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, Interim Assistant Executive Director, Executive Office Staff

FROM: SFWMD Staff Environmental Advisory Team

DATE: July 31, 2019

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A weak low- to mid-level ridge of high pressure extends from the Atlantic through the far southern portion of the District this morning. Weak steering winds around this feature should allow both the east and west coast sea breezes to begin propagating inland this morning, with widely scattered rains developing along them through the early afternoon along or not far inland from either coast. Later in the afternoon around peak heating, greater instability and near to somewhat above average levels of moisture should result in a concentration of rains over the interior again, stretching from north to south and away from both the east and west coasts. Some of the rains have the potential to be heavy from the mid-afternoon through the early evening, producing localized significant rainfall. The best guess is that near-climatological total District rainfall (normal daily total District rainfall is 0.22 inches) would occur today, but the overall confidence in the predicted value is low today while there is medium confidence associated with the forecast spatial distribution of rains. The Atlantic ridge of high pressure should strengthen on Wednesday, causing an easterly wind flow across the District to strengthen. The prevailing easterly wind regime, with normal levels of moisture and instability, should cause some early rains in the east, followed by a substantially greater concentration from the central interior to the west coast from the afternoon through the evening; near-climatological total District rainfall is again considered most likely on Wednesday. A tropical wave over the central Caribbean Sea this morning should reach eastern Cuba and the southeastern/central Bahamas by Wednesday and western Cuba/western Bahamas by Thursday, with the enhanced moisture and instability associated with the wave beginning to move over the southern half of the District on that day. Increasing rain chances and coverage of rain are forecast on Thursday, mainly over the southern half of the District and especially closer to and along the east coast and Florida Keys. Occasional moderate to heavy showers and thunderstorms over this region on Thursday could result in a few areas receiving significant rainfall. The northern end of the wave should fracture while moving over Cuba and the Florida Straits on Friday and move over the Florida peninsula late Friday and Saturday while turning northward or north northeastward. Considerable moisture over a large depth of the atmosphere, enhanced instability and the wave serving as a triggering mechanism should greatly enhance rainfall over the District on Friday and Saturday. The model guidance indicates the best lowlevel convergence/lift associated with the breakaway piece of the wave, a nearly saturated atmosphere and prime instability to be late Friday and Saturday, when there should be a heightened risk for significant rainfall across the area. Additionally, rains from Friday through Saturday could break from their typical diurnal peak in the afternoon to occur in waves throughout the day and into the night, in some cases, with at least some chance that a more continuous type of rain could occur on Saturday. As the fractured wave energy moves northeastward into the southwestern Atlantic and away from the area on Sunday, a very moist southwesterly wind flow should continue across the District through Monday next week. This should mean a continuation of enhanced rainfall each day, on top of a few days of already enhanced rainfall, but with the rains likely returning to a more typical afternoon to early evening peak. For the week ending next Tuesday morning, the deterministic total quantitative precipitation forecast (QPF) is a little over 2.4 inches

or about 145% of normal. The probabilistic model output shows a likelihood of much above normal weekly rainfall but with a rather broad range of possible outcomes. A long tail in the model solutions suggests that a reasonable worse-case scenario would be for total rainfall to reach about twice the long-term mean for the week, which could make this one of the rainiest weeks so far this wet season.

<u>Kissimmee</u>

Tuesday morning stages were 56.3 feet NGVD (0.2 feet below schedule) in East Lake Toho, 53.5 feet NGVD (at schedule) in Toho, and 50.1 feet NGVD (0.9 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.4 feet NGVD at S-65A and 25.7 feet NGVD at S-65D. Tuesday morning discharges were 982 cfs at S-65, 1,349 cfs at S-65A, 1,367 cfs at S-65D and 1,099 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 4.3 mg/L for the week through Sunday. Kissimmee River mean floodplain depth on Sunday was 0.49 feet. Recommendation(s) this week: (7/24/2019) Maintain flow of at least 750-800 cfs or higher at S-65A until the effects of forecast rainy period are known. Purpose is to manage stage in KCH while maintaining moderate discharge from S-65A.

