

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: December 19, 2018

SUBJECT: Weekly Environmental Conditions for Systems Operations

Summary

Weather Conditions and Forecast

A ridge of high pressure extending from the eastern United States through Florida should slide eastward into the western Atlantic by Wednesday while a cold front remains stationary from the southeastern Bahamas through the northwestern Caribbean Sea. Cool, dry and stable air associated with the ridge should result in no rainfall across the District Tuesday, except for a remote chance of light showers along the immediate east coast this evening or overnight as the low-level winds shift off the Atlantic and moisture begins to gradually increase. The stationary front south of the area should return to the District as a warm front Wednesday afternoon and then north of the area by Thursday morning in response to the upper-level winds backing to the southwest ahead of a sharp trough of low pressure developing over the southern Plains. A considerable increase of moisture overrunning the relatively cool air mass still in place over the District early Wednesday should cause rain chances to increase by afternoon and evening, primarily over the northwestern half or third of the District where the best 'lift' is likely to be present in association with the retreating boundary. Increasingly favorable jet dynamics, moisture convergence and instability should cause the rains to concentrate along an axis extending from the southeastern Gulf of Mexico through north Florida from Wednesday afternoon through the overnight hours, with some of the moderate to heavy rain likely spilling over into the northwestern half or third of the District during this time. Much lower areal average rainfall is predicted over the southeastern half or third of the area through Thursday morning, with many areas over this region possibly seeing little to no rainfall. The lowest spread in the model solutions from Wednesday through Thursday morning is over the southeastern half of the District, suggesting that the forecast of much lower total rainfall there is of greater confidence. Larger spread over the northwestern half and especially the far northwest makes for a less confident forecast over this region, with the difference between a lot or much less rainfall still hard to discern at this range. The trough moving out of the Plains should deepen and spark the development of a strong storm system over the southeastern United States by Friday. Very strong jet dynamics, increasing instability and high levels of moisture ahead of the developing storm are likely to result in widespread heavy rains across the District on Thursday, arriving over the northwest later in the morning or early afternoon and then sweeping through the remainder of the District from the afternoon through the early part of the night. Although rain areas should be fast-moving, intense rain rains and the likelihood of 'training' -- or the repeated movement or formation of showers and thunderstorms over the same areas -- favors areal average rainfall of half an inch to an each or more over the entire District and the possibility of some impressive local maxima. The broad coverage of heavy rains is very likely to make Thursday's total District rainfall exceed the 2 November rains of about a half an inch and become the greatest single-day total for the District since the passage of Tropical Storm Gordon in early September. The heavy rains should begin to diminish from northwest to southeast Thursday evening and then end completely Thursday night as a cold front associated with the storm system pushes rapidly through the area by Friday morning. Cooler but unsettled conditions are expected to prevail on Friday, with lingering light rains possible over a large area but

especially the west or northwest where the rains could occasionally be some heavier. The remaining light rains should end by Friday evening or overnight and give way to dry and cool weather over the weekend that should last through Monday next week. For the week ending next Monday morning, the deterministic quantitative precipitation forecast (QPF) is about nine tenths of an inch or about double the climatological average of 0.42", the majority of which should fall within a 12-hour period on Thursday. The probabilistic guidance shows a virtual certainty of above normal total District rainfall for the week ahead, a median total of just under an inch, and a lower but non-trivial chance that the total District rains would be like an average week's rains in late September.

Kissimmee

Tuesday morning stages were 57.2 feet NGVD (0.8 feet below schedule) in East Lake Toho, 54.7 feet NGVD (0.3 feet below schedule) in Toho, and 49.5 feet NGVD (3.0 feet below schedule) in Kissimmee-Cypress-Hatchineha; headwater stages were 46.5 feet NGVD at S-65A and 25.8 feet NGVD at S-65D. Tuesday morning discharges were 180 cfs at S-65, 180 cfs at S-65A, and 97 cfs at S-65E. Dissolved oxygen concentration in the Kissimmee River averaged 4.3 mg/L for the week. Kissimmee River mean floodplain depth on Sunday was 0.11 feet. Recommendations: 12/18/2018-Manage S-61 discharge to reduce stage in Lake Toho to 54 ft over the next 7-9 days. The purpose is to move water to KCH to reduce rate of stage decline in KCH and reduce the stage difference between S-61 headwater and tailwater.

Lake Okeechobee

Lake Okeechobee stage is 12.75 feet NGVD, falling 0.12 feet from the previous week and 0.62 feet over the past 30 days. Lake stages are the lowest they have been for this time of year since 2010 and are now 1.75 feet below the bottom of the preferred ecological envelope, which varies seasonally from 12.5 – 15.5 feet NGVD. Given potential for heavy rainfall associated with El Niño conditions this winter and the poor condition of SAV and EAV in the nearshore zone, these lower lake stages are ideal for vegetation recovery, but will reduce habitat for fish and wildlife in the near-term and encourage spread of invasive vegetation in the upper marsh. Cyanobacterial bloom potential is low for most of the lake based on the latest NOAA image (December 15), continuing the trend of gradually reducing potential over the past several weeks.

Estuaries

Total inflow to the St. Lucie Estuary averaged 191 cfs over the past week with 0 cfs coming from Lake Okeechobee. Surface salinity remained the same throughout the estuary over the last week. The seven-day average salinity at the US1 Bridge is in the good range for adult eastern oysters. Total inflow to the Caloosahatchee Estuary averaged 1,026 cfs over the past week with 573 cfs coming from the Lake. Over the past week in the estuary, salinity increased by up to 2 points at S-79 and Val I-75 but remained the same downstream. The 30-day moving average surface salinity is 2.0 at Val I-75 and 7.2 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 oysters at Cape Coral and Shell Point.

Stormwater Treatment Areas

Over the past week, the STAs received approximately 2,700 acre-feet of Lake releases. The total amount of inflows to the STAs in WY2019 (since May 1, 2018) is approximately 1,191,000 acre-feet, which includes approximately 332,000 acre-feet of Lake releases. Most STA cells are at or above target depths except the emergent aquatic vegetation cells in STA-5/6 which are below target. STA-1W Northern Flow-way is offline for STA-1W Expansion project construction activities, and operational restrictions are in place for STA-1W Expansion project construction activities in STA-1W Eastern and Western Flow-ways. STA-5/6 Flow-ways 2 and 3 are offline for Restoration Strategies project to grade non-effective treatment areas. This week, if Lake releases are sent to the WCAs and conditions allow, releases will be sent to STA-1E and STA-2.

Everglades

Conditions within the WCAs remain as they have over the past several weeks, stable but unseasonably dry. Stages in northern WCA-3A and WCA-1 continue to decline below ground. Over the last week water depths declined on average across the Everglades at a rate like the previous month. Stages remain below the regulation lines in the WCAs with WCA-2A the exception, though that basin now trends towards the regulation line. Water management supporting the ecological need for hydration in northeast WCA-3A continues with discharge from S-150 continuing around 375 cubic feet per second, providing water to northeastern WCA-3A. Stages continued to decline this week throughout Taylor Slough, and all stage locations are within 1 inch of the historic average. Salinities in Florida Bay remained unchanged on average this past week.

Supporting Information

KISSIMMEE BASIN

Kissimmee Basin Rainfall

The Upper Kissimmee Basin received 0.76 inches of rainfall in the past week and the Lower Basin received 0.58 inches (SFWMD Daily Rainfall Report 12/18/2018).

Upper Kissimmee Basin

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

Table 1. Average discharge (cfs) for the preceding seven days, one-day stage (feet NGVD), and departures from KCOL flood regulation (R) or temporary schedules (T, A, or S). Provisional, real-time data are from SFWMD.
Report Date: 12/18/2018

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)						
							12/16/18	12/9/18	12/2/18	11/25/18	11/18/18	11/11/18	11/4/18
Lakes Hart and Mary Jane	S-62	0	LKMJ	60.1	R	61.0	-0.9	-1.0	-1.1	-1.0	-1.0	-1.0	-1.1
Lakes Myrtle, Preston, and Joel	S-57	0	S-57	61.3	R	61.8	-0.5	-0.7	-0.9	-0.9	-0.8	-0.8	-0.8
Alligator Chain	S-60	0	ALLI	63.1	R	64.0	-0.9	-1.0	-1.0	-1.0	-0.9	-0.9	-0.9
Lake Gentry	S-63	8	LKGT	61.6	R	61.5	0.1	0.0	0.0	0.0	0.1	0.0	-0.1
East Lake Toho	S-59	0	TOHOE	57.2	R	58.0	-0.8	-1.0	-1.0	-1.0	-1.0	-0.9	-1.0
Lake Toho	S-61	434	TOHOW, S-61	54.8	R	55.0	-0.2	-0.2	-0.4	-0.4	-0.4	-0.4	-0.6
Lakes Kissimmee, Cypress, and Hatchineha	S-65	301	KUB011, LKISSB	49.4	R	52.5	-3.1	-3.2	-3.1	-3.0	-2.9	-2.8	-2.7

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 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: 12/18/2018

Metric	Location	1-Day Average		Average for the Preceding 7-Days ¹								10/14/18
		12/16/2018	12/16/18	12/9/18	12/2/18	11/25/18	11/18/18	11/11/18	11/4/18	10/28/18	10/21/18	
Discharge (cfs)	S-65	309	301	330	337	346	349	336	350	480	1,592	1,559
Discharge (cfs)	S-65A ²	164	180	252	232	254	256	252	288	383	1,394	1,382
Discharge (cfs)	S-65D ²	253	253	298	276	315	321	360	404	1,024	1,461	1,521
Headwater Stage (feet NGVD)	S-65D ²	25.96	25.80	25.84	25.82	26.20	26.66	27.15	27.62	27.69	27.78	27.89
Discharge (cfs)	S-65E ²	183	242	292	302	335	317	370	405	1,058	1,535	1,598
Discharge (cfs)	S-67	0	0	0	0	0	0	0	0	0	0	0
DO (mg/L) ³	Phase I river channel	4.1	4.3	5.1	5.9	5.5	5.7	5.2	5.3	4.3	4.6	4.7
Mean depth (feet) ⁴	Phase I floodplain	0.11	0.10	0.10	0.12	0.10	0.13	0.22	0.22	0.36	0.52	0.56

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

²S-65A discharge combines S-65A with auxillary structures; S-65D discharge combines discharge at S-65D, S-65DX1, and S-65DX2; S-65D stage averages stage at S-65D and S-65DX1; S-65E discharge combines S-65E and S-65EX1.

³DO is the average for sondes at PC62 and PC33.

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

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

KCOL Hydrographs (through Sunday midnight)

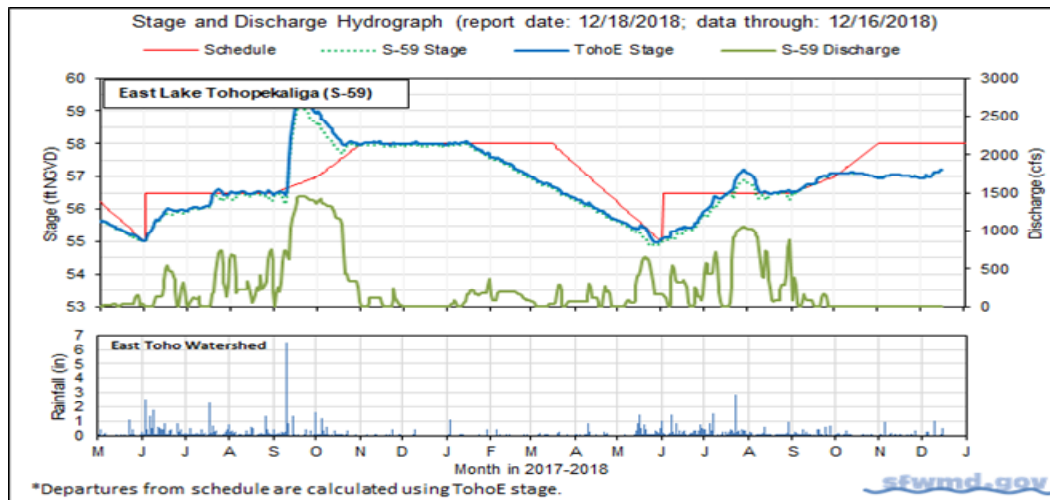


Figure 1.

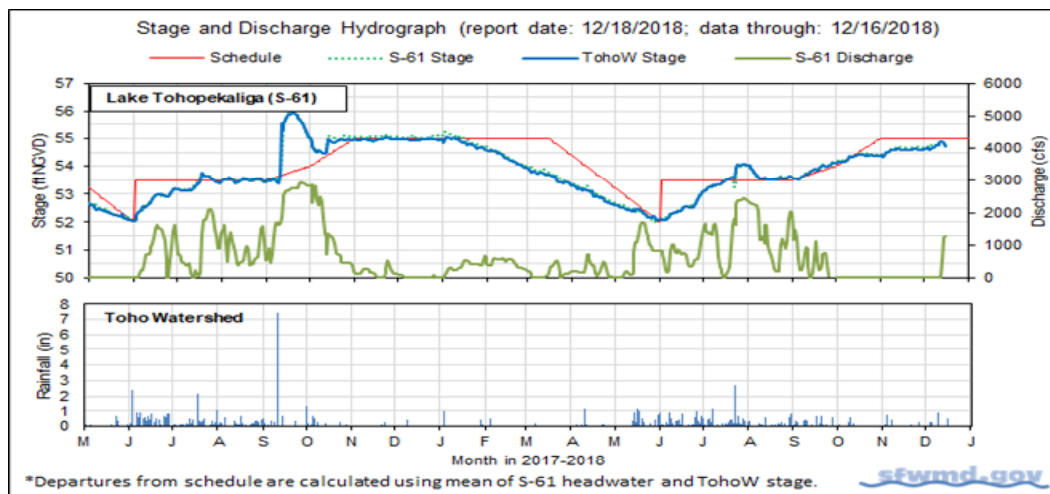


Figure 2.

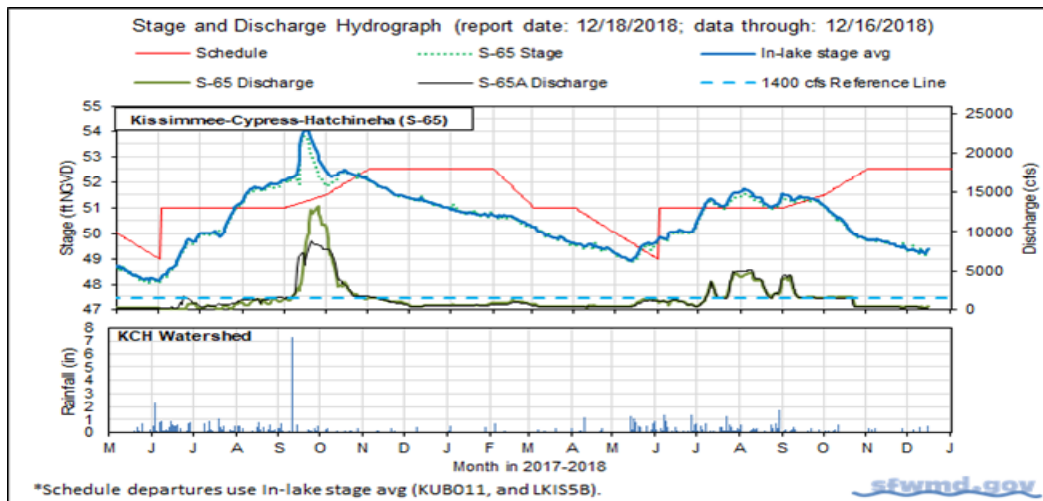


Figure 3.

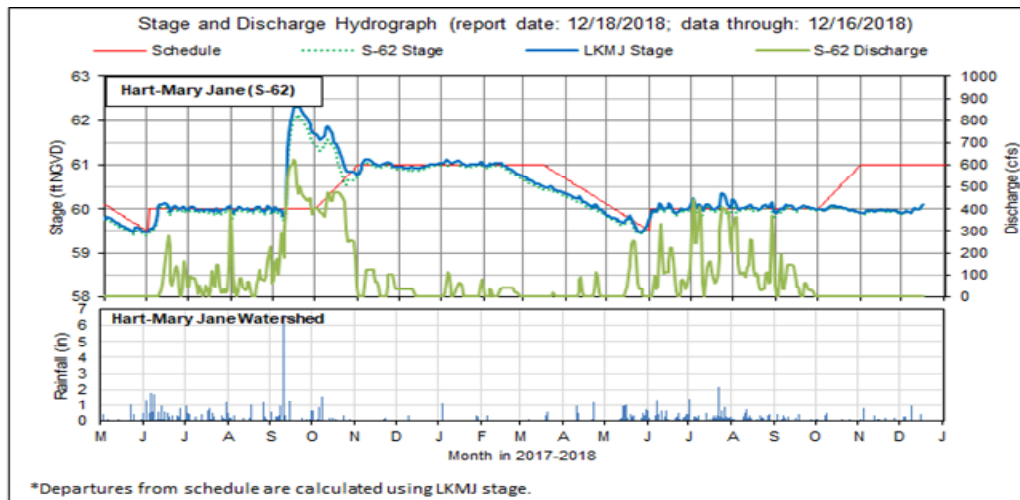


Figure 4.

