

Disclaimer: Information contained in the report addresses environmental conditions only and is not the official South Florida Water Management District operations recommendation or decision.

M E M O R A N D U M

TO: John Mitnik, Chief, Operations, Engineering and Construction Bureau
Paul Linton, Chief, Operations Section

FROM: SFWMD Staff Environmental Advisory Team

DATE: November 21, 2017

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

Showers/storms pulling out of the District this afternoon. A warm front will escort showers/storms northward through the afternoon before a relative lull occurs overnight and most of tomorrow. Look for activity to increase again on Thursday as energy drops into a long wave trough over the Gulf of Mexico. Models still have not come into agreement on timing and strength of this progression but will place a focus north of the Lake on Thursday along an incoming cold front. Showers/storms will likely continue Friday as a secondary surge of energy accompanies the exiting low pressure.

Kissimmee

Tuesday morning stages and departures from schedule were 58.0 feet (at schedule) in East Lake Toho, 55.0 feet (at schedule) in Lake Toho, and 51.5 feet (1.0 feet below schedule) in Kissimmee Cypress Hatchineha; S65A headwater stage was 46.3 feet. Tuesday morning discharges were 955 cfs at S65, 816 cfs at S65A, and 1,501 cfs at S65E. Dissolved oxygen concentration in the Kissimmee River averaged 5.0 milligrams per liter (mg/L) for the week. Kissimmee River mean floodplain depth on Sunday was 0.70 feet.

Lake Okeechobee

Lake stage is 16.42 feet NGVD having decreased -0.25 feet over the past week and -0.78 feet from its peak of 17.20 feet on October 13. Stages have exceeded 16 feet for 60 days, the longest period since late 2004. The submerged aquatic and emergent vegetation coverage in the nearshore areas of the Lake are expected to decline over the coming months and possibly years due to the high water conditions and turbidity from resuspended Lake sediment associated with Hurricane Irma. The high inflows and resuspended Lake sediment also increased water column total phosphorus, which could lead to algal blooms as turbidity begins to decline and water temperatures rise.

Estuaries

Total inflow to St. Lucie estuary averaged 5,756 cfs over the past week with 1,611 cfs coming from Lake Okeechobee. Salinity remains close to 0 in the North Fork (HR1), and slightly decreased at and downstream of A1A Bridge. The seven-day average salinity at the US1 Bridge is in the poor range for adult oysters. NOAA satellite imagery indicates low to medium potential for cyanobacteria bloom at just a few nearshore locations. Average chlorophyll a concentration levels at the LOBO stations (maintained by FAU) remain low (between 1.6-8.4 µg/L). Average oxygen levels near the surface and the bottom were between 5.9-7.7 mg/L. Turbidity remains high in the South Fork, especially near the S-80 structure.

Total inflow to Caloosahatchee estuary averaged 7,813 cfs over the past week with 6,098 cfs coming from the Lake. The 30-day moving average surface salinity is 0.2 at Val I-75 and Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the good range for adult oysters at Shell Point and in the poor range at Cape Coral. NOAA satellite imagery indicates low to medium potential for cyanobacteria bloom at just a few nearshore locations. Chlorophyll *a* measurements by the Sanibel-Captiva Conservation Foundation show low chlorophyll *a* concentration levels near Ft. Myers and Shell Point (between 1.9-4.9 µg/L) over the last week. *Karenia brevis* (red tide dinoflagellate) was observed in background to high concentrations in eleven samples collected along the Lee County coast. Turbidity remains high near the S-79 structure and in the central part of the estuary.

Stormwater Treatment Areas

Over the past week, the STAs/FEBs did not receive Lake releases. The total amount of Lake releases sent to the STAs/FEBs in WY2018 (since May 1, 2017) is approximately 21,800 acre-feet. Most STA cells are at or above target depths. Operational restrictions are in place for vegetation rehabilitation in STA-1E and STA-2. This week, if 2008 LORS recommends Lake releases to the WCAs and the conditions allow, releases will be sent to STA-1E Eastern Flowway.

Everglades

Over the last week water depths dropped across the Everglades at all the gauges monitored for this report with WDAT modeling in agreement. Keeping depths below 2.5 feet at gauge 65 in WCA-3A is important to moderate the stress to tree islands caused by flooding when durations last longer than 60-90 days. The depth on Sunday at that location was 3.95 feet, and has exceeded 2.5 feet for 157 days.

In Florida Bay salinity changes for the last week ranged from -3 to +21 psu and current salinities range from 16 psu in the central nearshore to 28 in the western nearshore. Based on satellite imagery, waters containing a high indication of cyanobacteria appear to be flushing west.

Supporting Information

KESSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.01 inch of rainfall in the past week and the Lower Basin received 0.25 inch (SFWMD Daily Rainfall Report 11/20/2017).

Upper Kissimmee Basin

Stages and departures in the Kissimmee Chain of Lakes (KCOL) are shown in Table 1.

Table 1. Average discharge (cfs) for the preceding seven days, one-day stage (feet NGVD), and departures from KCOL flood regulation (R) or temporary schedules (T, A, or S). Provisional, real-time data are from SFWMD.

Report Date: 11/21/2017

Water Body	Structure	7-day Average Discharge (cfs) ¹	Stage Monitoring Site ²	Lake Stage (feet)	Schedule Type ³	Schedule Stage (feet)	Daily Departure (feet)						
							11/19/17	11/12/17	11/5/17	10/29/17	10/22/17	10/15/17	10/8/17
Lakes Hart and Mary Jane	S62	40	LKMJ	61.0	R	61.0	0.0	0.1	0.1	0.0	0.3	1.0	1.4
Lakes Myrtle, Preston, and Joel	S57	32	S57	62.0	R	62.0	0.0	0.0	0.2	0.3	1.3	2.2	2.4
Alligator Chain	S60	33	ALLI	64.0	R	64.0	0.0	0.0	0.0	0.1	0.3	0.4	0.2
Lake Gentry	S63	42	LKGT	61.5	R	61.5	0.0	0.0	0.0	0.0	0.2	0.3	0.3
East Lake Toho	S59	53	TOHOE	58.0	R	58.0	0.0	0.0	0.0	0.1	0.3	0.7	1.4
Lake Toho	S61	67	TOHOW, S61	55.0	R	55.0	0.0	0.0	0.0	0.1	0.3	0.5	0.3
Lakes Kissimmee, Cypress, and Hatchineha	S65	1,097	KUB011, LKIS5B	51.6	R	52.5	-0.9	-0.7	-0.5	-0.2	0.1	0.5	0.5

¹ Seven-day average of weighted daily means through midnight.

² Names of in-lake monitoring sites and structures used to determine lake stage; if more than one site is listed, an average is reported.

³ T = temporary schedule, R = USACE flood control schedule, S = temporary snail kite schedule, A = projected ascension line, N/A = not applicable or data not available. DATA ARE PROVISIONAL

Lower Kissimmee Basin

Discharges at Lower Basin structures are shown in Table 2. SFWDAT depth maps for the Phase I restoration area are shown in Figure 12. Kissimmee River floodplain stages at selected stations are shown in Figure 13.

Table 2. One-day and seven-day averages of discharge at S-65x structures, of dissolved oxygen concentration in the Phase I area river channel, and water depth in the Phase I area floodplain. Data are provisional real-time data from SFWMD.

Report Date: 11/21/2017

Metric	Location	1-Day Average	Average for the Preceding 7-Days ¹									
		11/19/2017	11/19/17	11/12/17	11/5/17	10/29/17	10/22/17	10/15/17	10/8/17	10/1/17	9/24/17	9/17/17
Discharge (cfs)	S-65	1,052	1,097	1,349	1,439	1,564	2,319	3,200	6,671	11,491	12,054	5,535
Discharge (cfs)	S-65A	967	1,038	1,346	1,638	1,703	2,265	3,723	7,028	7,972	8,336	6,779
Discharge (cfs)	S-65D ²	1,673	1,925	2,467	3,714	3,240	4,298	7,381	12,111	12,914	13,332	11,906
Discharge (cfs)	S-65E ²	1,733	1,988	2,519	3,938	3,453	4,551	7,568	12,702	13,341	13,748	13,216
DO (mg/L) ³	Phase I river channel	5.5	5.0	4.1	4.2	3.4	2.0	1.1	1.4	1.0	0.8	1.3
Mean depth (feet) ⁴	Phase I floodplain	0.70	0.82	1.09	1.48	1.43	1.94	2.77	4.18	4.85	5.17	4.86

¹ Seven-day average of weighted daily means through Sunday midnight.

² S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S65E discharge combines S65E and S65EX1.

³ DO is the average for sondes at PC62 and PC33.

⁴ 1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).

DATA ARE PROVISIONAL; N/A indicates that data were not available.

Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Date	Recommendation	Purpose	Outcome	Source
11/21/2017	No new recommendations.		N/A	
11/13/2017	No new recommendations.		N/A	
11/1/2017	No new recommendations.		N/A	
10/24/2017	No new recommendations.		N/A	
10/17/2017	No new recommendations.		N/A	
10/10/2017	No new recommendations.		N/A	
10/3/2017	No new recommendations.		N/A	
9/25/2017	No new recommendations.		N/A	
9/19/2017	No new recommendations.		N/A	
9/5/2017	No new recommendations.		N/A	
8/29/2017	No new recommendations.		N/A	
8/22/2017	No new recommendations.		N/A	
8/15/2017	No new recommendations.		N/A	
8/4/2017	Increase S65A discharge by 150 cfs to about 1400 cfs.	Reduce rate of stage rise in KCH.		SFWMD Water Mgt, KB Ops
8/1/2017	No new recommendations.		N/A	
7/25/2017	Hold current discharge at S65A, adjusting S65 discharge to maintain current flow to the Kissimmee River.	Maintain current S65A discharge.		SFWMD Water Mgt, KB Ops
7/23/2017	Increase S65A discharge slowly using Figure 8a toward the seasonal target of 1400 cfs. Hold at 1400 cfs while stage in KCH remains above 50 feet (+/- 0.2 foot).	Reduce current rapid rate of stage rise in KCH; provide Kissimmee River floodplain inundation if conditions stay wet.	Implemented	KB Ops
7/16/2017	Reduce S65A flow to ~600-650 cfs. As Pool A runoff diminishes keep S65A around 650 +/- 50 cfs by increasing flow from S65.	Maintain moderate discharge to the Kissimmee River from S65A while maintaining S65A headwater within its operating range using flow from S65.	Implemented	SFWMD Water Mgt, KB Ops
7/6/2017	Hold 450 cfs at S65A due to reduced forecast.	Reduced-rainfall forecast led to decision to hold 450 cfs at S65A rather than continuing to ramp up.	Implemented	KB Ops
7/5/2017	Increase S65A flow by 150 cfs today to 450 cfs and by another 150 cfs tomorrow.	Control stage in KCH and Pool A in anticipation of forecast significant rainfall; begin discharge rampup in anticipation of forecast rainfall.	Implemented	KB Ops
6/28/2017	Reduce S65A discharge by a maximum of 150 cfs per day until 300 cfs is reached.	Allow KCH stage to rise before transitioning to 2017 Wet Season discharge plan; facilitate DO recovery in the Kissimmee River by reducing depth in the river channel.	Implemented	KB Ops
6/26/2017	Hold 800 cfs at S65A until further notice.	Maintain reduced discharge to allow stages in KRR project area to decline to facilitate DO recovery.	Implemented	KB Ops
6/22/2017	Reduce discharge by 150 cfs each day on Thursday 6/22, Friday 6/23, Saturday 6/24, and Sunday 6/25. After the Sunday reduction hold at approximately 800 cfs through Monday when new DO data should be available to help guide next steps.	Attempt to allow Kissimmee River dissolved oxygen concentration to rise.	Implemented	KB Ops
6/20/2017	Maintain 1400 cfs at S65A as KCH stage continues to rise. Supplement declining S65A basin runoff by increasing discharge at S65 as needed.	Transition from current operations to 2017 Wet Season discharge plan.	Implemented	KB Ops, SFWMD Water Management
6/15/2017	Attempt to slow the rates of stage rise in Lakes Toho and East Toho by increasing discharge from S59 into Toho and S61 into KCH.	Slow rates of rise in Lakes Toho and East Toho.	Implemented	KB Ops, SFWMD Water Management
6/15/2017	Increase discharge from S65A as necessary using the discharge rates of change table in Figure 8a.	Lower stage in Pool A following rainfall directly over the S65A Basin.	Implemented	SFWMD Water Management, KB Ops

KCOL Hydrographs (through Sunday midnight)

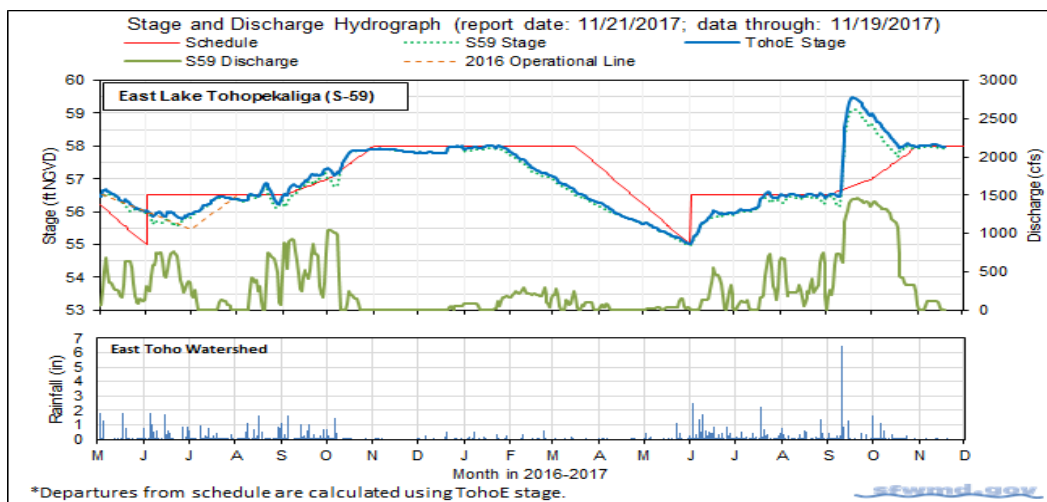


Figure 1.

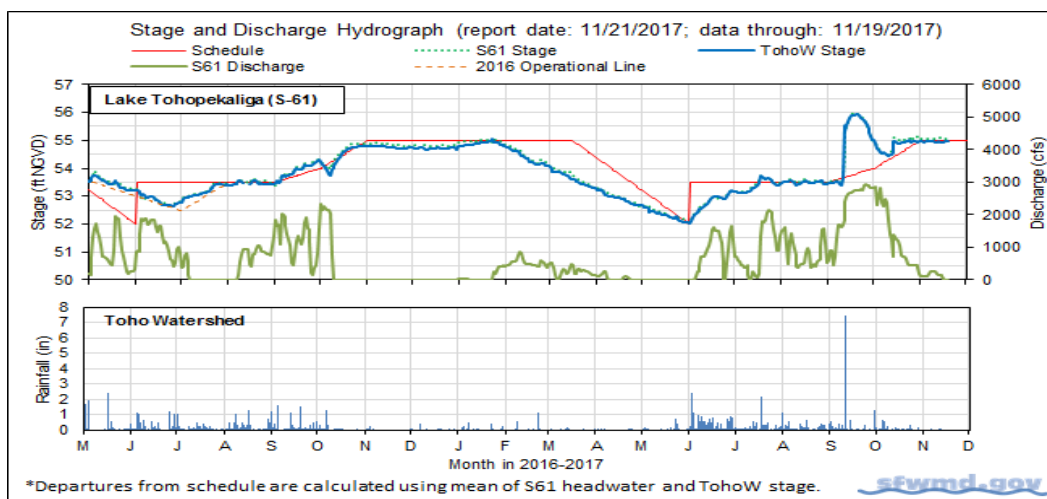


Figure 2.

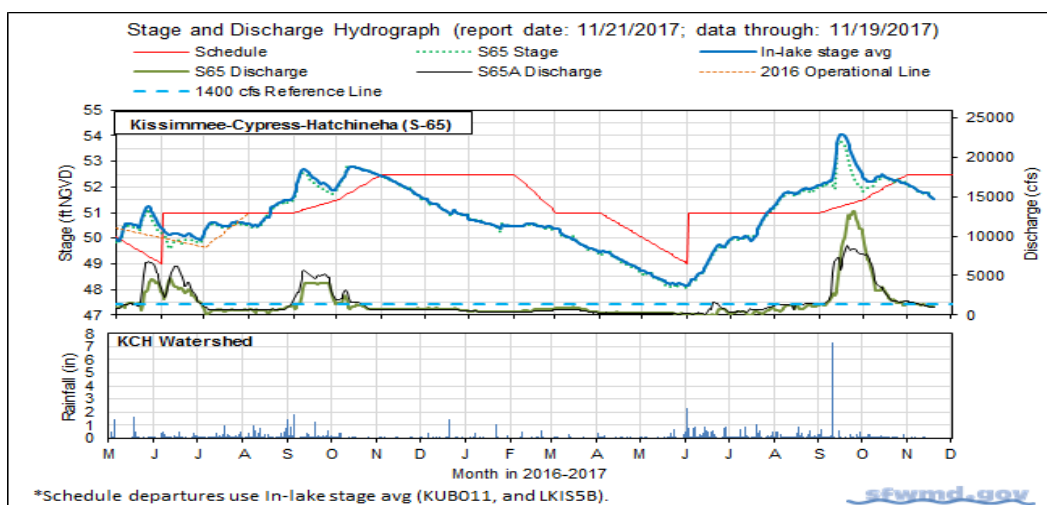


Figure 3.

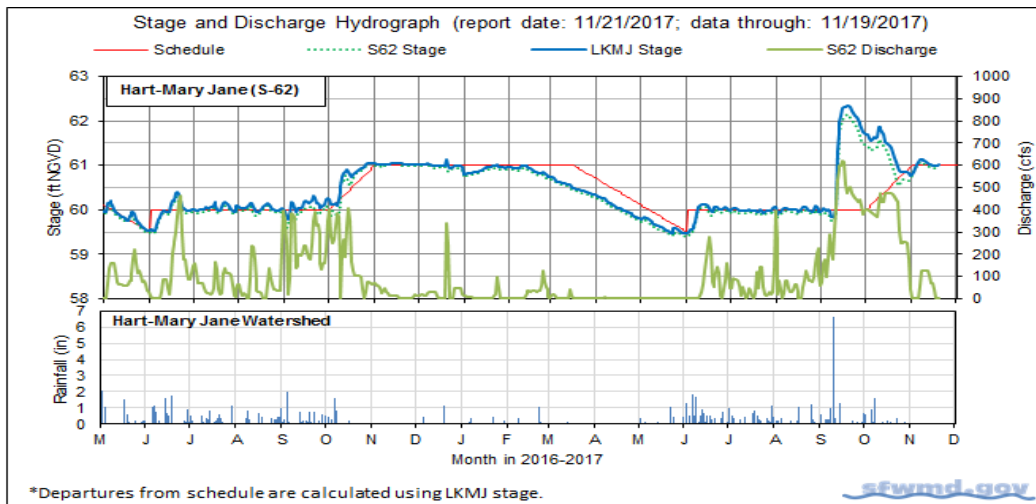


Figure 4.

