

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: September 18, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

There is the potential for some areas of heavy rain developing over the southern portion of the District on Friday, Saturday, and Sunday. Drier air moving in from the northwest on the back side of Hurricane Humberto should result in very limited shower activity this afternoon with some widely scattered showers popping up south and east. An upper level trough is forecast to swing southward over Florida and the Bahamas on Wednesday with an upper level low spinning up in this trough near the southeast coast of Florida on Thursday. Therefore, moisture is expected to begin to increase from the northeast bringing scattered showers to the northern portion of the District late tonight and then mainly eastern areas on Wednesday as the trough progresses southward. With the developing upper level low near the southeast coast, scattered shower activity is expected to persist east on Thursday and Thursday night. As the exiting Humberto helps push the tail end of a frontal boundary down the Florida peninsula, very dry air is expected to spread across the northern half of the District on Thursday resulting in very limited rainfall prospects north on Thursday and through this weekend. But as moisture pushes back north and overruns the old frontal boundary, shower activity should flare up over southern areas with the potential for areas of heavy rainfall developing on Friday, Saturday, and Sunday.

Kissimmee

Tuesday morning stages were 56.5 feet NGVD (0.3 feet below schedule) in East Lake Toho, 53.8 feet NGVD (0.0 feet below schedule) in Toho, and 50.7 feet NGVD (0.6 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.3 feet NGVD at S-65A and 26.8 feet NGVD at S-65D. Wednesday morning discharges were 1,479 cfs at S-65, 1,420 cfs at S-65A, 1,929 cfs at S-65D and 1,975 cfs S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 2.3 mg/L for the week through Sunday. Kissimmee River mean floodplain depth on Sunday was 0.86 feet. This week's recommendation is to continue S-65A 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.

Lake Okeechobee

Lake Okeechobee stage is 13.88 feet NGVD, decreasing 0.08 feet from the previous week but still 0.98 feet higher than last month. The Lake stage moved up into the Low sub-band last week then moved back down into the Base Flow sub-band this week. 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. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone and although a reversal occurred this week an increase in lake stage in the future will stress newly established plants and could reduce the beneficial effects that recent low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the Lake (September 15,

2019) shows reduced bloom potential across the northwestern and southern areas, however the latest pictures exhibit high cloud cover.

Estuaries

Total inflow to the St. Lucie Estuary averaged 978 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 fair range for adult eastern oysters.

Total inflow to the Caloosahatchee Estuary averaged 1,024 cfs over the past week with 158 cfs coming from the Lake. Salinity remained low upstream of Val I-75 but increased downstream. The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.5 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 Shell Point and Sanibel and in the fair range at Cape Coral. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to the areas further downstream.

Stormwater Treatment Areas

Over the past week, approximately 31,100 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 54,600 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 720,000 acre-feet. All STA cells are at or above 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, Central and Eastern Flow-ways for STA-1W Expansion #1 construction 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

Stages in WCA-1 remain below schedule. WCA-2A's stage fell dramatically over the last week to reach the regulation line. WCA-3A stage remains above the desired operational range but is moving roughly parallel to the rising limb of the regulation schedule. Stage changes were very moderate within the WCAs over the last week at the gauges monitored for this report except for WCA-2A which dropped 0.40 feet (gauge 2-17). Ascension rates should remain below 0.25 feet per week or 0.5 feet per 2 weeks to protect Apple Snail reproduction within the WCAs. This rate change will most likely be exceeded in WCA-2A due to an unseasonable descent. Stages in Taylor Slough are still 2 inches higher than average for this time of year. Florida Bay salinities continue to elicit some concern as both the bay and the nearshore area remain above average for this time of year.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.41 inches of rainfall in the past week and the Lower Basin received 0.74 inches (SFWMD Daily Rainfall Report 9/16/2019).

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: 9/17/2019

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)						
							9/15/19	9/8/19	9/1/19	8/25/19	8/18/19	8/11/19	8/4/19
Lakes Hart and Mary Jane	S-62	53	LKMJ	60.0	R	60.0	0.0	0.0	-0.2	-0.1	0.0	0.0	0.1
Lakes Myrtle, Preston, and Joel	S-57	9	S-57	61.0	R	61.0	0.0	0.0	-0.2	-0.1	0.0	0.0	-0.3
Alligator Chain	S-60	0	ALLI	63.1	R	63.2	-0.1	0.0	-0.2	0.0	0.0	0.1	-0.3
Lake Gentry	S-63	0	LKGT	60.9	R	61.0	-0.1	0.0	-0.2	0.0	-0.2	-0.1	-0.9
East Lake Toho	S-59	0	TOHOE	56.5	R	56.7	-0.2	-0.2	-0.2	0.0	0.3	0.5	0.0
Lake Toho	S-61	0	TOHOW, S-61	53.8	R	53.7	0.1	0.0	-0.1	-0.1	0.1	0.2	0.0
Lakes Kissimmee, Cypress, and Hatchineha	S-65	1,443	KUB011, LKIS5B	50.8	R	51.2	-0.4	-0.1	0.0	0.5	0.6	0.2	-0.3

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 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: 9/17/2019

Metric	Location	1-Day Average		Average for the Preceding 7-Days ¹								
		9/15/2019	9/15/19	9/8/19	9/1/19	8/25/19	8/18/19	8/11/19	8/4/19	7/28/19	7/21/19	7/14/19
Discharge (cfs)	S-65	1,482	1,443	2,135	5,414	5,640	3,852	2,198	783	777	1,110	548
Discharge (cfs)	S-65A ²	1,405	1,412	2,676	5,795	6,547	5,681	3,248	1,665	903	1,123	749
Discharge (cfs)	S-65D ²	2,172	2,976	5,734	6,983	8,207	5,917	3,167	1,618	1,378	1,396	1,020
Headwater Stage (feet NGVD)	S-65D ²	26.72	27.00	27.56	27.48	27.42	26.50	25.88	25.77	25.79	25.78	25.81
Discharge (cfs)	S-65E ²	2,205	2,988	5,615	6,932	8,155	5,871	3,000	1,495	1,259	1,250	944
Discharge (cfs)	S-67	0	28	17	31	24	34	46	85	93	92	97
DO (mg/L) ³	Phases I & II/III river channel	3.2	2.3	1.9	0.8	0.3	0.7	0.7	3.2	4.2	3.3	3.3
Mean depth (feet) ⁴	Phase I floodplain	0.86	1.04	2.18	2.82	3.25	2.71	1.73	0.77	0.52	0.55	0.46

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

²S-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.

³DO is the average for sondes at KRBN, PC62, PC33, PD62R, and PD42R.

⁴1-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)

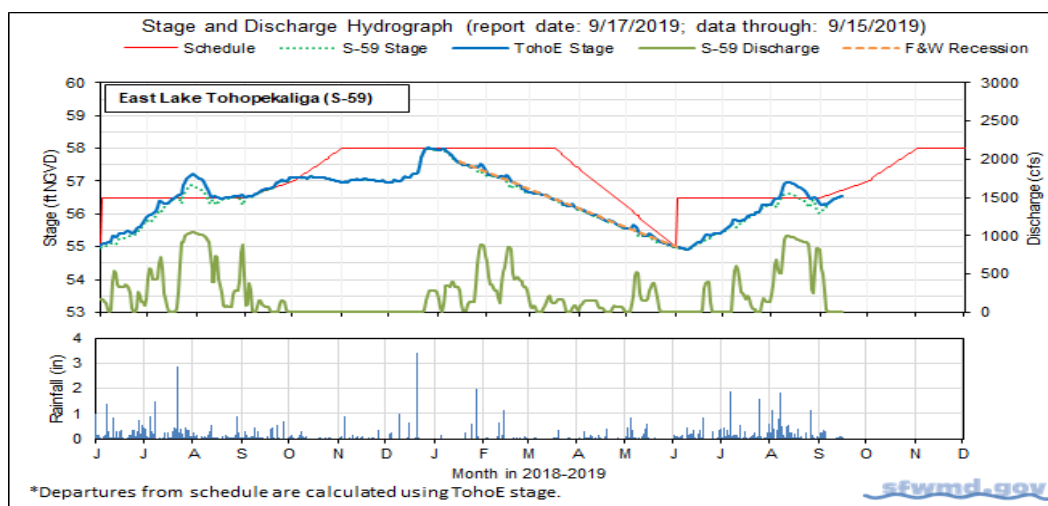


Figure 1.

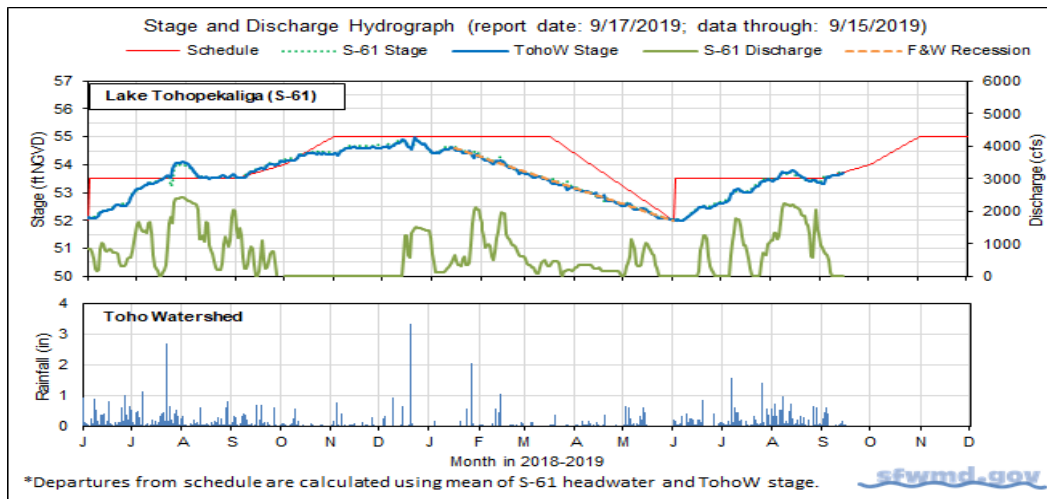


Figure 2.

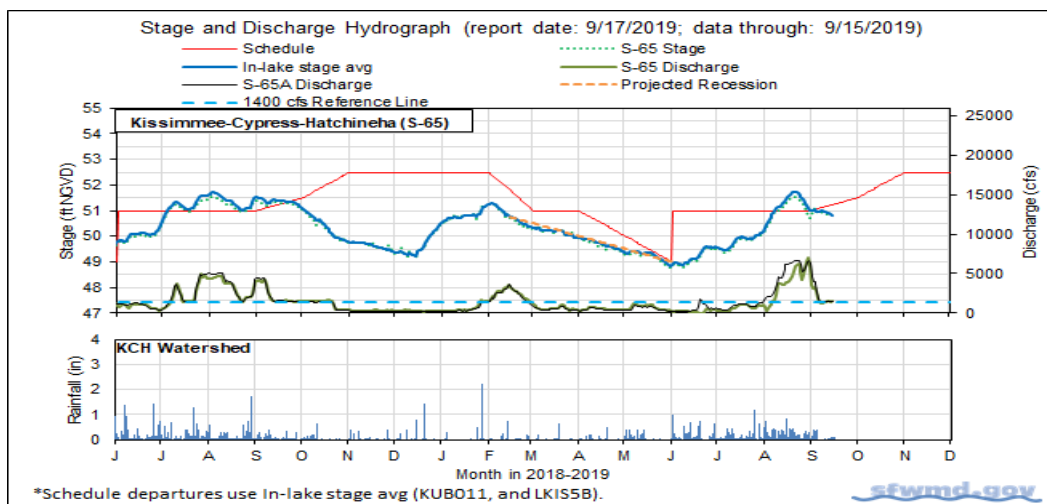


Figure 3.

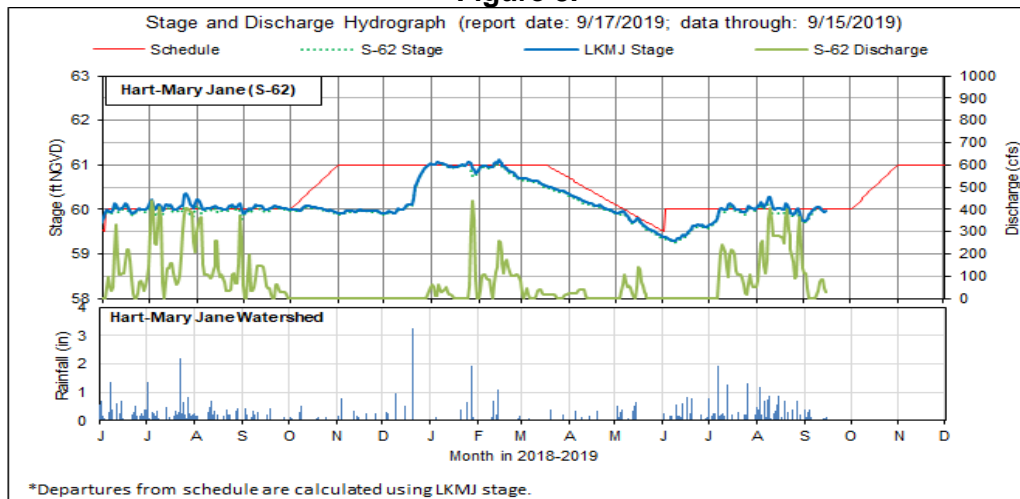


Figure 4.

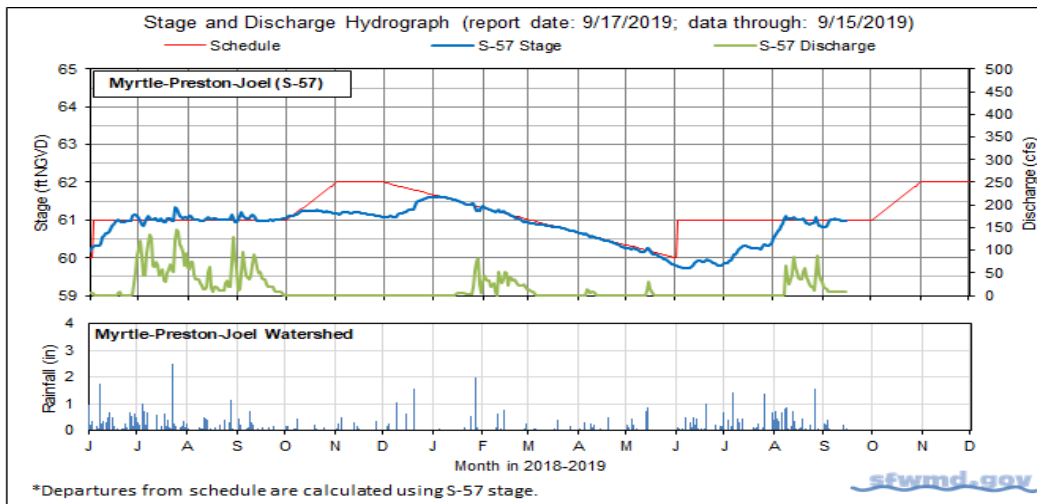


Figure 5.

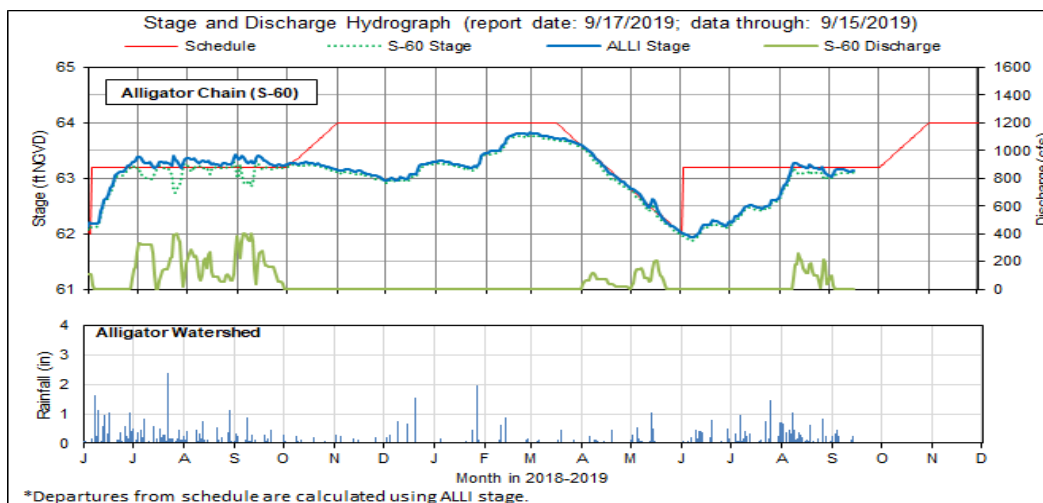


Figure 6.

