

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, Interim Assistant Executive Director, Executive Office Staff

**FROM:** SFWMD Staff Environmental Advisory Team

**DATE:** October 9, 2019

**SUBJECT:** Weekly Environmental Conditions for Systems Operations

### **Summary**

#### **Weather Conditions and Forecast**

A small but vigorous low- to mid-level cyclonic circulation located over southeastern Florida this morning is accompanied by a large area of moderate/heavy rainfall. This feature and its associated rains should move offshore the east coast of Florida before noon, leaving relatively quieter conditions across the District in the short term. In the wake of the passing disturbance a broad low-level trough and enhanced moisture over the District favor additional rains developing during the afternoon. However, with the main upper-level forcing moving away from the area, the rains forecast this afternoon should be scattered in nature and total District rainfall should be quite a bit lower than it was yesterday (~0.60"). A cold front moving through the southeastern United States today is forecast to sag southward to north-central Florida by Wednesday morning and to the central portion of the District by Thursday morning. Ahead of the front on Wednesday abundant moisture, increasing instability and upper-level forcing associated with trough approaching the area from the Gulf of Mexico should result in enhanced rains District wide, with some of the rains in the afternoon particularly heavy in some locales. With the front creeping south of Lake Okeechobee by early Thursday, a partial drying is expected over the northwestern portion of the District, with the most concentrated rains over the south and southeast ahead of the front. The front is forecast to clear the southern Florida peninsula by Friday morning, but residual moisture north of the boundary should help to trigger light to moderate shower activity over the southeast throughout the day Friday. A drying trend some commence over the weekend, with the generally dry conditions persisting into early next week; only isolated light shower activity is possible from Saturday-Monday next week, generally producing negligible amounts of rain. For the week ending next Tuesday morning, the deterministic total QPF is a little above three quarters of an inch or about 90% of average. The probabilistic model output indicates that a minimum weekly total of half of an inch while a reasonable upper bound would be a little more than an inch.

#### **Kissimmee**

Tuesday morning stages were 56.4 feet NGVD (0.8 feet below schedule) in East Lake Toho, 53.8 feet NGVD (0.4 feet below schedule) in Toho, and 50.2 feet NGVD (1.5 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.2 feet NGVD at S-65A and 25.8 feet NGVD at S-65D. Tuesday morning discharges were 362 cfs at S-65, 326 cfs at S-65A, 545 cfs at S-65D and 796 cfs S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 7.5 mg/L for the week through Sunday. Kissimmee River mean floodplain depth on Sunday was 0.24 feet. No new recommendations this week.

## **Lake Okeechobee**

Lake Okeechobee stage is 13.39 feet NGVD, decreasing 0.17 feet from the previous week and 0.58 feet over the last month. The Lake moved up into the Low sub-band on September 4, 2019 then moved back down into the Base Flow sub-band on September 11, 2019 where it has remained since. The lake moved back into the ecological envelope (which varies seasonally from 12.5 – 15.5 feet NGVD +/- 0.5 feet) at the start of August, after spending about 215 days below the envelope, and is expected to fall below the envelope again within the next week or two. Low lake stages continue to benefit recovering SAV communities, but also stress higher elevation marshes; areas with elevations greater than approximately 14 ft NGVD have now been dry for nearly a year. The latest estimate of cyanobacteria bloom potential (October 04, 2019) shows that bloom potential is low in the Lake, as the season for large-scale blooms has ended.

## **Estuaries**

Total inflow to the St. Lucie Estuary averaged 306 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinity increased throughout the estuary. Salinity at the US1 Bridge is in the good range for adult eastern oysters.

Total inflow to the Caloosahatchee Estuary averaged 533 cfs over the past week with 294 cfs coming from the Lake. Salinity increased throughout the estuary. The 30-day moving average surface salinity is 2.6 at Val I-75 and 6.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinities are in the good range for adult eastern oysters at Cape Coral, Shell Point and fair range at Sanibel.

Lake stage is in the Base Flow sub-band of 2008 LORS. Tributary hydrological conditions are dry. The forecast of 30-day moving average of surface salinity at Val I-75 would exceed 5 over the next two weeks if there are no releases. SFWMD's Lake Okeechobee Adaptive Protocols Release Guidance suggests up to 450 cfs @ S-79 and S-77 baseflow release to supplement as needed.

## **Stormwater Treatment Areas**

Over the past week, approximately 3,800 acre-feet of Lake Okeechobee water was delivered to the FEBs/STAs. The total amount of Lake releases sent to the FEBs/STAs in WY2020 (since May 1, 2019) is approximately 62,000 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 738,000 acre-feet. All STA cells are at or near target depths. STA-5/6 Flow-ways 2 and 3 are offline for the Restoration Strategies project to grade non-effective treatment areas. Operational restrictions are in place in STA-1W Northern Flow-way related to STA-1W Expansion #1 startup activities, in STA-5/6 Flow-way 1 to facilitate the Restoration Strategies grading project in Flow-way 2, and in STA-1E Central Flow-way and STA-2 Flow-way 3 for vegetation management activities. This week, if 2008 LORS recommends Lake releases to the WCAs and the conditions allow, releases will be sent to STA-1E, STA-2 and A-1 FEB/STA-3/4.

## **Everglades**

As we begin the climatological dry season the ecology of the Everglades is eliciting concern, as current stages in the WCAs are low for this time of year and salinities are high in Florida Bay. The rate at which stage is dropping in the WCAs slowed this week especially important in WCA-3A, though that basin's decline in stage remains the fastest. Rates of stage change should remain below 0.25 feet per week or 0.5 feet per 2 weeks to protect Apple Snail reproduction within the WCA's (probably the last week of this recommendation). Any depth change that exceeds this rate either on the ascent or descent is ecologically undesirable. This rate change was not exceeded at any of the gauges monitored for this report. All the Taylor Slough and Florida Bay gauge stations received rainfall this past week, with the central bay receiving the most. This held the elevated salinities there (Whipray Basin) steady, but

average for Florida Bay increased. Stages fell across Taylor Slough with the largest decreases in the northern reach, depths are below average for this time of year.

## **Supporting Information**

### **KISSIMMEE BASIN**

#### **Kissimmee Basin Rainfall**

The Upper Kissimmee Basin received 0.13 inches of rainfall in the past week and the Lower Basin received 0.16 inches (SFWMD Daily Rainfall Report 10/6/2019).

#### **Upper Kissimmee Basin**

Stages and departures in the Kissimmee Chain of Lakes (KCOL) are shown in **Table 1**. KCOL stage hydrographs with respective regulation schedules and rainfall are shown in Figures 1-7.

**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: 10/8/2019**

Water Body	Structure	7-day Average Discharge (cfs) <sup>1</sup>	Stage Monitoring Site <sup>2</sup>	Lake Stage (feet)	Schedule Type <sup>3</sup>	Schedule Stage (feet)	Daily Departure (feet)						
							10/6/19	9/29/19	9/22/19	9/15/19	9/8/19	9/1/19	8/25/19
Lakes Hart and Mary Jane	S-62	0	LKMJ	59.8	R	60.2	-0.4	-0.1	-0.1	0.0	0.0	-0.2	-0.1
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.8	R	61.2	-0.4	-0.1	0.0	0.0	0.0	-0.2	-0.1
Alligator Chain	S-60	0	ALLI	62.9	R	63.3	-0.4	-0.2	-0.1	-0.1	0.0	-0.2	0.0
Lake Gentry	S-63	0	LKGT	60.7	R	61.1	-0.4	-0.2	-0.1	-0.1	0.0	-0.2	0.0
East Lake Toho	S-59	0	TOHOE	56.4	R	57.2	-0.8	-0.6	-0.4	-0.2	-0.2	-0.2	0.0
Lake Toho	S-61	0	TOHOW, S-61	53.8	R	54.2	-0.4	-0.2	-0.1	0.1	0.0	-0.1	-0.1
Lakes Kissimmee, Cypress, and Hatchineha	S-65	411	KUB011, LKIS5B	50.2	R	51.7	-1.5	-1.2	-0.9	-0.4	-0.1	0.0	0.5

<sup>1</sup> Seven-day average of weighted daily means through midnight.

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

<sup>3</sup> A = projected ascension line, R = USACE regulation schedule, S = temporary recession target line, T = temporary schedule, N/A= not applicable or data not available.

DATA ARE PROVISIONAL

#### **Lower Kissimmee Basin**

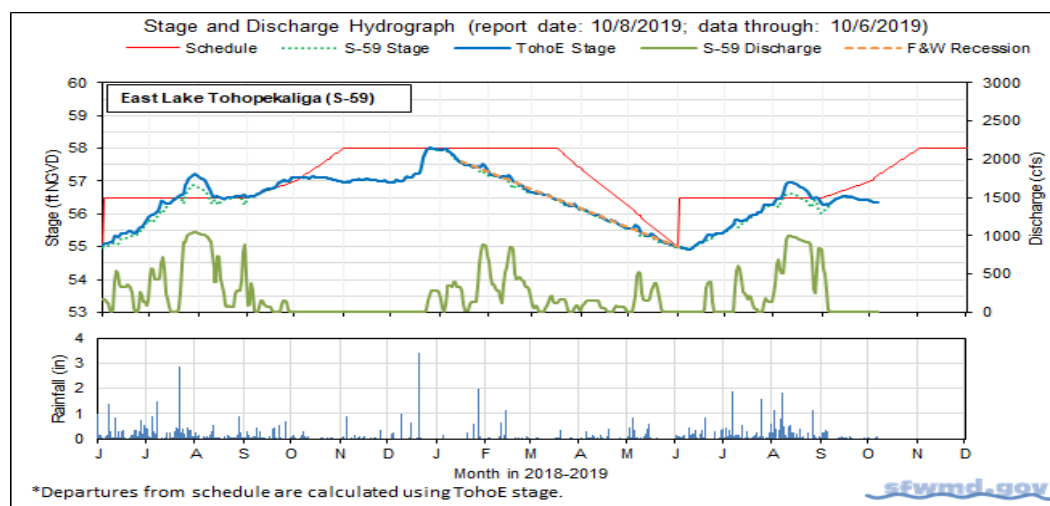
Discharges at Lower Basin structures are shown in Table 2. SFWDAT depth maps for the Phase I restoration area are shown in Figure 8. Kissimmee River floodplain stages at selected stations are shown in Figure 9.

**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: 10/8/2019											
Metric	Location	1-Day Average		Average for the Preceding 7-Days <sup>1</sup>							
		10/6/2019	10/6/19	9/29/19	9/22/19	9/15/19	9/8/19	9/1/19	8/25/19	8/18/19	8/11/19
Discharge (cfs)	S-65	409	411	507	1,337	1,443	2,135	5,414	5,640	3,852	2,198
Discharge (cfs)	S-65A <sup>2</sup>	327	327	423	1,248	1,412	2,676	5,795	6,547	5,681	3,248
Discharge (cfs)	S-65D <sup>2</sup>	426	483	1,189	1,780	2,976	5,734	6,983	8,207	5,917	3,167
Headwater Stage (feet NGVD)	S-65D <sup>2</sup>	25.87	25.84	26.64	26.78	27.00	27.56	27.48	27.42	26.50	25.88
Discharge (cfs)	S-65E <sup>2</sup>	464	453	1,070	1,766	2,988	5,615	6,932	8,155	5,871	3,000
Discharge (cfs)	S-67	0	0	0	0	28	17	31	24	34	46
DO (mg/L) <sup>3</sup>	Phases I & II/III river channel	7.6	7.5	5.9	4.6	2.3	1.9	0.8	0.3	0.7	0.7
Mean depth (feet) <sup>4</sup>	Phase I floodplain	0.24	0.26	0.45	0.74	1.07	2.18	2.82	3.25	2.71	1.73

<sup>1</sup>Seven-day average of weighted daily means through Sunday midnight.  
<sup>2</sup>S-65A discharge combines S-65A with auxiliary structures; S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S-65D stage averages stage at S-65D and S-65DX1; S-65E discharge combines S-65E and S-65EX1.  
<sup>3</sup>DO is the average for sondes at KRBN, PC62, PC33, PD62R, and PD42R.  
<sup>4</sup>1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).  
 DATA ARE PROVISIONAL; N/A indicates that data were not available.

## KCOL Hydrographs (through Sunday midnight)



**Figure 1.**

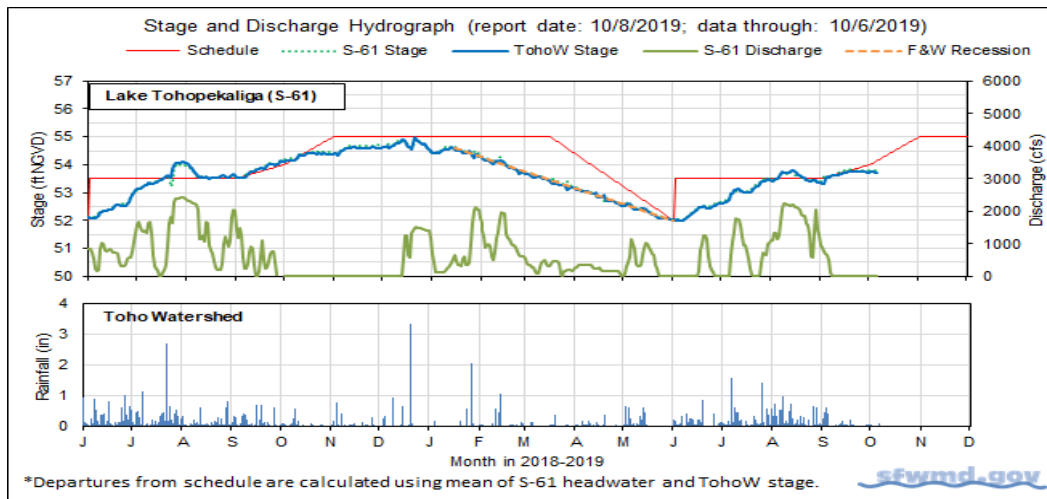


Figure 2.

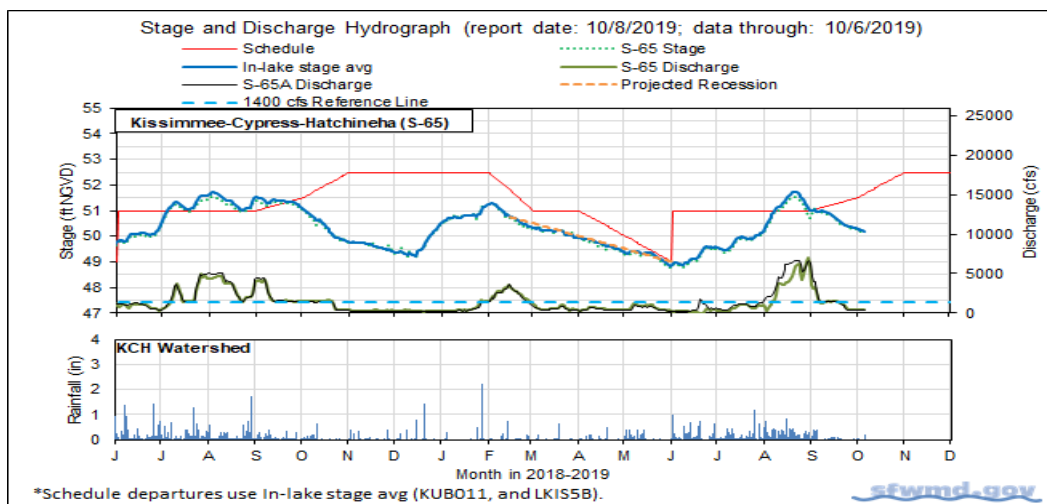


Figure 3.

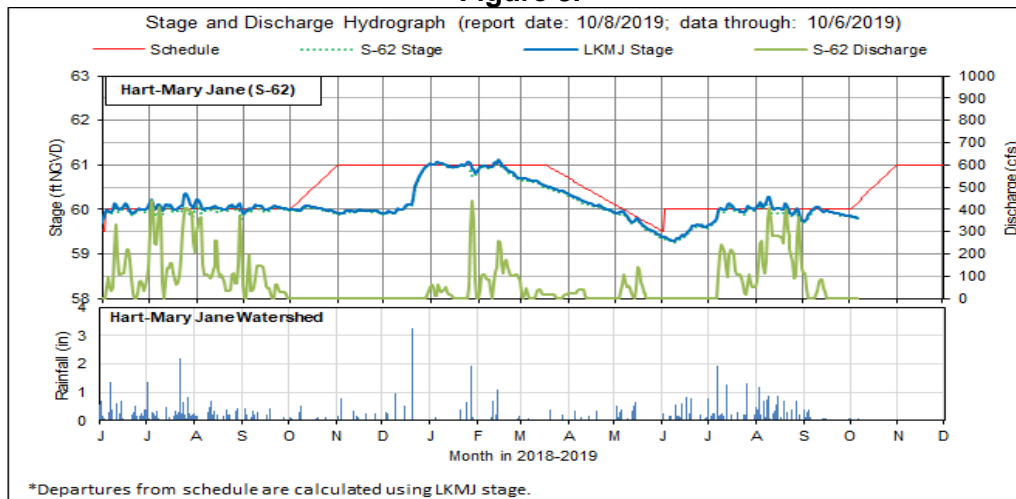


Figure 4.

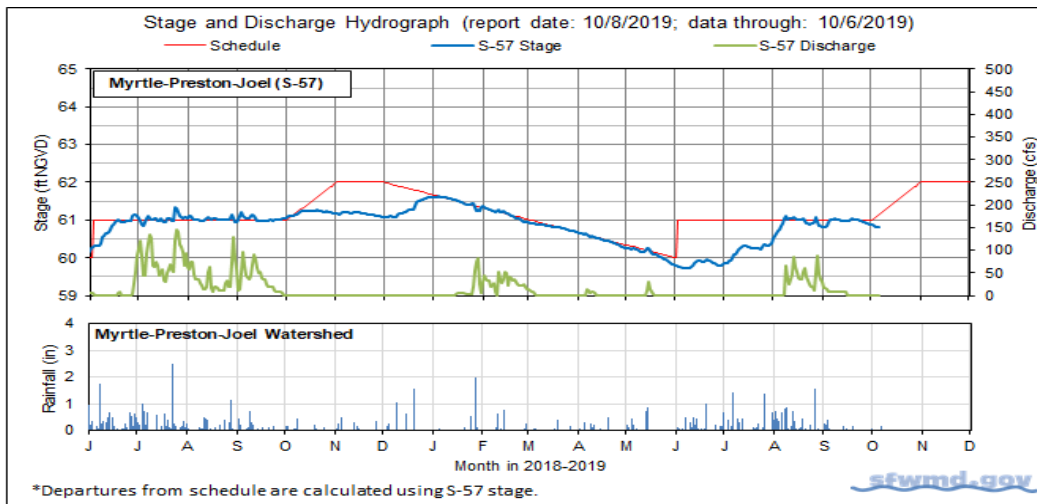


Figure 5.