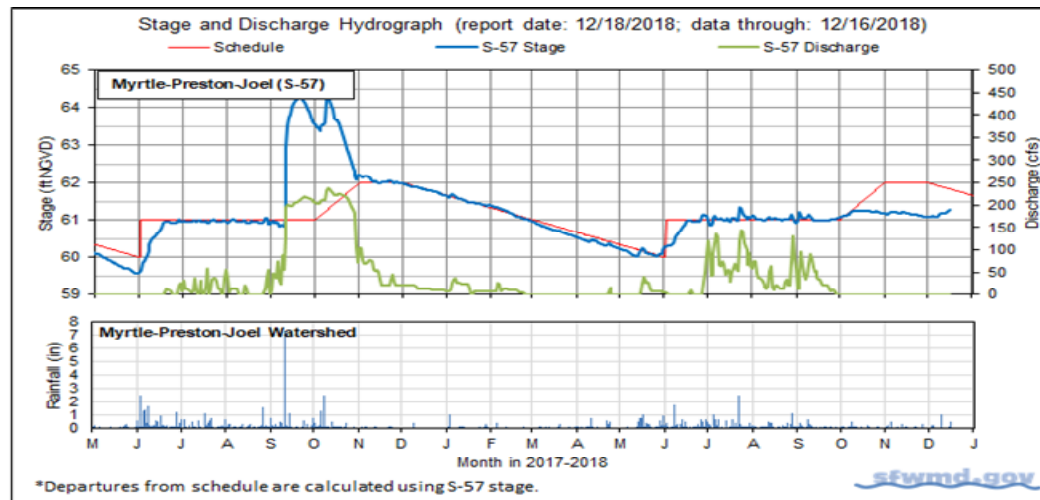


Figure 5.

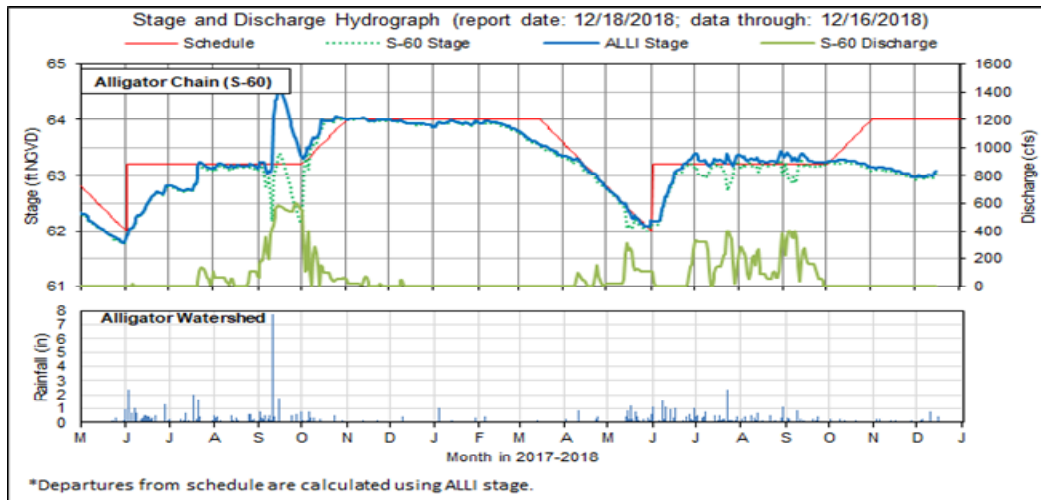


Figure 6.

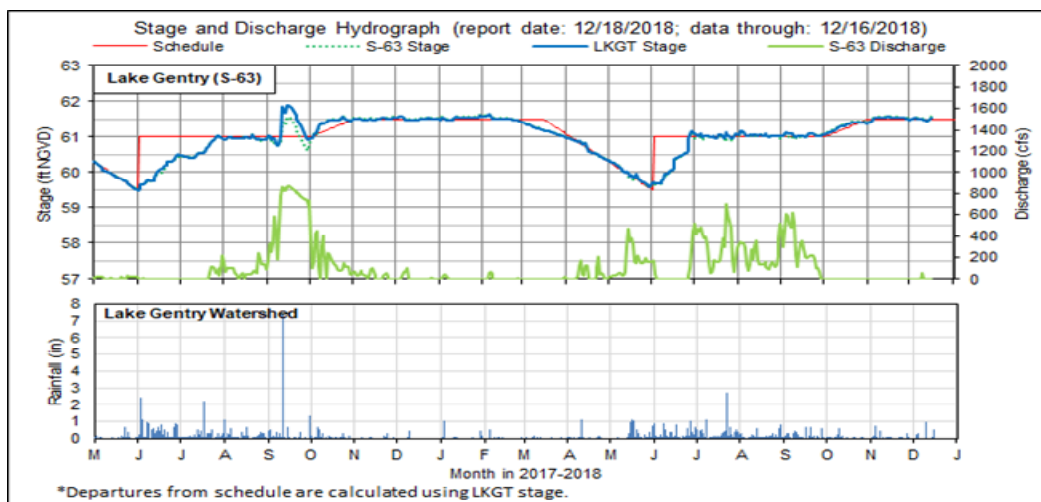


Figure 7.

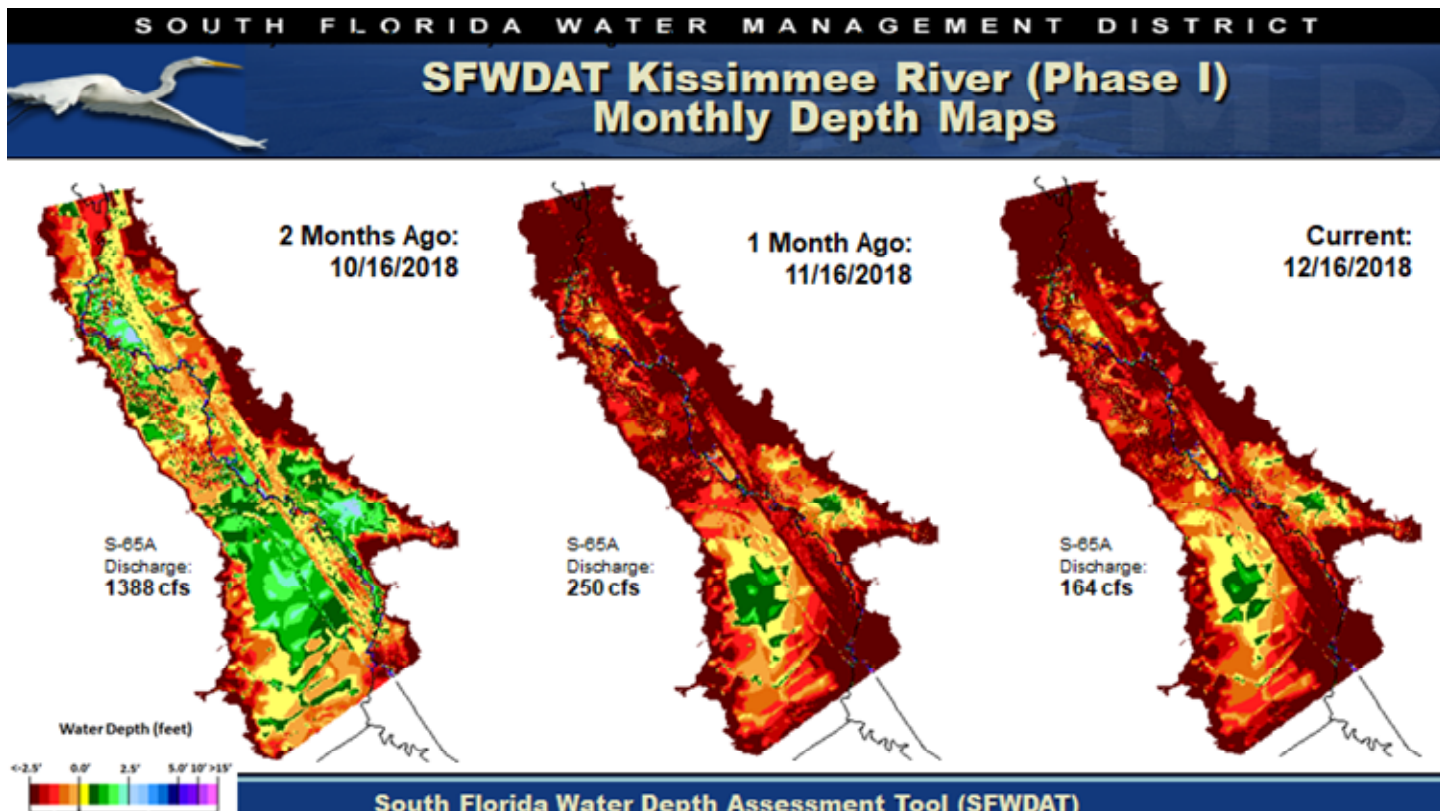


Figure 8. Phase I area floodplain water depths for this week, one month ago, and two months ago. Note that the WDAT color-coding has been modified to accommodate greater water depths; these maps are not directly comparable to Kissimmee Basin WDAT maps published prior to January 16, 2012.

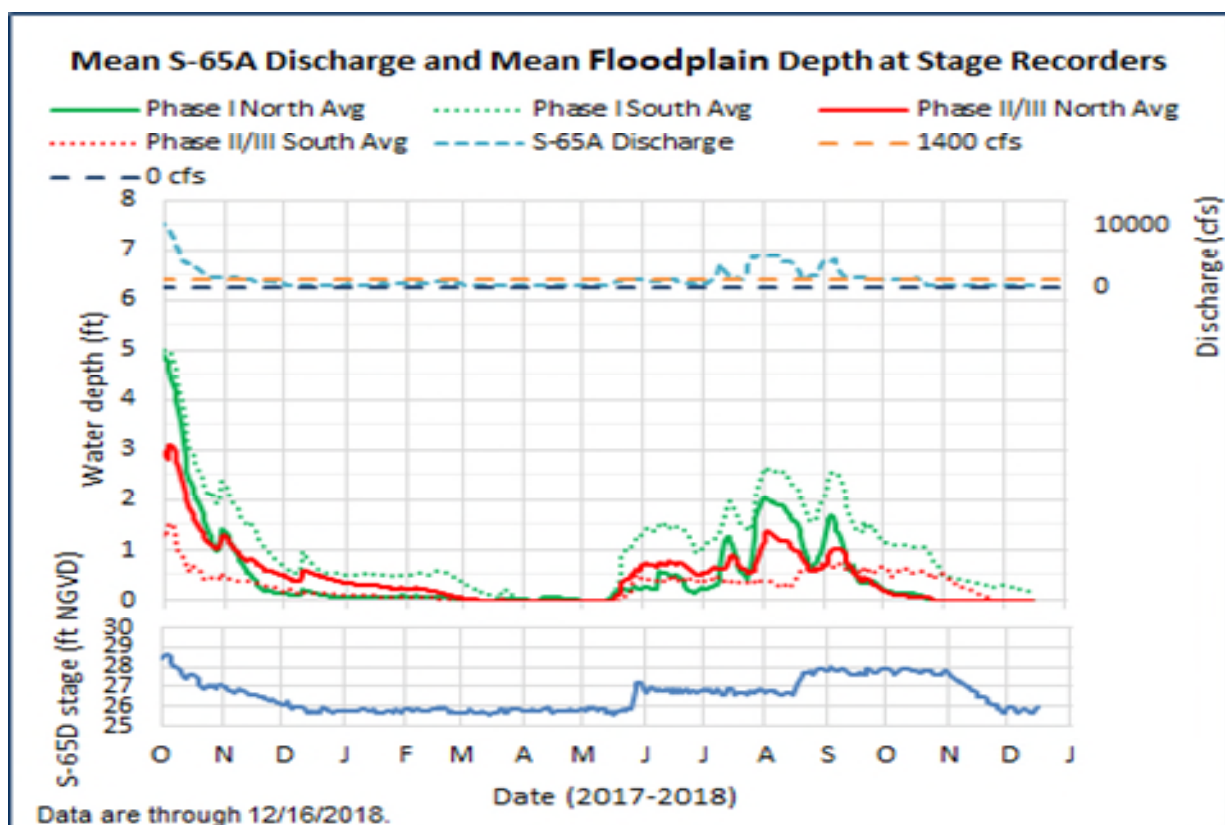
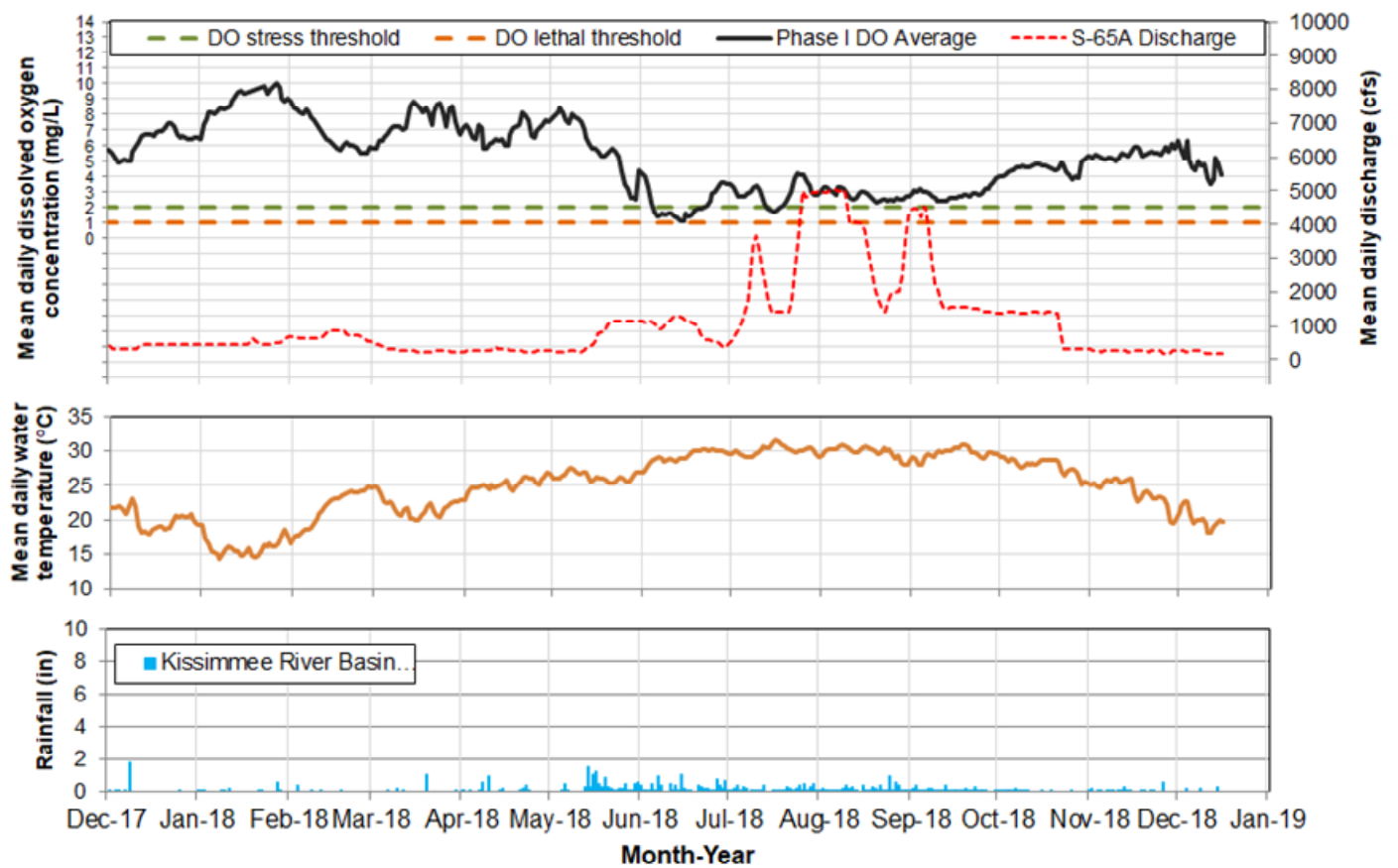


Figure 9. Mean water depth at stage recorders in the northern Phase I, southern Phase I, northern Phase II/III, and southern Phase II/III areas in relation to the S-65A discharge and S-65D headwater stage.



Report Date: 12/18/2018; data are through: 12/16/2018.

