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

## MEMORANDUM

- **TO:** John Mitnik, Chief, Operations, Engineering and Construction Bureau Paul Linton, Chief, Operations Section
- **FROM:** SFWMD Staff Environmental Advisory Team
- **DATE:** July 31, 2018
- SUBJECT: Weekly Environmental Conditions for Systems Operations

## Summary

### Weather Conditions and Forecast

After four straight days of above normal District-averaged rainfall, a much less active day for rains is forecast today. The decrease in rains is associated with the winds shifting from southerly to southeasterly, which should cause the supply of moisture-rich air over the District yesterday to be cut off and replaced with much drier mid-level air arriving over the east. The much drier air and moderately strong southeasterly wind flow favors only widely scattered showers and thunderstorms over the southeast today, with the activity over this region pushing well inland or diminishing later in the day. The short-range model guidance agrees with this scenario, showing very little rain over this region today. The southeasterly flow regime also means that shower and thunderstorm activity should concentrate from the southwestern interior and west coast northward through the upper Kissimmee valley later in the afternoon to early evening while a lake shadow northwest of Lake Okeechobee extending well into the lower Kissimmee valley limits any activity. Overall, the rainfall today is projected to be either somewhat below to near normal, based mainly on the strength of afternoon activity over the western part of the District. On Tuesday the flow should temporarily veer back to the south or south-southeast and allow moisture to creep back into the District, with the result being a greater coverage of rains compared to today and District rainfall close to, if not possibly, a bit above normal. The wind flow again favors more concentrated rains over the west tomorrow, heavier than today, stretching from the southwestern interior and west coast into the Kissimmee valley. From Thursday through Monday next week, the Atlantic subtropical ridge should reassert itself and bring very dry Saharan air in the mid-levels of the atmosphere through the District. The net effect of this should be to keep rainfall over the District below normal for the period, although from Friday and Saturday there could be some enhancement of rains over the far south and the Keys as a weak disturbance passes to the south. Overall, the deterministic quantitative precipitation forecast (QPF) for the week is about half of normal while the probabilistic data indicate a range from 50-80% of normal. Of the days this week ahead, tomorrow looks to be the rainiest and could account for a quarter to a third of the total rain for the week.

## **Kissimmee**

Tuesday morning stages were 57.2 feet NGVD (0.7 feet above schedule) in East Lake Toho, 54.0 feet NGVD (0.5 feet above schedule) in Toho, and 51.6 feet NGVD (0.6 feet above schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.5 feet NGVD at S-65A and 26.8 feet NGVD at S-65D. Tuesday morning discharges were: 4,304 cfs at S-65, 4,968 cfs at S-65A, and 3,804 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 4.2 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 1.79 feet. From 7/23/2018 to 7/24/2018, the recommendation was to increase discharge from 1,400 cfs to 3,000 cfs, then 3,200 cfs and 3,500 cfs for flood control on Lake Kissimmee.

## Lake Okeechobee

Lake Okeechobee stage is 14.36 feet NGVD, only 0.1 feet higher than last week and 0.12 feet higher than 30 days ago. The seasonal low for 2018 (12.83 feet NGVD) was the third highest since 2011, and the third time in six years that lake stage did not reach the bottom of the preferred stage envelope (12.5 – 15.5 feet NGVD). Due to record rainfall in May, the submerged aquatic vegetation (SAV) coverage on the Lake will likely remain at minimal levels throughout the summer and well into next year, prolonging impacts from high water levels associated with El Niño in 2016 and Hurricane Irma in 2017. Cyanobacteria blooms decreased in mid-July from a peak in early July, with NOAA's analysis of satellite data (see supporting information below) suggesting most of the pelagic zone had much reduced potential for blooms. The late-July imagery suggests the chances for another bloom may be increasing, with a few areas of the pelagic showing elevated potentials. Conditions will likely remain favorable for some level of recurring blooms throughout the remainder of the summer, particularly after more nutrient inputs from the watershed from rain events, or during stretches of low wind and high temperature on the Lake.

