Disclaimer: Information contained in the report addresses environmental conditions only and is not the official South Florida Water Management District operations recommendation or decision.

M E M O R A N D U M

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

FROM: SFWMD Staff Environmental Advisory Team

DATE: May 21, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A mid- to upper-level trough over the southwestern Atlantic should gradually shift eastward today as weak surface high pressure remains in place offshore the northeast coast of Florida. Upper-level convergence on the backside of the trough is resulting in large-scale sinking, warming, and drying of the atmosphere aloft across the Florida peninsula, all of which are strong negative factors favoring suppressed rain activity. Furthermore, the warming of the mid-levels of the atmosphere is contributing to greater static stability, another element that would weigh against rain production. Drier air over the Bahamas reaching the east coast early today should also inhibit rains along or near the east coast, with considerably less today compared to yesterday. Nevertheless, some shower and thunderstorm activity are expected to form from the south-central interior to the lower Kissimmee Valley in association with the east coast sea breeze that should already be well inland by mid-afternoon, with more over the south relative to the north. With the steering flow easterly to northeasterly today and over a deep layer, afternoon rains could progress inland more rapidly than yesterday and reach a maximum over the western interior to the west coast later in the day. Overall, total District rainfall is forecast to be lower than yesterday's total (0.07 inches) and well under the daily climatological average for the fourth week of May (0.16 inches).

Kissimmee

Tuesday morning stages were 55.2 feet NGVD (0.2 feet below schedule) in East Lake Toho, 52.2 feet NGVD (0.2 feet below schedule) in Toho, and 49.3 feet NGVD (0.1 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.4 feet NGVD at S-65A and 25.9 feet NGVD at S-65D. Tuesday morning discharges were 882 cfs at S-65, 715 cfs at S-65A, 891 cfs at S-65D and 751 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 5.1 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.22 feet. There were no new recommendations this week.

Lake Okeechobee

Lake Okeechobee stage is 11.21 feet NGVD, decreasing 0.08 feet from the previous week and experiencing a reversal mainly due to a decrease in rain and an increase in evapotranspiration. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.56 feet above the Water Shortage sub-band. The Lake remains below the bottom of the ecological envelope (currently 0.79 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 and the upcoming wet season) 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. Wading bird foraging numbers have decreased as suitable habitat is limited to small ponded areas in the marsh and along the outer

marsh-nearshore interface. Estimated algal bloom potential using satellite imagery suggests medium bloom risk in the north of the Lake and along the western shore, particularly within Fisheating Bay and along the edge of Indian Prairie. Bloom potential also increased along the eastern nearshore and pelagic regions.

Estuaries

Total inflow to the St. Lucie Estuary average 456 cfs over the past week with no flow coming from Lake Okeechobee. Over the past week, salinities decreased throughout 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 1,363 cfs over the past week with 147 cfs coming from the Lake. Over the past week, salinity decreased slightly in the estuary. The 30-day moving average surface salinity is 0.9 at Val I-75 and 6.2 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, and in the fair range at Sanibel.

Stormwater Treatment Areas

Over the past week, no Lake water was delivered to the STAs. The total amount of Lake releases sent to the STAs/FEBs in WY2020 (since May 1, 2019) is approximately 5,300 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 67,000 acre-feet. Most STA cells are at or above 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. The nest of an Endangered Species Act (ESA) protected species has been observed in STA-1E and the nests of Migratory Bird Treaty Act (MBTA) protected species have been observed in STA-1E and STA-5/6. It is recommended that no Lake releases be sent to the STAs this week.

Everglades

Stages within the Everglades region returned to a seasonal recession this week, and water from last week's above average rainfall made its way south. Ecological areas of concern remain the foraging conditions in WCA-2A and WCA-3A and peat soils/fire risk in northern WCA-3A. Stage conditions on average were categorized as good to fair for wading bird foraging within the WCAs over the last week. The recession rates in WCA-3A central and south increased faster than the optimal rate for wading bird foraging last week. A large increase in snail kite activity and snail kite nesting was observed in southern WCA-3A over the last reporting period. Water depths in Taylor Slough and the Everglades National Park (ENP) panhandle increased this week due to localized rainfall. Salinities in Florida Bay decreased on average but increased within the mangrove zone over the week. Large flocks of wading birds are foraging in western WCA-2A. Conditions remain good for Cape Sable Seaside Sparrow (CSSS) nesting; sub-population "D" nesting success remains above average.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 1.49 inches of rainfall in the past week and the Lower Basin received 0.34 inches (SFWMD Daily Rainfall Report 5/20/2019).

Upper Kissimmee Basin

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

Table 1. Average discharge (cfs) for the preceding seven days, one-day stage (feet NGVD), and departures from KCOL flood regulation (R) or temporary schedules (T, A, or S). Provisional, real-time data are from SFWMD.

Report Date: 5/21/2019

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)						
							5/19/19	5/12/19	5/5/19	4/28/19	4/21/19	4/14/19	4/7/19
Lakes Hart and Mary Jane	S-62	68	LKMJ	59.6	R	59.8	-0.2	-0.2	0.0	-0.2	-0.2	-0.3	-0.4
Lakes Myrtle, Preston, and Joel	S-57	10	S-57	60.1	R	60.1	0.0	0.0	0.0	-0.1	-0.1	0.0	0.0
Alligator Chain	S-60	149	ALLI	62.3	R	62.3	0.0	0.0	0.1	0.0	0.0	-0.1	0.0
Lake Gentry	S-63	218	LKGT	59.8	R	59.8	0.0	0.0	0.1	0.0	0.0	0.0	0.0
East Lake Toho	S-59	288	TOHOE	55.2	R	55.5	-0.3	-0.5	-0.4	-0.7	-0.8	-1.0	-1.1
Lake Toho	S-61	851	TOHOW, S-61	52.2	R	52.5	-0.3	-0.4	-0.5	-0.7	-0.8	-1.0	-1.1
Lakes Kissimmee, Cypress, and Hatchineha	S-65	984	KUB011, LKIS5B	49.3	R	49.4	-0.1	-0.4	-0.5	-0.6	-0.7	-0.9	-0.9

[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: **5/21/2019**

Metric	Location	1-Day Average	Average for the Preceeding 7-Days[1]									
		5/19/2019	5/19/19	5/12/19	5/5/19	4/28/19	4/21/19	4/14/19	4/7/19	3/31/19	3/24/19	3/17/19
Discharge (cfs)	S-65	1,033	**984**	1,014	428	438	525	710	434	452	833	529
Discharge (cfs)	S-65A[2]	845	**815**	823	314	314	400	559	334	353	699	420
Discharge (cfs)	S-65D[2]	896	**920**	795	403	466	584	703	367	563	859	505
Headwater Stage (feet NGVD)	S-65D[2]	25.81	**25.82**	25.78	25.81	25.76	25.78	25.77	25.73	25.76	25.77	25.78
Discharge (cfs)	S-65E[2]	735	**810**	703	351	441	563	679	330	539	855	497
Discharge (cfs)	S-67	0	**79**	102	68	107	110	106	0	9	162	0
DO (mg/L)[3]	Phase I river channel	4.3	**5.1**	5.4	6.7	6.7	6.7	6.3	6.9	7.4	6.7	5.9
Mean depth (feet)[4]	Phase I floodplain	0.22	**0.24**	0.15	0.10	0.12	0.16	0.18	0.16	0.21	0.34	0.29

[1]Seven-day average of weighted daily means through Sunday midnight.
[2]S-65A discharge combines S-65A with auxillary strucutures; 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.
[3]DO is the average for sondes at PC62 and PC33.
[4]1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).
DATA ARE PROVISIONAL; N/A indicates that data were not available.

KCOL Hydrographs (through Sunday midnight)

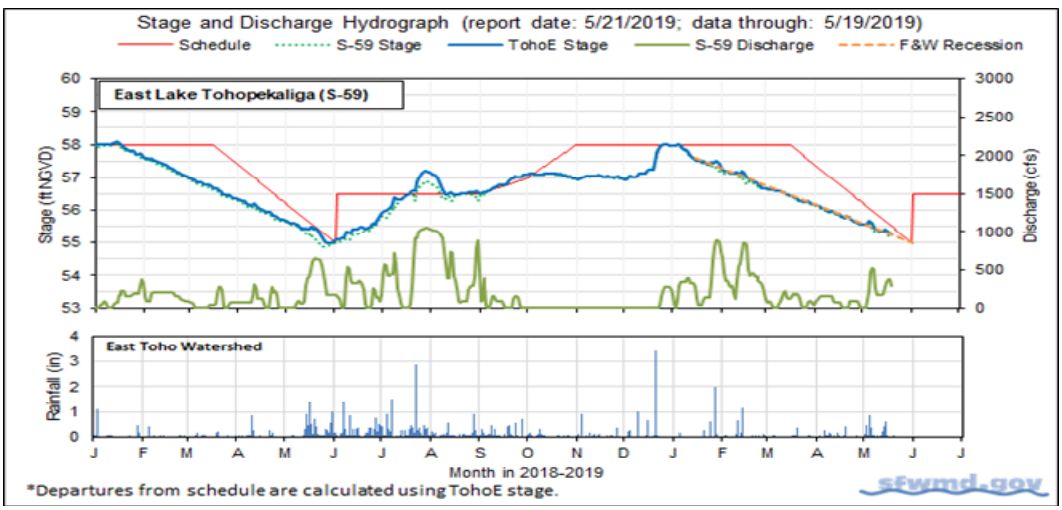


Figure 1.

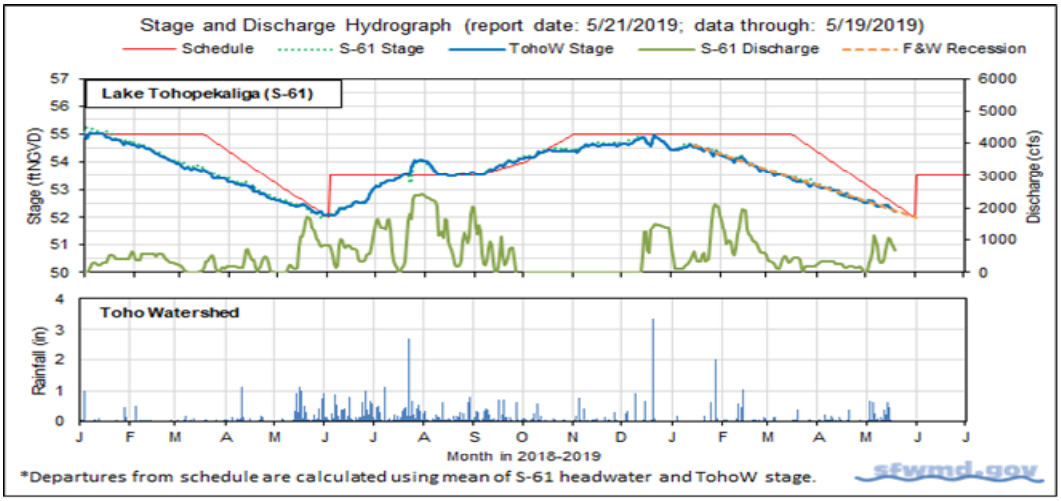


Figure 2.

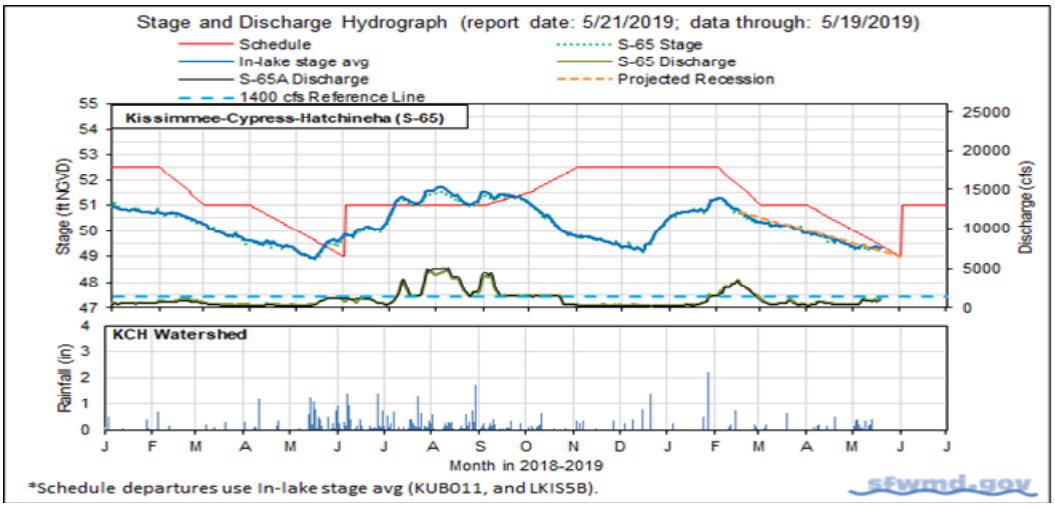


Figure 3.

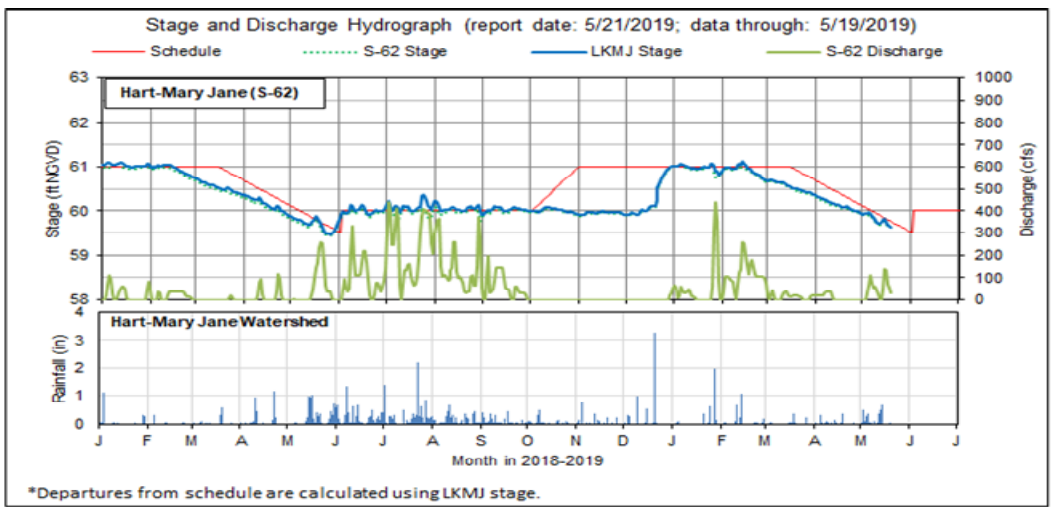


Figure 4.

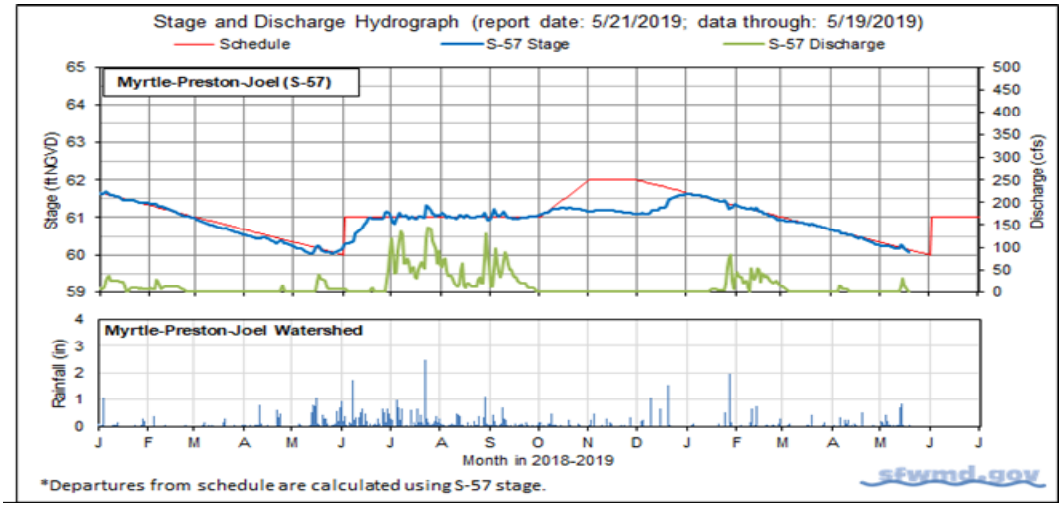


Figure 5.

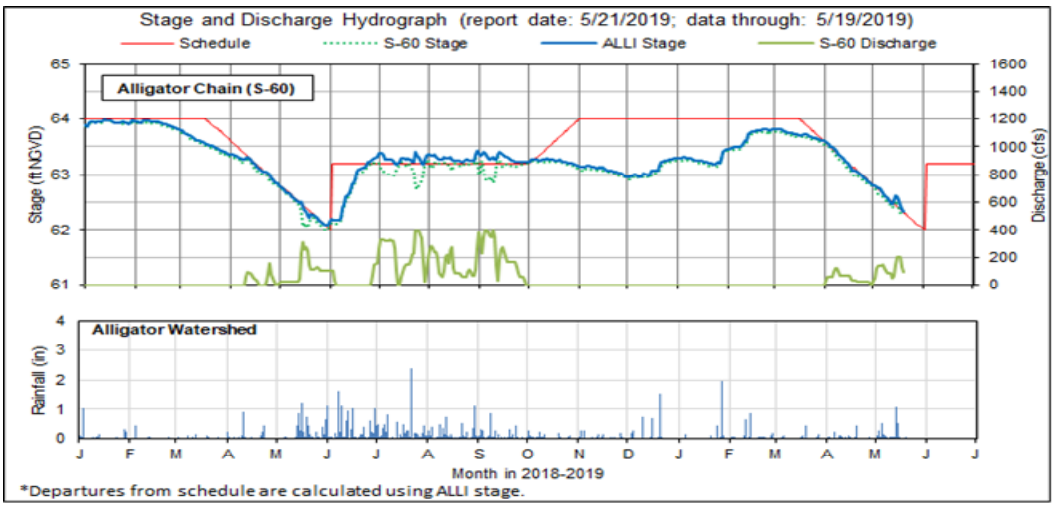


Figure 6.