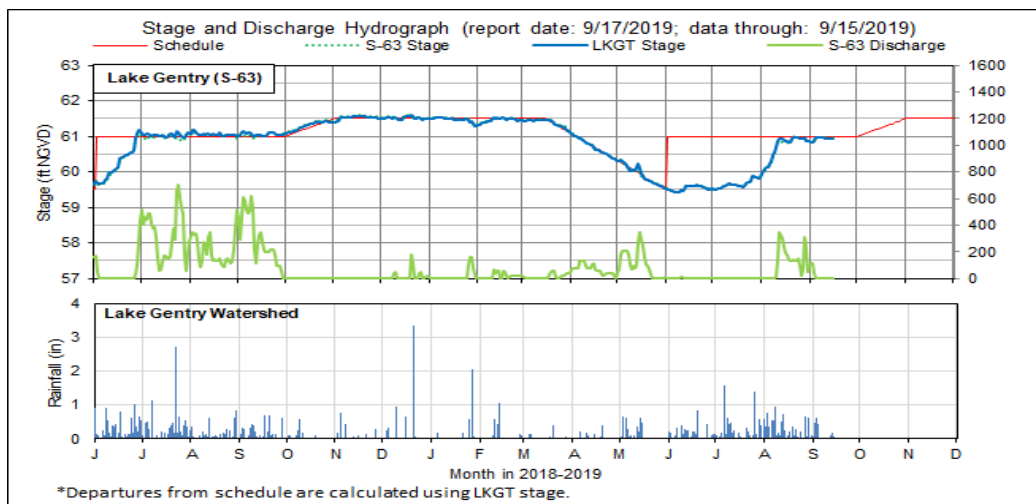


Figure 7.

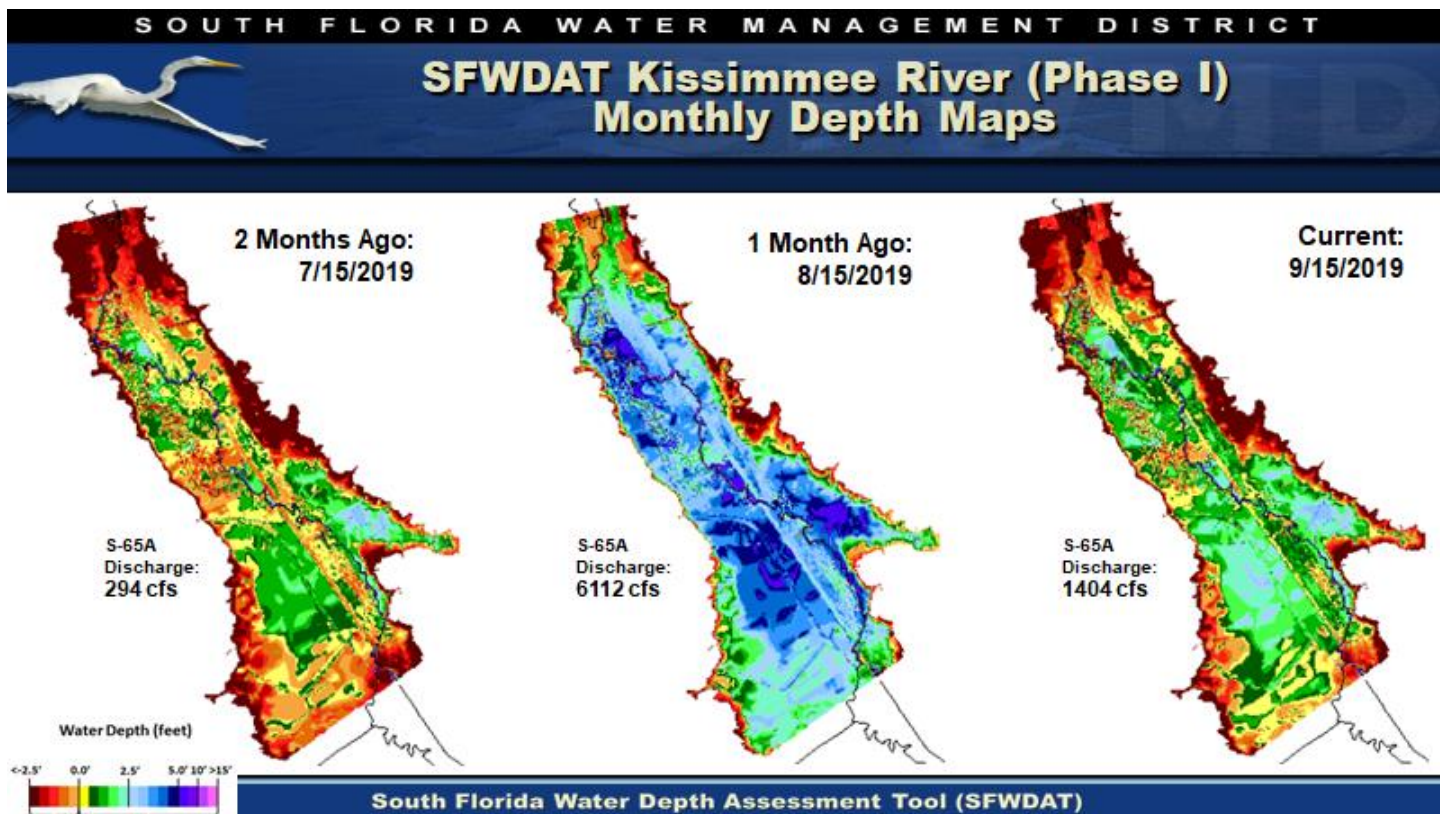


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

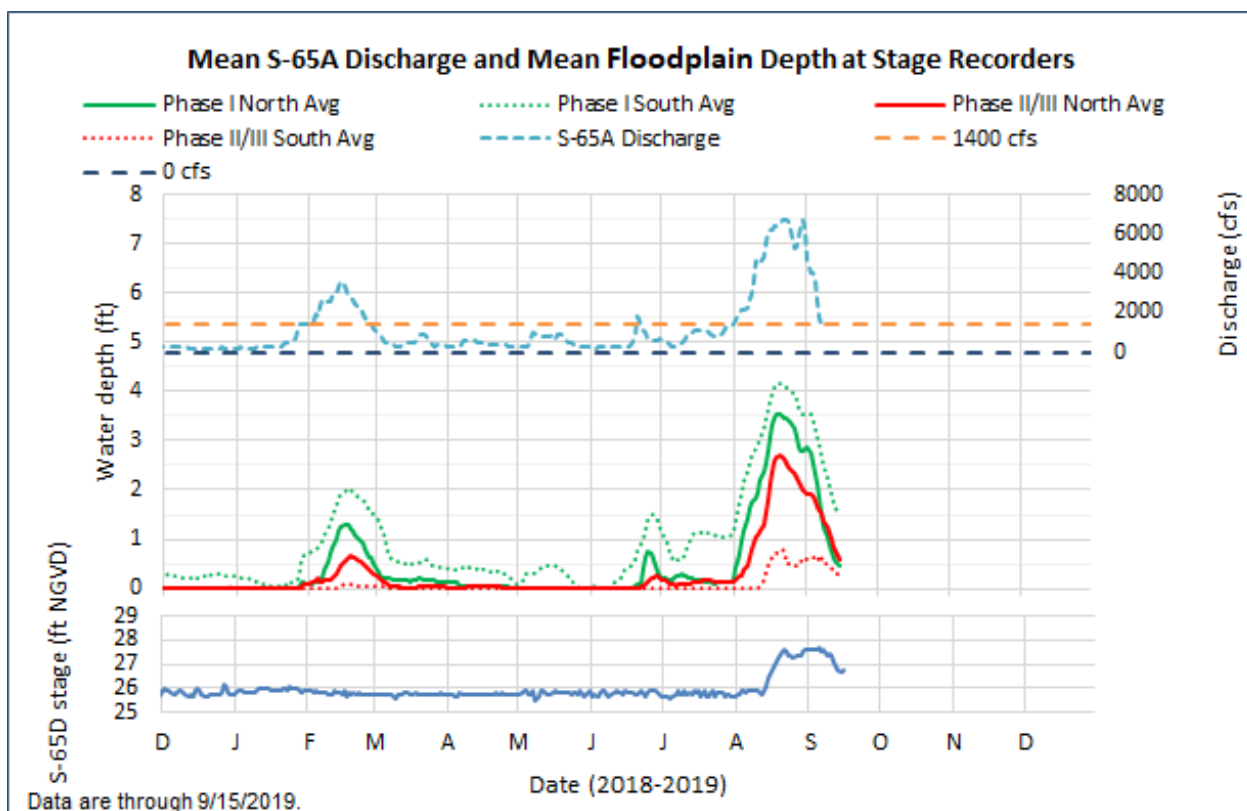
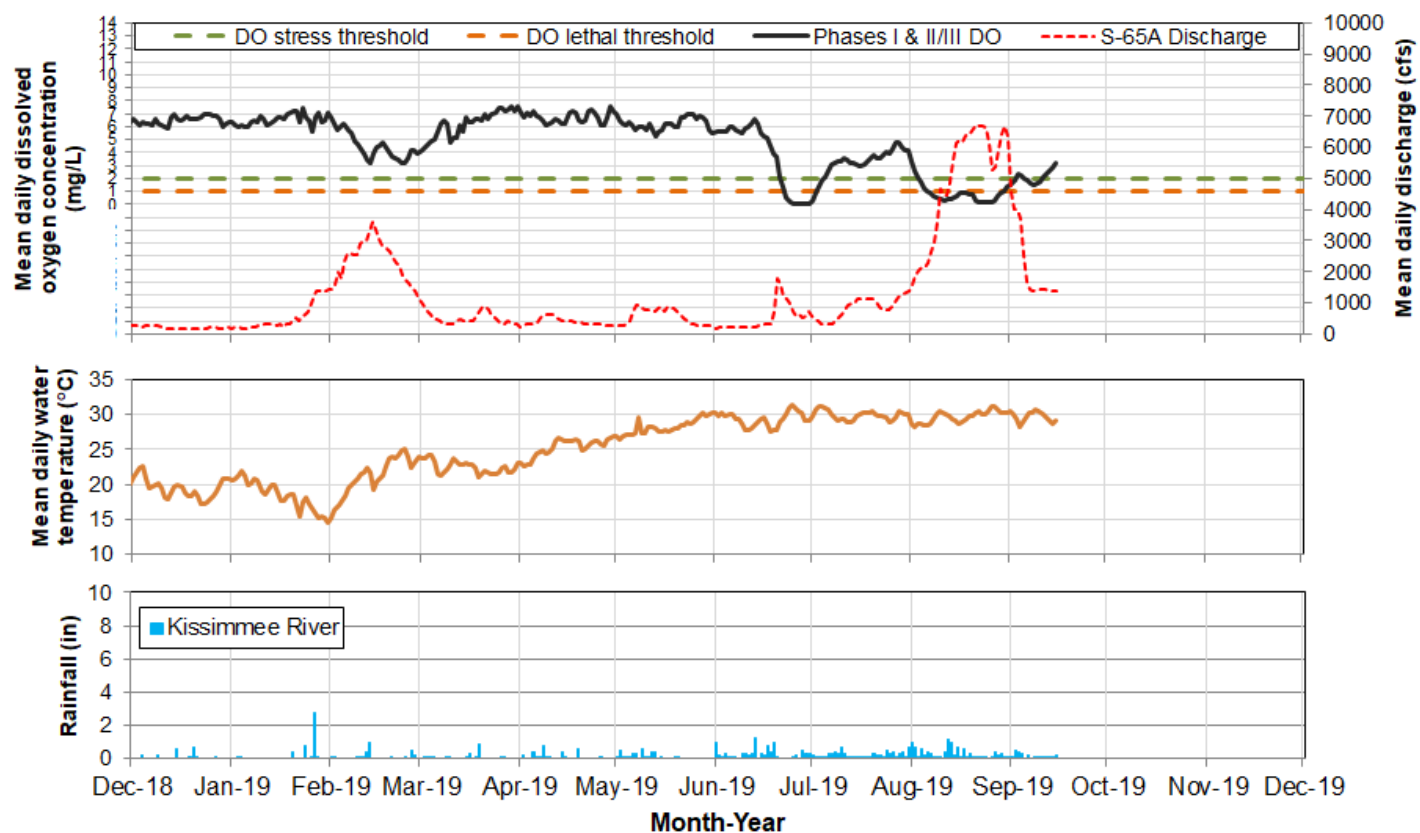


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.



Report Date: 9/17/2019; data are through: 9/15/2019.

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
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-65A 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-65A 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-65A 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-65A 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
7/8/2019	No new recommendations.		N/A		7/9/2019
6/27/2019	Continue discharge reductions at S-65A at up to double the normal rampdown rate, as possible.	Reduce river channel stage to allow DO recovery.	TBD	KB Ops	7/2/2019
6/27/2019	Manage S65 discharge to slow stage ascension to the extent possible.	Slow the rate of stage ascension in KCH.	TBD	KB Ops	7/2/2019
6/24/2019	Continue discharge reductions at S-65A at up to double the normal rampdown rate, as possible.	Reduce river channel stage to allow DO recovery.	Implemented	KB Ops	6/25/2019

Kissimmee Basin 2019 Wet Season

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 ± 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.

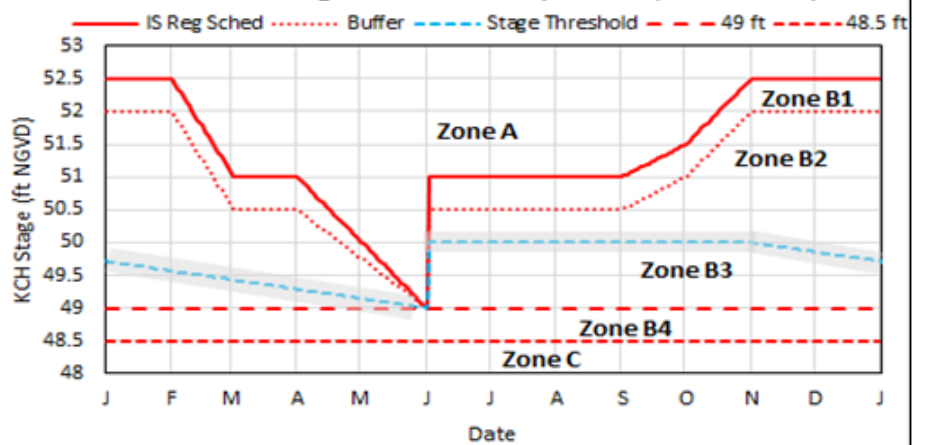
*Changes in discharge should not exceed limits in inset table below.

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 5/16/2019

Preferred Discharge Plan for S-65/S-65A (IS-14-50.0)

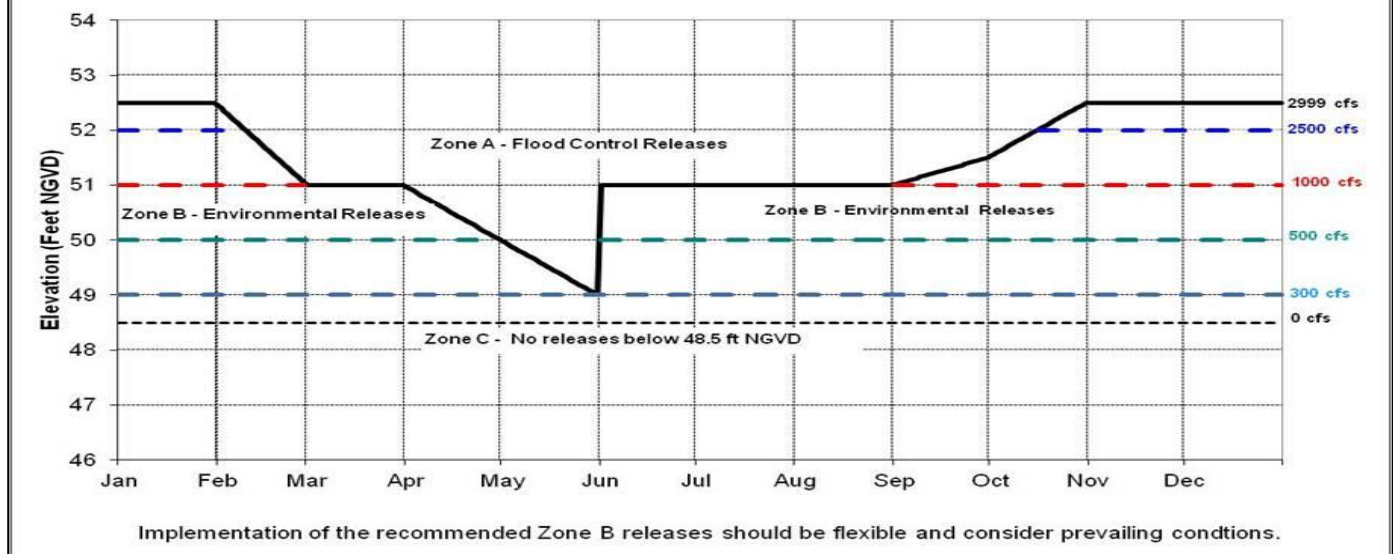


Other Considerations

- 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.