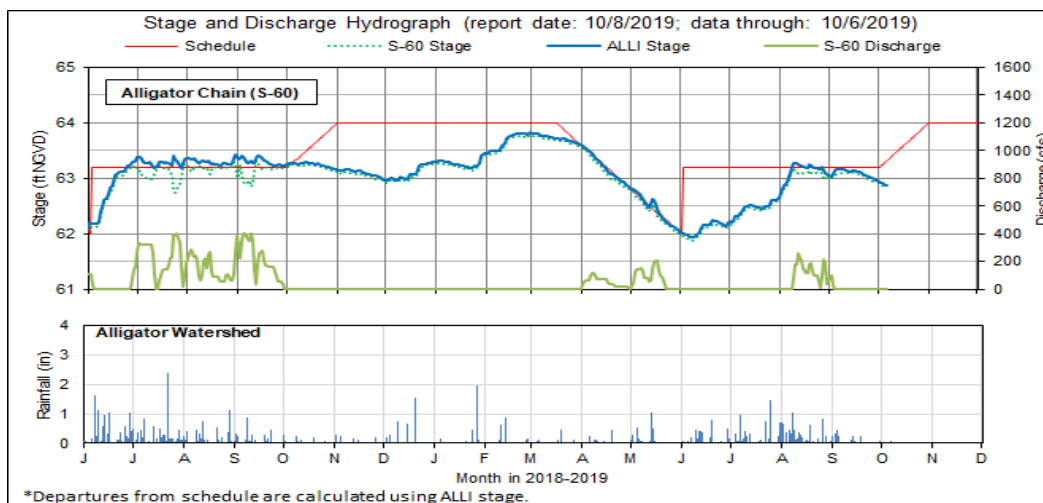


Figure 6.

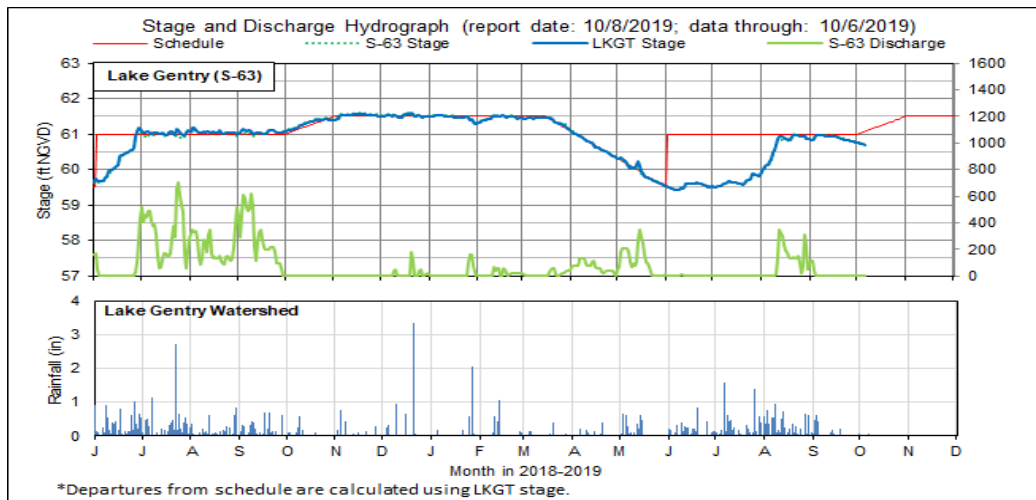
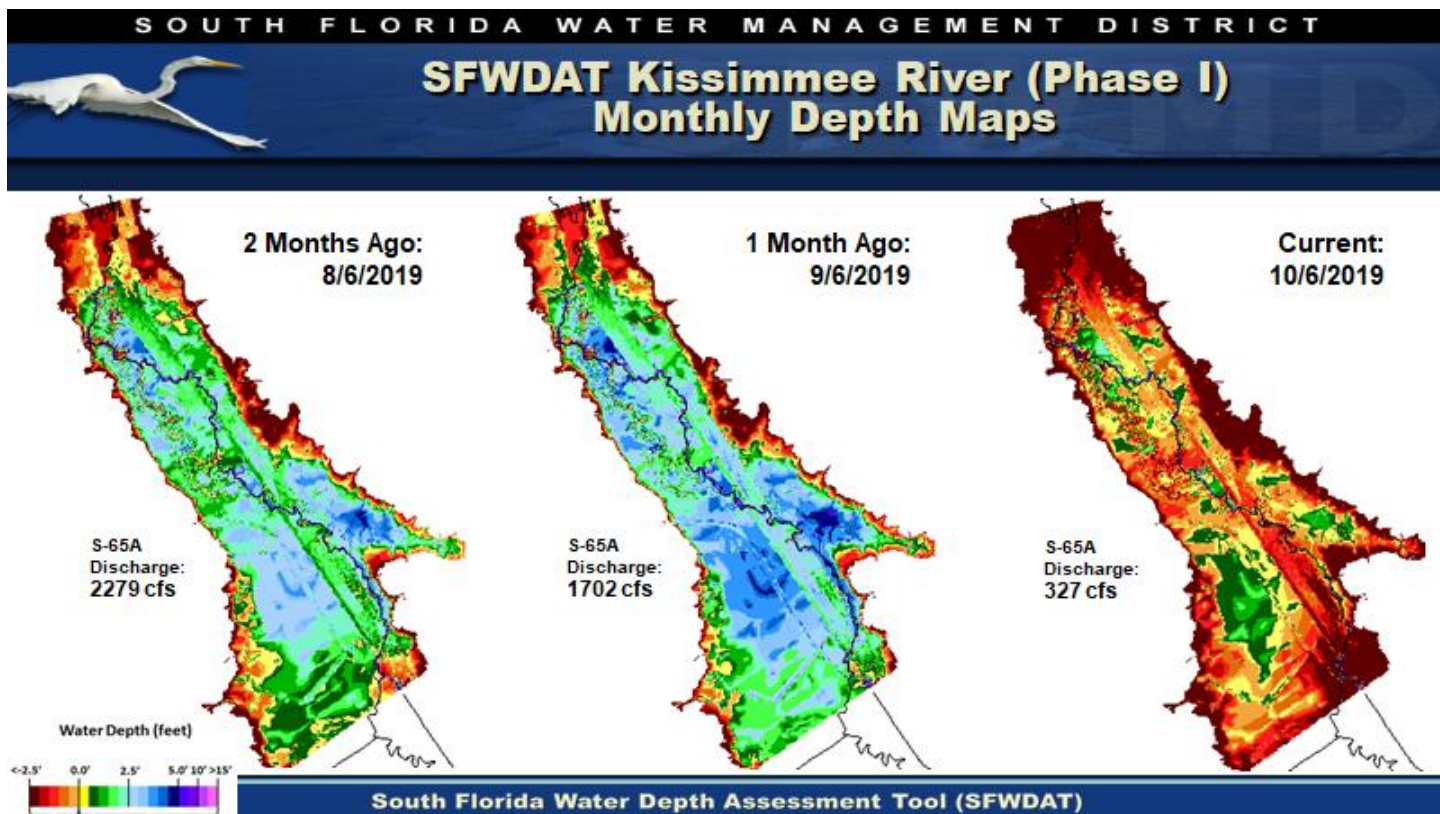
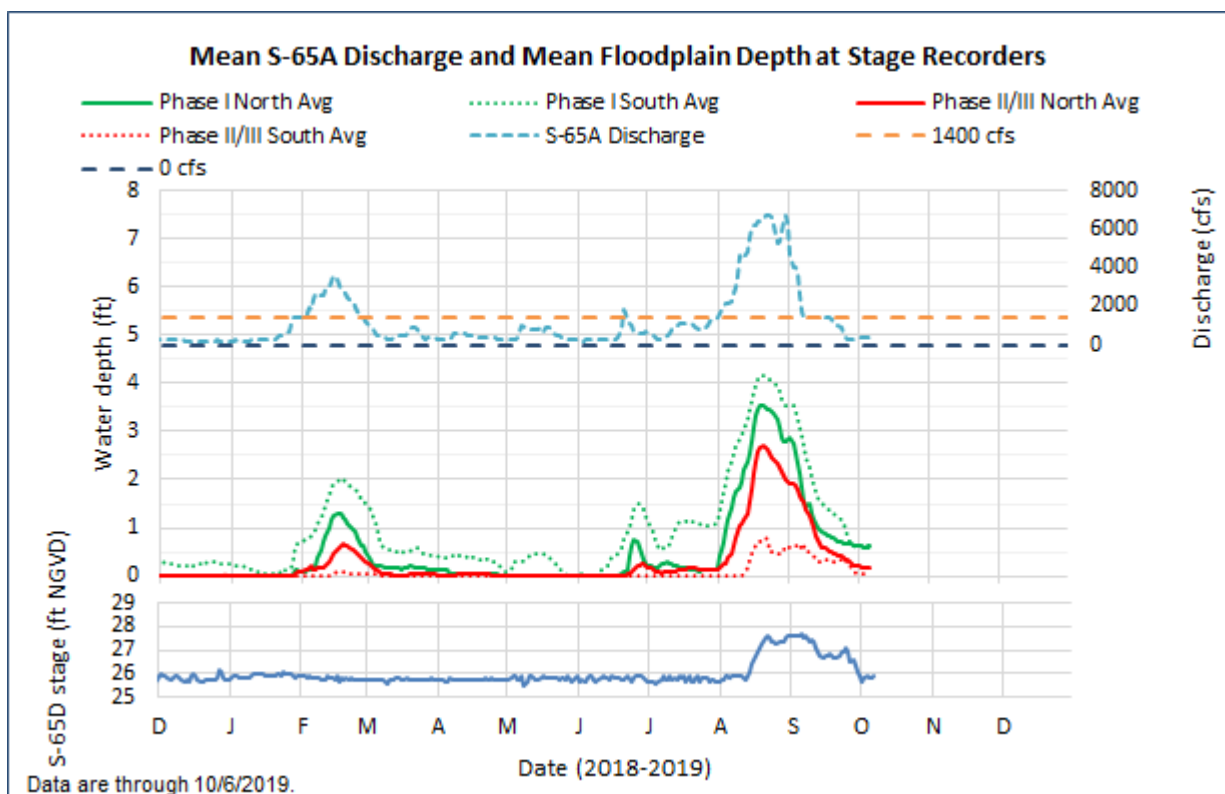


Figure 7.

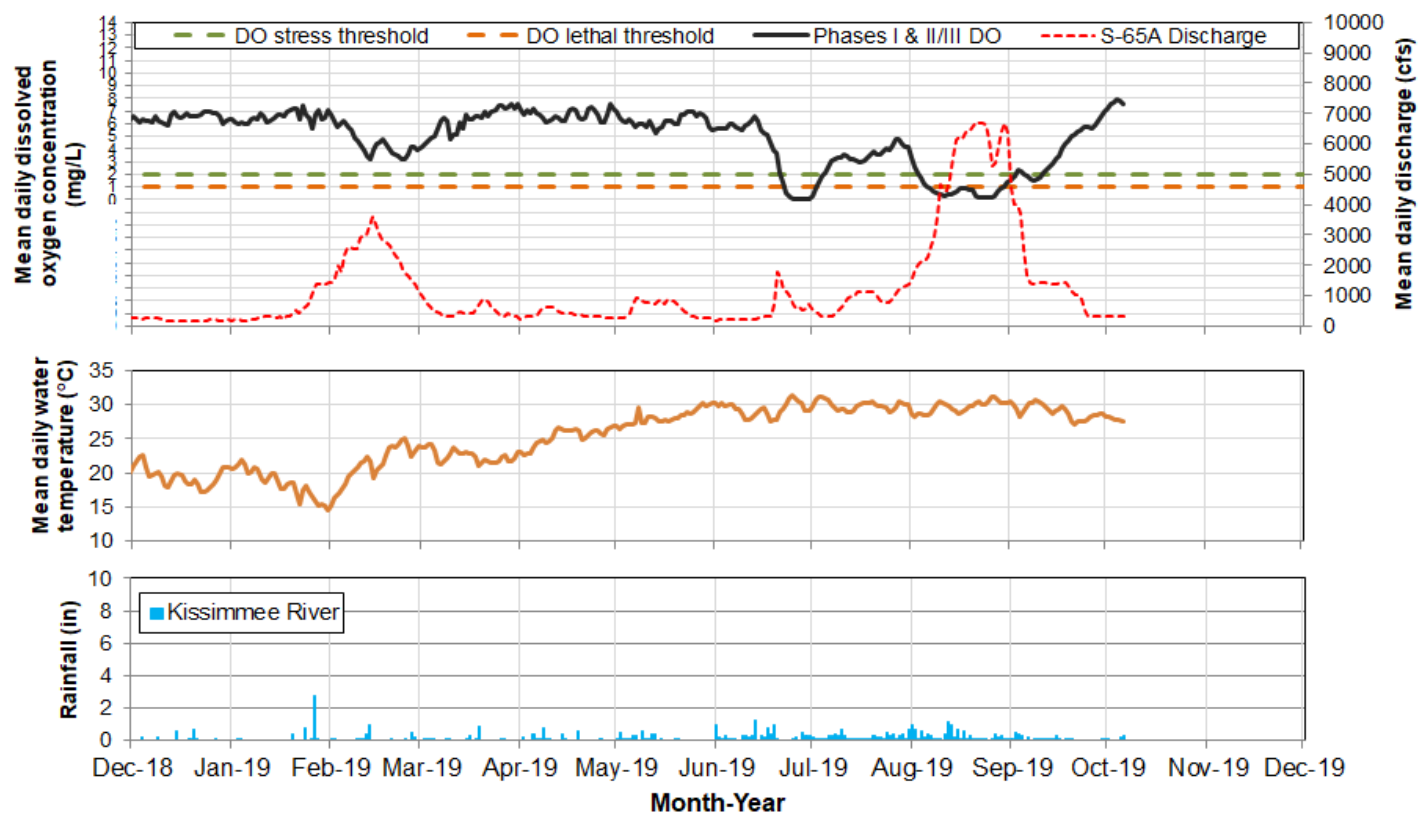




**Figure 8.** Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.



**Figure 9.** Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.



Report Date: 10/8/2019; data are through: 10/6/2019.

**Figure 10.** Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phases I/II/III river channel.



## Water Management Recommendations

### Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
10/8/2019	No new recommendations.		N/A		10/8/2019
9/30/2019	No new recommendations.		N/A		10/1/2019
9/23/2019	Reduce flow at S-65/S-65A by 300 cfs/day until minimum flow (300 cfs) is reached on Wednesday 9/25.	Reduce outflow from Kissimmee-Cypress-Hatchineha to slow the stage decline.	TBD	KB Ops	9/24/2019
9/17/2019	Continue S65A discharge of at least 1,400 cfs while stage in Lakes Kissimmee, Cypress and Hatchineha is above 50.0 feet NGVD, in accordance with the 2019 wet season IS-14-50 discharge plan.	Continue KR floodplain inundation.	TBD	KB Ops	9/17/2019
9/10/2019	Continue S65A discharge of at least 1,400 cfs while stage in Lakes Kissimmee, Cypress and Hatchineha is above 50.0 feet NGVD, in accordance with the 2019 wet season IS-14-50 discharge plan.	Continue KR floodplain inundation.	Implemented	KB Ops	9/10/2019
9/5/2019	Reduce S65A flow by another 400 cfs today 9/5, then make two 300 cfs reductions tomorrow 9/6, to arrive at 1400 cfs late in the day on 9/6. Continue S65A discharge of at least 1,400 cfs while stage in Lakes Kissimmee, Cypress and Hatchineha is above 50.0 feet NGVD, in accordance with the 2019 wet season IS-14-50 discharge plan.	Reduce discharge to 1400 cfs (bankfull) gradually to avoid stranding fish/snails/other organisms as floodplain stage declines.	Implemented	KB Ops	9/10/2019
9/3/2019	No new recommendations.		N/A		9/4/2019
8/26/2019	No new recommendations.		N/A		8/27/2019
8/19/2019	No new recommendations.		N/A		8/20/2019
8/7/2019	Manage discharge at S-65 and S-65A to control rising stage in KCH.	Switch to flood control operations as stage in KCH reaches the regulation line.	Implemented	KB Ops	8/13/2019
8/2/2019	a) Attempt to hold flow at S-65A steady during the rain forecast over the weekend. b) If it is necessary to increase discharge further, try to follow the discharge rate of change criteria to reduce effects on dissolved oxygen in the Kissimmee River c) Address stage rise in Pool A by reducing S-65 discharge. d) Stage in KCH will likely rise faster than the requested rate due to the need to control stage rise in Pool A. However, try to minimize the magnitude and duration of the exceedance after rainfall subsides.	Balance competing objectives while considering flood control in Pool A in light of the forecast for heavy cumulative rainfall.	Implemented	SFWMD Water Management/KB Ops	8/6/2019
7/24/2019	Maintain flow of at least 750-800 cfs or higher at S65A until the effects of forecast rainy period are known.	Manage stage in KCH while maintaining moderate discharge from S65A.	Implemented	KB Ops	7/30/2019
7/18/2019	a) Hold KCH stage steady until the risk of an exceedance of the 0.5 ft max rise per 14 days is past OR stage starts to decline. b) If KCH stage starts to decline, ramp down at 150 cfs/day over several days to 750 cfs. If this doesn't stop the decline we will regroup to discuss options.	Balance rate of rise in KCH against reduction of flow at S65A to avoid reducing flow to minimum until it is necessary.	Implemented	KB Ops/SFWMD Water Management	7/23/2019
7/14/2019	Do not increase S-65/S-S65A flow today	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	SFWMD Water Management/KB Ops	7/16/2019
7/12/2019	Postpone second 150 cfs increase today (total 150 cfs).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/11/2019	Increase S-65/S-S65A by 300 cfs tomorrow (double the rampup guidelines) in two increments of 150 cfs	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/11/2019	Increase S-65/S-S65A flow by 150 cfs today (double the rampup guidelines).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019
7/10/2019	Increase S-65/S-S65A flow by 150 cfs today (double the rampup guidelines).	Control rate of stage rise in KCH while addressing DO sag concerns.	Implemented	KB Ops	7/16/2019

**Stage and Discharge Guidance for Wet Season 2019.**

Zone	KCH Stage (ft NGVD)	S-65/S-65A Discharge*
A	Above regulation schedule line.	Flood control releases as needed with no limits on the rate of discharge change.
B1	In flood control buffer zone (0.5 ft below the schedule line).	Adjust S-65 discharge so that S-65A discharge is between 1400 cfs at the buffer zone line and 3000 cfs at the schedule line.
B2	Between the Flood Control Buffer and the 50.0 ft line.	Adjust S-65 discharge to maintain at least 1400 cfs at S-65A. Use $\pm 0.2$ ft buffer (gray band) above and below the 50.0 ft line to decide when to begin ramping up to 1400 cfs or down to 300 cfs; do not continue reducing discharge if stage rises back to or above the threshold stage line.
B3	Between the 50.0 ft line and 49 ft.	Adjust S-65 discharge to maintain at least 300 cfs at S-65A.
B4	Between 48.5 ft to 49 ft.	Adjust S-65 discharge to maintain S-65A discharge between 0 cfs at 48.5 ft and 300 cfs at 49 ft.
C	Below 48.5 ft.	0 cfs.

