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MEMORANDUM

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

FROM: SFWMD Staff Environmental Advisory Team

DATE: March 19, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

Discussion: *Updated forecast to indicate a somewhat lower District total rainfall and lower local maxima.*

A weak frontal wave along a stationary front in the southeastern Gulf of Mexico this morning should move rapidly toward the southern Florida peninsula by this afternoon and race eastward into western Atlantic by early tonight. A nearly saturated atmosphere, the 'lift' associated with the frontal wave and stalled front, as well as strong upper-level forcing associated with a southern jet stream disturbance should work together to produce periods of moderate to heavy rains across much of the District this morning and then mainly over the southeastern half of the District this afternoon and evening. The rains should gradually diminish from northwest to southeast, beginning later in the day and then exit all of the east with the frontal wave tonight or early Wednesday morning at the latest. A broad, uniform coverage of rainfall and significant areal average rainfall of greater than a half of an inch is expected over the region from around Lake Okeechobee southward, with embedded pockets of heavier, convective rains possibly producing local maxima on the order up to about 3 inches. Slowly decreasing rainfall accumulations are likely from around and northwest of Lake Okeechobee, with the gradient in rainfall becoming sharper over the far northwestern portion of the District. Deep in the cool air north of the frontal boundary where the instability is lower local maxima should be quite a bit lower, generally held to an inch or inch and a half or less. A lower probability alternate scenario would be the main rain shield associated with the frontal wave and upper-level disturbance to exit the area more quickly, and even with some re-development of rains later this afternoon and/or evening, it would ultimately result in a lower total district rainfall. Regardless, the rains today should combine with the rains that began last night to produce a 24- to 30-hour total for the District that would be the greatest total since late February. The stalled front should near the Florida Keys should push southeastward by Wednesday after the passage of the frontal low, but lingering, lighter post-frontal rains in the cool air could continue to affect a large portion of the District early in the day but mainly over the eastern half of the area. Another strong jet stream disturbance should force the front and unsettled weather persisting over Florida and the western Atlantic well east of the area on Thursday as cool high pressure builds across the area. This weather pattern should provide for several days of dry conditions after the significant heavy rainfall, with temperatures slowly beginning to moderate by the weekend. A return of low-level moisture is seen by Monday, which could help to trigger some shower activity over the southeastern portion of the District. However, much drier mid-level air and virtually no instability would generally keep overall rainfall amounts on the light side. The approach of a low-pressure system and cold front over the southeastern United States early next week would likely make for the next substantive weather maker for the District, possibly producing an increase of rains across much of the area beginning on Tuesday. For the week ending next Tuesday morning the deterministic total District QPF is a little under an inch, nearly all of which is forecast to fall today. While the probabilistic model output indicates some chance that the weekly total would be greater, the evolution of today's rain event would seem to support the current forecast.

Kissimmee

Tuesday morning stages were 56.4 feet NGVD (1.5 feet below schedule) in East Lake Toho, 53.8 feet NGVD (1.1 feet below schedule) in Toho, and 50.2 feet NGVD (0.8 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.3 feet NGVD at S-65A and 25.7 feet NGVD at S-65D. Tuesday morning discharges were 725 cfs at S-65, 606 cfs at S-65A, 670 cfs at S-65D and 896 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 5.6 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.29 feet. No new recommendations for the week.

Lake Okeechobee

Lake Okeechobee stage is 12.12 feet NGVD, decreasing 0.30 feet from the previous week. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.48 feet below the Base Flow sub-band. The lake remains below the bottom of the ecological envelope (currently 1.3 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. Satellite imagery suggest the potential for algal blooms remains low. Given the potential for above average rainfall associated with a weak El Niño conditions this winter/spring and the poor condition of SAV and EAV in the nearshore zone, these lower lake stages are ideal for vegetation recovery, but will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh.

Estuaries

Total inflow to the St. Lucie Estuary averaged 520 cfs over the past week with 262 cfs coming from Lake Okeechobee. Over the past week, salinity decreased in the estuary. The seven-day average salinity at the US1 Bridge is within the good range for adult eastern oysters.

Total inflow to the Caloosahatchee Estuary averaged 2,019 cfs over the past week with 1,241 cfs coming from the Lake. Over the past week, salinity decreased in the estuary. The 30-day moving average surface salinity is 0.3 at Val I-75 and 2.6 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the good range for adult eastern at Cape Coral and Shell Point. 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.

Stormwater Treatment Areas

Over the past week, the STAs/FEBs received approximately 17,200 acre-feet of Lake releases. The total amount of Lake releases sent to the STAs/FEBs in WY2019 (since May 1, 2018) is approximately 426,000 acre-feet. The total amount of inflows to the STAs in WY2019 is approximately 1,482,000 acre-feet. Most STA cells are at or near target depths. STA-1W Northern Flow-way is offline for STA-1W Expansion project construction activities, STA-1E Western Flow-way is offline for levee repairs in the West Distribution Cell, and 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-1E Central Flow-way for vegetation management activities, STA-3/4 Western Flow-way for a Restoration Strategies Science Plan study, and STA-5/6 Flow-ways 1 and 4 to facilitate the Restoration Strategies grading project in Flow-ways 2 and 3. This week, if Lake releases are sent to the WCAs and conditions allow, releases will be sent to the A-1 FEB and STA-2.

Everglades

Keeping rainfall runoff within the Everglades system, distributing it equally across the WCAs and moving it south through the system when possible remains ecologically beneficial as the WCAs are at or near average stages for this time of year. Northwestern WCA-3A and Rotenburger would benefit from additional inflows. The WCAs received below average rainfall last week and stages responded by dropping across the basins (except WCA-3B), on average -0.09 feet per week. The ENP station NESRS2 reversed its recent trend falling 0.17 feet this week. Very little rainfall on TS and FB this week.

Depths in Taylor slough remain above average for this time of year but continues with the seasonal recession. Average salinity increased slightly this week in Florida Bay, and continues to be above average for this time of year.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.22 inches of rainfall in the past week and the Lower Basin received 0.51 inches (SFWMD Daily Rainfall Report 3/18/2018).

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: 3/19/2019

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)						
							3/17/19	3/10/19	3/3/19	2/24/19	2/17/19	2/10/19	2/3/19
Lakes Hart and Mary Jane	S-62	26	LKMJ	60.5	R	61.0	-0.5	-0.3	-0.3	-0.2	0.0	0.0	0.0
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.8	R	60.8	0.0	0.0	-0.1	-0.1	0.1	0.1	0.0
Alligator Chain	S-60	0	ALLI	63.7	R	64.0	-0.3	-0.2	-0.2	-0.2	-0.2	-0.4	-0.5
Lake Gentry	S-63	0	LKGT	61.5	R	61.5	0.0	0.0	-0.1	0.0	0.0	0.0	-0.1
East Lake Toho	S-59	150	TOHOE	56.5	R	58.0	-1.5	-1.4	-1.4	-1.2	-1.0	-0.8	-0.8
Lake Toho	S-61	400	TOHOW, S-61	53.4	R	55.0	-1.6	-1.4	-1.3	-1.2	-1.0	-0.9	-0.8
Lakes Kissimmee, Cypress, and Hatchineha	S-65	529	KUB011, LKIS5B	50.2	R	51.0	-0.8	-0.8	-0.7	-0.8	-1.0	-1.0	-1.1

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: 3/19/2019												
Metric	Location	1-Day Average		Average for the Preceding 7-Days ¹								
		3/17/2019	3/17/19	3/10/19	3/3/19	2/24/19	2/17/19	2/10/19	2/3/19	1/27/19	1/20/19	1/13/19
Discharge (cfs)	S-65	522	529	513	1,368	2,386	3,220	2,653	1,615	950	392	343
Discharge (cfs)	S-65A ²	446	420	409	1,190	2,280	3,154	2,472	1,517	764	306	261
Discharge (cfs)	S-65D ²	585	505	1,103	2,310	3,097	2,668	1,564	1,221	621	341	261
Headwater Stage (feet NGVD)	S-65D ²	25.76	25.78	25.72	25.76	25.77	25.81	25.82	25.90	26.00	25.94	25.91
Discharge (cfs)	S-65E ²	570	497	1,026	2,167	2,945	2,533	1,442	1,151	606	309	261
Discharge (cfs)	S-67	0	0	51	30	53	0	0	0	0	0	0
DO (mg/L) ³	Phase I river channel	5.6	5.2	5.4	4.1	3.4	4.0	5.3	6.5	6.6	6.8	6.4
Mean depth (feet) ⁴	Phase I floodplain	0.31	0.29	0.43	0.86	1.20	1.25	0.71	0.46	0.12	0.07	0.08

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 PC62 and PC33.
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)

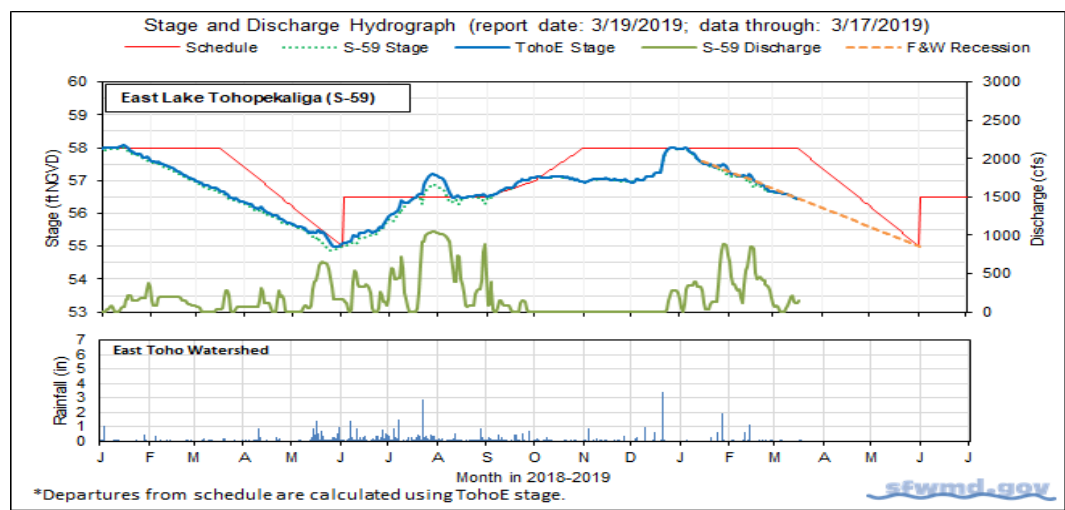


Figure 1.

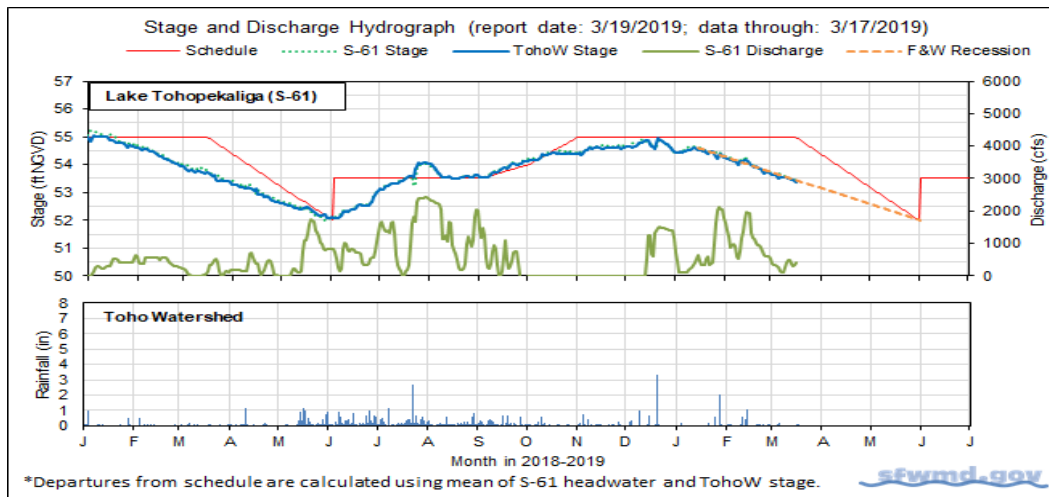


Figure 2.

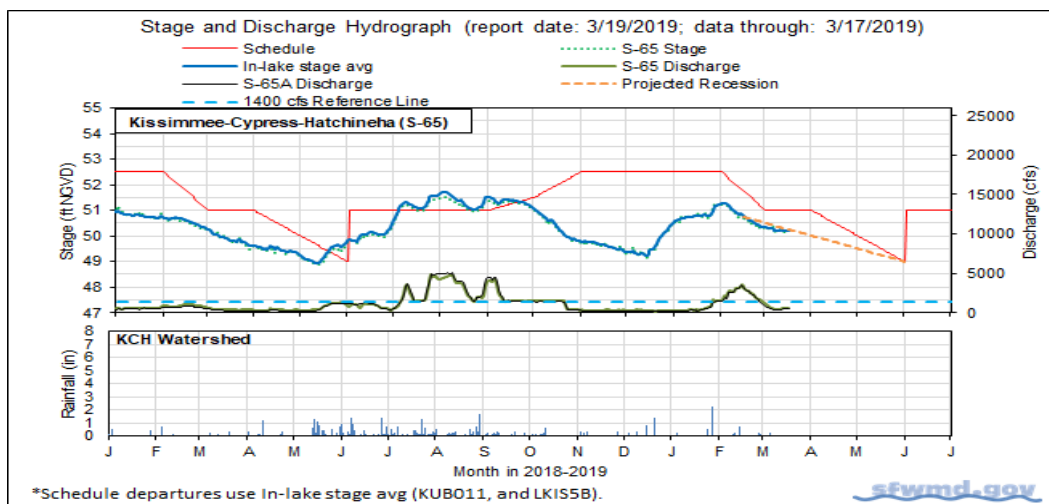


Figure 3.

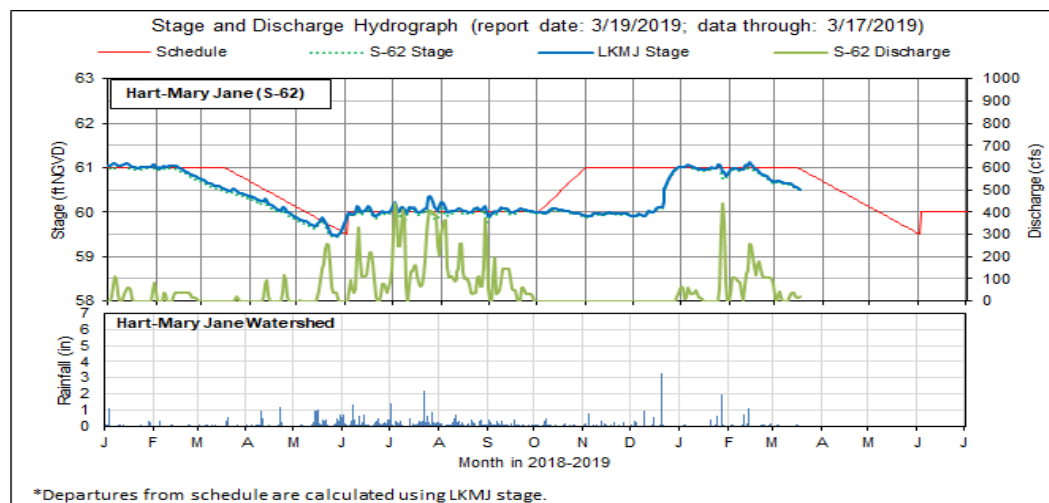


Figure 4.

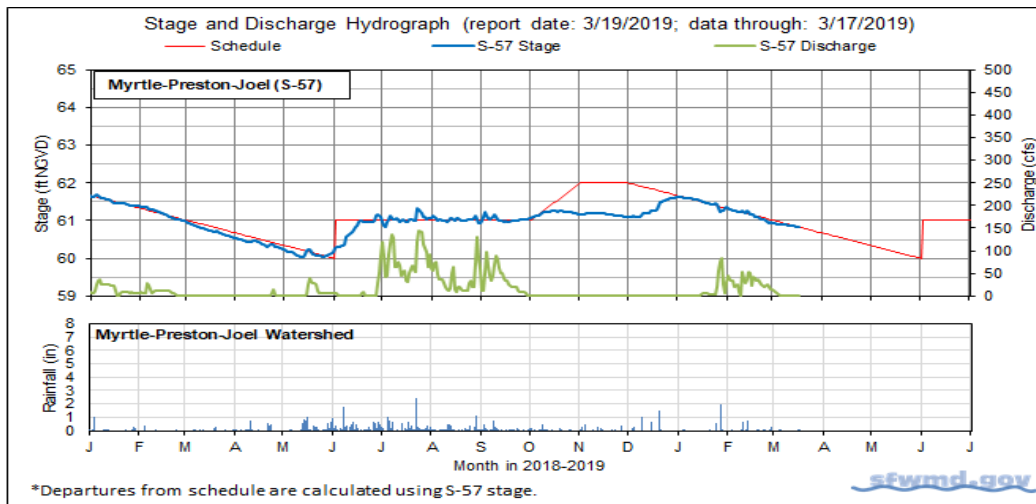


Figure 5.

