

Settlement Agreement Report

First Quarter
January – March 2018

Prepared for the
Technical Oversight Committee

July 12, 2018



Shark River Slough compliance results are published annually in this report when the final approved flow data for a federal water year (WY) are available. The WY 2018 (October 1, 2017 – September 30, 2018) results will be published at that time.

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PURPOSE

The South Florida Water Management District has prepared this report to provide a quarterly update to the Everglades Technical Oversight Committee on the compliance status with total phosphorus levels or limits defined in the 1991 Settlement Agreement, entered as a Consent Decree in 1992, and modified in 1995. The areas of interest in this report include the interior marsh stations in the Arthur R. Marshall Loxahatchee National Wildlife Refuge and two discharges to Everglades National Park: inflows to Shark River Slough and inflows to Taylor Slough and Coastal Basins.

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ACRONYMS AND ABBREVIATIONS

cfs	cubic feet per second
ENP	Everglades National Park
feet NGVD29	feet relative to the National Geodetic Vertical Datum of 1929
FWMC	flow-weighted mean concentration
kac-ft	thousand acre-feet
ppb	parts per billion
Refuge	Arthur R. Marshall Loxahatchee National Wildlife Refuge
STA	Stormwater Treatment Area
TOC	Everglades Technical Oversight Committee
TP	total phosphorus
µg/L	micrograms per liter
WCA	Water Conservation Area
WY	Water Year

EXECUTIVE SUMMARY

This report fulfills the South Florida Water Management District's reporting requirements under the 1991 Settlement Agreement, entered as a Consent Decree in 1992 and modified in 1995, for the first quarter of 2018 (January - March 2018). Total phosphorus (TP) compliance highlights for this period are summarized below for the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) and inflows to Everglades National Park (ENP) (**Table 1** and **Figure 1**):

- **Refuge:** The geometric mean TP concentration was below the long-term level for January, February, and March 2018.
- **Shark River Slough:** The provisional results of two calculation methods based upon provisional data are presented. The final Water Year (WY) 2018 (October 1, 2017 - September 30, 2018) 12-month TP flow-weighted mean concentrations (FWMCs) will be published at a later date when the final approved flow data are available for the current federal WY.
- **Taylor Slough and Coastal Basins:** All of the 12-month TP FWMCs calculated using Method 1, Method 2, or Method 3 were below the 12-month long-term limit of 11 parts per billion (ppb) during the first quarter of 2018 (January 1 - March 31, 2018).

Table 1. First quarter 2018 TP compliance results for the Refuge, TP calculation provisional tracking results for Shark River Slough, and TP calculation tracking results for Taylor Slough and Coastal Basins.

Month	Geometric Mean TP Concentration (ppb)	Long-Term Level (ppb)	Mean Stage (feet NGVD29)	Number of Samples	
Arthur R. Marshall Loxahatchee National Wildlife Refuge					
Jan 2018	4.5	7.3	17.12	14	
Feb 2018	5.8	8.2	16.85	14	
Mar 2018	6.0	9.9	16.45	14	
12-Month Period Ending	Total Flow (kac-ft)	12-Month TP FWMC (ppb)	Long-Term Limit (ppb)	Percent of Sampling Events Greater than 10 ppb	
				Guideline	Observed
Everglades National Park – Shark River Slough – PROVISIONAL DATA and RESULTS					
Jan 2018	1,795.0 (1,799.8)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Feb 2018	1,832.3 (1,837.0)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Mar 2018	1,842.2 (1,846.9)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	28.0 (28.0)
Everglades National Park – Taylor Slough and Coastal Basins					
Jan 2018	464.4 (545.5, 539.1)	6.0 (6.1, 6.0)	11.0	53.1	2.3 (1.8, 1.8)
Feb 2018	485.3 (566.4, 547.9)	6.0 (6.1, 6.0)	11.0	53.1	2.3 (1.9, 1.9)
Mar 2018	499.1 (580.1, 555.0)	6.1 (6.1, 6.1)	11.0	53.1	2.2 (2.0, 2.0)

Notes:

- Key to units: ppb – parts per billion (values are actually in µg/L [micrograms per liter], which, for the purposes of this report, are equivalent to ppb); feet NGVD29 – elevation in feet relative to the National Geodetic Vertical Datum of 1929; and kac-ft – thousand acre-feet.
- Compliance for inflows to ENP (Shark River Slough, and Taylor Slough and Coastal Basins) is evaluated annually based on the 12-month TP FWMC for the federal WY ending on September 30.
- For an explanation of the multiple results for ENP inflows, see **Tables 3** and **4**.

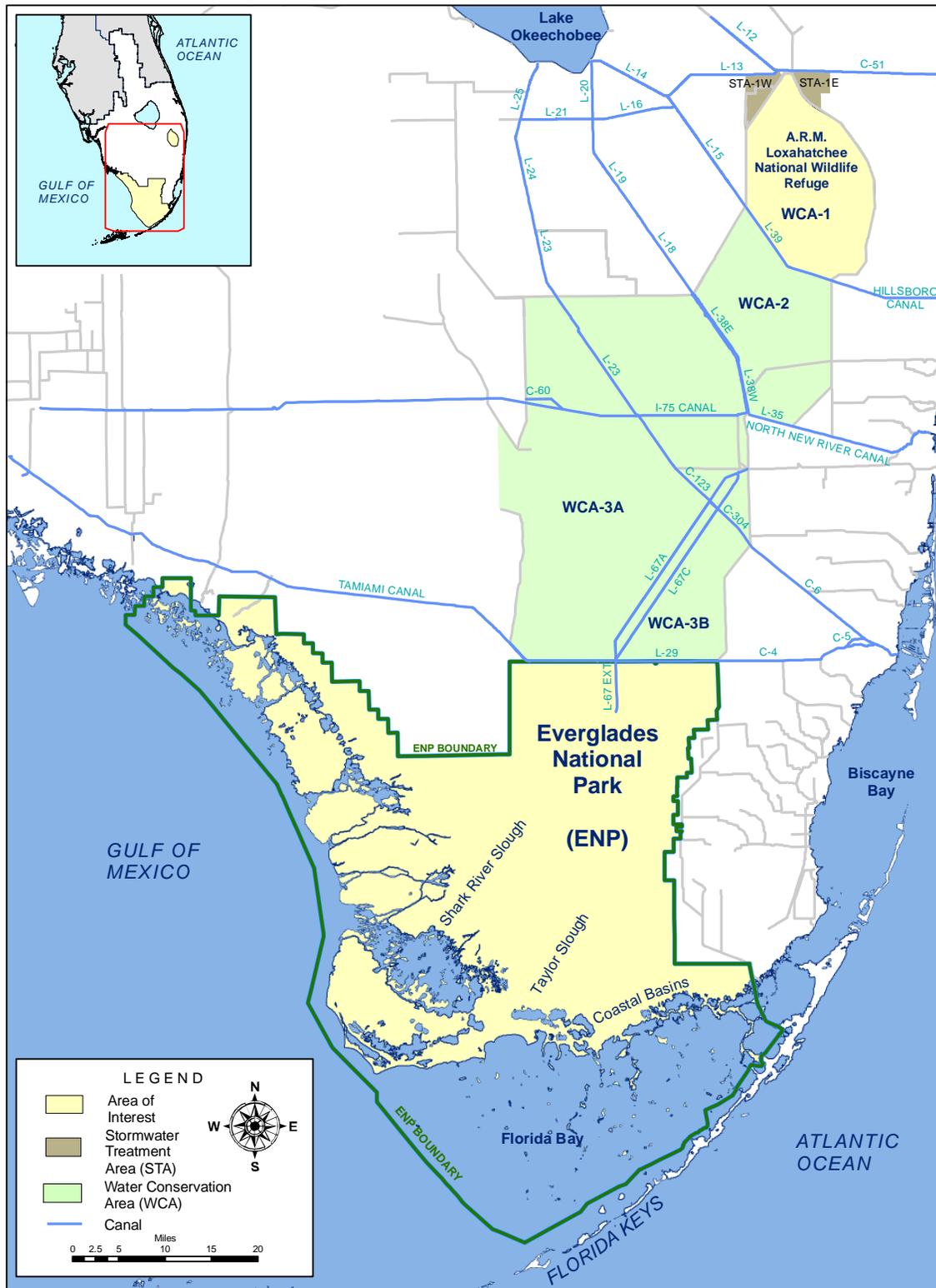


Figure 1. Areas of interest.

ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE

Background

The 1991 Settlement Agreement ended the Everglades lawsuit and was entered into by the federal government, the State of Florida, and the South Florida Water Management District. The subsequent Consent Decree, as modified in 1995, specified that interim and long-term TP concentration levels for the Refuge must be met by February 1, 1999, and December 31, 2006, respectively. Both the interim and long-term concentration levels vary monthly because they are calculated as a function of water stage measured at gaging stations 1-7, 1-8C, and 1-9 within the Refuge. The stage range within which the interim and long-term concentration levels are applicable is 15.42 to 17.14 feet relative to the National Geodetic Vertical Datum of 1929 (NGVD29). The monthly TP concentrations are determined from water samples collected at 14 interior marsh stations, LOX3 through LOX16 (**Figure 2**). As required in the Consent Decree, the concentrations are converted to a geometric mean, which is compared to the long-term concentration level. Monthly TP data for each station for the past 36 months are provided in **Appendix A**. The calculation methods specified in the Consent Decree are provided in **Appendix D**.

Reporting Period Update

All of the 14 stations were sampled in January, February, and March 2018. Sampling day average stages in the Refuge were 17.12, 16.85, and 16.45 feet NGVD29 in January, February, and March 2018, respectively (**Figure 3** and **Table 2**). The geometric means calculated from TP concentrations measured in water samples collected in January, February, and March 2018 were 4.5, 5.8, and 6.0 ppb, respectively. The geometric mean TP concentrations were below the long-term levels during the reporting period.

