Appendix 2-4: Annual Permit Report for C-111 Spreader Canal Phase 1 (Western) Project

Permit Report (May 1, 2012–April 30, 2013)
Permit Numbers: 0293559 (FDEP), and
SAJ-2005-9856(IP-AAZ) (USACE)

Chelsea Qiu

Contributors: Jason Godin, Binhe Gu, Jorge Jaramillo,
Richard Pfeuffer and Leslye Waugh

SUMMARY

Based on Florida Department of Environmental Protection (FDEP) and United States Army Corps of Engineers (USACE) permit reporting guidelines, **Table 1** lists key permit-related information associated with this report. **Table 2** lists the attachments included with this report. **Table A-1** in Attachment A lists specific pages, tables, graphs, and attachments where project status and annual reporting requirements are addressed. This annual report satisfies the reporting requirements specified in the permit.

Table 1. Key permit-related information.

	FDEP Permit	USACE Permit
Project Name:	C-111 Spreader Canal Phase 1 (Western) Project	
Permit Number:	0293559-007	SAJ-2005-9856 (IP-AAZ)
Issue and Expiration Dates:	Issued: 10/8/2009; Expires: 10/8/2014	Issued: 10/14/2009; Expires: 10/14/2014
Project Phase:	Operations	Operations
Permit Specific Condition Requiring Annual Report:	35	1, 7b
Relevant Period of Record:	May 1, 2012–April 30, 2013	
Report Lead:	Chelsea Qiu cqiu@sfwmd.gov 561-682-6196	
Permit Coordinator:	Leslye Waugh lwaugh@sfwmd.gov 561-682-6483	

Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Water Quality Data
C	Hydrologic Data

INTRODUCTION

PROJECT DESCRIPTION AND HISTORY

The C-111 Spreader Canal Phase 1 Western (C-111 SCW) Project is one of the key projects that make up the Comprehensive Everglades Restoration Plan (CERP). It is the first CERP project constructed with direct benefit to Everglades National Park (ENP), including Florida Bay.

The C-111 SCW Project is located in southern Miami-Dade County, in an area bounded by ENP, the Florida City-Homestead area, and Manatee Bay. The project was implemented by the South Florida Water Management District (SFWMD or District) in cooperation with the USACE project delivery team. A "dual track" approach was used to coordinate SFWMD activities with the ongoing planning efforts of the project delivery team. Any construction efforts initiated by SFWMD prior to the execution of the project partnership agreement with the USACE were identified in a pre-partnership credit agreement on August 13, 2009.

PROJECT OBJECTIVE

The C-111 canal in southern Miami-Dade County is the southernmost canal in the Central and Southern Florida Flood Control Project (C&SF Project). The canal historically served its authorized purpose providing flood protection. Unfortunately, it had unexpected negative impacts on the coastal and southern ecosystems, including damaging point source discharges to Manatee Bay, overdrainage of the Model Lands, Southern Glades, and ENP (particularly Taylor Slough), which has resulted in reduced flows to Florida Bay. The purpose of the C-111 SCW Project is to correct these problems while continuing to provide flood protection and other goals of the C&SF Project.

The objective of the C-111 SCW Project is to improve the quantity, timing, and distribution of water delivered to Florida Bay via Taylor Slough, improve hydroperiod and hydropattern in the Southern Glades and Model Lands, and reduce ecologically damaging flows to Florida Bay and other receiving waters. The project objectives will be accomplished by implementing multiple, often separable, project features in phases.

The initial phase of the C-111 SCW Project is also known as the "Western Components" in the C-111 Spreader Canal Western Project Final Project Implementation Report and Environmental Impact Statement (USACE and SFWMD 2011), referred to as the PIR. The "Eastern Components" identified in the PIR are not part of this permit, and are therefore not included in this report.

PROJECT FEATURES

The following features are associated with the C-111 SCW Project (**Figure 1**):

- Frog Pond Detention Area (FPDA) and S-200 Inflow Pump Station
- Aerojet Canal Impoundment/Modifications and S-199 Inflow Pump Station
- Plugging of the C-110 Canal (north of the C-111 canal)
- Canal Plug on the L-31E Canal (south of the S-20 structure)
- Incremental Operational Adjustments to Structures S-18C and S-20
- Construction of the S-198 Control Structure (to be built in the future, if needed)

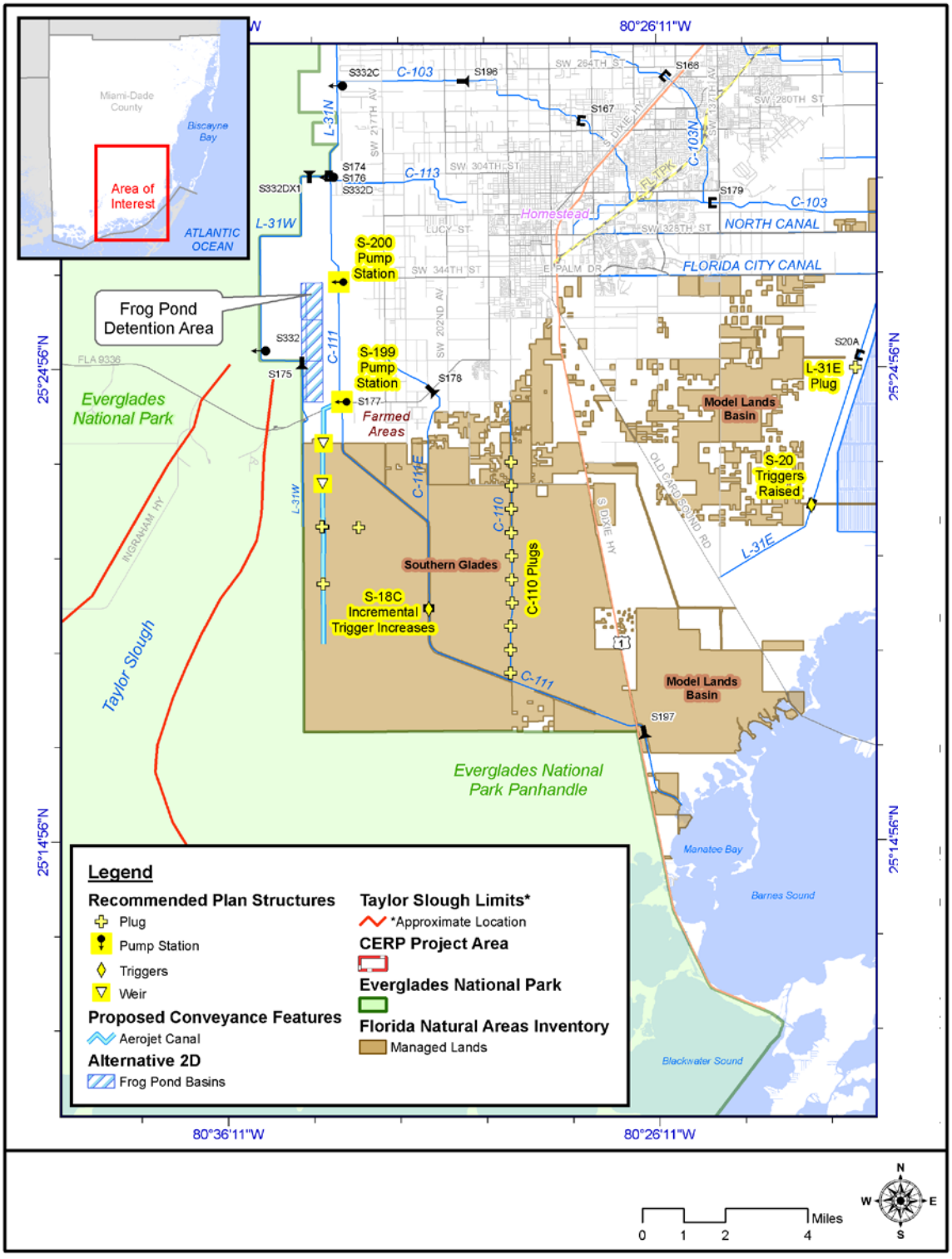

Figure 1. C-111 SCW Project features.

As stated in the C-111 SCW Project PIR, surface water flows will not be directly discharged into Taylor Slough or ENP because of this project. The FPDA and Aerojet Canal features are intended to work in unison to create an approximately nine-mile hydraulic ridge adjacent to ENP. The ridge will serve to block groundwater flows from moving into the C-111 canal from ENP, therefore retaining water in Taylor Slough and improving the quantity, timing, and distribution of flows into Florida Bay. Water removed from the C-111 canal to form the hydraulic ridge in the detention areas will gradually infiltrate into the ground and seep back into the canal. This water will then be pumped back via S-199 and S-200 to maintain the hydraulic ridge, so water from ENP is not lost to seepage.

FROG POND DETENTION AREA

The FPDA includes a 225-cubic feet per second (cfs) pump station (S-200), and an above-ground header channel and three detention cells (Cells 1-3) which include approximately 516 acres of land. The above-ground header channel stages up approximately two and a half feet above existing ground before "feeding" the three cells that make up the detention area. Weirs were constructed between the header canal and receiving cells to ensure that the header stage meaningfully rises prior to discharging to the reservoir cells. The header cell is fed by a lined conveyance channel located along the northern edge of the reservoir. The 225-cfs pump station consists of three 75-cfs pumps to allow stepped operations (see the *Operation Record* subsection in the *Construction and Operations* section of this report).

Aerojet Canal

A second 225-cfs pump station (S-199) was constructed immediately upstream of the existing S-177 structure. S-199 routes water to the Aerojet Canal and pumping discontinues if the elevation of the canal exceeds two and a half feet above existing ground (see the *Operation Record* subsection in the *Construction and Operations* section of this report).

TIMELINE OF CONSTRUCTION AND START-UP

Key construction and start-up dates are as follows:

- January 2012: Substantial completion of S-199 and S-200 pump stations construction
- May 3, 2012: Start-up monitoring initiated for the FPDA
- July 15, 2012: Start-up monitoring initiated for the Aerojet Canal Extension

PERMIT HISTORY

The original CERPRA permit and all major modifications issued to SFWMD by FDEP are as follows:

- 0293559-001, issued October 8, 2009, with an expiration date of October 8, 2014.
- 0293559-002, issued March 25, 2010, to modify the design plan for the Aerojet Canal.
- 0293559-003, issued April 13, 2010, to include the use of public water supply to service field office (trailer) restrooms.
- 0293559-004, issued June 9, 2010, to include the use of an additional 1.43 acres adjacent to the FPDA project footprint to stockpile material.

- 0293559-005, issued June 20, 2011, to include remedial actions within the former Blue Heron Aqua Farm infiltration pond, and changes to the stage and flow monitoring locations.
- 0293559-006, issued December 20, 2011, to expand the project footprint, and provide clarification on the start-up monitoring requirements for the FPDA and the long-term operational water quality monitoring requirements.
- 0293559-007, issued November 21, 2012, to modify routine monitoring plans, including significant monitoring reductions. This annual report follows the reduced monitoring plans.

The original Section 404 of the Clean Water Act permit, and all major modifications issued to the SFWMD by USACE, are as follows:

- SAJ-2005-9856 (IP-AAZ), issued October 14, 2009, with an expiration date of October 14, 2014.
- SAJ-2005-9856 (MOD-JJR) Modification #1, issued May 20, 2010, to modify the design plan for the Aerojet Canal and to include the use of an additional 1.43 acres adjacent to the Frog Pond project footprint to stockpile material.
- SAJ-2005-9856 (IP-AAZ) Modification #2, issued September 17, 2010, to relocate one canal plug within the East/West Canal off the Aerojet Canal.
- SAJ-2005-9856 (IP-AAZ) Modification #3, issued January 20, 2011, to allow construction activities associated with a culvert crossing and the canal bank to occur within the breeding season of the Cape Sable seaside sparrow (CSSS).
- SAJ-2005-9856 (MOD-AAZ) Modification #4, issued January 6, 2011, to allow construction activities associated with the corrective action plan to occur within the breeding season of the CSSS.
- SAJ-2005-9856 (MOD-AAZ) Modification #5, issued June 18, 2012, to reassess the actual impacts that occurred on the site and the associated mitigation lift.

CONSTRUCTION AND OPERATIONS

PROJECT STATUS

The construction of the C-111 SCW Project was completed in January 2012 with the completion of the S-199 and S-200 Pump Stations and the Aerojet, L-31E, and C-110 canals modification construction contracts. The FPDA construction contract was completed earlier, in June 2011. Testing and commissioning has been completed, and the project is currently in the operational testing and monitoring phase.

CONSTRUCTION/INSPECTION/MAINTENENCE PROGRESS

Construction of the project was completed in January 2012. As-builts and certification of completion were submitted to FDEP on March 19, 2012. SFWMD is currently conducting operation and maintenance of all the constructed project features.

OPERATION RECORD

The C-111 SCW Project features are intended to operate in conjunction with existing C&SF Project features. During Water Year (WY) 2013 (May 1, 2012 –April 30, 2013) operations through October 18, 2012 were in accordance with the Interim Operational Plan for Protection

(IOP) of the CSSS. The IOP was superseded by the 2012 Everglades Restoration Transition Plan (ERTP) operational guidance when a record of decision was signed by the USACE on October 19, 2012. The C-111 SCW Project is a restoration project, and only redistributes existing water within the lower C-111 basin. The project does not provide any new water to the regional system and, thus, proposes no change to existing water supply operations.

