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

Permit Report Dates: (May 1, 2009–April 30, 2010)
Permit Number: 0174552-007-EM

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SUMMARY

Based on Florida Department of Environmental Protection (FDEP) permit reporting guidelines, **Table 1** shows cross-references for permit-specific conditions in the permit and the specific reference pages. **Table 2** lists key permit-related information. Table A-1 in **Attachment A** shows specific pages, tables, and graphs where project status and annual reporting requirements are addressed. **Table 3** lists the attachments included with this report.

Table 1. Permit specific conditions and reference in the permit.

Permit Conditions	Permit Reference (0174552-001-GL)
Modification	0174552-006-EM
Annual Monitoring Reports	Specific Condition 14, page 9

Table 2. Key permit-related information.

Project Name	Lake Okeechobee Operating Permit
Permit Number	0174552-001-GL
Modification	0174552-006-EM
Issue and Expiration Date	Issue: June 18, 2007 Expiration: June 18, 2012
Project Phase	N/A
Relevant Period of Record	May 1, 2009–April 30, 2010
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Date	January 15, 2010

Table 3. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B1-B11	Lake Okeechobee Structure and Water Quality Monitoring Data
C1-C2	Lake Okeechobee After Action Reports for 2009 and 2010

INTRODUCTION

The Lake Okeechobee Operating Permit (0174552-001-GL) was issued under the authority of the Lake Okeechobee Protection Act, Chapter 373.4595, Florida Statutes (F.S.), and Title 62, Florida Administrative Code (F.A.C.). This annual report is submitted by the South Florida Water Management District (SFWMD or District) to the Florida Department of Environmental Protection (FDEP) to fulfill the requirements of Modification 006 of the Operating Permit (0174552-006-EM) and Specific Condition 14, Annual Monitoring Reports of the permit. The modifications to the permit include the following:

- Addition of monitoring at site C41H78, which replaces monitoring at structures HP-7, Inflow-1, Inflow-2, Inflow-3, and L-61E
- Change in the duration column for grab samples at S-2 and S-3 when pumping occurs
- Change in grab samples at S-2 and S-3 to include pH, temperature, conductivity, dissolved oxygen, and all chemical parameters listed in **Table 5**
- Replacement of BOD5 with total organic carbon
- Discontinued calcium monitoring
- Modified chlorophyll *a* monitoring requirements
- Modification of the parameter list for sites S351, S354, G207, and G208.

This report includes two sections: (A) *Monitoring Data*, which includes records and general descriptions of data collected to meet the requirements of this permit for Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010), and (B) *Performance Evaluation*, which includes an analysis of these data for Florida Class I water quality exceedances, total phosphorus (TP) loadings, data collected within Lake Okeechobee under the Lake Okeechobee Research and Monitoring Plan, and applicable records from the ambient pesticide and herbicide monitoring data. Two backpumping events reported to the FDEP (SFWMD, 2009b, 2010b) are evaluated in context of the complete hydrological and nutrient budget to the lake for WY2010.

A. MONITORING DATA

WATER QUALITY

An attachment of all water quality samples, including qualified samples, collected at Lake Okeechobee structures (**Figure 1** and **Table 4**) was developed from the District's hydrometeorological and water quality database, DBHYDRO (SFWMD 2010b; **Attachment B1**). These records include analytical results of grab or in situ samples taken throughout the year for 17 parameters required in the Permit (**Table 5**). For the two backpumping events, required auto-sampler-composite flow proportional and grab sample data are included (**Table 6**). These events were reported separately (SFWMD 2009b, 2010b). Daily flow data (**Attachment B2**) and daily rainfall data (**Attachment B3**) also are reported.

The appendices of water quality incorporate the Permit-required data and metadata that include (1) date, location, and time of sampling or measurements; (2) person responsible for performing the sampling or measurements; (3) date analyses were performed or the appropriate code as required by Chapter 62-160, F.A.C.; (4) laboratory/person responsible for performing the analyses; (5) analytical methods used, including Method Detection Limit (MDL) and Practical Quantitation Limit (PQL); (6) results of such analyses, including appropriate data qualifiers and all compounds detected; (7) depth of sampling (for grab samples); and (8) flow conditions and weather conditions at the time of sample collection.

FLOW DATA

Daily flow data for permitted structures are stored in DBHYDRO (**Attachment B2**). Additional flow information for structures that contribute to the phosphorus loads to Lake Okeechobee but are not included in the Permit (FECRSR78, S-77, S-308, CU-5A, CU-10, CU-4, CU-12, CU-12A) are also found in **Attachment B2**. These data were downloaded from DBHYDRO on July 20, 2010. Updates and revisions to the data may occur after this time.

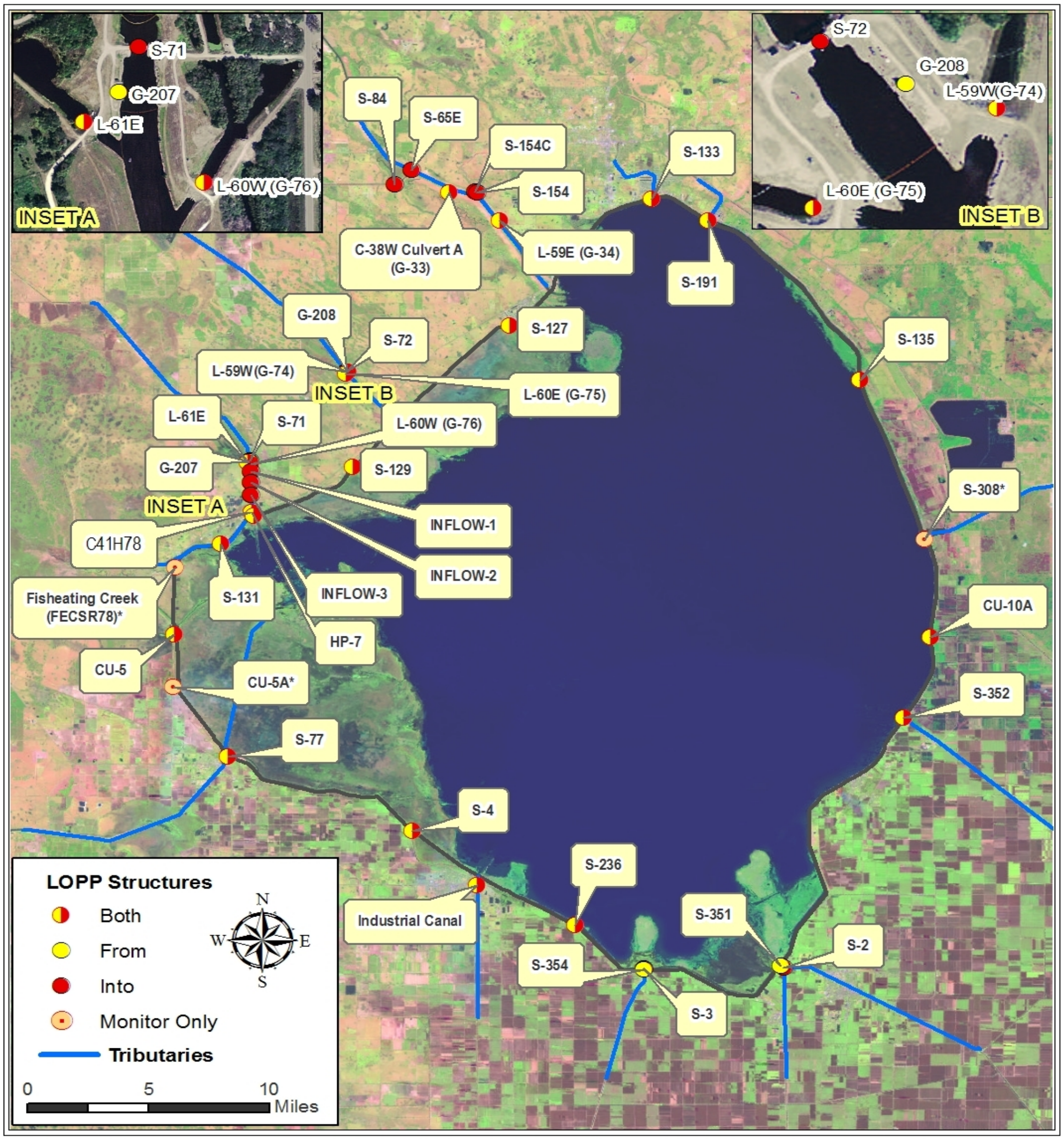

Figure 1. Structures included in the Lake Okeechobee Operating Permit.

Table 4. Structures monitored for compliance with Permit 0174552-001-GL (Modification 0174552-006-EM).

Structure	Into/ From	DBHYDRO Inflow Direction[5]	Structure Description	Latitude	Longitude
S-2	Into	-	Four (4) unit pump station, 3,600 cfs	26 41 58.81	80 42 48.09
S-3	Into	-	Three (3) unit pump station, 2,670 cfs	26 41 56.24	80 48 26.21
S-4	Both	+	Three (3) unit pump station, 2,805 cfs	26 47 24.64	80 57 42.43
S-65E	Into	+	Gated spillway with six (6) cable operated vertical lift gates, lock structure with sector gates	27 13 31.16	80 57 45.22
S-71	Into	+	Gated spillway, three (3) stem operated vertical lift gates	27 02 03.19	81 04 15.23
S-723	Into	+	Gated spillway, two (2) stem operated vertical lift gates	27 05 35.18	81 00 21.22
S-84	Into	+	Gated spillway with two (2) vertical lift gates	27 12 58.16	80 58 24.22
S-127	Both	+	Five (5) unit pump station, 625 cfs, plus gated spillway/lock	27 07 21.56	80 53 45.41
S-129	Both	+	Three (3) unit pump station, 375 cfs, plus gated spillway	27 01 48.19	81 00 05.22
S-131	Both	+	Two (2) unit pump station, 250 cfs, plus gated spillway, lock	26 58 45.23	81 05 24.72
S-133	Both	+	Five (5) unit pump station, 625 cfs, plus outlet structure	27 12 23.92	80 48 02.59
S-135	Both	+	Four (4) unit pump station, 500 cfs, plus spillway and lock	27 05 12.71	80 39 40.14
S-154C	Into	+	Concrete pipe culvert, one (1) barrel, with gate	27 12 39.58	80 55 11.38
S-154	Into	+	Reinforced concrete box culvert, two (2) barrels, sluice gate	27 12 38.82	80 55 06.24
S-191	Both	+	Gated spillway with three (3) cable operated vertical lift gates	27 11 31.17	80 45 45.20
S-236	Both	+	Three (3) unit pump station, 255 cfs, plus outlet	26 43 40.41	80 51 10.12
S-3511	Both	-	Gated spillway with three (3) vertical lift gates	26 42 03.00	80 42 54.96
S-3521	Both	-	Gated spillway with two (2) vertical lift gates	26 51 50.61	80 37 56.65
S-3541	Both	-	Gated spillway with two (2) vertical lift gates	26 41 55.96	80 48 26.25
CU-5	Both	+	Three (3) barrel cmp, slide gates	26 53 06.93	81 07 18.23
CU-10A	Both	-	Five (5) barrel cmp	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 (1) unit pump station, 135 cfs	27 1 59.54	81 04 17.36
G-2083	From	+	One (1) unit pump station, 135 cfs	27 5 32.65	81 00 20.04

Table 4. Continued.

Structure	Into/ From	DBHYDRO Inflow Direction[5]	Structure Description	Latitude	Longitude
S-72 Weir Auxiliary Water Supply Pump Station 4	From	-	Three Unit Pump station	27 03 59.36	80 58 41.07
L-59E (G-34)	Both	+	Three (3) barrel culvert	27 11 31.17	80 54 11.21
L-59W(G-74)	Both	+	Two (2) barrel gated culvert	27 06 26.18	80 59 57.22
L-60E (G-75)	Both	+	Two (2) barrel gated culvert	27 05 05.18	81 01 27.22
L-60W (G-76)	Both	+	Two (2) barrel gated culvert	27 01 58.19	81 03 06.23
C41H782	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
Industrial Canal	Both	-	Represents flows at S-310	26 45 14.00	80 55 07.22
L-61E2	Both	N/A	Two (2) barrel culvert with flashboards	27 01 59.19	81 05 17.23
HP-723	Both	N/A	Single Barrel Culvert with Flap gate with winch	27 00 00.00	81 04 10.00
Inflow-123	Into	N/A	Single barrel Culvert with flap gate, on Harney Pond Canal, downstream of S-71	27 01 36.53	81 04 12.49
Inflow-223	Into	N/A	Single barrel Culvert with flap gate, on Harney Pond Canal	27 01 10.77	81 04 12.20
Inflow-323	Into	N/A	Single barrel Culvert with flap gate, on Harney Pond Canal	27 00 41.13	81 04 11.74

[1] 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.
[2] 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
[3] Locations are approximate, not owned or operated by the SFWMD
[4] S-72 Weir Auxiliary Water Pump Station monitoring is conducted at both S-72 and G-208
[5] + : inflow to lake is a positive number and outflow is a negative number, - : inflow to lake is a negative number outflow is a positive number

cfs – cubic feet per second

cmp – corrugated metal pipe

Table 5. Parameters monitored and appendices where data are reported for compliance with Permit 0174552-001-GL (Modification 0174552-006-EM).

Parameter Name	Parameter Description	Units	Sample Type	Sampling Frequency	Structures Sampled[2,3]	Attachment
ALK	Alkalinity	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
TOC	Total Organic Carbon	µg/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-78, S-79, S-801	B1
NH4	Dissolved Ammonia	mg/L	G	BI-W if flowing, M if not flowing	ALL	B1
DO	Dissolved Oxygen	mg/L	INSITU	BI-W if flowing, M if not flowing	ALL	B1
PH	pH	SU	INSITU	BI-W if flowing, M if not flowing	ALL	B1
SCOND	Specific Conductance	µS/cm	INSITU	BI-W if flowing, M if not flowing	ALL	B1
TEMP	Temperature	Deg C	INSITU	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

Table 5. Continued.

Key to abbreviations

ALL – structures owned and operated by the District, as specified in Table 1	M – monthly
ACF – flow-proportional composite sampler	mg/L – milligrams per liter
BI-W – biweekly	NTU – nephelometric turbidity units
CAL – calculated	µg/L – micrograms per liter
CFS – cubic feet per second	µS/cm – microsiemens per centimeter
DAC – daily accumulation	PR – pump records
DAV – daily average	Q – quarterly
G – grab sample	RG – rain guage
INSITU – measured with probe on site	SU – standard units

[1] Chlorophyll values for S-78, S-79, and S-80 were to be taken to represent sites S-77 and S-308

[2] C41H78 (Harney Pond Canal) monitoring station is the representative monitoring site for HP-7, Inflow-1, Inflow-2, Inflow- 3, and L-61E.

[3] S-72 Weir Auxiliary Water Pump Station monitoring is conducted at both S-72 and G-208

Table 6. Water quality monitoring for S-2 and S-3 flood control backpumping for compliance with Permit 0174552-001-GL (Modification 0174552-006-EM).

Site	Type	Duration	Parameters
S-2	ACF*	Event** duration	TP and TN*** only
S-2	Grab	Event duration ≤ 72 hours: Collect one sample for nutrients (TN and TP) 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, conductivity, and dissolved oxygen; Chemical parameters - All chemical parameters listed in Table 4.
S-3	ACF	Event duration	TN and TP only
S-3	Grab	Event duration ≤ 72 hours: Collect one sample for nutrients (TN and TP) 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, conductivity, and dissolved oxygen; Chemical parameters - All chemical parameters listed in Table 4.

ACF – autosampler composite flow proportional
TP – total phosphorus
TN – total nitrogen
* Flow-proportional composite sampler
** An event is defined as continuous or intermittent pumping activity separated by a cessation of 72 hours or greater.
*** TN = Total Kjeldahl Nitrogen + Nitrate + Nitrite

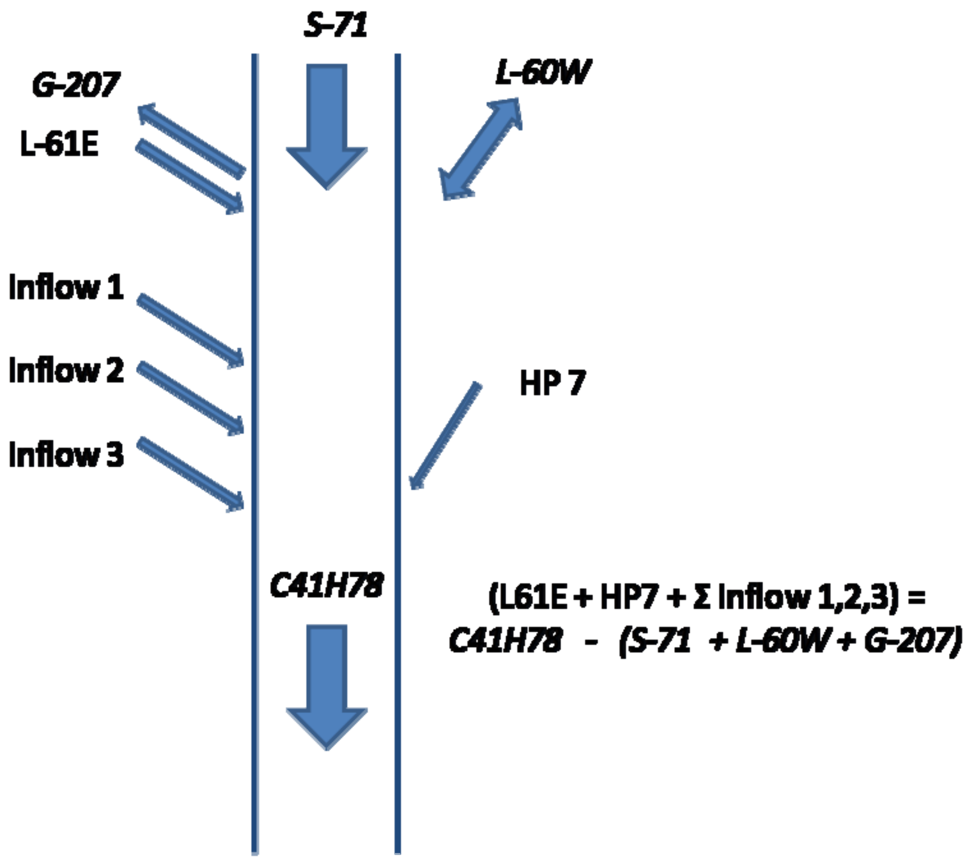

Figure 2. Schematic of the C-41 canal inflows and outflows. The smaller ungauged flows and loads (L-61E, HP-7, Inflow-1, Inflow-2, and Inflow-3) are estimated by difference of the downstream C41H78 minus the upstream flows: S-71 L-60W and G-207*. * G-207 flow is either negative (out of the canal) or zero.