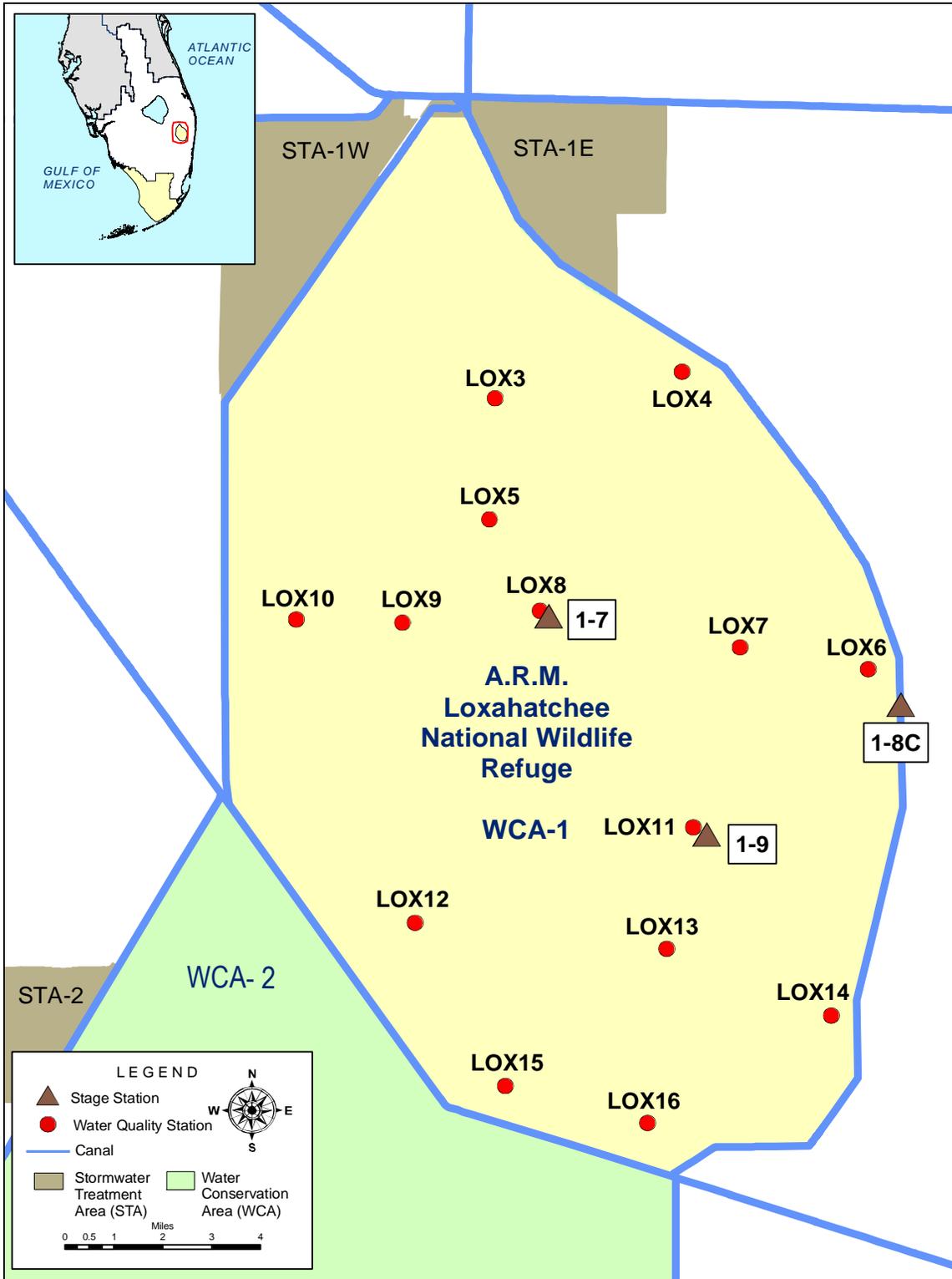


Figure 2. Refuge water quality sampling and stage measurement stations.

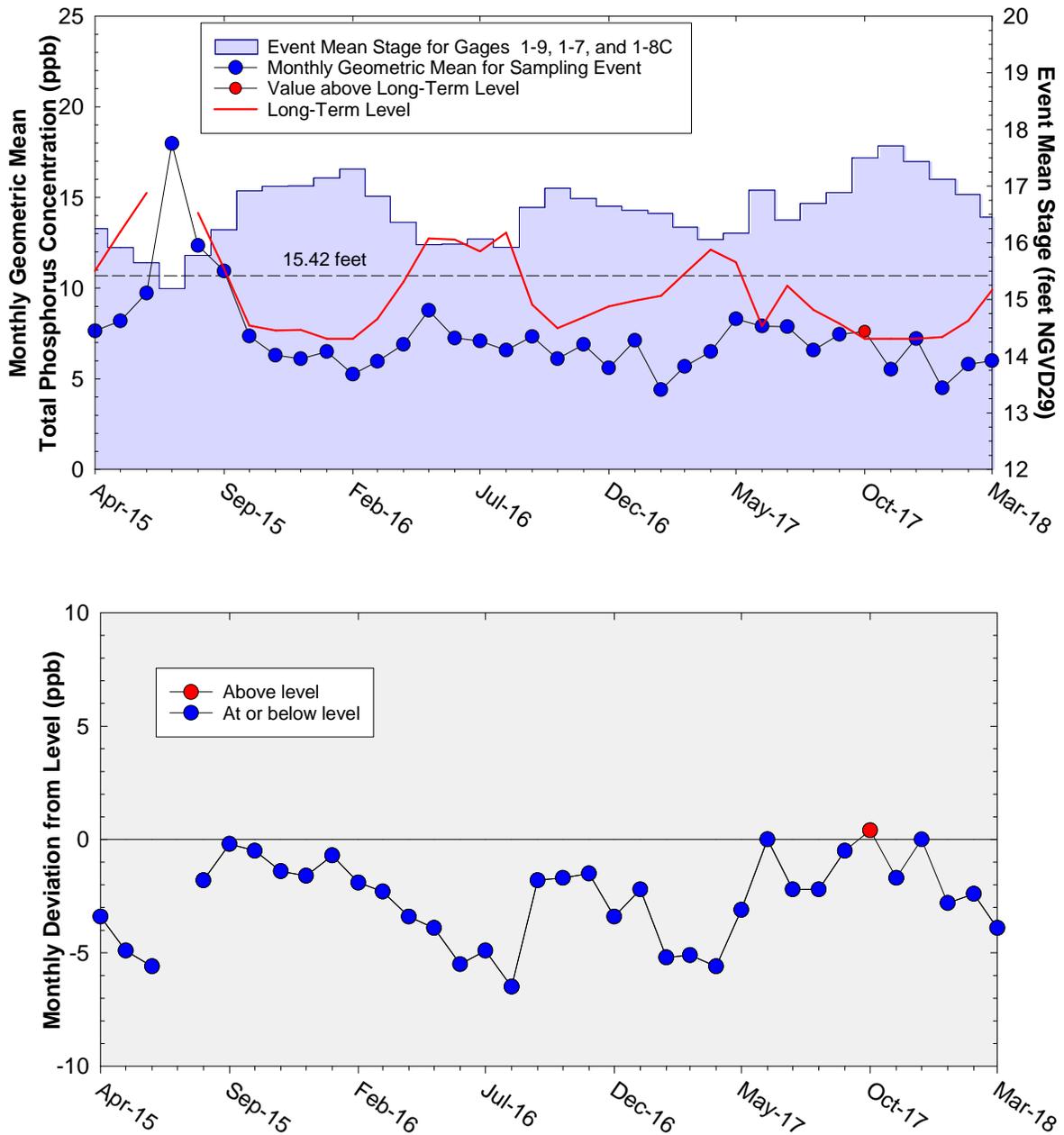


Figure 3. (A) Monthly TP geometric mean concentrations for the Refuge compared to calculated long-term levels, which are adjusted for fluctuations in stage. The geometric mean TP concentration was above the long-term level in October 2017. The long-term level was not applicable for July 2015 because the sampling event average stage was less than 15.42 feet NGVD29. **(B)** Deviation of monthly geometric mean TP concentrations from calculated long-term levels. Negative values indicate that the geometric mean was lower than the long-term level.

Table 2. Refuge TP compliance tracking.

Month	Geometric Mean TP Concentration (ppb)	Long-Term Level (ppb) <i>Effective 12/31/2006</i>	Average Stage ^a (ft NGVD29)	Number of Samples
Apr-2015	7.6	11.0	16.25	12
May-2015	8.2	13.1	15.91	10
Jun-2015	9.7	15.3	15.65	5
Jul-2015	18.0	NA	15.19	2
Aug-2015	12.3	14.1	15.78	8
Sep-2015	10.9	11.1	16.23	14
Oct-2015	7.4	7.9	16.92	14
Nov-2015	6.3	7.7	17.00	14
Dec-2015 ^b	6.1 (5.9)	7.7 (7.6)	17.00 (17.02)	12 (14)
Jan-2016	6.5	7.2	17.15	14
Feb-2016	5.3	7.2	17.30	14
Mar-2016	6.0	8.3	16.82	14
Apr-2016	6.9	10.3	16.36	14
May-2016	8.8	12.7	15.96	9
Jun-2016	7.2	12.7	15.97	9
Jul-2016	7.1	12.0	16.07	13
Aug-2016	6.6	13.1	15.92	6
Sep-2016	7.3	9.1	16.62	14
Oct-2016	6.1	7.8	16.96	14
Nov-2016	6.9	8.4	16.78	14
Dec-2016	5.6	9.0	16.64	14
Jan-2017	7.1	9.3	16.57	13
Feb-2017	4.4	9.6	16.52	13
Mar-2017	5.7	10.8	16.28	12
Apr-2017	6.5	12.1	16.06	7
May-2017	8.3	11.4	16.17	13
Jun-2017	7.9	7.9	16.93	14
Jul-2017	7.9	10.1	16.40	13
Aug-2017	6.6	8.8	16.69	14
Sep-2017	7.5	8.0	16.89	13
Oct-2017	7.6	7.2	17.50	14
Nov-2017	5.5	7.2	17.71	14
Dec-2017	7.2	7.2	17.43	14
Jan-2018	4.5	7.3	17.12	14
Feb-2018	5.8	8.2	16.85	14
Mar-2018	6.0	9.9	16.45	14

Notes:

- Key to units: ppb – parts per billion (values are actually in µg/L [micrograms per liter], which, for the purposes of this report, are equivalent to ppb); and feet NGVD29 – elevation in feet relative to the National Geodetic Vertical Datum of 1929.
 - Highlighted rows with bold, italicized text indicate when an excursion over the long-term level occurred.
- a. Average stage is calculated using stage elevations at stations 1-7, 1-8C, and 1-9 for a given sampling date.
- b. December 2015 values for the Refuge that include resampled data (at LOX14 and LOX15) are presented in parentheses.