Lake Okeechobee

Lake Okeechobee stage is 11.63 feet NGVD, increasing 0.11 feet from the previous week, 0.31 feet over the previous month, and is 2.70 feet below the stage one year ago. The Lake dropped into the Water Shortage sub-band on July 19, 2019. The Lake remains below the bottom of the ecological envelope (currently 0.37 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD (+/- 0.5 feet) but has been rising steadily towards it throughout the rainy season. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone; high ascension rates will stress newly established plants and could dramatically reduce the beneficial effects that low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the lake (July 27, 2019) remains somewhat elevated in the northern portions of the Lake, though values appear to have diminished somewhat from last week.

Estuaries

Total inflow to the St. Lucie Estuary averaged 1,003 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 averaged 2,498 cfs over the past week with only 50 cfs coming from the Lake. Over the past week, seven-day average salinity decreased slightly in the estuary. The 30-day moving average surface salinity is 0.3 at Val I-75 and 1.3 at Ft. Myers. Salinity conditions between Val I-75 and Ft. Myers are good for tape grass. Salinities are in the good range for adult eastern at Shell Point and Sanibel. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to the areas further downstream.

Stormwater Treatment Areas

Over the past week, no Lake Okeechobee 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 7,400 acre-feet. The total amount of inflows to the STAs in WY2020 is approximately 297,000 acre-feet. All STA cells are at or above target depths. STA-1W Northern Flow-way is offline for STA-1W Expansion project construction activities 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, in STA-1E Western Flow-way following levee repairs in the West Distribution Cell, and in STA-1E Central Flow-way and STA-2 Flow-way 3 for vegetation management activities. This week, if 2008 LORS recommends Lake releases to the WCAs and the conditions allow, releases will be sent to STA-2.

Everglades

Stages rose across most of the Everglades over the last week with the exception of WCA-2A. Stages in WCA-1 and WCA-2A remain above schedule but are trending towards the regulation lines. WCA-3A remains in Zone D. Stages in Taylor Slough remain higher than the historical average for this time of year, yet salinity conditions downstream in Florida Bay increased slightly on average last week. The flow from the 5 creeks calculated as part of the Florida Bay MFL was 50% of typical flows for this time of year.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 2.58 inches of rainfall in the past week and the Lower Basin received 1.82 inches (SFWMD Daily Rainfall Report 7/29/2019).

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.

		7-day				Schedule			Daily	Departur	e (feet)		
Water Body	Structure	Average Discharge (cfs) ¹	Stage Monitoring Site ²	Lake Stage (feet)	Schedule Type ³	Stage (feet)	7/28/19	7/21/19	7/14/19	7/7/19	6/30/19	6/23/19	6/16/19
Lakes Hart and Mary Jane	S-62	62	LKMJ	60.0	R	60.0	0.0	0.0	0.1	0.0	-0.4	-0.3	-0.5
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	60.3	R	61.0	-0.7	-0.8	-0.7	-0.9	-1.2	-1.1	-1.1
Alligator Chain	S-60	0	ALLI	62.6	R	63.2	-0.6	-0.7	-0.7	-0.8	-1.0	-1.0	-1.0
Lake Gentry	S-63	0	LKGT	59.9	R	61.0	-1.1	-1.4	-1.3	-1.4	-1.5	-1.4	-1.4
East Lake Toho	S-59	70	TOHOE	56.3	R	56.5	-0.2	-0.5	-0.7	-0.7	-1.0	-1.1	-1.4
Lake Toho	S-61	263	TOHOW, S-61	53.4	R	53.5	-0.1	-0.3	-0.4	-0.5	-0.8	-1.0	-1.1
Lakes Kissimmee, Cypress, and Hatchineha	S-65	777	KUB011, LKIS5B	50.1	R	51.0	-0.9	-1.1	-1.1	-1.6	-1.4	-1.4	-1.9

Report Date: 7/30/2019

¹Seven-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.

