Appendix 4-1: Annual Permit Report for Lake Okeechobee Water Control Structures Operation

Permit Report (May 1, 2014–April 30, 2015)
Permit Number: 0174552

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SUMMARY

Based on Florida Department of Environmental Protection (FDEP) permit reporting guidelines, **Table 1** lists key permit-related information associated with this report. **Table 2** lists the attachments included with this report. **Table A-1** in Attachment A lists specific pages, tables, graphs, and attachments where project status and annual reporting requirements are addressed. This annual report satisfies the reporting requirements specified in the permit.

Table 1. Key permit-related information.

Project Name:	Lake Okeechobee Operating Permit
Permit Number:	0174552-010
Issue and Expiration Dates:	Issued: 6/18/2007; Expires: 6/18/2012 *(A permit renewal request was submitted by the South Florida Water Management District to the FDEP on April 11, 2012, and is currently under review.)*
Project Phase:	Operation
Permit Specific Condition Requiring Annual Report:	16
Reporting Period:	May 1, 2014–April 30, 2015
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Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Water Quality and Hydrologic Data *(Note: Contains Attachments B1–B10)*

PROJECT STATUS

Total inflow to Lake Okeechobee in Water Year 2015 (WY2015; May 1, 2014–April 30, 2015) was over 2.8 million acre-feet (ac-ft). Outflow was 1.9 million ac-ft. A third (0.7 million ac-ft) of the outflow was discharged to the estuaries and over half (1.2 million ac-ft) was released south, with 585,300 ac-ft of that water directed to the Everglades Stormwater Treatment Areas (STAs). Water levels in the lake were at 13.1 feet in May 2014, increasing to 16 feet in October, and then declined, with the exception of a 0.2-foot reversal in February and another to 13.9 feet on April 30, 2015. Of the 2,398 Class I/III measurements [turbidity, alkalinity, specific conductance, pH, percent dissolved oxygen (DO) saturation, and total iron] at the 26 locations, 197 excursions were observed. Total phosphorus (TP) load was 450 metric tons (mt). The five-year average TP load to the lake was 436 mt, which exceeded the total maximum daily load (TMDL) of 140 mt by 296 mt.

CONCLUSIONS REGARDING PROJECT SUCCESS

The flow to Lake Okeechobee in WY2015 was almost the same as the previous year. However, a larger proportion of the flow came from the Upper Kissimmee Basin in WY2015 than in WY2014 (see Volume I, Chapter 8, Table 8-5). The lower TP concentrations from the Upper and Lower Kissimmee Basins contributed greatly to the lower TP loads to the lake in WY2015, which were 159 mt less than in WY2014.

PROBLEMS ENCOUNTERED

The current method to estimate flow and TP load at L-61E, HP-7, Inflow 1, Inflow 2, and Inflow 3 sums positive flow and load days at C41H78 for each month and subtracts S-71, G-207, and L-60W flows (James 2011; see **Figure 1** for structure and station locations). Using this calculation method, there were months with flow but no TP load (the load was negative).

ACTIONS TO ADDRESS PROBLEMS

TP loads were recalculated by multiplying estimated flows for the minor structures by the C41H78 flow-weighted mean concentration for each month. This resulted in an estimated TP load of approximately 4 mt.

INTRODUCTION

PROJECT OVERVIEW

The Lake Okeechobee Operating Permit (0174552) was issued under the authority of the Lake Okeechobee Protection Act, Chapter 373.4595, Florida Statutes (F.S.), which is now the Northern Everglades and Estuaries Protection Program (NEEPP), and Title 62, Florida Administrative Code (F.A.C.). This annual report is submitted by the South Florida Water Management District (District or SFWMD) to the FDEP to fulfill the requirements of the permit.

The project involves the operation and maintenance of 34 water control structures that are owned or operated by the SFWMD and that discharge into or from Lake Okeechobee (**Figure 1**). Discharges and flows authorized by this permit are into or from Lake Okeechobee, a Class I water body, pursuant to Rule 62-302.400, F.A.C.

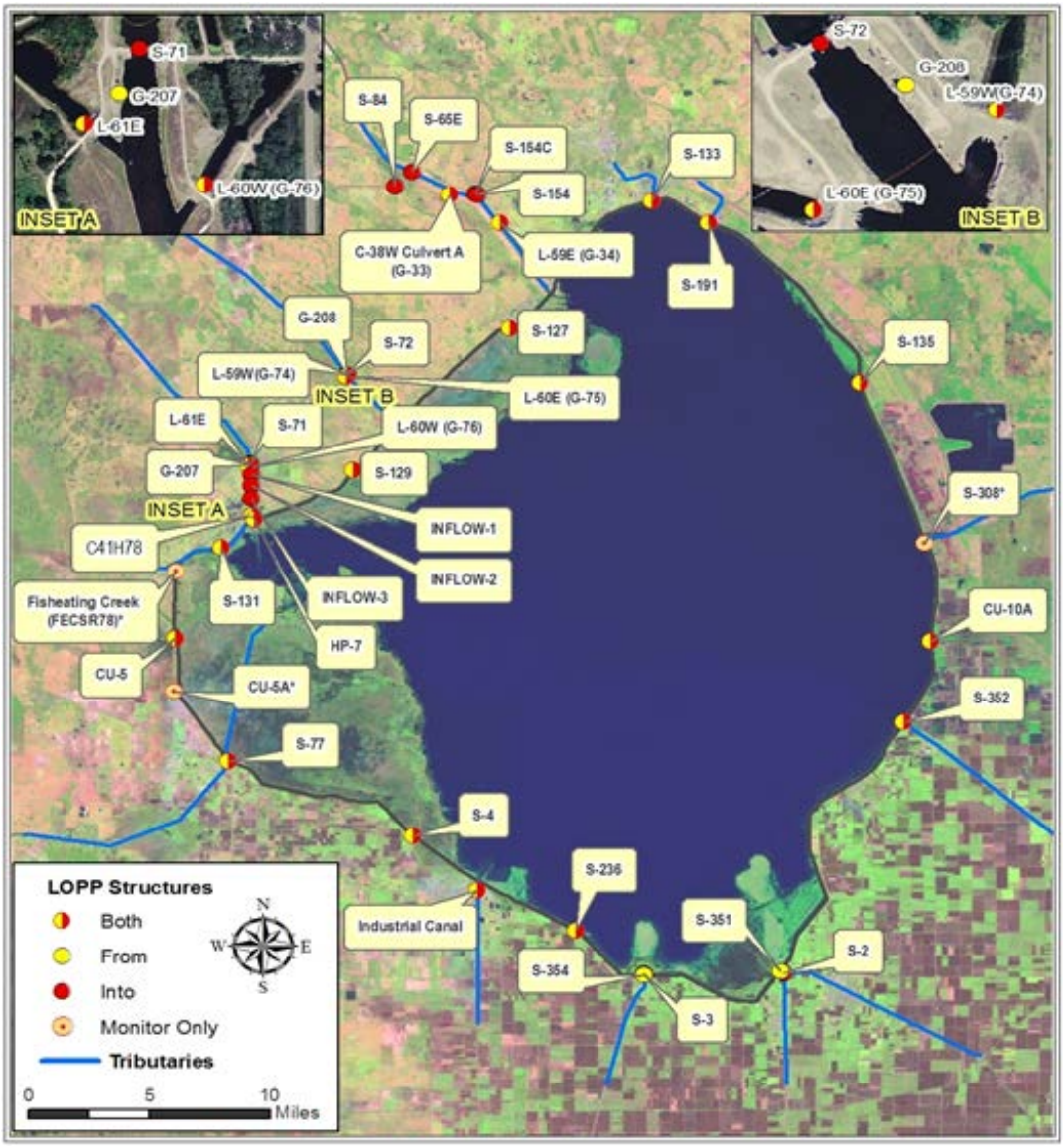

Figure 1. Structures included in the Lake Okeechobee Operating Permit.

This report includes two main sections: *Monitoring Data* and *Performance Evaluation. Monitoring Data* includes records and general descriptions of data collected to meet the requirements of this permit for WY2015, and *Performance Evaluation* includes an analysis of the data for Florida Class I water quality exceedances, TP loads, applicable records from the ambient pesticide monitoring data, and data collected through the Lake Okeechobee Research and Monitoring Program.

PERMIT HISTORY

The original Lake Okeechobee Operating Permit and all modifications issued to the SFWMD are as follows:

- 0174552-001-GL, issued June 18, 2007, expired June 18, 2012, is the original permit for the Lake Okeechobee water control structures.
- 0174552-002, withdrawn.
- 0174552-003, issued December 21, 2007, authorized an extension until May 31, 2008, for completing installation of instrumentation at permit monitoring sites S-154C, CU-5, and CU-5A; monitoring at the newly constructed Harney Pond Canal monitoring site (C41H78) in lieu of the monitoring required at Inflow 1, Inflow 2, Inflow 3, HP-7, and L-61E; and the addition of a provision for the testing of temporary structure modifications and temporary pumps, per review and approval of the FDEP.
- 0174552-004, issued May 16, 2008, authorized the SFWMD to operate an auxiliary water supply pump station consisting of three temporary pumps at the S-72 Tailwater weir along the C-40 canal about 4 miles upstream of Lake Okeechobee.
- 0174552-005, issued June 12, 2009, added a provision for the siphoning operation at the S-2 and S-3 pump stations to supplement flow from the temporary forward pumps at S-351 and S-354 and to more closely simulate those flows that would otherwise be provided when gravity flow is possible, and corrected the addresses listed in Specific Condition 2 to reflect the FDEP address in Tallahassee, Florida, and the email address RPPS_Comp@dep.state.fl.us.
- 0174552-006-EM, issued September 17, 2009, made the following changes:
  - Changed the duration column for grab samples at S-2 and S-3 listed in **Table 3**
  - Changed the parameter column for grab samples at S-2 and S-3 to include pH, temperature, specific conductance, DO, and all chemical parameters in **Table 4**
  - Replaced biological oxygen demand with total organic carbon in **Table 4**
  - Modified monitoring requirements for calcium and chlorophyll *a* in **Table 4**
  - Modified parameters for sites S-351, S-354, G-207, and G-208 listed in **Table 4**
- 0174552-007, issued July 21, 2010, authorized a change in chlorophyll *a* monitoring locations and clarified event reporting and interagency coordination requirements included in Specific Conditions 6.E.1, 6.E.2, and 6.E.3.
- 0174552-008, issued September 16, 2011, authorized maintenance and upgrade activities for structures S-129, S-131, S-133, and S-134, and a change in the Lake Okeechobee Regulation Study Schedule.
- 0174552-009, permit application withdrawn.
- 0174552-010, issued December 18, 2011, reduced monitoring for pesticides at specific locations around Lake Okeechobee.

Table 3. Water quality monitoring for S-2 and S-3 flood control backpumping, as updated in permit modification 0174552-006-EM.