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

Water Management Recommendations

Recommendation Date	Recommendation	Purpose	Outcome	Source	Report Date
12/14/2018	Manage S-61 discharge to reduce stage in Lake Toho to 54 ft over the next 7-9 days.	Move water to KCH to reduce the rate of stage decline in KCH; reduce the head difference between S-61 headwater and tailwater.	N/A	SFWMD Water Mgt/KB Ops	12/18/2018
12/10/2018	Reduce S-65A discharge to 180 cfs.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	N/A	SFWMD Water Mgt/KB Ops	12/11/2018
12/3/2018	No new recommendations.		N/A		12/4/2018
11/26/2018	No new recommendations.		N/A		11/27/2018
11/19/2018	No new recommendations.		N/A		11/20/2018
11/12/2018	No new recommendations.		N/A		11/13/2018
11/2/2018	Reduce S-65/S-65A discharge to approximately 250 cfs.	To conserve stage in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	11/6/2018
10/30/2018	No new recommendations.		N/A		10/30/2018
10/22/2018	Reduce S-65/S-65A discharge to approximately 300 cfs (minimum discharge) in one step of approximately 1100 cfs today.	Reduce rate of stage decline in lakes Kissimmee-Cypress-Hatchineha	Implemented	SFWMD Water Mgt/KB Ops	10/23/2018
10/16/2018	No new recommendations.		N/A		10/16/2018
10/9/2018	No new recommendations.		N/A		10/9/2018
10/2/2018	No new recommendations.		N/A		10/2/2018
9/25/2018	No new recommendations.		N/A		9/25/2018
9/18/2018	No new recommendations.		N/A		9/18/2018
9/11/2018	No new recommendations.		N/A		9/11/2018
9/4/2018	No new recommendations.		N/A		9/4/2018
8/28/2018	No new recommendations.		N/A		8/28/2018
8/21/2018	No new recommendations.		N/A		8/21/2018
8/14/2018	No new recommendations.		N/A		8/14/2018
8/7/2018	No new recommendations.		N/A		8/7/2018
7/23/2018-7/24/2018	Increase discharge from 1400 cfs to 3000 cfs, then 3200 cfs and 3500 cfs.	For flood control in Lake Kissimmee.	Implemented	SFWMD Water Mgt/KB Ops	7/31/2018
7/19/2018	Follow Revised (X2) 2018 Wet Season Discharge Plan to the extent possible, including 50 foot stage threshold and 0.5 foot flood control buffer.	To the extent possible, maintain sufficient discharge to keep areas under snail kites nests in Pool D hydrated until nests fledge, while avoiding large increases in discharge that might flood the nests.	N/A	KB Ops	7/24/2018
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.	Stabilize 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.	Stabilize 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 .	Stabilize 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).	Stabilize 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 ascension 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

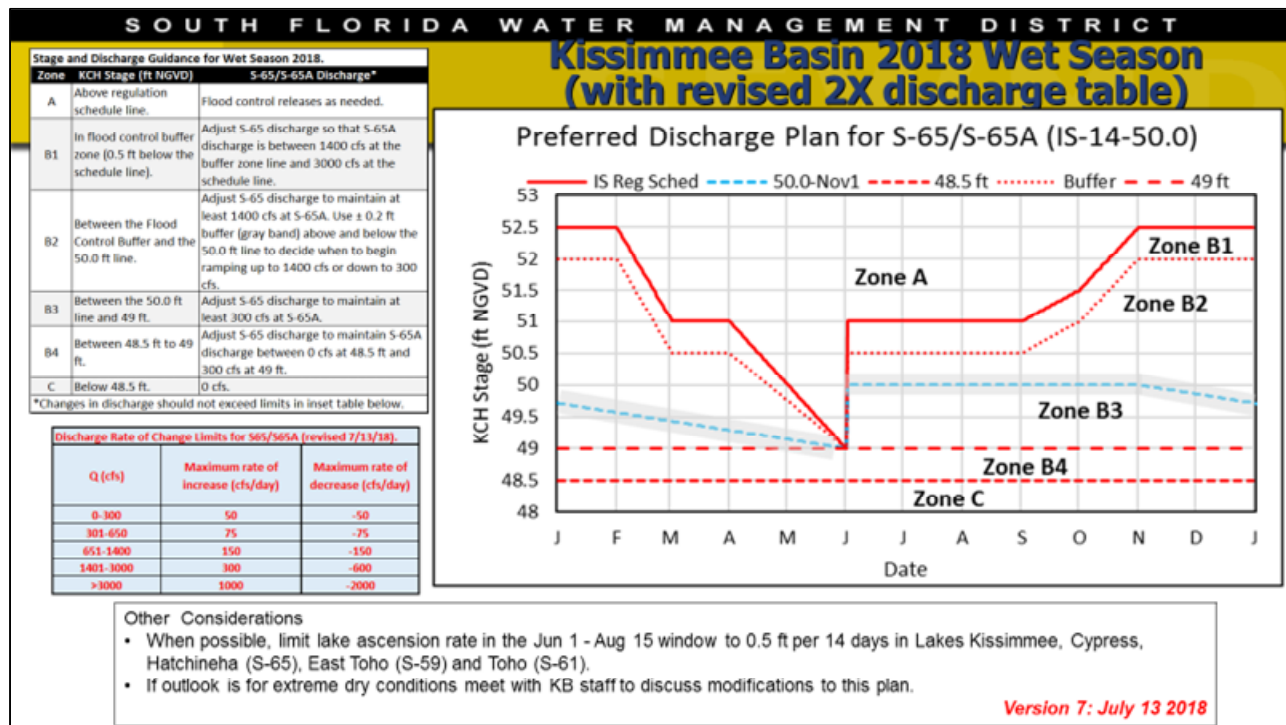


Figure 11. The 2018 Wet Season Discharge Plan for S-65/S-65A.

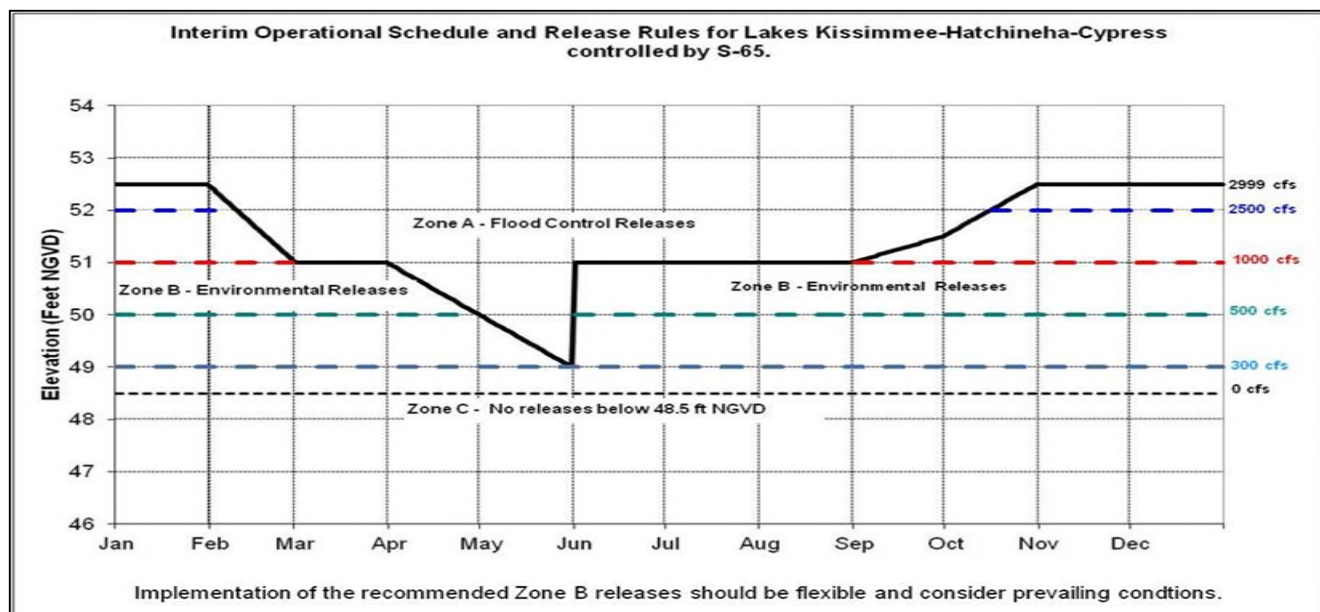


Figure 12. Interim operations schedule for S-65. The discharge schedule shown to the right has not been used in recent years.

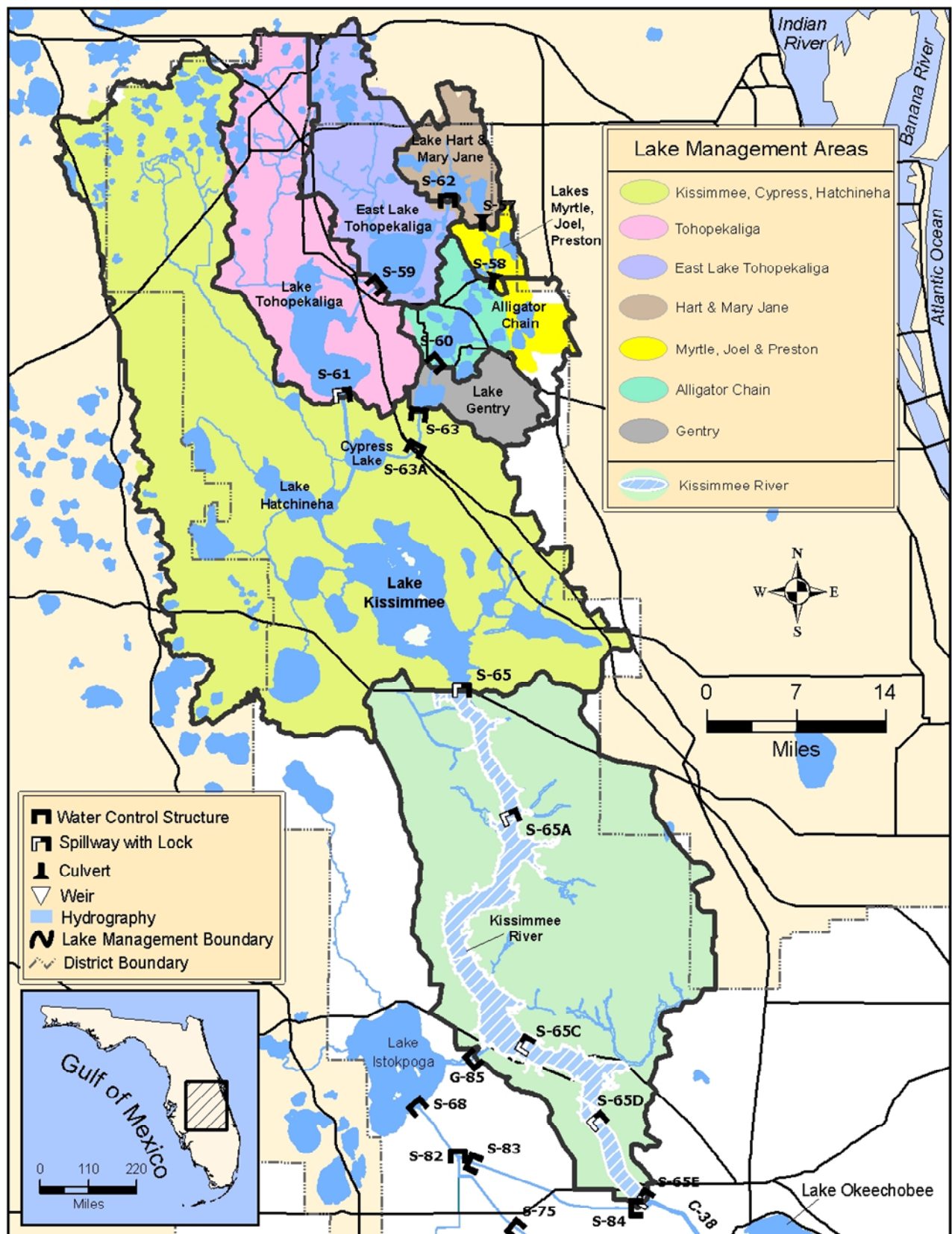


Figure 13. The Kissimmee Basin.

Water Management Recommendations

LAKE OKEECHOBEE

According to the USACE web site, Lake Okeechobee stage is at 12.75 feet NGVD for the period ending at midnight on December 17, 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 0.62 feet lower than it was a month ago and 2.98 feet lower than a year ago when runoff from Hurricane Irma caused extreme high lake stages (Figure 1). The Lake is in the Base-Flow sub-band (Figure 2). The December 17 lake stage was the lowest for this time of year since 2010 (Figure 3). According to RAINДАР, 0.25 inches of rain fell over the Lake during the week December 11, 2018 – December 17, 2018. Most of the northern portion of the watershed received more rainfall, between 0.5 and 1.0 inches, while the southern portion of the watershed received slightly less than (0 - 0.25 inches) (Figure 4).

Average daily inflows (minus rainfall) to the Lake were similar to the previous week, going from 327 cfs to 271 cfs, almost entirely from the Kissimmee River.

Total outflows (minus evapotranspiration) decreased from the previous week, going from 2,855 average daily cfs the previous week to 2,318 cfs this past week (Table 1). The decrease in outflows was primarily in discharges south through the S-351 structure and west via S-77. Flows south through the S-350s went from 1,679cfs the previous week to 1,397 cfs this past week. Outflows via the S-77 decreased slightly from 1,038 cfs the previous week to 890 average daily cfs this past week. Flows through the S-308 have been passive flows through the navigation lock and/or structure and averaged a backflow of -125 cfs. The corrected average daily evapotranspiration value for the week based on the L006 weather platform solar radiation remained the same at 0.06 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 (December 15) using the cyanobacteria monitoring product derived from NOAA's analysis of EUMETSAT's OLCI satellite sensor showed bloom potential is low for most of the lake, continuing the trend of gradually reducing potential over the past several weeks (Figure 6).

Water Management Recommendations

Lake Okeechobee stage is 12.75 feet NGVD, falling 0.12 feet from the previous week and 0.62 feet over the past 30 days. Lake stages are the lowest they have been for this time of year since 2010 and are now 1.75 feet below the bottom of the preferred ecological envelope, which varies seasonally from 12.5 – 15.5 feet NGVD. Given potential for heavy rainfall associated with El Niño conditions this winter and the poor condition of SAV and EAV in the nearshore zone, these lower lake stages are ideal. Recovery of vegetation in the nearshore zone from Hurricane Irma impacts and 2016 El Niño-associated rainfall will require lake stages in the lower portion of the ecological envelope or lower for extended periods, so efforts to prepare for such an event will help speed the rebound of this important community. However, low stages also encourage expansion of invasive vegetation in the upper marsh and temporarily reduce the quantity and quality of habitat for fish and wildlife.

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	293	240	0.1
S71 & 72	6	3	0.0
S84 & 84X	0	7	0.0
Fisheating Creek	20	22	0.0
S154	0	0	0.0
S191	0	0	0.0
S133 P	0	0	0.0
S127 P	0	0	0.0
S129 P	8	0	0.0
S131 P	0	0	0.0
S135 P	0	0	0.0
S2 P	0	0	0.0
S3 P	0	0	0.0
S4 P	0	0	0.0
L8 Backflow			
Rainfall	1479	556	0.2
Total	1806	827	0.4

OUTFLOWS	Previous Week Avg Daily cfs	Avg Daily Outflow cfs	Equivalent Depth Week Total (in)
S77	1038	890	0.4
S308	-51	-125	-0.1
S351	833	550	0.2
S352	531	544	0.2
S354	315	303	0.1
L8 Outflow	190	157	0.1
ET	909	1030	0.5
Total	3764	3348	1.5

PROVISIONAL DATA

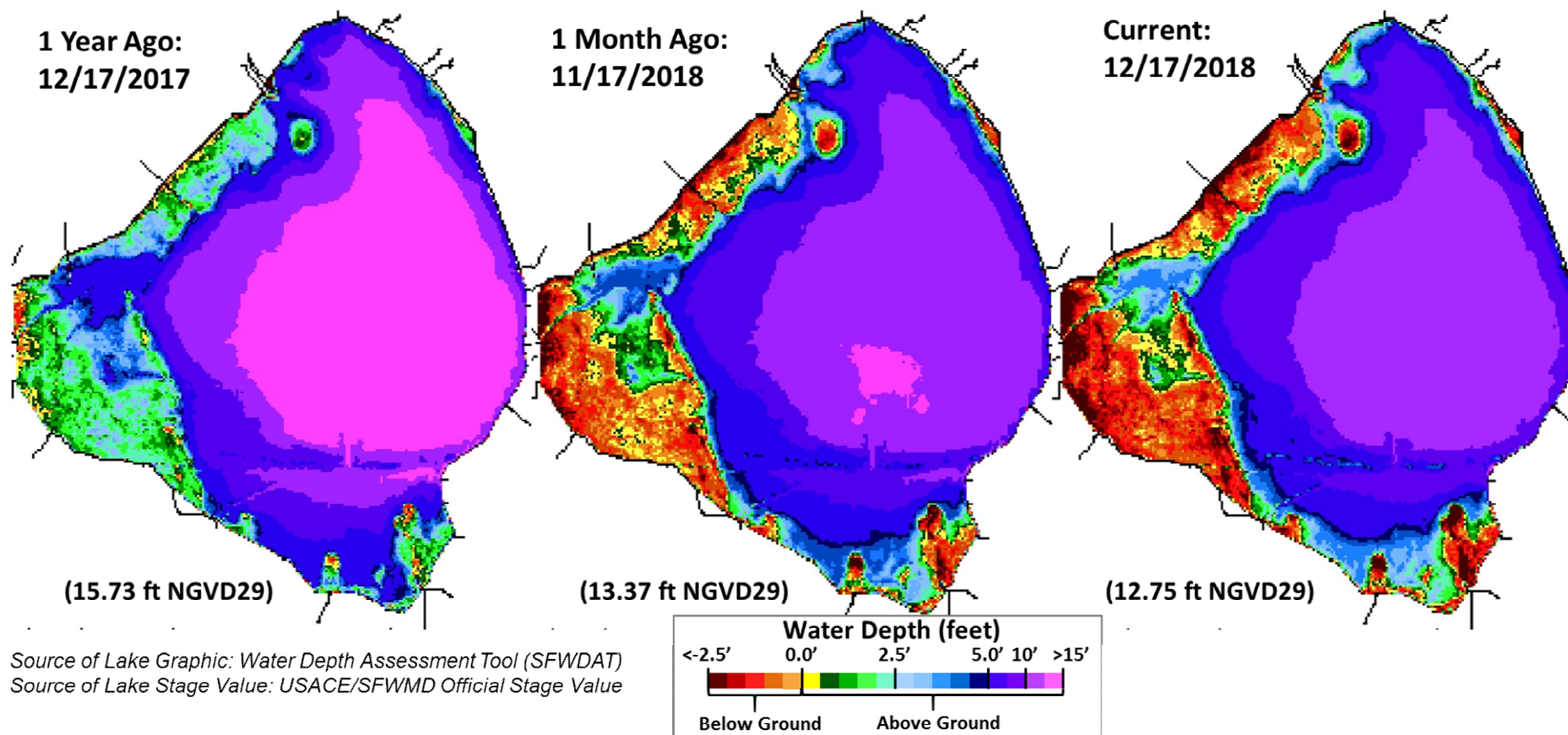


Figure 1. Water depth estimates on Lake Okeechobee based on the South Florida Water Depth Assessment Tool.

