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: October 17, 2017

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A cold front has pushed to northcentral Florida and it is expected to increase shower activity over the District as it remains over the area the next few days. A weak surface low is forecast to develop along the frontal boundary near Bermuda and exit east which should nudge the front further south to near Lake Okeechobee by Wednesday. Energy streaming across the area should flare up showers and thunderstorms along the frontal boundary today and Wednesday with heaviest activity along the east coast near and north of the frontal boundary where breezy on shore winds should bring a steady resupply of low level moisture. A second, stronger low is forecast to develop along the boundary east of Florida Thursday and push the front into the Florida Straits generating scattered showers and thunderstorms mainly east Thursday and southeast Friday. Breezy east winds should help some light shower activity persist mainly east on Saturday.

Kissimmee

Tuesday morning stages and departures from schedule were 58.1 feet (0.6 feet above schedule) in East Lake Toho, 54.9 feet (0.4 feet above schedule) in Lake Toho, and 52.3 feet (0.3 feet above schedule) in Kissimmee Cypress Hatchineha; S65A headwater stage was 46.3 feet. Tuesday morning discharges were 2,668 cfs at S65, 2,791 cfs at S65A, and 9,155 cfs at S65E. Dissolved oxygen concentration in the Kissimmee River averaged 1.0 milligrams per liter (mg/L) for the week. Kissimmee River mean floodplain depth on Sunday was 2.36 feet.

Lake Okeechobee

Lake stage is 17.16 feet NGVD having risen to 17.20 before declining back to 17.16 where it was last week. Lake stages have likely stabilized after rising over 3.5 feet in the last five weeks, and should start declining as inflows from the Kissimmee basin are slowing while discharges to the east and west estuaries remain high. 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. The high inflows and resuspended Lake sediment have also significantly increased water column total phosphorus, which could lead to algal blooms as turbidity begins to decline.

Estuaries

Total discharge to the St. Lucie estuary averaged 7,846 cfs over the past week with 3,580 cfs coming from Lake Okeechobee. Salinities at the three monitoring stations remain low, with values comparable to the week before. Water was stratified only near A1A bridge with higher salinities near the bottom compared to the surface. Water was well-mixed in the remaining parts of the estuary. The seven-day average salinity at the US1 Bridge is in the poor range for adult oysters. Average chlorophyll a

concentration levels at the LOBO stations (maintained by FAU) in South Fork remain low (on average between 4-6 µg/L). Average oxygen levels at HR1 monitoring station in North Fork were ~5mg/L both, near the surface and near the bottom. Cyanobacteria bloom potential status is very low this week. The October 12 water quality mapping trip to the estuary revealed much higher turbidity levels and lower chlorophyll a concentrations in the South Fork compared to the other parts of the estuary. Higher discharges from S-80 during the week of the sampling and the associated lower water residence time in the South Fork, and the lack of water column stratification combined with low light penetration due to elevated turbidity levels were the most likely causes of lower chlorophyll a concentration levels in the South Fork compared to other parts of the estuary.

Total inflow to Caloosahatchee estuary averaged 11,056 cfs over the past week with 7,219 cfs coming from the Lake. The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the poor range for adult oysters at Cape Coral and fair range at Shell Point. Chlorophyll a measurements by the Sanibel-Captiva Conservation Foundation show low chl a concentration levels neat Ft. Myers and Shell Point (<5 µg/L) over the last week. Cyanobacteria bloom potential status is very low this week, according to the NOAA bloom potential maps. *Karenia brevis* (red tide dinoflagellate) was observed at background levels in samples collected along the Lee County coast.

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 21,700 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

At the gauge locations monitored for this report and averaged by basin, water depths rose in WCA-1 and remained stable elsewhere. However, WDAT modeling shows increases in water depth within the central regions of WCA-2A, and the critical southern region of WCA-3A. Keeping depths below 2.5 feet at gauge 65 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 4.76 feet (+0.05 feet last week), and has exceeded 2.5 feet for 122 days. In Florida Bay salinities are staying stable or decreasing at each station and range from 7 psu in the US Highway 1 corridor to 32 psu in the western Bay.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.35 inches of rainfall in the past week and the Lower Basin received 0.88 inches (SFWMD Daily Rainfall Report 10/16/2017).

Upper Kissimmee Basin

Stages and departures in the Kissimmee Chain of Lakes (KCOL) are shown in Table1.

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: 10/17/2017

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)						
							10/15/17	10/8/17	10/1/17	9/24/17	9/17/17	9/10/17	9/3/17
Lakes Hart and Mary Jane	S62	444	LKMJ	61.6	R	60.5	**1.1**	1.4	1.7	2.1	2.3	0.1	0.0
Lakes Myrtle, Preston, and Joel	S57	231	S57	63.8	R	61.5	**2.3**	2.4	2.5	3.1	3.2	0.1	-0.1
Alligator Chain	S60	132	ALLI	63.9	R	63.6	**0.3**	0.2	0.1	0.7	1.3	0.0	0.0
Lake Gentry	S63	180	LKGT	61.5	R	61.2	**0.3**	0.3	0.0	0.4	0.9	0.0	0.0
East Lake Toho	S59	1,283	TOHOE	58.2	R	57.5	**0.7**	1.4	2.0	2.4	2.6	0.0	0.0
Lake Toho	S61	1,320	TOHOW, S61	54.8	R	54.5	**0.3**	0.3	1.0	1.8	2.1	0.0	0.0
Lakes Kissimmee, Cypress, and Hatchineha	S65	3,069	KUB011, LKIS5B	52.4	R	52.0	**0.4**	0.5	0.9	1.8	2.7	1.3	1.2

[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: 10/17/2017

Metric	Location	1-Day Average	Average for the Preceeding 7-Days[1]									
		10/15/2017	10/15/17	10/8/17	10/1/17	9/24/17	9/17/17	9/10/17	9/3/17	8/27/17	8/20/17	8/13/17
Discharge (cfs)	S-65	2,980	**3,069**	6,671	11,491	12,054	5,535	1,809	1,209	1,152	958	1,181
Discharge (cfs)	S-65A	3,254	**3,706**	7,028	7,972	8,336	6,779	2,375	1,465	1,448	1,213	1,298
Discharge (cfs)	S-65D[2]	5,382	**7,397**	12,111	12,847	13,332	11,906	2,442	2,262	2,032	2,255	2,154
Discharge (cfs)	S-65E[2]	5,591	**7,575**	12,702	13,342	13,748	13,216	2,584	2,279	2,085	2,276	2,195
DO (mg/L)[3]	Phase I river channel	1.3	**1.0**	1.4	1.0	0.8	1.3	2.3	2.3	2.0	2.8	2.0
Mean depth (feet)[4]	Phase I floodplain	2.36	**3.01**	4.45	5.13	5.27	4.86	1.58	1.53	1.40	1.31	1.32

[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
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
6/13/2017	No new recommendations.			
6/6/2017	No new recommendations.			
5/30/2017	No new recommendations.			
5/22/2017	No new recommendations.			
5/15/2017	Reduce discharge at S65/S65A by 40-50 cfs	Reduce rate of stage decline in KCH while maintaining discharge to the Kissimmee River.	Implemented	KB Ops

KCOL Hydrographs (through Sunday midnight)

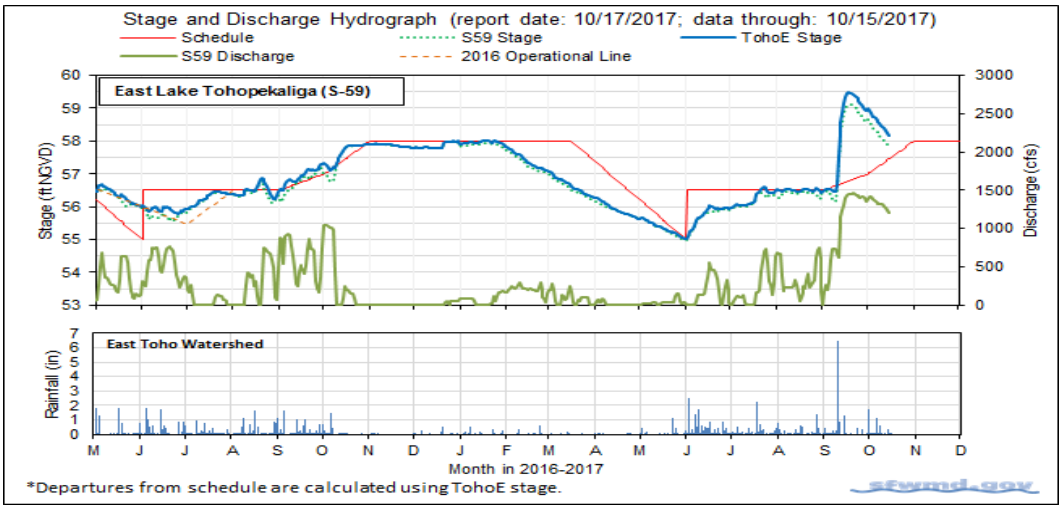


Figure 1.

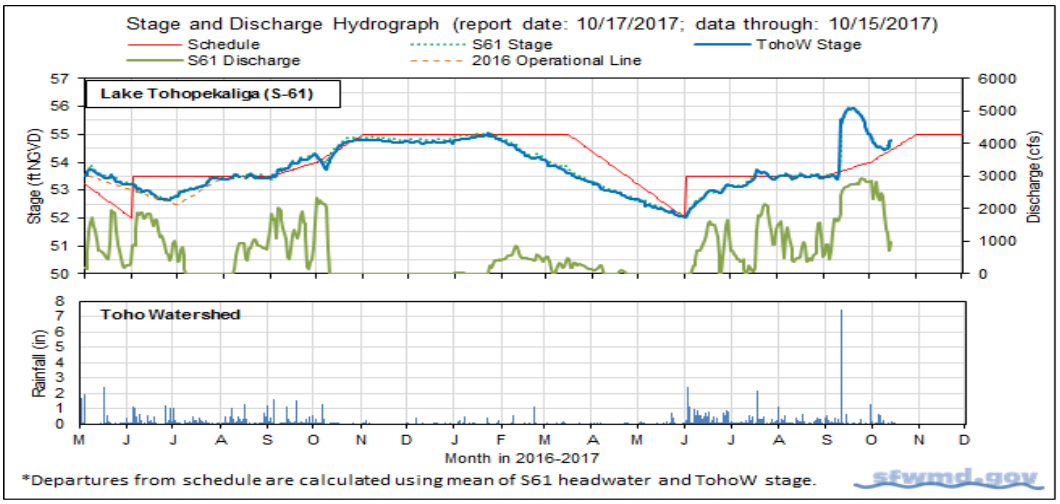


Figure 2.

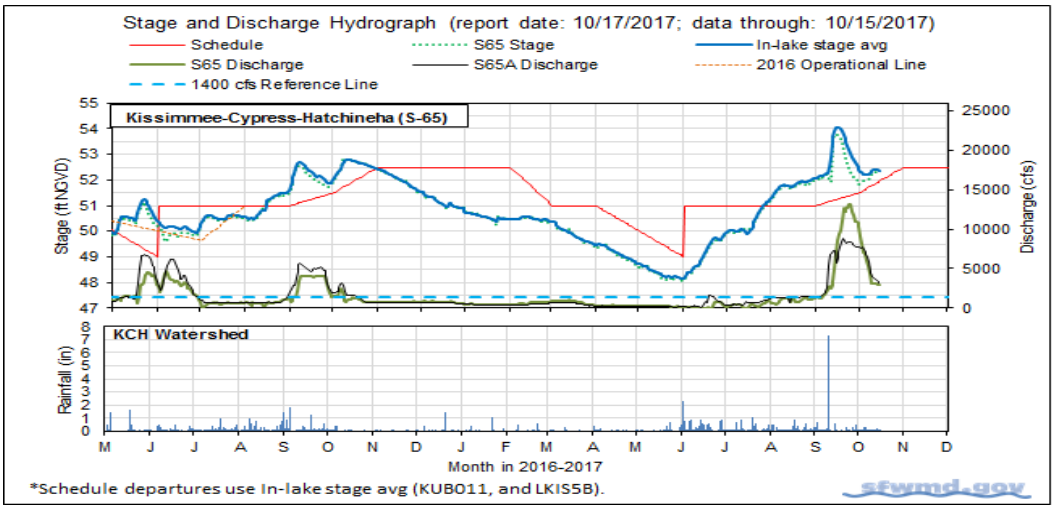


Figure 3.

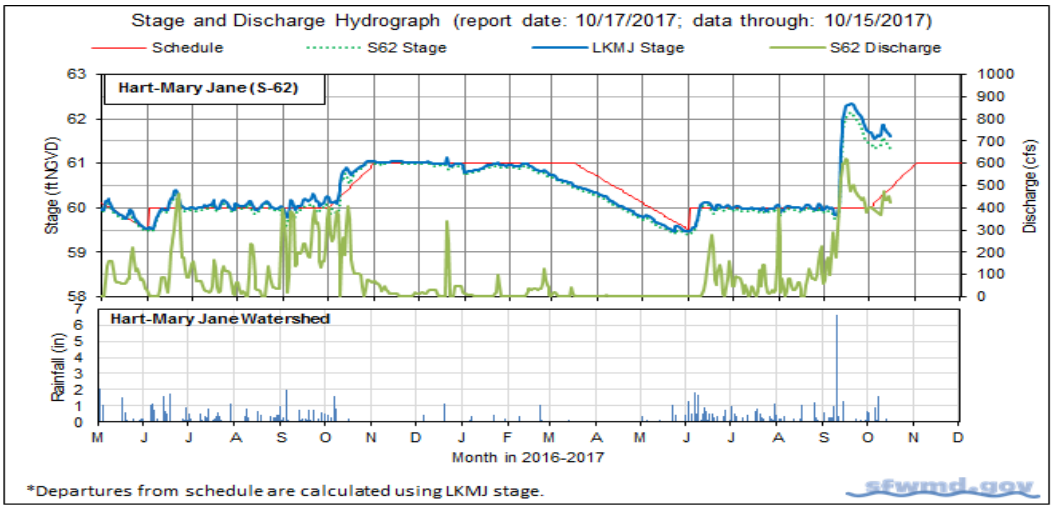


Figure 4.

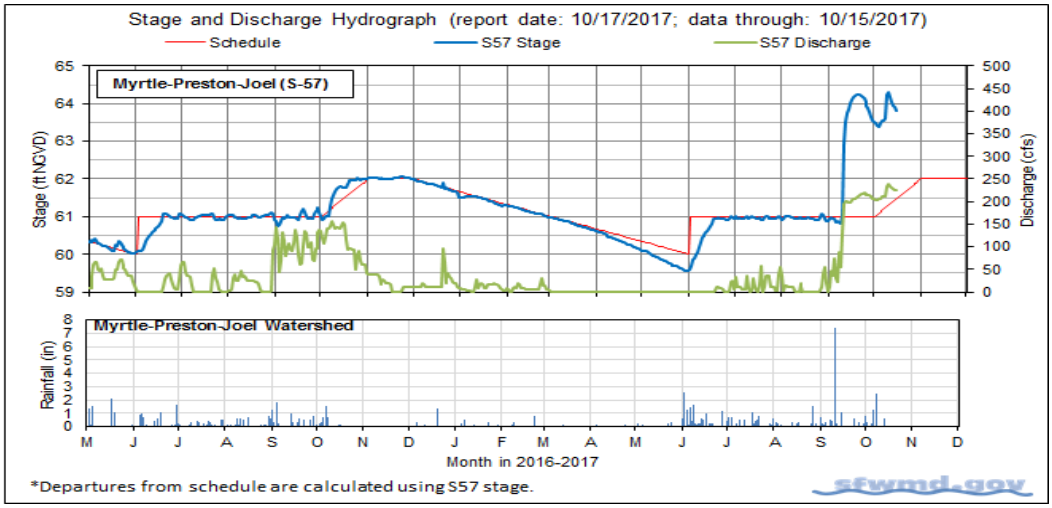


Figure 5.

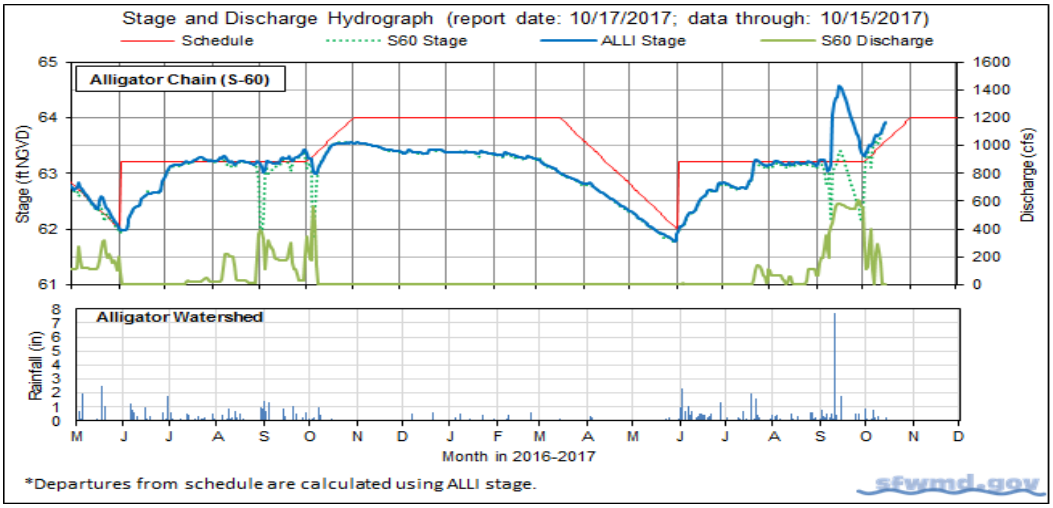


Figure 6.

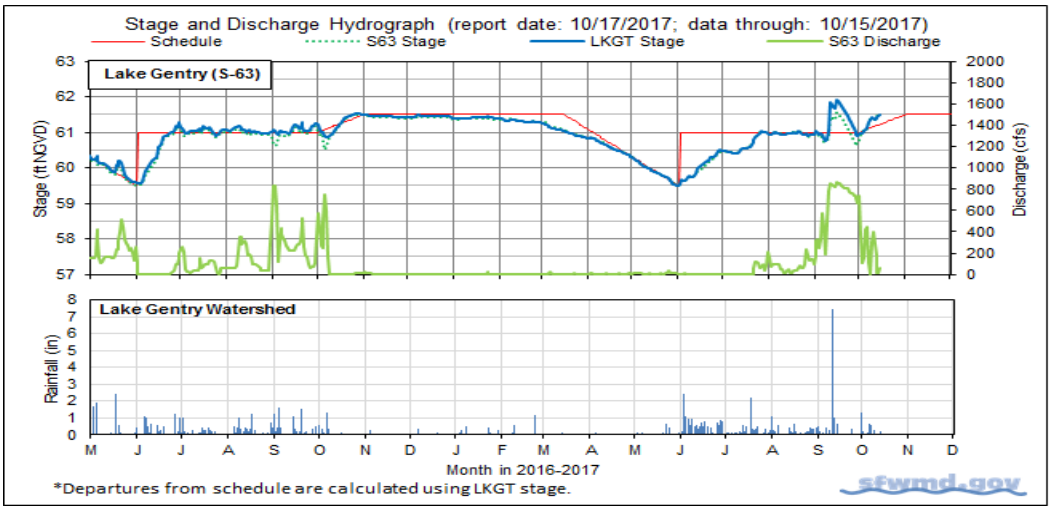


Figure 7.