## Estuaries

Total inflow to the St. Lucie Estuary averaged 1,432 cfs over the past week with 373 cfs (28% of total flow) coming from Lake Okeechobee. Surface salinity decreased at HRI and increased at US1 and A1A Bridges, while bottom salinity increased at HR1 and A1A Bridge. The seven-day average salinity at the US1 Bridge is in the fair range for adult eastern oysters. Total inflow to the Caloosahatchee Estuary averaged 4,316 cfs over the past week with 1,245 cfs (29% of total flow) coming from the Lake. Salinity remained about the same down to Ft. Myers Yacht Basin and increased downstream. The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinity conditions are in the poor range for adult eastern oysters at Cape Coral and in the fair range at Shell Point. Given the current estuarine conditions, there are no ecological benefits associated with freshwater releases from Lake Okeechobee.

## **Stormwater Treatment Areas**

Over the past week, the STAs received approximately 48,000 acre-feet of inflows (which includes approximately 7,800 acre-feet of Lake releases). The total amount of inflows to the STAs in WY2019 (since May 1, 2018) is approximately 645,000 acre-feet, which includes approximately 61,600 acre-feet of Lake releases. Most STA cells are at or above target depths. Operational restrictions are in place for vegetation rehabilitation in STA-2 and for construction related activities in STA-1W. STA-5/6 Flow-ways 2 and 3 are offline for initiation of a Restoration Strategies project to grade non-effective treatment areas. The nests of Endangered Species Act protected species have been observed in STA-1E. This week, if 2008 LORS recommends Lake releases to the WCAs and the conditions allow, releases will be sent to the STA-1E, A-1 FEB/STA-3/4 and STA-2.

## **Everglades**

Conditions within the Everglades remain stable. Stages on average rose slightly across the Everglades except for WCA-2A and 2B, and the increase in stage there stayed within the recommended weekly ascension rate. Keeping depths below 2.5 feet at gauge 65 in WCA-3A is important to moderate the stress to tree islands caused by flooding when durations last longer than 60-90 days. Depths reached 2.5 feet on June 13 (5 days earlier than last year). The depth on Sunday at that location was 2.55 feet, unchanged over the last week. In Taylor Slough, water depths are 4 to 6 inches above the historical average. Florida Bay salinities remain stable and below historical average, decreasing 0.7 psu on average in Florida Bay last week.

## **Supporting Information**

## KISSIMMEE BASIN

### **Kissimmee Basin Rainfall**

The Upper Kissimmee Basin received 2.26 inches of rainfall in the past week and the Lower Basin received 1.56 inches (SFWMD Daily Rainfall Report 7/30/2018).

### **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.

		7-day				Schedule			Daily	Departur	e (feet)		
Water Body	Structure	Average Discharge (cfs) <sup>1</sup>	Stage Monitoring Site <sup>2</sup>	Lake Stage (feet)	Schedule Type <sup>3</sup>	Stage (feet)	7/29/18	7/22/18	7/15/18	7/8/18	7/1/18	6/24/18	6/17/18
Lakes Hart and Mary Jane	S-62	373	LKMJ	60.0	R	60.0	0.0	0.1	0.1	0.1	0.2	0.0	0.0
Lakes Myrtle, Preston, and Joel	S-57	113	S-57	61.1	R	61.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Alligator Chain	S-60	297	ALLI	63.3	R	63.2	0.1	0.0	0.1	0.1	0.2	0.0	-0.1
Lake Gentry	S-63	457	LKGT	61.0	R	61.0	0.0	0.0	0.0	0.0	0.1	-0.5	-0.6
East Lake Toho	S-59	1,015	TOHOE	57.2	R	56.5	0.7	0.1	-0.1	-0.1	-0.5	-0.9	-1.0
Lake Toho	S-61	2,278	TOHOW, S-61	54.1	R	53.5	0.6	-0.1	0.0	-0.1	-0.4	-0.9	-0.9
Lakes Kissimmee, Cypress, and Hatchineha	S-65	4,179	KUB011, LKIS5B	51.6	R	51.0	0.6	0.2	0.1	0.3	-0.4	-0.9	-0.9

