increment 1 EA and FONSI (dated May 27, 2015) (USACE 2015). The ability for increased flows out of WCA 3A has the potential to alleviate concerns associated with excessive high water elevations and offers flexibility to provide additional outlets for water removal. However, any changes to the system are a priority concern for both Federally-recognized tribes as their cultures remain interconnected to the Everglades.

4.12.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD (PREFERRED ALTERNATIVE)

The implementation of Alternative B is not anticipated to effect Tribal lands. Alternative B has the ability to raise the L-29 Canal Stage maximum operation limit from 7.8 feet, NGVD to 8.5 feet, NGVD thereby increasing flows to NESRS and potentially providing a slight decrease in WCA 3A stages. Alternative B also includes additional operational flexibility by inclusion of an Extreme High Water Action Line to further allow for a rapid response to extreme high water levels in WCA 3A. This would assist in mitigating potential negative impacts to tribal lands as a result of high water events.

Members of both the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida continue to rely upon the Everglades to support their cultural, medicinal, subsistence, and commercial activities. The specific issues impacting each tribe have been different over the last few decades; however, both tribes have expressed concerns regarding the health of tree islands within WCA 3 and ENP. In particular, The Miccosukee Tribe of Indians of Florida's focus has

been on the detrimental ponding of water on tribal property in WCA 3A, which affects subsistence practices and increases inundation risks to tree islands utilized by the Tribe.

Prolonged periods of inundation are of particular concern for tree islands within WCA 3A where the Miccosukee Tribe's Alligator Alley Reservation is located. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the three-gage average, previously defined under the 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a). Implementation of the Action Line (*i.e.* Condition 3 and 4; **FIGURE 2-1**) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A.

Potential for flooding stress on tree islands within SRS is low with implementation of Alternative B. Since 1942, a 55 percent decline in the extent and number of tree islands in SRS has been observed due to intensive fires that migrate across the marshes and burn tree island peat soils leaving rocky outcroppings. Tree islands are connected to the surrounding marsh via the roots of the trees. When the water table drops below these roots, tree islands often become too dry and can burn. Under Alternative B, the duration of water above the marsh surface is expected to improve. Alternative B may have a temporary minor beneficial effect on tree islands within ENP by reducing the potential for devastating fires. **Reference Section 4.13.2** for additional information regarding tree islands and the potential for overtopping as a result of Alternative B.

4.12.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

Implementation of Alternative C would result in similar effects to tribal lands as discussed under Alternative B.

4.12.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

Implementation of Alternative G would result in similar effects as discussed under Alternative B. Operational criteria for Alternative G are identical to that described for Alternative B, except for the exclusion of additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. Exclusion of additional operational flexibility for extreme high water levels in WCA 3A has the potential for negative impacts to occur on tribal property within WCA 3A. Exclusion of this action line from the operational schedule will result in slower responses to extreme wet conditions in WCA 3A.

4.13 CULTURAL RESOURCES

As part of consideration of effects, the Corps has been actively consulting with interested parties in conjunction with its obligation under Section 106 of the National Historic Preservation Act (NHPA) and the ERTP Programmatic Agreement (PA). Within these consultation events, information has been sought to determine what if any effects the project could have on previously identified cultural resources located within the area of potential effects (**Appendix D**). Consultation has been initiated and is ongoing between the Corps, the State Historic Preservation Officer (SHPO), appropriate Federally-recognized tribes, Everglades National Park, the Bureau of

Indian Affairs, and the Advisory Council on Historic Preservation (ACHP) as signatories of the ERTP PA. Presentations and face-to-face meetings were conducted, as well as email and phone correspondence with state, federal, and tribal government staff members to brief them on the project development and to discuss issues of concern. Formal letters requesting consultation on potential effects to cultural resources were sent to the SHPO, Seminole THPO, Miccosukee Tribal Representative, and the ENP Superintendent on November 1, 2017. The SHPO concurred with the Corps' determination of no adverse effects in a letter dated December 12, 2017. In a letter dated December 20, 2017, the Seminole Tribe of Florida stated that they "have no objections to the project at this time" (**Appendix D**).

In conjunction with this effort, multiple lines of research were conducted as part of the analysis of the proposed alternatives. To better understand potential effects associated with the Action Alternatives (B, C, and G), an examination of tree islands and associated cultural resources that are currently monitored within the Everglades Depth Estimation Network (EDEN) network as part of the ERTP PA was performed. The use of this data is warranted as it is a common factor that most, if not all of the known archaeological sites are located on such tree islands thus creating relationship within effects to tree islands and the cultural resources contained within them. This research builds on previously existing information gathered as part of the ERTP PA, the Increment 1 EA and FONSI (dated May 27, 2015), and the Increment 1.1 and 1.2 EA and FONSI (dated February 16, 2017).

Based on the constraints of the Action Alternatives, effects to tree islands and their associated cultural resources would be a result of raising the L-29 Canal Stage maximum operation limit from 7.8 feet, NGVD to 8.5 feet, NGVD. The Action Alternatives could result in slight increases to water levels in NESRS and provide a slight decrease in WCA 3 stages compared to the effects from the ERTP, and Increment 1, and Increment 1.1 and 1.2 operational strategies. As such, the greatest difference between existing conditions and the effects of the Action Alternatives would be the potential overtopping of tree islands that do not seasonally inundated historically; therefore, an analysis of those tree islands that are not subject to periodic inundation was warranted.

