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M E M O R A N D U M

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

FROM: SFWMD Staff Environmental Advisory Team

DATE: April 24, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A dry and stable air mass associated with surface high pressure over the southeastern United States should gradually shift eastward into the western Atlantic by late Wednesday. The lack of moisture and strongly stable atmosphere should allow dry conditions to prevail through Wednesday across the District and likely even through Thursday, even though the atmosphere's moisture content should gradually be increasing by that time. A weak low-pressure area and cold front associated with a southern jet stream disturbance should move out of the southern Plains on Thursday, with the cold front expected to reach north Florida by Friday afternoon. A considerable increase of moisture, enhanced instability and weak jet dynamics in association with this weather system should cause a significant increase of rain chances across the District on Friday, with a tendency for the greatest areal average rainfall to be over the western and central portions of the District and closer to the best 'lift' associated with the front. The front should weaken as it sinks southward into the northern portion of the District by Saturday and bring with it a relative drying over the northwestern portion of the District. To the south of the frontal boundary, however, summertime levels of moisture and high instability should result in enhanced rains, even though the favorable jet dynamics from Friday should be less of a factor by then. Some of the rains on Saturday, especially near or along the southeast coast of Florida, could be locally heavy and produce some potentially significant local rainfall maxima. The stalled frontal zone should gradually weaken and lose its identity on Sunday while the upper-level system associated with it shifts east of the area. This weather pattern should lead to a gradual drying over the southern and eastern portions of the District by Monday, even if some rains continue over this region; meanwhile areas farther north and west should remain dry. Overall, the models have trended toward a more progressive solution regarding the weather system to affect the District late this week, which would favor a rainy Friday and Saturday but then at least some reduction in rainfall by early next week. For the week ending next Tuesday morning the deterministic total QPF is about a third of an inch or a little less than half of normal. The probabilistic model output supports the idea of below normal total weekly District rainfall, with the likeliest scenario of quarter to a third of an inch (25th percentile) and about an even chance (50th percentile) that it would result close to a half of an inch.

Kissimmee

Tuesday morning stages were 55.8 feet NGVD (0.7 feet below schedule) in East Lake Toho, 52.7 feet NGVD (0.8 feet below schedule) in Toho, and 49.6 feet NGVD (0.7 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 435 cfs at S-65, 326 cfs at S-65A, 510 cfs at S-65D and 542 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 6.0 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.16 feet. There were no new recommendations this week.

Lake Okeechobee

Lake Okeechobee stage is 11.48 feet NGVD, decreasing 0.11 feet from the previous week. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.35 feet above the Water Shortage sub-band. The lake remains below the bottom of the ecological envelope (currently 1.25 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. Given the continued potential for above average rainfall (associated with a weak El Niño) over the next few months, and the poor condition of SAV and EAV in the nearshore zone, these lower lake stages are ideal for vegetation recovery. However, low stages will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh. Satellite imagery suggest the potential for algal blooms has increased along the western shore, particularly within Fisheating Bay and along the edge of Indian Prairie.

Estuaries

Total Inflow to the St. Lucie Estuary average 265 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinity increased slightly 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 average 1,038 cfs over the past week with 333 cfs coming from the Lake. Over the past week, salinity decreased at Cape Coral and Shell Point. The 30-day moving average surface salinity is 0.3 at Val i-75 and 4.3 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 Cape Coral and Shell Point.

Stormwater Treatment Areas

Over the past week, approximately 1,900 acre-feet of Lake water was delivered to the STA-1W expansion cells for start-up purposes. The total amount of Lake releases sent to the STAs/FEBs in WY2019 (since May 1, 2018) is approximately 453,000 acre-feet. The total amount of inflows to the STAs in WY2019 is approximately 1,510,000 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-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 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. Data delivery issues from Everglades National Park (ENP) prevent a full report this week. Water depths in Taylor Slough and the ENP panhandle again increased on average. Salinity in the mangrove zone decreased over the week, however, the 30-day moving still increased due to previous high salinity values.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.70 inches of rainfall in the past week and the Lower Basin received 0.70 inches (SFWMD Daily Rainfall Report 4/22/2018).

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: 4/23/2019

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)						
							4/21/19	4/14/19	4/7/19	3/31/19	3/24/19	3/17/19	3/10/19
Lakes Hart and Mary Jane	S-62	0	LKMJ	60.1	R	60.3	-0.2	-0.3	-0.4	-0.3	-0.4	-0.5	-0.3
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.4	R	60.5	-0.1	0.0	0.0	0.0	0.0	0.0	0.0
Alligator Chain	S-60	45	ALLI	63.1	R	63.1	0.0	-0.1	0.0	0.0	-0.1	-0.3	-0.2
Lake Gentry	S-63	68	LKGT	60.6	R	60.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
East Lake Toho	S-59	20	TOHOE	55.8	R	56.6	-0.8	-1.0	-1.1	-1.2	-1.4	-1.5	-1.4
Lake Toho	S-61	197	TOHOW, S-61	52.8	R	53.6	-0.8	-1.0	-1.1	-1.2	-1.4	-1.6	-1.4
Lakes Kissimmee, Cypress, and Hatchineha	S-65	525	KUB011, LKISSB	49.6	R	50.3	-0.7	-0.9	-0.9	-1.1	-0.9	-0.8	-0.8

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: 4/23/2019

Metric	Location	1-Day Average		Average for the Preceding 7-Days ¹								
		4/21/2019	4/21/19	4/14/19	4/7/19	3/31/19	3/24/19	3/17/19	3/10/19	3/3/19	2/24/19	2/17/19
Discharge (cfs)	S-65	476	525	710	434	452	833	529	513	1,368	2,386	3,220
Discharge (cfs)	S-65A ²	344	400	558	334	353	699	420	409	1,190	2,280	3,154
Discharge (cfs)	S-65D ²	562	584	703	367	563	859	505	1,103	2,310	3,097	2,668
Headwater Stage (feet NGVD)	S-65D ²	25.80	25.78	25.77	25.73	25.76	25.77	25.78	25.72	25.76	25.77	25.81
Discharge (cfs)	S-65E ²	492	563	679	330	539	855	497	1,026	2,167	2,945	2,533
Discharge (cfs)	S-67	110	110	106	0	9	162	0	51	30	53	0
DO (mg/L) ³	Phase I river channel	5.6	6.0	6.3	6.9	7.4	6.7	5.9	5.6	4.1	3.6	4.0
Mean depth (feet) ⁴	Phase I floodplain	0.16	0.16	0.18	0.16	0.21	0.34	0.29	0.43	0.86	1.20	1.25

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)

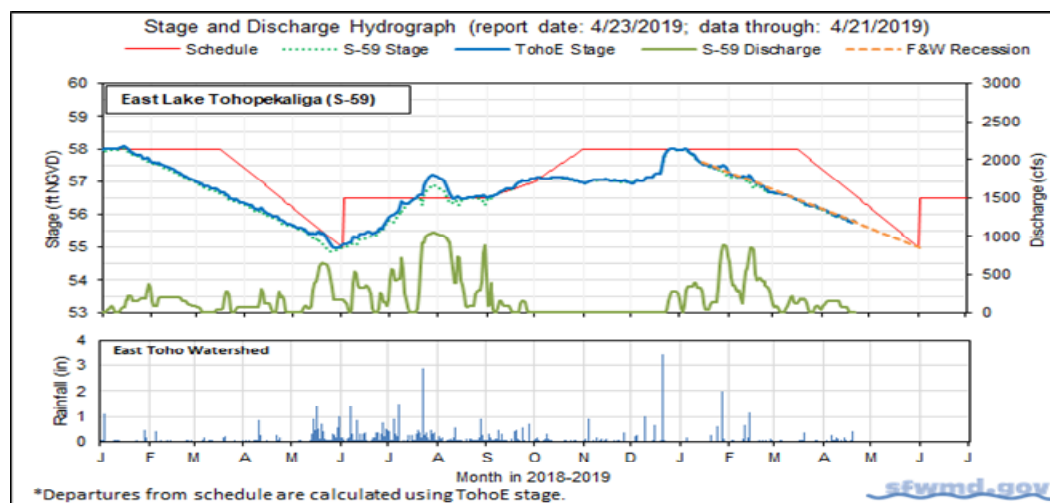


Figure 1.

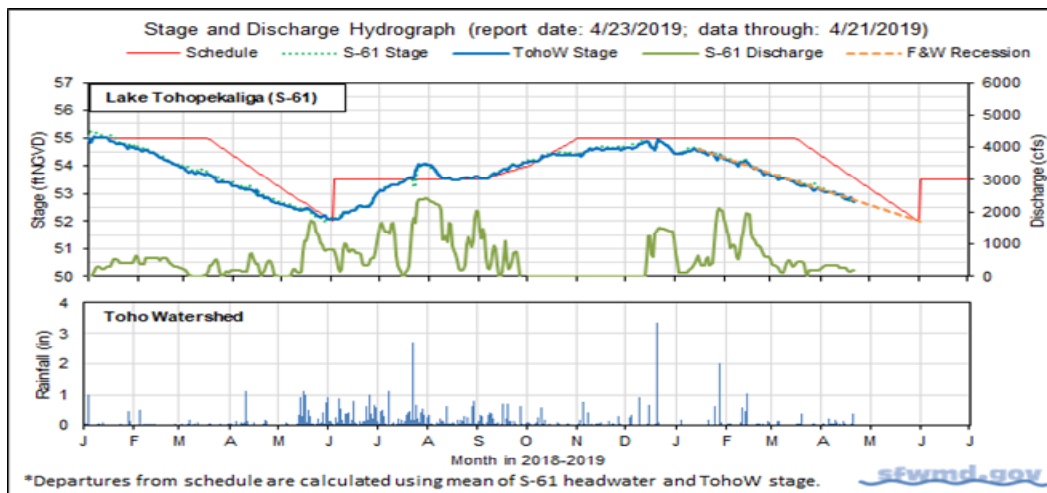


Figure 2.

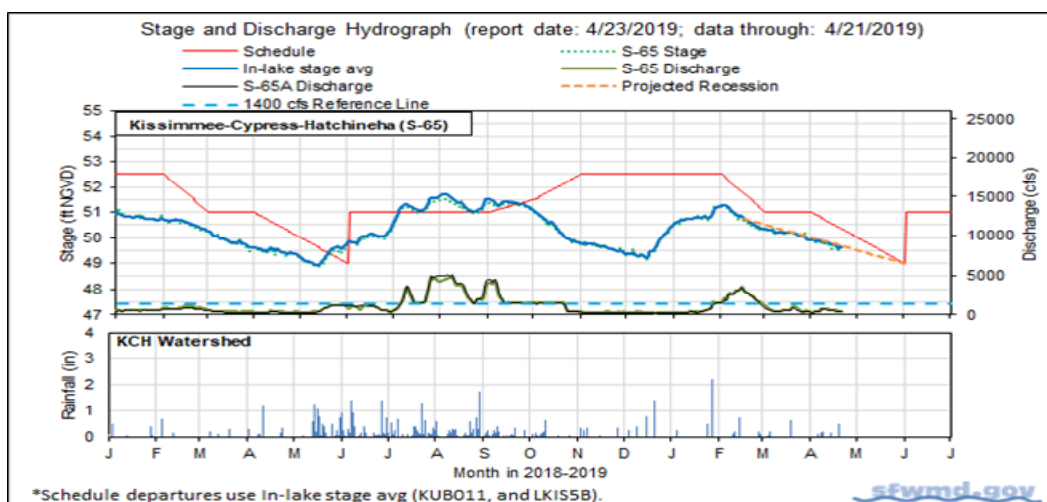


Figure 3.

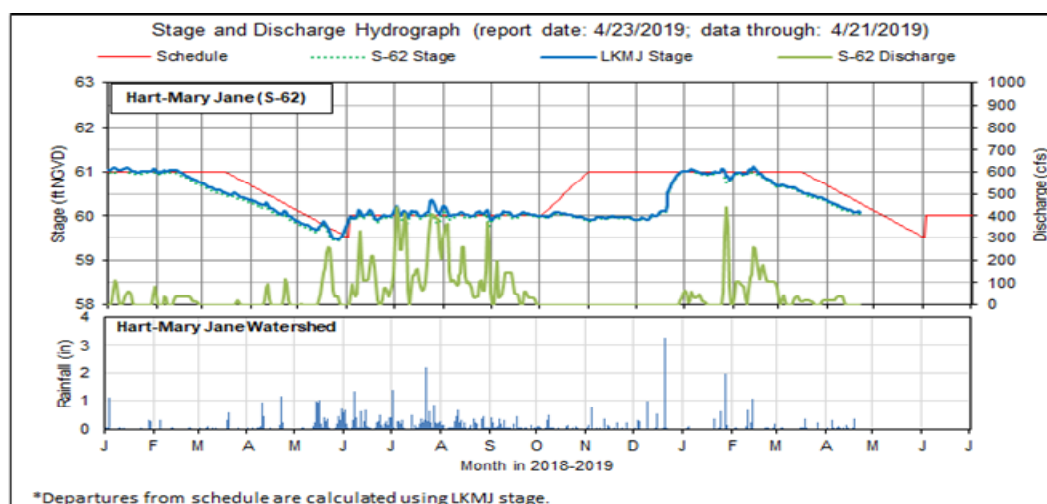


Figure 4.

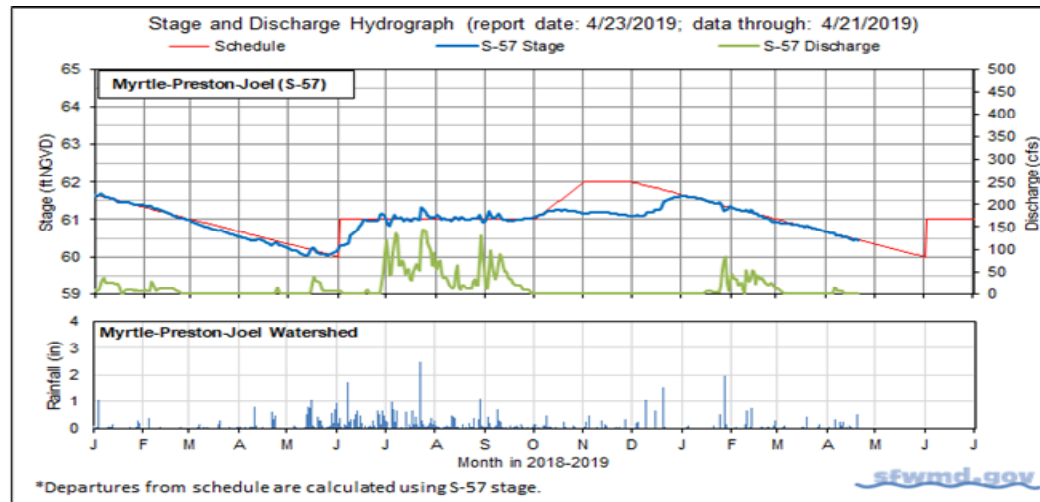


Figure 5.

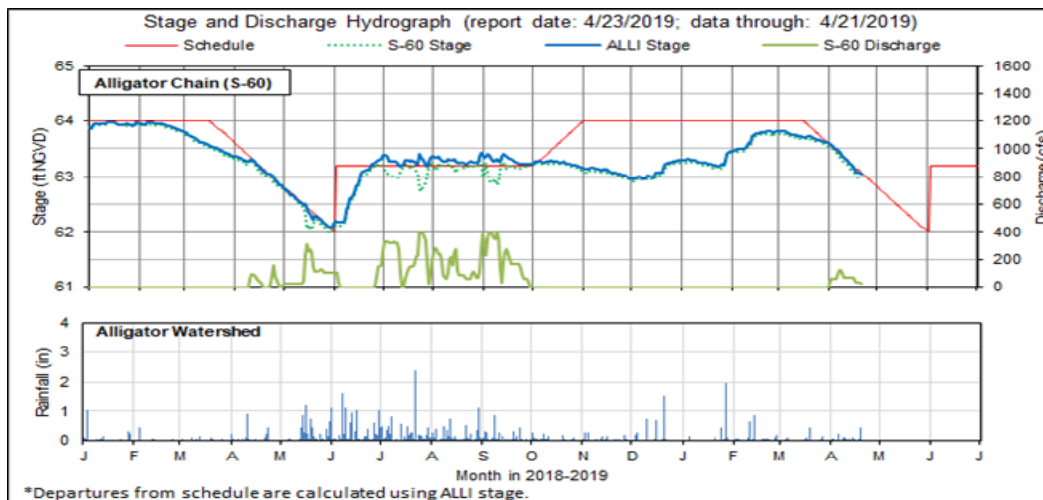


Figure 6.