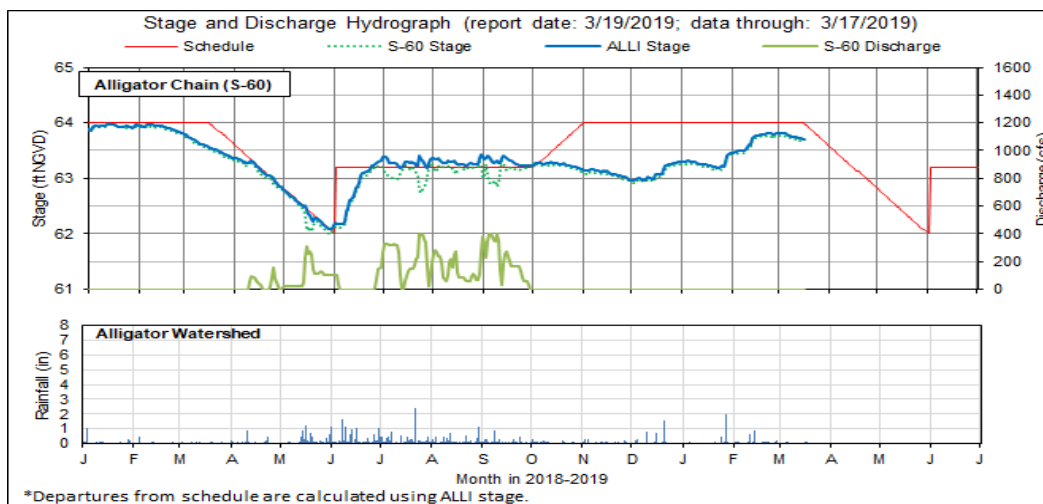


Figure 6.

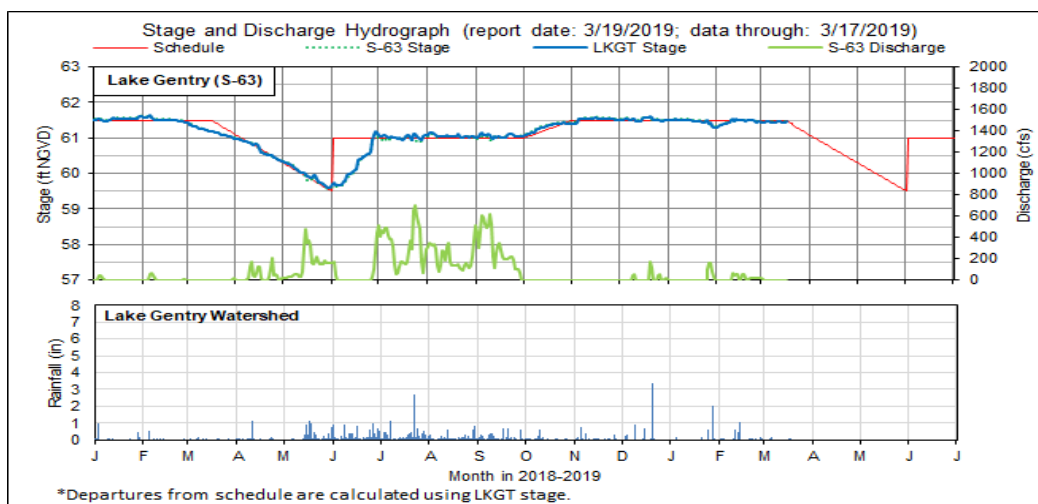


Figure 7.

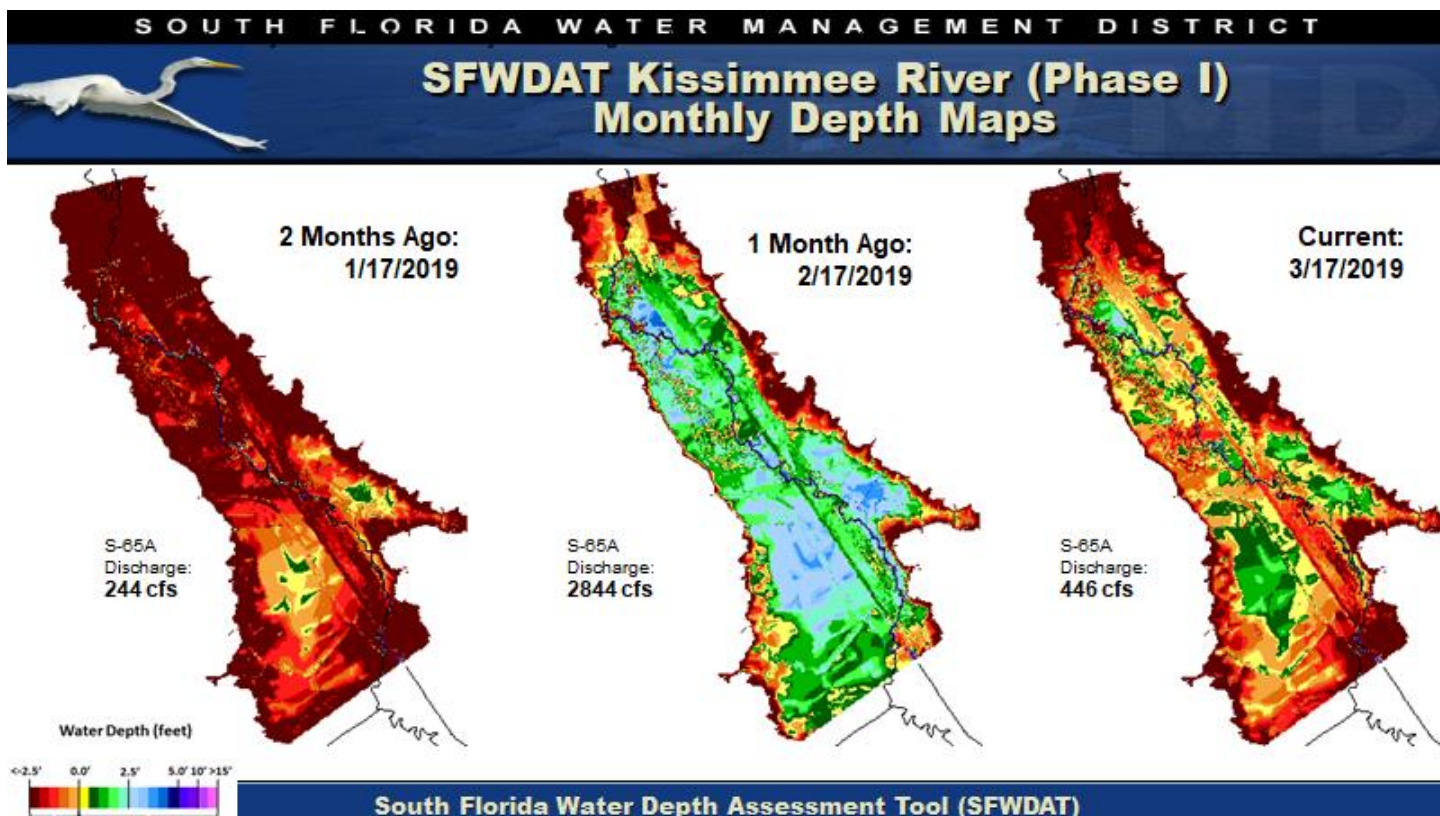


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

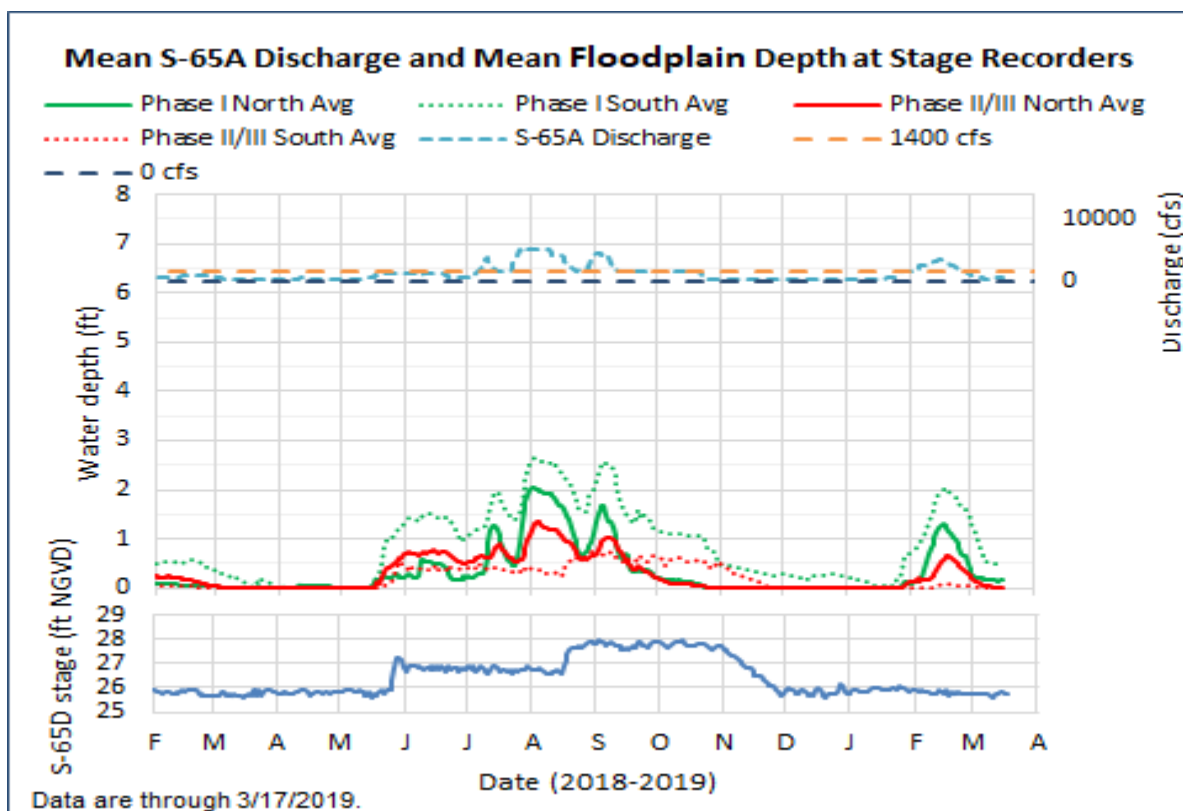


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.

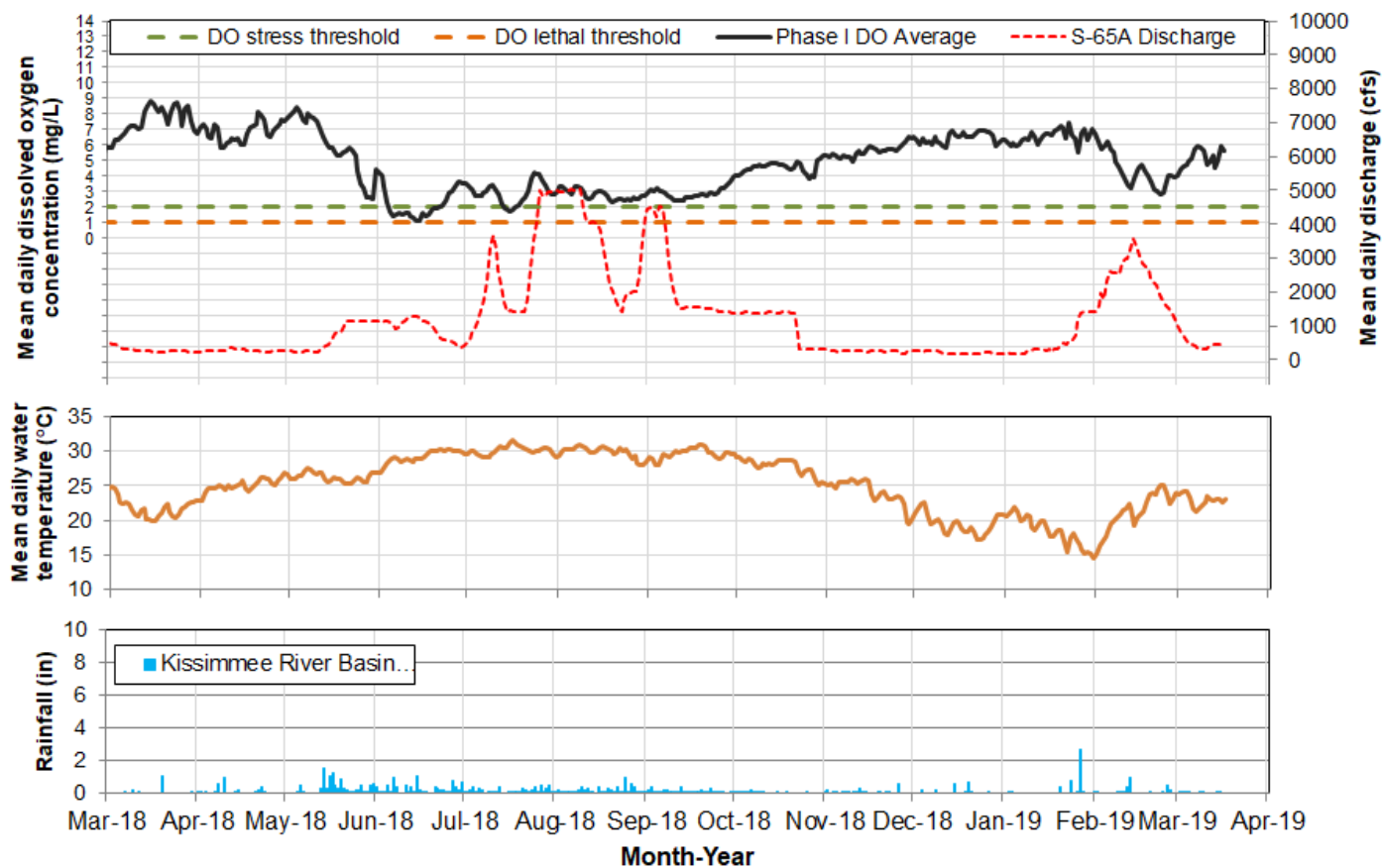


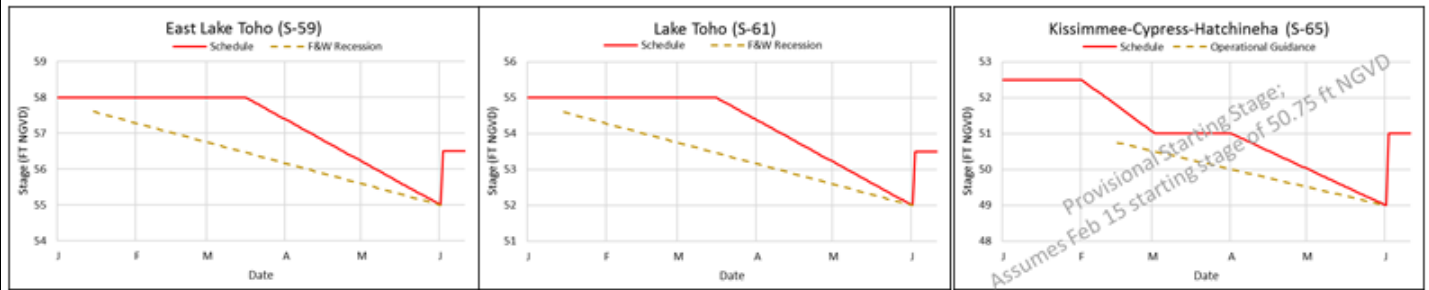
Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phase I river channel.

Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
3/18/2019	No new recommendations.		N/A		3/19/2019
3/11/2019	No new recommendations.		N/A		3/12/2019
3/4/2019	No new recommendations.		N/A		3/5/2019
2/26/2019	No new recommendations.		N/A		2/26/2019
2/19/2019	No new recommendations.		N/A		2/19/2019
2/10/2019	Increase discharge at S-65 by 600 cfs.	To compensate for increased inflow and rain forecast for Tuesday.	Implemented	KB Ops/SFWMD Water Mgt	2/12/2019
2/4/2019	Increase discharge at S-65/S-65A to begin reducing KCH stage to reach 50.75 ft on 2/15/2019.	Reduce to the stage at which the seasonal recession will begin.	Implemented	KB Ops/SFWMD Water Mgt	2/5/2019
1/26/2019	Increase S65A discharge by a total of 350 cfs today, which will put S65A at 1,400 cfs. Continue to increase discharge as needed.	Moderate or stop the rise in Lake KCH preemptively before forecast rainfall and provide capacity at S65A for S65A basin runoff.	Implemented	SFWMD Water Mgt/KB Ops	1/29/2019
1/22/2019	No new recommendations.		N/A		1/22/2019
	Begin recessions on Lake Toho and East Lake Toho on Jan 15, with a continuous recession to the regulation dry season low (52.0 ft on Toho; 55.0 ft on East Lake) on May 31. The lines are represented graphically in the Dry Season Operations slides.				
1/15/2019	Tentatively plan on a recession in Kissimmee-Cypress-Hatchineha starting on February 15 with a continuous recession to the dry season low (49 ft) on May 31. A provisional diagram is included in the Dry Season Operations slides; however, starting stage may change depending on conditions.	Slow recession rates in East Toho, Toho, and KCH to benefit fish and wildlife; as possible limit flow volume at S-65D to facilitate KRR construction.	N/A	KB Ops	1/15/2019
	Discharge and reversal guidelines are provided in the Dry Season Operations slides.				
1/4/2019	Discontinue 54 foot stage reduction target in Lake Toho.	Lake Kissimmee has already risen by ~1.5 ft.	Implemented	SFWMD Water Mgt/KB Ops	1/8/2019
12/14/2018	Manage S-61 discharge to reduce stage in Lake Toho to 54 ft over the next 7-9 days.	Move water to KCH to reduce the rate of stage decline in KCH; reduce the head difference between S-61 headwater and tailwater.	N/A	SFWMD Water Mgt/KB Ops	12/18/2018
12/10/2018	Reduce S-65A discharge to 180 cfs.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	N/A	SFWMD Water Mgt/KB Ops	12/11/2018
12/3/2018	No new recommendations.		N/A		12/4/2018
11/26/2018	No new recommendations.		N/A		11/27/2018
11/19/2018	No new recommendations.		N/A		11/20/2018
11/12/2018	No new recommendations.		N/A		11/13/2018
11/2/2018	Reduce S-65/S-65A discharge to approximately 250 cfs.	To conserve stage in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	11/6/2018
10/30/2018	No new recommendations.		N/A		10/30/2018
10/22/2018	Reduce S-65/S-65A discharge to approximately 300 cfs (minimum discharge) in one step of approximately 1100 cfs today.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	Implemented	SFWMD Water Mgt/KB Ops	10/23/2018
10/16/2018	No new recommendations.		N/A		10/16/2018
10/9/2018	No new recommendations.		N/A		10/9/2018
10/2/2018	No new recommendations.		N/A		10/2/2018
9/25/2018	No new recommendations.		N/A		9/25/2018
9/18/2018	No new recommendations.		N/A		9/18/2018
9/11/2018	No new recommendations.		N/A		9/11/2018
9/4/2018	No new recommendations.		N/A		9/4/2018
8/28/2018	No new recommendations.		N/A		8/28/2018
8/21/2018	No new recommendations.		N/A		8/21/2018
8/14/2018	No new recommendations.		N/A		8/14/2018
8/7/2018	No new recommendations.		N/A		8/7/2018
7/23/2018-7/24/2018	Increase discharge from 1400 cfs to 3000 cfs, then 3200 cfs and 3500 cfs.	For flood control in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	7/31/2018
7/19/2018	Follow Revised (X2) 2018 Wet Season Discharge Plan to the extent possible, including 50 foot stage threshold and 0.5 foot flood control buffer.	To the extent possible, maintain sufficient discharge to keep areas under snail kites nests in Pool D hydrated until nests fledge, while avoiding large increases in discharge that might flood the nests.	N/A	KB Ops	7/24/2018

Dry Season Operations Slide 1 - 2018-2019 (NOTE revised discharge table)



Other Considerations

- KCH starting stage may vary; the maximum is 50.75 ft NGVD on Feb 15.
- Maintain S65/S65A discharge of at least 300 cfs.
- If outlook is for extreme dry conditions meet with KB staff to discuss modifications to this plan.

Version 1: January 14 2019

Discharge Rate of Change Limits for S65/S65A (revised 1/14/19).

Q (cfs)	Maximum rate of INCREASE (cfs/day)	Maximum rate of DECREASE (cfs/day)
0-300	100	-50
301-650	150	-75
651-1400	300	-150
1401-3000	600	-300
>3000	1000	-1000

Figure 11A. Slide 1 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

Dry Season Operations Slide 2 - 2018-2019

East Lake (ELT) and Toho (WLT)

- **East Toho and Toho Recessions:**
 - Make releases to begin recessions on Jan 15 with lake stage approximately 0.4 ft below winter pool and continue to follow straight line recessions through May 31st to the extent practical
- **East Toho and Toho Stage Reversals :**
 - Adjust discharge to bring stage back to the recession line within about a week
 - Pre-storm releases may be used to lower stage below the recession line and create storage of about half of the forecast rain volume
 - If stage cannot be brought back to the recession line within about a week, the recession line may need to be reset following discussion with partner agencies
 - In general, the water released from ELT and WLT basins will be released to KCH (to the extent that hydraulic capacity is available) without consideration for Lake KCH stage. However, the priority of KCH is subject to change if more nesting occurs in KCH than Toho or East

Kissimmee-Cypress-Hatchineha (KCH)

- **KCH Recession:**
 - Begin recession on February 15 (subject to change) starting no higher than 50.75 feet
 - To the extent feasible considering discharge constraints, make releases to follow a straight-line recession through May 31
 - In general, use the available storage in Lake KCH to keep flow at S-65D below 1,000 cfs; when possible keep flow below 600 cfs
- **KCH Stage Reversals :**
 - To address reversals, in general increase flow by 100 cfs for every 0.1 foot of rise above the recession line (e.g. from 300 cfs at the line to 800 cfs at 0.5 feet above the line)

Figure 11B. Slide 2 of the 2018-2019 Dry Season Operations Plan for S-59, S-61, and S-65/S-65A.

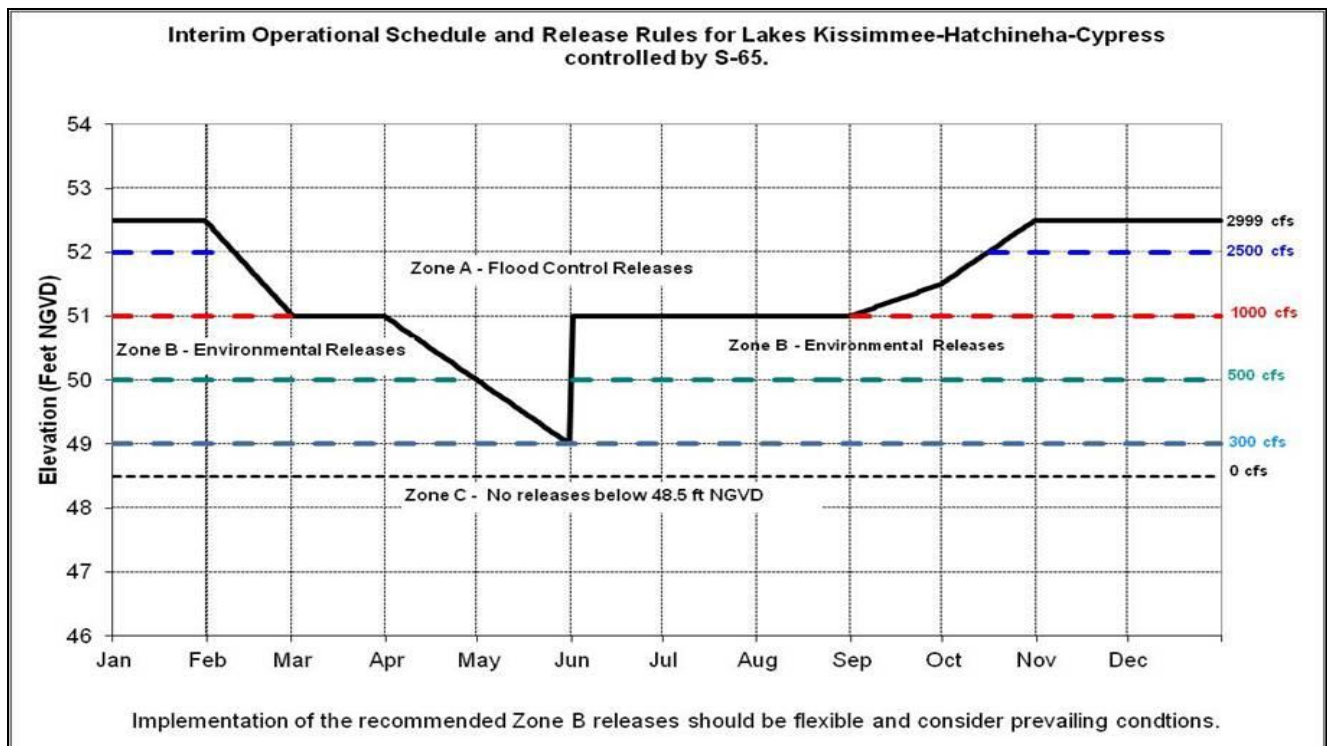


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

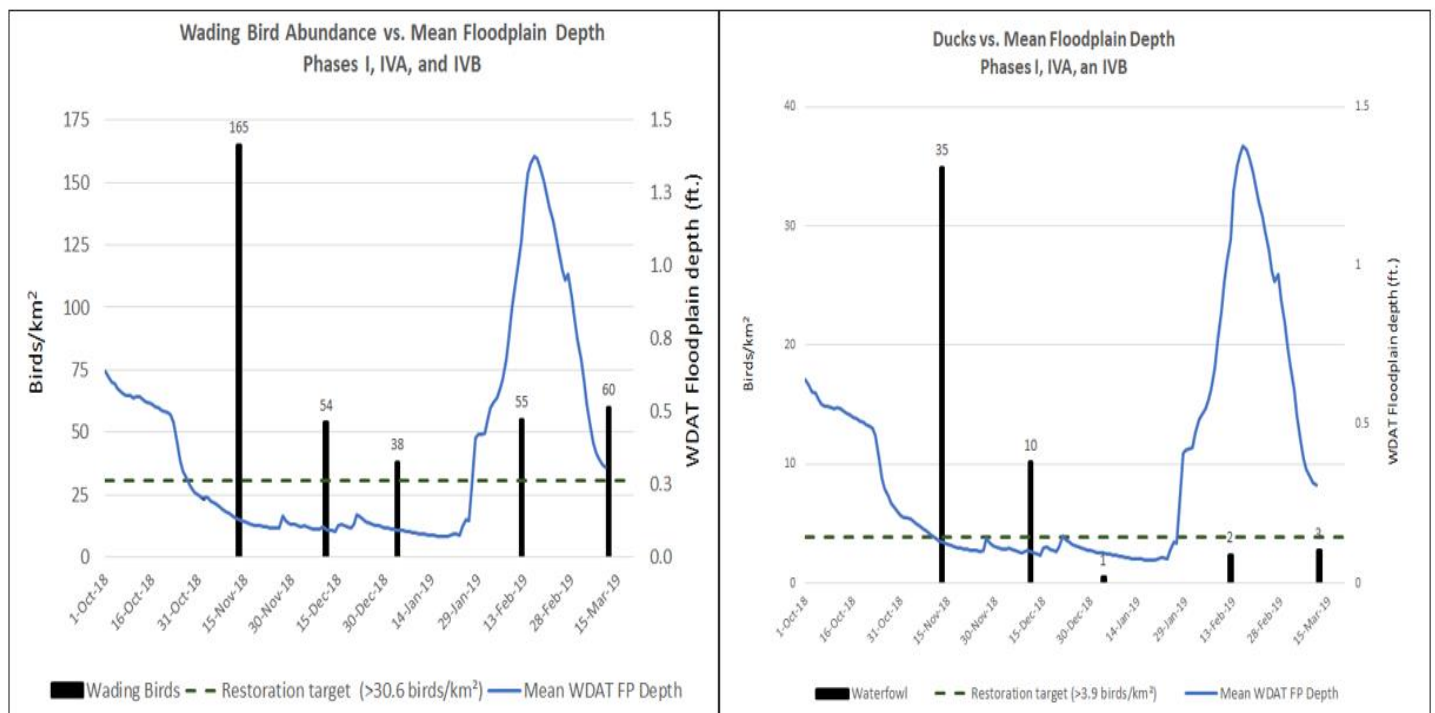


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to March 2019.

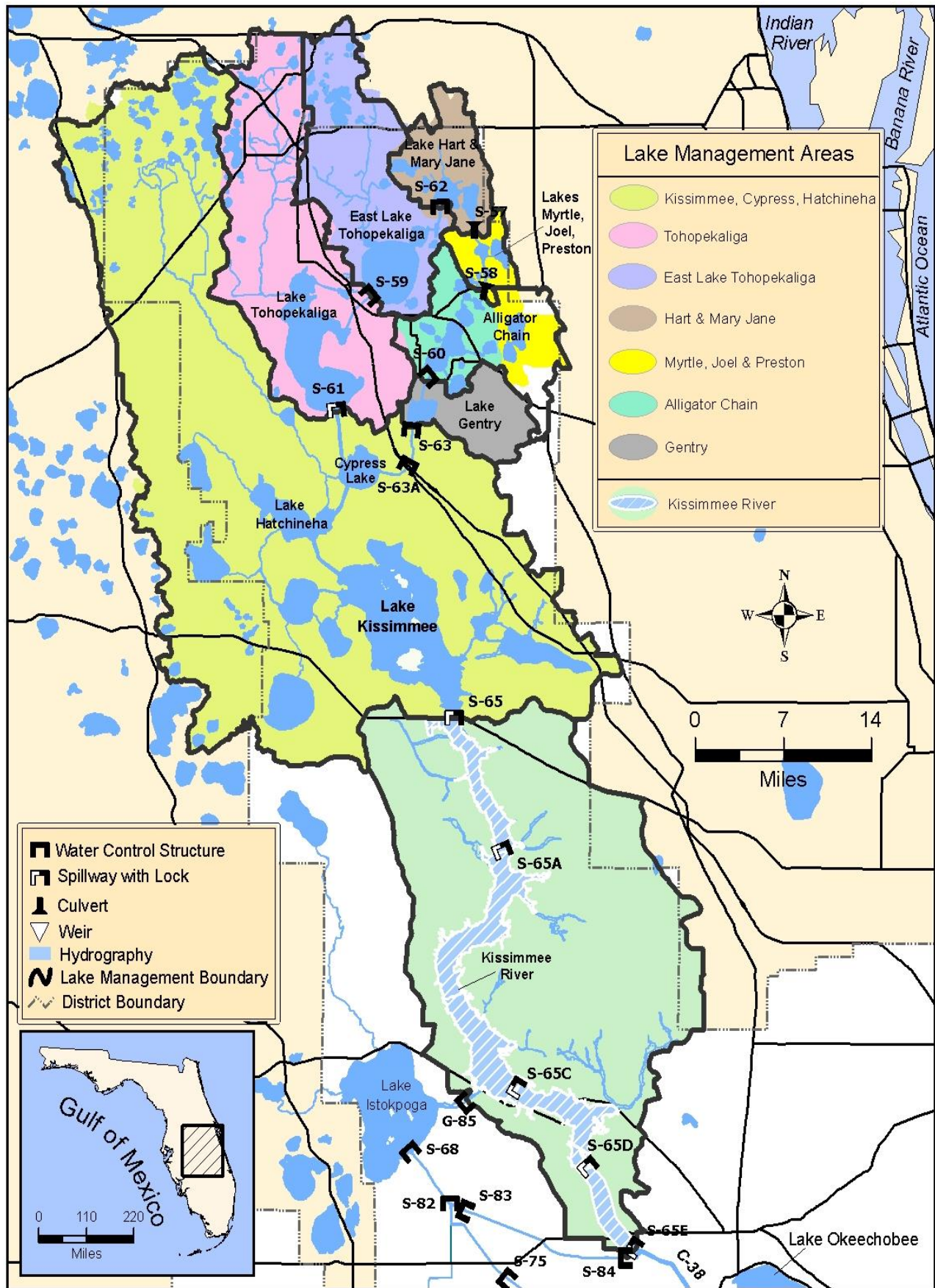


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 12.12 feet NGVD for March 18, 2019. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and three perimeter stations (S-308, S-4 and S-133). The Lake is now 0.69 feet lower than a month ago and 2.16 feet lower than a year ago when runoff from Hurricane Irma caused extreme high lake stages (Figure 1). The Lake dropped back into the Beneficial Use sub-band on March 7, 2019 and is 0.48 feet below the Base Flow sub-band (Figure 2). Lake stage is the lowest for this time of year since 2011, which followed a very dry rainy season in 2010 (Figure 3). According to RAINДАР, during the week of March 12 - March 18, 2019, 0.35 inches of rain fell directly over the Lake and the entire watershed received an average of approximately 0.46 inches (Figure 4). The Kissimmee Basin and the western part of the watershed received up to 1.5 inches of rain while the south-central region received less than 0.25 inches of rain.

Average daily inflows (minus rainfall) to the Lake this week were lower than last week at 525 cfs compared to 892 cfs, respectively. The inflows from the Kissimmee River also decreased, dropping from 858 cfs to 501 cfs; inflows from the remaining structures were similar or slightly decreased from the previous week (Table 1).

Total outflows (minus evapotranspiration) decreased from the previous week, going from 4,915 average daily cfs to 4,733 cfs this past week (Table 1). Outflows increased at S-77 but decreased at S-308, L-8 at Canal point, and the S-350 structures. Outflows west via S-77 increased compared to the previous week going from 1,184 cfs to 1,486 cfs. Outflows to the east via S-308 decreased from 767 cfs to 430 cfs, and south through the S-350 structures from 3,274 cfs to 2,784 cfs. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiations was 0.07 inches this week.

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 5 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 satellite imagery (Mar 14, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel OLCI sensor data showed bloom potential is low for most of the Lake, continuing the trend of gradually reducing potential over the past several weeks (Figure 6).