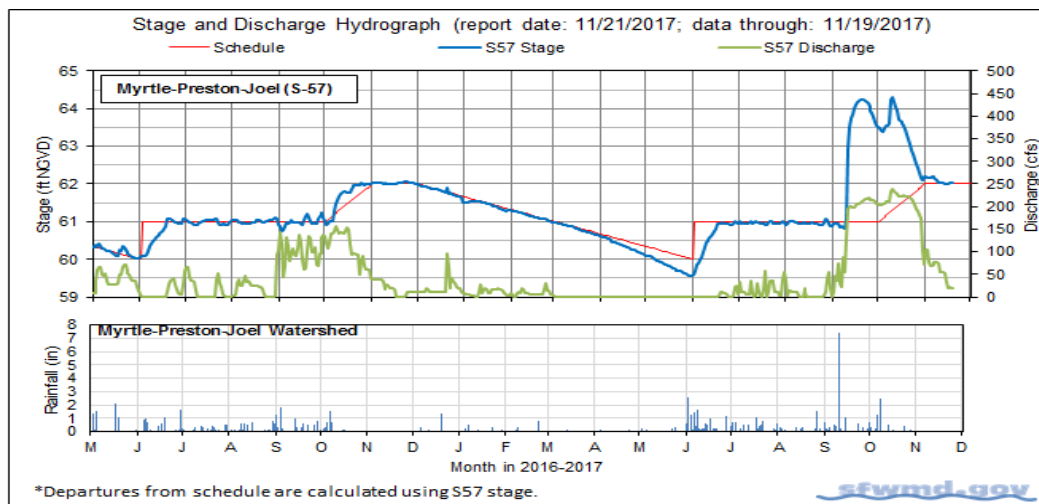


Figure 5.

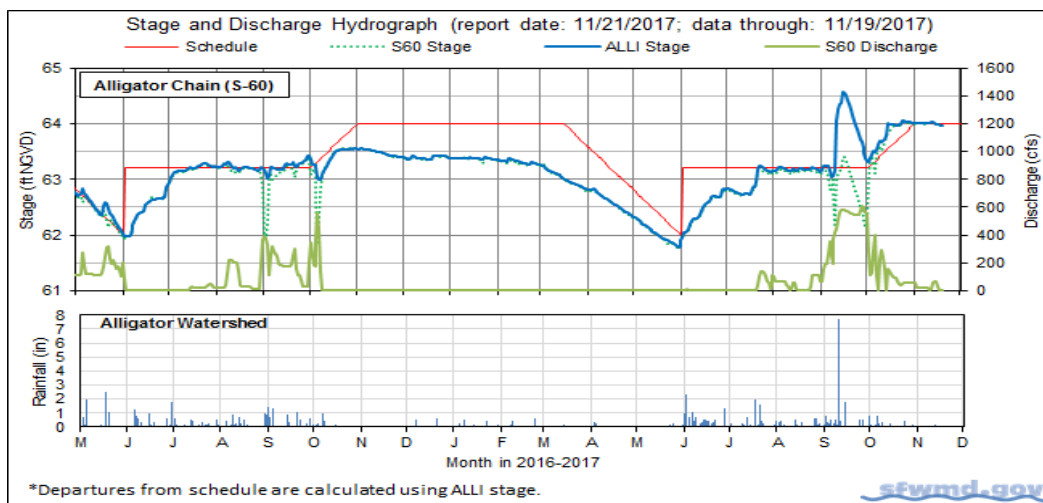


Figure 6.

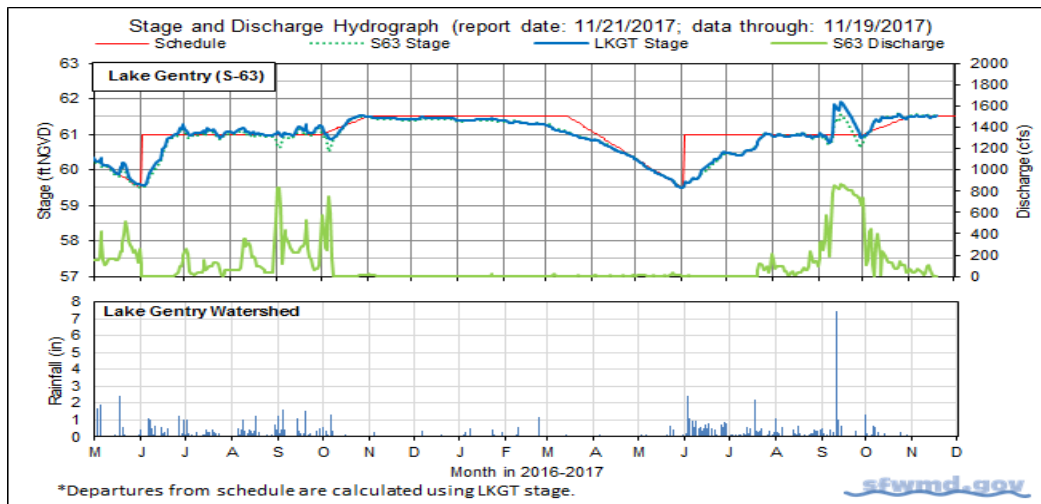


Figure 7.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT	
Limits on Rate of Discharge Change at S65/S65A During Dry Season 2016-2017	
Discharge Rate of Change Limits for S65/S65A (revised 11/16/16).	
Q (cfs)	Maximum rate of increase or decrease (cfs/day)
300-650	75
650-1700	150
1700-3000	300
>3000	1000

Figure 8. Limits on rate of discharge change at S65/S65A as of the 2016-2017 Dry Season.

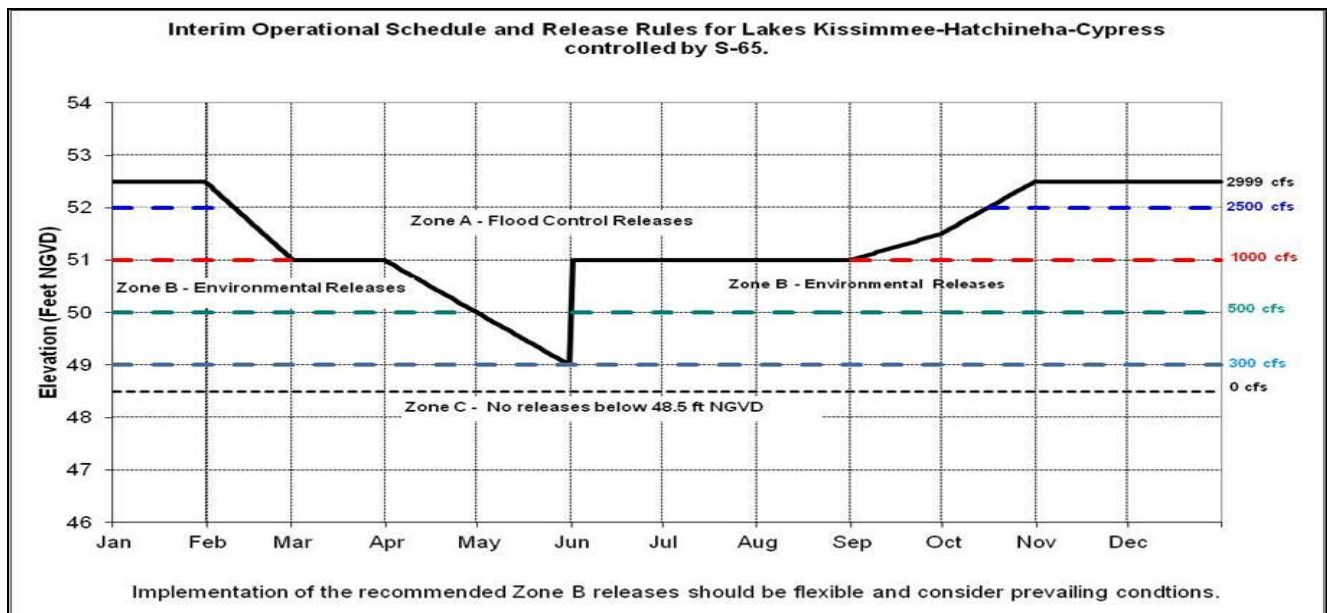


Figure 9. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

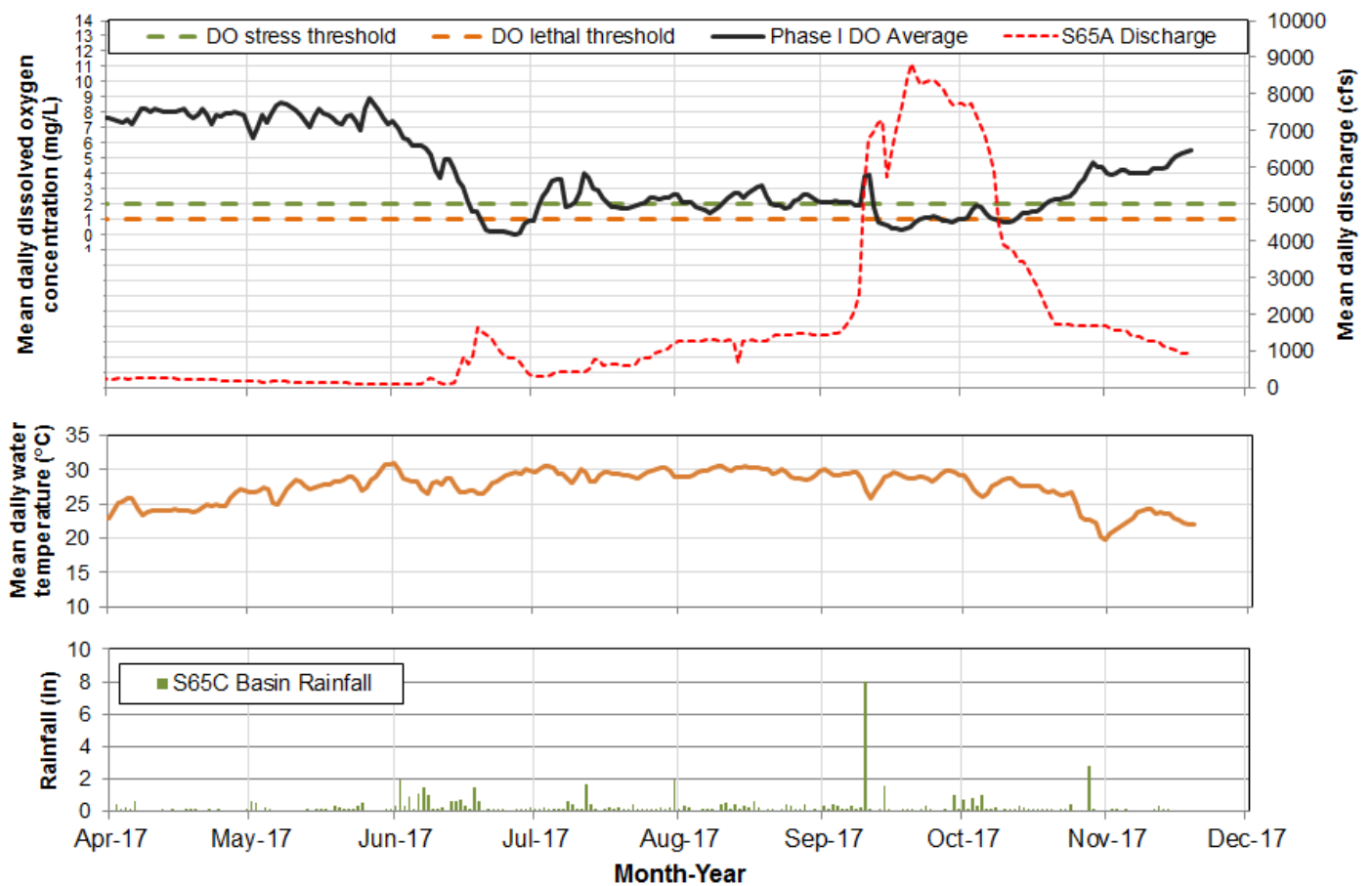


Figure 10. Mean daily Dissolved Oxygen, discharge, temperature and rainfall in the Phase I river channel.

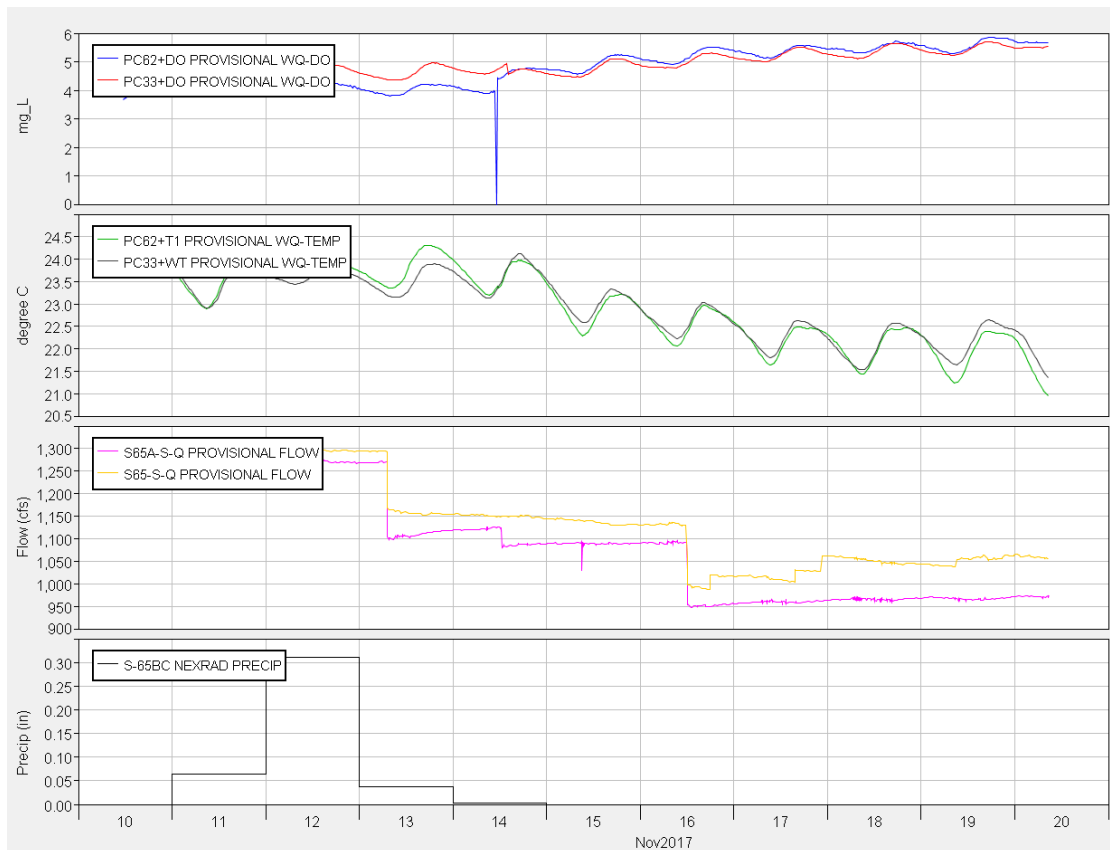


Figure 11. Phase I river channel dissolved oxygen and water temperature (measured at 15 minute intervals) and Pool BC daily rainfall.

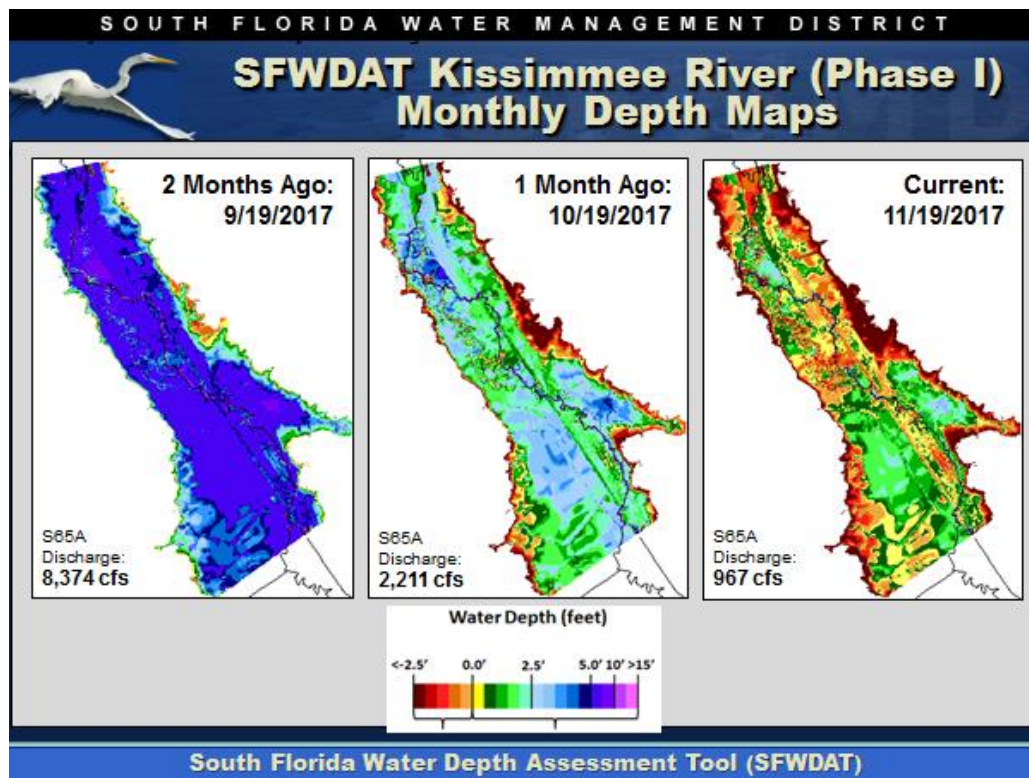
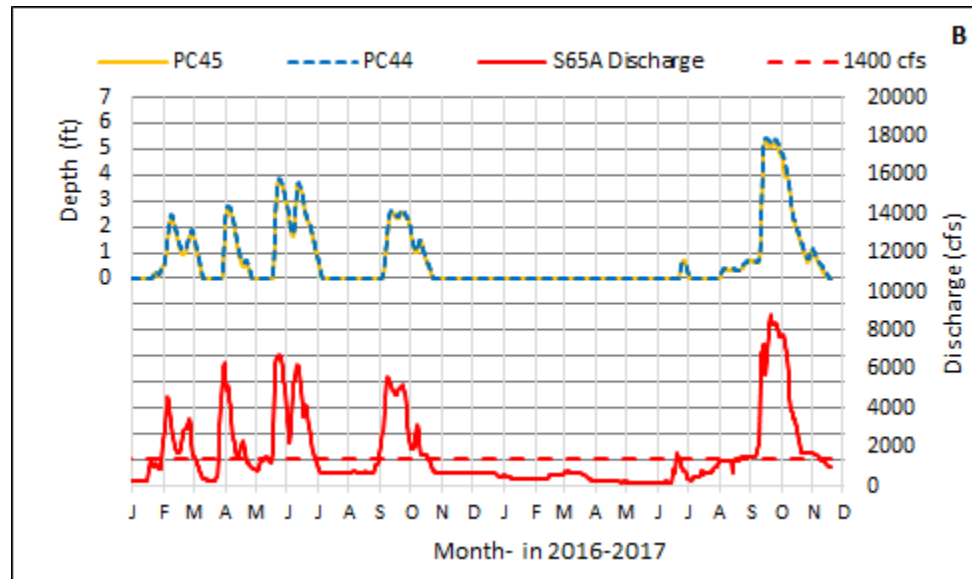
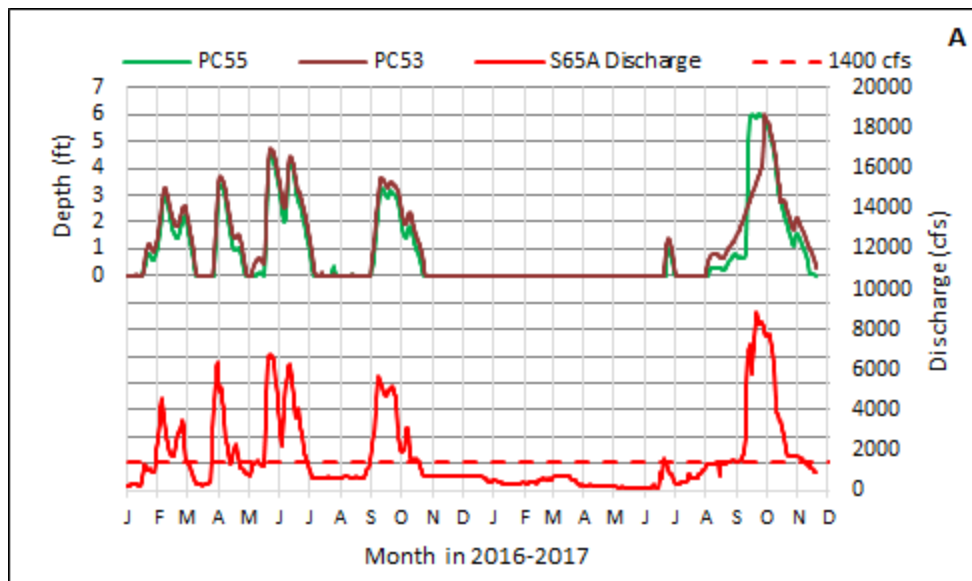


Figure 12. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to Jan. 16, 2012.