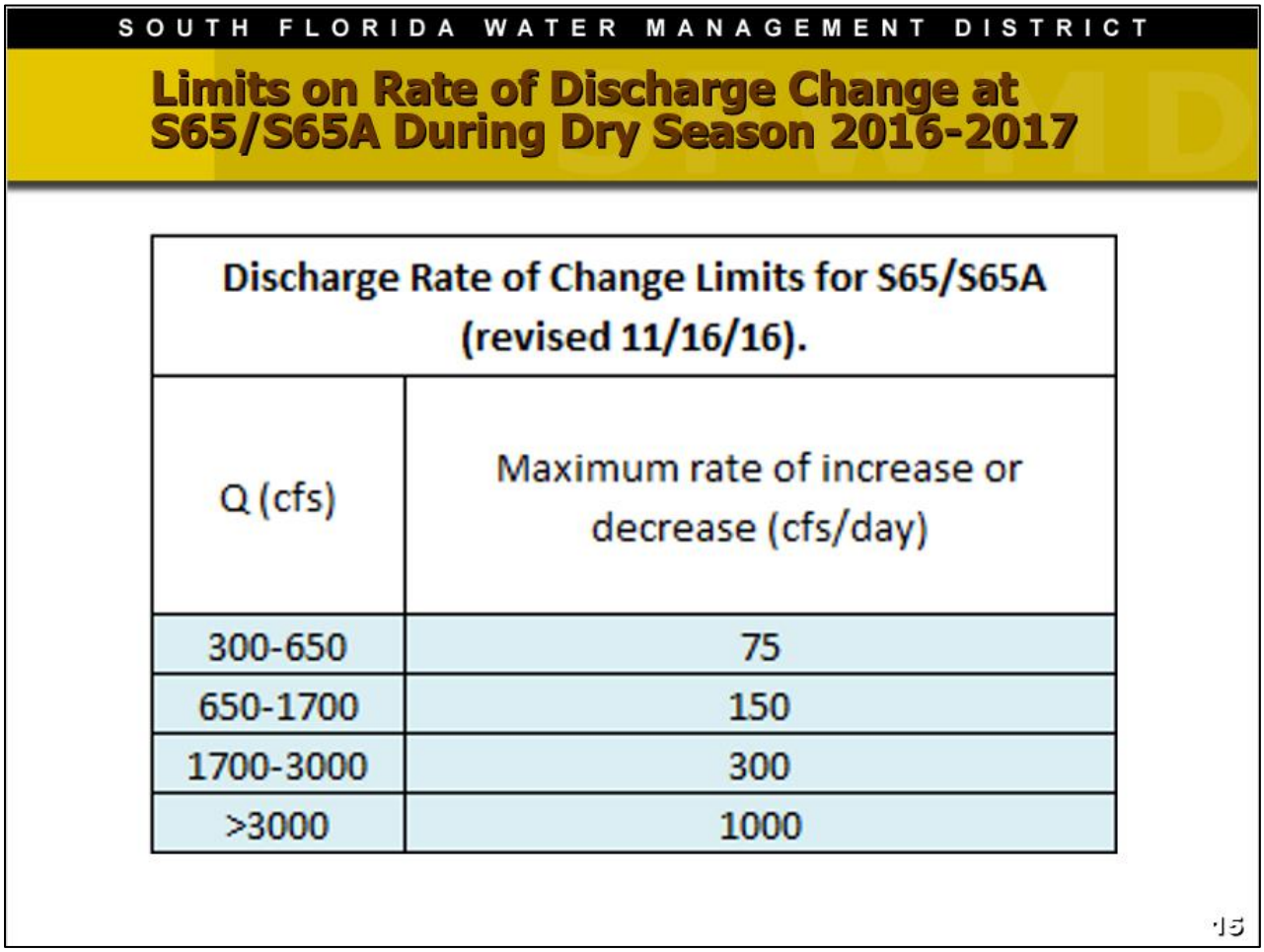


Figure 8. Limits on rate of discharge change at S65/S65A as of the 2016-2017 Dry Season.

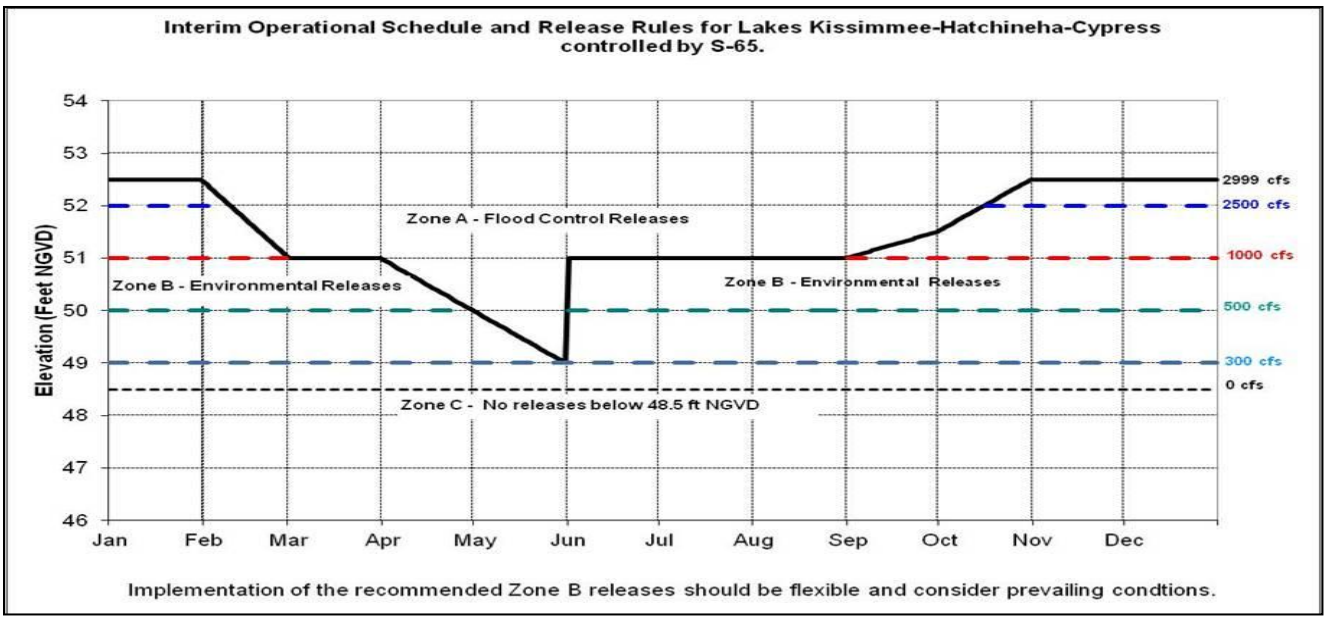


Figure 9. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

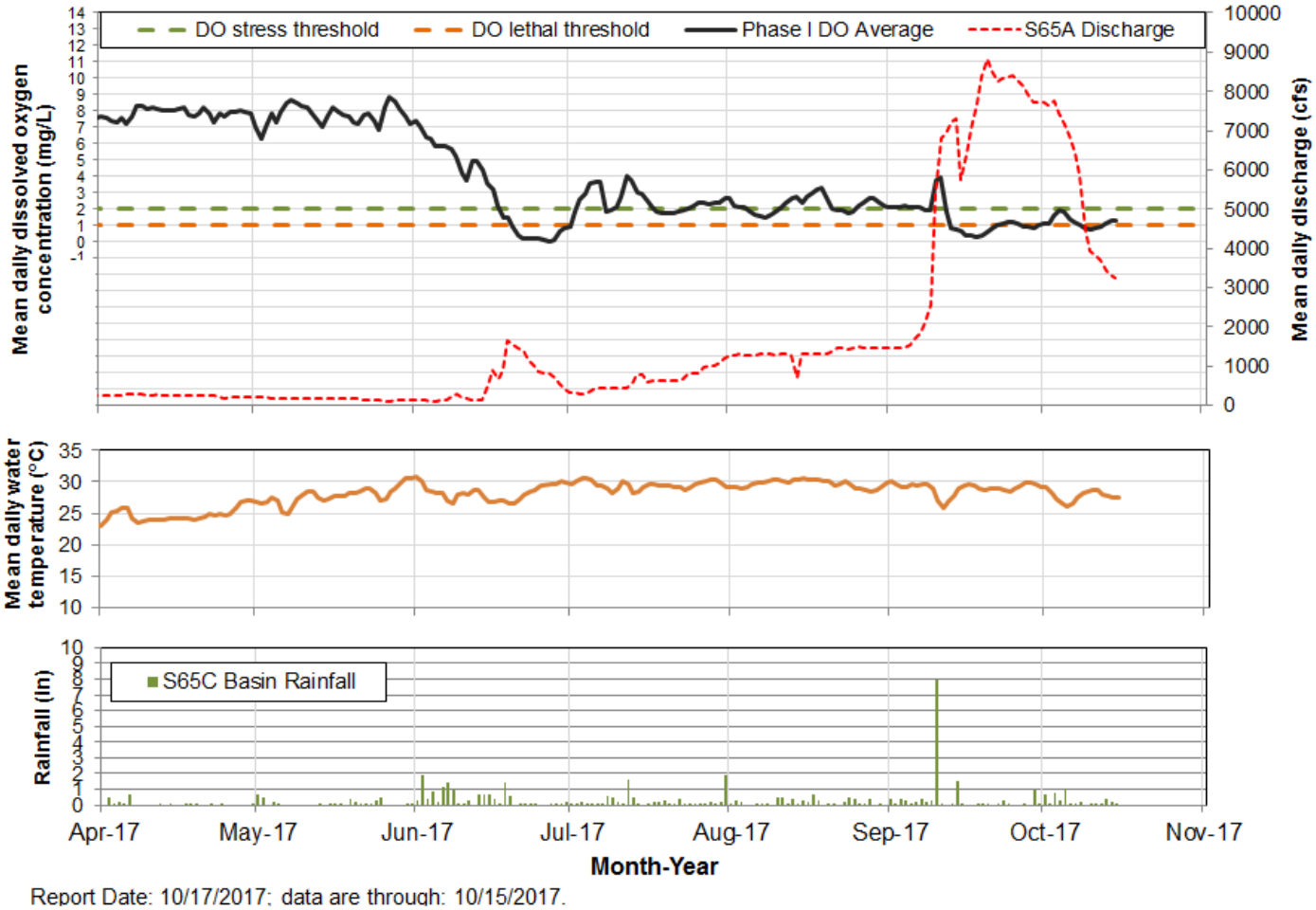


Figure 10. Mean daily Dissolved Oxygen, discharge, temperature and rainfall in the Phase I river channel.

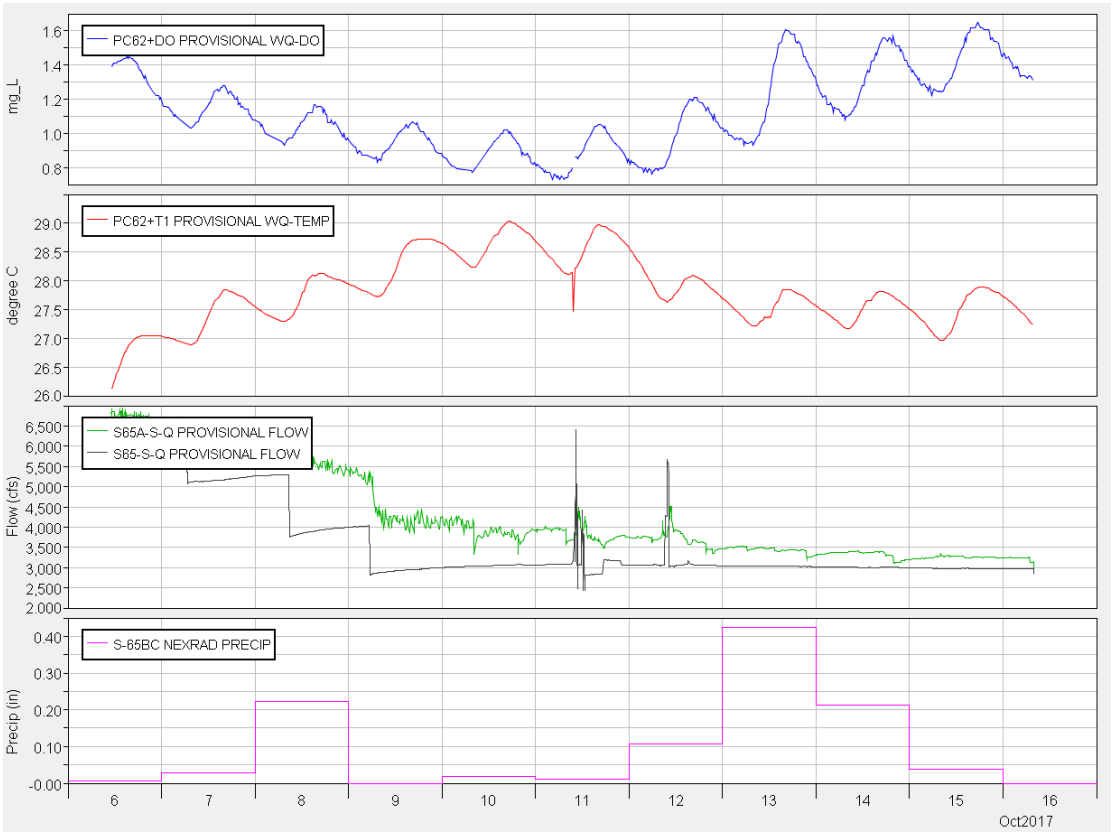


Figure 11. Phase I river channel dissolved oxygen and water temperature (measured at 15 minute intervals) and Pool BC daily rainfall.

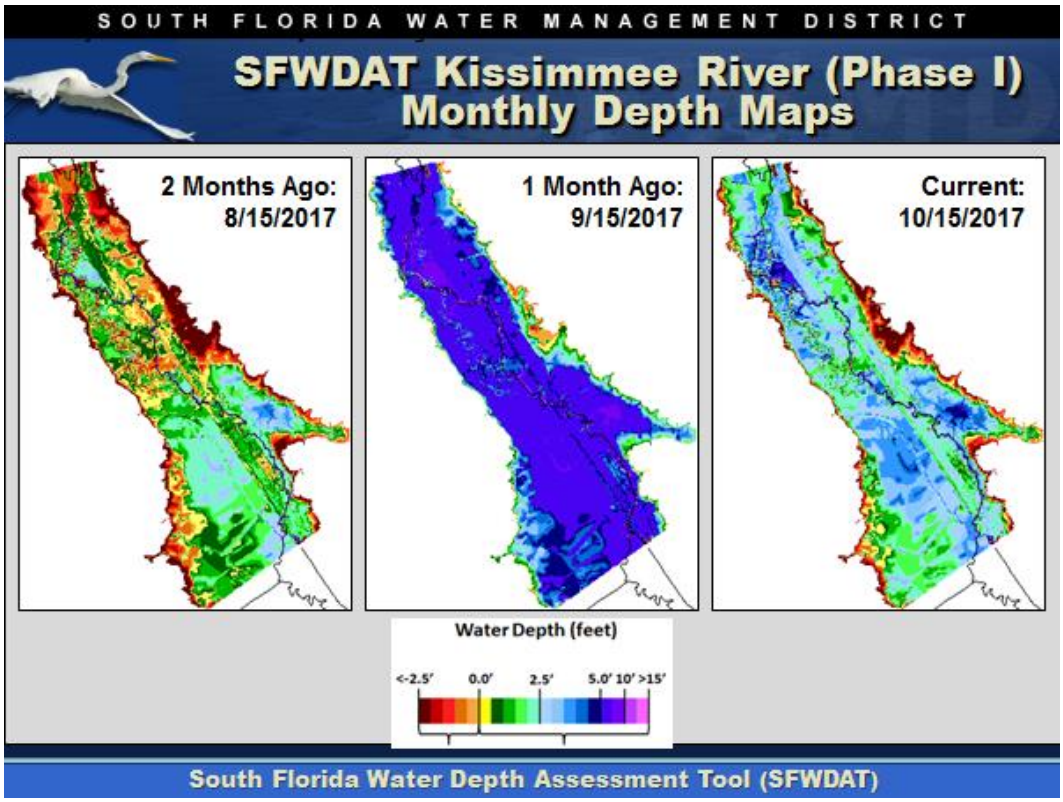
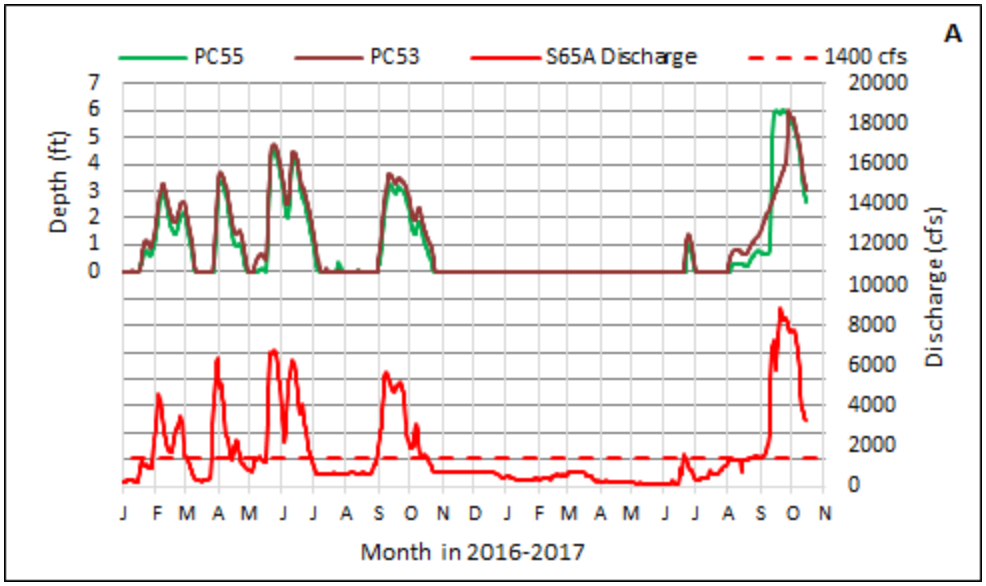
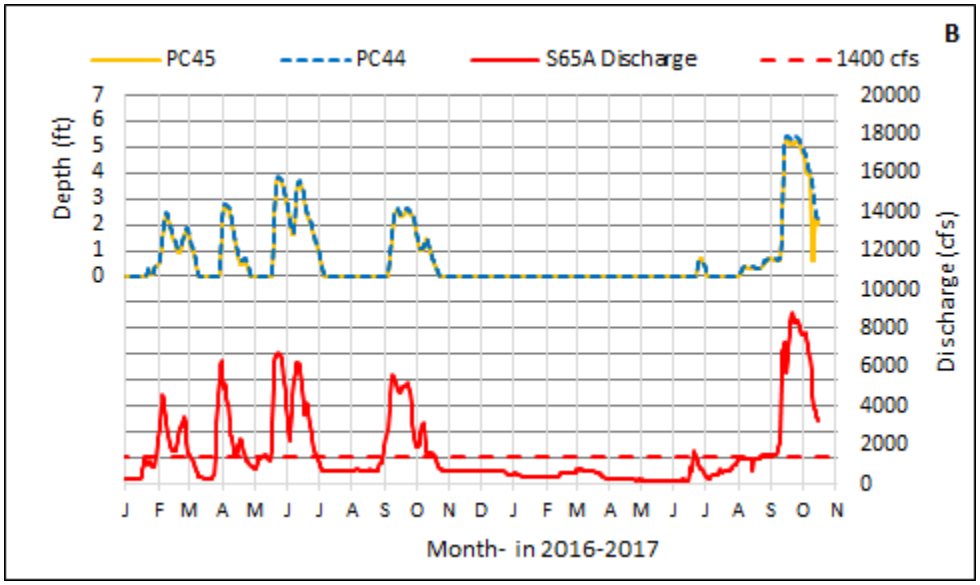


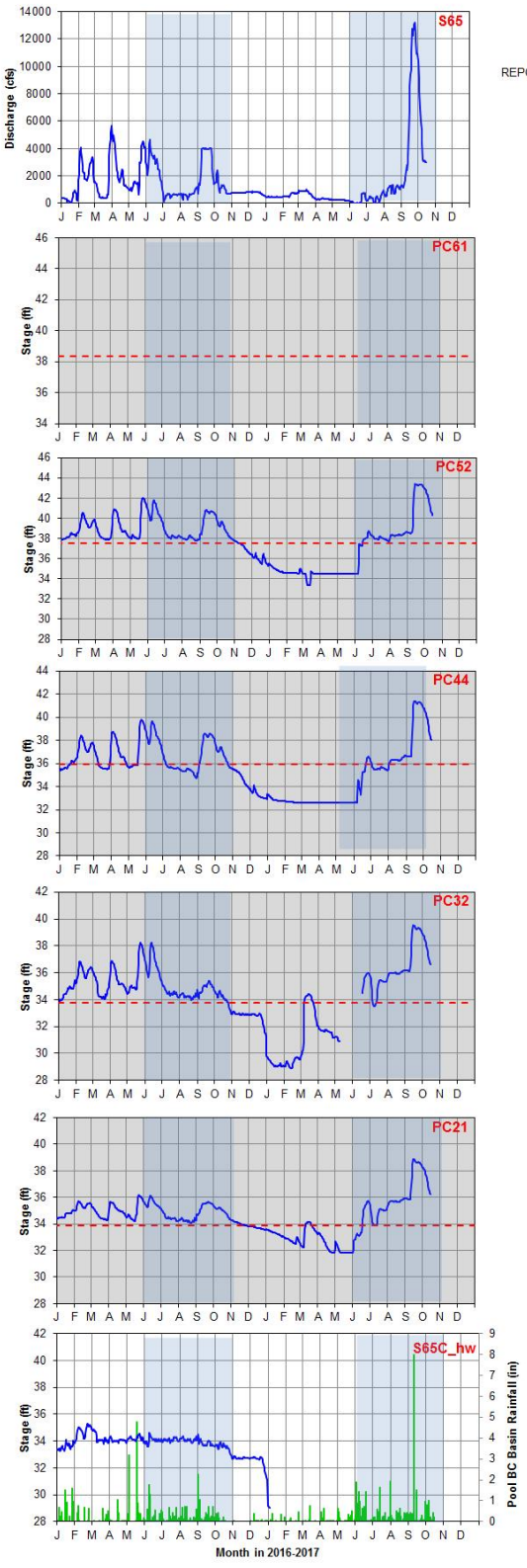
Figure 12. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to Jan. 16, 2012.