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

Interim Operational Schedule and Release Rules for Lakes Kissimmee-Hatchineha-Cypress controlled by S-65.



Implementation of the recommended Zone B releases should be flexible and consider prevailing conditions.

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

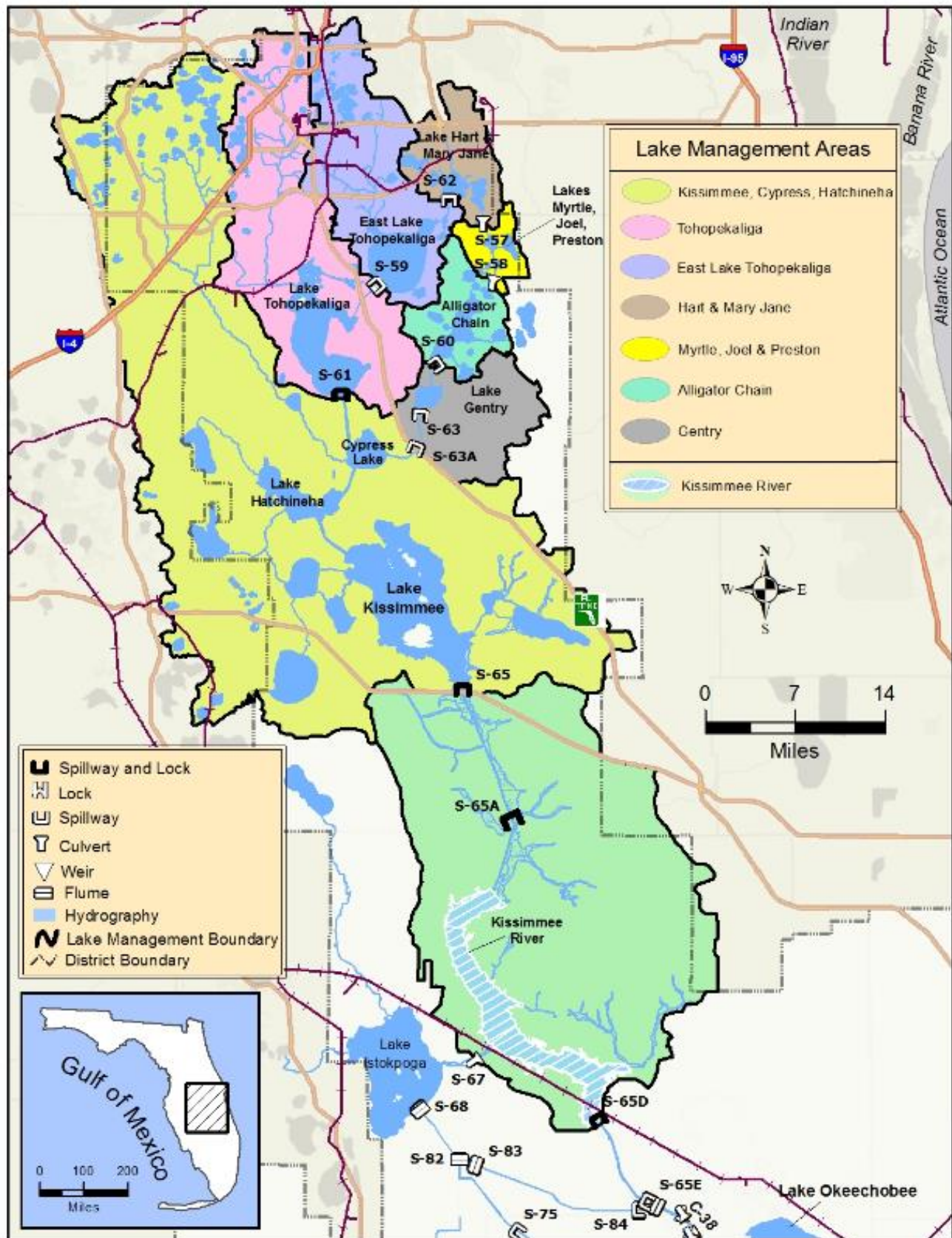


Figure 13. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 13.88 feet NGVD for September 16, 2019 decreasing 0.08 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 0.98 feet higher than a month ago and 0.92 feet lower than a year ago (Figure 1) when stages were about a foot above the top of the preferred ecological envelope (Figure 2). The Lake moved into the Beneficial Use sub-band in early August, continued to rise and moved into the Low sub-band last week but dropped back down into the Base Flow sub-band this week (Figure 3). With the recent reversal, Lake stage is now the same as in 2015 and lower than all other years for this time of year except 2011 (Figure 4). According to RAINDAR, during the week of September 10 to September 16, 2019, 0.61 inches of rain fell directly over the Lake, compared to 0.37 inches the previous week. During that same time period, 0.828 inches of rain fell District-wide, compared to 0.557 inches the previous week. This week, most of the watershed received between 0.5 and 1.5 inches of rain although a few sections received slightly more or slightly less than the lake (Figure 5).

The average daily inflows (minus rainfall) to the Lake decreased for the second consecutive week going from 6,055 cfs to 2,991 cfs. All source inflows except S-133 P decreased with the Kissimmee River (S-65E & S-65EX1) going from 5,256 cfs to 2,749 cfs, those from Lake Istokpoga (via S-84 and S71) going from 518 cfs to 99 cfs and inflows from Fisheating Creek decreased from 157 cfs to 83 cfs. Passive backflow from the L-8 at Canal Point (via CLV10A) also decreased to 0 cfs, as did pumping from the various S-100 pumps. (Table 1).

Outflow (minus evapotranspiration) increased from 1,760 cfs to 3,542 cfs with 3,190 cfs going south through the S-350 structures for water supply and 352 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 1.21 inches to 1.13 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.

The most recent viable satellite imagery (September 15, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel 3 OLCI sensor data had cloud cover over the northwest portions of the lake but appears to show reduced bloom potential in the west and north (Figure 7).

Water Management Recommendations

Lake Okeechobee stage is 13.88 feet NGVD, decreasing 0.08 feet from the previous week but still 0.98 feet higher than last month. The Lake moved up into the Low sub-band last week then moved back down into the Base Flow sub-band this week. 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. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone and although a reversal occurred this week an increase in lake stage in the future will stress newly established plants and could reduce the beneficial effects that recent low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the Lake (September 15, 2019) shows reduced bloom potential across the northwestern and southern areas, however the latest pictures exhibit high cloud cover.

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	5256	2749	1.1
S-71 & S-72	189	31	0.0
S-84 & S-84X	329	68	0.0
Fisheating Creek	157	83	0.0
S-154	40	18	0.0
S-191	41	11	0.0
S-133 P	10	20	0.0
S-127 P	16	11	0.0
S-129 P	5	0	0.0
S-131 P	2	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	12	0	0.0
Rainfall	889	1463	0.6
Total	6945	4455	1.9

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	0	352	0.1
S-308	2	0	0.0
S-351	555	832	0.3
S-352	490	873	0.4
S-354	713	1485	0.6
L-8 Outflow			
ET	2026	2708	1.1
Total	3786	6249	2.6

Provisional Data

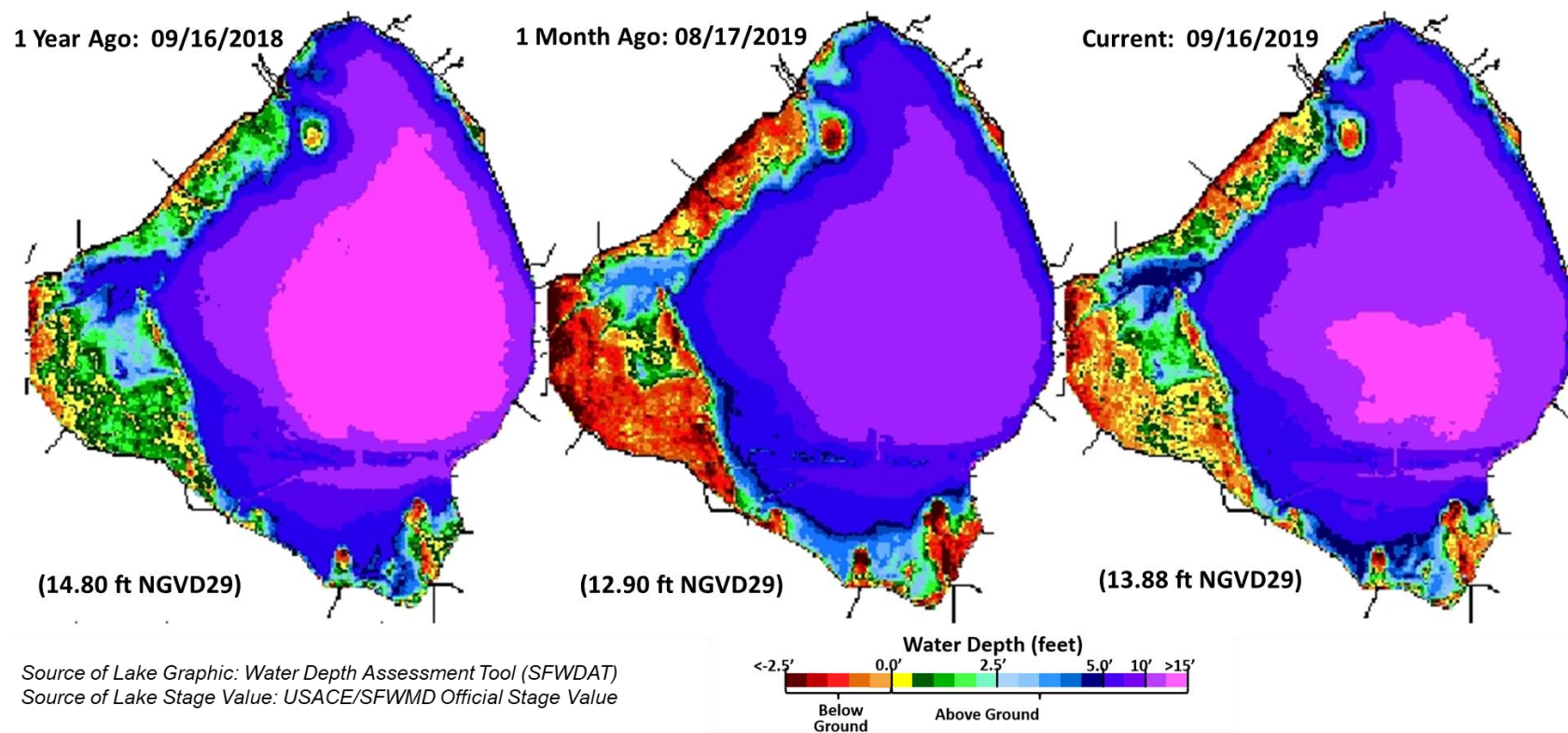


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

Lake Okeechobee Stage vs Ecological Envelope

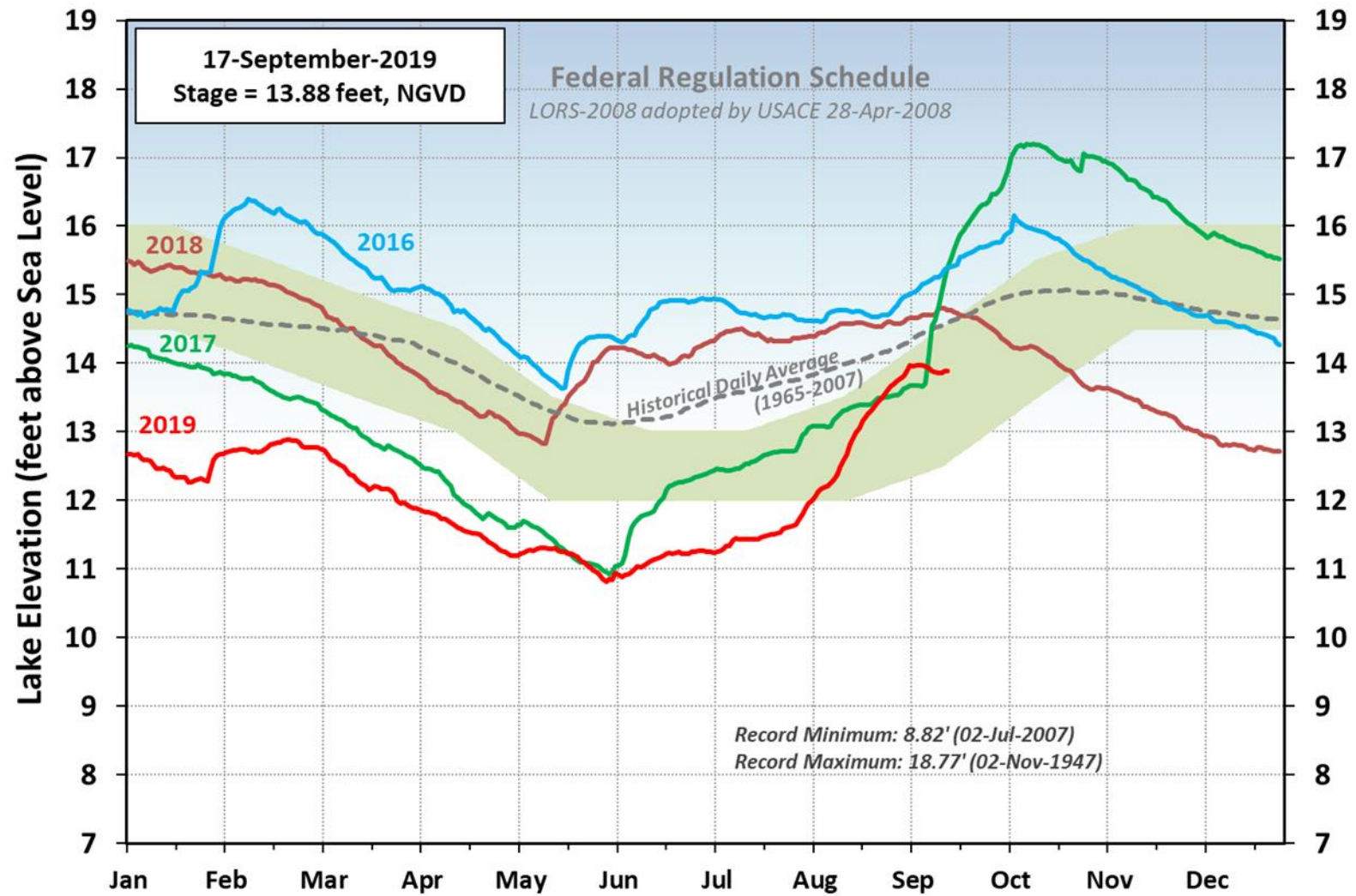


Figure 2. Select annual stage hydrographs for Lake Okeechobee in comparison to the Ecological Envelope.