Lake Okeechobee Water Level History and Projected Stages

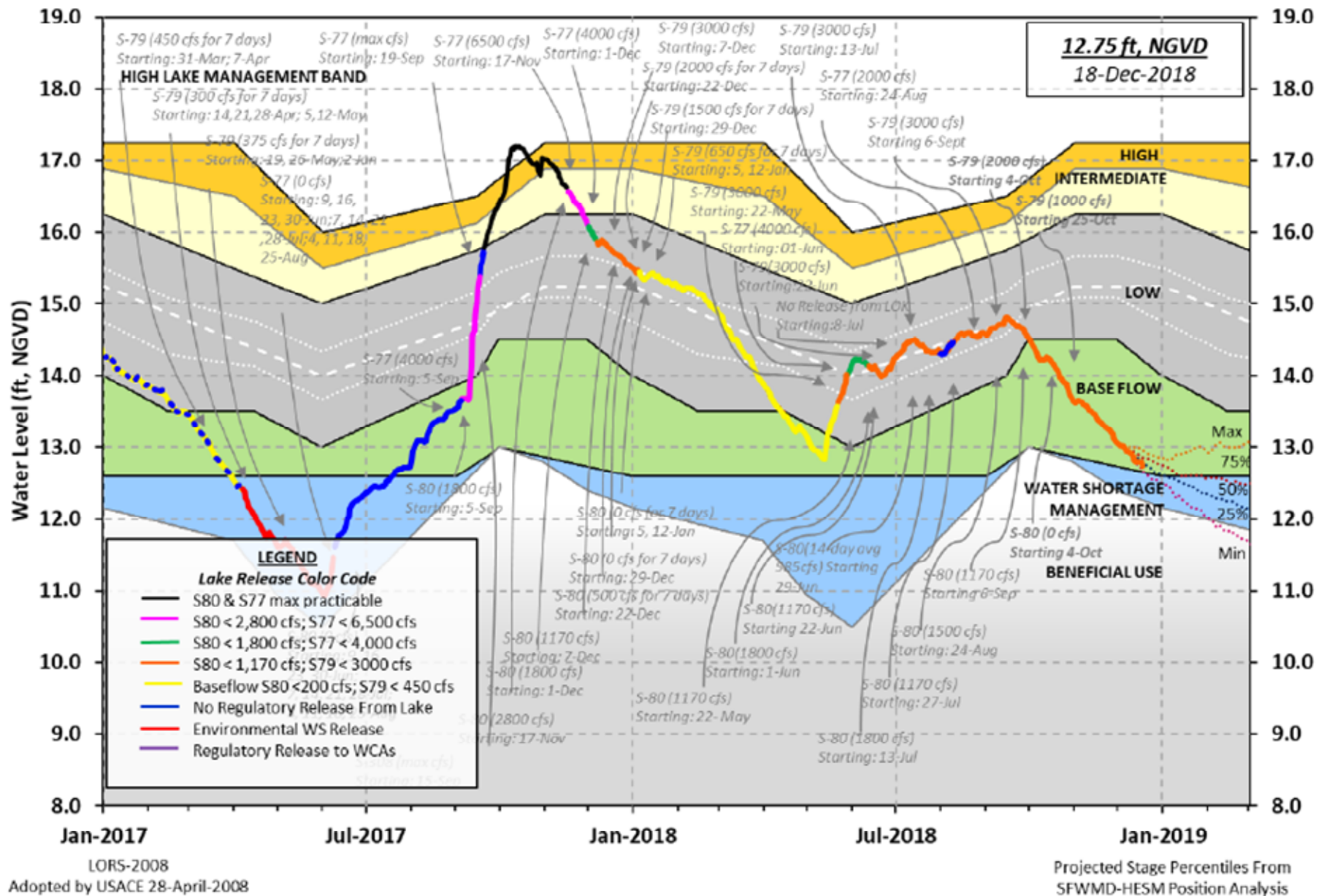


Figure 2. Recent Lake Okeechobee stage and releases, with projected stages based on a dynamic position analysis.

Lake Okeechobee Water Level Comparison

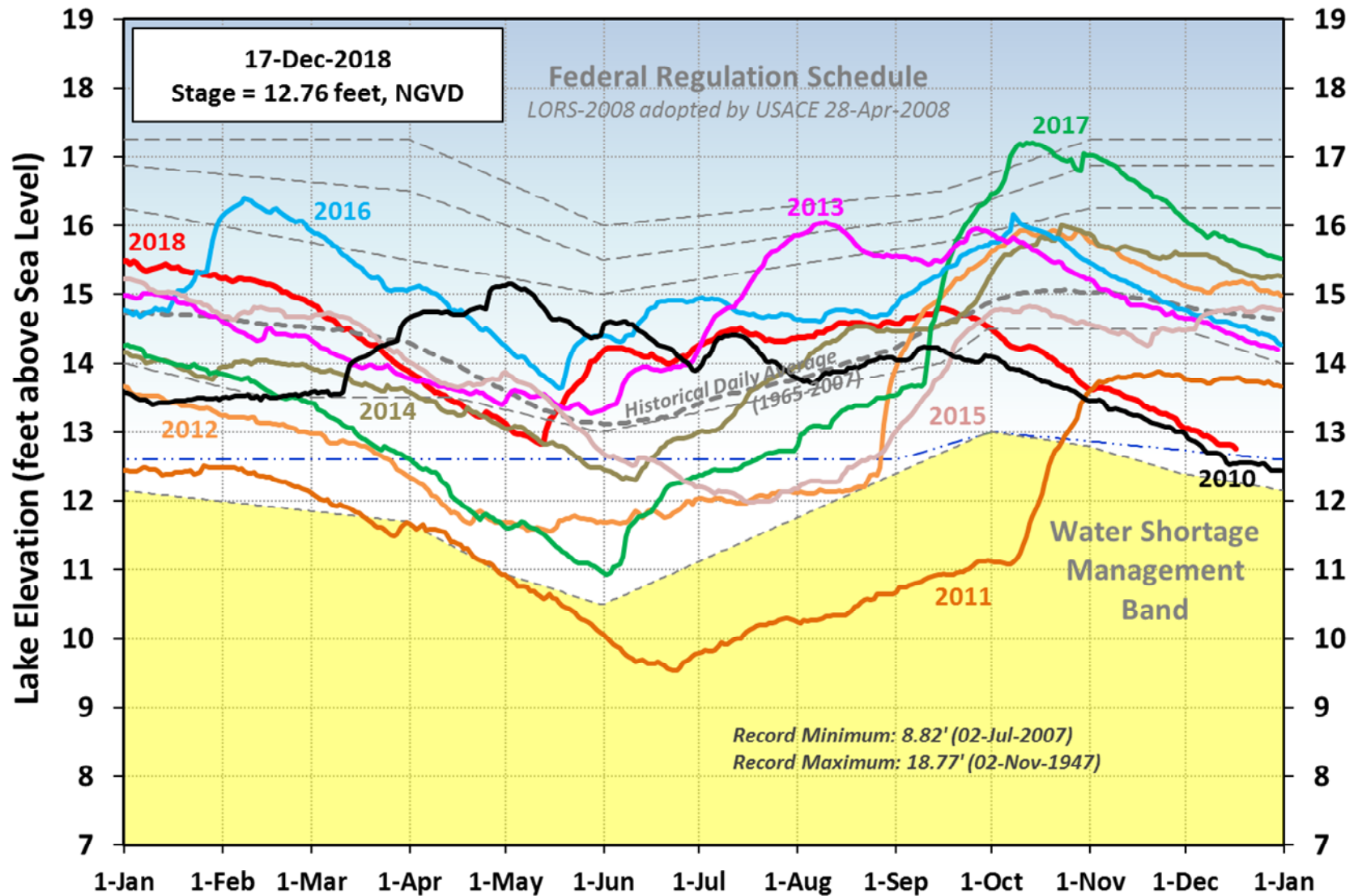


Figure 3. Annual stage hydrographs for Lake Okeechobee from 2010 – 2018.

SFWMD PROVISIONAL RAINDAR 7-DAY BASIN RAINFALL ESTIMATES

FROM: 0330 EST, 12/11/2018 THROUGH: 0330 EST, 12/18/2018

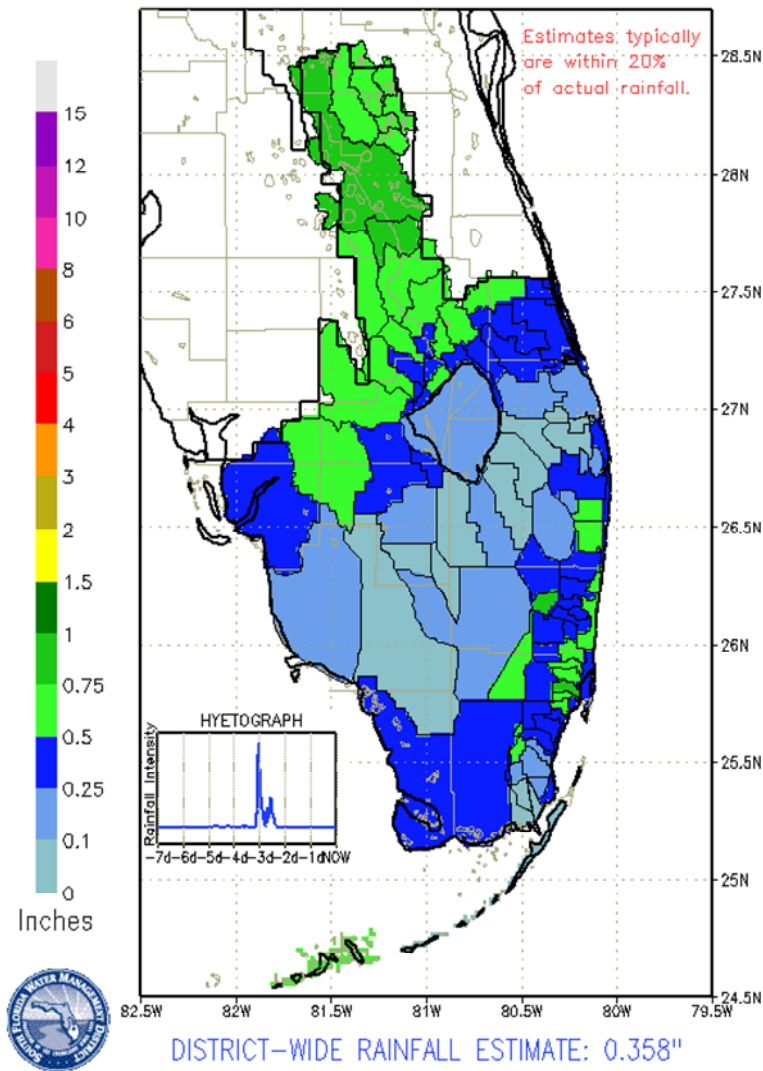


Figure 4. Rainfall estimates by basin.

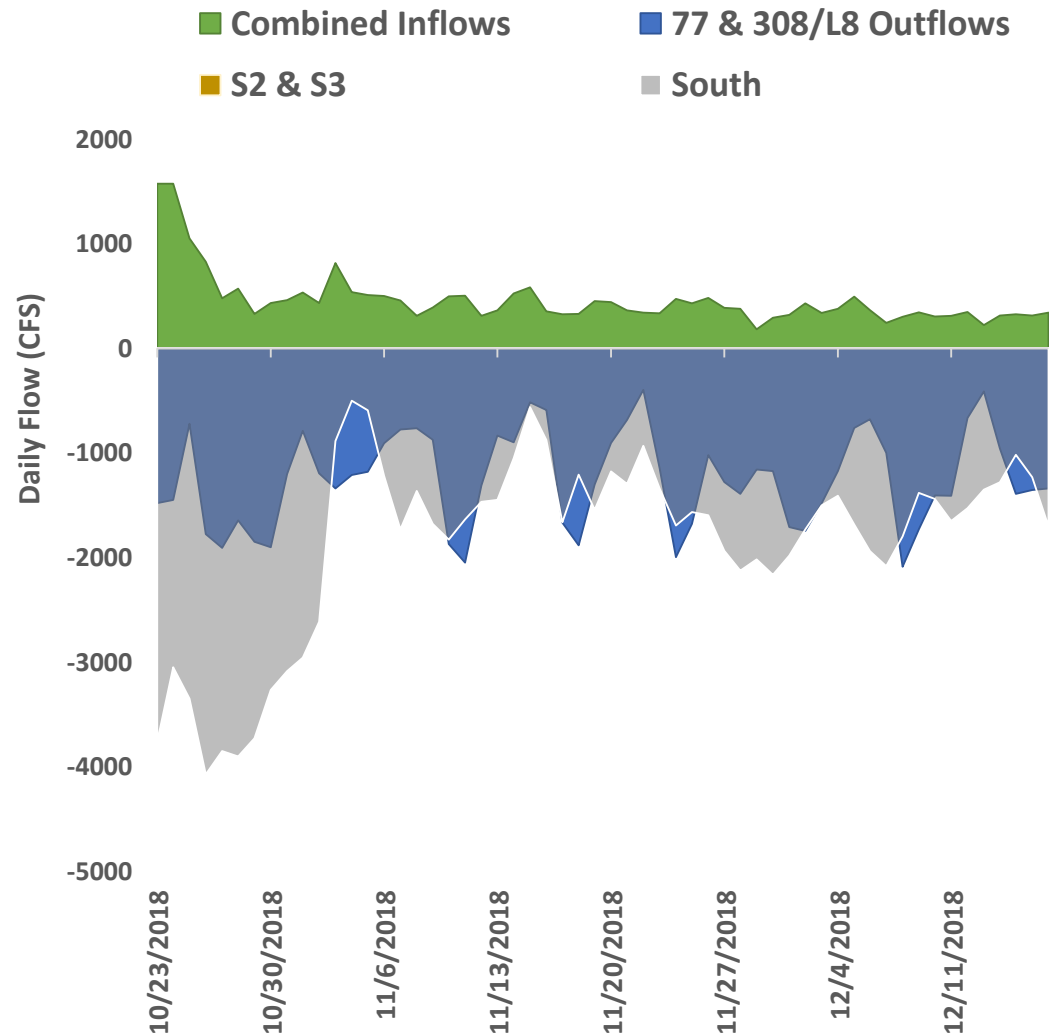


Figure 5. Major inflows (orange) and outflows (green) of Lake Okeechobee, including the S350 structures designated as South (blue). The L8 canal flows through culvert 10A are included as outflows when positive, and as inflows when backflowing into the lake. All inflows and outflows are shown as positive and negative, respectively, for visual purposes.

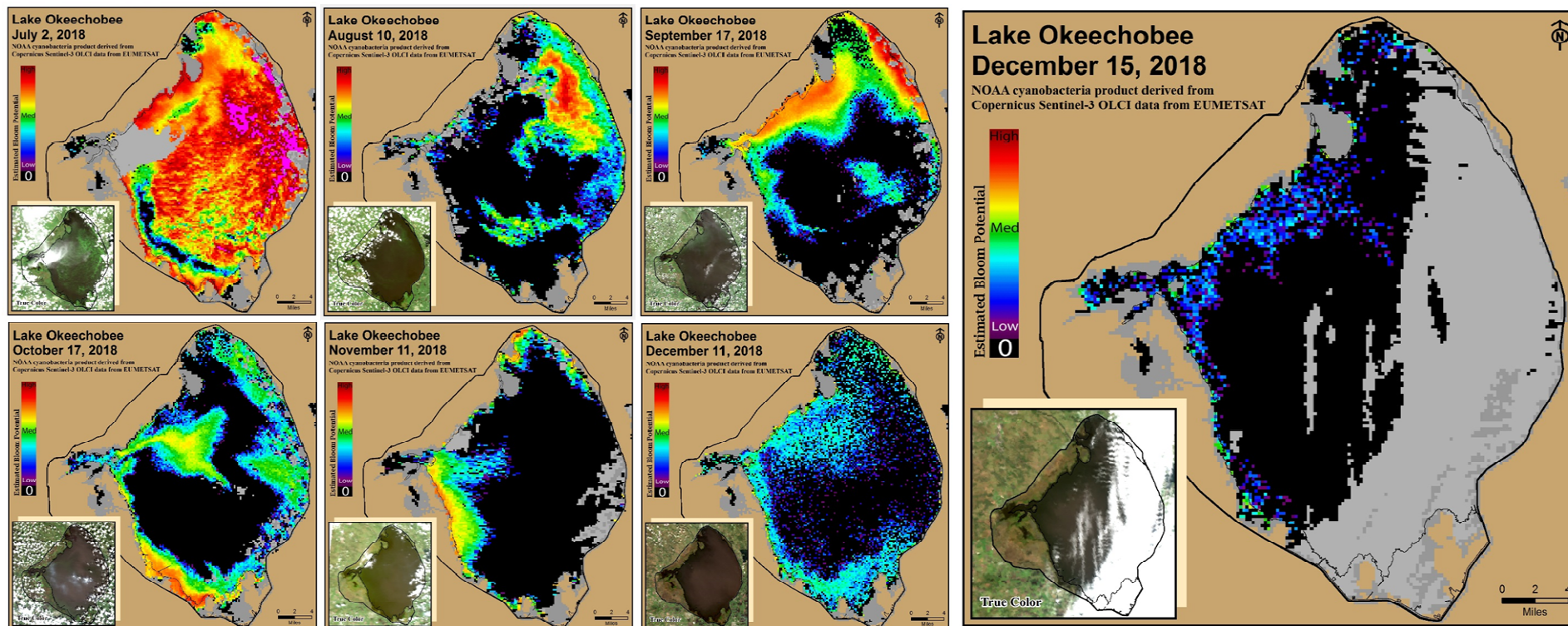


Figure 6. Potential for cyanobacterial blooms on Lake Okeechobee based on NOAA's harmful algal bloom monitoring system derived from Copernicus Sentinel-3 OLCI data from EUMETSAT. Gray indicates cloud cover. All data are experimental and unvalidated at this point in product development.