Insert. Water depth at selected northern Kissimmee River floodplain sites on (A) the PC5's transect and (B) the PC4's transect, with S65A discharge.

Kissimmee River Hydrographs

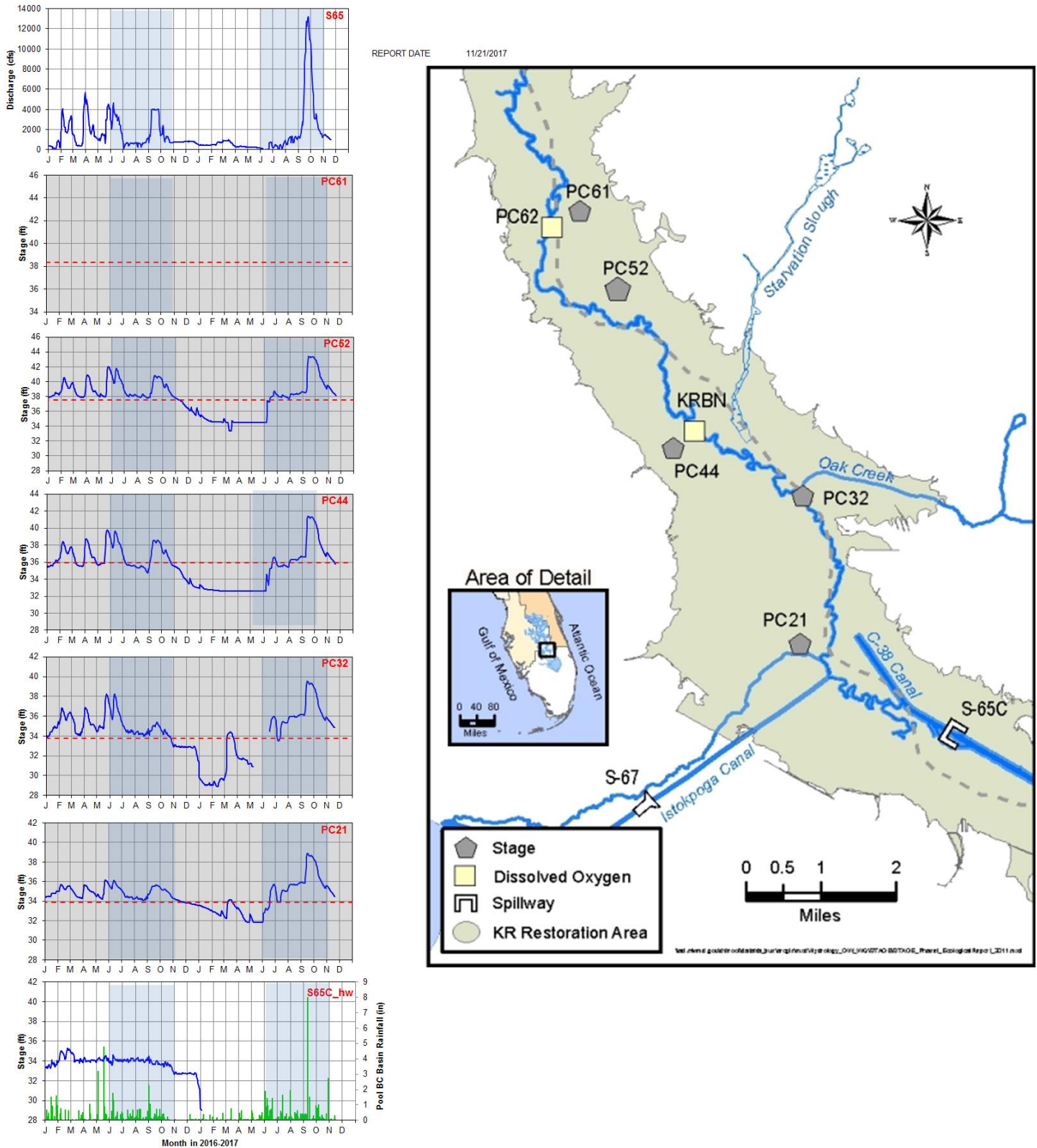


Figure 13. Discharge at S65, stages at five monitoring stations in the Phase I area of the Kissimmee River floodplain, and headwater stage at S65-C since January 1, 2016. The most recent data (~2 weeks) are provisional real-time data from SFWMD DualTrend; previous data are from SFWMD DB-HYDRO (validated). Dashed lines are ground elevations.



Figure 14. The Kissimmee Basin

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee stage is at 16.42 feet NGVD for the period ending at midnight on November 20, 2017. This value is based on the use of four interior Lake stations (L001, L005, L006 and LZ40) and four perimeter stations (S308, S352, S4 and S133). Lake stage last peaked at 17.20 feet on October 13, before declining to 16.8 feet on October 28 and then back up to 17.02 feet. The Lake is now -0.57 feet lower than it was a month ago but 1.5 feet higher than it was a year ago (Figure 1). The Lake is currently in the Intermediate sub band (Figure 2). According to RAINDAR, only 0.01 inches of rain fell directly over the Lake during the week Nov 14 - Nov 20 (Figure 3), with similar low rainfall throughout the watersheds (between 0.0 – 0.4 inches).

Average daily inflows to the Lake decreased again over the past week, from 5,704 cfs to 4,453 cfs. Most of the inflows were from the Kissimmee River via the S65E and S84 structures, which averaged 1,888 cfs and 855 cfs daily, respectively. S71 and S72 structures, along with Fisheating Creek, contributed a combined 1,096 average daily cfs as well.

Average daily outflows for the Lake decreased from the previous two weeks, primarily due to reductions through the S308 structure. Total outflows went from 8,762 cfs to 7,730 cfs, with S308 discharges going from 2,666 cfs to 1,618 cfs. S77 discharges were unchanged, with 6,125 average daily cfs the previous week and 6,103 cfs this past week. There were no discharges south through the S350 structures or to the L8 canal via Culvert 10A (average of only 10 cfs). The corrected evapotranspiration value based on the L006 weather platform solar radiation data decreased slightly to 0.13 inches for the past week.

Total inflows and outflows for the last two weeks are detailed in Table 1, as well as the approximate change in Lake stage from each major structure's total flows over the period (midnight Nov 14 to midnight Nov 20). Figure 4 shows the combined average daily cfs for inflows and outflows for the Lake over the past eight weeks. These data are provisional, and are subject to change.

INFLOWS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S65E & S65EX1	1888	0.7
S71 & 72	289	0.1
S84 & 84X	855	0.3
Fisheating Creek	807	0.3
S154	87	0.0
S191	340	0.1
S133 P	76	0.0
S127 P	55	0.0
S129 P	20	0.0
S131 P	4	0.0
S135 P	33	0.0
S2 P	0	0.0
S3 P	0	0.0
S4 P	0	0.0
C5	0	0.0
Rainfall	39	0.0
Total	4491	1.7

OUTFLOWS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S77	6103	2.3
S308	1618	0.6
S351	0	0.0
S352	0	0.0
S354	0	0.0
L8	10	0.0
ET	2425	0.9
Total	10155	3.8

PROVISIONAL
DATA

Table 1

Satellite imagery indicates that algal bloom potential has remained very low over the past two months, based on NOAA's cyanobacteria monitoring product derived from the OLCI satellite sensor. Potential for elevated cyanobacterial levels were last observed in the northern portion of the Lake in early September (Figure 5). Along with decreasing temperatures, high winds from Hurricane Irma may have further reduced bloom potential on the Lake by increasing turbidity, but elevated total phosphorus levels from high inflows and resuspended Lake sediment are expected to produce high bloom potentials next year as turbidity declines and temperatures increase.

Water Management Recommendations

The Lake is 16.42 feet NGVD having decreased 0.25 feet from the week prior, and 0.5 feet over the past two weeks. Submerged and emergent vegetation communities in the nearshore region have experienced stages >16 feet three times in less than two years, and for 60 consecutive days and counting, the longest since late 2004. These stages, combined with turbid conditions from Hurricane Irma's winds, will likely cause substantial declines in these communities over the coming months and/or years. Lower Lake stages near the end of WY2018 would help to recover these important communities, and long, steady recessions of water levels throughout the dry season may help promote another productive year for wading birds on the Lake as well.

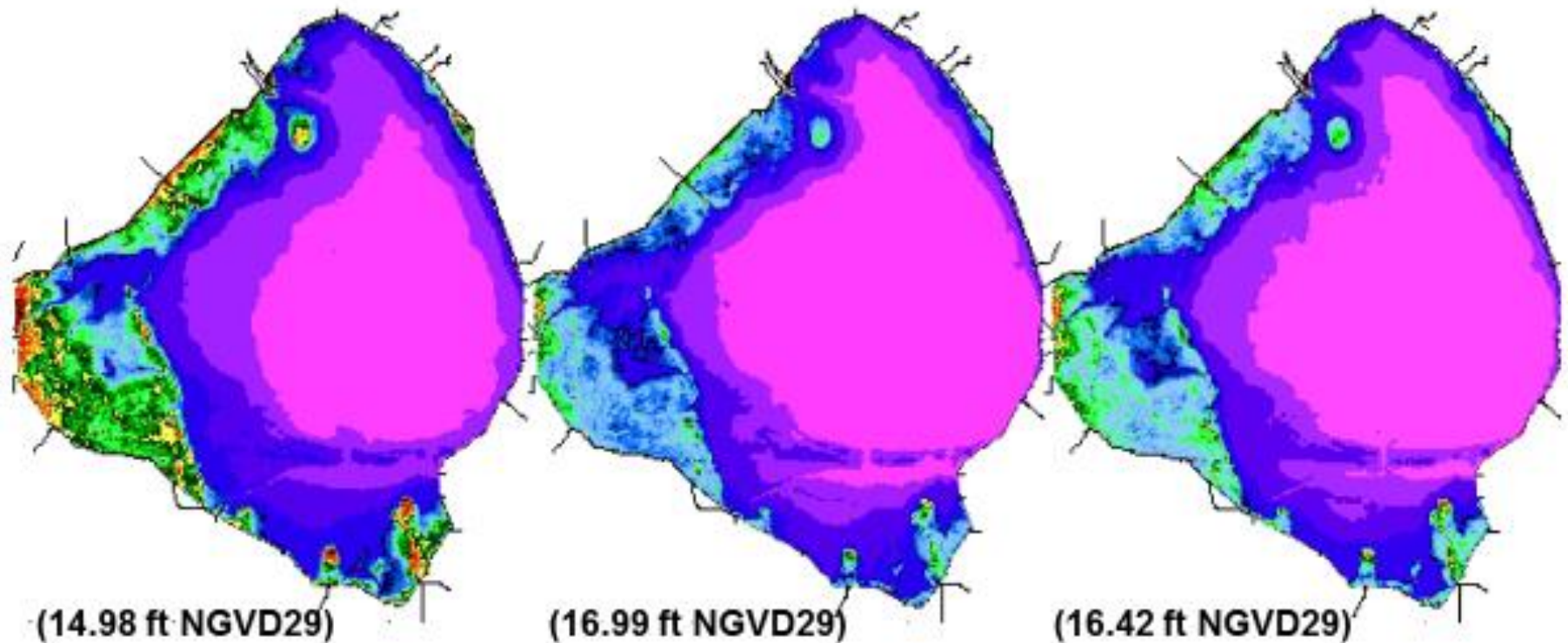
Lake Okeechobee

Water Depth Timeseries Maps

1 Year Ago: 11/20/2016

1 Month Ago: 11/21/2017

Current: 11/20/2017



Source of Lake Graphic: Water Depth
Assessment Tool (SFWDAT)
Source of Lake Stage Value:
USACE/SFWMD Official Stage Value