The monitoring site, C41H78, is operational along the Harney Pond Canal. This new site as approved in Modification 0174552-006-EM accounts for the combined flow and phosphorus load contribution from the minor structures L-61E, HP7, Inflow 1, Inflow 2, and Inflow 3 (**Figure 2**). To determine the contributions from these minor structures, the flow measured and load calculated from sites S71, L60W (G76), and G207 are subtracted from the C41H78 measurement and load calculation. A comparison of flow and TP loads between C41H78 and the combined flow and load at S71, L60W, and G207 indicates that the combined flows account for 98 percent of the variability in the C41H78 flows (**Figure 3**). Both the C41H78 flow and load are less than at S71 over the water year indicating little flow and load through the small structures. While C41H78 is reported in the appropriate tables, loads, and flows from S71 and L60W are used to estimate TP loads to the lake (**Tables 4** and **12**). District staff are working on methodologies to more precisely estimate the flow and load from these minor structures using the C41H78 information.

Two sets of flow information for Fisheating Creek are reported: (1) DBKEY 15627, near Palmdale, which is used in the past hydrologic evaluation for the District (see Volume I, Chapter 2), and (2) DBKEY WH036, a site closer to Lake Okeechobee, near Lakeport (U.S. Geological Survey, ID 02257000). The WH036 site is where water quality samples are taken (FECRSR78), thus providing more accurate load and flow information to the lake. However, flows at this site can be negative as wind-driven seiches move water from the lake into the area. A comparison of flows and estimated loads from these two Fisheating Creek sites shows that Palmdale flow and load accounts for 85 percent and 82 percent of the variability, respectively, observed at Lakeport (**Figure 4**). For the current water year Lakeport flow and load estimates are 11 percent greater and 16 percent less, respectively than Palmdale estimates (**Tables 7** and **15**). This discrepancy can be explained by flows being lower at Lakeport compared to Palmdale when TP concentrations were higher and vice versa.

Flows and loads from Fisheating creek, using the Lakeport (WHO36) site were developed for the nine-year period covered in the most recent Lake Okeechobee Protection Plan Update (SFWMD et al., 2011). This site is now used for all load calculations for Lake Okeechobee. Only positive values are used in load calculations to the lake.

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 S-2 and S-3 pump stations while flow out of the lake occurs at spillways S-351 and S-354 through either gravity flow or temporary forward pumps.

During WY2010, inflow volume to Lake Okeechobee was approximately 2.4 million acre feet (ac-ft) (**Table 7**). This is roughly equivalent to the baseline period (1991–2005) of 2.5 million ac-ft (SFWMD et al., 2007). The four largest flows for this water year were S-65E, Fisheating Creek, S-71, and S-84. All of these are northern basins where the majority of flow to the lake originates.

Inflow to Lake Okeechobee in WY2010 began with a typical wet season. Flow to the lake was highest from May to September. This was followed by low flow in the dry season months of October to February. Rainfall increased in March resulting in higher flows for March and April (see Rainfall below).

Two backpump events occurred in WY2010. A rainfall event from May 18 to 19, 2009, led to a backpump event at S-3 from May 19 to 21 (SFWMD 2009b). The flow (1,826 acre-ft) and phosphorus (P) load (0.1896 metric tons) from this backpumping were 1.3 percent and 0.92 percent of the total to the lake for the month, respectively. Another rainfall event from March 11-12, 2010, resulted in backpumping at S-2 and S-3 from March 12 to 15, 2010 (SFWMD 2010b). The flow (13,928 acre-feet) and load (3.4 metric tons) from backpumping represented 4.0 percent and 5.6 percent to the lake for the month of March. The resulting flow from the two backpump events (15,838 acre-ft) and load (3.5 metric tons) were 0.65 percent and 0.82 percent of the total to the lake for WY2010.

Lake stage increased from near the water shortage management criteria in May 2009 (approximately 10.6 ft) to average (14.5 ft NGVD) lake levels from July to through the end of the water year (**Figure 5**). In the dry season stage declined and then increased in March as flow increased, primarily due to the rain event described above and discussed below.

Outflow from the lake was slightly more than 0.5 million ac-ft (**Table 8**). Discharges to the south (Everglades Agricultural Area [EAA]) through S-351, S-352 and S-354 were highest in May, November, and October. A number of separate base-flow releases through S-77 were implemented in November 2009 and January and February 2010 and are discussed in Volume I, Chapter 2. Regulatory pulse releases were begun in March at S-77 and continued through April with only 12 days without flow. These releases were to offset the higher March and April inflows in an effort to maintain lower water levels at the start of the wet season.

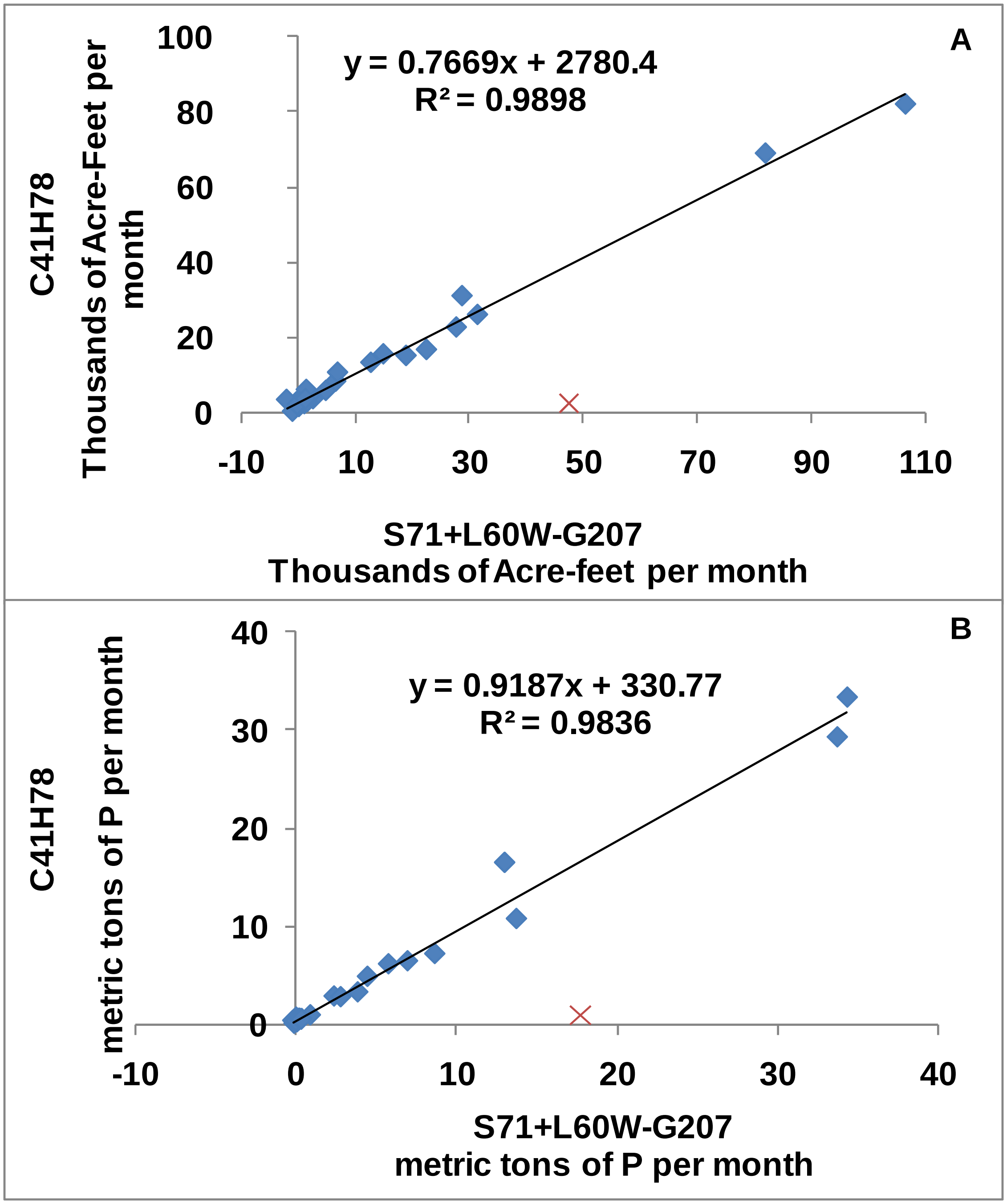

Figure 3. Comparison of monthly S71+L60W(G76)-G207 and C41H78 (A) flow and (B) total phosphorus (TP) loads for the period January 2008 to April 2010 (X – value not included in regression relationship)

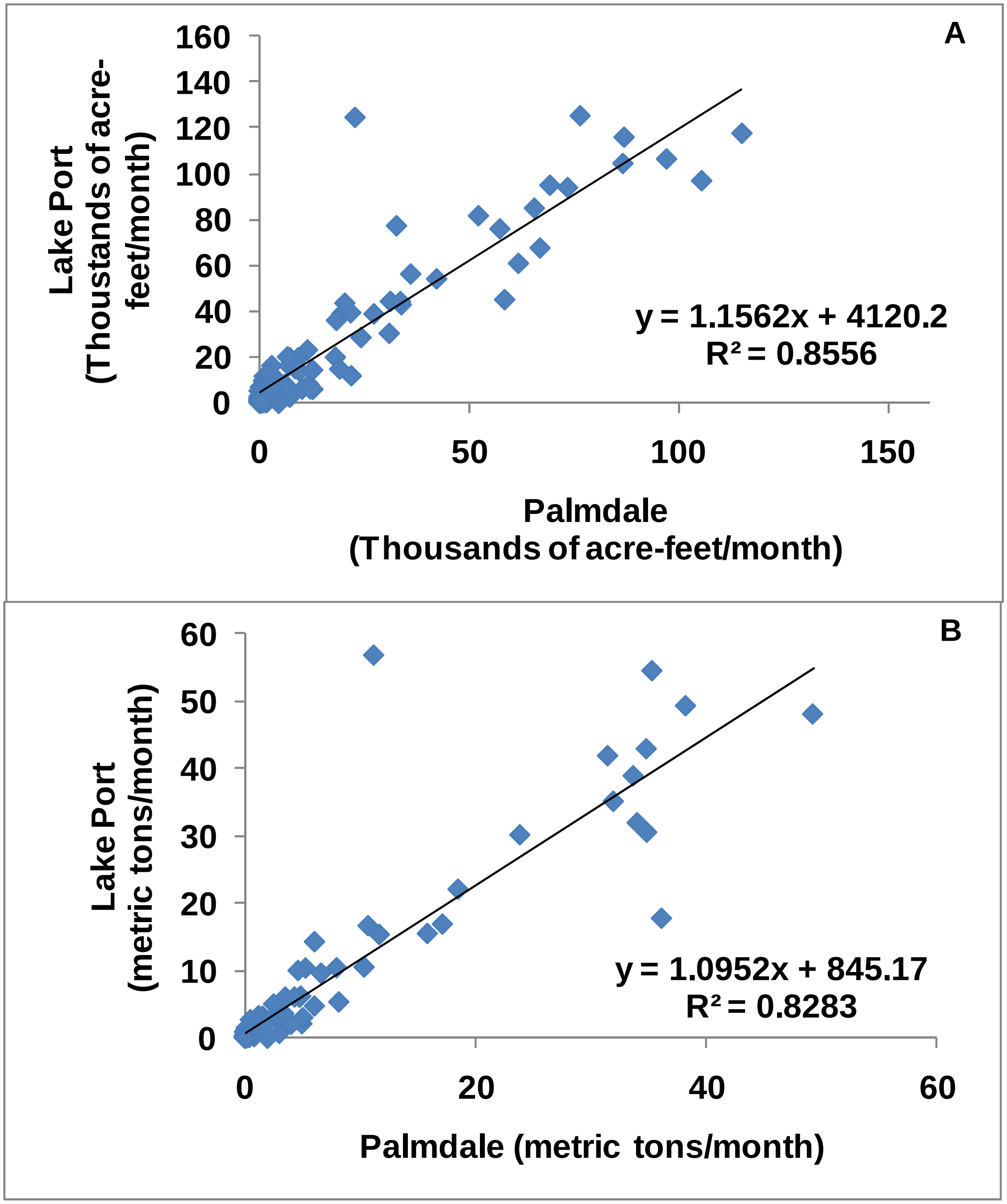

Figure 4. Comparison of monthly Fisheating Creek (A) flow and (B) TP loads estimated using flow data from Palmdale and Lakeport May 2000 to April 2010.

Table 7. Monthly inflow to Lake Okeechobee by structure (acre-feet) for Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010).

Region	Structure	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	Total
East	L8 (CU-10A)	1,487	22,586	7,181	752	240		13	15	363	1,168	4,058	171	38,034
	S-308[2]	13,186	13,908	7,452	1,458	2,101	2,129	48	2,795	3,258	2,246	2,300	135	51,015
	Total	**14,673**	**36,494**	**14,633**	**2,210**	**2,341**	**2,129**	**61**	**2,810**	**3,621**	**3,413**	**6,358**	**305**	**89,049**
North	C-38W Culvert A (G-33)	0	0	0	0	0	0	0	0	3,508	7,346	193	581	11,628
	C41H78	10,752	16,778	2,234	15,612	15,184	2,989	2,254	4,507	6,175	3,707	31,026	13,358	124,577
	CU-5	0	269	2,006	95	63	3	0	0	3	0	301	390	3,131
	Fisheating Creek- Palmdale	4	21,971	65,532	33,667	12,774	3,352	205	880	420	534	12,220	19,208	170,768
	Fisheating Creek-Lakeport	1,034	12,014	85,020	44,346	14,527	7,347	1,146	329	2,298	132	6,289	14,943	189,424
	L-59E (G-34)	67	7	10,650	0	0	0	2	0	0	0	1,191	3,060	14,977
	L-59W(G-74)	1,397	3,801	7,595	1,438	2,990	0	261	552	623	0	3,692	942	23,292
	L-60E (G-75)	768	1,519	1,247	150	1,267	0	0	0	0	0	364	151	5,467
	L-60W (G-76)	269	695	1,826	0	162	177	178	20	34	13	312	77	3,762
	S-127	10	120	3,736	449	1,761	0	0	0	0	42	4,386	1,609	12,111
	S-129	1,028	3,021	4,952	590	1,000	275	252	1,335	706	711	4,549	2,262	20,680
	S-131	3	0	0	**52**	733	16	0	326	252	112	2,068	1,896	5,457
	S-133	0	0	0	72	244	77	0	0	0	0	1,559	1,506	3,459
	S-135	0	0	9	1,384	3,427	0	0	0	58	54	3,305	2,376	10,613
	S-154	1	58	2,207	856	2,340	1	15	0	0	1	3,131	4,509	13,118
	S-154C	0	274	446	115	91	81	65	1	20	110	872	317	2,389
	S-191	1	3,101	8,239	7,278	15,171	737	0	905	471	875	7,844	8,278	52,899
	S-65E	69,074	189,182	208,169	159,926	160,498	19,293	7,990	17,575	20,746	99,498	207,795	250,646	1,410,393
	S-71	8,759	21,869	45,755	15,005	18,830	1,467	181	2,022	1,451	1,318	28,504	12,737	157,897
	S-72	1,814	4,006	7,690	650	1,165	12	67	315	14	141	8,117	2,242	26,232
	S-84	11,347	28,700	49,837	18,878	3,656	890	1	413	14	6,241	20,258	24,524	164,759
	Total *	**95,571**	**268,634**	**439,383**	**251,285**	**227,925**	**30,376**	**10,158**	**23,793**	**30,196**	**116,594**	**304,729**	**333,046**	**2,131,689**

Table 7. Continued.