The first step in the analysis was to determine past water elevations based on the EDEN network and to determine if tree islands were inundated using a period of record from 1965 to 2005. Next this data was correlated with water elevations during the 2002-2012 period of IOP regulation schedule to identify a subset of tree islands that have not been subjected to past flooding events. A total of 394 tree islands are located within the current area of potential effects, of these, 66 tree islands have not been overtopped by water since the 2002 implementation of IOP. These 66 tree islands and their corresponding 53 cultural resources were analyzed using data collected from the EDEN network and the RSM-GL hydrologic modeling briefly discussed in **Section 4.5** of this EA (a more detailed discussion of the hydrologic modeling conducted in support of the 2016 ERTP BO is provided in the February 2016 EA for Increment 1 Plus).

The INCR2B hydrologic model run was utilized to predict anticipated water levels as a result of Increment 2 in the area of potential effects (APE). Each of the 66 tree islands were correlated to the closest modeled gage to determine predicted effects of water levels. The observed water elevations during the period of record for each gage was used as a baseline and compared with modeled data. Comparisons were also made to predicted water level averages during ERTP and

Increment 1 based on the modeled data. Using the observed IOP yearly averages and the predicted model yearly averages, each of the 66 tree island were graphed and data from the closest modeled gage was overlain on the IOP graph. The observed IOP period yearly averages of each tree island and the corresponding modeled gage yearly averages were analyzed to determine in the predicted water elevations would exceed previously observed water levels. Modeled results do not account for the FDOT constraint or additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A as described in Alternative B. This analysis most accurately predicts conditions that may occur as a result of Alternative C; however, as the implementation of Alternative B, C, or G would result in minimal stage differences within WCA 3A and smaller stage increases for NESRS, the modeling may be extrapolated to approximate conditions of all Action Alternatives.

Results of this analysis determined that Increment 2 will decrease water levels in WCA 3A during wet hydrologic conditions. In northern WCA 3A, implementation of the Action Alternatives may decrease water levels an average of 3.2 inches from the period of record, 0.4 inches from ERTP, and 0.5 inches from Increment 1/1.1. In southern WCA 3A, implementation of the Action Alternatives may decrease water levels an average of 6.5 inches from the period of record, 1.1 inches from ERTP, and 1.2 inches from Increment 1/1.1. Implementation of the Action Alternatives will not affect tree islands in WCA 3B as that part of the system is subject to constraints outlined in the operational plan for the DPM (USACE 2017f).

During wet hydrologic conditions, implementation of the Action Alternatives would result in drier conditions within northwestern ENP due to the continued closure of the S-12A, S-12B, S-343A, S-343B, and S-344 structures; however, the remainder of ENP would experience increased flows. In northwest ENP, implementation of the Action Alternatives may decrease water levels an average of 5.1 inches from the period of record, 2.3 inches from ERTP, and 2.2 inches from Increment 1 and 1.1. In northern and central ENP, implementation of the Action Alternatives may increase water levels an average of 5.2 inches from the period of record, 3.2 inches from ERTP, and 2.2 inches from Increment 1 and 1.1. In southern and western ENP, implementation of the Action Alternatives may increase water levels an average of 0.7 inches from the period of record, 0.24 inches from ERTP, and 0.1 inches from Increment 1 and 1.1. Overall, the analysis predicts minimal changes to the average water levels within WCA 3A and ENP as a result the Action Alternatives. A review of the graphed IOP yearly averages of tree islands in ENP compared to their corresponding modeled gage also indicates that tree islands to have not been subject to seasonal inundation historically will not be inundated as a result of implementing the Action Alternatives.

4.13.1 ALTERNATIVE A: NO ACTION ALTERNATIVE

Continued implementation of Increment 1.1 and 1.2 will have no adverse effects on cultural resources. During Increment 1.1 and 1.2, the Corps undertook a review of water elevations provided by the EDEN network in relation to overtopping of tree islands within WCA 3A and ENP (USACE 2017a). The No Action Alternative was previously consulted upon and consultation history can be found within the Increment 1.1 and 1.2 EA and FONSI (dated February 16, 2017).

4.13.2 ALTERNATIVE B: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD

The implementation of Alternative B is not anticipated to adversely affect historic properties eligible of potentially eligible for listing in the NRHP based on the above referenced modeling of tree islands and the archaeological sites that are associated with them. Although Alternative B has the potential to produce slight water level increases in ENP and minor decreases in WCA 3A, significant changes from current conditions are not expected. Alternative B continues to include the seasonally varying WCA 3A water level of 10.0 to 10.75 feet, NGVD, as measured by the 3-gage average, previously defined under the May 2015 Increment 1 EA (USACE 2015) and February 2017 Increment 1.1 and 1.2 EA (USACE 2017a), to define the priority of releases from S-333 and S 356 to the L-29 Canal and NESRS. Implementation of the Action Line (i.e. Condition 3 and 4) to manage high water conditions in WCA 3A, would help to prevent conditions of prolonged periods of inundation within WCA 3A. Prolonged periods of inundation result in negative impacts to tree islands, which are intrinsically connected to archaeological sites in the Everglades. Furthermore, Alternative B includes additional operational flexibility by inclusion of an Extreme High Water Action Line to further allow for a rapid response to extreme high water levels in WCA 3A. The operational flexibilities are not expected to be triggered frequently. When comparing the Extreme High Water Action Line to the historical WCA 3A three-gage average, these operations would have been triggered five times within the past 15 years, with an average duration of 51 days.