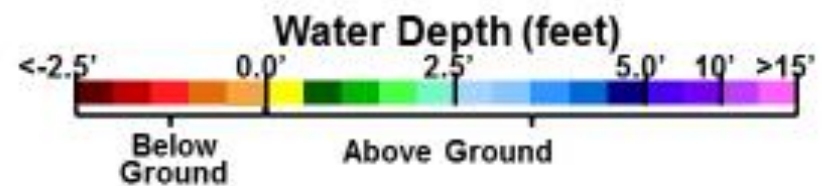


Figure 1

Lake Okeechobee Water Level History and Projected Stages

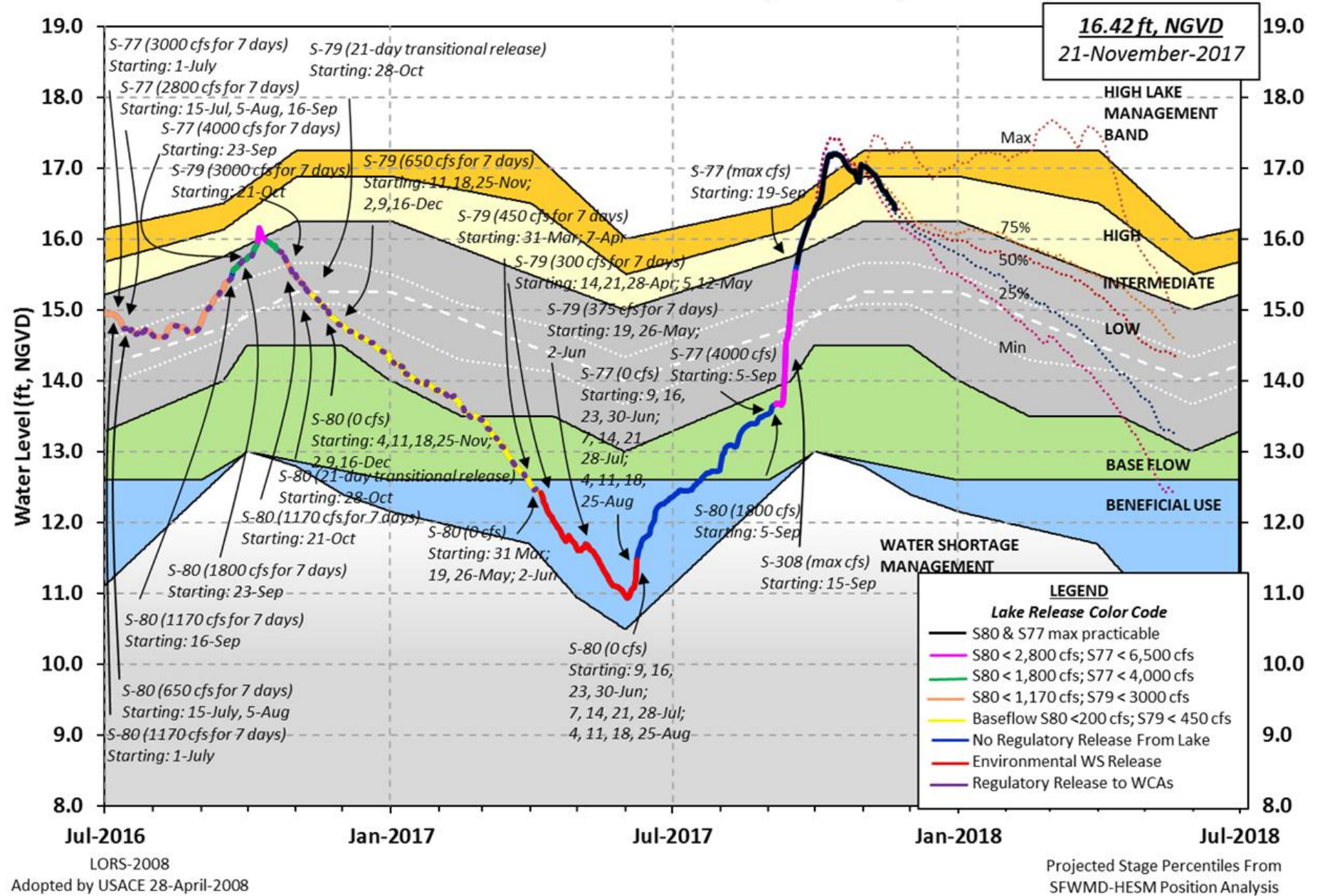


Figure 2

SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES

FROM: 0615 EST, 11/14/2017 THROUGH: 0615 EST, 11/21/2017

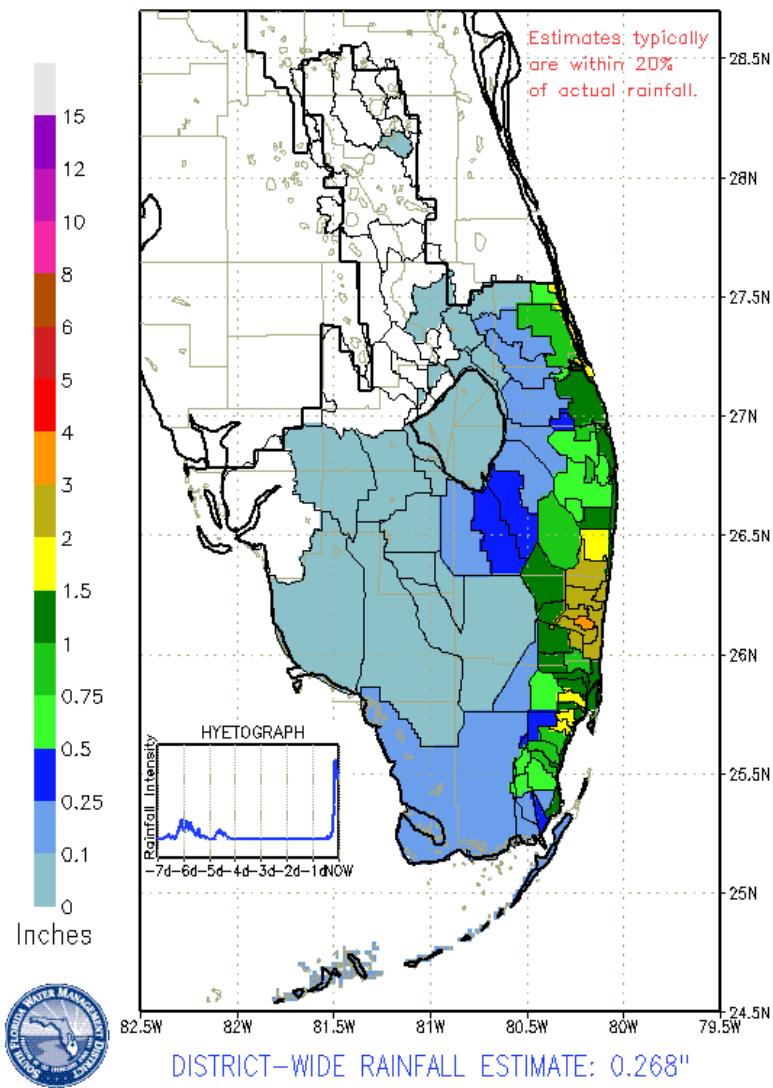


Figure 3

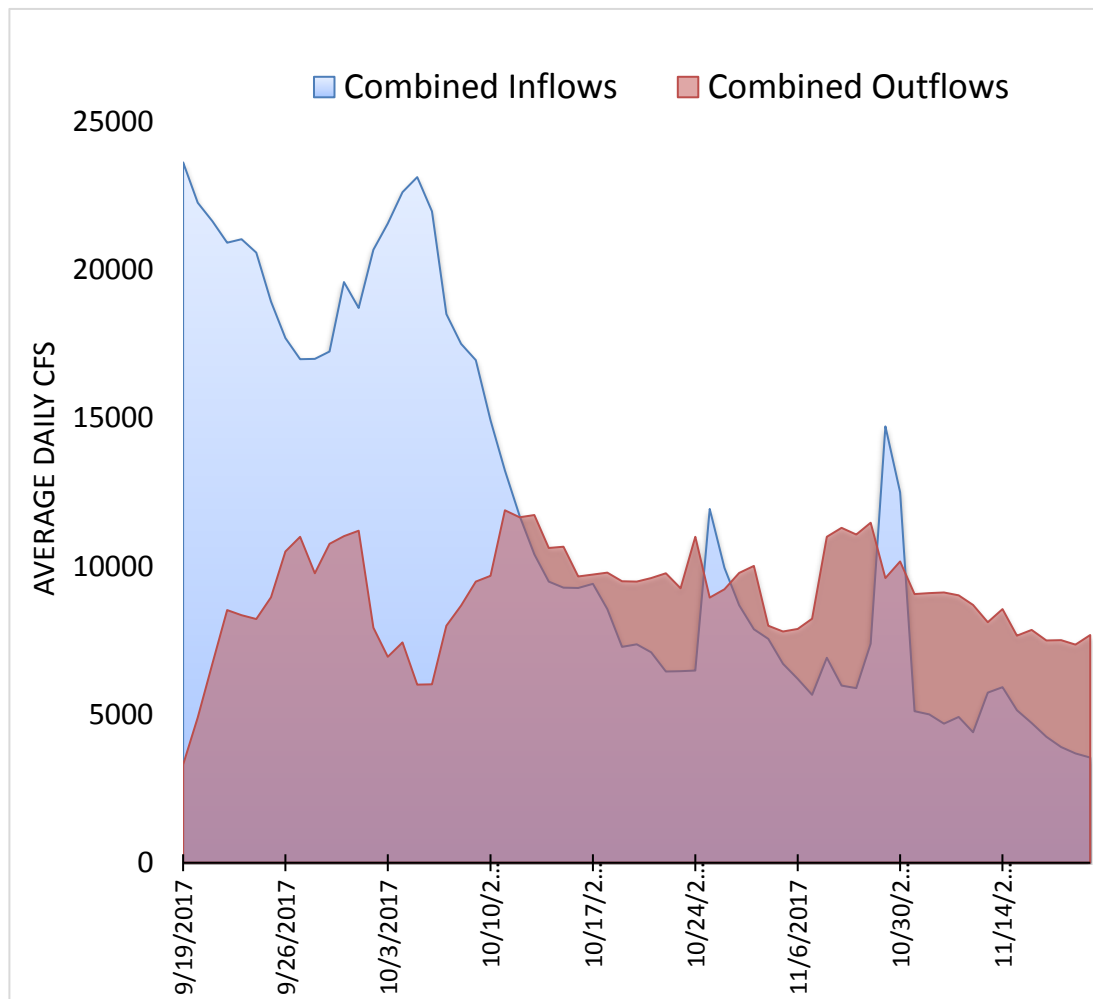


Figure 4

Lake Okeechobee Cyanobacteria Bloom Potential

NOAA cyanobacteria product derived from Copernicus Sentinel-3 OLCI data from EUMETSAT

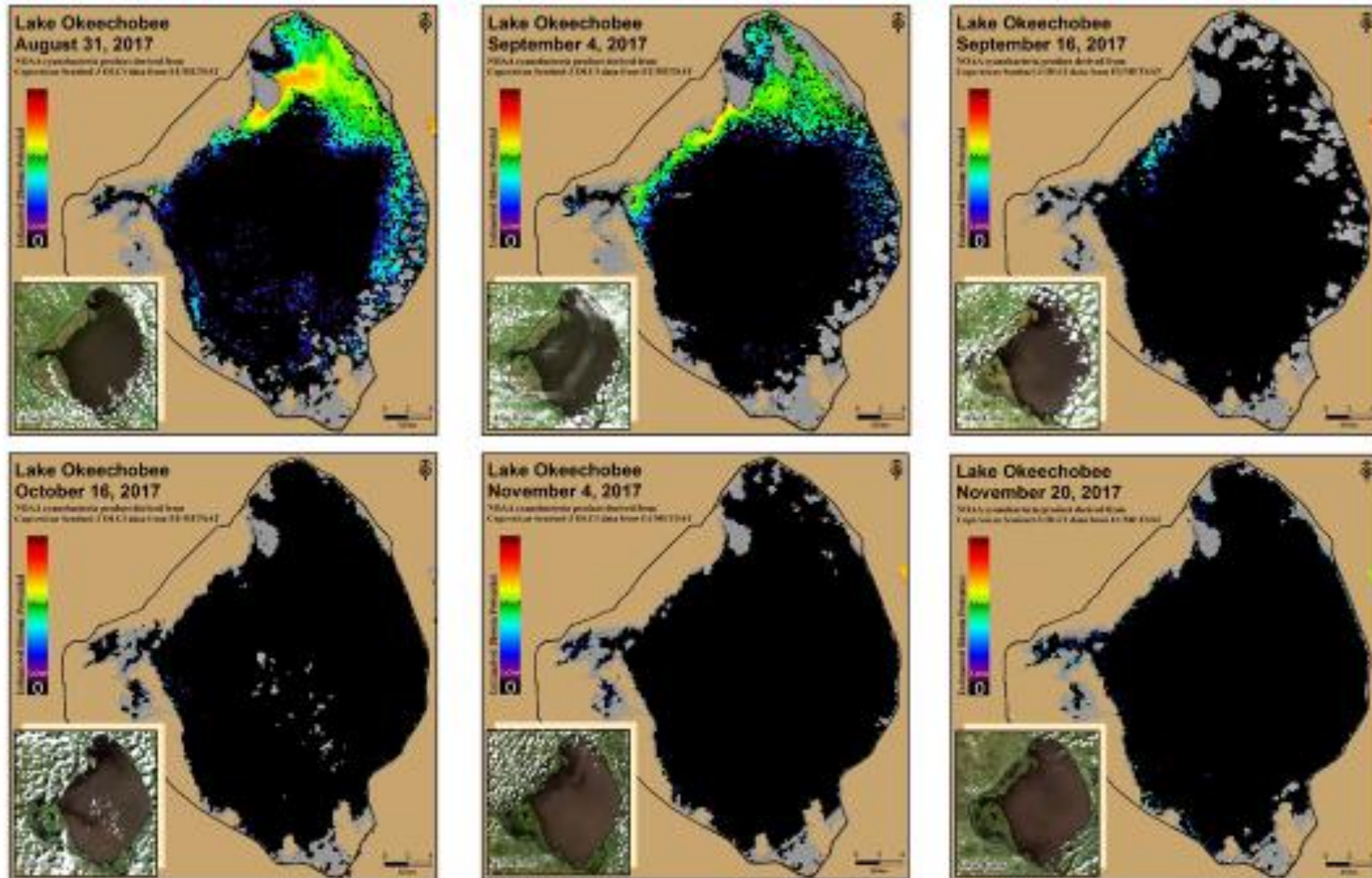


Figure 5

LAKE ISTOKPOGA

Lake Istokpoga stage is 39.24 feet NGVD as of midnight November 20, 2017 and is currently -0.26 feet below its regulation schedule to accommodate construction on downstream structures (Figure 6). Average daily flows into the Lake from Josephine Creek for the week Nov 14 – Nov 20 were slightly lower than the previous week, at 146 cfs. No data have been reported for Arbuckle Creek since July 4 as the gauge is being recalibrated after construction in the area. Average daily discharge from S68 and S68X over the past week was similar to the previous week, going from 893 cfs to 852 cfs. According to RAINDAR, no rain (0.00 inches) fell in the Lake Istokpoga basin in the past week.



Figure 6

ESTUARIES

St. Lucie Estuary

Over the past week, provisional flows averaged about 3,237 cfs at S-80, 1,611 cfs at S-308, 501 cfs at S-49 on C-24, 392 cfs at S-97 on C-23, and 360 cfs from Ten Mile Creek at the Gordy Road Structure. Average inflow from tidal basin tributaries is estimated to be 1,266 cfs (Figures 1 and 2). Total inflow averaged about 5,756 cfs last week and 6,425 cfs over last month.

Over the past week, salinity remained about the same in North Fork (HR1) and in the middle estuary (US1 Bridge) and decreased slightly in lower parts of the estuary (Table 1, Figures 3 and 4). The seven-day moving average salinity of the water column (an average of the surface and bottom salinity)

at the US1 Bridge is 1.0. Salinity conditions in the middle estuary are in the poor range for the adult eastern oysters (Figure 3).

Table 1. Seven-day average salinity at three monitoring stations in the St. Lucie Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for adult eastern oysters (*Crassostrea virginica*) in the middle estuary.

Sampling Site	Surface	Bottom	Envelope
HR1 (N. Fork)	0.4 (0.4)	0.4 (0.4)	NA ¹
US1 Bridge	0.5 (0.6)	1.5 (1.1)	10.0-26.0
A1A Bridge	4.2 (5.6)	14.2 (15.6)	NA ¹

¹Envelope not applicable.

Continuous monitoring of water quality is conducted at HR1 in the North Fork. Weekly dissolved oxygen data are summarized in Table 2.

Table 2. Weekly dissolved oxygen conditions at HR1 in the North Fork of the St. Lucie Estuary.

Location	Depth	Average DO (mg/l)	Minimum DO (mg/l)	Maximum DO (mg/l)
HR1	surface	7.05	4.80	7.77
HR1	bottom	6.26	2.23	7.70

Continuous monitoring of water quality is conducted at five Land/Ocean Biogeochemical Observatory (LOBO) stations located in the St. Lucie Estuary and maintained by Florida Atlantic University/Harbor Branch Oceanographic Institute (FAU-HBOI). Data are summarized in Table 3 and station location map is shown in Figure 5.

Table 3. Weekly ranges of Instrument Depth, Chlorophyll *a* (a measure of algal biomass) and dissolved oxygen concentrations at five FAU-HBOI LOBO stations located in the St. Lucie Estuary.

Location	Depth (m)	Chlorophyll <i>a</i> (µg/l)	Average DO (mg/l)	Minimum DO (mg/l)	Maximum DO (mg/l)
SF2	3.15	4.78 - 5.44	6.23	5.88	6.53
SF	1.92	5.4 - 6.22	7.73	7.16	8.33
NF	2.36	5.54 - 8.4	7.09	6.26	7.45
ME	2.12	4.75 - 6.41	7.29	6.73	7.78
IRL-SLE	3.84	1.58 - 4.65	5.86	5.18	6.39

NOAA satellite imagery indicates low to medium potential for cyanobacteria blooms at just few nearshore locations in the St. Lucie Estuary (Figure 6).

Caloosahatchee Estuary

During the past week, provisional flows averaged approximately 6,103 cfs at S-77, 6,163 cfs at S-78, and 7,569 cfs at S-79. Average inflow from tidal basin tributaries is estimated to be 244 cfs (Figures 7 & 8). Total inflow averaged 7,813 cfs last week and 9,635 cfs over last month.

Over the past week, surface salinity remained about the same to Ft. Myers Yacht Basin and increased downstream (Table 4, Figures 9 A & B and 10). The seven-day average salinity values are within the poor range for the adult eastern oysters at Cape Coral and in the good range at Shell Point (Figure 11). Salinity data was not available at Sanibel. The 30-day moving average surface salinity is 0.2 at both Val I-75 and at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

Table 4. Seven-day average salinity at six monitoring stations in the Caloosahatchee Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for tape grass (*Vallisneria americana*) at Val I-75 and for adult eastern oysters (*Crassostrea virginica*) elsewhere.

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	0.1 (0.1)	0.1 (0.1)	NA ¹
*Val I75	0.1 (0.2)	0.1 (0.2)	0.0-5.0 ²
Ft. Myers Yacht Basin	0.2 (0.2)	0.2 (0.2)	NA
Cape Coral	0.6 (0.3)	0.8 (0.4)	10.0-30.0
Shell Point	9.8 (8.6)	11.5 (12.0)	10.0-30.0
Sanibel	NR ³ (NR)	NR (NR)	10.0-30.0

¹Envelope not applicable, ²Envelope is based on a 30-day average, and ³Not Reporting.

*Val I75 is temporarily unavailable (salinity values are estimated using models developed for this site).

Monitoring data collected by the River, Estuary and Coastal Observing Network of Sanibel-Captiva Conservation Foundation using continuous sensors are summarized in Table 5 as concentration ranges of chlorophyll *a* and dissolved oxygen at Beautiful Island, Ft. Myers, and Shell Point in the Caloosahatchee Estuary.

Table 5. Weekly ranges of Chlorophyll *a* (a measure of algal biomass) and dissolved oxygen concentrations at three monitoring stations maintained by the Sanibel-Captiva Conservation Foundation.

	RECON Monitoring Stations		
	Beautiful Island	Ft. Myers	Shell Point
Chlorophyll <i>a</i> (µg/l)	Down for maintenance	1.86 - 2.14	2.37 - 4.89
Dissolved Oxygen (mg/l)	Down for maintenance	No Data	6.69 - 8.48

The Florida Fish and Wildlife Research Institute reported on November 17, 2017, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed in background to high concentrations in eleven samples collected from Lee County.

NOAA satellite imagery indicates low to medium potential for cyanobacteria blooms at just a few nearshore locations in the Caloosahatchee Estuary (Figure 12).

Water Management Recommendations

Lake stage is in the Intermediate sub band of 2008 LORS. Tributary hydrological conditions are wet. The 2008 LORS recommends up to 4,000 cfs at S-77 and up to 1,800 cfs at S-80. Given the current estuarine conditions, there are no ecological benefits associated with freshwater releases from Lake Okeechobee.

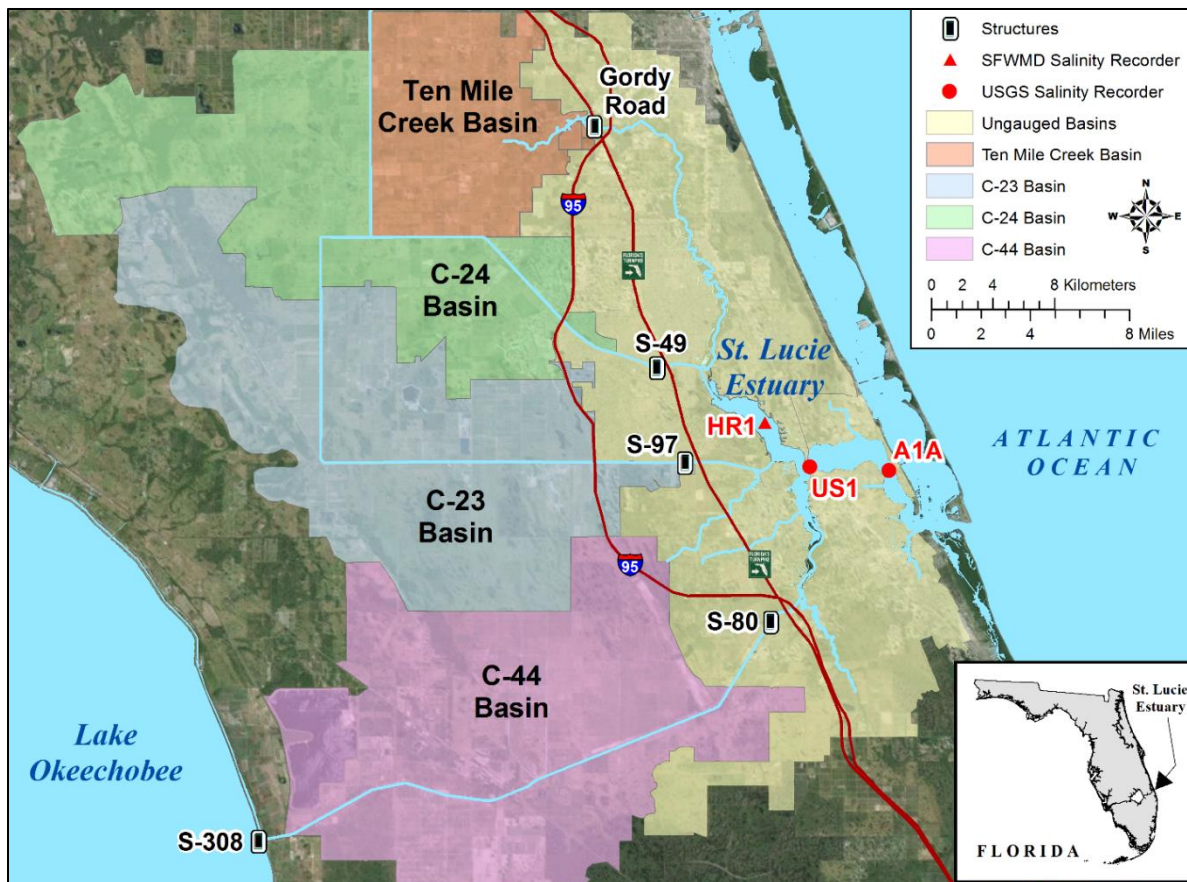


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

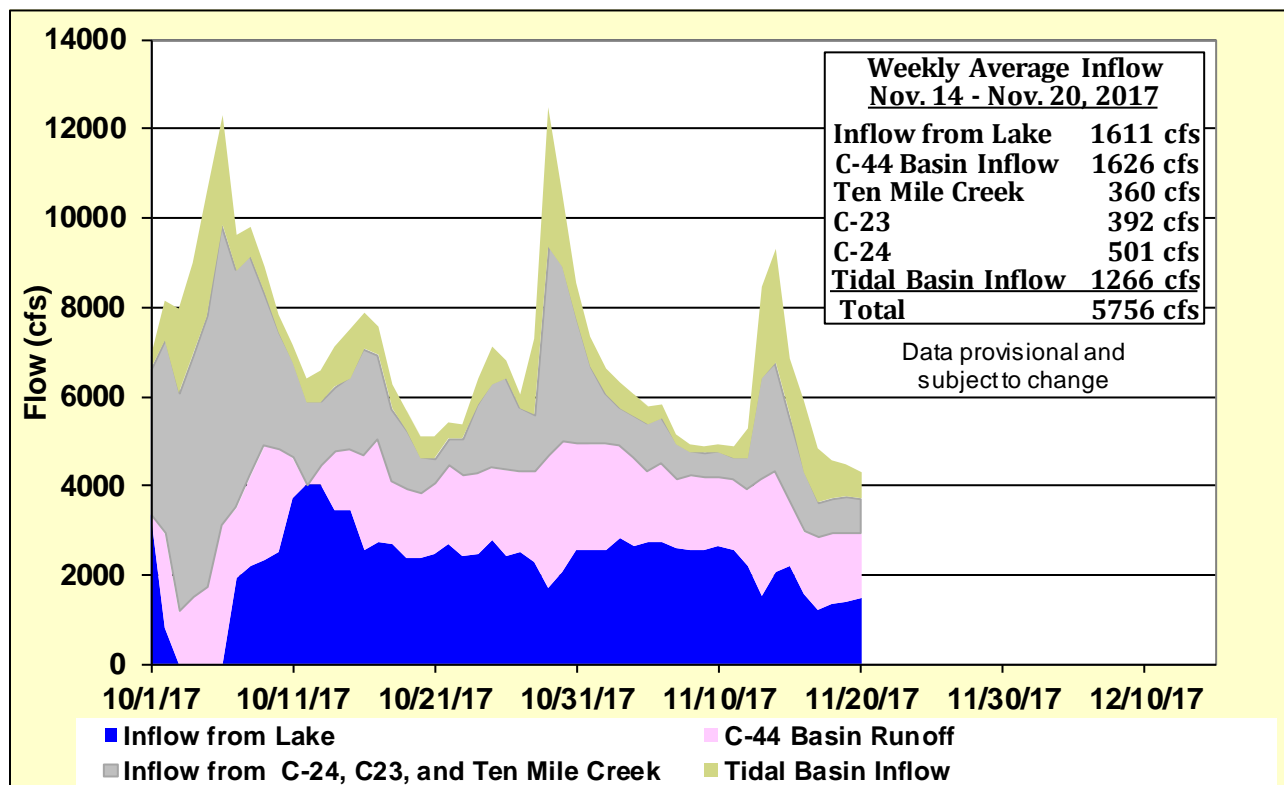


Figure 2. Estimated surface freshwater inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