Site	Type	Duration	Parameters
S-2	Auto-sampler composite flow proportional (ACF)[a]	Event[b] duration	Total phosphorus (TP) and total nitrogen (TN)[c] only
S-2	Grab	Event duration ≤ 72 hours: collect one sample for nutrients (TP and TN) and all chemical parameters listed in **Table 4** within 24 hours of initiation of pumping operations. Event duration >72 hours: collect one sample during first 24 hours, and then every 72 hours.	Physical parameters: pH, temperature, conductance, and DO Chemical parameters: all chemical parameters listed in **Table 4**.
S-3	ACF[a]	Event[b] duration	TP and TN[c] only
S-3	Grab	Event duration ≤ 72 hours: collect one sample for nutrients (TP and TN) and all chemical parameters listed in **Table 4** within 24 hours of initiation of pumping operations. Event duration >72 hours: collect one sample during first 24 hours, and then every 72 hours.	Physical parameters: pH, temperature, conductance, and DO Chemical parameters: all chemical parameters listed in **Table 4**.

a. Flow-proportional composite sampler.

b. An event is defined as continuous or intermittent pumping activity separated by a cessation of 72 hours or greater.

c. TN = total Kjeldahl nitrogen + nitrate + nitrite.

Table 4. Water quality and hydrologic parameters monitored for the Lake Okeechobee Operating Permit, and attachments to this report where associated data are provided.

Parameter Name	Parameter Description	Units	Sample Type	Sampling Frequency	Structures Sampled[a,b]	Attachment
ALK	Alkalinity	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
TOC	Total Organic Carbon	mg/L	G	BI-W if flowing, M if not flowing	S-308, S-77	B1
CHLA	Chlorophyll *a*	µg/L	G	BI-W if flowing, M if not flowing	S-308, S-77	B1
NH4	Dissolved Ammonia	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
DO	Dissolved Oxygen	mg/L	IN SITU	BI-W if flowing, M if not flowing	ALL	B1
PH	pH	SU	IN SITU	BI-W if flowing, M if not flowing	ALL	B1
SCOND	Specific Conductance	µS/cm	IN SITU	BI-W if flowing, M if not flowing	ALL	B1
TEMP	Temperature	ºC	IN SITU	BI-W if flowing, M if not flowing	ALL	B1
TURB	Turbidity	NTU	G	BI-W if flowing, M if not flowing	ALL	B1
TKN	Total Kjeldahl Nitrogen	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
			ACF	W if flowing	G-207, G-208	B1
TP	Total Phosphorus	mg/L	G	BI-W if flowing, M if not flowing	ALL, FECSR78, S-77, S-308, CU-5A	B1
			ACF	W if flowing, M if not flowing	S-351, S-354	B1
			ACF	W if flowing	G-207, G-208	B1
TN	Total Nitrogen	mg/L	CAL	BI-W if flowing, M if not flowing	ALL	B1
			CAL	W if flowing, M if not flowing	S-351, S-354	B1
			CAL	W if flowing	G-207, G-208	B1
NOX	Nitrate + Nitrite	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
			ACF	W if flowing	G-207, G-208	B1
SRP	Soluble Reactive Phosphorus	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
TFE	Total Iron	µg/L	G	Q	ALL	B1
TSS	Total Suspended Solids	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
FLOW	Flow	cfs	PR	DAV	ALL (pumps)	B2
	Flow	cfs	CAL	DAV	ALL (culverts or gates), FECSR78, S-77, S-308, CU-5A	B2
RAIN	Rainfall Volume	inches	RG	DAC	Rainfall Sampling Station	B3

Key to Abbreviations

ºC – degrees Celsius
ALL – structures owned and operated by the District, as specified in **Table 5**.
ACF – flow-proportional composite sampler
BI-W – biweekly
CAL – calculated
cfs – cubic feet per second
DAC – daily accumulation
DAV – daily average
G – grab sample
IN SITU – measured with probe on-site
M – monthly
mg/L – milligrams per liter
NTU – nephelometric turbidity units
µg/L – micrograms per liter
µS/cm – microsiemens per centimeter
PR – pump records
Q – quarterly
RG – rain gauge
SU – standard units
W – weekly

a. C41H78 (Harney Pond Canal) monitoring station is the representative monitoring site for HP-7, Inflow-1, Inflow-2, Inflow-3, and L-61E.
b. S-72 weir auxiliary water pump station monitoring is conducted at both S-72 and G-208.

MONITORING DATA

WATER QUALITY

Water quality data, including qualified data, collected at Lake Okeechobee structures (**Figure 1**; **Table 5**) were retrieved from the SFWMD's hydro-meteorological and water quality database, DBHYDRO (SFWMD 2015a), and included with this report as Attachment B1. These records include analytical results of grab or in-situ samples taken throughout the year for 18 parameters required in the permit (**Table 4**). Daily flow data (Attachment B2) and daily rainfall data (Attachment B3) also were reported. The water quality information in Attachment B1 incorporates all data required by the permit.

Water quality samples were taken during the water year in the canal outside of the lake at Culvert 5A. This culvert was closed for renovation in WY2015. The contractor responsible for this renovation work was required to supply water (70 cfs minimum) from the lake to the landside via a bypass pump and 36-inch diameter pipe, when requested by permitted users. There were no discharges of surface water into the lake at this culvert location, therefore water quality data were excluded from this report.

Table 5. Structures monitored for the Lake Okeechobee Operating Permit.

Structure	Into/ From	DBHYDRO Inflow Direction[a]	Structure Description	Latitude	Longitude
S-2	Into	-	Four unit pump station, 3,600 cubic feet per second (cfs)	26 41 58.81	80 42 48.09
S-3	Into	-	Three unit pump station, 2,670 cfs	26 41 56.24	80 48 26.21
S-4	Both	+	Three unit pump station, 2,805 cfs	26 47 24.64	80 57 42.43
S-65E	Into	+	Gated spillway with six cable operated vertical lift gates, lock structure with sector gates	27 13 31.16	80 57 45.22
S-71	Into	+	Gated spillway, three stem operated vertical lift gates	27 02 03.19	81 04 15.23
S-72[b]	Into	+	Gated spillway, two stem operated vertical lift gates	27 05 35.18	81 00 21.22
S-84	Into	+	Gated spillway with two vertical lift gates	27 12 58.16	80 58 24.22
S-127	Both	+	Five unit pump station, 625 cfs, plus gated spillway/lock	27 07 21.56	80 53 45.41
S-129	Both	+	Three unit pump station, 375 cfs, plus gated spillway	27 01 48.19	81 00 05.22
S-131	Both	+	Two unit pump station, 250 cfs, plus gated spillway, lock	26 58 45.23	81 05 24.72
S-133	Both	+	Five unit pump station, 625 cfs, plus outlet structure	27 12 23.92	80 48 02.59
S-135	Both	+	Four unit pump station, 500 cfs, plus spillway and lock	27 05 12.71	80 39 40.14
S-154C	Into	+	Concrete pipe culvert, one barrel, with gate	27 12 39.58	80 55 11.38
S-154	Into	+	Reinforced concrete box culvert, two barrels, sluice gate	27 12 38.82	80 55 06.24
S-191	Both	+	Gated spillway with three cable operated vertical lift gates	27 11 31.17	80 45 45.20
S-236	Both	+	Three unit pump station, 255 cfs, plus outlet	26 43 40.41	80 51 10.12
S-351[c]	Both	-	Gated spillway with three vertical lift gates	26 42 03.00	80 42 54.96
S-352[c]	Both	-	Gated spillway with two vertical lift gates	26 51 50.61	80 37 56.65
S-354[c]	Both	-	Gated spillway with two vertical lift gates	26 41 55.96	80 48 26.25
CU-5	Both	+	Three barrel corrugated metal pipe, slide gates	26 53 06.93	81 07 18.23

Table 5. Continued.

Structure	Into/From	DBHYDRO Inflow Direction[a]	Structure Description	Latitude	Longitude
CU-10A	Both	-	Five barrel corrugated metal pipe	26 55 01.45	80 36 51.33
C-38W Culvert A (G-33)	Both	+	Pipe inflow under levee	27 12 39.00	80 56 11.69
G-207	From	-	One unit pump station, 135 cfs	27 1 59.54	81 04 17.36
G-208[b]	From	-	One unit pump station, 135 cfs	27 5 32.65	81 00 20.04
S-72 Weir Auxiliary Water Supply Pump Station[b]	From	-	Three unit pump station	27 03 59.36	80 58 41.07
L-59E (G-34)	Both	+	Three barrel culvert	27 11 31.17	80 54 11.21
L-59W(G-74)	Both	+	Two barrel gated culvert	27 06 26.18	80 59 57.22
L-60E (G-75)	Both	+	Two barrel gated culvert	27 05 05.18	81 01 27.22
L-60W (G-76)	Both	+	Two barrel gated culvert	27 01 58.19	81 03 06.23
C41H78[d]	Both	+	Canal downstream of G-207, Inflow-1, Inflow-2, Inflow-3, HP-7, L-61E, and S-71	26 59 51.52	81 04 05.90
INDUSCAN	Both	-	Represents flows at S-310	26 45 14.00	80 55 07.22
L-61E[d]	Both	NA	Two barrel culvert with flashboards	27 01 59.19	81 05 17.23
HP-7[d,e]	Both	NA	Single barrel culvert with flap gate with winch	27 00 00.00	81 04 10.00
Inflow-1[d,e]	Into	NA	Single barrel culvert with flap gate, on Harney Pond Canal downstream of S-71	27 01 36.53	81 04 12.49
Inflow-2[d,e]	Into	NA	Single barrel culvert with flap gate, on Harney Pond Canal	27 01 10.77	81 04 12.20
Inflow-3[d,e]	Into	NA	Single barrel culvert with flap gate, on Harney Pond Canal	27 00 41.13	81 04 11.74

NA – Not available

a. + flow to the lake is a positive number; - flow to the lake is a negative number.

b. S-72 weir auxiliary water pump station monitoring is conducted at both S-72 and G-208.

c. Structures have the ability to incorporate the use of temporary forward pumps (see Specific Condition 4) for discharging water from Lake Okeechobee during periods of low water levels.

d. C41H78 site is used to estimate required inflow and water quality at Inflow-1, Inflow-2, Inflow-3, HP-7, and L-61E, per Modification 0174552-006-EM, dated September 17, 2009.

e. Locations are approximate and are not owned or operated by the SFWMD.

FLOW AND STAGE DATA

Daily flow data for permitted structures are provided in Attachment B2. Additional flow information for structures not included in the permit (FECRSR78, S-77, S-308, CU-5A, CU-10, CU-4, CU-12, and CU-12A), but which contribute TP loads and flows to Lake Okeechobee, also are provided in Attachment B2. As described in the water quality section, Culvert 5A was closed for renovation. There were no flows to report at this location. All flow data were retrieved from DBHYDRO on June 16, 2015 (SFWMD 2015a). Updates and revisions may occur after this time but will not be reflected in this report.

Structures S-2 and S-351, and structures S-3 and S-354, share common preferred flow data. Flow into the lake at these locations occurs through the S-2 and S-3 pump stations, while flow out of the lake occurs at spillways S-351 and S-354, by gravity flow or temporary forward pumps.

No backpumping after action reports were submitted in WY2015. Two small test pumping events occurred at S-3 and two at S-2. The total flows for these events were between 7 and 621 ac-ft. These events were for pump maintenance. After action reports are not required for these events (FDEP 2007).