EVERGLADES NATIONAL PARK

Shark River Slough

Background

The Settlement Agreement/Consent Decree (1995) specified that interim and long-term TP concentration limits for discharges into ENP (**Figure 4**) through Shark River Slough be met by October 1, 2003, and December 31, 2006, respectively. It was specified that the TP concentrations be presented as 12-month flow-weighted means. Only the TP concentrations for the WY ending September 30 are evaluated for compliance with the Consent Decree limits (**Appendix D**). The long-term TP concentration limit for inflows to Shark River Slough is represented by concentrations delivered through S12A, S12B, S12C, and S12D during the Outstanding Florida Waters baseline period of March 1, 1978, to March 1, 1979, and is adjusted for variations in flow. Inflow concentrations of TP through S12A, S12B, S12C, S12D, S333, S355A, and S355B are compared to the interim and long-term limits at the end of each WY (October 1 through September 30). The long-term limit went into effect in WY 2007.

Routine monitoring was changed to weekly for all Shark River Slough sites beginning in August 2007. In accordance with Appendix A of the Consent Decree, only the every-other-week grab concentration data were used for the FWMC calculations from October 2007 forward. Weekly TP data for each station for the past 12 months are provided in **Appendix B**.

Pursuant to agreement among all Everglades Technical Oversight Committee (TOC) members at the May 14, 2013, TOC meeting, the following three changes were made to the quarterly Settlement Agreement Report: (1) publishing of the quarterly 12-month TP FWMCs for Shark River Slough is discontinued, (2) provisional quarterly 12-month TP FWMCs are posted separately to the TOC website, <https://www.sfwmd.gov/our-work/toc>, and (3) the annual 12-month TP FWMC for the WY ending on September 30 will be published once the final approved flow data for the S12A, S12B, S12C, and S12D structures become available. These changes have been implemented beginning with the January - March 2013 first quarter report. Based on a vote by the TOC on July 19, 2016, provisional 12-month results are now included in the Executive Summary of this report.

The TOC has recognized that the S356 seepage return pump, which initiated operation under the United States Army Corps of Engineers field test in fall 2015, has the ability to discharge water that originated from the Water Conservation Areas (WCAs) to Shark River Slough. The Appendix A Subteam has been tasked with recommending an appropriate method for incorporating S356 into the compliance calculation. Since adoption of a single appropriate method has not yet been made by the TOC, this report contains results based upon two calculation methods. Method 1 is TP FWMC computed as $S12s + (S333 + S355A + S355B - S334)$. Method 2 is TP FWMC computed as $S12s + (S333 + S355A + S355B + S356 - S334)$ using all flow and TP grabs on biweekly compliance sampling dates. Neither method excludes S334 flow from the total flow for long-term limit calculations.

Beginning with the 12-month period ending October 2015, both Method 1 and Method 2 (in parenthesis) values have been presented.

Both results of the alternative methods for the 12-month TP FWMCs were 9.8 ppb and higher than the long-term limits (Method 1 was 7.9 ppb and Method 2 was 7.8 ppb) for the 12-month period ending on September 30, 2017. Therefore, inflows to Shark River Slough did not meet the TP limit for WY 2017 (October 1, 2016 – September 30, 2017). At the May 1, 2018, meeting, representatives of the TOC determined that the WY 2017 Shark River Slough FWMC TP exceedance was the result of extraordinary natural phenomena.

Reporting Period Update

Table 3 presents the provisional 12-month FWMCs for each month with the corresponding long-term TP concentration limits calculated using the provisional 12-month period flow. WY 2018 flow data for the S12s are provisional values.

It is anticipated that the final approved flow data for WY 2018 will be available in April 2019. The annual 12-month TP FWMC will be calculated to determine compliance with the long-term limit and will be published as a revision to the July – September 2017 third quarter report.

In addition to the provisional quarterly 12-month FWMCs that are posted separately to the TOC website, the water quality data for Shark River Slough are available in **Appendix B** of this report.

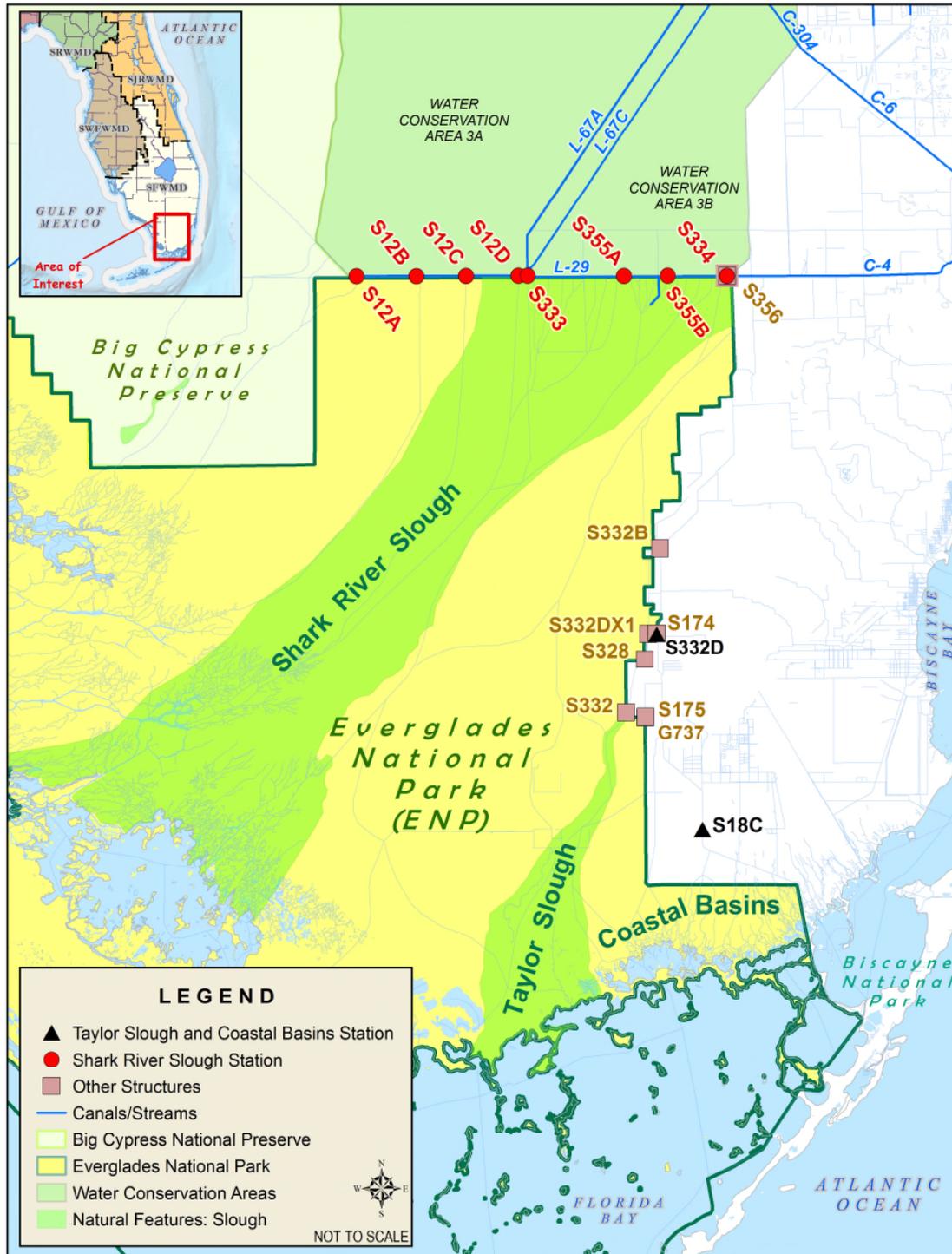


Figure 4. ENP flow structures.

Table 3. Provisional Shark River Slough TP compliance tracking.