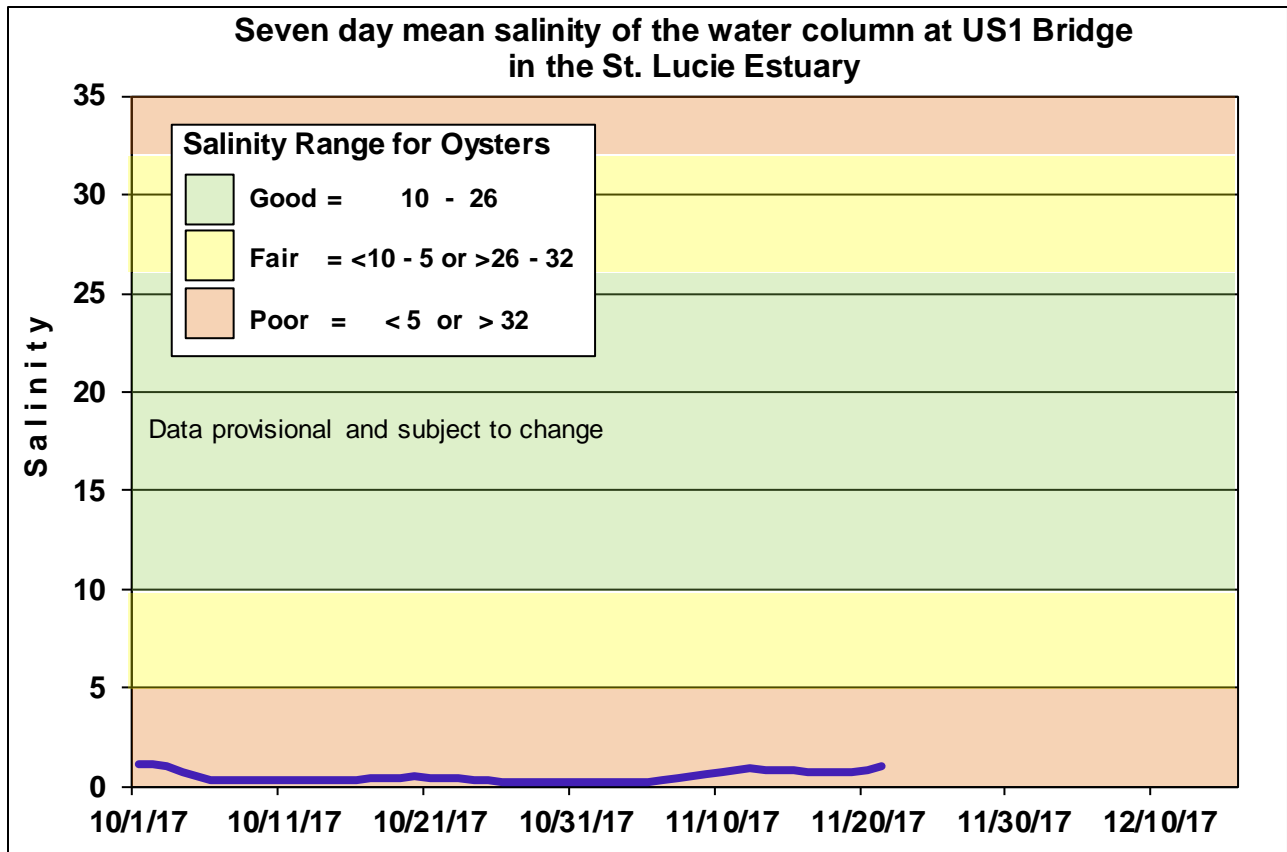


Figure 3. Seven-day mean salinity of the water column at the U.S. Highway 1 Bridge.

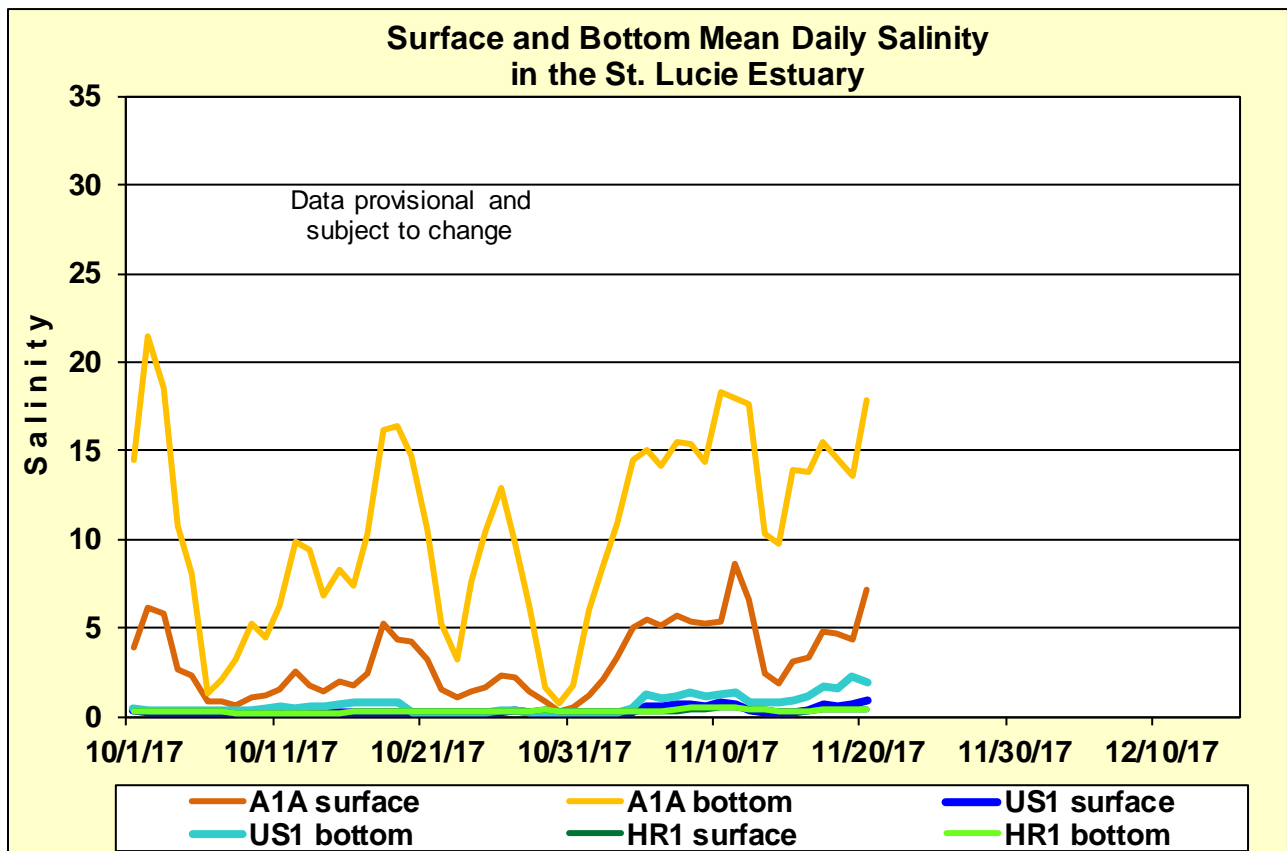


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

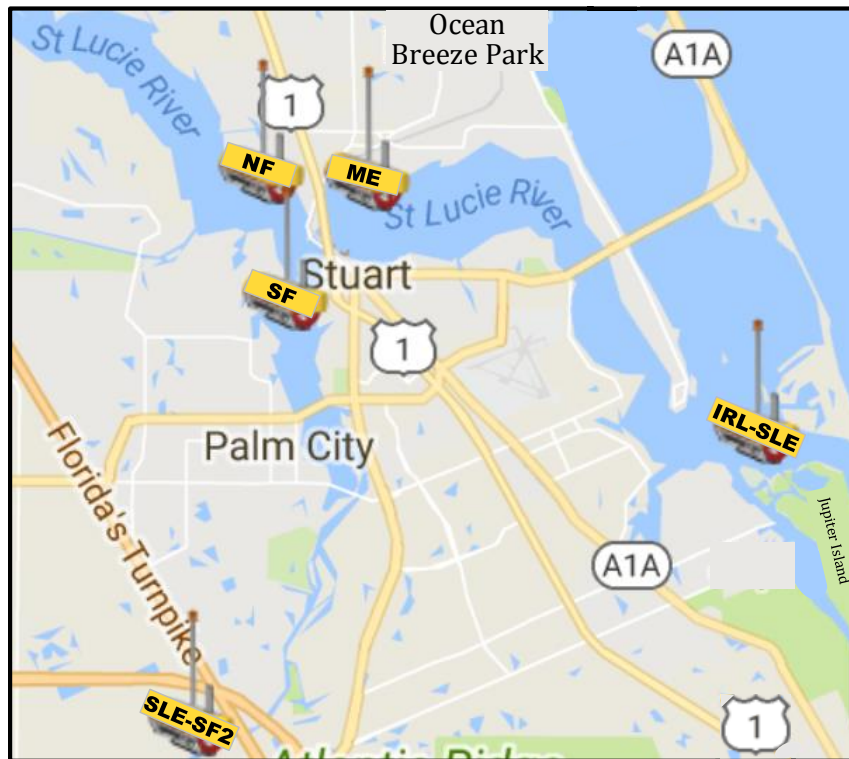


Figure 5. Location of FAU-HBOI LOBO water quality stations in the St. Lucie Estuary.

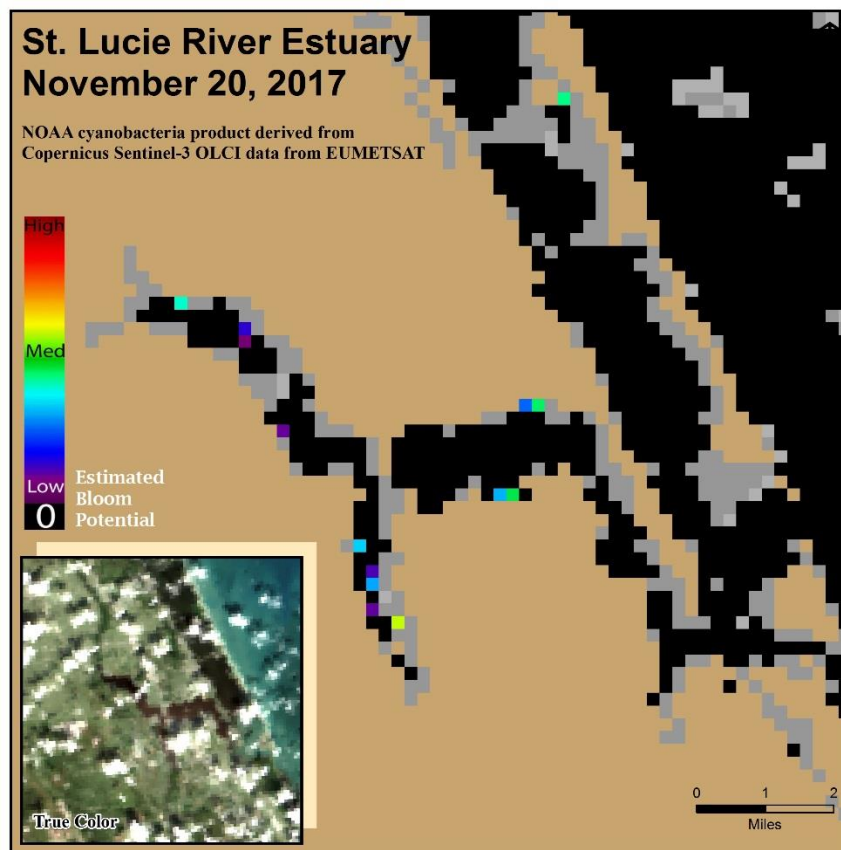


Figure 6. Sentinel 3a Satellite imagery provided by NOAA uses Ocean and Land Color Instrument (OLCI) to estimate cyanobacteria bloom potential in St. Lucie Estuary.