During WY2015, inflow to Lake Okeechobee was approximately 2.86 million ac-ft (**Table 6**). This is more than the baseline period (1991–2005) average of 2.5 million ac-ft per year (SFWMD et al. 2011). The largest inflows during WY2015 were from S-65E, S-84, FECRSR78, and S-71. The monthly flows were more similar to baseline conditions than the previous water year (**Figure 2**). The more moderate flows during the wet season and higher flows in the dry season, compared to WY2014, resulted in increased discharge during the dry season from the lake (see below). Another difference between WY2014 and WY2015 is the increased total flow at S-65E, which was 1.6 million ac-ft in WY2015, compared to 1.3 million ac-ft in the previous water year. Almost all of this extra flow can be attributed to increased discharge from the Upper Kissimmee Subwatershed at S-65 (see Chapter 8 in Volume I). Despite the increased flow from the Upper Kissimmee Basin in WY2015, total flows for WY2014 and WY2015 were very similar, at 2.81 and 2.86 million ac-ft, respectively.

Despite efforts to improve the calculated combined flow from L-61E, HP7, and inflows 1, 2, and 3, it is apparent that the uncertainty of these flows is still quite large. This is best exemplified by the application of the original method to calculate TP load. Three months when there was flow, there was no detectable TP load. Therefore, TP loads were determined from monthly flow and flow-weighted concentrations at C41H78. An ongoing effort of data analysis is being undertaken by District staff, and a report with recommendations should be forthcoming in Fiscal Year 2015-2016 (October 1, 2015–September 30, 2016).

Lake stage was 13.07 feet (ft) National Geodetic Vertical Datum of 1929 (NGVD29) on May 1, 2014 (**Figure 3**). Stage declined to 12.3 ft NGVD29 on June 12, 2014 and steadily rose as water flows increased over the course of the wet season. The stage reached a maximum of 16.01 ft NGVD29 on October 23, 2014 and declined thereafter as inflows declined, although two reversals in stage occurred during the decline. The first of these occurred from February 3 (14.63 ft NGVD29) to February 11, 2015 (14.81 ft NGVD29), and totaled 0.18 ft NGVD29. The second occurred from April 16 (13.65 ft NGVD29) to April 30, 2015 (13.87 ft NGVD29), and totaled 0.22 ft NGVD29 (**Figure 3**). The lake stage ended at 13.87 ft NGVD29 on April 30, 2015.

Outflows from Lake Okeechobee in WY2015 were 1.93 million ac-ft (**Table 7**). Nearly a third of this discharge was through S-77, primarily for regulatory releases from July 19, 2014, to September 11, 2014, and from October 17, 2014, to April 28, 2015. Over half of the outflow was through C10A, S-351, S-352, and S-354, with 585,300 ac-ft of that water being directed to the STAs. These releases occurred from June 21, 2014, to September 20, 2014, and from October 19, 2014, to April 30, 2015. Discharges through S-308 were only 6 percent of the total outflows, primarily from January to March 2015.

Table 6. Monthly inflow to Lake Okeechobee by structure in ac-ft for WY2015.

Region	Structure	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Total
East	L-8 (CU-10A)	17,988	26,001	9,293	0	367	887	0	0	0	0	0	0	54,536
	S-308[a]	2,061	2,243	3,560	1,397	1,255	1,549	1,337	524	397	1,293	0	1,260	16,876
	Total	20,050	28,245	12,853	1,397	1,622	2,435	1,337	524	397	1,293	0	1,260	71,412
North	C41H78[b]	3,411	4,235	23,485	12,207	17,498	1,067	3,589	3,607	2,517	2,535	4,307	5,645	84,103
	C-38W Culvert A (G-33)	0	386	1,822	1,276	382	228	43	1	0	0	31	60	4,229
	CU-5	0	0	117	1,329	637	587	1,597	2,072	1,090	0	787	1,499	9,717
	FECRSR78	1,094	1,675	17,923	39,299	39,229	43,053	5,582	9,306	2,382	3,039	3,402	4,590	170,574
	L-59E (G-34)	0	948	65	57	92	60	37	3	0	0	0	0	1,262
	L-59W(G-74)	0	6,115	8,793	5,177	2,275	3,669	2,103	4,452	3,322	923	4,241	5,287	46,356
	L-60E (G-75)	0	2,331	2,379	666	1,583	128	99	614	1,037	2,375	786	45	12,042
	L-60W (G-76)	226	348	1,053	379	120	21	18	40	26	74	17	210	2,531
	L-61E, HP-7, Inflow 1, 2, 3 [a,b,c]	4,517	3,181	2,890	370	0	0	1,571	2,690	1,675	1,648	6,741	6,426	31,709
	S-127	0	4,658	5,204	3,697	1,085	2,051	617	659	338	287	0	666	19,262
	S-129	11	383	952	1,430	1,764	1,425	485	471	353	468	47	806	8,595
	S-131	35	789	1,384	1,882	2,371	1,009	452	409	229	272	0	264	9,096
	S-133	0	4,252	7,814	6,486	4,647	4,685	1,284	1,504	1,057	793	245	684	33,452
	S-135	0	3,262	2,200	2,030	6,484	5,802	2,202	3,517	2,830	2,457	648	672	32,105
	S-154	0	2,106	7,060	7,752	2,071	2,359	1,030	336	342	29	2	0	23,087
	S-154C	2	579	974	499	164	145	68	51	58	30	31	19	2,620
	S-191	0	15,042	20,775	15,782	8,579	13,956	219	1	1,034	2	0	962	76,353
	S-65E	61,522	60,458	167,293	219,372	139,470	189,389	32,155	104,037	109,801	224,353	192,338	114,128	1,614,316
	S-71	2,050	4,884	42,654	23,478	35,760	11,352	5,544	4,439	3,305	3,319	1,798	4,574	143,157
	S-72	579	6,582	8,022	6,430	3,566	1,415	1,985	1,557	148	426	19	2,081	32,807
	S-84	19,813	41,706	82,714	77,663	78,637	47,356	27,426	21,559	9,588	25,251	13,430	32,392	477,535
	Total[d]	89,848	159,687	382,087	415,055	328,916	328,689	84,517	157,718	138,616	265,745	224,564	175,364	2,750,805

Table 6. Continued.

Region	Structure	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Total
South	CU-10[a, c]	0	0	0	0	0	0	0	0	0	0	0	0	0
	CU-12[a, c]	0	0	0	0	0	0	0	0	0	0	0	0	0
	CU-12A[a, c]	0	0	0	0	0	0	0	0	0	0	0	0	0
	CU-4A[a, c]	0	0	0	0	0	0	0	0	0	0	0	0	0
	Industrial Canal	142	4,769	4,269	97	7,531	342	40	2	9	445	114	3,495	21,255
	S-2 (S-351)	0	0	52	0	0	0	0	0	0	0	621	0	673
	S-236	0	0	0	0	0	0	0	0	0	0	0	0	0
	S-3 (S-354)	0	0	61	0	0	7	0	0	0	0	0	0	69
	S-352	0	0	0	0	0	0	0	0	0	0	0	0	0
	S-4	384	691	8,945	483	6,334	744	197	0	116	176	882	329	19,281
	Total	526	5,460	13,328	579	13,865	1,094	237	2	125	621	1,617	3,824	41,278
West	CU-5A[e]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	S-77[a]	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total	0	0	0	0	0	0	0	0	0	0	0	0	0
Total[d]		110,424	193,391	408,268	417,032	344,403	332,218	86,090	158,244	139,138	267,659	226,181	180,448	2,863,495

a. Provides flows and TP loads to lake. Not owned or operated by the SFWMD.
b. Calculated as specified in the 2011 Annual Permit Report for Lake Okeechobee Water Control Structures Operation (James 2011).
c. Included in other permits.
d. Does not include C41H78 flows.
e. NA – Not available; structure closed for reconditioning.

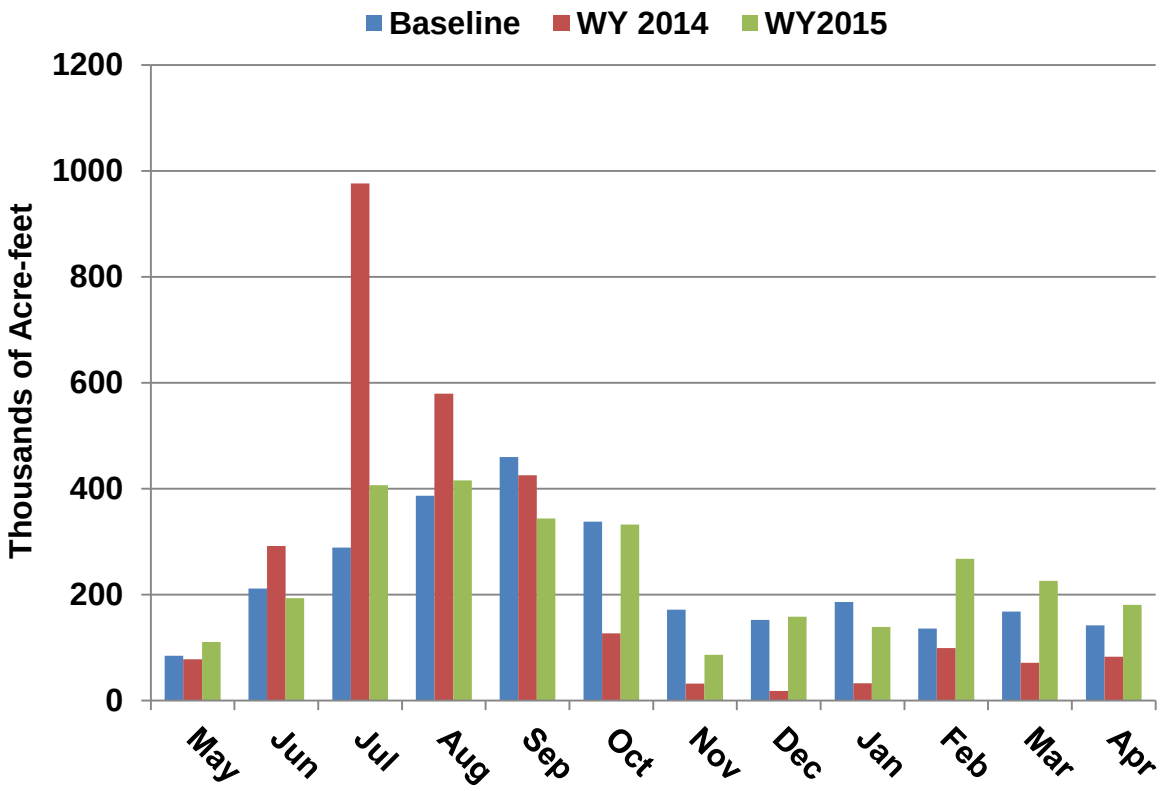

Figure 2. Flow to Lake Okeechobee by month for the baseline period (1991–2005), WY2014, and WY2015.