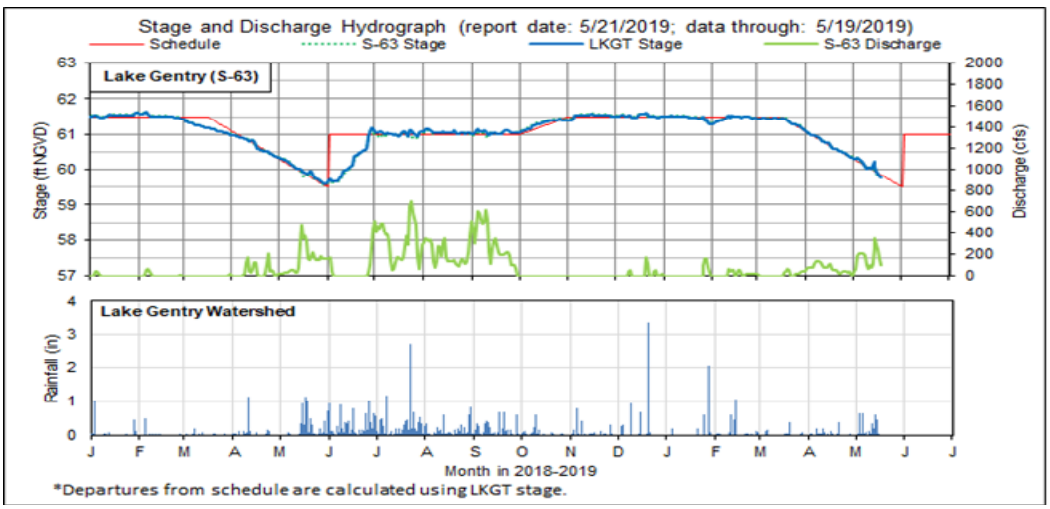


Figure 7.

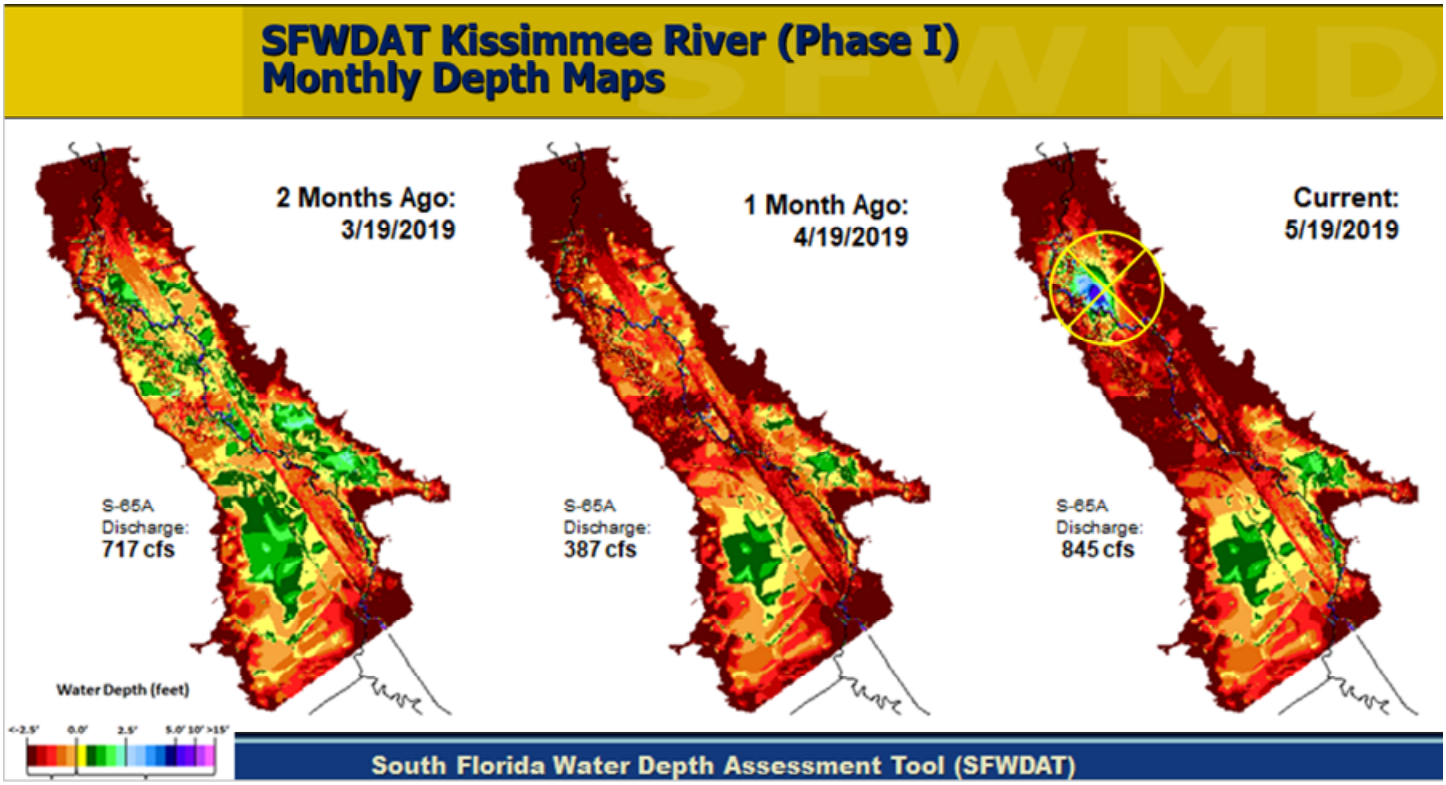


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

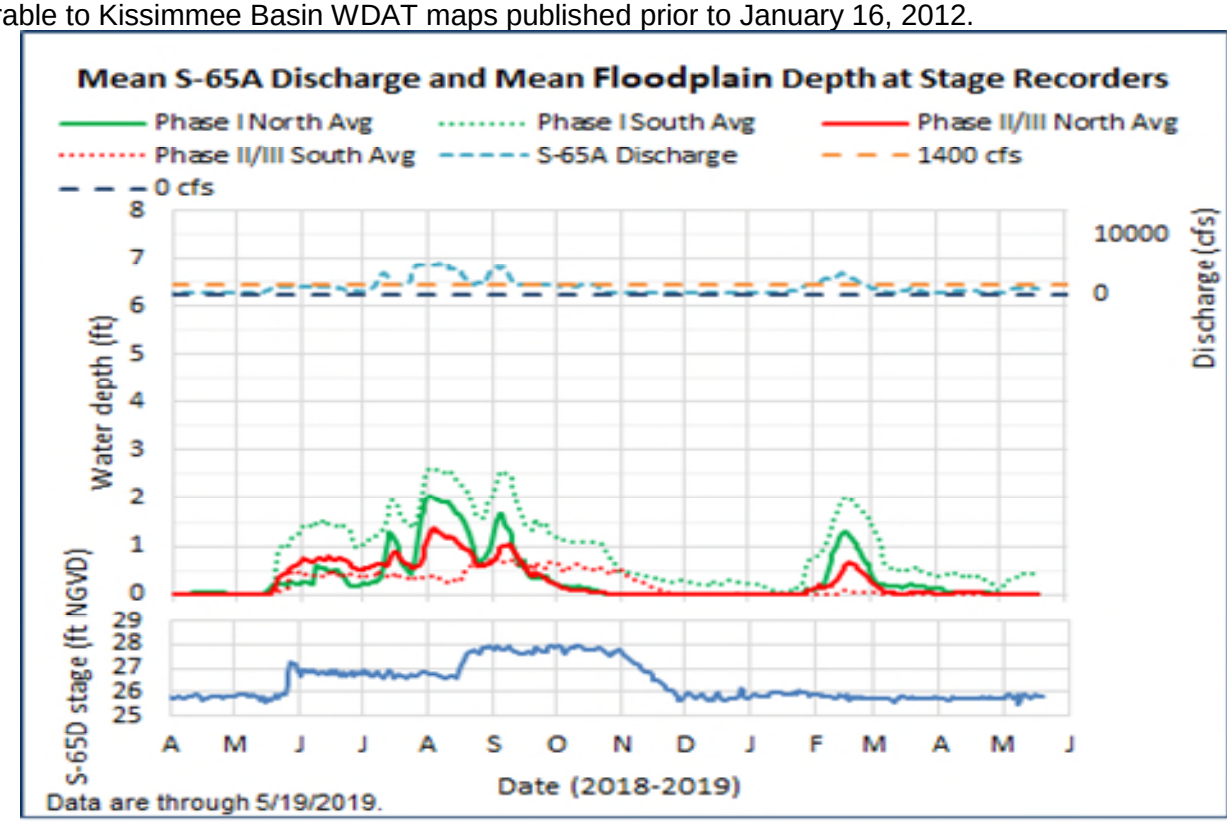


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.

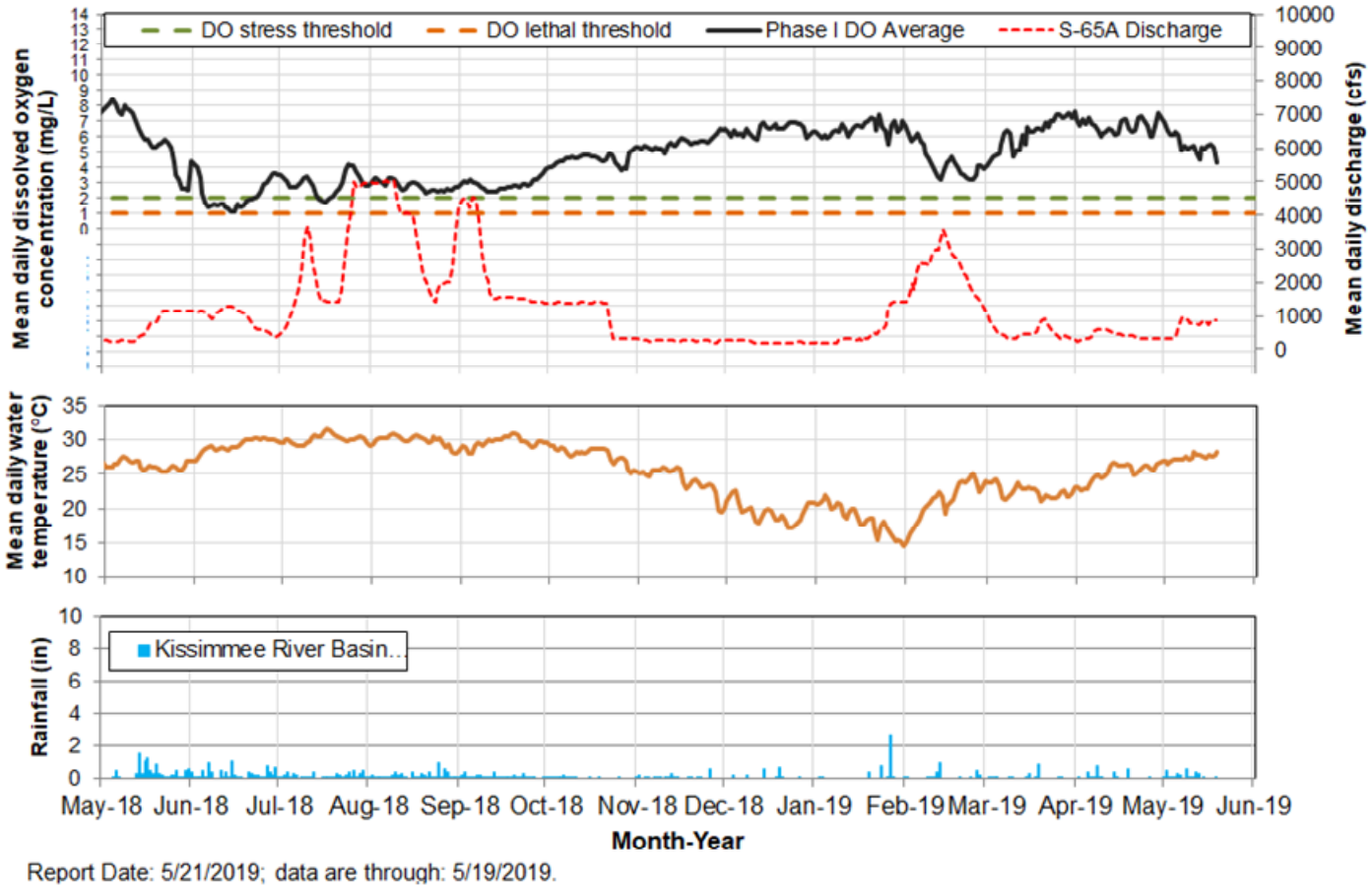


Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phase I river channel.

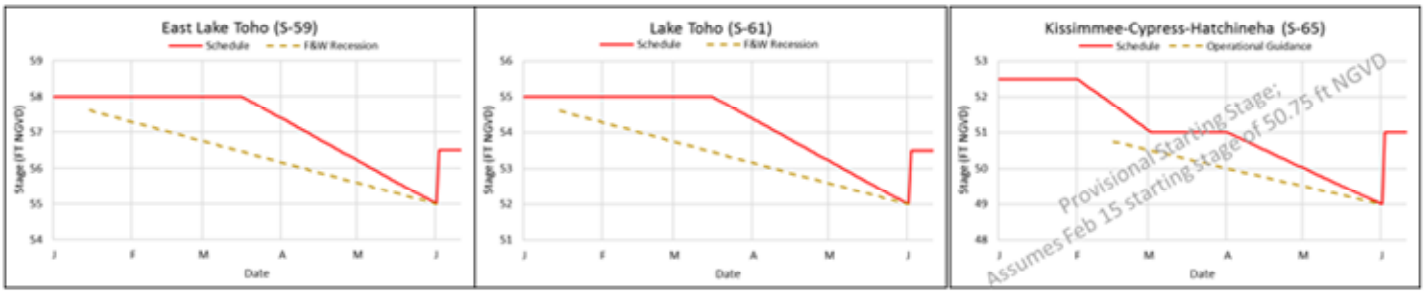
Water Management Recommendations

Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
5/20/2019	No new recommendations.		N/A		5/21/2019
5/13/2019	No new recommendations.		N/A		5/14/2019
5/6/2019	Due to the rainfall, increase S65-A to 1000 cfs today in two increments and increase flow at S-65 accordingly. We will reassess the rise in KCH stage tomorrow 5/7.	Short-term goals: try to keep S65-A discharge at or below 1000 cfs for KR fish sampling this week and next, while keeping the reversal in KCH less than about 0.4 ft.	Implemented	KB Ops	5/7/2019
4/29/2019	No new recommendations.		N/A		4/30/2019
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 dishcarge 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
1/15/2019	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. 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. Discharge and reversal guidelines are provided in the Dry Season Operations slides.	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
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

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

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.