³A = 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:	7/30/2019											
		1-Day Average Average for the Preceeding 7-Days ¹										
Metric	Location	7/28/2019	7/28/19	7/21/19	7/14/19	7/7/19	6/30/19	6/23/19	6/16/19	6/9/19	6/2/19	5/26/19
Discharge (cfs)	S-65	1,104	777	1,110	548	287	400	106	165	284	319	596
Discharge (cfs)	S-65A ²	1,175	903	1,123	749	387	673	1,014	255	215	244	456
Discharge (cfs)	S-65D ²	1,187	1,378	1,396	1,020	1,288	1,801	975	290	222	329	706
Headwater Stage (feet NGVD)	S-65D ²	25.77	25.79	25.78	25.81	25.70	25.84	25.80	25.84	25.78	25.79	25.80
Discharge (cfs)	S-65E ²	1,108	1,259	1,250	944	1,158	1,606	903	331	208	313	591
Discharge (cfs)	S-67	94	93	92	97	92	62	96	22	0	0	0
DO (mg/L) ³	Phases I & II/III river channel	5.0	4.3	3.3	3.3	1.8	0.0	3.0	5.9	5.7	6.0	6.7
Mean depth (feet) ⁴	Phase I floodplain	0.49	0.52	0.55	0.46	0.46	0.82	0.39	0.13	0.06	0.07	0.11

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

²S-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.

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

⁴1-day spatial average from South Florida Water Depth Assessment Tool (SFWDAT).

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

KCOL Hydrographs (through Sunday midnight)



Figure 1.











Figure 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.



Figure 10. Mean daily dissolved oxygen, discharge, temperature and rainfall in the Phases I/II/III river channel.