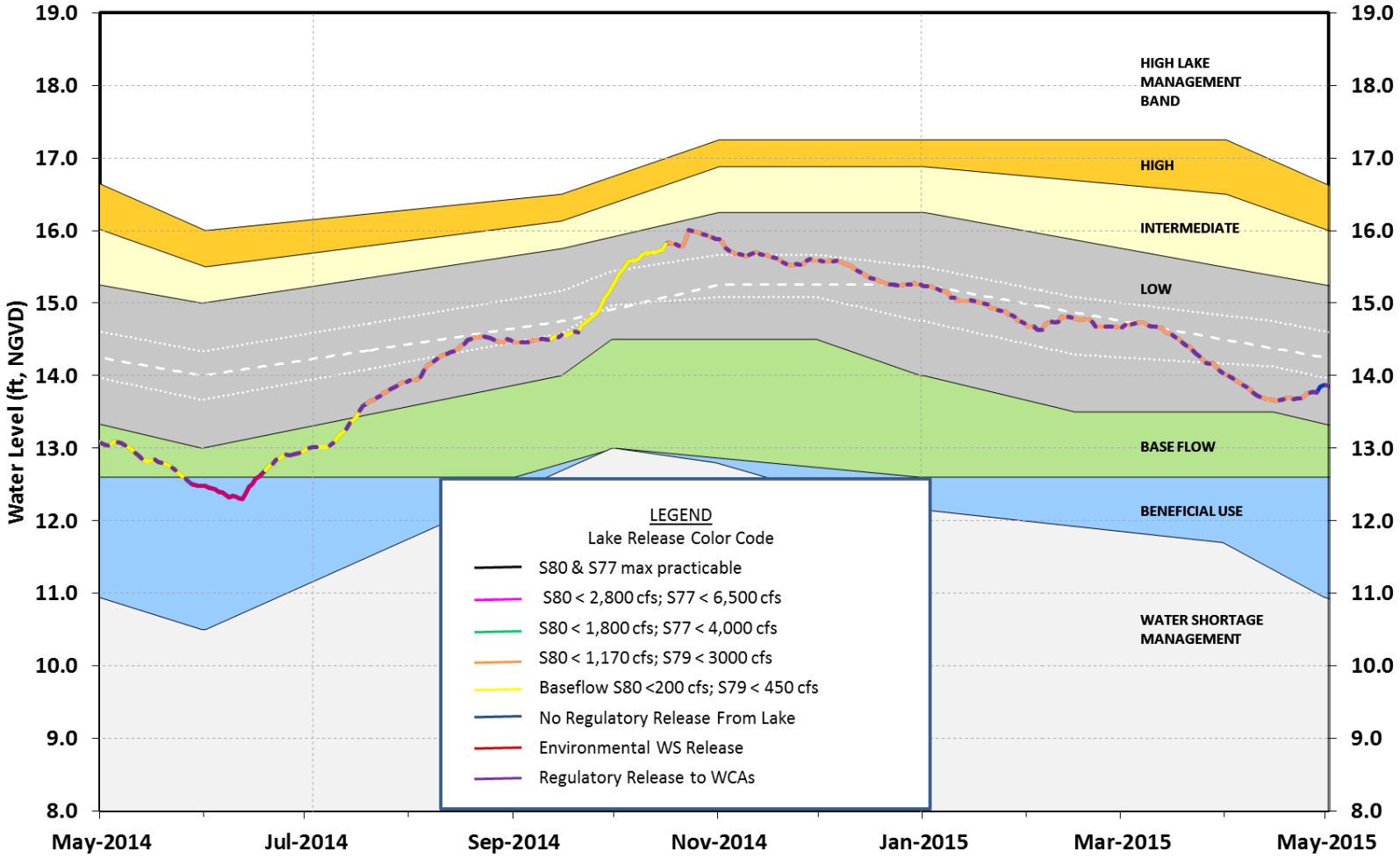

Figure 3. Lake Okeechobee stage values for WY2015 and the 2008 Lake Okeechobee Regulation Schedule. [Note: cfs – cubic feet per second; max – maximum; NGVD – National Geodetic Vertical Datum of 1929; WCA – Water Conservation Area; and WS – Water Supply.]

Table 7. Monthly discharge flow in ac-ft from Lake Okeechobee for WY2015.

Station	May 2014	June 2014	July 2014	August 2014	Sep. 2014	Oct. 2014	Nov. 2014	Dec. 2014	Jan. 2015	Feb. 2015	March 2015	April 2015	Total
CU-10A	0	0	3,557	19,438	11,280	8,083	11,718	17,361	21,951	19,682	18,220	14,892	146,182
CU-5	0	0	0	0	0	0	249	0	891	5,725	3,714	39	10,618
CU-5A[a]	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
G-207	28	14	15	13	13	34	14	15	14	13	13	13	199
G-208	0	0	0	0	0	0	21	15	15	2	13	13	79
Industrial Canal	6,935	2,892	1,037	2,387	107	1,991	2,123	1,988	2,166	931	2,667	1,324	26,548
S-127	0	0	0	0	0	0	0	0	0	0	0	514	514
S-129	0	0	0	0	0	0	0	0	0	0	0	0	0
S-131	0	0	0	0	0	0	0	0	0	0	0	0	0
S-135	0	0	0	0	0	0	0	0	0	0	0	0	0
S-308[b]	6,635	1,669	1,802	2,293	3,220	2,386	2,716	6,519	13,911	19,648	62,469	5,956	129,225
S-351[c]	57,808	18,922	3,600	36,175	14,267	16,467	16,005	68,670	83,791	59,522	57,976	45,901	479,105
S-352[c]	53,360	29,323	11,487	36,839	5,870	8,764	3,111	42,269	20,098	19,338	17,336	13,583	261,378
S-354[c]	31,311	10,242	5,215	38,582	15,206	9,600	20,989	35,216	35,634	30,125	44,303	25,773	302,196
S-77[b]	41,714	7,898	16,824	13,571	4,806	19,012	46,867	64,707	72,272	78,161	136,193	73,938	575,962
Total	197,791	70,960	43,537	149,299	54,768	66,337	103,813	236,759	250,743	233,147	342,906	181,946	1,932,006

a. NA – Not available; structure closed for reconditioning.

b. Provides flows and TP loads from the lake. Not owned or operated by the SFWMD.

c. Structures have the ability to incorporate the use of temporary forward pumps for discharging water from Lake Okeechobee during periods of low water levels.

RAINFALL

Daily rainfall measurements collected from the stations used to report Lake Okeechobee Basin rainfall (SFWMD 2015b; **Attachment B3**) were used for consistency with Chapter 2. In addition, next generation radar (NEXRAD) estimates for the Lake Okeechobee region and District-wide were also included (SFWMD 2015c). Rainfall estimates for the Lake Okeechobee Basin and District-wide were 4.3 and -4.7 inches above/below the 30-year average (**Table 8**). For the Lake Okeechobee region, with the exception of August, the wet season values were above the 30-year average while dry season monthly average rainfall was within 1 inch of the 30-year average from November to February. March was very dry (-2.1 inches below the 30-year average) followed by a very wet April (3 inches above the 30-year average). The District-wide rainfall deficit of 4.7 inches was attributed to drier than normal October, December, January, and March values of at least 1.0 inch or more.

Table 8. Lake Okeechobee monthly rainfall averages (in inches) for the rainfall station network, and Lake Okeechobee and Districtwide NEXRAD estimates for WY2015 compared to the 30-year period (Calendar Years 1981–2010).

Month	*Lake Okeechobee*				*Districtwide*		
	WY2015 NEXRAD Estimate	1981–2010 Average	WY2015 Rainfall Network	Difference[a]	1981–2010 Average	WY2015 NEXRAD Estimate	Difference[b]
May	3.2	3.3	3.9	0.6	3.9	3.3	-0.6
June	8.1	7.0	8.8	1.8	8.3	7.8	-0.5
July	6.0	6.0	6.9	0.9	7.0	7.3	0.3
August	5.2	6.7	5.6	-1.1	7.8	6.0	-1.8
September	7.1	5.6	7.1	1.5	6.8	8.1	1.3
October	4.2	3.0	3.4	0.4	3.8	2.1	-1.7
November	1.7	1.9	2.3	0.4	2.4	2.5	0.1
December	0.7	1.6	0.8	-0.8	1.9	0.7	-1.2
January	0.6	1.7	1.1	-0.6	1.9	0.9	-1.0
February	2.3	2.1	2.5	0.4	2.3	2.7	0.4
March	0.7	3.2	1.1	-2.1	3.1	1.1	-2.0
April	4.1	2.2	5.2	3.0	2.5	4.3	1.8
Total	**43.8**	**44.3**	**48.6**	**4.3**	**51.7**	**47.0**	**-4.7**

a. Difference between 1981–2010 average and WY2015 rainfall network.

b. Difference between 1981–2010 average and WY2015 NEXRAD estimates.

PERFORMANCE EVALUATION

CLASS I WATER QUALITY ANALYSIS

The parameters included in the Lake Okeechobee Operating Permit with Florida Class I criteria are alkalinity, percent DO saturation, pH, specific conductance, total iron, and turbidity (**Table 9**). Permit modification 0174552-006-EM replaced biochemical oxygen demand with total organic carbon, which does not have a Class I criterion. The turbidity criterion of 32.3 nephelometric turbidity units (NTU) was based on natural background values, as described in the 2009 annual permit report (Unsell 2009). The criterion for specific conductance was set to 1,275 micro-Siemens per centimeter (µS/cm), because this was greater than 50 percent above background value (Unsell 2009).

Table 9. Class I criteria values for Lake Okeechobee monitoring.

Parameter Name	Parameter Description	Units	Criteria
ALK	Alkalinity	mg/L	≥ 20
DO%	Percent Dissolved Oxygen Saturation	%	> 38% (daily average)
pH	pH	standard units	6 – 8.5
SCOND	Specific Conductance	µS/cm	≤ 1,275
TFE	Total Iron	micrograms per liter (µg/L)	≤ 1,000
TURB	Turbidity	NTU	≤ 32.3 (≤ 29 + 3.3 natural background)

The Class I criterion for DO for streams is a daily DO saturation not less than 38 percent for the Peninsula and Everglades (62-302.533, F.A.C.; State of Florida 2013). Percent DO saturation was calculated for each DO-temperature pair using the equation listed on page 60 of the FDEP technical support document (FDEP 2012). Because only instantaneous readings were available, this value was compared to a standard based on a time-of-day-specific translation of the daily average DO criterion (62-303.320(3)(c), F.A.C.). To meet this criterion, no more than 10 percent of samples of a given stream may be below the 38 percent DO saturation for the Peninsula and Everglades bioregion (62-302.533, F.A.C.; State of Florida 2013).

A binomial hypothesis test was used to determine if there was a greater than 10 percent excursion rate of Class I standards (H0: $f \leq 0.10$; HA: $f \geq 0.10$; Weaver and Payne 2005; Unsell 2009). This excursion rate is given a category of concern (**Table 10**). All flow and structure sample sets contained fewer than 28 samples for WY2015 (the cutoff at which the type II error rate is greater than 20 percent for the binomial test). Therefore, a preliminary evaluation was used based on the percent of excursions greater than 20 percent (“concern” or C), between 0 and 20 percent (“potential concern” or PC), and 0 percent (“no concern” or NC). To accommodate the new DO saturation regulation, with less than 28 samples if there were 10 percent or more excursions, then the category was set to “concern” or C.

Table 10. Excursion categories for Class I water quality tests (adapted from Weaver and Payne 2005).