Based on preliminary hydrologic modeling conducted by the Corps in support of the July 2016 ERTP BO, current water management operations for WCA 3A would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 3-4 months during normal hydrologic conditions (characterized by the 50 percent exceedance). During wet hydrologic conditions (characterized by the 10 to 25 percent exceedance) regional water availability may enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for durations of 4-6 months. During dry hydrologic conditions (characterized by the 90 to 75 percent exceedance), regional water availability would generally enable raising the L-29 Canal maximum operating limit above 8.3 feet, NGVD for limited durations of 0-1 months (**FIGURE 4-10**). Therefore, the above referenced modeling of tree islands and the archaeological sites that are associated with them depicts a greater increase in hydroperiods than will be achievable under Alternative B. However, Alternative B is still expected to provide minor beneficial effects on tree islands within ENP (Reference **Section 4.7.2.8**). Improved hydroperiods within NESRS and ENP have the potential to reduce soil oxidation, which is expected to promote peat accretion. A potential decease in drying event severity, if achieved under Alternative B may aid in the restoration of tree islands and stabilize associated cultural resources.

Hydroperiods achieved with the implementation of Alternative B are not likely to exceed levels tree islands have been subject to historically. Based on the analysis described above, tree islands and their associated archaeological sites that have not been subject to seasonal inundation historically will not be inundated as a result of implementing Alternative B. Alternative B also represents a temporary change in the water control plan, during which time the Corps will continue to monitor the effects of fluctuating water levels on cultural resources pursuant to the ERTP PA outlined in **Appendix C**. As such, Alternative B is not expected to adversely affect to historic properties eligible of potentially eligible for listing in the NRHP.

4.13.3 ALTERNATIVE C: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT FDOT/LRR CONSTRAINT

The implementation of Alternative C would see similar affects to historic properties compared with Alternative B; however, Alternative C would potentially cause higher water levels in ENP due to the ability to raise the L-29 Canal stage operating limit up to 8.5 feet, NGVD without constraining the duration at which this stage can be maintained (**Appendix A**, **Part 1**). Based on the above referenced modeling of tree islands and the archaeological sites that are associated with them, Alternative C would not be anticipated to adversely affect historic properties eligible of potentially eligible for listing in the NRHP.

4.13.4 ALTERNATIVE G: RELAXATION OF G-3273 STAGE CONSTRAINT AND L-29 CANAL UP TO 8.5 FEET NGVD WITHOUT ADDITIONAL FLEXIBILITIES FOR HIGH WATER IN WCA 3A

The implementation of Alternative G would see similar affects to historic properties compared with Alternative B except for the exclusion of additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. Exclusion of additional operational flexibility for extreme high water levels in WCA 3A will result in slower responses to extreme wet conditions in WCA 3A. Prolonged periods of inundation has the potential for negative impacts to occur on tree islands, which are intrinsically connected to archaeological sites in the Everglades.

4.14 AIR QUALITY

Air quality conditions within the project area are in compliance under the No Action Alternative. Air quality within the project area would not be expected to change from current conditions under the Action Alternatives. Air quality emissions associated with continued implementation of the No Action Alternative would occur from continued operation of diesel powered pump stations (S-331, S-332B, S-332C, S-332D) related to C&SF operations. Diesel exhaust includes gaseous compounds (*e.g.,* carbon dioxide, oxygen, nitrogen, water vapor, carbon monoxide, nitrogen compounds, sulfur compounds, and numerous low molecular-weight hydrocarbons) and contains fine particulate matter, $PM_{2.5}$. Air quality within the project area as a result of implementation of the Action Alternatives is expected to be similar to that of the No Action. Potential impacts would be limited to the immediate vicinity of the associated pump stations which are located in remote rural areas. Air quality impacts are not expected to cause negative effects to human health. Potential impacts due to implementation of the Action Alternatives on air quality would be negligible.

4.15 HAZARDOUS, TOXIC OR RADIOACTIVE WASTES (HTRW)

Implementation of the No Action and Action Alternatives would not result in the discovery of HTRW since there is no excavation or other construction activities being considered. The project has a very low risk for increased mobilization of existing HTRW where it might exist within the study area. Increased operation of C&SF Project features will increase the frequency of diesel fuel delivery to pump stations.

4.16 NOISE

Noise levels within the project area would not be expected to change from current conditions with implementation of the No Action Alternative. Noise levels associated with implementation of the No Action Alternative would occur from continued operation of diesel powered pump stations related to C&SF operations (USACE 2017a). Noise levels within the project area as a result of implementation of the Action Alternatives are expected to be similar to that of the No Action. Potential impacts would be limited to the immediate vicinity of the associated pump stations which are located in remote rural areas. Sound levels would decrease with distance from the pump stations due to attenuation. Noise levels are not expected to cause negative effects to human health. Potential impacts due to implementation of the Action Alternatives on noise levels would be negligible.

4.17 AESTHETICS

Aesthetics within the project area would not be expected to change from current conditions with implementation of the No Action Alternative. The Action Alternatives consist of an operational change to the 2012 Water Control Plan and do not include construction of permanent structures or structural modifications to existing C&SF Project features. As such, the existing landscape profile would not be altered. The Action Alternatives would result in similar effects as the No Action Alternative.