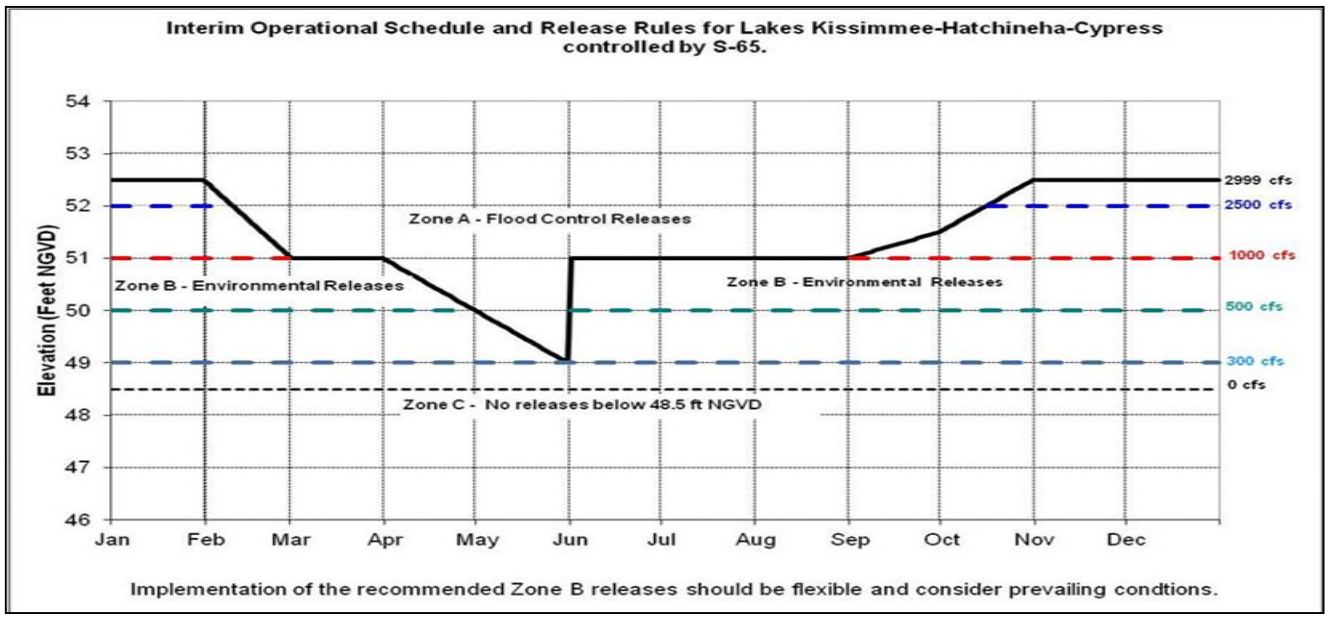


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

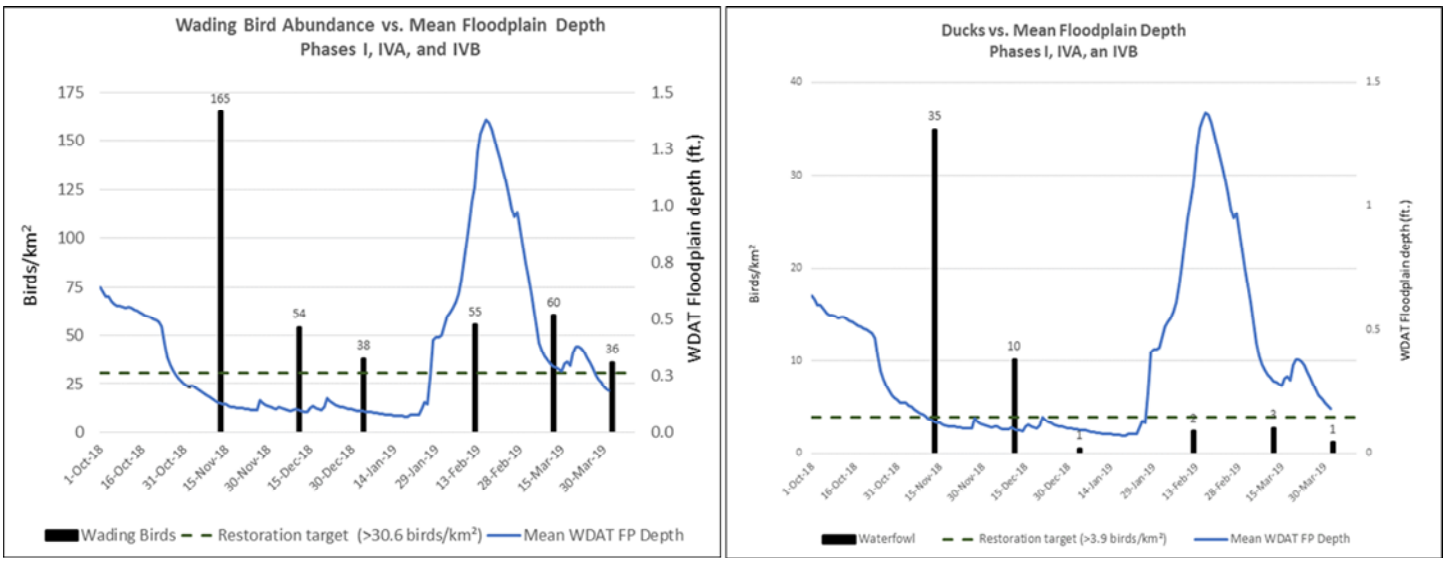


Figure 13. Kissimmee River Wading Bird and Waterfowl Surveys from November 2018 to March 2019.

Table 3. Upper Kissimmee Basin Snail Kite Survey Update

Survey 3: April 27-29, 2019

Area	KITES	TOTAL NESTS	SUCCESSFUL	ACTIVE NESTS
E TOHO	8	4	0	2
TOHO	124	48	1	18
KISSIMMEE	235	37	9	27
Grand Total	**367**	**89**	**10**	**47**

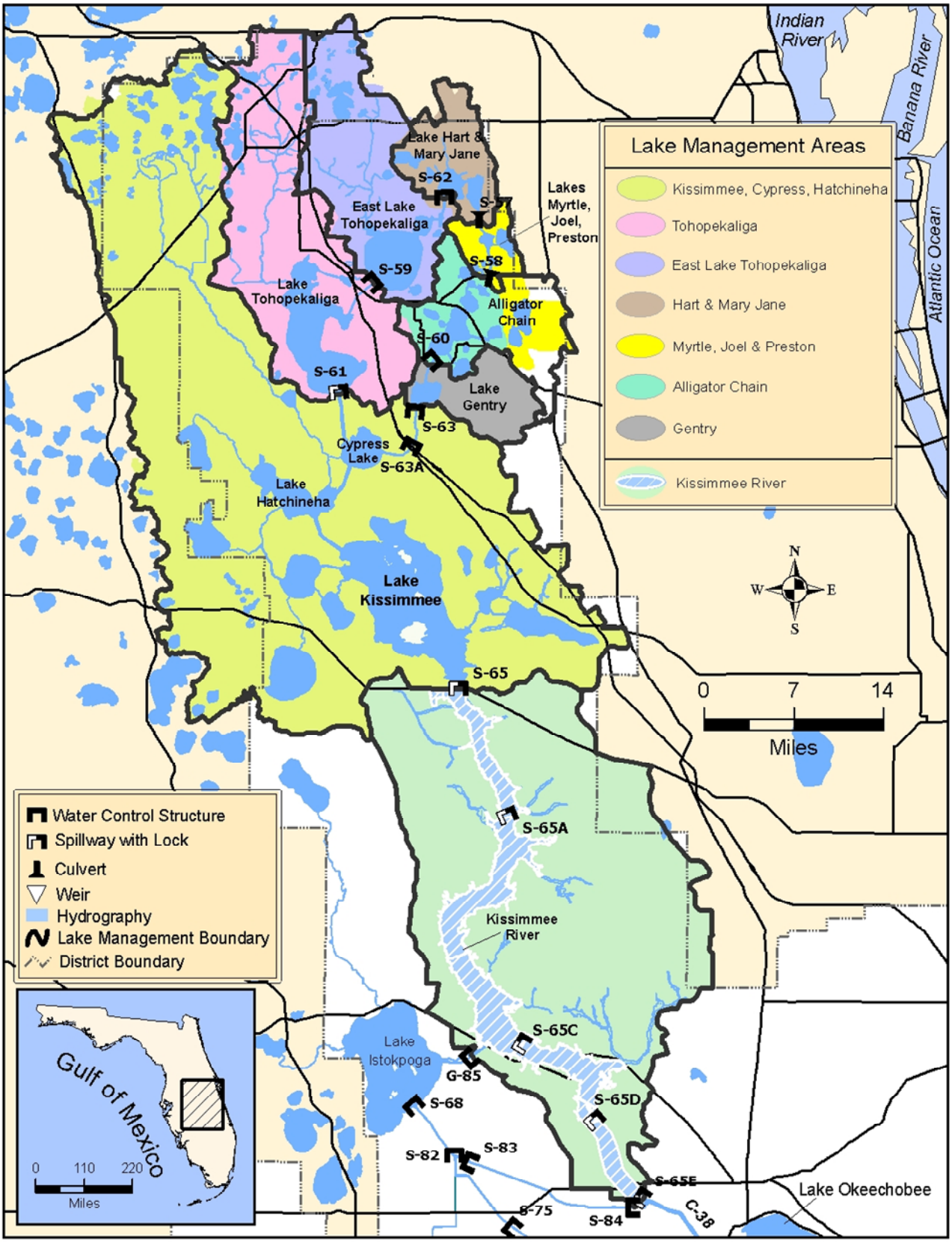


Figure 14. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 11.21 feet NGVD for May 21, 2019 decreasing 0.08 feet from the previous week and experiencing a reversal mainly due to a decrease in rain and an increase in evapotranspiration. 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 0.31 feet lower than a month ago and 2.29 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 same as it was in 2017, matching the lowest levels for this time of year since 2011 (Figure 3). According to RAINDAR, during the week of May 14 to May 21, 2019, 0.16 inches of rain fell directly over the Lake. Rainfall across most of the northern, eastern, and western watersheds received less than 0.5 inches of rain while the southwestern region received between 0.5 and 1.5 inches of rain (Figure 4).

Average daily inflows (minus rainfall) to the Lake decreased this week from 1,050 cfs to 952 cfs. The inflows from the Kissimmee River increased slightly from 764 cfs to 800 cfs. Inflows from Lake Istokpoga into the Kissimmee River (via the S-84 structures) decreased from the previous week, going from 214 cfs to 110 cfs. Inflows from S-71 and S-72 also decreased from the previous week, going from 9 cfs to 0 cfs. Fisheating Creek average daily inflow flow did not change (Table 1).

Total outflows (minus evapotranspiration) increased from the previous week, going from 4 average daily cfs to 241 cfs this past week. (Table 1). Outflows south through the S-350s increased from 0 cfs to 36 cfs. Outflows west via S-77 averaged 205 cfs, compared to the previous weeks 4 cfs. Outflows east via S-308 were zero again this week. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation was 0.18 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 (May 19, 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 north and western shores, particularly in Fisheating Bay and along Indian Prairie (Figure 6). Bloom potential also increased along the eastern nearshore and pelagic regions. 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.

The most recent wading bird survey (May 14, 2019) reported approximately 2,600 foraging wading birds on the lake, a considerable decrease from the May 03, 2019 survey (Figure 7). Even with the slight increase in lake stage two weeks ago, suitable foraging habitat is limited to small ponded areas of the marsh and along the outer marsh-lake interface (Figure 8, yellow/green areas). Current water levels remain too shallow to support much wading bird breeding effort on the lake this nesting season.

Water Management Recommendations

Lake Okeechobee stage is 11.21 feet NGVD, decreasing 0.08 feet from the previous week and experiencing a reversal. The Lake dropped into the Beneficial Use sub-band on March 7, 2019 and is now 0.56 feet above the Water Shortage sub-band. The Lake remains below the bottom of the ecological envelope (currently 0.79 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 and the upcoming wet season) 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. Estimated algal bloom potential using satellite imagery suggests medium bloom risk in the north of the lake and along the western shore, particularly within Fisheating Bay and along the edge of Indian Prairie. Bloom potential also increased along the eastern nearshore and pelagic regions.

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

INFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-65E & S-65EX1	764	800	0.4
S-71 & S-72	9	0	0.0
S-84 & S-84X	214	110	0.1
Fisheating Creek	3	3	0.0
S-154	0	0	0.0
S-191	0	0	0.0
S-133 P	0	0	0.0
S-127 P	0	0	0.0
S-129 P	0	0	0.0
S-131 P	0	0	0.0
S-135 P	0	0	0.0
S-2 P	0	0	0.0
S-3 P	0	0	0.0
S-4 P	0	0	0.0
L-8 Backflow	58	39	0.0
Rainfall	2462	319	0.2
Total	**3511**	**1271**	**0.6**

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	4	205	0.1
S-308	0	0	0.0
S-351	0	0	0.0
S-352	0	0	0.0
S-354	0	36	0.0
L-8 Outflow			
ET	2177	2645	1.3
Total	**2181**	**2886**	**1.4**