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



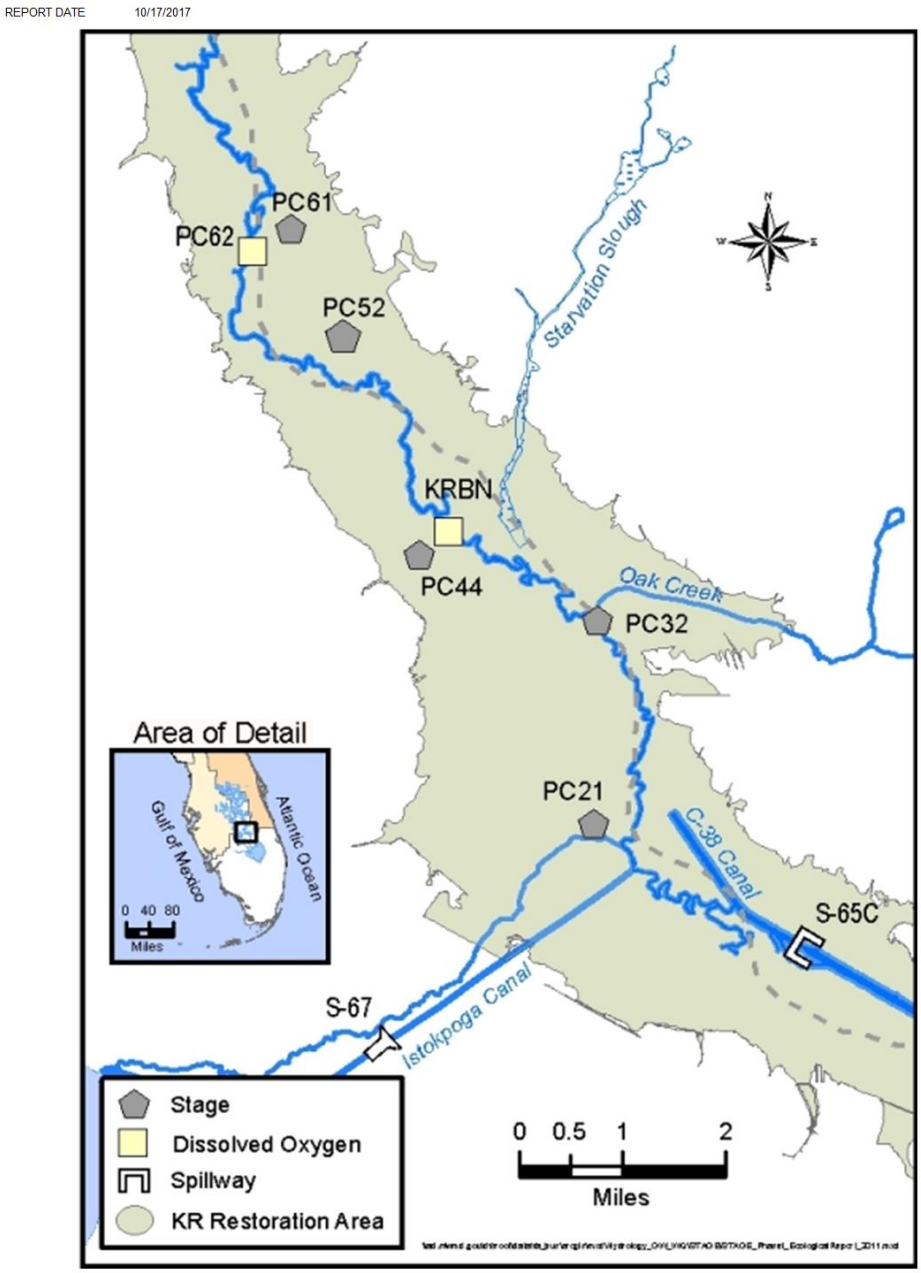


Figure 13. Discharge at S65, stages at five monitoring stations in the Phase I area of the Kissimmee River floodplain, and headwater stage at S65-C since January 1, 2015. The most recent data (~2 weeks) are provisional real-time data from SFWMD DualTrend; previous data are from SFWMD DB-HYDRO (validated). Dashed lines are ground elevations.

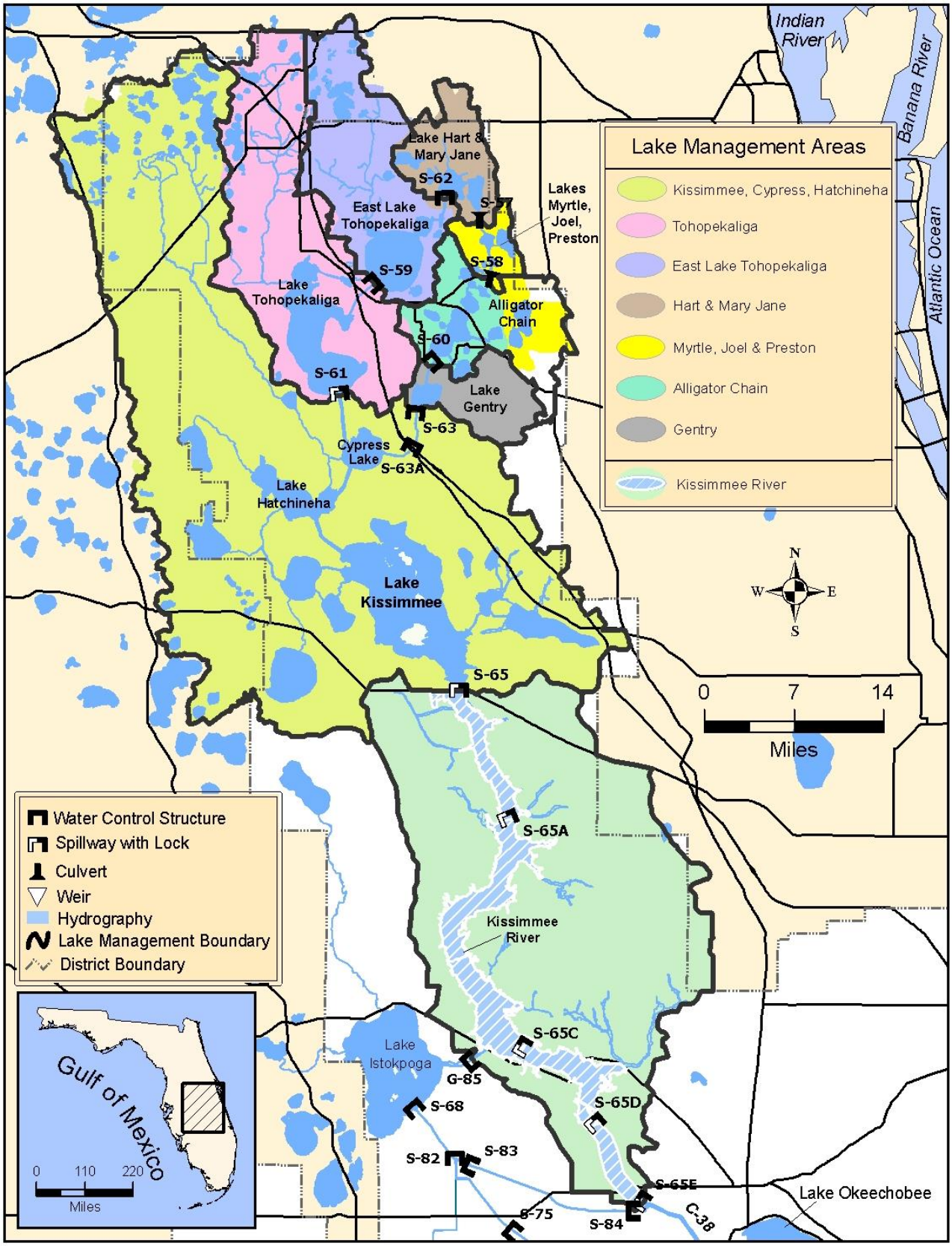


Figure 14. The Kissimmee Basin

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee stage is at 17.16 feet NGVD for the period ending at midnight on October 16, 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 increased slightly to 17.20 feet over the past week before declining back to 17.16, the same stage it was one week ago. The Lake is still 1.77 feet higher than it was a month ago and 1.25 feet higher than it was a year ago (Figure 1). The Lake is currently in the High Lake Management Band (Figure 2). According to RAINDAR, only 0.35 inches of rain fell directly over the Lake during the week October 10 - October 16 (Figure 3), though the majority of the surrounding watershed had between 0.75 and 1.5 inches.

Average daily inflows to the Lake decreased by about half over the past week from 20,113 cfs to 10,558 cfs. Most of the inflows were from the Kissimmee River via the S65E and S84 structures, which averaged 6,515 cfs and 1,990 cfs daily, respectively. This was the first week in over a month that inflows were less than 12,000 cfs from the S65E structures.

Average daily outflows for the Lake increased over the past week, primarily due to increases in discharges to the St Lucie estuary (via the S308) after high basin runoff and king tides had limited flows the week prior. Outflows increased from 7,601 cfs to 11,034 cfs, with S308 discharges going from 1,139 cfs to 3,850 cfs this past week. Most of the Lake discharges were through S77, which increased slightly from 6,951 cfs to 7,189 cfs. Backflows from the L8 canal through Culvert 10A decreased after basin runoff subsided, going from -489 average daily cfs the previous week to just -5 cfs over the past week. There were no discharges south through the S350 structures. The corrected evapotranspiration value based on the L006 weather platform solar radiation data increased to 1.08 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 October 10, 2017 to midnight October 16, 2017). Figure 4 shows the combined average daily cfs for inflows and outflows for the Lake over the past eight weeks, as well as backpumping that occurred immediately following Hurricane Irma from S2 and S3. These data are provisional and are subject to change.

Table 1

INFLOWS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S65E & S65EX1	6515	2.4
S71 & 72	376	0.1
S84 & 84X	1990	0.7
Fisheating Creek	486	0.2
S154	210	0.1
S191	627	0.2
S133 P	116	0.0
S127 P	98	0.0
S129 P	40	0.0
S131 P	9	0.0
S135 P	88	0.0
S2 P	0	0.0
S3 P	0	0.0
S4 P	3	0.0
C5	0	0.0
Rainfall	956	0.3
Total	**11514**	**4.2**

OUTFLOWS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S77	7189	2.7
S308	3850	1.4
S351	0	0.0
S352	0	0.0
S354	0	0.0
L8	-5	0.0
ET	2976	1.1
Total	**14010**	**5.2**

PROVISIONAL DATA

Hurricane Irma increased total phosphorous (TP) concentrations by resuspending phosphorous-laden sediments from the muddy, pelagic zone of the Lake, and bringing in phosphorous-laden inflows from flooded watersheds. But the algal bloom potential remains low, as evidenced by the post-Hurricane Irma, mid-September Chlorophyll a (Chla) counts and NOAA's cyanobacteria monitoring product derived from the OLCI satellite sensor. None of the 19 sites sampled for Chla were higher than 40 ug/L, the minimum value considered as an algal bloom (Figure 5). Satellite imagery also indicated no areas of the Lake had potential for cyanobacterial blooms, since early September and prior to Hurricane Irma (Figure 6).

Submerged aquatic vegetation was resampled after Hurricane Irma to determine the direct impacts from rapid water level rise and combined wind/wave energy. All sites that had submerged aquatic vegetation (SAV) present in the August 2017 sample were revisited in September and early October, finding that out of 91 sample grid cells, representing roughly 22,500 acres, no SAV was found in 26 grids (6,422 ac) and another 18 grids (4,446 ac) were too deep to sample. Assuming the grids that were too deep to sample (>2.5 meters deep) will not support SAV at these Lake stages, Hurricane Irma's direct impacts may have caused a decline of roughly 10,900 ac of SAV (Figure 7).

Water Management Recommendations

The Lake is 17.16 feet NGVD having increased 1.77 feet over the past month. Submerged and emergent vegetation communities in the nearshore region have experienced stages >16 feet three times in less than two years, and are now experiencing a 13 year high in water levels. 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.

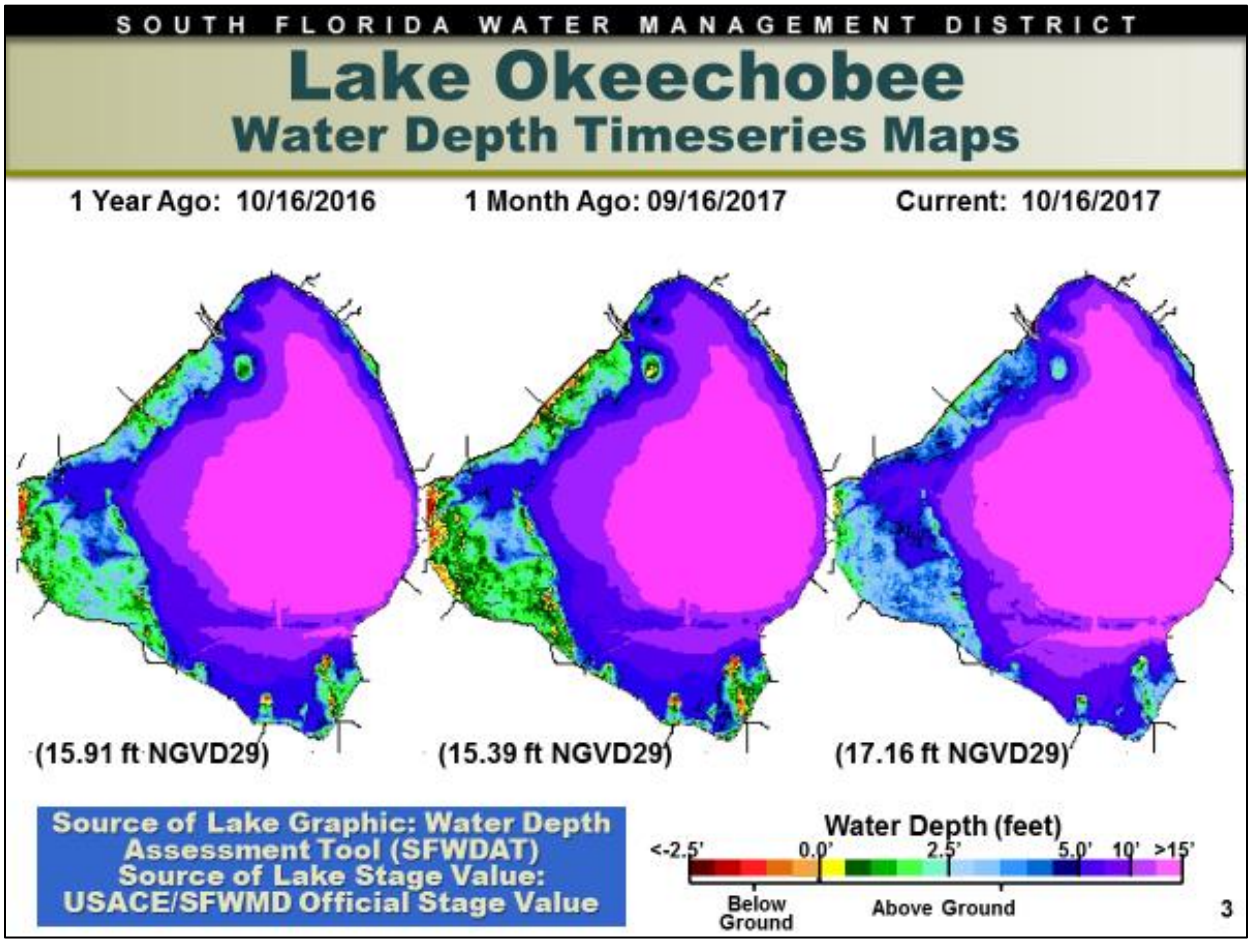

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Lake Okeechobee
Water Depth Timeseries Maps
1 Year Ago: 10/16/2016
1 Month Ago: 09/16/2017
Current: 10/16/2017
(15.91 ft NGVD29)
(15.39 ft NGVD29)
(17.16 ft NGVD29)
Source of Lake Graphic: Water Depth Assessment Tool (SFWDAT)
Source of Lake Stage Value: USACE/SFWMD Official Stage Value
Water Depth (feet)
<-2.5'
0.0'
2.5'
5.0'
10'
>15'
Below Ground
Above Ground
3

Figure 1

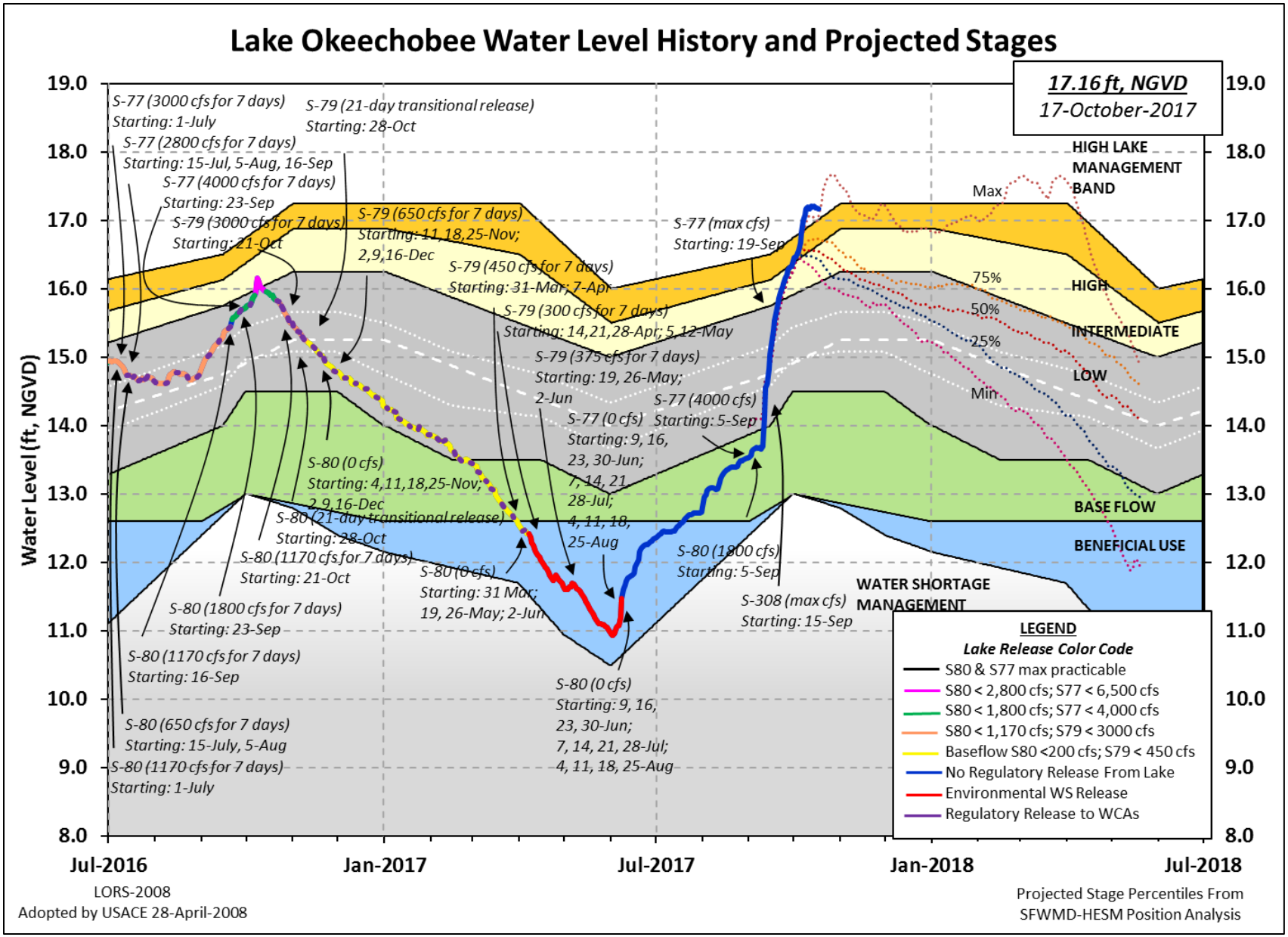

Lake Okeechobee Water Level History and Projected Stages
17.16 ft, NGVD
17-October-2017
Water Level (ft, NGVD)
19.0
18.0
17.0
16.0
15.0
14.0
13.0
12.0
11.0
10.0
9.0
8.0
Jul-2016
Jan-2017
Jul-2017
Jan-2018
Jul-2018
HIGH LAKE MANAGEMENT BAND
HIGH
INTERMEDIATE
LOW
BASE FLOW
BENEFICIAL USE
WATER SHORTAGE MANAGEMENT
Max
75%
50%
25%
Min
S-77 (3000 cfs for 7 days) Starting: 1-July
S-77 (2800 cfs for 7 days) Starting: 15-Jul, 5-Aug, 16-Sep
S-77 (4000 cfs for 7 days) Starting: 23-Sep
S-79 (3000 cfs for 7 days) Starting: 21-Oct
S-79 (21-day transitional release) Starting: 28-Oct
S-79 (650 cfs for 7 days) Starting: 11,18,25-Nov; 2,9,16-Dec
S-79 (450 cfs for 7 days) Starting: 31-Mar; 7-Apr
S-79 (300 cfs for 7 days) Starting: 14,21,28-Apr; 5,12-May
S-79 (375 cfs for 7 days) Starting: 19, 26-May; 2-Jun
S-77 (max cfs) Starting: 19-Sep
S-77 (0 cfs) Starting: 9, 16, 23, 30-Jun; 7, 14, 21 28-Jul; 4, 11, 18, 25-Aug
S-77 (4000 cfs) Starting: 5-Sep
S-80 (0 cfs) Starting: 4,11,18,25-Nov; 2,9,16-Dec
S-80 (21-day transitional release) Starting: 28-Oct
S-80 (1170 cfs for 7 days) Starting: 21-Oct
S-80 (0 cfs) Starting: 31 Mar; 19, 26-May; 2-Jun
S-80 (1800 cfs for 7 days) Starting: 23-Sep
S-80 (1170 cfs for 7 days) Starting: 16-Sep
S-80 (650 cfs for 7 days) Starting: 15-July, 5-Aug
S-80 (1170 cfs for 7 days) Starting: 1-July
S-80 (0 cfs) Starting: 9, 16, 23, 30-Jun; 7, 14, 21, 28-Jul; 4, 11, 18, 25-Aug
S-80 (1800 cfs) Starting: 5-Sep
S-308 (max cfs) Starting: 15-Sep
LEGEND
Lake Release Color Code
S80 & S77 max practicable
S80 < 2,800 cfs; S77 < 6,500 cfs
S80 < 1,800 cfs; S77 < 4,000 cfs
S80 < 1,170 cfs; S79 < 3000 cfs
Baseflow S80 <200 cfs; S79 < 450 cfs
No Regulatory Release From Lake
Environmental WS Release
Regulatory Release to WCAs
LORS-2008
Adopted by USACE 28-April-2008
Projected Stage Percentiles From SFWMD-HESM Position Analysis