Region	Structure	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	Total
South	CU-10[12]	0	0	0	0	0	0	0	0	0	0	367	0	367
	CU-12[12]	0	0	0	0	0	0	0	0	0	0	1,617	0	1,617
	CU-12A[12]	0	0	0	0	0	0	0	0	0	0	0	0	0
	CU-4A[12]	0	0	0	0	0	0	0	0	0	0	289	0	289
	Industrial Canal	7,404	8,227	3,546	3,551	2,910	16	70	998	503	790	3,469	1,832	33,316
	S-2 (S-351)	0	0	423	227	86	130	0	232	0	0	9,277	135	10,509
	S-236	0	0	0	0	0	0	0	0	0	0	862	0	862
	S-3 (S-354)	1,856	0	232	84	0	188	0	0	0	0	4,211	0	6,572
	S-352	0	0	0	0	0	0	0	0	0	0	0	0	0
	S-4	0	256	9,540	3,230	4,589	230	0	0	0	197	11,982	7,691	37,716
	Total	**9,261**	**8,484**	**13,741**	**7,093**	**7,585**	**565**	**70**	**1,230**	**503**	**987**	**32,074**	**9,658**	**91,250**
West	CU-5A[2]	12,956	17,520	20,604	1,313	1	1,527	325	8,432	4,565	8,956	3,913	2,876	82,987
	S-77[2]	6,105	1,615	2,593	0	0	0	0	0	0	0	0	0	10,312
	Total	**19,061**	**19,135**	**23,196**	**1,313**	**1**	**1,527**	**325**	**8,432**	**4,565**	**8,956**	**3,913**	**2,876**	**93,300**
Total*		**138,566**	**332,746**	**490,953**	**261,901**	**237,852**	**34,596**	**10,613**	**36,266**	**38,884**	**129,950**	**347,075**	**345,886**	**2,405,288**

* does not include Fisheating Creek-Palmdale or C41H78 flows

1. included in other permits

2. provides flows and loads to lake, not owned operated by SFWMD

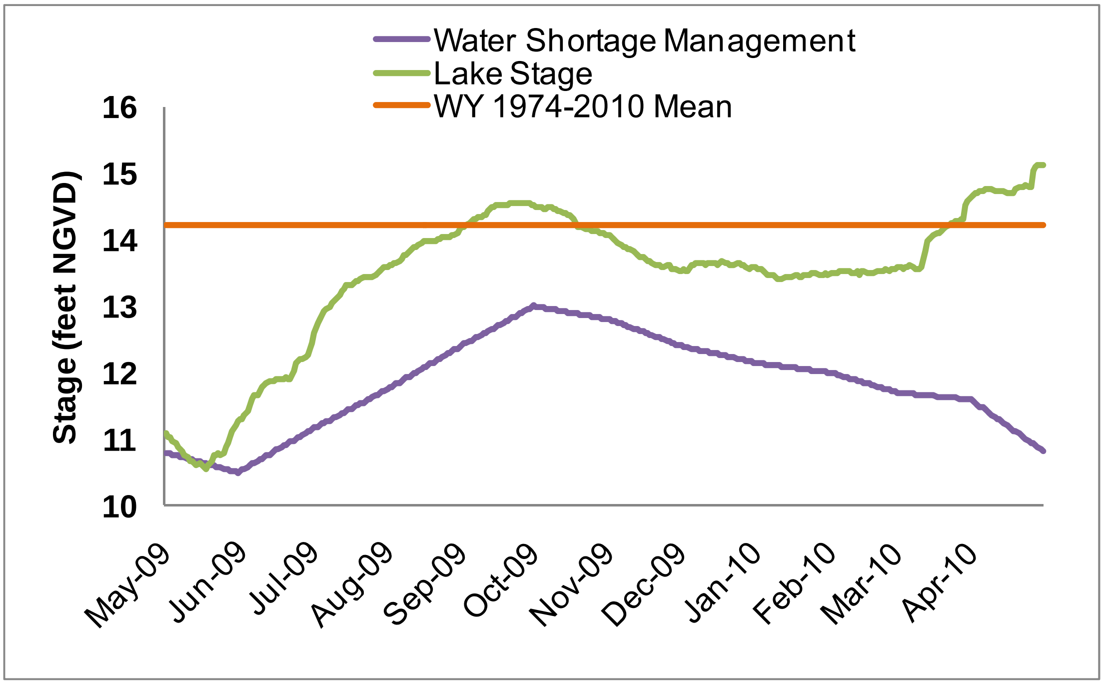

Figure 5. Lake Okeechobee stage values (feet National Geodetic Vertical Datum [NGVD]) for WY2010 water shortage management criteria (From U.S. Army Corps of Engineers [USACE] 2008), and average water level from WY1974-WY2010.

RAINFALL

Daily rainfall measurements were obtained from the stations used to report the Lake Okeechobee Basin rainfall (SFWMD 2010a). These were used for consistency with Volume I, Chapter 2. Each station has one to four separate methods to record rainfall. One recording method from each station was chosen in the order of Preferred, Operations and Maintenance Department, Telemetry, and Campbell Scientific Recorder. Monthly rainfall estimates for the Okeechobee Basin and for the District as a whole were 4.6 inches and 9.4 inches above the 30-year averages (**Table 9**). The rainfall in May and March were 3.5 and 4.7 inches greater than the 30-year average, respectively, which contributed to conditions that required backpump events at S-2 and S-3 (SFWMD, 2009b, 2010b).

Table 8. Monthly discharge flow (acre-feet) from Lake Okeechobee for WY2010.

Station	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	Total
CU-10A	472	0	2,932	8,848	11,887	14,795	13,087	6,856	5,708	2,763	11,094	18,198	96,640
CU-5	0	0	0	0	0	0	0	0	0	0	0	3	3
CU-5A[2]	241	0	0	0	520	1,220	3,424	77	373	85	1,887	5,384	13,213
G-207	2,076	0	0	0	0	0	458	0	0	0	0	0	2,534
G-208	946	2	0	0	0	0	7	3	0	0	0	0	957
Industrial Canal	4,001	0	119	263	226	3,300	2,438	964	1,178	821	909	969	15,187
S-127	0	0	11	23	1	504	517	93	90	0	0	1	1,240
S-129	1	1	0	0	0	0	0	0	0	0	0	15	17
S-131	0	0	0	0	0	0	0	0	0	0	0	0	0
S-135	5	0	6	0	0	327	425	189	135	126	37	0	1,250
S-308[2]	33,695	0	0	2,316	0	4,718	15,979	0	2,191	132	0	2,176	61,207
S-351[1]	32,780	254	961	977	225	3,318	16,767	0	2,243	114	421	1,472	59,532
S-352[1]	3,484	88	8,305	4,239	1,134	2,308	13,045	4,294	3,183	1,309	7,357	27,182	75,926
S-354[1]	14,088	0	0	246	0	2,567	6,060	0	842	6	0	522	24,331
S-77[2]	13,915	760	14,709	3,181	0	10,485	22,229	2,715	17,060	19,476	24,982	69,118	198,630
Total	**105,702**	**1,104**	**27,043**	**20,094**	**13,994**	**43,541**	**94,434**	**15,192**	**33,004**	**24,832**	**46,685**	**125,041**	**550,667**

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

[2] Provides flows and loads from the lake, not owned operated by SFWMD

Table 9. Monthly rainfall averages (inches) for WY2010 compared to the 30-year period (1976–2005).

	Lake Okeechobee			District-wide		
Month	**1976-2005 Average**	**WY 2010**	**Difference**	**1976-2005 Average**	**WY 2010**	**difference**
May	3.7	7.1	3.5	4.2	9.0	4.9
June	6.8	7.8	1.0	8.0	9.2	1.1
July	6.0	6.8	0.8	6.8	7.1	0.3
August	6.7	5.6	-1.1	7.5	6.7	-0.8
September	6.3	3.8	-2.5	7.1	6.9	-0.1
October	2.9	0.6	-2.3	3.8	1.2	-2.6
November	2.3	0.8	-1.5	2.7	1.5	-1.1
December	1.8	3.1	1.3	2.0	4.0	1.9
January	2.1	1.3	-0.8	2.2	1.7	-0.5
February	2.1	1.8	-0.2	2.2	2.8	0.6
March	2.9	7.6	4.7	3.0	6.5	3.5
April	2.2	4.0	1.8	2.5	4.8	2.3
Total	**45.7**	**50.3**	**4.6**	**52.0**	**61.4**	**9.4**

B. LAKE OKEECHOBEE OPERATING PERMIT CLASS I WATER QUALITY PERFORMANCE EVALUATION

The parameters included in the Lake Okeechobee Operating Permit with Florida Class I criteria include alkalinity, biochemical oxygen demand (BOD), dissolved oxygen, pH, specific conductivity, turbidity, and total iron (**Table 10**). BOD, which was sampled at S-308 and S-77, was discontinued during this reporting interval as specified in Permit Modification 0174552-006-EM. In its place, total organic carbon (TOC) was added. Two parameters (turbidity and conductivity) are based on natural background values as described in a previous annual report (SFWMD, 2009c). The criteria used were 32.3 nephelometric turbidity units (NTU) for turbidity and 1,275 microsiemens per centimeter (μS/cm) for specific conductivity.

The water quality data for each station were separated into three categories (inflow, outflow, and no-flow), where appropriate. These categories were determined primarily from daily flow measurements when available (**Attachment B2**) or from visual inspection records (**Attachment B1**). All flagged measurements (denoted by "yes") 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, 25^{th}, median and 75^{th} percentiles, and number of exceedances from Class I standards were determined for each structure for each given flow period (**Attachments B4** through **B6**). The samples that exceeded the Class I criteria were tabulated (**Attachment B7**).

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; SFWMD, 2009c). This excursion rate is given a category of concern-C (**Table 11**). All flow and structure sample sets contained fewer than 28 samples (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), between 0 and 20 percent (potential concern-PC), and 0 percent (no concern-NC).

To more accurately evaluate the excursion rate, a longer 10-year period of record (WY2001–WY2010) was used for the binomial hypothesis testing. The categories for the tests included C (HA: $f \geq 0.10$), PC (HA: $0.05 \leq f < 0.1$), minimal concern-MC (HA: $0 < f < 0.05$), and NC (H0: $f=0$) (**Table 11**). An evaluation of these data: mean, maximum, minimum, number of samples, standard deviation, 25^{th}, median and 75^{th} percentiles, and number of exceedances from Class I standards were determined for each structure for each given flow period for the previous 10-year period (**Attachment B8**).

DISSOLVED OXYGEN AND BIOCHEMICAL OXYGEN DEMAND

The Class I criteria for dissolved oxygen specifies that values shall not be less than 5 milligrams per liter (mg/L) (**Table 10**). Dissolved oxygen was sampled at 26 locations during inflow events (**Table 12**, **Attachment B4**). Of these, one was classified as no concern and 23 were classified as a concern. Two other inflow structures were not sampled during inflow events in the current water year: at S-236 there were only four days of inflow and at S-352 there were no days of inflow. Of the 160 samples collected during inflow events, 95 were below the dissolved oxygen Class I criterion of 5 mg/L (**Attachment B4**). For the 10-year analysis, all 26 structures were classified as concern (**Table 12**, **Attachment B8**). The low dissolved oxygen may be caused by a number of factors, including high temperature, high dissolved organic carbon, microbial activity, or laminar flow of water in the canals that prevents turbulent mixing of the water with air. Further research is needed to understand which are the most important factors. Management practices to meet the proposed numeric nutrient criteria may reduce the organic carbon input to the tributaries. Other practices to increase turbulence of the canal flow (baffle boxes or mechanical mixing) may also improve dissolved oxygen conditions.

Table 10. Class I criteria values for Lake Okeechobee monitoring.

Parameter	Units	Criteria
ALK	mg/L	≥ 20
BOD5	mg/L	Shall not be increased to exceed values which would cause dissolved oxygen to be depressed below the limit established for each class and, in no case, shall it be great enough to produce nuisance conditions.
DO	mg/L	≥ 5
pH	SU	6 - 8.5
SCOND	µS/cm	≤ 1275 or ≤ 1.5 * natural background (whichever is greater) ≤ 1275
TURB	NTU	≤ 29 + natural background ≤ 32.3
TFE	µg/L	≤ 1000

mg/L – milligrams per liter
SU – standard units
µS/cm – microsiemens per centimeter
NTU – nephelometric turbidity units
µg/L – micrograms per liter

Table 11. 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 % Exceedances (less than 28 samples)
Concern	> 10%	>20%
Potential Concern	5 to 10%	> 0% and < 20%
Minimal Concern	0% < and < 5%	N/A
No Concern	0%	0%

Table 12. Levels of concern[A] for Class I parameters at Lake Okeechobee structures during inflow events.

Station	Alkalinity	Dissolved Oxygen	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/C*	MC/NC*	C/NC*	PC*/C*	C/C*
CULV5	NC*/NC*	C*/C*	NC*/NC*	NC*/NC*	NC*/	NC*/NC*
Industrial Canal	NC/NC*	C/C*	MC/NC*	NC/NC*	PC*/NC*	C/NC*
L59E	MC/NC*	C/C*	MC/NC*	C/C*	PC*/NC*	PC/NC*
L59W	NC/NC*	C/C*	NC/NC*	NC/NC*	C*/	NC/NC*
L60E	C/NC*	C/C*	NC/NC*	NC/NC*	NC*/	NC/NC*
L60W	NC*/NC*	C*/C*	NC*/NC*	NC*/NC*	NC*/	NC*/NC*
S127	NC*/NC*	C*/C*	NC*/NC*	NC*/NC*	NC*/	NC*/NC*
S129	NC*/NC*	C/C*	NC/NC*	NC/NC*	NC*/	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*/	PC*/NC*
S135	NC*/NC*	C*/NC*	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
S154	NC/NC*	C/C*	NC/NC*	C/C*	C*/NC*	NC/NC*
S154C	NC/NC*	C/C*	NC/NC*	C/C*	PC*/NC*	MC/NC*
S191	NC/NC*	C/C*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S2	NC/	C/C*	NC/NC*	C/NC*	NC*/	C/
S236	NC/	C*/	NC/	C*/	NC*/	NC*/
S3	NC/NC*	C/C*	NC/NC*	PC/NC*	NC*/NC*	NC/NC*
S352	NC*/	C*/	NC*/	C*/	NC*/	NC*/
S4	NC/NC*	C/C*	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
S65E	MC/NC	C/C*	MC/NC	NC/NC	PC*/NC*	NC/NC
S71	C/NC*	C/C*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S72	MC/NC*	C/C*	NC/NC*	NC/NC*	PC*/NC*	NC/NC*
S84	C/NC*	C/C*	MC/PC*	MC/NC*	PC*/NC*	MC/NC*

[A] C - concern; PC - potential concern; MC - minimal concern; NC - no concern

* less than 28 samples preliminary test used

Listing before '/' is for WY2001–WY2010, after '/' is for WY2010

Table 13. Levels of concern[A] for Class I parameters at Lake Okeechobee structures during no-flow events.

Station	Alkalinity	Dissolved Oxygen	pH	Specific Conductivity	Total Iron	Turbidity
C38W	NC/NC*	C/C*	C/NC*	C/C*	NC/NC*	C/NC*
C41H78	NC*/	NC*/	NC*/	NC*/		NC*/
CULV10A	NC*/	C*/	NC*/	NC*/	NC*/	C*/
CULV5	NC/NC*	C/C*	NC/NC*	NC/NC*	PC*/NC*	MC/NC*
Industrial Canal	NC*/	NC*/	NC*/	NC*/		NC*/
L59E	NC/NC*	C/C*	MC/NC*	C/C*	NC*/NC*	MC/NC*
L59W	MC/NC*	C/C*	NC/NC*	NC/NC*	NC*/NC*	NC/NC*
L60E	NC/NC*	C/C*	MC/NC*	NC/NC*	PC*/NC*	NC/NC*
L60W	NC/NC*	C/NC*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S127	NC/NC*	C/C*	NC/NC*	C/C*	NC*/NC*	NC/NC*
S129	NC/NC*	C/C*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S131	NC/NC*	C/C*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S133	NC/NC*	C/C*	NC/NC*	NC/NC*	C/NC*	NC/NC*
S135	NC/NC*	C/PC*	MC/NC*	NC/NC*	NC*/NC*	MC/NC*
S154	NC/NC*	C/C*	MC/NC*	C/C*	C/C*	MC/PC*
S154C	NC*/NC*	C*/C*	NC*/NC*	C*/C*	NC*/NC*	PC*/NC*
S191	NC/NC*	C/PC*	MC/NC*	C/NC*	NC*/NC*	NC/NC*
S2	NC/NC*	C/C*	NC/NC*	C/C*	C/NC*	C/NC*
S236	NC/NC*	C/C*	NC/NC*	C/C*	NC*/NC*	NC/NC*
S3	NC/NC*	C/C*	MC/NC*	C/NC*	C/NC*	C/NC*
S351	NC*/NC*	C*/C*	NC/NC*	NC/NC*	NC*/NC*	NC*/NC*
S352	NC/NC*	C/C*	MC/NC*	MC/NC*	C*/NC*	C/C*
S354	NC*/NC*	PC*/C*	NC/NC*	C/NC*	NC*/NC*	NC*/NC*
S4	NC/NC*	C/C*	MC/NC*	MC/PC*	NC*/NC*	MC/NC*
S65E	NC/	C/	PC/	NC/	NC*/	NC/
S71	MC/NC*	C/C*	MC/PC*	NC/NC*	NC*/NC*	NC/NC*
S72	MC/NC*	C/C*	MC/NC*	NC/NC*	NC*/NC*	NC/NC*
S84	MC/NC*	C/C*	MC/NC*	NC/NC*	PC*/NC*	MC/NC*

[A] C - concern; PC - potential concern; MC - minimal concern; NC - no concern
[*] - less than 28 samples preliminary test used
Listing before '/' is for WY2001–WY2010, after '/' is for WY2010

For no-flow events, one structure was classified as no concern, two were classified as potential concern, and 21 were classified as concern (**Table 13**). At Industrial Canal and S-65E, there were zero and two days of no-flow in WY2010. No samples were taken on the two no flow days at S-65E. At CULV10A there were two days where flow data were missing and a no-flow event could not be confirmed. No samples were taken on these two days. At C41H78, there were 39 days when flow data were missing due to equipment problems. One sample was taken during this period and a no-flow event was observed. Of the 221 samples taken during no-flow events, 93 were below the dissolved oxygen Class 1 criterion of 5 mg/L (**Attachment B5**). For the 10-year analysis, two were classified as no concern, one as potential concern, and 25 as concern (**Table 13**, **Attachment B8**). Because there is even less turbulence during no-flow events, DO conditions are likely to be worse than flow conditions.