Provisional Data

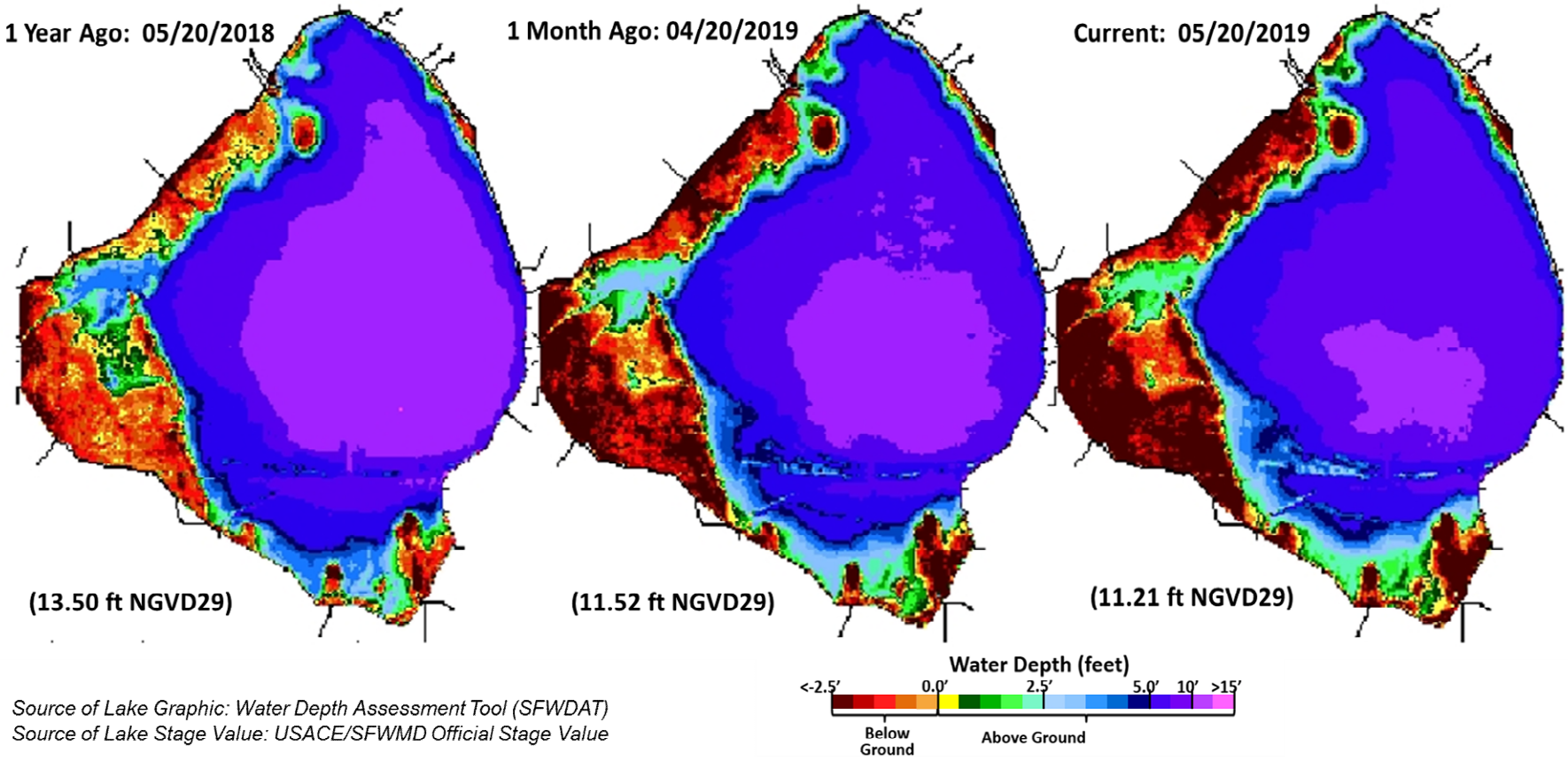


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

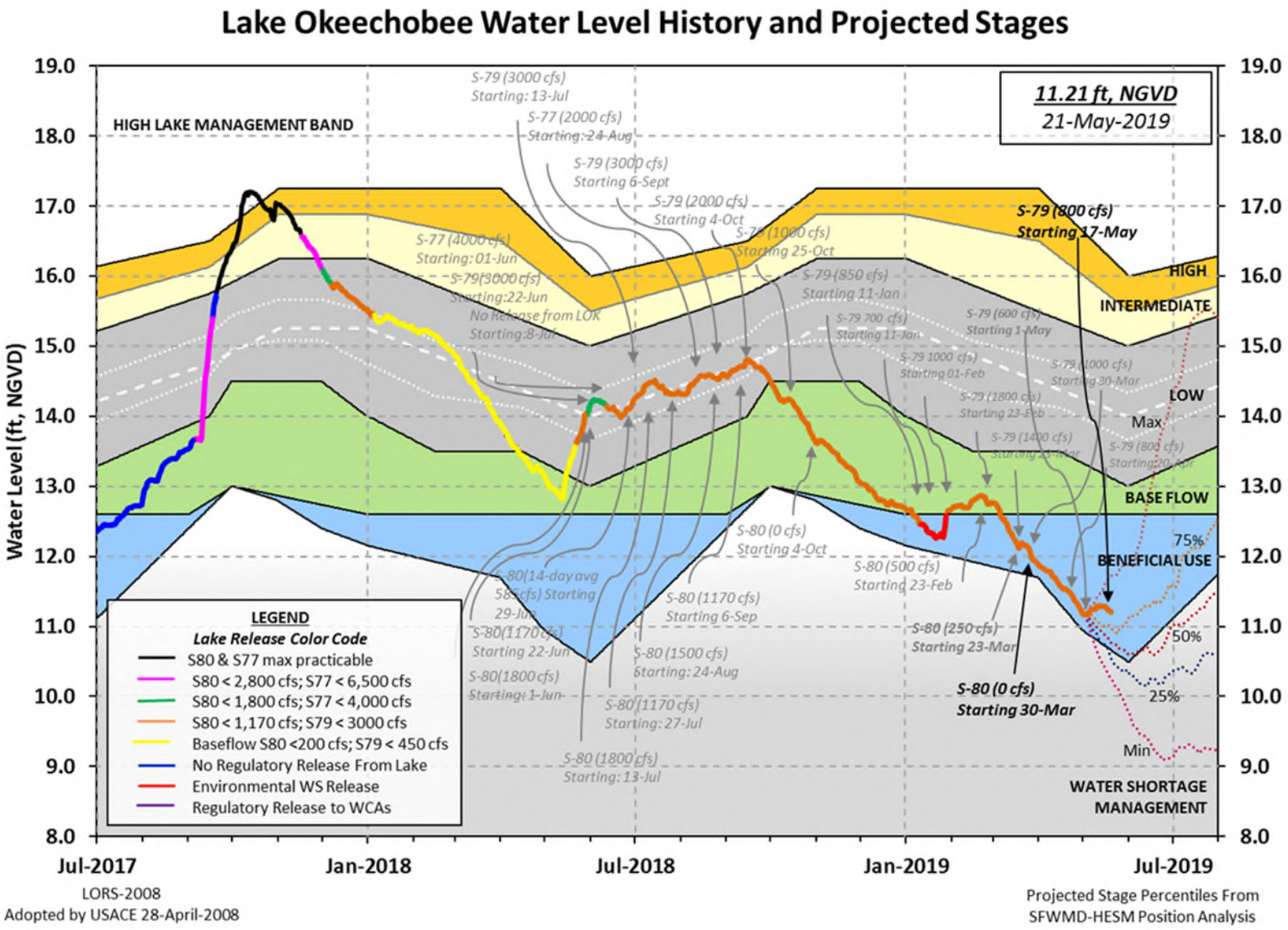


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

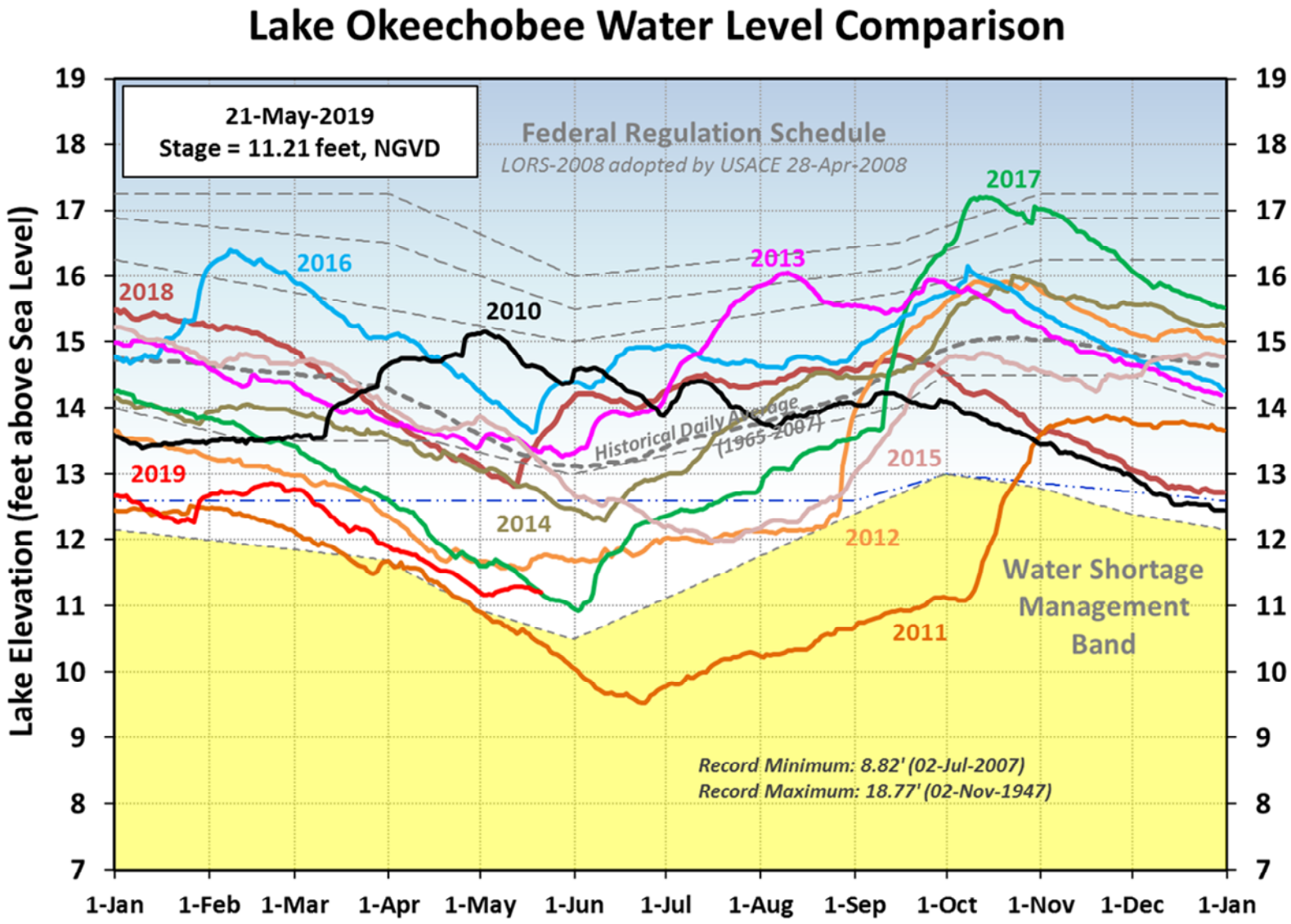


Figure 3. Select annual stage hydrographs for Lake Okeechobee from 2008 – 2019.

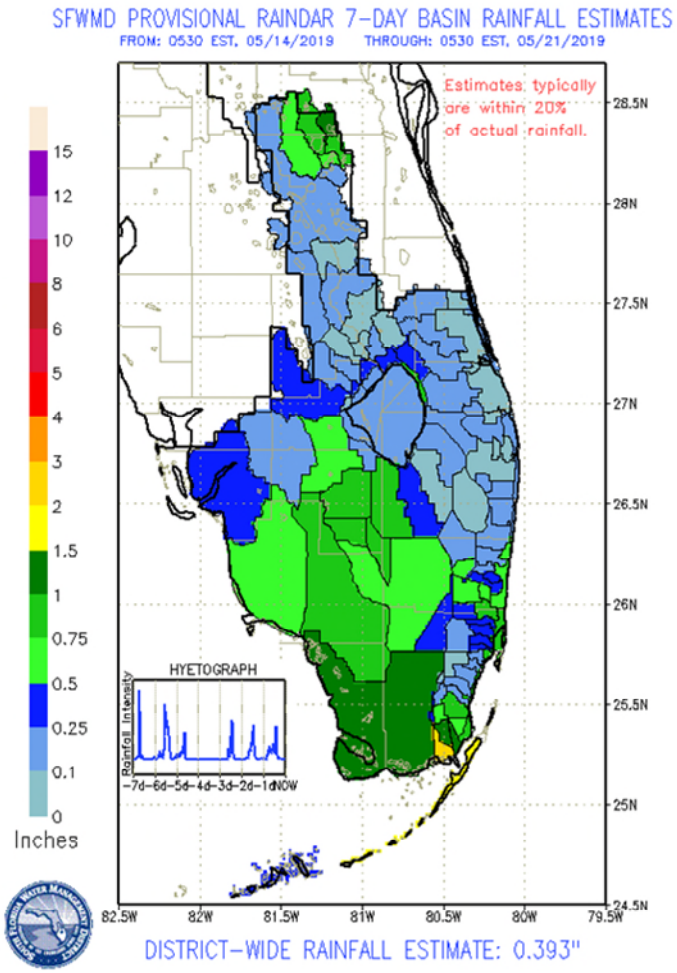


Figure 4. Rainfall estimates by basin.

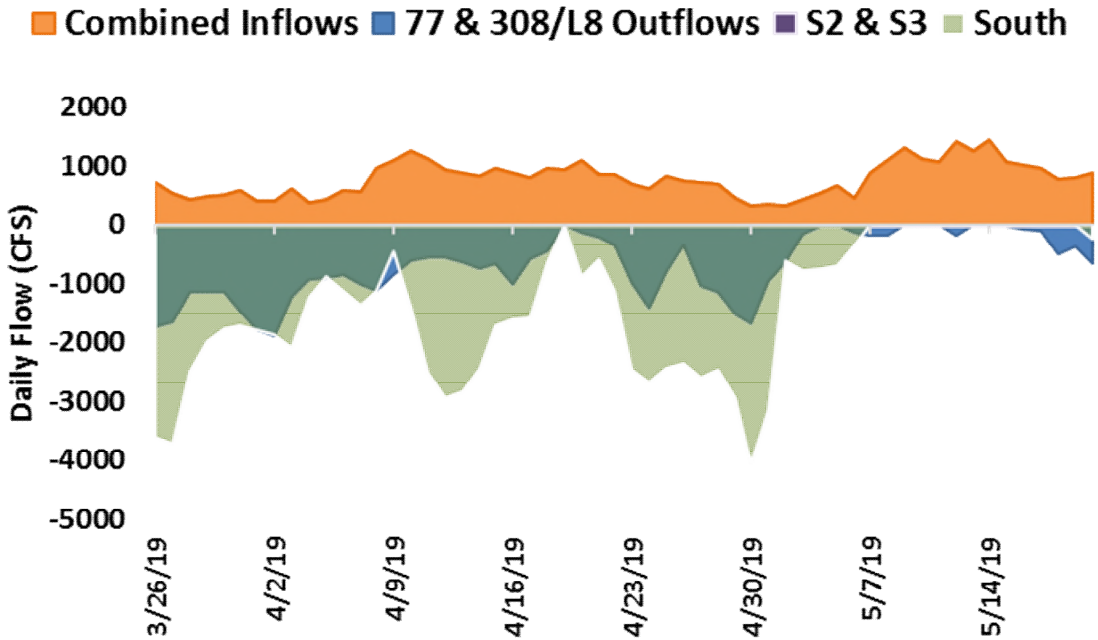


Figure 5. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive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

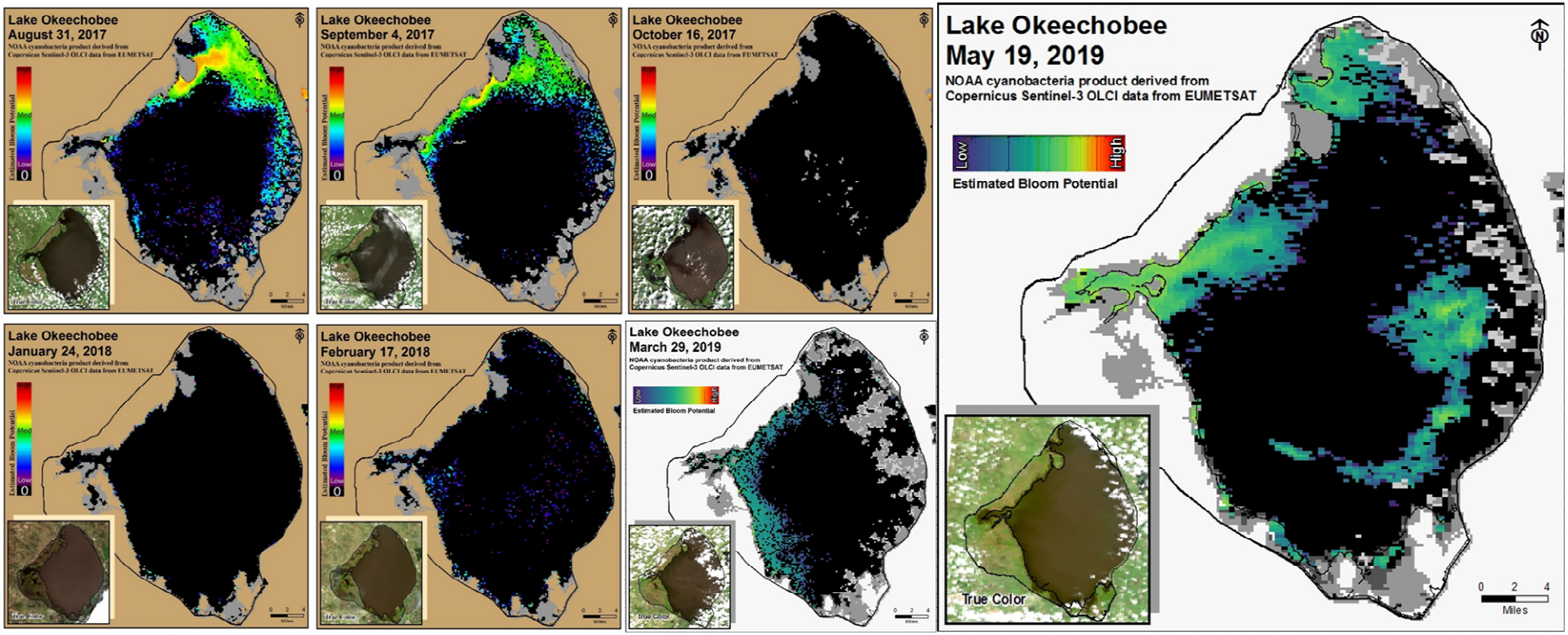


Figure 6. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. **Note** new color scale on larger image. Gray indicates cloud cover. All data are experimental and unvalidated at this point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

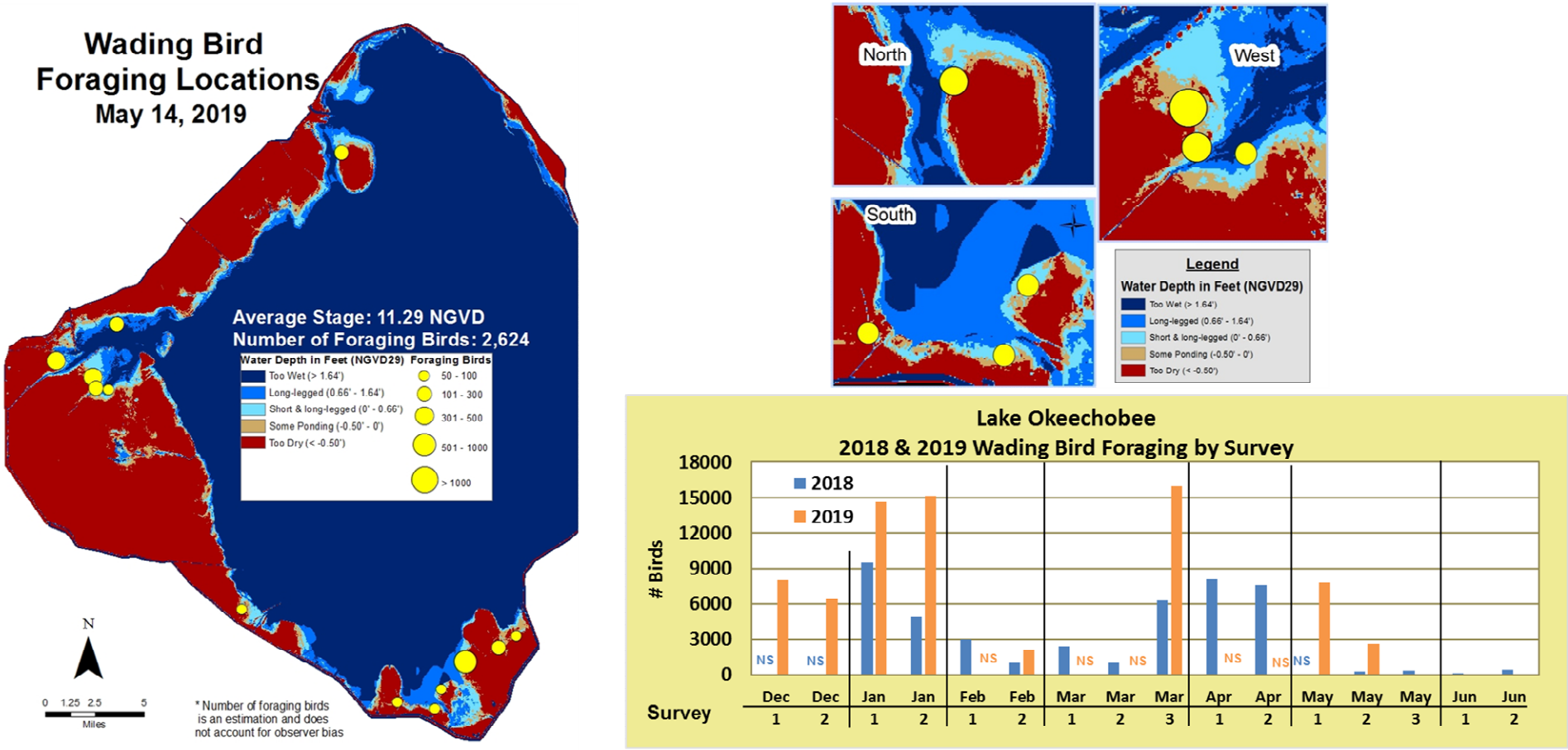
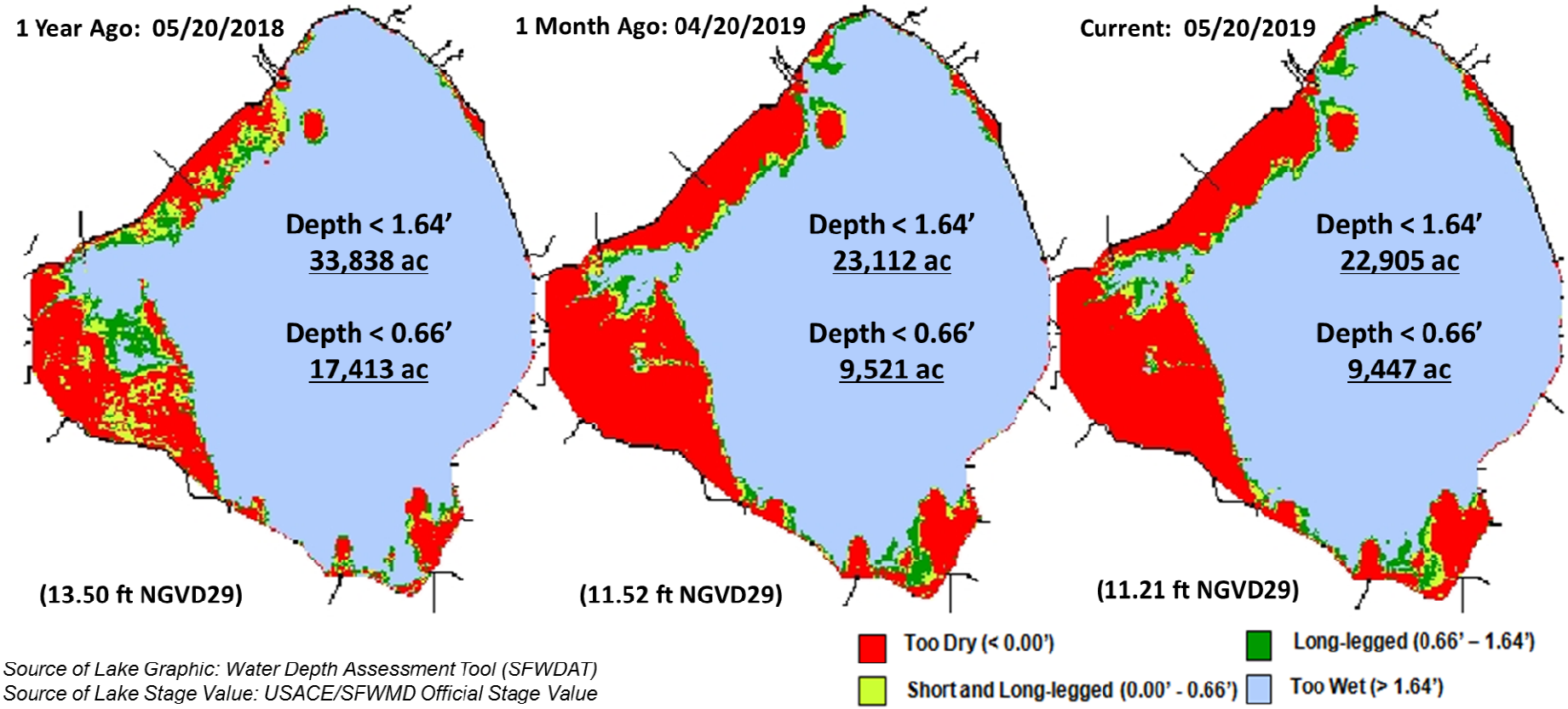