Figure 2

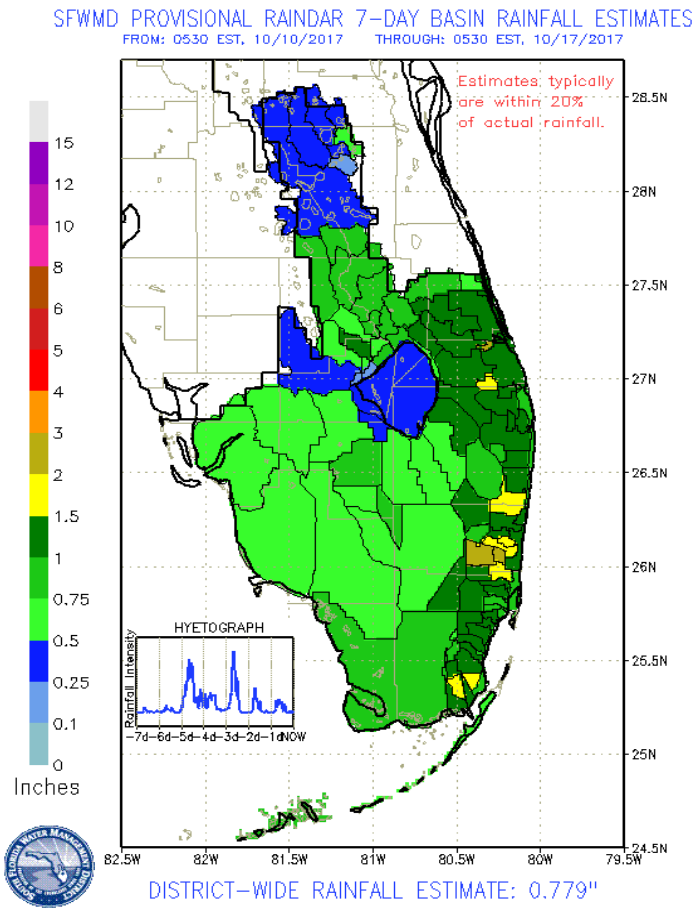


Figure 3

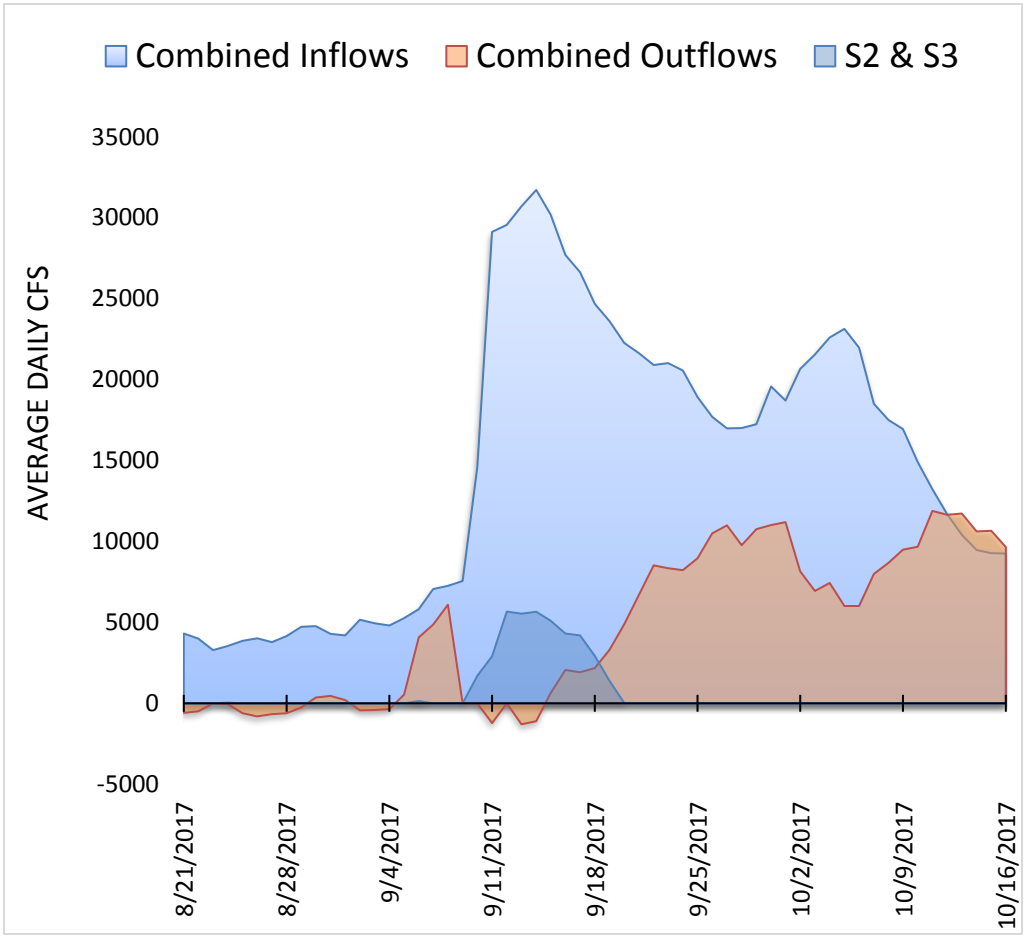


Figure 4

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

Lake Okeechobee
Water Quality

September 18-19, 2017		
Site	Chlorophyll *a* (ug/L)	Microcystin (ug/L)
Nearshore Stations		
FEBIN	3.3	
FEBOUT	17.3	
KISSR0.0	15.5	0.23
LZ2	18.9	BDL
LZ25A	9.0	
PALMOUT	17.8	
PELBAY3	8.7	
POLE3S	17.1	
POLESOUT	32.6	BDL
RITTAE2	10.6	
Pelagic Stations		
L001	17.5	
L004	8.9	
L005	35.0	0.29
L006	5.0	
L007	10.2	
L008	10.0	
LZ30	10.9	BDL
LZ40	4.3	
CLV10A	6.8	BDL

BDL=Below Detection Limit

Figure 5

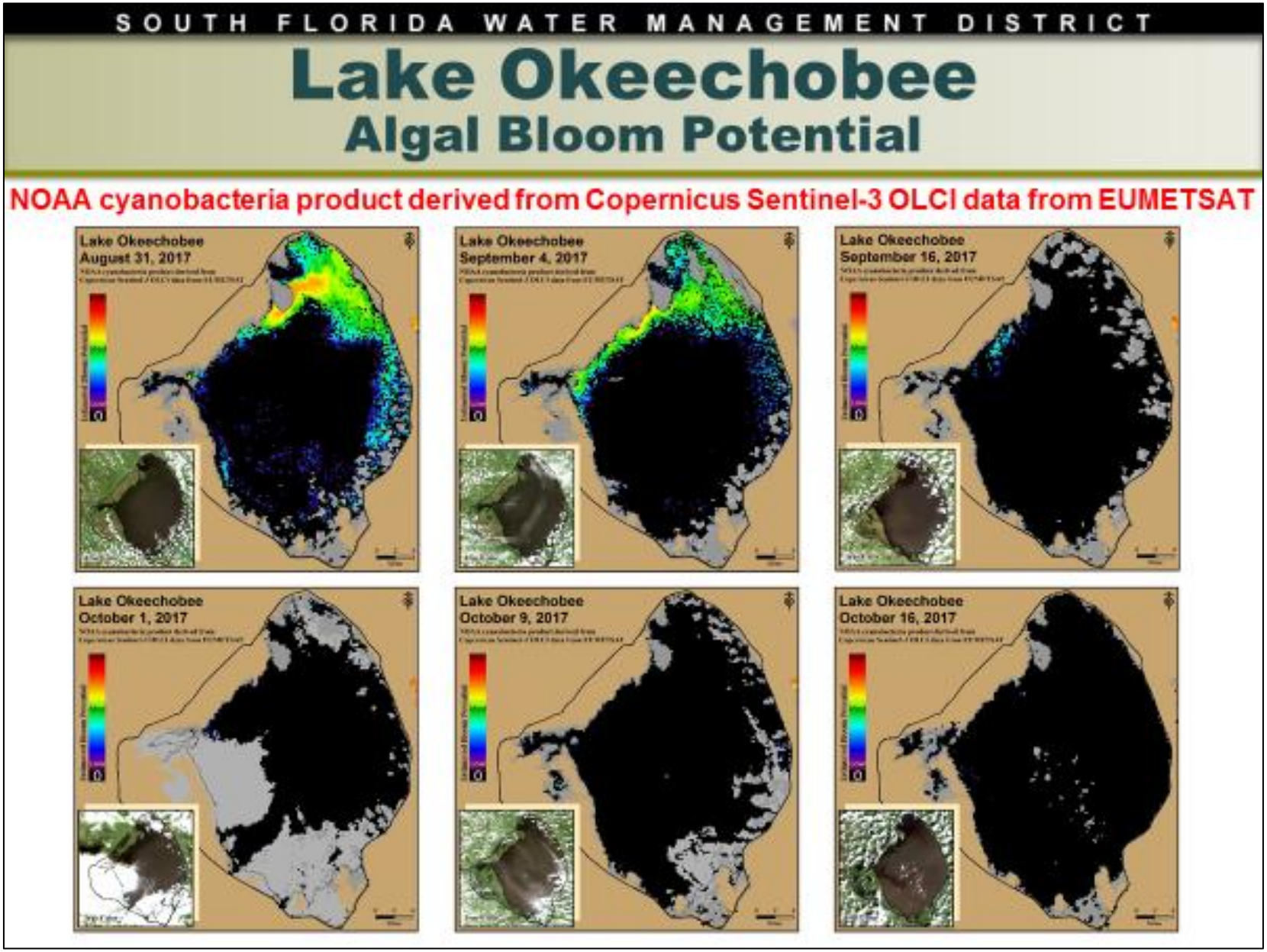

SOUTH FLORIDA WATER MANAGEMENT DISTRICT
Lake Okeechobee
Algal Bloom Potential
NOAA cyanobacteria product derived from Copernicus Sentinel-3 OLCI data from EUMETSAT
Lake Okeechobee
August 31, 2017
Lake Okeechobee
September 4, 2017
Lake Okeechobee
September 16, 2017
Lake Okeechobee
October 1, 2017
Lake Okeechobee
October 9, 2017
Lake Okeechobee
October 16, 2017

Figure 6

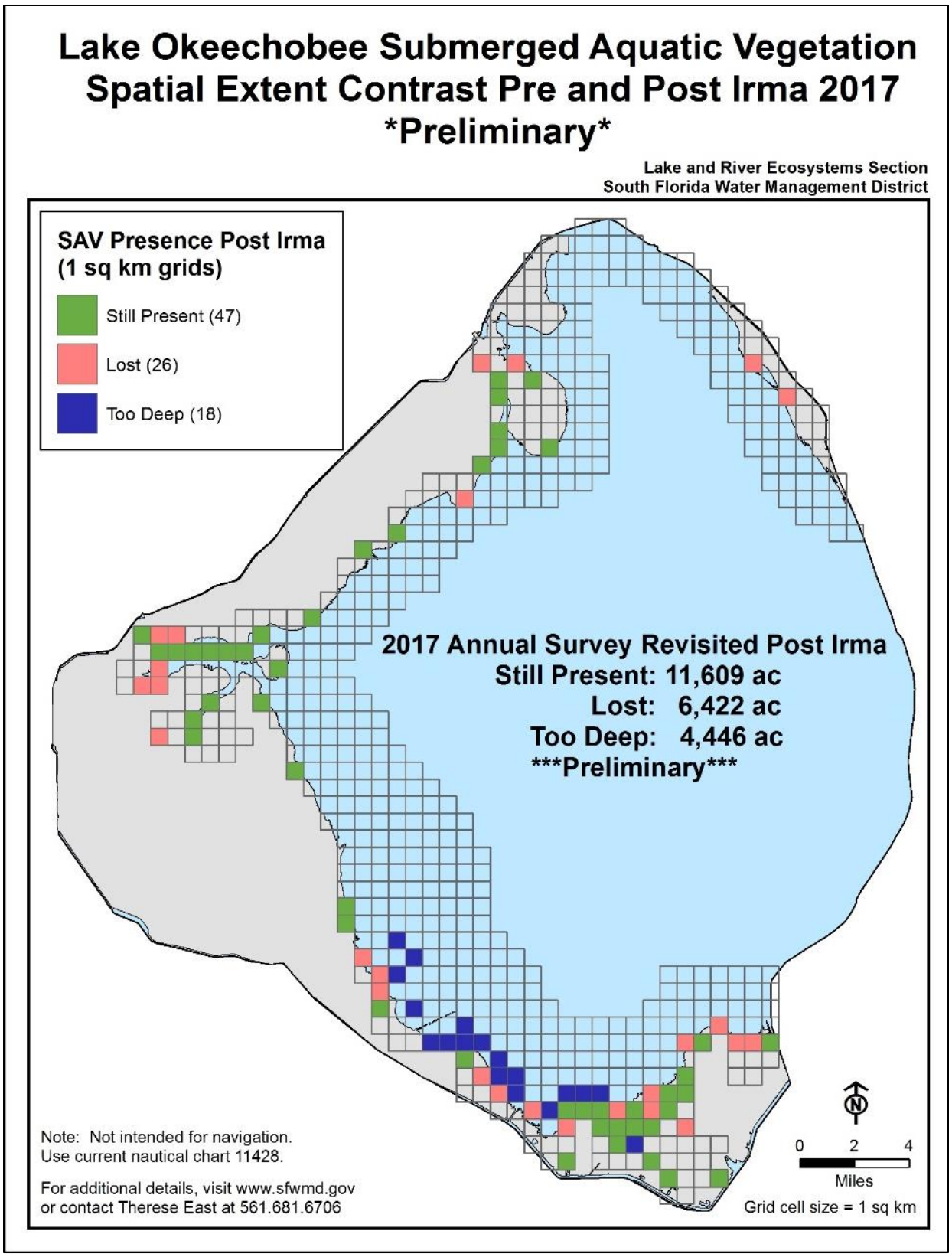


Figure 7

LAKE ISTOKPOGA

Lake Istokpoga stage is 39.24 feet NGVD as of midnight October 16, 2017 and is currently -0.26 feet below its regulation schedule to accommodate construction on downstream structures (Figure 8). Average daily flows into the Lake from Josephine Creek for the week October 10 – October 16

decreased from the previous week, from 423 cfs to 342 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 decreased from the previous week as well, from 2,663 cfs to 1,907 cfs. According to RAINDAR, 0.8 inches of rain fell in the Lake Istokpoga basin in the past week.

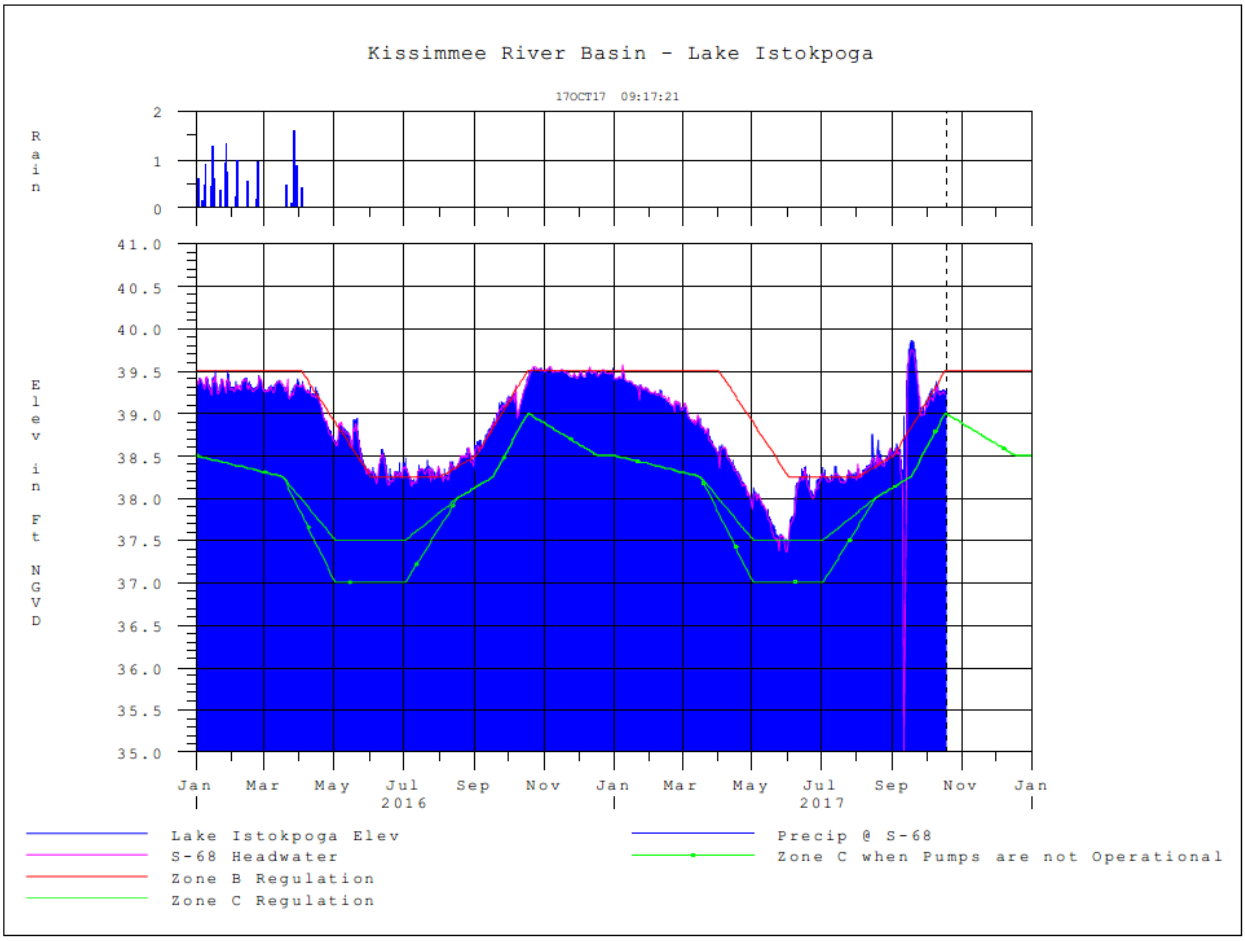


Figure 8

ESTUARIES

St. Lucie Estuary

Over the past week, provisional flows averaged about 4,600 cfs at S-80, 3,857 cfs at S-308, 787cfs at S-49 on C-24, 902 cfs at S-97 on C-23, and 921 cfs from Ten Mile Creek at the Gordy Road Structure. Average inflow from tidal basin tributaries is estimated to be 636 cfs (Figures 1 and 2). Total inflow averaged about 7,846 cfs last week and 7,223 cfs over last month.

Over the past week, surface salinity decreased throughout 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 0.4. Salinity conditions in the middle estuary are in the poor range for the adult eastern oysters.

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)	**0.2** (0.3)	**0.2** (0.3)	NA[1]
US1 Bridge	**0.2** (0.3)	**0.6** (0.4)	10.0-26.0
A1A Bridge	**1.7** (2.0)	**7.5** (7.0)	NA[1]

[1]Envelope 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	5.48	2.92	6.51
HR1	bottom	4.55	0.57	6.26

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 *a* (µg/l)	Average DO (mg/l)	Minimum DO (mg/l)	Maximum DO (mg/l)
SF2 (towards the S80 structure)	3.24	4.58 - 5.34	N/A	N/A	N/A
SF	1.83	5.23 - 6.03	6.45	5.85	6.83
NF	2.33	N/A	N/A	N/A	N/A
ME[1]	N/A	N/A	N/A	N/A	N/A
IRL-SLE[2]	N/A	N/A	N/A	N/A	N/A

[1]Data is not available or unreliable.

NOAA satellite imagery indicates low potential cyanobacterial presence at some nearshore locations in the St. Lucie estuary (Figure 6).

The October 12, 2017 water quality mapping trip to the estuary revealed very high turbidity levels in the South Fork (> 80 FNU), especially in vicinity of the S-80 structure (discharge from the structure was high during the survey), which coincided with relatively low chlorophyll *a* concentrations (<10 µg/L) compared to the North Fork and the middle part of the estuary (Appendix A; Figures A3 and A4).

Caloosahatchee Estuary

During the past week, provisional flows averaged approximately 7,219 cfs at S-77, 7,717 cfs at S-78, and 10,406 cfs at S-79. Average inflow from tidal basin tributaries is estimated to be 650 cfs (Figures 7 & 8). Total inflow averaged 11,056 cfs last week and 12,397 cfs over last month.