For outflow events, three structures were classified as no concern, one as potential concern, four as concern, and five (CU-5, L-59W, L-60W, S-129, and S-131) were unmeasured (**Table 14**). Of the 45 samples taken during outflow events, 11 were below the Class 1 criterion of 5 mg/L (**Attachment B6**). For the 10-year analysis, two structures were classified as no concern, one as minimal concern, one as potential concern, and nine as concern (**Table 14**, **Attachment B8**). As with inflow events, the low dissolved oxygen may be due to a combination of factors including high temperature, high dissolved organic carbon, microbial activity, and laminar flow of water in the canals that prevents turbulent mixing of the water with air.

Table 14. Levels of concern[A] for Class I parameters at Lake Okeechobee structures during out flow events.

Station	Alkalinity	Dissolved Oxygen	pH	Specific Conductivity	Total Iron	Turbidity
C41H78	NC*/NC*	C*/C*	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
CULV10A	NC/NC*	C/PC*	MC/NC*	MC/NC*	C*/C*	C/C*
CULV5	NC*/	C*/	NC*/	NC*/	NC*/	NC*/
Industrial Canal	NC/NC*	C/C*	MC/C*	MC/NC*	PC*/NC*	C/NC*
L59W	NC*/	NC*/	NC*/	NC*/		NC*/
L60W	NC*/	NC*/	NC*/	NC*/		NC*/
S127	NC*/NC*	C*/C*	NC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*
S129	NC*/	C*/	NC*/	NC*/	NC*/	NC*/
S131	NC*/	C*/	NC*/	NC*/	NC*/	NC*/
S135	NC*/NC*	PC*/NC*	NC*/NC*	NC*/NC*	NC*/NC*	PC*/NC*
S351	NC*/NC*	C/NC*	PC/NC*	NC/NC*	NC*/	PC*/NC*
S352	NC/NC*	MC/NC*	MC/NC*	NC/NC*	C*/C*	C/C*
S354	NC*/NC*	C/C*	NC/NC*	NC/NC*	NC*/NC*	PC*/NC*

[A] C - concern; PC - potential concern; MC - minimal concern; NC - no concern
* - less than 28 samples preliminary test used
Listing before '/' is for WY2001–WY2010, after '/' is for WY2010

ALKALINITY AND PH

The Class I criteria for alkalinity specifies that the value shall not be less than 20 mg/L $CaCO_3$ equivalents. For inflow events in WY2010, alkalinity was measured at 23 structures (**Table 12**). Three structures (S-2, S-236, S-352) had no inflow alkalinity measurements. Of the 163 measurements, no excursions were found (**Attachment B4**). For the 10-year period, 20 locations were classified as no concern, three as minimal concern and three as concern (**Table 12**, **Attachment B8**). Low alkalinity was associated with basins in the Indian Prairie, which may indicate natural conditions with more acidic soils from wetlands. Further investigation is needed to confirm this assertion.

For no-flow events, no excursions were found at 24 structures (**Table 13**, **Attachment B5**). The other four structures (C41H78, CU-10A, Industrial Canal, S-65E) were not measured during no flow events. Of the 233 samples taken during no flow events, no excursions were found. For the 10-year period of analysis, 24 structures were classified as no concern and four as minor concern (**Table 12**, **Attachment B8**).

For outflow events in WY2010, alkalinity was measured at eight structures (**Table 14**, **Attachment B6**). Of the 47 samples taken, no excursions were found. Three structures (CU-5, S-129, and S-131) had two or less outflow days and no samples were taken. At L-59W (G-74) and L-60W (G-76) there were no outflow events. For the 10-year period of record, no excursions were found at the 13 stations (**Table 14**, **Attachment B8**).

The Class I criteria for pH specifies that the value shall not be below 6.0 or above 8.5. For inflow events, no excursions were found at the 23 structures. One structure (S-84) was classified as a potential concern (**Table 12**). Two sites, S236 and S352, were not measured. Of the 166 samples taken during flow events, only two were outside the pH criteria range (**Attachment B4**). For the 10-year period, 19 structures were classified as no concern and seven as minimal concern (**Table 12**, **Attachment B8**).

For no-flow events, there was one structure (S-71) classified as potential concern. The remaining 23 structures that were sampled were classified as no concern (**Table 13**). Four structures: C41H78, CU-10A, Industrial Canal, and S-65E were not measured. Of the 233 samples taken during no-flow events, one was outside the pH criteria range (**Attachment B5**). For the 10-year period, there were 12 sites listed as no concern, 14 as minimal concern, one as potential concern (S-65E), and one as concern (C-38W) (**Table 13**, **Attachment B8**). The concern at C-38W was for pH above 8.5, which may have been caused by high groundwater inflows

For outflow events, only one structure (Industrial Canal) was classified as concern, the other seven that were measured were classified as no concern (**Table 14**). CU-5, L-59W, L-60E, S-129 and S-131 were not measured. Of the 47 samples taken during outflow events, only one was outside the pH criteria range (**Attachment B6**). For the 10-year period, nine structures were classified as no concern, three as minimal concern, and one (S-351) as potential concern (**Table 14**, **Attachment B8**).

CONDUCTIVITY

The conductivity criterion for Lake Okeechobee tributaries was set at 1,275 microsiemens per centimeter (µS/cm) (**Table 10**). For inflow events, 20 structures were classified as no concern, four as concern, and two (S-236 and S-352) were not sampled (**Table 12**). Of the 166 samples taken during inflow events, 17 exceeded the conductivity criterion (**Attachment B4**). For the 10-year period of record, 16 were classified as no concern, one as minimal concern, one as potential concern, and eight as concern (**Table 12**, **Attachment B8**). High conductivity is likely a result of groundwater seepage.

For no-flow events, 16 structures were classified as no concern, one as potential concern, seven as concern, and four (C41H78, CULV10A, Industrial Canal, S-65E) were not sampled (**Table 13**). Of the 233 samples taken during no-flow conditions, 35 exceeded the conductivity criterion (**Attachment B5**). For the 10-year period of record, 16 were classified as no concern, two as minimal concern, and 10 as concern (**Table 13**, **Attachment B8**). High conductivity was likely a result of groundwater seepage

For outflow events, no excursions were found out of the 47 samples measured among eight structures (**Table 14**, **Attachment B6**). CU-5, L-59W, L-60E, S-129, and S-131 were not measured. For the 10-year period, 11 structures were classified as no concern and two as minimal concern (**Table 14**, **Attachment B8**).

TURBIDITY

The Class I turbidity criterion for Lake Okeechobee tributaries was set at 32.3 nephelometric turbidity units (NTUs) (**Table 10**). The exceedance value was based on 29 plus a background value of 3.3, which was determined based on the median value of turbidity in lake tributaries from 1990 to 2000 (SFWMD, 2009). For inflow events, 22 structures were classified as no concern, one as concern, and three (S-2, S-236, S-352) were not measured (**Table 12**). Of the 160 samples taken during inflow events, one exceeded the Class I criterion for turbidity (**Attachment B4**). For the 10-year period, 19 structures were classified as no concern, two as minimal concern, two as potential concern, and three as concern (**Table 12**, **Attachment B8**). Turbidity concerns in the S-2, Culv10A, and Industrial Canal 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. Further investigation would be needed to confirm these explanations.

For no-flow events, 22 structures were classified as no concern, one as potential concern, one as concern, and four (C41H78, CU-10A, Industrial Canal, S-65E) were not sampled (**Table 13**). Of the 232 samples taken during no-flow conditions, 11 exceeded the criterion for turbidity (**Attachment B5**). For the 10-year period, 16 structures were classified as no concern, six as minimal concern, one as potential concern, and five as concern (**Table 13**, **Attachment B8**). Turbidity concerns in S-2, S-3, S-352 and Culv10A and C-38W could be related to accumulation of sediments in the bottom of the canals.

For outflow events, six were classified as no concern, two as concern, and five (CU-5, L-59W, L-60E, S-129 and S-131) were not sampled (**Table 14**). Of the 45 samples taken during outflow events, 12 exceeded the criteria for turbidity (**Attachment B6**). For the 10-year period, seven structures were classified as no concern, three as potential concern, and three as concern (**Table 13**, **Attachment B8**). Turbidity concerns at S-352 and CULV10A during outflow could be attributed to their location, which is near the very open turbid region of Lake Okeechobee. Industrial Canal is not as close to open water, but a canal leads directly to open water of the lake.

IRON

The Class I criterion for iron is not to exceed 1 mg/L. While not toxic at this level, the criterion is primarily to prevent staining in clothes washing (Environmental Health Laboratory, 2010). This parameter is only measured quarterly; therefore, there are enough samples at only a few structures to perform a binomial test with accuracy for the 10-year period. For inflow events, 15 structures were classified as no concern, one (CU-10A) as concern, and 10 were not sampled (**Table 12**). Of the 25 samples taken during inflow events, one exceeded the criterion for iron (**Attachment B4**). For the 10-year period of record, 16 structures were classified as no concern, eight as potential concern, and two as concern (**Table 12**, **Attachment B8**). Iron occurs in soils and groundwater of the Lake Okeechobee watershed and thus is considered natural in origin (Ground Water Protection Section, 2009).

For no-flow events, 23 structures were classified as no concern, one as concern, and two (C41H78 and Industrial Canal) were not measured (**Table 13**). Of the 66 samples taken during no-flow periods, only two exceeded the iron standard (**Attachment B5**). For the 10-year period, 18 structures were classified as no concern, three as potential concern, and five as concern. Iron concerns at S-135, S-254, S-352, S-2, and S-3 could be attributed to groundwater seepage.

For outflow events, five structures were classified as no concern, two as concern, and six (CULV5, L-59W, L-60W, S-129, S-131, S-351) were not sampled (**Table 14**). Of the 12 samples taken during outflow periods, two exceeded the criterion for iron (**Attachment B6**). For the 10-year period, eight structures were classified as no concern, one as potential concern, two as concern, and two were not measured (L-59W, L-61E; **Table 12**, **Attachment B8**). The two concerns, S-352 and CULV10A, could be attributed to the proximity of the structures to open water of the lake, which is high in iron (Ground Water Protection Section, 2009)

TOTAL PHOSPHORUS LOADS

The WY2010 total phosphorus (TP) load to Lake Okeechobee is 478 metric tons (mt) including 35 mt from atmospheric deposition (FDEP, 2001). Most of the surface load comes from the northern watersheds (393 mt), followed by south (21 mt), east (17 mt), and west (12.5 mt, **Table 15**). Target loads based on the Total Maximum Daily Load (TMDL) were exceeded by 314 mt in the north, 11 mt in the south, 0.1 mt in the east, and 12.5 mt in the west region. For 2010, the TMDL was exceeded by 338 mt.

The five-year average (WY2006–WY2010) phosphorus load to Lake Okeechobee was 496 mt per year, which exceeds the TMDL by 356 mt (**Table 16a**). This five-year average includes one very high flow year (WY2006) that includes the effects of Hurricane Wilma. WY2007 and WY2008 loads were much lower (203 and 246 mt, respectively) due to low flow conditions caused by the regional drought. WY2009 included the effects of Tropical Storm Fay. Further analysis of these loads can be found in Volume I, Chapter 10, which documents the trends of water flow, TP load, and TP mean flow-weighted concentration in each Lake Okeechobee sub-watershed. Results from these analyses show that flow and load from Taylor Creek/Nubbin Slough and Lake Istokpoga had both significantly declined from 2001 to 2009. Although flow-weighted mean concentration of TP in any of the nine sub-watersheds, the slope of the trend in the Taylor Creek/Nubbin Slough Watershed was negative, which was expected since this region has had the greatest implementation of Best Management Practices (BMPs) and other TP control projects.

Each of these sub-watersheds is further evaluated in Volume I, Chapter 4. Comparing WY2010 loads with average historical loads for WY1991-WY2005, four basins were more than 40 percent below the historical average (Lower Kissimmee, Taylor Creek/Nubbin Slough, Fisheating Creek and Nicodemus Slough, and South Lake Okeechobee), two were 38 percent or more above (Upper Kissimmee and Indian Prairie), and three were between 1 and 10 percent above (Lake Istokpoga, West Lake Okeechobee, and East Lake Okeechobee). Further management activities in these watersheds, including the Lake Okeechobee Watershed Protection Program, additional TP control projects, and model application and development are described in Volume I, Chapter 7.

Table 15. TP loads (metric tons) for each structure by month.

Region	Structure	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	Total	Target Loads	Above Target
East	L-8(C10A)	0.27	4.24	0.99	0.09	0.03	0.00	0.00	0.00	0.04	0.14	0.50	0.02	6.34		
	S-308	2.90	3.30	1.48	0.16	0.28	0.27	0.01	0.62	0.76	0.44	0.36	0.02	10.60		
	Total													16.94	16.84	0.10
North	C-38W C-33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.46	1.10	0.02	0.05	1.63		
	C41H78	2.76	10.75	0.86	6.12	3.26	0.52	0.30	0.54	0.56	0.45	16.50	4.84	47.47		
	CU-5	0.00	0.11	0.18	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.05	0.06	0.41		
	FECR Lakeport	0.37	17.80	35.14	10.46	2.20	0.95	0.14	0.05	0.41	0.02	2.09	4.80	74.43		
	FECR - Palmdale	0.01	36.18	32.00	8.00	1.91	0.44	0.03	0.17	0.08	0.09	4.05	6.07	89.05		
	L-59E	0.01	0.00	4.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.32	0.81	5.16		
	L-59W	1.59	5.05	10.79	1.89	3.49	0.00	0.22	0.40	0.38	0.00	1.27	0.32	25.39		
	L-60E	0.26	0.58	0.49	0.06	0.51	0.00	0.00	0.00	0.00	0.00	0.15	0.06	2.10		
	L-60W	0.07	0.17	0.46	0.00	0.03	0.02	0.02	0.00	0.00	0.00	0.08	0.01	0.87		
	S-127	0.00	0.05	1.40	0.15	0.50	0.00	0.00	0.00	0.00	0.01	0.85	0.31	3.27		
	S-129	0.12	0.33	0.50	0.05	0.09	0.02	0.02	0.09	0.05	0.06	0.45	0.38	2.17		
	S-131	0.00	0.00	0.00	0.01	0.08	0.00	0.00	0.04	0.03	0.01	0.26	0.25	0.68		
	S-133	0.00	0.00	0.00	0.02	0.07	0.02	0.00	0.00	0.00	0.00	0.48	0.46	1.04		
	S-135	0.00	0.00	0.00	0.07	0.17	0.00	0.00	0.00	0.00	0.00	0.20	0.17	0.60		
	S-154	0.00	0.01	1.18	0.38	1.25	0.00	0.00	0.00	0.00	0.00	1.33	5.97	10.12		
	S-154C	0.00	0.09	0.23	0.07	0.06	0.04	0.02	0.00	0.01	0.08	0.75	0.30	1.65		
	S-191	0.00	0.97	5.15	3.98	9.48	0.38	0.00	0.30	0.14	0.20	3.72	6.26	30.58		
	S-65E	6.09	23.46	22.77	12.71	14.96	1.54	0.72	1.16	1.49	8.38	19.22	28.80	141.31		
	S-71	2.91	13.57	17.26	5.76	3.81	0.32	0.02	0.23	0.17	0.31	12.91	4.43	61.71		
	S-72	0.50	1.82	3.24	0.22	0.32	0.00	0.01	0.05	0.00	0.02	3.67	0.74	10.59		
	S-84	1.72	4.17	5.17	0.94	0.27	0.06	0.00	0.01	0.00	0.38	3.32	3.15	19.20		
	Total*													392.91	78.59	314.32

Table 15. Continued.

Region	Structure	May-09	Jun-09	Jul-09	Aug-09	Sep-09	Oct-09	Nov-09	Dec-09	Jan-10	Feb-10	Mar-10	Apr-10	Total	Target Loads	Above Target
South	CU-10	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05		
	CU-12	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.00	0.34		
	CU-12A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	CU-4A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	0.02		
	INDS	1.54	1.68	0.49	0.41	0.40	0.00	0.01	0.11	0.06	0.09	0.53	0.27	5.58		
	S-2	0.00	0.00	0.13	0.02	0.03	0.05	0.00	0.09	0.00	0.00	2.55	0.03	2.89		
	S-236	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.00	0.11		
	S-3	0.19	0.00	0.03	0.02	0.00	0.05	0.00	0.00	0.00	0.00	0.83	0.00	1.12		
	S-352	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
	S-4	0.00	0.04	1.75	0.75	0.66	0.04	0.00	0.00	0.00	0.05	4.86	2.35	10.50		
	Total													20.62	9.56	11.06
West	CU-5A	1.27	3.16	3.09	0.13	0.00	0.14	0.03	0.61	0.26	0.68	0.50	0.46	10.32		
	S-77	0.83	0.42	0.93	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.18		
	Total													12.50	0.01	12.49
Total	**Surface***	20.27	99.41	113.72	35.89	38.38	3.39	1.11	3.88	3.95	12.07	63.76	61.75	442.95	105.00	337.95
	Atmospheric Deposition													35.00	35.00	
	Sum*													477.95	140	337.95

*does not include FECR-Lakeport or C41H78

Table 16a. TP loads (metric tons) to Lake Okeechobee over the past five water years.

Water Year	North	East	South	West	Atmospheric Deposition*	Total
2006	756	8	26	0	35	825
2007	183	13	5	7	35	243
2008	93	95	5	21	35	249
2009	585	22	26	17	35	685
2010	393	17	21	12	35	478
Average	402	31	17	11	35	496
Percent of total	81%	6%	3%	2%	7%	100%

* 35 metric tons/year from atmospheric deposition (FDEP, 2001).

Table 16b. Surface flows (millions of acre-feet) to Lake Okeechobee over the past five water years.

Water Year	North	East	South	West	Total
2006	3.76	0.03	0.09	0.00	3.87
2007	0.55	0.06	0.03	0.04	0.68
2008	0.46	0.43	0.02	0.11	1.03
2009	1.82	0.16	0.10	0.10	2.18
2010	2.14	0.09	0.09	0.09	2.42
Average	1.75	0.15	0.07	0.07	2.04
percent total	86%	8%	3%	3%	100%

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 semi-annual basis for sediments, samples are measured for 73 pesticides and their breakdown products at sites throughout the District. Additional information on the pesticide monitoring program can be found on the District's website at www.sfwmd.gov under the *Scientist & Engineers, Environmental Monitoring* section, and the *Pesticide Reports* link.