Figure 7. Locations of foraging flocks of wading birds observed during a monitoring flight on May 14, 2019 are shown in yellow, with circle sizes representing the size of the flocks. Previous survey totals from this season and from 2018 are compared in the bar graph.



Source of Lake Graphic: Water Depth Assessment Tool (SFWDAT)
Source of Lake Stage Value: USACE/SFWMD Official Stage Value

Figure 8. Wading bird habitat suitability index for Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 456 cfs (Figures 1 and 2) and last month inflow averaged about 420 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	142
S-80	54
S-308	0
S-49 on C-24	20
S-97 on C-23	88
Gordy Rd. structure on Ten Mile Creek	152

Over the past week, salinity decreased throughout the estuary (Table 2, Figures 3 and 4). The seven-day moving average of the water column (an average of the surface and bottom salinity) at the US1 Bridge is estimated to be 18.8. Salinity conditions in the middle estuary are within the good range for adult eastern oysters (Figure 3).

Table 2. Seven-day average salinity at three monitoring sites in the St. Lucie Estuary. Current average is in bold face type, previous average in parentheses. The envelope reflects the preferred salinity range for adult eastern oysters (*Crassostrea virginica*) in the middle estuary.

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	**13.3** (16.2)	**17.0** (19.6)	NA[1]
US1 Bridge	**18.3** (21.8)	**19.4** (22.4)	10.0-26.0
A1A Bridge	**27.2** (29.2)	**29.5** (31.0)	NA[1]

[1]Envelope not applicable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1,363 cfs (Figures 5 and 6) and last month inflow averaged about 1,191 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	205
S-78	582
S-79	1245
Tidal Basin Inflow	118

Over the past week, salinity decreased throughout the estuary (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 and likely in the fair range at Sanibel (Figure 9). The 30-day moving average surface salinity is 0.9 at Val I-75 and 6.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

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

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	**NR**[3](0.9)	**NR** (1.0)	NA[1]
Val I75	**0.9** (1.2)	**1.1** (1.8)	0.0-5.0[2]
Ft. Myers Yacht Basin	**5.7** (7.2)	**7.1** (9.3)	NA
Cape Coral	**13.8** (15.2)	**16.1** (18.0)	10.0-30.0
Shell Point	**NR** (28.1)	**NR** (28.2)	10.0-30.0
Sanibel	**31.7** (NR)	**32.0** (NR)	10.0-30.0

[1]Envelope not applicable, [2]Envelope is based on a 30-day average, and [3]Not 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 1.8 to 4.5 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 800 cfs and Tidal Basin inflows of 100 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	100	4.5	2.3
B	300	100	3.5	1.7
C	450	100	2.9	1.6
D	650	100	2.3	1.5
E	800	100	1.8	1.4

Red tide

The Florida Fish and Wildlife Research Institute reported on May 17, 2019, that *Karenia brevis,* the Florida red tide dinoflagellate, was observed at background concentrations in one sample collected from Lee county and was not observed in samples collected from Palm Beach or Miami-Dade counties (no samples from St. Lucie, Martin, and 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.