### Report Date: 7/31/2018

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

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

<sup>3</sup>T = temporary schedule, R = USACE flood control schedule, S = temporary snail kite schedule, A = projected ascension line, 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:	7/31/2018											
		1-Day Average			Avera	ge for the Pre	eceeding 7-I	Days <sup>1</sup>				
Metric	Location	7/29/2018	7/29/18	7/22/18	7/15/18	7/8/18	7/1/18	6/24/18	6/17/18	6/10/18	6/3/18	5/27/18
Discharge (cfs)	S-65	4,727	4,179	1,567	2,561	1,287	514	834	1,110	915	1,092	1,271
Discharge (cfs)	S-65A <sup>2</sup>	4,967	4,267	1,479	2,615	1,294	466	801	1,224	1,043	1,139	1,142
Discharge (cfs)	S-65D <sup>2</sup>	2,958	2,264	2,641	2,226	1,827	1,608	2,094	2,062	1,925	1,869	1,495
Headwater Stage (feet NGVD)	S-65D <sup>2</sup>	26.88	26.75	26.68	26.77	26.80	26.79	26.79	26.82	26.86	27.00	26.08
Discharge (cfs)	S-65E <sup>2</sup>	3,016	2,400	2,764	2,399	2,000	1,834	2,347	2,261	2,107	2,082	1,623
Discharge (cfs)	S-67	168	209	183	217	292	298	277	273	278	282	298
DO (mg/L) <sup>3</sup>	Phase I river channel	3.4	4.2	2.3	2.7	2.9	3.4	2.0	1.4	1.7	3.4	4.8
Mean depth (feet) <sup>4</sup>	Phase I floodplain	1.79	1.22	1.05	1.20	0.60	0.46	0.75	0.84	0.76	0.66	0.47

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

<sup>2</sup>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.

<sup>3</sup>DO is the average for sondes at PC62 and PC33.

<sup>4</sup>1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).

DATA ARE PROVISIONAL; N/A indicates that data were not available.

## KCOL Hydrographs (through Sunday midnight)



Figure 1.







Figure 3.



Figure 4.



Figure 5.







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.