Over the past week in the estuary, salinity remained about the same (Table 4, Figures 9 and 10). The seven-day average salinity values are within the poor range for adult oysters at Cape Coral and within the fair range at Shell Point (Figure 11). Salinity data was not available for Sanibel. 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.

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)	**0.2** (0.2)	**0.2** (0.2)	NA[1]
*Val I75	**0.2** (0.2)	**0.2** (0.2)	0.0-5.0[2]
Ft. Myers Yacht Basin	**0.2** (0.2)	**0.2** (0.2)	NA
Cape Coral	**0.2** (0.3)	**0.2** (0.3)	10.0-30.0
Shell Point	**5.7** (6.3)	**9.7** (7.9)	10.0-30.0
Sanibel	**NR**[3](NR)	**NR** (NR)	10.0-30.0

[1]Envelope not applicable, [2]Envelope is based on a 30-day average, and [3]Not 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 *a* (µg/l)	Down for maintenance	3.91 - 4.98	2.64 - 5.31
Dissolved Oxygen (mg/l)	Down for maintenance	No Data	No Data

The Florida Fish and Wildlife Research Institute reported on October 13, 2017, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed at background concentrations in one sample collected from Lee County.

NOAA satellite imagery indicates low to medium potential cyanobacterial presence in the Caloosahatchee estuary, mostly in nearshore areas (Figure 12).

Water Management Recommendations

Lake stage is in the High Lake Management Band of 2008 LORS. Tributary hydrological conditions are very wet. The 2008 LORS recommends up to maximum discharge capacity to tidewater. Given the current estuarine conditions, there are no ecological benefits associated with freshwater releases from Lake Okeechobee.

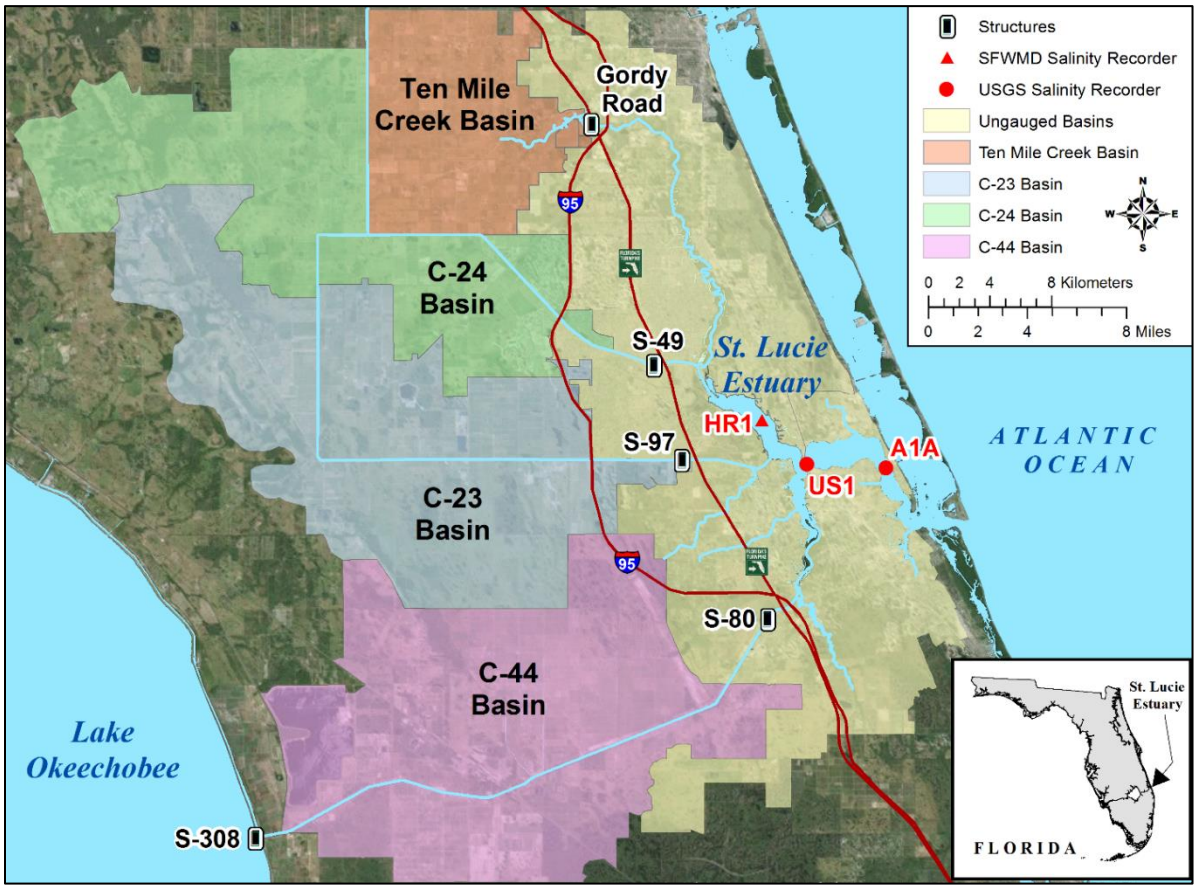


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

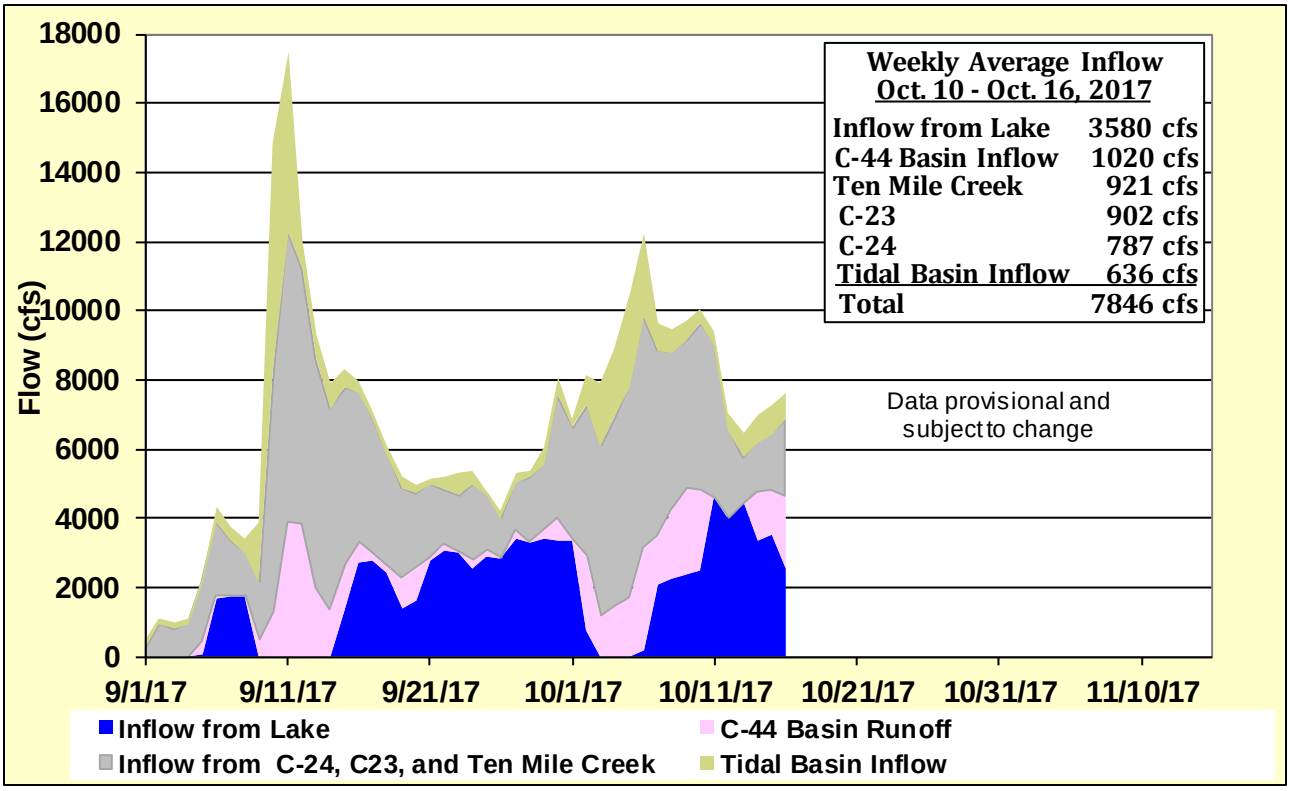


Figure 2. Estimated surface freshwater inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

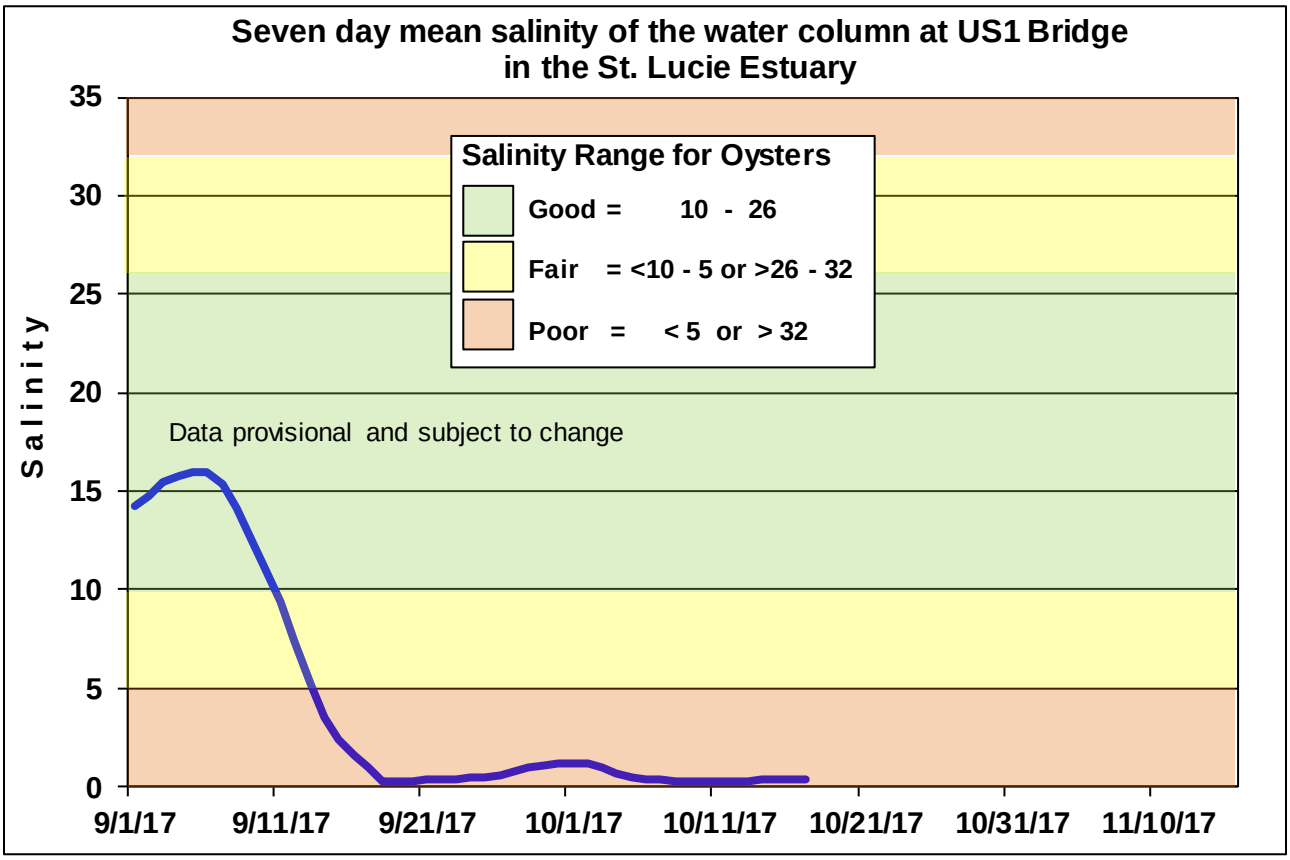


Figure 3. Seven-day mean salinity of the water column at the U.S. Highway 1 Bridge.

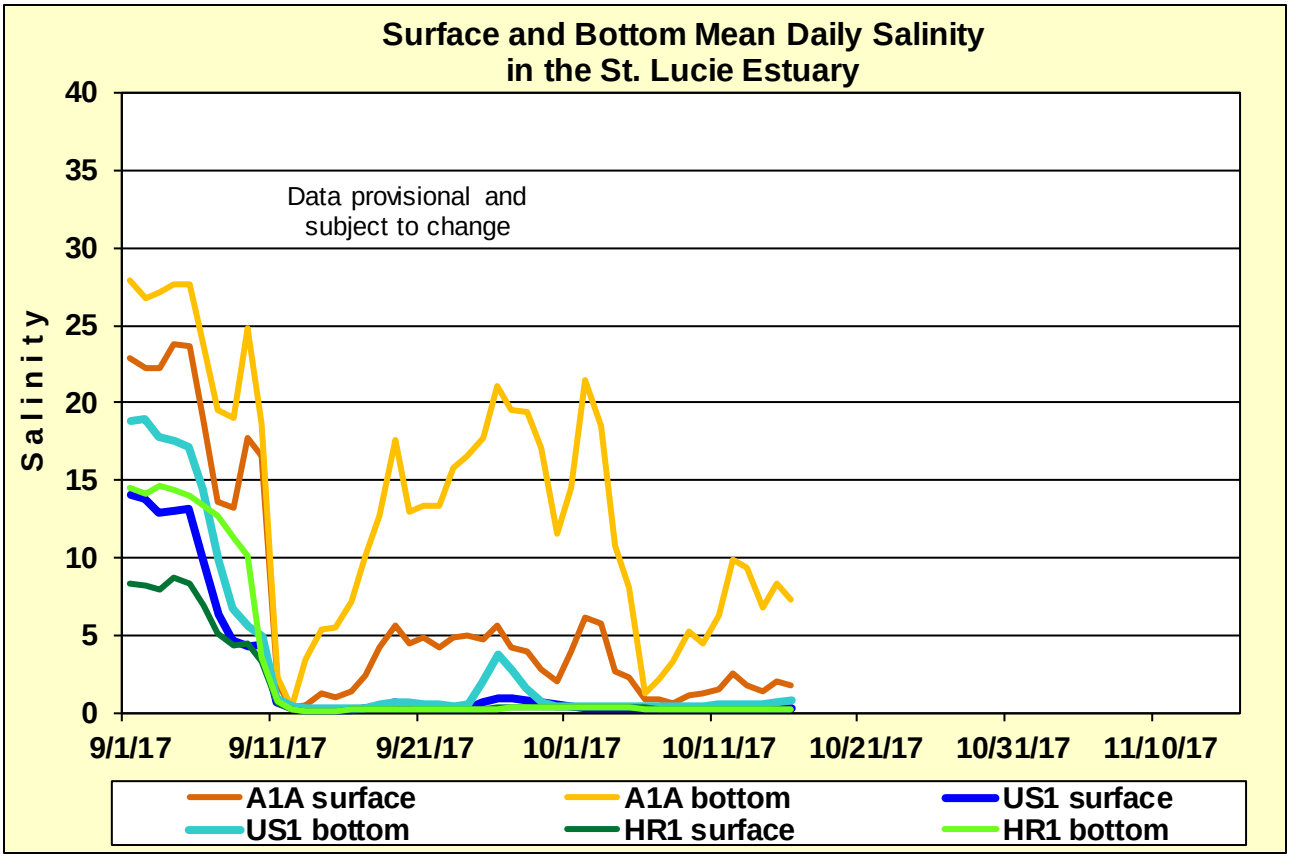


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

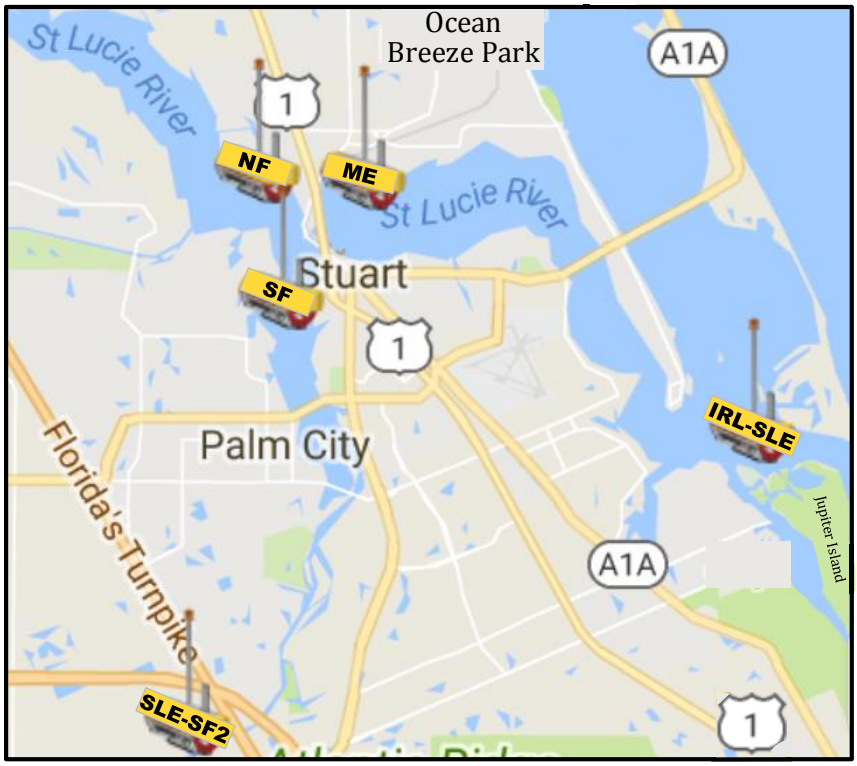


Figure 5. Location of FAU-HBOI LOBO water quality stations in the St. Lucie Estuary.

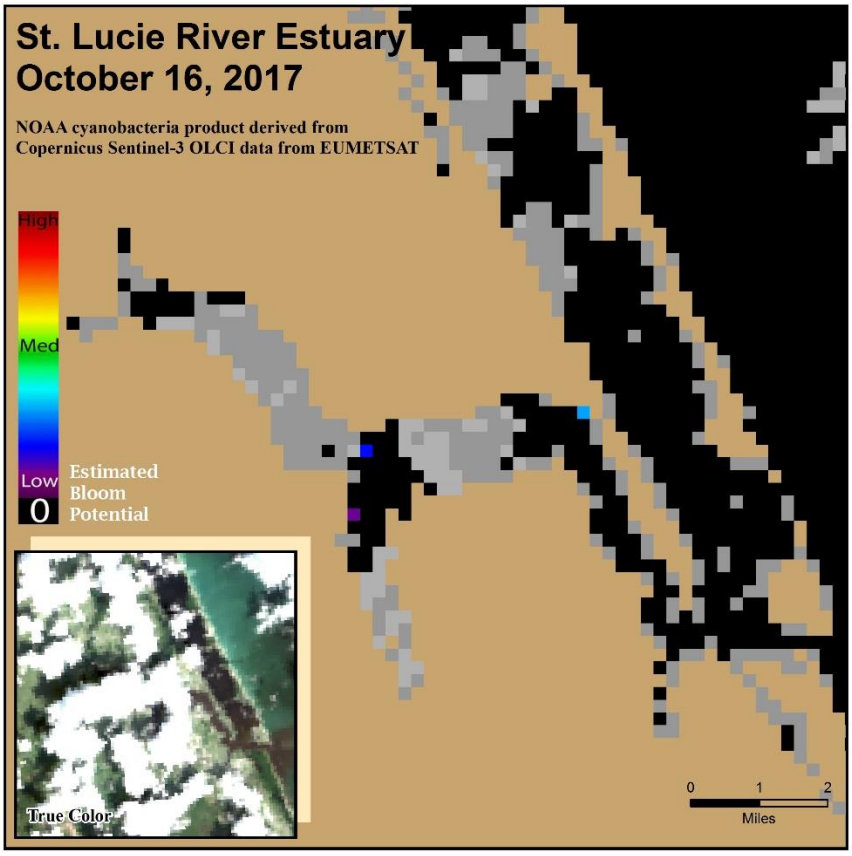


Figure 6. Sentinel 3a Satellite imagery provided by NOAA uses Ocean and Land Color Instrument (OLCI) to estimate cyanobacteria bloom potential in St. Lucie Estuary.