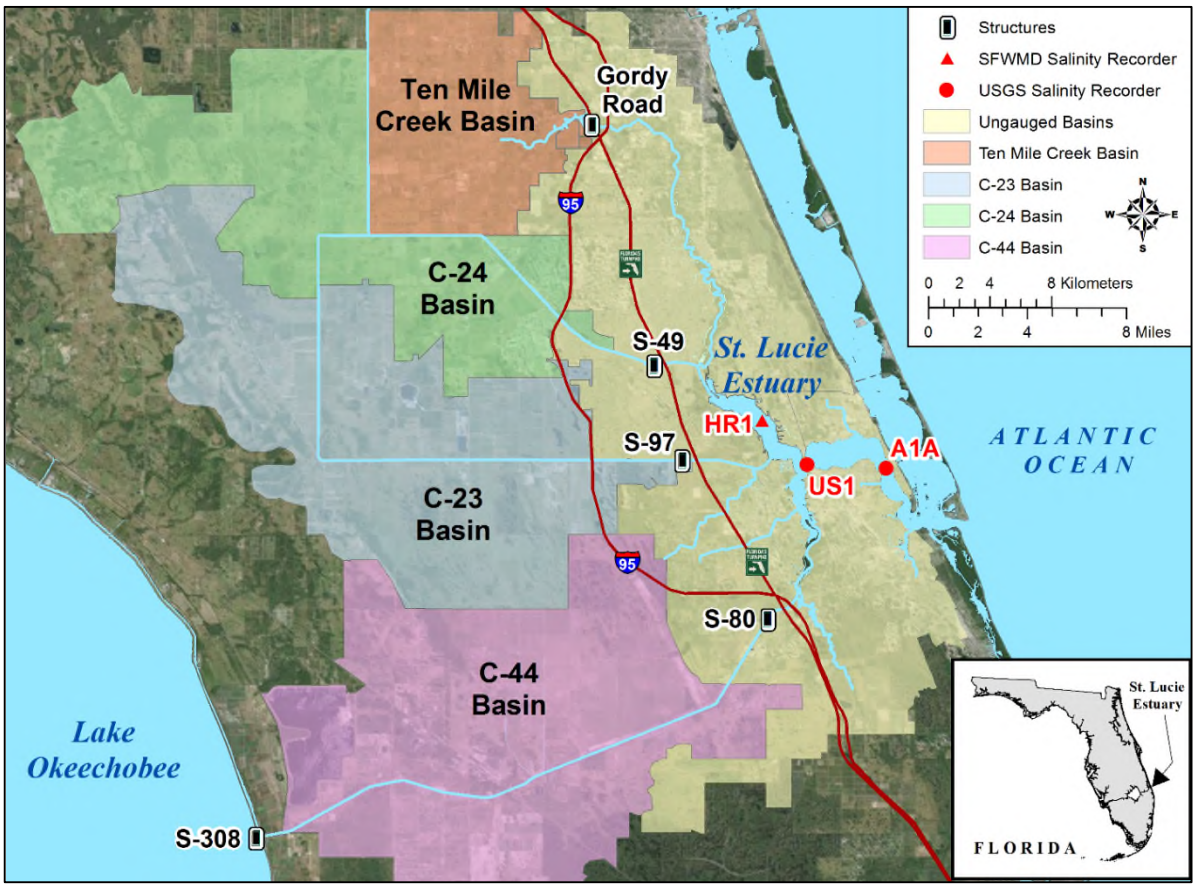


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

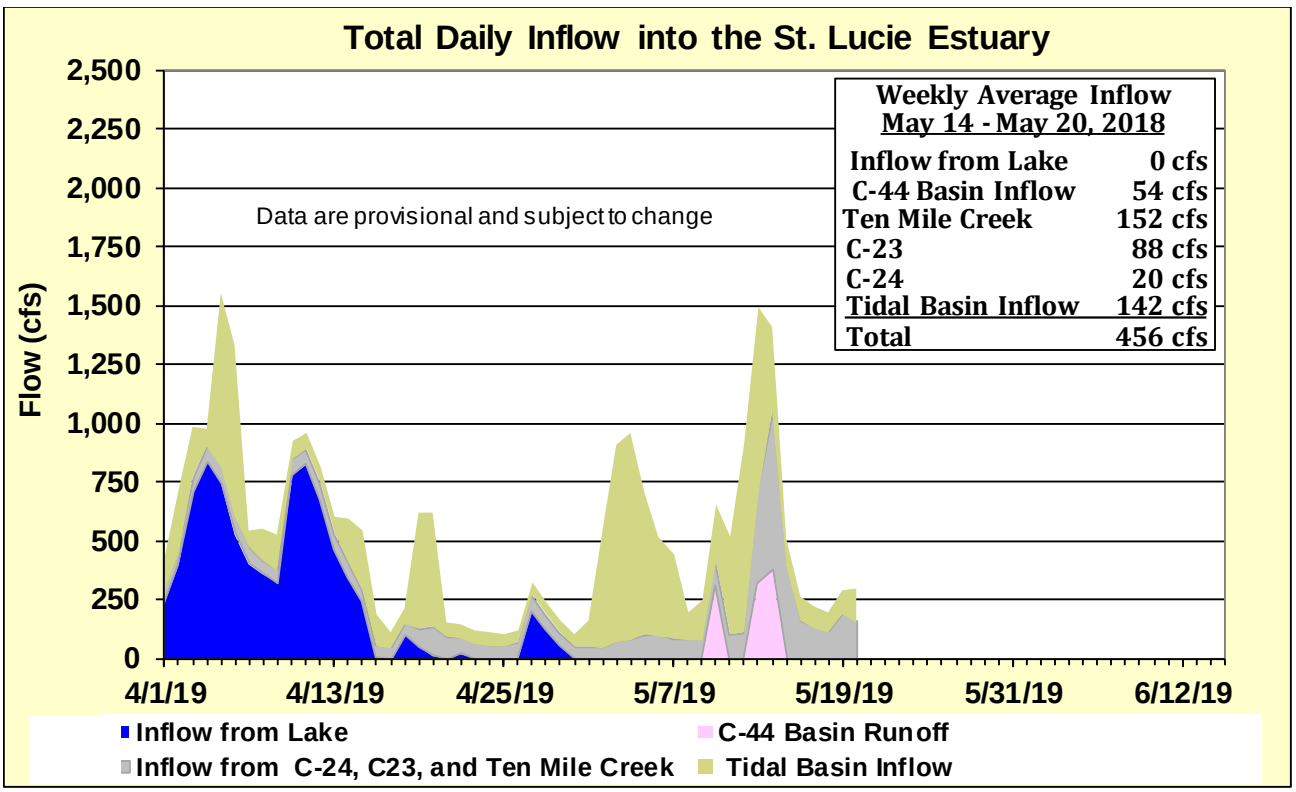


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

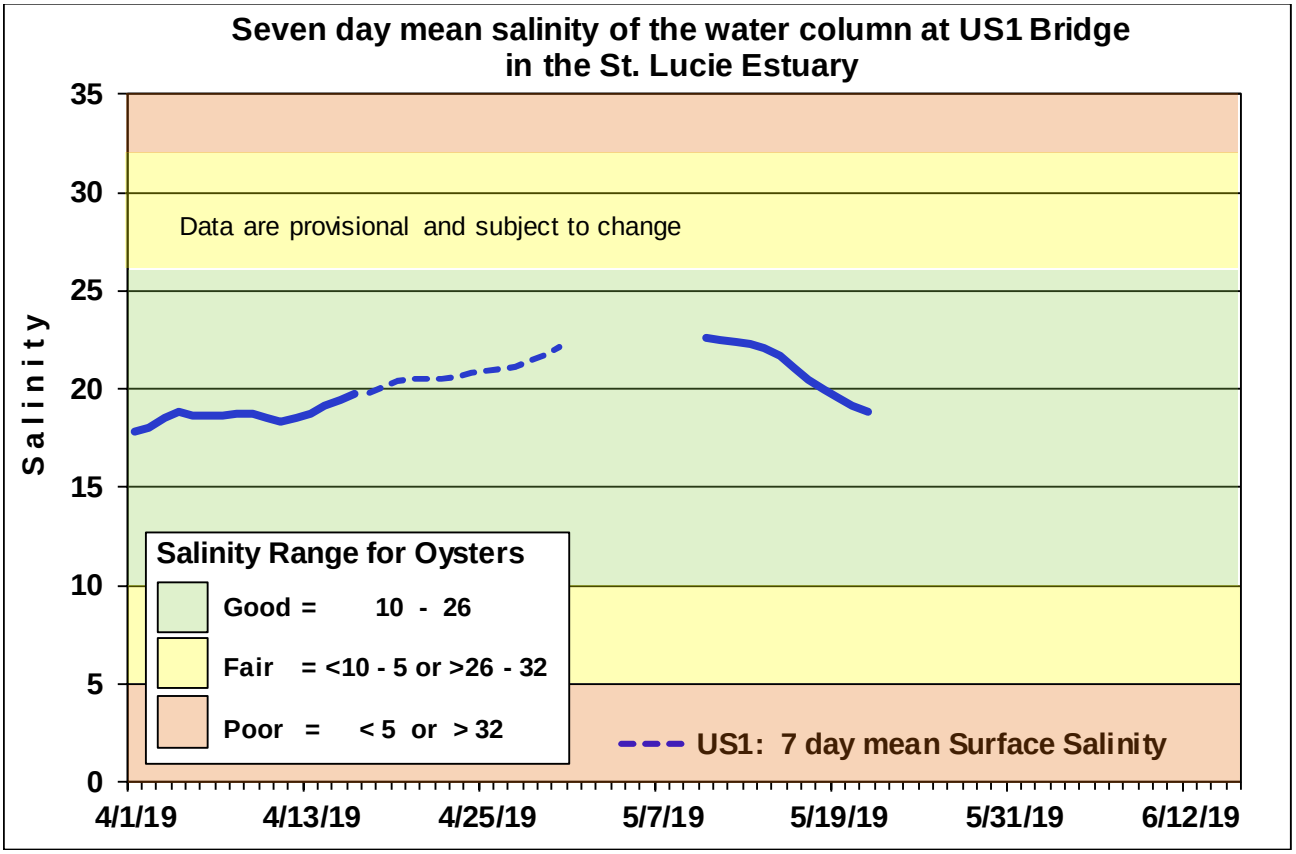


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

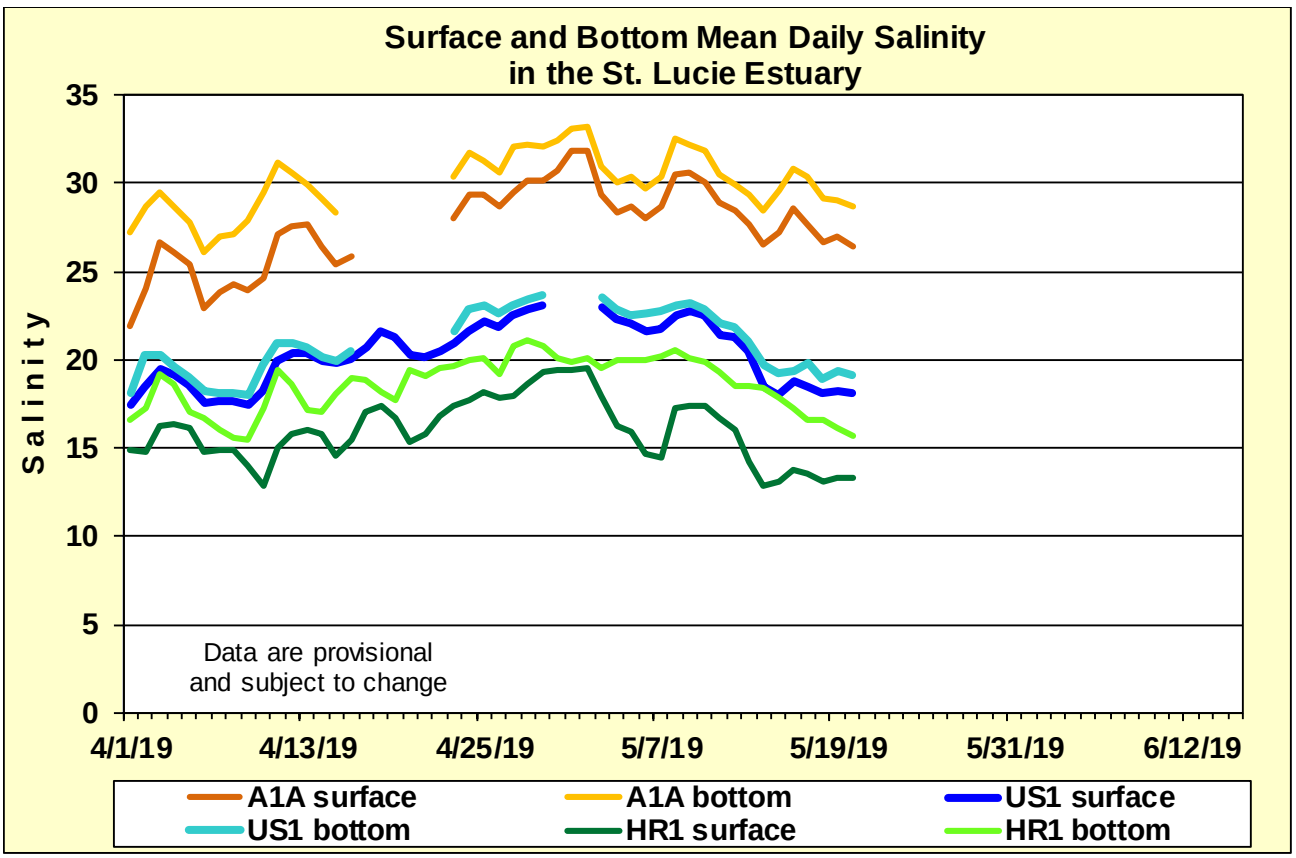


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

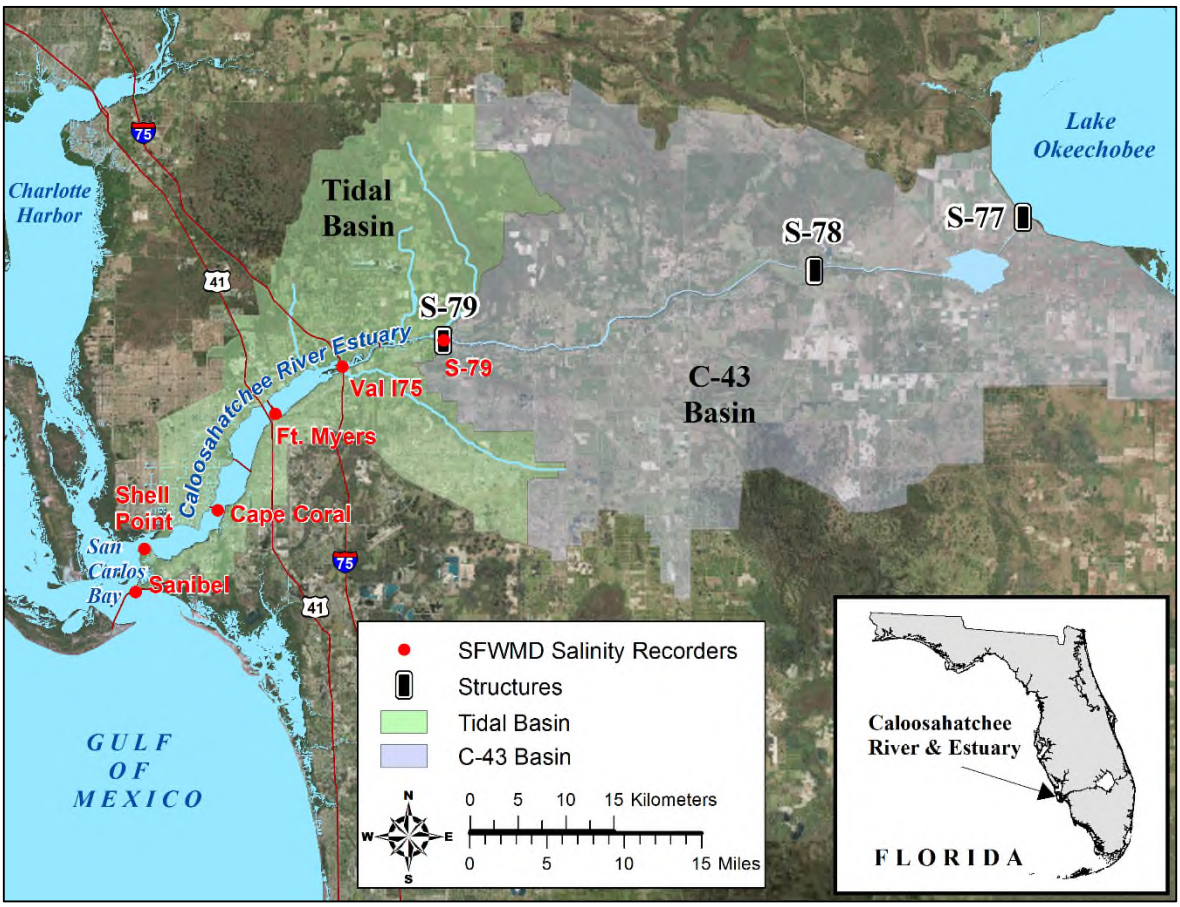


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

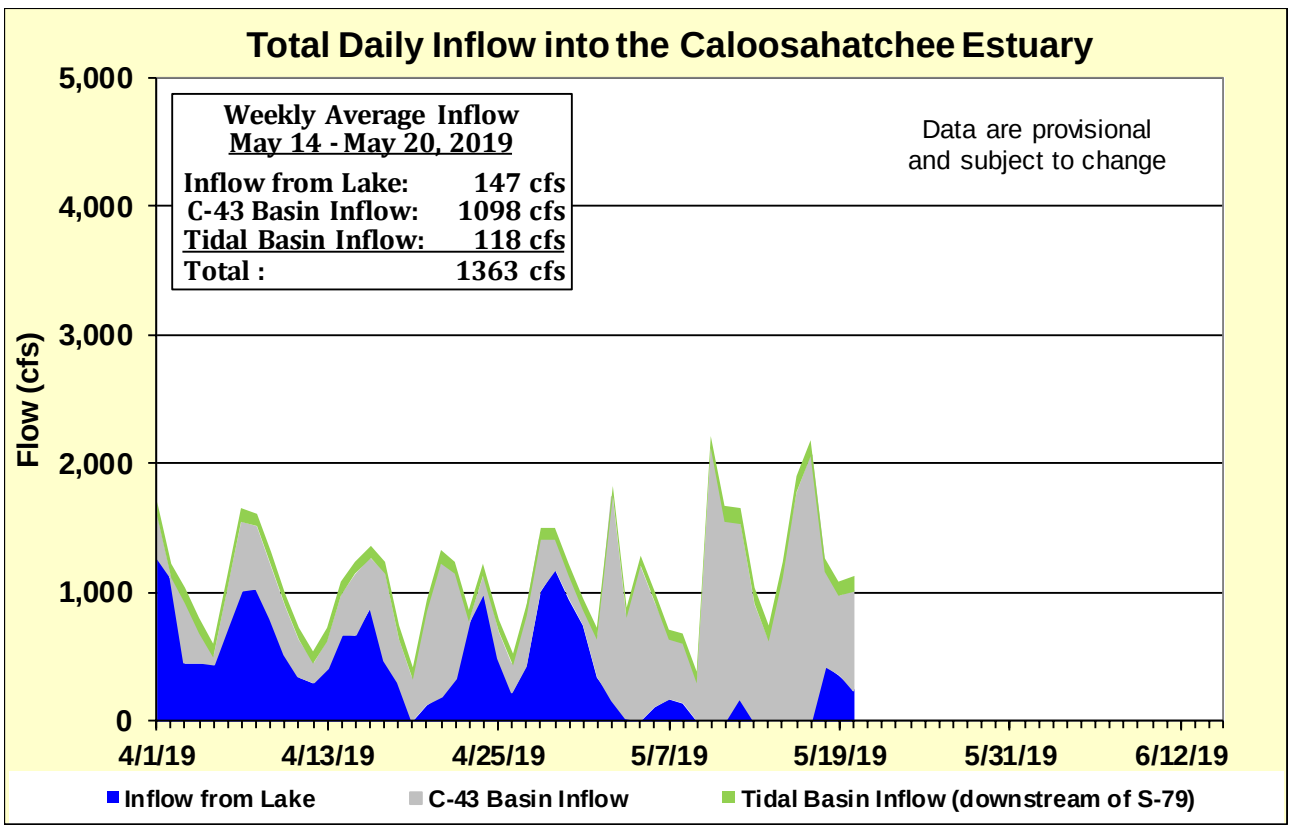


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

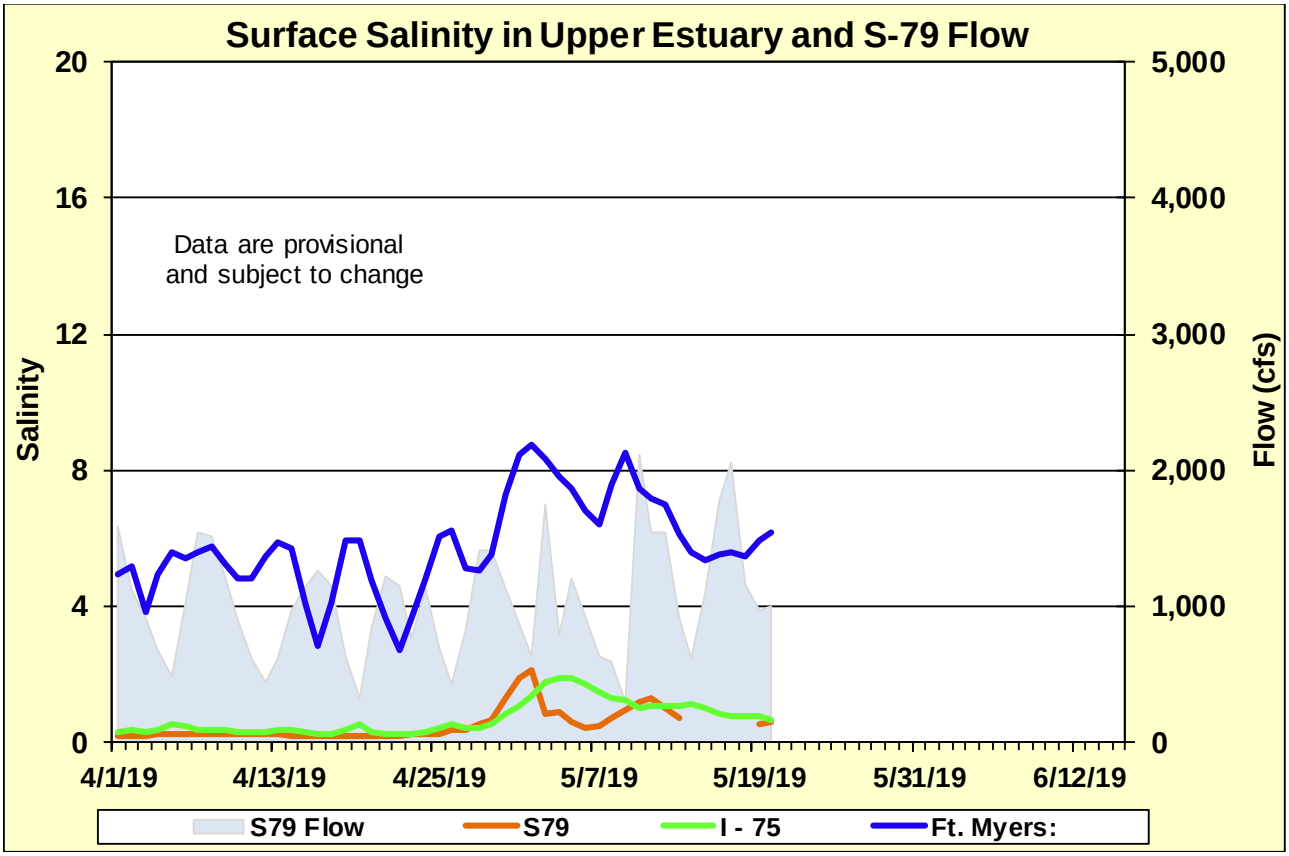


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

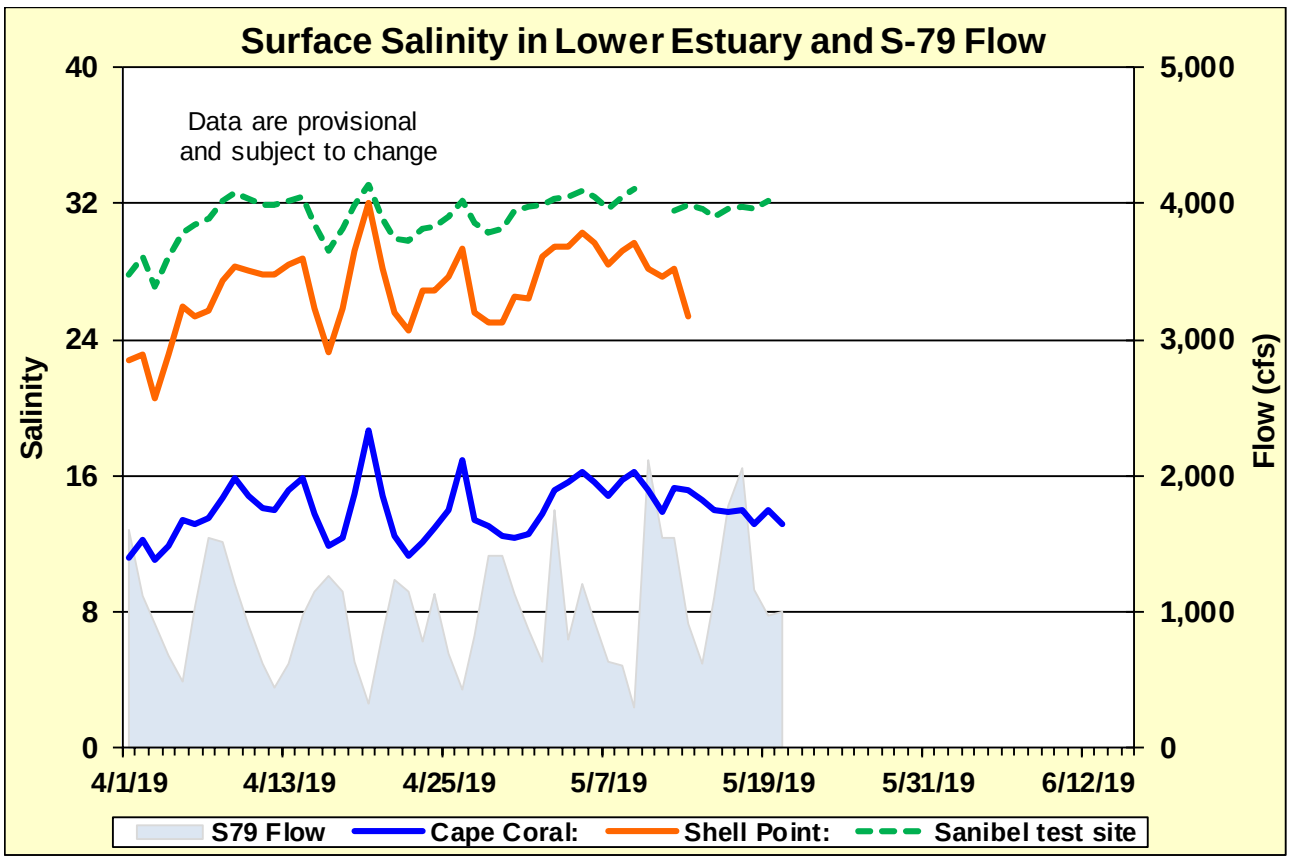


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

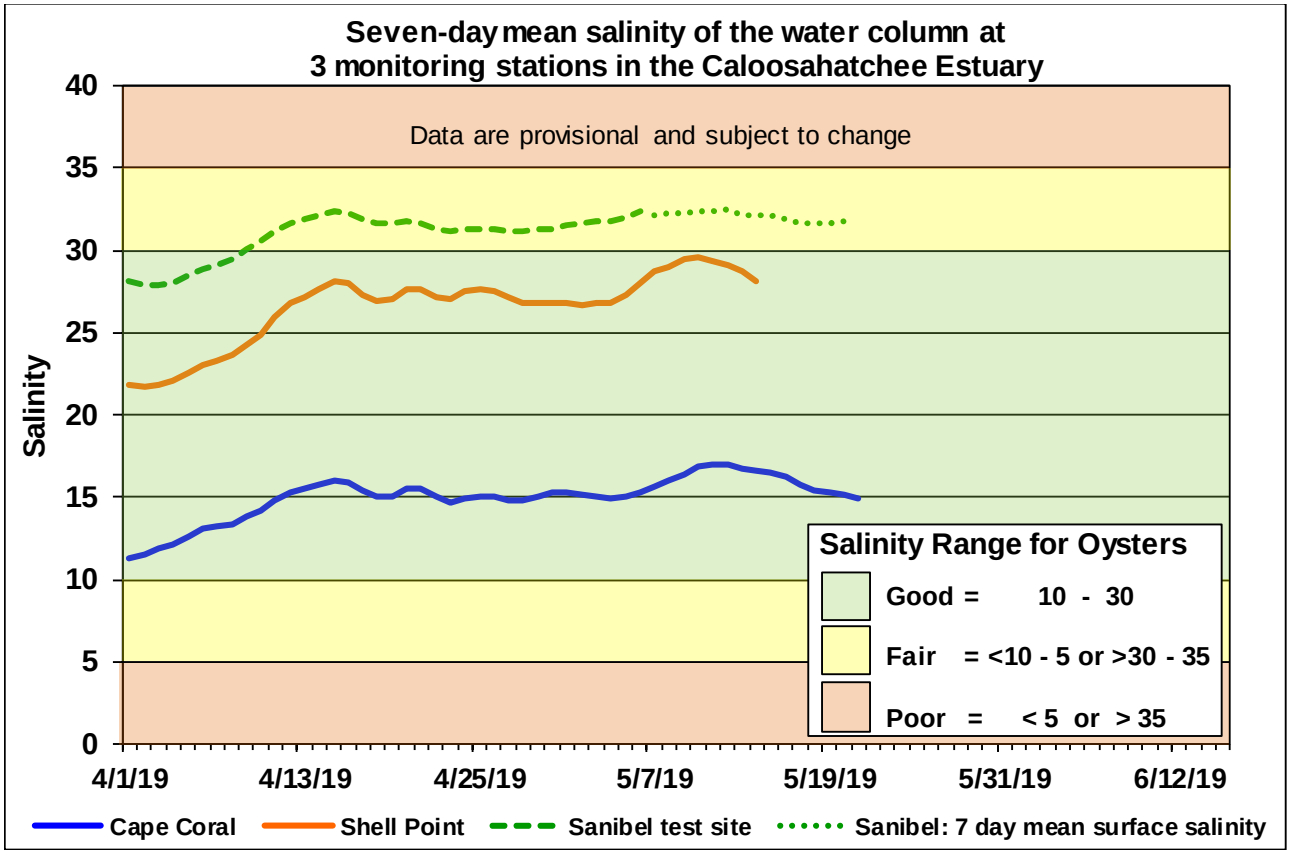


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

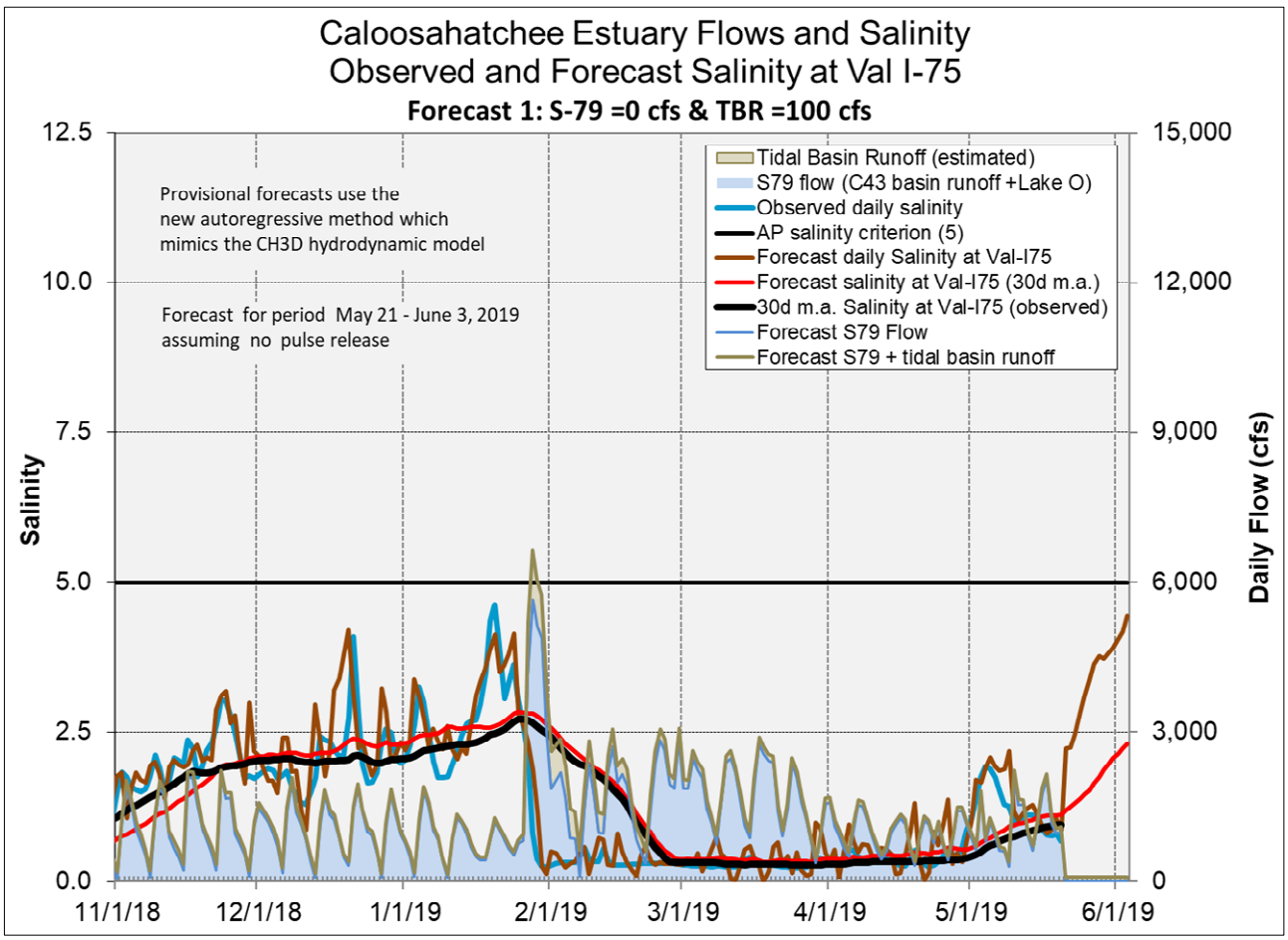


Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S79.

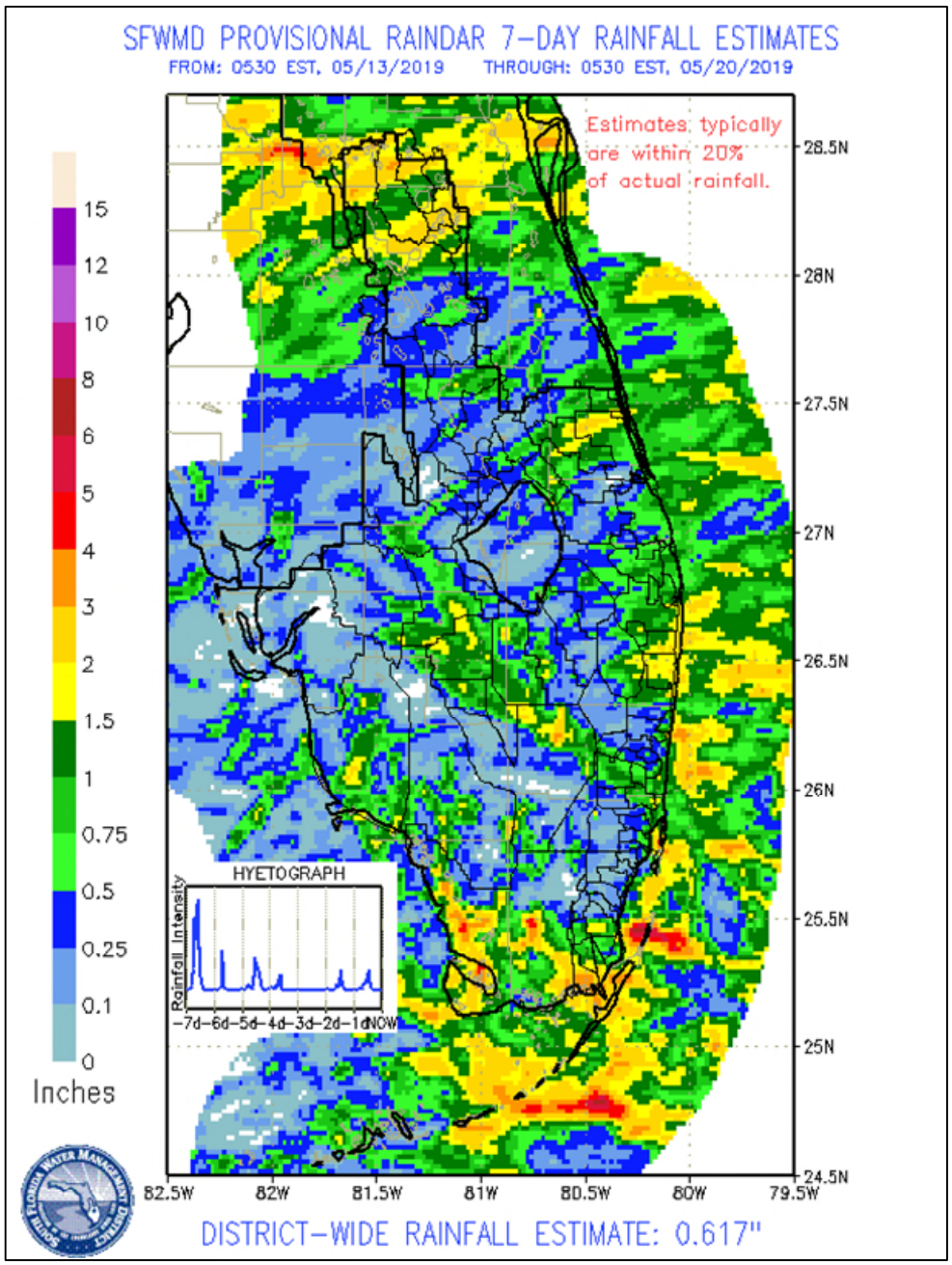
EVERGLADES

At the gauges monitored for this report, the stages in the Everglades receded on average 0.06 feet last week. All the WCAs' stage recession rates were in the fair or optimal range for wading bird foraging. The most extreme individual gauge changes ranged from +0.16 feet (ENP) to -0.17 feet (WCA-3A central). Pan evaporation was estimated at 1.87 inches this week.

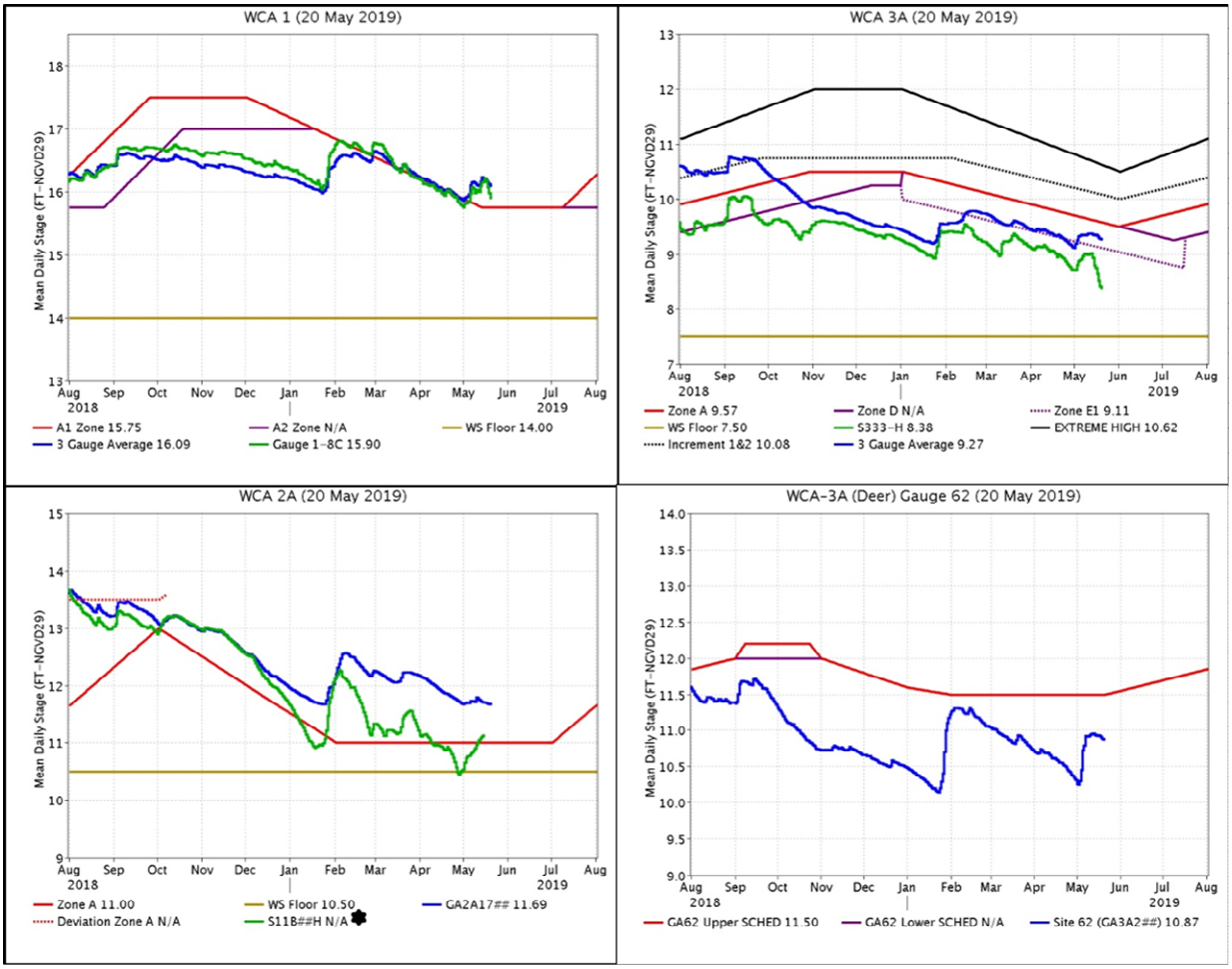
Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.70	+0.00
WCA-2A	0.21	−0.07
WCA-2B	0.41	−0.15