## Water Management Recommendations

#### Kissimmee Basin Adaptive Recommendations and Operational Actions

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
7/23/2018- 7/24/2018	Increase discharge from 1400 cfs to 3000 cfs, then 3200 cfs and 3500 cfs.	For flood control in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	7/31/2018
7/19/2018	Follow Revised (X2) 2018 Wet Season Discharge Plan to the extent possible, including 50 foot stage threshold and 0.5 foot flood control buffer.	To the extent possible, maintain sufficient discharge to keep areas under snail kites nests in Pool D hydrated until nests fledge, while avoiding large increases in discharge that might flood the nests.	N/A	KB Ops	7/24/2018
7/13/2018	Maintain at least 1400 cfs at S-65A while Lake Kissimmee stage is above 50 feet. (See revised 2018 discharge plan).	To the extent possible, maintain sufficient discharge to keep areas under snail nest kites in Pool D hydrated until nests fledge.	N/A	KB Ops	7/17/2018
7/13/2018	Reduce S-65/S-65A discharge by 600 cfs/day until 1400 cfs is reached. (See revised 2018 discharge plan, below).	Reach 1400 cfs faster to help stabilize Lake Kissimmee stage.	Implemented	SFWMD Water Mgt/KB Ops	7/17/2018
7/9/2018	Increase S-65/S-65A discharge by 300 cfs if needed.	Stablize Lake Kissimmee stage.	N/A	SFWMD Water Mgt/KB Ops	7/10/2018
7/8/2018	Increase S-65/S-65A discharge by 900 cfs today in 3 increments of 300 cfs each.	Stablize Lake Kissimmee stage.	Implemented	KB Ops	7/10/2018
7/5/2018	Increase S-65/S-65A discharge by 300 cfs/day (double the prescribed rate of increase) Thursday through Sunday .	Stablize Lake Kissimmee stage.	Implemented	SFWMD Water Mgt	7/10/2018
7/2/2018	Increase S-65/S-65A discharge by 150 cfs/day (double the prescribed rate of increase).	Stablize Lake Kissimmee stage.	Implemented	SFWMD Water Mgt/KB Ops	7/10/2018
6/30/2018	Increase S-65/S-65A discharge as slowly as feasible	Slow stage ascencsion in Kissimmee-Cypress- Hatchineha	Implemented	KB Ops/SFWMD Water Mgt	7/3/2018
6/28/2018	Continue to reduce discharge at S-65/S-65A as slowly as feasible.	Prevent stage decline in Kissimmee-Cypress- Hatchineha.	Implemented	KB Ops/SFWMD Water Mgt	7/3/2018
6/21/2018	Reduce discharge at S-65/S-65A as slowly as feasible.	Prevent stage decline in Kissimmee-Cypress- Hatchineha.	Implemented	KB Ops/SFWMD Water Mgt	6/26/2018
6/15/2018	Reduce S-65A discharge by 150-300 cfs over the weekend.	Slow or stop DO decline in Kissimmee River.	Implemented	KB Ops	6/19/2018
6/12/2018	No new recommendations.		N/A		6/12/2018
6/5/2018	No new recommendations.		N/A		6/5/2018
5/29/2018	Begin implementation of the 2018 Wet Season Discharge Plan for S-65/S-65A on June 1 (see figure).	Provide variable flow from S-65/S-65A to balance Kissimmee River and Headwaters Lakes objectives including Kissimmee River floodplain inundation, moderated rates of change in discharge, and constrained rate of stage rise in the lakes.	Planned	KB Ops/SFWMD Water Mgt/FWC/FWS	5/29/2018
5/22/2018	Hold Kissimmee-Cypress-Hatchineha at current stage of approximately 49.5 ft until June 1.	(a) Reduce impacts of rising water on DO in the Kissimmee River; and (b) limit stage reversal in KCH to <1 foot to protect snail kite nests.	Implemented	KB Ops/SFWMD Water Mgt	5/29/2018
5/18/2018- 5/20/2018	Increase discharge gradually in response to rainfall in consultation with KB staff.	(a) Reduce impacts of rising water on DO in the Kissimmee River; and (b) limit stage reversal in KCH to <1 foot to protect snail kite nests.	Implemented	KB Ops	5/22/2018
5/15/2018	Adjust S-65/S-65A discharge over the next few days to avoid additional stage rise in Kissimmee- Cypress-Hatchineha. Make any needed discharge changes gradually in consultation with Kissimmee Basin staff to reduce potential effects on Kissimmee River dissolved oxygen.	Protect Lake Kissimmee snail kite nests from rising water if there is additional rainfall.	N/A	KB Ops	5/22/2018
5/8/2018	No new recommendations.		N/A		5/8/2018
5/1/2018	No new recommendations.		N/A		5/1/2018
4/24/2018	No new recommendations.		N/A		4/24/2018
4/17/2018	No new recommendations.		N/A		4/17/2018
4/10/2018	No new recommendations.		N/A		4/10/2018
3/27/2018	No new recommendations		N/A		3/27/2018
3/20/2018	No new recommendations.		N/A		3/20/2018
3/13/2018	No new recommendations.		N/A		3/13/2018
3/6/2018	No new recommendations.		N/A		3/6/2018
2/27/2018	No new recommendations.		N/A		2/27/2018



Figure 11. The 2018 Wet Season Discharge Plan for S-65/S-65A.



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



Figure 13. The Kissimmee Basin.

## LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee stage is at 14.36 feet NGVD for the period ending at midnight on July 30, 2018. This value is based on the use of four interior lake stations (L001, L005, L006 and LZ40) and four perimeter stations (S-308, S-352, S-4 and S-133). The Lake is now 0.12 feet higher than it was a month ago and 1.63 feet higher than a year ago (Figure 1). The Lake remains in the Low sub-band (Figure 2). The July 30 lake stage was the third highest since 2011, with only 2013 and 2016 having higher stages, at 1.46 feet and 0.29 feet higher, respectively (Figure 3). According to RAINDAR, 0.83 inches of rain fell over the Lake during the week July 24, 2018 – July 30, 2018. Most of the watershed received considerably more rainfall, between 1.0 - 4.0 inches (Figure 4).

Average daily inflows to the Lake were nearly unchanged from the previous week, at 3,979 cfs. Most of the inflows were similar as well, with the largest difference from Lake Istokpoga (S-84 structures), going from 744 cfs the previous week to 566 cfs this past week (Table 1). There have been no back-pumping operations from the S-2 or S-3 pumps during the wet season thus far.

Total outflows decreased substantially from the previous week as discharges to the estuaries were scaled back to mimic pulse releases and due to substantial rainfall in the outflow basins. Total outflows fell from 7,130 cfs the previous week to 2,011 cfs this past week, from reductions in discharges in all directions. Discharges west via the S-77 structure went from 2,989 cfs to 1,041 cfs this past week, while S-308 discharges to the east fell from 2,228 cfs to just 344 cfs this past week. Outflows to the south through the S-350 structures decreased from 1,912 cfs average daily cfs the previous week to 625 cfs this past week. The corrected average daily evapotranspiration value for the week based on the L006 weather platform solar radiation fell from 0.19 inches the previous week to 0.15 inches this past 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.

Water quality samples collected on July 17 – 18, 2018 showed chlorophyll *a* (Chla) values were elevated in many areas of the Lake, with 10 of 17 stations having values between 21 – 39 µg/L and one with 66 µg/L (Figure 6). Algal blooms are defined by the District as having Chla values >40 µg/L. Additionally, all sites had detectable levels of microcystin, and one (LZ30) was 19.6 µg/L, near the recommended limit for direct contact with water (20 µg/L). The most recent satellite imagery (July 29) using the cyanobacteria monitoring product derived from NOAA's analysis of EUMETSAT's OLCI satellite sensor showed the potential for a cyanobacteria bloom may have slightly increased over the past week, primarily in the pelagic zone (Figure 7).

**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	2641	2680	1.1
S71 & 72	285	363	0.1
S84 & 84X	744	566	0.2
Fisheating Creek	175	122	0.0
S154	18	40	0.0
S191	18	77	0.0
S133 P	29	70	0.0
S127 P	32	46	0.0
S129 P	9	10	0.0
S131 P	1	8	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	3	0	0.0
Rainfall	3665	2287	0.8
Total	7620	6266	2.4

OUTFLOWS	Previous Week Avg Daily cfs	Avg Daily Outflow cfs	Equivalent Depth Week Total (in)
S77	2989	1041	0.4
S308	2228	344	0.1
S351	510	243	0.1
S352	36	0	0.0
S354	1366	382	0.2
L8 Outflow	0	1	0.0
ET	3720	2811	1.1
Total	10850	4822	2.0

## **PROVISIONAL DATA**

## Water Management Recommendations

Lake Okeechobee stage is 14.36 feet NGVD, only 0.1 feet higher than last week and 0.12 feet higher than 30 days ago. The seasonal low for 2018 (12.83 feet NGVD) was the third highest since 2011, and the third time in six years that lake stage did not reach the bottom of the preferred stage envelope (12.5 – 15.5 feet NGVD). Due to record rainfall in May, the submerged aquatic vegetation (SAV) coverage on the Lake will likely remain at minimal levels throughout the summer and well into next year, prolonging impacts from high water levels associated with El Niño in 2016 and Hurricane Irma in 2017. Recovery of SAV in the nearshore zone will require low lake stages in the summer of 2019, so efforts to prepare for such an event will help speed the rebound of this important community.