For Lake Okeechobee, pesticides are monitored at S-65E, S-191, Fisheating Creek (FECSR78), S-2, S-3, and S-4. The data are included in **Attachments B9** and **B10**. In the four surface water sampling events (April, August, October 2009, and March 2010), 2,4-D, ametryn, atrazine, atrazine breakdown product, bromacil, chlorpyrifos ethyl, hexazinone, metribuzin, norflurazon, and simazine were detected in at least one sample. However, bromacil and norflurazon were detected at the one northern sample site (S-191) while ametryn, chlorpyrifos ethyl, metribuzin, and simazine were detected at the three southern sites (S-2, S-3, and S-4) (**Table 16**). The concentrations of most of these pesticides were below the practical quantitation limit for the analytical procedure.

Table 17. Pesticide residues (µg/L) above the method detection limit found in surface water samples collected by SFWMD at Okeechobee sampling sites in April, August and October 2009, and March 2010 (From Pfeuffer, 2008a,b,c, and 2010) and chronic toxicity values for the water flea (*Daphnia magna*). Values in bold exceeds chronic toxicity of *Daphnia magna*.

Site	Date	Flow	2,4-D	Ametryn	Atrazine	Atrazine Desethyl	Bromacil	Chlorpyrifos ethyl	Hexazinone	Metribuzin	Norflurazon	Simazine
FECSR78	4/28/2009	N	BDL	BDL	BDL	0.011 [b]	BDL	BDL	0.32	BDL	BDL	BDL
	8/4/2009	Y	BDL	BDL	BDL	BDL	BDL	BDL	0.036 [b]	BDL	BDL	BDL
	10/27/2009	Y	BDL	BDL	BDL	BDL	BDL	BDL	0.036 [b]	BDL	BDL	BDL
	3/23/2010	Y	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
S-65E	4/28/2009	Y	BDL	BDL	0.023 [b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	8/3/2009	Y	BDL	BDL	0.015 [b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	10/27/2009	N	0.24 [b]	BDL	BDL	BDL	BDL	BDL	0.089	BDL	BDL	BDL
	3/22/2010	Y	BDL	BDL	0.040	BDL	BDL	BDL	BDL	BDL	BDL	BDL
S-191	4/28/2009	N	BDL	BDL	0.026 [b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	8/3/2009	N	0.30 [b]	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	10/27/2009	Y	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	3/22/2010	N	4.9	BDL	BDL	BDL	0.055 [b]	BDL	BDL	BDL	0.032 [b]	BDL
S-2	4/27/2009	N	BDL	BDL	0.26	0.034 [b]	BDL	BDL	BDL	BDL	BDL	BDL
	8/4/2009	N	BDL	0.013 [b]	0.096	0.025 [b]	BDL	BDL	0.023 [b]	BDL	BDL	BDL
	10/26/2009	N	BDL	0.026 [b]	0.065	0.012 [b]	BDL	BDL	BDL	BDL	BDL	BDL
	3/23/2010	N	0.28 [ab]	0.13 [a]	3.3 [a]	0.10 [a]	BDL	**0.32** [ab]	BDL	BDL	BDL	BDL
S-3	4/27/2009	N	BDL	BDL	BDL	0.036 [b]	BDL	BDL	BDL	BDL	BDL	BDL
	8/4/2009	N	BDL	0.015 [b]	0.073	0.025 [b]	BDL	BDL	0.028 [b]	BDL	BDL	BDL
	10/26/2009	N	BDL	BDL	0.097	0.024 [b]	BDL	BDL	BDL	BDL	BDL	BDL
	3/23/2010	N	0.41 [b]	0.082	2.5	0.099	BDL	BDL	BDL	0.030 [b]	BDL	BDL
S-4	4/27/2009	N	BDL	BDL	0.26 [a]	0.040 [a]	BDL	BDL	BDL	BDL	BDL	0.01 [ab]
	8/4/2009	N	BDL	0.018 [b]	BDL	0.015 [b]	BDL	BDL	0.075 [b]	BDL	BDL	BDL
	10/26/2009	N	BDL	BDL	0.057	0.015 [b]	BDL	BDL	BDL	BDL	BDL	BDL
	3/23/2010	Y	0.58 [b]	BDL	5.1	0.23	BDL	BDL	BDL	BDL	BDL	BDL
Chronic toxicity of *Daphnia magna*			1,250 (c)	1,400 (c)	345 (c)	N/A	6,050 (d)	0.005 (e)	7,580 (c)	210 (f)	>750 (g)	55 (c)

N - no Y - yes ; BDL denotes that the result is below the method detection limit
a - results are the average of replicate samples
b - value reported is greater than or equal to the method detection limit and less than the practical quantitation limit
c - U.S. Environmental Protection Agency (1991)
d - U.S. Environmental Protection Agency (1996a)
e - U.S. Environmental Protection Agency (2002)
f - U.S. Environmental Protection Agency (1998)
g - U.S. Environmental Protection Agency (1996b)

The observed concentration of each is 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}). The EC_{50} is a 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 a concentration at which 50 percent of the aquatic animals tested die within a short (acute) exposure period. These criteria are determined using data from the 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**). Based on excursion categories recommended for the Everglades Protection Area (Weaver and Payne, 2005) all sites where the pesticide was detected are to be labeled as potential concern. The chlorpyrifos ethyl residue detected at S-2 exceeded the calculated chronic toxicity for *Daphnia magna*. At this level, exposure can cause impacts to macroinvertebrate populations.

Sediment samples taken at all of the sites in August 2009 and March 2010, showed detectable concentrations of five different pesticides (**Table 18**). Sediment concentrations are compared to freshwater sediment quality assessment guidelines (MacDonald Environmental Sciences, Ltd., and United States Geological Survey, 2003). A value below the threshold effect concentration (TEC) should not have a harmful effect on sediment-dwelling organisms. Values above the probable effect concentration (PEC) demonstrate that harmful effects to sediment-dwelling organisms are likely to be frequently or always observed.

Atrazine is a selective systemic herbicide registered for use on pineapple, sugarcane, corn, rangelands, ornamental turf and lawn grasses, and non-crop areas. Only a TEC level (0.30 µg/kg) has been developed for atrazine concentrations in freshwater sediments. The detected sediment concentration of atrazine at S-4 (9.5 µg/kg) exceeds this value and it is uncertain if this level may impact sediment-dwelling freshwater organisms.

Chlordane is a chlorinated hydrocarbon previously used as a contact insecticide. Freshwater sediment quality assessment guidelines identified a TEC of 3.2 µg/kg and PEC of 18 µg/kg for chlordane. The detected sediment residue at S-3 (16 µg/kg) is at a concentration where harmful effects to sediment-dwelling organisms may be frequently or always observed. While the use of this compound has been discontinued in recent years, its persistence and tendency to accumulate in sediments makes chlordane a compound of concern.

DDE, DDD, and DDT were detected at S-2, S-3, and S-4. DDE is an abbreviation for dichlorodiphenyldichloroethylene [2, 2-bis (4-chlorophenyl)-1, 1-dichloroethene]. This compound is an environmental dehydrochlorination product of DDT, a popular insecticide for which the U.S. Environmental Protection Agency (USEPA) cancelled all uses in 1973. The large volume of DDT used, the persistence of DDT, DDE and another metabolite, DDD (dichlorodiphenyldichloroethane), and the large hydrophobicity of these compounds account for the frequent detections in sediments. The latter attribute also results in a significant bioconcentration factor. In sufficient quantities, these residues have reproductive effects in wildlife and carcinogenic effects in many mammals.

The DDD sediment concentrations detected range from 2.7 to 19 µg/kg. Any concentration below the TEC (4.9 µg/kg) should not impact sediment-dwelling organisms while concentrations above the PEC (28 µg/kg) frequently or always have the possibility for impacting sediment-dwelling organisms. The sediment concentrations detected at S-2 and S-3 were less than the PEC and did not exceed the level of concern.

DDE values ranged from 2.6 to 75 µg/kg in these sediments. The TEC is 3.2 µg/kg and the PEC is 31 µg/kg for DDE in freshwater sediments. The concentrations of DDE detected at S-2 and S-3 exceeded the PEC and frequently or always have the possibility for affected sediment-dwelling organisms.

The DDT concentrations detected at S-2 exceeded the TEC (4.2 µg/kg) but not the PEC (63 µg/kg). At this level, there may be a possibility for impacting sediment-dwelling freshwater organisms.

Table 18. Pesticide residues (µg/kg) above the method detection limit found in sediment samples collected by the SFWMD at Okeechobee sampling sites in April, August and October 2009, and March 2010 (Pfeuffer, 2009b, 2010). Values in bold are above the probable effect concentration.

Site	Date	Atrazine	Chlordane	DDD-p,p'	DDE-p,p'	DDT-p,p'
S-2	8/4/2009	BDL	BDL	19 [b]	**66**	17 [b]
	3/23/2010	BDL	BDL	18 [ab]	**75 [a]**	BDL
S-3	8/4/2009	BDL	BDL	10 [b]	**37**	BDL
	3/23/2010	BDL	16 [b]	2.7 [b]	10	BDL
S-4	8/4/2009	BDL	BDL	BDL	2.6 [b]	BDL
	3/23/2010	9.5 [b]	BDL	BDL	4.4 [b]	BDL

BDL denotes that the result is below the method detection limit

a - results are the average of replicate samples

b - value reported is greater than or equal to the method detection limit and less than the practical quantitation limit

IN-LAKE WATER QUALITY MONITORING

The South Florida Water Management District maintains 37 in-lake sampling stations to monitor water quality in all ecological regions of the lake (**Figure 6**). 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; Zhang et al., 2007; James et al., 2008; Zhang et al., 2009; McCormick et al. 2010). Volume I, Chapter 10 includes a detailed evaluation of these data. An attachment of all water quality samples collected at Lake Okeechobee in-lake sampling sites (**Figure 6**) was developed from DBHYDRO (**Attachment B11**). These records include analytical results of grab samples taken throughout the year for 15 water quality parameters (**Table 5**).

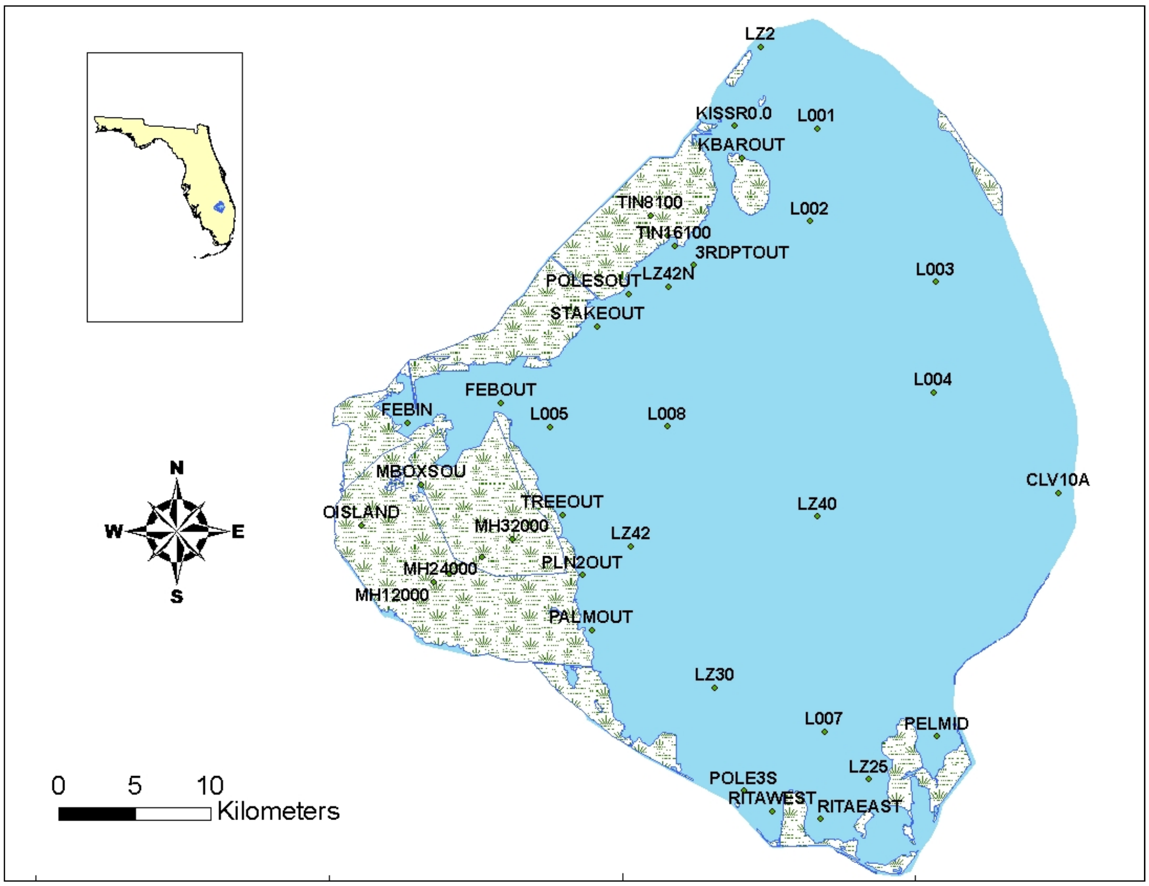

Figure 6. Active stations in Lake Okeechobee.

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Weaver K. and G. Payne. 2005. Chapter 2A: Status of Water Quality in the Everglades Protection Area. In*: 2005 South Florida Environmental Report*. South Florida Water Management District, West Palm Beach, FL.

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Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions and cross-references presented in this report.

Specific Condition	Table	Narrative (pages)	Figure	Attachment
14. Annual Monitoring Report	4 — 18	App. 4-1-2 — 4-1-32	1 — 5	B1 — B11
14A. Water Quality Data. Records of monitoring information shall include all applicable laboratory information specified in Rule 62-160.340(2), F.A.C.	4, 5, 6	App. 4-1-3	1	B1
14A1. Date, location, and time of sampling or measurements	---	---	1	B1
14A2. Person responsible for performing the sampling or measurements	---	---	---	B1
14A3. Dates analyses were performed or the appropriate code as required by Chapter 62-160, F.A.C.	---	---	---	B1
14A4. Laboratory/Person responsible for performing the analyses	---	---	---	B1
14A5. Analytical methods used, including MDL and PQL	---	---		B1
14A6. Results of such analyses, including appropriate data qualifiers, and all compounds detected	---	---	---	B1
14A7. Depth of sampling (for grab samples)	---	---	---	B1
14A8. Flow conditions and weather conditions at time of sample collection	---	---	---	B1
14A9. Monthly flow volumes	7, 8	App. 4-1-3 — 4-1-15	---	---
14B. Performance Evaluation. With the raw data, the permittee must submit an evaluation of the water quality monitoring data collected	10 – 18	App. 4-1-17 — 4-1-30	---	B4 — B11
14B1. The analysis shall include the identification of exceedances of water quality criteria, other than phosphorus, as well as the frequency of exceedances	10 – 14	App. 4-1-17 — 4-1-23	---	B4, B5, B6, B7, B8
14B2. The permittee shall determine the annual total phosphorus loading to Lake Okeechobee	15, 16a, SFER 10-13	App. 4-1-23, SFER 10-59	SFER 10-20	---
14B3. The permittee shall report the 5-year rolling average of phosphorus loading to Lake Okeechobee	16a, SFER 10-12	App. 4-1-23, SFER 10-54	---	---
9B. Annual compliance evaluation by region	15, 16a	App. 4-1-23	---	---
14B4. The permittee shall provide the data from their ambient pesticide and herbicide monitoring program that is applicable to Lake Okeechobee	17,18	App. 4-1-26 — 4-1-29	---	B9, B10
14B5. The permittee shall provide data collected within Lake Okeechobee under the Lake Okeechobee Research and Monitoring Program	---	App. 4-1-30	5	B11
6E3 After Action Report	---	---	---	C1, C2

SFER**-** South Florida Environmental Report, Volume I, Chapter 10

Attachment B: Lake Okeechobee Structure and Water Quality Monitoring Data

Note: This supporting information (Attachments B1–B11) is available upon request.

Attachment C1: Lake Okeechobee S3 Backpumping After Action Report for May 19 to 20, 2009, and May 21, 2009

Lake Okeechobee S3 Backpumping After Action Report for May 19 to 20, 2009, and May 21, 2009

June 10, 2009

Prepared for
Florida Department of Environmental Protection

Prepared by
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL

CONTENTS

TABLES AND FIGURES

Introduction and Background

The South Florida Water Management District has prepared this after action report to comply with the requirements of the Lake Okeechobee Operating Permit (Florida Department of Environmental Protection 2007, permit number 0174552-001-GL, the Permit) issued under the authority of the Lake Okeechobee Protection Act (LOPA), Chapter 373.4595, Florida Statutes (F.S.) and Title 62 of the Florida Administrative Code (Florida Department of Environmental Protection, 2007). This report is submitted to the Florida Department of Environmental Protection (Department) to fulfill the requirements of Specific Condition 6E(3) of the Permit:

> *The permittee shall submit an After Action Report to the Department. The report shall include: monitoring results; documentation of volume of water conveyed to Lake Okeechobee, by structure; documentation of total phosphorus and total nitrogen loading conveyed to Lake Okeechobee, by structure; rainfall data; Lake stage measurements; and a written justification for initiating back pumping operations. The After Action Report may be provided through the Annual Report required by Specific Condition 14.*

From May 18 to May 20, a non-tropical, low pressure system interacting with a frontal boundary stalled over south Florida. The District-wide average rainfall was about 3.08 inches with local maximums of 10 inches in the Upper Kissimmee during this three-day period (Table 1, Figures 1 through 4). The heaviest 24-hour period of rainfall was from 0700 May 18 to 0700 on May 19 (1.5 inches District-wide). After the system moved away from the District, heavy rain continued to fall on a daily basis over the then saturated Everglades Agricultural Area (EAA).