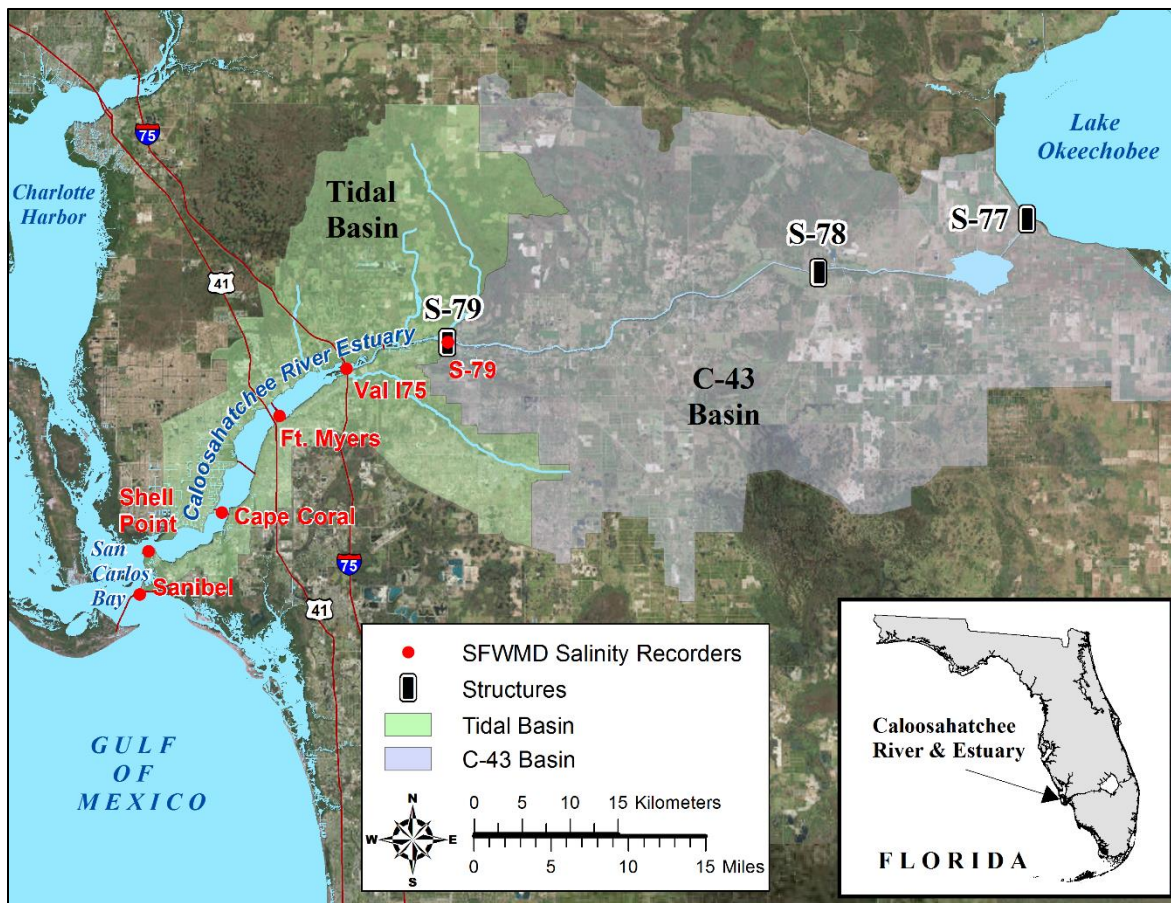


Figure 7. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

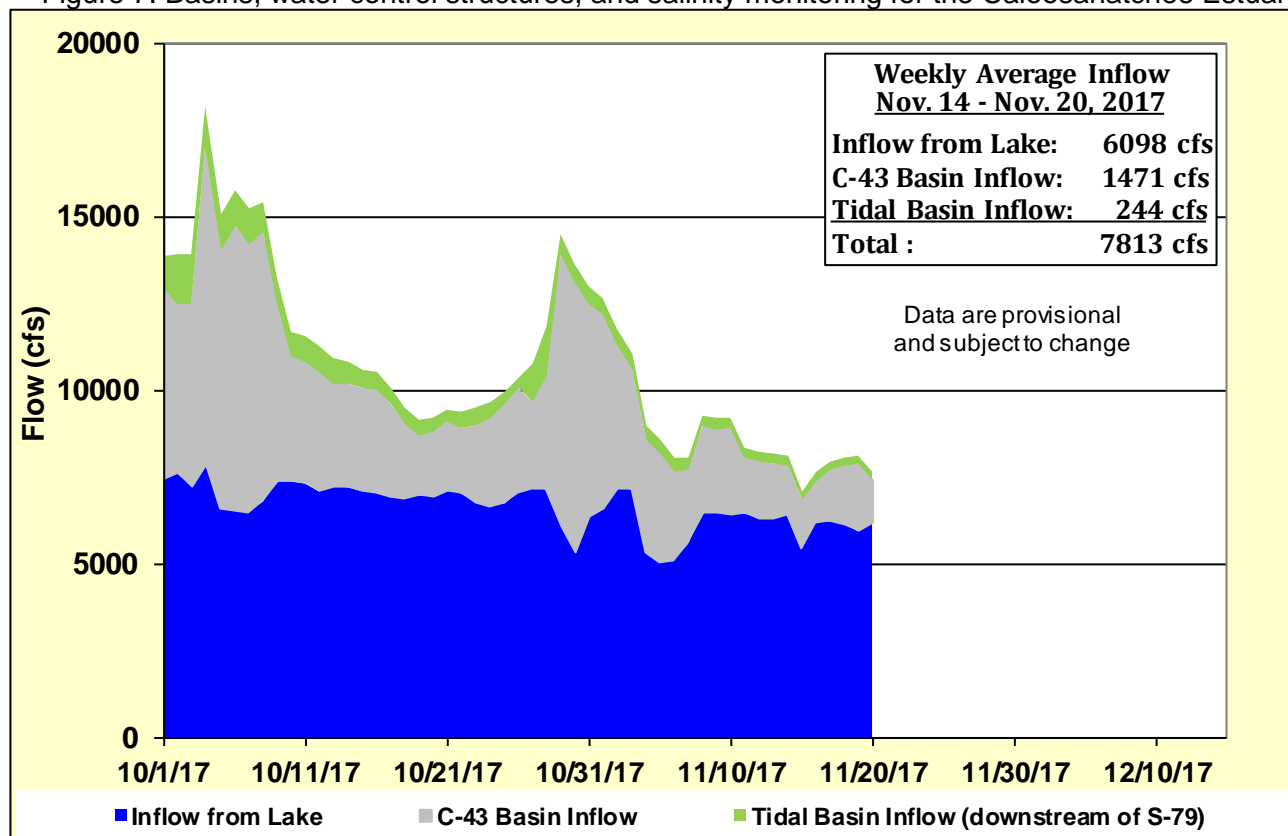


Figure 8. Freshwater inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

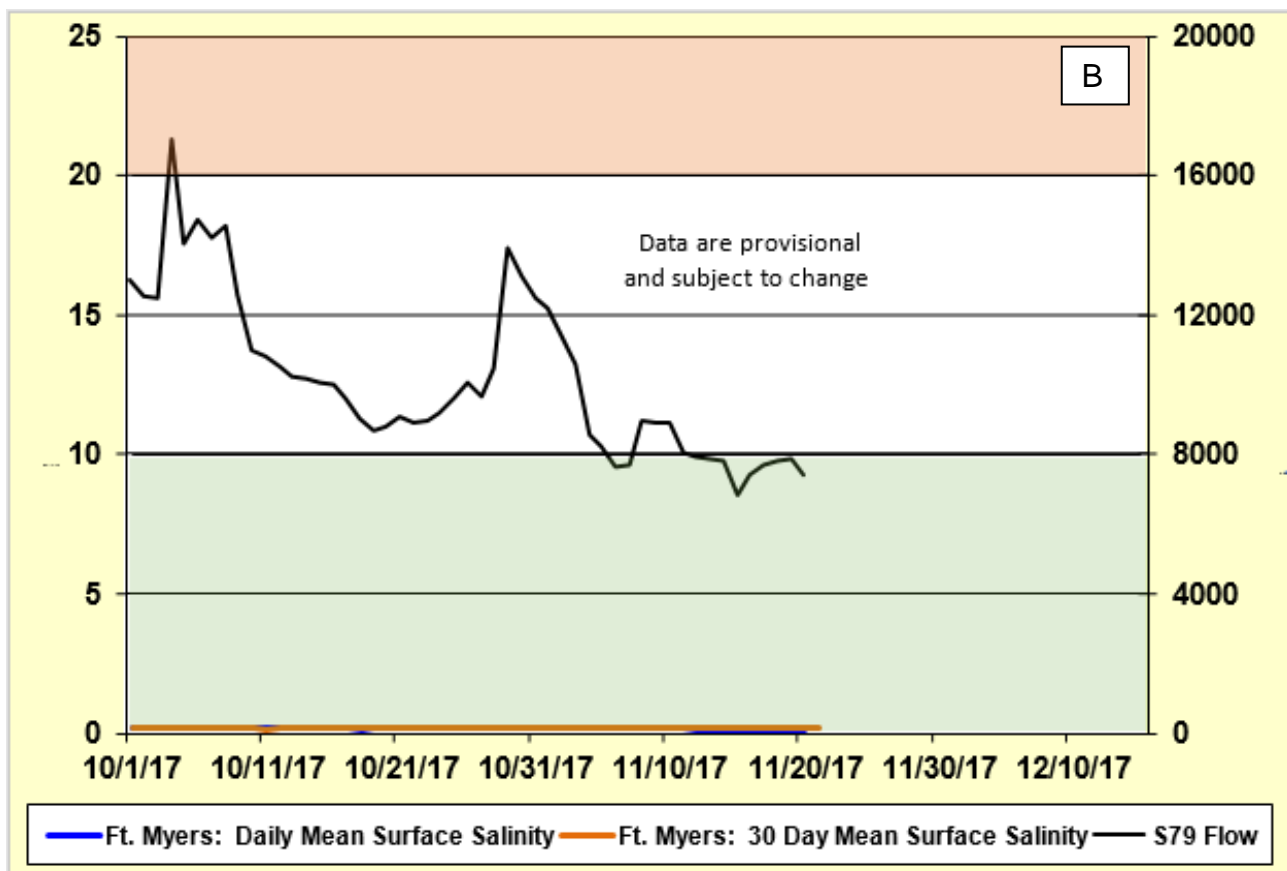
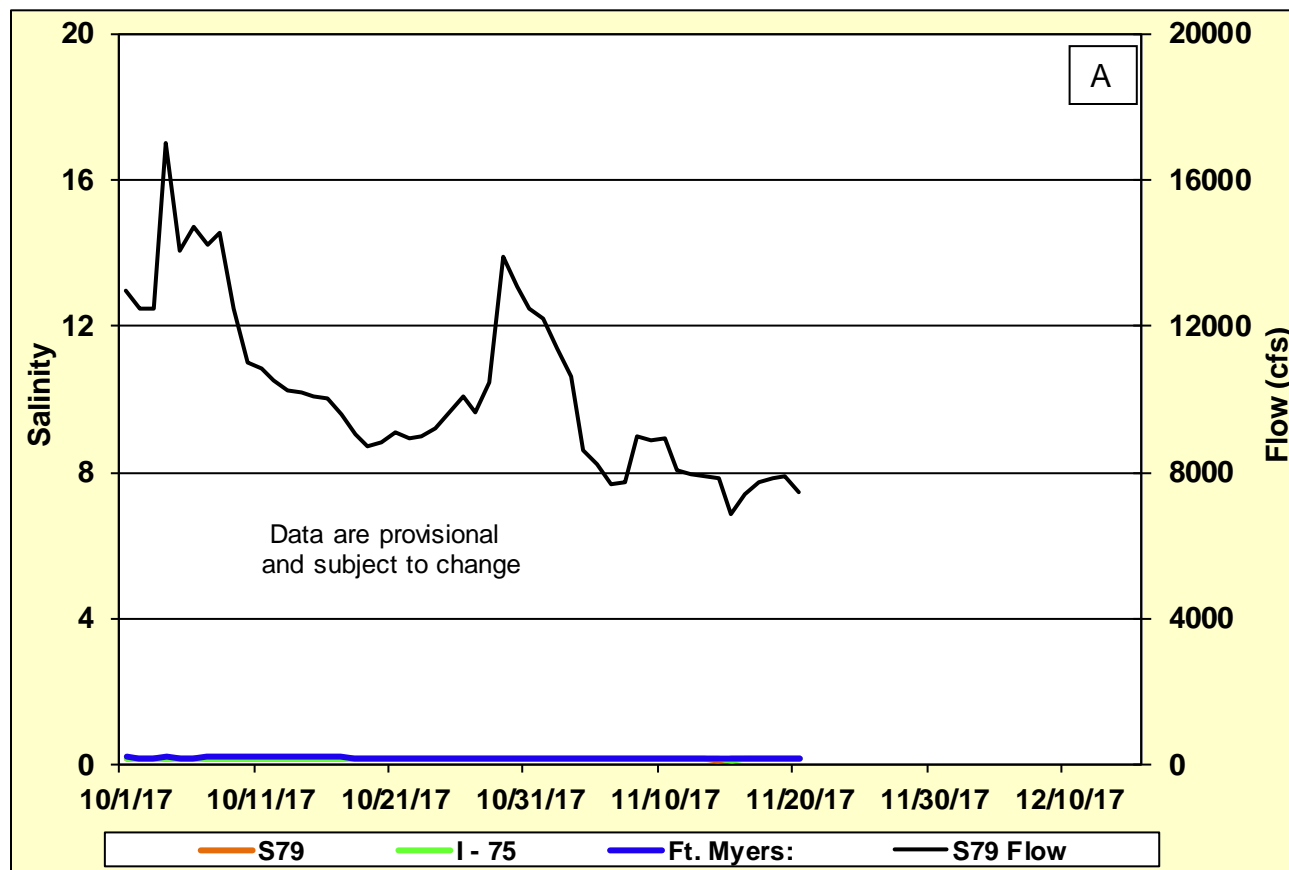


Figure 9. Daily mean flows at S-79 and salinity at upper estuary monitoring stations (A) and 30-day moving average salinity at Ft. Myers (B).

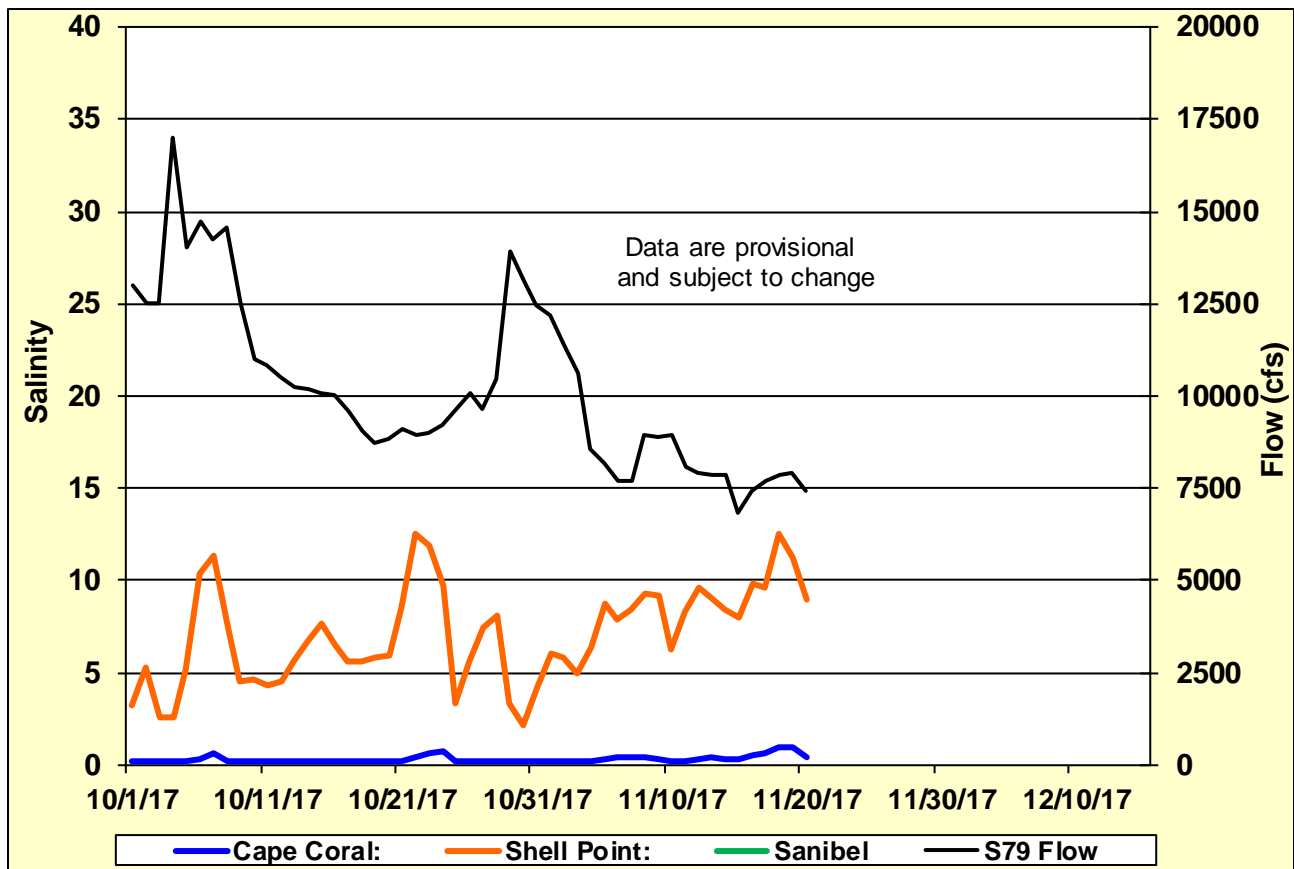


Figure 10. Daily mean flows at S-79 and salinity at lower estuary stations.

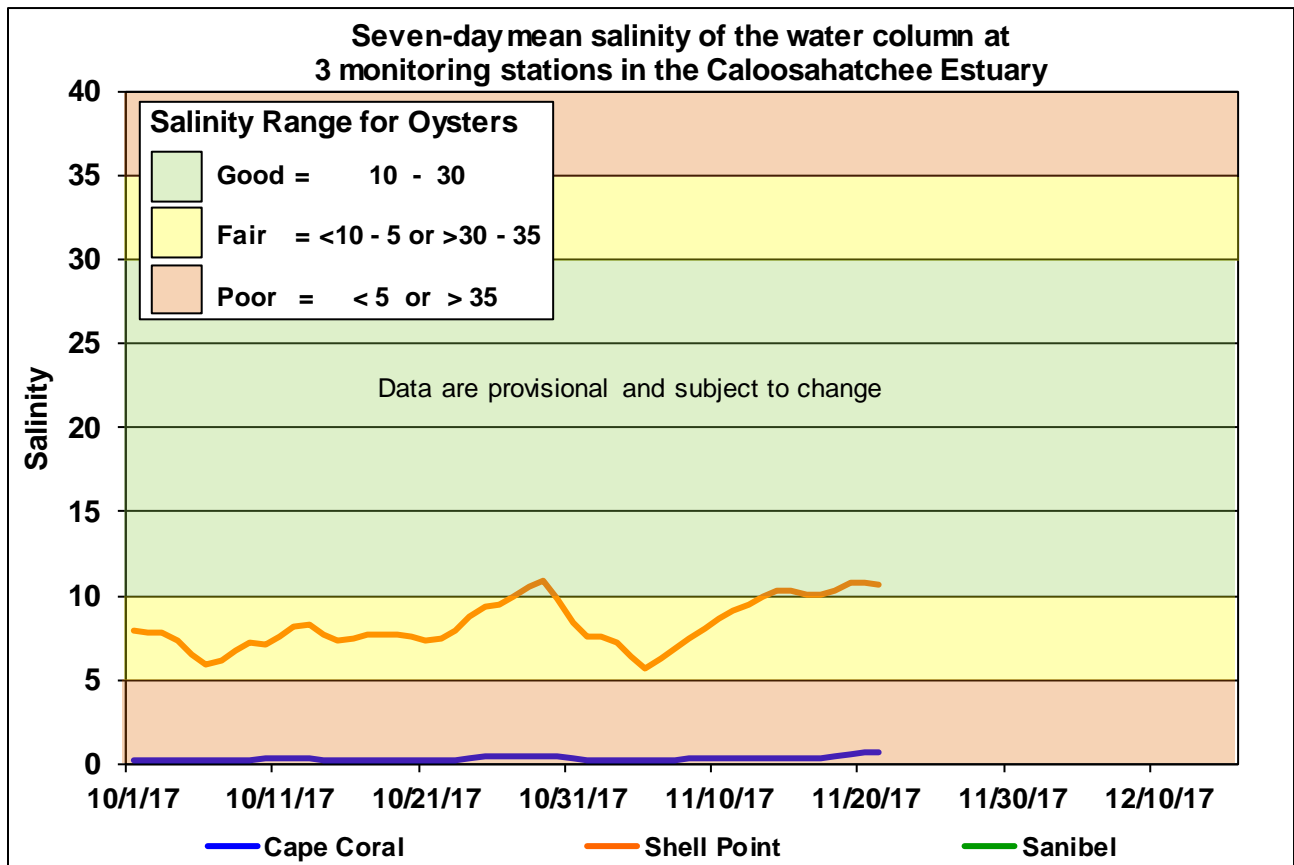


Figure 11. Seven-day mean salinity at Cape Coral Bridge, Shell Point and Sanibel Bridge monitoring stations.

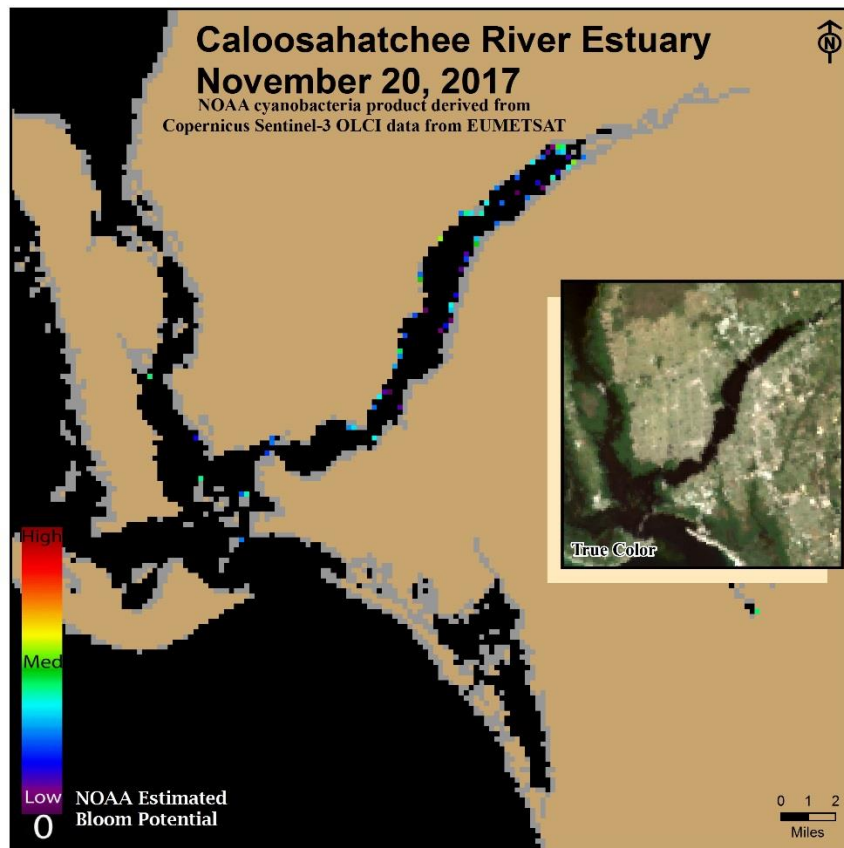


Figure 12. Sentinel 3a Satellite imagery provided by NOAA uses Ocean and Land Color Instrument (OLCI) to estimate cyanobacteria bloom potential in Caloosahatchee Estuary.

Appendix A

Water quality mapping using an onboard flow through system

The flow through system consists of an intake ram attached to the transom of a boat, a data sonde, and intake and outlet flow. The data sonde is a YSI EXO that records temperature, salinity, turbidity, dissolved oxygen, chlorophyll *a*, phycocyanin, and lat/long. The intake ram was set at 0.5 m depth. The surface water data are integrated into an ArcGIS shapefile used to display surface water properties and facilitate the post-processing of spatial data. The data are recorded at 5-s intervals. Discrete water samples were also taken for analysis of chlorophyll *a* following the SFWMD's Standard Operating Procedures. Laboratory determination of chlorophyll *a* concentrations will be used to calibrate in situ values of chlorophyll *a* reported in the field by the optical chlorophyll probe.

The St. Lucie Estuary survey track covers the St. Lucie inlet to the Roosevelt Bridge, the North Fork up to Fork Point, and the South Fork to S-80 (Figure A1). Turbidity is quite high near the S-80 structure and particulate and dissolved material is most likely being flushed down the estuary (Figure A2). The Caloosahatchee Estuary survey track covers from S-79 to just upstream on the Sanibel Causeway Bridge (Figure A3). Turbidity is quite high near the S-79 structure and particulate and dissolved material is most likely being flushed down the estuary (Figure A4).



Figure A1. Water quality mapping track with river kilometers away from the Roosevelt Bridge (US1).