Excursion Category	Class I Water Quality Binomial Test	Preliminary Analysis of Class I Water Quality Percent Exceedances (less than 28 samples)	
		Other Parameters	DO Saturation
Concern	> 10%	> 20%	> 10%
Potential Concern	5 to 10%	> 0% and < 20%	> 0% and < 10%
Minimal Concern	0% < and < 5%	NA[a]	NA[a]
No Concern	0%	0%	0%

a. Minimal concern category is not calculated for sample sets less than 28 due to statistical uncertainty.

To evaluate the excursion rate more accurately, a ten-year period of record (WY2006–WY2015) was included for the binomial hypothesis testing. The categories for the tests were the same as above, with the addition of "minimal concern" or MC. The category statistics were C (HA: $f \geq 0.10$), PC (HA: $0.05 \leq f < 0.10$), MC (HA: $0 < f < 0.05$), NC (H0: $f = 0$), and ND (no data) (**Table 10**). An evaluation of these data—mean, maximum, minimum, number of samples, standard deviation, median, 25th and 75th percentiles, and number of exceedances from Florida Class I standards—were determined for each structure, for each given flow period, for the ten-year period (Attachment B8). Since pH is a log-based value, means and standard deviations were not calculated, but were listed as "NA" (not applicable). Levels of concern for each Class I parameter are discussed in separate sections for each measured variable.

All results not meeting data quality objectives specified by the FDEP in Chapter 62-160, F.A.C. were removed from this analysis. All measurements below the detection limit were set to half of the detection limit. The mean, maximum, minimum, number of samples, standard deviation, median, 25th and 75th percentiles, and number of exceedances from Florida Class I standards were determined for each structure for each given flow period (Attachments B4 through B6). Samples that exceeded the Class I criteria were tabulated (Attachment B7).

Water quality data for each station was separated into three categories based on flow direction (inflow, no-flow, and outflow or reverse flow). These categories were determined from daily flow measurements, when available (Attachment B2), or from visual inspection records (Attachment B1). Of the 30 structures where water quality is measured to fulfill permit requirements, four primarily outflow structures (G-207, G-208, S-351, and S-354) are only monitored for flow, nitrogen, and phosphorus (modification 6 of the permit). These four structures were eliminated from the Class I analyses, but can be found in previous reports (James and Sharfstein 2014). Of the 26 inflow structures that are included in this analysis, one (S-352) was not included in the inflow analyses because there have been few days of inflow in the last decade, and no samples measured during inflow events. In WY2015, there were no days of inflow at S-236; therefore, no samples were taken under this condition (**Table 11**). No samples were taken at S-3 during operation because all events were for maintenance and no samples were required. One sample was taken at S-2 during maintenance operations, and it did not exceed any criteria. For no-flow events, four stations (C41H78, CU-10A, INDUSCAN, and S-65E) were not sampled because there was flow at these locations for all days of WY2015 (**Table 12**). For the outflow (reverse flow) conditions, six (C-38W, L-59W, L-60E, L-60W, and S-135) of the 15 structures were not sampled because there were no outflows at these locations in WY2015 (**Table 13**).

Table 11. Levels of concern[a] for Class I parameters at Lake Okeechobee structures during WY2015 inflow events.[b]

Station	Alkalinity	Percent DO Saturation	pH	Specific Conductivity	Total Iron	Turbidity
C38W	NC/NC*	C/C#	NC/NC*	C/C*	PC*/NC*	NC/NC*
C41H78	NC/NC*	C/C#	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
CULV10A	NC/NC*	C/NC*	NC/NC*	C/NC*	C*/C*	C/C*
CULV5	NC*/NC*	C#/C#	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
INDUSCAN	NC/NC*	C/C#	NC/NC*	NC/NC*	NC*/NC*	MC/NC*
L59E	C/NC*	C/C#	NC/NC*	C/NC*	C*/C*	NC/NC*
L59W	PC/NC*	C/C#	NC/NC*	NC/NC*	C*/C*	NC/NC*
L60E	C/NC*	C/C#	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
L60W	NC/NC*	C/C#	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
S127	NC*/NC*	C#/C#	NC/NC*	NC/NC*	NC*/NC*	NC*/NC*
S129	NC*/NC*	C#/C#	NC*/NC*	NC*/NC*	NC*/ND	NC*/NC*
S131	NC/NC*	C/C#	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
S133	NC*/NC*	C#/C#	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
S135	NC/NC*	C/C#	NC/NC*	NC/NC*	NC*/ND	NC/NC*
S154	NC/NC*	C/C#	NC/NC*	PC/NC*	C*/C*	NC/NC*
S154C	NC/NC*	C/C#	NC/NC*	C/C*	PC*/C*	MC/NC*
S191	NC/NC*	C/C#	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S2	NC*/NC*	C#/NC*	NC/NC*	C/NC*	PC*/ND	PC*/NC*
S236	NC*/ND	C#/ND	NC*/ND	C*/ND	ND/ND	NC*/ND
S3	NC*/ND	C#/ND	NC*/ND	PC*/ND	NC*/ND	NC*/ND
S4	NC/NC*	C/C#	NC/NC*	C/NC*	NC*/NC*	NC/NC*
S65E	MC/NC	C/C	MC/C	NC/NC	NC/NC*	NC/NC
S71	MC/NC*	C/PC*	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
S72	NC/NC*	C/C#	NC/NC*	NC/NC*	PC*/NC*	NC/NC*
S84	C/C*	C/NC*	MC/NC*	MC/NC*	NC*/NC*	MC/NC*

a. C - concern; PC - potential concern; MC - minimal concern; NC - no concern; and ND - Not Determined (no data).
b. Listing before '/' is for WY2006–WY2015, after '/' is for WY2015.
* Less than 28 samples preliminary test used.
# Less than 28 samples and more than 10 percent of the percent saturation of DO do not meet the criteria.

Table 12. Levels of concern[a] for Class I parameters at Lake Okeechobee structures during WY2015 no-flow events.[b]

Station	Alkalinity	Percent DO Saturation	pH	Specific Conductivity	Total Iron	Turbidity
C38W	NC/NC*	C/C#	C/NC*	C/C*	NC/NC*	C/NC*
C41H78	NC*/NC*	C#/C#	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
CULV10*	NC*/ND	C#/ND	NC*/ND	NC*/ND	NC*/ND	C*/ND
CULV5	NC/NC*	C/NC*	NC/NC*	NC/NC*	NC/NC*	MC/NC*
L59E	NC/NC*	C/C#	MC/NC*	C/NC*	NC*/NC*	MC/NC*
L59W	MC/NC*	C/C#	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
L60E	NC/NC*	C/NC*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
L60W	NC/NC*	C/C#	MC/NC*	NC/NC*	NC*/ND	NC/NC*
S127	NC/NC*	C/NC*	NC/NC*	C/NC*	NC/NC*	NC/NC*
S129	NC/NC*	MC/C#	NC/NC*	NC/NC*	NC/NC*	NC/NC*
S131	NC/NC*	PC/NC*	MC/NC*	NC/NC*	NC/NC*	NC/NC*
S133	NC/NC*	C/NC*	MC/NC*	NC/NC*	PC/NC*	NC/NC*
S135	NC/NC*	MC/NC*	MC/NC*	NC/NC*	NC/NC*	MC/NC*
S154	NC/NC*	MC/NC*	MC/NC*	C/C*	C/C*	MC/NC*
S154C	NC/NC*	C/C#	NC/NC*	C/C*	NC*/ND	C/NC*
S191	NC/NC*	MC/NC*	MC/NC*	MC/NC*	NC/NC*	NC/NC*
S2	NC/NC*	C/PC*	MC/NC*	C/PC*	C/C*	PC/NC*
S236	NC/NC*	C/C#	NC/NC*	C/C*	NC/NC*	NC/NC*
S3	NC/NC*	C/NC*	NC/NC*	C/PC*	C/PC*	C/PC*
S352	NC/NC*	MC/NC*	MC/NC*	NC/NC*	C*/ND	C/C*
S4	NC/NC*	MC/NC*	MC/NC*	MC/NC*	NC*/NC*	MC/NC*
S65E	NC*/ND	PC*/ND	NC*/ND	NC*/ND	NC*/ND	NC*/ND
S71	MC/NC*	C/NC*	MC/NC*	NC/NC*	NC*/ND	NC/NC*
S72	MC/NC*	C/C#	MC/NC*	NC/NC*	NC/NC*	NC/NC*
S84	C/C*	MC/NC*	MC/NC*	NC/NC*	NC*/ND	MC/NC*

a. C - concern; PC - potential concern; MC - minimal concern; NC - no concern; and ND - Not Determined.
b. Listing before '/' is for WY2006–WY2015. Listing after '/' is for WY2015.
* Less than 28 samples preliminary test used.
# Less than 28 samples, and more than 10 percent of the percent saturation of DO, do not meet the criteria.

Table 13. Levels of concern[a] for Class I parameters at Lake Okeechobee structures during WY2015 outflow events.[b]

Station	Alkalinity	Percent DO Saturation	pH	Specific Conductivity	Total Iron	Turbidity
C41H78	NC/NC*	C/NC*	NC/NC*	NC/NC*	NC*/ND	NC/NC*
CULV10*	NC/NC*	MC/NC*	MC/NC*	MC/NC*	C*/C*	C/C
CULV5	NC*/NC*	C#/NC*	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
INDUSCAN	NC/NC*	C/NC*	MC/NC*	NC/NC*	C/NC*	C/NC*
L59E	NC*/ND	C#/ND	NC*/ND	NC*/ND	NC*/ND	NC*/ND
L60W	NC*/ND	C#/ND	NC*/ND	NC*/ND	NC*/ND	NC*/ND
S127	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*	NC*/ND	NC*/NC*
S135	NC*/ND	NC*/ND	PC*/ND	NC*/ND	NC*/ND	PC*/ND
S352	NC/NC*	NC/NC*	MC/NC*	NC/NC*	C*/C*	C/C

a. C – concern; PC – potential concern; MC – minimal concern; NC – no concern; and ND – no data.
b. Listing before "/" is for WY2006–WY2015. Listing after "/" is for WY2015.
* Less than 28 samples preliminary test used.
# Less than 28 samples and more than 10 percent of the percent saturation of DO do not meet the criteria.

Alkalinity

Of the 23 structures sampled for alkalinity during inflow events, one structure (S-84) was defined as "concern" and 22 as "no concern" (**Table 11**). Of the 232 measurements, 9 excursions were found, all at S-84 (Attachment B4). For the ten-year period, 18 structures were classified as "no concern", two (S65-E and S-71) as "minimal concern", one (L59W) as "potential concern", and three (L-59E, L-60E, and S-84) as "concern" (**Table 11**; Attachment B8). Low alkalinity was associated with basins in the Indian Prairie, which may indicate natural conditions with more acidic soils from wetlands.

Of the 23 structures sampled during no-flow events, one structure (S-84) was defined as "concern" (**Table 12**; Attachment B5), and all others were categorized as "no concern". Of the 165 samples taken during no-flow events, three excursions were found, all at S-84. For the ten-year period of analysis, 21 structures were classified as "no concern", three (L-59W, S-71, and S-72) as "minimal concern", and one (S-84) as "concern" (**Table 12**; Attachment B8).