Over the period of record (1932 – 2009), the average District-wide rainfall for the third week of May is approximately 0.4 inches. The week of May 18-24, 2009, produced more rainfall (4.81 inches) over the District than the entire period of November 1, 2008, to April 30, 2009 (4.47 inches), which is the driest six-month period on record.

The South Florida Water Management District is responsible for maintaining the primary canal system. Staff routinely clears this system of floating vegetation and trash. Contractors are hired to spray vegetation and keep it under control. However, vegetation built up in the secondary canal system from the preceding six months was flushed into the primary canal system by this event.

According to normal operating protocol, flood control pumping was initiated at G372 on May 18 (Figure 5). The trash rack at G372 developed mechanical problems that may have been the result of the excessive load of vegetation and trash. In addition, the station was struck by lightning and developed electronic problems during this storm event.

The problems at G372 resulted in canal headwater levels at S-3 reaching the 12.5 foot (NGVD 29) trigger that initiates backpumping in accordance with the Permit (Florida Department of Environmental Protection 2007). Backpumping at S3 began at 1815 on May 19 and ended at 0645 on May 20, 2009. One unit pumped for the entire duration of the event. Backpumping was restarted on May 21, 2009, and occurred between the hours of 0540 and 1430.

Results

As of 1730 on May 19, 2009, the headwater at S2 had increased to 12.6 ft-NGVD 29. Because the criteria had been reached (headwaters above 12.5 feet), backpumping at S3 began at 1815 on May 19 and continued until May 20 at 0645 (Table 2). Backpumping was resumed at 0540 on May 21 and continued until 1430.

The stage of Lake Okeechobee increased from 10.55 feet on May 18, 2009, to 10.77 on May 21, 2009. This was a net change in water volume of approximately 72,670 acre-feet and an increase in water levels of 0.22 ft (Table 3, Figure 6). The onset of the wet season along with this rain event stopped the decline of water levels in Lake Okeechobee occurring since August of 2008, creating a slight increase of water levels in the past week.

Flow-proportional autosamples were taken at S3 on May 20 and 22, 2009, and grab samples were taken on May 20 and 21, 2009 (Table 4). In accordance with the permit, autosamples were analyzed for nutrients and grab samples were analyzed for nutrients, alkalinity, hardness, total iron, and ions. Dissolved oxygen, pH, and specific conductance were measured at the site with a probe. All Class I standards (Table 5) were met with the exception of dissolved oxygen. No fatal qualifiers were determined in the validation of any measurements from these samples (see Appendix 1)

Estimated nutrient loads to the lake were 0.19 metric tons of total phosphorus (TP) and 11.5 metric tons of total nitrogen (TN)(Table 2). Flow-weighted mean concentrations of TP and TN were 0.083 mg/L and 5.04 mg/L, respectively. The former value is less than the current in-lake average concentration, while the latter value is higher. Sample results also indicate that over half of the TP was orthophosphate and approximately half of the TN was nitrate+nitrite (Table 4). These inorganic forms of nutrients are bioavailabile and tend to stimulate algae and plant growth.

Conclusion

The backpumping at S3 discharged 1,856 acre-feet of water with a load of 0.19 metric tons of phosphorus and 11.5 metric tons of nitrogen (Table 2). This backpumping was a small portion of the total change in water volume in Lake Okeechobee (less than 3 percent). Due to this small percentage of the flow to the lake during this period, it is likely that the loading contributions from this event were small in comparison to the total loads to the lake over the same period. These total loads (a part of Water Year 2010 – May 2009 to April 2010) will be reported in the 2011 Lake Okeechobee Operating Permit Annual Report.

References

Florida Department of Environmental Protection. 2007. Lake Okeechobee Protection Act (LOPA) Permit - Operations Authorization. Permit Number 0174552-001-GL, Tallahassee, FL, pp. 17.

Table 1. Rainfall estimates at S3, the Everglades Agricultural Area, and District-wide from May 18 to 21, 2009. Rainfall was measured in 24-hour periods ending at 0700 on the date of the measurement. Bolded values represent period of backpumping at S3. EAA east region and District-wide values are Thiessen weighted averages of District rainfall gauges. Values were obtained from South Florida Water Management District weather daily rainfall reports.

Date	S3 Rainfall (Gauge)	EAA East Rainfall (inches)	District-wide Rainfall (inches)
5/18/2009	0.00	0.01	0.14
5/19/2009	**4.00**	**2.19**	**1.49**
5/20/2009	**0.43**	**1.07**	**1.00**
5/21/2009	**0.58**	**0.54**	**0.59**
5/22/2009	0.37	0.36	0.46

Table 2. Daily flow, estimated TP and TN loads, and flow-weighted concentration at S3 during the May 19 to 21, 2009, backpumping event.

Date	Flow in Acre-feet	TP (mg/L)	TP Loads (kg)	TN (mg/L)	TN Loads (kg)
5/19/2009	583	0.094	67.6	4.929	3,547.2
5/20/2009	530	0.094	61.4	4.929	3,220.2
5/21/2009	743	0.066	60.5	5.216	4,782.1
Total	1,856	0.083	189.6	5.044	11,549.4

Table 3. Stage and storage volume estimates of Lake Okeechobee and changes in volume during the May 19 to 21, 2009, backpumping event.

Date	Stage (ft-NGVD 29)	Estimated Lake Volume (acre- feet)
5/18/2009	10.55	2,193,699
5/19/2009	10.60	2,210,099
5/20/2009	10.66	2,229,904
5/21/2009	10.77	2,266,370
Change	0.22	72,670

Table 4. S3 water quality data collected May 20 to 22, 2009.

	May 20, 2009		May 21, 2009	May 22, 2009
Test Name	**Grab Sample**	**Flow-Proportional Autosample**	**Grab Sample**	**Flow-Proportional Autosample**
Alkalinity (as mg/L CaCO3)			211	
Dissolved Calcium (mg/L)	82.2		105.3	
Specific Conductance (μmhos)	816		998	
Dissolved Oxygen (mg/L)	2.6		3.5	
Hardness (as mg/l CaCO3)	285.4		359	
Potassium (mg/L)	10.4		13.2	
Magnesium (mg/L)	19.5		23.3	
Sodium (mg/L)	49.7		60.1	
Ammonia (mg/L)	0.308		0.608	
Nitrite (mg/L)	0.195		2.551	
Nitrate(mg/L)	2.743		0.315	
Nitrite + Nitrate (mg/L)	2.938	2.349	2.866	2.716
Ortho-Phosphate (mg/L)	0.056		0.099	
pH	7.0		7.4	
Temperature (^{o}C)	24.9		26.0	
Total Kjeldahl Nitrogen (mg/L)	2.21	2.68	3.01	2.5
Total Nitrogen	5.15	5.03	5.88	5.22
Total Iron (μg/L)			129	
Total Phosphorus (mg/L)	0.100	0.094	0.145	0.066
Total Suspended Solids (mg/L)			5	
Turbidity (NTUs)	6		4	

Table 5. Class I criteria values for Lake Okeechobee monitoring

Parameter	Units	Criteria
Alkalinity	mg/L	**≥ 20**
Dissolved Oxygen	mg/L	**≥ 5**
pH	SU	**6 - 8.5**
Specific Conductance	µS/cm	≤ 1275 or ≤ 1.5 * natural background (whichever is greater) **≤ 1275**
Turbidity	NTU	≤ 29 + natural background **≤ 32.3**
Total Iron	µg/L	**≤ 1000**

Figure 1. Twenty-four hour (0700 05/18 to 0700 05/19/2009) rainfall estimates from the South Florida Water Management District's RAINDAR.

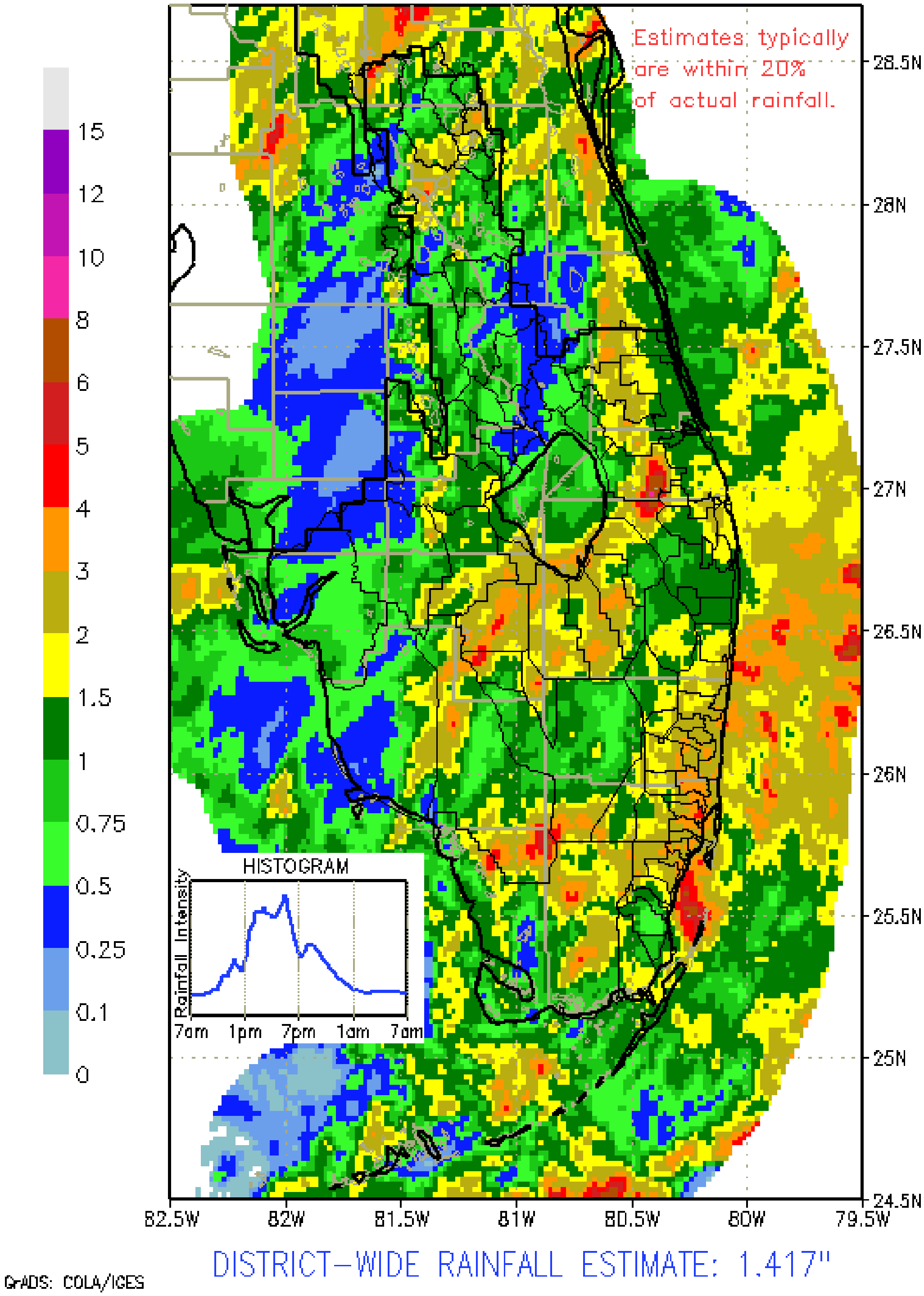


Figure 2. Twenty-four hour (0700 05/19 to 0700 05/20/2009) rainfall estimates from the South Florida Water Management District's RAINDAR

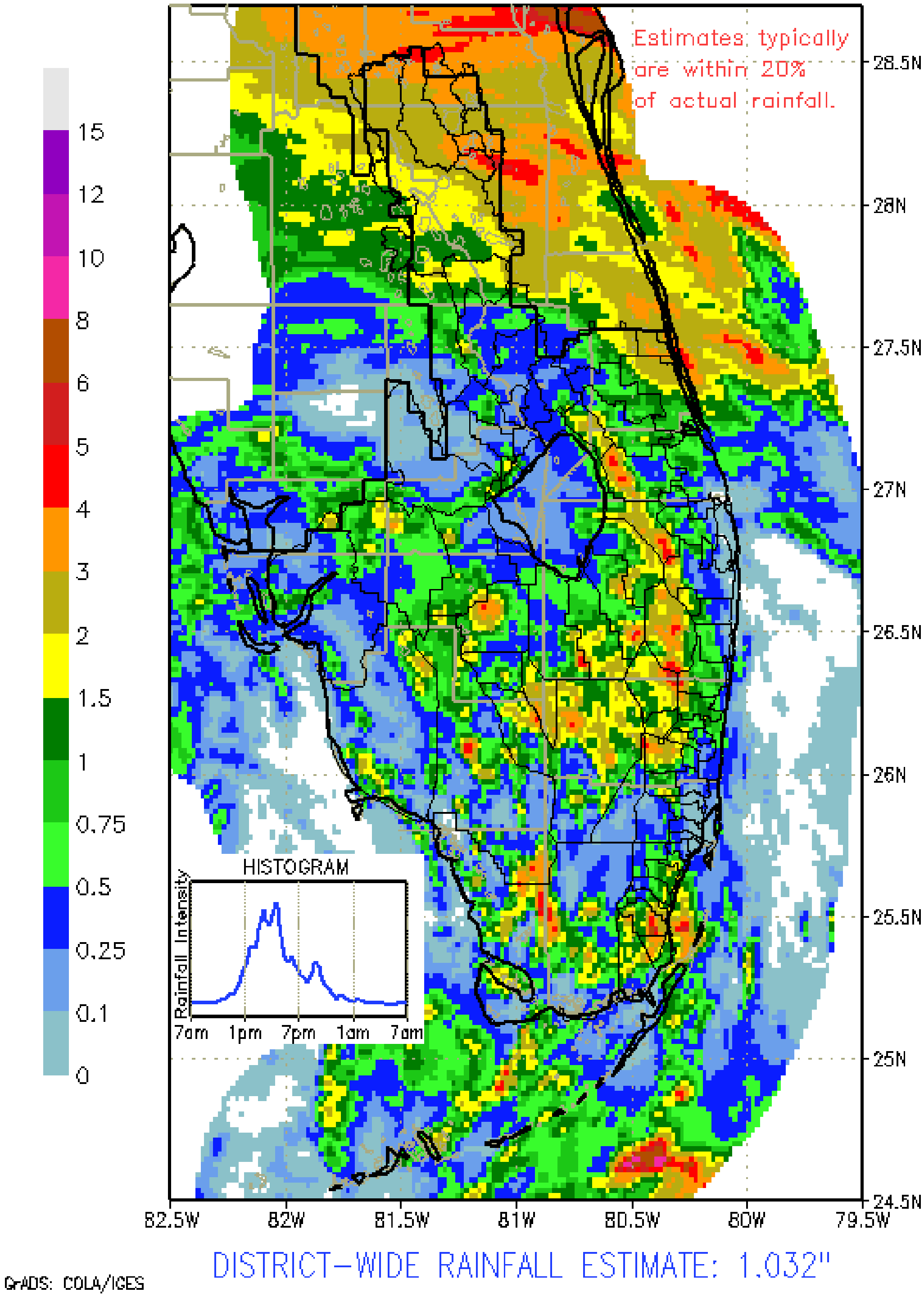


Figure 3. Twenty-four hour (0700 05/20 to 0700 05/21/2009) rainfall estimates from the South Florida Water Management District's RAINDAR

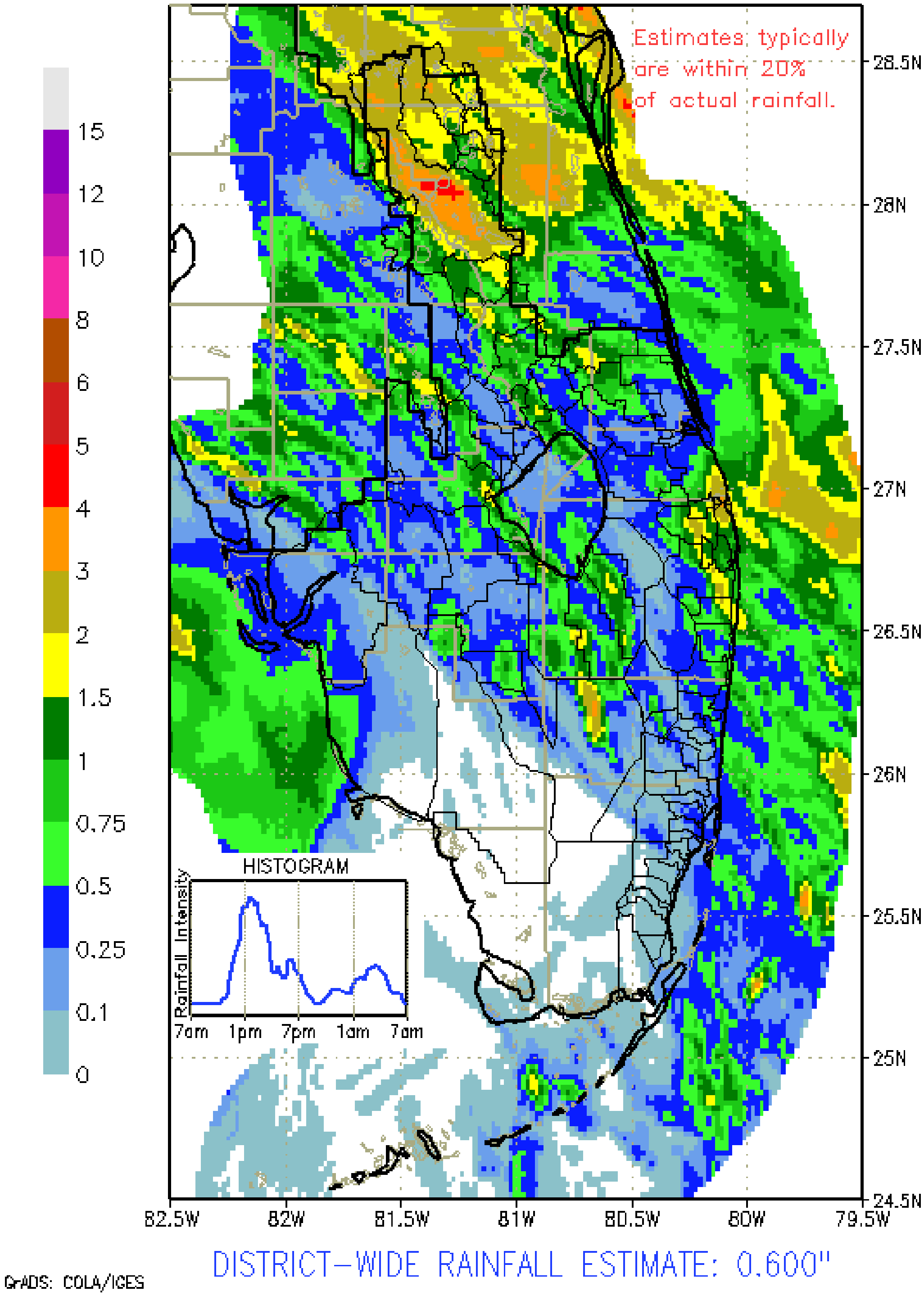


Figure 4. Twenty-four hour (0700 05/21 to 0700 05/22/2009) rainfall estimates from the South Florida Water Management District's RAINDAR