12-Month Period	Total Flow (kac-ft)	Flow-Weighted Mean TP Concentration (ppb)	Long-Term Limit (ppb) <i>Effective 12/31/2006</i>	Percent of Sampling Events Greater than 10 ppb	
				Guideline	Observed
May 2014 - Apr 2015	524.2	12.0	10.4	54.5	39.1
Jun 2014 - May 2015	507.3	12.0	10.5	55.0	33.3
Jul 2014 - Jun 2015	491.6	11.0	10.6	55.5	26.3
Aug 2014 - Jul 2015	429.7	8.8	10.9	57.6	17.6
Sep 2014 - Aug 2015	354.2	8.0	11.4	60.2	6.7
Oct 2014 - Sep 2015	267.0	7.7	11.9	63.4	7.7
Nov 2014 - Oct 2015	288.7 (303.8)	8.5 (8.5)	11.8 (11.7)	62.6 (62.0)	15.4 (15.4)
Dec 2014 - Nov 2015	254.4 (285.3)	8.8 (8.7)	12.0 (11.8)	63.9 (62.7)	15.4 (15.4)
Jan 2015 - Dec 2015	356.8 (398.3)	8.1 (7.9)	11.4 (11.1)	60.1 (58.7)	15.4 (15.4)
Feb 2015 - Jan 2016	458.9 (511.3)	7.6 (7.4)	10.8 (10.5)	56.6 (54.9)	15.4 (15.4)
Mar 2015 - Feb 2016	639.4 (691.9)	6.9 (6.8)	9.8 (9.5)	50.9 (49.4)	15.4 (15.4)
Apr 2015 - Mar 2016	848.3 (900.8)	6.6 (6.5)	8.7 (8.4)	45.1 (43.8)	7.7 (7.7)
May 2015 - Apr 2016	995.3 (1,047.9)	6.7 (6.6)	7.9 (7.7)	41.6 (40.4)	6.7 (6.7)
Jun 2015 - May 2016	1,076.9 (1,129.6)	6.8 (6.8)	7.6 (7.6)	40.1 (40.1)	11.1 (11.1)
Jul 2015 - Jun 2016	1,147.8 (1,200.5)	7.0 (6.9)	7.6 (7.6)	40.1 (40.1)	15.0 (15.0)
Aug 2015 - Jul 2016	1,250.3 (1,303.1)	7.1 (7.1)	7.6 (7.6)	40.1 (40.1)	18.2 (18.2)
Sep 2015 - Aug 2016	1,341.4 (1,397.3)	7.2 (7.2)	7.6 (7.6)	40.1 (40.1)	16.7 (16.7)
Oct 2015 - Sep 2016	1,444.5 (1,494.8)	7.2 (7.2)	7.6 (7.6)	40.1 (40.1)	15.4 (15.4)
Nov 2015 - Oct 2016	1,441.9 (1482.8)	6.8 (6.8)	7.6 (7.6)	40.1 (40.1)	11.1 (11.1)
Dec 2015 - Nov 2016	1,462.5 (1,487.6)	6.7 (6.7)	7.6 (7.6)	40.1 (40.1)	11.1 (11.1)
Jan 2016 - Dec 2016	1,344.5 (1,359.1)	6.8 (6.8)	7.6 (7.6)	40.1 (40.1)	11.5 (11.5)
Feb 2016 - Jan 2017	1,231.9 (1,235.7)	6.9 (6.9)	7.6 (7.6)	40.1 (40.1)	11.5 (11.5)
Mar 2016 - Feb 2017	1,041.5 (1,045.3)	7.3 (7.3)	7.7 (7.7)	40.5 (40.5)	11.5 (11.5)
Apr 2016 - Mar 2017	825.2 (829.0)	7.7 (7.7)	8.8 (8.8)	45.7 (45.6)	12.0 (11.5)
May 2016 - Apr 2017	681.8 (685.6)	7.8 (7.8)	9.5 (9.5)	49.6 (49.5)	16.0 (15.4)
Jun 2016 - May 2017	602.3 (606.1)	7.6 (7.6)	10.0 (9.9)	52.0 (51.9)	20.8 (20.0)
Jul 2016 - Jul 2017	648.9 (662.7)	11.9 (11.9)	9.7 (9.7)	50.6 (50.5)	25.0 (24.0)
Aug 2016 - Jul 2017	768.2 (772.0)	10.7 (10.7)	9.1 (9.1)	47.2 (47.1)	20.8 (20.0)
Sep 2016 - Aug 2017	871.9 (872.7)	10.1 (10.1)	8.5 (8.5)	44.5 (44.5)	20.8 (20.0)
Oct 2016 - Sep 2017	1,010.6 (1,014.8)	9.7 (9.7)	7.9 (7.8)	41.2 (41.1)	20.8 (20.0)
Nov 2016 - Oct 2017	1,230.4 (1,234.5)	8.9 (8.9)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Dec 2016 - Nov 2017	1,454.2 (1,458.3)	8.3 (8.3)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Jan 2017 - Dec 2017	1,692.7 (1,696.6)	8.0 (8.0)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Feb 2017 - Jan 2018	1,795.0 (1,799.8)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Mar 2017 - Feb 2018	1,832.3 (1,837.0)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	20.8 (20.0)
Apr 2017 - Mar 2018	1,842.2 (1,846.9)	7.8 (7.8)	7.6 (7.6)	40.1 (40.1)	28.0 (28.0)

Notes:

- Key to units: kac-feet – thousand acre feet; and ppb – parts per billion (values are actually in µg/L [micrograms per liter], which, for the purposes of this report, are equivalent to ppb).
- Compliance is evaluated annually based on the 12-month TP FWMC for the federal WY ending on September 30. The compliance periods are shown as highlighted rows with bold, italicized text.
- From the 12-month period ending October 2015, results of both Method 1 and Method 2 are presented:
 - Method 1 (left value) is computed as S12s + (S333 + S355A + S355B - S334).
 - Method 2 (value in parentheses) is computed as S12s + (S333 + S355A + S355B + S356 - S334) using all flow and TP grabs on biweekly compliance sampling dates.

Neither method excludes S334 flow from the total flow for long-term limit calculations.

Taylor Slough and Coastal Basins

Background

Under the Consent Decree, a single TP long-term limit of 11 ppb, to be met by December 31, 2006, was set for the two points of inflow to Taylor Slough (S332 and S175) and the inflow point to Coastal Basins (S18C) (see **Appendix C**). The 12-month TP FWMCs have consistently been lower than the long-term limit of 11 ppb.

Inflow TP concentrations to ENP through Taylor Slough and Coastal Basins are compared to the 11 ppb limit at the end of each water year using data from both the old (S175, S332, and S18C) and new (S174, S332D, and S18C) combinations of structures (**Figure 5**). The narrow bars in **Figure 5** represent the 12-month TP FWMCs from S332, S175, and S18C for WY 1991 through WY 2002. The wider bars for WY 1999 and forward represent the new combination of structures.

TP and flow data from both sets of structures presented in prior editions of this report through December 2001 (April 2002 report) showed that, beginning in October 2000, the 12-month moving total flow for S332D, S174, and S18C was consistently greater than flow at S332, S175, and S18C. There was also a shift in TP FWMC data whereby S332D, S174, and S18C concentrations became equal to, and then consistently lower than, the concentrations at S332, S175, and S18C. These changes reflected the switch from S332 to S332D for water delivery to Taylor Slough between July 3 and July 5, 2000. Furthermore, the S174 site was plugged in September 2007, preventing any additional flow. Consequently, for WY 2002 through WY 2007, compliance tracking was represented by S332D, S174, and S18C. Since WY 2008, S332D and S18C have represented the compliance tracking structures.

Three alternative methods were proposed for the 12-month TP FWMC compliance tracking calculation for Taylor Slough and Coastal Basins. Method 1, computed as $S332D + S18C$; Method 2, computed as $S332D + S18C + G737$; and Method 3, computed as $(S332D - S332DX1 - S328) + S328 + S18C + G737$.

Results of the alternative methods for the 12-month TP FWMCs for the 12-month period ending on September 30, 2017, were 5.9, 5.9, and 6.0 ppb for Method 1, Method 2, and Method 3, respectively, and lower than the 11.0 ppb long-term limits. Therefore, inflows into ENP through Taylor Slough and Coastal Basins met the TP limit for WY 2017.

Reporting Period Update

Figure 6 presents the 12-month and individual sampling event TP FWMCs at the S332D and S18C structures. All TP grab sample concentrations taken on positive flow days reported for surface water monitoring at the sites were used for the compliance calculations.

The daily flows into ENP through S332D, G737, and S18C are presented in **Figure 7**. Daily flows from S332D pumps and downstream structures are presented in **Figure 8**. Daily flows at individual Taylor Slough and Coastal Basins structures into ENP are presented in **Figure 9**.

For the periods ending January, February, and March 2018, the 12-month TP FWMCs for Method 1 were 6.0, 6.0, and 6.1 ppb, respectively; for Method 2, they were all 6.1 ppb; and for Method 3, they were 6.0, 6.0 and 6.1 ppb, respectively (**Table 4**).

The Consent Decree stipulates that the percent of TP FWMCs greater than 10 ppb from each sampling event in any 12-month period must not exceed the fixed guideline of 53.1 percent (**Table 3**). For the 12-month periods ending January to March 2018, there was only one sampling event TP concentration (10.2 ppb on September 14, 2017) greater than 10 ppb out of 70, 66, and 62 sampling events, respectively, for all three methods.

Figure 10 shows the relationship between the daily inflows and the corresponding TP FWMCs for each sampling event for Method 1. The sampling event TP FWMCs generally remained low. The averages of the sampling event TP FWMCs were 6.2, 6.2, and 6.4 ppb, respectively, for Methods 1, 2, and 3 in the first quarter of 2018.

The United States Army Corps of Engineers authorized the C-111 Spreader Canal project in 1995 to restore more natural hydrologic conditions in Taylor Slough and to maintain flood protection to the east of the L-31N and C-111 canals. The original project facilities consisted of pump stations (S332B, S332C, and S332D), detention cells (Cell 1 through Cell 5), a connector cell between Cell 2 and Cell 3, a flow-way cell originating at Berm B3 of Cell 5, and four diversion structures (DS1 through DS4). Upon completion of a United States Army Corps of Engineers construction project in 2009, an interconnected detention system now exists starting at the S332B west discharge and continuing to the S332D high head cell.