Water Management Recommendations

Kissimmee Basin Adaptive	Recommendations and	Operational Actions
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Recommendation	Recommendation	Purpose	Outcome	Source	Report Date
Date	Maintain flow of at least 7E0, 800 of a or higher at				
7/24/2019	S65A until the effects of forecast rainy period are	Manage stage in KCH while maintaining moderate discharge from S65A.	Implemented	KB Ops	7/30/2019
	a) Hold KCH stage steady until the risk of an				
	exceedance of the 0.5 ft max rise per 14 days is				
	past OR stage starts to decline.	Balance rate of rise in KCH against reduction of		KB Ops/SEWMD Water	
7/18/2019	b) If KCH stage starts to decline, ramp down at 150	flow at S65A to avoid reducing flow to minimum	Implemented	Management	7/23/2019
	cfs/day over several days to 750 cfs. If this	until it is necessary.			
	doesn't stop the decline we will regroup to discuss				
· · ·	options.	Control rate of stage rise in KCH while addressing		SEWMD Water	
7/14/2019	Do not increase S-65/S-S65A flow today	DO sag concerns.	Implemented	Management/KB Ops	7/16/2019
7/12/2010	Postpone second 150 cfs increase today (total 150	Control rate of stage rise in KCH while addressing	Implemented	KB Opc	7/16/2019
//12/2019	cfs).	DO sag concerns.	Implementeu	Kb Ops	//10/2019
	Increase S-65/S-S65A by 300 cfs tomorrow	Control rate of stage rise in KCH while addressing			
7/11/2019	(double the rampup guidelines) in two increments	DO sag concerns.	Implemented	KB Ops	7/16/2019
	of 150 cfs				
7/11/2019	Increase S-65/S-S65A flow by 150 cfs today	Control rate of stage rise in KCH while addressing	Implemented	KB Ops	7/16/2019
	Increase S-65/S-S654 flow by 150 cfs today	Control rate of stage rise in KCH while addressing			
7/10/2019	(double the rampup guidelines).	DO sag concerns.	Implemented	KB Ops	7/16/2019
7/8/2019	No new recommendations.	5	N/A		7/9/2019
6/27/2010	Continue discharge reductions at S-65A at up to	Reduce river channel stage to allow DO recovery		KB One	7/2/2019
0/2//2015	double the normal rampdown rate, as possible.	Reduce river channel stage to allow DO recovery.	TUD	Kb Ops	1/2/2015
6/27/2019	Manage S65 discharge to slow stage ascension to	Slow the rate of stage ascension in KCH.	TBD	KB Ops	7/2/2019
	the extent possible.	5			
6/24/2019	Continue discharge reductions at S-65A at up to	Reduce river channel stage to allow DO recovery.	Implemented	KB Ops	6/25/2019
	Reduce discharge at S-65A to below 1400 cfs as	Reduce chance of DO crash given the need for			
6/21/2019	soon as possible.	continued high discharge.	Implemented	KB Ops	6/25/2019
			Implemented		
6/19/2019	Start flood control measures as headwater stage at	Avoid flooding in Pool A	(flow increased	SFWMD Water	6/25/2019
0/13/2015	S-65A reaches 47 ft		to 2000 cfs)	Management/KB Ops	0/23/2015
			,		
6/17/2019	If needed, double rates of discharge increase for S-	Slow rate of rise in KCH if necessary.	TBD	KB Ops	6/18/2019
6/17/2019	Increase flow at S-61	Slow Lake Tobo ascension rate	Implemented	KB Ops	6/18/2019
	Increase discharge at S-65A. Double the rate of		Implemented		0/10/2015
6/13/2019	discharge increase if necessary to maintain	Purpose: Control stage in Pool A due to heavy	Implemented	Water Management/KB	6/18/2019
	headwater at S-65A.	rain overnight in Pool A basin.		Ops	
		Provide variable flow from S-65/S-65A to balance			
		Kissimmee River and Headwaters Lakes			
6/1/2019	Begin implementation of the 2019 Wet Season	objectives, including Kissimmee River floodplain	Planned	KB Ops	6/11/2019
-,-,	Discharge Plan for S-65/S-65A (see figure).	inundation, moderate rates of change in			-,,
		discharge, and controlled rate of stage rise in the			
		lakes.			
		Slow rate of stage decline in KCH while sustaining			
5/31/2019	Reduce S-65 flow by 100 cfs over 2 days (5/31 and	about 150 cfs at S-65A. (Note: Unexpected	Implemented	KB Ops/SFWMD Water	6/4/2019
	6/1) to about 280 cfs.	rainfall late on 6/1 allowed S-65A discharge to be	·	Management	
		returned to about 220 crs 00 6/2).			
5/28/2019	No new recommendations.		N/A		5/28/2019
5/20/2019	No new recommendations.		N/A		5/21/2019
5/13/2019	No new recommendations.	Chart term geals, that a loss OCE A dischard	N/A		5/14/2019
	Due to the rainfall, increase 565-A to 1000 cfs	short-term goals: try to keep 565-A discharge at			
5/6/2019	accordingly. We will reassess the rise in KCH stage	and next, while keeping the reversal in KCH less	Implemented	KB Ops	5/7/2019
	tomorrow 5/7.	than about 0.4 ft.			
4/29/2019	No new recommendations.		N/A		4/30/2019







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



Figure 13. The Kissimmee Basin.

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee average daily lake stage is at 11.63 feet NGVD for July 29, 2019 increasing 0.11 feet from the previous week. 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 higher than a month ago and 2.70 feet lower than a year ago (Figure 1) when stages were about a foot above the top of the preferred ecological envelope (Figure 2). The Lake dropped into the Water Shortage sub-band on July 19, 2019 after roughly paralleling it for a few weeks (Figure 3). Lake stage is currently at the lowest level for this time of year since 2011 but is still over a foot above those stages (Figure 4). According to RAINDAR, during the week of July 23 to July 29, 2019, 1.64 inches of rain fell directly over the Lake, compared to 0.87 inches the previous week. Most of the central watershed received similar amounts of rainfall, though west, south-west and east of the lake received less than 1.5 inches (Figure 5).