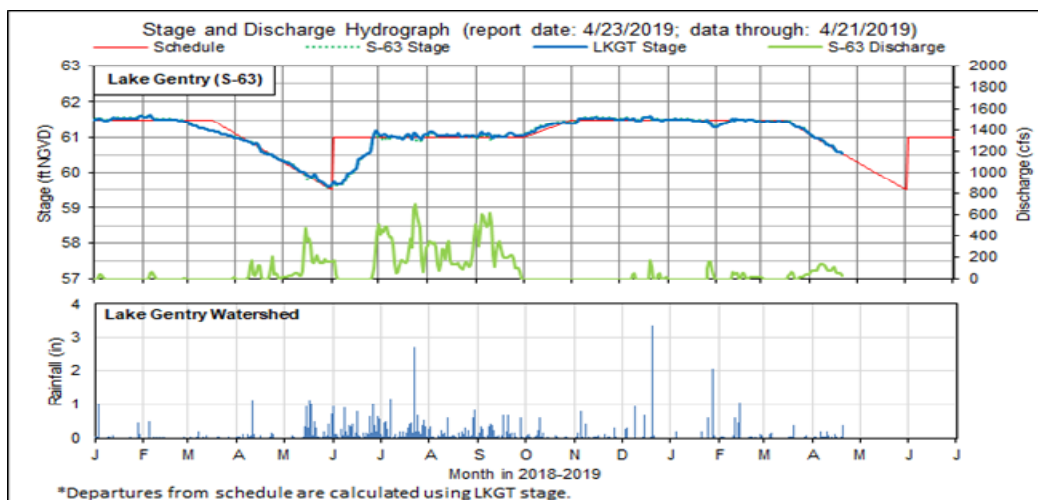


Figure 7.

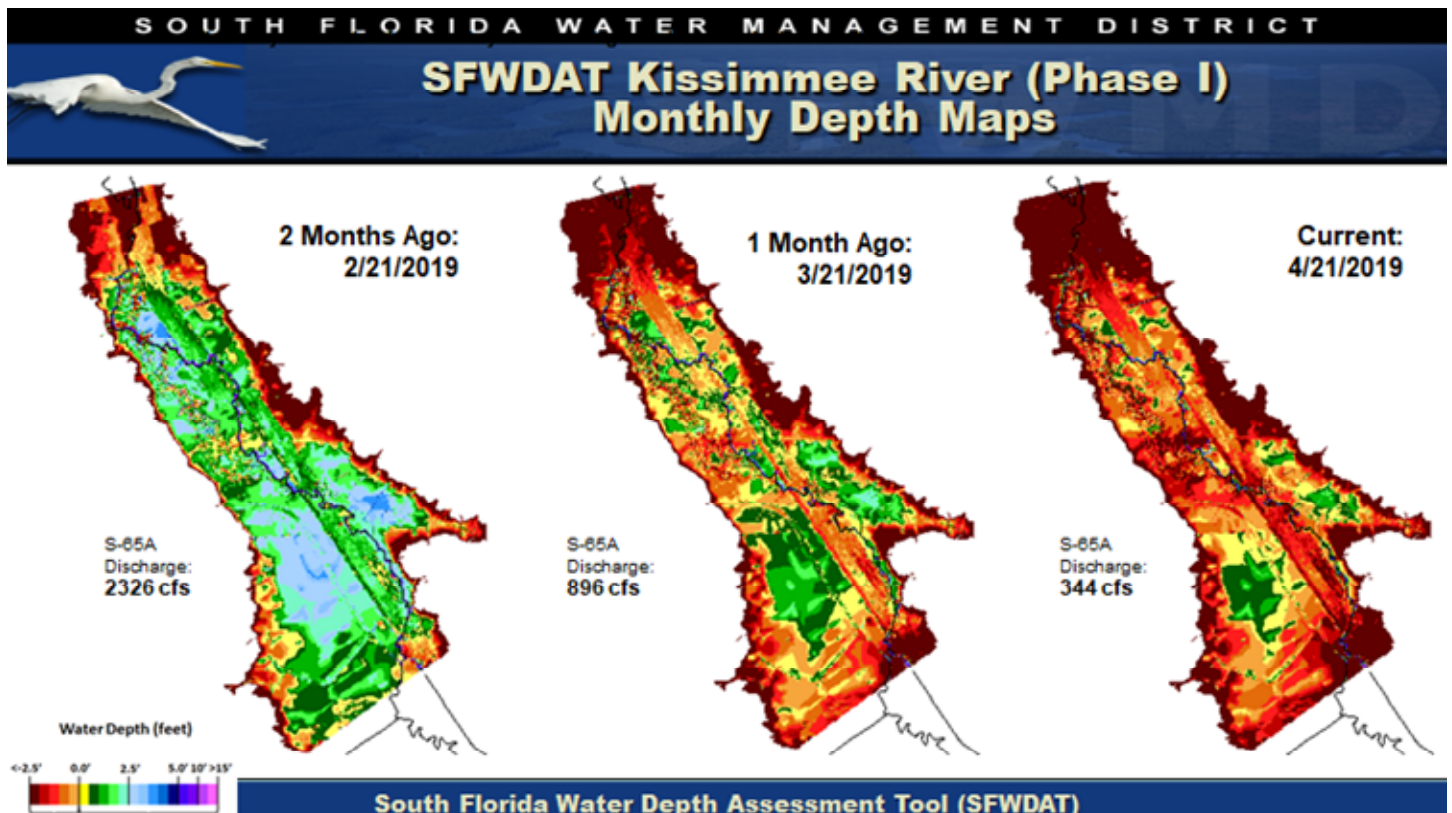


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

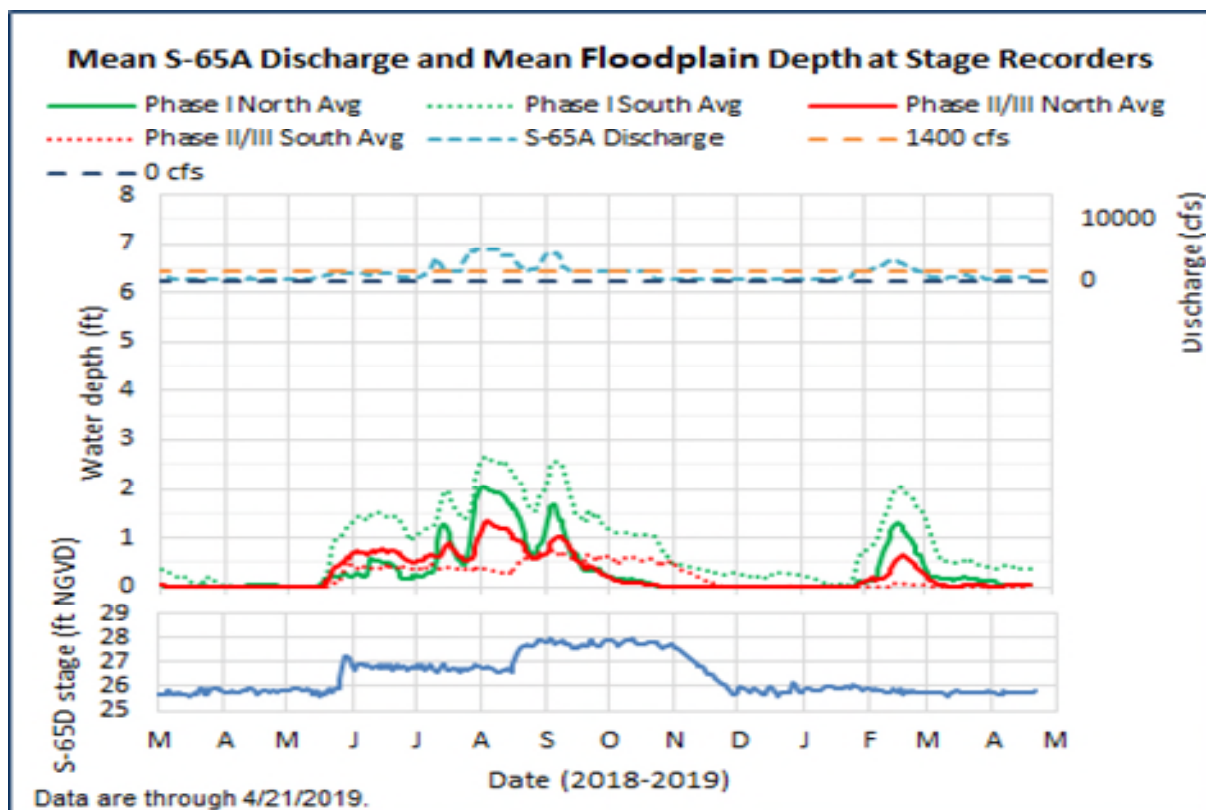


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.

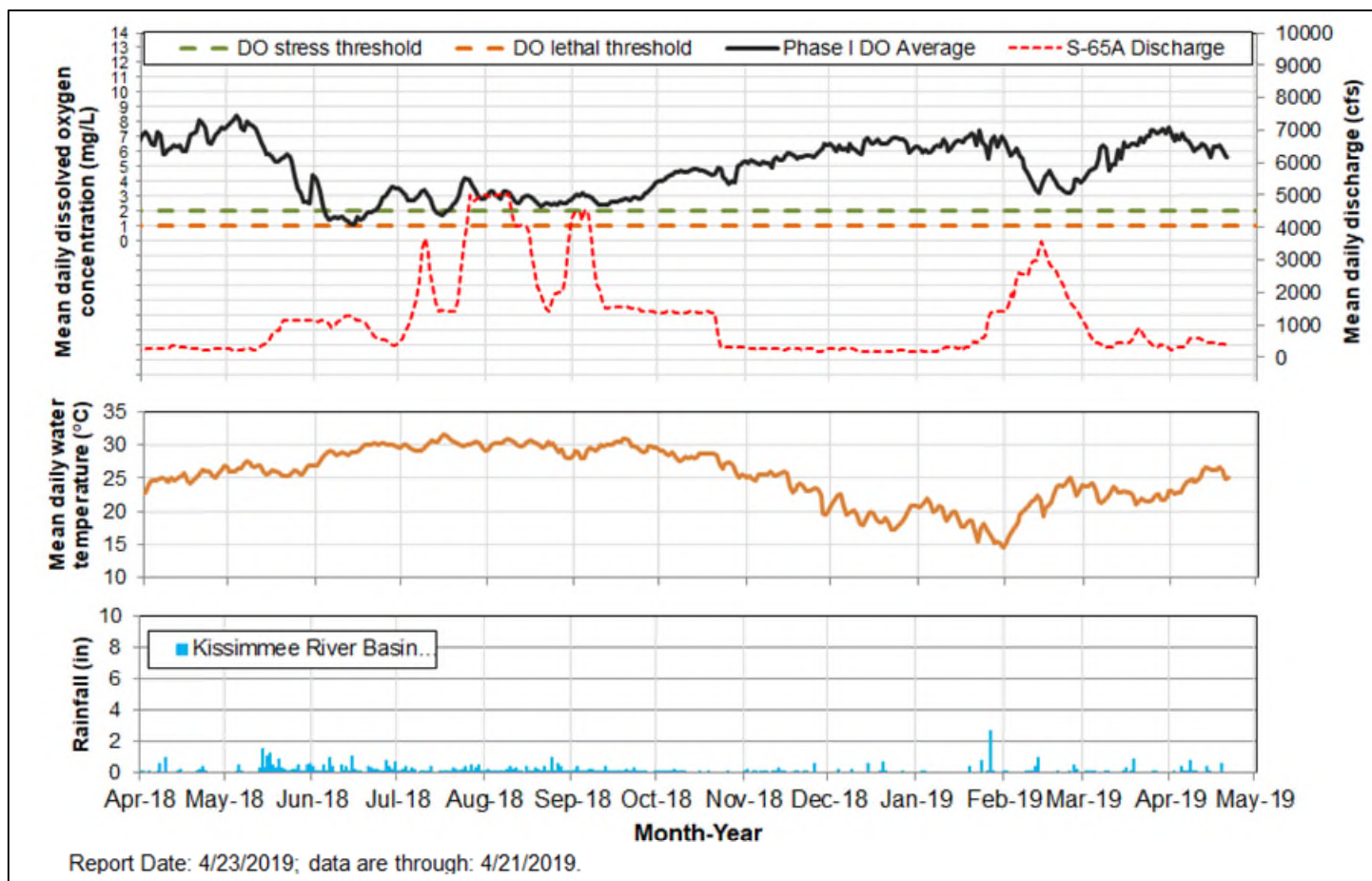


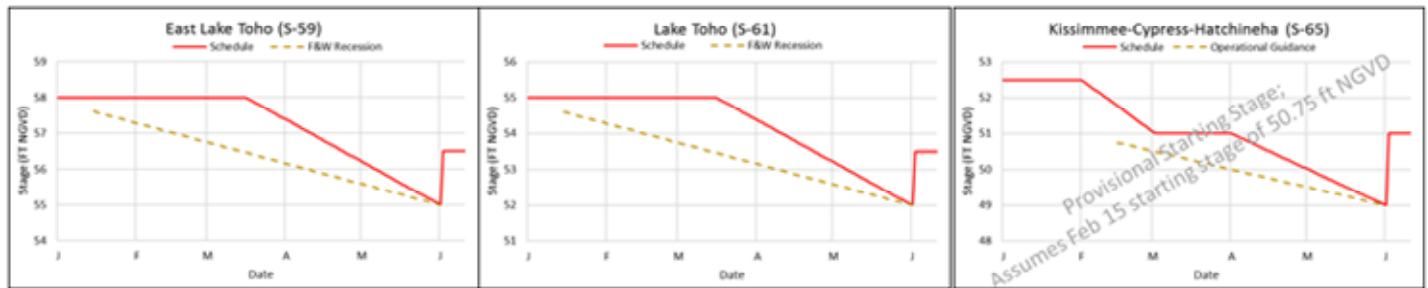
Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phase I river channel.

Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
4/23/2019	No new recommendations.		N/A		4/23/2019
4/15/2019	No new recommendations.		N/A		4/16/2019
4/8/2019	No new recommendations.		N/A		4/9/2019
4/1/2019	No new recommendations.		N/A		4/2/2019
3/25/2019	No new recommendations.		N/A		3/26/2019
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

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 KHC (to the extent that hydraulic capacity is available) without consideration for Lake KHC 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.