Water Management Recommendations

Lake Okeechobee stage is 12.12 feet NGVD, decreasing 0.30 feet from the previous week and 0.69 feet for the past 30 days. The Lake has entered Beneficial Use and is 0.48 feet below the Base Flow sub-band. The Lake is also 1.3 feet below the bottom of the ecological envelope, which varies seasonally from 12.5 – 15.5 feet NGVD. Given the potential for above average rainfall associated with weak El Niño conditions this winter/spring and the poor condition of SAV and EAV in the nearshore zone, lower lake stages are ideal for vegetation recovery but will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh.

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 Inflow cfs	Equivalent Depth Week Total (in)
S65E & S65EX1	858	501	0.2
S71 & 72	0	7	0.0
S84 & 84X	7	3	0.0
Fisheating Creek	27	14	0.0
S154	0	0	0.0
S191	0	0	0.0
S133 P	0	0	0.0
S127 P	0	0	0.0
S129 P	0	0	0.0
S131 P	0	0	0.0
S135 P	0	0	0.0
S2 P	0	0	0.0
S3 P	0	0	0.0
S4 P	0	0	0.0
L8 Backflow			
Rainfall	44.3	762	0.4
Total	936	1287	0.6

OUTFLOWS	Previous Week Avg Daily cfs	Avg Daily Outflow cfs	Equivalent Depth Week Total (in)
S77	1184	1486	0.7
S308	767	430	0.2
S351	1085	959	0.4
S352	892	748	0.3
S354	1297	1077	0.5
L8 Outflow	107	33	0.0
ET	857	1141	0.5
Total	6190	5874	2.7

Provisional Data

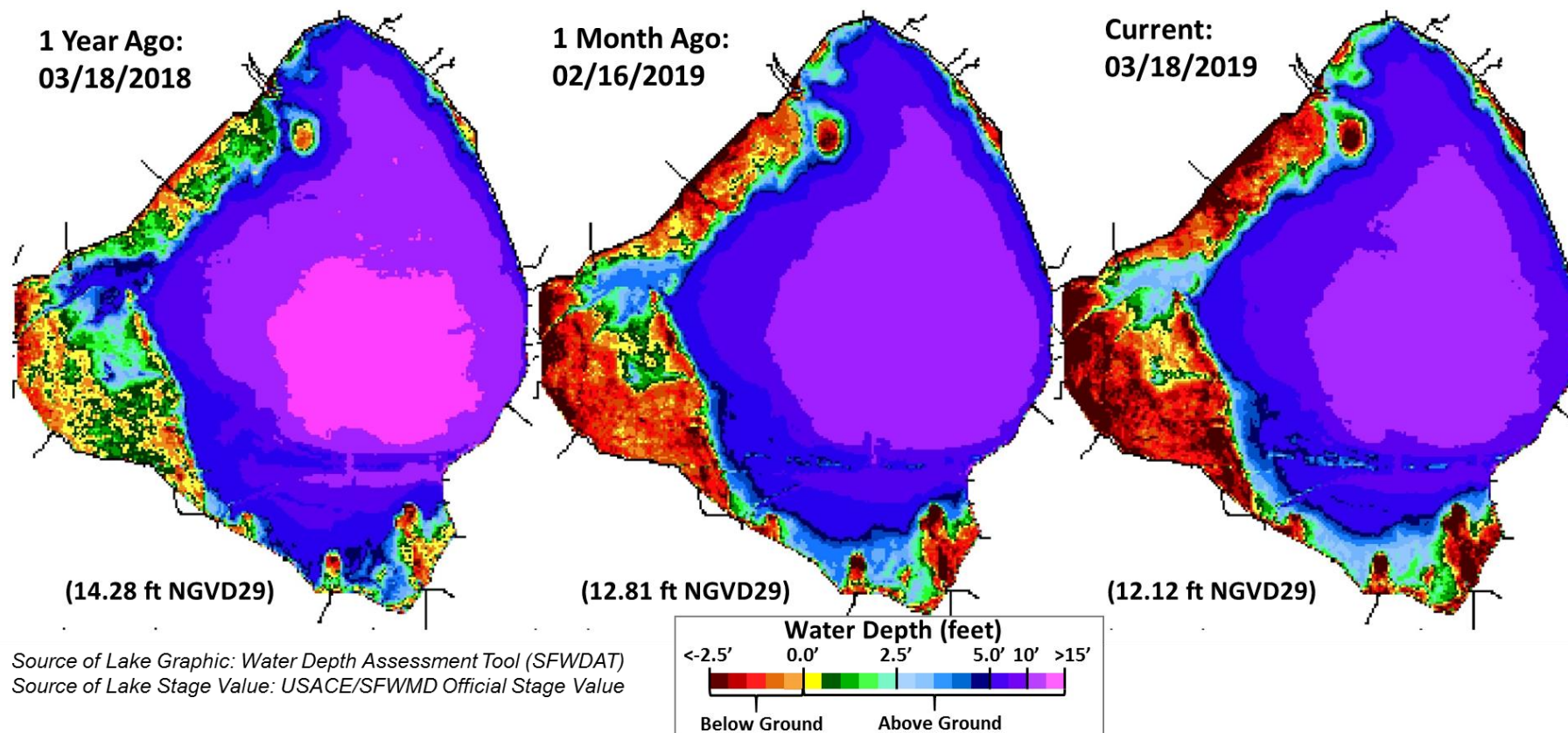
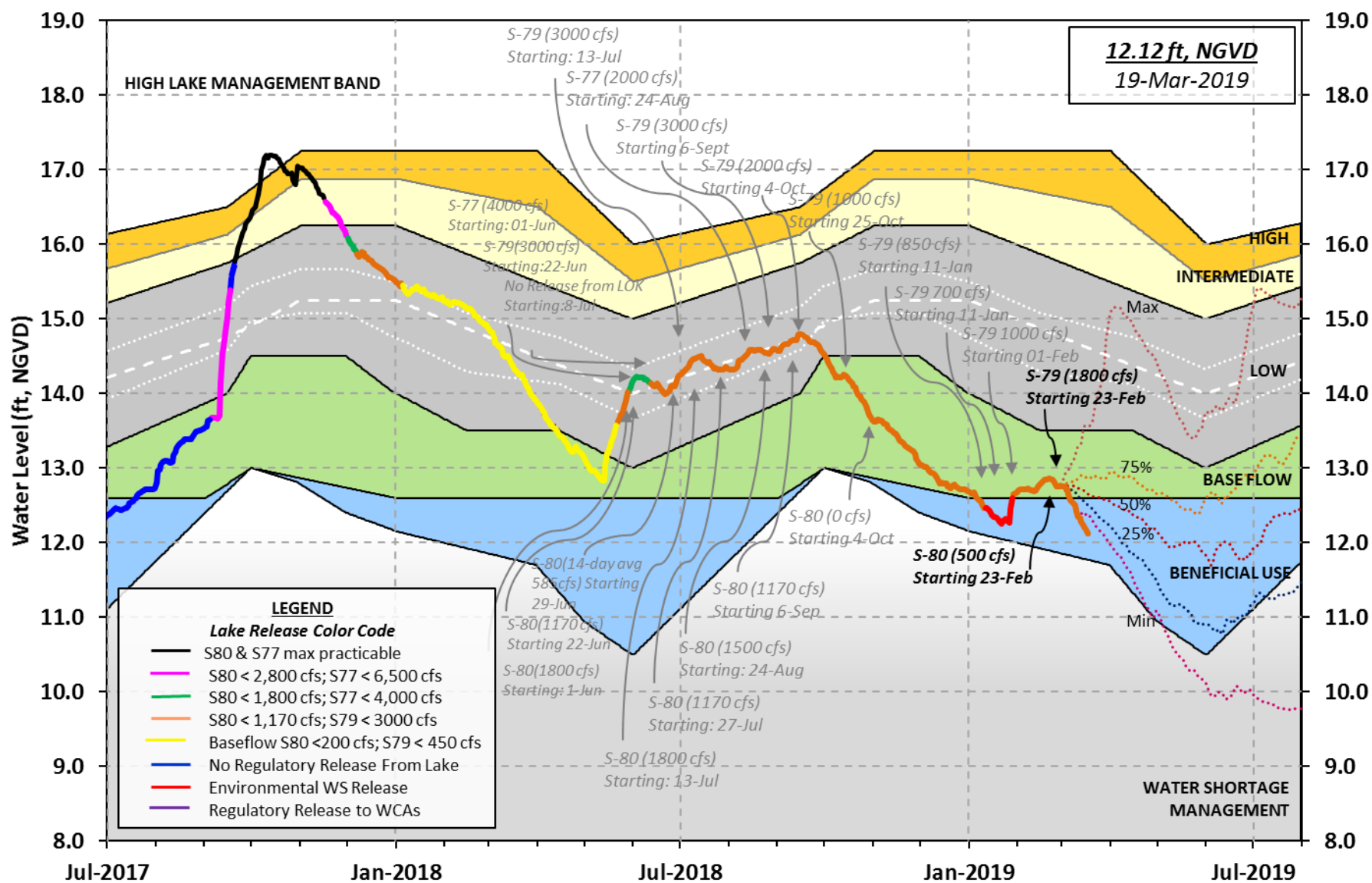


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

Lake Okeechobee Water Level History and Projected Stages



LORS-2008

Adopted by USACE 28-April-2008

Projected Stage Percentiles From
SFWMD-HESM Position Analysis

Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

Lake Okeechobee Water Level Comparison

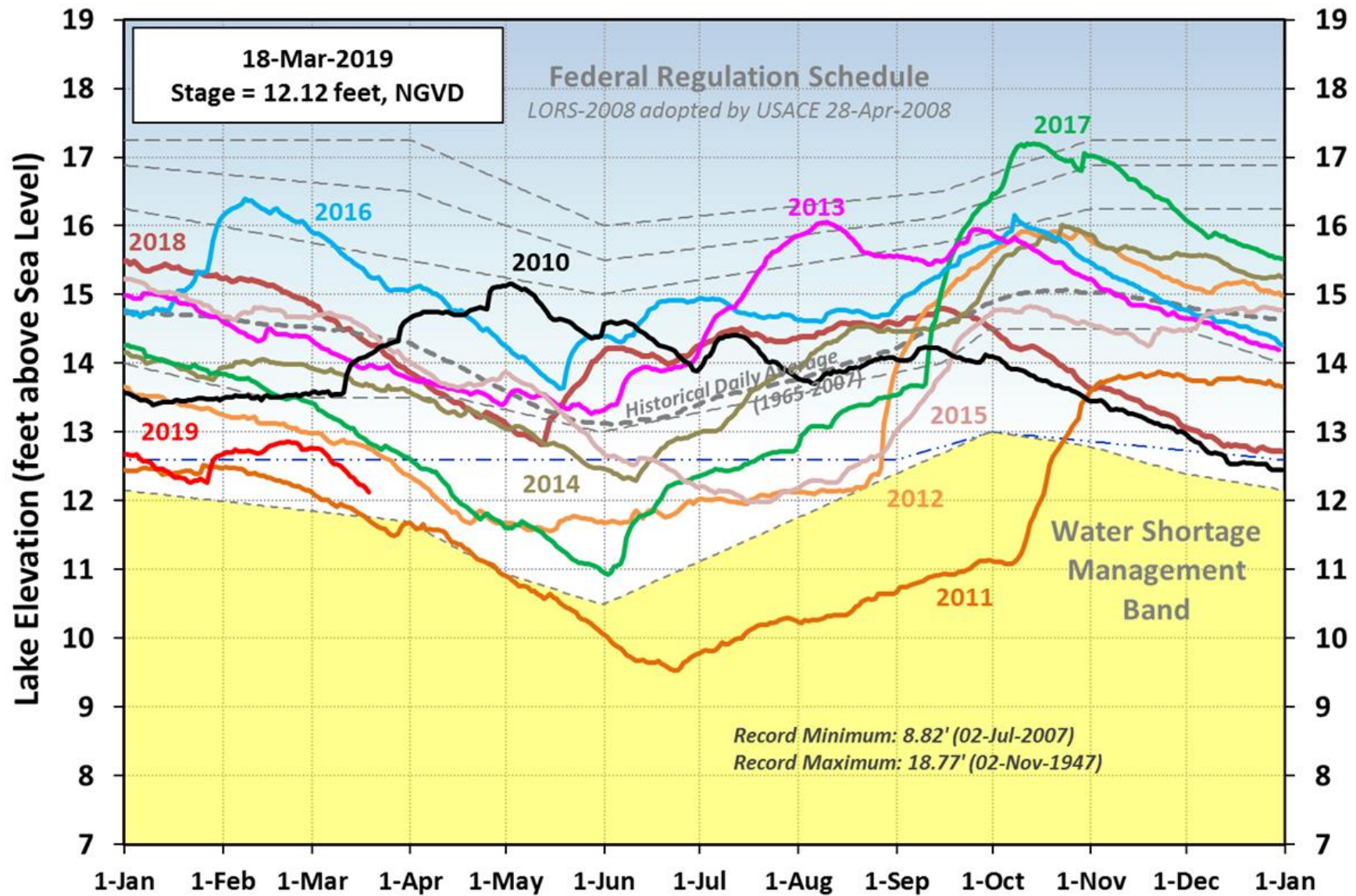


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES
FROM: 0530 EST, 03/12/2019 THROUGH: 0530 EST, 03/19/2019

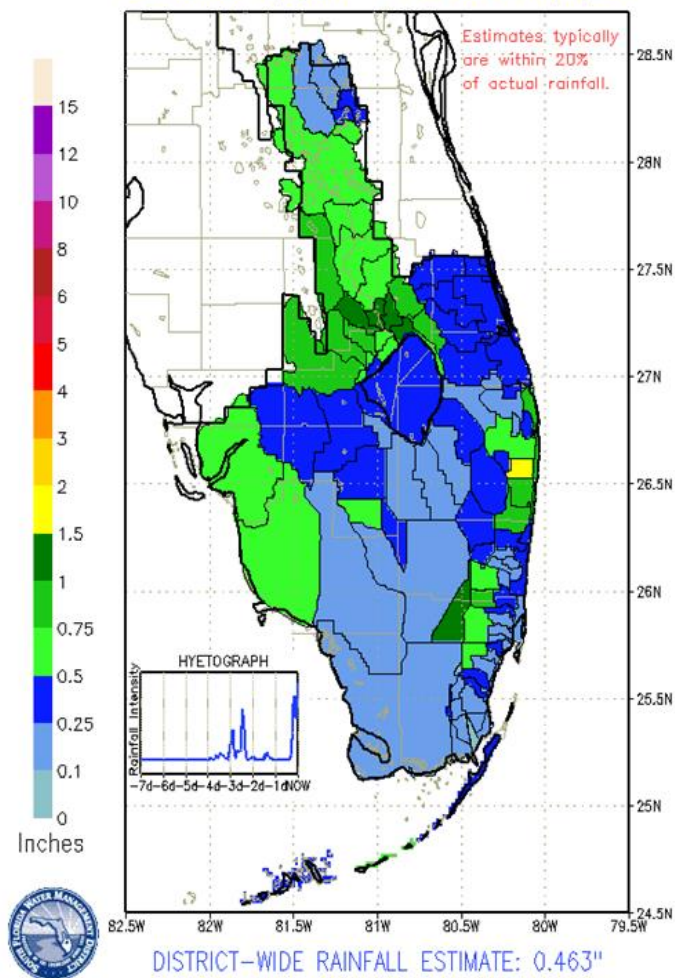


Figure 4. Rainfall estimates by basin.