In general, the standing instructions are to be used for the normal day-to-day operations for all project and related project structures. Unless otherwise noted, existing structures will continue to be operated under the current ERTP and/or the Combined Structures Operating Plan (CSOP) for the Modified Water Deliveries to ENP and South Dade C-111 Projects. The C-111 SCW Project resulted in two new operable pump stations upstream of S-177 (S-200 and S-199). Pump station S-200, which was constructed downstream of S-176, is intended to initiate pumping prior to reaching the open trigger for flood control operations at S-177 (currently when the headwater stage at S-177 reaches elevation 4.2 feet National Geodetic Vertical Datum of 1929 (ft NGVD)). It consists of three individual 75-cfs electric pumps that will trigger according to the schedule in **Table 3**. More information is available in the Preliminary Project Operating Manual (PPOM) (SFWMD 2013).

Table 3. Pump station S-200 on/off headwater triggers. [a]

Pump	Rating	Pump on Elevation	Pump off Elevation
Unit 1	75 cfs	3.8 ft NGVD	3.6 ft NGVD
Unit 2	75 cfs	3.9 ft NGVD	3.6 ft NGVD
Unit 3	75 cfs	4.0 ft NGVD	3.6 ft NGVD
S-177 [b]	1,400 cfs	Open 4.3 ft NGVD	Close 3.6 ft NGVD

a. In addition to the headwater criteria listed above, all pumps will be shut off if the tailwater at S-200 reaches 8.5 ft NGVD. Pumping at S-200 will also cease if ponding at a predetermined representative site, monitoring station R3110, within designated CSSS Critical Habitat Unit 2 (C) (Subpopulation C) exceeds ten centimeters (elevation 4.95 ft NGVD) during the critical portion of the nesting season, as identified by U.S. Fish and Wildlife Service which is March 15 to June 30.

b. With S-177, open/close is shown for comparison.

During current operation of the S-332D pump station, a significant amount of the pumped water returns to the C-111 canal as seepage from one or more of the S-332D cells. In order to reduce S-177 openings, the S-200 pumps may also be used on a "one-to-one" basis with the 125-cfs pumps at pump station S-332D, at any time that the S-177 headwater is at or above elevation of 3.8 ft NGVD. For example, if two of the 125-cfs diesel pumps are on at S-332D, and the S-177 headwater is at least 3.8 ft NGVD, then up to two of the S-200 pumps can be turned on independent of the stages in **Tables 3** and **4.** The intent is not to restrict operations to a specific plan, but to allow for flexibility in order to maintain the stages within the operating range.

To avoid overtopping, and to ensure the stability of the FPDA, pumping will cease if the stage in the header channel reaches 8.5 ft NGVD. Pumping at S-200 will also cease if ponding at a predetermined representative site, in this case monitoring station R3110 within designated CSSS Critical Habitat Unit 2 (C), exceeds ten centimeters (elevation 2.36 ft NGVD) during the critical portion of the nesting season, March 15 to June 30, as identified by the U.S. Fish and Wildlife Service (USFWS). Operations at pump station S-199, which has been constructed immediately upstream of S-177 (downstream of Ingraham Highway [Florida State Road 9336]), mirror those at S-200, as shown in **Table 4**.

Table 4. Pump station S-199 on/off headwater triggers. [a]

Pump	Rating	Pump on Elevation	Pump off Elevation
Unit 1	75 cfs	3.8 ft NGVD	3.6 ft NGVD
Unit 2	75 cfs	3.9 ft NGVD	3.6 ft NGVD
Unit 3	75 cfs	4.0 ft NGVD	3.6 ft NGVD
S-177 [b]	1,400 cfs	Open 4.3 ft NGVD	Close 3.6 ft NGVD

a. In addition to the headwater criteria listed above, all pumps will be shut off if the tailwater at S-199 reaches 8.0 ft NGVD. Pumping at S-199 will also cease if ponding at a predetermined representative site, in this case monitoring station EVER4, within designated CSSS Critical Habitat Unit 3 (D) (Subpopulation D) exceeds ten centimeters (elevation 2.36 ft NGVD) during the critical portion of the nesting season, from March 15 to June 30, as identified by USFWS.

b. With S-177, open/close is shown for comparison.

Similar to the FPDA, in order to avoid overtopping, and to ensure stability of the Aerojet Canal perimeter berms, pumping will cease if the stage in the Aerojet Canal at the S-199 tailwater reaches 8.0 ft NGVD. Pumping at S-199 will also cease if ponding at a predetermined representative site, in this case monitoring station EVER4, within designated CSSS Critical Habitat Unit3 (D), exceeds ten centimeters (elevation 2.36 ft NGVD) during the critical portion of the nesting season, March 15 to June 30, as identified by USFWS. As described in Section 3 of the PPOM, as part of this project, S-20 open and close trigger stages will be increased one half foot. Under the revised operational criteria, operational triggers will be as shown in **Table 5** by the end of the fifth year of operations, as the triggers will be increased 0.1 feet per year to incrementally assess the effects.

Table 5. Year 5 final incremental operating criteria for S-20.

Operation Mode	Trigger	Action
Normal Operations	Headwater rises to elevation 2.9 ft NGVD.	Gate opens at 6 inches per minute
	Headwater rises or falls to elevation 2.6 ft NGVD	Gate becomes stationary
	Headwater falls to elevation 2.3 ft NGVD	Gate closes at 6 inches per minute
Emergency Flood Fighting Mode	Headwater rises to elevation 1.4 ft NGVD	Gate open at 6 inches per minute
	Headwater rises or falls to elevation 1.2 ft NGVD	Gate becomes stationary
	Headwater falls to elevation 1.0 ft NGVD	Gate closes at 6 inches per minute

In addition to the changes described above, the project will also experiment with incremental increases in the open/close stage triggers at S-18C. The first incremental increase is scheduled for 2014. An interagency meeting will be held prior to implementing any changes. We will report information on interagency meetings and incremental changes in the annual report for WY2015.

The project operated smoothly and as ex pected. As indicated in the permit, the project objectives will be accomplished by implementing multiple, often separate, project features in phases. C-111 SCW is one of the components of the CERP and other projects planned in the area. Although improvement of flows in Taylor Slough may be partly attributed to the benefits of this project (see the information about flows in the next section, *Hydrometeorological Monitoring Summary*), it is too early to evaluate the success of the project in achieving its objectives with the current phase and with less than one year of operation and monitoring data. However, we are encouraged by the observed hydrologic pattern of increased flow in Taylor Slough, which is the anticipated outcome of the project. Additional monitoring will reduce uncertainty in the relationship between project operations and stage and discharge into Taylor Slough.

All project features were completed in January 2012, and the project became operational in June 2012. During the WY2013 reporting period, the project was operational for less than one year. An annual facility inspection was scheduled for September 2013, and will be included in the next annual permit report. No problems were encountered with the project during the reporting period.

HYDROMETEOROLOGICAL MONITORING SUMMARY

The purpose of hydrometeorological monitoring is mainly to provide reasonable assurances that existing levels of flood protection will not be diminished outside the geographic area of the project component because of incremental trigger increases at S-18C and S-20.

There are 10 monitoring stations covered in the hydrometeorological monitoring plan. Their locations are shown in **Figures 1** and **2**. Two of the stations collect rainfall data, and the other stations measure flows and/or stages in the project area. Hydrometeorological data reported here were obtained from databases maintained by three government agencies: the District (DBHYDRO), U.S. Geological Service (USGS; Everglades Depth Estimation Network), and ENP.

Table 6. Hydrometeorological monitoring sites and parameters in the project area.

Site	Latitude	Longitude	Agency	Parameter	Reporting
S-200 (HW &TW)	25°26'38.95"	80°33'37.27"	SFWMD	Stage & Flow	Daily Average
S-199 (HW &TW)	25°24'11.63"	80°33'32.71"	SFWMD	Stage & Flow	Daily Average
S-177 (HW &TW)	25°24'10.41"	80°33'30.22"	SFWMD	Stage, Flow & Rainfall	Daily Average
S-18C (HW &TW)	25°19'50.42"	80°31'30.22"	SFWMD	Stage, Flow & Rainfall	Daily Average
S-197 (HW &TW)	25°17'13.43"	80°26'29.21"	SFWMD	Stage & Flow	Daily Average
C111AW (new Ag well)	25°23'35.47"	80°34'87.22"	SFWMD	Stage	Daily Average
C111AE (new Ag well)	25°23'33.37"	80°32'29.81"	SFWMD	Stage	Daily Average
NP-EPS (EPSW)	25°16'49.90"	80°30'11.42"	ENP	Stage	Daily Average
USGS-G-3356	25°25'08.30"	80°25'39.80"	USGS	Stage	Daily Average
R3110	25°26'46.00"	80°37'34.00"	USGS	Stage	Daily Average
EVER4	25°20'19.50"	80°32'48.00"	USGS	Stage	Daily Average
Taylor Slough Bridge	25°24'06.41"	80°36'24.22"	ENP	Flow	Daily Average

Note:
Ag – agriculture
ENP – Everglades National Park
HW – headwater
SFWMD - South Florida Water Management District
TW – tailwater
USGS – U.S. Geological Survey

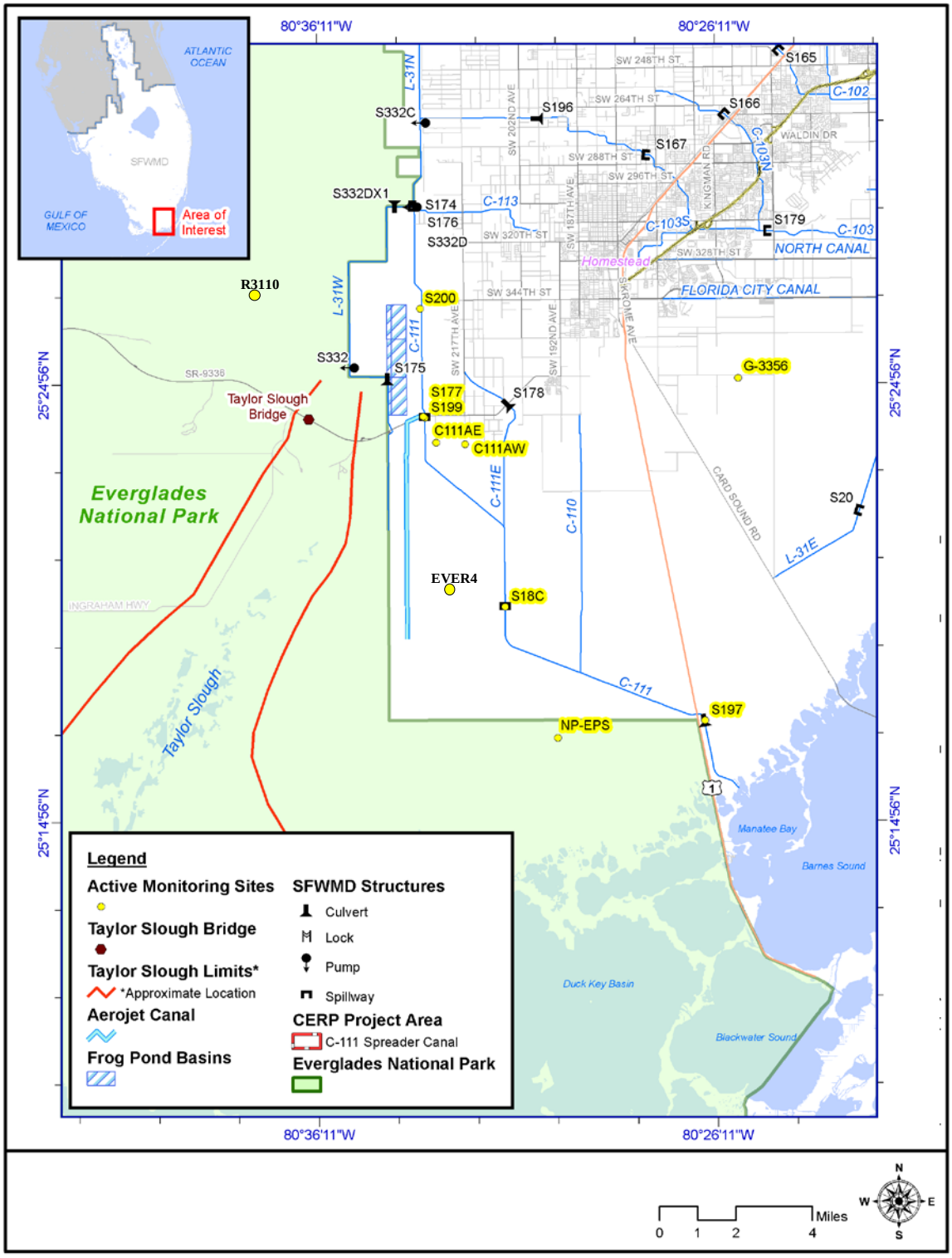

Figure 2. Hydrometeorological monitoring sites in the project area.

RAINFALL

Daily rainfall data were retrieved from the SFWMD's DBHYDRO database for stations at S-177 and S-18C. The historical annual rainfall (for WY1992 to WY2013) averaged 51 inches at S-177 and 61 inches at S-18C (**Figure 2**). The C-111 SCW project area received 53.6 inches of rainfall at S-177, and 56.3 inches at S-18C during WY2013, which is comparable to the historical averages. Monthly rainfall is shown in **Table 7** and **Figure 3**. About 80 percent of the annual rainfall in the project area was received in the wet season (May to October), and the remaining 20 percent was received in the dry season (November through April).