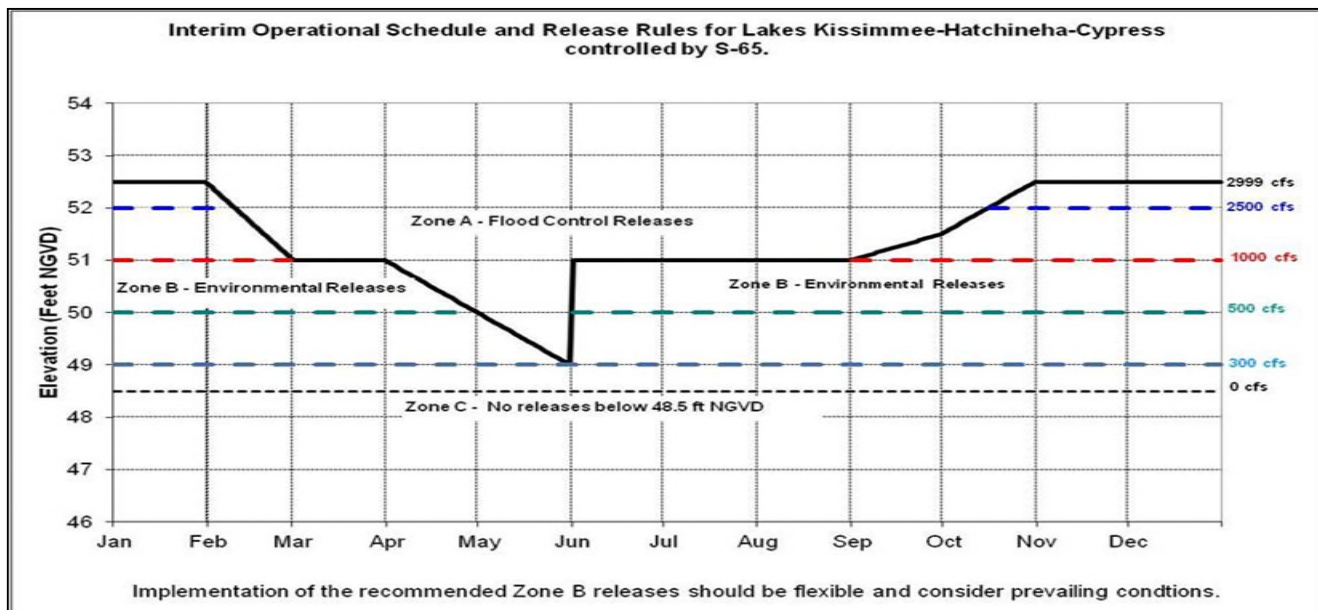


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

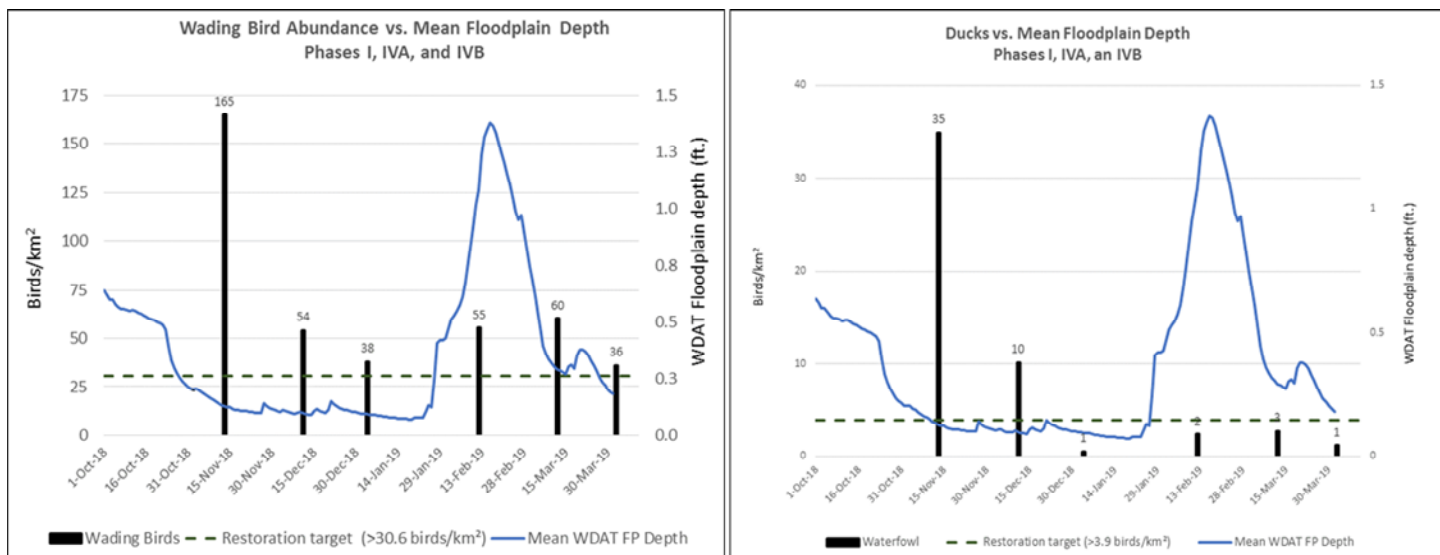


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to March 2019.

Table 3. Upper Kissimmee Basin Snail Kite Survey in April 2019

Survey 2	Date	Snail Kites	Total Nests	Active Nests
Kissimmee	4/5/2019	172	22	21
Cypress	4/6/2019	0	0	0
Hatchineha	4/6/2019	0	0	0
East Toho	4/6/2019	10	2	0
Toho	4/7/2019	157	41	32

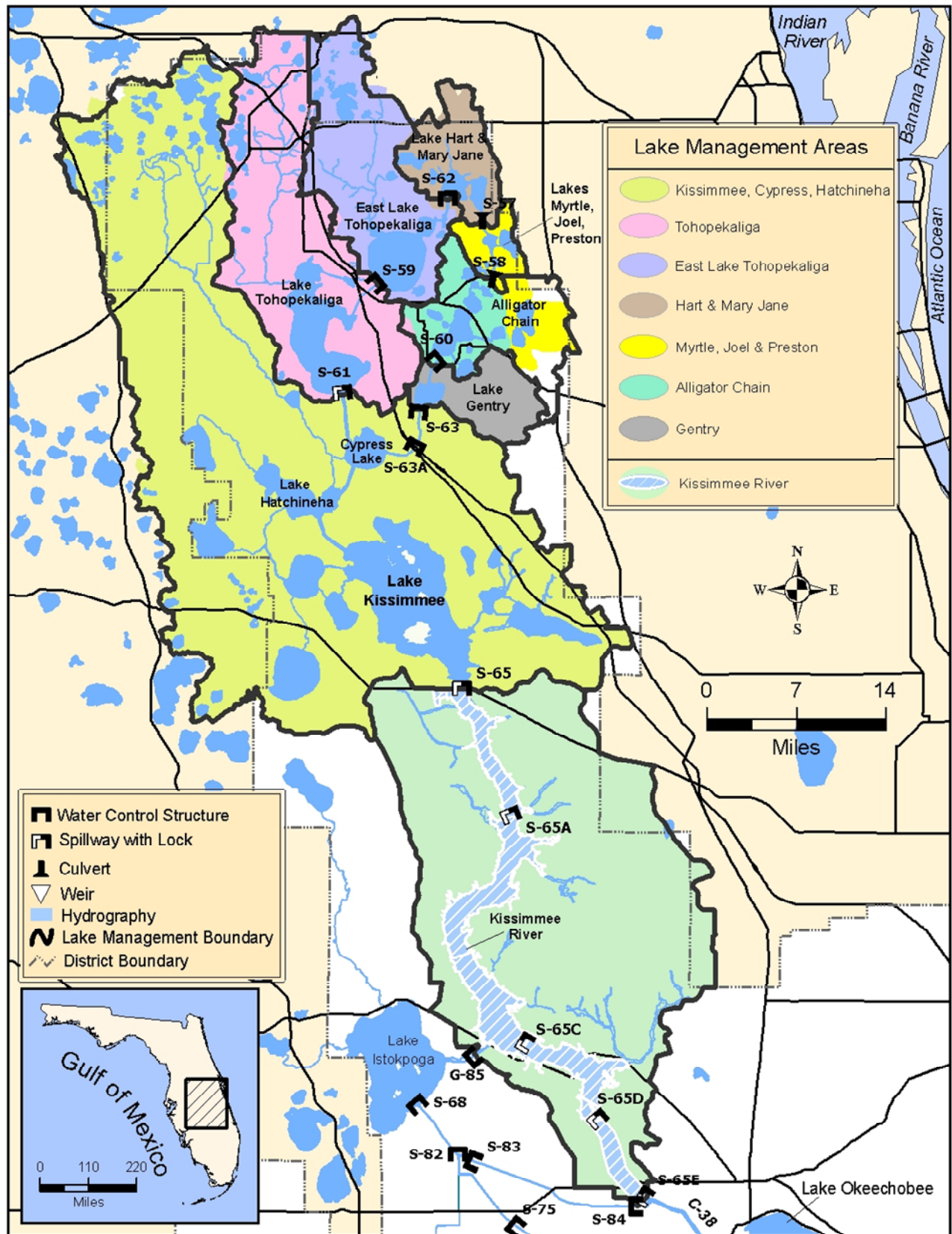


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 11.48 feet NGVD for April 22, 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 0.67 feet lower than a month ago and 1.74 feet lower than a year ago when stages were still recovering from Hurricane Irma (Figure 1). The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is currently 0.35 feet above the Water Shortage 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 April 16-22, 2019, 0.72 inches of rain fell directly over the Lake. There were large variations in rainfall across the rest of the watershed, with basins receiving between 0.25 and 1.5 inches of rain (Figure 4).

Average daily inflows (minus rainfall) to the Lake this week were lower than last week at 844 cfs compared to 938 cfs, respectively. The inflows from the Kissimmee River decreased, going from 687 cfs to 540 cfs. Inflows from Lake Istokpoga into the Kissimmee River (via the S-84 structures) increased from the previous week, going from 188 cfs to 292 cfs. The L8 canal at Canal Point switched from inflow to outflow, going from 45 cfs of backflow into the Lake the previous week to 8 cfs of outflow this past week. Passive inflow from S-308 increased slightly from the previous week, going from 38 cfs to 82 cfs this week (Table 1).

Total outflows (minus evapotranspiration) also decreased from the previous week, going from 2,599 average daily cfs to 1,087 cfs this past week mostly due to decreased outflows south through the S-350 structures (Table 1). Outflows south decreased from 2,037 cfs to 821 cfs. Outflows west via S-77 also decreased from the previous week going from 619 cfs to 342 cfs. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiations was 0.15 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.

Submerged aquatic vegetation was sampled in March and April along 20 transects set perpendicular to shore, stretching from the edge of the dense marsh out to open water, with samples occurring approximately every 0-8 inches (0-20 cm) of elevation change (Figure 6). SAV was found in 20% of samples (n=169), and on 65% of transects; almost exclusively in the shallowest samples of the transects. The southwestern shore had SAV on 5 of 5 transects, Indian Prairie had SAV on 4 of 5, Fisheating Bay had SAV on 3 of 5, while only 1 of 5 had SAV in the south. Eelgrass (*Vallisneria spiralis*) was the most abundant, in 12% of the samples. Most of the observed SAV was very small, though several areas of dense, short eelgrass plants were observed in very shallow water.

The most recent satellite imagery (April 21, 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 but is increasing and in the medium range along the northwestern shore and particularly in Fisheating Bay and along Indian Prairie (Figure 7). The color scheme that classifies algal densities in the image has changed, so direct comparison between the latest image and earlier images is more difficult.

Water Management Recommendations

Lake Okeechobee stage is 11.48 feet NGVD, decreasing 0.11 feet from the previous week. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.35 feet above the Water Shortage sub-band. The lake remains below the bottom of the ecological envelope (currently 1.25 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD. Given the potential for above average

rainfall (associated with a weak El Niño) over the next few months, 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. Satellite imagery suggest the potential for algal blooms has increased along the western shore, particularly within Fisheating Bay and along the edge of Indian Prairie.

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	687	540	0.3
S71 & 72	74	26	0.0
S84 & 84X	188	292	0.1
Fisheating Creek	17	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	-45		
Rainfall	885	1507	0.7
Total	1805	2380	1.1

OUTFLOWS	Previous Week Avg Daily cfs	Avg Daily Outflow cfs	Equivalent Depth Week Total (in)
S77	619	342	0.2
S308	-38	-82	0.0
S351	736	194	0.1
S352	631	363	0.2
S354	670	264	0.1
L8 Outflow		8	0.0
ET	1836	2186	1.0
Total	4454	3273	1.6