4.18 AGRICULTURE

The majority of agricultural activities within Miami-Dade County are located south of Tamiami Trail and directly east of ENP within and adjacent to the SDCS. The net effect of reduced WCA 3A regulatory discharges to NESRS combined with increased flood control releases from S-331/S-173 and increased seepage to the L-31N Canal south of S- 331 is not able to be quantified prior to completion of the field test and associated hydrologic monitoring. The field test hydrologic monitoring will aid in quantifying both long-term and intra annual/seasonal effects of increased stages within NESRS. Additional inflow volumes to L-31N Canal, if resultant from the Proposed Action, are expected to be primarily managed with the C- 111 South Detention Area using S-332 B, S-332C, and S-332D, given the significant reduction in WCA 3A regulatory releases to the SDCS. Alternatives B, C, and G propose to retain the target operational ranges for the SDCS L-31N Canal consistent with the No Action Alternative. A moderate reduction in WCA 3A regulatory discharges to the SDCS will be realized with increased utilization of the storage within NESRS, given no changes to the WCA 3A Regulation Schedule, which is anticipated to provide a minor improvement in the flood protection for areas adjacent to the L-3N Canal, north of S-176.

To mitigate for potential increased risk to flood protection in south Miami-Dade County areas, which may be affected by increased water levels in NESRS and associated water management operations within south Miami-Dade County during the field test, low volume releases from S-197 are included as components of Alternative B, C, and G consistent with the No Action Alternative. The field test will continue to include assessment of the combined effects of increased seepage east resultant from increased stage levels in NESRS and will incorporate the ongoing SFWMD operations, monitoring, and performance assessments conducted as part of the C-111 Spreader Canal Western Project.

The inclusion of additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-1**), under Alternatives B and C, will not result in increased discharge to the SDCS if canal stages are unable to be maintained within the specified operational ranges. Inclusion of these criteria will therefore not alter the level of flood protection within South Dade, compared to the levels identified for the No Action Alternative and Alternative G. Significant impacts under the Action Alternatives are not anticipated.

4.19 RECREATION

Implementation of the No Action Alternative and Action Alternatives would not result in significant impacts to recreation. Alternatives B and C would provide additional benefits to recreation relative to the No Action and Alternative G, as these alternatives include additional operational flexibility to allow for a rapid response to extreme high water levels in WCA 3A. This may help lessen impacts to recreation and reduce durations of FWC closures that restrict public access within the Everglades and Francis S. Taylor, Holey Land and Rotenberger Wildlife Management areas when the two gage average (Sites 62 and 63) within WCA 3A exceeds 11.60 feet, NGVD. Exclusion of this action line from the operational schedule under Alternative G will result in slower responses to extreme wet conditions in WCA 3A.

4.20 CUMULATIVE EFFECTS

Cumulative effects are defined in 40 CFR 1508.7 as those effects that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. The following summarizes past, present, and projected Corps efforts that cumulatively affect the regional environment of south Florida (**TABLE 4-3**). Additional information on design refinements and operational modifications to MWD and C-111 South Dade Project features can be found within the environmental documents listed in **Section 1.7**. **TABLE 4-5** shows the net cumulative effects of the various resources which are directly or indirectly impacted. Increment 2 is expected to contribute to a net beneficial cumulative impact on the regional ecosystem, providing benefits to ENP by increasing flows to NESRS and Taylor Slough.

TABLE 4-4. PAST, PRESENT, AND REASONABLY FORESEEABLE ACTIONS AND PLANS AFFECTING THE PROJECT AREA

	Past Actions/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 Reevaluation Report (2008) - MWD 8.5 SMA Interim Operating Criteria EA (2011) and Design Refinement EA (2012) - 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	- SFWMD Restoration Strategies Project - MWD Closeout - C-111 South Dade Project (Contracts 8, 8A, and 9)
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 - ERTP October 2012 to present; deviation includes Increment 1 and Increment 1.1 and 1.2 Operational Strategies and 2016/2017 Planned and Emergency Deviations for south Florida - Herbert Hoover Dike Dam Safety Modification Study (HHD DSMS) risk reduction measures (2011 through 2025)	- LORS 2008 to be replaced by revised Lake Okeechobee Regulation Schedule by 2024-2025 (per Integrated Delivery Schedule) - SFWMD periodically revises the LEC Regional Water Supply Interim Plan - ERTP to be replaced by COP to be anticipated January 1, 2020 to include MWD and C-111 components.
CERP Projects		Congressional Authorization Received: - Broward County Water Preserve Areas Project - Caloosahatchee River (C-43) West Basin Storage Reservoir - C-111 Spreader Canal Western Project - Central Everglades Planning Projects	- Future CERP Projects (Lake Okeechobee Watershed Restoration Project, Western Everglades Restoration Project - CEPP PPA South , including DOI removal of portions of the old Tamiami Trail roadway and SFWMD

	Past Actions/Authorized Plans	Current Actions and Operating Plans	Reasonably Foreseeable Future Actions and Plans
		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	construction of the increased S-333 structure