Lake Okeechobee Water Level History and Projected Stages

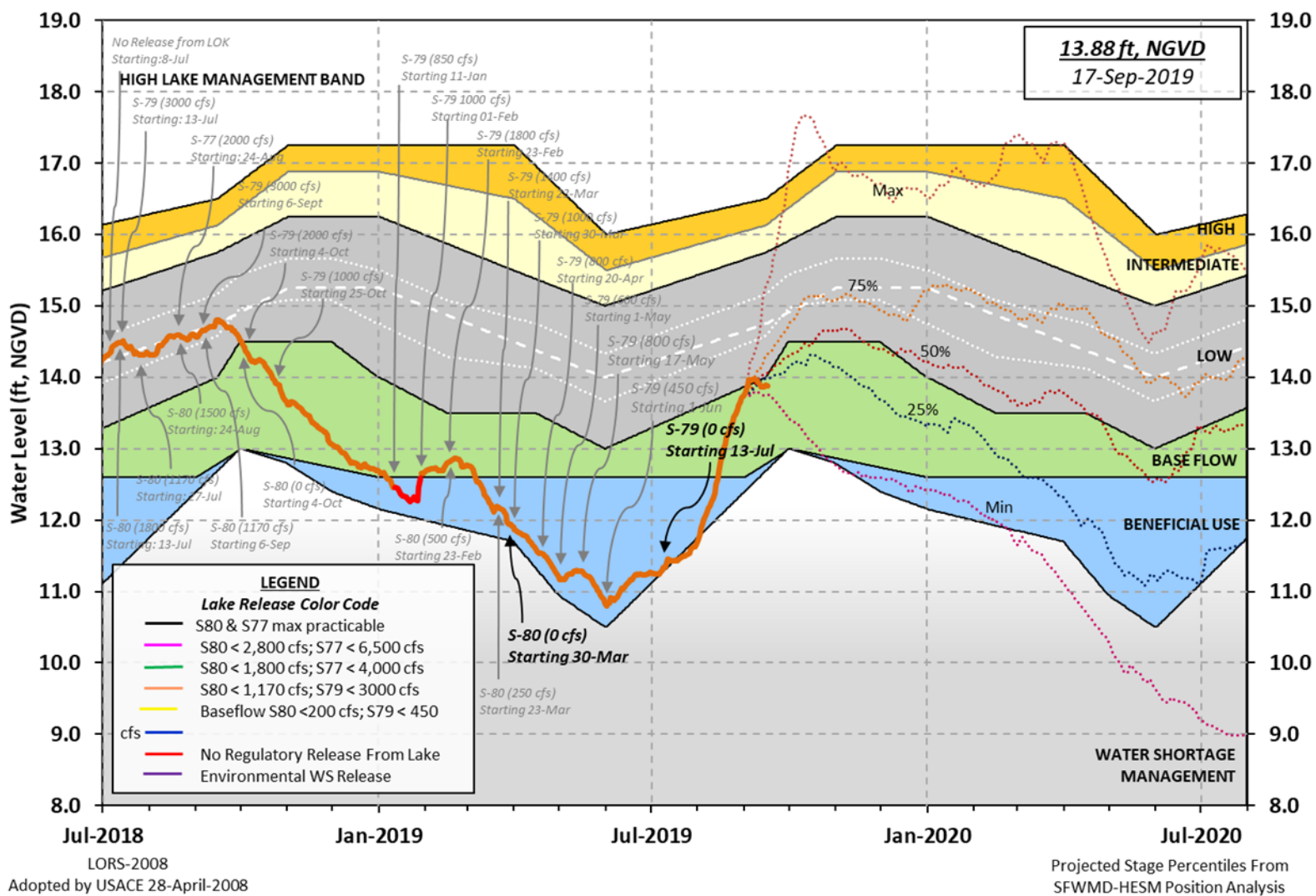


Figure 3. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

Lake Okeechobee Water Level Comparison

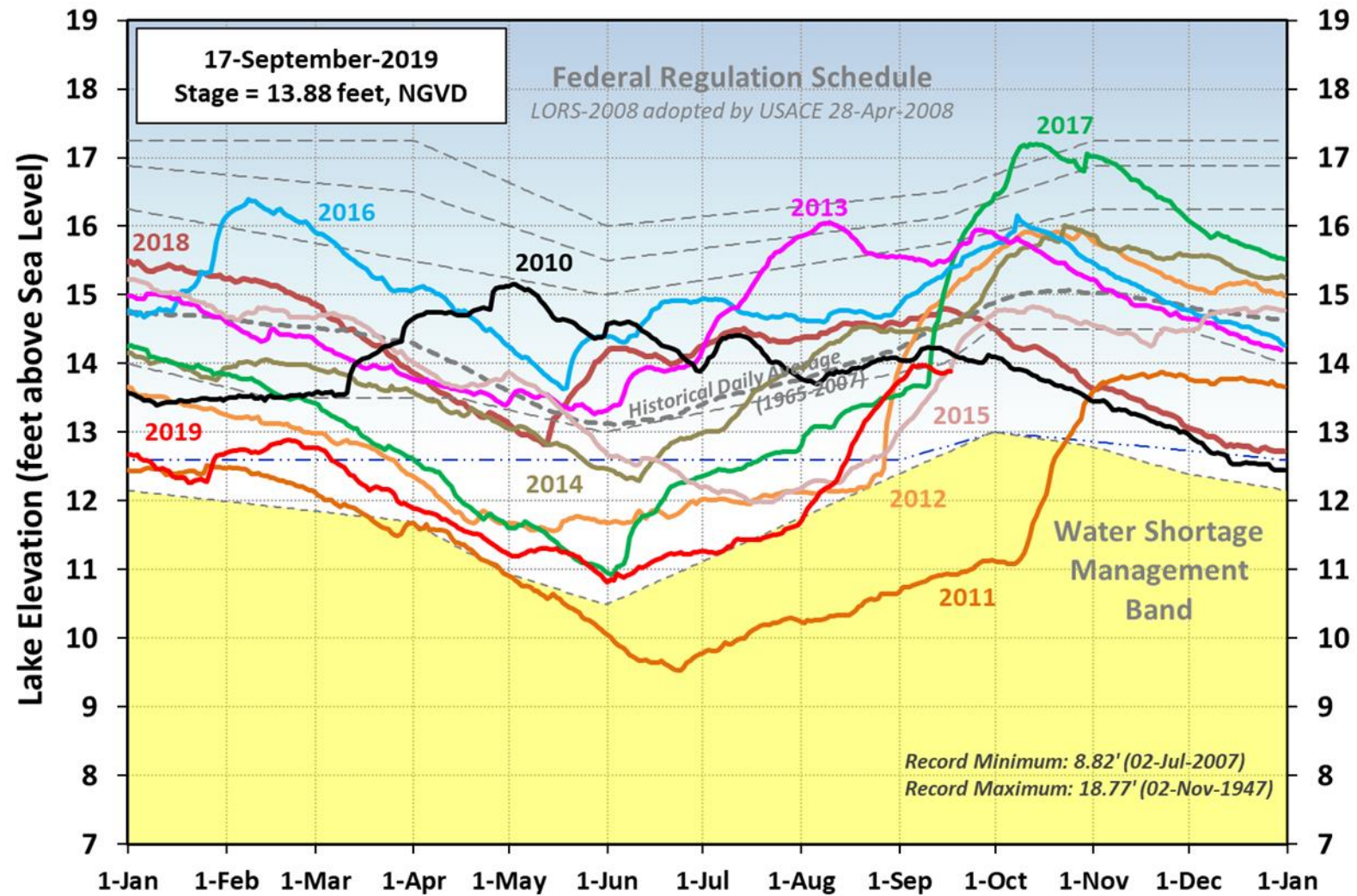


Figure 4. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

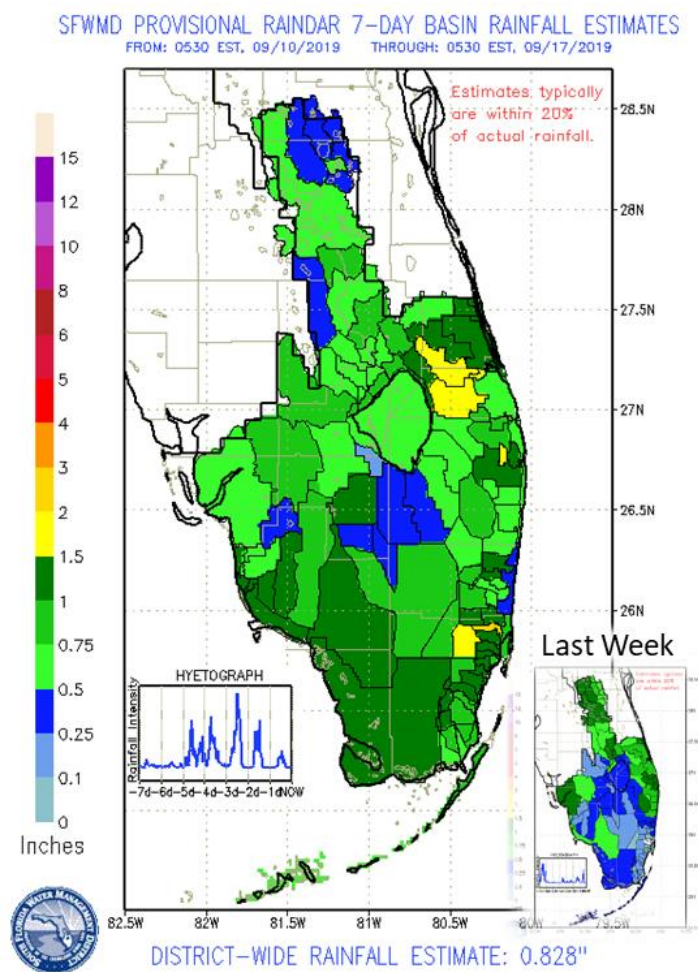


Figure 5. Rainfall estimates by basin.

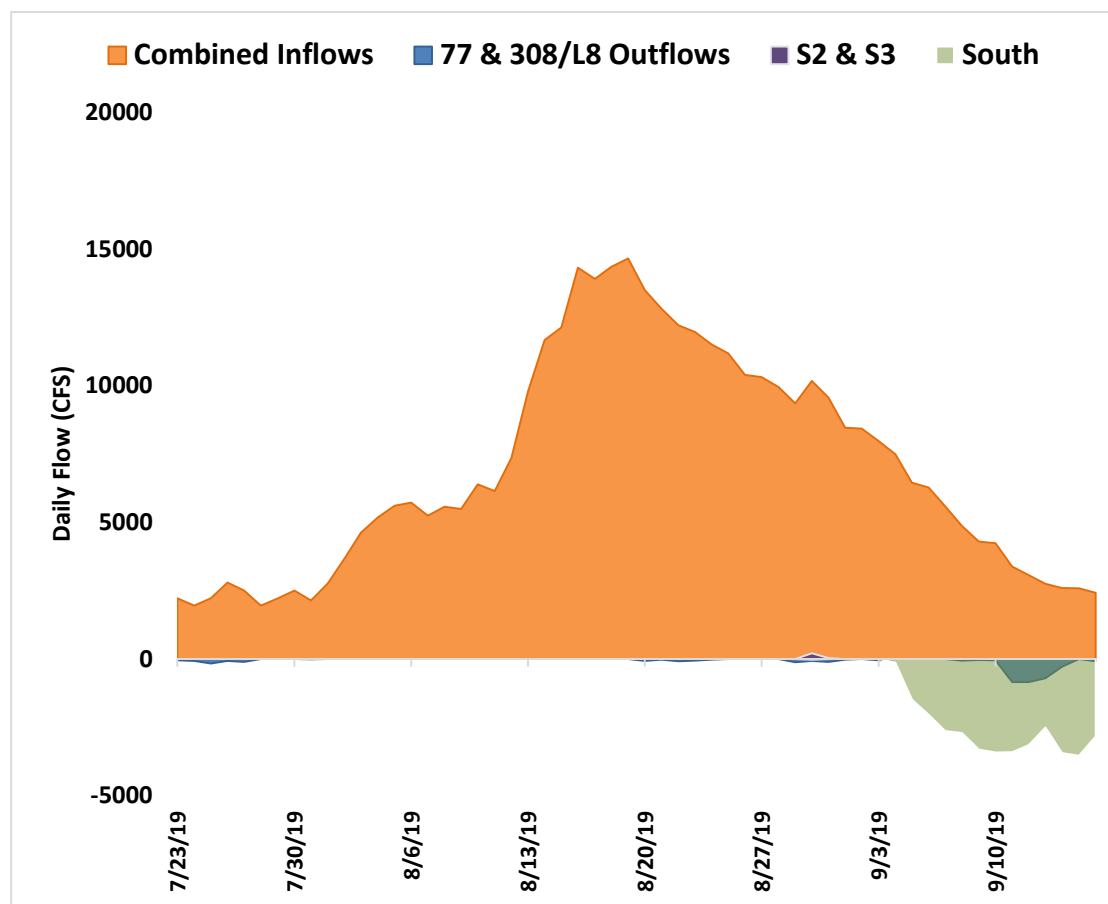


Figure 6. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive 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.

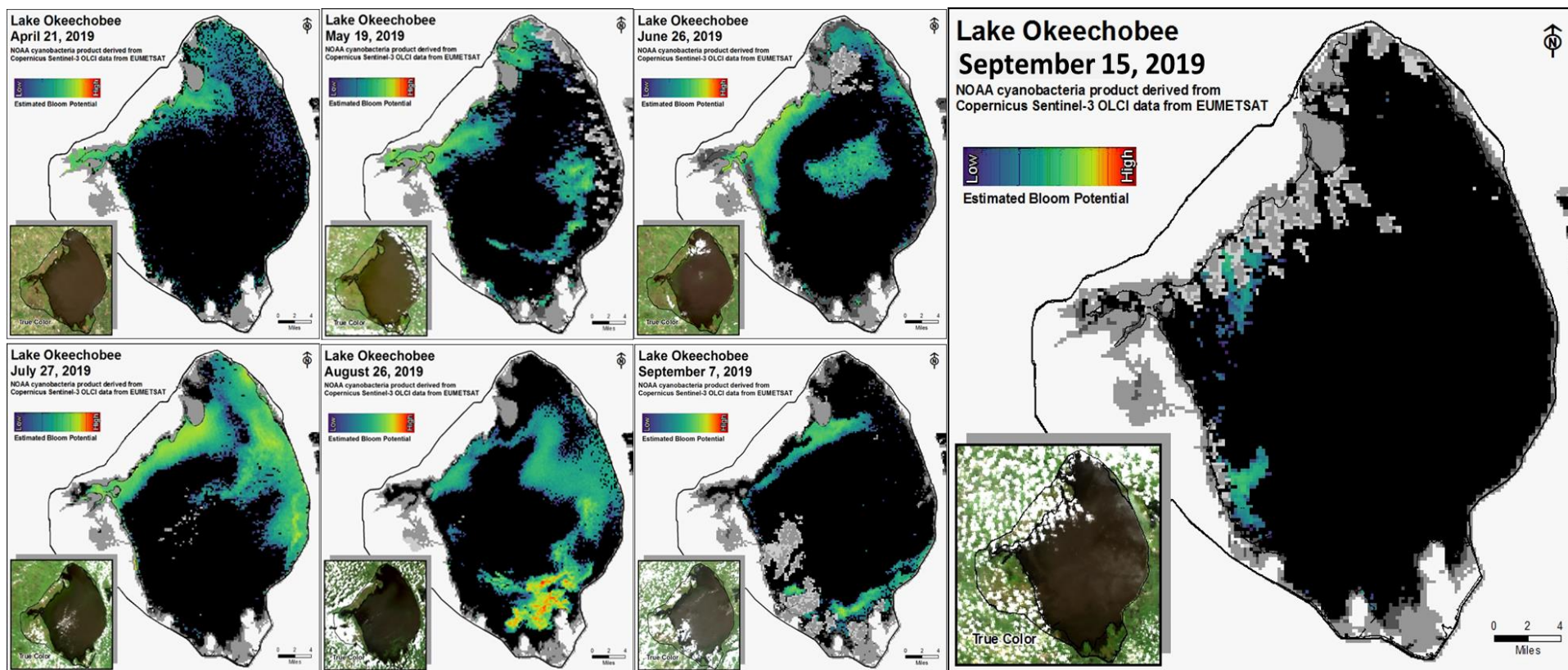


Figure 7. Potential for cyanobacterial blooms on Lake Okeechobee in 2019, based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 978 cfs (Figures 1 and 2) and last month inflow averaged about 1,788 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).

Location	Flow (cfs)
Tidal Basin Inflow	439
S-80	159
S-308	0
S-49 on C-24	137
S-97 on C-23	111
Gordy Rd. structure on Ten Mile Creek	132

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 9.2. Salinity conditions in the middle estuary are within the fair 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.