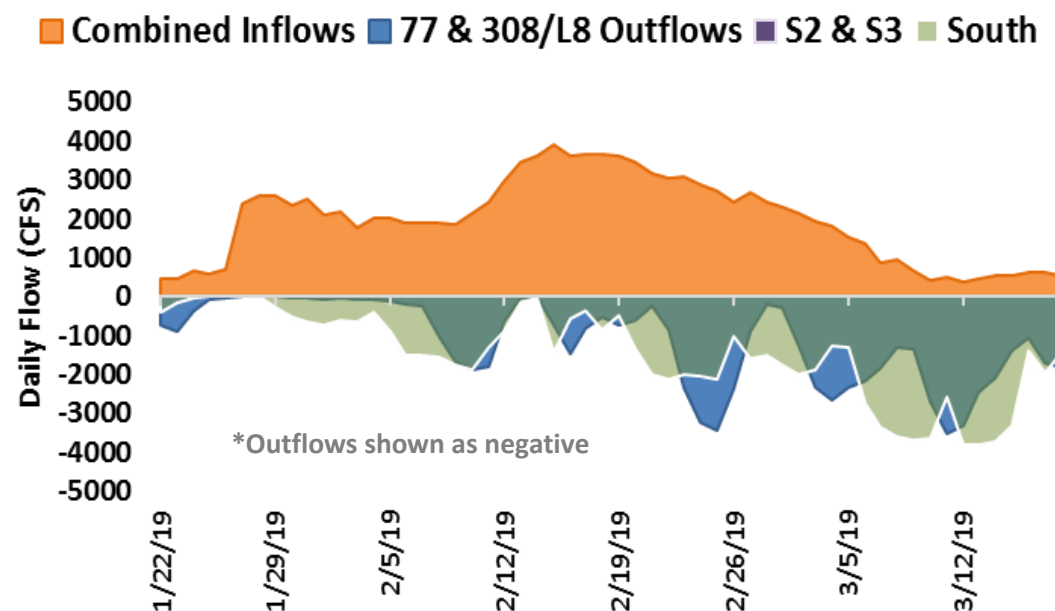
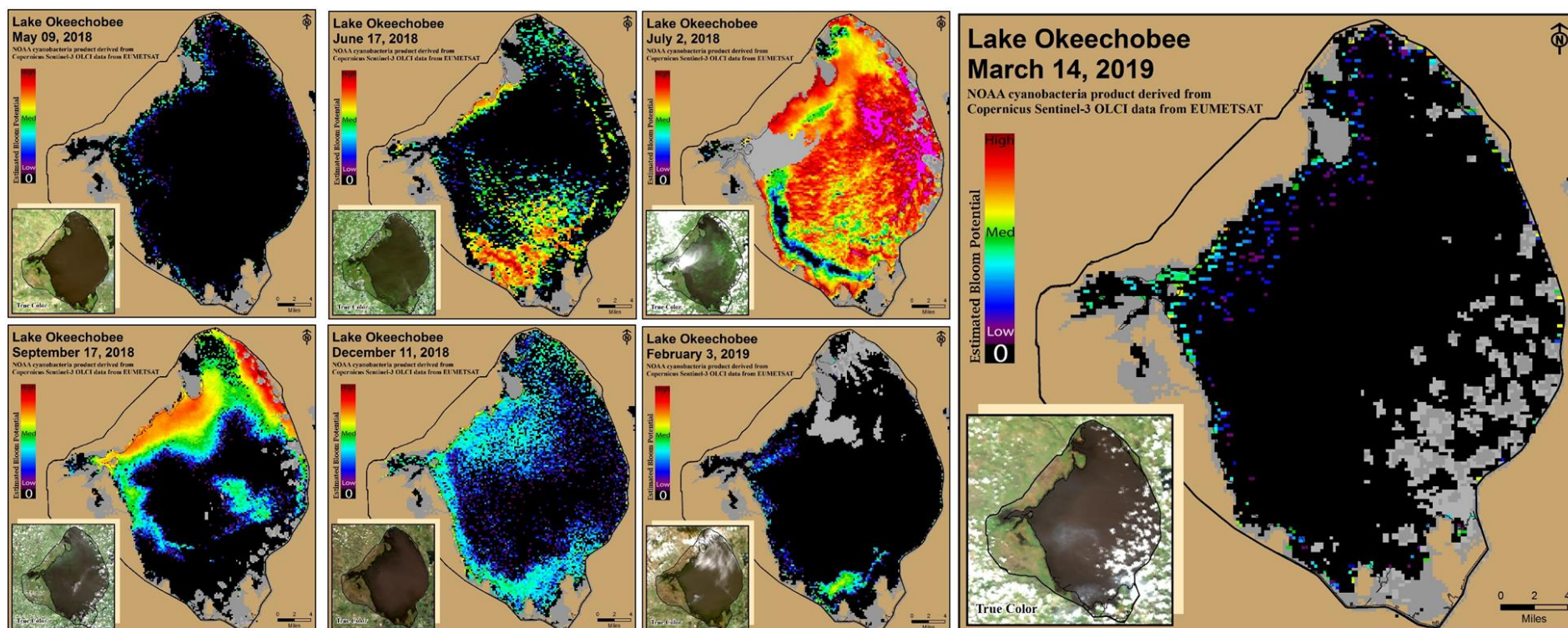


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes.



Gray = Cloud Cover

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

Unvalidated and Experimental Data

Figure 6. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover. All data are experimental and unvalidated at this point in product development.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 520 cfs (Figures 1 and 2) and last month inflow averaged about 657 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	111
S-80	335
S-308	430
S-49 on C-24	0
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	74

Over the past week, surface salinity decreased at HR1, US1 (Table 2, 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 estimated to be between 10 and 26. 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.

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	11.1 (13.0)	12.2 (13.7)	NA ¹
US1 Bridge	12.8 (14.1)	10.2 ² (11.7 ²)	10.0-26.0
A1A Bridge	20.2 (21.4)	27.3 (25.3)	NA ¹

¹Envelope not applicable and ²Questionable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 2,019 cfs (Figures 5 and 6) and last month inflow averaged about 2,027 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	1,486
S-78	1,317
S-79	1,873
Tidal Basin Inflow	146

Over the past week in the estuary, surface salinity remained about the same to Val-I75 and increased downstream (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be within the good range for adult eastern oysters at Cape Coral and at Shell Point (Figure 9). Salinity values were not available at Sanibel. The 30-day moving average surface salinity is 0.3 at Val I-75 and 2.6 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 (0.3)	0.4 (0.3)	0.0-5.0 ²
Ft. Myers Yacht Basin	3.2 (1.6)	5.4 (2.0)	NA
Cape Coral	9.3 (8.2)	~13.0 (10.8)	10.0-30.0
Shell Point	22.1 (20.0)	22.0 (NR)	10.0-30.0
Sanibel	NR ³ (NR)	NR (NR)	10.0-30.0

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

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 0.7 to 3.3 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 1800 cfs and Tidal Basin inflows of 185 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	185	3.3	1.2
B	300	185	3.1	1.1
C	450	185	2.8	1.1
D	650	185	1.8	0.9
E	1800	185	0.7	0.6

Red tide

The Florida Fish and Wildlife Research Institute reported on March 15, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was not observed in samples collected from Lee, Martin, Palm Beach, or Miami-Dade counties (no samples were collected from St. Lucie or Broward counties).

Water Management Recommendations

Lake stage is in the Beneficial Use sub-band of 2008 LORS. Tributary hydrological conditions are normal. The 2008 LORS recommends no release at S-79 and S-80. 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.