Table 7. Comparison of monthly rainfall between WY2013 and historical averages in the project area.

Month	Total of Rainfall at S-177 (inches)		Total of Rainfall at S-18C (inches)	
	WY 2013	Historical Average (1992-2012)	WY 2013	Historical Average (1992-2012)
May	8.6	4.8	10.0	5.2
June	7.5	8.3	8.2	10.4
July	9.4	6.0	10.7	6.9
August	9.5	8.4	8.6	8.4
September	4.8	7.6	4.6	10.1
October	3.9	5.5	3.6	6.3
November	0.2	2.2	0.8	2.3
December	0.4	1.5	0.9	2.2
January	0.1	1.6	0.5	2.0
February	1.7	1.6	1.6	2.3
March	1.7	1.7	1.8	2.1
April	5.9	2.3	4.9	3.1
Annual	**53.6**	**51.3**	**56.3**	**61.2**

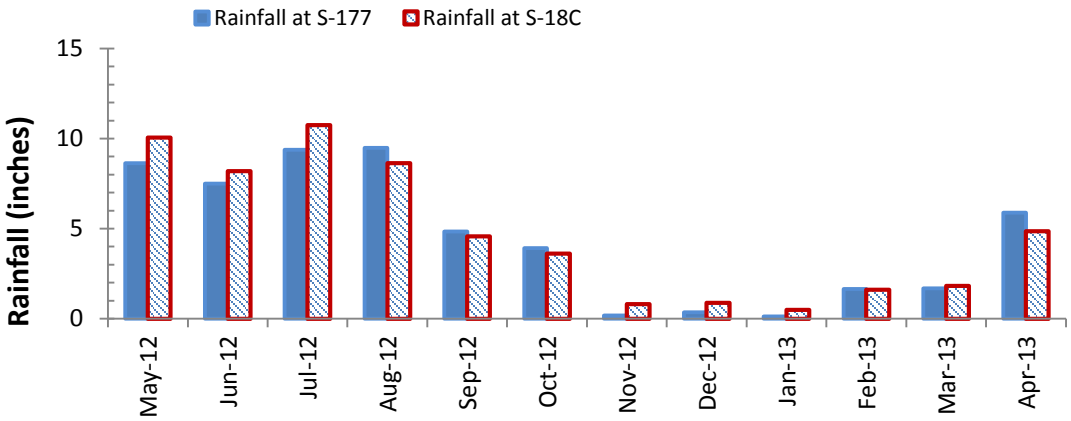

Figure 3. WY2013 monthly rainfall (in inches) at sites S-177 and S-18C.

FLOWS

Flows were monitored at 6 locations, including S-200, S-199, S-177, S-18C, S-197, and Taylor Slough Bridge (TSB). All flow data were downloaded from the District's DBHYDRO database except for TSB, where the data were obtained through ENP. **Tables 8** and **9** show the monthly flows at these locations. Daily flow variations are depicted in **Figure 4**.

S-200 began pumping from the C-111 canal into the FPDA in June 2012, and stopped pumping in January 2013. The annual average flow was 102 cfs. S-199 started pumping from the C-111 canal into the Aerojet Canal in July 2012, and ended in January 2013 with an annual average flow of 58 cfs. S-200 and S-199 were consistently in operation after they were built until the middle of the dry season, when the water level in the C-111 canal was too low. In the wet season, the maximum discharge reached their capacities of 225 cfs (**Figure 4**).

High discharges occurred at S-177 from May to August 2012, with monthly mean flows ranging from 137 to 254 cfs. Flows in the remainder of WY2013 were low at this location. At S-18C, discharges were sustained from May through November 2012, with monthly mean flows ranging from 147 to 403 cfs. The annual average flows in WY2013 were 79 cfs at S-177, and 205 cfs at S-18C.

At S-197, the southernmost structure of the District, there were only three brief discharge events in 2012, occurring from July 31–August 4, September 9–October 2, and October 20–28. Discharges ranged from 100 cfs to 1,300 cfs, averaging about 500–600 cfs within the three discharge events. The annual average flow at S-197 was 16 cfs.

TSB recorded an average flow of 134 cfs in WY2013, which is an almost 60 percent increase over the historical average (84 cfs from 1992 to 2013). While the rainfall of WY2013 was comparable to the historical average in the upper stream, the 60 percent increase in flows in Taylor Slough may be partly attributed to the benefits of the C-111 SCW Project. Other structure modifications and operations as well as changes in hydrology may also have contributed to the increase in TSB flows.

Table 8. Monthly flow at the C-111 structures during WY2013.

Month	Average Flow (cfs)				
	S-200	S-199	S-177	S-18C	S-197
May 2012		0	214	342	0
Jun 2012	137	0	254	394	0
July 2012	145	0	197	394	0
Aug 2012	148	158	137	403	184
Sep 2012	220	190	14	343	0
Oct 2012	168	134	54	307	0
Nov 2012	154	79	1	147	0
Dec 2012	122	35	0	78	0
Jan 2013	46	1	15	26	0
Feb 2013	0	0	31	13	0
Mar 2013	0	0	28	6	0
Apr 2013	0	0	6	4	0
Annual	**104**	**58**	**79**	**205**	**16**

Table 9. Comparison of monthly flows historically and during WY2013 at Taylor Slough Bridge.

Month	Average Flow at Taylor Slough Bridge (cfs)	
	WY2013	Historical Flow (1992-2013)
May	46	11
June	184	78
July	286	103
August	227	155
September	299	214
October	331	206
November	147	105
December	71	60
January	13	34
February	1	22
March	0	11
April	1	6
Annual	**134**	**84**

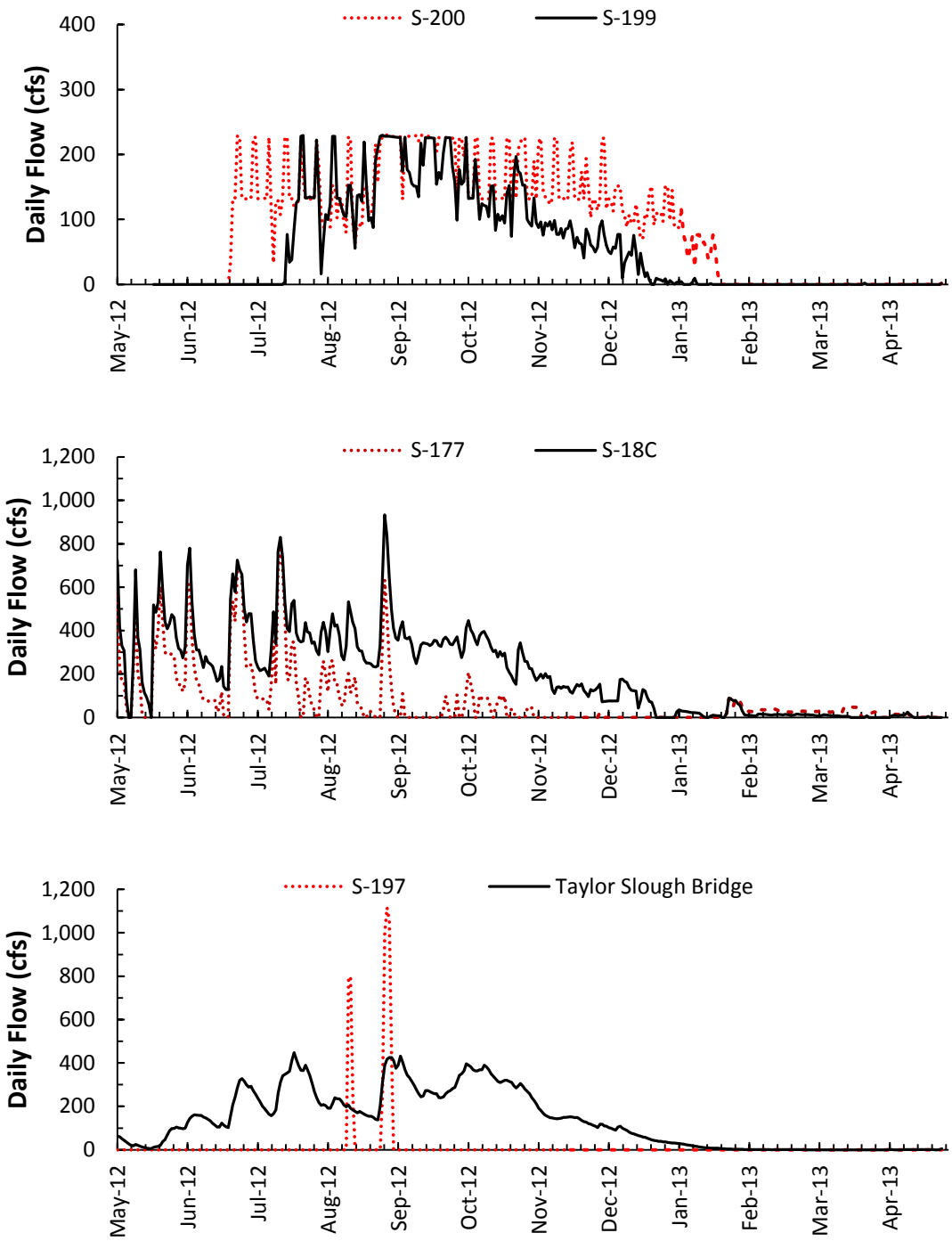

Figure 4. Variation of daily flows in cfs at the C-111 structures during WY2013.

STAGES

Table 10 shows the headwater and tailwater levels at five structures in the C-111 SCW Project area. S-200, S-199, and S-177 were operated with similar headwater levels. S-177 tailwater and S-18C headwater were similar levels and were controlled by the downstream structure, S18C. **Table 11** shows monthly water levels of six monitoring wells in the project area. Daily variations are shown in **Figure 5**.

The tailwater of S-200 was maintained between 7 and 9 ft NGVD when the pump was operational during the wet season (**Figure 5**, top panel). After January, when pumping ceased, water level returned to 6 feet. Similarly, the tailwater of S-199 remained between 7 and 9 ft NGVD between June and December 2012, during pumping, and returned to 6 ft NGVD when pumping ceased in January 2013.

S-18C tailwater and S-197 headwater were controlled by the S-197 structure to maintain similar water levels during operation. S-197, discharging directly to Manatee Bay, has the lowest tailwater levels among all of the stage monitoring stations due to tidal influence (**Figure 5**, middle panel).

Water levels at C111AW and C111AE, located between S-177 and S-18C, exhibited similar patterns as S -177 tailwater and S-18C headwater (**Figure 5**, bottom panel). Water levels at NP-EPS, located east of S-197, were slightly lower than S-197 headwater (**Figure 5**, bottom panel).

USGS-G-3356, the easternmost site in this area, is probably more influenced by the operation of S-20 than by the operation of structures listed in **Table 6** (**Figure 5**, bottom panel).

R3110 and EVER4 are used to monitor water levels and hydroperiods in CSSS Unit 2 (C) and Unit 3 (D), respectively (see **Figure 6**). As stated in the *Operation Record* section of this report, pumping will stop if water depths at R3110 and EVER4 are above 4.96 ft NGVD and 2.36 ft NGVD, respectively, during the critical portion of the nesting season, between March 15 and June 30.

In addition to stage monitoring listed in **Table 6**, an ongoing soil moisture study, funded by the District, has been conducted by the University of Florida to investigate S-18C water level changes. In addition to C111AW and C111AE, four agriculture study sites were chosen in the project area to monitor water table elevations and soil water content. Collected data were used to calibrate modeling tools that were developed to predict basinwide water level responses to changes in canal stages.

Table 10. Headwater and tailwater levels in ft NGVD29 at C-111 structures in WY2013.

Month	Headwater (ft)					Tailwater (ft)				
	S-200	S-199	S-177	S-18C	S-197	S-200	S-199	S-177	S-18C	S-197
May 2012		3.9	3.8	2.5	2.4		6.1	2.6	2.3	1.1
Jun 2012	4.0	3.9	3.8	2.5	2.5	8.1	6.1	2.6	2.4	1.1
July 2012	3.9	3.8	3.8	2.6	2.6	8.1	6.7	2.7	2.5	0.8
Aug 2012	3.9	3.7	3.8	2.5	2.5	8.0	7.6	2.6	2.5	1.0
Sep 2012	3.8	3.7	3.7	2.6	2.6	8.6	8.6	2.6	2.5	1.2
Oct 2012	3.8	3.7	3.7	2.5	2.6	8.5	7.8	2.6	2.5	1.7
Nov 2012	3.7	3.7	3.6	2.3	2.4	8.3	7.1	2.4	2.3	1.8
Dec 2012	3.7	3.6	3.6	2.4	2.1	8.1	6.6	2.5	2.1	1.2
Jan 2013	3.7	3.5	3.5	2.3	1.9	7.1	6.2	2.4	1.8	1.0
Feb 2013	3.3	3.1	3.1	2.1	1.8	6.2	6.1	2.2	1.7	0.9
Mar 2013	2.9	2.8	2.7	1.8	1.6	6.2	6.1	1.9	1.5	1.1
Apr 2013	3.3	3.2	3.2	2.1	1.7	6.2	6.1	2.3	1.6	1.0

Table 11. Stage levels in ft NGVD29 in monitoring wells during WY2013.