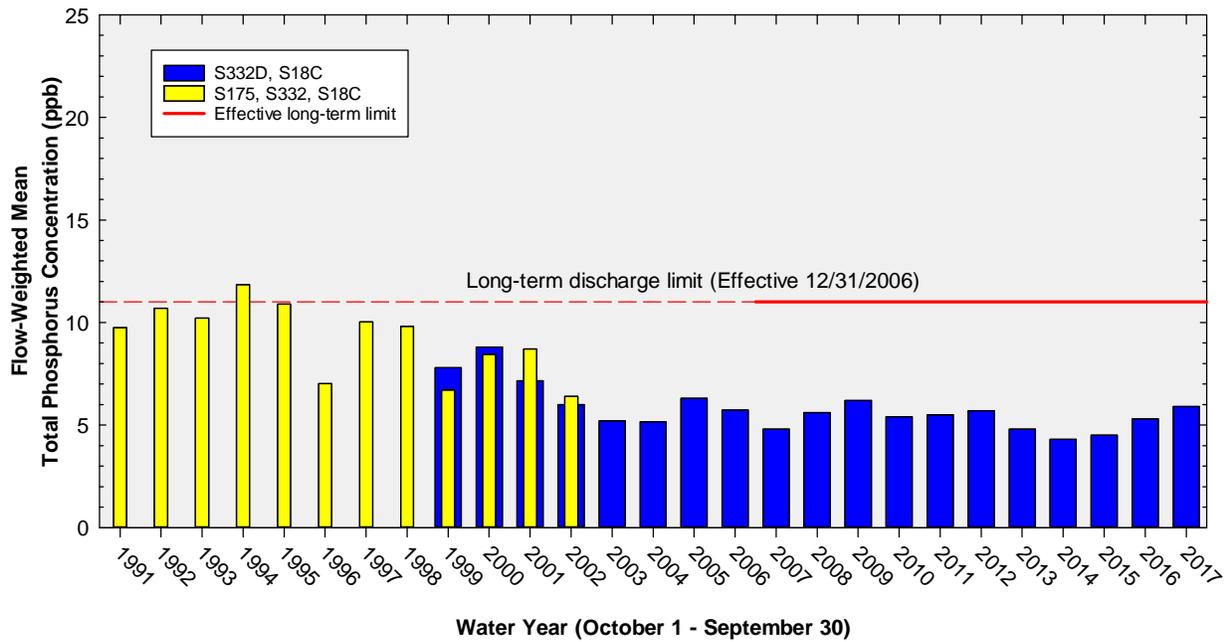


Figure 5. The 12-month TP FWMCs in inflows to ENP through Taylor Slough and Coastal Basins at the end of each water year compared to the 11 ppb long-term TP limit. Blue bars show S332D, S174, and S18C for WY 1999 through WY 2007, and S332D and S18C (Method 1) from WY 2008 to WY 2017.

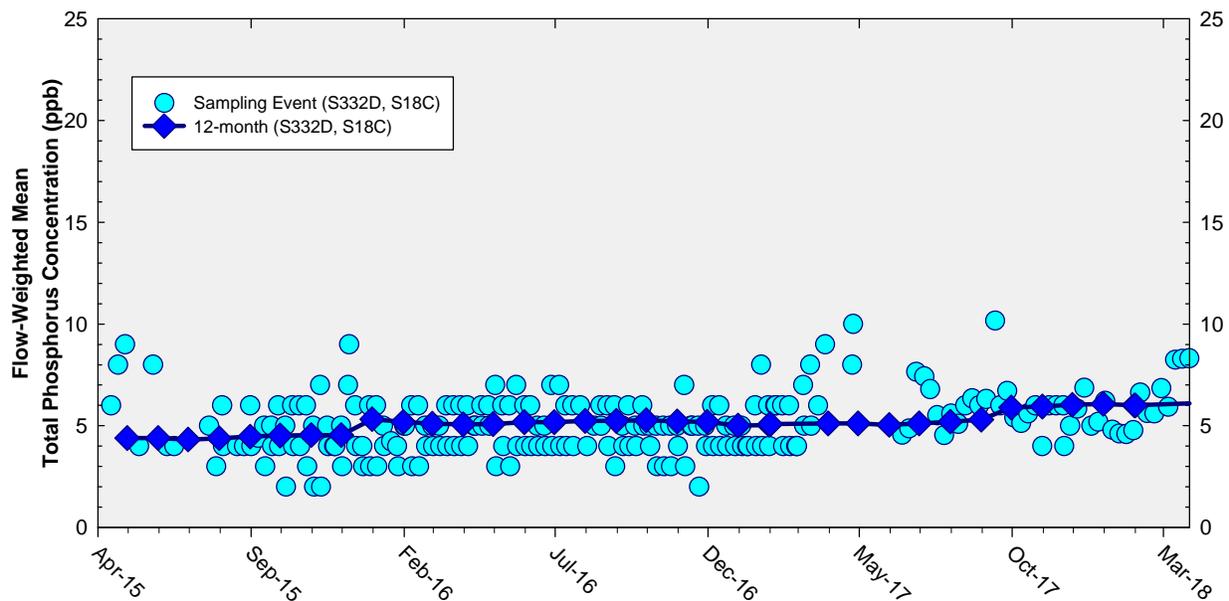


Figure 6. The 12-month TP FWMCs in inflows to ENP through Taylor Slough and Coastal Basins at the end of each month and the TP FWMC for each sampling event (Method 1).

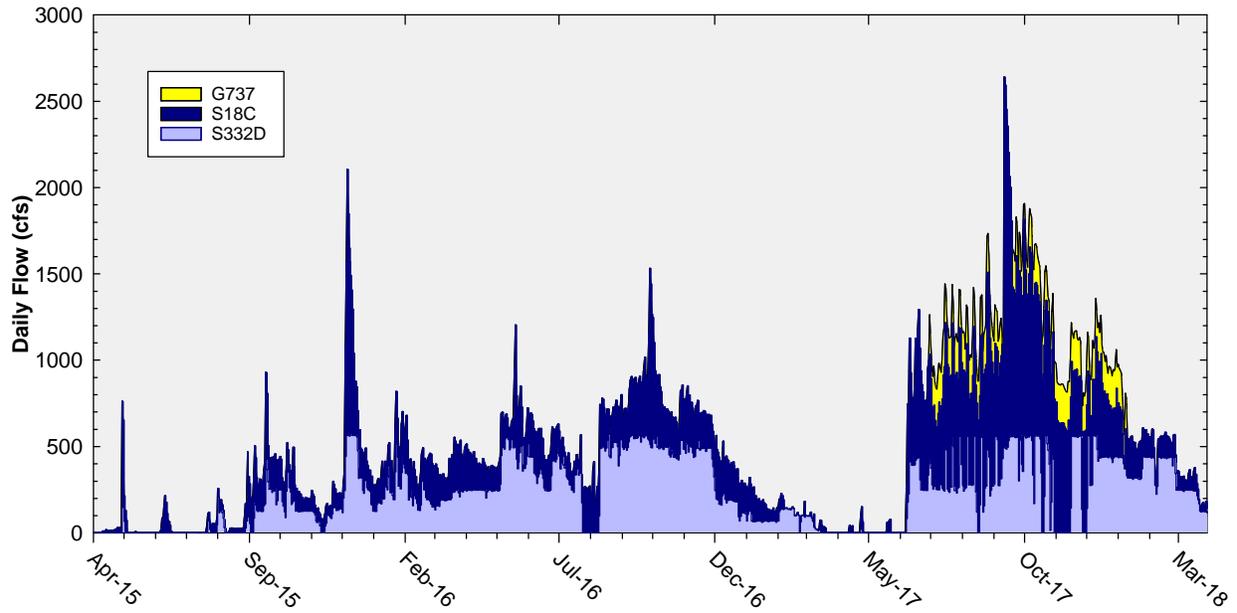


Figure 7. Daily flows into ENP as a stacked sum of Taylor Slough (structures S332D and G737) and Coastal Basins (structure S18C).

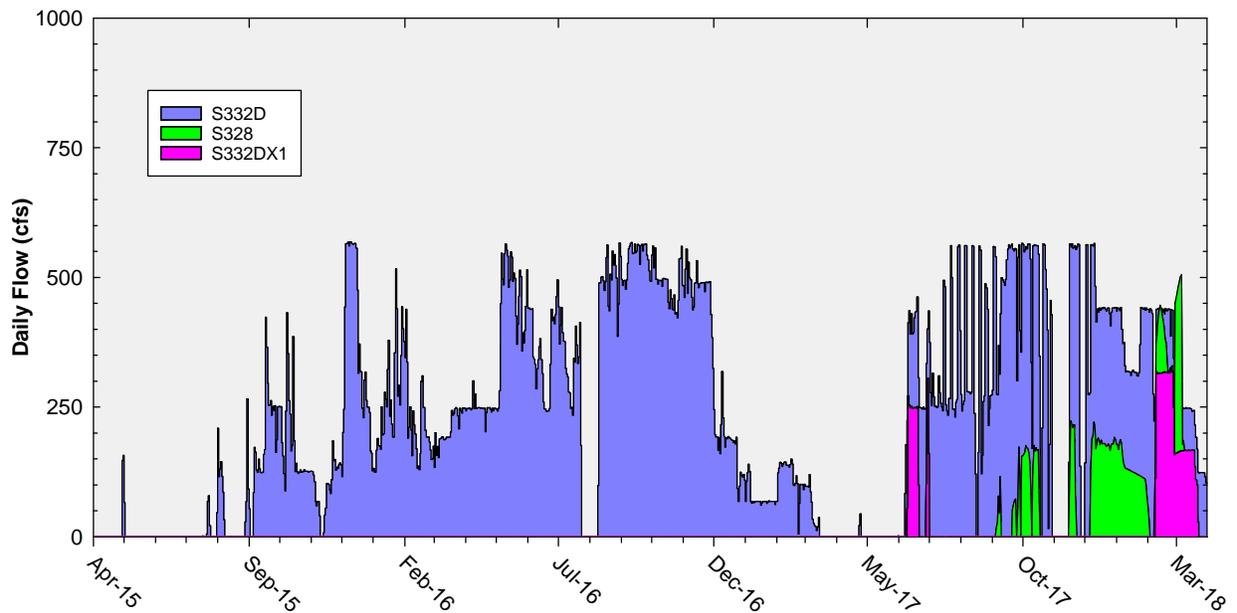


Figure 8. Daily flows from S332D pumps overlaid with stacked daily flows at downstream structures.