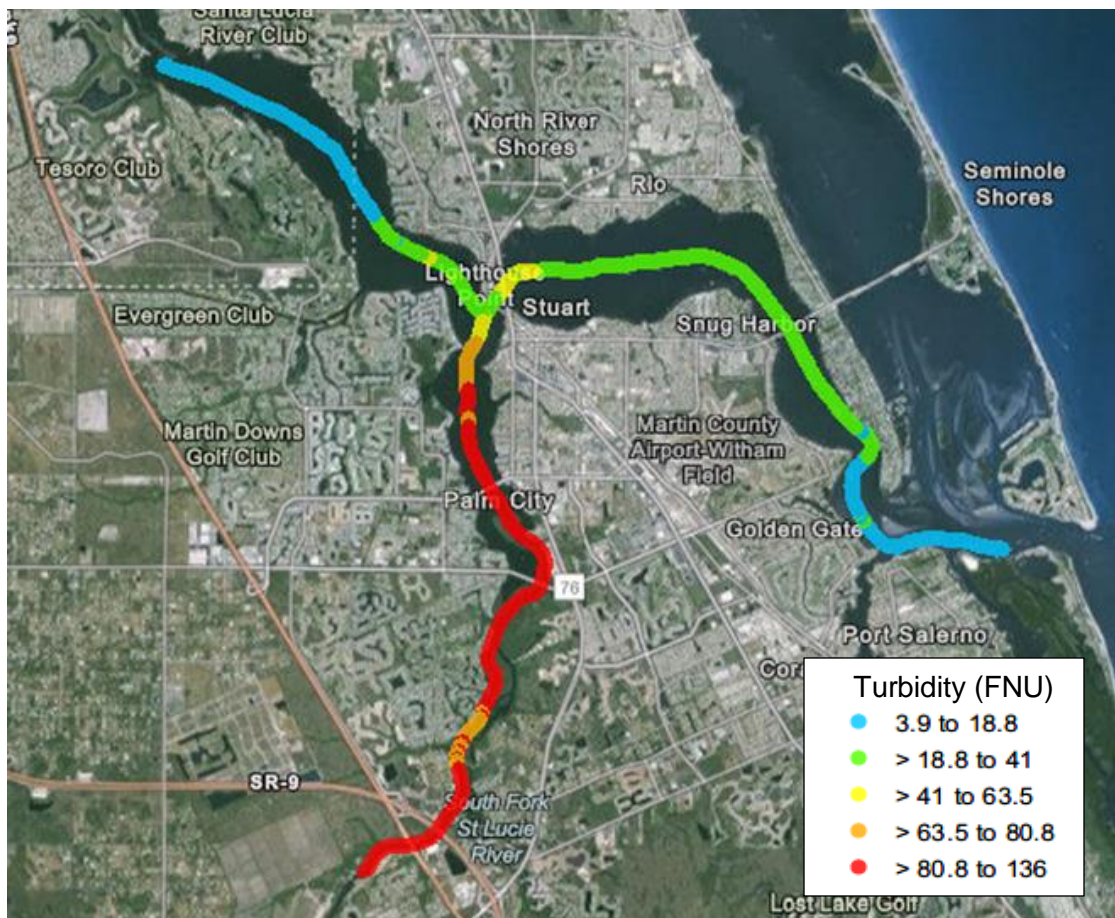


Figure A2. Turbidity concentrations (FNU) in the St. Lucie Estuary on November 16, 2017.

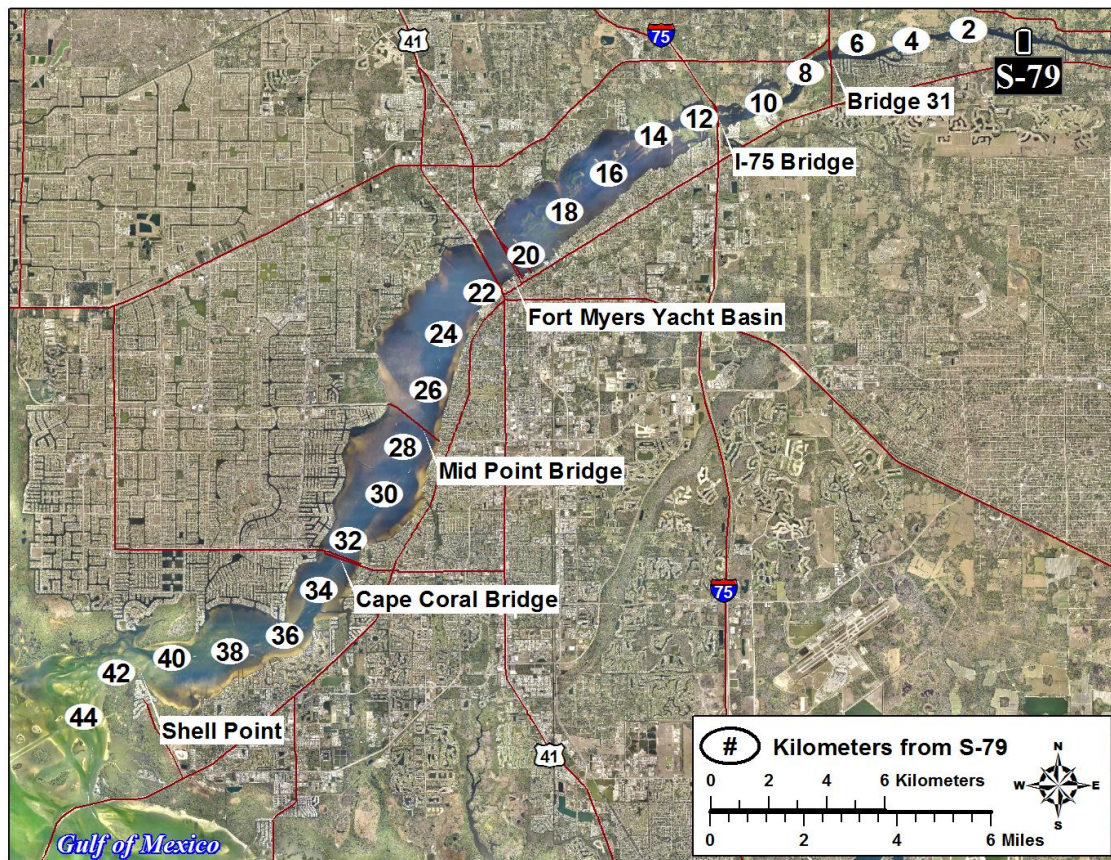


Figure A3. Water quality mapping track with river kilometers from S-79.

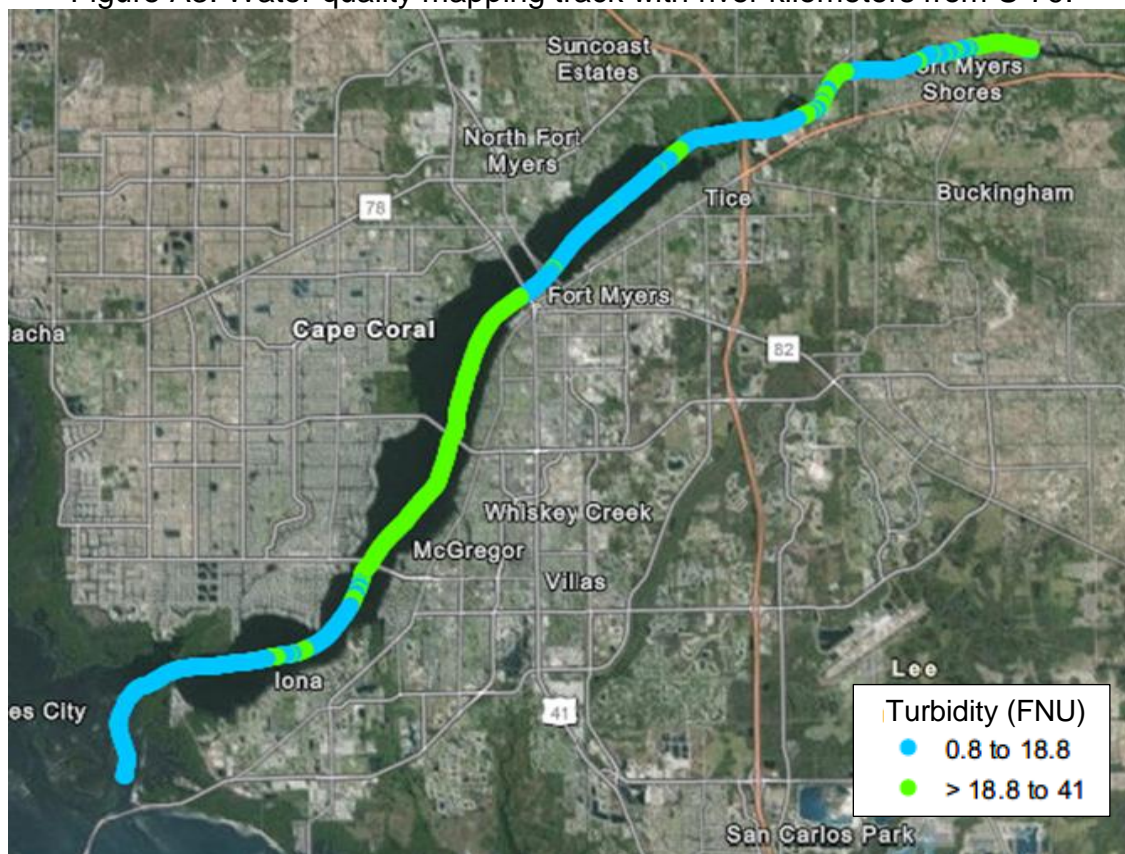


Figure A4. Turbidity concentrations (FNU) in the Caloosahatchee Estuary.

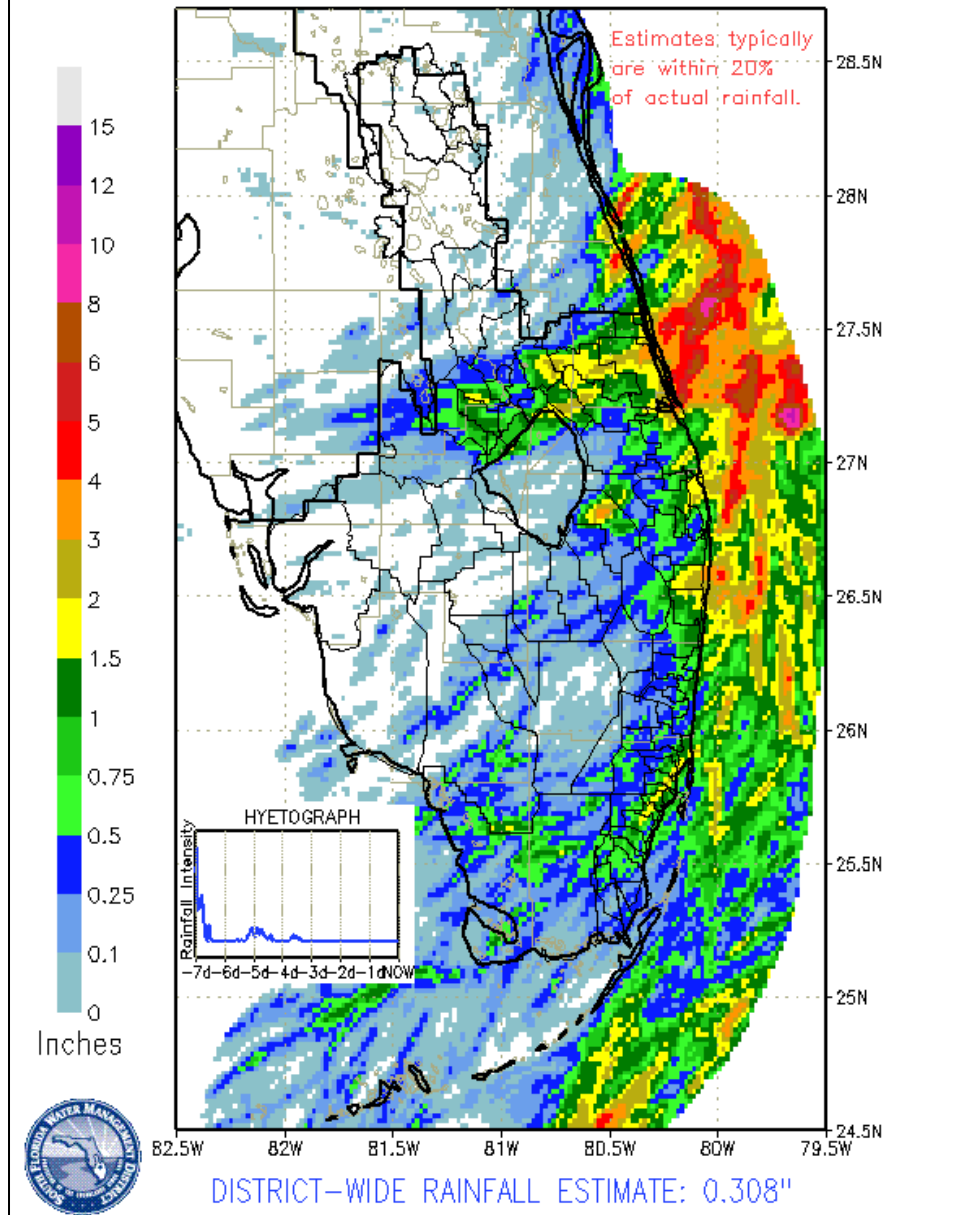
EVERGLADES

A very similar rainfall pattern as last week with a focus along the coast meaning sparse rain fell across the interior Everglades late. WCA-1 is at regulation schedule, WCA-2A is below the temporary deviation and WCA-3A remains significantly above schedule.

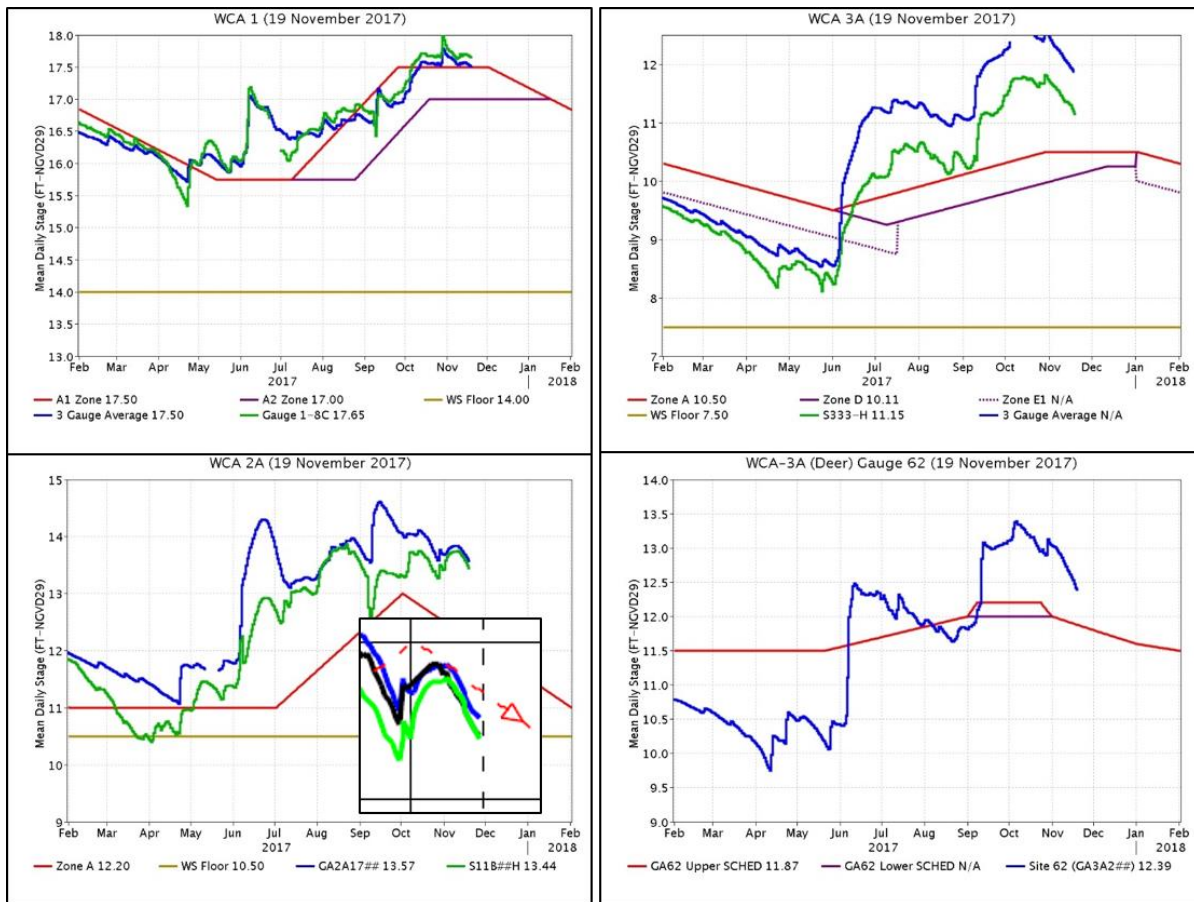
Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.44	-0.06
WCA-2A	0.15	-0.25
WCA-2B	0.17	-0.11
WCA-3A	0.08	-0.26
WCA-3B	0.29	-0.10
ENP	0.50	-0.13