Of the 55 alkalinity samples taken at the six structures during outflow events in WY2015, no excursions were found (**Table 13**, Attachment B6). For the ten-year period of record, no excursions were found at the nine stations (**Table 13**; Attachment B8).

Percent Dissolved Oxygen Saturation

Of the 23 structures where DO and temperature were measured, and percent DO saturation could be calculated during inflow events in WY2015, three (S-2, S-84, and CULV10A) were classified as "no concern", one (S-71) as "potential concern", and all others as "concern" (**Table 11**; Attachment B4). Of the 231 measurements during inflow events, 84 did not meet the percent DO saturation Class I criterion (Attachment B4).

Factors other than high temperature could result in the high exceedance of the percent DO saturation criteria. These include high dissolved organic carbon, high microbial activity, high plant respiration during low light conditions, and/or laminar flow of water in the canals that prevents turbulent mixing of the water with air. Management practices to meet the proposed numeric nutrient

criteria may reduce organic carbon input to the tributaries. Other practices to increase turbulence of the canal flow (e.g., baffle boxes or mechanical mixing) also may improve DO conditions. For the ten-year period of record, all 24 structures were classified as "concern" (**Table 11**; Attachment B8).

Of the 23 structures where percent DO saturation was calculated during no-flow events, 13 were classified as "no concern", one (S-2) as "potential concern", and nine (C38W, C41H78, L-59E, L-59W, L-60W, S-129,S-154C, S-236, and S-72) as "concern" (**Table 12**; Attachment B5). Of the 164 samples taken during no-flow events, 14 were below the percent DO saturation Class I criterion (Attachment B5). For the ten-year analysis, seven (S-129, S-135, S-154, S-191, S-352, S-4, and S-84) were classified as "minimal concern, two (S-131 and S-65E) as "potential concern", and 16 as "concern" (**Table 12**; Attachment B8).

Of the six structures where percent DO saturation was calculated during outflow events, all were classified as "no concern" (**Table 13**; Attachment B6). Of the 55 samples taken during outflow events, none were below the percent DO saturation Class I criterion. For the ten-year analysis, four (C41H78, CU-5, INDUSCAN, L-59E, and L-60W) were classified as "concern", one (CU-10A) as "minimal concern", one (S-354) as "potential concern", and three (S-127, S-135, and S-352) as "no concern" (**Table 13**; Attachment B8). As with inflow events, the low DO may be due to various factors, as noted above.

pH

Of the 23 structures where pH was measured during inflow events, 22 were classified as "no concern" and one (S-65E) as "concern" (**Table 11**). Of the 231 measurements taken during inflow events, there was one excursion (Attachment B4). For the ten-year period, 21 structures were classified as "no concern", and three (S-191 and S-65E, S-84) as "minimal concern" (**Table 11**; Attachment B8). Excursions at S-191 were below pH 6.0. At S-65E, some were above pH 8.5, and others were below pH 6.0. The excursions at S-84 were all above pH 8.5.

Of the 23 structures where pH was measured during no-flow events, all were classified as "no concern" (**Table 12**). Of the 164 samples taken during no-flow events, none were outside the pH criteria range, above 8.5 (Attachment B5). For the ten-year period, there were nine structures listed as "no concern", 15 as "minimal concern", and one as "concern" (C-38W) (**Table 12**; Attachment B8). Of the structures listed as "minimal concern", one (S-191) had excursions below the 6.0 pH criterion and above the 8.5 pH criterion, while excursions at the other structures were all above the pH 8.5 criterion (Attachment B8). The concern at C-38W was for pH samples above 8.5, which may have been caused by high groundwater inflows or algal blooms.

No excursions were found in the 55 pH measurements at six structures during outflow events in WY2015 (**Table 13**; Attachment B6). For the ten-year period, five structures were classified as "no concern", one structure (S-135) as "potential concern", and three structures (CU-10A, INDUSCAN, S-352) as "minimal concern" (**Table 13**; Attachment B8). The pH excursions at all of these structures exceeded the pH 8.5 criterion.

Specific Conductance

Of the 23 structures measured for specific conductance during inflow events, 21 were classified as "no concern", and two (C-38W and S154C) as "concern" (**Table 11**). Of the 231 samples taken during inflow events, 29 exceeded the conductance criterion (Attachment B4). For the ten-year period of record, 15 were classified as "no concern", one (S-84) as "minimal concern", two (S-154 and S-3) as "potential concern", and six (C-38W, CU-10A, L-59E, S-154C, S-2, and S-4) as "concern" (**Table 11**; Attachment B8). High conductance is likely a result of groundwater seepage.

Of the 23 structures measured for specific conductance during no-flow events, 17 were classified as "no concern", two (S-2 and S-3) as "potential concern", and four (C-38W, S-154, S-154C, and S-236) as "concern" (**Table 12**). Of the 164 samples taken during no flow conditions, 15 exceeded the conductance criterion (Attachment B5). For the ten-year period of record, 15 structures were classified as "no concern", two (S-191 and S-4) as "minimal concern", and eight (C-38W, L-59E, S-127, S-154, S-154C, S-2, S-236, and S-3) as "concern" (**Table 12**; Attachment B8). Similar to inflow conditions, high conductance was likely a result of groundwater seepage.

No excursions were found in the 55 specific conductance measurements at six structures during outflow events in WY2015 (**Table 13**; Attachment B6). For the ten-year period, eight structures were classified as "no concern" and one (CU-10A) as "minimal concern" (**Table 13**; Attachment B8).

Total Iron

The Class I criterion specifies that total iron shall not exceed 1 milligram per liter (mg/L). While not toxic at this level, the criterion is primarily to prevent staining in clothes washing (Environmental Health Laboratory 2010). Currently, only one local municipality, the City of Okeechobee, uses lake water for part of its water supply. This parameter is only measured quarterly. Therefore, the binomial test could only be performed on a few structures with accuracy for the ten-year period.

Of the 20 structures sampled for total iron during inflow events in WY2015, five (CU-10A, L-59E, L59W, S-154, and S-154C) were classified as "concern", and the other 15 as "no concern" (**Table 11**; Attachment B4). Of the 43 samples taken during inflow events, five exceeded the total iron criterion (Attachment B4). For the ten-year period of record, 16 structures were classified as "no concern", four (C-38W, S-154C, S-2, and S-72) as "potential concern", and four (CU-10A, L-59E, L-59W, and S-154) as "concern" (**Table 11**; Attachment B8). Iron occurs naturally in soils and groundwater of the Lake Okeechobee Watershed, resulting in the high concentrations (FDEP 2009).

Of the 18 structures sampled for total iron during no-flow events, 15 were classified as "no concern", two (S-154 and S2) as "concern", and one (S-3) as "potential concern" (**Table 12**). Of the 48 samples taken during no flow periods, three exceeded the iron standard (Attachment B5). For the ten-year period, 20 structures were classified as "no concern", one (S-133) as "potential concern", and four (S-154, S-2, S-3, and S-352) as concern. Iron concerns at S-133, S-154, S-2, S-3, and S-352 may be attributed to groundwater seepage.

Of the four structures sampled for total iron during outflow events, two structures (CU-5 and INDUSCAN) were classified as "no concern" and two (CU-10A and S-352) as "concern" (**Table 13**). Of the ten samples taken during outflow periods, five exceeded the criterion for iron (Attachment B6). For the ten-year period, six structures (C41H78, CU-5, L-59E, L-60W, S-127, and S-135) were classified as "no concern" and three (CU-10A, INDUSCAN, and S-352) as "concern" (**Table 13**; Attachment B8). Two of the "concerns", S-352 and CU-10A, may be attributed to the proximity of the structures to the open water of the lake, which is relatively high in iron (FDEP 2009).

Turbidity

The Class I turbidity criterion for Lake Okeechobee tributaries is 32.3 NTU. The exceedance value was based on 29 NTU, plus a background value of 3.3 NTU, which was determined based on the median value of turbidity in lake tributaries from 1990 to 2000 (Unsell 2009).

Of the 23 structures sampled for turbidity during inflow events, 22 were classified as "no concern" and one (CU-10A) as "concern" (**Table 11**). Of the 231 samples taken, there were three exceedances of the criterion, which occurred at CU-10A (Attachment B4). For the ten-year period, 19 structures were classified as "no concern", three (INDUSCAN, S-154C, and S-84) as "minimal concern", one (S-2) as "potential concern", and one (CU-10A) as "concern" (**Table 11**; Attachment B8). Turbidity concerns in CU-10A may be due to runoff from agricultural lands, as well as resuspended sediments that have accumulated in the bottom of the canals during inflow events.

Of the 23 structures sampled for turbidity during no-flow events, 21 were classified as "no concern", one (S-2) as "potential concern", and one (S-352) as "concern" (**Table 12**). Of the 167 samples taken during no-flow events, six samples exceeded the criterion for turbidity (Attachment B5). For the ten-year period, 13 structures were classified as "no concern", six (CU-5, L-59E, S-135, S-154, S-4, and S-84) as "minimal concern", one (S-2) as "potential concern", and five (C-38W, CU-10A, S-154C, S-3, and S-352) as "concern" (**Table 12**; Attachment B8). Turbidity concerns at S-2, S-3, S-352, CU-10A, and C-38W may be related to accumulation of sediments in the bottom of the canals.

Of the six structures sampled for turbidity during outflow events, four structures (C41H78, CU-5, INDUSCAN, and S127) were classified as "no concern" and two (CU-10A and S-352) as "concern" (**Table 13**). Of the 96 samples taken during outflow events, 40 exceeded the criteria for turbidity (Attachment B6). For the ten-year period, five structures (C41H78, CU-5, L-59E, L-60W, and S-127) were classified as "no concern", one (S-135) as "potential concern", and three (CU-10A, INDUSCAN, and S-352) were classified as "concern" (**Table 13**; Attachment B8). Turbidity concerns at S-352 and CU-10A during outflow could be attributed to their location, which is near the open, turbid waters of the lake. The INDUSCAN location is at the end of a cut leading to open water and also may be affected by sediments entrained from a nearby launching basin located between the Roland Martin Marina and the Herbert Hoover Dike.

TOTAL PHOSPHORUS LOADS

The WY2015 TP load to Lake Okeechobee was 450 mt, which included an estimated 35 mt from atmospheric deposition (FDEP 2001; **Table 14**). Most of the surface load came from the north region (391 mt), followed by east (15.4 mt), and south (8.7); there was no load from the west. Adding an estimated 35 mt from atmospheric deposition produced the estimated 450 mt of load to the lake in WY2015. Target loads based on the TMDL were exceeded by 312 mt in the northern region. All other regions were below target loads. Overall, the WY2015 TP load was less than WY2014 by 26 percent (**Table 15**). This lower load is primarily attributed to greater flow with lower TP concentration from the Upper Kissimmee Subwatershed and Lower Kissimmee Subwatershed and less flow from watersheds near the lake with higher phosphorus concentrations (**Table 14**). The flow-weighted concentrations for each region demonstrated the significant reduction that occurred in the north region, from 162 ppb in WY2014 to 155 ppb in WY2015 (**Table 17**). This region, which contributes over 83 percent of the flow to the lake (**Table 16**), produced an overall reduction of TP concentration from 164 ppb to 119 ppb (**Table 17**). The five-year (WY2011–WY2015) average TP load to Lake Okeechobee is 436 mt per year, which exceeds the TMDL by 296 mt (**Table 14**).