TABLE 4-5. SUMMARY OF CUMULATIVE EFFECTS

Hydrology	
Past Actions	Flood and water control projects have greatly altered the natural hydrology.
Present Actions	Federal and state agencies are coordinating on and implementing projects to improve hydrology.
Proposed Action	Modifications under the Proposed Action include the relaxation of the G-3273 stage constraint of 6.8 feet, NGVD (L-29 Canal stage maximum operating limit up to 8.5 feet, NGVD, subject to constraints identified in Operational Strategy) to increase water deliveries from WCA 3 to ENP through NESRS. The combined flows to NESRS are anticipated to be more than what would have otherwise been discharged to ENP relative to the 2012 Water Control Plan. Hydroperiods within NESRS and Taylor Slough are expected to improve with the Proposed Action.
Future Actions	Additional CERP projects propose to restore hydrology to more natural conditions.
Cumulative Effect	Although it is unlikely that natural hydrologic conditions would be fully restored to pre-drainage conditions, improved hydrology would occur with implementation of the Proposed Action. CERP is expected to improve the quantity, quality, timing and distribution of freshwater flow.
Threatened and Endangered Species	
Past Actions	Water management practices and urbanization have resulted in the degradation of existing habitat function and direct habitat loss leading to negative population trends of threatened and endangered species.
Present Actions	ERTP implementation represents a paradigm shift from single species to multi-species management. ERTP includes performance measures specifically directed at managing water levels and releases for the protection of multiple species and their habitats within the project area.
Proposed Action	Effects determinations for Federally threatened and endangered species within the project area are listed within **TABLE 4-1**. The Proposed Action is being implemented in accordance with the mandated RPAs of the 2016 ERTP BO and RPA for the benefit of the CSSS.
Future Actions	Ongoing projects would be implemented to maintain threatened and endangered species within the project area. It is anticipated that suitable CSSS habitat will be maintained under future restoration initiatives, but it may not occur with the current or historic footprints in some areas.
Cumulative Effect	Habitat improvement, monitoring and management of threatened and endangered species are anticipated to allow populations to be maintained. Improvement of degraded populations is expected to be facilitated by the restoration and enhancement of suitable habitat through efforts to restore more natural hydrologic conditions within the project area.
Fish and Wildlife Resources	
Past Actions	Water management practices have resulted in aquatic vegetation community changes and a resultant disruption of aquatic productivity and function that has had repercussions through the food web, including effects on wading birds, large predatory fishes, reptiles and mammals.
Present Actions	Ongoing efforts have been made by Federal and state agencies to implement projects to improve hydrology within the project area to restore habitat conditions for fish and wildlife resources.
Proposed Action	Increases in forage prey availability (*i.e.* crayfish and other invertebrates, fish) resulting from improved hydroperiods would in turn provide beneficial effects for amphibian, reptile, small mammal, and wading bird species within NESRS. Additional operational flexibility has been included within the Proposed Action to further allow for a rapid response to extreme high water levels in WCA 3A. Low volume freshwater releases from S-197 would not be sufficient to affect mangrove and seagrass habitats within the coastal estuaries due to the temporary nature of the proposed action. Significant effects to fish and wildlife resources with eastern Florida Bay, Biscayne Bay, and Manatee Bay and Barnes Sound are not anticipated.
Future Actions	Some level of improvement to fish and wildlife resources is expected to occur as a result of implementation of projects with the capability of improving the timing, quantity, quality and distribution of freshwater flow to the study area. Hydrologic restoration planned as part of CERP would further improve fish and wildlife habitat.

Cumulative Effect	Habitat improvement efforts are anticipated to benefit fish and wildlife resources.
Vegetation and Wetlands	
Past Actions	Drainage of Florida's interior wetlands, conversion of wetlands to agriculture, and urban development has reduced the spatial extent and quality of wetland resources.
Present Actions	Efforts are being taken by state and Federal regulatory agencies to reduce wetland losses.
Proposed Action	Increased hydroperiods within the eastern marl prairies may act to alleviate some of the problems associated with drier conditions. The Proposed Action may have a temporary minor beneficial effect on vegetative communities within NESRS. Additional operational flexibility has been included within the Proposed Action to further allow for a rapid response to extreme high water levels in WCA 3A, directly benefitting tree islands within WCA 3A.
Future Actions	Some level of improvement to vegetative communities is expected to occur as a result of implementation of projects with the capability of improving the timing, quantity, quality and distribution of freshwater flow to the study area. More natural hydrology as part of the CERP would assist in restoring natural plant communities.
Cumulative Effect	While the spatial extent of natural plant communities would not be restored to historic proportions, the quality of vegetative communities would be improved.
Cultural Resources	
Past Actions	Previous water control plans and associated environmental analyses had determined that there were no effects associated with changing water regulation schedules.
Present Actions	Long term effects to cultural resources remain unknown. Current testing associated with the ERTP Programmatic Agreement is investigating such cumulative issues.
Proposed Action	The Proposed Action by its short nature is not capable of producing a cumulative effect as such effects if they were to occur would cease at the end of the Proposed Action.
Future Actions	Continued improvement to hydroperiods and sheetflow within WCA 3A, 3B and ENP could reduce soil oxidation, which could stabilize the environment, and this in turn could stabilize tree islands containing cultural resources. Investigations mandated in the Programmatic Agreement for ERTP will be completed and will determine the effects of fluctuating water on subsurface historic properties.
Cumulative Effect	Cumulative effects to historic properties and culturally significant sites will potentially be long-term adverse effects if not avoided. Mitigation measures for effects to historic properties could potentially reduce the cumulative effect to minor long-term adverse effects. Mitigation measures for culturally significant sites are unknown.
Water Quality	
Past Actions	Water quality has been degraded from urban, suburban, commercial, industrial, recreational and agricultural development.
Present Actions	Efforts to improve water quality from agricultural areas are ongoing. Construction of Federal and state projects can temporarily elevate localized levels of suspended solids and turbidity.
Proposed Action	Water quality conditions in the vicinity of the L-29 Canal and L-31N Canal may be affected by implementation of the Proposed Action.
Future Actions	Actions by the State of Florida's Restoration Strategies is expected to decrease nutrient concentrations and loadings to the project area. The Broward County Water Preserve Area Project would reduce storm runoff deliveries to WCA 3 via S-9 deliveries and improve water quality coming across Tamiami Trail. In general there is a slowly improving trend in water quality entering and exiting the upstream WCA's.
Cumulative Effect	While anthropogenic effects on water quality are unlikely to be eliminated, water quality is expected to slowly improve. This is based on trends indicated by data analysis and the fact that BMP's are continuing to reduce nutrient loading to the system. Significant improvement in water quality from Lake O discharges and other upstream areas will take decades due to the large legacy