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. Annual stage hydrographs for Lake Okeechobee from 2011 – 2018.



SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES FROM: 0515 EST, 07/24/2018 THROUGH: 0515 EST, 07/31/2018

Figure 4. Rainfall estimates by basin.

**Figure 5.** Major inflows and outflows of Lake Okeechobee, including the S-350 structures designated as South. The L-8 canal flows through culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. Inflows and outflows are shown as positive and negative, respectively, for visual purposes.



**Figure 6.** Chlorophyll *a* ( $\mu$ g/L) and microcystin ( $\mu$ g/L) values for nearshore and pelagic stations for mid-July 2018. <sup>(1)</sup> SFWMD classifies an algal bloom as having Chla values >40  $\mu$ g/L.



Unvalidated and Experimental Data

**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. 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 about 1,432 cfs (Figures 1 and 2) and last month inflow averaged about 2,343 cfs. Last week's provisional averaged inflows from the tidal basin and the structures are shown in Table 1.

Location	Flow (cfs)
Tidal Basin Inflow	399
S-80	396
S-308	385
S-49 on C-24	86
S-97 on C-23	139
Gordy Rd. structure on Ten Mile Creek	412

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

Over the past week, surface salinity decreased at HR1 and increased at other monitoring sites (Table 2, Figures 3 and 4). The seven-day moving average salinity of the water column (an average of the surface and bottom salinity) at the US1 Bridge is unavailable but estimated less than 10. Salinity conditions in the middle estuary are within the fair range for adult eastern oysters (Figure 3).

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

Sampling Site	Surface	Bottom	Envelope
HR1 (North Fork)	<b>2.7</b> (3.1)	<b>4.5</b> (3.4)	NA <sup>1</sup>
US1 Bridge	<b>6.0</b> (3.7)	<b>NR</b> <sup>2</sup> (NR)	10.0-26.0
A1A Bridge	<b>13.6</b> (10.2)	<b>21.1</b> (18.8)	NA <sup>1</sup>

<sup>1</sup>Envelope not applicable and <sup>2</sup>Not Reporting (US1 bottom sensor repaired July 27, 2018).

Surveys of water quality were conducted in the St. Lucie during July (Appendix A). Relative chlorophyll *a* concentrations have declined in some sections of the South Fork since early July (Figure A2).

## Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged about 4,316 cfs (Figures 5 and 6) and last month inflow averaged about 5,754 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

Location	Flow (cfs)
S-77	1,333
S-78	1,865
S-79	3,601
Tidal Basin Inflow	715

Table 3. Weekly average inflows (dat	a is	provisional	).
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Over the past week, salinity was near 0 down to Ft. Myers Yacht Basin and increased downstream (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be in the poor range for adult eastern oysters at Cape Coral, in the fair range at Shell Point, and were not available at Sanibel

(Figure 9). The 30-day moving average surface salinity is 0.2 at Val I-75 and 0.2 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass.

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

Sampling Site	Surface	Bottom	Envelope
S-79 (Franklin Lock)	<b>0.2</b> (0.2)	<b>0.2</b> (0.2)	NA <sup>1</sup>
Val 175	<b>0.2</b> (0.2)	<b>0.2</b> (0.2)	0.0-5.0 <sup>2</sup>
Ft. Myers Yacht Basin	<b>0.2 (</b> 0.2)	<b>0.2</b> (0.2)	NA
Cape Coral	<b>0.9</b> (0.3)	<b>1.1</b> (0.4)	10.0-30.0
Shell Point	~12.0 (~9.0)	~12.0 (~9.0)	10.0-30.0
Sanibel	NR <sup>3</sup> (NR)	<b>NR</b> (NR)	10.0-30.0

<sup>1</sup>Envelope not applicable, <sup>2</sup>Envelope is based on a 30-day average, <sup>3</sup>Not Reporting, and Shell Point repaired on July 26, 2018.