ESTUARIES

St. Lucie Estuary:

Last week total inflow to the St. Lucie Estuary averaged approximately 191 cfs (Figures 1 and 2) and last month inflow averaged about 189 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	129
S-80	0
S-308	-146
S-49 on C-24	0
S-97 on C-23	0
Gordy Rd. structure on Ten Mile Creek	62

Over the past week, salinity stayed about the same throughout the estuary (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 25.7. 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)	23.1 (22.5)	24.9 (24.6)	NA ¹
US1 Bridge	25.8 (25.6)	25.7 (25.2)	10.0-26.0
A1A Bridge	30.5 (30.5)	31.1 (31.1)	NA ¹

¹Envelope not applicable and ²Not Reporting.

Caloosahatchee Estuary:

Last week total inflow to the Caloosahatchee Estuary averaged approximately 1,026 cfs (Figures 5 and 6) and last month inflow averaged about 1,202 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	841
S-78	584
S-79	928
Tidal Basin Inflow	98

Over the past week in the estuary, salinity increased to Cape Coral and remained about the same downstream (Table 4, Figures 7 & 8). The seven-day average salinity values are estimated to be within the good range for adult eastern oysters at Cape Coral and at Shell Point (Figure 9). Salinity values were not available at Sanibel. The 30-day moving average surface salinity is 2.0 at Val I-75 and 7.2 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)	1.9 (1.0)	2.1 (1.0)	NA ¹
Val I75	1.9 (1.7)	3.9 (2.3)	0.0-5.0 ²
Ft. Myers Yacht Basin	7.1 (6.6)	10.5 (9.5)	NA
Cape Coral	15.1 (15.5)	18.2 (18.1)	10.0-30.0
Shell Point	25.4 (25.9)	26.2 (26.5)	10.0-30.0
Sanibel	NR ³ (NR)	NR (NR)	10.0-30.0

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

Forecast of surface salinity (Table 5 and Figure 10) at Val I-75 for the next two weeks using the autoregression model (Qiu and Wan, 2013) coupled with a linear reservoir model for the tidal basin predicts daily salinity ranging from 3.3 to 5.7 at the end of the next two weeks for pulse release at S-79 ranging from 0 to 650 cfs and Tidal Basin inflows of 220 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	220	5.7	3.1
B	300	220	4.8	3.0
C	375	220	4.4	3.0
D	450	220	4.0	2.9
E	650	220	3.3	2.8

Red tide

The Florida Fish and Wildlife Research Institute reported on December 14, 2018, that *Karenia brevis*, the Florida red tide dinoflagellate, was observed at background to low concentrations in three samples collected from and offshore of Lee County and was not observed in samples collected from Palm Beach, Broward, or Miami-Dade counties. No samples were collected from St. Lucie or Martin counties.

Water Management Recommendations

Lake stage is in the Base Flow sub-band of 2008 LORS. Tributary hydrological conditions are dry. The 2008 LORS recommends up to 450 cfs at S-79 and up to 200 cfs at 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.

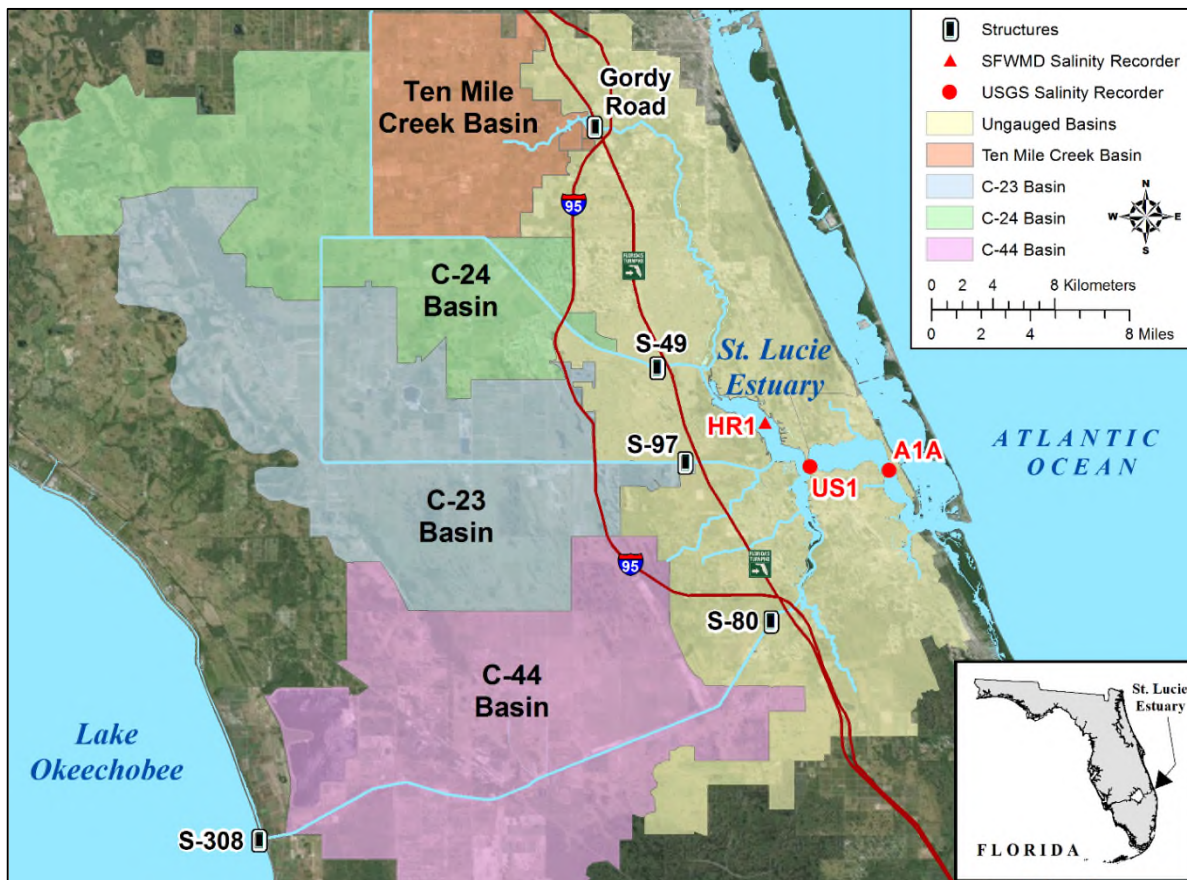


Figure 1. Basins, water control structures, and salinity monitoring for the St. Lucie Estuary.

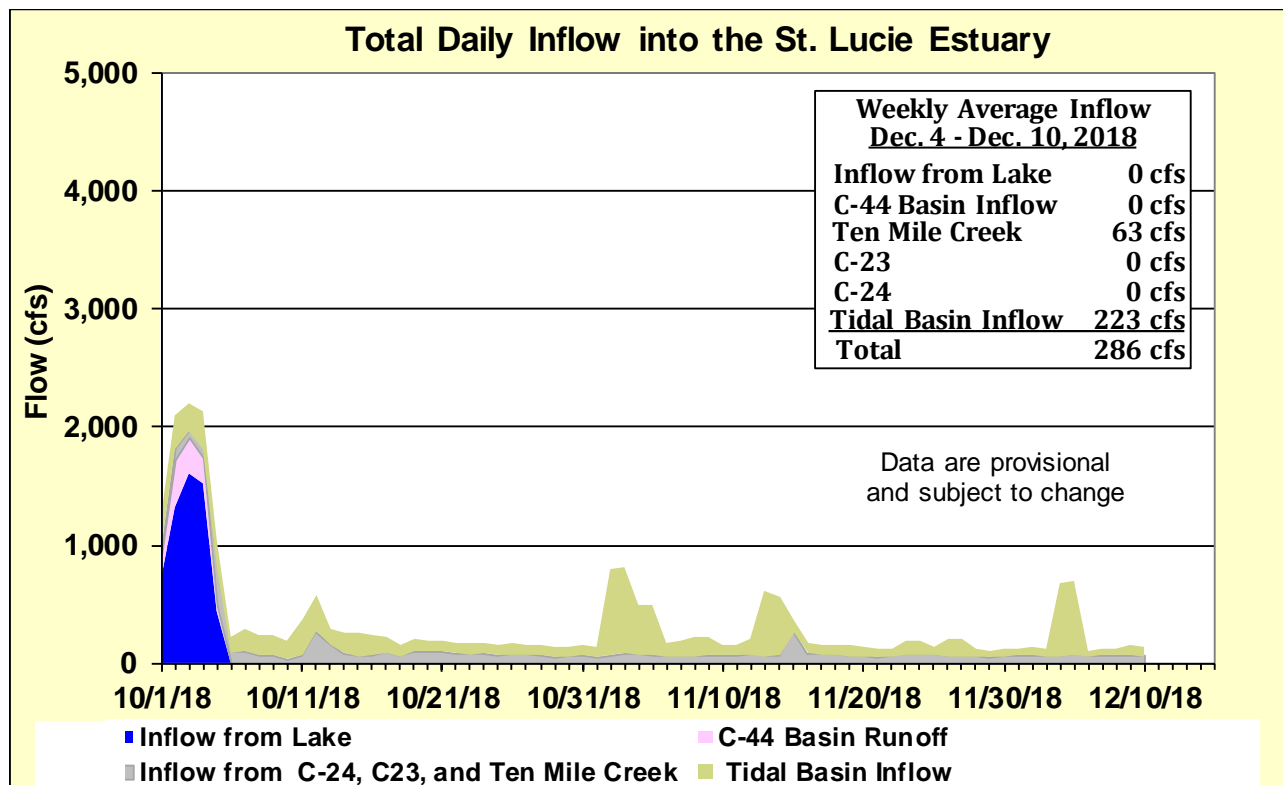


Figure 2. Total daily inflows from Lake Okeechobee and runoff from the C-44, C-23, C-24, Ten Mile Creek, and tidal basins into the St. Lucie Estuary.

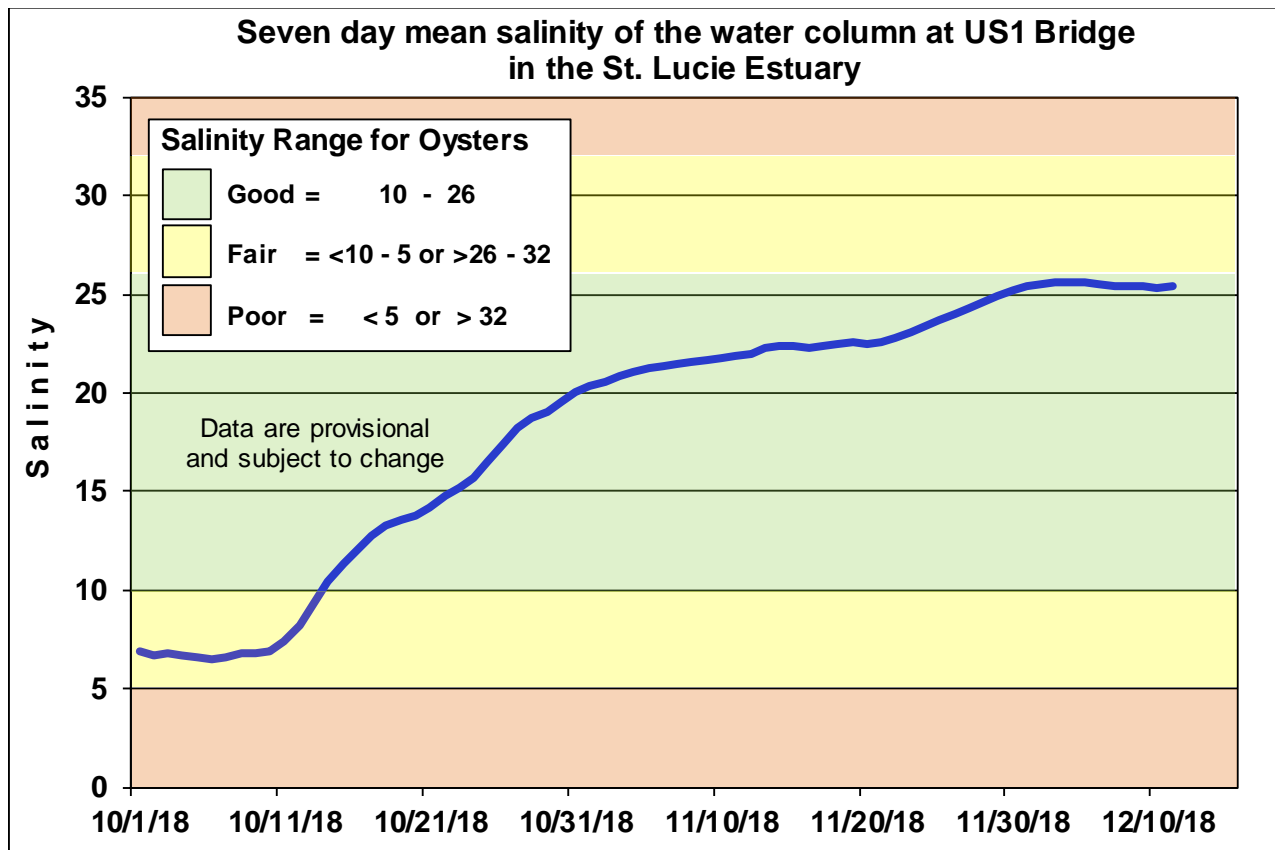


Figure 3. Seven-day mean salinity of the water column at the US1 Bridge.

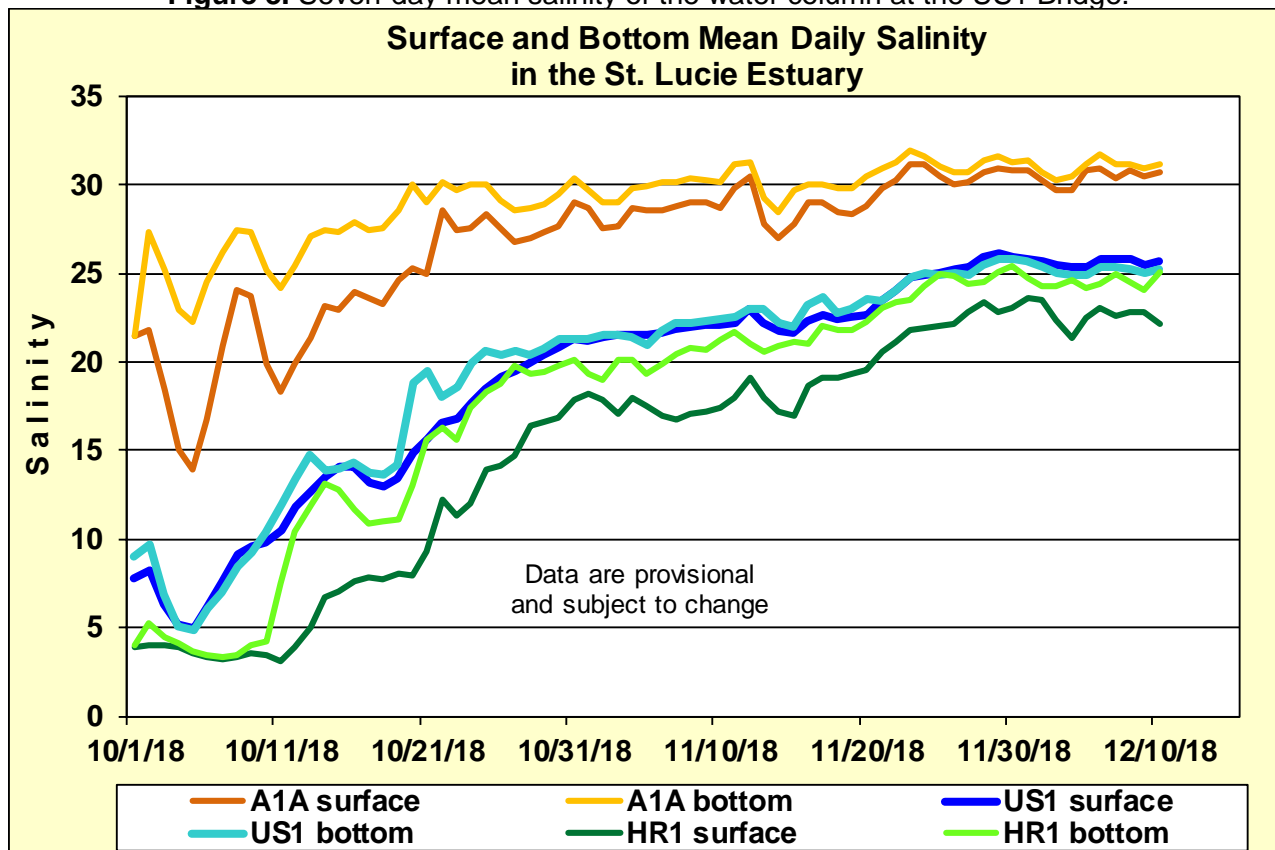


Figure 4. Daily mean salinity at the A1A, US1 and estimated HR1 stations.