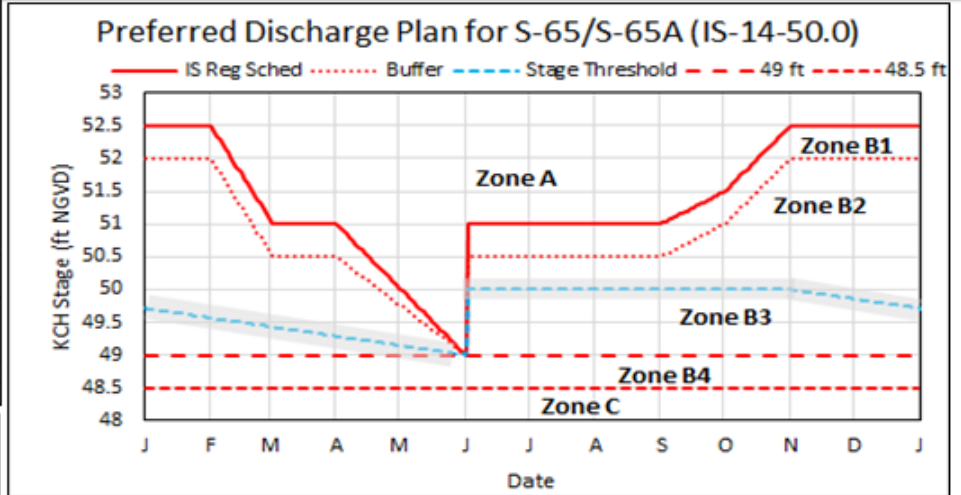
\*Changes in discharge should not exceed limits in inset table below.

**Discharge Rate of Change Limits for S65/S65A (revised 7/13/18).**

Q (cfs)	Maximum rate of increase (cfs/day)	Maximum rate of decrease (cfs/day)
0-300	50	-50
301-650	75	-75
651-1400	150	-150
1401-3000	300	-600
>3000	1000	-2000

Revised 5/18/2019

## Kissimmee Basin 2019 Wet Season

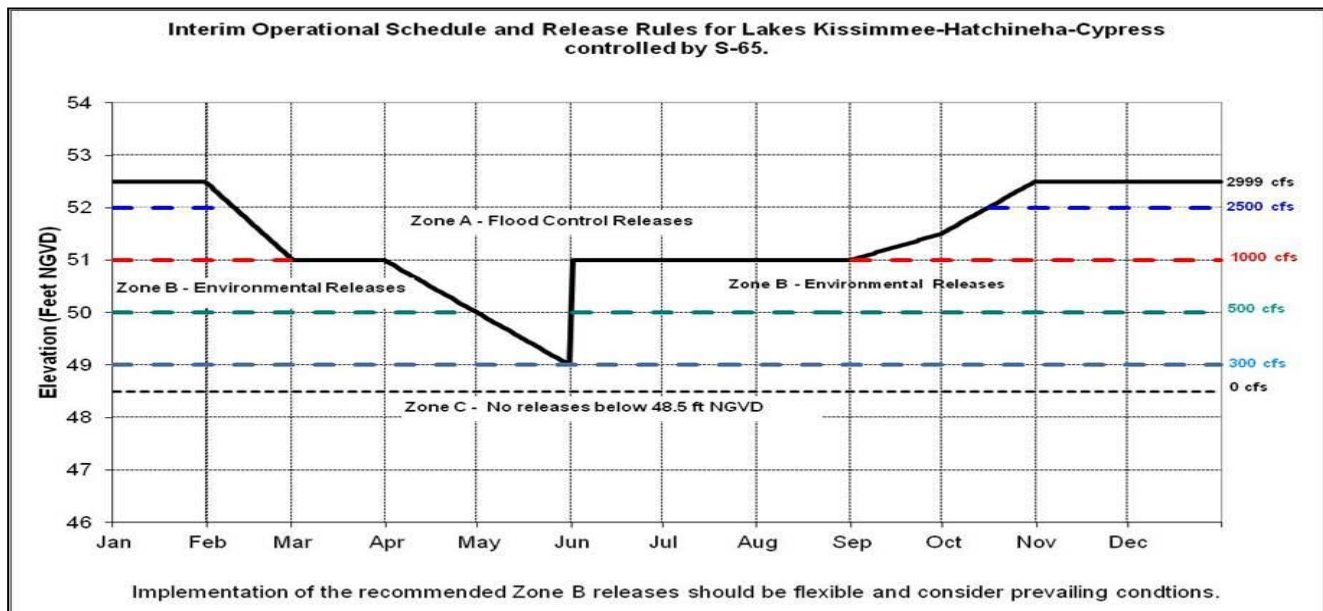


**Other Considerations**

- When possible, limit lake ascension rate in the Jun 1 - Aug 15 window to 0.5 ft per 14 days in Lakes Kissimmee, Cypress, Hatchineha (S-65), East Toho (S-59) and Toho (S-61).
- If outlook is for extreme dry conditions meet with KB staff to discuss modifications to this plan.

8

**Figure 11.** The 2019 Wet Season Discharge Plan for S-65/S-65A.



**Figure 12.** Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

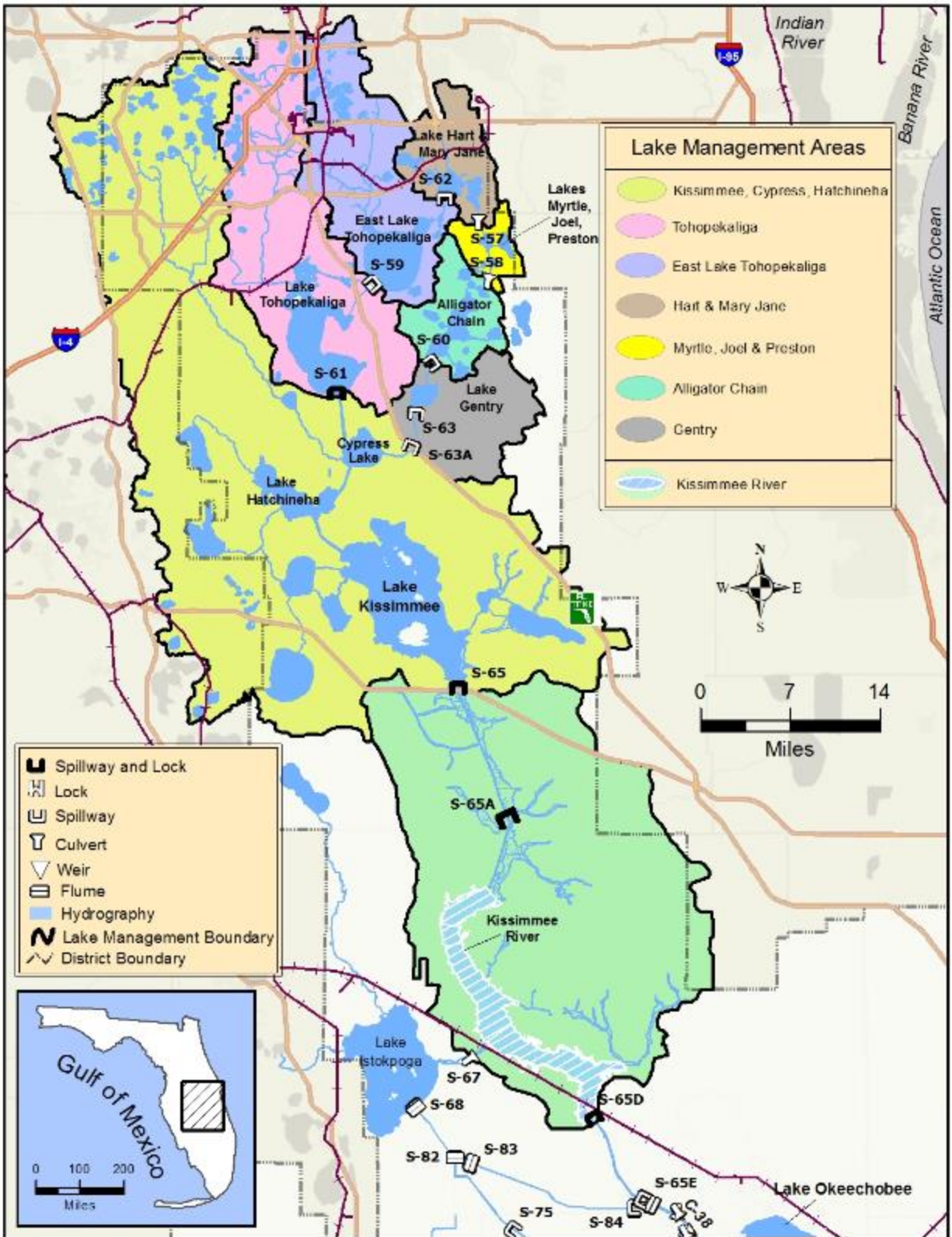


Figure 13. The Kissimmee Basin.

## **LAKE OKEECHOBEE**

According to the USACE web site, Lake Okeechobee average daily lake stage is at 13.39 feet NGVD for October 04, 2019 decreasing 0.17 feet from the previous week. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and four perimeter stations (S-308, S-352, S-4 and S-133). The Lake is now 0.58 feet lower than a month ago and 0.86 feet lower than a year ago (Figure 1) when stages were in the middle portion of the preferred ecological envelope (Figure 2). The Lake moved up into the Low sub-band on September 4, 2019 then moved back down into the Base Flow sub-band on September 11, 2019 where it has remained since (Figure 3). With the decline over the past month, lake stage is now the lowest it has been for this time of year since 2011 (Figure 4). According to RAINДАР, during the week of October 01 to October 07, 2019, 0.40 inches of rain fell directly over the Lake, compared to just 0.07 inches the previous week. Much of the watershed received similar or more rainfall, with the majority receiving between 0.5 – 0.75 inches of rain (Figure 5).

The average daily inflows (minus rainfall) to the Lake decreased for the fifth consecutive week going from 1,006 cfs to just 480 cfs. Almost all of the inflow was from the Kissimmee River (S-65E & S-65EX1) which decreased from 940 cfs to just 439 cfs. No passive backflow from the L8 at Canal Point (via CLV10A) occurred this week (Table 1).

Outflow (minus evapotranspiration) increased from 2,533 cfs to 3,139 cfs with 2,525 cfs going south through the S-350 structures and the L8 at Canal Point (via CLV10A) for water supply and 615 cfs released west through S-77. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation decreased from the previous week going from 1.16 inches to 0.94 inches.

Total lake inflows and outflows for the past week are detailed in Table 1, as well as the approximate change in lake stage from each major structure's total flows over the period. Figure 6 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.

Water quality samples collected on September 9th – 10th found several elevated values of Chlorophyll a (Chla) scattered throughout the lake (Figure 7). Three of nine stations in the nearshore zone had Chla values of 20 µg/L or more, one of which was above what the District considers bloom density (40 µg/L). That station was along the Indian Prairie shoreline and has had elevated Chla values since July. Two pelagic stations had values > 20 µg/L. Only one station had a microcystin value above the detection limit of 0.20 µg/L; which was a value of 0.26 µg/L along the northern shoreline at LZ2.

The most recent viable satellite imagery (October 04, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel 3 OLCI sensor data showed that bloom potential remains low in the lake, as the season for potential wide-spread algal blooms has likely ended (Figure 8).

## **Water Management Recommendations**

Lake Okeechobee stage is 13.39 feet NGVD, decreasing 0.17 feet from the previous week and 0.58 feet over the last month. The lake moved up into the Low sub-band on September 4, 2019 then moved back down into the Base Flow sub-band on September 11, 2019 where it has remained since. The lake moved back into the ecological envelope (which varies seasonally from 12.5 – 15.5 feet NGVD +/- 0.5 feet) at the start of August, after spending about 215 days below the envelope, and is expected to fall below the envelope again within the next week or two. Low lake stages continue to benefit recovering SAV communities, but also stress higher elevation marshes; areas with elevations greater than approximately 14 ft NGVD have now been dry for nearly a year. The latest estimate of cyanobacteria bloom potential (October 04, 2019) shows that bloom potential is low in the Lake, as the season for large-scale blooms has ended.

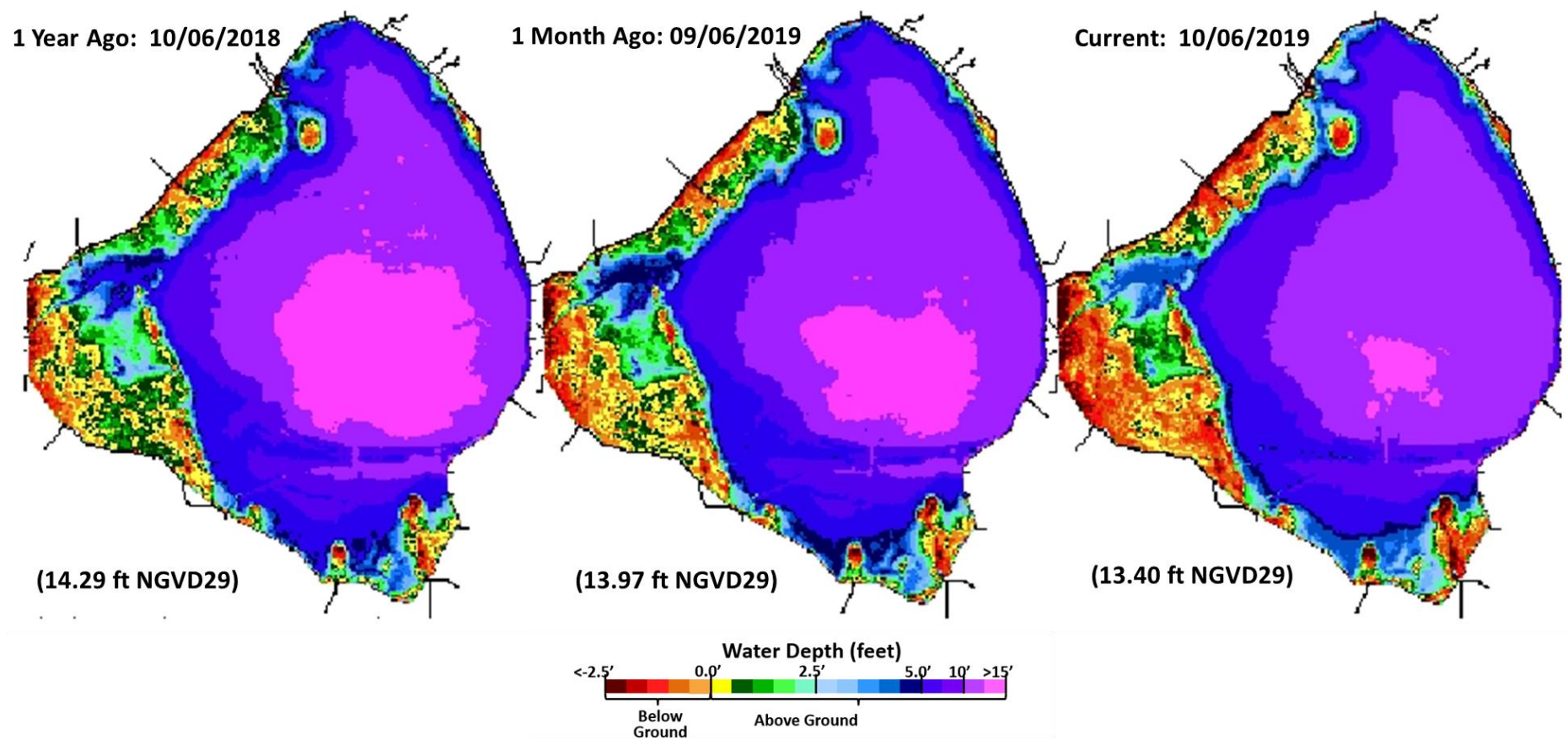


**Table 1.** Average daily inflows and outflows and the approximate depth equivalents on Lake Okeechobee for various structures.

INFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-65E & S-65EX1	940	439	0.2
S-71 & S-72	0	19	0.0
S-84 & S-84X	13	0	0.0
Fisheating Creek	51	22	0.0
S-154	0	0	0.0
S-191	2	0	0.0
S-133 P	0	0	0.0
S-127 P	0	0	0.0
S-129 P	0	0	0.0
S-131 P	0	0	0.0
S-135 P	0	0	0.0
S-2 P	0	0	0.0
S-3 P	0	0	0.0
S-4 P	0	0	0.0
L-8 Backflow			
Rainfall	162	919	0.4
<b>Total</b>	<b>1169</b>	<b>1399</b>	<b>0.6</b>

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	155	615	0.3
S-308	0	0	0.0
S-351	1014	1198	0.5
S-352	609	540	0.2
S-354	539	614	0.3
L-8 Outflow	215	173	0.1
ET	2357	2152	0.9
<b>Total</b>	<b>4890</b>	<b>5291</b>	<b>2.3</b>

Provisional Data



**Figure 1.** Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

# Lake Okeechobee Stage vs Ecological Envelope

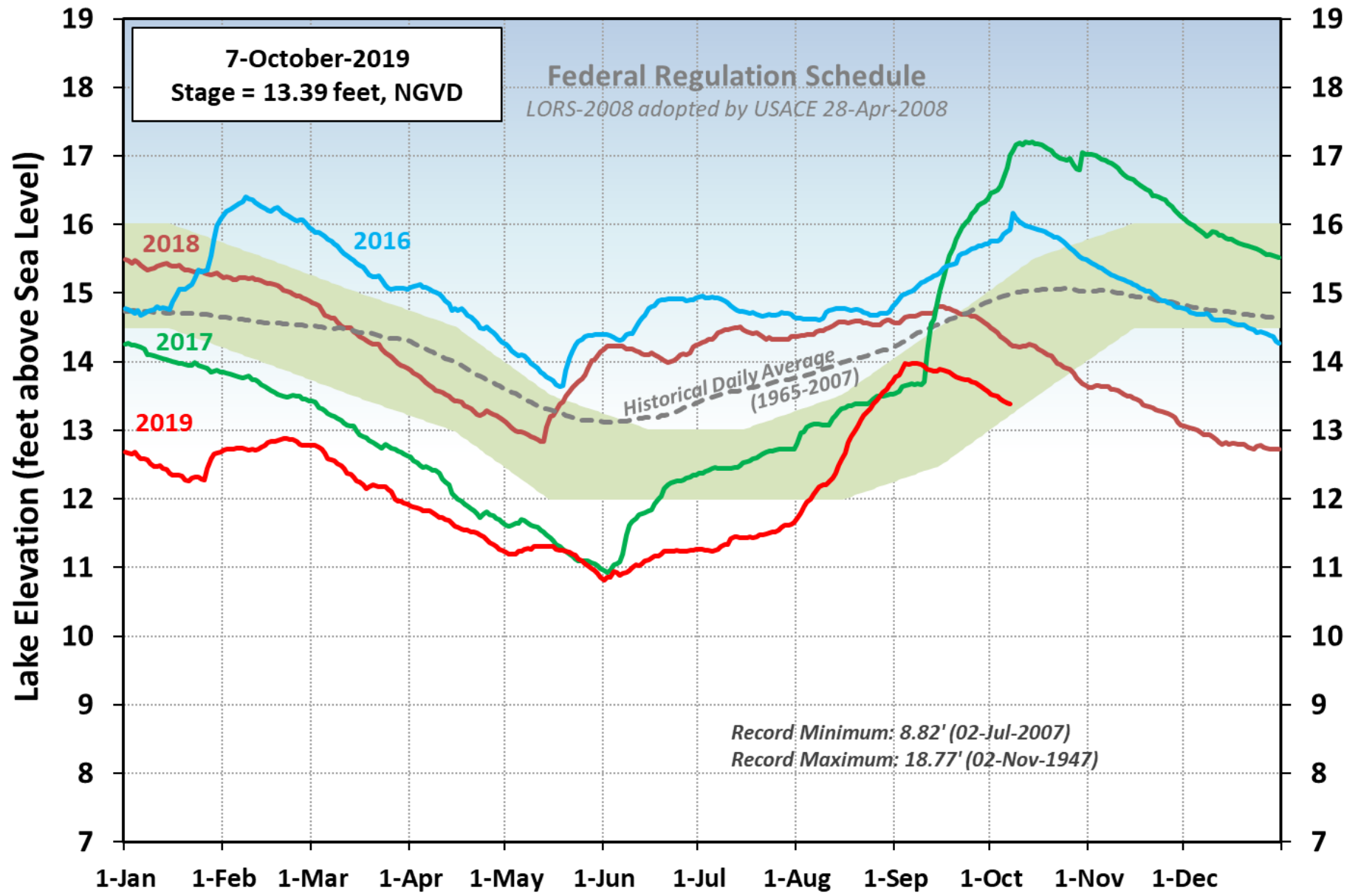
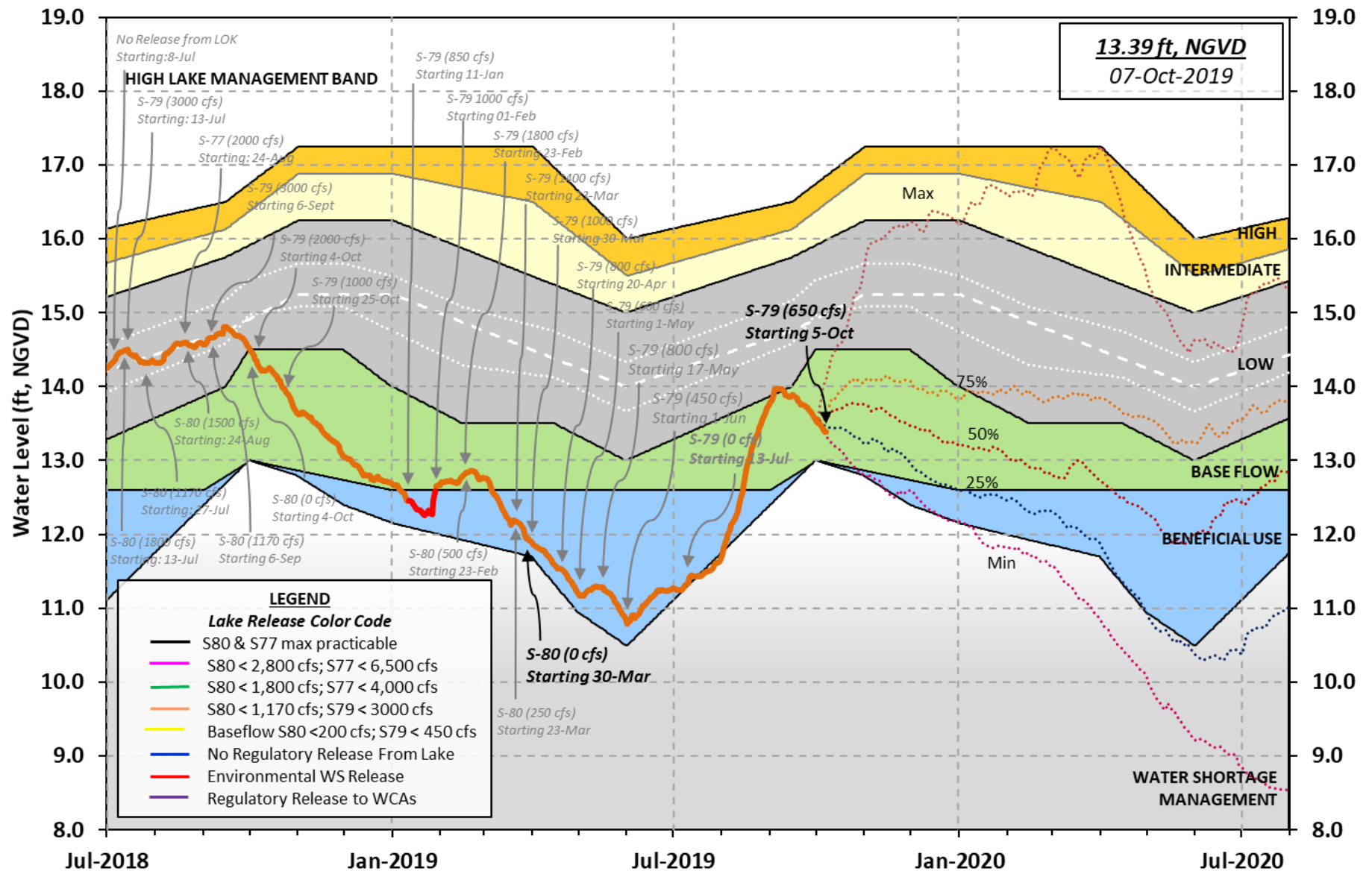


Figure 2. Select annual stage hydrographs for Lake Okeechobee in comparison to the Ecological Envelope.



# Lake Okeechobee Water Level History and Projected Stages



LORS-2008  
Adopted by USACE 28-April-2008

Projected Stage Percentiles From  
SFWM-D-HESM Position Analysis

**Figure 3.** Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

# Lake Okeechobee Water Level Comparison

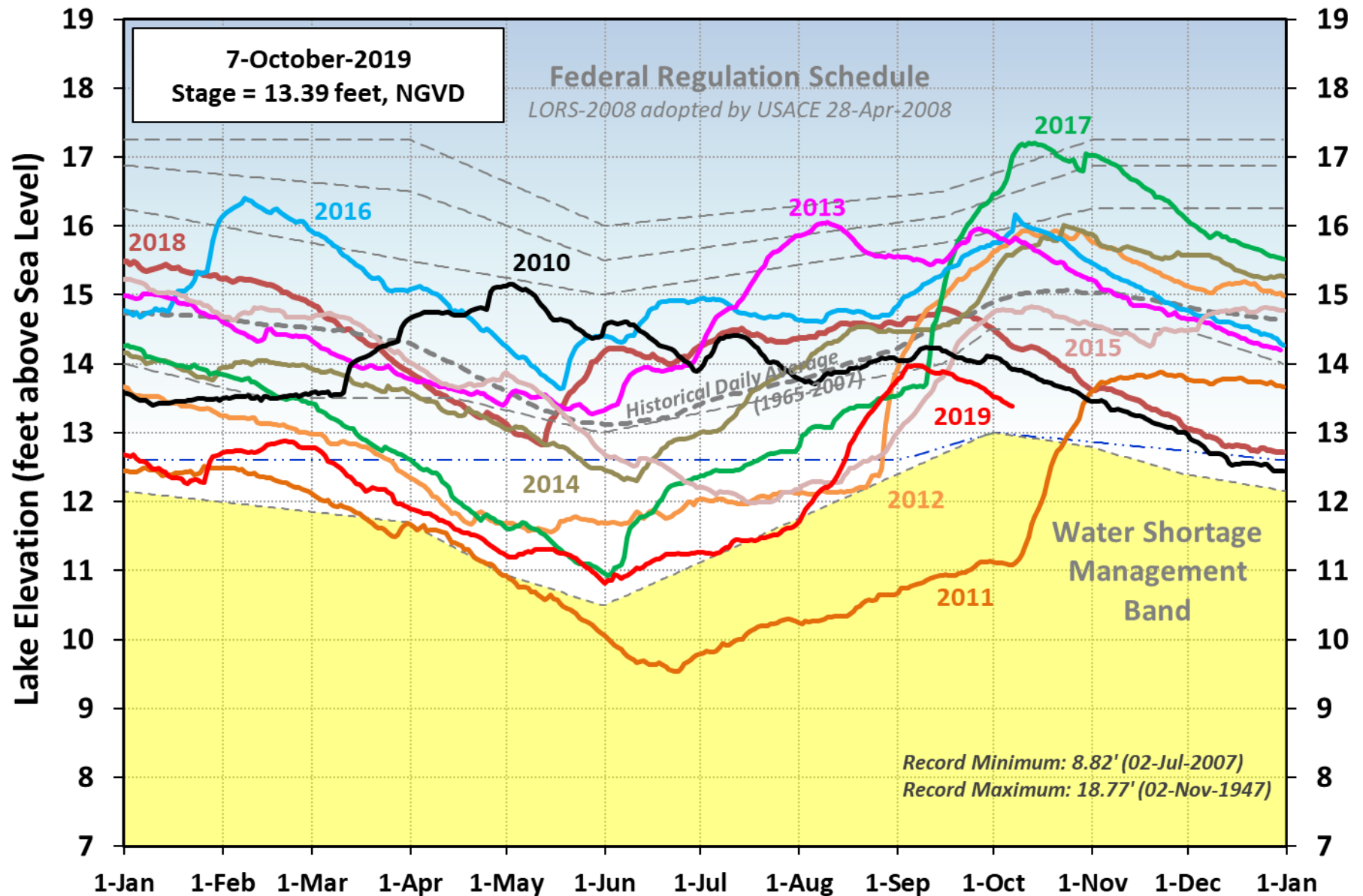
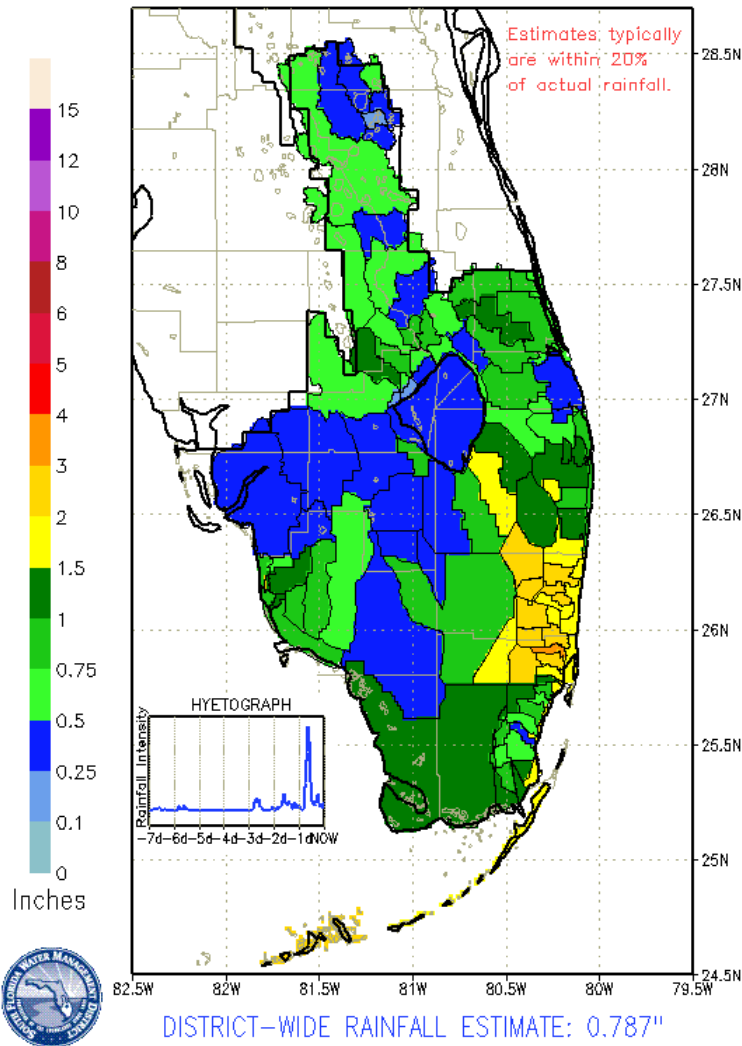


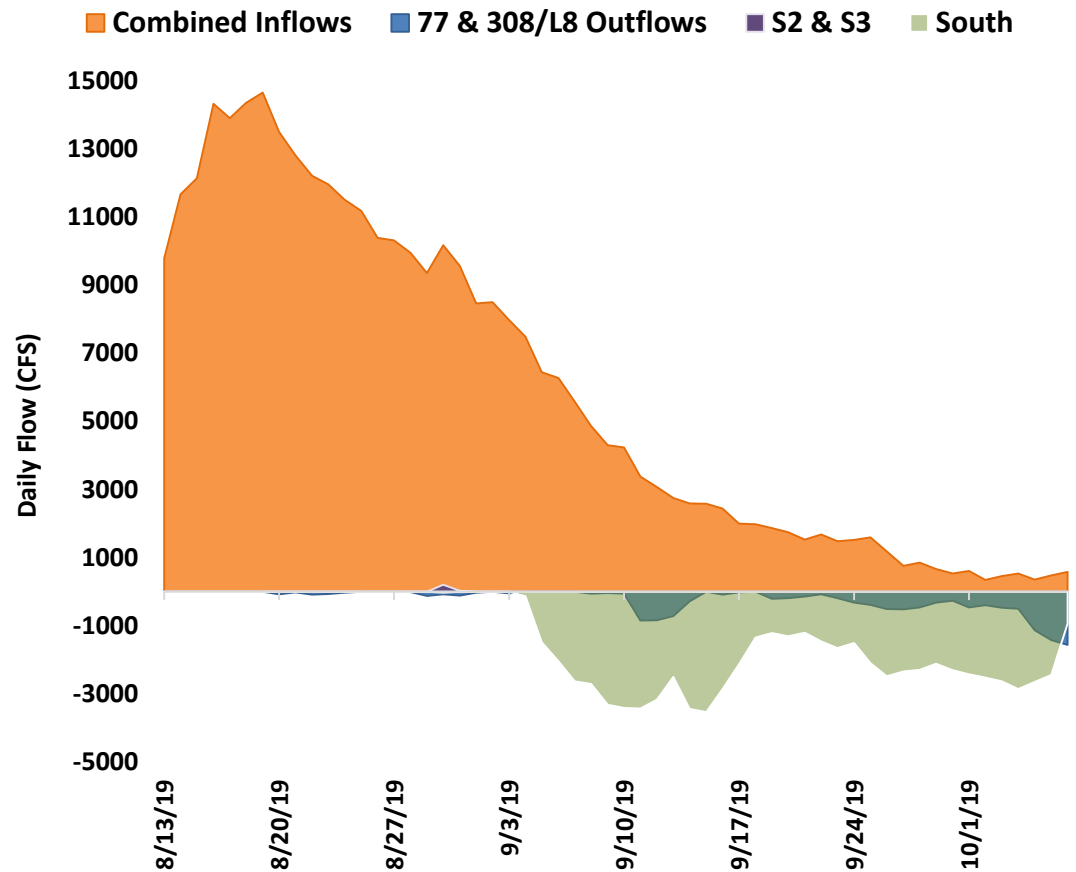
Figure 4. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

# SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES

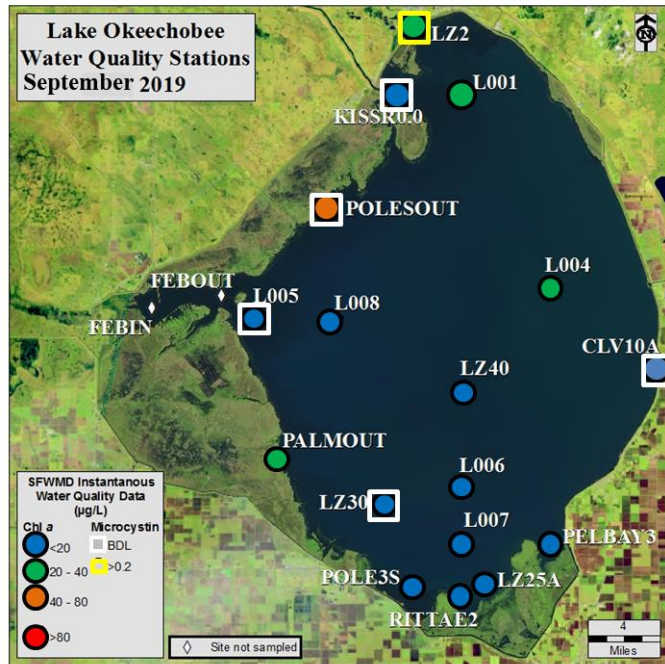
FROM: 0530 EST, 10/01/2019 THROUGH: 0530 EST, 10/08/2019



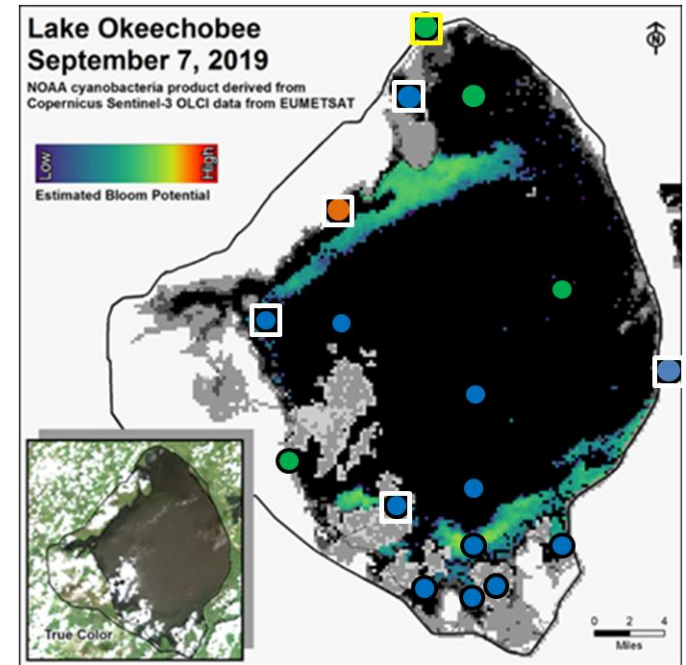
**Figure 5.** Rainfall estimates by basin.