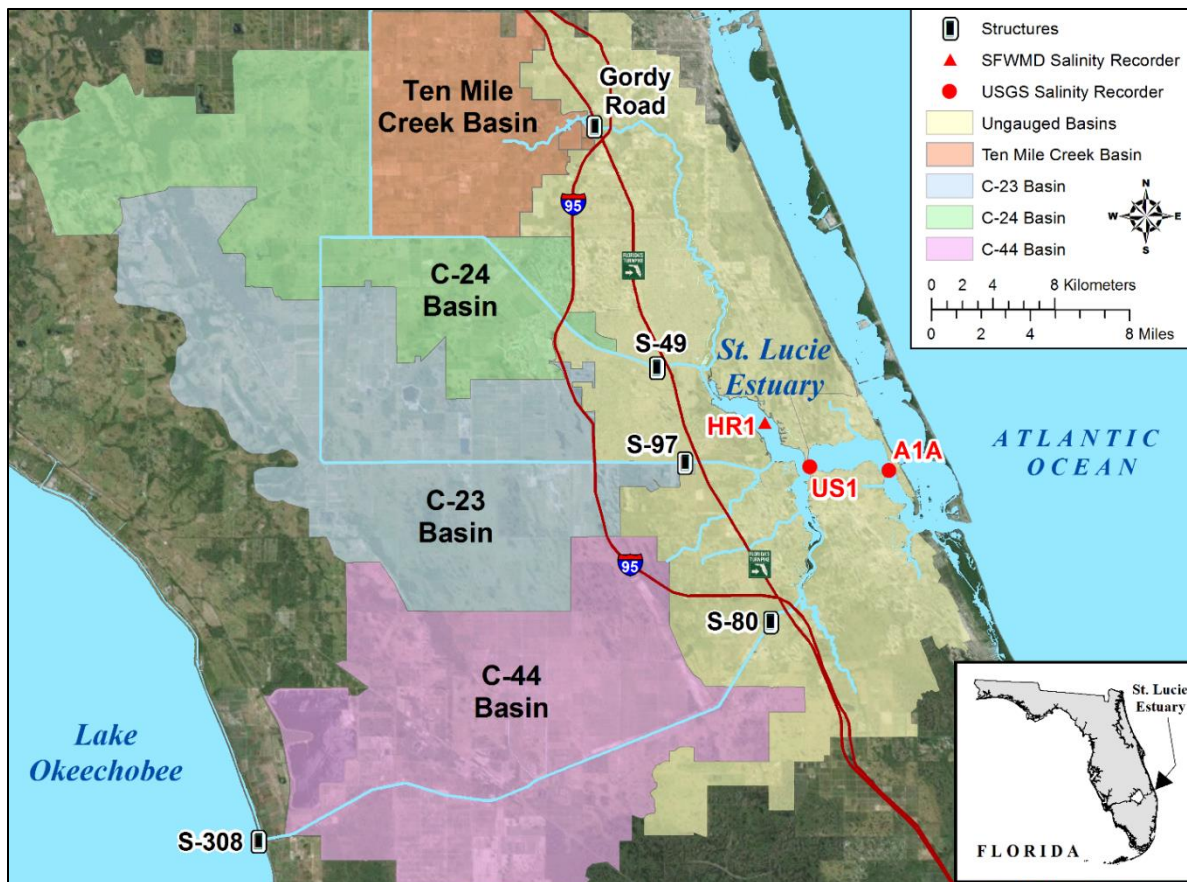


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

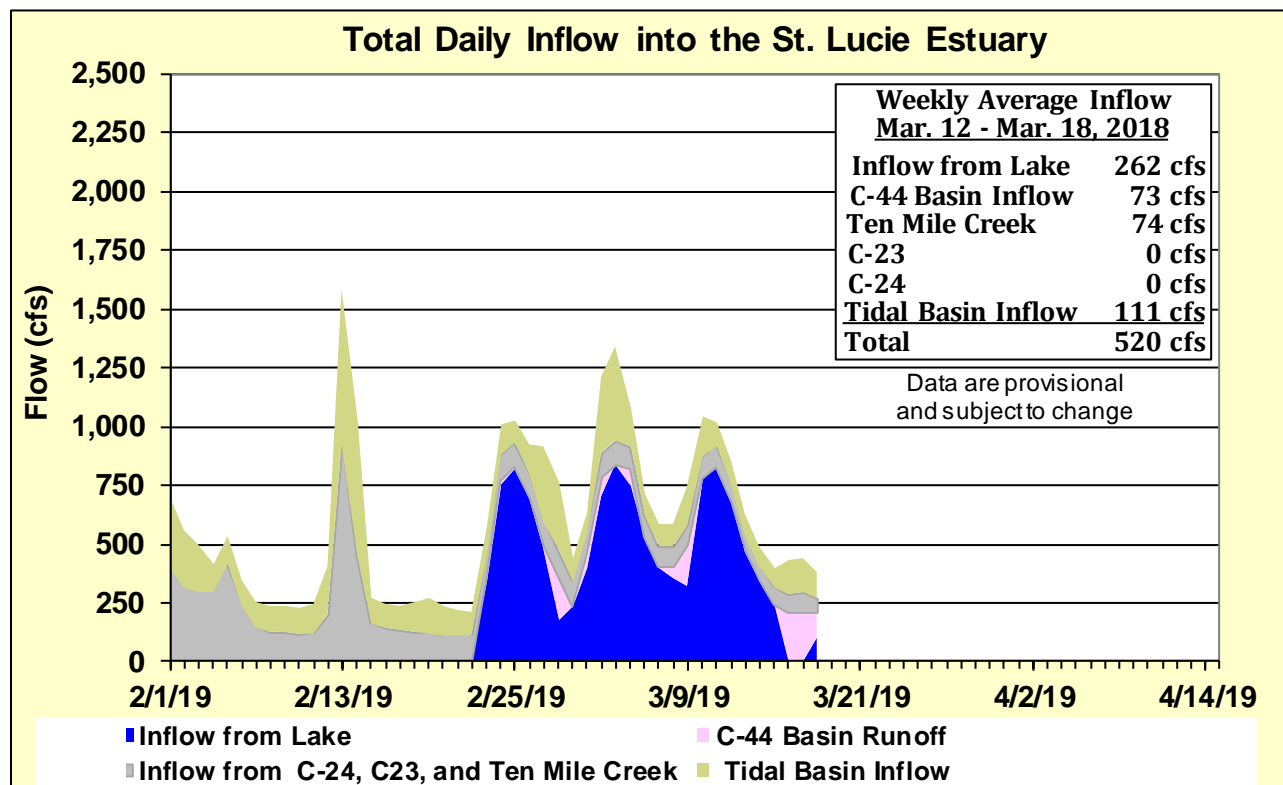


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

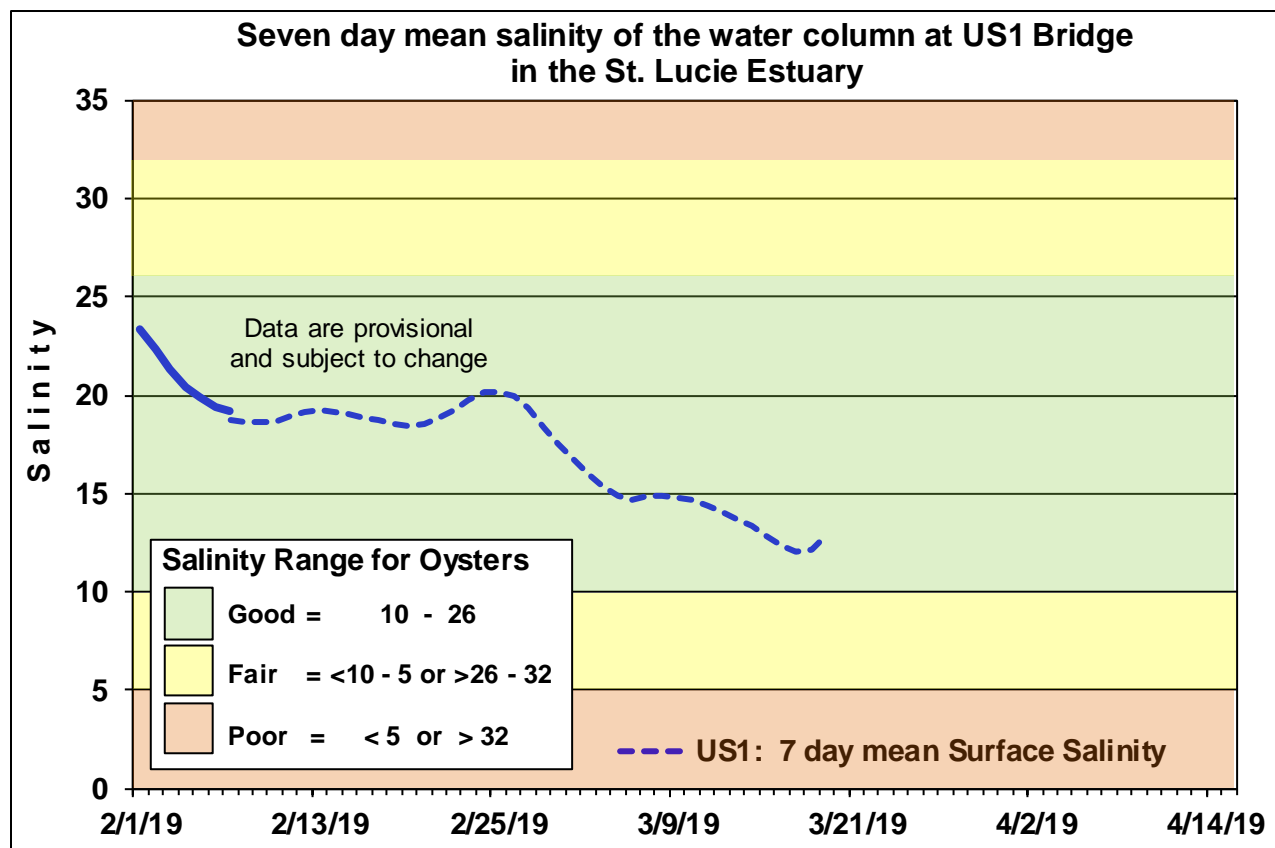


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

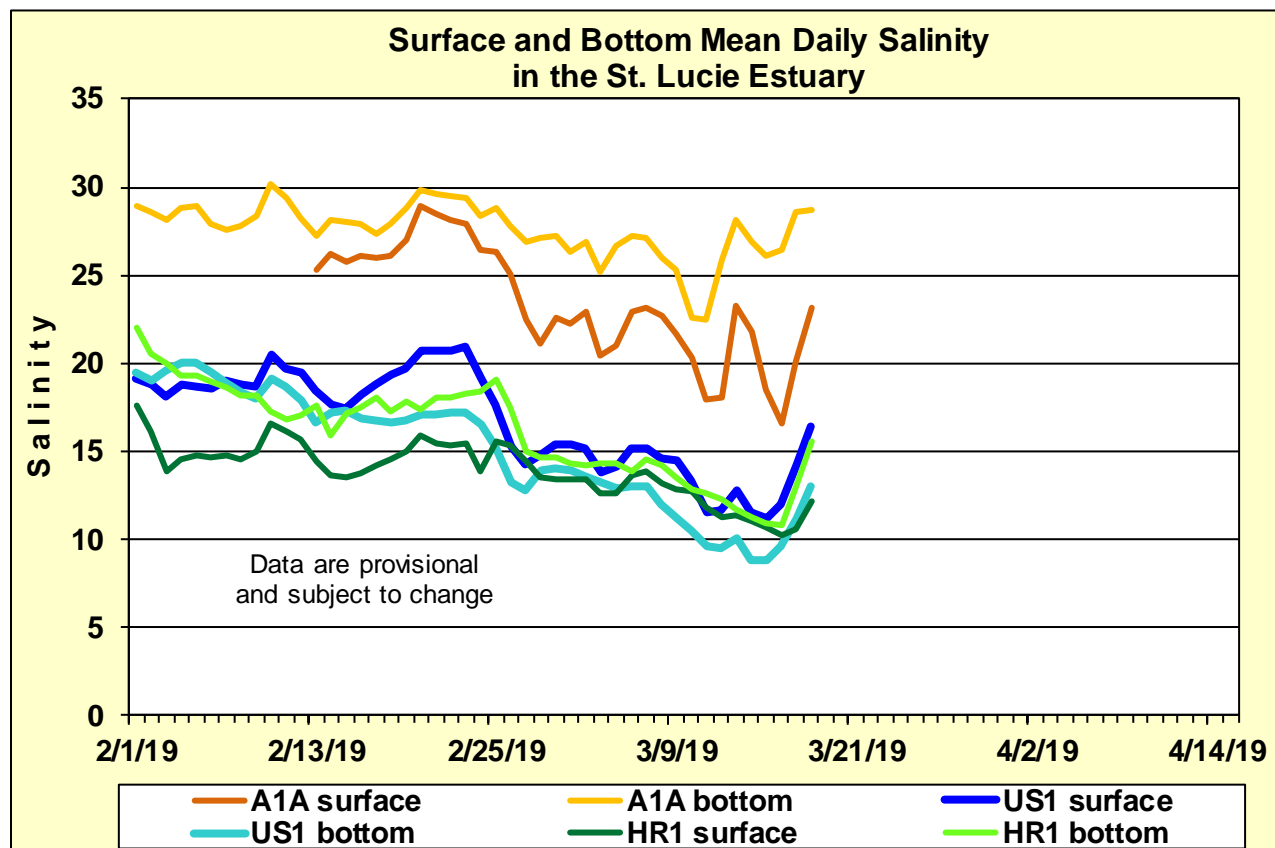


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

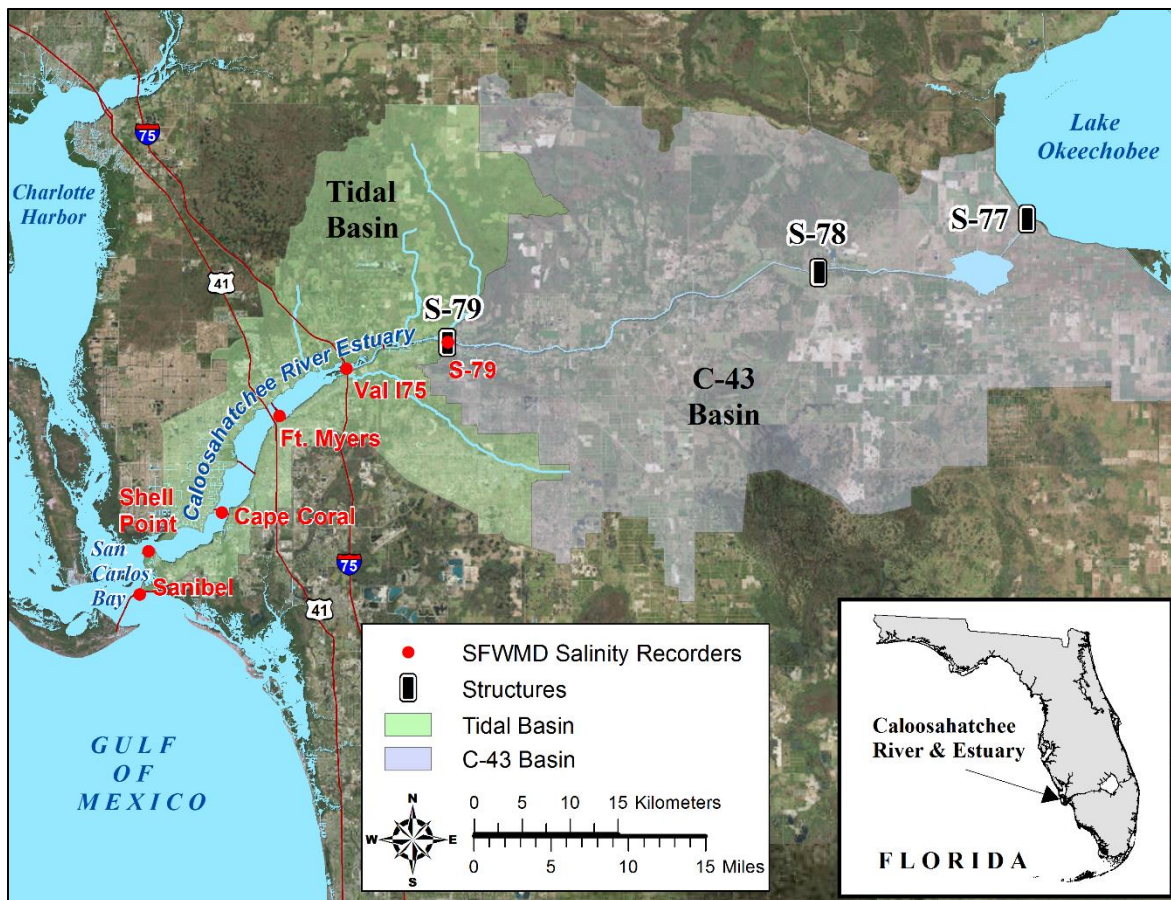


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

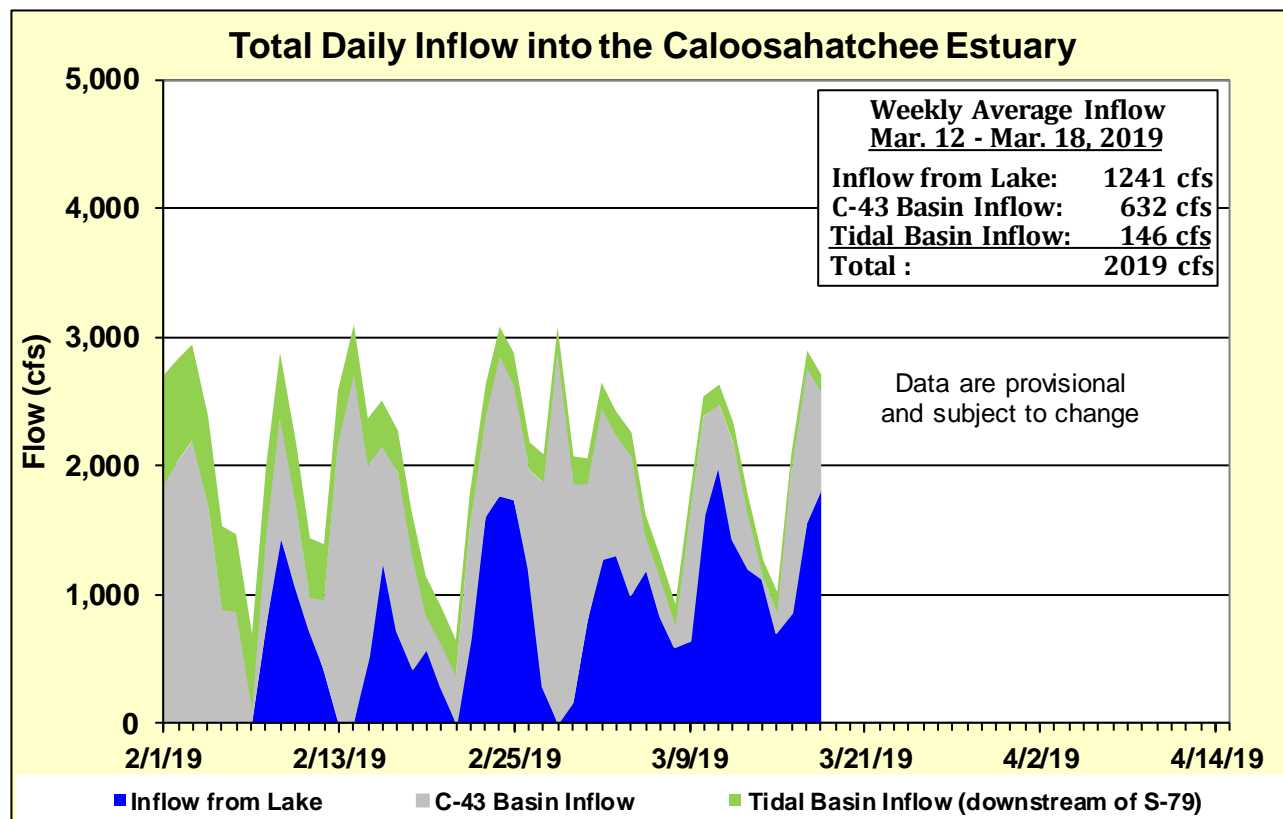


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

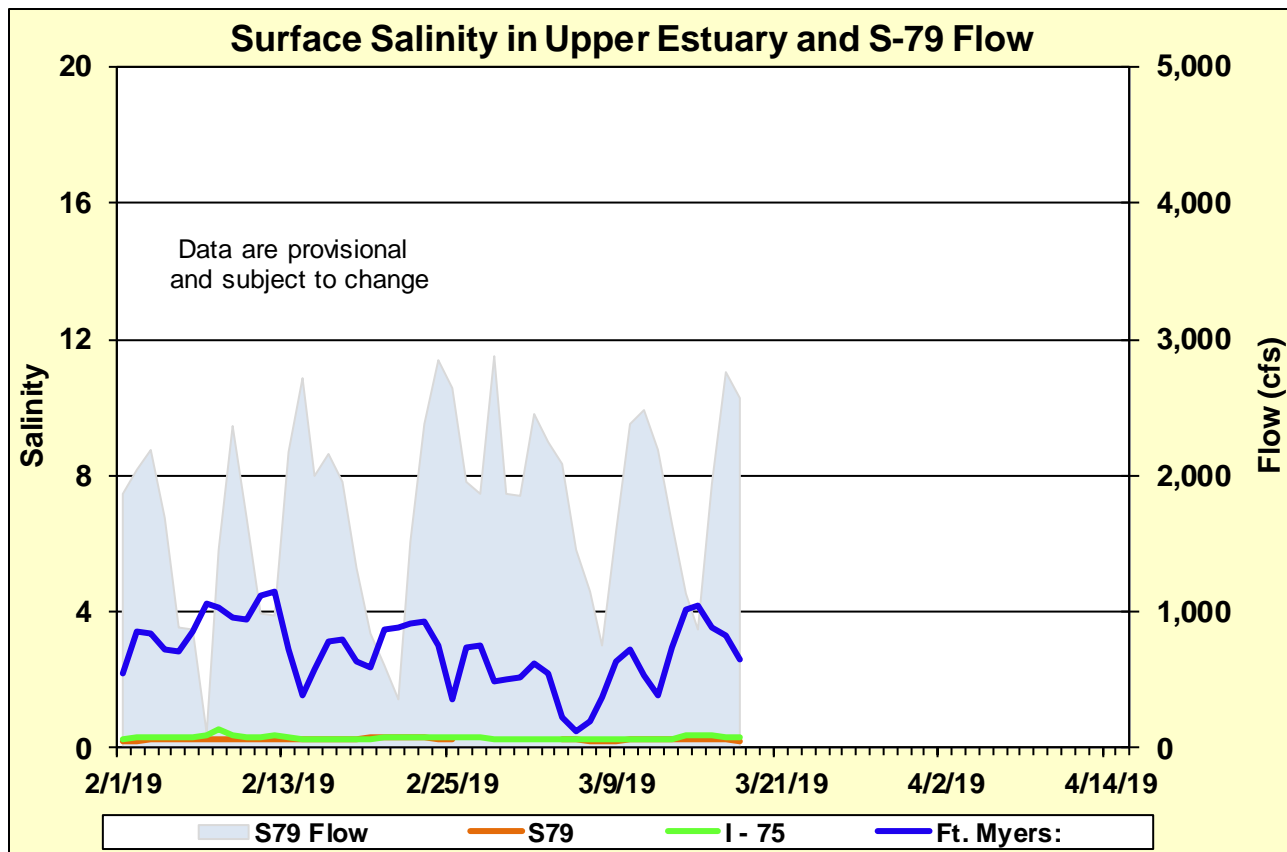


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

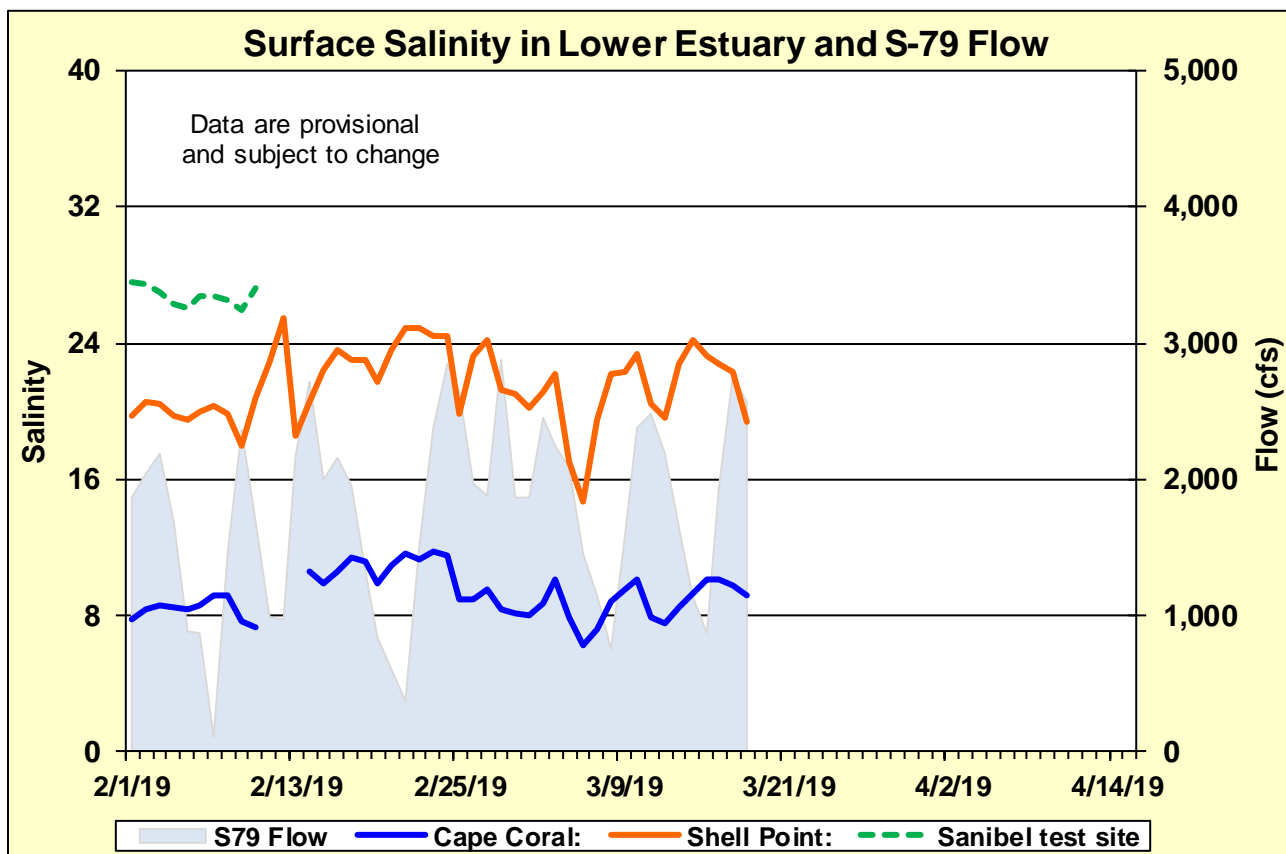


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

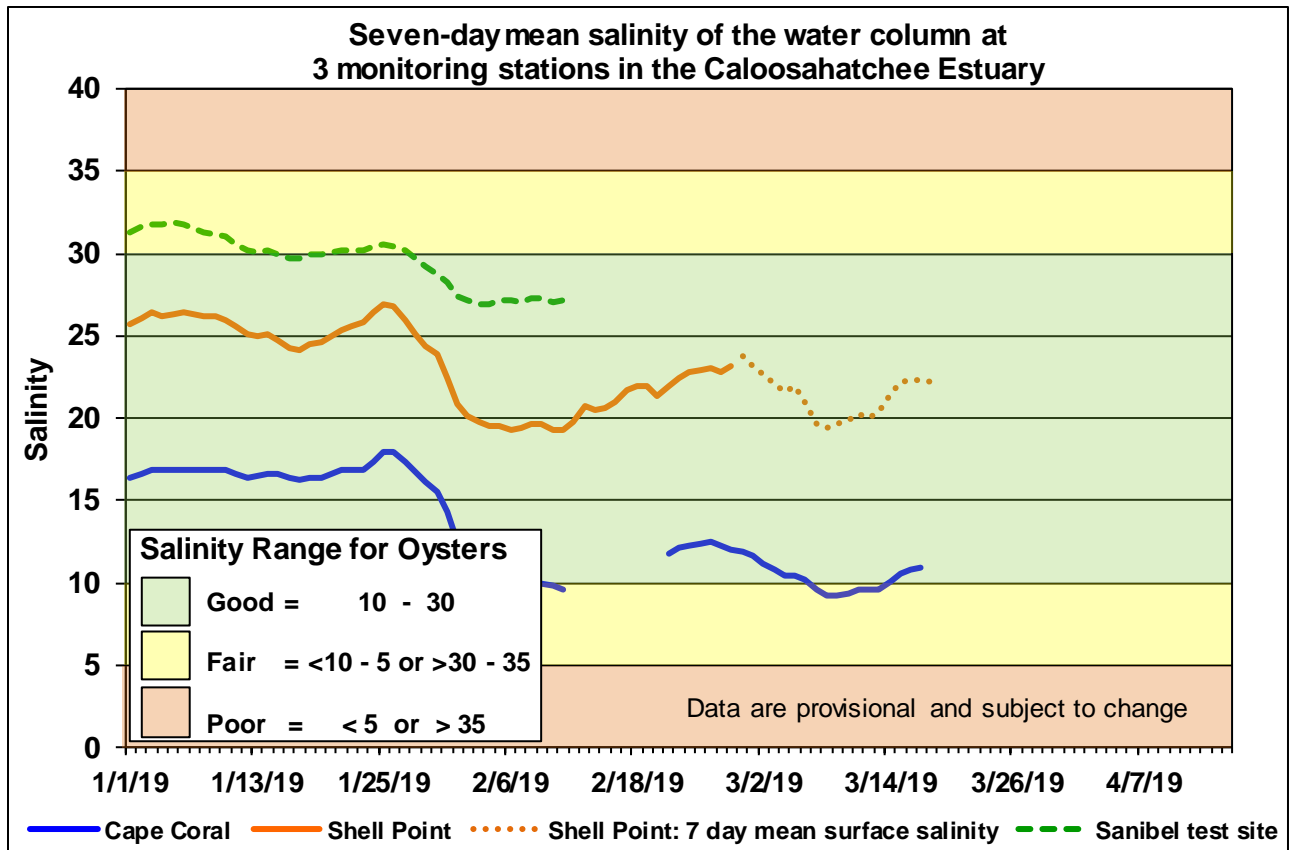


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

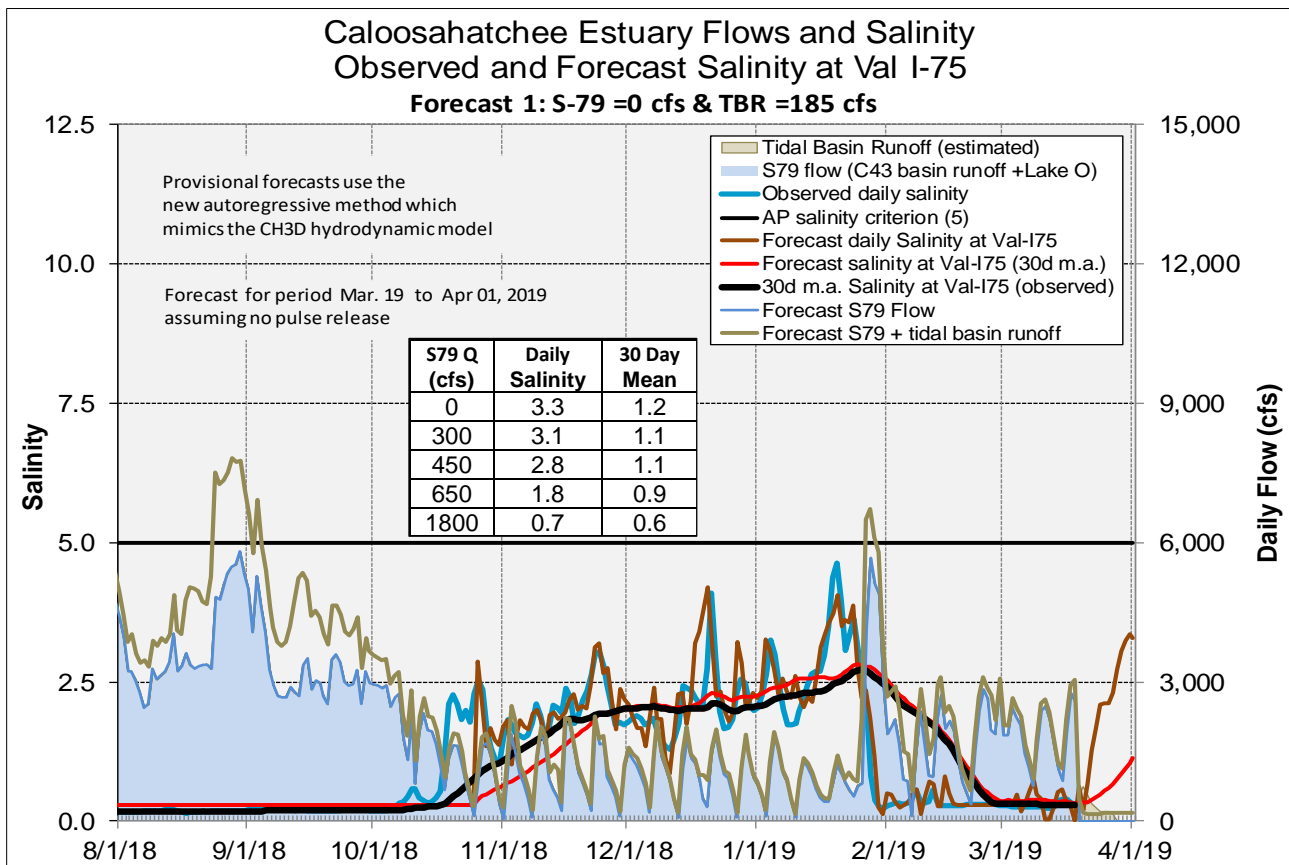
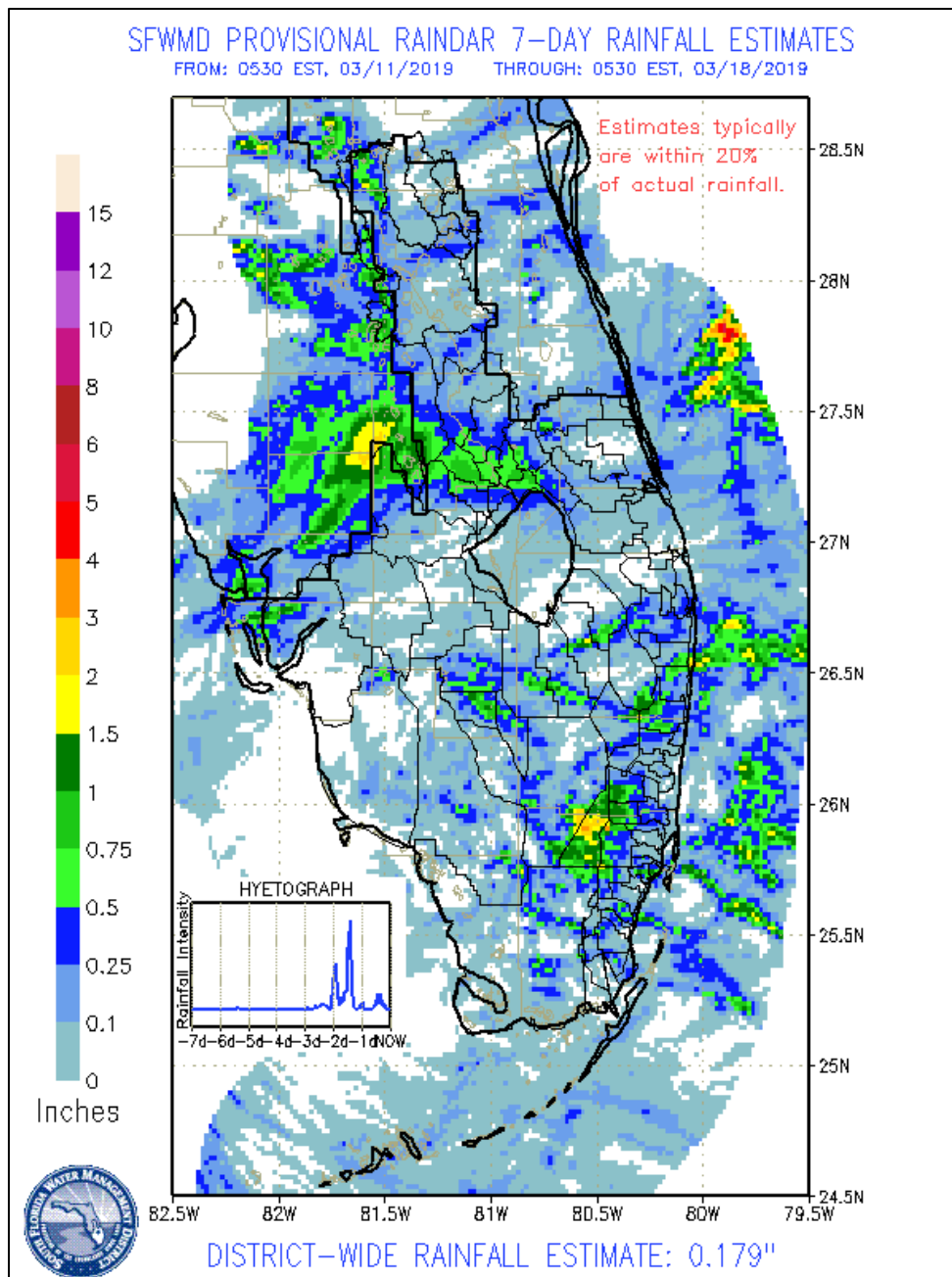


Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S-79.

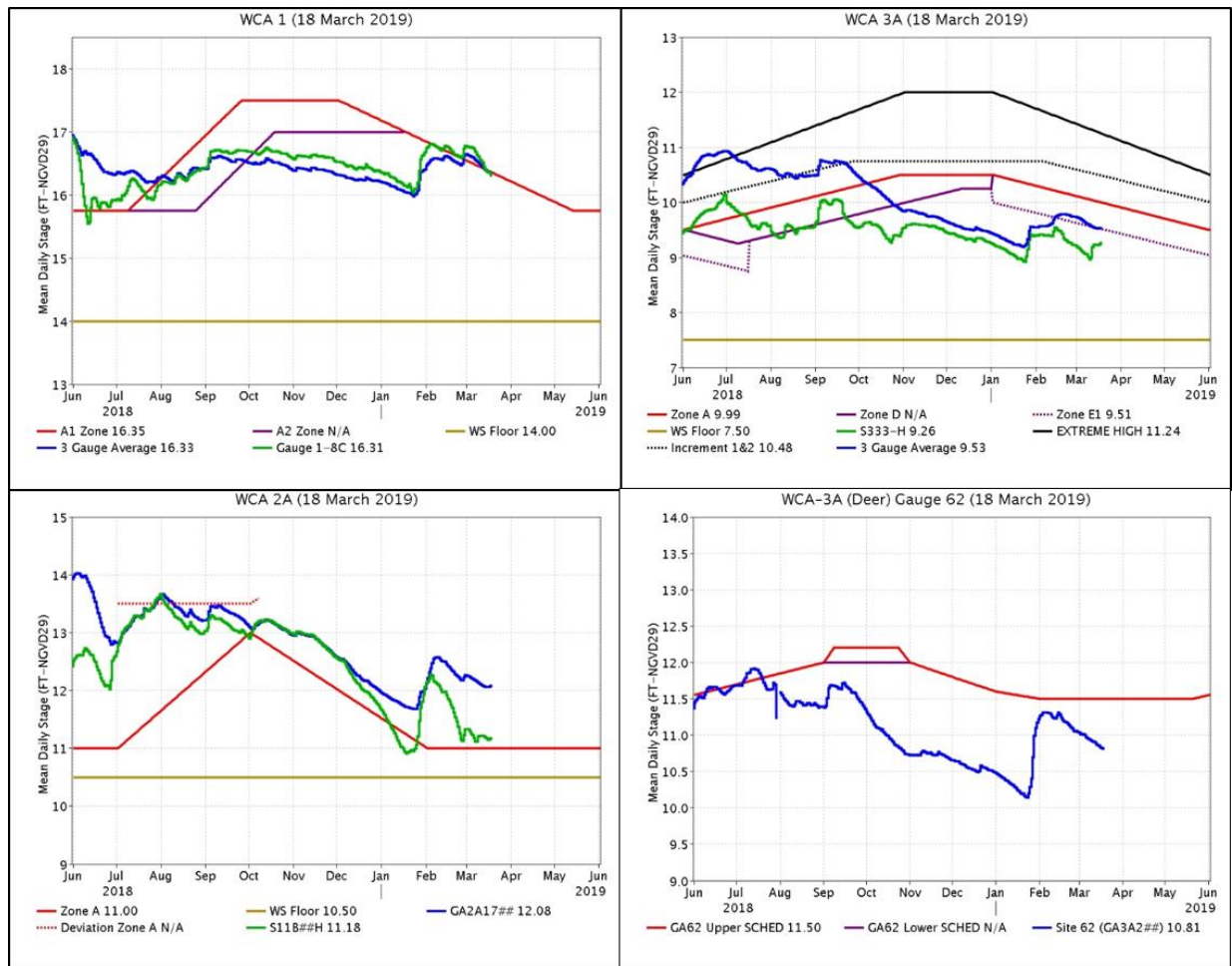
EVERGLADES

With below average rainfall across the Everglades through Sunday (except in WCA-3B), stages at the gauge locations monitored for this report receded in the WCAs at or near the rate determined optimal for wading bird foraging. The most extreme individual gauge changes within the WCAs ranged from -0.21 feet (WCA-1) to +0.09 feet (WCA-3B). Pan evaporation was estimated at 1.52 inches this week. Color coding designates the foraging conditions that could be expected at the rate provided.