Month	C111AW	C111AE	NP-EPS	USGS-G-3356	CSSS Subpopulation C (Unit 2)	CSSS Subpopulation D (Unit 3)
May 2012	2.7	2.7	1.7	2.7	3.8	2.4
Jun 2012	2.7	2.6	1.9	2.6	4.2	2.4
July 2012	2.8	2.8	1.9	2.7	4.3	2.6
Aug 2012	2.8	2.9	1.9	2.9	4.3	2.6
Sep 2012	2.8	2.8	2.0	2.9	4.4	2.7
Oct 2012	2.8	2.8	2.0	2.6	4.5	2.7
Nov 2012	2.5	2.5	1.9	2.1	4.2	2.5
Dec 2012	2.6	2.5	1.8	2.0	4.0	2.4
Jan 2013	2.4	2.4	1.6	1.6	3.4	2.2
Feb 2013	2.2	2.2	1.5	1.6	2.2	1.9
Mar 2013	1.9	1.9	1.4	1.6	1.2	1.6
Apr 2013	2.3	2.2	1.5	2.2	2.0	1.9

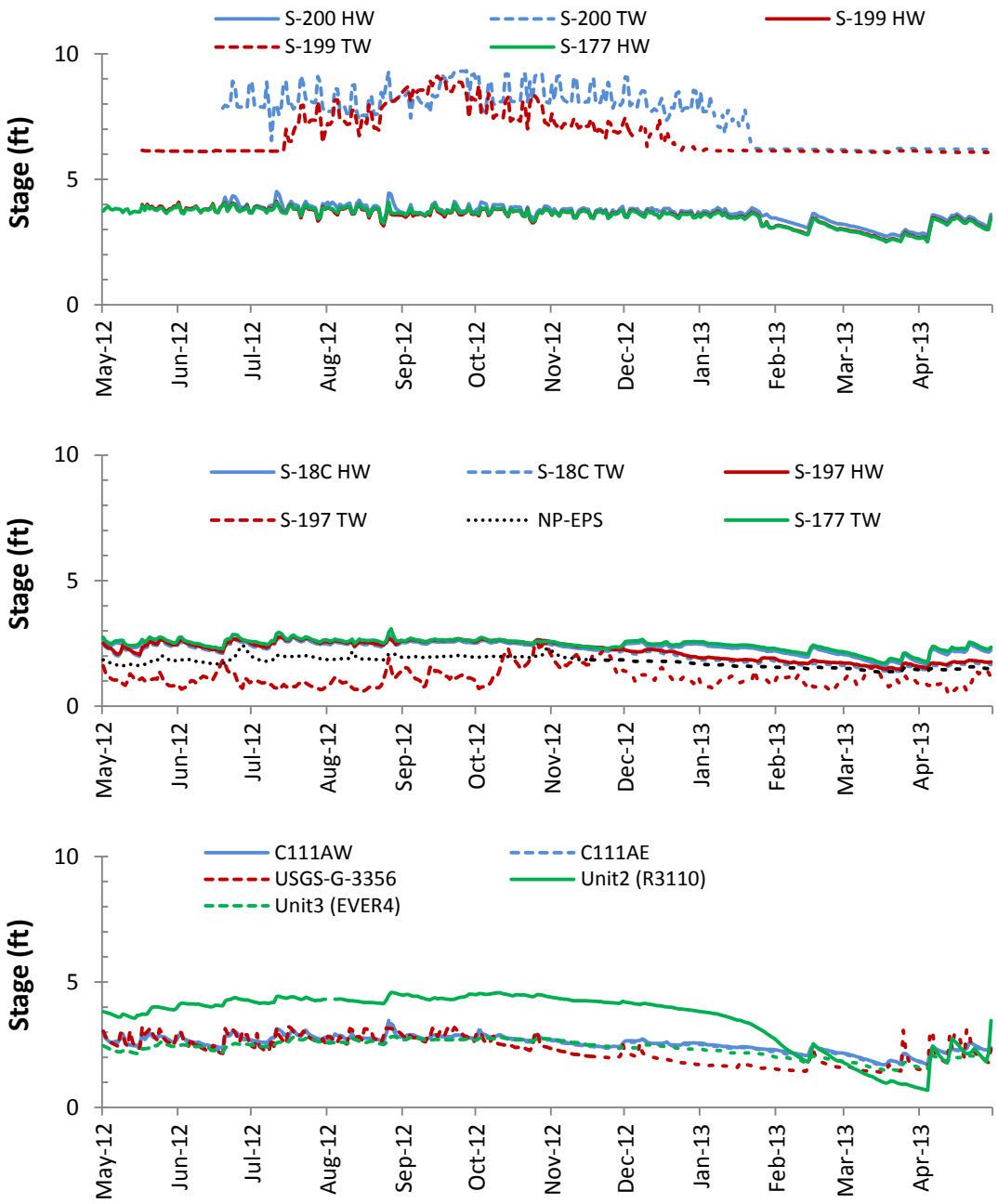

Figure 5. Permit reporting of stage levels in ft NGVD for the C-111 SCW Project during WY2013.

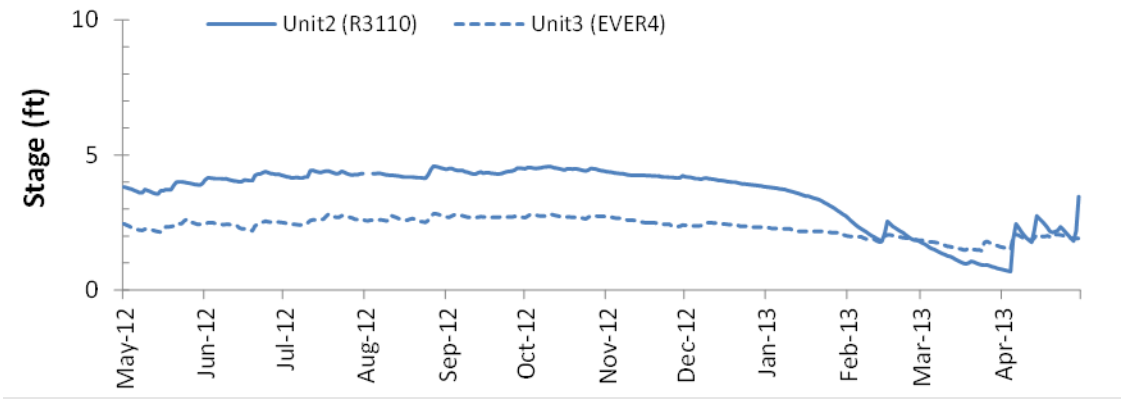

Figure 6. Water levels in ft NGVD in CSSS subpopulation areas during WY2013.

WATER QUALITY MONITORING SUMMARY

The water quality data evaluated in this report were retrieved from the District's DBHYDRO database. The District follows strict quality assurance/quality control procedures, outlined in the District's Chemistry Laboratory Quality Manual (SFWMD, 2012) and Field Sampling Quality Manual (SFWMD, 2011). The laboratory manual was developed in accordance with National Environmental Laboratory Accreditation Conference requirements, and both the laboratory and field manual were developed in accordance with the FDEP Quality Assurance Rule (Chapter 62-160, Florida Administrative Code [F.A.C.]). The quality manuals describe procedures that the water quality monitoring program follows to obtain accurate data to assess the progress being made toward achieving water quality standards.

PERMIT SAMPLING SITES

In addition to authorizing the operation and maintenance of C-111 SCW Project structures, the permit requires a routine water quality monitoring program to characterize the quality of water discharged through District structures. Currently, the C-111 SCW Project permit requires water quality monitoring at five sites in the project area (**Table 12** and **Figure 7**).

Table 12. Water quality monitoring sites in the project area.

Site	Latitude	Longitude	Description
S-332DX	25°28'59.92"	80°33'46.40"	At the eastern end of the land in front of S-332D pump
S-177 (S199)	25°24'10.40"	80°33'30.20"	At the S-177 and S-199 structure
S-200	25°26'38.94"	80°33'37.26"	At the S-200 structure
AJC1	25°22'36.66"	80°33'58.18"	In the Aerojet Canal downstream of the fish farm
FPDAH1	25°26'37.00"	80°34'25.75"	In the Frog Pond Detention Area header canal

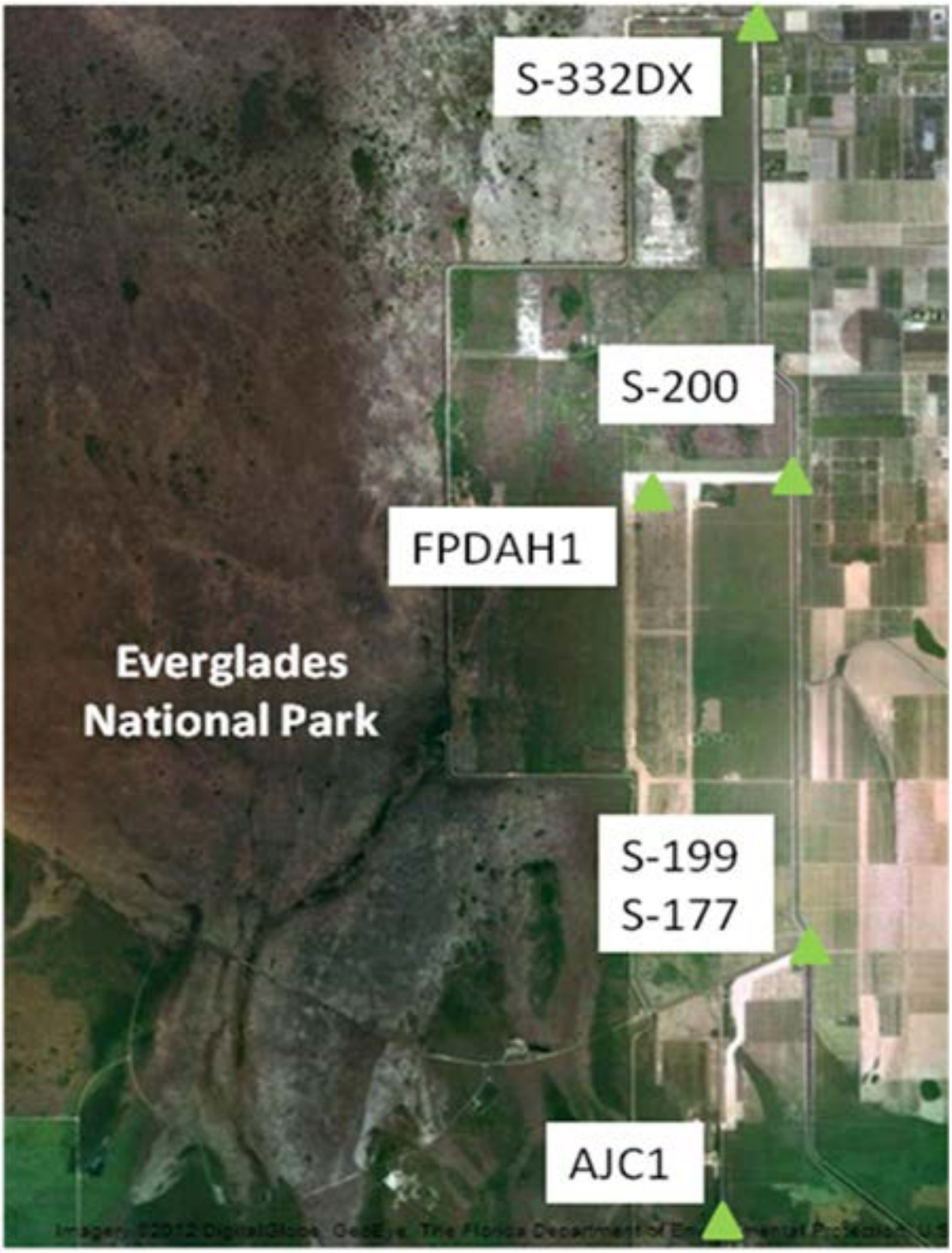

Figure 7. Water quality monitoring sites in the C-111 SCW Project area.

ASSESSMENT OF WATER QUALITY DATA

All of the water quality samples were measured at a 0.5-meter depth from the water surface. At S-200 and AJC1, physical parameters and grab samples for nutrients were collected weekly if structures recorded flows (WRF). At the other monitoring sites, water quality grab samples and physical parameters were collected weekly if flowing, otherwise monthly (WF/M).

PHYSICAL PARAMETERS

The physical parameters analyzed in the project include temperature, dissolved oxygen (DO), pH, specific conductance, turbidity, and total suspended solids (TSS). Temperature, DO, pH, and specific conductance were measured in situ at the time of grab sample collection. Turbidity samples from S-177 were collected quarterly. TSS samples collected from S-177 were collected WF/M. S200 and AJ Canal samples were collected WRF for laboratory analysis. **Table 13** shows the surface water quality parameters of Florida Class III criteria required by the permit. **Table 14** shows the statistical summary of physical parameters. The statistical summary table reports the number of sample observations, the average, the standard deviation, the range of constituent concentrations, and selected data percentiles (25^{th}, median, and 75^{th}). Specific conductance, turbidity, and TSS values were low.

Table 13. Surface water quality parameters with Florida Class III criteria specified in Section 62-302.530, F.A.C.