WCA-3A	0.53	−0.10
WCA-3B	0.31	−0.05
ENP	1.22	+0.16

Good
Fair
Poor

Recession rate for wading bird foraging



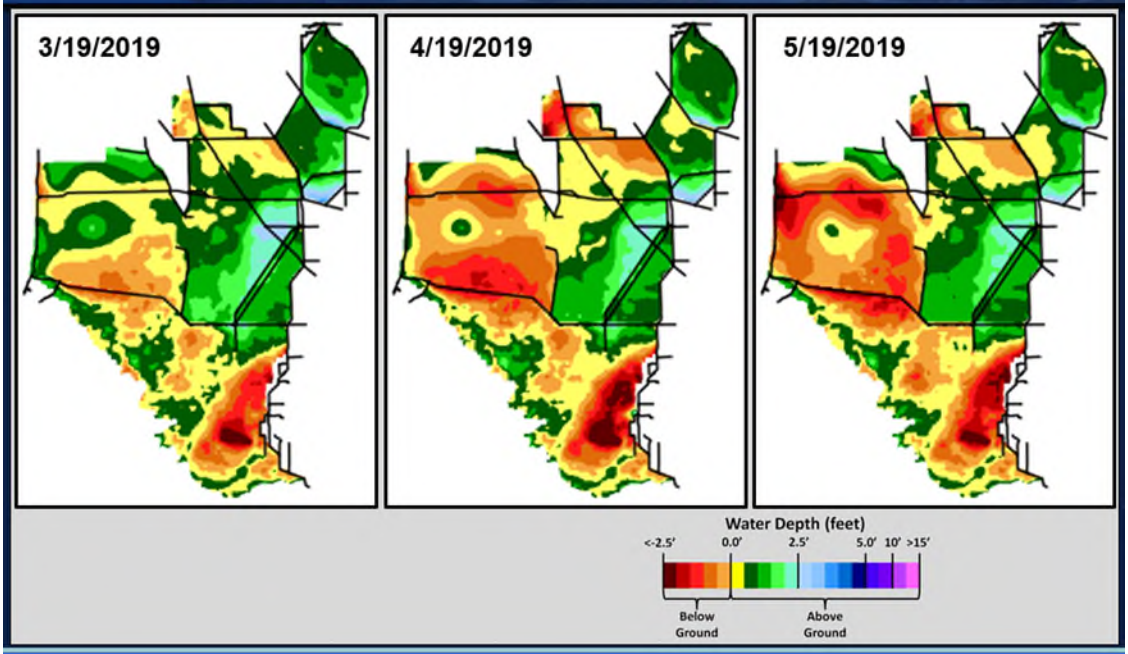
Regulation Schedules: WCA1: Gauge 1-8C remains 0.34 feet above the Zone A1 regulation line. WCA2A: S11B Headwater stage has risen steadily and is an estimated 0.10 (sensor issue at gauge* – USGS notified) feet below the Zone A regulation line. WCA-3A: The Three Gauge Average stage is 0.16 feet above Zone E1 regulation line and is trending towards regulation. WCA-3A at gauge 62 (Northwest corner) is 0.63 feet below the Upper Schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicates stages in WCA-3A North have increased over the last month. Conditions in WCA-1 and WCA-2A look slightly wet to typical for this time of year. The drying front in WCA-2A moved from the northeast to the southwest. In the western basins, stages remain above ground in Lostmans slough. WDAT difference output indicates that depth changes were mixed over the last month, only falling significantly in southern WCA-2A, while the northern end of that basin is significantly wetter. WCA-3A and WCA-1 depths did not change significantly. In the “1 Year” inset the difference between current depth conditions and those a year ago is shown. Currently the depths are significantly greater across the extreme western WCA-3A than they were a year ago, but lower in WCA-2A and WCA-1. Conditions in the western basins including in the Lostmans slough region remain significantly wetter than they were a year ago.