The Florida Fish and Wildlife Research Institute reported on July 27, 2018, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed at background to high concentrations in 19 samples collected from nearshore and offshore of Lee County. Fish kills and respiratory irritation were reported in Lee County over the past week.

Surveys of water quality were conducted in the Caloosahatchee during July (Appendix A). Relative chlorophyll *a* concentrations have declined throughout the C-44 Canal and estuary since mid-July (Figure A3).

## Water Management Recommendations

Lake stage is in the Low sub-band of 2008 LORS. Tributary hydrological conditions are wet. The 2008 LORS recommends up to 3,000 cfs at S-79 and up to 1,170 cfs at S-80. Given the current estuarine conditions, there are no ecological benefits associated with freshwater releases from Lake Okeechobee.



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.

## Appendix A

## Water quality mapping using an onboard flow-through system

The flow-through system consists of an intake ram attached to the transom of a boat, a data sonde, and intake and outlet flow (Figure A1). The data sonde is a YSI EXO2 that records temperature, salinity, turbidity, dissolved oxygen, chlorophyll *a*, phycocyanin, and location. The intake ram was set at 0.5 m depth. The surface water data are integrated into an ArcGIS shapefile used to display surface water properties and facilitate the post-processing of spatial data. The data are recorded at 5-s intervals. Discrete water samples were also taken for analysis of chlorophyll *a* following the SFWMD's Standard Operating Procedures. Laboratory determination of chlorophyll *a* concentrations will be used to calibrate *in situ* values of chlorophyll *a* reported in the field by the optical chlorophyll probe.

The St. Lucie Estuary survey track covers the St. Lucie inlet to the Roosevelt Bridge, the North Folk up to Fork Point, and the South Fork to S-80. Maps showing chlorophyll *a* concentrations on July 5, 2018 and July 25, 2018 (Figure A2).

The Caloosahatchee River Estuary survey track is from S-77 to Sanibel Causeway Bridge. Maps showing chlorophyll *a* concentrations on July 12, 2018 and July 26, 2018 (Figure A3).



Figure A1. Diagram of flow-through water quality sampling system.



Figure A2. Chlorophyll a concentrations (RFU) in the St. Lucie Estuary.



Figure A3. Chlorophyll a concentrations (RFU) in the Caloosahatchee Estuary.

## **EVERGLADES**

WCA-1 stages remained steady within the marsh but rose 0.17 feet near the eastern canal. Stage changes at WCA-3A gauge locations were minimal. The most extreme individual gauge changes within the WCAs ranged from -0.03 feet (WCA-1 northwest) to +0.39 feet (WCA-2B). Pan evaporation was estimated at 1.90 inches.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	1.91	+0.06
WCA-2A	1.77	+0.19
WCA-2B	3.53	+0.39
WCA-3A	2.25	-0.15
WCA-3B	1.53	+0.03
ENP	1.80	+0.02



Regulation Schedules: WCA-1 three-gauge average stage is 0.04 feet above Zone A1, and gauge 1-8C stage is 0.08 feet below. WCA-2A marsh stage is 1.95 feet above Zone A. S-11B headwater stage is 1.99 feet above schedule. S-11B stage is 0.15 above the temporary deviation schedule. WCA-3A three-gauge average stage is now 1.22 feet above Zone D and continues to trend towards the schedule. WCA-3A stage at gauge 62 (northwest corner) increased to 0.24 feet below the upper schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate relatively stable depths in WCA-3A over the last month, and lower depths along the northern reaches of the L-67 in WCA-3A South. Depths in WCA-3A North remain relatively shallow compared to WCA-3A South. In WCA-2B water depths have increased over the last month. WDAT output indicates that water depths significantly decreased in the previous month across northeastern WCA-3A. Water depths are somewhat lower in central WCA-3A South and central portions of ENP. WCA-3A is significantly drier at this time than it was a year ago along the L-67 and central WCA-3A South.