Everglades Region	Rainfall (Inches)	Stage Change (feet)	
WCA-1	0.19	-0.15	
WCA-2A	0.23	-0.02	
WCA-2B	0.20	-0.15	
WCA-3A	0.20	-0.05	Good
WCA-3B	1.34	+0.04	Fair
ENP	0.11	-0.17	Poor



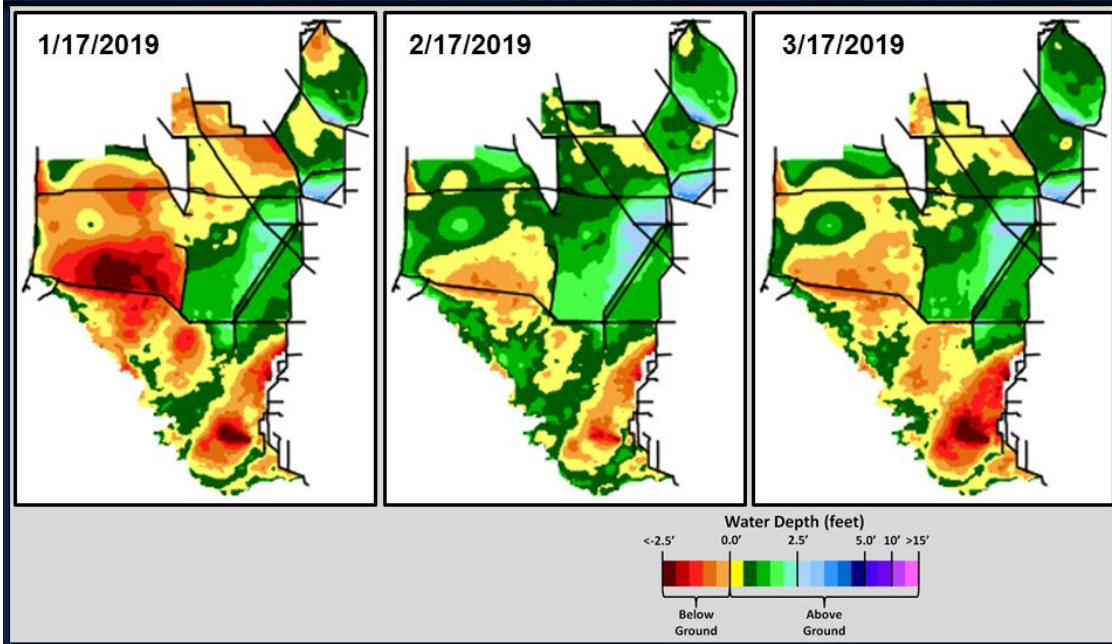
Regulation Schedules: WCA1: Gauge 1-8C is 0.04 feet below the Zone A1 regulation line. The three-gauge average is 0.02 above the canal stage. WCA2A: S-11B Headwater stage remains 0.18 feet above the Zone A regulation line. WCA-3A: The Three Gauge Average stage is 0.02 feet above Zone E1 regulation line and is following the line. WCA-3A at gauge 62 (northwest corner) is 0.69 feet below the upper schedule and continues to steadily recede.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate a gradual drying down of WCA-3A and WCA-2A. WCA-1 depths look more consistent across that basin. Depth conditions in the western basins looks to be relatively stable, with depths similar to a month ago. Conditions to the south are drying. WDAT difference output indicates that water levels fell across the Everglades over the month. Increases in depth seem to reflect the management goal of moving water through the Everglades system and south. In the “1 Year” inset we see continue to see the difference between current depth conditions and the unusual water conditions a year ago. Now significantly higher in northeast WCA-3A and lower in the historically ponded regions WCA-3A South, these differences are ecologically favorable as we look to protect peat soils in the north of WCA-3A and moderate the flooding of tree islands in the south.