Parameter	Units	Florida Class III Criteria
Dissolved Oxygen	mg/L	≥ 5.0 mg/L
Specific Conductance	µS/cm	Not > 50 percent of background or > 1,275 µS/cm, whichever is greater
pH	standard units	Not < 6.0 or > 8.5
Turbidity	NTU	≤ 29 NTUs above background conditions

Note: µS/cm – microsiemens per centimeter; mg/L – milligrams per liter; NTU – nephelometric turbidity units.

Table 14. Statistical summary of physical parameters measured at C-111 SCW Project monitoring sites.

Temperature (ºC)				Total Suspended Solids (TSS) (mg/L)			
Statistics	**S-200**	**S-177 (S-199)**	**AJC1**	**Statistics**	**S-200**	**S-177 (S-199)**	**AJC1**
Count	40	44	33	**Count**	43	42	35
Average	26.0	25.4	26.2	**Average**	3	3	3
STD	1.0	1.9	1.3	**STD**	1	0	0
Min	23.8	21.1	23.7	**Min**	3	3	3
1st Quartile	25.3	24.5	24.9	**1st Quartile**	3	3	3
Median	26.0	25.8	26.4	**Median**	3	3	3
3rd Quartile	26.6	26.6	27.1	**3rd Quartile**	3	3	3
Max	30.0	29.4	29.5	**Max**	10	4	3

pH (units)				Dissoved Oxygen (mg/L)			
Statistics	**S-200**	**S-177 (S-199)**	**AJC1**	**Statistics**	**S-200**	**S-177 (S-199)**	**AJC1**
Count	40	44	33	**Count**	40	45	33
Average	7.3	7.4	7.5	**Average**	2.0	4.1	4.7
STD	0.1	0.2	0.1	**STD**	1.4	2.2	1.2
Min	7.1	6.9	7.3	**Min**	0.3	1.3	2.3
1st Quartile	7.2	7.2	7.4	**1st Quartile**	1.4	2.0	3.9
Median	7.3	7.4	7.4	**Median**	1.7	3.4	4.5
3rd Quartile	7.4	7.5	7.6	**3rd Quartile**	2.6	6.0	5.7
Max	7.4	7.5	7.6	**Max**	2.6	6.0	5.7
Excursions	0 (40)	0 (44)	0 (33)	**Excursions**	38 (40)	29 (45)	22 (33)

Turbidity (NTU)				Specific Conductance (µS/cm)			
Statistics	**S-200**	**S-177 (S-199)**	**AJC1**	**Statistics**	**S-200**	**S-177 (S-199)**	**AJC1**
Count	N/A	3	2	**Count**	40	44	33
Average	N/A	1.4	1.6	**Average**	526	534	510
STD	N/A	N/A	N/A	**STD**	23	31	19
Min	N/A	0.8	0.6	**Min**	496	482	448
1st Quartile	N/A	N/A	N/A	**1st Quartile**	507	503	504
Median	N/A	1.5	N/A	**Median**	527	538	512
3rd Quartile	N/A	N/A	N/A	**3rd Quartile**	538	555	523
Max	N/A	0.0	0.0	**Max**	538	555	523
Excursions	N/A	0 (3)	0 (2)	**Excursions**	0 (40)	0 (44)	0 (33)

Note: ºC – degrees Celsius; µS/cm – microsiemens per centimeter; Max – maximum; mg/L – milligrams per liter; Min – minimum; NTU – nephelometric turbidity units; STD – standard deviation; and TSS – total suspended solids; N/A – not applicable. For excursions, the first number is the number of excursions, and the number in parentheses is the total number of samples analyzed.

All of the physical parameters consistently met the water quality criteria specified in Section 62-302.530, F.A.C. (**Table 13**), except DO. **Figure 8** shows DO variation over the water year at the three required monitoring sites. Due to natural phenomena, it is common for DO concentrations to naturally fall below existing DO criteria in many of Florida's minimally disturbed and healthy fresh and marine water systems (FDEP, 2013). In general, DO at AJC1 in the Aerojet Canal was higher than the inflow at S-177 (S-199) between May and December 2012, due to the S-199 pumping and wet season rainfall. After S-199 pumping ceased in January 2013, DO at AJC1 decreased to a level lower than that in the C-111 canal. The annual average DO concentrations at S-200 and S-177 in the C-111 canal were 2.0 and 4.1 milligrams per liter (mg/L), respectively. The annual average concentration of DO in the Aerojet Canal (AJC1) was 4.7 mg/L, higher than the inflow water from the C-111 canal. The variation of DO at AJC1 between the wet and dry seasons indicates that S-199 pumping was beneficial in maintaining good DO conditions in the Aerojet Canal, and that the C-111 SCW Project did not contribute to DO degradation in the project area.

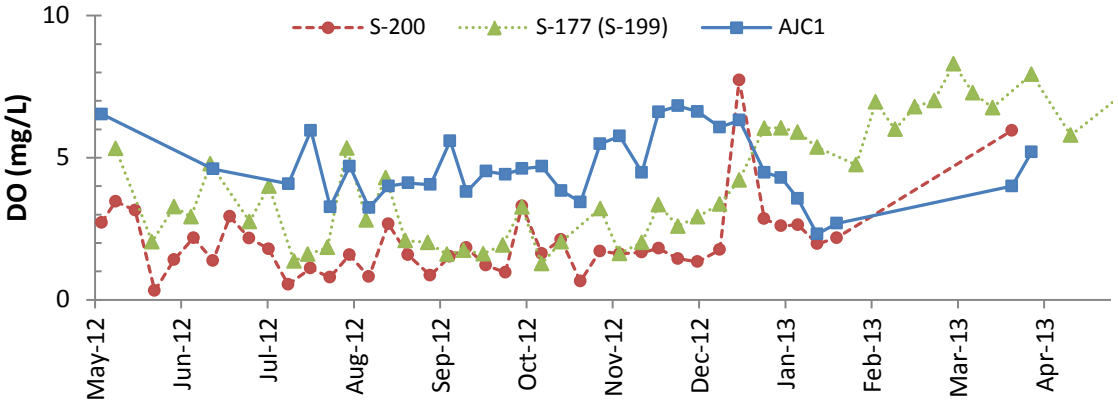

Figure 8. DO variation at three C-111 SCW Project monitoring sites during WY2013.

Water depths in the FPDA and Aerojet Canal were reported weekly when there were flows. The seasonal variations are shown in **Figure 9.** The FPDA was shallow, with depth up to 3 feet (**Figure 9**, top panel), which is close to the design depth. The maximum design depth in the FPDA is about 5 to 6 feet. Water will overflow to the east detention area through weirs if the water level is higher than the maximum depth. After S-200 stopped pumping in January 2013, the FPDA dried out quickly. Water in the Aerojet Canal was as deep as 20 to 25 feet (bottom panel of **Figure 9**). During the dry season, when S-199 stopped pumping, water depth decreased gradually to about 20 feet.

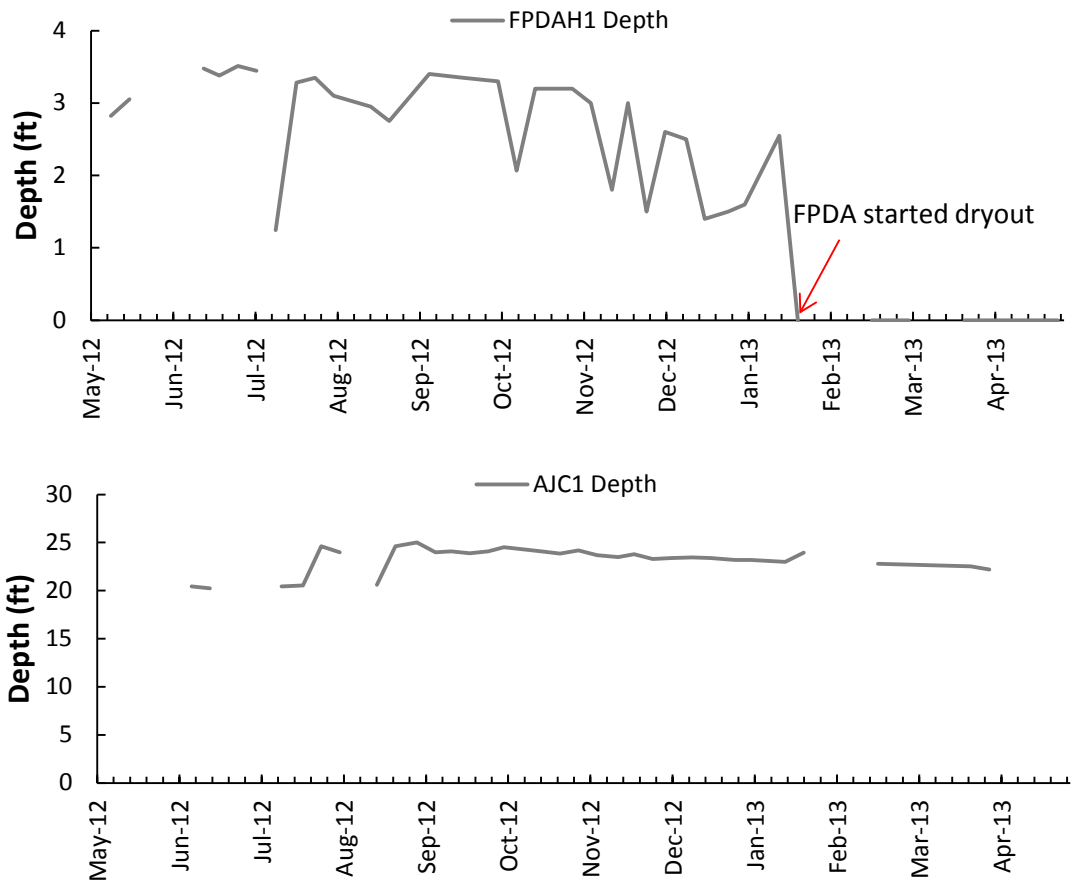

Figure 9. Depth changes in the FPDA (top) and Aerojet Canal (bottom) during WY2013.

NUTRIENT PARAMETERS

The nutrients analyzed include ammonia, total Kjeldahl nitrogen (TKN), nitrate + nitrite as N (NO_x), orthophosphate, and total phosphorus (TP). Nutrient data are summarized in **Table 15**, with individual measurements included in **Attachment B**. The statistical summary table reports the number of sample observations, the average, the standard deviation, the range of constituent concentrations, and selected data percentiles (1st quartile, median, and 3rd quartile). Nutrients in Class III criteria have narrative descriptions. The statistical tables provide basic information about water quality conditions in the project area.

For nitrogen constituents, AJC1 had generally lower concentrations than S-200 and S-177 in the C-111 canal. TKN varied in a narrow range of 0.45–0.6 mg/L when water was discharged through structures (**Figure 10**, top panel). Starting in January 2013, after discharges ceased, TKN in the canal increased. Overall, orthophosphate concentrations remained in the range of 2 to 3 parts per billion (ppb), and were relatively low in the project area. TP concentrations at AJC1 were higher than the canal water in the dry season, when water levels were low. In June and July 2012, as well as after January 2013, water levels in the Aerojet Canal were very low (see the tailwater stage at S-199 in the top panel of **Figure 9**). The average TP concentration at AJC1 was 7 ppb (**Figure 10**, bottom panel).

Based on available data, the C-111 SCW Project does not appear to cause or contribute to an increase in phosphorus or nitrogen in the area.

Table 15. Statistical summary of nutrient parameters at C-111 SCW Project monitoring sites for WY2013.