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	4.1 (3.4)	8.0 (6.9)	NA ¹
US1 Bridge	6.6 (4.7)	11.9 (11.0)	10.0-26.0
A1A Bridge	21.7 (16.1)	EM ² (EM)	NA ¹

¹Envelope not applicable and ²Equipment Malfunction.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1,024 cfs (Figures 5 and 6) and last month inflow averaged about 3,618 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

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

Location	Flow (cfs)
S-77	352
S-78	211
S-79	641
Tidal Basin Inflow	383

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 Shell Point and Sanibel and in the fair range at Cape Coral (Figure 9). The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.5 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

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

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	0.2 (0.2)	0.2 (0.2)	NA ¹
Val I75	0.3 (0.2)	0.4 (0.2)	0.0-5.0 ²
Ft. Myers Yacht Basin	1.2 (0.2)	1.5 (0.2)	NA
Cape Coral	6.6 (3.5)	9.2 (4.9)	10.0-30.0
Shell Point	20.6 (18.0)	22.2 (19.5)	10.0-30.0
Sanibel	27.2 (25.0)	28.2 (26.7)	10.0-30.0

¹Envelope not applicable, ²Envelope is based on a 30-day average, and ³Equipment 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 0.5 to 2.5 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 215 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	215	2.5	0.7
B	300	215	1.4	0.5
C	450	215	1.0	0.4
D	650	215	0.7	0.3
E	800	215	0.5	0.3

Red tide

The Florida Fish and Wildlife Research Institute reported on September 13, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed in background to very low concentration in 13 samples collected from or offshore of Lee County and was not observed in samples collected from St. Lucie, Martin, or Palm Beach counties (no samples were analyzed this week from Broward or Miami-Dade counties).

Water Management Recommendations

Lake stage is in the Base Flow sub-band. Tributary conditions are wet. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to areas further downstream.