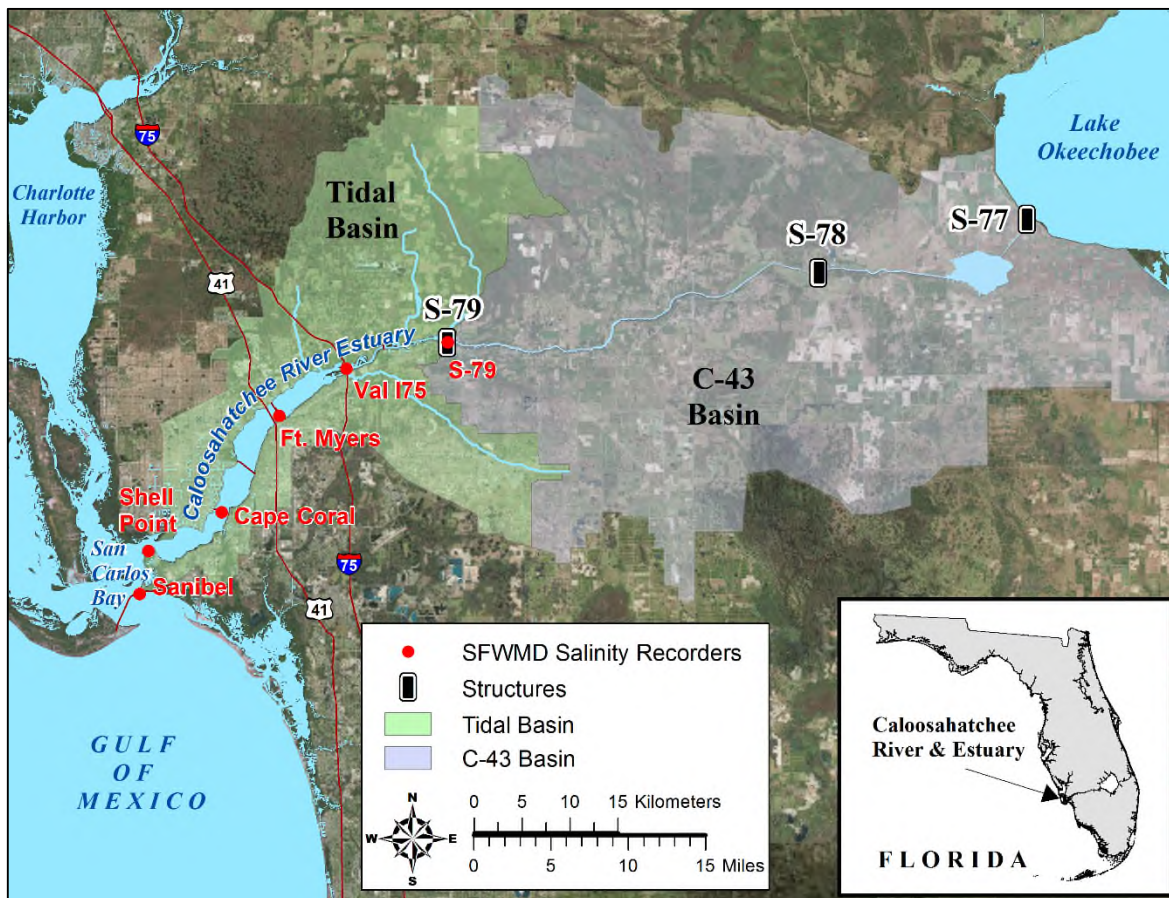


Figure 5. Basins, water control structures, and salinity monitoring for the Caloosahatchee Estuary.

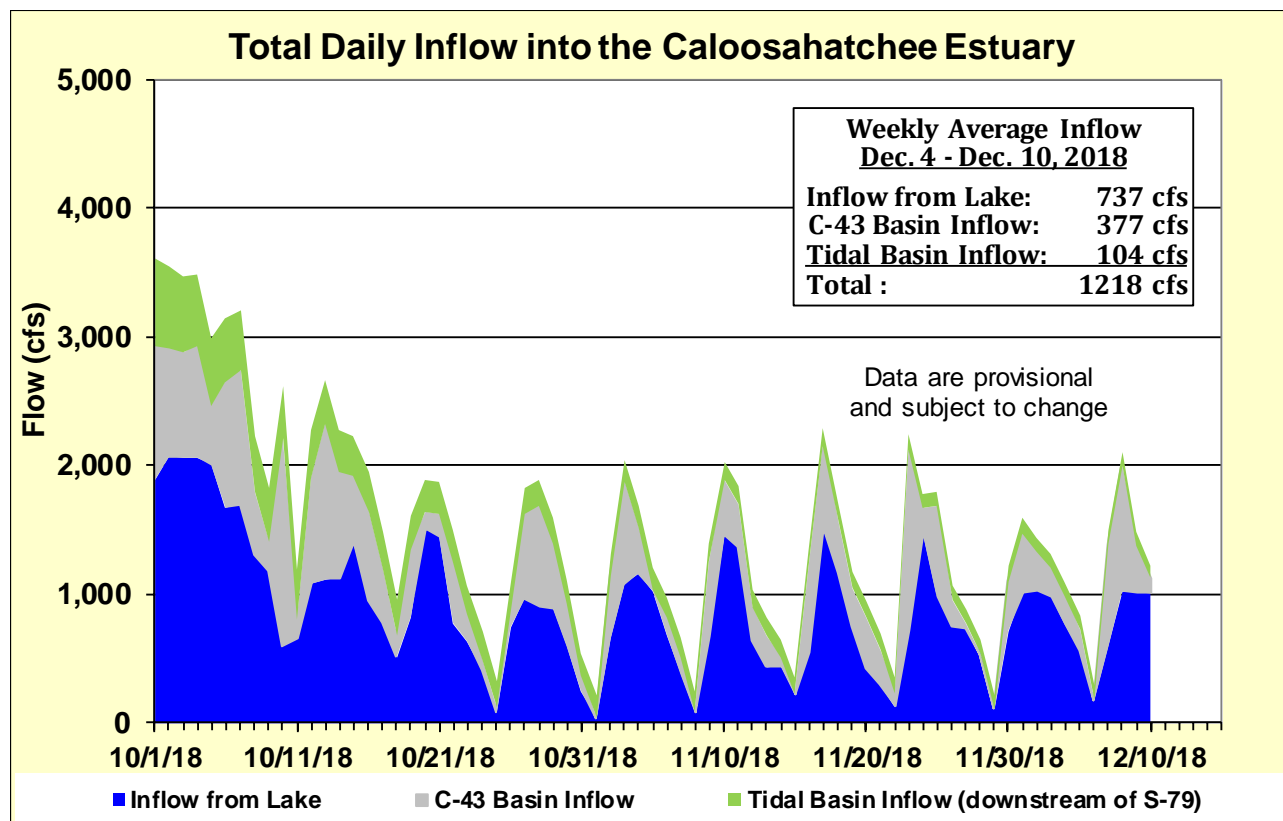


Figure 6. Total daily inflows from Lake Okeechobee, runoff from the C-43 basin, and tributaries in the tidal basin into the Caloosahatchee River Estuary.

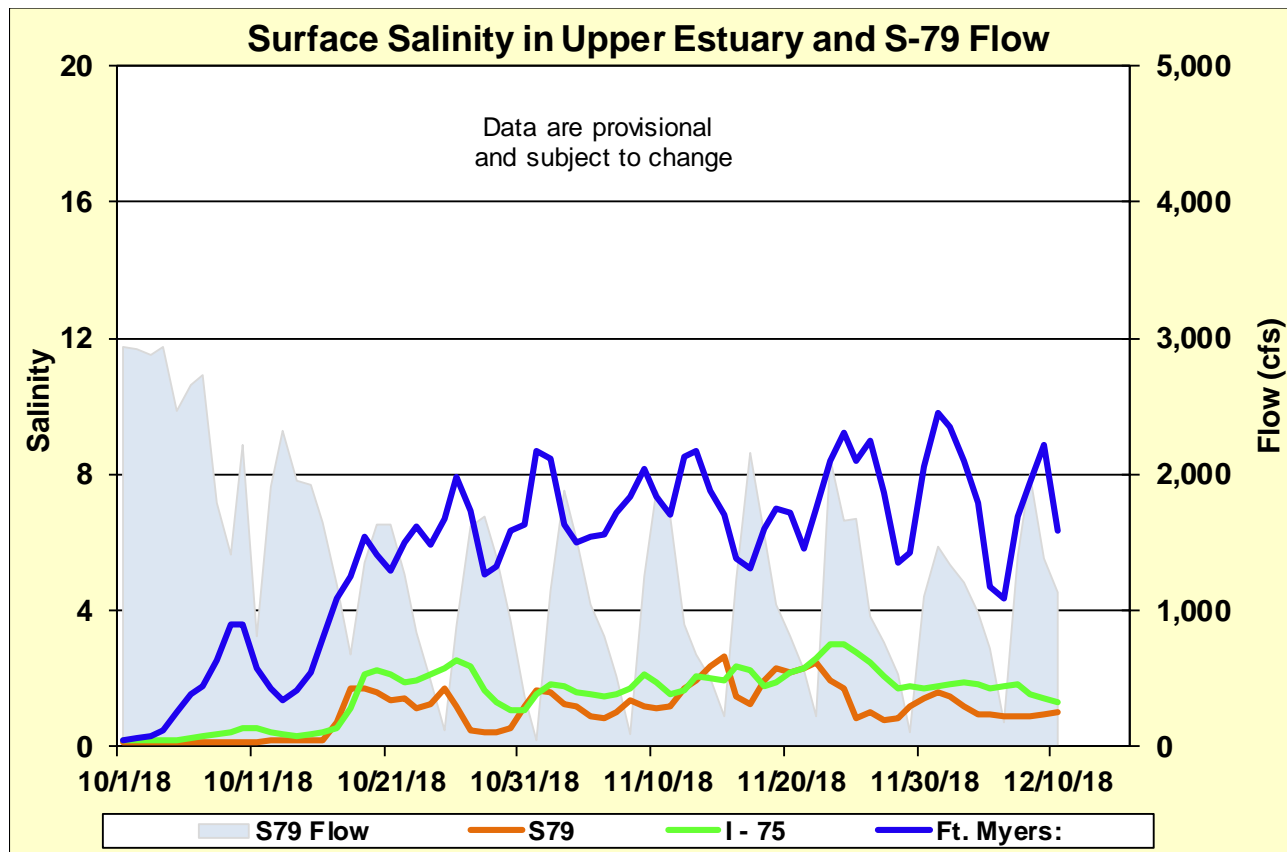


Figure 7. Daily mean flows at S-79 and salinity at upper estuary monitoring stations.

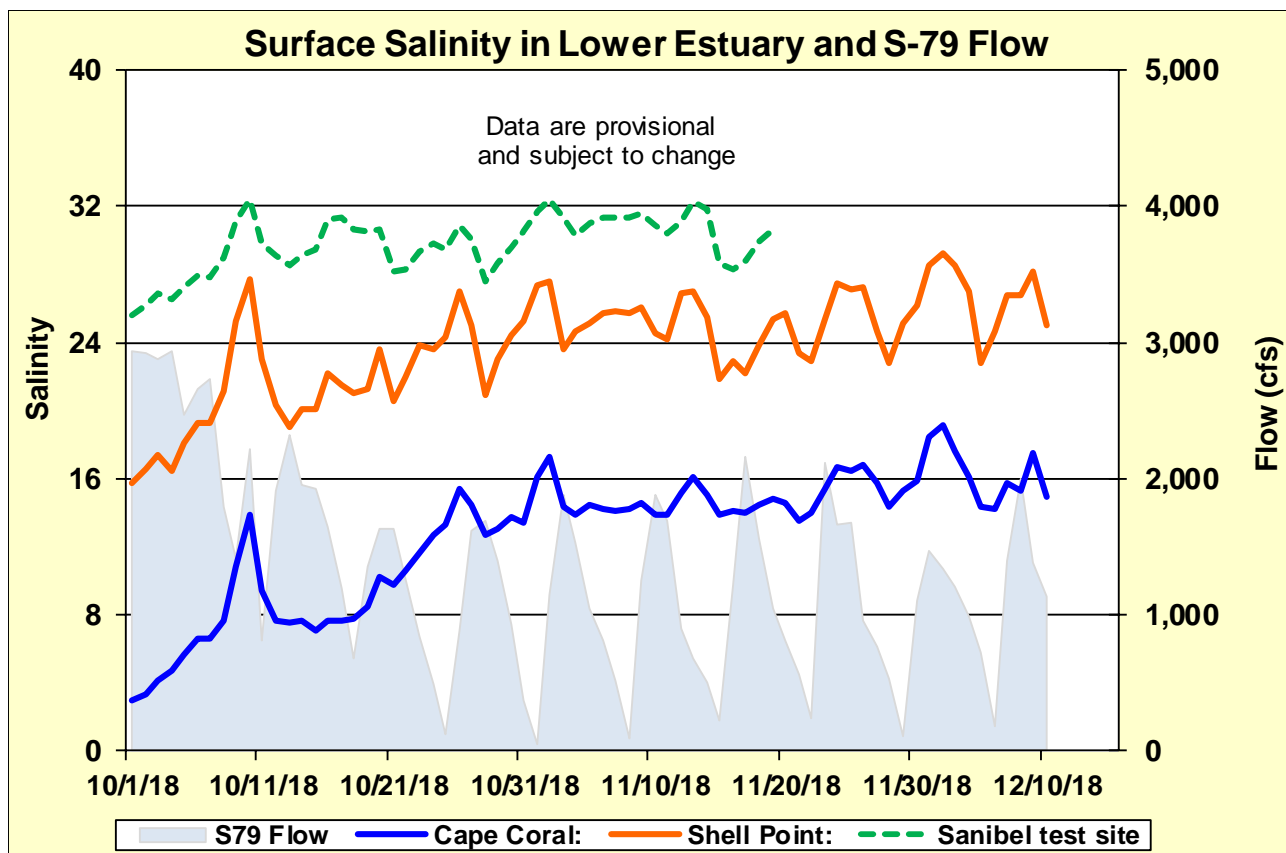


Figure 8. Daily mean flows at S-79 and salinity at lower estuary stations.

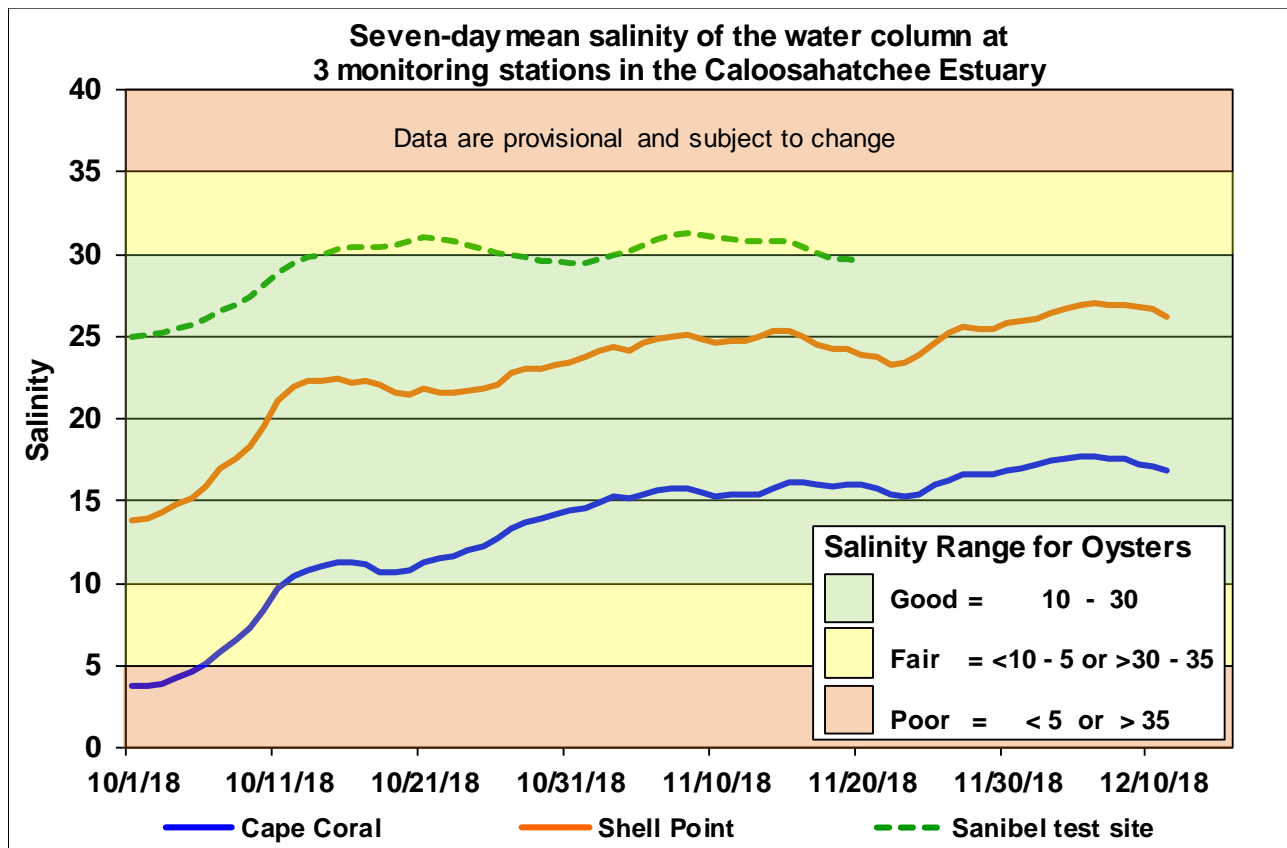


Figure 9. Seven-day mean salinity at Cape Coral, Shell Point, and Sanibel monitoring stations.