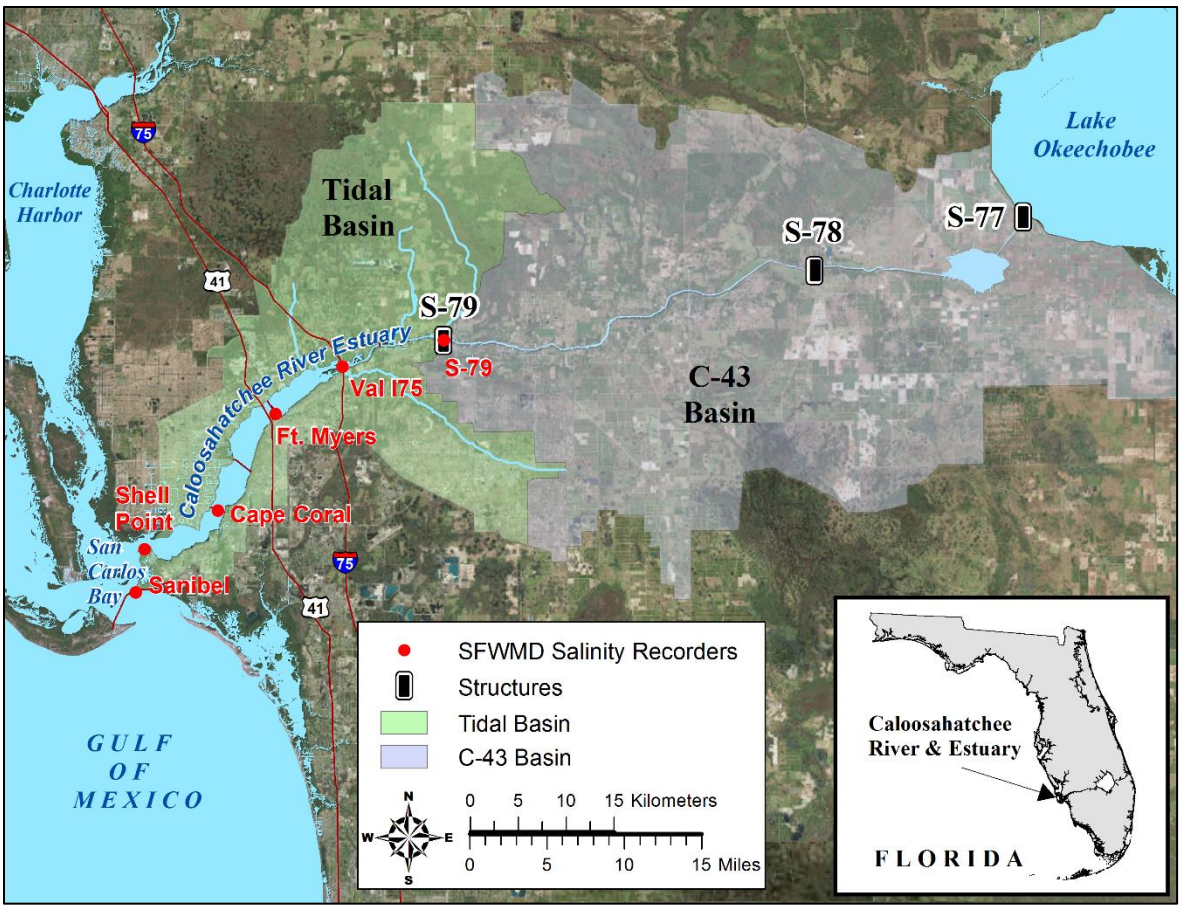


Figure 7. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

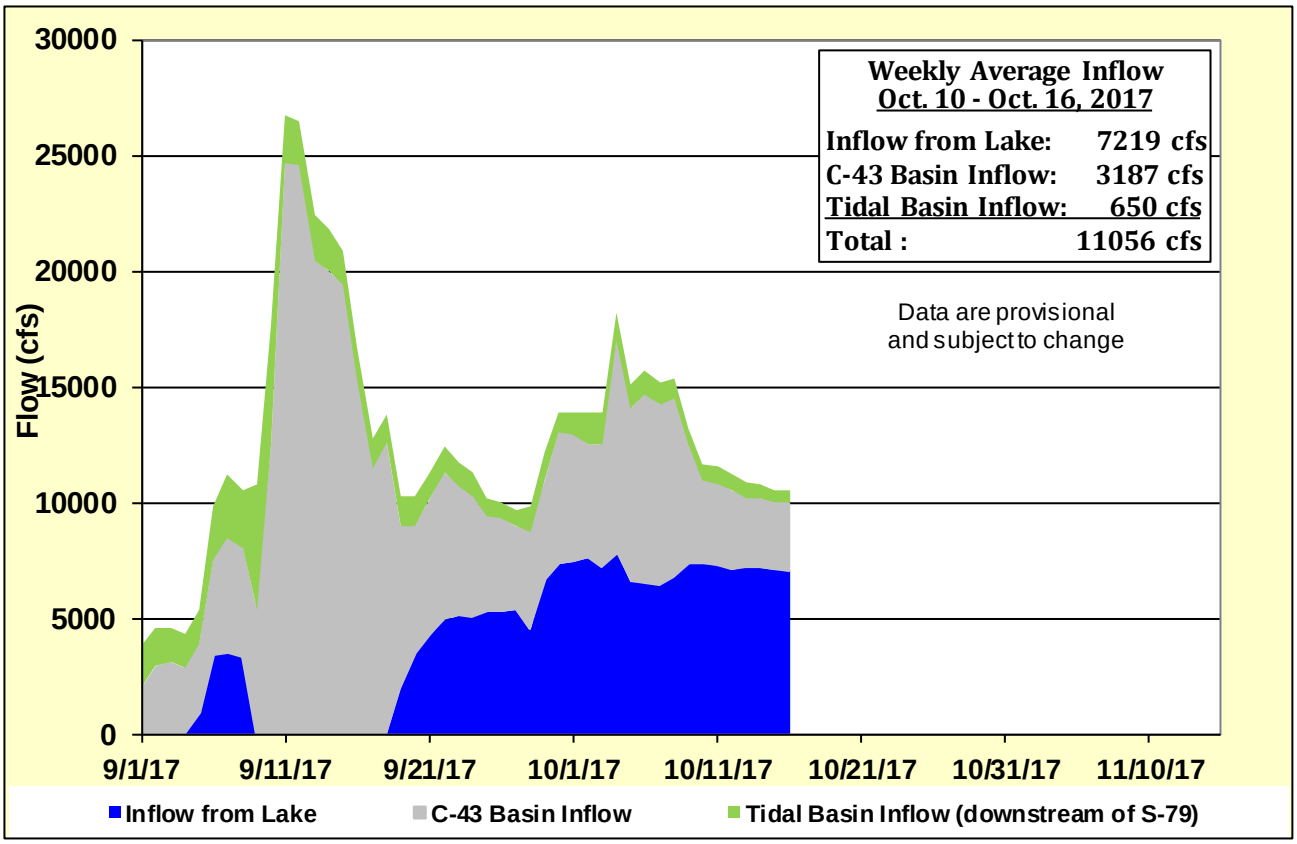
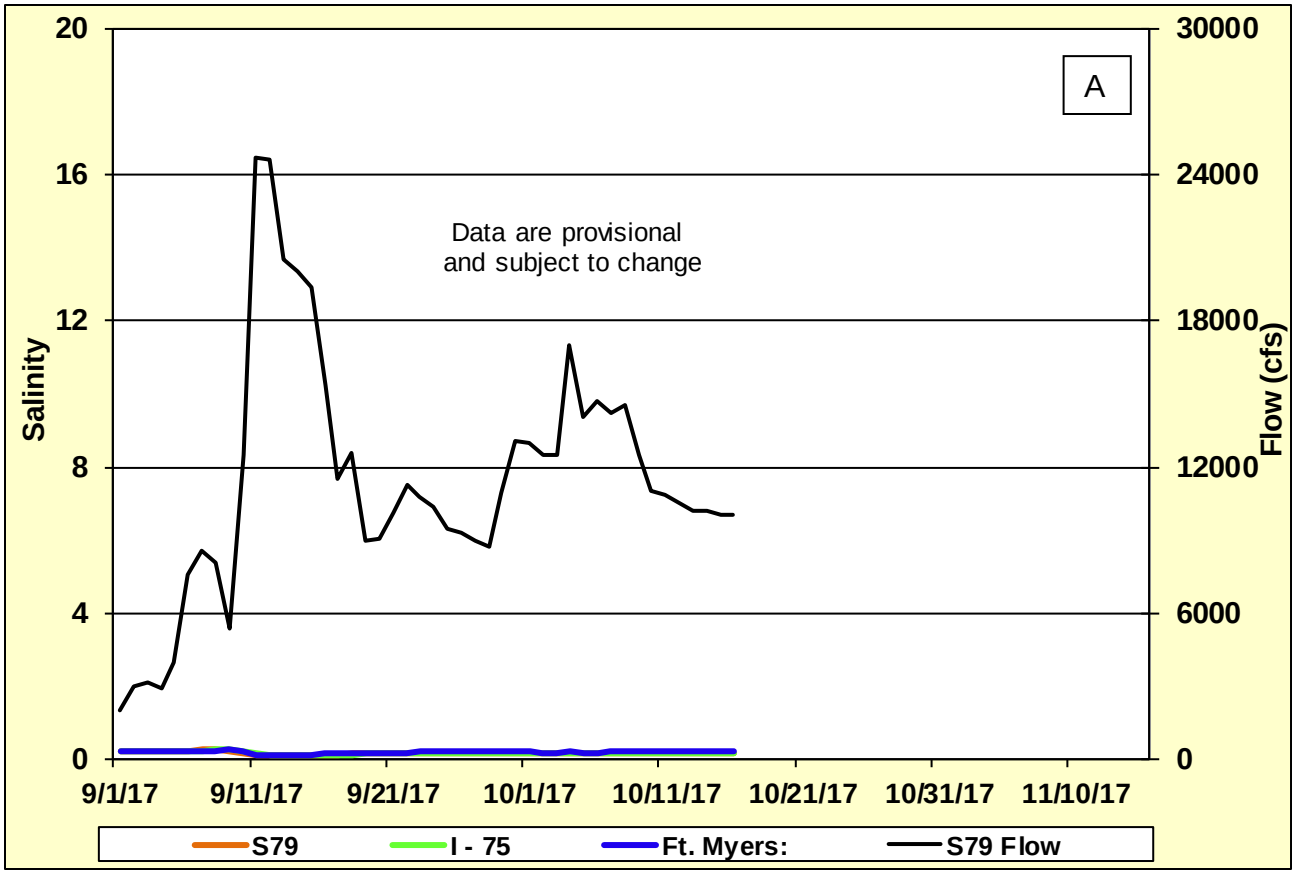


Figure 8. Freshwater inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.



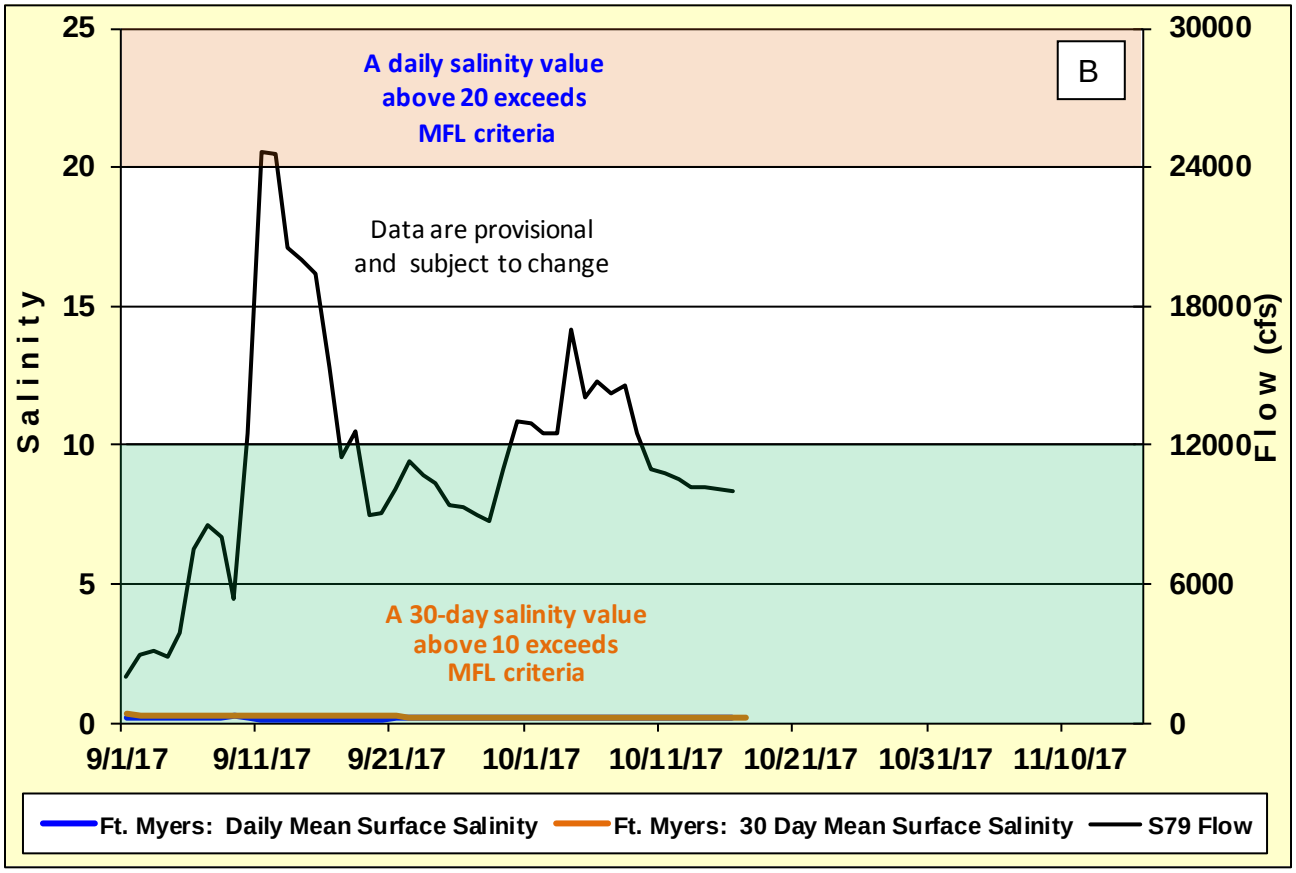


Figure 9. Daily mean flows at S-79 and salinity at upper estuary monitoring stations (A) and 30-day moving average salinity at Ft. Myers (B).

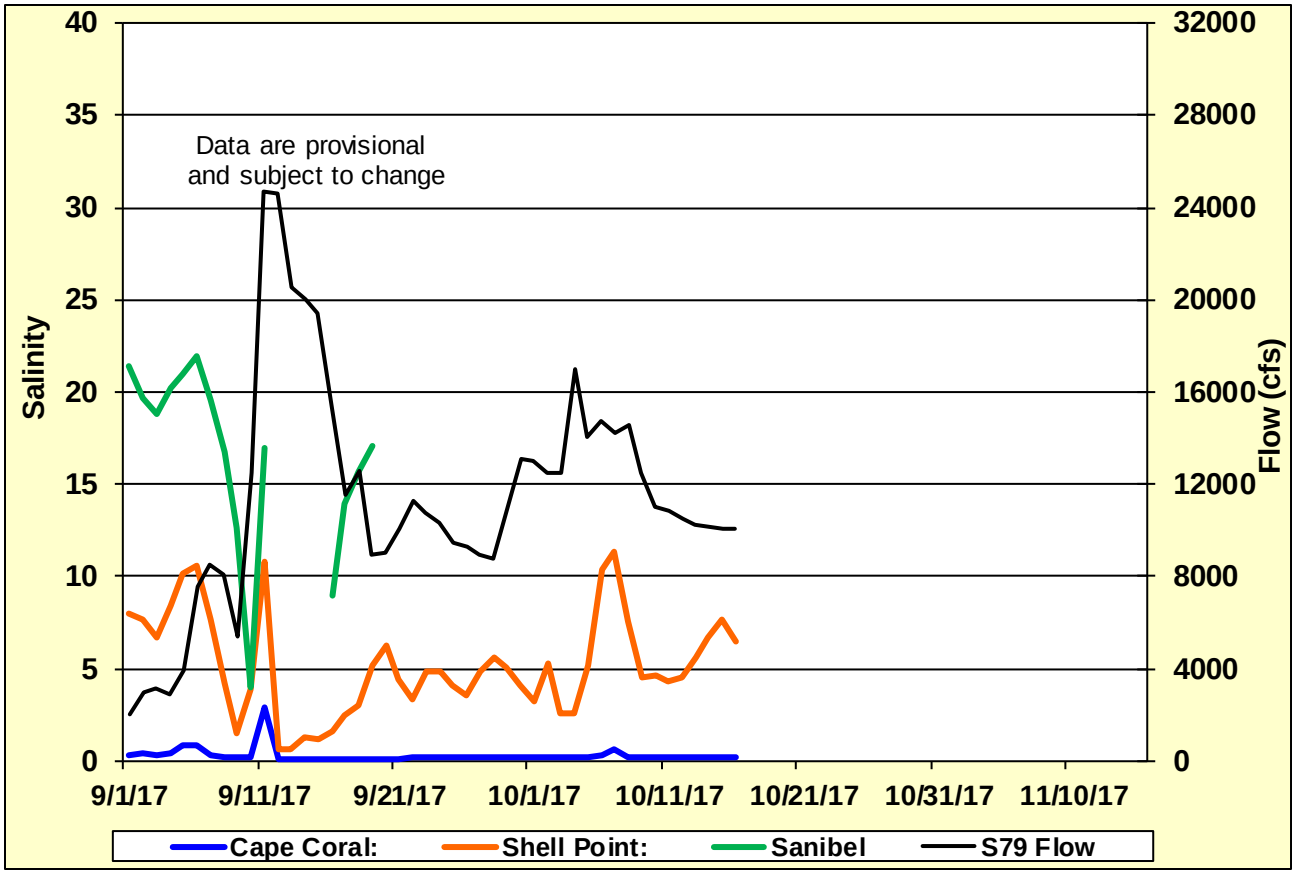


Figure 10. Daily mean flows at S-79 and salinity at lower estuary stations.

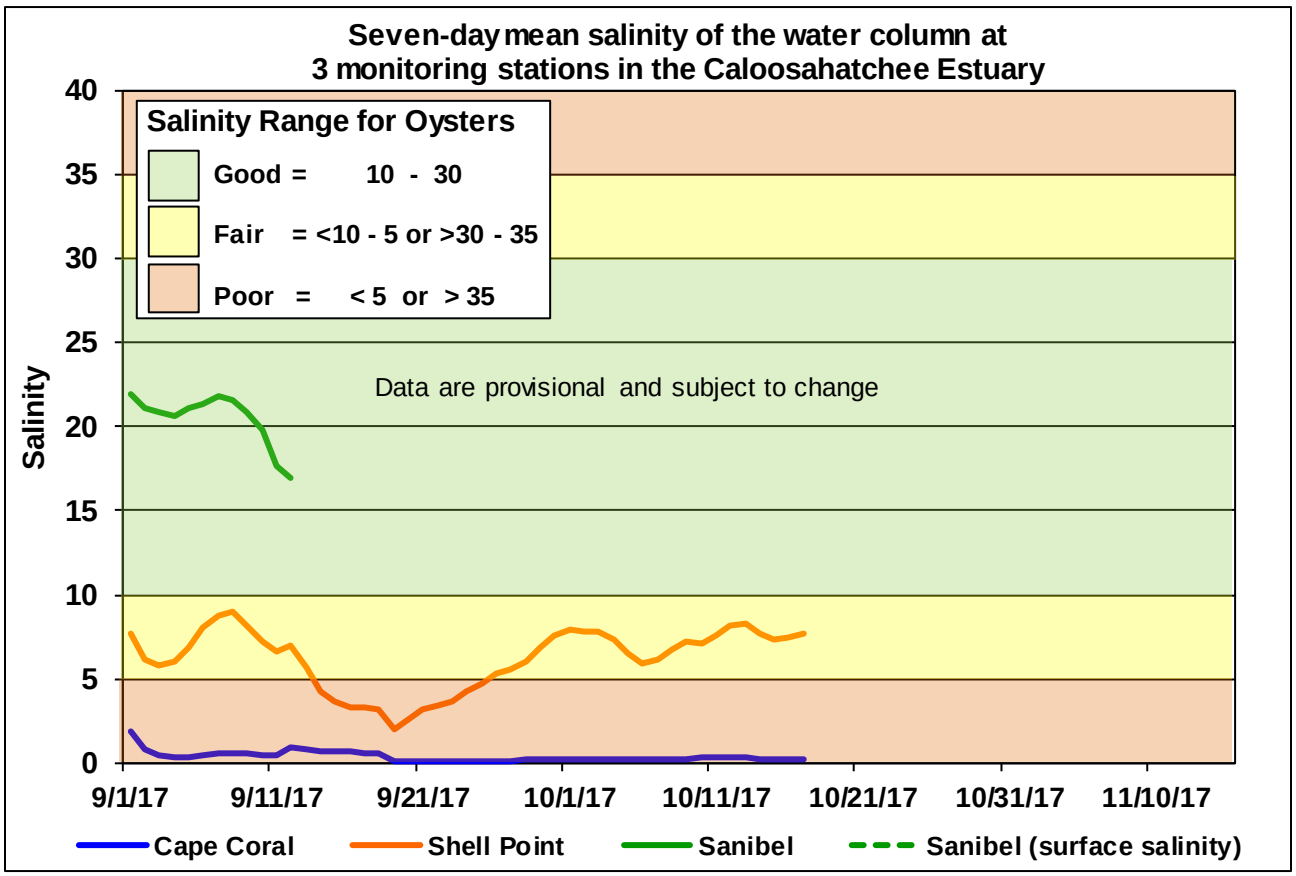


Figure 11. Seven-day mean salinity at Cape Coral Bridge, Shell Point and Sanibel Bridge monitoring stations.