The average daily inflows (minus rainfall) to the Lake were higher than the prior week at 2,218 cfs compared to 1,723 cfs. The inflows from the Kissimmee River (S-65E) decreased slightly from 1,273 cfs to 1,247 cfs, while those from Lake Istokpoga (via S-84 and S-71) increased, going from 351 cfs to 791 cfs. Passive flow from the L-8 at Canal Point increased by 40 cfs over the previous week and all other structures increased by less than 20 cfs (Table 1).

Outflows from the Lake decreased, averaging just 50 daily cfs. Outflows (minus evapotranspiration) were solely west through the S-77 to accommodate a flow-through algal collection experiment conducted by the USACE. The corrected average daily evapotranspiration value for the week based on the L006 and LZ40 weather platform solar radiation increased slightly from the previous week to 0.16 inches.

Total lake inflows and outflows for the past week are detailed in Table 1, as well as the approximate change in lake stage from each major structure's total flows over the period. Figure 6 shows the combined average daily cfs for inflows and outflows for the Lake over the past eight weeks. These data are provisional and are subject to change.

The most recent viable satellite imagery (July 27, 2019) using NOAA's cyanobacteria monitoring product derived from EUMETSAT's Sentinel 3a OLCI sensor data showed bloom potential remains elevated in northern portions of the lake but is possibly less dense (Figure 7).

Water Management Recommendations

Lake Okeechobee stage is 11.63 feet NGVD, increasing 0.11 feet from the previous week, 0.31 feet over the previous month, and is 2.70 feet below the stage one year ago. The Lake dropped into the Water Shortage sub-band on July 19, 2019. The lake remains below the bottom of the ecological envelope (currently 0.37 feet below), which varies seasonally from 12.5 – 15.5 feet NGVD (+/- 0.5 feet) but has been rising steadily towards it throughout the rainy season. Lake stage ascension rates remain important to the continued recovery of SAV and EAV (Submerged and Emergent Aquatic Vegetation) in the nearshore zone; high ascension rates will stress newly established plants and could dramatically reduce the beneficial effects that low lake stages have had on these communities. The latest estimate of cyanobacteria bloom potential on the lake (July 27, 2019) remains somewhat elevated in the northern portions of the Lake, though values appear to have diminished somewhat from last week.

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	1273	1247	0.6
S-71 & S-72	0	161	0.1
S-84 & S-84X	351	630	0.3
Fisheating Creek	52	72	0.0
S-154	0	0	0.0
S-191	0	14	0.0
S-133 P	7	1	0.0
S-127 P	4	1	0.0
S-129 P	2	0	0.0
S-131 P	2	5	0.0
S-135 P	9	24	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	22	62	0.0
Rainfall	1815	3440	1.6
Total	3539	5658	2.7

OUTFLOWS	Previous week Avg Daily CFS	Avg Daily Flow cfs	Equivalent Depth Week Total (in)
S-77	57	50	0.0
S-308	0	0	0.0
S-351	101	0	0.0
S-352	156	0	0.0
S-354	58	0	0.0
L-8 Outflow			
ET	1999	2340	1.1
Total	2371	2390	1.1

Provisional Data



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

Lake Okeechobee Stage vs Ecological Envelope



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



Lake Okeechobee Water Level History and Projected Stages

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

Lake Okeechobee Water Level Comparison



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



Figure 5. Rainfall estimates by basin.



Figure 6. Major inflows (orange) and outflows (blue) of Lake Okeechobee, including the S-350 structures designated as South (green). The L-8 Canal flows through Culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes. Outflows through the S-77 and S-308 structures are shown based on their downstream gauges to account for lock openings for navigation.