Provisional Data

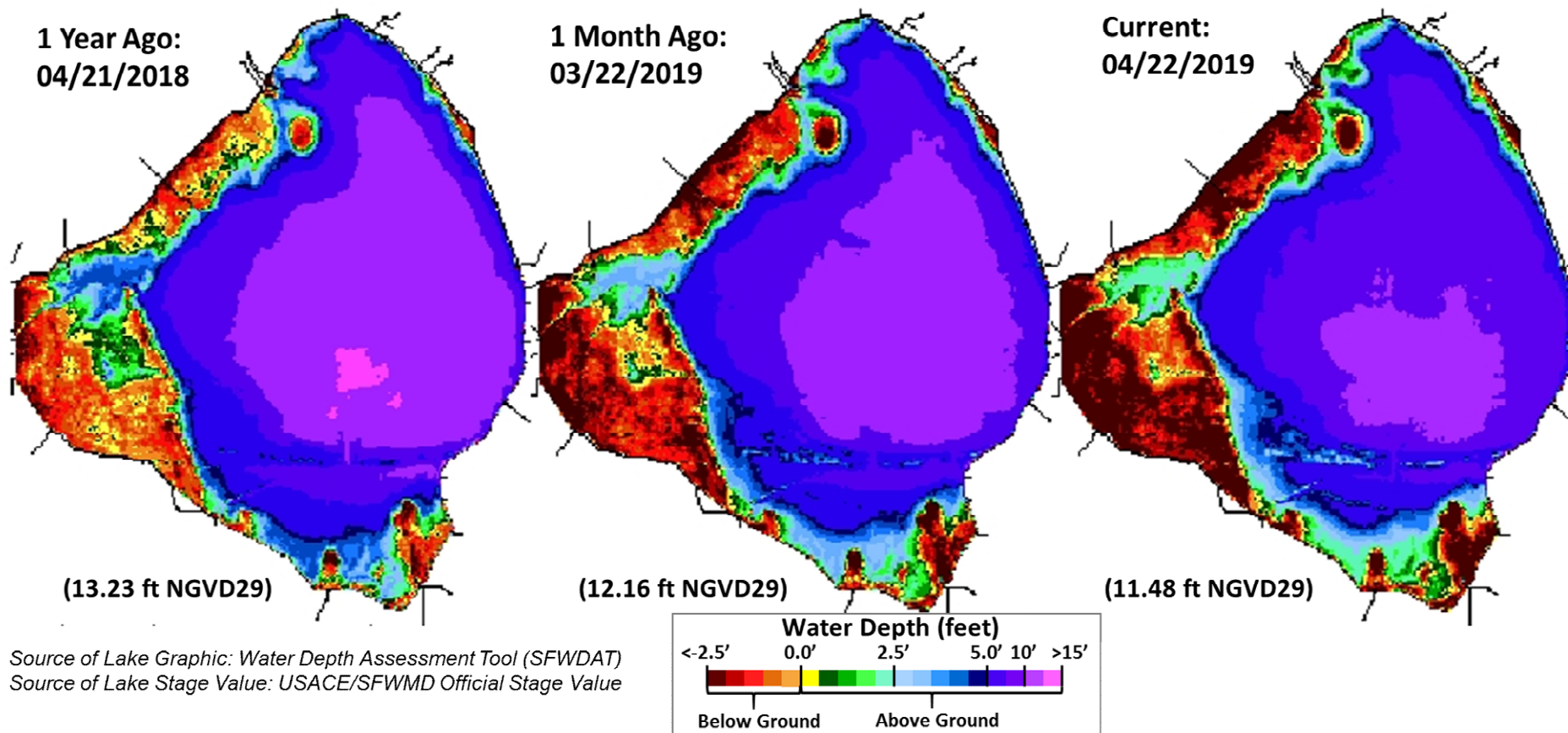


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

Lake Okeechobee Water Level History and Projected Stages

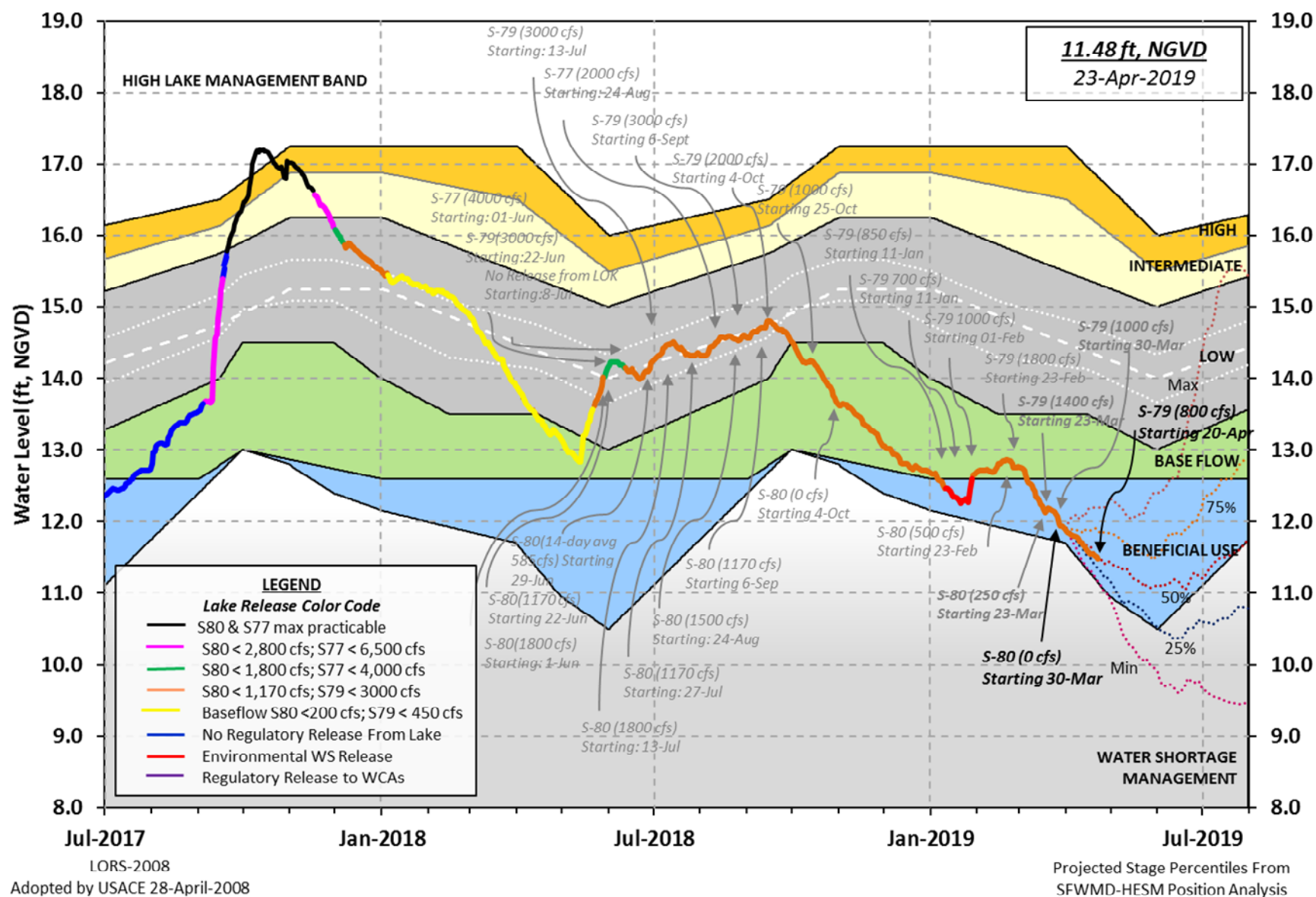


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

Lake Okeechobee Water Level Comparison

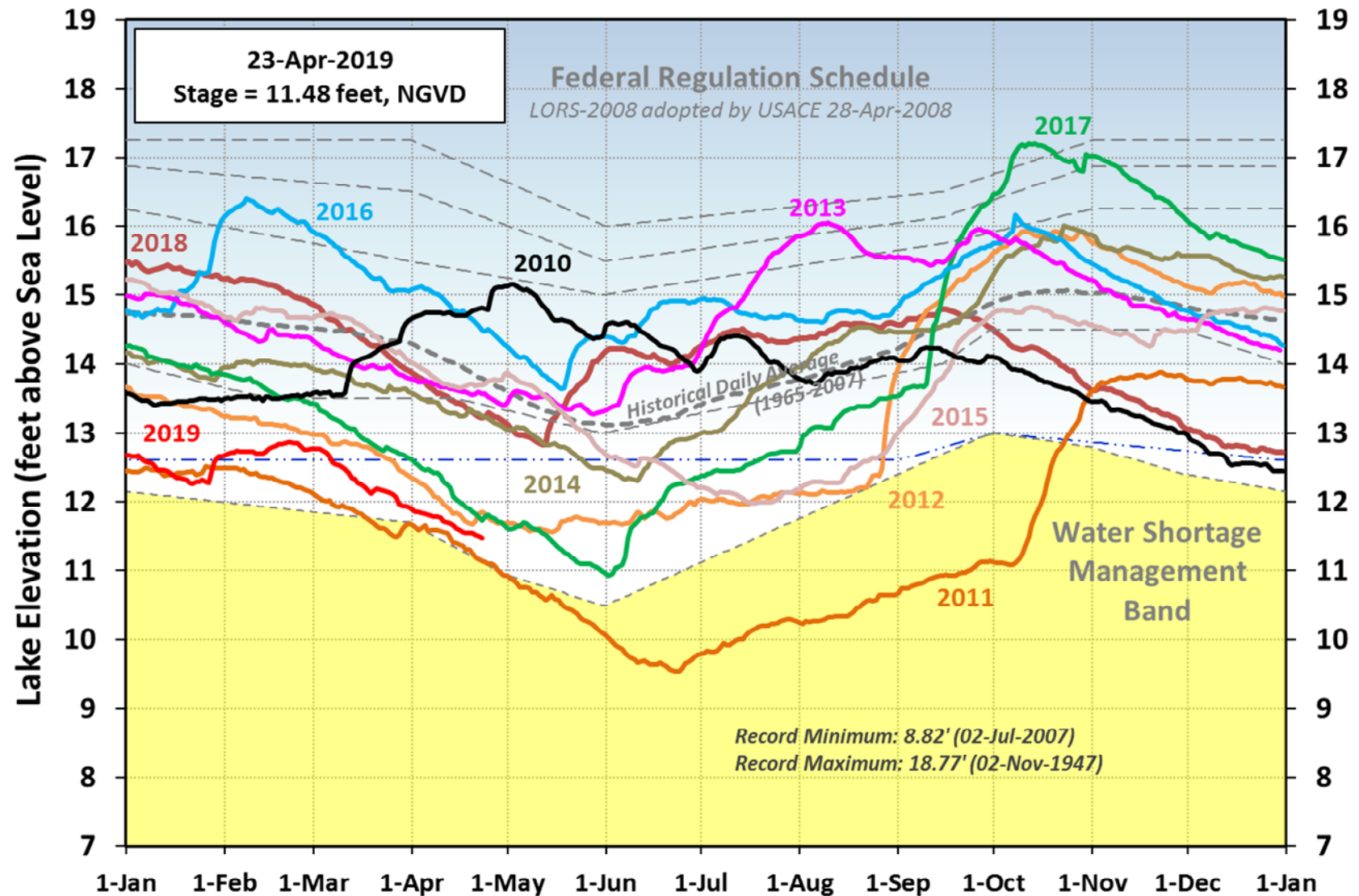


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2010 – 2019.

SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES
FROM: 0815 EST, 04/16/2019 THROUGH: 0815 EST, 04/23/2019

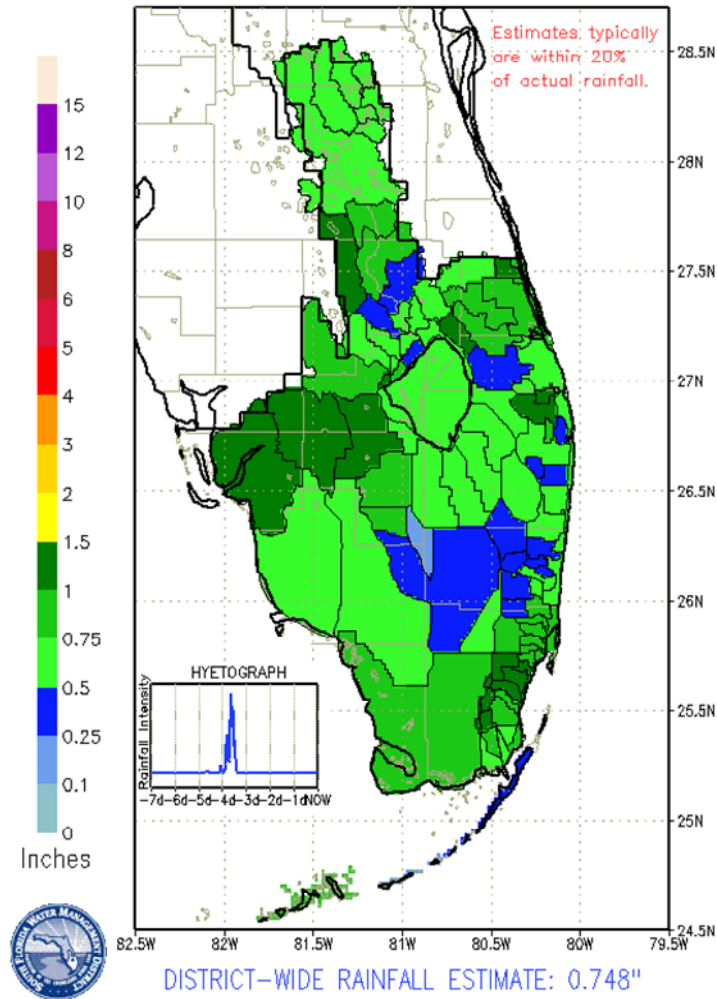


Figure 4. Rainfall estimates by basin.

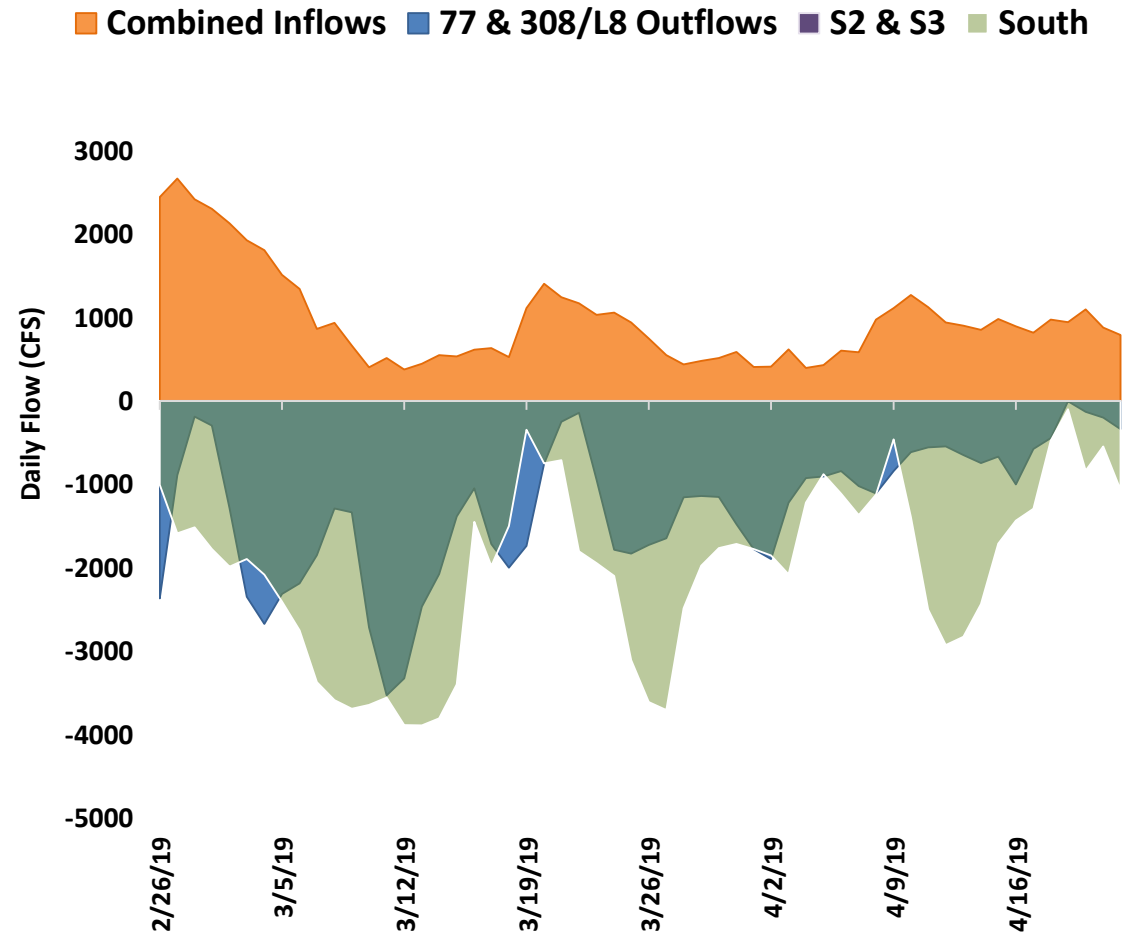


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive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

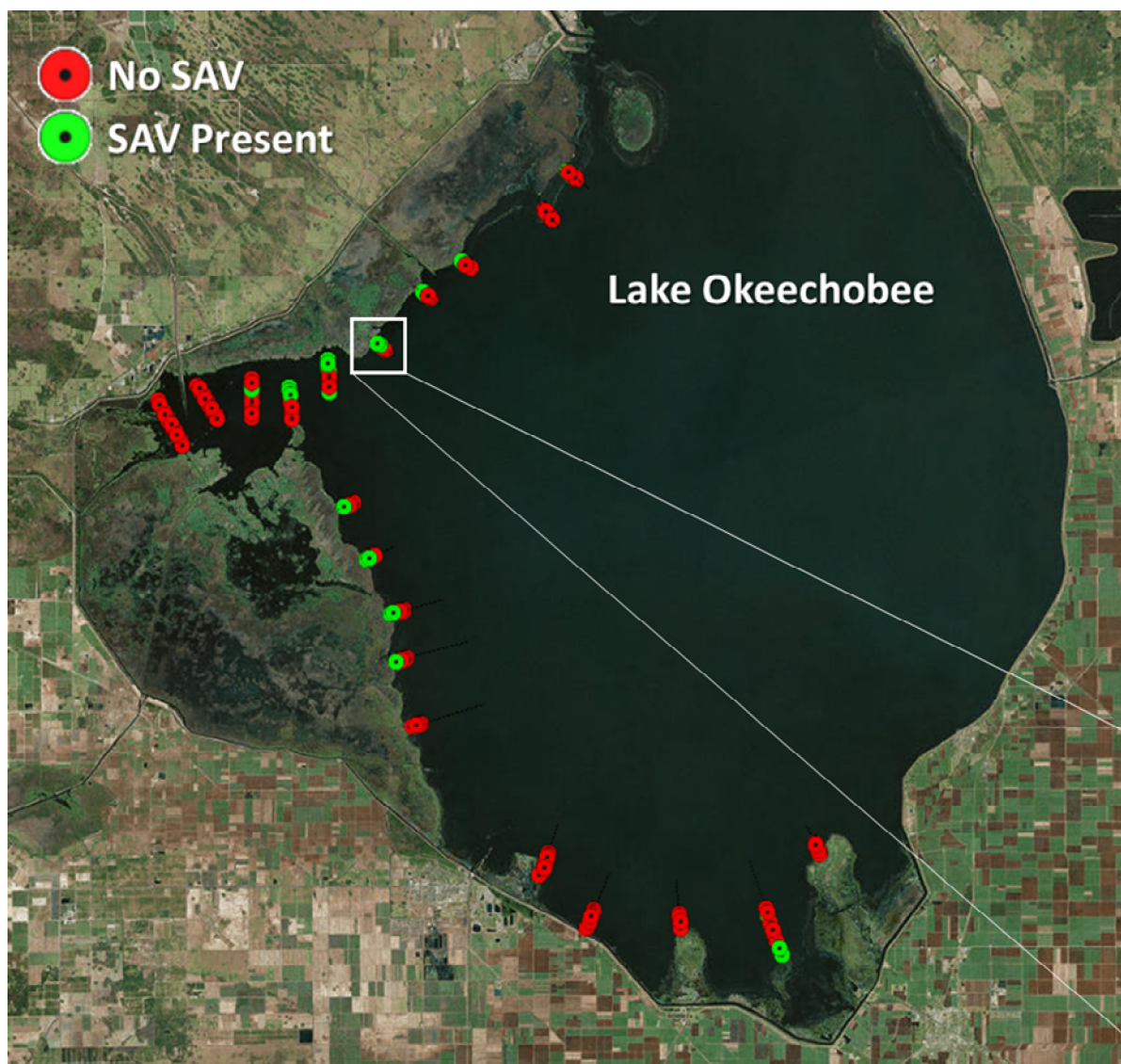
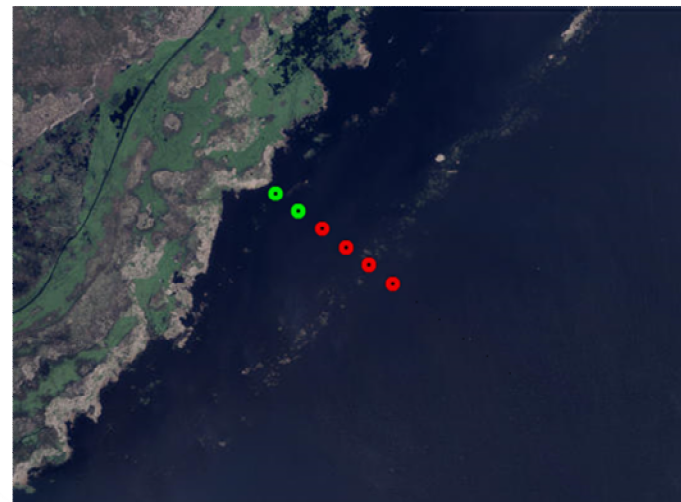


Figure 6. Location of SAV monitoring stations along 20 transects. Green indicates SAV was present while red indicates no SAV was observed.

Table 2. Abundance of observed SAV species during March-April 2019 sample event.