SFWMD PROVISIONAL RAINDAR 7-DAY RAINFALL ESTIMATES

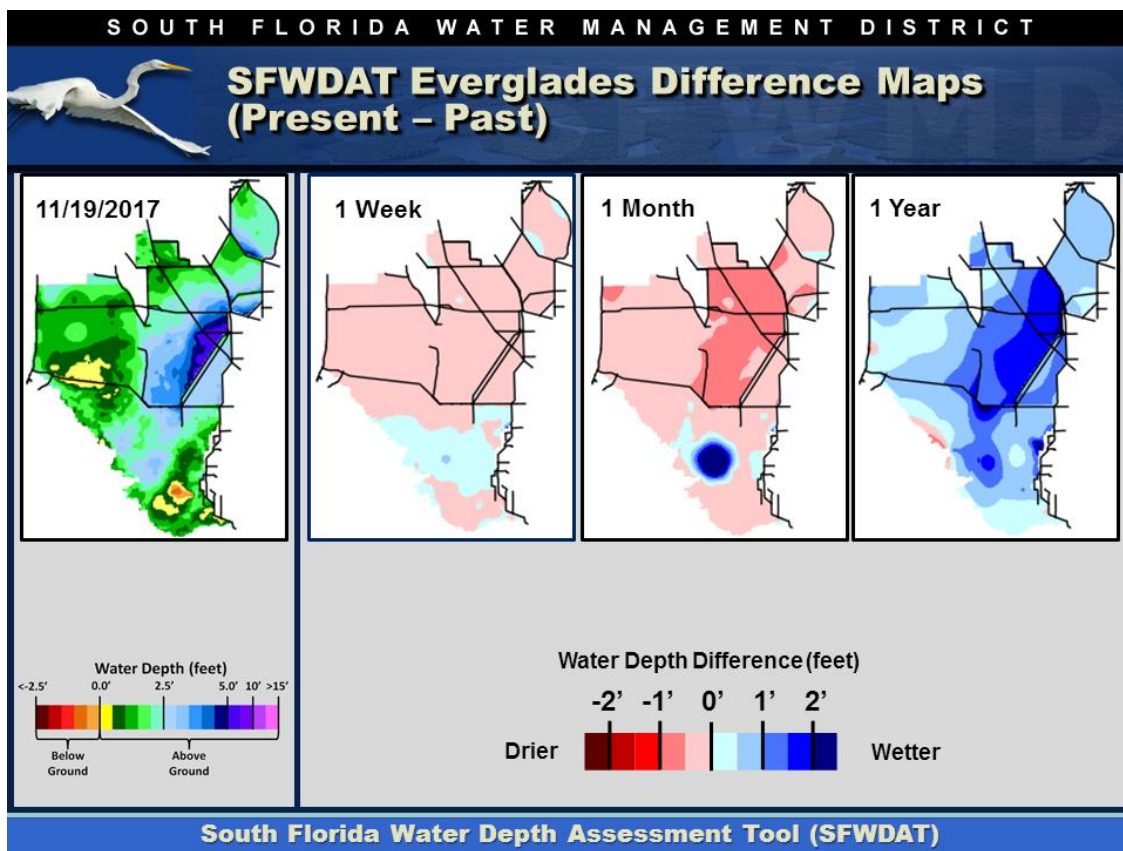
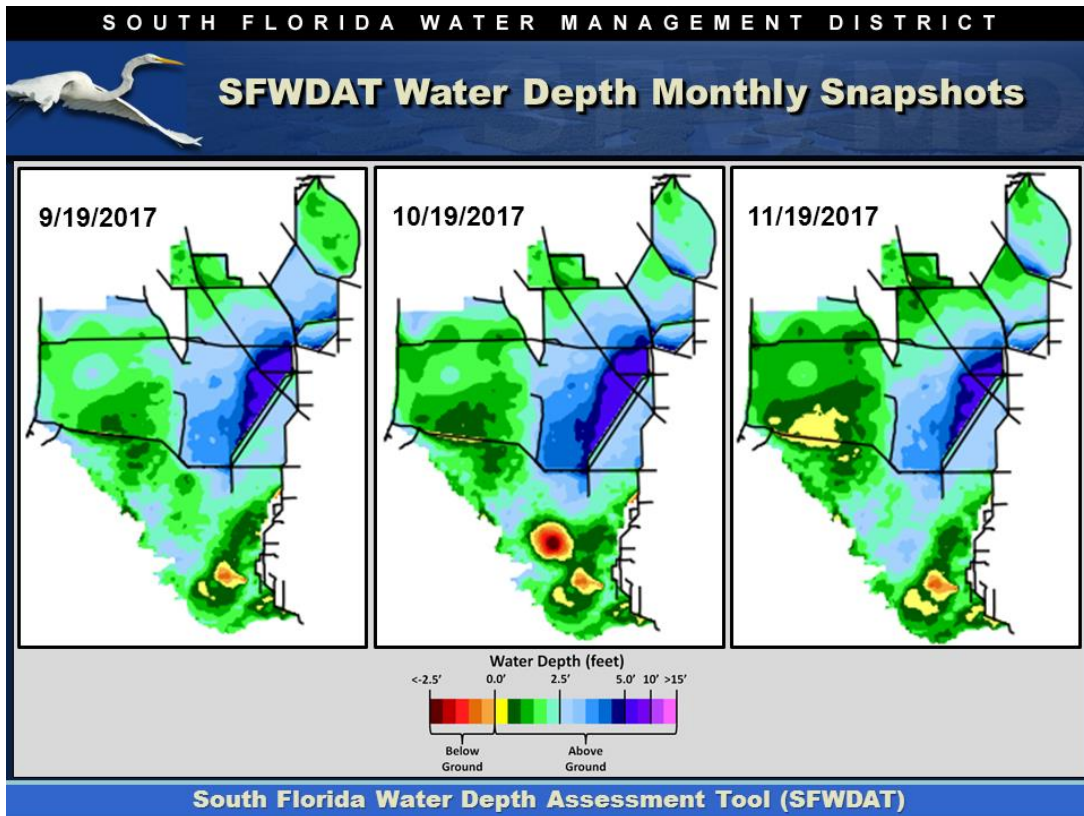
FROM: 0615 EST, 11/13/2017 THROUGH: 0615 EST, 11/20/2017



Regulation Schedules: WCA-1 three-gauge average is at Zone A1 schedule, and stage difference between the marsh and the canal is 0.15 feet. WCA-2A marsh stage at gauge GA2A17 is currently 0.18 feet below the current temporary deviation. Marsh stage is 0.13 feet above canal stage at S11B. WCA-3A three-gauge average stage is 1.32 feet above zone A. Stage difference between marsh and canal is 0.67 feet. WCA-3A at gauge 62 (Northwest corner) is 0.52 feet above the upper schedule.

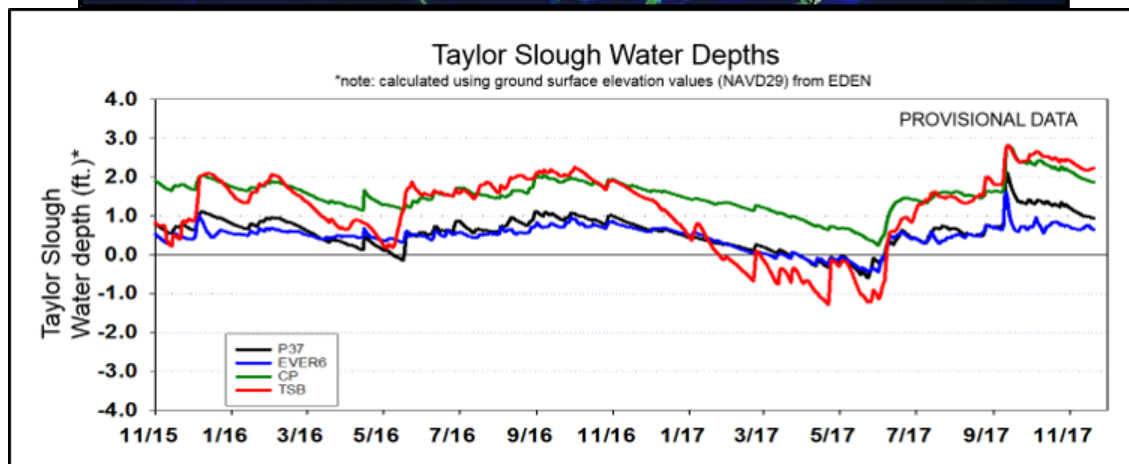
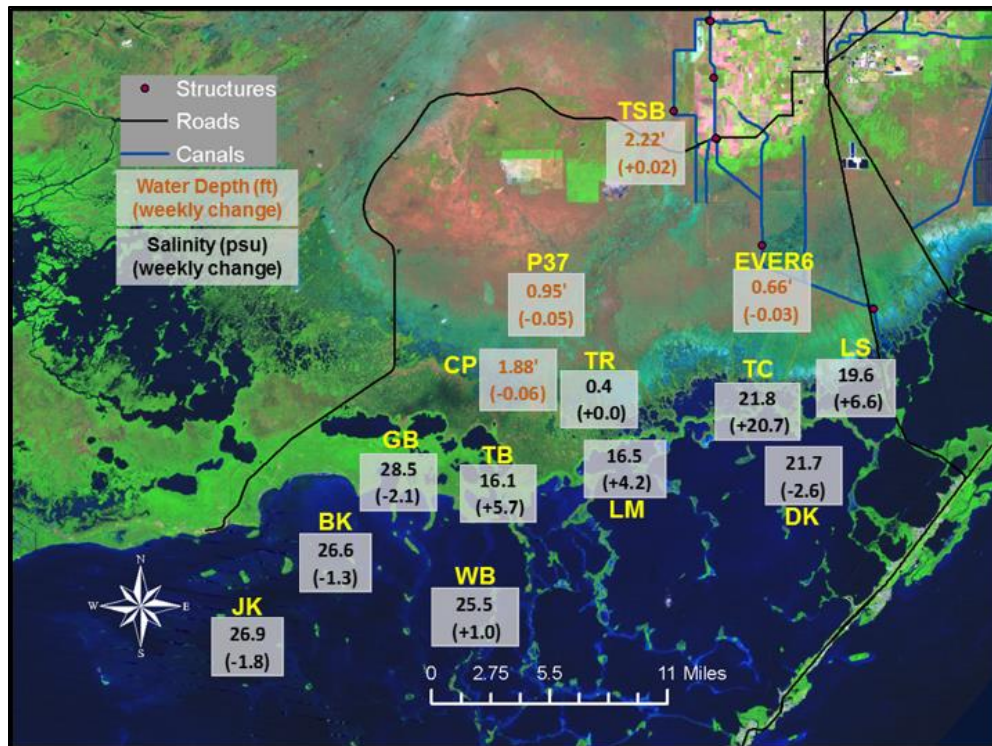


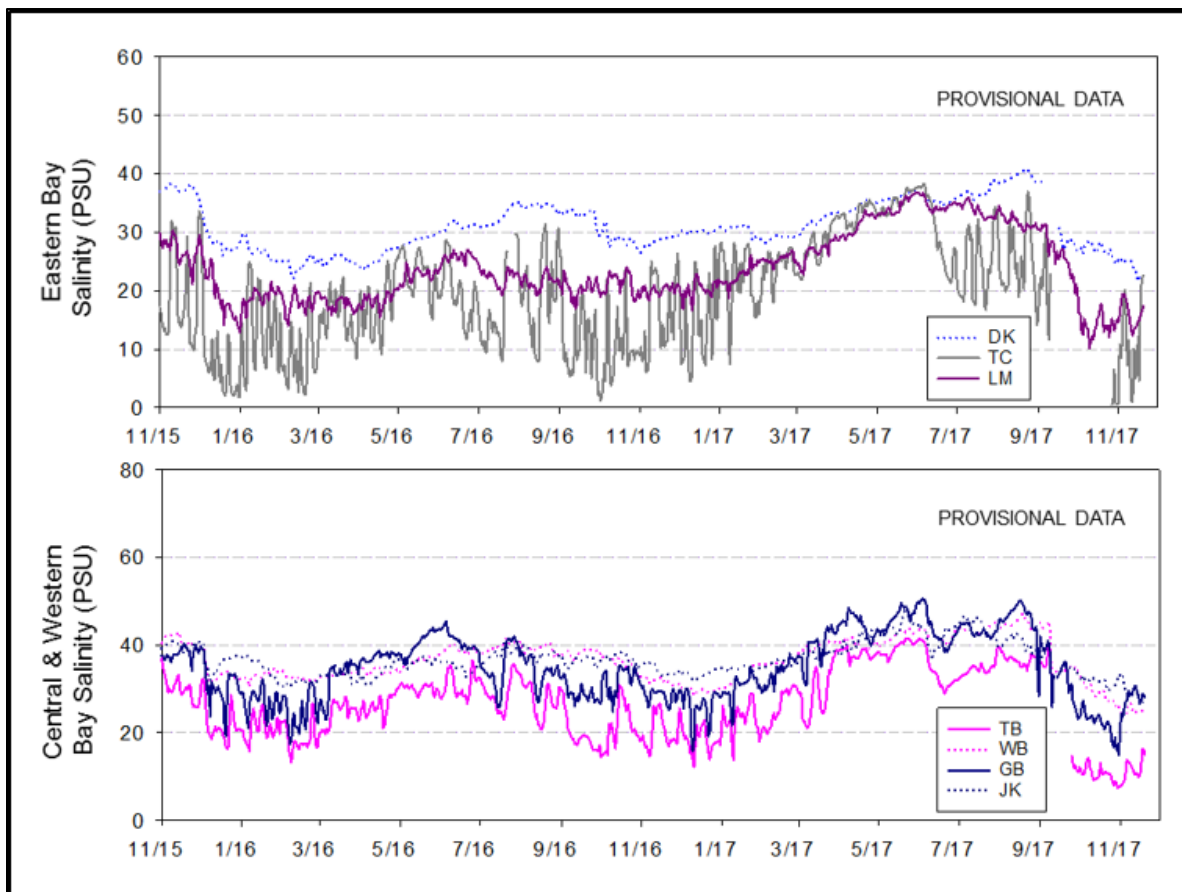
Water Depths and Changes: The WDAT tool for spatial interpolation of depth indicates a range from a low of 0.5 feet to 1.0 feet in Northwest WCA-3A to a high of 5.0+ feet along the L-67A canal in WCA-3A South. Over the last week individual gauge changes ranged from -0.04 feet (WCA-1) to -0.30 feet (Northwestern WCA-3A). Comparing WDAT water levels from present, water depths over the last week fell across the Everglades, only rising along the perimeter of WCA-1. WCA-3A is significantly lower than it was a month ago. Anomaly within Everglades National Park thought to be a result of storm damaged sensors.



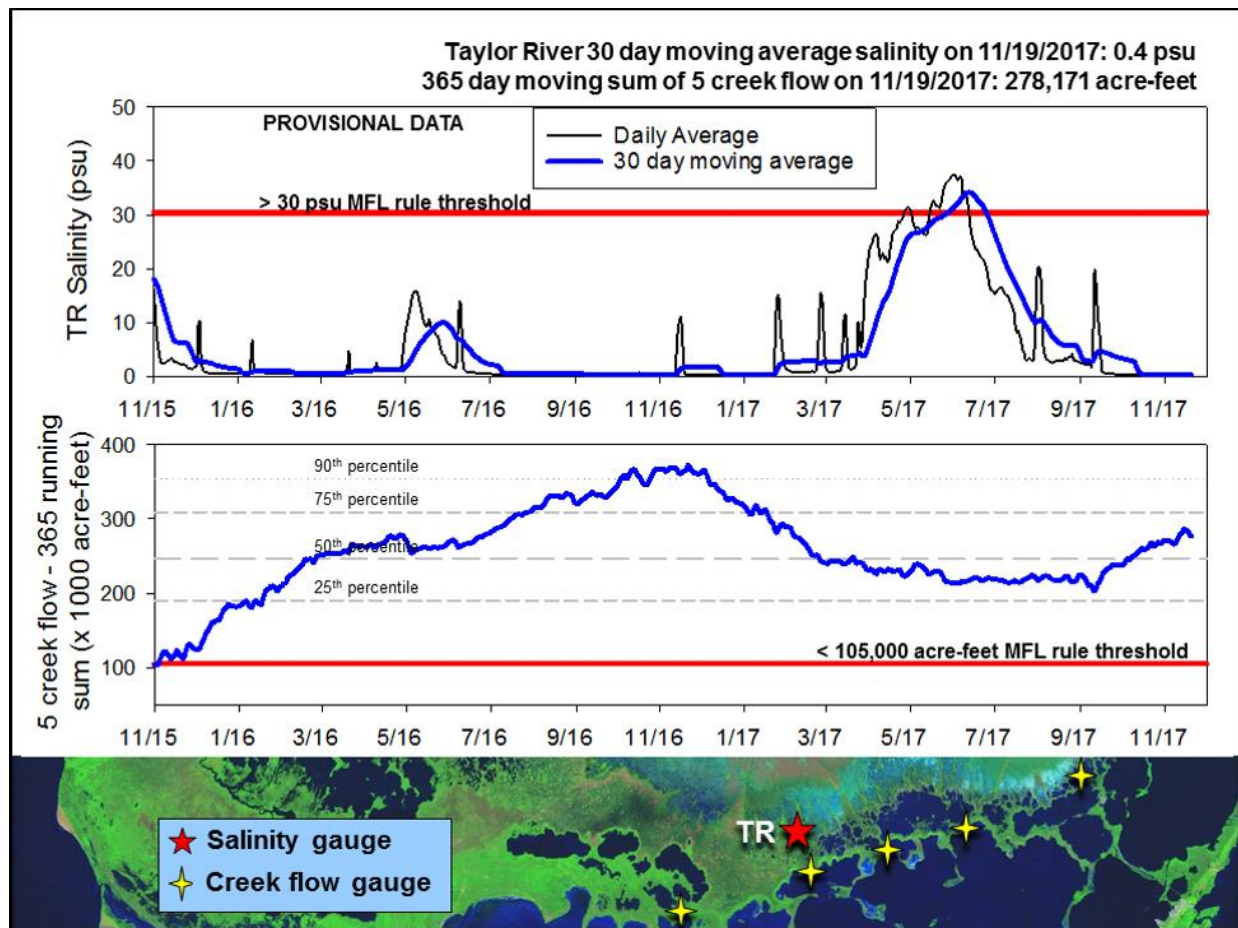
Taylor Slough stages: Water levels changed -0.06 feet in southwestern Taylor Slough and $+0.02$ feet in the northern Taylor Slough. Weekly rainfall in the area averaged 0.23 inches. Water levels are 3 to 14 inches above the historic average for this time of year with the highest divergence occurring in northern Taylor Slough (similar to last week).

In Florida Bay salinity changes for the last week ranged from -3 to +21 psu and current salinities range from 16 psu in the central nearshore to 28 in the western nearshore. Upstream flows over the weekend caused the northeastern shoreline to increase in salinity. Western bay salinities are 7 psu below the historic averages and the eastern nearshore is 3 to 9 psu above the historic averages.





Florida Bay MFL: Mangrove zone daily average salinity remains near fresh at 0.4 psu and has been very slowly increasing over the last few weeks. The 30-day moving average is 0.4 psu. The weekly cumulative flow from the five creeks denoted by yellow stars on the map was 7,800 acre-feet last week which is about average for this time of year. The 365-day moving sum of flow from the five creeks identified by yellow stars on the map decreased about 1,000 acre-feet this past week to end at 278,171 acre-feet (still greater than the long-term average of 257,628 acre feet). Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Deep water conditions persist in WCA-3A and across most of the Everglades. All practicable and novel management options should be explored in order to relieve high water conditions particularly in WCA-3A South. Florida Bay conditions continue to reflect the stress caused by the extraordinary climatic conditions this wet season, including active algal blooms and low dissolved oxygen in the creeks. Freshwater discharges into Florida Bay could break up and flush out problem areas.

More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

Everglades Ecological Recommendations, November 21st, 2017 (red is new)

Area	Current Condition	Cause(s)	Recommendation	Reasons
WCA-1	Stages decreased from -0.04' to -0.08'	Rainfall, ET, management	Maintain depths at high water targets (17.5 ft) at regulation schedule or slightly above.	Protect habitat and facilitate invasive plant treatments.
WCA-2A	Stages decreased -0.25'	Rainfall, ET, management	Maintain depths at temporary regulation schedule or slightly above.	Protect habitat and wildlife from high water stress.
WCA-2B	Stages decreased -0.11'	Rainfall, ET, management	Maintain depths at regulation schedule or slightly above.	Protect habitat and wildlife from high water stress.
WCA-3A NE	Stages decreased -0.26'	Rainfall, ET, management	Moderate ascension rates as possible. Manage for relief of high water conditions.	Protect habitat and wildlife from high water stress.
WCA-3A NW	Stages decreased -0.30'	Rainfall, ET, management		
Central WCA-3A S	Stages decreased -0.24'	Rainfall, ET, management	Moderate ascension rates as possible. Manage for relief of high water conditions.	Water depths above 2.5 feet at gauge 65 are indicative that tree islands are flooded and under stress. Depths exceeded that mark on 18 June, meaning the tree islands have been flooded for 150 days.
Southern WCA-3A S	Stages decreased -0.23'	Rainfall, ET, management		
WCA-3B	Stages decreased -0.10'	Rainfall, ET, management	Maintain depths at regulation schedule.	Protect habitat and wildlife from high water stress.
ENP-SRS	Stages decreased -0.13'	ET, rainfall, topography, management	Make discharges to the Park according to the 2012 WCP rainfall plan.	Keep peat wet to promote native habitat and maintain wetland plant and animal communities. Protect habitat and wildlife, including apple snail reproduction.
Taylor Slough	Stage changes ranged from -0.06' to +0.02'	Rain, ET, inflows	Move water southward as possible	When available provide freshwater buffer for ecosystems.
FB- Salinity	Salinity changes ranged -2.6 to +20.7 psu.	Rain, ET, inflows, wind	Move water southward as possible	When available, provide freshwater to main low salinity buffer and promote water movement.