Ammonia (NH_4) (mg/L)				Total Kjeldahl Nitrogen (TKN) (mg/L)			
Statistics	**S-200**	**S-177 (S-199)**	**AJC1**	**Statistics**	**S-200**	**S-177 (S-199)**	**AJC1**
Count	N/A	38	17	**Count**	39	42	33
Average	N/A	0.047	0.025	**Average**	0.580	0.604	0.510
STD	N/A	0.030	0.010	**STD**	0.092	0.146	0.040
Min	N/A	0.005	0.012	**Min**	0.510	0.440	0.440
1st Quartile	N/A	0.024	0.018	**1st Quartile**	0.540	0.510	0.475
Median	N/A	0.046	0.021	**Median**	0.560	0.550	0.510
3rd Quartile	N/A	0.069	0.034	**3rd Quartile**	0.600	0.625	0.535
Max	N/A	0.125	0.044	**Max**	1.090	1.020	0.610

Nitrate + Nitrite as N (NO_x) (mg/L)				Orthophosphate (OPO_4) (mg/L)			
Statistics	**S-200**	**S-177 (S-199)**	**AJC1**	**Statistics**	**S-200**	**S-177 (S-199)**	**AJC1**
Count	39	34	32	**Count**	40	42	33
Average	0.047	0.072	0.046	**Average**	0.002	0.002	0.002
STD	0.048	0.053	0.037	**STD**	0.000	0.000	0.000
Min	0.005	0.005	0.005	**Min**	0.002	0.002	0.002
1st Quartile	0.011	0.035	0.016	**1st Quartile**	0.002	0.002	0.002
Median	0.030	0.051	0.042	**Median**	0.002	0.002	0.002
3rd Quartile	0.057	0.113	0.060	**3rd Quartile**	0.002	0.002	0.002
Max	0.195	0.186	0.156	**Max**	0.003	0.003	0.002

Total Phosphorus (TP) (mg/L)				
Statistics	**S-200**	**S-177 (S-199)**	**S-18C**	**AJC1**
Count	38	44	52	32
Average	0.005	0.006	0.004	0.007
STD	0.001	0.002	0.002	0.003
Min	0.003	0.003	0.003	0.004
1st Quartile	0.004	0.005	0.003	0.005
Median	0.005	0.006	0.004	0.006
3rd Quartile	0.005	0.007	0.005	0.007
Max	0.009	0.014	0.015	0.017

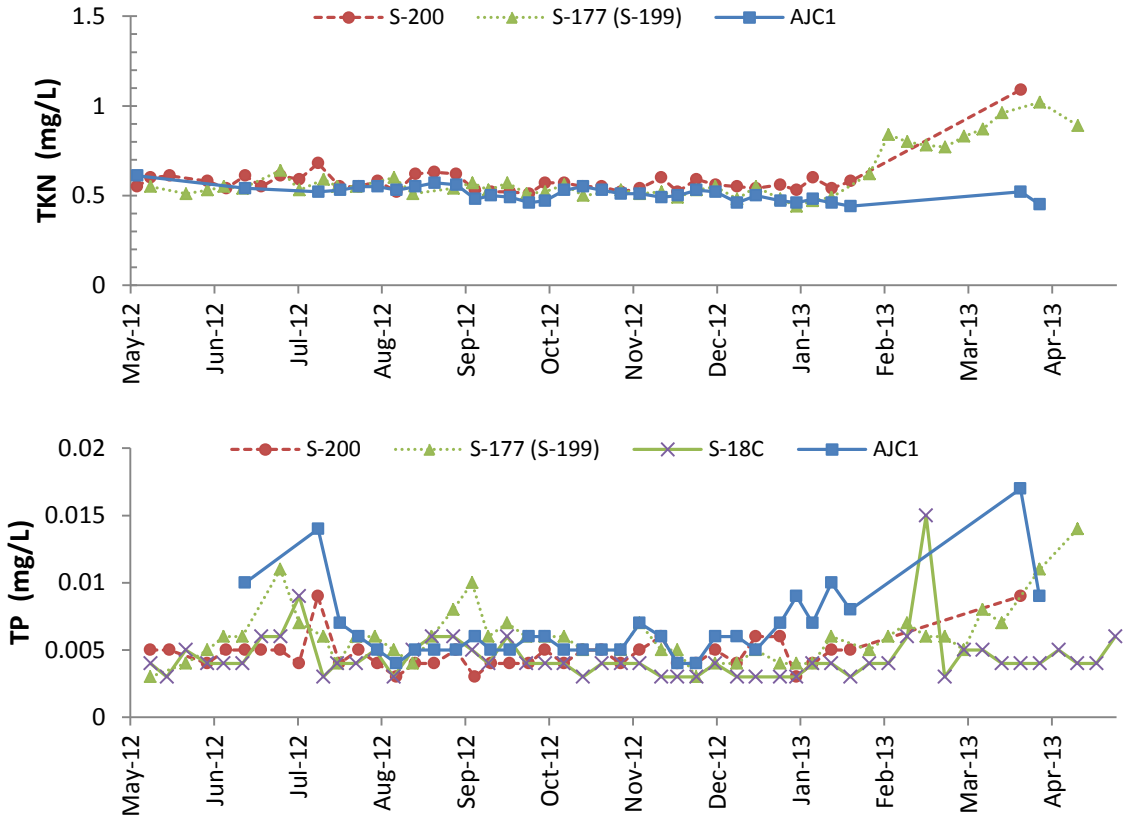

Figure 10. TKN (top) and TP (bottom) variations at C-111 SCW Project monitoring sites during WY2013.

ECOLOGICAL MONITORING SUMMARY

Unlike the accompanying Water Quality and Hydrometeorological Monitoring Plans, which place a greater emphasis on regulatory and assurances monitoring, the Ecological Monitoring Plan focuses on performance monitoring. For this project, ecological monitoring includes (1) hydroperiods in the Southern Glades and Model Lands, and (2) coastal zone salinities in Florida Bay.

HYDROPERIODS

C-111 SCW Project features are intended to restore more natural (pre-drainage) hydroperiods within the Southern Glades and Model Lands. Through partnerships between SFWMD and other government agencies, including ENP, USGS, and USACE, real-time water level data are collected at hundreds of water level gauges throughout the District's boundaries. In order for these data to be meaningful for reporting hydroperiods within the Southern Glades and Model Lands, SFWMD staff expanded the domain of the existing South Florida Water Depth Assessment Tool (SFWDAT), and developed a project-specific post-processing query for the project area, which routinely produces annual hydroperiod maps for the area of interest.

The SFWDAT interpolates between hundreds of existing water level gauges to produce spatially continuous estimates of mean daily surface water elevations for hydrologically distinct basins within the Everglades Protection Area. Water depth surfaces are calculated by subtracting

the best available ground elevation surface (or gridded elevation models) from the interpolated water elevation surfaces, and the resultant water depths are summarized by color ramped hydroperiod maps.

Inundated days (**Table 16**) represent the average of tens of thousands of cells for the two zones, the Southern Glades and Model Lands, in each month. The Southern Glades was flooded most of time in the wet season. In March and April of the dry season, scattered areas of higher ground were exposed. The hydroperiod of the Model Lands was shorter than that of the Southern Glades. Even in the wet season, a small area in the Model Lands remained exposed. The average hydroperiod conditions for WY2013 were 319 days in the Southern Glades, and 265 days in the Model Lands. **Figure 11** shows a map of hydroperiods around the C-111 SCW Project area for WY2013.

Table 16. Hydroperiods in the Southern Glades and Model Lands.

Inundated Days	Southern Glades	Model Lands
May 2012	29	27
Jun 2012	29	27
July 2012	29	27
Aug 2012	30	28
Sep 2012	30	28
Oct 2012	29	27
Nov 2012	28	26
Dec 2012	29	21
Jan 2013	28	15
Feb 2013	24	14
Mar 2013	17	12
Apr 2013	24	18
WY2013 Hydroperiods	**319**	**265**

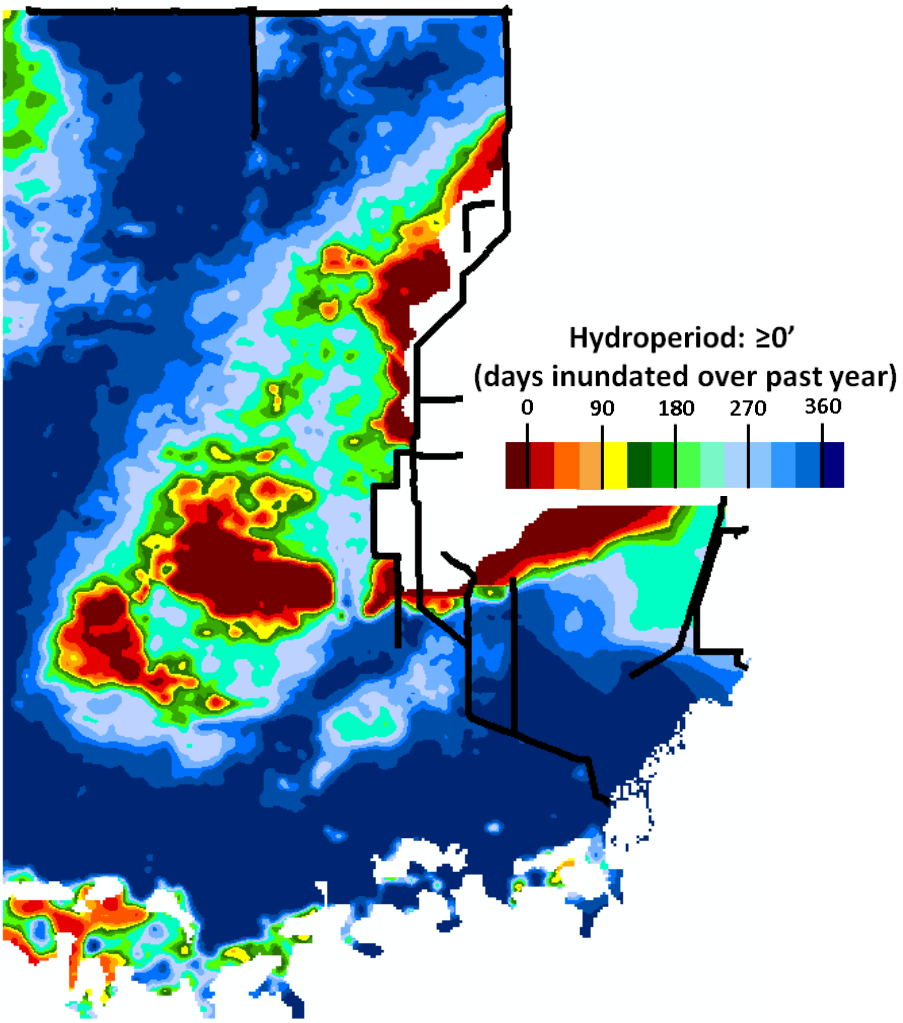

Figure 11. WY2013 hydroperiods in the C-111 SCW Project area.

COASTAL ZONE SALINITY

Because of improved timing, distribution, and flows within Taylor Slough, the C-111 SCW Project is expected to improve (reduce) salinities within the nearshore Florida Bay embayments. Modeling associated with the project indicated that the net improvement of salinity concentrations in the nearshore embayments could be about 3 percent. With less frequent gate openings at S-197, salinities within Manatee Bay are anticipated to increase correspondingly. However, salinity can be affected by a multitude of factors including freshwater inflows, tides, wind, and currents. Long-term monitoring data covering both with and without project conditions are needed to detect the overall impact of the project on salinity in Florida Bay. This section summarizes the salinity monitoring data collected in WY2013.

Continuous measurements of salinity were recorded at five stations, four in the lower Taylor Slough by USGS (McCormick Creek at Terrapin Bay, Upper Taylor River, Taylor Mouth, and Trout Creek at Joe Bay), and one in Manatee Bay (MBTS) by the District. USGS data were collected as part of the CERP Restoration Coordination and Verification Program/USGS funded Coastal Gradients project. The locations of these five monitoring sites are shown in **Table 17** and **Figure 12**. Salinity data were recorded every 15 minutes at all stations.

Table 17. Salinity monitoring locations in the C-111 SCW Project area.
[Note: ft – feet; mi – miles]

Site	Latitude	Longitude	Agency	Decription
TB- Terrapin Bay (USGS site name: McCormick Creek)	25°10'03"	80°43'55"	USGS	Approximately 500 ft upstream of the mouth, 17 mi east of Flamingo.
TR- Taylor River (USGS site name: Upstream Taylor River)	25°12'41"	80°38'53"	USGS	Located upstream on the left bank, approximately 12 mile northwest of Key Largo.
TM- Taylor Mouth (USGS site name: Taylor River Mouth)	25°11'27"	80°38'21"	USGS	Located at the mouth of Taylor River on the left bank, approximately 10 mile northwest of Key Largo.
TC- Trout Creek (USGS site name: Trout Creek)	25°12'53"	80°32'01"	USGS	Located on left bank, 100 ft upstream of mouth of Trout Creek, 10 mile northwest of Key Largo.
MBTS - Manatee Bay Temperature & Salinity	25°14'21.9"	80°25'18.1"	SFWMD	Manatee Bay, approx. 4 mile from Gilbert's Resort, overseas Hwy boat ramp, Key Largo.

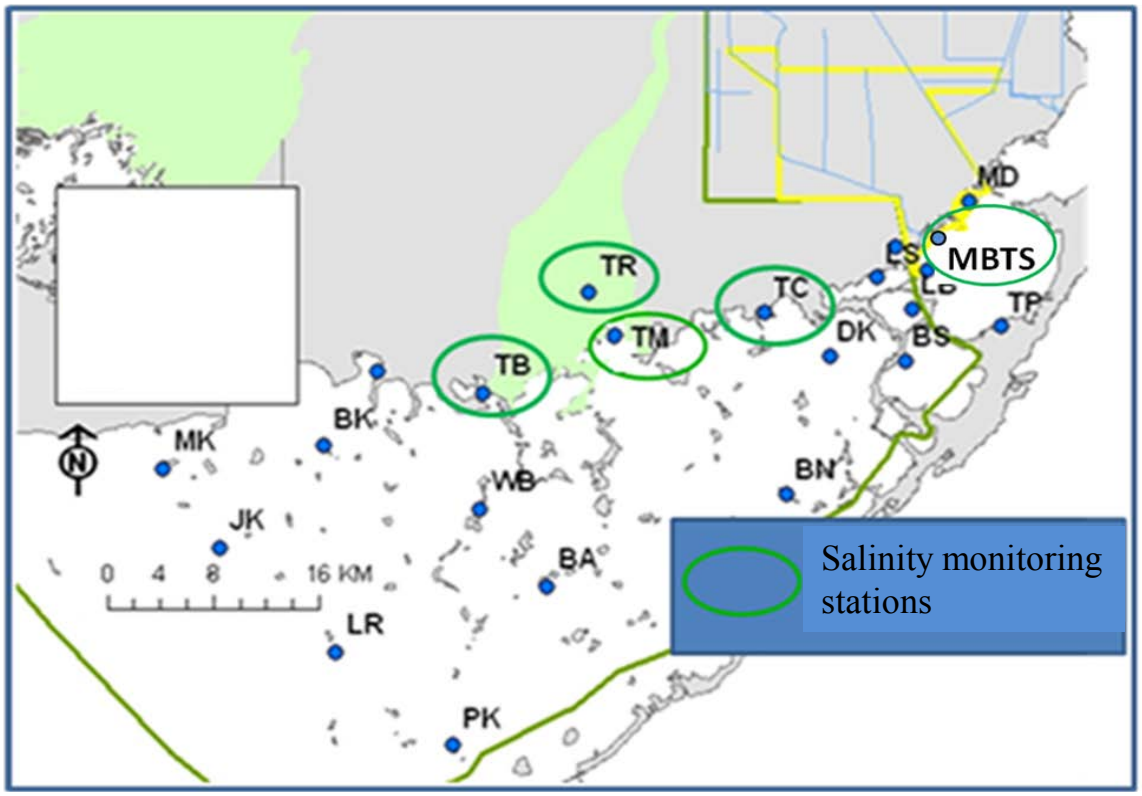

Figure 12. Salinity monitoring stations in Florida Bay.