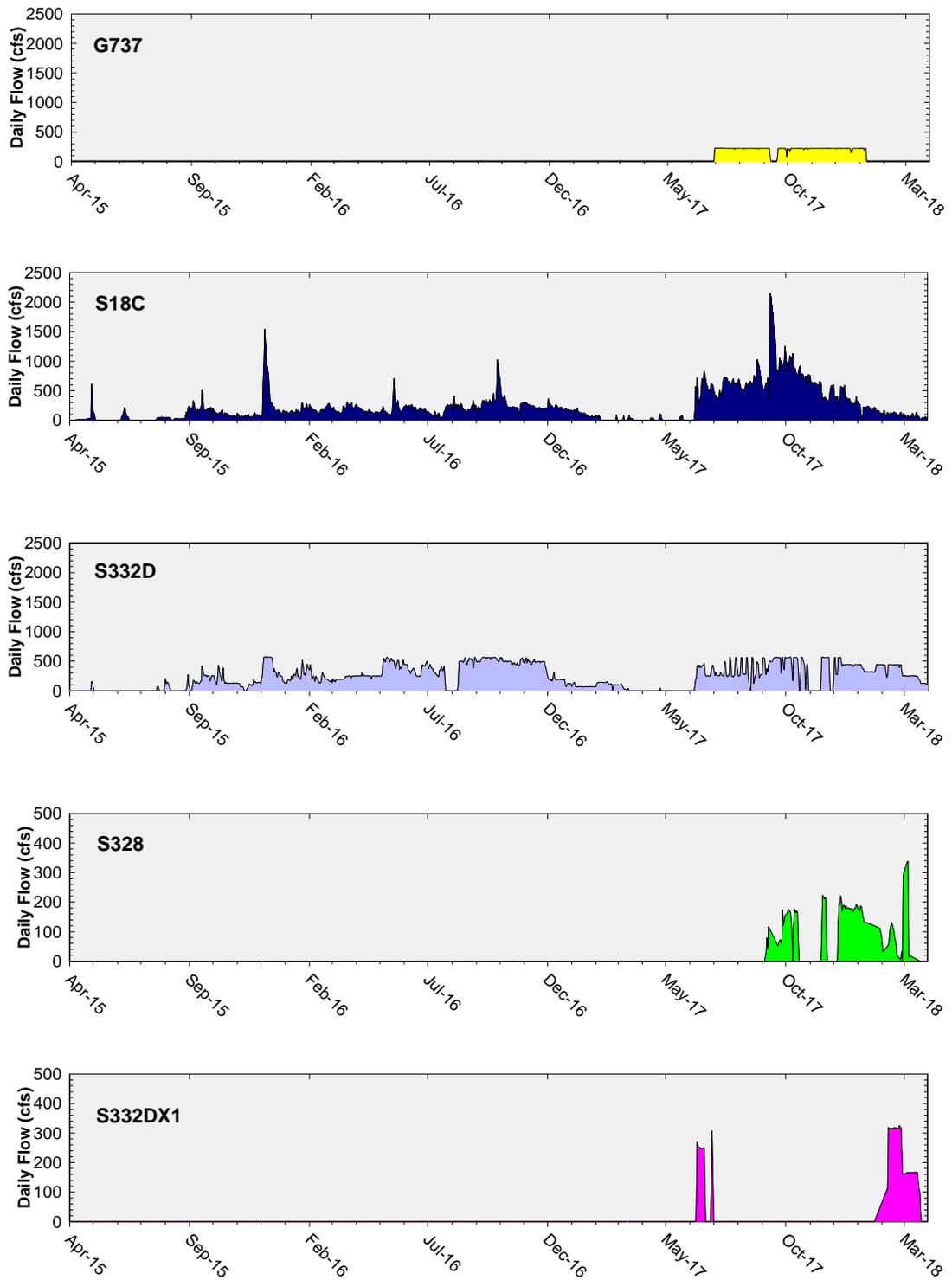


Figure 9. Daily flows at individual Taylor Slough and Coastal Basins structures into ENP.

Table 4. Taylor Slough and Coastal Basins TP compliance tracking.

12-Month Period	Total Flow (kac-ft)	Flow-Weighted Mean TP Concentration (ppb)	Long-Term Limit (ppb) <i>Effective 12/31/2006</i>	Percent of Sampling Events Greater than 10 ppb	
				Guideline	Observed
May 2014 - Apr 2015	184.6	4.4	11.0	53.1	1.6
Jun 2014 - May 2015	185.2	4.4	11.0	53.1	1.5
Jul 2014 - Jun 2015	182.9	4.3	11.0	53.1	0.0
Aug 2014 - Jul 2015	154.4	4.4	11.0	53.1	0.0
Sep 2014 - Aug 2015	124.1	4.5	11.0	53.1	0.0
Oct 2014 - Sep 2015	117.8	4.5	11.0	53.1	0.0
Nov 2014 - Oct 2015	107.3	4.5	11.0	53.1	0.0
Dec 2014 - Nov 2015	93.1	4.5	11.0	53.1	0.0
Jan 2014 - Dec 2015	122.4	5.3	11.0	53.1	0.0
Feb 2015 - Jan 2016	139.4	5.2	11.0	53.1	0.0
Mar 2015 - Feb 2016	162.2	5.1	11.0	53.1	0.0
Apr 2015 - Mar 2016	187.2	5.1	11.0	53.1	0.0
May 2015 - Apr 2016	207.9	5.1	11.0	53.1	0.0
Jun 2015 - May 2016	247.2	5.2	11.0	53.1	0.0
Jul 2015 - Jun 2016	278.4	5.2	11.0	53.1	0.0
Aug 2015 - Jul 2016	300.7	5.2	11.0	53.1	0.0
Sep 2015 - Aug 2016	330.9	5.2	11.0	53.1	0.0
Oct 2015 - Sep 2016	361.3	5.3	11.0	53.1	0.0
Nov 2015 - Oct 2016	391.0	5.2	11.0	53.1	0.0
Dec 2015 - Nov 2016	423.0	5.2	11.0	53.1	0.0
Jan 2016 - Dec 2016	399.5	5.0	11.0	53.1	0.0
Feb 2016 - Jan 2017	384.1	5.0	11.0	53.1	0.0
Mar 2016 - Feb 2017	368.1	5.1	11.0	53.1	0.0
Apr 2016 - Mar 2017	345.0	5.1	11.0	53.1	0.0
May 2016 - Apr 2017	321.7	5.1	11.0	53.1	0.0
Jun 2016 - May 2017	282.1	5.0	11.0	53.1	0.0
Jul 2016 - Jun 2017	290.9 (291.4, 285.0)	5.1 (5.1, 5.1)	11.0	53.1	0.0
Aug 2016 - Jul 2017	322.1 (336.4, 329.9)	5.2 (5.2, 5.2)	11.0	53.1	0.0
Sep 2016 - Aug 2017	346.6 (374.6, 368.2)	5.3 (5.3, 5.3)	11.0	53.1	0.0
Oct 2016 - Sep 2017	383.3 (420.1, 413.7)	5.9 (5.9, 6.0)	11.0	53.1	1.6 (1.6, 1.6)
Nov 2016 - Oct 2017	413.4 (463.8, 457.3)	5.9 (6.0, 6.0)	11.0	53.1	1.8 (1.8, 1.8)
Dec 2016 - Nov 2017	414.5 (478.2, 471.8)	6.0 (6.1, 6.0)	11.0	53.1	1.9 (1.9, 1.9)
Jan 2017 - Dec 2017	441.4 (518.5, 512.1)	6.1 (6.1, 6.0)	11.0	53.1	2.0 (2.0, 2.0)
Feb 2017 - Jan 2018	464.4 (545.5, 539.1)	6.0 (6.1, 6.0)	11.0	53.1	2.3 (1.8, 1.8)
Mar 2017 - Feb 2018	485.3 (566.4, 547.9)	6.0 (6.1, 6.0)	11.0	53.1	2.3 (1.9, 1.9)
Apr 2017 - Mar 2018	499.1 (580.1, 555.0)	6.1 (6.1, 6.1)	11.0	53.1	2.2 (2.0, 2.0)

Notes:

- Key to units: kac-feet – thousand acre feet; ppb – parts per billion (values are actually in µg/L [micrograms per liter], which, for the purposes of this report, are equivalent to ppb).
- Compliance is evaluated annually based on the 12-month TP FWMC for the federal WY ending on September 30. The compliance periods are shown as highlighted rows with bold, italicized text.
- From the 12-month period ending June 2017, results of Method 1, Method 2, and Method 3 are presented:
 - Method 1 (left value) is computed as S332D + S18C.
 - Method 2 (first value in parentheses) is computed as S332D + S18C + G737.
 - Method 3 (second value in parentheses) is computed as (S332D - S332DX1 - S328) + S328 + S18C + G737.