**Figure 6.** Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes. Outflows through the S-77 and S-308 structures are shown based on their downstream gauges to account for lock openings for navigation.

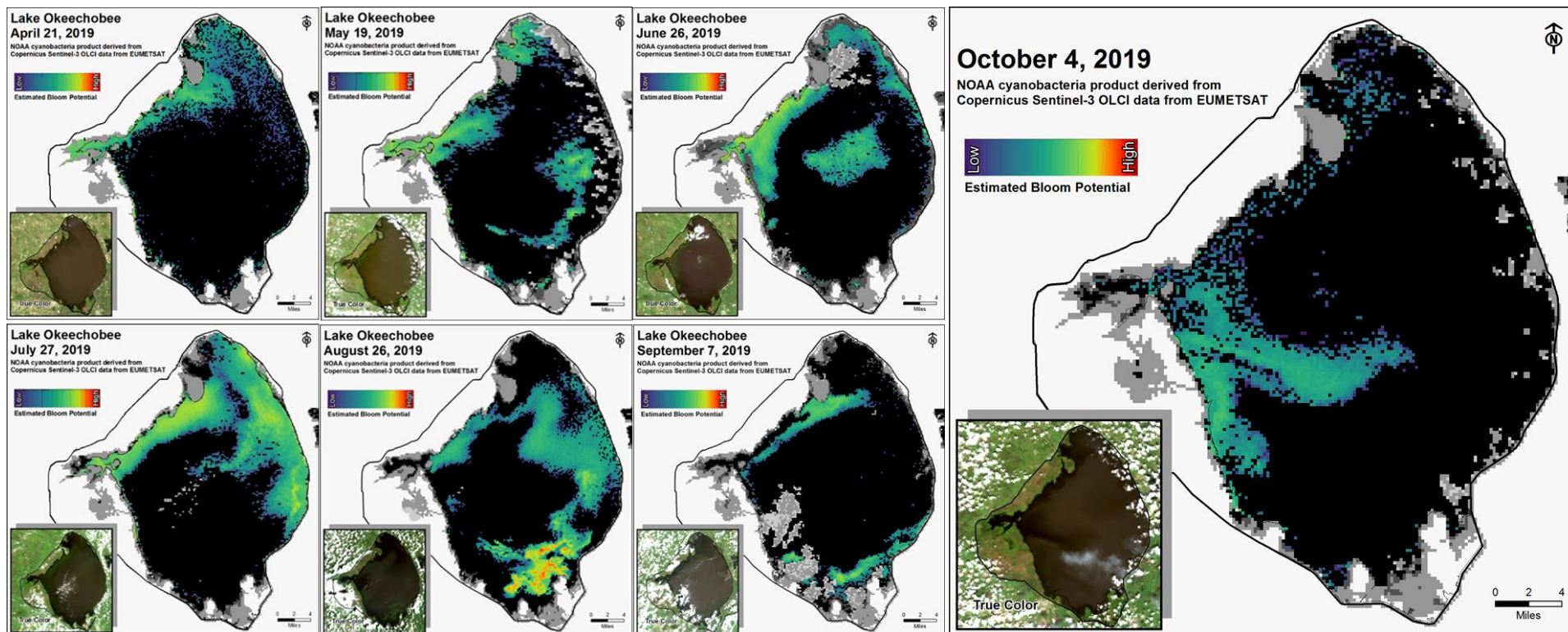


September 9 - 10, 2019		
Site	Chlorophyll <i>a</i> (µg/L)	Microcystin (µg/L)
<b>Nearshore Stations</b>		
KISSR0.0	8.0	BDL
L005	17.1	BDL
LZ2	30.5	0.26
LZ25A	13.3	
PALMOUT	22.4	
PELBAY3	13.4	
POLE3S	16.5	
POLESOUT	59.6	BDL
RITTAE2	19.1	
<b>Pelagic Stations</b>		
CLV10A	19.3	BDL
L001	26.3	
L004	30.0	
L006	11.4	
L007	12.6	
L008	15.3	
LZ30	19.8	BDL
LZ40	16.9	



**Figure 7.** Chlorophyll *a* (µg/L) and microcystin (µg/L) values for nearshore and pelagic stations for September 2019. SFWMD classifies an algal bloom as having Chl *a* values >40 µg/L. Microcystin values <0.20 µg/L are below the detection limit (BDL). The image on the right is an estimate of cyanobacteria density (bloom potential) from roughly the same time as samples were collected and is based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT.





**Figure 8.** Potential for cyanobacterial blooms on Lake Okeechobee in 2019, based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover.

## **ESTUARIES**

### **St. Lucie Estuary:**

Last week total inflow to the St. Lucie Estuary averaged approximately 306 cfs (Figures 1 and 2) and last month inflow averaged about 522 cfs. Last week's provisional averaged inflows from the tidal basin and the structures are shown in Table 1.

**Table 1.** Weekly average inflows (data are provisional).

<b>Location</b>	<b>Flow (cfs)</b>
Tidal Basin Inflow	228
S-80	0
S-308	0
S-49 on C-24	0
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	78

Over the past week, salinity increased throughout the estuary (Table 2, Figures 3 and 4). The seven-day moving average of the water column (an average of the surface and bottom salinity) at the US1 Bridge is estimated to be 13.8. Salinity conditions in the middle estuary are within the good range for adult eastern oysters (Figure 3).

**Table 2.** Seven-day average salinity at three monitoring sites 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.

<b>Sampling Site</b>	<b>Surface</b>	<b>Bottom</b>	<b>Envelope</b>
HR1 (North Fork)	<b>12.0</b> (10.1)	<b>15.6</b> (13.4)	NA <sup>1</sup>
US1 Bridge	<b>9.7</b> (9.0)	<b>17.9</b> (16.7)	10.0-26.0
A1A Bridge	<b>28.2</b> (25.6)	<b>EM</b> <sup>2</sup> (EM)	NA <sup>1</sup>

<sup>1</sup>Envelope not applicable and <sup>2</sup>Equipment Malfunction.

### **Caloosahatchee Estuary:**

Last week total inflow to the Caloosahatchee Estuary averaged approximately 533 cfs (Figures 5 and 6) and last month inflow averaged about 647 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

**Table 3.** Weekly average inflows (data is provisional).

<b>Location</b>	<b>Flow (cfs)</b>
S-77	615
S-78	295
S-79	367
Tidal Basin Inflow	166

Over the past week, salinity increased throughout the estuary (Table 4, Figures 7 & 8). The seven-day average salinity values within the good range for adult eastern oysters at Cape Coral, Shell Point and in the fair range at Sanibel (Figure 9). The 30-day moving average surface salinity is 2.6 at Val I-75 and 6.2 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)	<b>6.6</b> (3.4)	<b>7.4</b> (4.8)	NA <sup>1</sup>
Val I75	<b>7.1</b> (3.2)	<b>8.8</b> (5.6)	0.0-5.0 <sup>2</sup>
Ft. Myers Yacht Basin	<b>12.9</b> (8.9)	<b>15.2</b> (11.4)	NA
Cape Coral	<b>18.3</b> (15.2)	<b>21.1</b> (17.7)	10.0-30.0
Shell Point	<b>28.9</b> (26.8)	<b>29.4</b> (27.3)	10.0-30.0
Sanibel	<b>32.3</b> (30.7)	<b>32.3</b> (31.0)	10.0-30.0

<sup>1</sup>Envelope not applicable, <sup>2</sup>Envelope is based on a 30-day average, and <sup>3</sup>Equipment Malfunction.

Forecast of surface salinity (Table 5 and Figure 10) at Val I-75 for the next two weeks using the autoregression model (Qiu and Wan, 2013) coupled with a linear reservoir model for the tidal basin predicts daily salinity ranging from 5.4 to 9.8 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 800 cfs and Tidal Basin inflows of 120 cfs.

**Table 5.** Predicted salinity at Val I-75 at the end of forecast period

Scenario	Q79 (cfs)	TB runoff (cfs)	Daily salinity	30 day mean
A	0	120	9.8	6.7
B	300	120	8.1	6.1
C	450	120	7.1	5.7
D	650	120	5.7	5.3
E	800	120	5.4	5.1

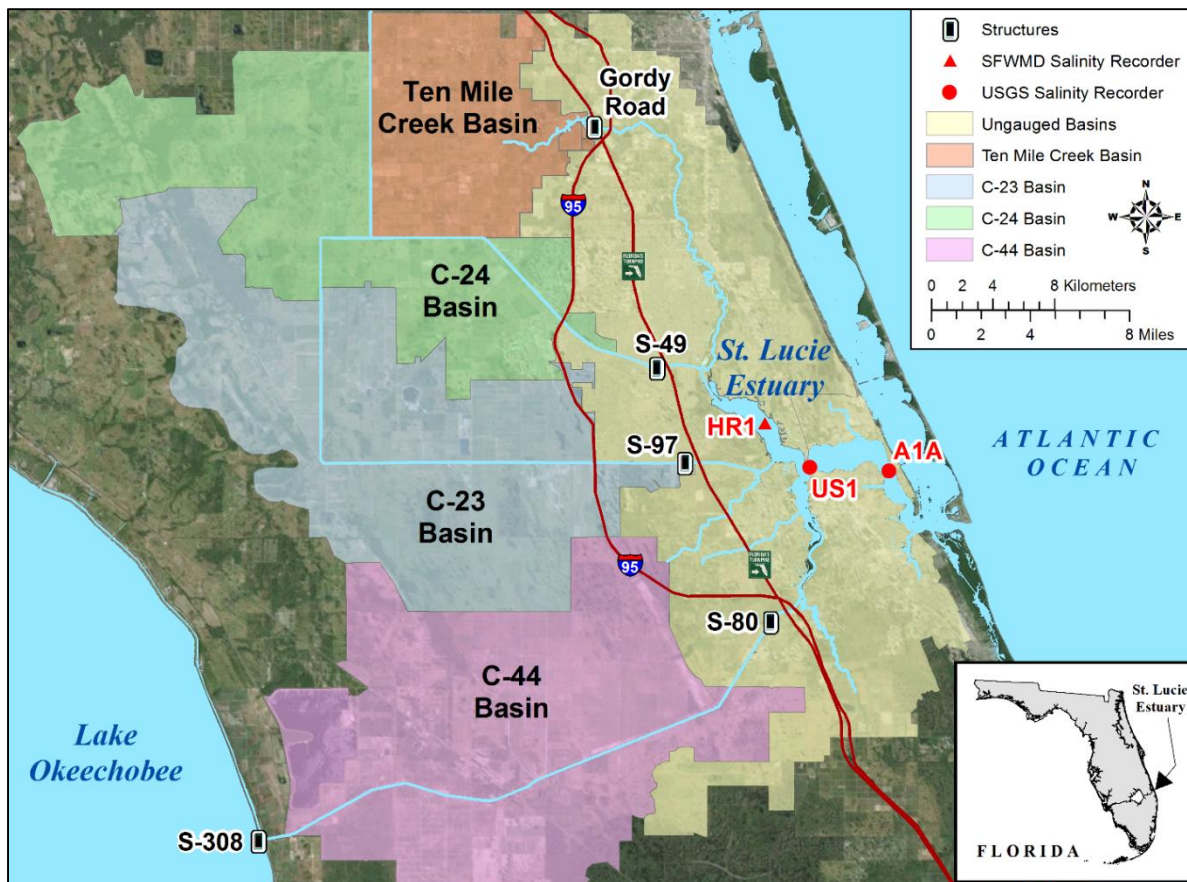
### Red tide

The Florida Fish and Wildlife Research Institute reported on October 4, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed at very low to low concentrations in five samples collected from or offshore of Lee County. *Karenia brevis* was not observed in samples collected from Palm Beach or Broward counties (no samples were analyzed this week from St. Lucie, Martin, or Miami-Dade counties).

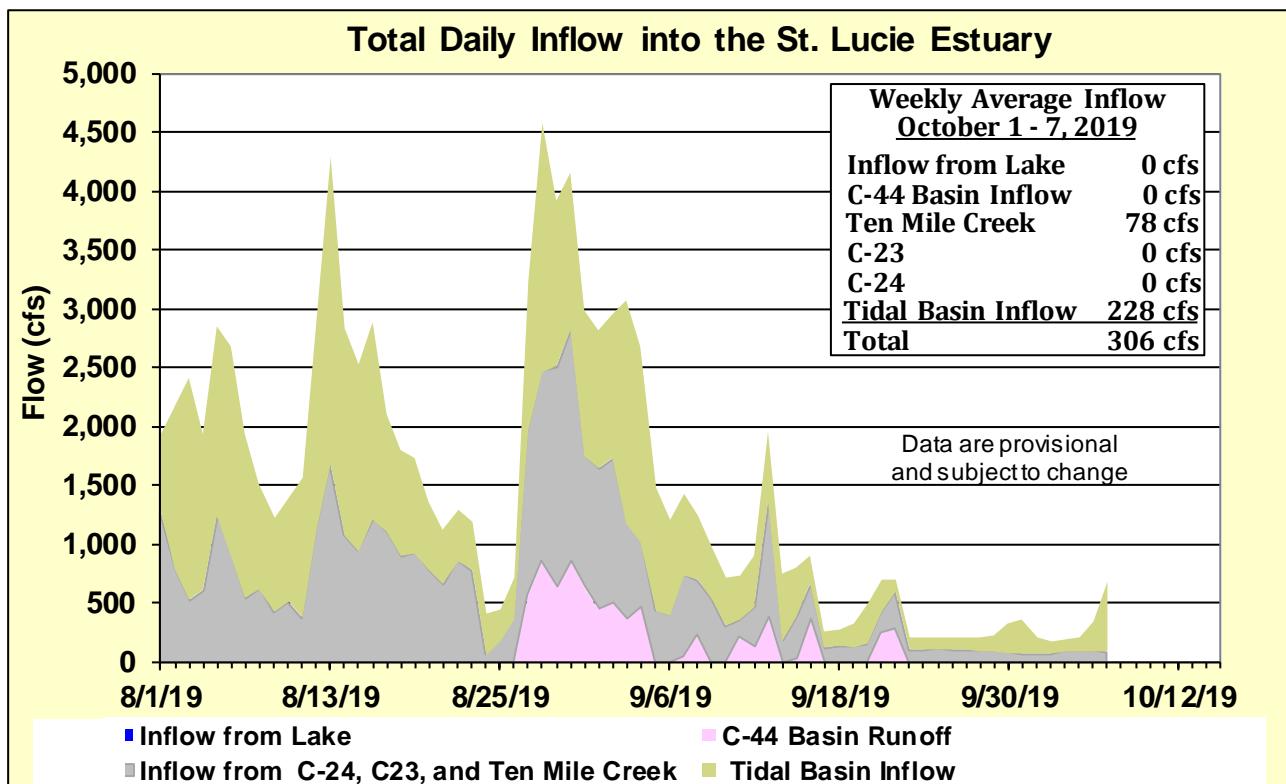
### Water Management Recommendations

Lake stage is in the Base Flow sub-band. Tributary conditions are dry. The 30-day moving average of surface salinity at Val I-75 is predicted to exceed 5 over the next two weeks. SFWMD's Lake Okeechobee Adaptive Protocol's Release Guidance suggests up to 450 cfs @ S-79 and S-77 baseflow release to supplement as needed.