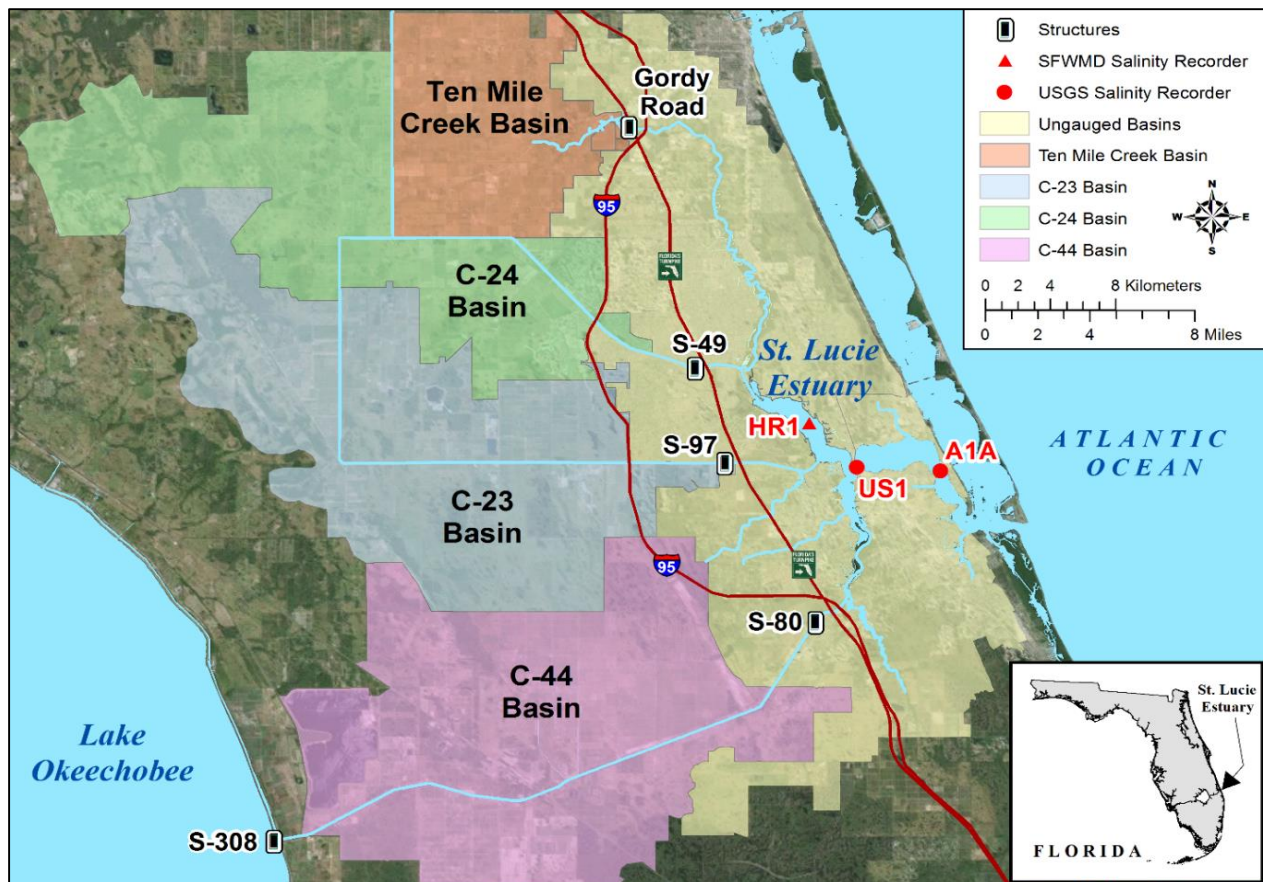


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

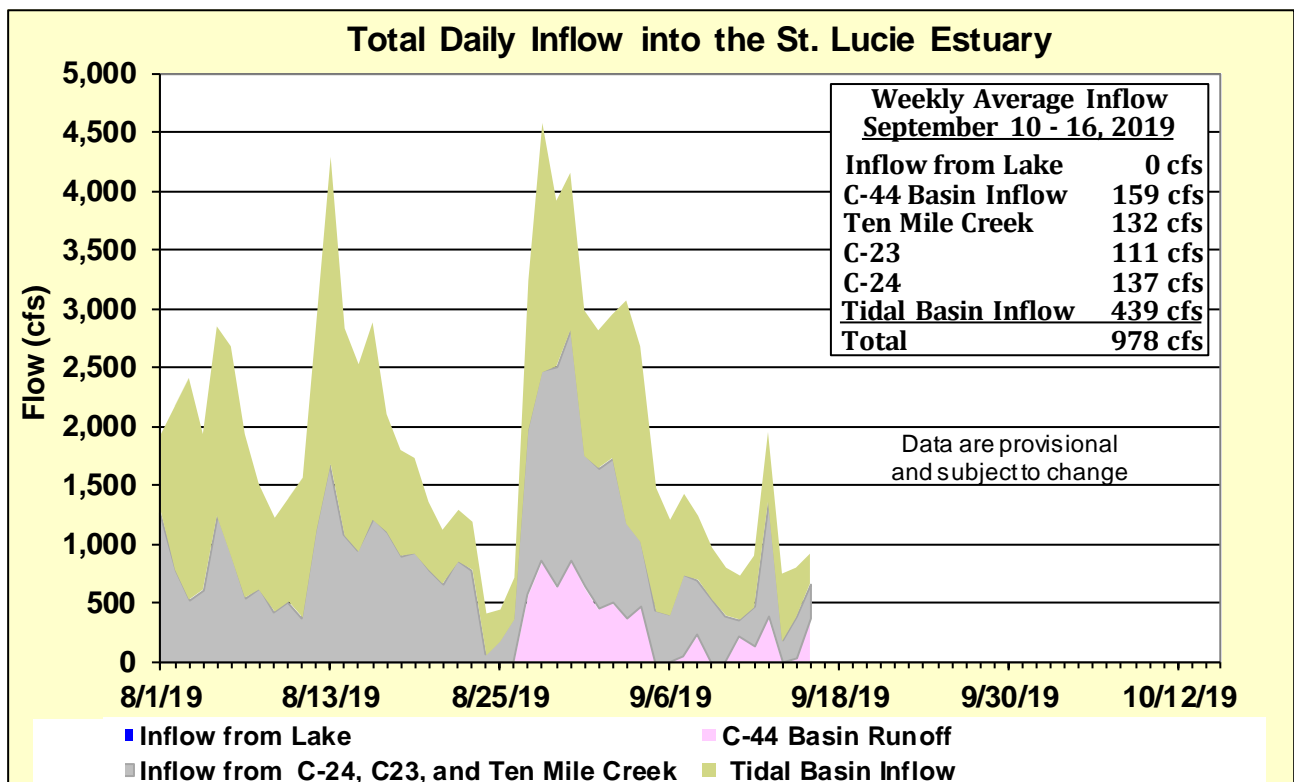


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

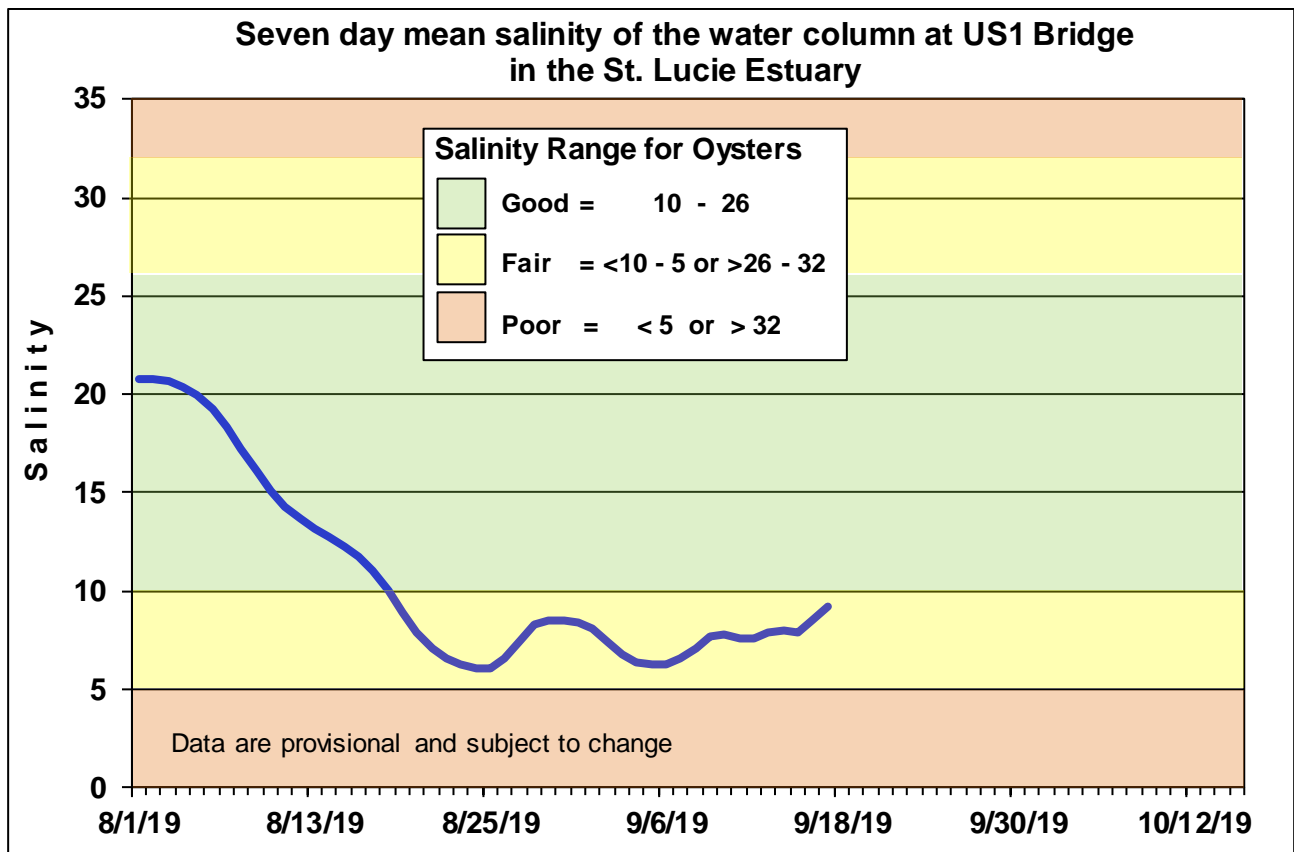


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

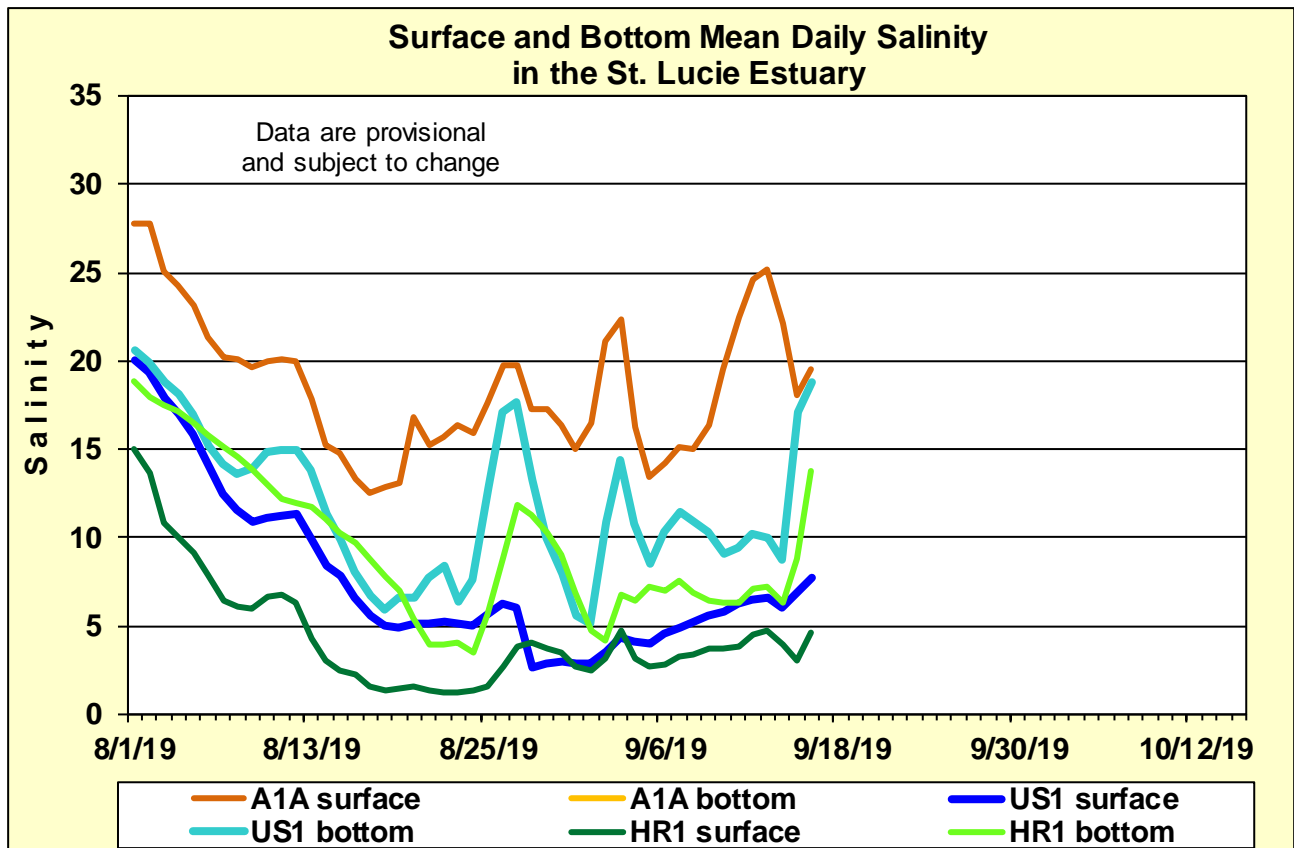


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

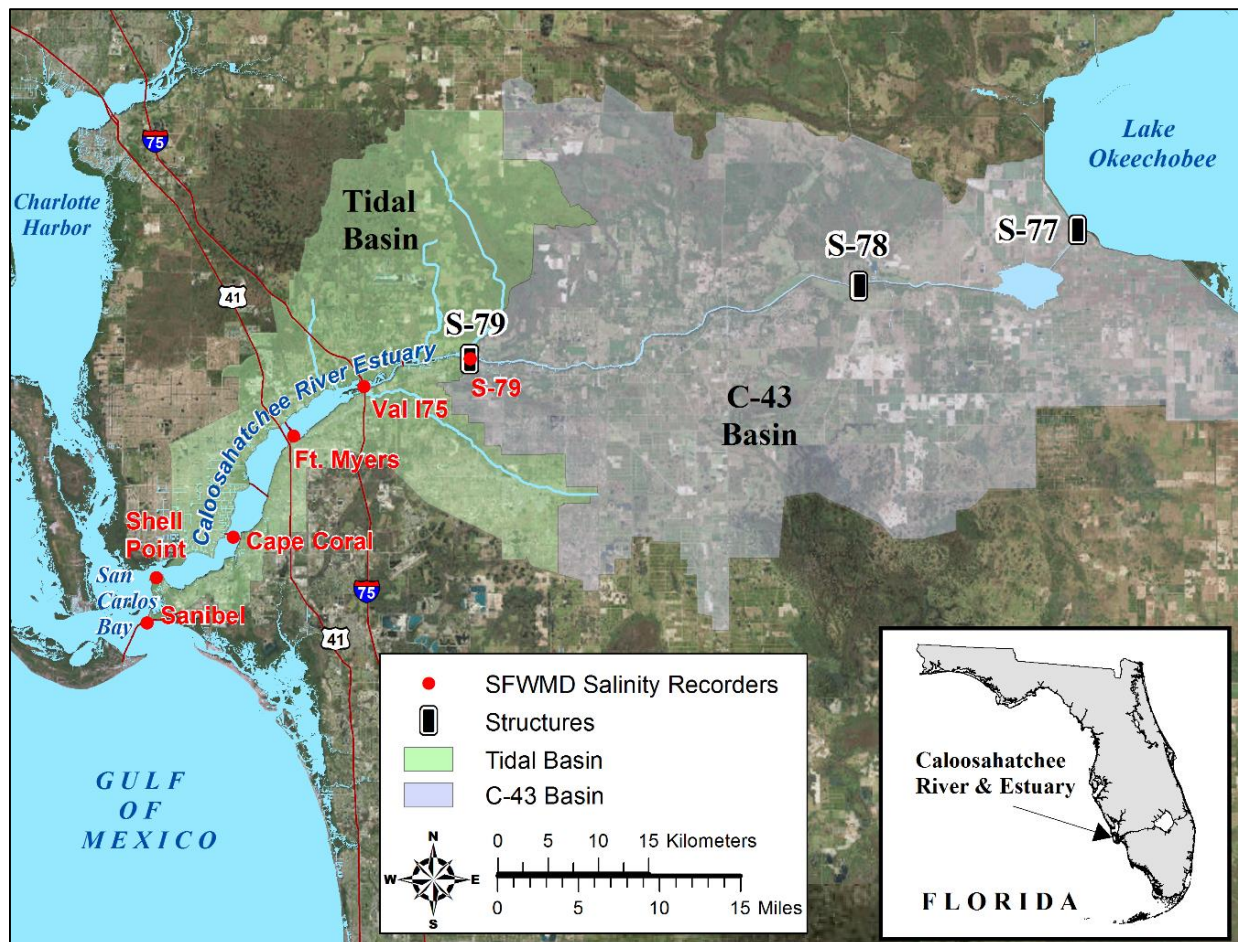


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

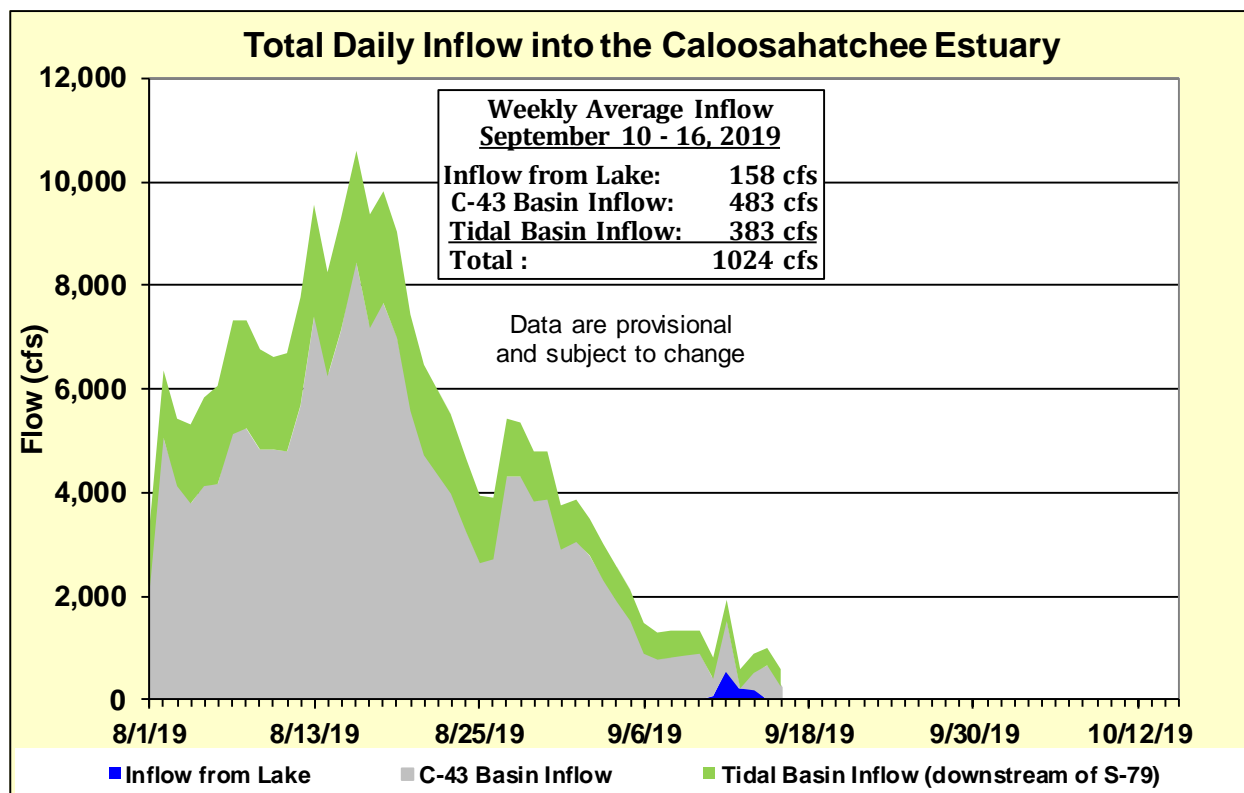


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

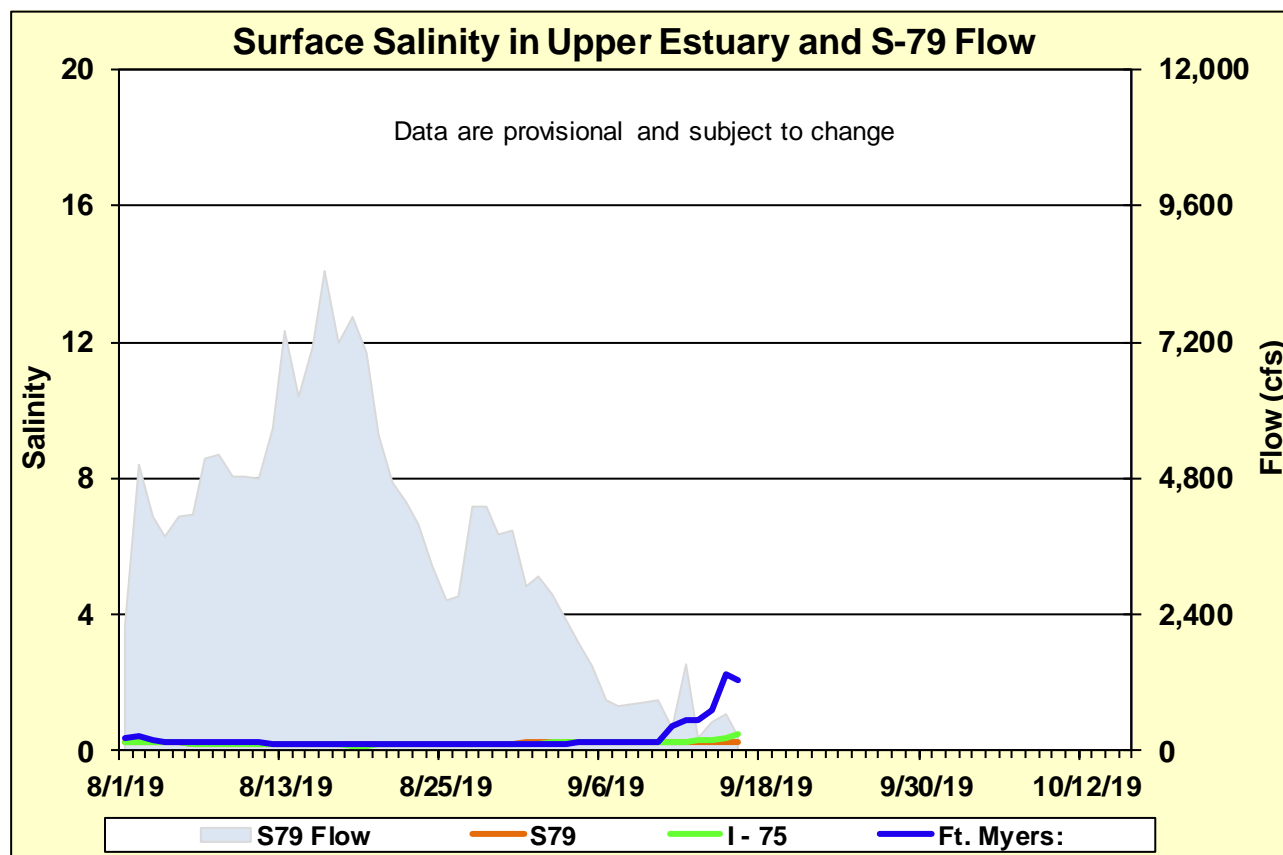


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

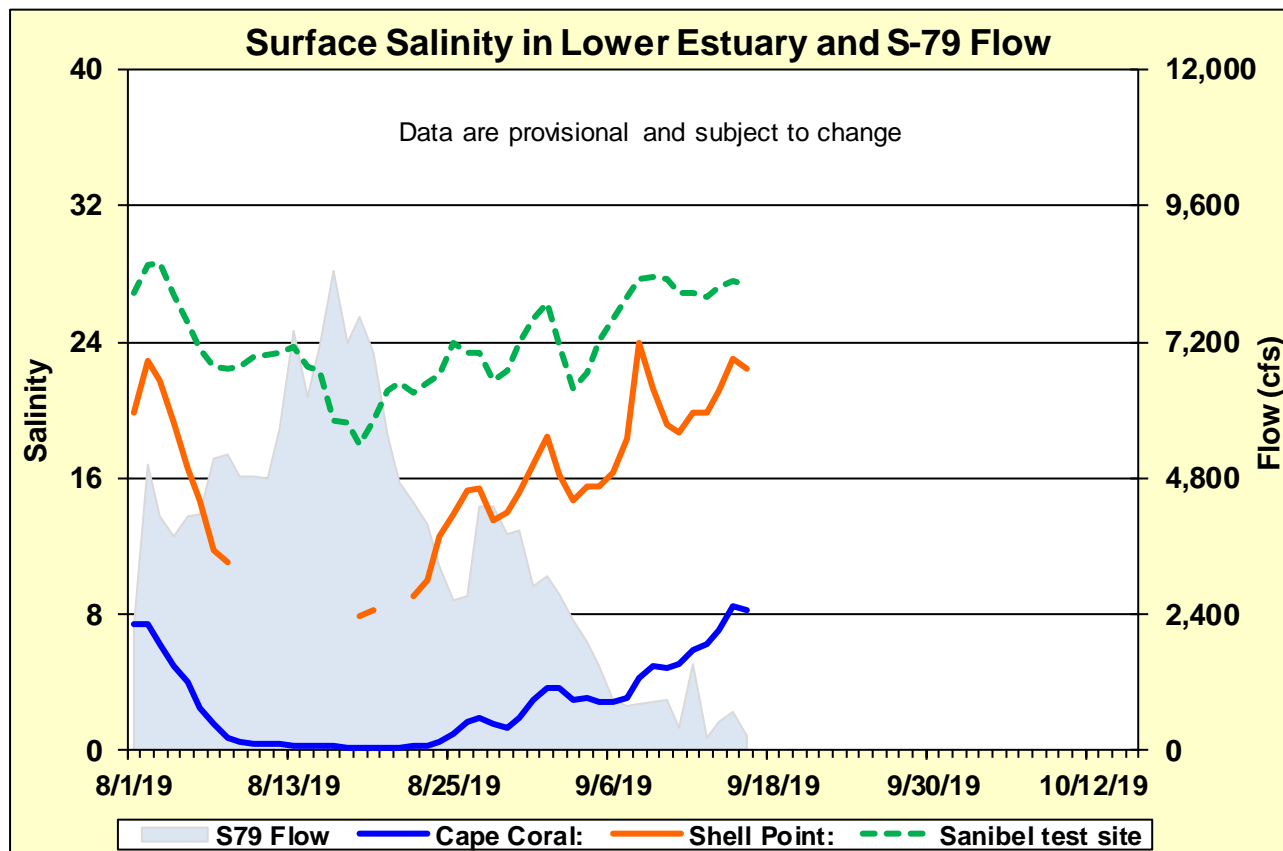


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

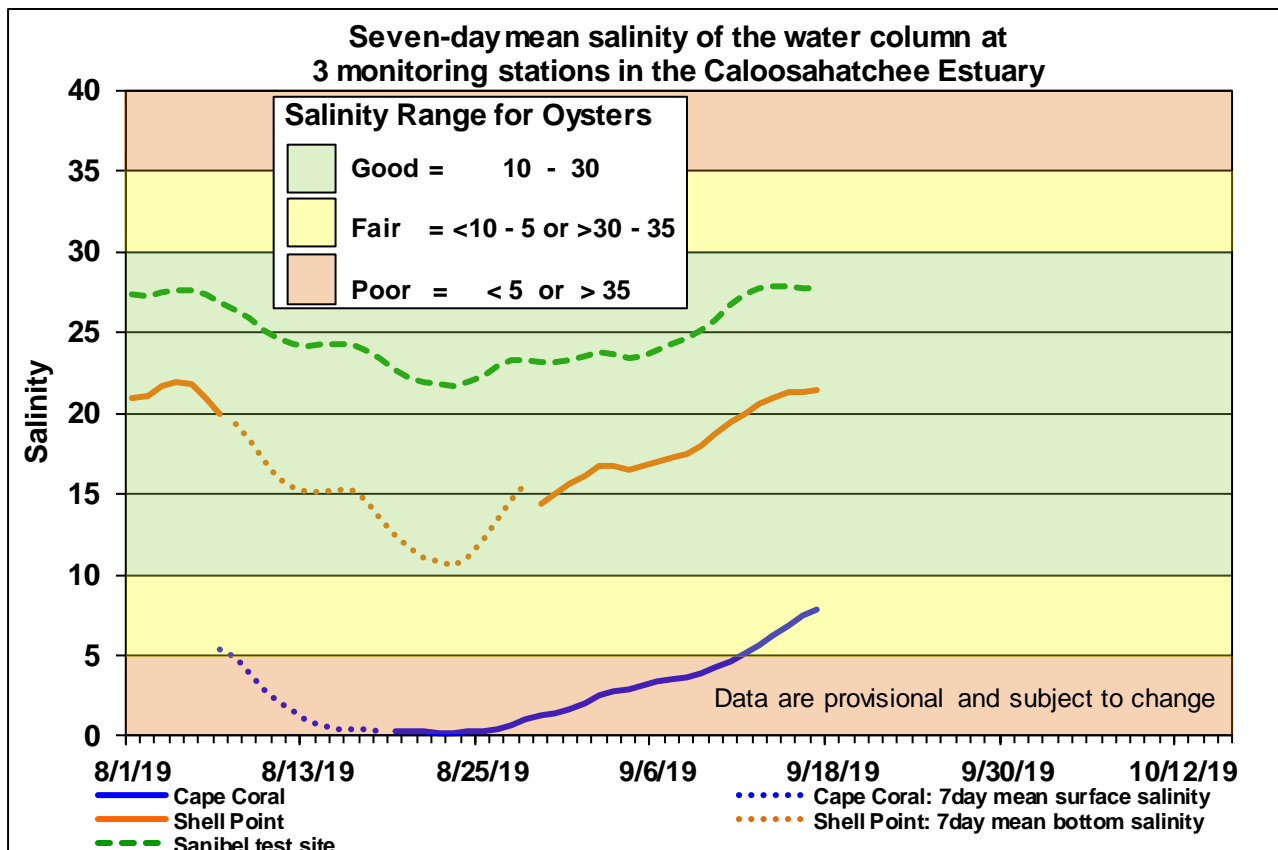


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

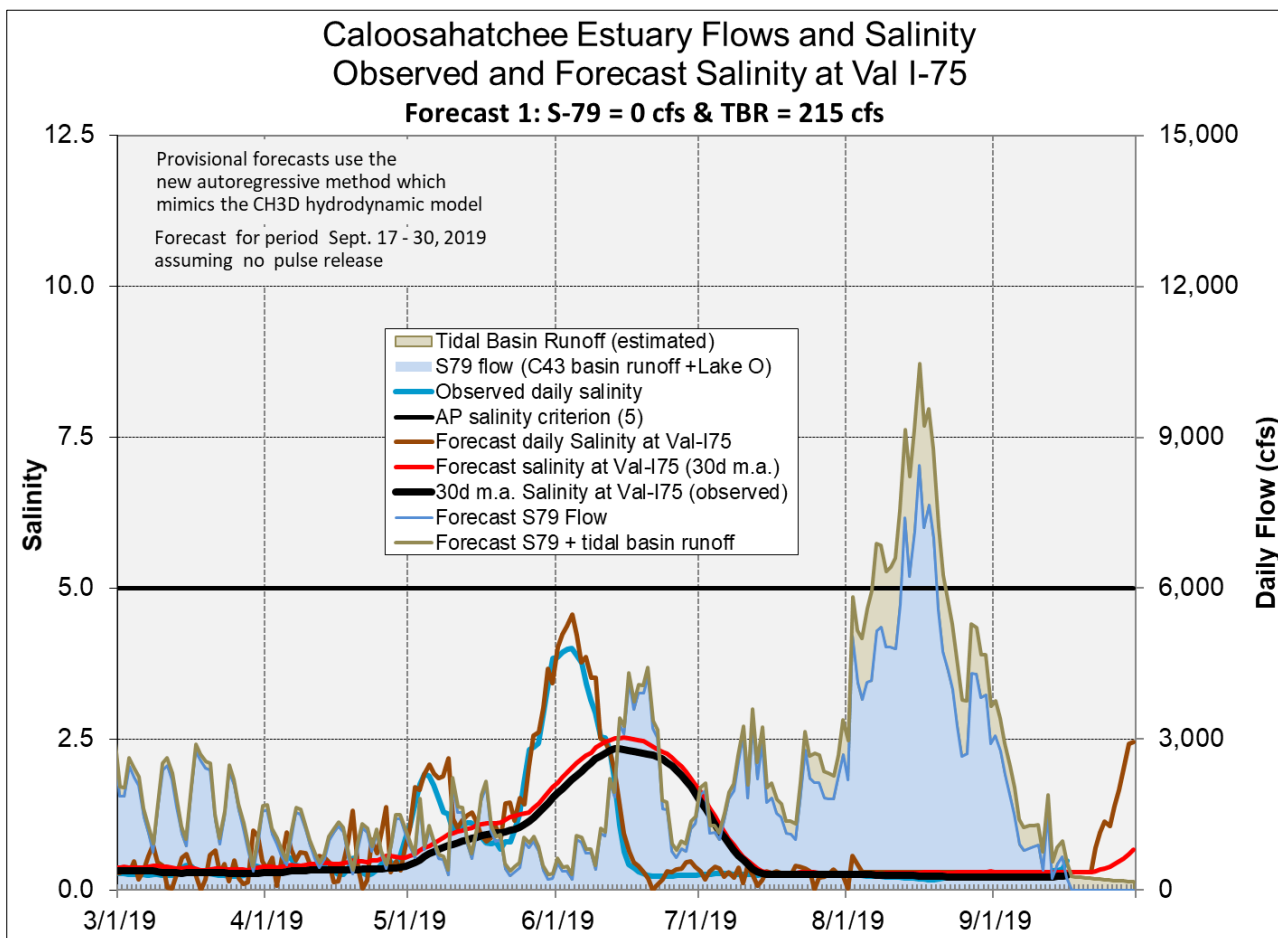
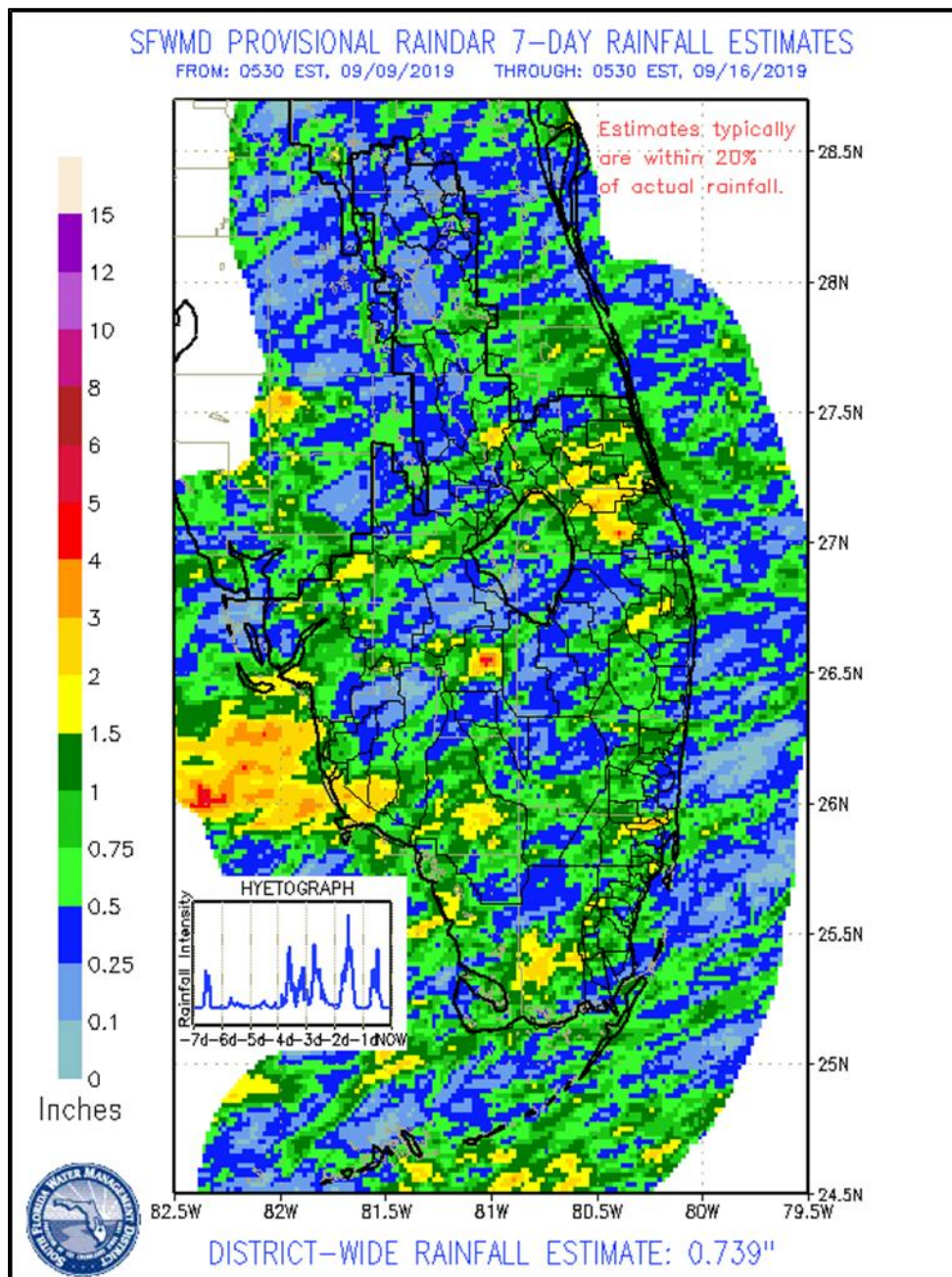


Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S-79.

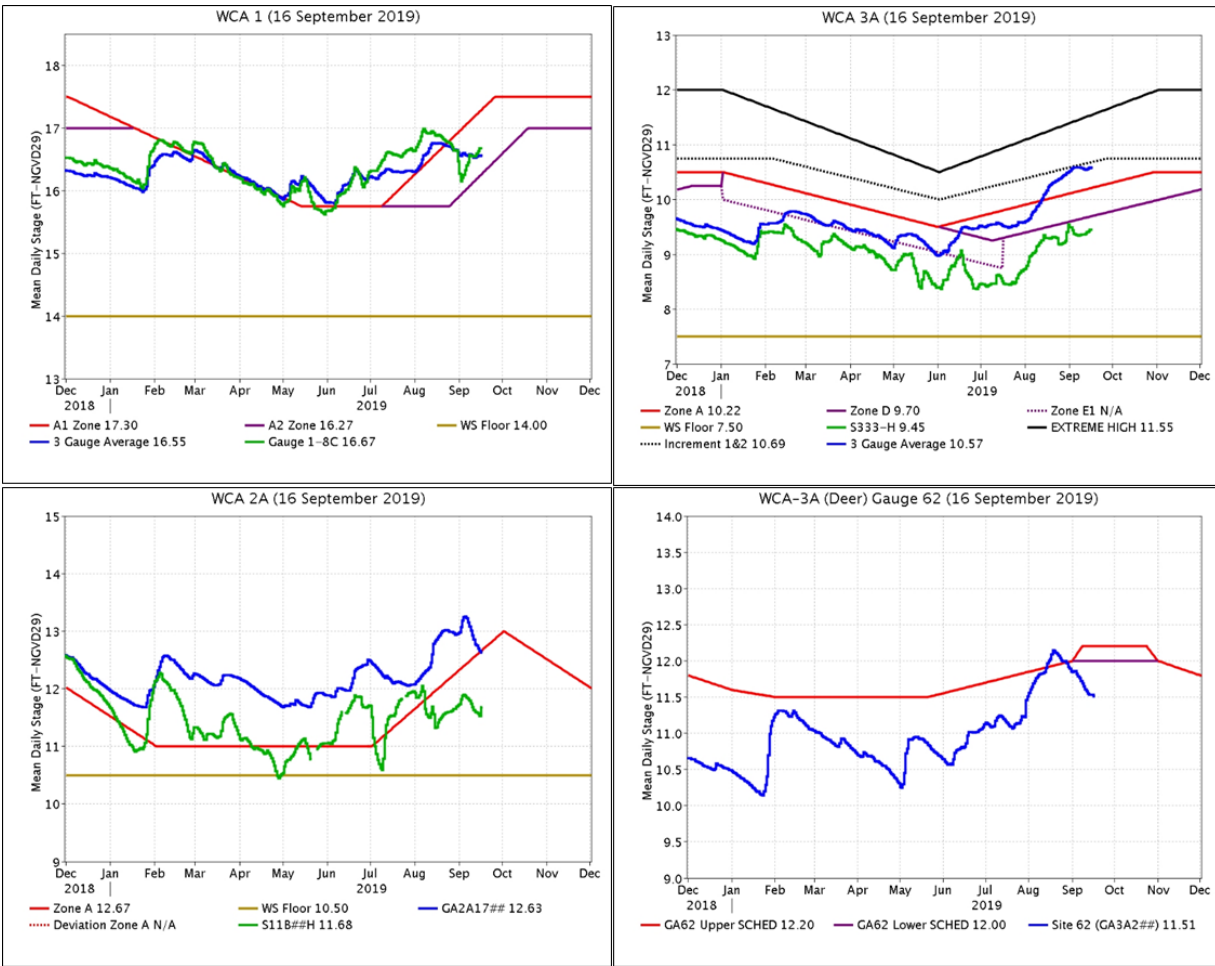
EVERGLADES

Rainfall was consistent and below average across the WCAs. The average stage change across all the gauges monitored for this report was only +0.02 feet. Pan evaporation was estimated at 1.73 inches and the Rainfall Plan continues to call for the maximum release.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.81	-0.02
WCA-2A	0.79	-0.40
WCA-2B	0.87	+0.07