	loading. Corps and SFWMD are committed to ensuring that project feature implementation will not result in violations of water quality standards.

4.21 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

The Proposed Action consists of an operational change to current water management operations and does not include construction of permanent structures or modifications to existing water management features. The Proposed Action would not cause the permanent removal or consumption of any natural resources.

4.22 UNAVOIDABLE ADVERSE ENVIRONMENTAL EFFECTS

Environmental effects for each resource are discussed in **Section 4.0**. Temporary minor adverse impacts as previously identified in the May 2015 Increment 1 EA and FONSI and February 2017 Increment 1.1 and 1.2 EA and FONSI have the potential to occur within Manatee Bay and Barnes Sound due to increases in the frequency, duration, and volume of S-197 discharges relative to the 2012 Water Control Plan; however significant impacts are not expected. Potential environmental effects would be limited in spatial extent to the nearshore areas of the southern estuaries. A monitoring plan has been developed for Increment 2 to evaluate potential effects of S-197 operations on downstream salinity and natural resources. Reference **Appendix C**. The Proposed Action does include additional operational flexibility by inclusion of an Extreme High Water Action Line (**FIGURE 2-1**). Under this condition discharges at S-197 may be increased up to a maximum of 2400 cfs as summarized in **Section 4.3.2** and detailed in **Appendix A, Part 1**. However, these operational flexibilities are not expected to be triggered frequently.

4.23 CONFLICTS AND CONTROVERSY

Over the lifetime of the MWD and C-111 South Dade Projects, considerable interest has been generated among local and regional stakeholders. The Corps continually strives to include all interested parties in its decision making process and will continue to consider all issues that arise.

4.24 ENVIRONMENTAL COMMITMENTS

The Corps commits to avoiding, minimizing or mitigating for adverse effects. All practicable means to avoid or minimize environmental effects were incorporated into the Proposed Action. A monitoring plan has been developed for Increment 2. Reference **Appendix C**. Interagency workshops to facilitate discussion of field test performance relative to the achievement of field test goals and objectives are planned to be conducted. Field Test operations updates and action items will be discussed on a weekly basis between water managers from the Corps and SFWMD, as well as ENP when needed, to provide collective interpretation of results and evaluate implementation of field test operations relative to the goals, objectives, and constraints. Corps, SFWMD, and ENP water managers will meet monthly to discuss the collected data and the results of preliminary analyses, as well as system conditions and field test operations; additional technical staff from these agencies who are involved in the monitoring and data assessment efforts will also participate in the monthly coordination meetings, as needed. Results from these weekly and monthly coordination meetings, including preliminary recommendations from water managers to incrementally modify the Operational Strategy (within the covered NEPA EA scope), will be further discussed with the project delivery team (PDT) during regularly-scheduled interagency meetings to occur four times per year. PDT meetings will also include updates from the water

quality and ecological monitoring sub-teams. Additional meetings (*i.e.* WCA 3 Periodic Scientist Calls) and/or workshops may be conducted in support of the field test on an as-needed basis based upon ongoing or anticipated conditions within WCAs, ENP, and/or the SDCS.

4.25 COMPLIANCE WITH ENVIRONMENTAL REQUIREMENTS

4.25.1 National Environmental Policy Act of 1969

Environmental information on the project has been compiled and this EA and FONSI has been prepared and coordinated for public, state, and Federal agency review. The Proposed Action is in compliance with NEPA.