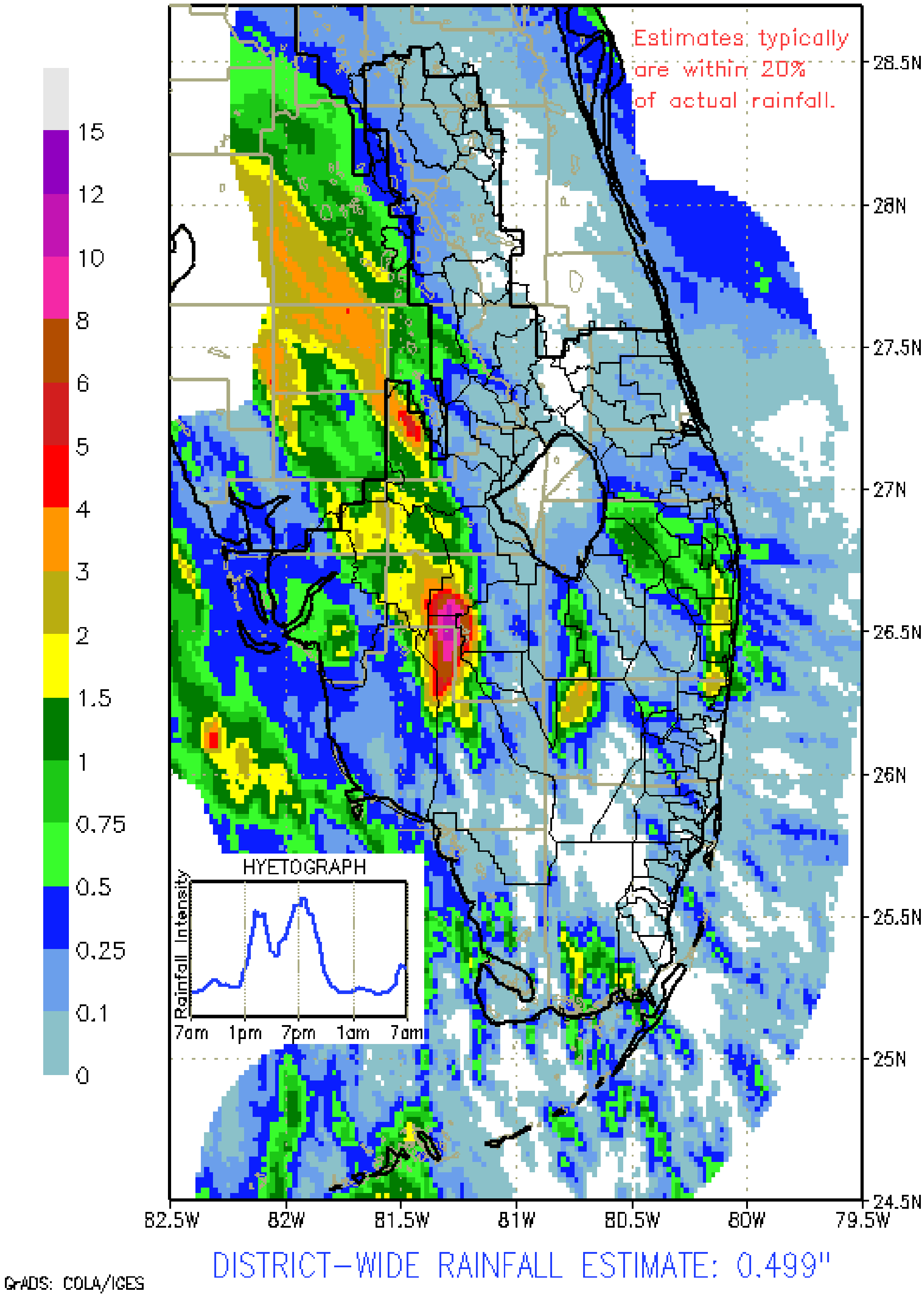


Figure 5. Map of Everglades Agricultural Area structures active during May 19 to May 21 backpumping event

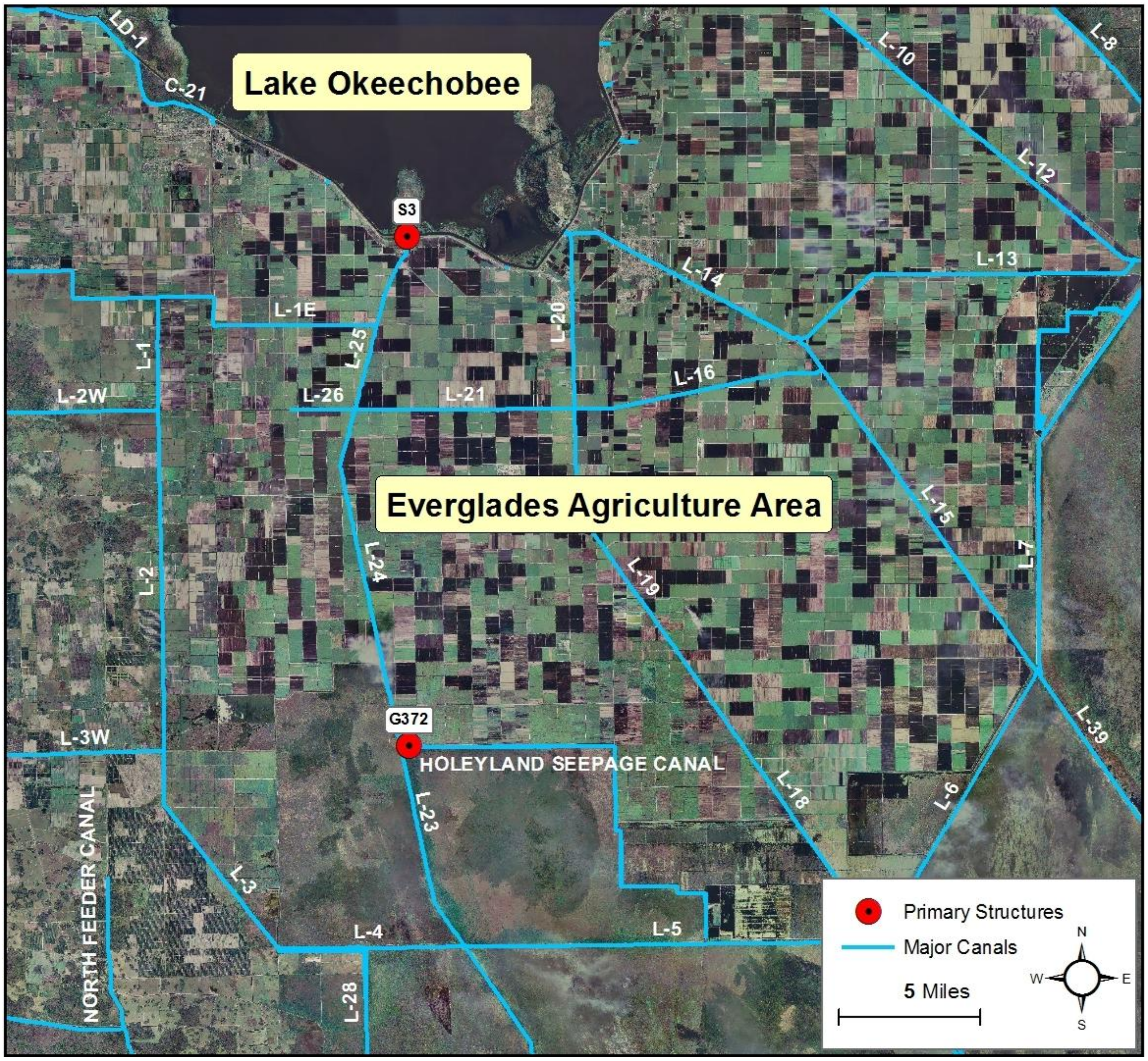
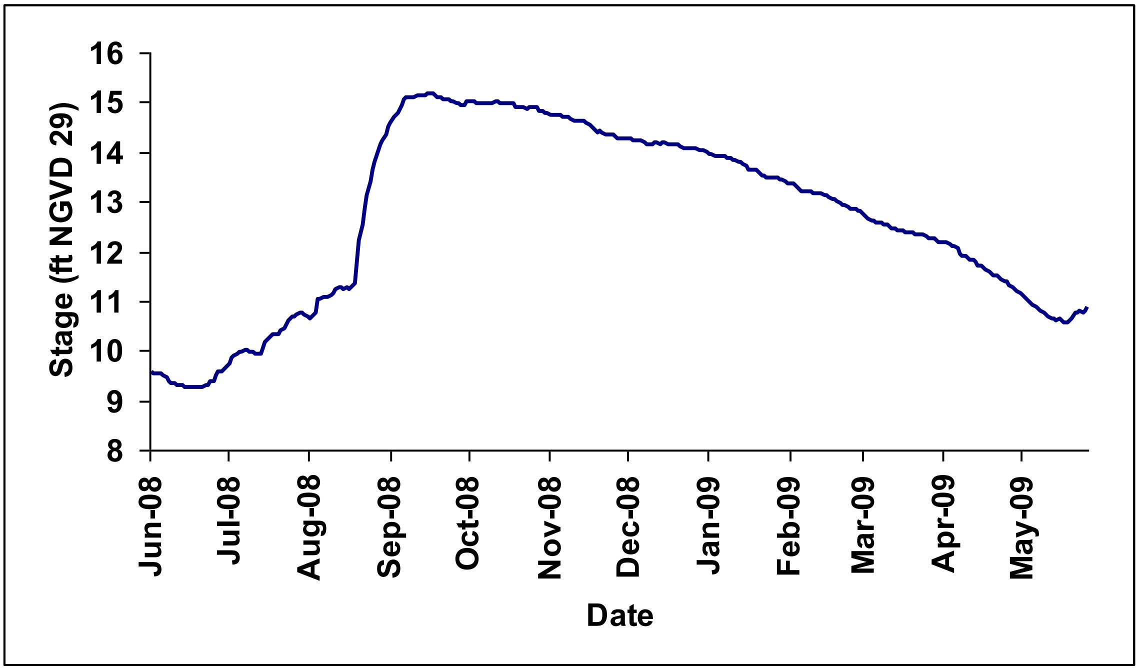


Figure 6. Lake Okeechobee stage – June 1, 2008, to May 26, 2009.



APPENDIX A:
Water quality analysis of samples collected at S3, May 20 and 21 2009

SAMPLE ID	LAB_ID	STATION	MATRIX	COLLECT METHOD	SAMPLE TYPE	PROJECT CODE
P41538-4	14466004	S3	SW	ACF	SAMP	X
P41538-4	14466004	S3	SW	ACF	SAMP	X
P41538-4	14466004	S3	SW	ACF	SAMP	X
P41538-5	14466013	S3	SW	G	SAMP	X
P41538-6	14466006	S3	SW	ACF	EB	X
P41538-6	14466006	S3	SW	ACF	EB	X
P41538-6	14466006	S3	SW	ACF	EB	X
P41538-7	14466007	S3	SW	ACF	FCEB	X
P41538-7	14466007	S3	SW	ACF	FCEB	X
P41538-7	14466007	S3	SW	ACF	FCEB	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P41242-8	14053008	S3	SW	G	SAMP	X
P44574-4	18180004	S3	SW	ACF	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
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P44574-5	18180005	S3	SW	G	SAMP	X
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P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44574-5	18180005	S3	SW	G	SAMP	X
P44575-4	18181004	S3	SW	ACF	SAMP	X
P44575-4	18181004	S3	SW	ACF	SAMP	X
P44575-4	18181004	S3	SW	ACF	SAMP	X
P44575-6	18181006	S3	SW	ACF	EB	X
P44575-6	18181006	S3	SW	ACF	EB	X

SAMPLE ID	COLLECT DATE	DISCHARGE	UP DOWN STREAM	WEATHER	DEPTH	FIRST TRIGGER DATE
P41538-4	5/20/2009 9:39 AM	0	1	0		05/19/09 18:09
P41538-4	5/20/2009 9:39 AM	0	1	0		05/19/09 18:09
P41538-4	5/20/2009 9:39 AM	0	1	0		05/19/09 18:09
P41538-5	5/20/2009 9:38 AM					
P41538-6	5/20/2009 9:46 AM	0	0	0		
P41538-6	5/20/2009 9:46 AM	0	0	0		
P41538-6	5/20/2009 9:46 AM	0	0	0		
P41538-7	5/20/2009 9:52 AM	0	0	0		
P41538-7	5/20/2009 9:52 AM	0	0	0		
P41538-7	5/20/2009 9:52 AM	0	0	0		
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P41242-8	5/20/2009 9:29 AM	2	1	1	0.5	
P44574-4	5/21/2009 2:19 PM	0	0	0		05/21/09 5:31
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44574-5	5/21/2009 1:57 PM	1	1	3	0.5	
P44575-4	5/22/2009 10:22 AM	0	1	0		05/21/09 6:31
P44575-4	5/22/2009 10:22 AM	0	1	0		05/21/09 6:31
P44575-4	5/22/2009 10:22 AM	0	1	0		05/21/09 6:31
P44575-6	5/22/2009 10:13 AM	0	0	0		
P44575-6	5/22/2009 10:13 AM	0	0	0		

SAMPLE ID	PREPARATION DATE	RUN DATE	STORET CODE	TEST NAME	TEST NUMBER
P41538-4	5/22/2009 8:19 AM	5/22/2009 9:17 AM	00665	TPO4	25
P41538-4	5/27/2009 7:30 AM	5/27/2009 1:25 PM	00625	TKN	21
P41538-4	5/21/2009 4:17 PM	5/21/2009 4:17 PM	00631	NOX	18
P41538-5		5/27/2009 9:04 AM	NOBO	No Bottle	
P41538-6	5/22/2009 8:19 AM	5/22/2009 9:18 AM	00665	TPO4	25
P41538-6	5/27/2009 7:30 AM	5/27/2009 1:26 PM	00625	TKN	21
P41538-6	5/21/2009 3:49 PM	5/21/2009 3:49 PM	00631	NOX	18
P41538-7	5/22/2009 8:19 AM	5/22/2009 9:29 AM	00665	TPO4	25
P41538-7	5/27/2009 7:30 AM	5/27/2009 1:27 PM	00625	TKN	21
P41538-7	5/21/2009 3:50 PM	5/21/2009 3:50 PM	00631	NOX	18
P41242-8	5/20/2009 9:34 AM	5/20/2009 9:34 AM	00299	DO	8
P41242-8	5/20/2009 9:34 AM	5/20/2009 9:34 AM	00094	COND	9
P41242-8	5/20/2009 9:34 AM	5/20/2009 9:34 AM	00010	TEMP	7
P41242-8	5/20/2009 9:34 AM	5/20/2009 9:34 AM	00400	PH	10
P41242-8	5/27/2009 10:15 AM	5/27/2009 10:15 AM	00925	MG	31
P41242-8	5/27/2009 10:15 AM	5/27/2009 10:15 AM	00915	CA	30
P41242-8	5/27/2009 10:15 AM	5/27/2009 10:15 AM	00930	NA	28
P41242-8	5/27/2009 10:15 AM	5/27/2009 10:15 AM	CALCHARD	Hardness	
P41242-8	5/27/2009 10:15 AM	5/27/2009 10:15 AM	00935	K	29
P41242-8	5/21/2009 4:19 PM	5/21/2009 4:19 PM	00615	NO2	19
P41242-8	5/21/2009 4:19 PM	5/21/2009 4:19 PM	00671	OPO4	23
P41242-8	5/22/2009 8:19 AM	5/22/2009 9:56 AM	00665	TPO4	25
P41242-8	5/27/2009 7:30 AM	5/27/2009 1:45 PM	00625	TKN	21
P41242-8	5/21/2009 3:32 PM	5/21/2009 3:32 PM	00608	NH4	20
P41242-8	5/21/2009 4:15 PM	5/21/2009 4:15 PM	00631	NOX	18
P41242-8	5/21/2009 4:15 PM	5/21/2009 4:15 PM	00620	NO3	78
P41242-8	5/22/2009 8:04 AM	5/22/2009 8:04 AM	82079	TURB	12
P44574-4		5/27/2009 9:04 AM	NOBO	No Bottle	
P44574-5	5/21/2009 2:05 PM	5/21/2009 2:05 PM	00010	TEMP	7
P44574-5	5/21/2009 2:05 PM	5/21/2009 2:05 PM	00094	COND	9
P44574-5	5/21/2009 2:05 PM	5/21/2009 2:05 PM	00400	PH	10
P44574-5	5/21/2009 2:05 PM	5/21/2009 2:05 PM	00299	DO	8
P44574-5	5/22/2009 11:32 PM	5/22/2009 11:32 PM	00410	ALKA	67
P44574-5	5/26/2009 6:07 PM	5/27/2009 7:47 AM	00665	TPO4	25
P44574-5	5/22/2009 2:21 PM	5/22/2009 2:21 PM	00671	OPO4	23
P44574-5	5/26/2009 11:00 AM	5/26/2009 11:00 AM	00925	MG	31
P44574-5	5/26/2009 11:00 AM	5/26/2009 11:00 AM	00915	CA	30
P44574-5	5/26/2009 11:00 AM	5/26/2009 11:00 AM	00930	NA	28
P44574-5	5/26/2009 11:00 AM	5/26/2009 11:00 AM	CALCHARD	Hardness	
P44574-5	5/26/2009 11:00 AM	5/26/2009 11:00 AM	00935	K	29
P44574-5	5/27/2009 10:07 AM	5/27/2009 10:07 AM	00608	NH4	20
P44574-5	5/27/2009 10:30 AM	5/27/2009 10:30 AM	00631	NOX	18
P44574-5	5/27/2009 10:30 AM	5/27/2009 10:30 AM	00620	NO3	78
P44574-5	5/22/2009 1:38 PM	5/22/2009 1:38 PM	82079	TURB	12
P44574-5	5/27/2009 12:40 PM	5/27/2009 12:40 PM	00530	TSS	16
P44574-5	5/26/2009 5:00 PM	5/28/2009 11:45 AM	01045	TOTFE	36
P44574-5	5/27/2009 11:05 AM	5/28/2009 9:19 AM	00625	TKN	21
P44575-4	5/26/2009 6:07 PM	5/27/2009 7:43 AM	00665	TPO4	25
P44575-4	5/27/2009 10:06 AM	5/27/2009 10:06 AM	00631	NOX	18
P44575-4	5/27/2009 7:30 AM	5/27/2009 2:58 PM	00625	TKN	21
P44575-6	5/26/2009 6:07 PM	5/27/2009 7:46 AM	00665	TPO4	25
P44575-6	5/27/2009 10:27 AM	5/27/2009 10:27 AM	00631	NOX	18