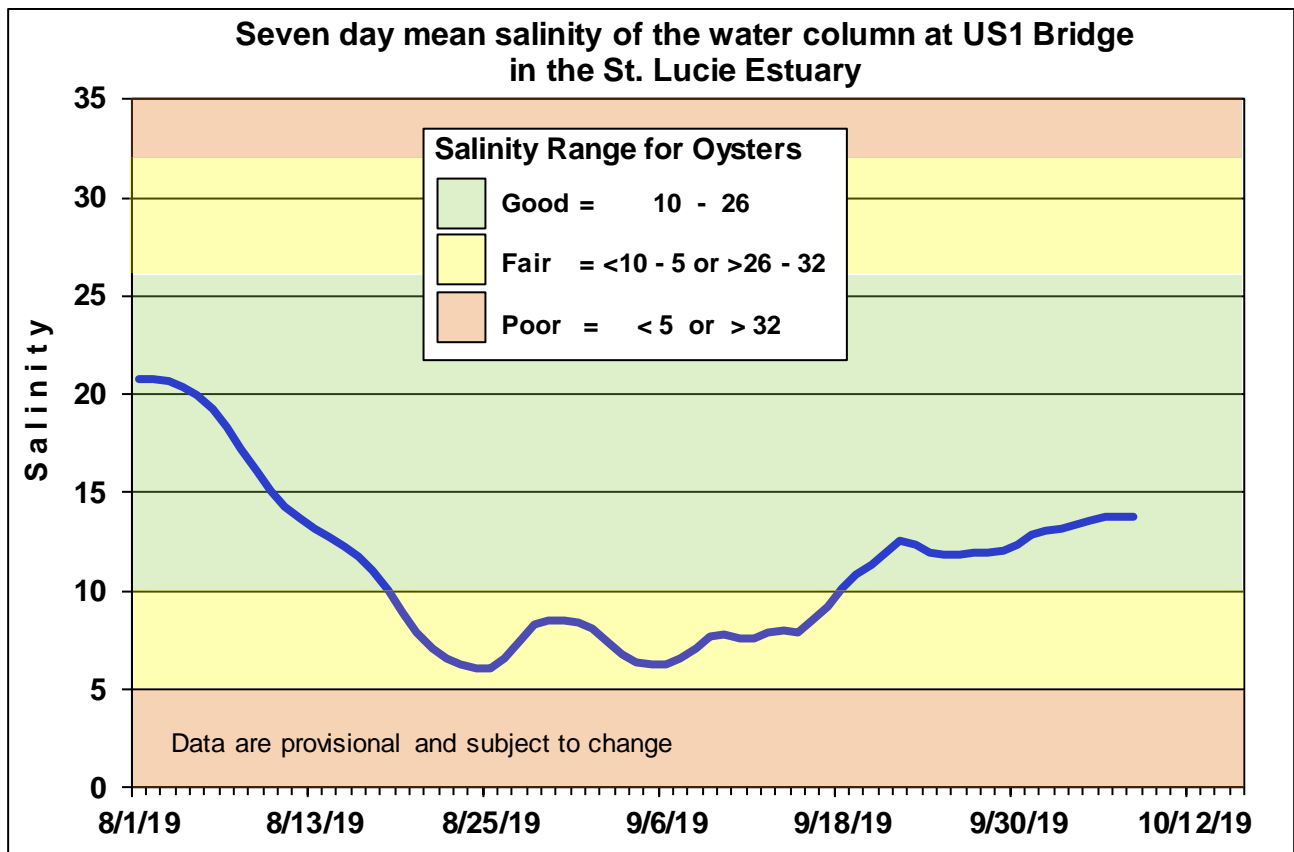




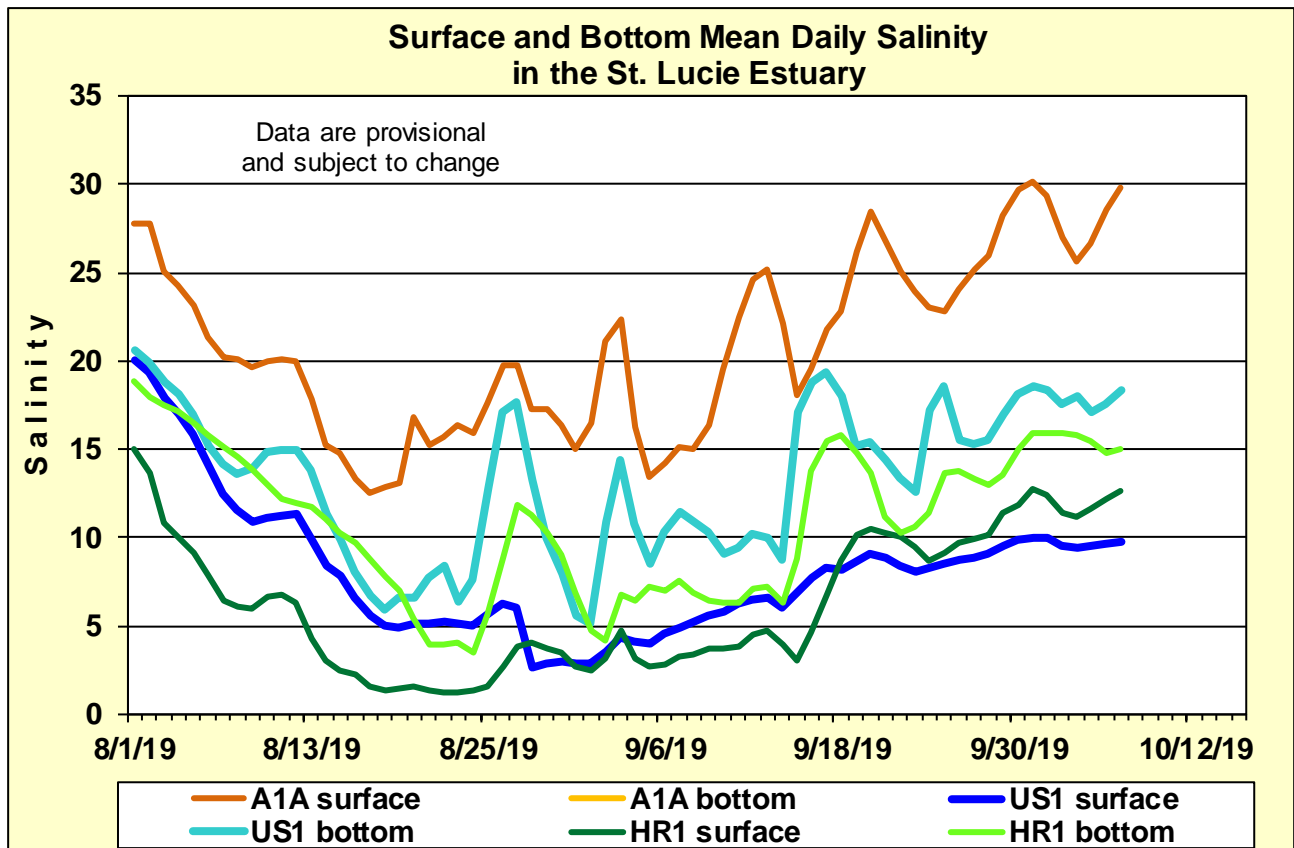
**Figure 1.** Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.



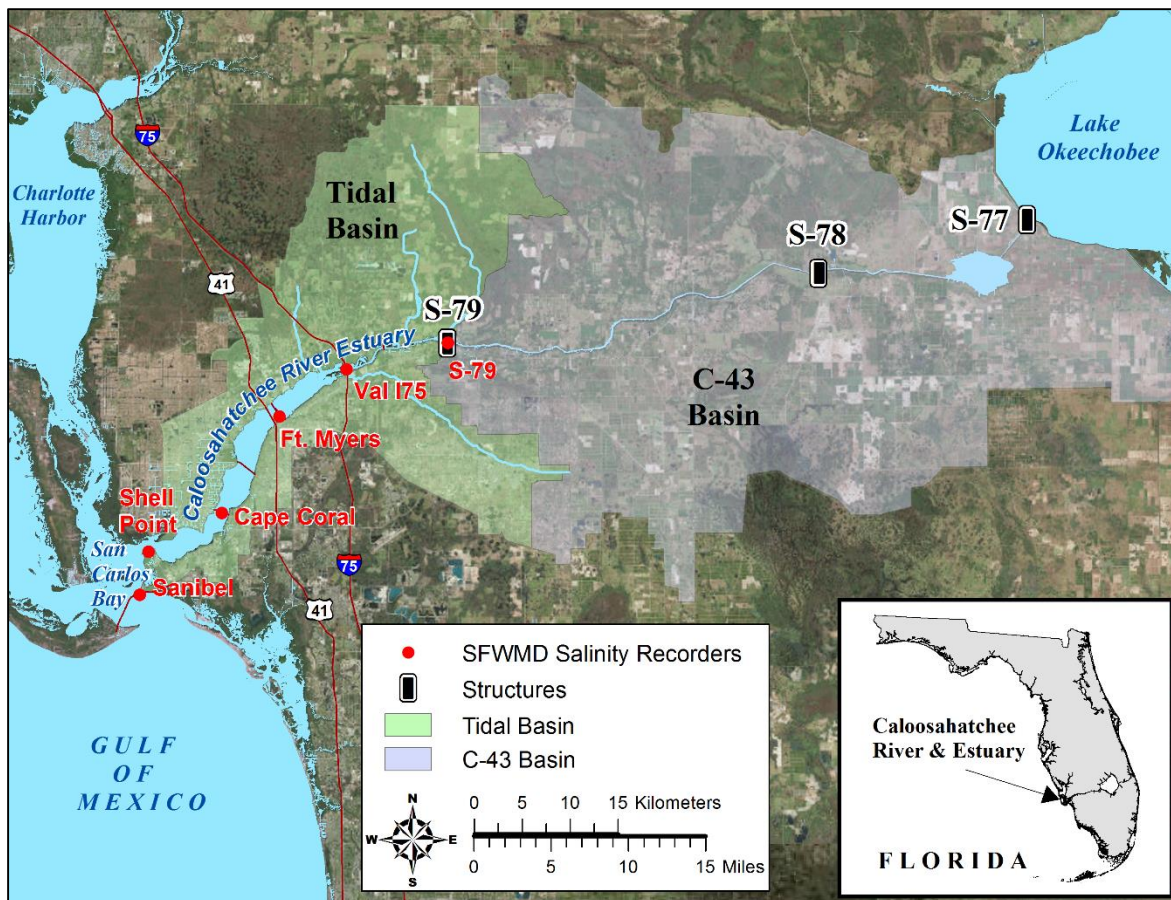
**Figure 2.** Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.



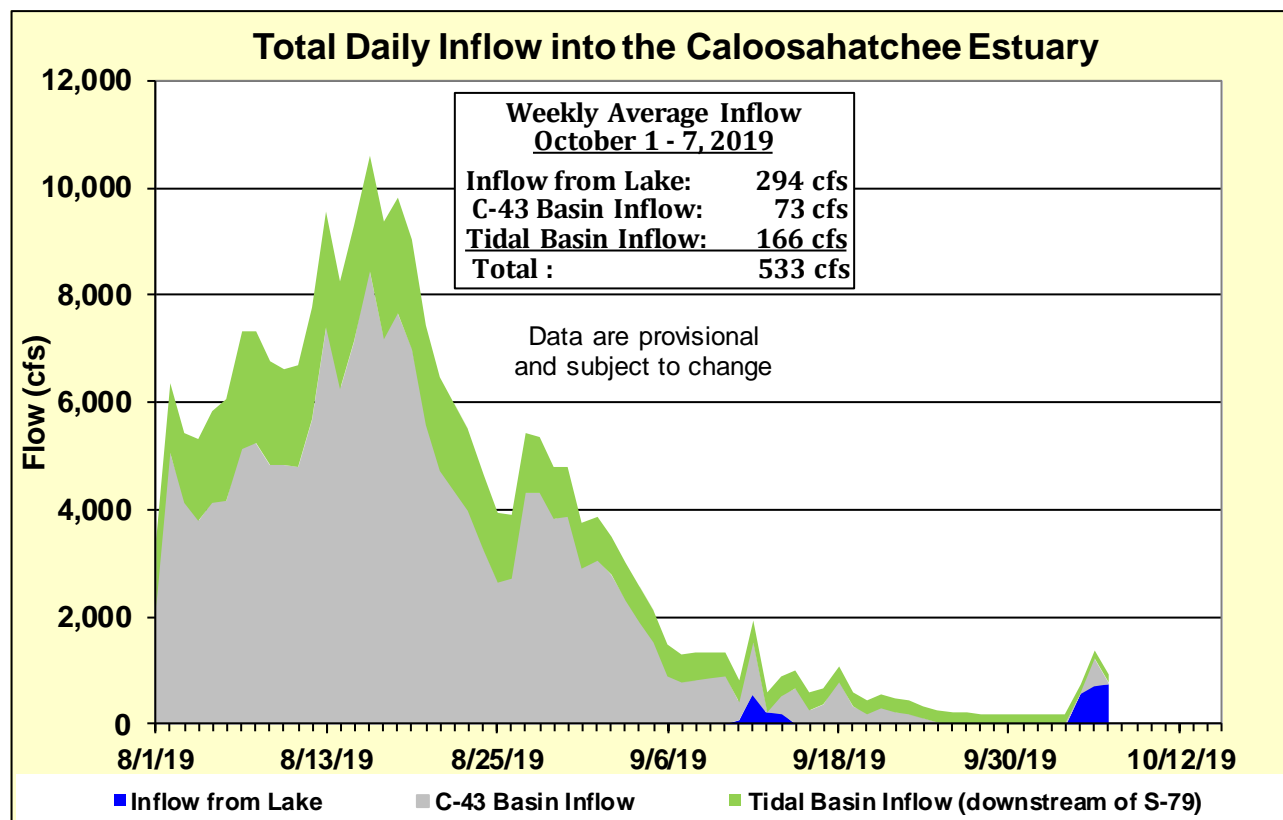
**Figure 3.** Seven-day mean salinity of the water column at the US1 Bridge.



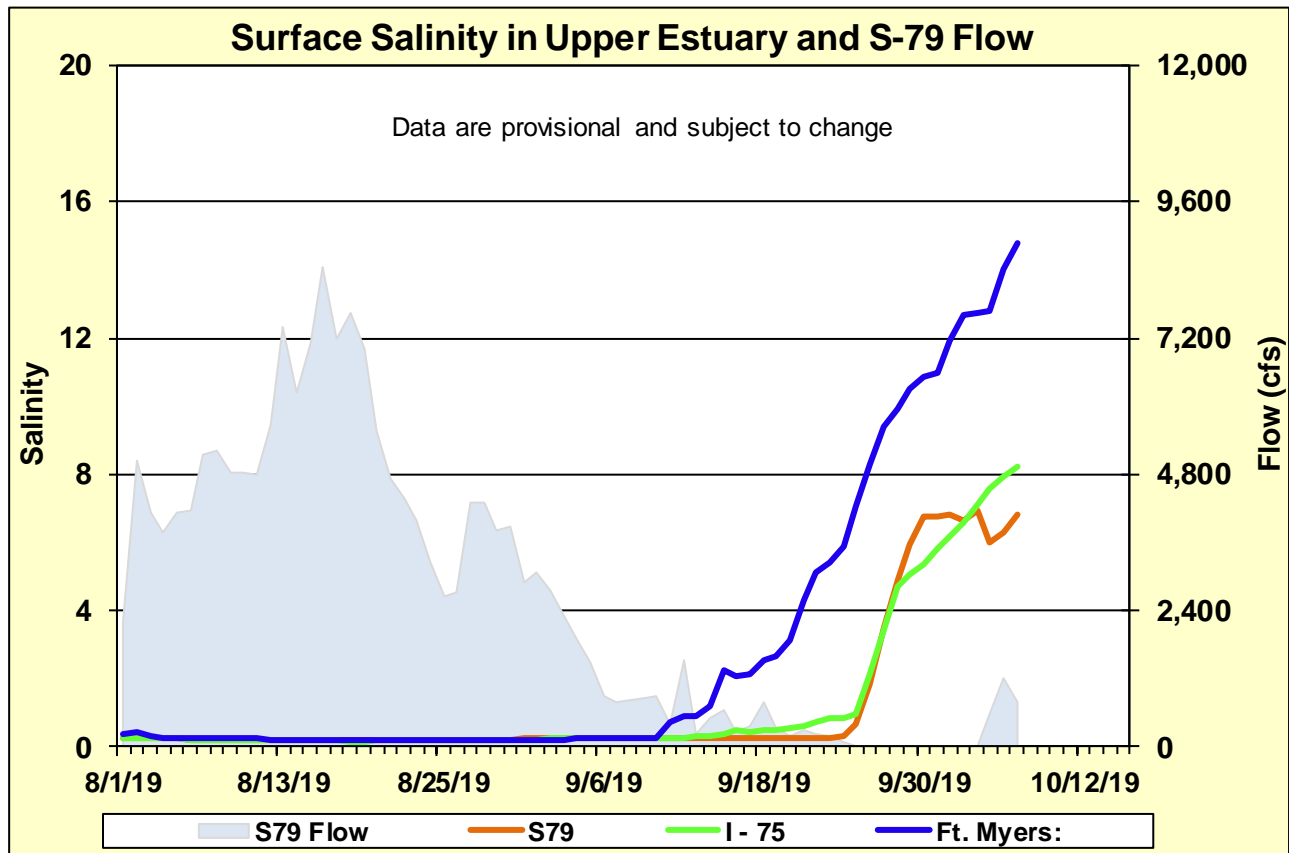
**Figure 4.** Daily mean salinity at the A1A, US1 and estimated HR1 stations.



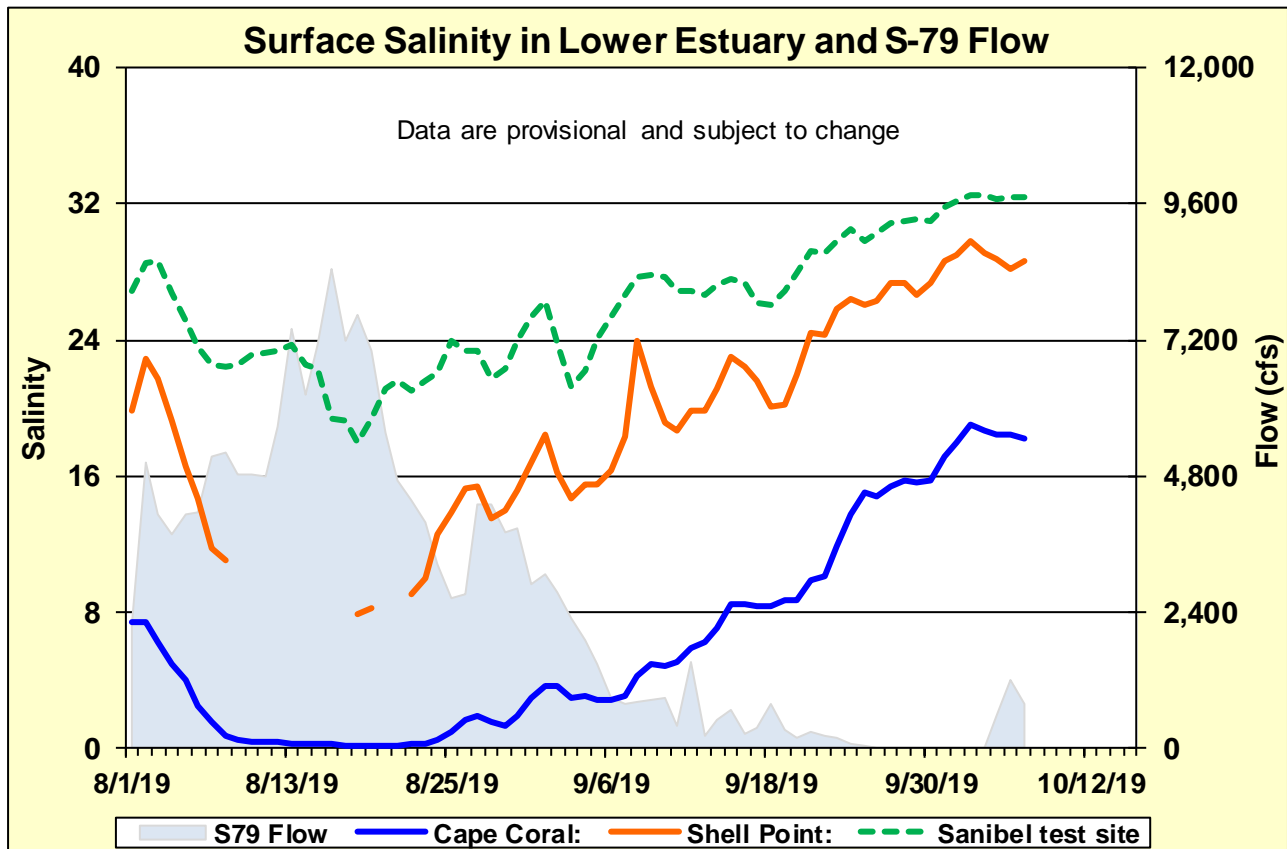
**Figure 5.** Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.