SAV Species	Percent of Samples
Eelgrass (<i>V. americana</i>)	12%
Hydrilla (<i>H. verticillata</i>)	3%
Muskgrass (<i>Chara</i> spp.)	1%
Coontail (<i>C. demersum</i>)	2%
Pondweed (<i>P. illinoensis</i>)	1%
Total	20%



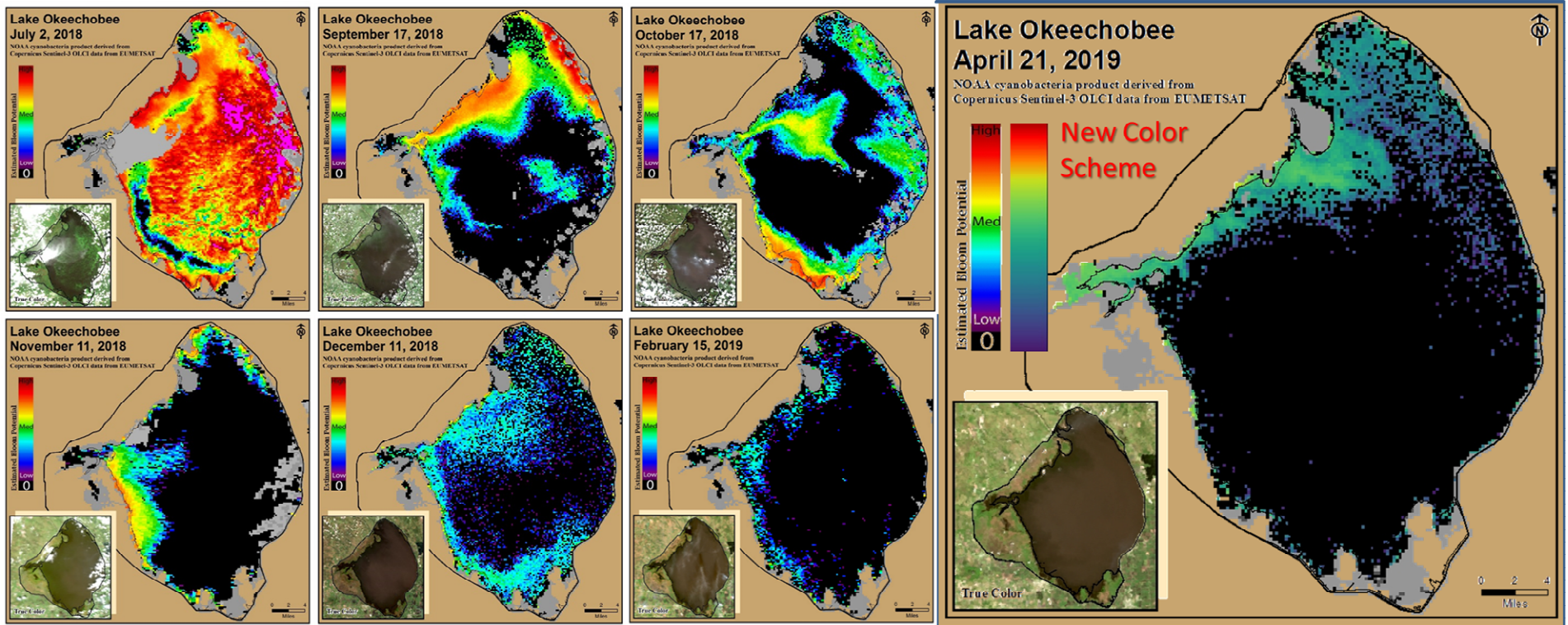


Figure 7. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. **Note** new color scale on larger image. Gray indicates cloud cover. All data are experimental and unvalidated at this point in product development.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 265 cfs (Figures 1 and 2) and last month inflow averaged about 283 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	194
S-80	0
S-308	-82
S-49 on C-24	0
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	71

Over the past week in the estuary, salinity increased to downstream of US1 Bridge and was unavailable at A1A Bridge (Table 2, Figures 3 and 4). The seven-day moving average surface salinity was 20.7, the seven-day moving average of the water column (an average of the surface and bottom salinity) was unavailable. 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)	16.4 (14.9)	18.8 (17.6)	NA ¹
US1 Bridge	20.7 (19.4)	NR ² (20.1)	10.0-26.0
A1A Bridge	NR (26.1)	NR (29.5)	NA ¹

¹Envelope not applicable and ²Not Reporting

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1038 cfs (Figures 5 and 6) and last month inflow averaged about 1,183 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	343
S-78	451
S-79	943
Tidal Basin Inflow	95

Over the past week in the estuary, salinity remained about the same to Val I-75 and decreased 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). The seven-day average salinity value was not available at Sanibel. The 30-day moving average surface salinity is 0.3 at Val I-75 and 4.3 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)	0.3 (0.4)	0.0-5.0 ²
Ft. Myers Yacht Basin	4.3 (5.1)	5.2 (5.8)	NA
Cape Coral	13.8 (14.8)	15.6 (17.1)	10.0-30.0
Shell Point	27.0 (27.9)	27.1 (28.1)	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 0.6 to 4.0 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 1000 cfs and Tidal Basin inflows of 140 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	140	4.0	1.4
B	300	140	2.5	0.7
C	450	140	1.9	0.7
D	650	140	1.4	0.6
E	1000	140	0.6	0.4

Red tide

The Florida Fish and Wildlife Research Institute reported on April 19, 2019, that *Karenia brevis*, the Florida red tide dinoflagellate, was not observed in samples collected from Lee, St. Lucie, Martin, or Palm Beach counties (no samples from Broward or Miami-Dade 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.