4.25.2 Endangered Species Act of 1973

Upon completion of an assessment for species under NMFS purview it was determined that the Proposed Action would have no effect on these species; therefore, consultation with NMFS was not necessary. The Corps requested written confirmation of federally listed threatened and endangered species that are either known to occur or are likely to occur within the project area from USFWS by correspondence dated July 17, 2017. A revised species list was provided by the USFWS through correspondence dated July 25, 2017. Correspondence dated October 18, 2017 was provided to the USFWS requesting concurrence on species determinations as a result of the Proposed Action, noting that the conclusion of ESA consultation on Increment 2 presented within this EA is previously covered under the 2016 ERTP BO. The USFWS concurred with this assessment by correspondence dated November 15, 2017, noting that the Everglades bully (*Sideroxylon reclinatum spp.* austofloridense), the proposed threatened Florida pineland crabgrass (*Digitaria pauciflora),* proposed threatened Florida pineland sandmat (*Chaemaesyce deltoidea pinetorium*), and the proposed endangered Florida prairie clover (*Dalea carthagenesis floridana*) have now been officially listed as threatened (Everglades bully, Florida pineland crabgrass, Florida pineland sandmat), and endangered (Florida prairie clover). Reference **Appendix D** for pertinent correspondence. The Proposed Action has been fully coordinated under the Endangered Species Act and will be in full compliance with the Act.

4.25.3 Fish and Wildlife Coordination Act of 1958, as amended

The Proposed Action has been fully coordinated with USFWS and FWC. In response to the requirements of this Act, the Corps has and will continue to maintain continuous coordination with USFWS and FWC. The Proposed Action is in full compliance with the Act.

4.25.4 National Historic Preservation Act of 1966

The Proposed Action is in compliance with Section 106 of the National Historic Preservation Act, as amended (Public Law 89-665). As part of the requirements and consultation process contained within the National Historic Preservation Act implementing regulations of 36 CFR 800, this project is also in compliance through ongoing consultation with the Archaeological and Historic Preservation Act, as amended (Public Law 93-291), Archeological Resources Protection Act (Public Law 96-95), American Indian Religious Freedom Act (Public Law 95-341), Native American Graves Protection and Repatriation Act (NAGPRA) (Public Law 101-601), Executive Order 11593, 13007, and 13175, the Presidential Memo of 1994 on Government to Government Relations and appropriate Florida Statutes. Presentations and face-to-face meetings were

conducted, as well as email and phone correspondence with state, federal, and tribal government staff members to brief them on the project development and to discuss issues of concern. Formal letters requesting consultation on potential effects to cultural resources were sent to the SHPO, Seminole THPO, Miccosukee Tribal Representative, and the ENP Superintendent on November 1, 2017. The Corps has determined that the Proposed Action will have no adverse effect on historic properties eligible or potentially eligible for listing in the National Register of Historic Places. The SHPO concurred with the Corps' determination of no adverse effects and the Seminole Tribe of Florida "have no objections to the project at this time" (**Appendix D**). No formal comments were received from the Miccosukee Tribe of Indians of Florida or Everglades National Park.

4.25.5 Clean Water Act of 1972

The Proposed Action is in compliance with this Act.

4.25.6 Clean Air Act of 1972

The Proposed Action is being coordinated with the State of Florida. The Proposed Action is in compliance with Section 176 of the Clean Air Act, known as the General Conformity Rule. The Proposed Action will not cause or contribute to violations of the National Ambient Air Quality Standards.

4.25.7 Coastal Zone Management Act of 1972

A Federal consistency determination in accordance with 15 CFR 930 Subpart C is included in this report as **Appendix B**. The Corps has coordinated a consistency determination pursuant to the CZMA through circulation of the EA and FONSI. The Corps has determined that the Proposed Action is consistent to the maximum extent practicable with the enforceable policies of Florida's approved CZMP. The Florida State Clearinghouse has reviewed the Proposed Action and has stated that the State has no objection to the Proposed Action. Final concurrence of consistency with the CZMP will be determined during environmental permitting processes, as applicable.

4.25.8 Farmland Protection Policy Act of 1981

Correspondence with USDA-NRCS for Increment 1 occurred on November 21, 2014. Reference Appendix C of the 2015 Increment 1 EA and FONSI. The USDA-NRCS had previously determined that there are delineations of Important Farmland Soils (Farmland of Unique Importance) within the project area. Approximately 975 acres of Prime and Unique Farmland are located mainly within the boundaries of ENP. Correspondence related to Increment 2 was provided to the USDA-NRCS on August 15, 2017 noting conversion of Prime and Unique Farmland are not anticipated as a result of the Proposed Action. The USDA-NRCS concurred that no permanent conversion of important farmlands will take place under the Proposed Action. In addition, correspondence received from the USDA-NRCS dated August 15, 2017, noted that protected lands (*i.e.* ENP) would be exempt as the property is set aside by the National Park Service.

4.25.9 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.

4.25.10 Marine Mammal Protection Act of 1972

No marine mammals would be harmed, harassed, injured or killed as a result of the Proposed Action. Therefore, the Proposed Action is in compliance with this Act.

4.25.11 Estuary Protection Act of 1968

No designated estuary would be affected by the Proposed Action. This Act is not applicable.

4.25.12 Federal Water Project Recreation Act of 1965, as amended

Recreation and fish and wildlife enhancement have been given full consideration in the Proposed Action.

4.25.13 Fishery Conservation and Management Act of 1976

No fisheries or other areas under the purview of NMFS would be affected by this action. The Proposed Action is in compliance with the Act.

4.25.14 Submerged Lands Act of 1953

Temporary minor adverse impacts as previously identified in the May 2015 Increment 1 EA and FONSI and February 2017 Increment 1.1 and 1.2 EA and FONSI have the potential to occur within Manatee Bay and Barnes Sound due to increases in the frequency, duration, and volume of S-197 discharges relative to the 2012 Water Control Plan under the Proposed Action; however significant impacts are not expected. Potential environmental effects would be limited in spatial extent to the nearshore areas of the southern estuaries and temporary in nature. Significant effects to fish and wildlife resources and vegetative communities within submerged lands of the State of Florida are not expected. The Proposed Action is in compliance with the Act.