Taylor Slough Water Levels: An average of 2.6 inches of rain fell on Taylor Slough and Florida Bay. Stages increased an average of 0.13 feet this past week with individual station changes ranging from +0.08 feet to +0.21 feet. Water depths are 4 to 6 inches above the historical averages.

Florida Bay Salinities: Salinities are stable across Florida Bay with the average weekly decrease of 0.7 psu and individual station changes ranging from -3.5 psu to +2.4 psu. Salinities ranged from 7 psu in the northeast to 35 psu in the central bay. This is average to 9 psu below average at the individual stations for an average of 4 psu below average in Florida Bay. The central and western nearshore areas are the furthest from the average for this time of year.







Florida Bay MFL: Mangrove zone daily average remains near fresh this week at 0.7 psu. The 30-day moving average decreased 0.2 psu over the week to end at 0.7 psu. The weekly cumulative flow from the five creeks denoted by yellow stars on the map totaled about 2,200 acre-feet for the last week. The 365-day moving sum of flow from the five creeks ended the last week at 356,164 acre-feet (still greater than the long-term average of 257,628 acre-feet and near the 90th percentile). Creek flow is provisional data from the USGS and is highly variable.



## Water Management Recommendations

Inflows to northernmost WCA-3A create lower ecological stress when compared to flows to more southern WCA-3A. Water depths in WCA-3A North are lower than in WCA-3A South particularly along the L-67 levee's more northern reaches where water has currently ponded to a depth of 4.0 to 4.5 feet. Incremental change in the rate of structure flows (i.e., when changing flow rates from 0 cfs to 1,000 cfs, make 500 cfs adjustment per week) to the WCAs is more ecologically sensitive than abrupt rate changes. Ascension rates are now critical for apple snail reproduction in the Everglades. The current recommended stage ascension rate is less than 0.25 feet per week (or 0.5 feet per 2 weeks). Due to elevated levels of phosphorus in the S-332D detention area and the Frog Pond detention area, a recommendation is being made to limit the increase in depths within the L-31W to no more than 3 inches per day over the course of 3 to 4 weeks when S-332D, S-328, and/or G-737 are opened. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

	SFWMD Ever	glades Ecological Recommendations	s, July 31st, 2018 (red is new)	
Area	Weekly change	Recommendation	Reasons	
WCA-1	Stage changes from -0.03' to +0.17'	Maintain depths at temporary regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect habitat and wildlife.	
WCA-2A	Stage increased by 0.19	Maintain depths at temporary regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife.	
WCA-2B	Stage increased by 0.39'	Maintain depths at temporary regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife.	
WCA-3A NE	Stage increased by 0.03'	Maintain depths at regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect habitat including peat soil development, tree islands and	
WCA-3A NW	Stage decreased by 0.?'	Maintain depths at regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	wildlife.	
Central WCA-3A S	Stage increased by 0.05'	Maintain depths at regulation schedule. Manage for a rate	Protect habitat including peat soil development, tree islands and	
Southern WCA-3A S	Stage remained unchanged	per 2 weeks.	wildlife.	
WCA-3B	Stage increased by 0.03'	Maintain depths at or above regulation schedule. Manage for a rate of ascension less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife.	
ENP-SRS	Stage increased by 0.02'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.	
Taylor Slough	Stage changes ranged from +0.08' to +0.21'	Move water southward as possible. Limit increases in the L 31W to less than 3 inches per day for 3-4 weeks to allow for reductions in phosphorus concentrations.	When available, provide freshwater buffer for downstream conditions. Decrease potential for high phosphorus input to ENP.	
FB- Salinity	Salinity changes ranged -3.5 to +2.4 psu.	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.	