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

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 1,003 cfs (Figures 1 and 2) and last month inflow averaged about 758 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	363
S-80	491
S-308	0
S-49 on C-24	43
S-97 on C-23	9
Gordy Rd. structure on Ten Mile Creek	97

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

Over the past week, salinity increased throughout the estuary except surface salinity at A1A Bridge which decreased (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 20.2. 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)	13.0 (11.6)	18.3 (16.3)	NA ¹
US1 Bridge	19.2 (17.7)	21.2 (19.0)	10.0-26.0
A1A Bridge	26.6 (27.4)	29.9 (29.1)	NA ¹

¹Envelope not applicable.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 2,498 cfs (Figures 5 and 6) and last month inflow averaged about 2,134 cfs. Last week's provisional averaged inflows from the structures are shown in Table 3.

Location	Flow (cfs)
S-77	50
S-78	764
S-79	2104
Tidal Basin Inflow	394

Table 3.	Weekly average	ae inflows	(data is	provisional	١.
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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 Shell Point and Sanibel and unknown at Cape Coral (Figure 9). The 30-day moving average surface salinity is 0.3 at Val I-75 and 1.3 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 (0.3)	0.2 (0.3)	NA ¹
Val 175	0.3 (0.3)	0.3 (0.3)	0.0-5.0 ²
Ft. Myers Yacht Basin	0.6 (1.1)	0.9 (1.5)	NA
Cape Coral	EM ³ (EM)	EM (EM)	10.0-30.0
Shell Point	20.0 (20.8)	21.5 (22.6)	10.0-30.0
Sanibel	26.9 (28.2)	28.5 (28.8)	10.0-30.0

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

Forecast of surface salinity (Table 5 and Figure 10) at Val I-75 for the next two weeks using the autoregression model (Qiu and Wan, 2013) coupled with a linear reservoir model for the tidal basin predicts daily salinity ranging from 0.5 to 2.7 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 175 cfs.

Scenario	Q79	TB runoff	Daily	30 day
	(cfs)	(cfs)	salinity	mean
А	0	175	2.7	0.8
В	300	175	1.8	0.6
С	450	175	1.2	0.5
D	650	175	0.8	0.4
E	800	175	0.5	0.3

Table 5. Predicted salinity at V	al I-75 at the end of forecast period
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Red tide

The Florida Fish and Wildlife Research Institute reported on July 26, 2019, that *Karenia brevis, the Florida red tide dinoflagellate,* was not observed in samples collected from Lee, St. Lucie, Martin, Palm Beach or Miami-Dade counties (no samples from Broward County).

Water Management Recommendations

Lake stage is in the Water Shortage sub-band of 2008 LORS. Tributary hydrological conditions are normal. The 2008 LORS recommends no release at S-79 and S-80. Given the current estuarine conditions, there are no ecological benefits to the upper estuary associated with freshwater releases from Lake Okeechobee, but some benefits may accrue to areas further downstream.



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



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



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



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



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



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



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



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



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



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

EVERGLADES

Stages only decreased in one area (WCA-2A) this past week. Elsewhere, stages increased by up to 0.14 feet which is within the good range for supporting apple snail reproduction. Pan evaporation was estimated at 1.65 inches this week which is greater than the estimated 1.42 inches of rain for the corresponding period.

Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	1.16	+0.03
WCA-2A	0.66	-0.05
WCA-2B	0.30	+0.00
WCA-3A	1.74	+0.09
WCA-3B	2.24	+0.09
ENP	1.27	+0.14



Regulation Schedules: WCA-1: The three-gauge average stage continues to trend towards the Zone A1 line this week, currently 0.10 feet above the A1 Zone regulation line. WCA-2A: Gauge 2A-17 stage continues its trend towards the rising Zone A regulation line, now 0.46 feet above it. WCA-3A: The three-gauge average stage is staying in the preferred band and is currently 0.20 feet above the Zone D line. WCA-3A at gauge 62 (northwest corner) remains below schedule at 0.62 feet below the rising limb of the upper schedule.