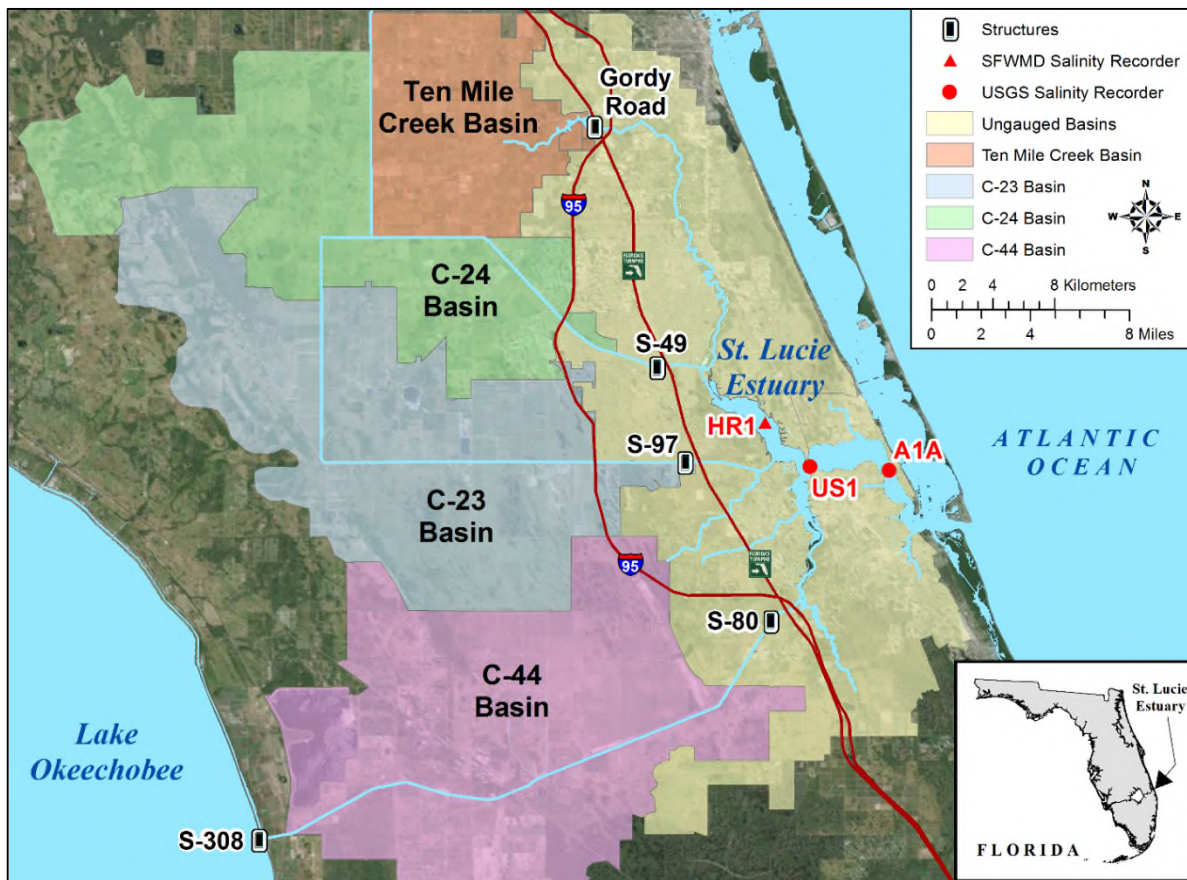


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

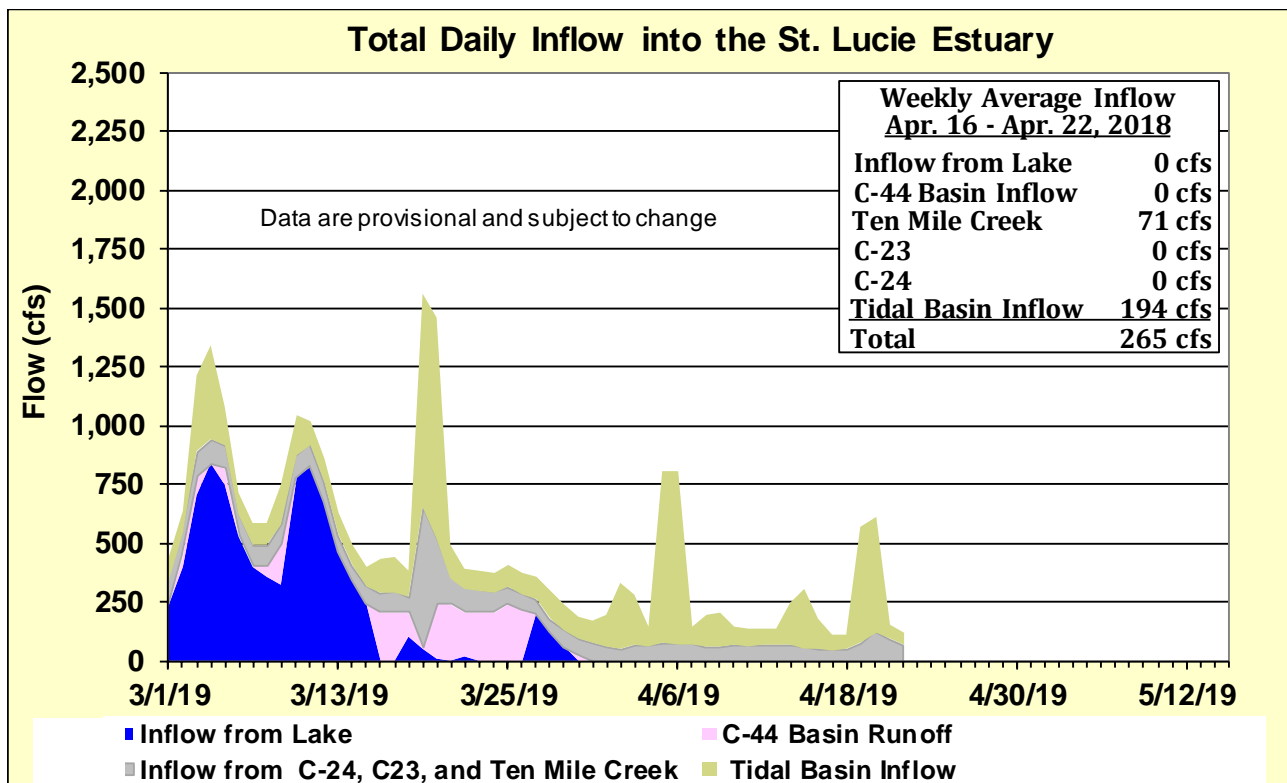


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

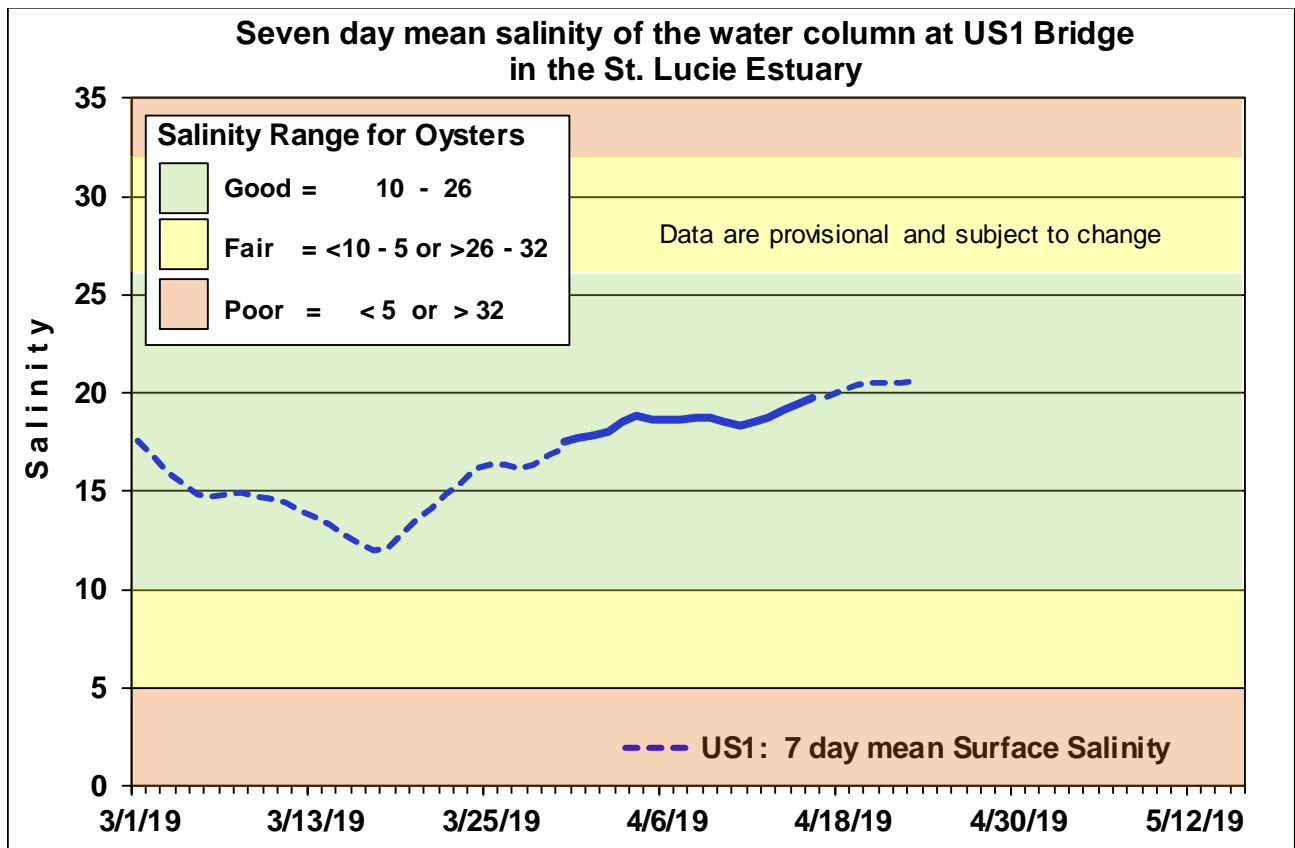


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

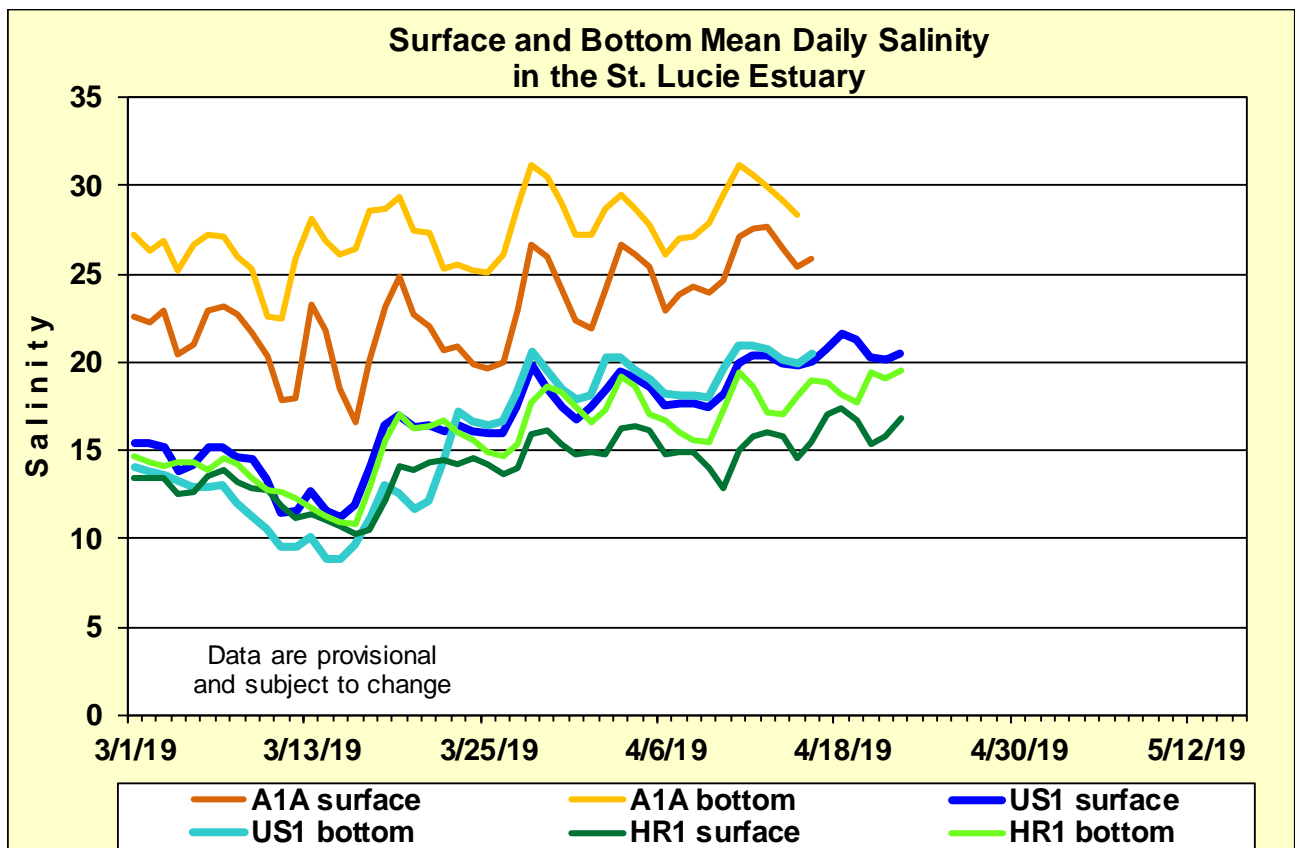


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

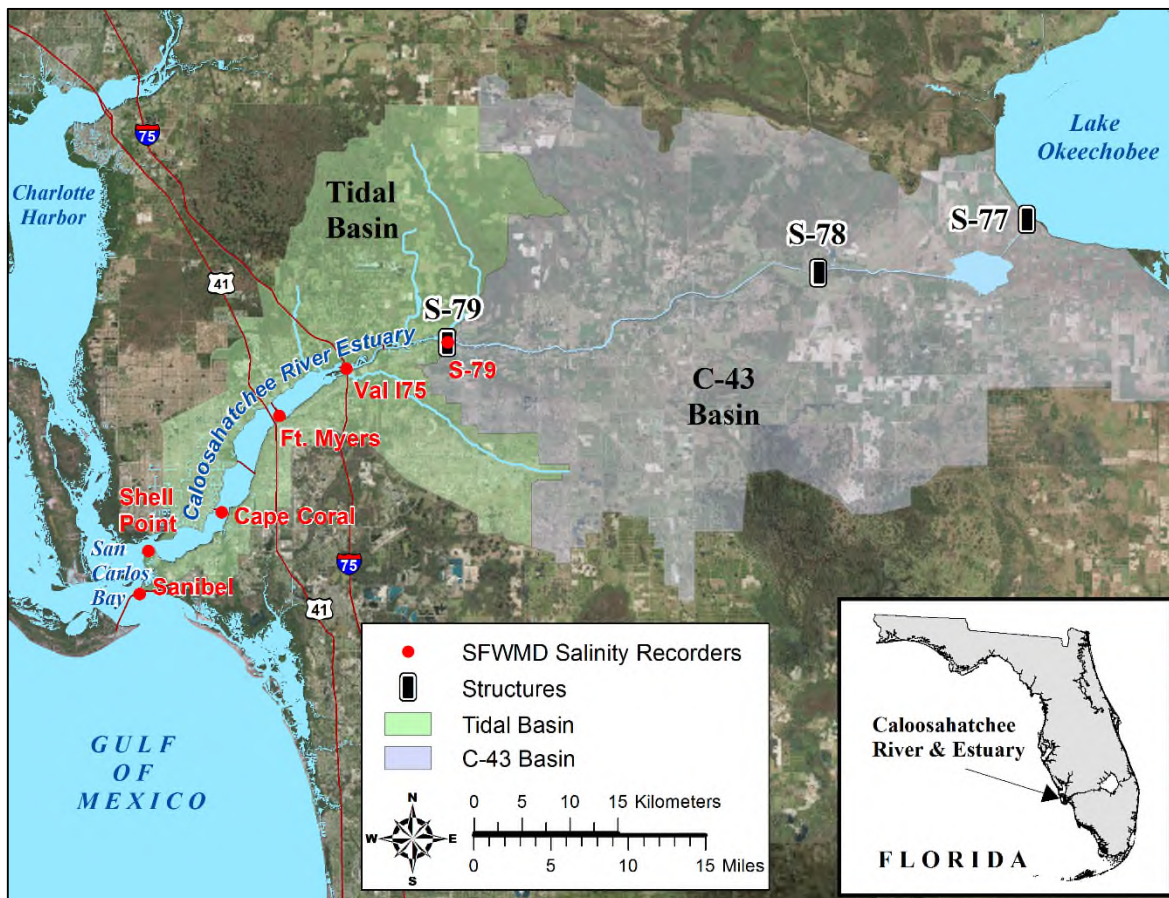


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

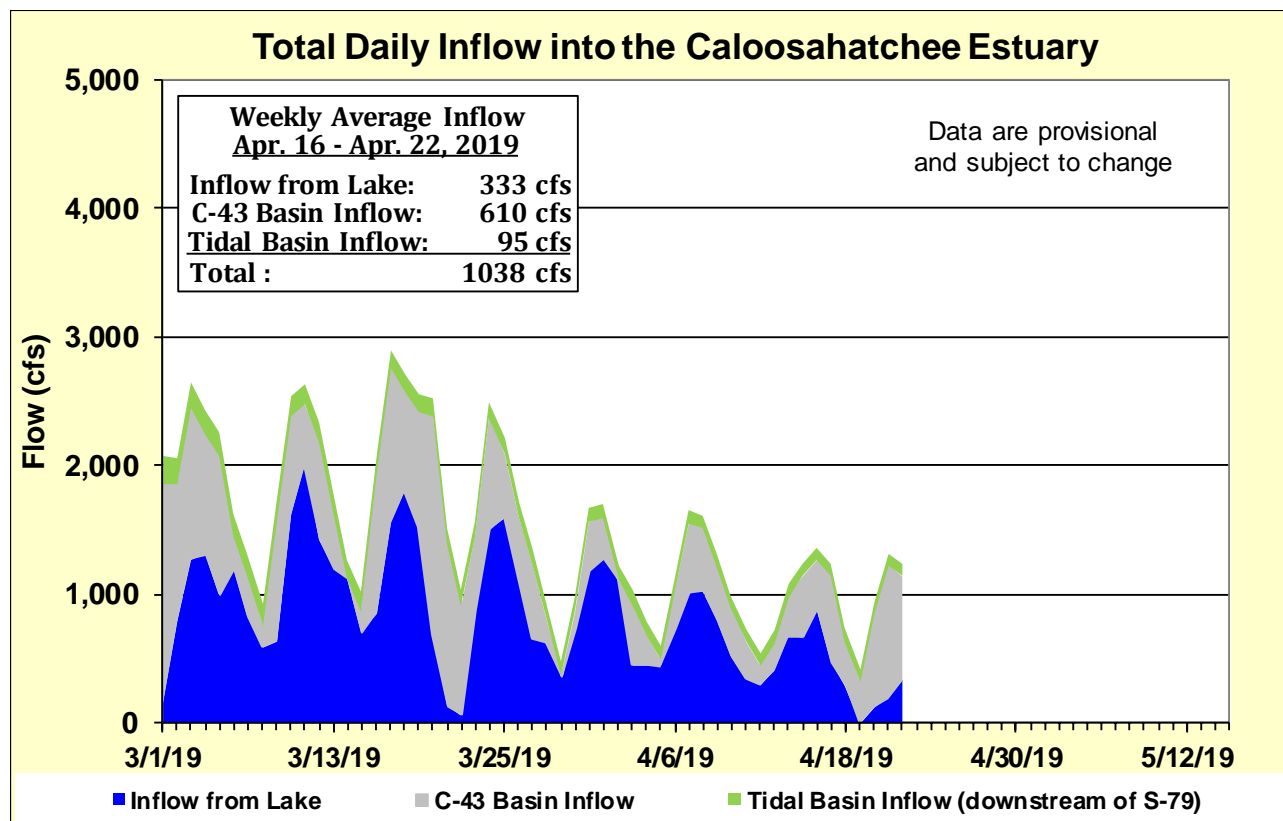


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

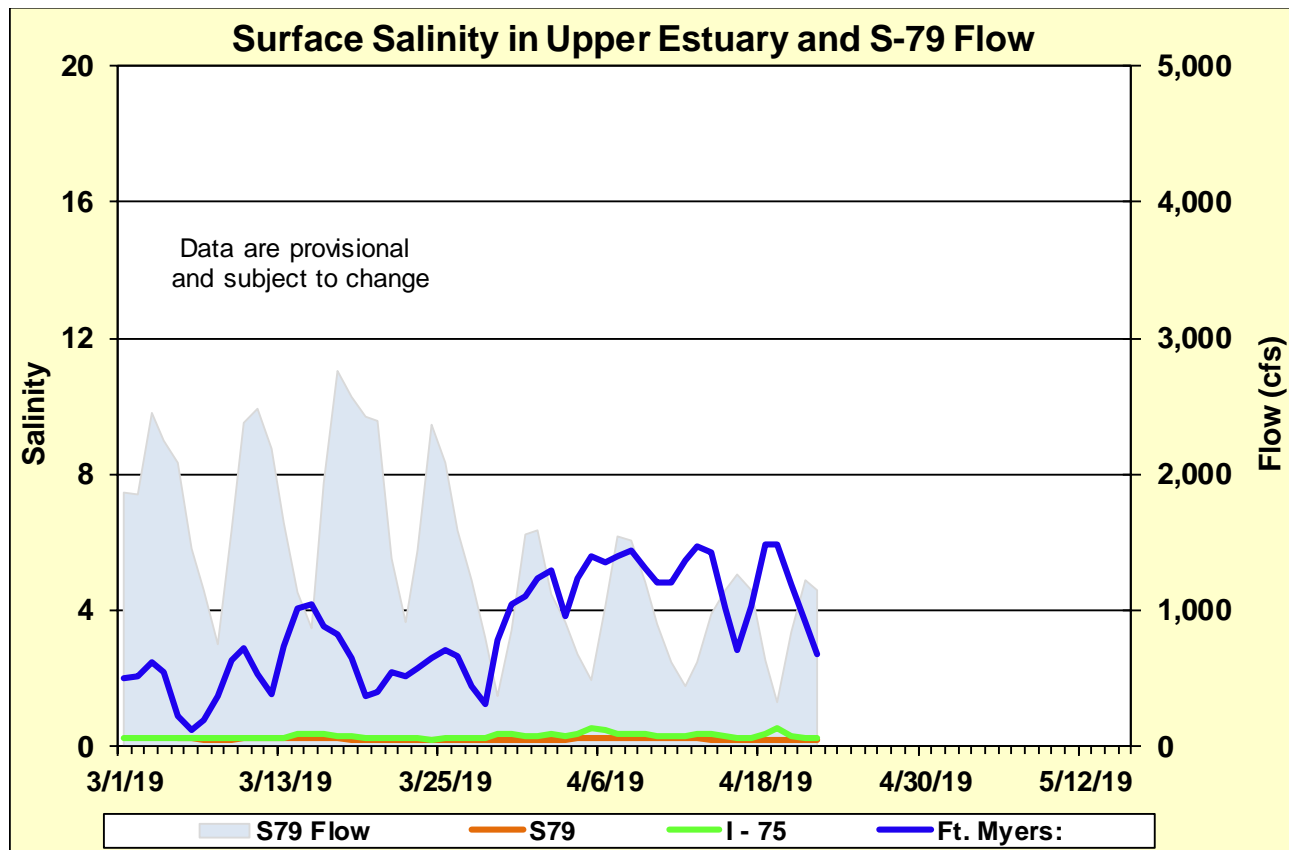


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

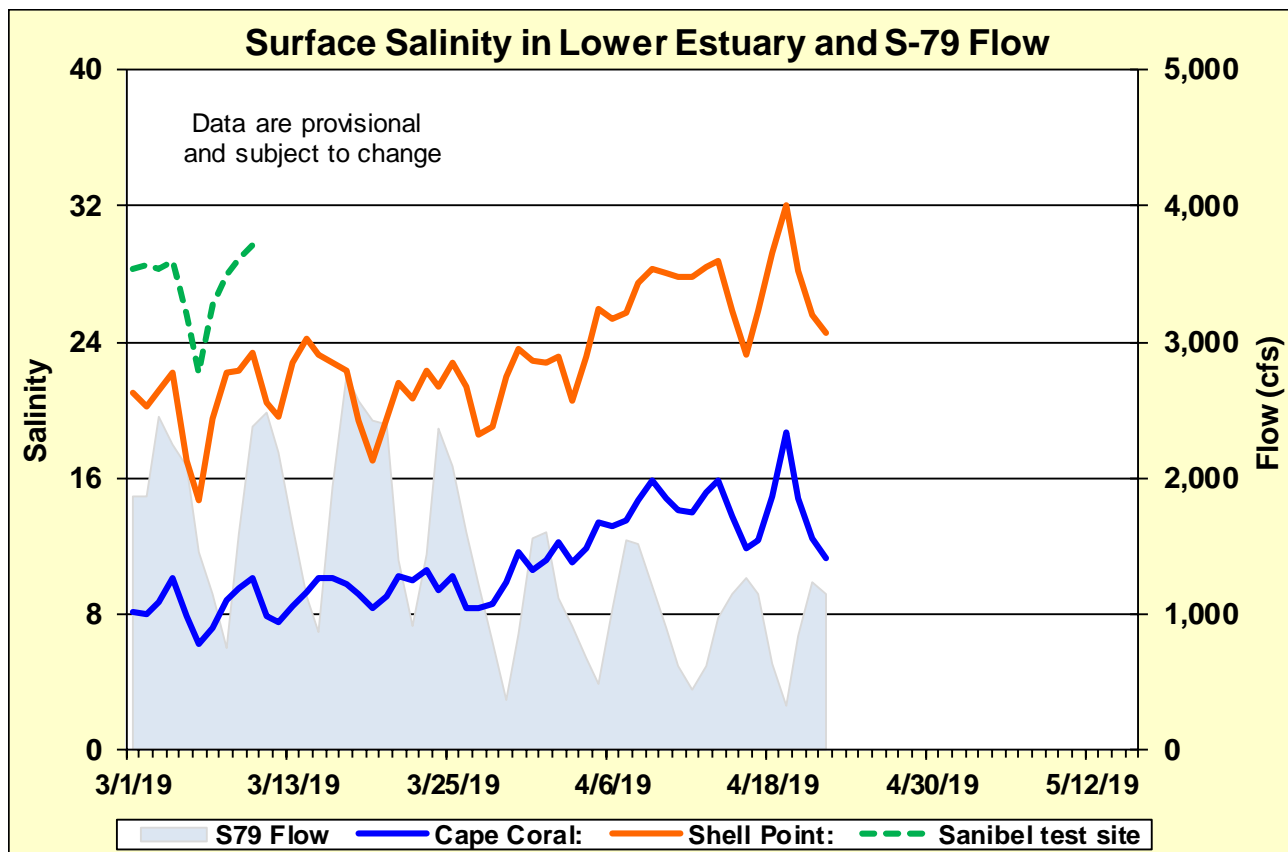