WCA-3A	0.65	-0.04
WCA-3B	0.76	+0.00
ENP	0.89	+0.05



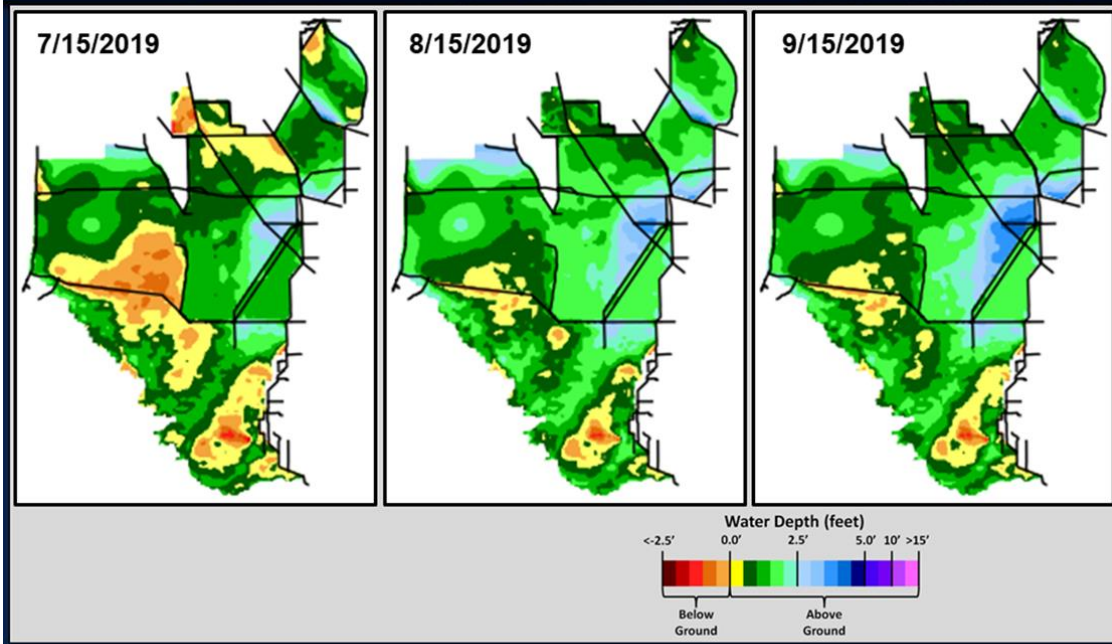
Regulation Schedules: WCA-1: The three-gauge average stage remains below the Zone A1 line this week, currently 0.75 feet below the rising A1 Zone regulation line. WCA-2A: Gauge 2A-17 stage fell quickly to schedule over the last week, from 0.58 feet above to now 0.04 feet below. WCA-3A: The three-gauge average stage moved closer to the rising Zone A regulation line at 0.35 feet above the desired operational band. WCA-3A stage at gauge 62 (northwest corner) is back below schedule at 0.69 feet below the upper schedule and descending.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate depths in northeastern WCA-3A and northern WCA-1 have changed little in the last month, with the potential for some small area of habitat in WCA-1 that remains dry. Ponding has increased in WCA-2B and along the L-67 levees in WCA-3A South and central WCA-3A South, however gauge data there remains below the 2.5-foot threshold indicating tree island stress. WDAT difference maps indicate that in general conditions are consistently deeper within the L-67 region of WCA-3A South and 2B, and significantly drier in northwest WCA-3A North now compared to a month ago. At this time last year, the WCAs were nearing the end of a high-water emergency order due to flooded spring conditions in WCA-3A. Depths are significantly different in southern WCA-2A and WCA-3B.