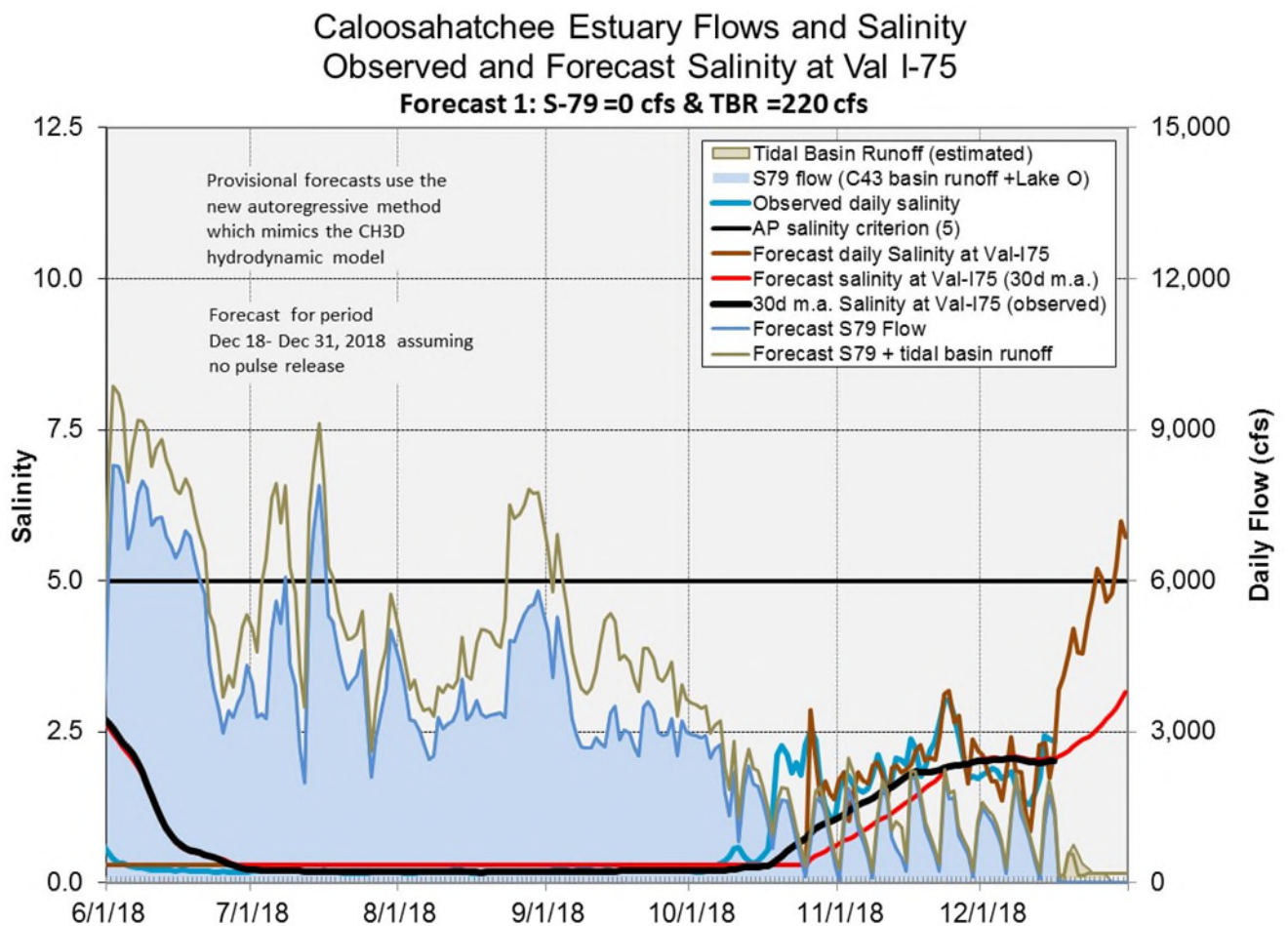


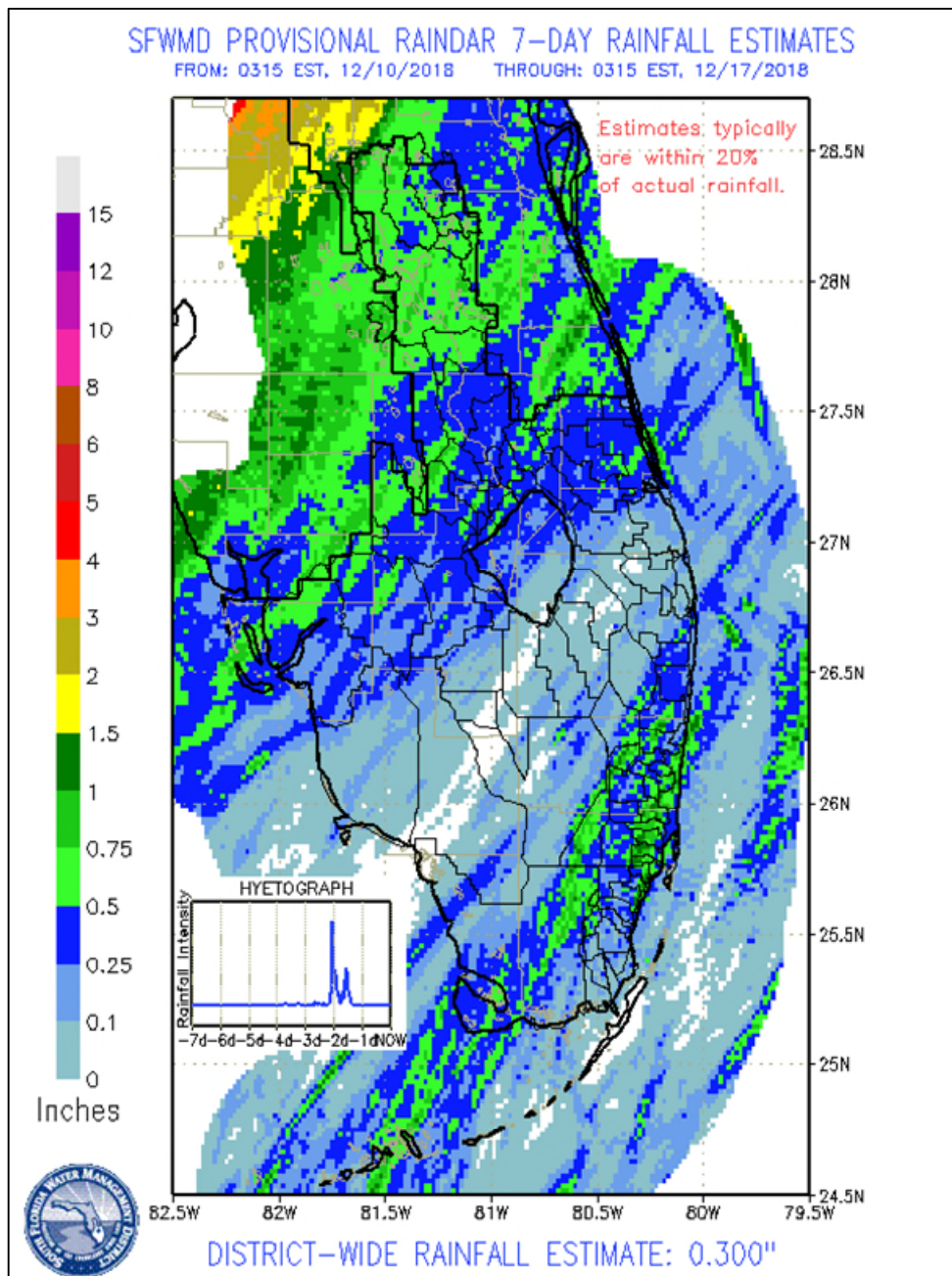
Figure 10. Forecasted Val I-75 surface salinity assuming no pulse release at S79.

Water Management Recommendations

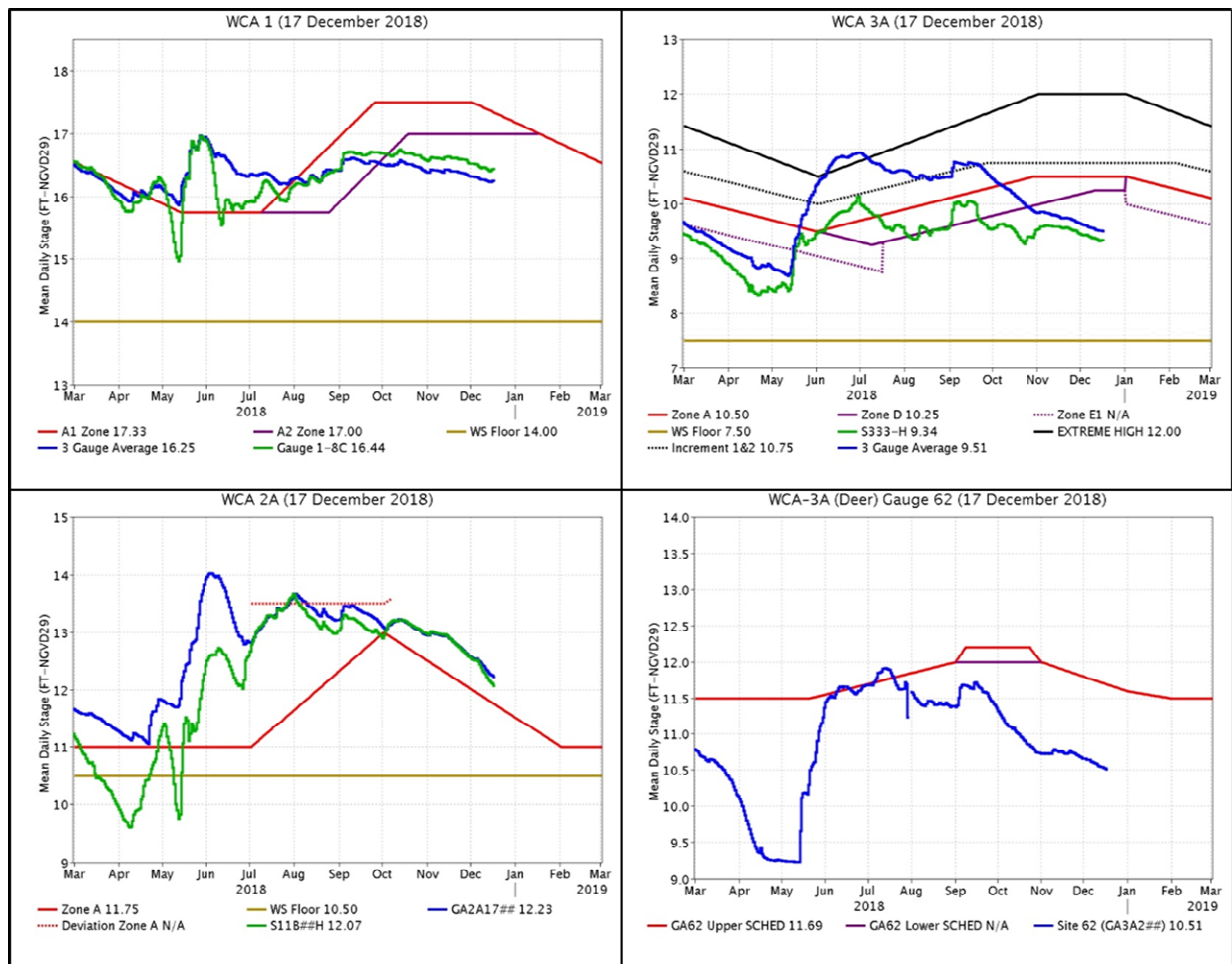
EVERGLADES

At the gauge locations monitored for this report stages within the WCAs fell 0.04 feet on average over the last week, a similar rate as the last month. The most extreme individual gauge changes within the WCAs ranged from +0.01 feet (WCA-2B) to -0.18 feet (WCA-2A). Pan evaporation was estimated at 0.85 inches this week.

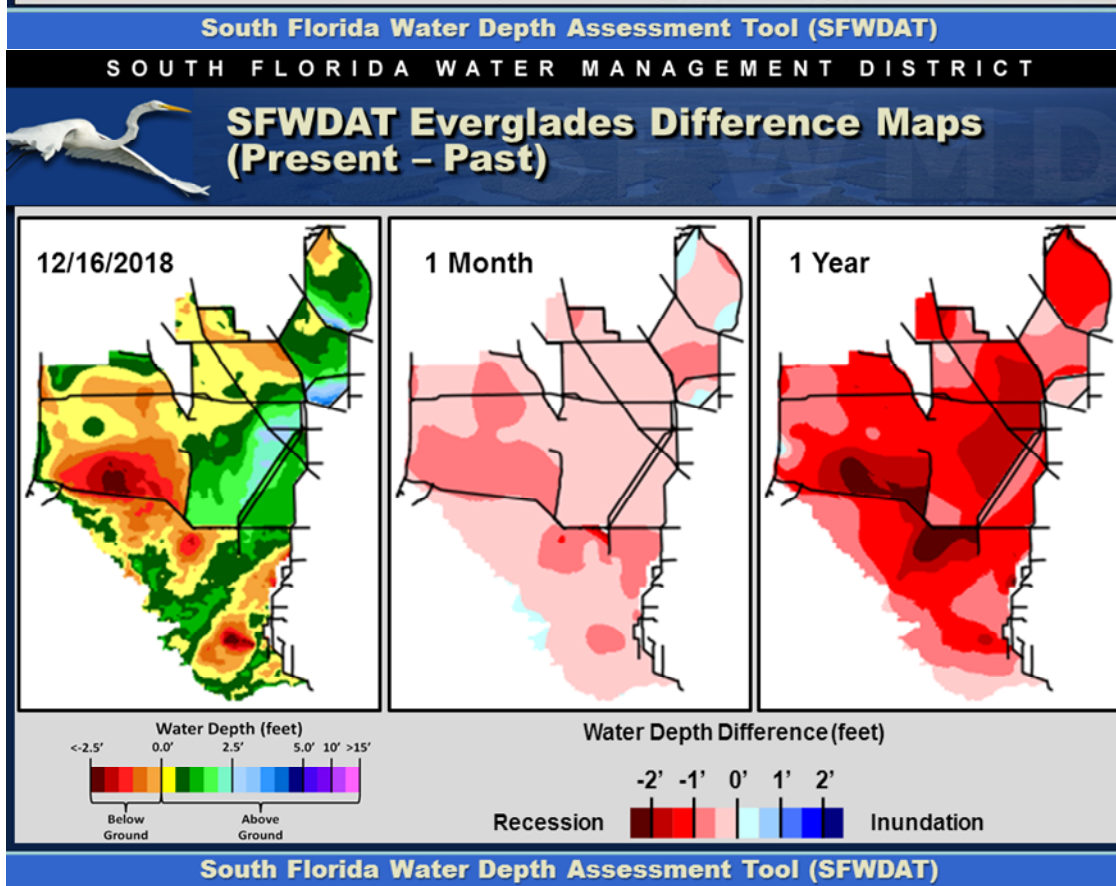
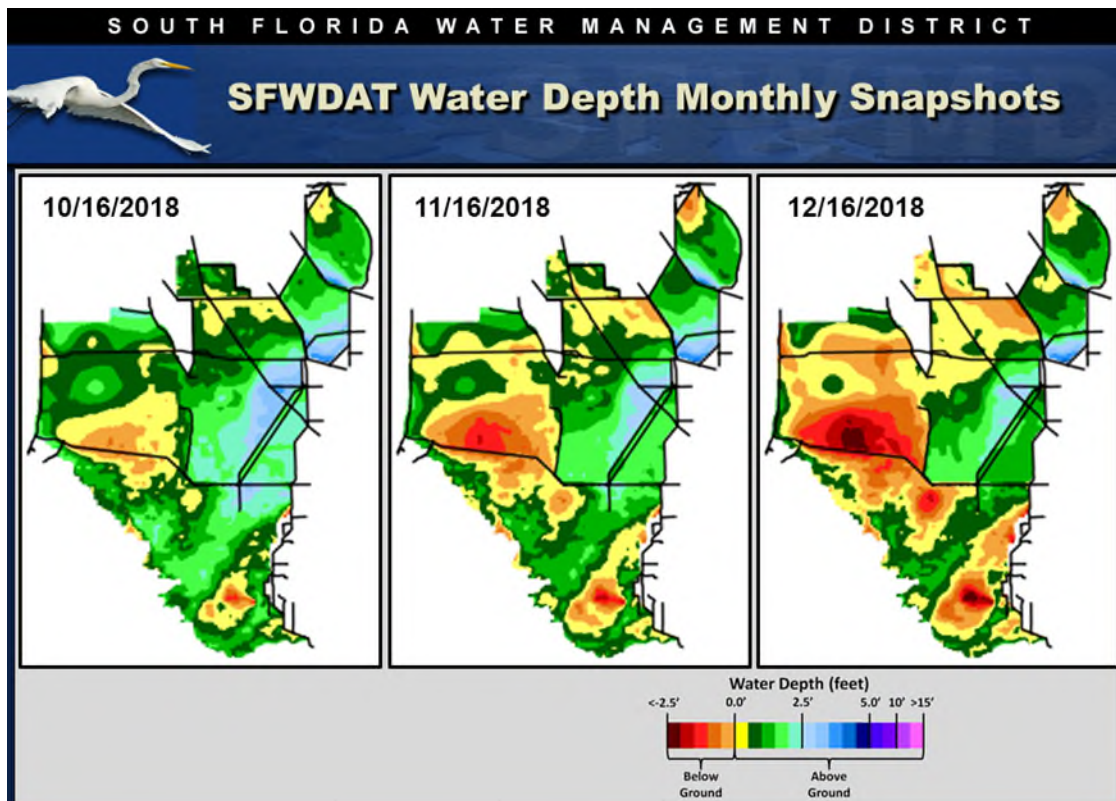
Everglades Region	Rainfall (Inches)	Stage Change (feet)
WCA-1	0.15	-0.03
WCA-2A	0.24	-0.18
WCA-2B	0.71	+0.00
WCA-3A	0.12	-0.06
WCA-3B	0.60	+0.00
ENP	0.31	-0.04



Regulation Schedules: Gauge 1-8C is 0.89 feet below the Zone A2 regulation line. The three-gauge average remains near 0.20 below the canal stage. S11B Headwater stage is 0.32 feet above the Zone A regulation line (0.1 foot closer than last week) and is receding slightly faster than parallel to that line. WCA-3A three-gauge average stage is 0.74 feet below the Zone D regulation line and trends away from the rising regulation line. WCA-3A at gauge 62 (Northwest corner) remains 1.18 feet below the Lower Schedule.