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

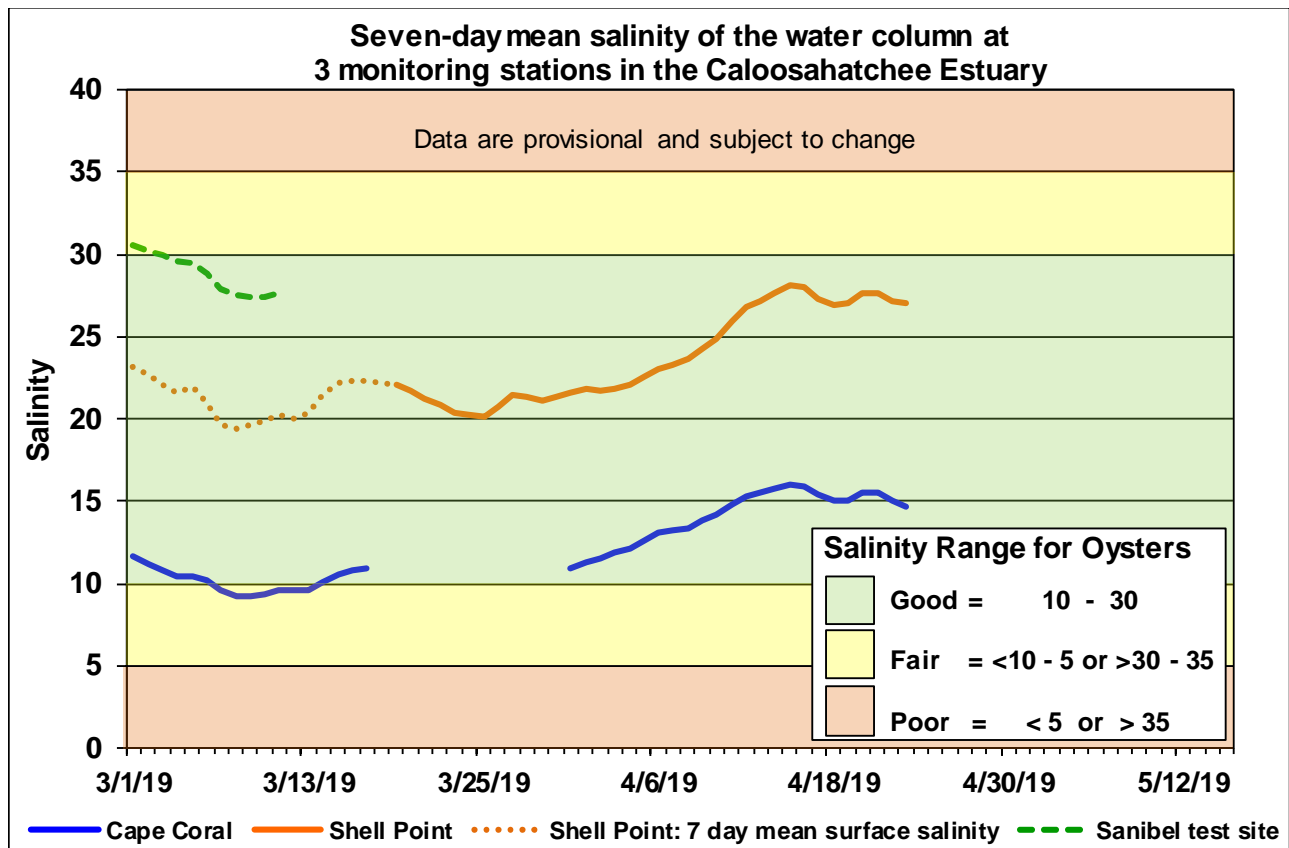


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

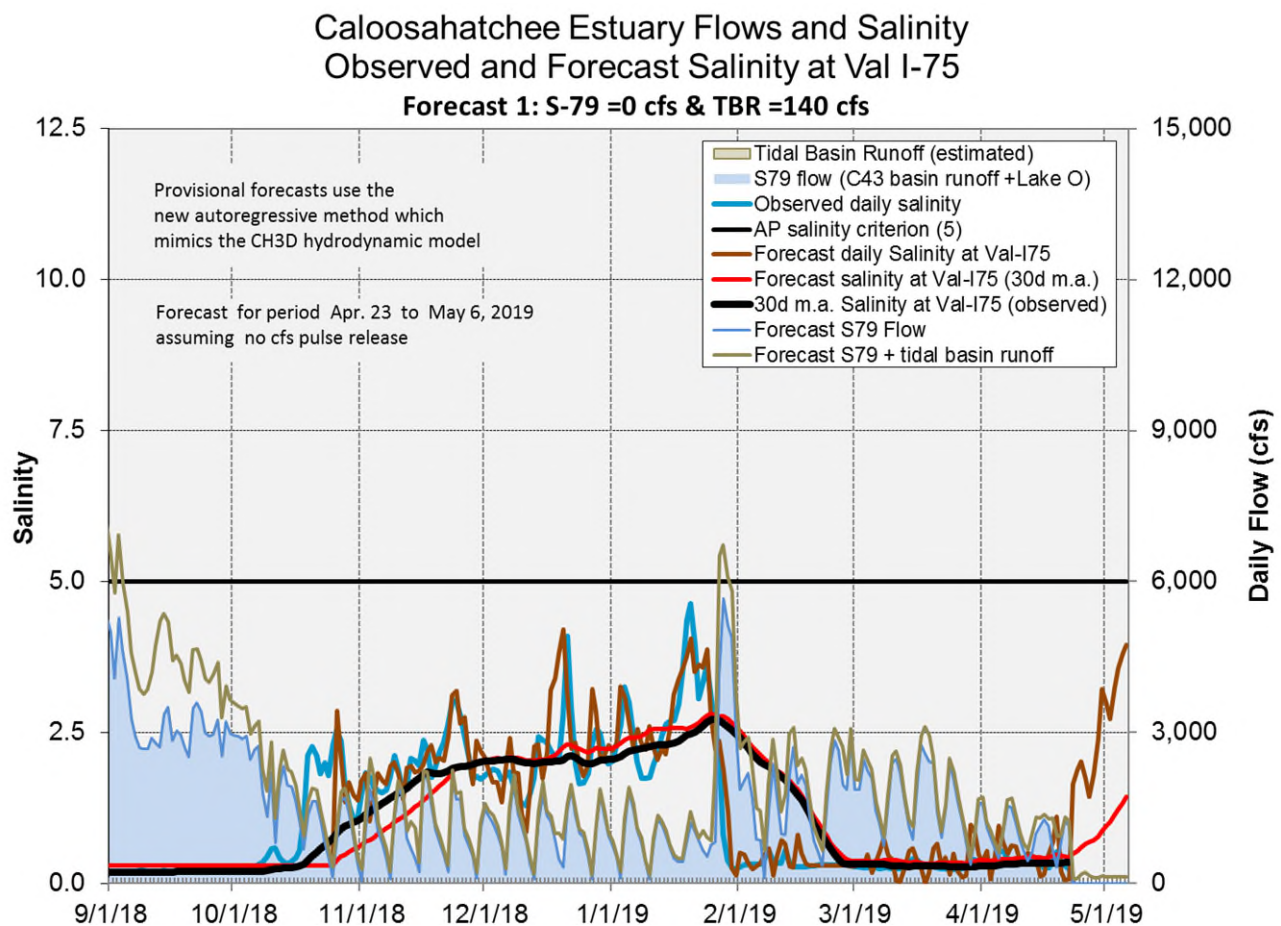


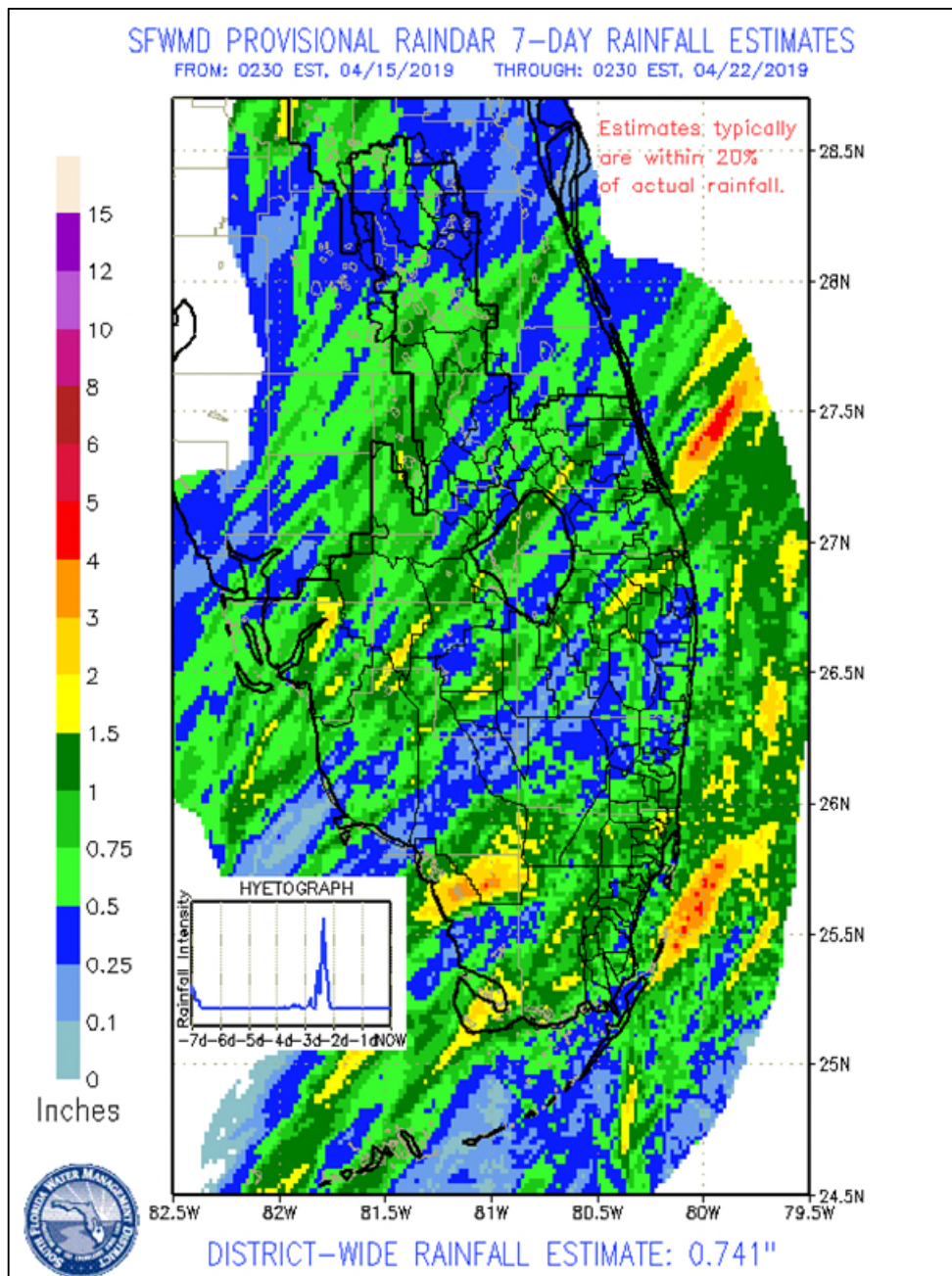
Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S79.

EVERGLADES

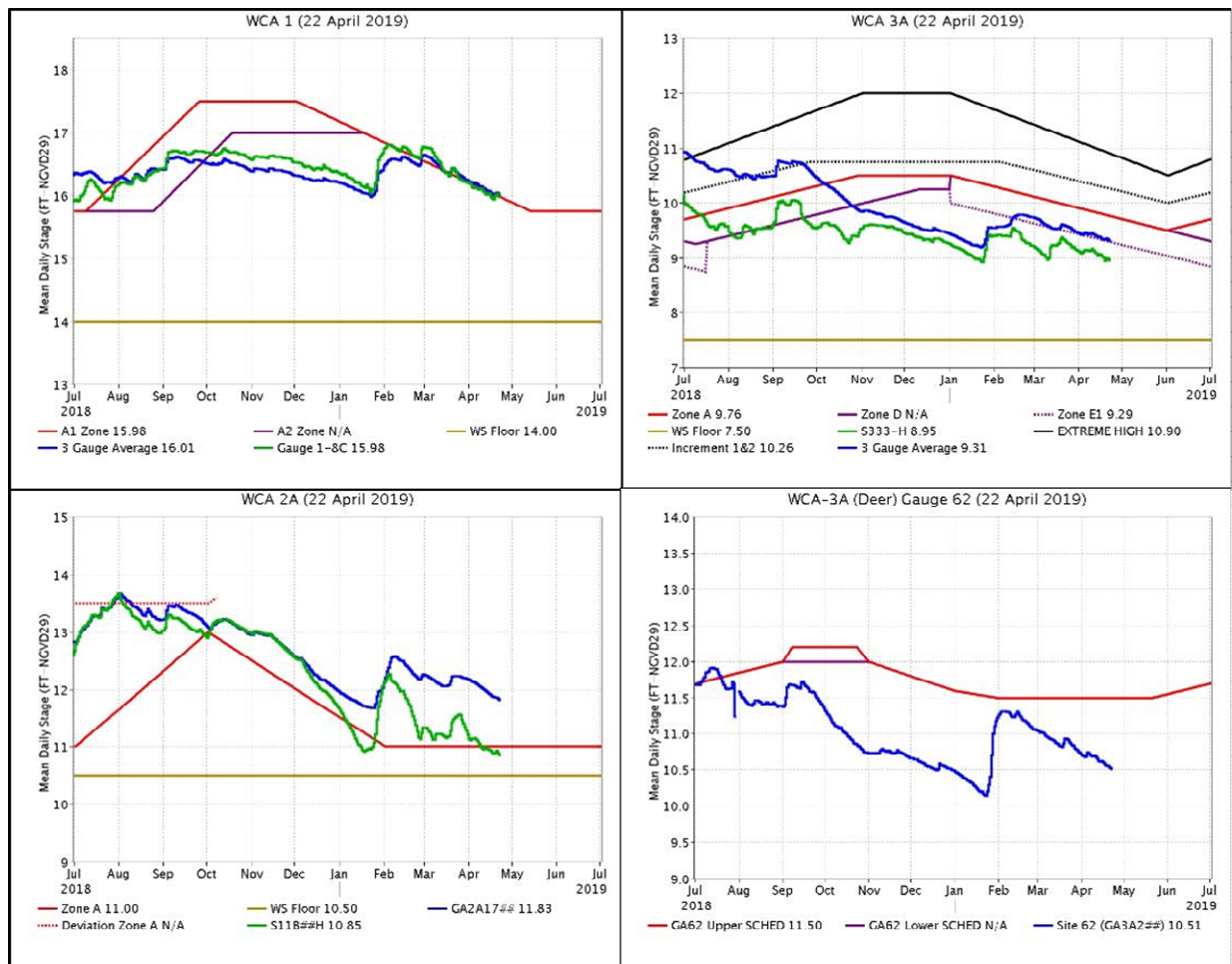
At the gauges monitored for this report the stages in the Everglades declined on average 0.06 feet last week. All of the basins were again very near the optimal rate of recession for wading bird foraging. The most extreme individual gauge changes ranged from -0.15 feet (WCA-2B) to +0.01 feet (ENP). Pan evaporation was estimated at 1.81 inches this week.