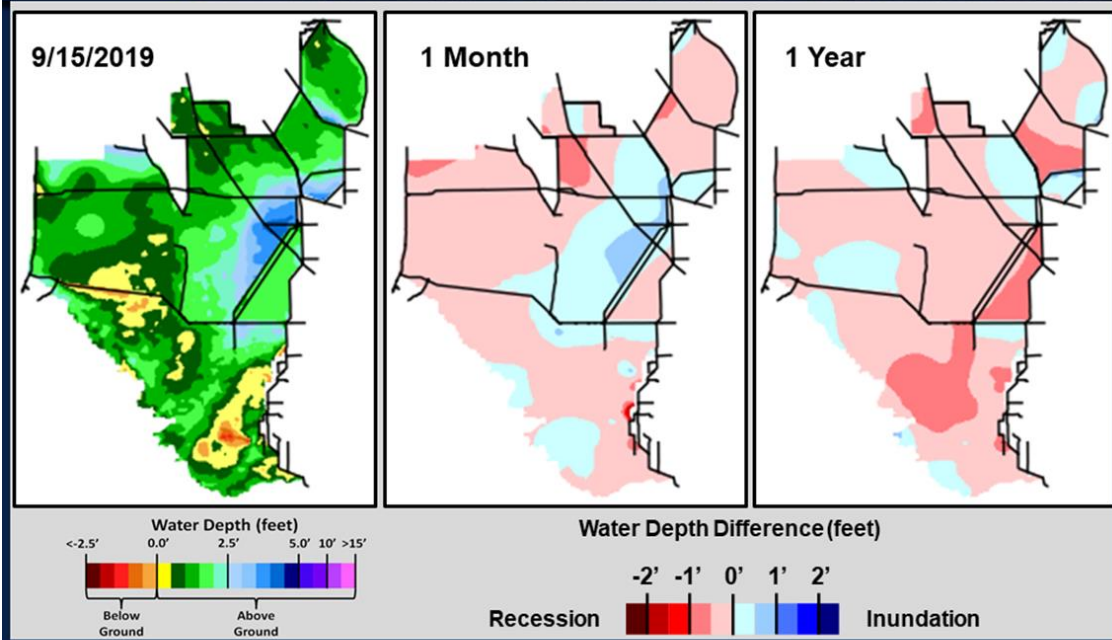
SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)



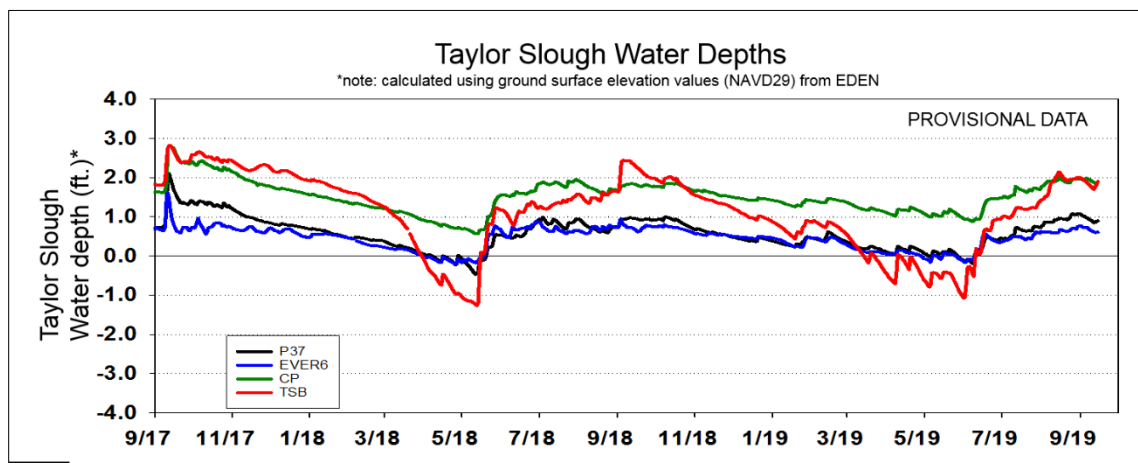
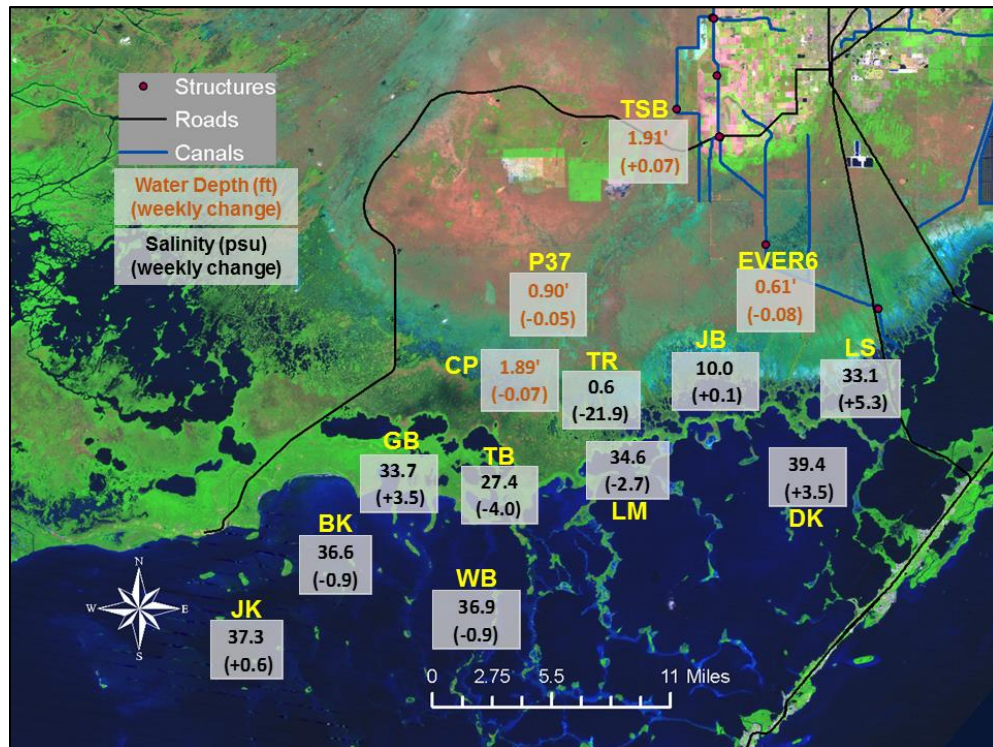
SFWDAT Everglades Difference Maps (Present - Past)

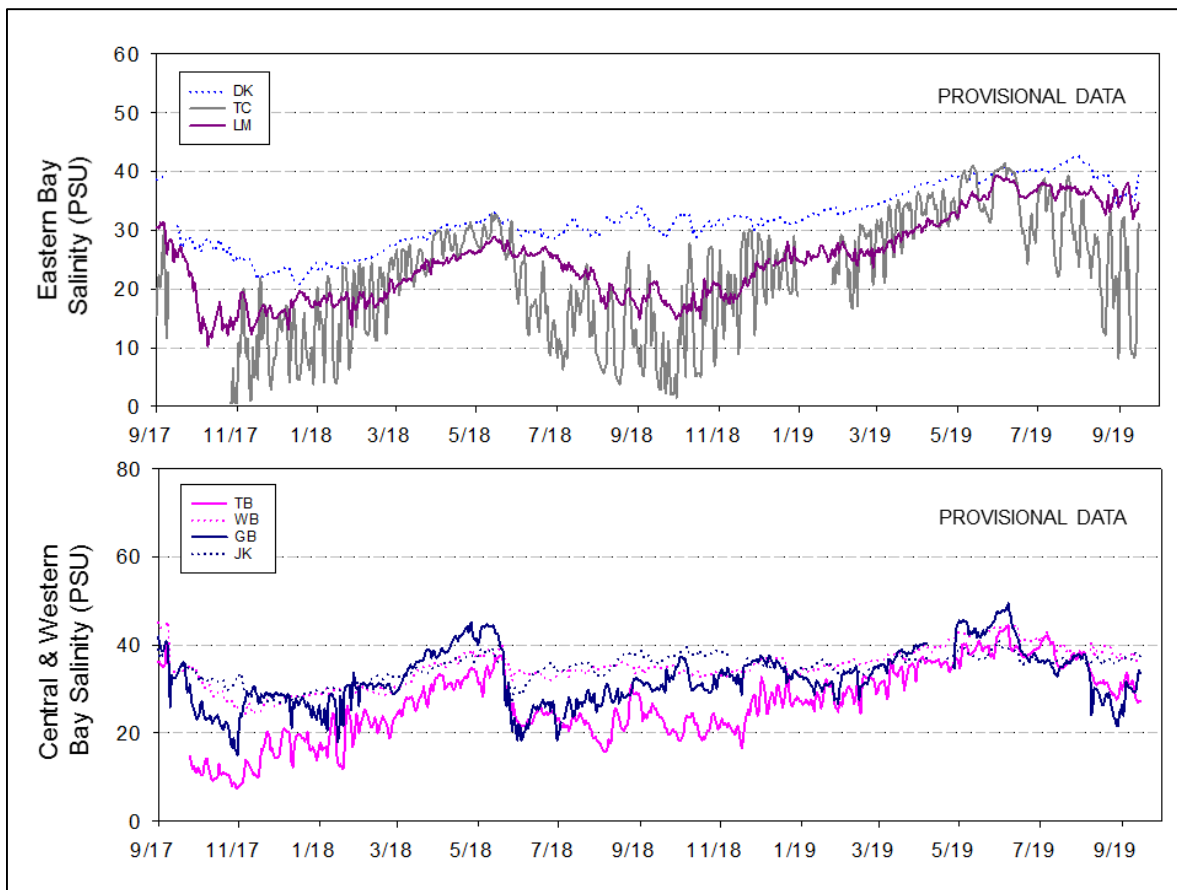


South Florida Water Depth Assessment Tool (SFWDAT)

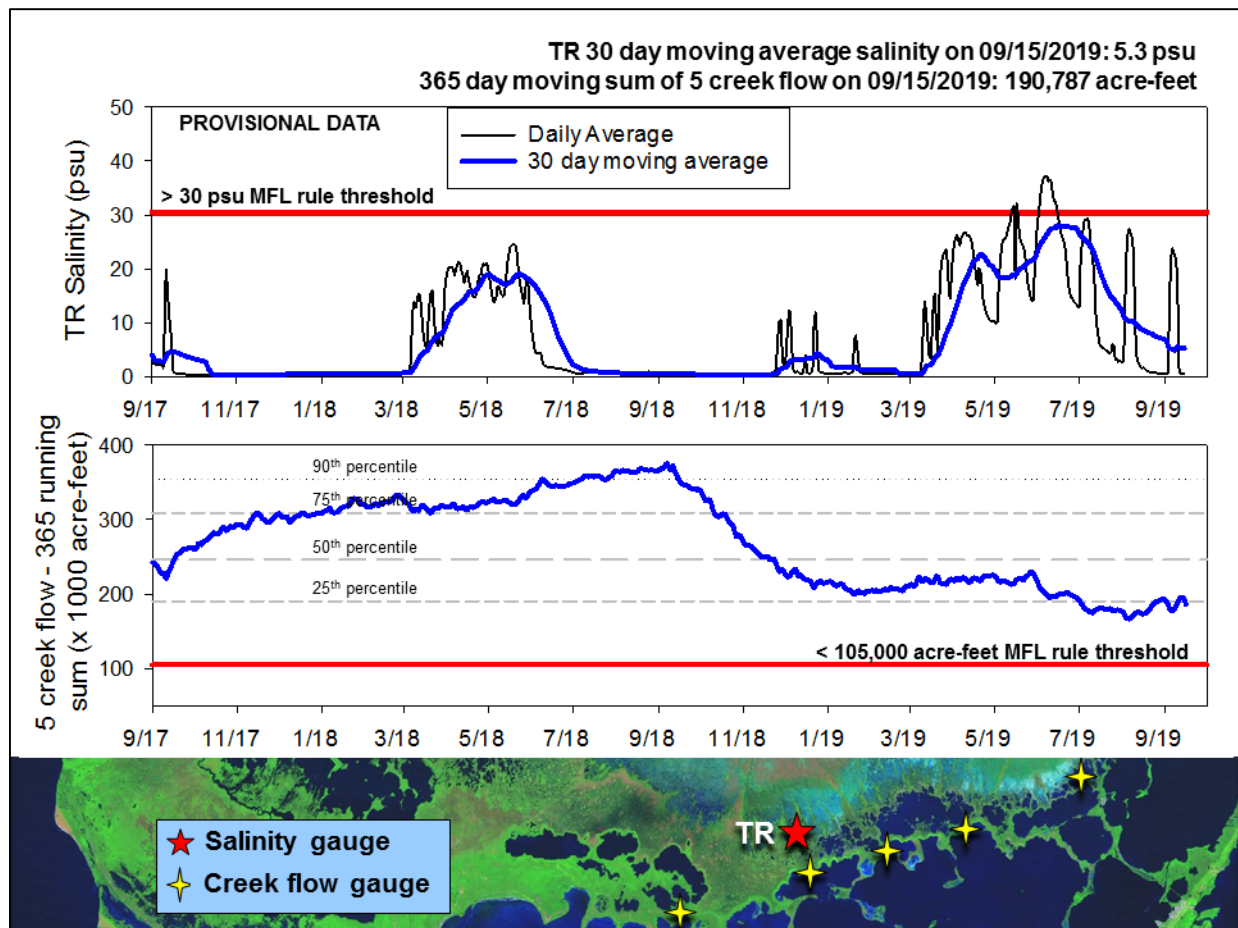
Taylor Slough Water Levels: An average of 1.18 inches of rain fell over Taylor Slough and Florida Bay this past week with the highest amounts at TSB in northern Taylor Slough. Stage changes ranged from -0.08 feet to +0.07 feet with only TSB showing an increase. Stages are still 2 inches higher than average for this time of year, and higher stages are desirable.

Florida Bay Salinities: Average salinity in Florida Bay was 32 psu, same as last week, and the average change in the individual stations was +0.5 psu. The mangrove zone has returned to near fresh while the nearshore area is still 9 psu above the average for this time of year while the bay as a whole is 6 psu above average.





Florida Bay MFL: Salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) returned to near-fresh at 0.6 psu. The 30-day moving average increased 0.4 psu to end at 5.3 psu. The elevated salinity within eastern Florida Bay creates the large increases in salinity every time wind reverses flows, and it is a concern as we approach the end of the wet season. The 5 creeks identified by yellow stars on the map totaled almost 18,000 acre-feet of flow this past week which includes the return of bay water that flowed upstream last week. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) increased to 190,787 acre-feet and continues to hover around the 25th percentile (190,165 acre-feet). Creek flows are provisional USGS data.



Water Management Recommendations

WCA-1 depths have been relatively low over the past year, with stages below the seasonal historic averages since September. There is some consensus in the scientific community that allowing variability is good for the ecological health of the Everglades. Allowing current stages to run higher in WCA-1 may have ecological value. Allowing current stages to run higher in WCA-2A may have ecological value as well, as 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. While perhaps less than desirable operationally, the current elevated stage in WCA-3A could prove beneficial ecologically. The entirety of the marsh within WCA-3A North is inundated and the 2.5-foot threshold at Gauge 65 which indicates flooding stress to tree islands has not been exceeded, and steady discharges from WCA-3A are making it into the major sloughs of the Everglades National Park. Conserving water within the WCAs, allowing stages to ascend to peak conditions, and moving low nutrient water south has many ecological benefits. Water flowing through the WCAs towards Taylor Slough and Florida Bay will 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. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, September 17th, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage changes ranged from -0.10' to +0.12'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
WCA-2A	Stage decreased by 0.40'	Conserving water in this basin as we near the seasonal peak water depths has potential ecological benefit. Manage for a rate of change less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
WCA-2B	Stage increased by 0.07'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
WCA-3A NE	Stage decreased by 0.15'	Conserving water in this region as we near the seasonal peak water depths has potential ecological benefit. Maintain depths at regulation schedule. Manage for a rate of change less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands and peat soils, upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
WCA-3A NW	Stage decreased by 0.13'	Conserving water in this region as we near the seasonal peak water depths has potential ecological benefit. Maintain depths at regulation schedule. Manage for a rate of change less than +0.25' per week, or less than +0.5 per 2 weeks.	
Central WCA-3A S	Stage increased by 0.05'	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
Southern WCA-3A S	Stage increased by 0.08'		
WCA-3B	Stage remained unchanged	Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.
ENP-SRS	Stage increased by 0.05'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.08' to +0.07'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions.
FB- Salinity	Salinity changes ranged -4.0 to +5.3 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.