Table 14. WY2015 TP loads in mt for each structure by month.

Region	Structure	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Total	Target Load	Above Target
East	L-8(C10A)	4.0	5.6	1.9	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0	11.8		
	S-308	0.5	0.5	0.9	0.3	0.2	0.3	0.2	0.1	0.1	0.2	0.0	0.3	3.6		
	Total	4.5	6.1	2.8	0.3	0.3	0.5	0.2	0.1	0.1	0.2	0.0	0.3	15.4	16.8	0
North	C41H78	0.7	1.0	18.3	6.2	10.2	0.7	0.9	0.9	0.6	0.6	1.1	1.1	42.5		
	C-38W	0.0	0.0	0.2	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4		
	CU-5	0.0	0.0	0.0	0.2	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.7		
	FECRSR78	0.3	0.5	4.4	5.9	5.6	6.4	0.6	1.2	0.3	0.3	0.4	0.5	26.5		
	L-61E	0.5	0.4	1.1	0.1	0.0	0.0	0.2	0.3	0.2	0.2	0.8	0.6	4.5		
	L-59E	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2		
	L-59W	0.0	4.0	3.8	1.8	0.8	1.1	0.6	1.2	0.4	0.1	0.4	0.5	14.8		
	L-60E	0.0	0.8	0.8	0.2	0.3	0.0	0.0	0.1	0.1	0.3	0.1	0.0	2.6		
	L-60W	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4		
	S-127	0.0	1.8	1.0	0.9	0.2	0.4	0.1	0.1	0.0	0.0	0.0	0.1	4.6		
	S-129	0.0	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.4		
	S-131	0.0	0.0	0.1	0.2	0.3	0.1	0.1	0.1	0.0	0.0	0.0	0.0	1.0		
	S-133	0.0	1.1	2.4	1.5	1.2	1.2	0.2	0.2	0.2	0.1	0.0	0.1	8.2		
	S-135	0.0	0.2	0.1	0.1	0.5	0.6	0.2	0.4	0.3	0.2	0.1	0.1	2.7		
	S-154	0.0	1.2	4.4	4.7	0.7	0.8	0.3	0.1	0.1	0.0	0.0	0.0	12.2		
	S-154C	0.0	0.5	1.5	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.6		
	S-191	0.0	12.7	16.1	8.5	4.5	8.4	0.1	0.0	0.3	0.0	0.0	0.7	51.3		
	S-65E	5.4	7.3	29.7	24.7	17.3	18.4	2.7	7.3	7.6	10.6	15.0	8.4	154.3		
	S-71	0.2	1.5	21.7	6.2	12.7	2.8	0.8	0.6	0.4	0.5	0.3	0.9	48.6		
	S-72	0.1	2.4	3.1	2.2	1.3	0.5	0.2	0.3	0.0	0.0	0.0	0.4	10.8		
	S-84	1.7	4.7	10.5	6.0	6.2	3.5	1.9	1.6	0.7	2.2	1.6	3.2	43.9		
	Total[a]	8.2	39.4	101.0	64.0	51.9	44.4	8.4	13.6	10.8	14.7	18.8	15.8	390.9	78.6	312.3

Table 14. Continued.

Region	Structure	May 2014	Jun 2014	Jul 2014	Aug 2014	Sep 2014	Oct 2014	Nov 2014	Dec 2014	Jan 2015	Feb 2015	Mar 2015	Apr 2015	Total	Target Load	Above Target
South	CU-10	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	CU-12	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	CU-12A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	CU-4A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	INDS	0.0	0.5	0.5	0.0	0.8	0.0	0.0	0.0	0.0	0.0	0.0	1.1	3.0		
	S-2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.2		
	S-236	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	S-3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	S-352	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	S-4	0.0	0.1	2.5	0.1	2.1	0.3	0.0	0.0	0.0	0.0	0.2	0.1	5.5		
	Total	0.0	0.6	3.0	0.1	2.9	0.3	0.0	0.0	0.0	0.1	0.3	1.3	8.7	9.6	0.0
West	CU-5A	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	S-77	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0		
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total	Surface[a]	12.7	46.1	106.8	64.5	55.1	45.2	8.6	13.6	10.9	15.0	19.1	17.3	415.0	105.0	310.0
	Atmospheric Deposition													35	35	
	Sum[a]													450	140	310

a. Does not include C41H78.

Table 15. TP loads in mt to Lake Okeechobee, WY2011-WY2015.

Water Year	North	East	South	West	Atmospheric Deposition[a]	Total
2011	136	2	4	1	35	178
2012	278	16	10	38	35	377
2013	467	37	29	0.4	35	568
2014	538	11	25	0.1	35	609
2015	391	15	9	0	35	450
Average	362	16	15	8	35	436
Percent of Total	83%	4%	4%	2%	8%	100%

a. 35 mt per year from atmospheric deposition (FDEP 2001).

Table 16. Surface flows in millions of ac-ft to Lake Okeechobee, WY2011–WY2015.

Water Year	North	East	South	West	Total
2011	0.89	0.01	0.03	0.02	0.95
2012	1.62	0.09	0.04	0.2	1.95
2013	1.85	0.2	0.09	0.01	2.15
2014	2.69	0.06	0.08	0	2.83
2015	2.75	0.07	0.04	0	2.83
Average	1.96	0.09	0.06	0.05	2.14
Percent Total	92%	4%	3%	2%	100%

Table 17. Surface flow weighted TP concentrations by region, WY2011–WY2015.

Water Year	North	East	South	West	Total
2011	124	162	108	41	122
2012	139	144	203	154	142
2013	205	150	261	32	201
2014	162	149	253	27	164
2015	115	170	177	NA	119
Average	150	152	222	110	152

This five-year average includes one regional drought that lasted from December 2010 to October 2011. During this period, flow and TP load to the lake were reduced substantially compared to the 1991–2005 baseline of 2.5 million ac-ft and 546 mt TP (SFWMD et al. 2011) (**Tables 15** and **16**). The overall average flow in the past five years was 2.14 million ac-ft, which is 0.36 million ac-ft below the baseline (**Table 16**). Further analysis is presented in Chapter 8 of Volume I, which documents water flow, TP load, and TP mean flow-weighted concentrations in each Lake Okeechobee sub-watershed.

PESTICIDE MONITORING PROGRAM

The District maintains a pesticide monitoring program to meet various permit and other mandated requirements, including Class I (drinking water) criteria of Chapter 62-302, F.A.C. On a quarterly basis for water, and an annual/semi-annual basis for sediments, samples are measured for 73 pesticides and their breakdown products at sites throughout the District (Pfeuffer 2014a, b, c, 2015). A minor modification of the Lake Okeechobee Water Control Structure Operations Permit Number 0174552-010, dated December 18, 2011, eliminated sediment sampling at S-65E, S-191, and FECSR78. Additionally, sediment sampling was reduced to an annual frequency at S-2, S-3, and S-4 for ametryn, chlordane, dichlorodiphenyldichloroethane (DDD), dichlorodiphenyldichloroethylene (DDE), and dichlorodiphenyltrichloroethane (DDT) analysis. No sediment samples were collected in WY2015; however, sediment samples are targeted for collection during June 2015. Additional information on the pesticide monitoring program can be found on the District's website (www.sfwmd.gov).

For Lake Okeechobee, pesticides are monitored at S-65E, S-191, Fisheating Creek (FECSR78), S-2, S-3, and S-4 (Attachment B9). In the four surface water sampling events (April, July, and November 2014, and January 2015), 2,4-dichlorophenoxyacetic acid (2,4-D), ametryn, atrazine, atrazine breakdown product, bentazon, bromacil, diuron, hexazinone, imidacloprid, norflurazon, and simazine were detected in at least one sample (**Table 17**).

The observed concentration of each compound was compared to the appropriate criterion outlined in Rule 62-302.530, F.A.C. If a pesticide compound is not specifically listed, acute and chronic toxicity criterion are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50 percent of the test organisms in 96 hours, using the lowest technical grade effective concentration (EC_{50}) or lethal concentration (LC_{50}). EC_{50} is the concentration at which 50 percent of the aquatic species tested exhibit a toxic effect short of mortality within a short (acute) exposure period. The LC_{50} technical grade is the concentration at which 50 percent of the aquatic animals tested die within a short (acute) exposure period. These criteria are determined using data from summarized literature for the species significant to the indigenous aquatic community (62-302.200, F.A.C.). These values are listed for the water flea (*Daphnia magna*), which is the most susceptible test organism for these pesticides (**Table 17**). None of the detected concentrations exceeded these values. However, the pulsed nature of agricultural runoff releases to the canal system precludes drawing any conclusions about the effects of long-term average exposures. Based on excursion categories recommended for the Everglades Protection Area (Weaver and Payne 2005), any site where a pesticide was detected is to be labeled as a potential concern.

Table 17. Pesticide residues in micrograms per liter (µg/L) above the method detection limit found in surface water samples collected by the SFWMD at Lake Okeechobee sampling sites in April, July, and November 2014, and January 2015 (from Pfeuffer 2014a, b, c, 2015), and chronic toxicity values for the water flea (*Daphnia magna*).