Water Depths and Changes: The WDAT tool for spatial interpolation of depth snapshots indicates stages in most areas have been increasing month to month. WCA-2A and northwestern WCA-1 have dried out a little. WDAT difference maps confirm that WCA-2A has decreased in stage during the last month. Almost all areas of the WCA's are estimated to have above-ground water depths. The eastern areas of Everglades National Park seem to be showing impacts of the projects on the eastern boundary of the park with increased water depths from northeastern Shark River Slough south towards Taylor Slough. Conditions are mostly drier than last year at this time when the area was under a high-water emergency order for conditions in WCA-3A. One notable exception to this is the northeastern area of Everglades National Park.





Taylor Slough Water Levels: An average of only 1.26 inches of rain fell over Taylor Slough and Florida Bay this past week, and stages in the marsh and mangrove zone increased 1.5 inches as a result. Stages are still 3 inches higher than average for this time of year. TPO4 levels at S-328 and G-737 were 3 μ g/L as measured last week (provisional data).

Florida Bay Salinities: Average salinity in Florida Bay was 36 psu, up 1 psu from last week. The nearshore area is still elevated in the 22-38 psu range and still needs to decrease to near 25 psu to prevent additional stress to the system.







Florida Bay MFL: Salinity at the TR station in the mangrove zone (tracked for the Florida Bay MFL) has decreased to 3 psu. The 30-day moving average decreased 2.7 psu to end the week at 13.6 psu. The weekly flow from the 5 creeks feeding Florida Bay was 3,400 acre-feet which is still half of expected conditions for this time of year. Flows were negative for 3 days of the last week. The 365-day moving sum of flow from the five creeks (tracked as part of the Florida Bay MFL criteria) decreased 1,000 acre-feet to end the week at 178,276 acre-feet which is still less than the 25th percentile (190,165 acre-feet). Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Within the WCAs, the area with the lowest stage (in fact the region remains below ground) is north eastern WCA-3A North. Raising the stage in that location would protect the sensitive peat soils in that region from oxidation and wildfire. For the Water Conservation Areas, a rate of ascension less than 0.25 feet per week or less than 0.5 feet per 2 weeks is the general ecological recommendation. Moving water towards Taylor Slough and Florida Bay will freshen salinity conditions within the nearshore areas of Florida Bay and decrease the currently stressful conditions for seagrasses and fauna. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, July 30nd, 2019 (red is new)				
Area	Weekly change	Recommendation	Reasons	
WCA-1	Stage increased by 0.03'	Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.	
WCA-2A	Stage decreased by 0.05'	Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.	
WCA-2B	Stage averaged no change	Maintain depths at regulation schedule. Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.	
WCA-3A NE	Stage decreased by 0.06'	Maintain depths at regulation schedule. Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect tree islands, upstream/downstream habitat and wildlife. Protect	
WCA-3A NW	Stage increased by 0.10'	Maintain depths at regulation schedule. Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.		
Central WCA-3A S	Stage increased by 0.13'	Maintain depths at regulation schedule. Manage for a rate	Protect tree islands, upstream/downstream habitat and wildlife. Protect conditions for snail kite nesting.	
Southern WCA-3A S	Stage increased by 0.20'	per 2 weeks.		
WCA-3B	Stage increased by 0.09'	Manage for a rate of ascencion less than +0.25' per week, or less than +0.5 per 2 weeks.	Protect upstream/downstream habitat and wildlife. Protect conditions for apple snail reproduction.	
ENP-SRS	Stage increased by 0.14'	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 +0.18'	Move water southward as possible	When available, provide freshwater buffer for downstream conditions. Decrease potential for high phosphorus input to ENP.	
FB- Salinity	Salinity changes ranged -1.7 to +3.0 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.	