Table 18 shows the statistical summary of salinity data collected in WY2013, and **Figure 13** shows daily average salinity concentrations at the five monitoring sites during WY2013. Overall, salinities at all stations showed a strong seasonal pattern, with lower salinity in the wet season and higher salinity in the dry season. During most of the year, salinities at those sites were below 25 practical salinity units (PSU). Hypersalinity (salinity higher than 35 PSU), a typical phenomenon in Florida Bay, was not observed at these sites.

Salinity also varied with location. Taylor River (TR) station, located in the upstream of Taylor Slough, had the lowest salinity value among the five monitoring sites due to freshwater discharge from Taylor Slough. At the downstream sites, such as Taylor Mouth (TM), salinity increased. Trout Creek (TC) and Terrapin Bay (TB) also had relatively low salinity in the wet season. Manatee Bay had the highest salinity among the five sites due to reduced freshwater inputs from the C-111 canal (S-197 only opened three times in WY2013).

Table 18. Statistical summary of salinity in Florida Bay in WY2013.
[Note: PSU – practical salinity units.]

Statitics	TB (Terrapin Bay)	TR (Taylor River)	TM (Taylor Mouth)	TC (Trout Creek)	MTBS (Manatee Bay)
Count	365	355	364	365	365
Mean (PSU)	16.4	4.2	10.7	13.5	24.3
STD (PSU)	6.8	5.2	7.8	9.5	6.1
Min (PSU)	4.7	0.5	0.8	0.5	8.8
1st Quartile (PSU)	11.5	0.8	2.4	3.8	18.5
Median (PSU)	15.0	1.2	10.1	13.5	25.3
3rd Quartile (PSU)	22.1	6.3	17.5	22.6	29.7
Max (PSU)	34.4	21.2	25.9	31.5	34.8
<15	178	333	250	208	21
Days of salinity >=15 & <25	139	22	110	101	153
Days of salinity >=25 & <30	39	0	4	54	106
Days of salinity >=30 & <35	9	0	0	2	85
Days of salinity >=35	0	0	0	0	0

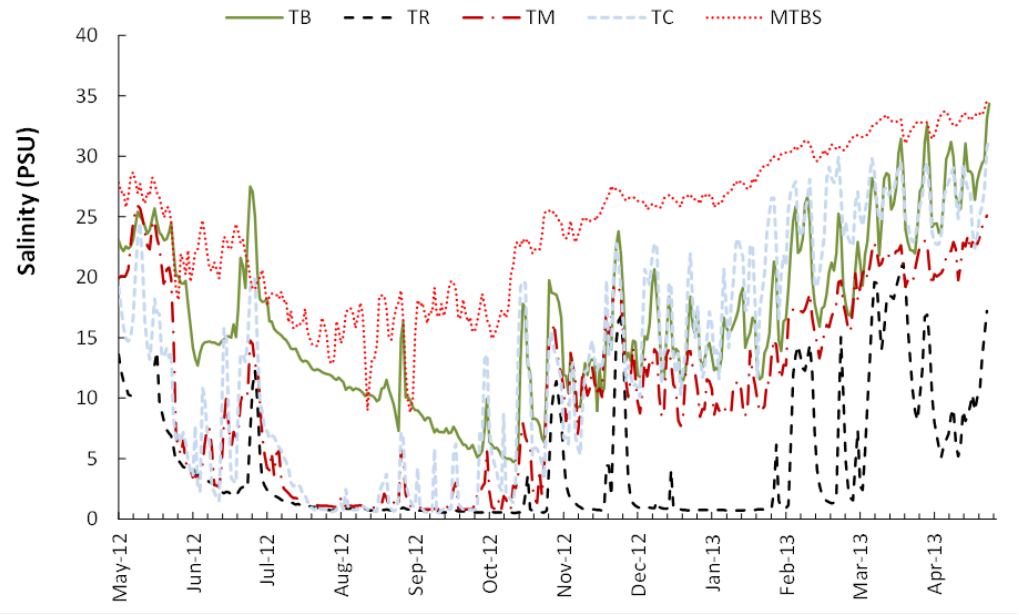

Figure 13. Daily salinity variation at five monitoring sites during WY2013.

BIOLOGICAL OPINION

The C-111 SCW Project operation implemented the terms and conditions described in the Biological Opinion, and separate reports were submitted to USFWS. Reports are available upon request.

OTHER TOXICANTS

Routine surface water and fish monitoring for other toxicants (selected pesticides and metals) under project codes PEST, PIE, and C111F, started in May 2012 at specific locations (**Figure 7**) following the monitoring requirements in Specific Condition Number 27 of CERPRA Permit Number 293559-006. Data are reported for the Phase 1 – Tier 2: Field Sampling for Initial Start-up Monitoring Prior to Discharge and sampling events collected for the Phase 2 – Tier 1 Routine Monitoring During Stabilization Period.

EVALUATION CRITERIA

Evaluation criteria are as follows:

- If concentrations of other toxicants do not exceed the critical benchmarks established in ecological risk assessments completed as part of the environmental sight assessment (ESA).
- If water column concentrations of other toxicants do not exceed the Water Quality Standard in Chapter 62-302, F.A.C.
- If levels of other toxicants in tissues do not exceed recognized background tissue concentrations or benchmarks established in ecological risk assessments completed as part of the ESA.

EVALUATION CRITERIA ASSESSMENT

The following sections provide assessments of the evaluation criteria listed above for surface water and fish.

SURFACE WATER ASSESSMENT

Surface water samples collected for pesticide analysis at sites S-332DX and S-177 (**Figure 7**) on June 14, July 23, and October 22, 2012, and January 28, 2013, did not contain any detectable levels, with the exception of the chlorpyrifos ethyl detection of 0.015 micrograms per liter (µg/L) at S-177, collected in January 2013. This detection could have a harmful impact on aquatic invertebrates because this level is greater than the calculated chronic toxicity for *Daphnia magna* (0.005 µg/L) (62-302.200, F.A.C.). At this level, exposure can cause impacts to macroinvertebrate populations. Results from subsequent routine sampling, which occurred June 2013, indicated no exceedance for chlorpyrifos ethyl; therefore, the project will continue to be monitored under Phase 2 – Tier 1 (Routine Monitoring during Stabilization Period). SFWMD notified FDEP of the January 2013 chlorpyrifos ethyl detection on July 10, 2013, and of the June 2013 sampling results on August 28, 2013.

Copper and zinc levels detected in surface water samples collected at selected locations did not exceed water quality standards (**Table 19**).

Table 19. Selected metal concentrations and Chapter 62-302, F.A.C. Class III Freshwater Standard.

Date	Station	Total Hardness (mg/L)	Metal	Concentration (µg/L)	Remark Code	Standard (µg/L)
5/3/2012	FPDAH1	212.5	copper	2.5	I [b]	17.8
			zinc	BDL [c]		226.9
	AJC1	202.8	copper	2.5	I	17.1
			zinc	BDL		218.1
7/9/2012	FPDAH1	168.6	copper	BDL		14.6
			zinc	BDL		186.5
	AJC1	173.4	copper	BDL		14.9
			zinc	BDL		191
10/8/2012	FPDAH1	198.2	copper	BDL		16.7
			zinc	BDL		213.9
	AJC1	195.3	copper	BDL		17
			zinc	BDL		211
1/8/2013	FPDAH1	186.5	copper	BDL		15.9
			zinc	BDL		203.2
	AJC1	189.4	copper	BDL		16.1
			zinc	BDL		205.8

a. µg/L – micrograms per liter

b. I – value reported is less than the practical quantification limit, and greater than or equal to the method detection limit.

c. BDL – below detection limit

FISH ASSESSMENT

Mosquitofish (*Gambusia holbrooki*) monitoring is outlined in **Table 20** for metals and **Table 21** for pesticides. Detected copper and zinc concentrations were below evaluation criteria. The zinc threshold range reported in Hinck et al. (2009) was derived from a 1976 publication, and that constraint should be considered during criteria evaluation (**Table 20**). For the first and last sampling events, site FPDAH1 was dry; therefore, mosquitofish samples could not be obtained. Pesticides detected in mosquitofish were below any critical tissue benchmarks (**Table 21**).

Concentrations of metals (**Table 22**) and pesticides (**Table 23**) detected in bluegill (*Lepomis macrochirus*) and largemouth bass (*Micropterus salmoides*) were below evaluation criteria. Other fish collected did not have any detectable metal or pesticide concentrations. We were unable to catch and largemouth bass at FPDAH1.

SUMMARY

All evaluation criteria for other toxicants monitoring in fish were met for the C-111 SCW Project. An exceedance for chlorpyrifos ethyl occurred on January 28, 2013. Results from subsequent routine sampling, during June 10, 2013, indicated no exceedance for chlorpyrifos ethyl; therefore, the project will continue to be monitored under Phase 2 – Tier 1 (Routine Monitoring during Stabilization Period).

Table 20. Summary of mosquitofish metal analysis for the C-111 SCW Project in WY2013. [Note: mg/kg – milligram per kilogram.]

Date Collected	Station	Metal (mg/kg wet weight)		Criteria				
				Tissue Residue for the Protection of Human Health (mg/kg) (Environment Canada, 1999)		Toxicity Thresholds for Fish and Wildlife (mg/kg) (Hinck et al., 2009)		No Observed Adverse Effect Levels (mg/kg body weight per day) (USEPA, 2007)
		Copper	Zinc	Copper	Zinc	Copper	Zinc	Zinc
5/3/2012	AJC1	1.7 A[a]	53 A	400	3,200	11.0 to 42.0	40 to 64	66.1
	FPDAH1	Site dry, no sample						
7/17/2012	AJC1	1.9 A	42 A					
	FPDAH1	2.02	32.6					
10/15/2012	AJC1	1.48	35.5					
	FPDAH1	1.89 A	35.2 A					
1/10/2013	AJC1	1.4	47.6					
	FPDAH1	1.69	42.6					
4/16/2013	AJC1	1.24	42.2					
	FPDAH1	Site dry, no sample						

a: A – value reported is the mean of two or more determinations.

Table 21. Summary of mosquitofish pesticide analysis for the C-111 SCW Project in WY2013.

Date Collected	Station	DDTr µg/kg wet weight (includes o,p'-DDD, p,p'-DDD, o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT) [a]	Criteria								
			p,p'-DDE µg/kg wet weight screening levels correspond to exposure equal to no observed adverse effects levels, wet weight basis, for overall receptor diet. (Newfields 2006)					Whole fish benchmark for protection of fish eating wildlife (Newell, et. al 1987)	Whole fish total DDTr µg/kg dry weight; tissue residue (Environment Canada 1999)		Total DDTr µg/kg dry weight (USEPA 2000)
			Bald eagle	Great blue heron	Little blue heron	White pelican	Wood stork	Whole fish total DDTr µg/kg wet weight	Protection of fish-consuming birds	Available tissue residue for protection of human health	Screening value for recreational fishers
5/3/2012	AJC1	BDL [b]	14,700	10,000	5,200	12,200	10,100	200	1,000	320	117
	FPDH1	Site dry, no sample									
7/17/12	AJC1	1.8 I [c]									
	FPDH1	BDL									
10/15/2012	AJC1	2.5 I									
	FPDH1	2.1 I									
1/10/2013	AJC1	3.8 I									
	FPDH1	2.2 I									
4/16/2013	AJC1	2.8 I									
	FPDH1	Site dry, no sample									

a. µg/kg – micrograms per kilogram

o,p'-DDD: ortho, para **d**ichloro**d**iphenyl**d**ichloroethane

p,p'-DDD: para, para **d**ichloro**d**iphenyl**d**ichloroethane

o,p'-DDE: ortho, para **d**ichloro**d**iphenyldichloro**e**thylene

p,p'-DDE: para, para **d**ichloro**d**iphenyldichloro**e**thylene

o,p'-DDT: ortho, para **d**ichloro**d**iphenyl**t**richloroethane

p,p'-DDT: para, para **d**ichloro**d**iphenyl**t**richloroethane

b. BDL - below detection limit

c. I – value reported is less than the practical quantification limit, and greater than or equal to the method detection limit

Table 22. Summary of large bodied fish metal analysis for the C-111 SCW Project in WY2013.