Everglades Region	Rainfall (Inches)	Stage Change (feet)			
WCA-1	0.61	-0.05			
WCA-2A	0.45	-0.10			
WCA-2B	0.37	-0.15			
WCA-3A	0.50	-0.06			
WCA-3B	0.76	-0.04			
ENP	0.90	+0.01			

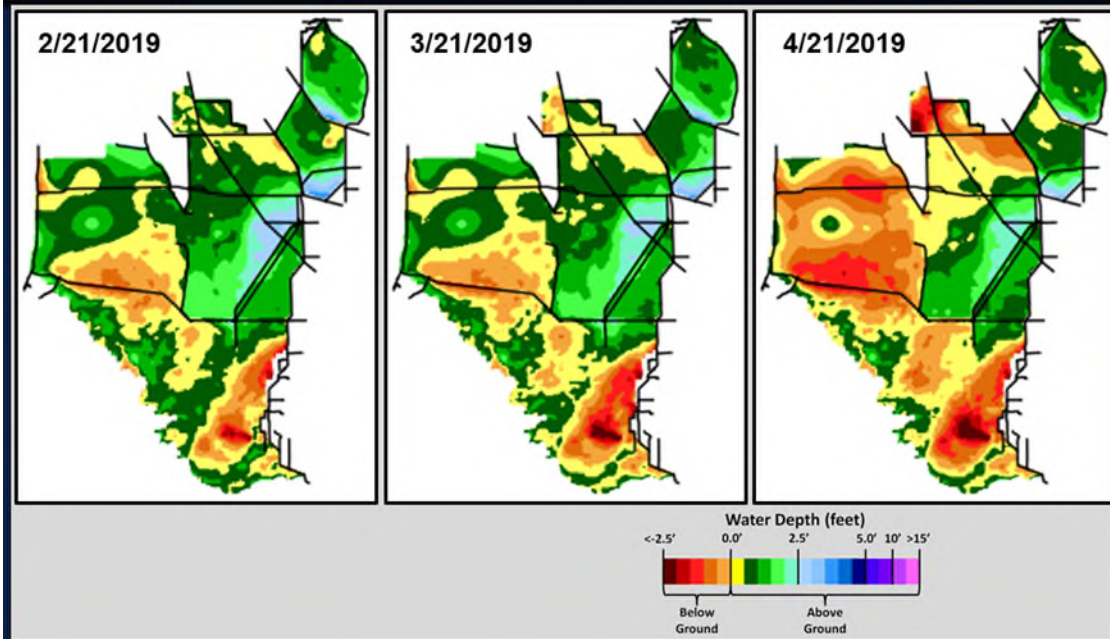
	Good	Recession rate for wading bird foraging
	Fair	
	Poor	



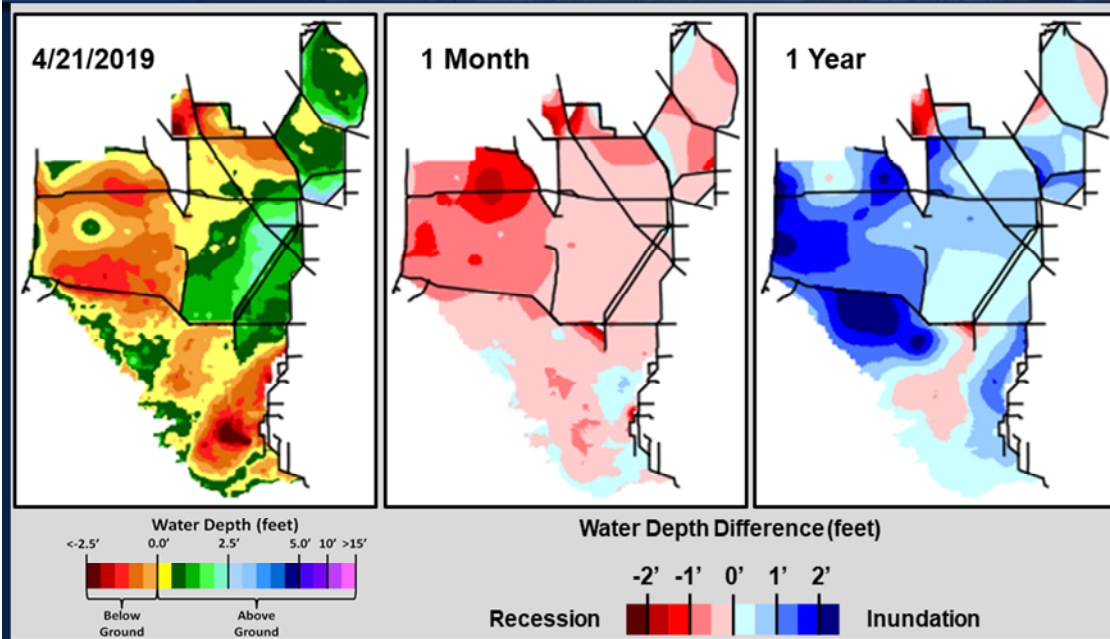
Regulation Schedules: WCA1: Gauge 1-8C is at the Zone A1 regulation line and following the seasonal recession. WCA2A: S11B Headwater stage is now 0.15 feet below the Zone A regulation line after an extended time above regulation. WCA-3A: The Three Gauge Average stage is 0.03 feet above Zone E1 regulation line and continues to follow the regulation line. WCA-3A at gauge 62 (Northwest corner) is 0.99 feet below the Upper Schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate a gradual drying down from north to south in WCA-3A and depths across most of WCA-3A North are approaching or below ground surface. WDAT difference output indicates that water levels fell gradually across the majority of the Everglades during the last month and there is the more water in portions of western ENP (Lostman's slough). In the "1 Year" inset we see the difference between current depth conditions and those a year ago. Currently the depths are significantly greater across WCA-3A than they were a year ago, but current depths are typical and conducive to wading bird foraging success.

**SFWDAT Water Depth Monthly Snapshots**

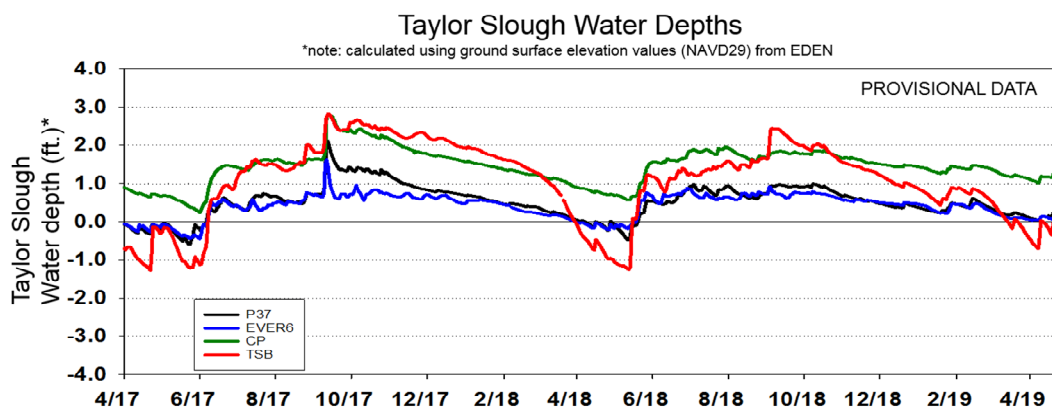
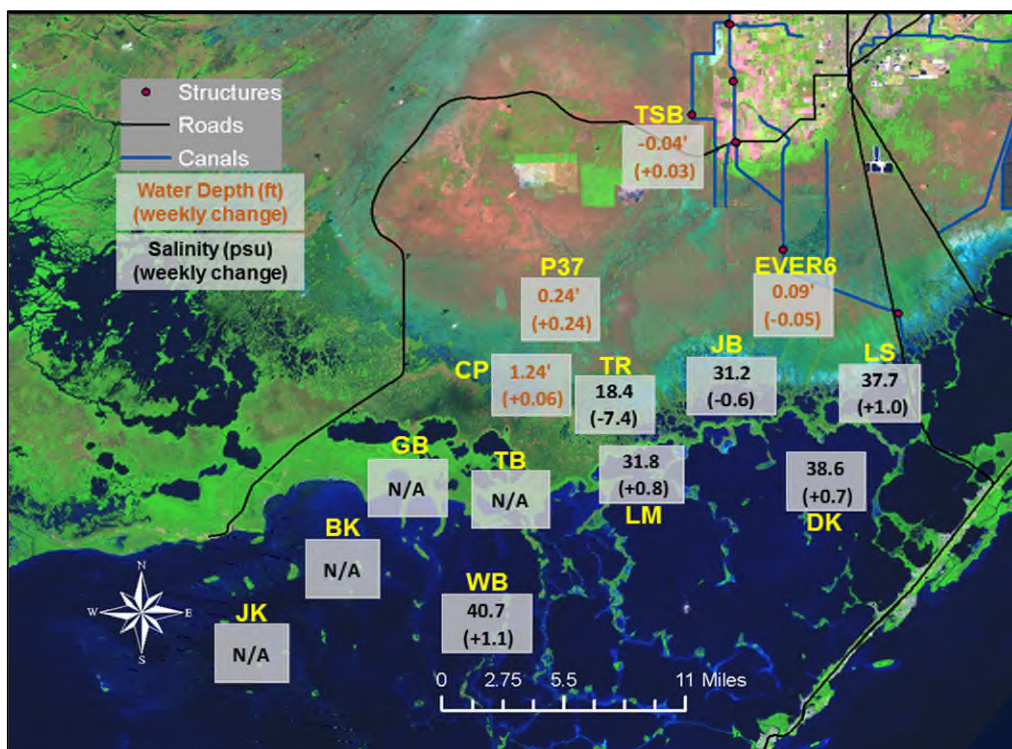
South Florida Water Depth Assessment Tool (SFWDAT)

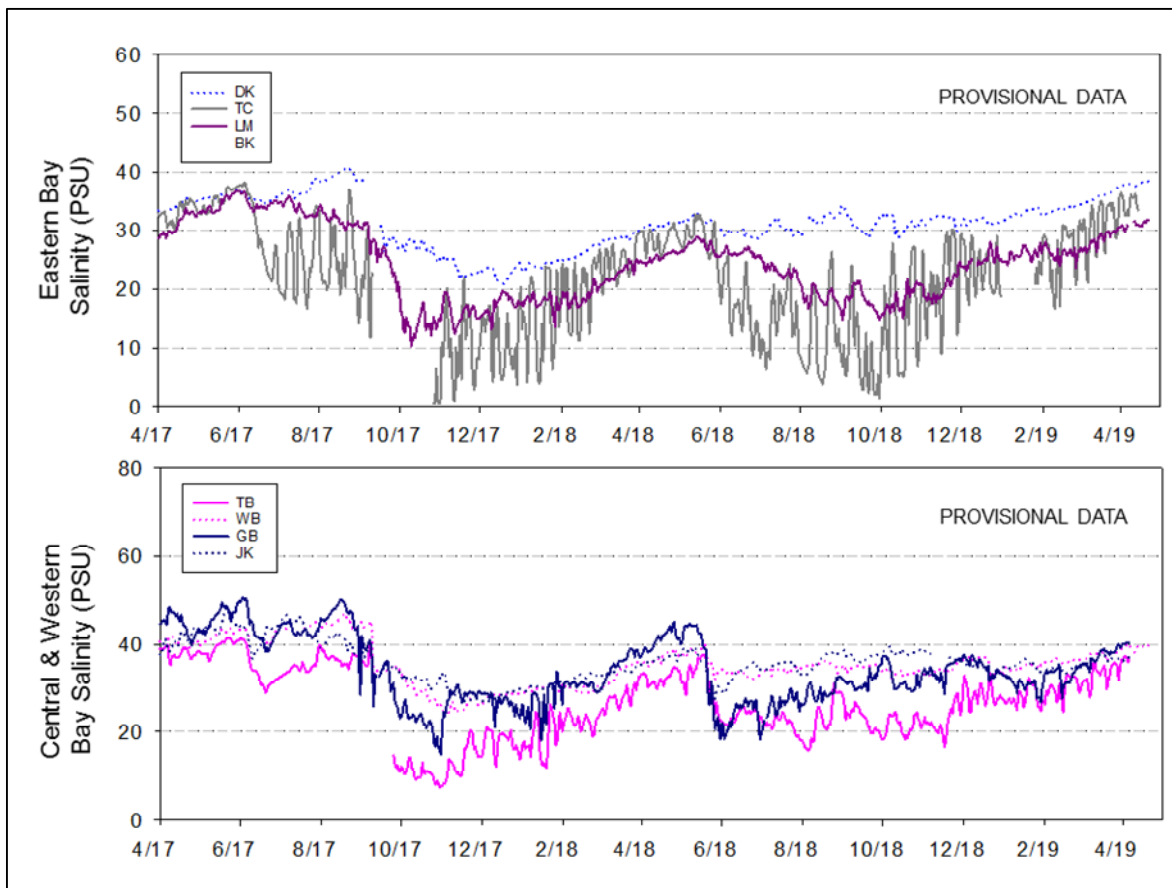
**SFWDAT Everglades Difference Maps (Present - Past)**

South Florida Water Depth Assessment Tool (SFWDAT)

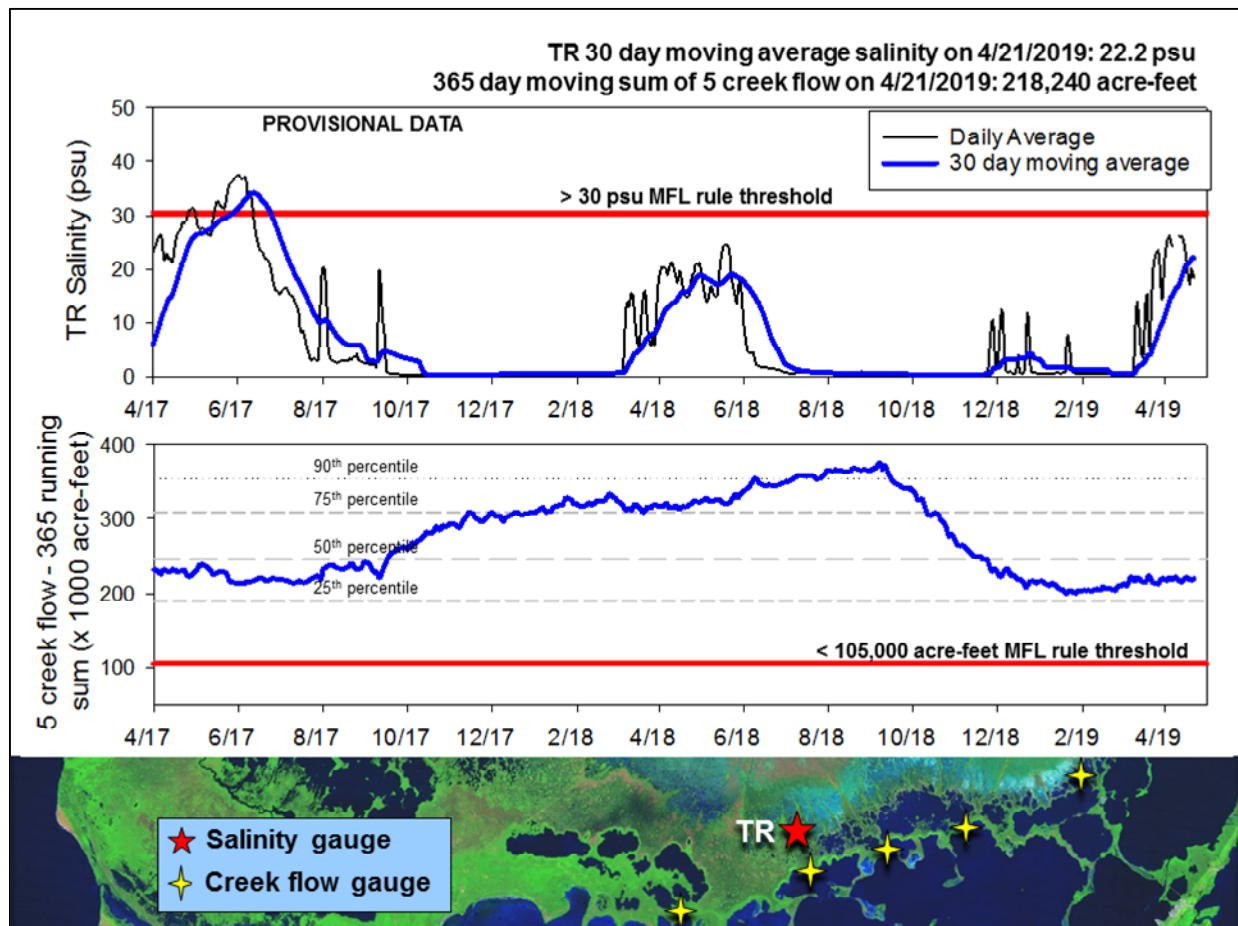
Taylor Slough Water Levels: Data delivery issues from Everglades National Park (ENP) prevent a full report this week. Water depths in Taylor Slough and the ENP panhandle again increased by 0.1 feet on average to end at an average of 0.38 feet by Sunday.

Florida Bay Salinities: Western Florida Bay and the central shoreline area had no data again this week. Elsewhere, salinity averaged a 0.6 psu increase from last week with individual stations changing less than 1.1 psu. Daily average salinities ranged from 31 psu in the northeast to 41 psu in the central bay and are still approximately 6 psu above average for this time of year.





Florida Bay MFL: Salinity in the mangrove zone decreased 7 psu over the week to end the week at 18 psu. However, the 30-day moving still increased to 22.2 psu due to previous high salinity values. The weekly cumulative flow from the five creeks denoted by yellow stars on the map totaled about 2,600 acre-feet with negative flows only occurring 3 of the last 7 days. 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 increased about 1,600 acre-feet to 218,240 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

Discharges into WCA-3A North continue to have ecological benefit by moderating the recession rate and protecting peat soils in that sensitive region. Current recession rates are very conducive to prey concentration and wading bird foraging success. Protecting those foraging conditions by curtailing reversals and providing a recession rate between -0.05 and -0.09 for the remainder of the wading bird nesting season will provide ecological benefit. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, April 23rd, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.05'	Maintain depths at regulation schedule. 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 0.10'	Maintain depths at regulation schedule. Maintain 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. Maintain recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.08'	Maintain depths at regulation schedule. Maintain recession rates, not to exceed the recommended max rate for optimal wading bird foraging of -0.09 ft per week.	Protect habitat including peat soil development and wildlife. Protect conditions that provide wading bird foraging habitat later into the nesting season.
WCA-3A NW	Stage decreased by 0.09'	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 0.03'	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 tree islands, 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 0.06'		
WCA-3B	Stage decreased by 0.04'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect 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 -0.05' to +0.24	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 -0.6 to +1.1 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.