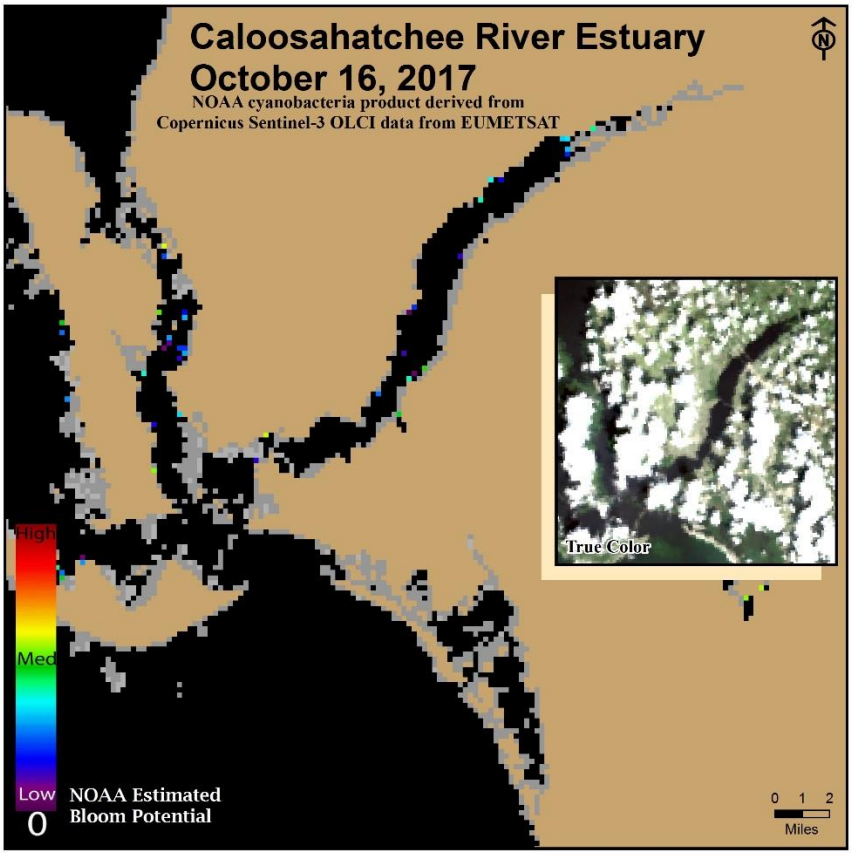


Figure 12. Sentinel 3a Satellite imagery provided by NOAA uses Ocean and Land Color Instrument (OLCI) to estimate cyanobacteria bloom potential in Caloosahatchee Estuary.

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 Folk up to Fork Point, and the South Fork to S-80 (Figure A2). Turbidity is quite high near the S-80 structure and particulate and dissolved material is most likely being flushed down the estuary (Figure A3). Higher flushing time in South Fork combined with low light penetration due to high turbidity are keeping chlorophyll a concentrations relatively low in this part of the estuary compared to other parts of the estuary (Figure A4).

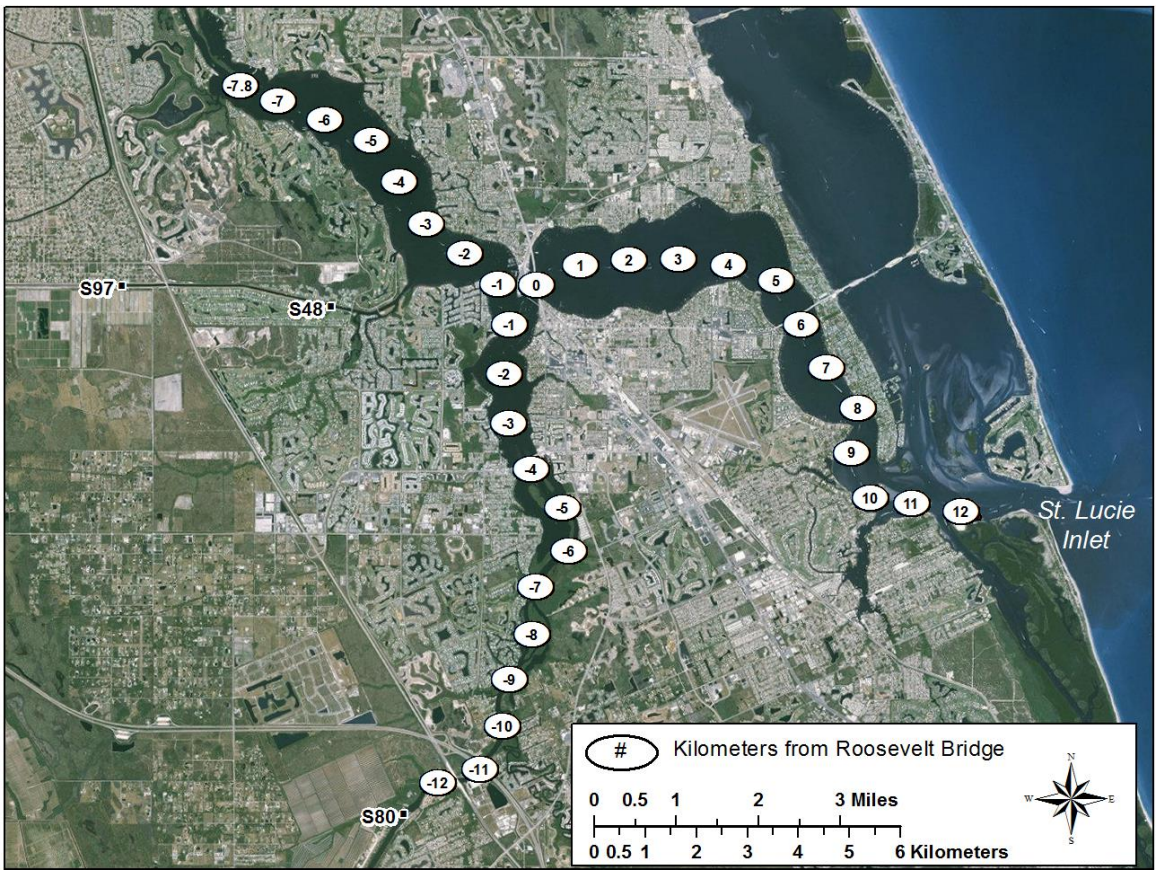


Figure A2. Water quality mapping track with river kilometers away from the Roosevelt Bridge (US1).

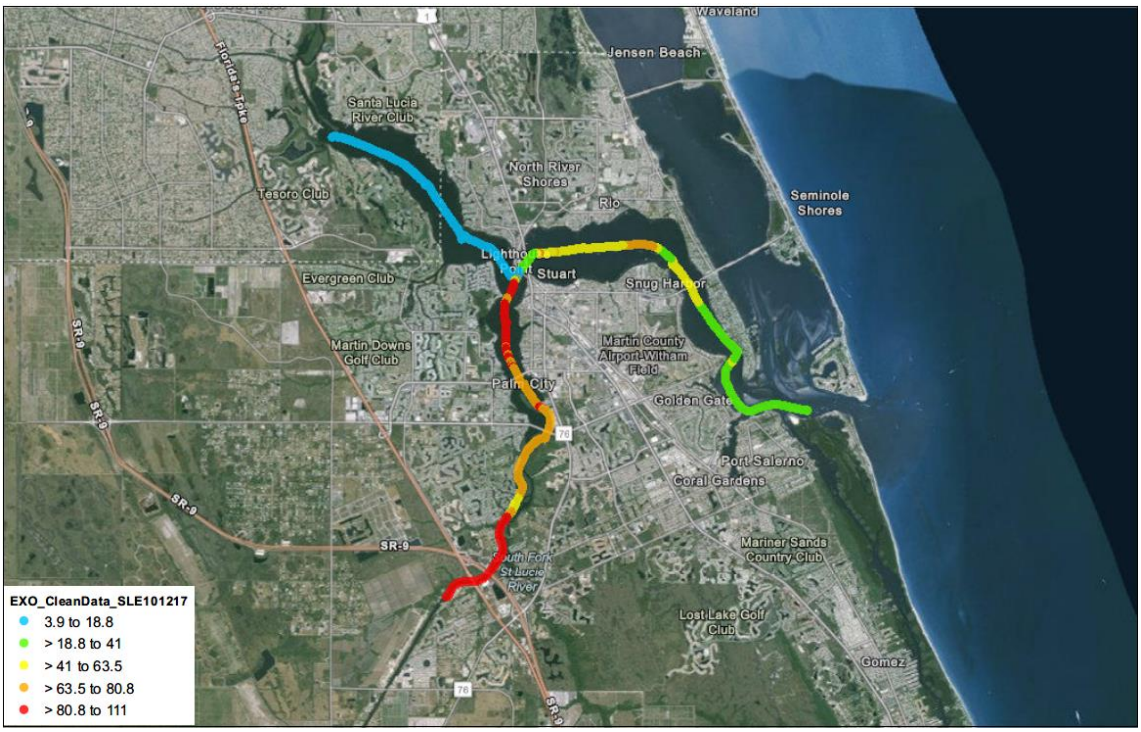


Figure A3. Turbidity concentrations (FNU) in the St. Lucie Estuary.

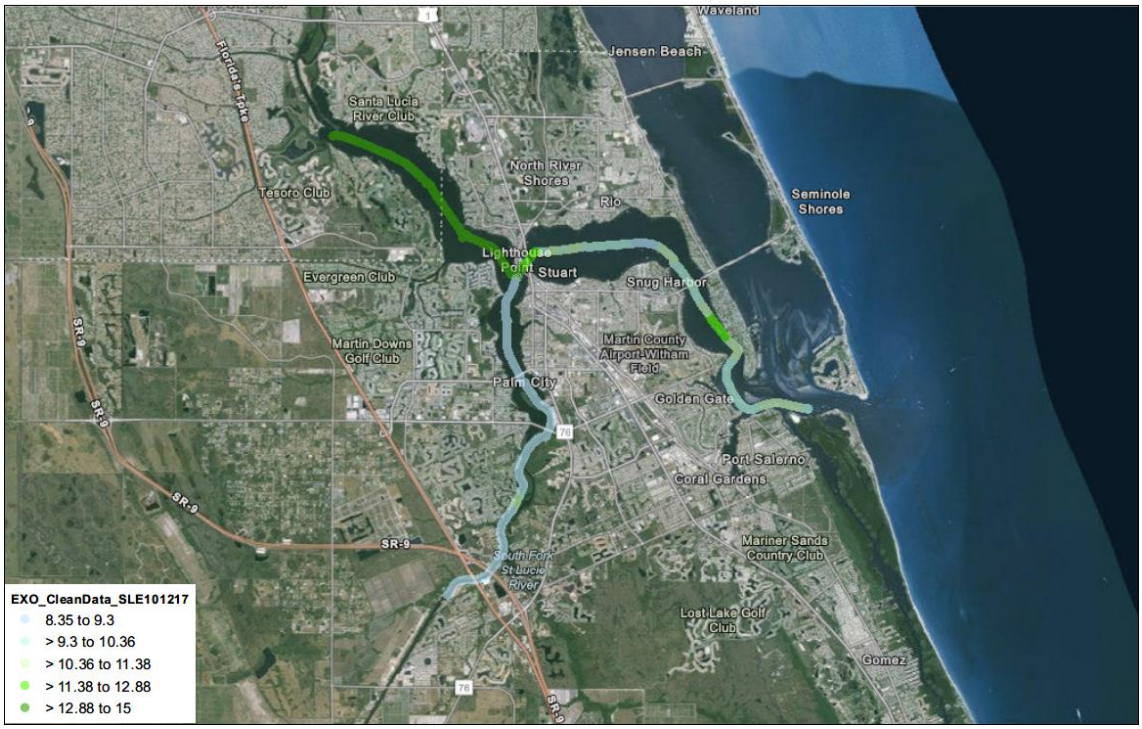
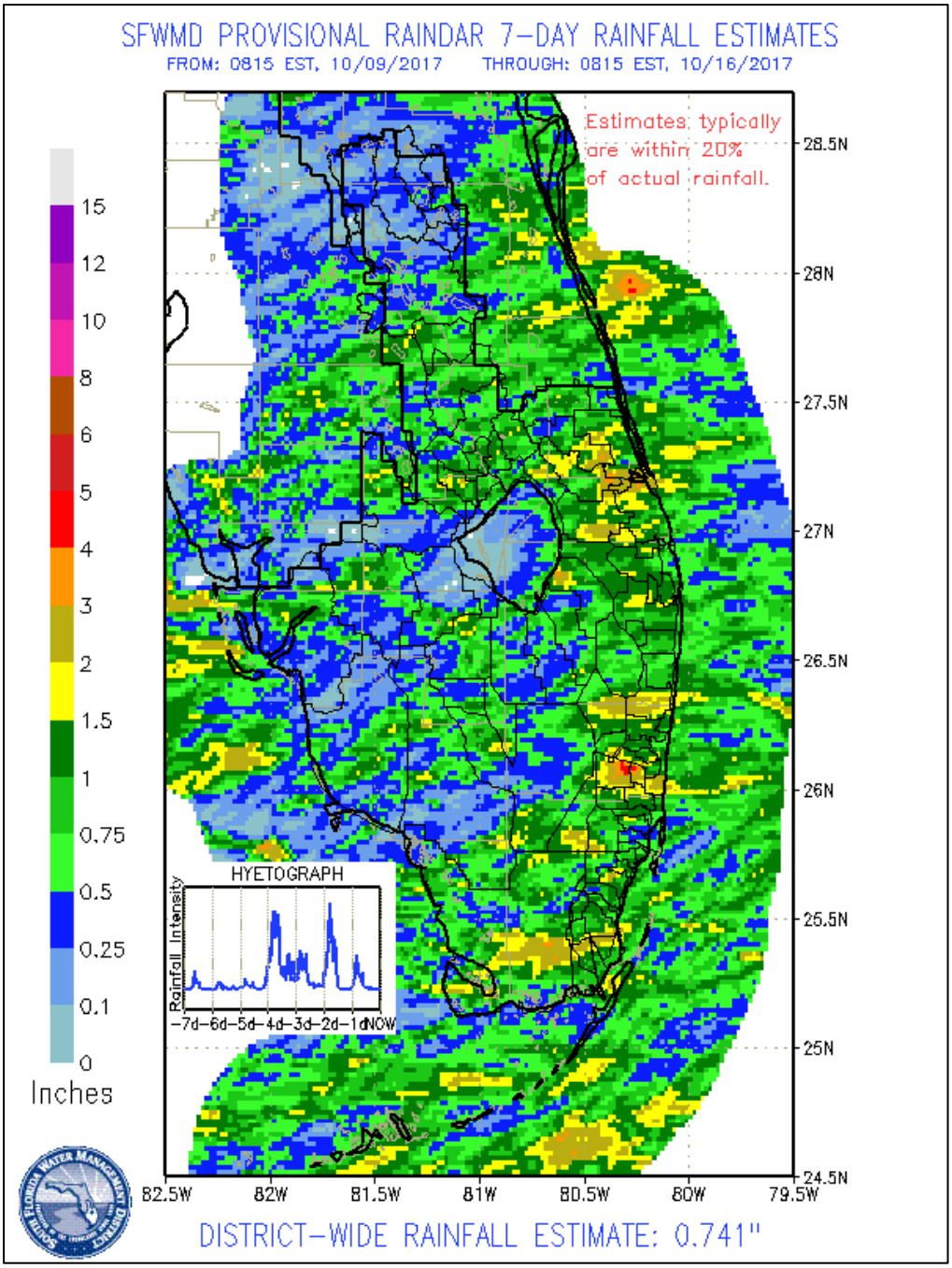


Figure A4. Chlorophyll a concentrations (µg/l) in the St. Lucie Estuary

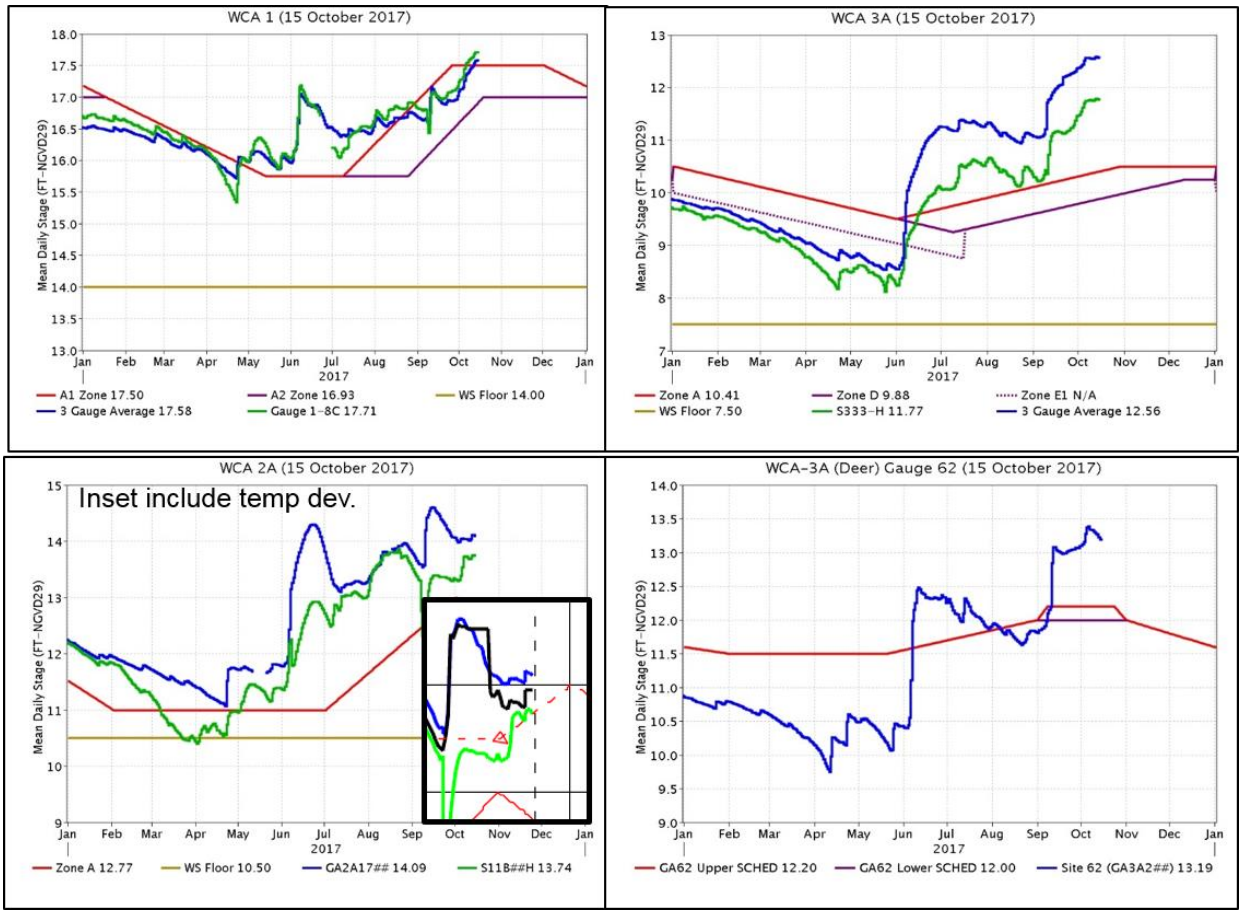
EVERGLADES

Scattered rainfall across the Everglades resulted in some basins receiving above average amounts while others below. WCA-1 is just above regulation schedule. WCA-2A is just above the current temporary schedule. WCA-3A is significantly above schedule and continues to trend deeper in the southern part of that basin.