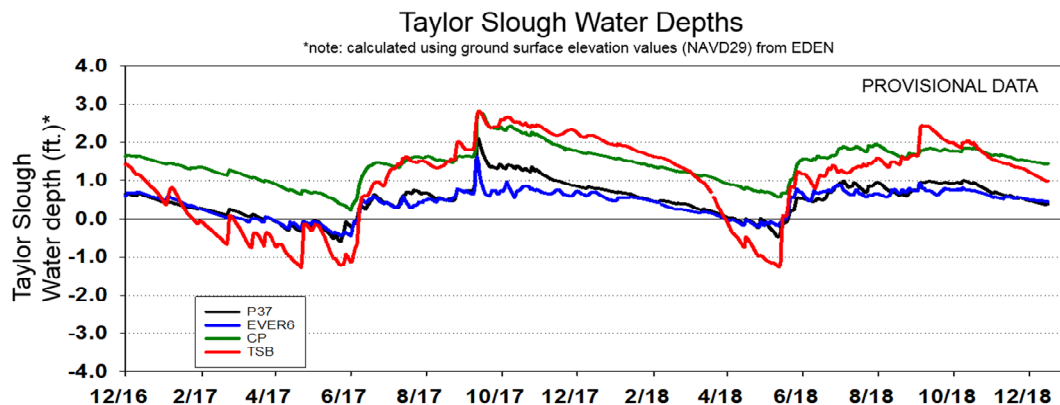
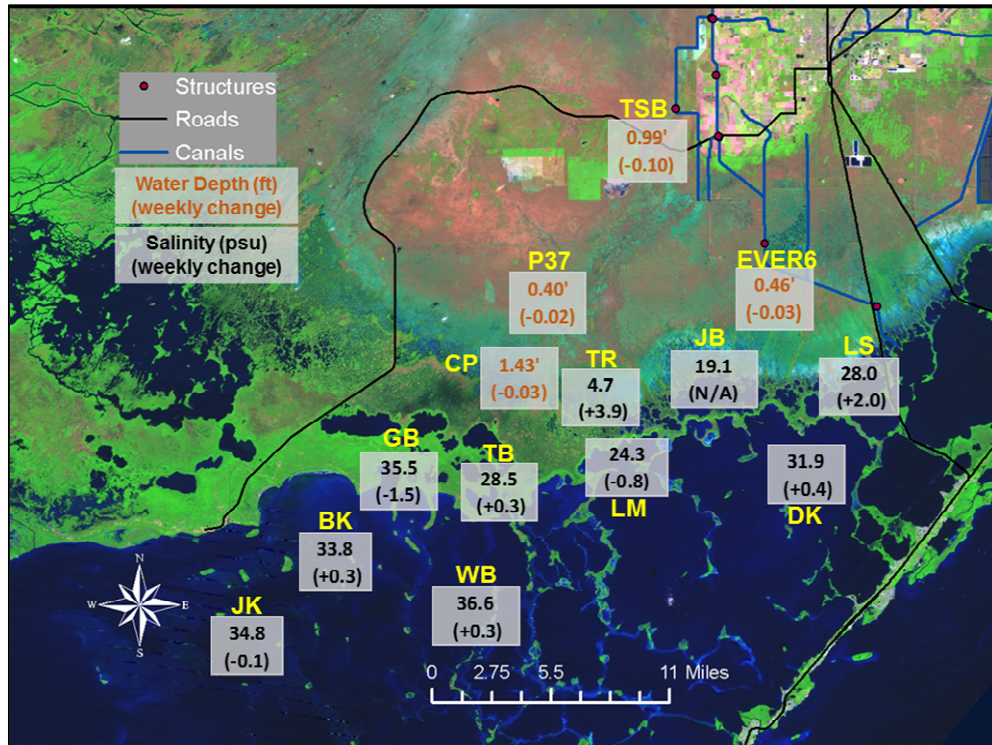


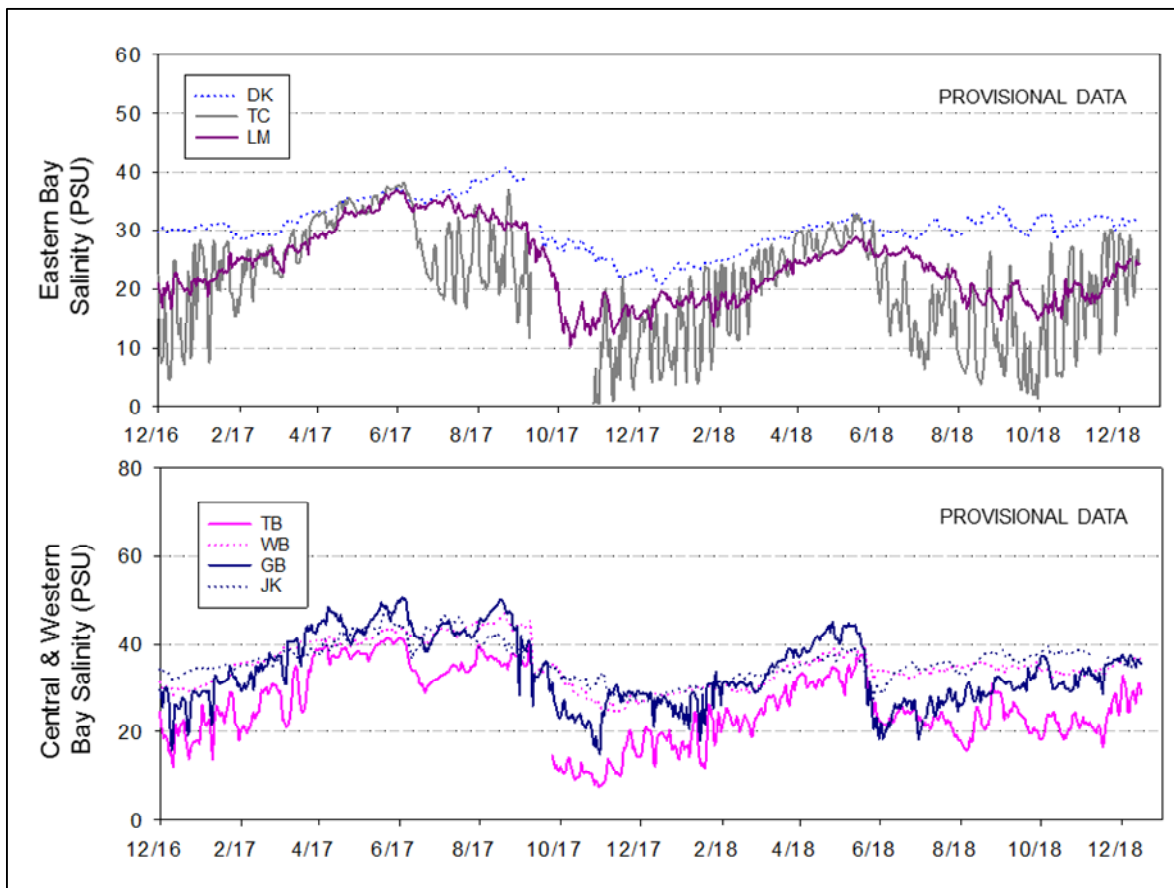
Water Depths and Changes: The WDAT tool for spatial interpolation of depth monthly snapshots indicate gradually drying conditions. Most of WCA-3A North is now below 0.5 feet. In the northeast region of WCA-3A the model indicates expanding regions with water depths below ground, and now clearly showing pockets of habitat at greater than 0.5 feet below ground. Northern WCA-1 looks to have recovered slightly. WDAT difference output indicates that water levels dropped across all of the Everglades over the last month, yet the rate of change is moderate except in southern WCA-2A. In the “1 Year” inset we see the comparison between current depth conditions and post Hurricane Irma’s (9/10/17) lessening impact on water depths a year ago, this previous year’s high-water event suggest the current lower than seasonal water depths, while precarious may be allowing ecological process to recover from high water stress.



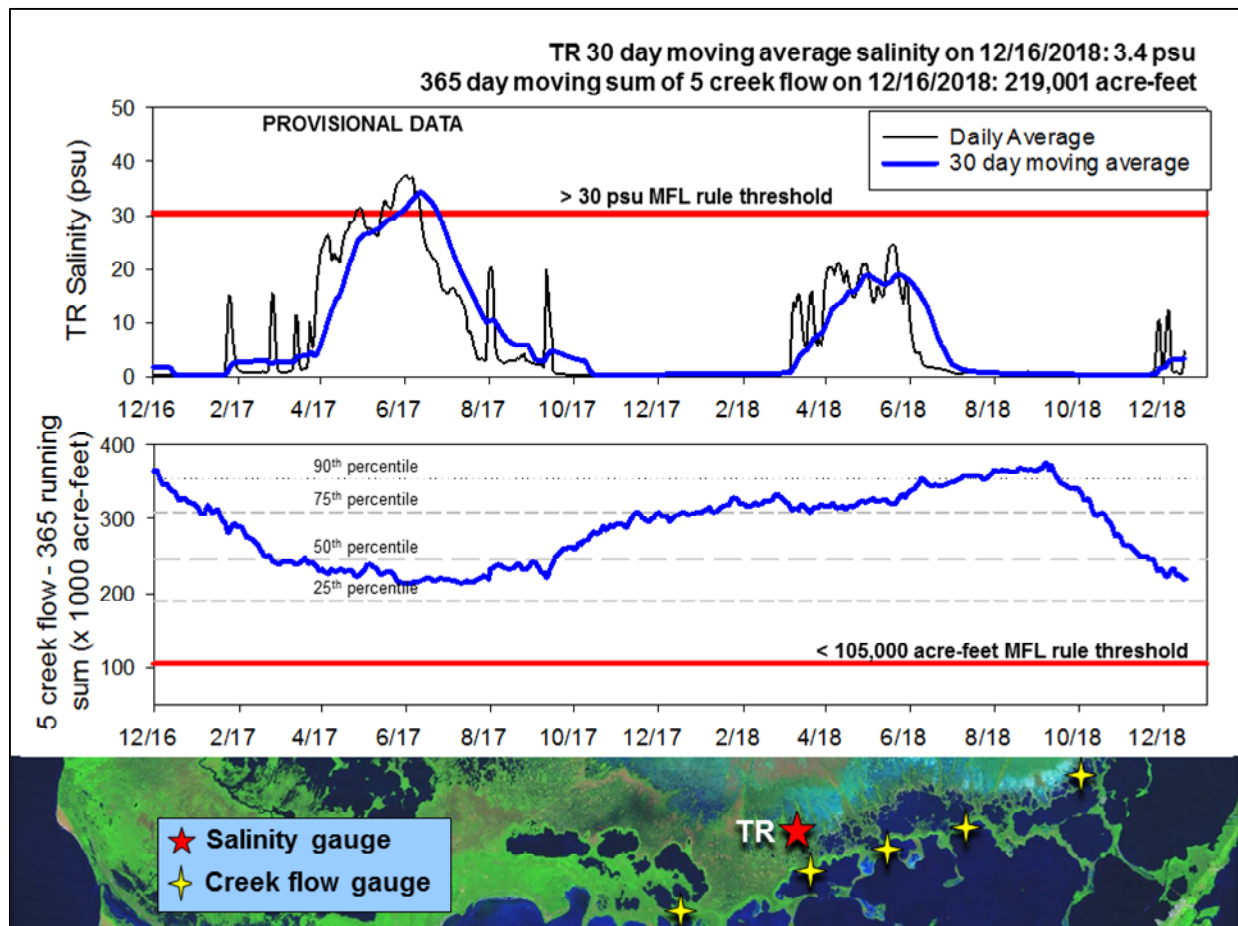
Taylor Slough Water Levels: About 0.3 inches of rain fell on Taylor Slough and Florida Bay this past week allowing stages to continue decreasing by an average of 0.05 feet last week. Water depths averaged 0.77 feet across Taylor Slough and within an inch of the historical averages for this time of year at all stations.

Florida Bay Salinities: Salinities average no change for the last week with individual station changes staying within 2 psu for the last week. Daily average salinities ranged from 19 psu in the northeast to 37 psu in the central bay on Sunday which averages about 6 psu higher than the mean for this time of year (individual gauges at 2 to 12 psu higher than their historical mean).





Florida Bay MFL: Salinity in the mangrove zone averaged 0.7 psu for most of the week before rising again over the weekend. The 30-day moving average rose to 3.4 psu. The weekly cumulative flow from the five creeks denoted by yellow stars on the map totaled about 2,400 acre-feet last week. The 365-day moving sum of flow from the five creeks has been dropping rapidly, and it decreased 12,600 acre-feet this past week to end at 219,001 acre-feet (less than the long-term average of 257,628 acre-feet). Creek flow is provisional data from the USGS and is highly variable.



Water Management Recommendations

Water management that protects peat soils, especially in WCA-3A North, as the dry season becomes established has increasing ecological benefit as unusually dry conditions pervade the WCA-3A basin. Moving water from WCA-2A, as that basin is above its regulation schedule and receding roughly in parallel to the regulation line, into northeastern WCA-3A has ecological benefit in protecting the historically over-dried peat soils in that region. This benefit was anecdotally noted from a helicopter flight this last week, as it was evident from the air that the marsh downstream of S-150 discharges look to be holding more water than the marsh further west and downstream of the structure. Due to the holiday season, predicted rains and the potential for basin run off routed into STA $\frac{3}{4}$ to lessen the capacity for backflow through the S7 thus lowering the discharge from WCA-2A to WCA-3A we are recommending to continue routing water via this path (WCA-2A, backflow S-7, S-150 discharge, WCA-3A) until the stage reaches the regulation line in WCA-2A. Any water not available to protect the peat soils in WCA-3A North, would be ecologically beneficial to Holeyland and Rotenburger WMA. According to the WDAT modeling, depths in the northern portion of WCA-1 that are below ground level have not expanded significantly over the last month and is no longer showing depths significantly below ground. However, this historically dry area would continue to benefit from hydration as the 3-gauge average stage is now 0.75 feet below the Zone A2 regulation line but has remained steady over the last several weeks. 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. More specific recommendations appear in the summary table below. The red text represents new or modified information or recommendations.

SFWMD Everglades Ecological Recommendations, December 18th, 2018 (red is new)

Area	Weekly change	Recommendation	Reasons
WCA-1	Stage decreased by 0.03'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-2A	Stage decreased by 0.18'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-2B	Stage remained unchanged	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
WCA-3A NE	Stage decreased by 0.05'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect habitat including <u>peat soil</u> development, tree islands and wildlife. Hydration provided to this area has high ecological value due to unseasonably dry conditions.
WCA-3A NW	Stage decreased by 0.06'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	
Central WCA-3A S	Stage decreased by 0.05'	Maintain depths at regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
Southern WCA-3A S	Stage decreased by 0.07'		
WCA-3B	Stage remained unchanged	Maintain depths at temporary regulation schedule. Moderate recession rates to the extent possible.	Protect upstream/downstream habitat and wildlife.
ENP-SRS	Stage decreased by 0.04'	Make discharges to the Park according to the 2012 WCP rainfall plan.	Protect upstream/downstream habitat and wildlife.
Taylor Slough	Stage changes ranged from -0.10' to -0.02'	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 -1.5 to +2.0 psu	Move water southward as possible	When available, provide freshwater to maintain low salinity buffer and promote water movement.