Site	Date	Flow	2,4-D	Ametryn	Atrazine	Atrazine Desethyl	Bentazon	Bromacil	Diuron	Hexazinone	Imidacloprid	Norflurazon	Simazine
FECSR78	4/28/2014	N	0.013	BDL	BDL	BDL	0.0045[a]	0.11[a]	0.0043[a]	BDL	0.038	0.098[a]	0.012[a]
	7/14/2014	Y	0.0037[a]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	11/3/2014	N	0.0076[a]	BDL	BDL	BDL	BDL	BDL	BDL	0.070[a]	0.0059[a]	BDL	BDL
	1/26/2015	ND	BDL	BDL	0.014[a]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
S-65E	4/28/2014	Y	0.0055[a]	BDL	0.02[a]	BDL	0.0036[a]	BDL	BDL	BDL	BDL	BDL	BDL
	7/14/2014	Y	0.26	BDL	BDL	BDL	0.0097[a]	BDL	BDL	BDL	0.016	BDL	BDL
	11/3/2014	Y	0.013	BDL	0.069	BDL	0.036	BDL	BDL	0.031[a]	0.0080[a]	BDL	BDL
	1/26/2015	Y	0.0033[a]	BDL	0.025[a]	BDL	0.016	BDL	BDL	BDL	0.0052[a]	BDL	BDL
S-191	4/28/2014	N	0.19	BDL	BDL	0.011[a]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	7/14/2014	Y	0.055	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	11/3/2014	N	0.094	BDL	BDL	BDL	BDL	BDL	BDL	0.21	BDL	BDL	BDL
	1/26/2015	N	0.025	BDL	0.021[a]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
S-2	4/28/2014	N	0.0032[a]	0.015[a]	0.35	0.047	0.0021[a]	BDL	BDL	BDL	BDL	BDL	BDL
	7/14/2014	N	0.14	BDL	0.16	0.028[a]	0.042	BDL	BDL	BDL	BDL	BDL	BDL
	11/3/2014	N	0.013	0.013[a]	0.083	0.022[a]	0.0025[a]	BDL	BDL	BDL	BDL	BDL	BDL
	1/26/2015	N	0.0040[a]	BDL	0.12	0.017[a]	0.0074[a]	BDL	BDL	BDL	BDL	BDL	BDL
S-3	4/28/2014	N	0.0047[a]	0.013[a]	0.39	0.048	0.0024[a]	BDL	BDL	BDL	BDL	BDL	BDL
	7/14/2014	N	0.064	0.033[a]	0.14	0.019[a]	0.0074[a]	BDL	BDL	BDL	BDL	BDL	BDL
	11/3/2014	N	0.0097[a]	0.011[a]	0.12	0.036[a]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	1/26/2015	N	0.0070[a]	BDL	0.1	0.017[a]	0.0080[a]	BDL	BDL	BDL	BDL	BDL	BDL
S-4	4/28/2014	N	0.0032[a]	0.016[a]	0.38	0.047	0.0026[a]	BDL	BDL	BDL	BDL	BDL	BDL
	7/14/2014	Y	0.38[b]	0.033[a,b]	0.15[b]	0.034[ab]	0.058[b]	BDL	BDL	BDL	BDL	BDL	BDL
	11/3/2014	N	0.031	0.073	0.87	0.044	0.0040[a]	BDL	BDL	BDL	BDL	BDL	BDL
	1/26/2015	N	0.0084[a]	0.015[a]	0.17	0.017[a]	0.0084[a]	BDL	BDL	BDL	BDL	BDL	BDL
Chronic toxicity of *Daphnia magna*			1,250[c]	1,400[c]	345[c]	NA	5,000[d]	6,050[e]	70[f]	7,580[c]	4,260[g]	1,175[c]	55[c]

Key: N – no; Y – yes; BDL – result is below the method detection limit; ND – not discernable.
a. Value reported is greater than or equal to the method detection limit and less than the practical quantitation limit.
b. Results are the average of replicate samples.
c. United States Environmental Protection Agency (1991)
d. United States. Environmental Protection Agency (1994a)
e. United States Environmental Protection Agency (1996)
f. United States Environmental Protection Agency (2003)
g. United States Environmental Protection Agency (1994b)

IN-LAKE WATER QUALITY MONITORING

The District sampled 26 locations during WY2015 to monitor water quality in all ecological regions of Lake Okeechobee (**Figure 4**). The effects of nutrient loading, high and low water levels, droughts, and hurricanes on trends and changes in water quality have been evaluated using this information (Havens and James 2005, James and Havens 2005, James et al. 2008, 2011a, b). Chapter 8 of Volume I includes a detailed evaluation of these WY2015 data. All water quality data collected at the in-lake sampling sites (**Figure 4**) was downloaded from DBHYDRO (SFWMD 2015a), as presented in Attachment B10. These records include analytical results of grab samples for the 16 water quality parameters listed in **Table 4**.

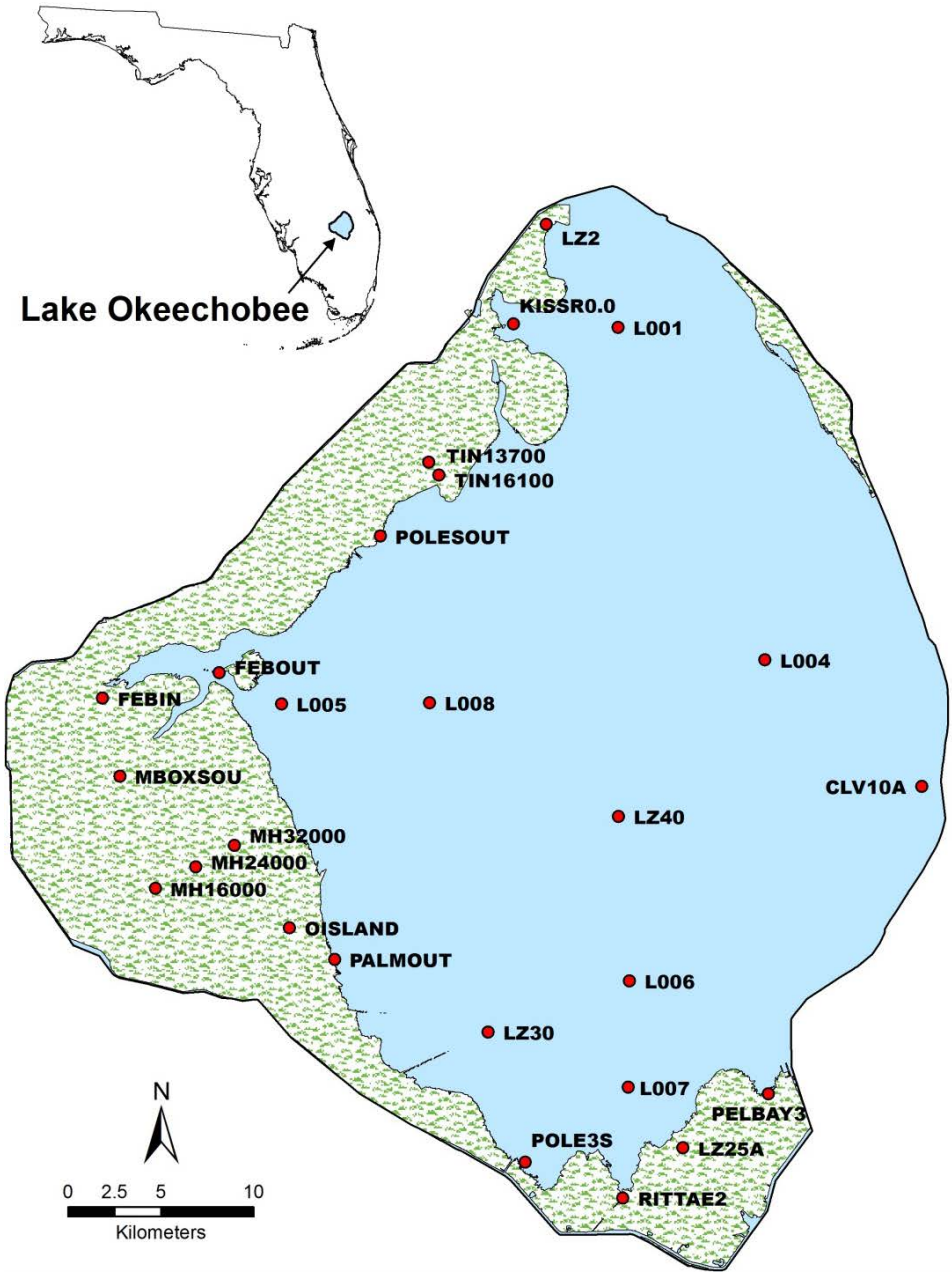

Figure 4. Active water quality monitoring stations in Lake Okeechobee.

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Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented in this report for the Lake Okeechobee Operating Permit (NEEPP permit 0174552-010).

Specific Condition	Description	Applicable Phase	Action Taken	Reported in the 2016 SFER in: *(All references are to Volume III, except where noted as "V1" for Volume I - Chapter 8, and "LOPP" for the 2013 Lake Okeechobee Protection Plan Update [SFWMD et al. 2013])*			
				Narrative (page #s)	**Figure**	**Table**	**Attachment**
6E(3)	Operations at the S-2 and S-3 structures – event reporting and coordination – after action reports	Operations	Only maintenance pumping events occurred in the past year, no action taken	9			
9A	Implementation of the Lake Okeechobee Protection Plan	Operations	Ongoing implementation of the Lake Okeechobee Protection Plan to meet Lake Okeechobee total maximum daily load	V1: 8-1 to 8-48	V1: 8-1 to 8-13	V1: 8-1 to 8-14	
9B	Annual compliance evaluation by region	Operations	Completed annual compliance evaluation (by region), as required	23–27		14,15	
16	Annual monitoring reports	Operations	Completed and submitted annual report (this document), as required	All	All	All	All
16 A	Water quality data	Operations	Data records include all applicable laboratory information specified in Rule 62-160.340(2), F.A.C.	5–8	1	3–5	B1
16 A1	Date, location and time of sampling or measurements	Operations	Reported as required		1		B1
16 A2	Person responsible for performing the sampling or measurements	Operations	Reported as required				B1
16 A3	Dates analyses were performed or appropriate code as required by Chapter 62-160, F.A.C.	Operations	Reported as required				B1
16 A4	Laboratory/person responsible for performing the analyses	Operations	Reported as required				B1
16 A5	Analytical methods used, including method detection limits and practical quantitation limits	Operations	Reported as required				B1
16 A6	Results of such analyses, including appropriate data qualifiers, and all compounds detected	Operations	Reported as required				B1
16 A7	Depth of sampling (for grab samples)	Operations	Reported as required				B1

Table A-1. Continued.

Specific Condition	Description	Applicable Phase	Action Taken	Reported in the 2016 SFER in: *(All references are to Volume III, except where noted as "V1" for Volume I - Chapter 8, and "LOPP" for the 2013 Lake Okeechobee Protection Plan Update [SFWMD et al. 2013])*			
				Narrative (page #s)	**Figure**	**Table**	**Attachment**
16 B	Performance evaluation: with the raw data, the permittee must submit an evaluation of the water quality monitoring data collected	Operations	Evaluated raw water quality data and included in report	16–29		9–17	B4–B11
16 B1	The analysis shall include the identification of exceedances of water quality criteria, other than phosphorus, as well as the frequency of exceedances	Operations	Performed exceedance analyses and included all required information in report	16–23		9–13	B4–B8
16 B2	The permittee shall determine the annual TP loading to Lake Okeechobee	Operations	Calculated TP loads and included in report, as required	23–27; V1: 8-29 to 8-32,8-41 to 8-44	V1: 8-8 to 8-9	14–15, 17; V1: 8-5, 8-6, 8-9, 8-12, 8-13	
16 B3	The permittee shall report the five-year rolling average of phosphorus loading to Lake Okeechobee	Operations	Reported five-year rolling average total phosphorus loads, as required	23–27; V1: 8-25		15, V1: 8-3	
16 B4	The permittee shall provide the data from their ambient pesticide and herbicide monitoring program that is applicable to Lake Okeechobee	Operations	Provided pesticide and herbicide monitoring data, as required	27–28		17	B9
16 B5	The permittee shall provide data collected within Lake Okeechobee under the Lake Okeechobee Research and Monitoring Program	Operations	Provided Lake Okeechobee Research and Monitoring Program data, as required	29; V1: 8-46 to 8-48	4; V1: 8-13 to 8-33	V1: 8-15 to 8-17	B11
21	Permit modifications for the 3-Year Updates to the Lake Okeechobee Protection Plan	Operations	Modification 0174552-010 in effect. Procedure to authorize structure improvements and maintenance added (3c). Also includes changes in responsible persons, programs, offices, and regulation schedule.	1; LOPP			

Attachment B: Water Quality and Hydrologic Data

This project information is required by Specific Condition 16 of the Lake Okeechobee Operating Permit (0174552-010), and is available upon request.