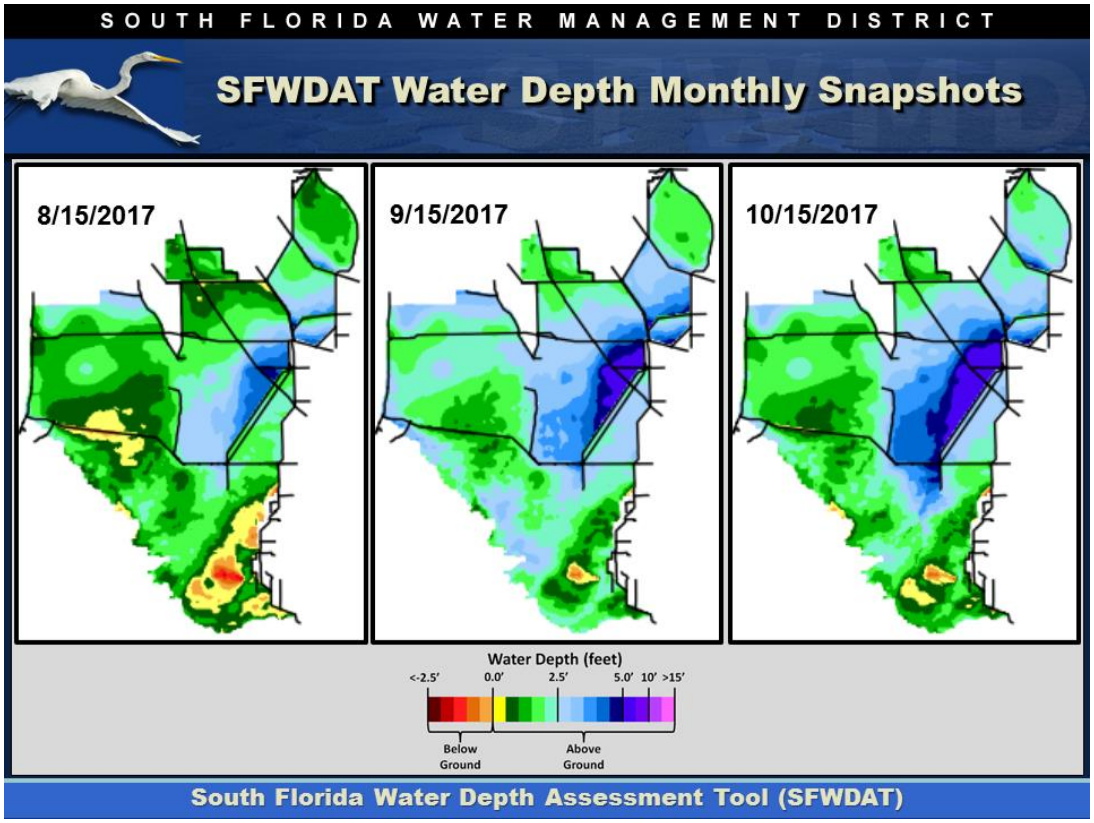
Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.89	+0.16
WCA-2A	1.43	+0.03
WCA-2B	1.04	−0.05
WCA-3A	0.70	−0.04
WCA-3B	1.19	−0.01
ENP	0.96	NA

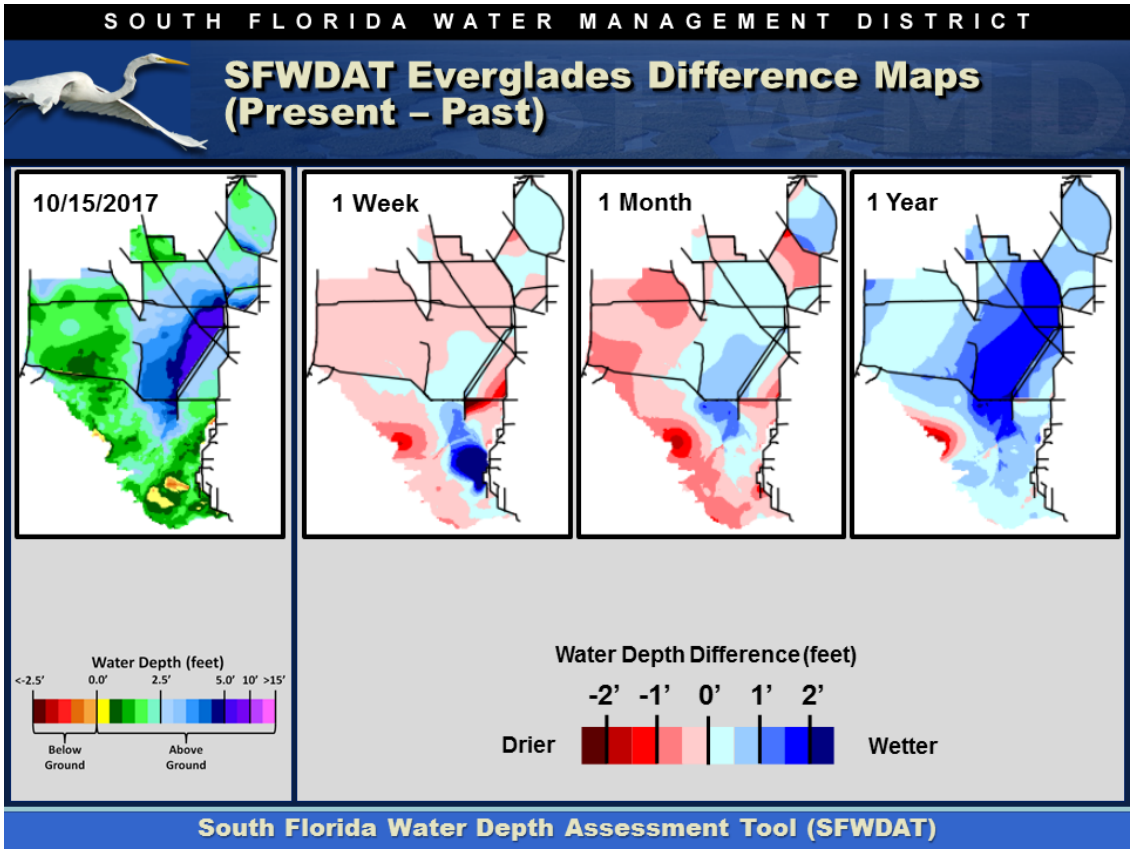


Regulation Schedules: WCA-1 three-gauge average is 0.08 feet above Zone A1, and stage difference between the marsh and the canal is 0.13 feet. WCA-2A marsh stage at gauge GA2A17 is currently 1.32 feet above zone A and less than 0.5 feet higher than temporary deviation. Marsh stage is 0.35 feet above canal stage at S11B. WCA-3A three-gauge average stage is 2.15 feet above zone A, and 0.79 higher than canal stage. WCA-3A at gauge 62 (Northwest corner) is 0.99 feet above the upper schedule.

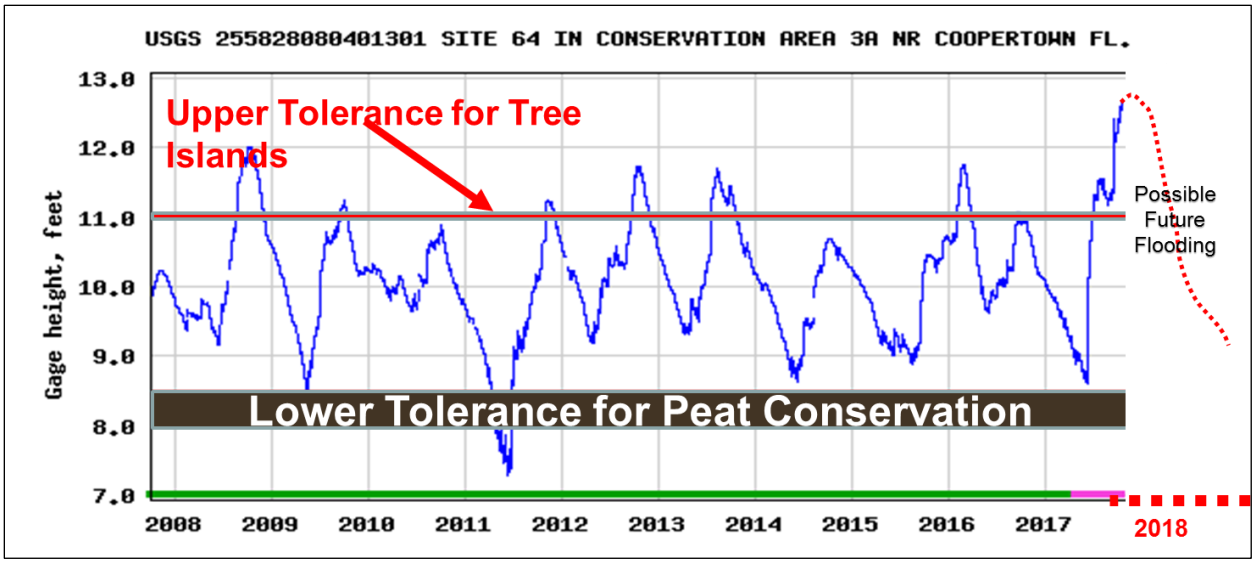


Water Depths and Changes: Over the last week individual gauge changes ranged from −0.16 feet (WCA-3A NW) to +0.18 feet (WCA-1). The WDAT tool for spatial interpolation of depth indicates a range from a low of 1.5 feet to 2.0 feet in Northern WCA-1,2 and 3 to a high of 5.0+ along the L-67A canal. Pan evaporation fell slightly this week, estimated at 1.33 inches, above the pre-project 1.16 inches. Comparing WDAT water levels from present, water depths rose in WCA-1, central WCA-2A and southern WCA-3A.



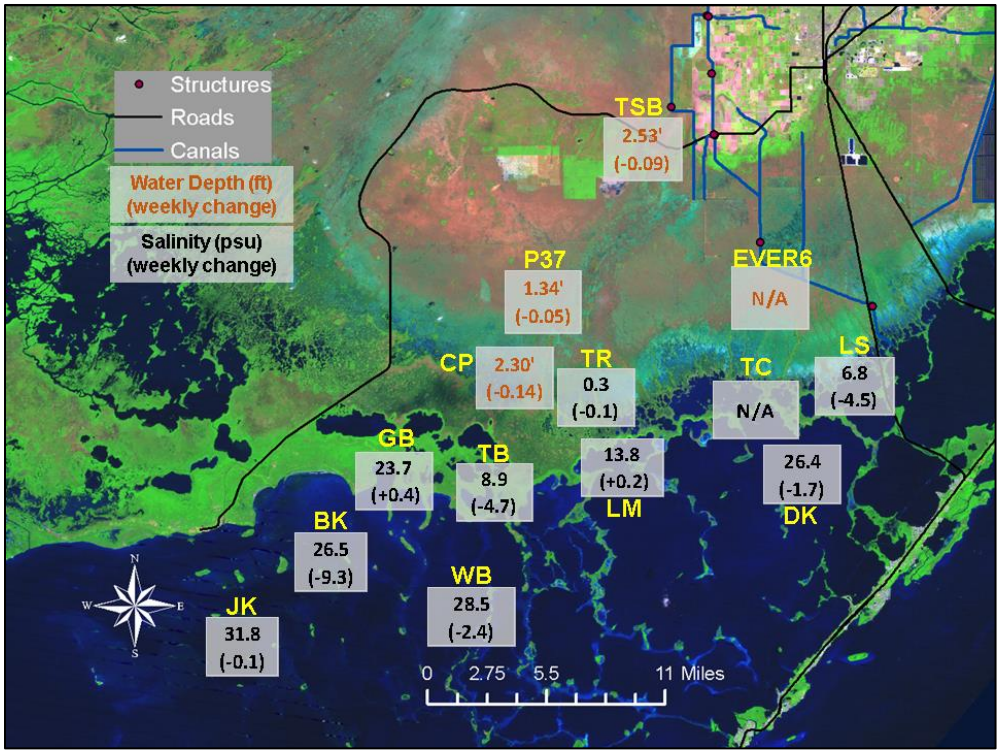


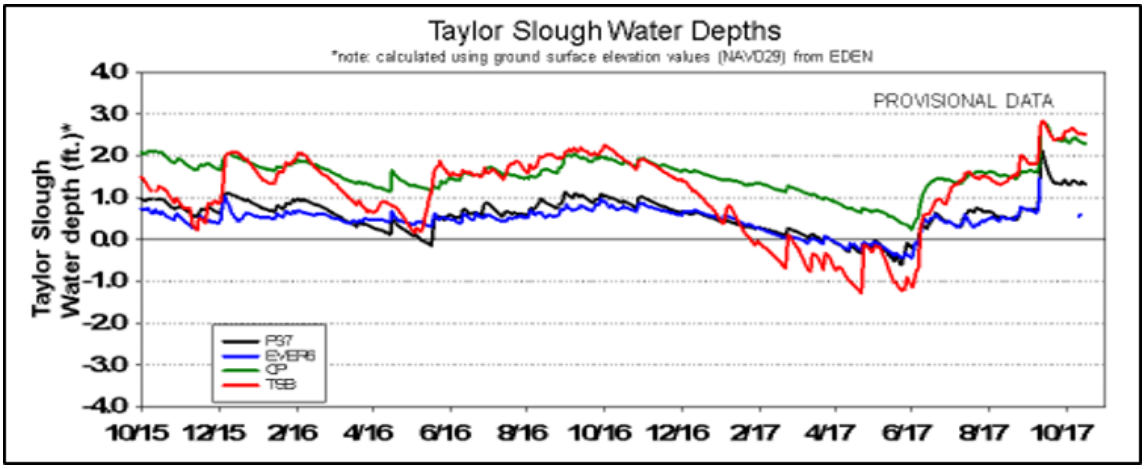
Potential for continued flooding of tree islands in WCA-3A: The graph below illustrates the historically deep current conditions at site 64, the typical length of time that tree islands undergo high water stress there and the potential duration for lengthy, continued flooding this water year.

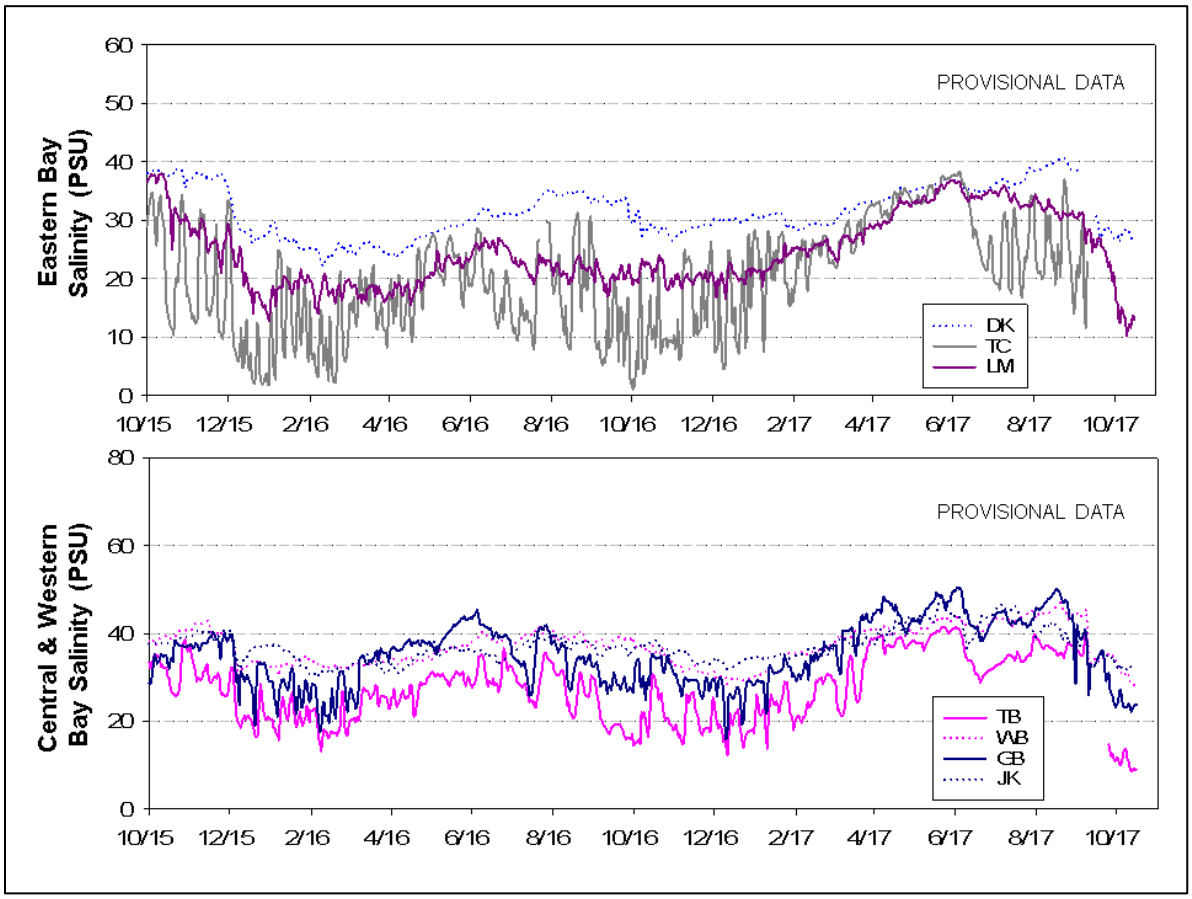


Taylor Slough stages: Water levels in Taylor Slough are decreasing now with the largest change of −0.14 feet in southwest Taylor Slough. Water levels are now 5 to 11 inches above the historic average for this time of year with the highest divergence occurring in northern Taylor Slough.

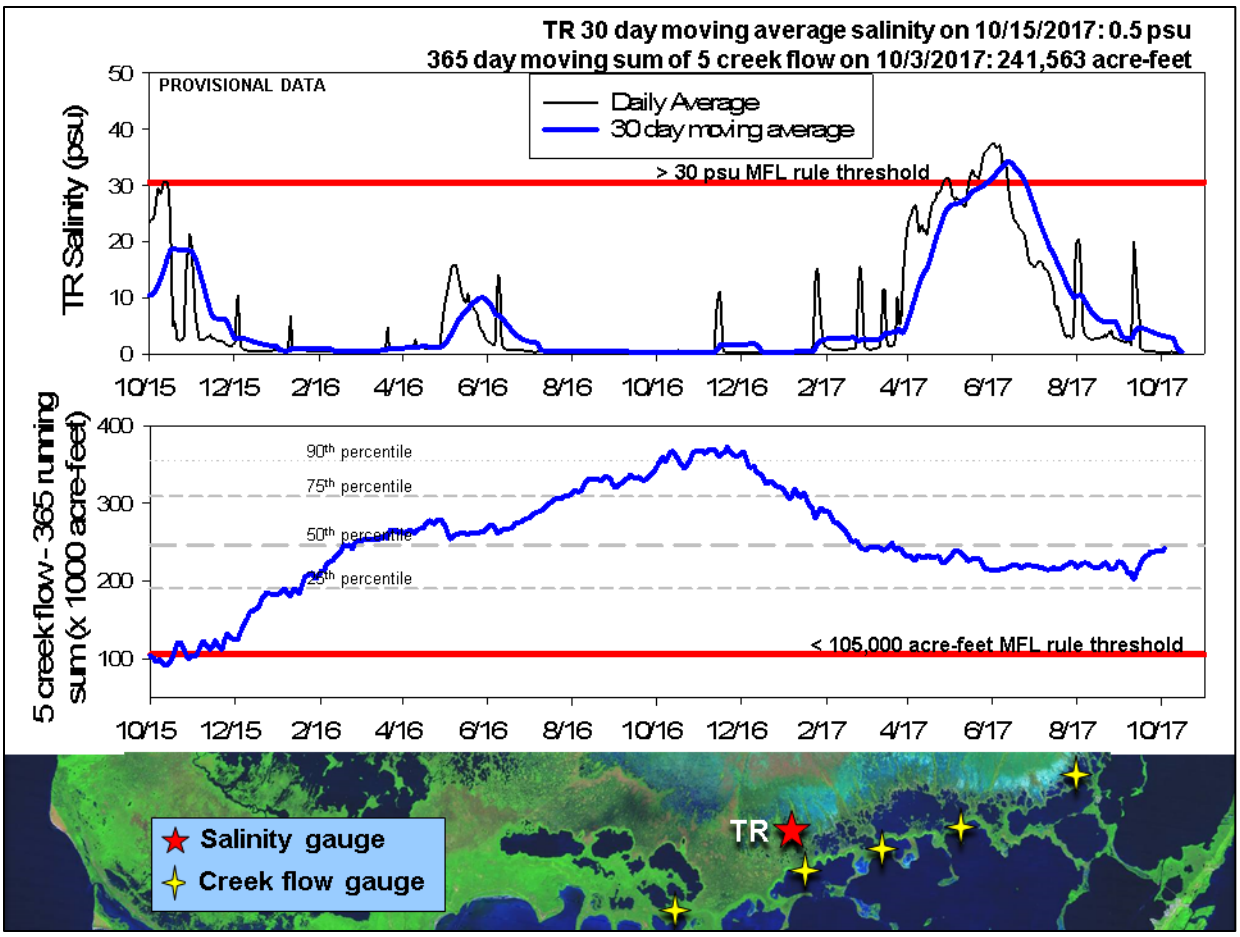
Salinities are staying stable or decreasing at each station with the largest weekly change of −9 psu occurring in the western central area. Currently, salinities range from 7 in the US Highway 1 corridor to 32 in the western Bay and average to 7 psu below the historical average (central nearshore area) for this time of year.







Florida Bay MFL: Mangrove zone daily average salinity remains near fresh at 0.3 psu. As the Hurricane Irma storm surge now falls more than 30 days into the past, the calculated 30-day moving average decreased 2.4 psu to reach 0.5 psu. One of the five creek stations used for the MFL (Taylor River Mouth) stopped reporting on October 3 due to telemetry issues, so the 365-day moving sum of flow could not be calculated at this time. As of October 3, the 365-day moving sum of flow from the five creeks identified by stars on the map was 241,563 acre-feet (still below 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. One measure of stress to the ecology of Everglades' tree islands is continuous water depths above 2.5 feet at gauge 65 in Southern WCA-3A beyond 90 days. The water depth at that location on Sunday was 4.76 feet and as of today had exceeded that mark for 122 days.

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

Everglades Ecological Recommendations, October 17th, 2017 (red is new)				
Area	**Current Condition**	**Cause(s)**	**Recommendation**	**Reasons**
WCA-1	Stages increase from +0.12 to +0.18'	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 increased +0.03'	Rainfall, ET, management	Moderate ascension rates as possible.	Protect habitat and wildlife from high water stress.
WCA-2B	Stages decreased -0.05'	Rainfall, ET, management	Moderate ascension rates as possible.	Protect habitat and wildlife from high water stress.
WCA-3A NE	Stages decreased -0.13'	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 -0.16'	Rainfall, ET, management		
Central WCA-3A S	Stages increased +0.08'	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 122 days.
Southern WCA-3A S	Stages increased +0.05'	Rainfall, ET, management		
WCA-3B	Stages decreased -0.01'	Rainfall, ET, management	Moderate ascension rates as possible..	Protect habitat, wildlife and support apple snail reproduction.
ENP-SRS	N/A	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 −0.05' to −0.14'	Rain, ET, inflows	Move water southward as possible	When available provide freshwater buffer for ecosystems and slow recession rates.
FB- Salinity	Salinity changes ranged -9.3 to +0.4 psu.	Rain, ET, inflows, wind	Move water southward as possible	When available, provide freshwater to produce low salinity wet season conditions.