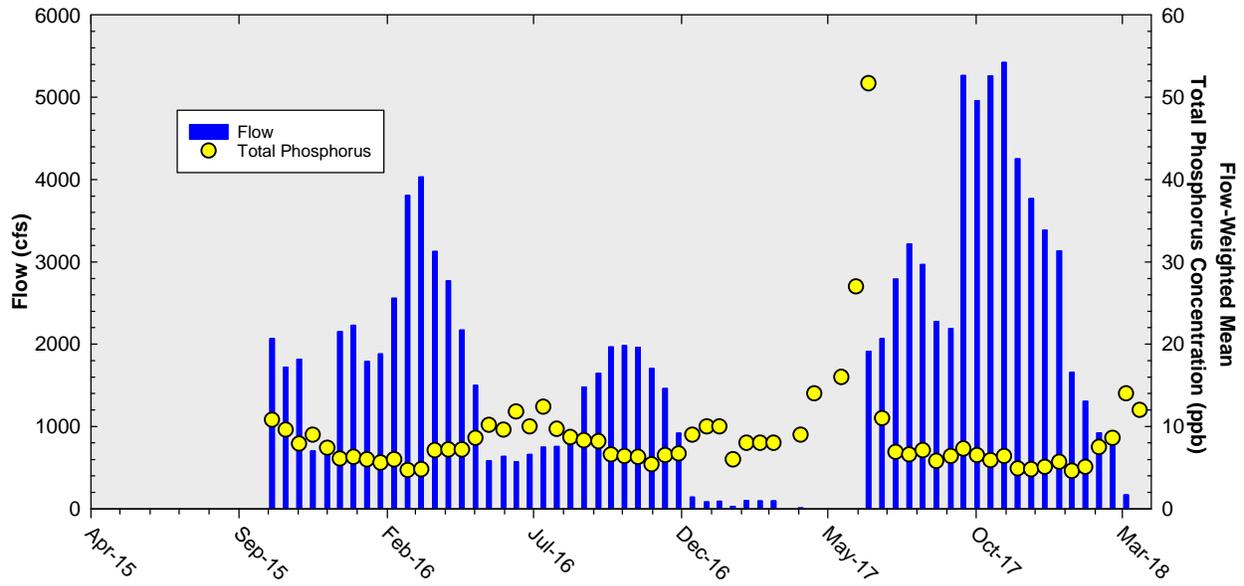


Figure 10. Flow from Taylor Slough and Coastal Basins structures (S332D and S18C) on the days of sampling, and the corresponding TP FVMCs for individual sampling events (Method 1).

APPENDIX A

MONTHLY TOTAL PHOSPHORUS CONCENTRATION DATA FOR THE ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE

TP concentration data used in this report can be directly retrieved from the South Florida Water Management District's DBHYDRO database by copying and pasting the following link into the address field of a web browser:

[http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+like+\('LOX%25'\)+and+station_id+not+like+\('LOXA%25'\)+and+test_number+=+25+and+date_collected+>='01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv](http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+like+('LOX%25')+and+station_id+not+like+('LOXA%25')+and+test_number+=+25+and+date_collected+>='01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv)

The link above only generates data that have not been qualified. Qualified water quality data must be retrieved interactively via the DBHYDRO browser.

Stage data for stations 1-7, 1-8C, and 1-9 from the reporting quarter can be retrieved by copying and pasting the following link into the address field of a web browser:

http://my.sfwmd.gov/dbhydroplsql/web_io.report_process?v_period=uspec&v_start_date=20180101&v_end_date=20180331&v_report_type=format7&v_target_code=file_csv&v_run_mode=onLine&v_js_flag=Y&v_dbkey=FE775/FE776/FE777

Table A-1. Arthur R. Marshall Loxahatchee National Wildlife Refuge monthly TP data (in parts per billion).

Month-Year	LOX3	LOX4	LOX5	LOX6	LOX7	LOX8	LOX9	LOX10	LOX11	LOX12	LOX13	LOX14	LOX15	LOX16
Apr-2015	---	7	12	6	8	12	10	---	6	7	7	8	5	7
May-2015	---	10	---	11	7	12	---	---	7	7	9	7	6	8
Jun-2015	---	---	---	---	---	---	---	---	---	11	9	14	7	9
Jul-2015	++	++	++	---	++	---	++	++	---	19	---	17	---	---
Aug-2015	---	18	---	---	9	14	---	---	15	12	---	15	8	11
Sep-2015	13	23	9	16	9	10	10	15	9	12	10	9	7	9
Oct-2015	9	8	12	8	7	7	7	8	6	6	6	5	6	11
Nov-2015	6	6	6	5	7	6	7	7	7	6	7	5	6	8
Dec-2015	5	5	6	5	15	6	5	6	6	6	5	(4)	(6)	7
Jan-2016	8	8	8	6	7	7	6	7	6	7	6	5	5	6
Feb-2016	5	8	6	4	5	7	5	5	5	5	6	4	4	6
Mar-2016	5	6	6	8	7	8	6	7	5	5	4	6	5	7
Apr-2016	8	7	8	7	7	8	8	8	5	8	7	5	5	7
May-2016	---	0	---	9	14	10	---	---	10	8	8	8	6	8
Jun-2016	---	15	---	7	8	---	---	---	7	7	7	8	4	6
Jul-2016	8	12	10	6	6	8	8	7	7	6	7	5	5	---
Aug-2016	---	---	---	---	---	---	---	---	5	6	7	6	8	8
Sep-2016	10	11	8	5	6	6	9	10	7	8	6	5	6	9
Oct-2016	6	8	4	6	6	5	7	9	5	10	5	6	4	7
Nov-2016	7	12	11	5	8	7	7	14	5	6	5	5	5	6
Dec-2016	7	7	5	4	5	7	5	6	5	5	5	6	5	8
Jan-2017	8	9	---	5	7	10	7	7	6	7	8	6	6	8
Feb-2017	5	4	---	4	5	5	5	4	4	5	3	4	4	6
Mar-2017	---	8	---	5	7	7	10	8	4	5	5	3	4	6
Apr-2017	---	---	---	6	---	---	---	---	7	7	7	7	5	7
May-2017	9	11	---	8	8	9	10	11	8	7	7	7	6	9
Jun-2017	12	15	10	6	11	10	9	8	7	5	7	7	5	5
Jul-2017	10	8	10	4	8	---	13	9	6	7	7	8	7	9
Aug-2017	6	8	8	5	6	6	7	6	6	6	7	7	7	8
Sep-2017	---	10	9	8	7	8	8	8	8	6	6	7	7	6
Oct-2017	7	11	7	6	10	10	9	9	6	8	7	6	6	7
Nov-2017	5	9	5	5	6	8	6	6	5	5	5	5	4	5
Dec-2017	6	6	9	6	7	13	9	9	7	8	6	6	6	6
Jan-2018	4	6	5	4	6	6	5	5	5	4	3	4	3	4
Feb-2018	5	6	6	4	8	8	7	7	6	5	5	6	4	6
Mar-2018	6	5	5	8	5	8	5	6	6	6	6	7	5	7

Notes:

--- indicates sample was not collected due to insufficient water depth.

++ indicates the sampling trip was suspended due to low stage (See page 3 for details), following the guidance for suspending marsh sampling.

() LOX14 and LOX15 water quality samples taken on December 2, 2015, were discarded due to processing errors and resampled on December 3, 2015.

APPENDIX B

WEEKLY GRAB TOTAL PHOSPHORUS CONCENTRATION DATA FOR SHARK RIVER SLOUGH

TP concentration data used in this report can be directly retrieved from the South Florida Water Management District's DBHYDRO database by copying and pasting the following link into the address field of a web browser:

[http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+in+\('S12A','S12B','S12C','S12D','S333','S355A','S355B','S356-334'\)+and+test_number+=+25+and+collect_method+=+'G'+and+date_collected+>='01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv](http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+in+('S12A','S12B','S12C','S12D','S333','S355A','S355B','S356-334')+and+test_number+=+25+and+collect_method+=+'G'+and+date_collected+>='01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv)

The link only generates data that have not been qualified. Qualified water quality data must be retrieved interactively via the DBHYDRO browser.

The provisional daily mean flow data for stations S12A, S12B, S12C, S12D, S355A, S355B, S355B Temporary Pumps, and S356 and the "Preferred DBKEY" daily mean flow data for stations S333 and S334, during the reporting quarter can be retrieved by copying and pasting the following link into the address field of a web browser:

http://my.sfwmd.gov/dbhydroplsql/web_io.report_process?v_period=uspec&v_start_date=20180101&v_end_date=20180331&v_report_type=format7&v_target_code=file_csv&v_run_mode=onLine&v_js_flag=Y&v_dbkey=03620/03626/03632/03638/MQ895/MQ896/AM173/64136/15042/FB752

The "Preferred DBKEY" daily mean flow data for S12A, S12B, S12C, and S12D structures will be available for retrieval upon completion of the final approved flow data (expected April 2019).

Table B-1. Weekly grab TP data (in parts per billion) for Shark River Slough.

Date	S12A	S12B	S12C	S12D	S333	S355A	S355B	S356	Remarks
04/03/2017	23	---	---	---	9	37	71	11	Compliance date
04/10/2017	22	---	---	---	10	---	---	23	N/A
04/17/2017	30	---	---	---	14	69	98	16	Compliance date
04/24/2017	34	---	---	---	17	---	---	10	N/A
05/01/2017	29	---	---	---	16	54	89	18	Compliance date
05/08/2017	27	---	---	---	14	---	---	10	N/A
05/15/2017	29	---	---	---	16	---	---	14	Compliance date
05/22/2017	35	---	---	---	18	---	---	15	N/A
05/30/2017	33	---	---	---	27	---	---	18	Compliance date
06/05/2017	36	---	---	---	24	---	---	13	N/A
06/12/2017	32	---	11	24	87	33	34	18	Compliance date
06/19/2017	20	---	10	11	13	---	---	12	N/A
06/26/2017	14	---	10	9	17	---	---	22	Compliance date
07/05/2017	6	5	4	8	6	---	---	15	N/A
07/10/2017	8	6	6	7	8	18	10	16	Compliance date
07/17/2017	7	5	5	7	14	---	---	7	N/A
07/24/2017	8	5	5	8	8	---	6	8	Compliance date
08/01/2017	7	6	6	8	8	---	---	8	N/A
08/07/2017	7	5	7	8	7	8	6	8	Compliance date
08/14/2017	6	5	6	7	7	---	---	7	N/A
08/21/2017	5	6	6	6	7	---	5	11	Compliance date
08/28/2017	5	5	6	8	7	---	---	8	N/A
09/05/2017	6	6	5	8	8	---	6	12	Compliance date
09/13/2017	11	7	6	10	---	---	---	5	N/A
09/14/2017	---	---	---	---	11	---	---	---	N/A
09/18/2017	9	7	6	6	10	8	8	7	Compliance date
09/25/2017	8	6	6	5	7	---	---	8	N/A
10/02/2017	6	6	5	8	9	7	6	7	Compliance date
10/09/2017	8	6	6	7	7	---	---	14	N/A
10/16/2017	8	5	4	6	7	6	12	9	Compliance date
10/23/2017	8	7	5	8	7	---	---	10	N/A
10/30/2017	7	6	5	7	7	---	---	10	Compliance date
11/06/2017	7	6	6	8	7	---	---	9	N/A
11/13/2017	5	4	4	6	7	6	11	12	Compliance date
11/20/2017	5	4	4	6	5	---	---	12	N/A
11/27/2017	5	4	3	6	6	---	---	10	Compliance date
12/04/2017	5	6	4	6	5	---	---	14	N/A
12/11/2017	4	5	4	6	6	4	6	8	Compliance date
12/18/2017	4	5	3	6	7	---	---	7	N/A
12/26/2017	5	4	5	6	7	---	---	7	Compliance date
01/02/2018	10	---	5	6	7	---	---	8	N/A
01/08/2018	5	---	4	5	4	5	4	6	Compliance date
01/16/2018	10	---	6	7	6	---	---	7	N/A
01/22/2018	8	10	5	5	6	3	3	5	Compliance date
01/29/2018	11	---	6	6	6	---	---	6	N/A
02/05/2018	12	---	---	7	8	---	---	8	Compliance date
02/12/2018	13	---	---	9	10	---	---	9	N/A
02/19/2018	15	---	---	8	9	10	13	10	Compliance date
02/26/2018	17	---	---	---	11	---	---	10	N/A
03/05/2018	21	---	---	10	14	12	12	12	Compliance date
03/12/2018	19	---	---	9	9	---	---	11	N/A
03/19/2018	23	---	---	11	12	---	---	14	Compliance date
03/26/2018	24	---	---	11	12	---	---	12	N/A