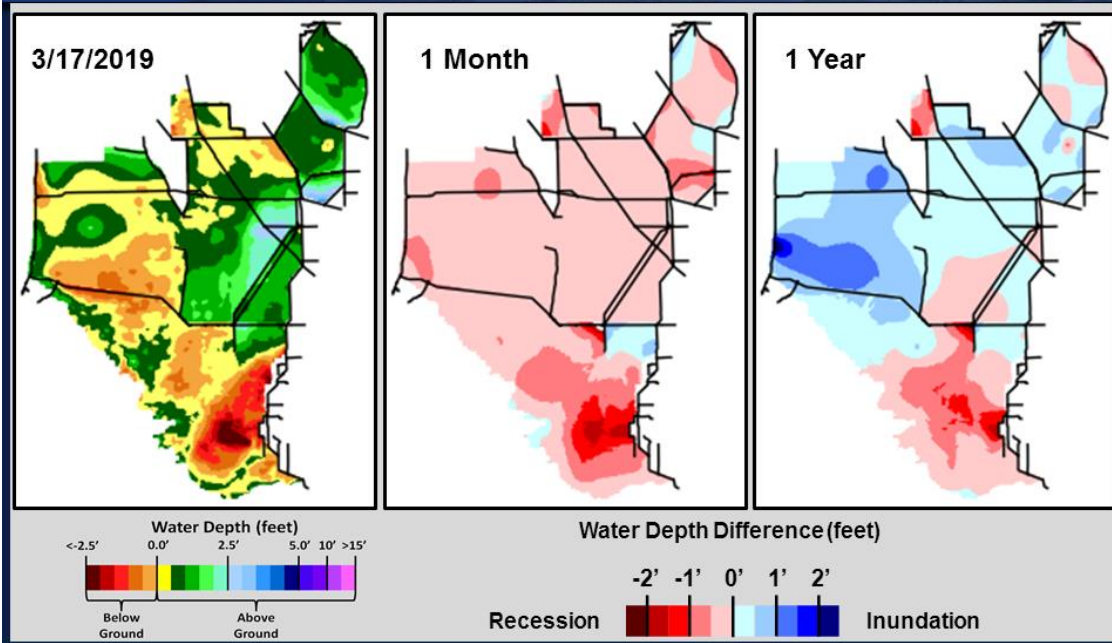
SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)



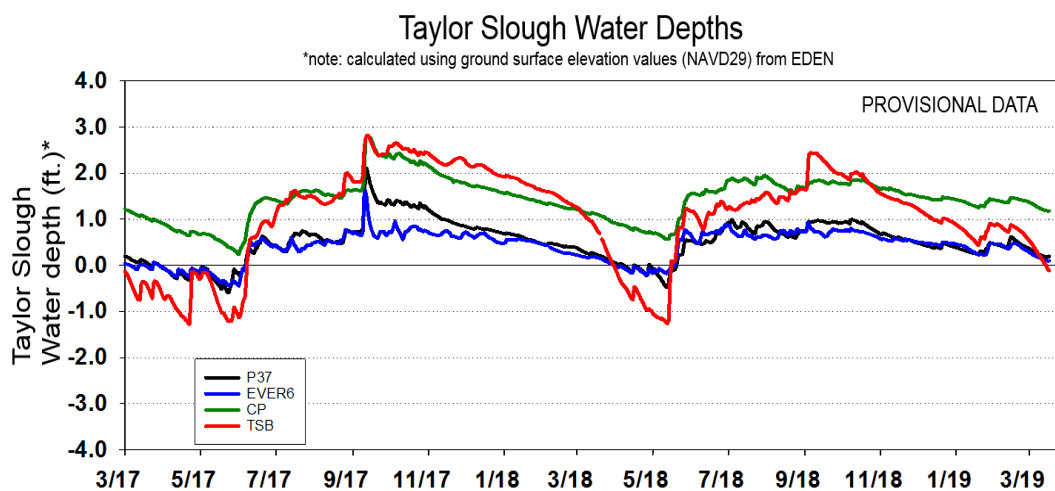
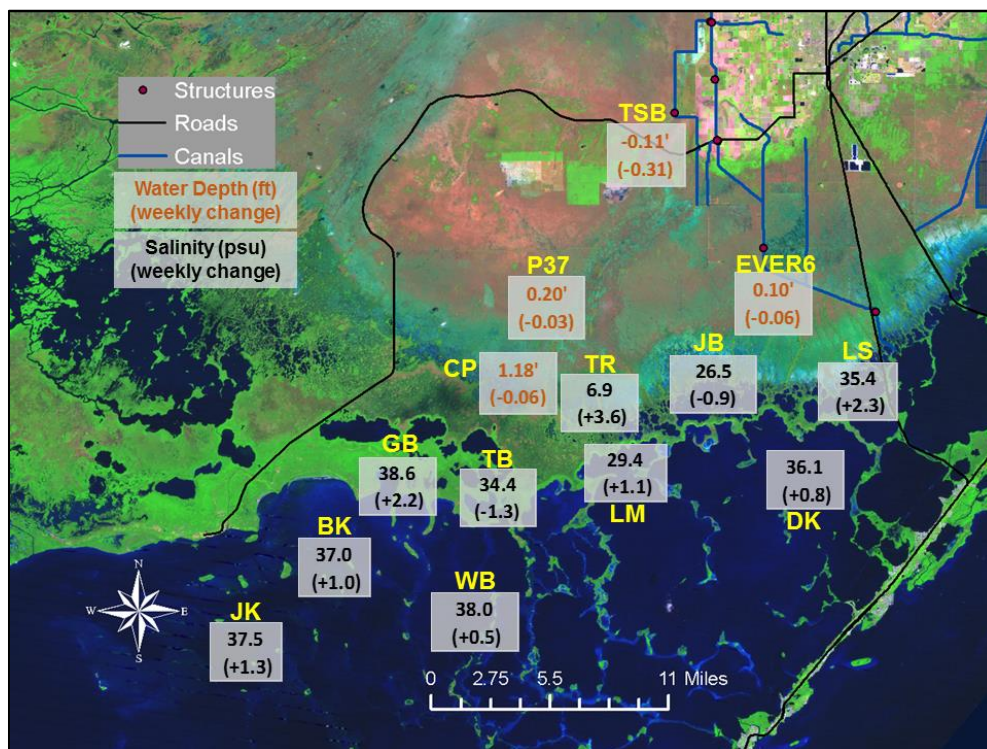
SFWDAT Everglades Difference Maps (Present – Past)

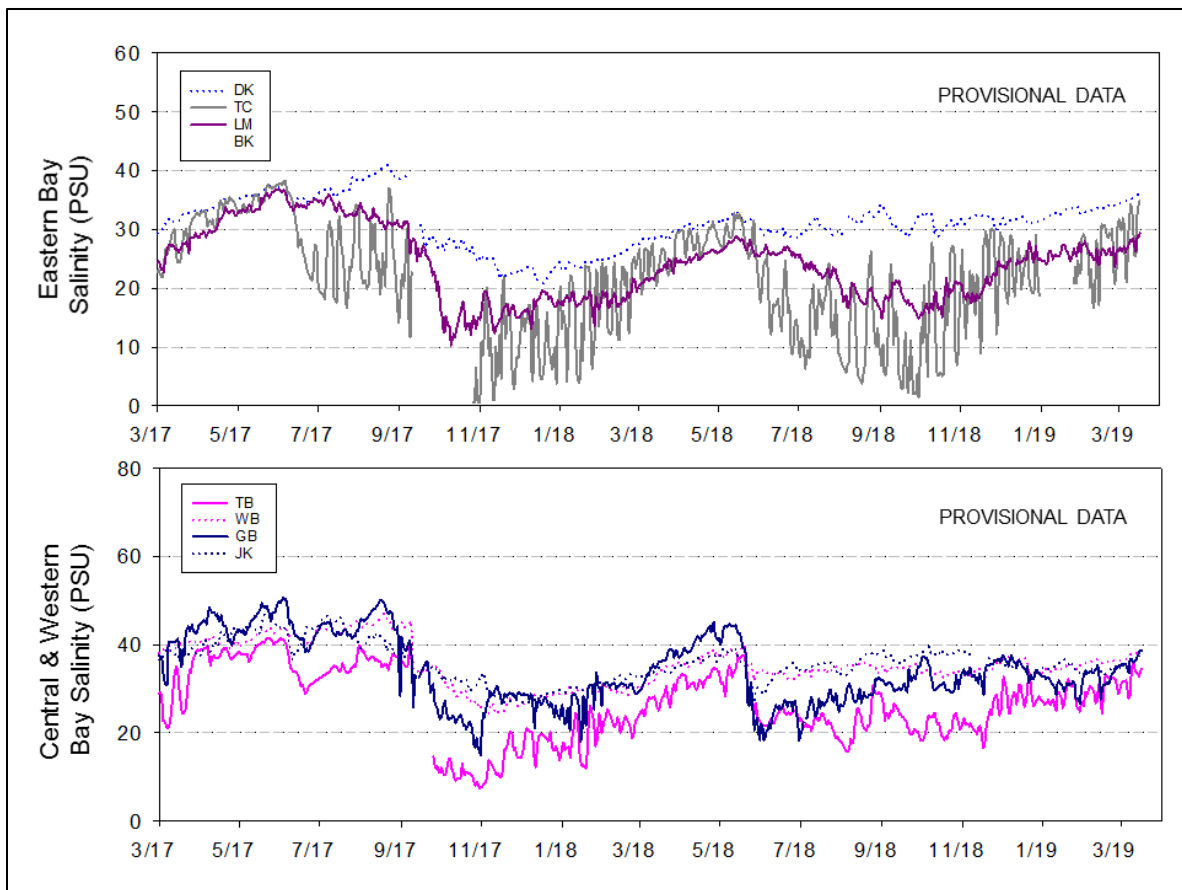


South Florida Water Depth Assessment Tool (SFWDAT)

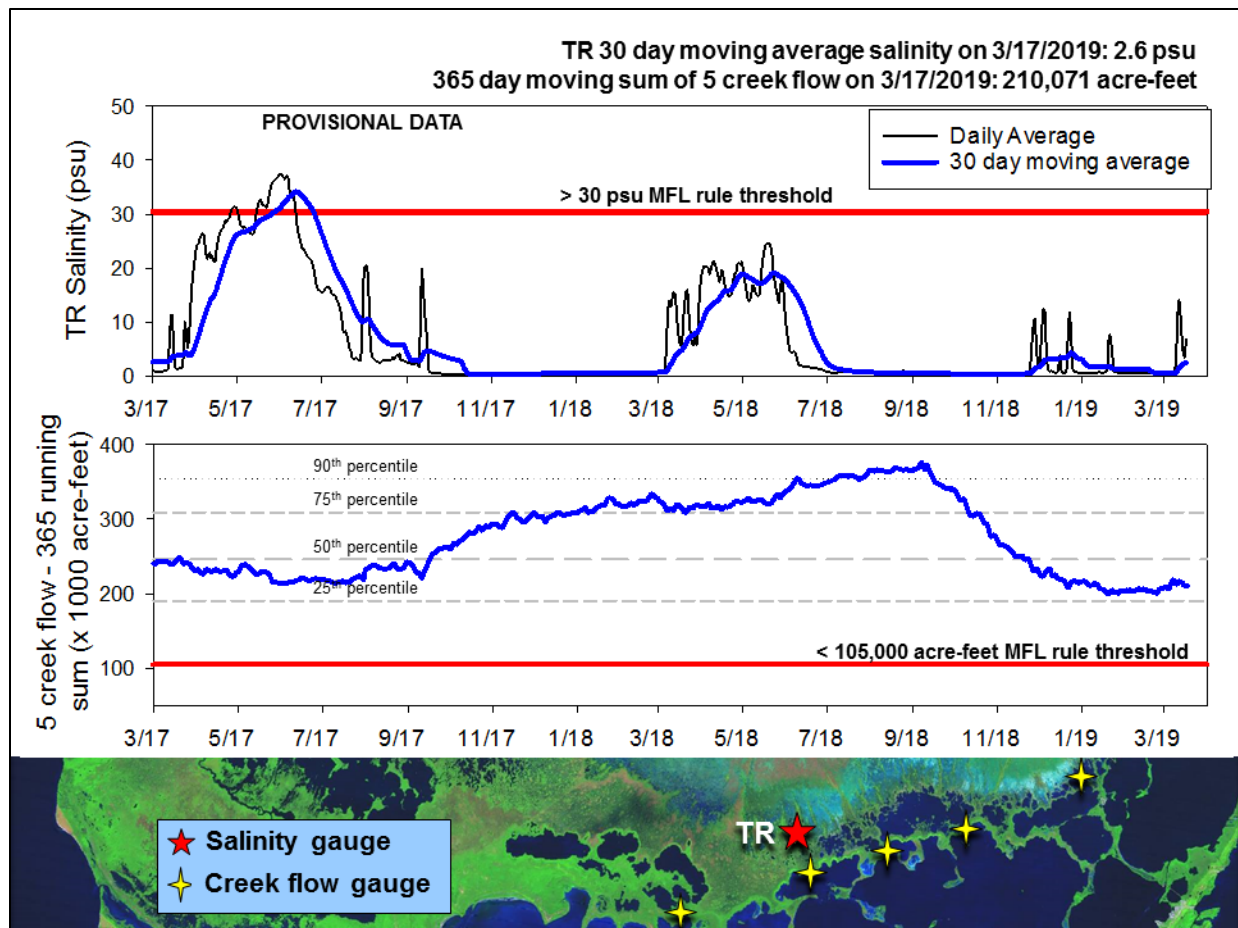
Taylor Slough Water Levels: An average of 0.1 inches of rain fell on Taylor Slough and Florida Bay this past week allowing water depths to continue decreasing an average of 0.11 feet. Water depths averaged 0.34 feet across Taylor Slough by Sunday. Conditions are 3 inches above average for this time of year as the natural system proceeds with seasonal recession.

Florida Bay Salinities: Average salinity in Florida Bay increased 1 psu from last week with individual station changes ranging from a decrease of 1 psu to an increase of 3 psu. Daily average salinities ranged from 27 psu in the northeast to 39 psu in the western nearshore area and are still about 4.6 psu above average for this time of year.





Florida Bay MFL: Salinity in the mangrove zone increased to 14 psu at the beginning of the week before decreasing to 7 psu by Sunday. The 30-day moving increased to 2.6 psu as a result. The weekly cumulative flow from the five creeks denoted by yellow stars on the map totaled about -550 acre-feet with the negative flows having started again on Friday, 3/15. At this time of year, there is very little gravity driven downstream flow. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) has decreased slightly to 210,071 acre-feet (less than the long-term average of 257,628 acre-feet but above the 25th percentile). Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Keeping rainfall/freshwater in the Everglades system while protecting a dry season recession is a priority. Discharges into northwestern WCA-3A, Holey Land and Rotenberger remain ecologically beneficial and an ecological priority. While very low numbers of wading birds have been noted foraging in the WCAs and expectations are for lower than average nesting success. Discharges into WCA-3A North continue to have ecological benefit as white ibis begin to nest at the Alley North colony within that basin. WCA-2A has the potential to support nesting colonies in WCA-1 and WCA-3A. A careful recession is recommended in WCA-2A with the goal to reach suitable wading bird foraging depths within the next month and not too fast as to over drain the area. The recession rate as calculated by the three main gauges in WCA-1 (1-7, 1-9 and 1-8T) was faster (-0.15 feet last week on average) than the maximum rate determined to be optimal for wading bird foraging (-0.09 feet per week). More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, March 19th, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.15'	Maintain depths at regulation schedule. Moderate ascension rates as possible, manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect upstream/downstream habitat and wildlife.
WCA-2A	Stage decreased by 0.02'	Moderate ascension rates as possible, manage recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-2B	Stage decreased by 0.15'	Maintain depths at regulation schedule.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.14'	Maintain depths at regulation schedule. Moderate recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect habitat including <u>peat soil</u> development, tree islands and wildlife. Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-3A NW	Stage decreased by 0.08'	Maintain depths at regulation schedule. Moderate recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	
Central WCA-3A S	Stage decreased by 0.05'	Maintain depths at regulation schedule. Moderate recession rates not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect upstream/downstream habitat and wildlife. Protect conditions that provide wading bird foraging habitat later into the nesting season.
Southern WCA-3A S	Stage decreased by 0.08'		
WCA-3B	Stage increased by 0.04'	Maintain depths at regulation schedule. Moderate ascension rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage decreased by 0.17'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.03' to -0.31'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions. Decrease potential for high phosphorus input to ENP.
FB- Salinity	Salinity changes ranged -1.3 to +2.3 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.