**Figure 6.** Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

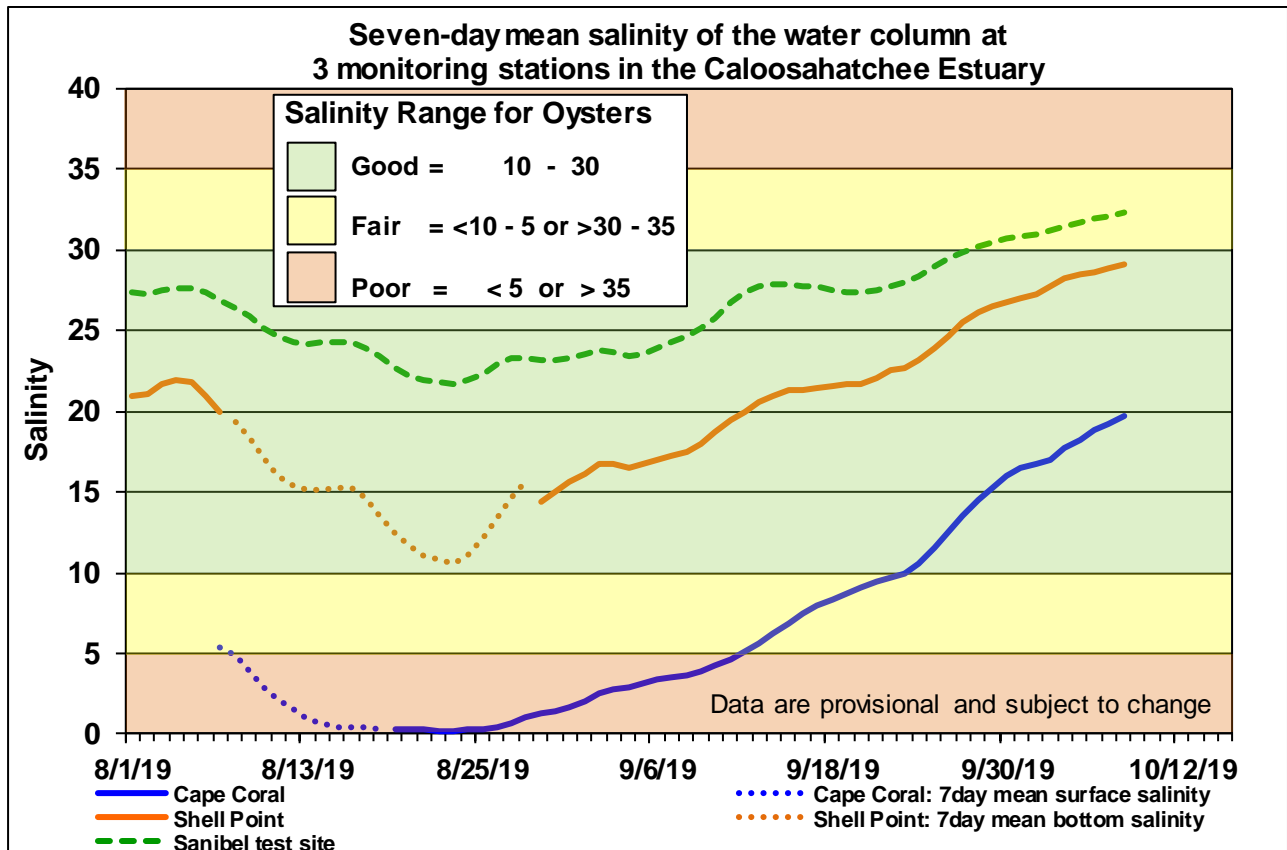


**Figure 7.** Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

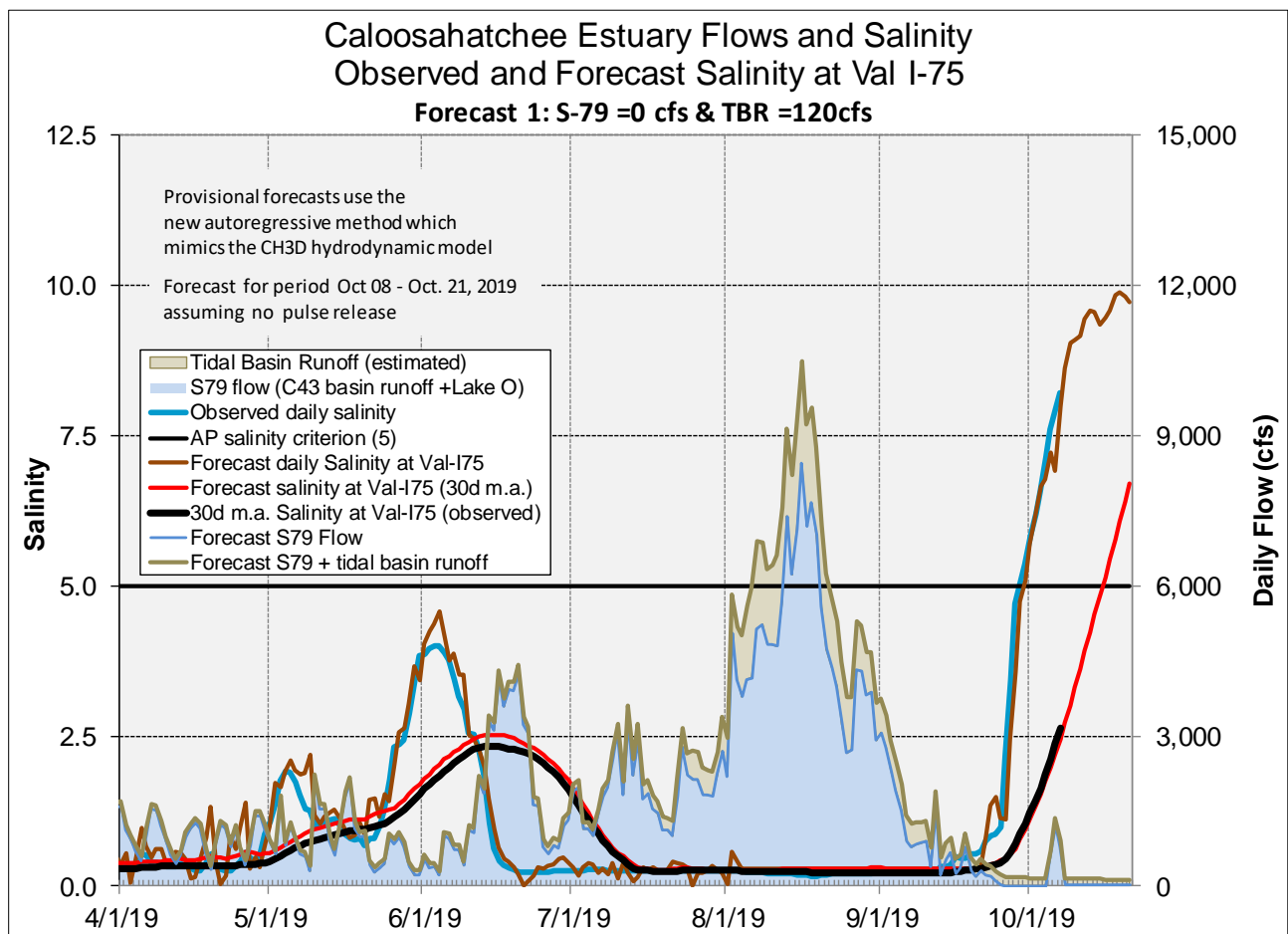


**Figure 8.** Daily mean flows at S-79 and salinity at lower estuary stations.





**Figure 9.** Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

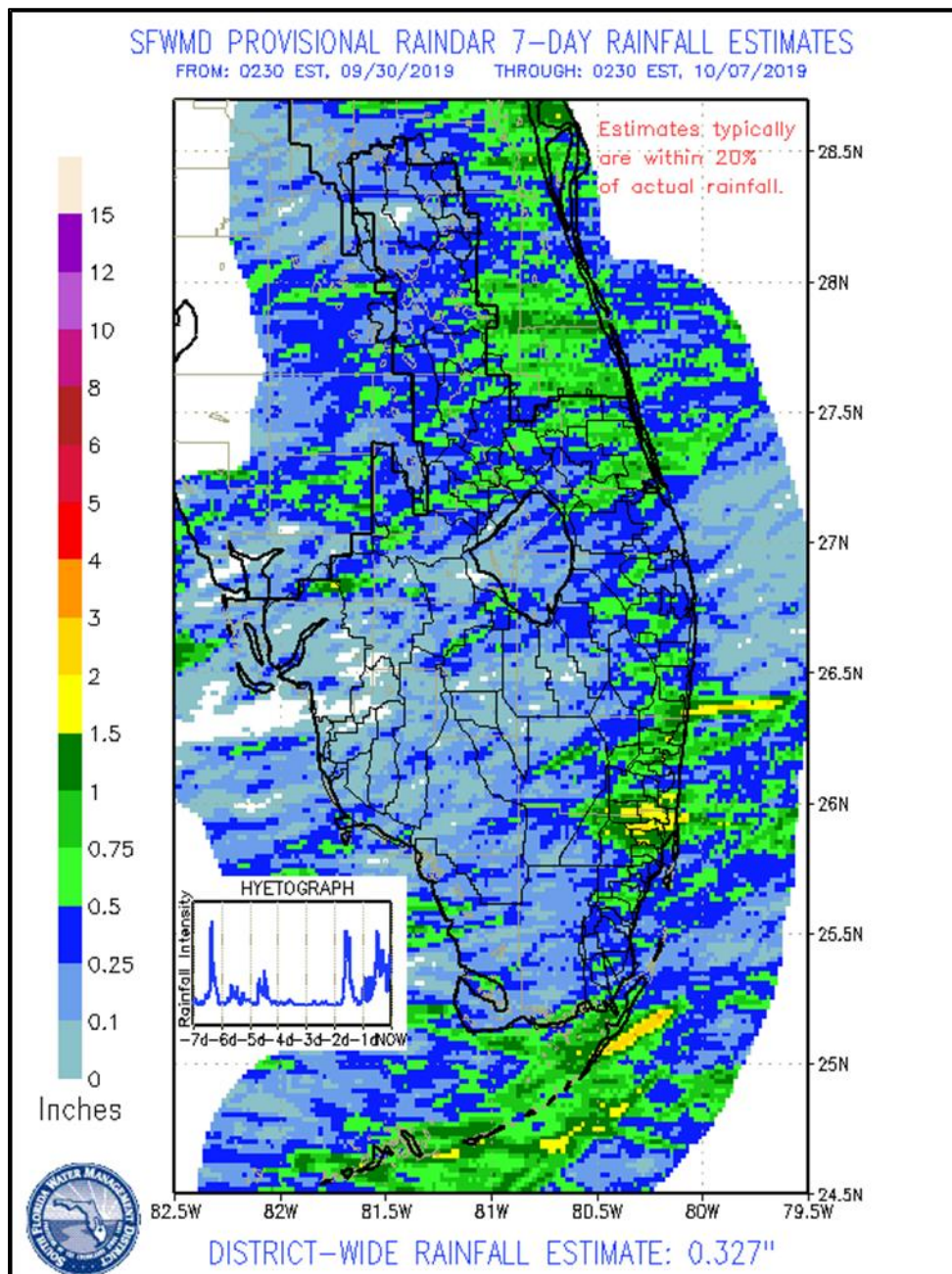


**Figure 10.** Forecasted Val I-75 surface salinity assuming no pulse release at S79.

## **EVERGLADES**

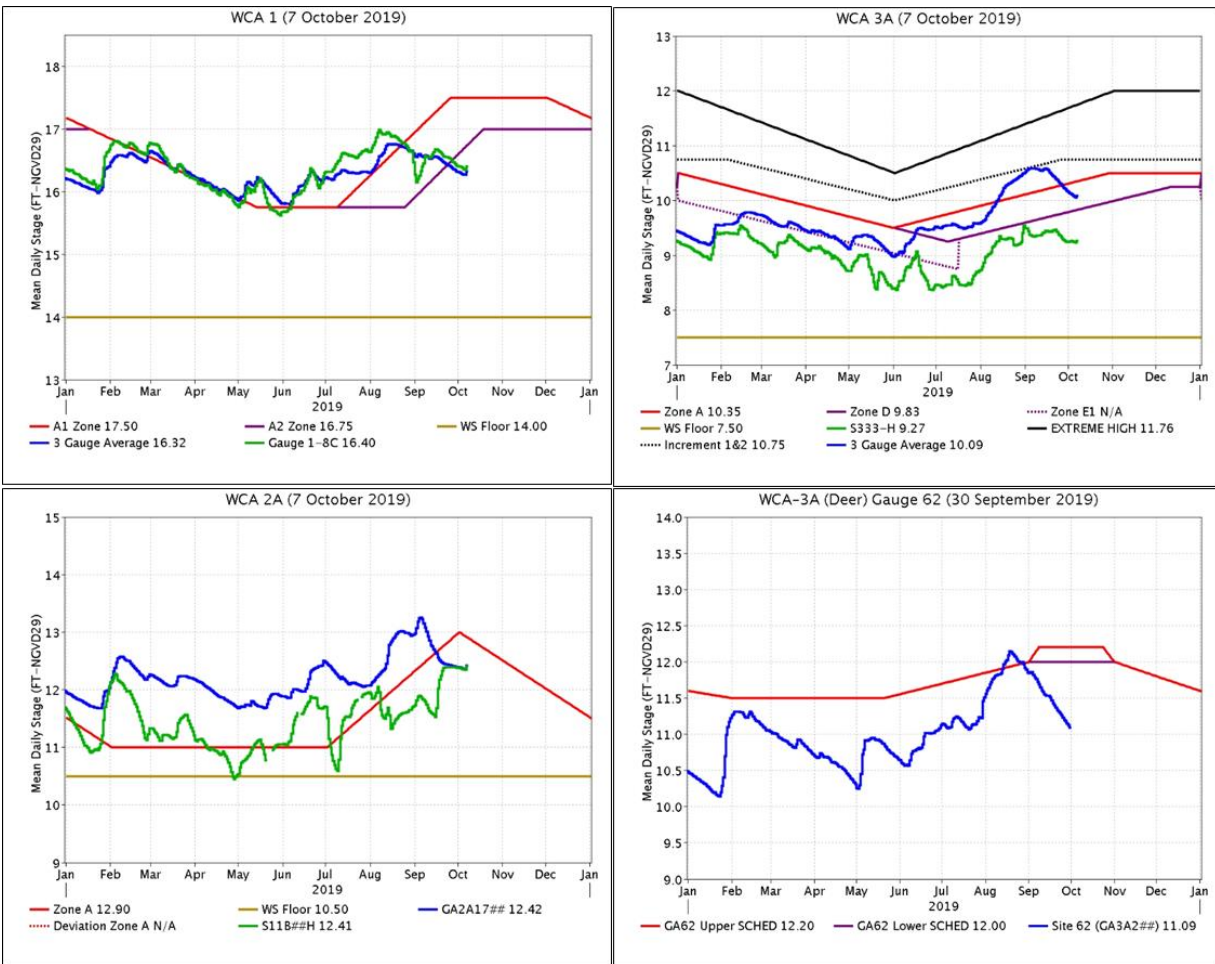
WCA-1 received the most rainfall of the WCAs last week, nearly double the amount that fell in WCA-2A and 3A. The average stage change for the gauges monitored in this report fell 0.07 feet last week, about half the rate as the week prior. Pan evaporation was estimated at 1.51 inches and the Rainfall Plan calls for a release of 1290 cfs from WCA-3A (a 1000 cfs reduction from last week).

<b>Everglades Region</b>	<b>Rainfall (Inches)</b>	<b>Stage Change (feet)</b>
WCA-1	0.41	-0.05
WCA-2A	0.29	-0.04
WCA-2B	0.74	-0.09
WCA-3A	0.27	-0.15
WCA-3B	0.51	-0.02
ENP	0.23	+0.01



Regulation Schedules: WCA-1: The three-gauge average is now below the Zone A2 line falling away from the rising limb, currently at 0.43 feet below the regulation line. WCA-2A: Gauge 2A-17 is 0.48 feet below the Zone A regulation line and generally paralleling that line. WCA-3A: The three-gauge average stage falls towards the rising Zone D regulation line, currently 0.26 feet above. WCA-3A at gauge 62 (northwest corner) continues to drop sharply now 1.03 feet below the lower schedule.