4.25.15 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 the Proposed Action. These Acts are not applicable.

4.25.16 Resource Conservation and Recovery Act (RCRA), As Amended by the Hazardous and Solid Waste Amendments (HSWA) of 1984, Comprehensive Environmental Response Compensation and Liability Act (CERCLA), Toxic Substances Control Act (TSCA) of 1976

Implementation of the Proposed Action is not expected to result in the discovery of HTRW since there is no excavation or other construction activities associated with this project. The Proposed Action has a very low risk for increased mobilization of existing HTRW where it might exist within the study area. The Proposed Action is in compliance with these Acts.

4.25.17 Rivers and Harbors Act of 1899

The Proposed Action would not obstruct navigable waters of the United States. The Proposed Action is in full compliance.

4.25.18 Safe Drinking Water Act of 1974, As Amended

The Proposed Action would not impact safe drinking water standards. The Proposed Action is in full compliance.

4.25.19 Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (Public Law 91-646)

Acquisition of real estate is not required for the Proposed Action. The Proposed Action is in compliance with this Act.

4.25.20 Anadromous Fish Conservation Act

Anadromous fish species would not be affected. The Proposed Action is in compliance with the Act.

4.25.21 Migratory Bird Treaty Act and Migratory Bird Conservation Act

Migratory and resident bird species have been observed within the project area and are likely to use available habitat for foraging, nesting, and breeding. The Proposed Action is not expected to destroy migratory birds, their active nests, their eggs, or their hatchlings. The Proposed Action will not pursue, hunt, take, capture, kill or sell migratory birds. The Proposed Action is in compliance with these Acts.

4.25.22 Marine Protection, Research and Sanctuaries Act

The Marine Protection, Research and Sanctuaries Act does not apply to the Proposed Action. Ocean disposal of dredge material is not proposed as part of the Proposed Action.

4.25.23 Magnuson-Stevens Fishery Conservation and Management Act

No Essential Fish Habitat would be impacted by this action. Therefore the Proposed Action is in compliance with this Act.

4.25.24 E.O. 11990, Protection of Wetlands

The Proposed Action is expected to have beneficial effects on wetlands. The Proposed Action is in compliance with the goals of this Executive Order (E.O.).

4.25.25 E.O. 11988, Floodplain Management

This E.O. instructs Federal agencies to avoid development in floodplains to the maximum extent possible. The Proposed Action is an operational change to existing infrastructure; therefore, no construction is proposed. This action is consistent with the intent of this E.O. and is in compliance.

4.25.26 E.O. 12898, Environmental Justice

E.O. 12989 provides that each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority or low income populations. The Proposed Action would not result in disproportionately high and adverse

human health or environmental effects on minority populations and low-income populations. The Proposed Action is in compliance with this E.O.

4.25.27 E.O. 13089, Coral Reef Protection

No coral reefs would be impacted by the Proposed Action. This E.O. does not apply.

4.25.28 E.O. 13112, Invasive Species

The Proposed Action would have no significant impact on invasive species. The Proposed Action is in compliance with the goals of this E.O.

4.25.29 E.O. 13045, Protection of Children

E.O. 13045, requires each Federal agency to "identify and assess environmental risk 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 action has no environmental safety risks that may disproportionately affect children. The Proposed Action is in compliance.

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

Migratory and resident bird species have been observed within the project area and are likely to use available habitat for foraging, nesting, and breeding. The Proposed Action is not expected to destroy migratory birds, their active nests, their eggs, or their hatchlings. The Proposed Action is in compliance with the goals of this E.O.

5 LIST OF PREPARERS

TABLE 5-1. TABLE OF PREPARERS

Name	Organization	Role in EA
Donna George	USACE	Project Manager
Melissa Nasuti	USACE	Biologist
Dan Crawford	USACE	Hydrologist/Engineer
Ceyda Polatel	USACE	Hydrologist/Engineer
Lan Do	USACE	Water Manager
Olice Williams	USACE	Water Manager
Tamela Kinsey	USACE	Water Manager
June Mirecki	USACE	Geologist
Jim Riley	USACE	Water Quality
Meredith Moreno	USACE	Archeologist

6 PUBLIC INVOLVEMENT

6.1 SCOPING AND EA

Reference **Section 1.9**.

6.2 AGENCY COORDINATION

The Corps is in continuous coordination with other Federal and state agencies, Tribal representatives, and members of the general public. This extensive coordination is a result of the magnitude of Corps efforts underway to implement water management strategies in south Florida. All agency coordination letters are included in **Appendix D**.

6.3 LIST OF RECIPIENTS

A notice of availability for the EA and FONSI was mailed to Federal and state agencies, Tribal representatives, and members of the general public. A complete mailing list is available upon request. The EA and FONSI was also posted the internet at the following address:

http://www.saj.usace.army.mil/About/DivisionsOffices/Planning/EnvironmentalBranch/EnvironmentalDocuments.aspx#

http://www.saj.usace.army.mil/Missions/Environmental/EcosystemRestoration/G3273andS356PumpStationFieldTest.aspx#

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