Notes:

--- indicates water sample was not collected.

"Compliance date" indicates biweekly sampling date for Consent Decree calculation.

"N/A" indicates sampling data presented for informational purposes only.

APPENDIX C

WEEKLY GRAB TOTAL PHOSPHORUS CONCENTRATION DATA FOR TAYLOR SLOUGH AND COASTAL BASINS

TP concentration data used in this report can be directly retrieved from the South Florida Water Management District's DBHYDRO database by copying and pasting the following link into the address field of a web browser:

[http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+in+\('S332DX','S18C','S328','G737'\)+and+test_number+=+25+and+collect_method+=+'G'+and+date_collected+>+'01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv](http://my.sfwmd.gov/dbhydroplsql/water_quality_data.report_full?v_where_clause=where+station_id+in+('S332DX','S18C','S328','G737')+and+test_number+=+25+and+collect_method+=+'G'+and+date_collected+>+'01-JAN-2018'+and+date_collected+<+'01-APR-2018'+and+sample_type_new+=+'SAMP'&v_target_code=file_csv)

The link only generates data that have not been qualified. Qualified water quality data must be retrieved interactively via the DBHYDRO browser.

The "Preferred DBKEY" daily mean flow data for stations at Taylor Slough and the Coastal Basins (S332D, S18C, S328, and G737) during the reporting quarter can be retrieved by copying and pasting the following link into the address field of a web browser:

http://my.sfwmd.gov/dbhydroplsql/web_io.report_process?v_period=uspec&v_start_date=20180101&v_end_date=20180331&v_report_type=format7&v_target_code=file_csv&v_run_mode=onLine&v_js_flag=Y&v_dbkey=15760/TA413/AN558/AI315

The daily flow at S200 Pump Station on the days when the G737 gates were opened were used as the surrogate daily flow data for G737. The break point gate opening data can be assessed using the following link:

http://my.sfwmd.gov/dbhydroplsql/web_io.report_process?v_period=uspec&v_start_date=20180101&v_end_date=20180331&v_report_type=format7&v_target_code=file_csv&v_run_mode=onLine&v_js_flag=Y&v_dbkey=AN670/AN671/AN672

Table C-1. Weekly grab TP data (in parts per billion) for Taylor Slough and Coastal Basins.

Date	S332DX	S18C	S328	G737	Date	S332DX	S18C	S328	G737
04/03/2017	6	--	--	--	09/05/2017	7	6	11	7
04/04/2017	--	5	--	--	09/14/2017	7	11	5	58
04/10/2017	10	--	--	--	09/19/2017	6	6	4	11
04/11/2017	--	G	--	--	09/26/2017	8	6	5	7
04/17/2017	9	--	--	--	10/03/2017	6	5	4	6
04/18/2017	--	8	--	--	10/10/2017	6	5	10	6
04/24/2017	8	--	--	--	10/17/2017	7	5	6	6
04/25/2017	--	10	--	--	10/24/2017	6	--	4	--
05/01/2017	6	--	--	--	10/31/2017	5	4	6	--
05/02/2017	--	6	--	--	11/07/2017	6	6	6	--
05/08/2017	8	--	--	--	11/14/2017	6	6	8	--
05/09/2017	--	6	--	--	11/21/2017	6	--	4	--
05/15/2017	20	--	--	--	11/22/2017	--	4	--	--
05/16/2017	--	5	--	--	11/28/2017	7	5	5	--
05/22/2017	7	--	--	--	12/05/2017	7	5	8	--
05/23/2017	--	G	962	97	12/12/2017	8	6	4	--
05/30/2017	8	--	--	--	12/19/2017	5	5	5	--
05/31/2017	--	7	465	16	12/26/2017	6	4	4	--
06/06/2017	8	8	320	21	01/02/2018	7	5	4	--
06/13/2017	5	4	44	16	01/09/2018	6	3	5	--
06/20/2017	7	4	13	14	01/16/2018	5	4	4	--
06/27/2017	9	7	23	13	01/23/2018	5	4	4	8
07/05/2017	8	7	12	7	01/30/2018	5	4	4	6
07/11/2017	8	6	9	7	02/06/2018	7	5	5	6
07/18/2017	7	5	12	6	02/13/2018	6	4	5	6
07/25/2017	6	4	10	5	02/20/2018	6	4	5	18
08/01/2017	7	5	7	6	02/27/2018	7	6	6	6
08/08/2017	7	4	6	4	03/06/2018	7	3	16	4
08/15/2017	6	6	8	5	03/13/2018	8	9	20	7
08/22/2017	8	6	19	7	03/20/2018	9	6	47	18
08/29/2017	6	6	9	5	03/27/2018	9	5	--	15

Notes:

-- indicates water sample was not collected.

G indicates that analyte was detected at or above the method detection limit in both the sample and the associated field blank, equipment blank, or trip blank, and the blank value was greater than 10 percent of the associated sample value.

APPENDIX D

CALCULATION METHODS

Long Term Marsh Concentration Levels for Loxahatchee National Wildlife Refuge

Long Term Marsh Concentration Levels:

$$C = 10.7172 - 0.541156S + 1.372\sqrt{7.5819 - 0.9310S + 0.02902216S^2}$$

Terms:

C = the natural log of the geometric mean total phosphorus concentration across 14 marsh stations.

S = average stage measured at gauges CA1-9, CA1-7, and CA1-8C on sampling date (feet).

This equation is applicable over a stage range of 15.42 to 17.14 feet. If the stage on any sampling date exceeds 17.14 feet, a stage of 17.14 feet should be used in calculating the long term concentration levels. The equation shall not apply to dates when the average stage is less than 15.42 feet.

(1991 Settlement Agreement entered as a Consent Decree in 1992 and modified in 1995, Exhibit B, Appendix B, Attachment II, page B-7)

Discharge Limits and OFW Standards for Shark River Slough

Interim Discharge Limit:

$$C = 11.16 - 0.00465Q + 1.397\sqrt{6.377 - 0.00591Q + 0.00000436 Q^2}$$

Long-Term Discharge Limit & OFW Standard:

$$C = 11.38 - 0.00538Q + 1.397\sqrt{2.493 - 0.00231Q + 0.00000170 Q^2}$$

Frequency Exceedance:

$$F = 48.411 - 0.02896Q + 1.397\sqrt{330.1 - 0.3071Q + 0.0002254 Q^2}$$

Terms:

Water Year = October through September

Q = total inflow to Shark River Slough for water year, S-12s + S-333 + any additional inflow from the WCAs established in the future, thousand acre-ft/yr (Kac-ft/yr).

C = limit on maximum flow-weighted-mean inflow concentration for any Water Year, composite of all inflows to Shark Slough (ppb).

F = exceedance for maximum frequency (percent) of inflow concentrations exceeding 10 ppb, computed from the time series of concentrations composited across all inflow structures on each sampling date with positive flow in a given Water Year.

The range of flow (Q) used in deriving the limits is 117 to 1061 Kac-ft/yr. If the total flow for any water year exceeds 1061 Kac-ft/yr, a flow of 1061 Kac-ft/yr should be used in calculating the discharge limits.

(1991 Settlement Agreement entered as a Consent Decree in 1992 and modified in 1995, Exhibit B, Appendix A, Attachment I, page A-5)

Discharge Limits and OFW Standards for Taylor Slough and Coastal Basins

Long-Term Flow-Weighted Discharge Limit & OFW Standard = 11.0 ppb

Frequency Exceedance:

Frequency of values > 10 ppb must be less than 53.1%.

Terms:

Limits are defined on a Water Year basis, October through September.

Basin flow is the total flow through structures S-332, S-175, S-18C, plus any new release points from this basin established in the future, thousand acre-ft/yr (Kac-ft/yr).

Limits apply to the flow-weighted-mean concentration for any Water Year, composite of all inflows to Taylor Slough (S-332) and Coastal Basin (S-18C).

Frequency exceedance is the exceedance for maximum frequency (percent) of inflow concentrations exceeding 10 ppb, computed from the time series of concentrations composited across all inflow structures on each sampling date with positive flow in a given Water Year.

(1991 Settlement Agreement entered as a Consent Decree in 1992 and modified in 1995, Exhibit B, Appendix A, Attachment II, page A-6)

APPENDIX E

DOCUMENT REVISIONS

Table E-1. Revisions to this report since initial publication.

Page/Date	Original	Revision