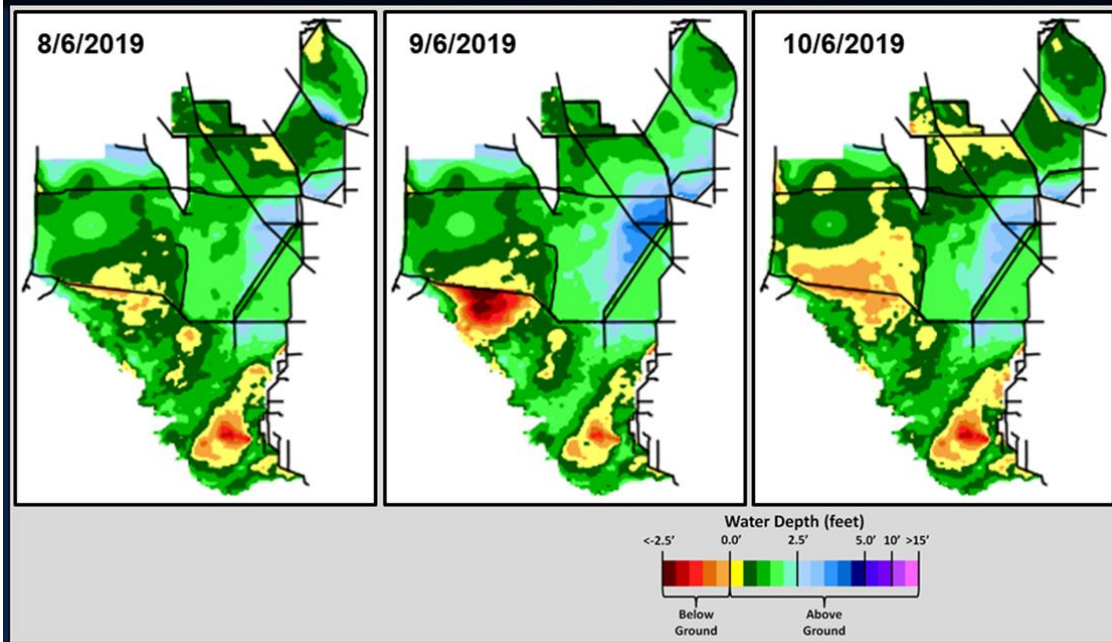




Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate conditions have peaked and are now drying down. There is potential for depths at ground surface along the northern stretches of the Miami and L3-L4 Canal in WCA-3A North; and small regions in the extreme north of WCA1 and 2. The spatial extent of ponding along the L-67 canal in WCA-3A has diminished. Hydrologic connectivity has diminished, most dramatically in Lostman's but remains through the major sloughs of ENP. WDAT difference maps indicate that in general conditions are significantly shallower in stage within portions of all the WCAs compared to a month ago, more than 1.0 feet drop in WCA-3A North downstream of the S-11s and the eastern half of WCA-2A. Stages are up to 1.5 feet lower in southern WCA-2A and northern WCA-3B. Stage changes are mixed within WCA-1 and seem to be associated with inflow and outflow from that basin.



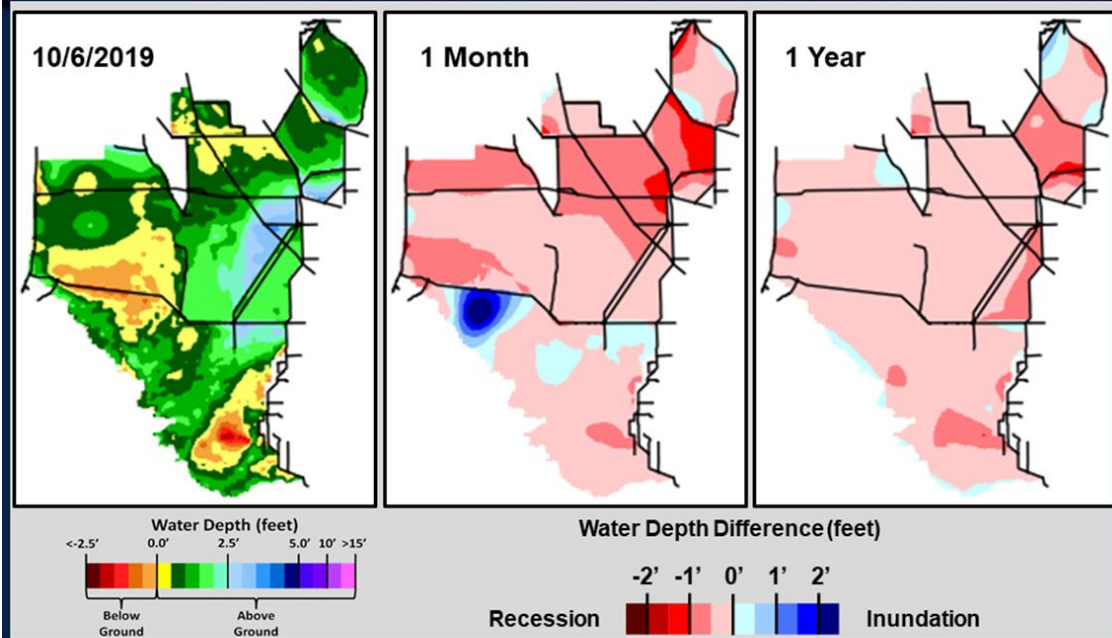
## SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)



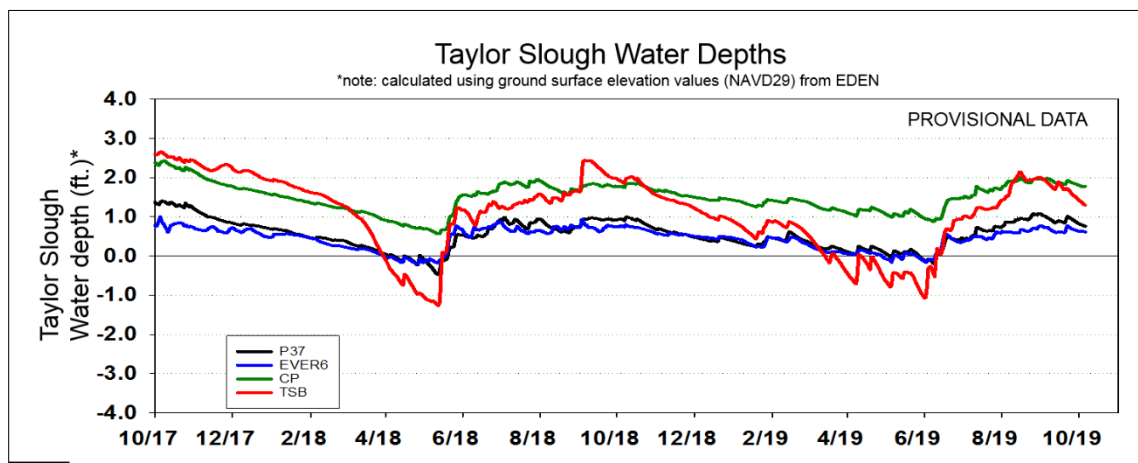
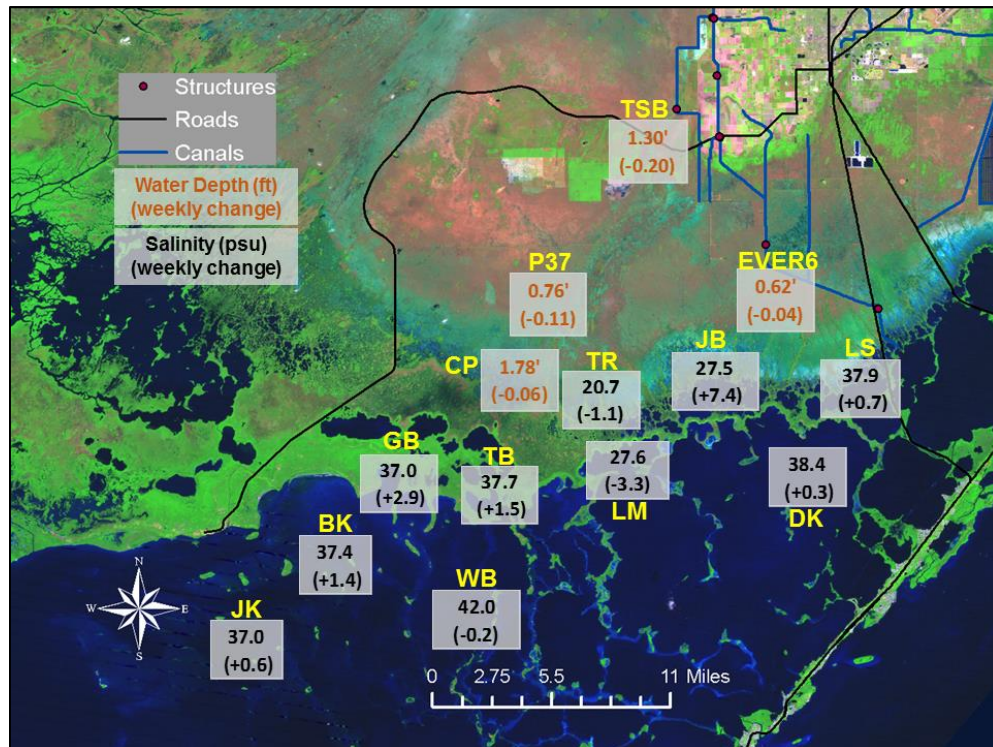
## SFWDAT Everglades Difference Maps (Present - Past)



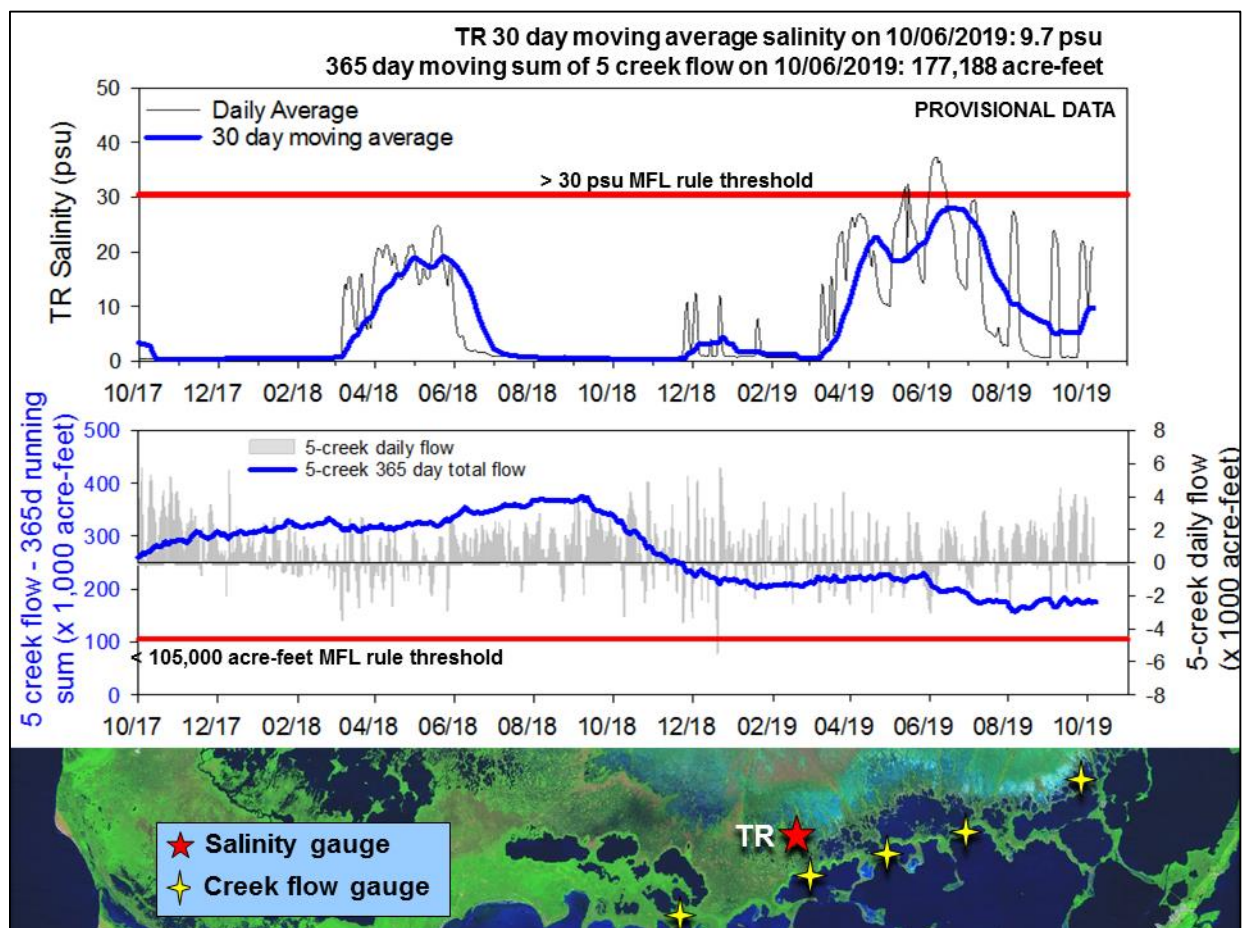
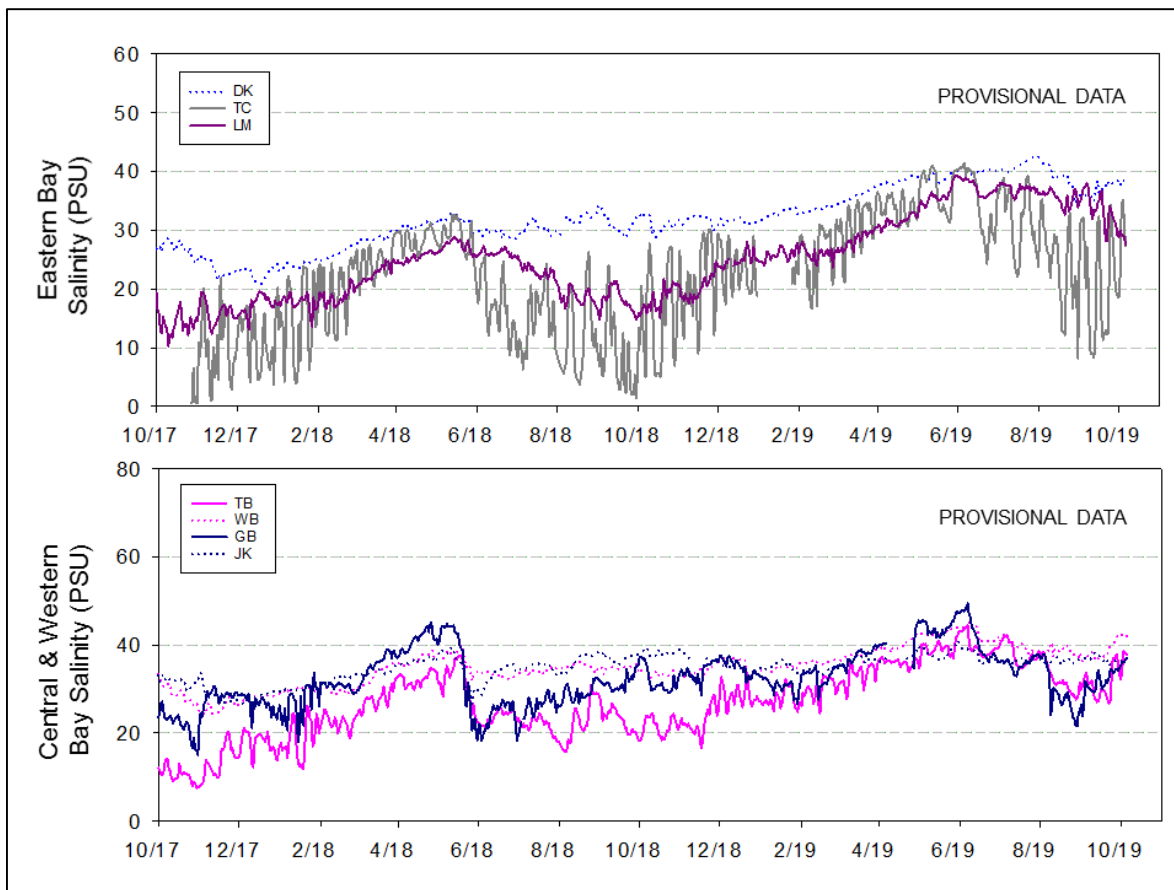
South Florida Water Depth Assessment Tool (SFWDAT)

Taylor Slough Water Levels: An average of 0.63 inches of rain fell over Taylor Slough and Florida Bay this past week. Stage changes ranged -0.04 feet to -0.20 feet with the largest decreases in the north still. Stages now average 2 inches less than the historical averages for this time of year.

Florida Bay Salinities: Average salinity in Florida Bay was 36 psu, 1 psu higher than last week. The average for the northern shoreline remains at 34 psu which is more similar to open ocean than estuarine. Conditions are 11 psu above average for this time of year. The highest rainfall for the week (2.21 inches) fell over central Florida Bay at WB which kept the salinity there from continuing to increase.







Florida Bay MFL: Salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) decreased from last week's 22 psu to 9 psu before again increasing to 21 psu. The 30-day moving average also increased 1.8 psu to end at 9.7 psu. Weekly flow from the 5 creeks identified by yellow stars on the map totaled about 10,000 acre-feet this past week which is about 60% of the historical average for this time of year. The far eastern creek is the only creek that did not experience any negative flows this week. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) increased roughly 2,300 acre-feet to 177,188 acre-feet and continues to hover under the 25th percentile (190,165 acre-feet). Creek flow are provisional USGS data.

### **Water Management Recommendations**

As we begin the climatological dry season the ecology of the Everglades is eliciting concern, as current stages in the WCAs are low for this time of year and salinities are high in Florida Bay. Deeper water during the wet season allows the prey base to build to optimal densities prior to the dry season and wading bird nesting season. Deeper early dry season depths also mean that the seasonal drawdown that concentrates prey for easier foraging can extend throughout the nesting season. WCA-3A North has a high potential for good wading bird foraging this year as a fire in that basin, near the Alley North colony, may have opened the sloughs making it easier for wading birds to forage for prey in that critical region but it is drying down at a rapid rate, dropping 0.22 feet per week over the last month. Overall conserving water within the WCAs and moving low nutrient water south has many ecological benefits. Flows towards Taylor Slough and Florida Bay freshen salinity conditions within the nearshore areas of Florida Bay and decrease the currently stressful conditions for seagrasses and fauna as nearshore salinities remain elevated. A potential indicator of stress in the Taylor Slough mangrove zone is the minimum that the 30-day moving average salinity reaches during the peak of the wet season; compared to salinities of one and two years ago current conditions are elevated. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

## SFWMD Everglades Ecological Recommendations, October 8th, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.05'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-2A	Stage decreased by 0.04'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-2B	Stage decreased by 0.09'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.21'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
WCA-3A NW	Stage decreased by 0.16'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	
Central WCA-3A S	Stage decreased by 0.13'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
Southern WCA-3A S	Stage decreased by 0.08'		
WCA-3B	Stage decreased by 0.08'	Conserving water in this basin has ecological benefit as we near the seasonal peak for water depths.	Protect tree islands, upstream/downstream habitat and wildlife.
ENP-SRS	Stage increased by 0.01'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.04' to -0.20"	Move water southward as possible	When available, provide freshwater buffer for downstream conditions.
FB- Salinity	Salinity changes ranged -3.3 to +7.4 psu.	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.