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

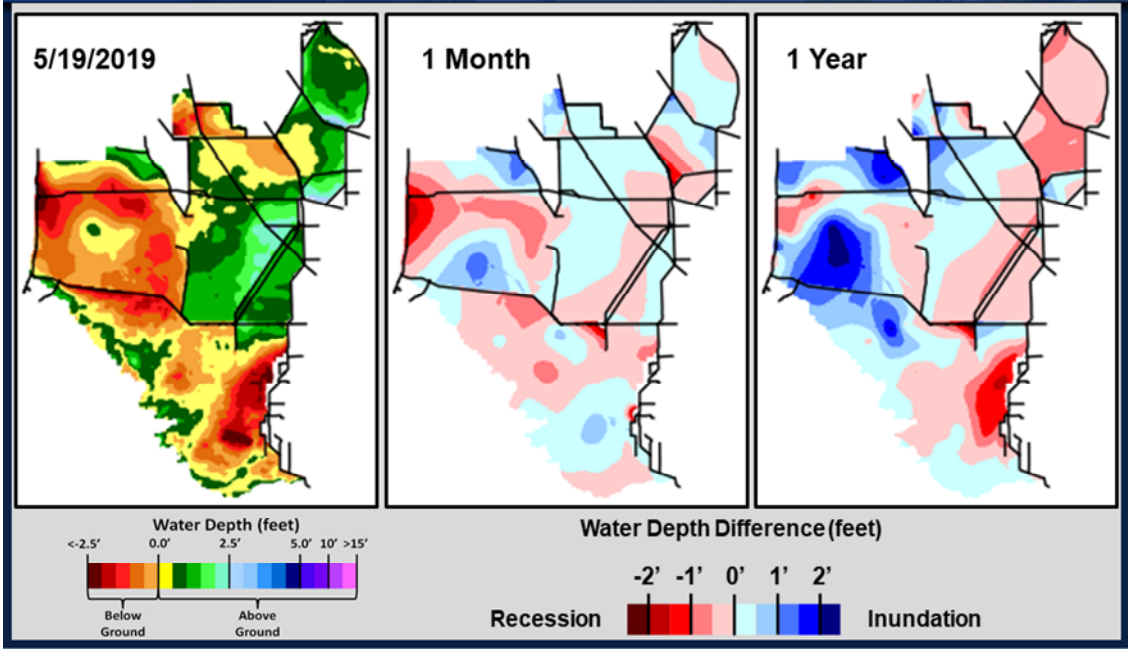
SFWDAT Water Depth Monthly Snapshots



South Florida Water Depth Assessment Tool (SFWDAT)

SOUTH FLORIDA WATER MANAGEMENT DISTRICT

SFWDAT Everglades Difference Maps (Present – Past)



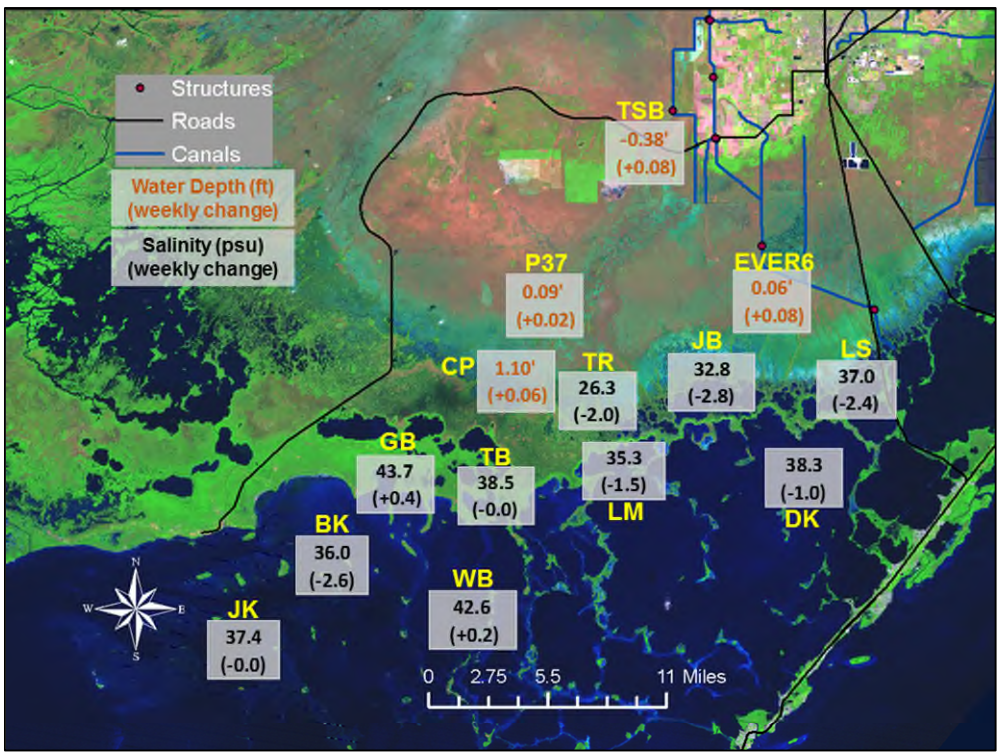
South Florida Water Depth Assessment Tool (SFWDAT)

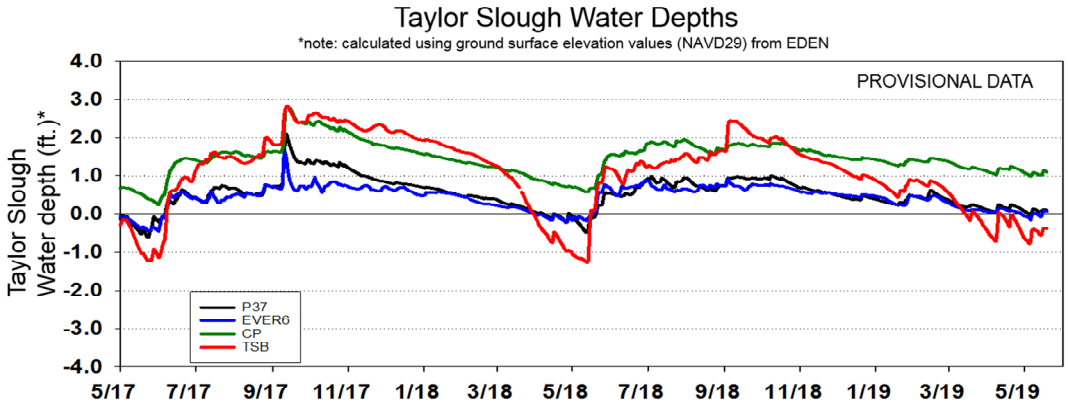
Wildlife Update::

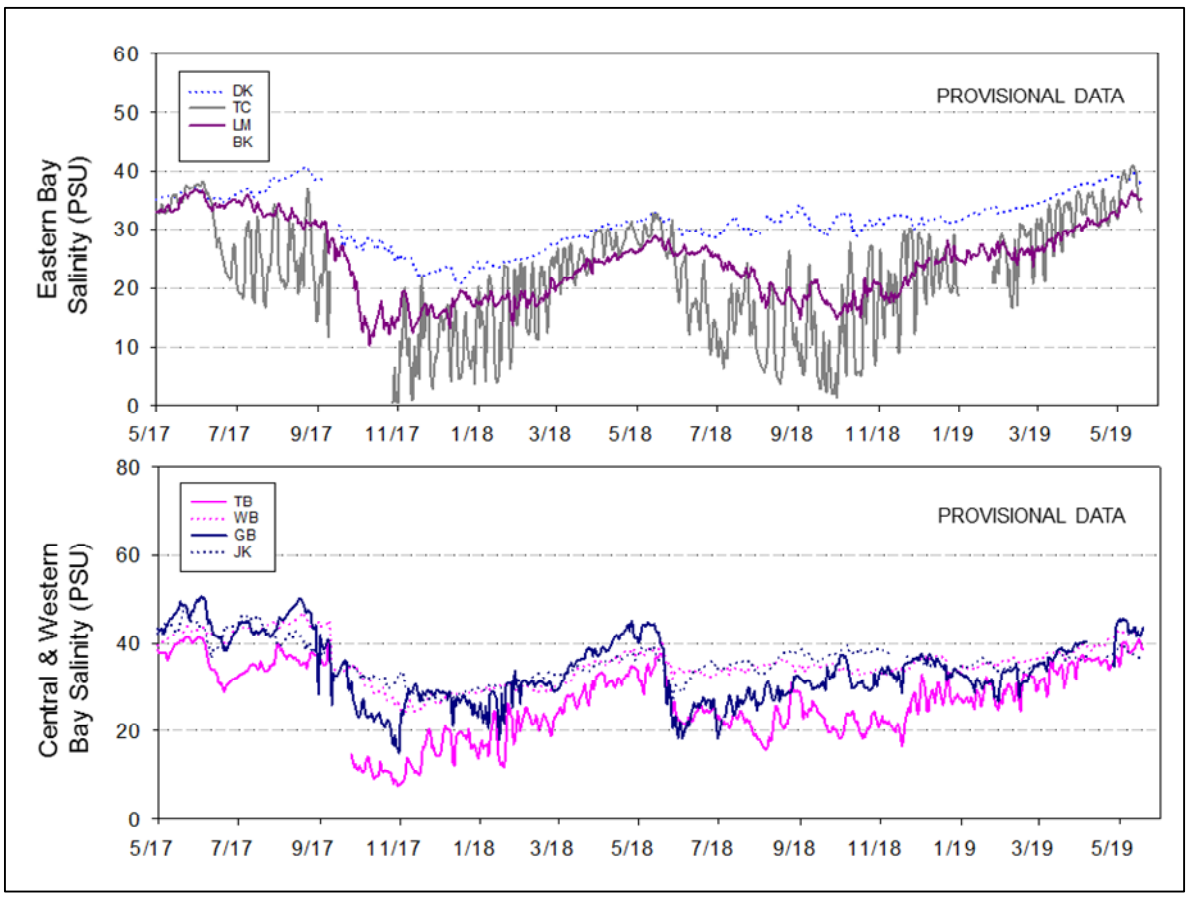
- Despite recent rains, conditions look favorable for continued CSSS nesting; sub population D breeding and nesting metrics continue to improve (noted as remarkable)
- Low numbers of foraging birds in the Refuge
- Thousands of egrets, spoonbills, storks, ibis (10,000 plus) were feeding throughout southern WCA-2A including upstream of the S-11s
- Large numbers snowy egrets nesting in northeast WCA-1
- Significant increase in Everglade snail kite activity in southern WCA-3A, 23 total nests.

Taylor Slough Water Levels: Stages in Taylor Slough and the ENP panhandle increased this past week due to local rainfall which averaged 1.9 inches. The average weekly increase in water levels was 0.06 feet which left the marsh area at an average depth of 0.22 feet by Sunday. Northern Taylor Slough is the only area still below ground.

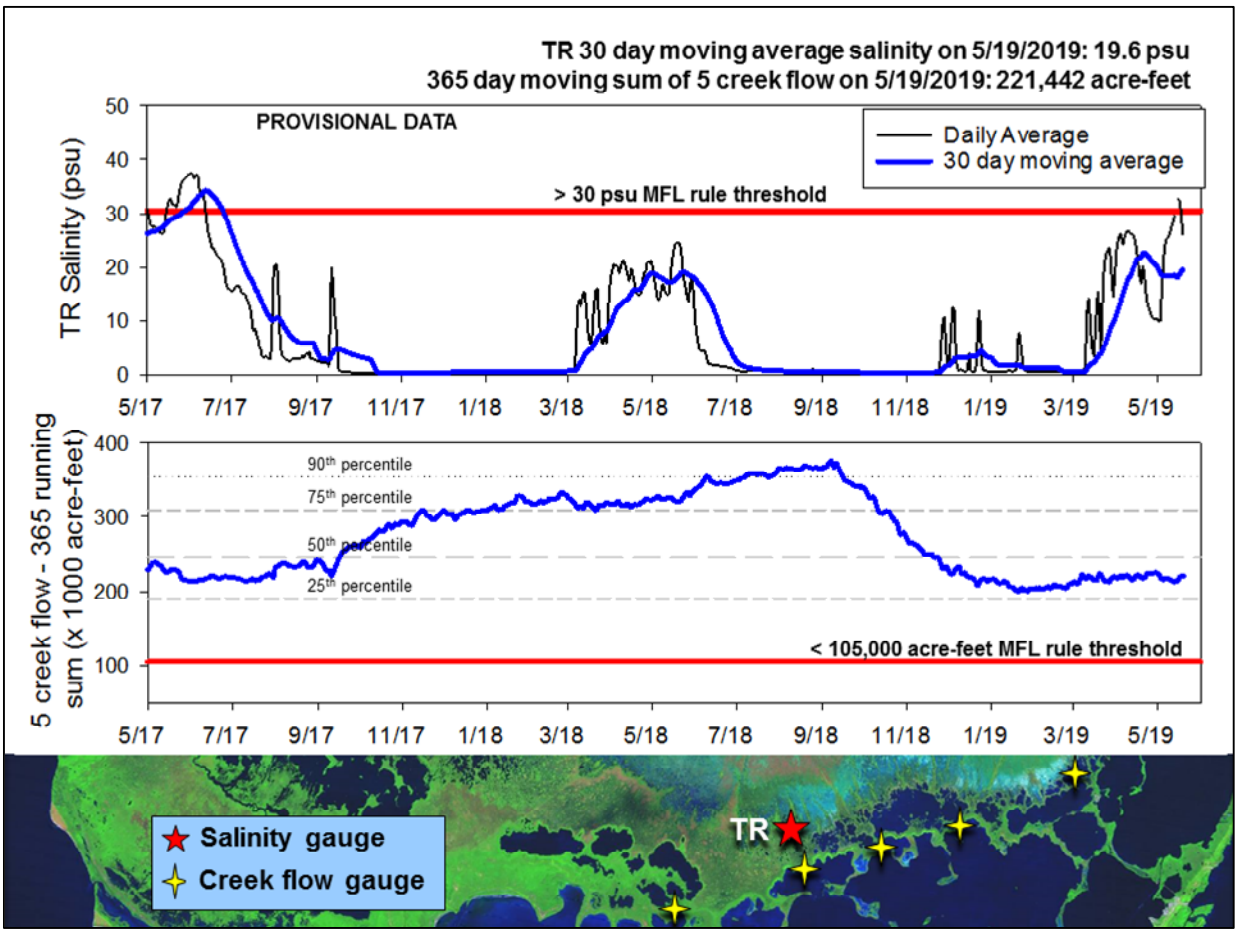
Florida Bay Salinities: Salinity in Florida Bay averaged a 1.1 psu decrease from last week with most of the central and western areas of the Bay showing very little change from last week. The largest weekly decrease in salinity (2.8 psu) occurred downstream of the degraded levee. Daily average salinities ranged from 37 psu along the US Hwy-1 corridor to 44 psu in the western nearshore area.







Florida Bay MFL: There were some data irregularities with the salinity in the mangrove zone, but it ended the week at 26 psu after peaking somewhere near 33 psu. The 30-day moving average increased to 19.6 psu. The weekly cumulative flow from the five creeks denoted by yellow stars on the map totaled about 1,600 acre-feet as a result of 4 days of positive flow at the end of the week. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) has increased about 8,000 acre-feet to 221,442 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

Wading bird nesting is currently very uncertain in the WCAs. Large wading bird flocks (greater than 10,000 birds) were observed foraging in western WCA-2A on 5/21/19. Moderating any reversals and maintaining near optimal recession rates in WCA-2A and WCA-3A South will have ecological benefit throughout the remainder of the wading bird nesting season. Recent Everglade Snail Kite activity has increased with southern WCA-3A, with four new nests located there in the last reporting period. Slowing the recession rate in that area (gauge 65 near that area receded 0.14 feet last week) would have an ecological benefit for both kite nesting and wading bird foraging. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, May 21st, 2019 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Average stage unchanged	Maintain depths near 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 0.07'	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 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 0.02'	Maintain depths at regulation schedule.	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 increased by 0.08'	Maintain depths at regulation schedule.	
Central WCA-3A S	Stage decreased by 0.17'	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 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 0.14'		
WCA-3B	Stage decreased by 0.05'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage increased by 0.16'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from +0.02' to +0.08'	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 −2.8 to +0.4 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.