Metal mg/kg	Sampling Date, Station, and Fish		Criteria		
	10/10/2012		Tissue Residue for the Protection of Human Health (mg/kg) (Environment Canada, 1999)	Toxicity Thresholds for Fish and Wildlife (mg/kg) (Hinck et al., 2009)	No Observed Adverse Effect Levels (mg/kg body weight per day) (USEPA, 2007)
	AJC1	FPDAH1			
copper	Bluegill: 0.24 I [a] Bluegill: 0.25 I Bluegill: 0.3 I Bluegill: 0.31 I Bluegill: 0.41 I	Bluegill: 0.26 I Bluegill: 1.33 Bluegill: 0.3 I Bluegill: 0.43 I	400	11.0 to 42.0	NC
zinc	Bass: 3.6 I Bass: 4.5 I Bass: 3.5 I Bluegill: 18.6 Bluegill: 20.8 Bluegill: 20.4 Bluegill: 19 Bluegill: 25.3	Bluegill: 15.4 Bluegill: 13.2 Bluegill 13.3 Bluegill:12.5 Bluegill: 15.1	3,200	40 to 64	66.1

a. I - value reported is less than the practical quantification limit, and greater than or equal to the method detection limit.

NC – no criteria

Table 23. Summary of large bodied fish pesticide analysis for the C-111 SCW Project in WY2013.

Date Collected	Station	DDTr µg/kg wet weight (includes o,p'-DDD, p,p'-DDD, o,p'-DDE, p,p'-DDE, o,p'-DDT, p,p'-DDT) [a]	Criteria								
			p,p'-DDE µg/Kg wet weight screening levels correspond to exposure equal to no observed adverse effects levels, wet weight basis, for overall receptor diet (Newfields 2006)					Whole fish benchmark for protection of fish eating wildlife (Newell, et. al 1987)	Whole fish total DDTr µg/kg dry weight; tissue residue (Environment Canada 1999)		Total DDTr µg/kg dry weight (USEPA 2000)
			Bald eagle	Great blue heron	Little blue heron	White pelican	Wood stork	Whole fish total DDTr µg/kg wet weight	Protection of fish-consuming birds	Available tissue residue for protection of human health	Screening value for recreational fishers
10/10/2012	FPDAH1	Bluegill 2.8 I [b] Bluegill 2.9 I	14,700	10,000	5,200	12,200	10,100	200	1,000	320	117

a. µg/kg – micrograms per kilogram.

o,p'-DDD: ortho, para **d**ichloro**d**iphenyl**d**ichloroethane

p,p'-DDD: para, para **d**ichloro**d**iphenyl**d**ichloroethane

o,p'-DDE: ortho, para **d**ichloro**d**iphenyldichloro**e**thylene

p,p'-DDE: para, para **d**ichloro**d**iphenyldichloro**e**thylene

o,p'-DDT: ortho, para **d**ichloro**d**iphenyl**t**richloroethane

p,p'-DDT: para, para **d**ichloro**d**iphenyl**t**richloroethane

b. I - value reported is less than the practical quantification limit, and greater than or equal to the method detection limit

MERCURY

The District is mandated to implement monitoring and evaluation of mercury in specific media in restoration projects that may potentially discharge water with negative impacts to downstream receiving waters; this is described in the A Protocol for Monitoring Mercury and Other Toxicants, referred to as the Protocol (FDEP and SFWMD, 2011). The C-111 SCW Project is currently under Phase 2 – Tier 1: Routine Monitoring during Stabilization Period. For the next three water years, beginning in WY2013, surface water will be collected quarterly for total mercury (THg) and methylmercury (MeHg) analysis. Mosquitofish composite samples will be collected quarterly, while large-bodied fish (sunfish, *Lepomis sp.*, and largemouth bass) will be collected annually, for THg analysis at designated stations described in the project's mercury and other toxicants monitoring plan.

Surface water samples were collected at station S332DX located at the eastern end of the land in front of the S-332D structure. Mosquitofish composites and large-bodied fish were collected at station AJC1 in the Aerojet Canal south of the fish farm, and at station FPDAH1 in the FPDA header canal (**Figure 7**).

SURFACE WATER ASSESSMENT

During the first year Phase 2 – Tier 1 monitoring period in WY2013, no surface water THg sample exceeded the Florida Class III water quality standard of 12 nanograms per liter (ng/L). Surface water samples were collected at station S332DX quarterly for THg and MeHg analysis (**Table 24**). THg concentrations ranged from 0.20 to 0.64 ng/L, with an average of 0.33 ng/L. The THg concentration fluctuated over time, and there was no apparent trend of change during WY2013. THg concentrations are well below the U.S. Environmental Protection Agency (USEPA) standard of 12 ng/L. MeHg concentrations ranged from 0.011 to 0.025 ng/L, with no data for the second quarter.

Table 24. Surface water THg and MeHg levels in station S332DX during quarterly collection in WY2013.

Collection date	THg (ng/L)	MeHg (ng/L)
7/26/2012	0.28	0.011*
10/11/2012	0.21	ND**
1/16/2013	0.20	0.011*
4/16/2013	0.64	0.025

* Detected values were -0.022 ng/L which were converted to half of the absolute value

** No data

MOSQUITOFISH ASSESSMENT

Quarterly composite samples (N=1 per station) of mosquitofish (≥100 fish/composite) and annual collection of sunfish (N=5) and largemouth bass (N=5) during the first year Phase 2 – Tier 1 monitoring period are used for fish total mercury analysis. During WY2013, except for the THg concentration (0.100 mg/kg) in mosquitofish collected in the first quarter, the subsequent collection did not contain any composite samples with a THg concentration that exceeded the 75th percentile (THg = 0.070 mg/kg) for the period of record, for all monitoring stations in the Everglades Protection Area (**Table 25**). The average mosquitofish composite THg concentrations are approximately an order of magnitude below the 75th percentile for all Everglades Protection Area basins, and are also well below the USEPA criterion for trophic level 3 fish (0.077 milligram per kilogram [mg/kg]).

Table 25. Total mercury level in mg/kg in quarterly mosquitofish composite samples collected during WY2013.

Collection date	AJC1	FPDAH1
3-May-12	0.1	ND*
17-Jul-12	0.051	0.011
15-Oct-12	0.013	0.013
10-Jan-13	0.011	0.012
16-Apr-13	0.016	ND*
Average	**0.038**	**0.012**

*No data

LARGE-BODIED FISH ASSESSMENT

The target size range (total length) for sunfish described in the Protocol is from 102 millimeter (mm) to 178 mm. The target size range for largemouth bass is from 307 mm to 385 mm (FDEP and SFWMD, 2011). All 10 individual sunfish collected from the two monitoring sites were bluegill sunfish, and were within the target size ranges. All largemouth bass were also within the target size range. No largemouth bass samples were collected at the FPDA (FPDAH1).

During the first year Phase 2 – Tier 1 monitoring period, bluegill sunfish THg concentrations ranged from 0.014 to 0.200 mg/kg, with an average of 0.117, while largemouth bass THg concentrations ranged from 0.309 to 0.820 mg/kg, with an average of 0.602 mg/kg. Despite exceedances by two largemouth bass, no sunfish or largemouth bass annual average THg concentrations exceed the 75th percentile (THg = 240 mg/kg for sunfish and 678 mg/kg for largemouth bass) for the period of record for all monitoring stations in the Everglades Protection Area (**Table 26**).

Table 26. THg (mg/kg) in large-bodied fish collected on October 10, 2012.

Species	AJC1			FPDAH1		
	Average	Standard Deviation	Count	Average	Standard Deviation	Count
Bluegill sunfish	0.117	0.053	5	0.019	0.005	5
Largemouth bass	0.602	0.196	5	No data		

SUMMARY

Mercury concentrations in surface water and fish samples were measured during the project first year Phase 2 – Tier 1 monitoring period (WY2013). Surface water THg and MeHg concentrations are below the 75th percentile for all basins, and below the USEPA criterion for THg concentration. The THg concentration in mosquitofish collected at AJC1 on May 3, 2012, was above the 75th percentile for the C-111 basin. Further sample collection during the subsequent three quarters showed that mosquitofish THg concentrations were well below the 90th percentile for the C-111 basin. Mosquitofish samples taken at FPDAH1 showed that THg levels were well below the 75th percentile level for C-111 basin. No sunfish annual average THg concentrations exceeded the 75th percentile (THg = 240 mg/kg for sunfish, and 678 mg/kg for largemouth bass) for the period of record, for all monitoring stations in the Everglades Protection Area.

LITERATURE CITED

Environment Canada. 1999. A Compendium of Environmental Quality Benchmarks. Environment Canada, Vancouver, British Columbia.

FDEP. 2013. Technical Support Document, Derivation of Dissolved Oxygen Criteria to Protect Aquatic Life in Florida's Freshwaters and Marine Waters. DEP-SAS-001/13, Florida Department of Environmental Protection, Tallahasee, FL. March 2013

FDEP and SFWMD. 2011. A Protocol for Monitoring Mercury and Other Toxicants. Florida Department of Environmental Protection, Tallahasee, FL, and South Florida Water Management District, West Palm Beach, FL.

Hinck, J.E., C.J. Schmitt, K.A. Chojnacki and D.E. Tillitt. 2009. Environmental contaminants in freshwater fish and their risk to piscivorous wildlife based on a national monitoring program. *Environmental Monitoring and Assessment*, 152:469-494.

Newell, A.J., D.W. Johnson and L.K. Allen. 1987. Niagara River Biota Contamination Project-fish Flesh Criteria for Piscivorous Wildlife. Technical Report 87-3, New York State Department of Environmental Conservation, Division of Fish and Wildlife, Bureau of Environmental Protection, Albany, NY.

Newfields. 2006. Risk Based Screening Levels for Select Organochlorine Pesticides in Sediment and Fish Tissue. Prepared for South Florida Water Management District, West Palm Beach, FL.

SFWMD, 2011. Field Sampling Quality Manual. South Florida Water Management District, West Palm Beach, FL.

SFWMD, 2012. C hemistry Laboratory Quality Manual, SFWMD-LAB-QM-2012-01. South Florida Water Management District, West Palm Beach, FL.

SFWMD. 2013. Preliminary Project Operating Manual, C-111 Spreader Canal Western Project. South Florida Water Management District, West Palm Beach, FL.

USACE and SFWMD. 2011. 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, FL, and South Florida Water Management District, West Palm Beach, FL.

USEPA. 2000. Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories, Volume 1: Fish Sampling and Analysis, (3rd edition). EPA 823-B-00-007, Office of Water, U.S. Environmental Protection Agency, Washington, DC.

USEPA. 2007. Ecological Soil Screening Levels for Zinc. Interim Final: OSWER Directive 9285.7-73. Office of Solid Waste and Emergency Response, United States Environmental Protection Agency, Washington, DC.

Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented in this report for the C-111 Spreader Canal Phase 1 (Western) Project (CERPRA permit 0293559-007).

Specific Condition	Description	Applicable Phase	Action Taken	Reported in 2014 SFER Vol. III, App. 2-4 in			
				Narrative (page #s)	Figure	Table	Attachment
2	Threatened and Endangered Species	Construction and Operation	No action needed				
3	Contaminated Sites and Residual Agrichemicals	Construction and Operation	No contamination found after initial operations				
4	Wetland Impact and Restoration	Operation	Routine operation followed the Preliminary Project Operating Manual (2013)				
22	Project Operation Plan	Operation	Operation was consistent with the Preliminary Project Operating Manual (2013)	6 – 8		3 – 5	
23	Water Quality Compliance, Hydrometeorological and Ecological Monitoring Plans	Operation	Monitoring plans were reviewed, and monitoring reduction was approved in October 2012	9, 18, 25	2		
24	Pump Testing and Maintenance	Operation	Pumps were in operation most of the time				
25	Emergency Discharge Frog Pond Detention Area	Operation	No action needed				
26	Public Health, Safety, and Welfare	Operation	Discharges did not pose a serious danger to public health/safety/welfare				
27	Water Quality Monitoring	Operation	Water quality monitoring program conducted as required	18 – 25	7 – 10	12 – 15	B
28	Start-up Monitoring for Frog Pond Detention Area (modified in 0293559-006)	Operation	Two start-up sampling events were conducted and reports were submitted as required				
29	Mercury and Pesticide Monitoring	Operation	Revised mercury and pesticide monitoring plans were submitted as required.	30 – 37	7	19 – 26	

Table A-1. Continued.

Specific Condition	Description	Applicable Phase	Action Taken	Reported in 2014 SFER Vol. III, App. 2-4 in			
				Narrative (page #s)	Figure	Table	Attachment
30	Removal of Monitoring Requirements	Operation	None	6			
31	Addition of Monitoring Requirements	Operation	Not needed				
32	Facility Inspection Plan and Reports	Operation	The first annual inspection was done in September 2012 and will be reported in the next annual report.	9			
33	Construction Status Report	Construction	Construction meeting minutes from the biweekly construction meetings during construction were submitted.				
34	As-Built Certification and Record Drawings	Construction	As-Built and Certification of Completion were submitted on March 19, 2012				
35	Annual Reports	Operation	Annual report completed and submitted as required	All	All	All	All
36	Emergency Suspension of Sampling	Operation	Not needed				

Attachment B: Water Quality Data

This project information is required by Specific Condition 35 of the C-111 Spreader Canal Phase 1 (Western) Project permit (0293559-007), and is available upon request.

Attachment C: Hydrologic Data

This project information is required by Specific Condition 35 of the C-111 Spreader Canal Phase 1 (Western) Project permit (0293559-007), and is available upon request.