SAMPLE ID	VALUE	UNITS	REMARK CODE	METHOD	MDL	SAMP COMMENT
P41538-4	0.094	mg/L		SM4500PF	0.002	
P41538-4	2.68	mg/L		EPA 351.2	0.05	
P41538-4	2.349	mg/L		SM4500NO3F	0.025	
P41538-5	0					
P41538-6	0.002	mg/L	U	SM4500PF	0.002	
P41538-6	0.05	mg/L	U	EPA 351.2	0.05	
P41538-6	0.005	mg/L	U	SM4500NO3F	0.005	
P41538-7	0.002	mg/L	U	SM4500PF	0.002	
P41538-7	0.05	mg/L	U	EPA 351.2	0.05	
P41538-7	0.005	mg/L	U	SM4500NO3F	0.005	
P41242-8	2.56	mg/L				
P41242-8	816	umhos/cm				
P41242-8	24.86	Deg C				
P41242-8	7.01	pH Units				
P41242-8	19.49	mg/L		SM3120B	0.1	
P41242-8	82.15	mg/L		SM3120B	0.2	
P41242-8	49.73	mg/L		SM3120B	0.2	
P41242-8	285.38837	mg/L			1	
P41242-8	10.42	mg/L		SM3120B	0.1	
P41242-8	0.195	mg/L		SM4500NO3F	0.002	
P41242-8	0.056	mg/L		SM4500PF	0.002	
P41242-8	0.1	mg/L		SM4500PF	0.002	
P41242-8	2.21	mg/L		EPA 351.2	0.05	
P41242-8	0.308	mg/L		SM4500NH3H	0.005	
P41242-8	2.938	mg/L		SM4500NO3F	0.025	
P41242-8	2.743	mg/L		SM4500NO3F	0.025	
P41242-8	6.16	NTU		SM2130B	0.1	
P44574-4	0					
P44574-5	26	Deg C				
P44574-5	998	umhos/cm				
P44574-5	7.4	pH Units				
P44574-5	3.5	mg/L				
P44574-5	211	mg/L		SM2320B	2	
P44574-5	0.145	mg/L		SM4500PF	0.002	
P44574-5	0.099	mg/L		SM4500PF	0.002	
P44574-5	23.3	mg/L		SM3120B	0.1	
P44574-5	105.3	mg/L		SM3120B	0.2	
P44574-5	60.1	mg/L		SM3120B	0.2	
P44574-5	359	mg/L			1	
P44574-5	13.2	mg/L		SM3120B	0.1	
P44574-5	0.608	mg/L		SM4500NH3H	0.005	
P44574-5	2.866	mg/L		SM4500NO3F	0.025	
P44574-5	2.551	mg/L		SM4500NO3F	0.025	
P44574-5	4	NTU		SM2130B	0.1	
P44574-5	5	mg/L	I	SM 2540 D	3	
P44574-5	129	ug/L		SM3120B	3	
P44574-5	3.01	mg/L		EPA 351.2	0.05	
P44575-4	0.066	mg/L		SM4500PF	0.002	
P44575-4	2.716	mg/L		SM4500NO3F	0.025	
P44575-4	2.5	mg/L		EPA 351.2	0.05	
P44575-6	0.002	mg/L	U	SM4500PF	0.002	
P44575-6	0.01	mg/L	I	SM4500NO3F	0.005	

SAMPLE ID	RESULT COMMENT	FLAG	HSN	SCHEDULE SEQ	CMP
P41538-4			14466004	1645376	00665
P41538-4			14466004	1645374	00625
P41538-4			14466004	1649699	00631
P41538-5			14466013	1645377	NOBO
P41538-6			14466006	1645380	00665
P41538-6			14466006	1645382	00625
P41538-6			14466006	1645378	00631
P41538-7			14466007	1645387	00665
P41538-7			14466007	1645384	00625
P41538-7			14466007	1645385	00631
P41242-8			14053008	1645610	00299
P41242-8			14053008	1645610	00094
P41242-8			14053008	1645610	00010
P41242-8			14053008	1645610	00400
P41242-8			14053008	1645613	00925
P41242-8			14053008	1645613	00915
P41242-8			14053008	1645613	00930
P41242-8			14053008	1645613	CALCHARD
P41242-8			14053008	1645613	00935
P41242-8			14053008	1645621	00615
P41242-8			14053008	1645621	00671
P41242-8			14053008	1645617	00665
P41242-8			14053008	1645609	00625
P41242-8			14053008	1645614	00608
P41242-8			14053008	1649698	00631
P41242-8			14053008	1649698	00620
P41242-8			14053008	1645619	82079
P44574-4			18180004	1648647	NOBO
P44574-5			18180005	1648649	00010
P44574-5			18180005	1648649	00094
P44574-5			18180005	1648649	00400
P44574-5			18180005	1648649	00299
P44574-5			18180005	1648655	00410
P44574-5			18180005	1648654	00665
P44574-5			18180005	1648648	00671
P44574-5			18180005	1648657	00925
P44574-5			18180005	1648657	00915
P44574-5			18180005	1648657	00930
P44574-5			18180005	1648657	CALCHARD
P44574-5			18180005	1648657	00935
P44574-5			18180005	1648656	00608
P44574-5			18180005	1652203	00631
P44574-5			18180005	1652203	00620
P44574-5			18180005	1648658	82079
P44574-5			18180005	1648652	00530
P44574-5			18180005	1648651	01045
P44574-5			18180005	1648660	00625
P44575-4			18181004	1648615	00665
P44575-4			18181004	1648613	00631
P44575-4			18181004	1648612	00625
P44575-6			18181006	1648618	00665
P44575-6	Value confirmed	J9	18181006	1648616	00631

Attachment C2: Lake Okeechobee S2 and S3 Backpumping After Action Report for March 12 to 15 2010

Lake Okeechobee S2 and S3 Backpumping After Action Report for March 12 to March 15, 2010

April 1, 2010

Prepared for

Prepared for Florida Department of Environmental Protection

Prepared by

South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL

Contents

Tables and Figures

INTRODUCTION AND BACKGROUND

The South Florida Water Management District has prepared this after action report to comply with the requirements of the Lake Okeechobee Operating Permit (Florida Department of Environmental Protection 2007, permit number 0174552-001-GL [the Permit]) issued under the authority of the Lake Okeechobee Protection Act (LOPA), Chapter 373.4595, Florida Statutes (F.S.) and Title 62 of the Florida Administrative Code (Florida Department of Environmental Protection, 2007). This report is submitted to the Florida Department of Environmental Protection (Department or FDEP) to fulfill the requirements of Specific Condition 6E(3) of the Permit:

> *The permittee shall submit an After Action Report to the Department. The report shall include: monitoring results; documentation of volume of water conveyed to Lake Okeechobee, by structure; documentation of total phosphorus and total nitrogen loading conveyed to Lake Okeechobee, by structure; rainfall data; Lake stage measurements; and a written justification for initiating back pumping operations. The After Action Report may be provided through the Annual Report required by Specific Condition 14.*

A rain event from March 11 to March 12, 2010 delivered over 3.7 inches of rain to the Everglades Agricultural Area (EAA, Table 1, Figures 1 and 2). The S-2/S-6 basin received 3.01 inches of rain with local maximums of 5.14 inches (Linton 2010a). The S-3/S-8 Basin received an average of 3.27 inches with local maximums of 6.4 inches (Linton 2010b). Rainfall at stations S2 and S3 were 5.25 and 6.59 inches respectively for these two days (Table 1).

According to normal operational protocol, pumping stations G370, G372, and S6 (Figure 3) were operated to provide necessary protection to the EAA while minimizing effects to Lake Okeechobee. The rainfall amount and intensity were enough to raise the stage at S2 and S3 headwaters above the 12.5 foot NGVD trigger that allows the District to initiate backpumping in accordance with the Permit (FDEP 2007). Backpumping at S2 began at 1400 hours on March 12 and continued until 1220 on March 15. Backpumping at S3 began at 1815 hours on March 12 and continued until 1300 hours on March 14 (Table 2).

Results

Backpumping at S2 from March 12 to March 15 delivered 9,282 acre-feet of water to Lake Okeechobee (Table 2). Backpumping at S3 from March 12 to March 14 delivered 4,646 acre-feet of water to the lake. From March 11 to March 15 the stage of Lake Okeechobee increased from 13.58 ft NGVD to 14.02 ft, an increase of 0.44 ft and a net change in water volume of approximately 183,852 acre-feet (Table 3). Backpumping contributed 13,928 ac-ft, or 7.6 percent of the net change.

Estimated nutrient loads to the lake were 2.5 and 0.9 metric tons of total phosphorus (TP) and 99 and 55 metric tons of total nitrogen (TN) through the S2 and S3 pump stations respectively (Table 2). Flow-weighted mean concentrations were 0.223 mg/L and 0.161 mg/L for TP and 8.7 and 9.7 mg/L for TN at S2 and S3, respectively. These TP values were similar to the in-lake concentrations in the last few years, while the TN values were much higher than current in-lake concentrations. Between 55 and 70 percent of each nitrogen sample was in the form of Nitrate+Nitrite (Table 4).

Because of the short duration of the event, less than 72 hours, only two samples were required: one autosampler composite and one grab for nutrients only (FDEP 2007). A second autosampler composite was collected to verify the operation of the equipment. Dissolved oxygen, pH, and specific conductivity were measured at the S2 on March 12 and both S2 and S3 on March 13 (Table 4, grab sample). Of the three parameters, only dissolved oxygen failed to meet the Class I water quality standards (Table 5).

Conclusion

Rainfall over January and February in the EAA was approximately 4.29 inches, which is roughly equivalent to the 30-year average for these months of 4.11 inches. Rainfall in the EAA basin was more than 3.7 inches between March 12 and March 13, 2010, which was greater than the 30-year average rainfall of 2.8 inches for March in this basin (South Florida Water Management District 2009).

Backpumping from S2 and S3 from March 12 to March 15 discharged 13,928 acre-feet of water, 3.5 metric tons of phosphorus and 155 metric tons of nitrogen to Lake Okeechobee (Table 2). The volume of backpumping was approximately 7.6 percent of the net increase of lake volume over this period. Total loads for all inflows to Lake Okeechobee will be available in the 2011 annual report for the Lake Okeechobee Operating Permit.

REFERENCES

Florida Department of Environmental Protection. 2007. Lake Okeechobee Protection Act Permit, Operations Authorization. Permit Number: 0 174552-001-GL. Tallahassee, FL, pp. 17.

Linton, P. 2010a. Memorandum, Lake Okeechobee Back Pumping Advisory [S2]. South Florida Water Mangement District, West Palm Beach, FL. March 12, 2010, pp. 2.

Linton, P. 2010b. Memorandum: Lake Okeechobee Back Pumping Advisory [S3]. South Florida Water Mangement District, West Palm Beach, FL, March 13, 2010, pp. 1.

South Florida Water Management District. 2009. South Florida Water Management District Weather: Rainfall: Historical. SFWMD. March 19, 2010. http://www.sfwmd.gov/portal/page?_pageid=3194,21328260,3194_21169358:3194_21178610:3194_21212154&_dad=portal&_schema=PORTAL.

Table 1. Rainfall measurements (inches) from gauges at S2 and S3 pump stations, and over rainfall areas EAA East, EAA West, Lake Okeechobee and District from March 11 to March 15, 2010. Rainfall was measured in 24-hour periods ending at 7:00 am of the recording day.

Date	S2 (Gauge)	S3 (Gauge)	Everglades Agricultural Area East (Rain Area)	Everglades Agricultural Area West (Rain Area)	Lake Okeechobee (Rain Area)	District-wide (Rain Area)
3/11/2010	0.00	0.00	0.00	0.00	0.00	0.00
3/12/2010	3.87	4.48	2.37	1.64	1.81	1.51
3/13/2010	1.38	2.11	1.60	2.06	2.08	1.59
3/14/2010	0.00	0.00	0.00	0.00	0.00	0.00
3/15/2010	0.00	0.00	0.00	0.00	0.00	0.00
Total	**5.25**	**6.59**	**3.97**	**3.70**	**3.89**	**3.10**

Table 2. Daily flow, estimated TP and TN loads and flow-weighted mean concentrations (FWMC) at S2 and S3 pump stations during the March 12 to March 15 backpumping event.

S2	Flow (ac-ft)	TP Load (kg)	TP FWMC (mg/L)	TN Load (kg)	TN FWMC (mg/L)
3/12/2010	1,661	496	0.242	17,715	8.64
3/13/2010	4,161	1,242		44,370	
3/14/2010	2,705	637	0.191	29,022	8.70
3/15/2010	755	178		8,096	
Total	**9,282**	**2,553**	**0.223**	**99,203**	**8.66**

S3	Flow (ac-ft)	TP Load (kg)	TP FWMC (mg/L)	TN Load (kg)	TN FWMC (mg/L)
3/12/2010	435	94	0.175	5,270	9.82
3/13/2010	3,254	702		39,408	
3/14/2010	957	129	0.109	10,785	9.14
Total	**4,646**	**925**	**0.161**	**55,463**	**9.68**

Table 3. Stage and storage volume estimates of Lake Okeechobee and changes in volume during the event period.

Date	Stage (ft-NGVD)	Estimated Lake Volume (acre- feet)
3/11/2010	13.58	3,377,543
3/15/2010	14.02	3,561,396
Change	**0.44**	**183,852**

Table 4. Water quality data collected at S2 and S3 pump stations from March 10, 2010 to March 15, 2010.

		S2		S3	
Date	Test Name	Flow Weighted Autosample	Grab Sample	Flow Weighted Autosample	Grab Sample
3/12/2010	Dissolved Oxygen (mg/L)		1.96		
	Total Kjedahl Nitrogen (mg/L)		4		
	Nitrate+Nitrite Nitrogen (mg/L)		3.391		
	pH (Standard Units)		7.4		
	Total Phosphorus (mg/L)		0.361		
	Specific Conductivity (umhos/cm)		1,100		
	Temperature (^oC)		19.7		
3/13/2010	Dissolved Oxygen (mg/L)		4.51		4.67
	Total Kjedahl Nitrogen (mg/L)	3.73	3.64	3.01	3.27
	Nitrate+Nitrite Nitrogen (mg/L)	4.915	6.2	6.808	7.243
	pH (Standard Units)		7.3		7.3
	Total Phosphorus (mg/L)	0.242	0.243	0.175	0.202
	Specific Conductivity (umhos/cm)		917		710
	Temperature (^oC)		19.6		19.4
3/15/2010	Total Kjedahl Nitrogen (mg/L)	3.28	3.77	2.56	3.11
	Nitrate+Nitrite Nitrogen (mg/L)	5.419	4.631	6.575	6.625
	Total Phosphorus (mg/L)	0.191	0.18	0.109	0.135

Table 5. Class I criteria values for Lake Okeechobee Monitoring

Parameter	Units	Criteria
Dissolved Oxygen	mg/L	**≥ 5**
pH	SU	**6 - 8.5**
Specific Conductivity	μS/cm	**≤ 1275**

Figure 1. Twenty-Four hour (0700 03/11 to 0700 03/12/2010) Rainfall estimates from the South Florida Water Management District's RAINDAR

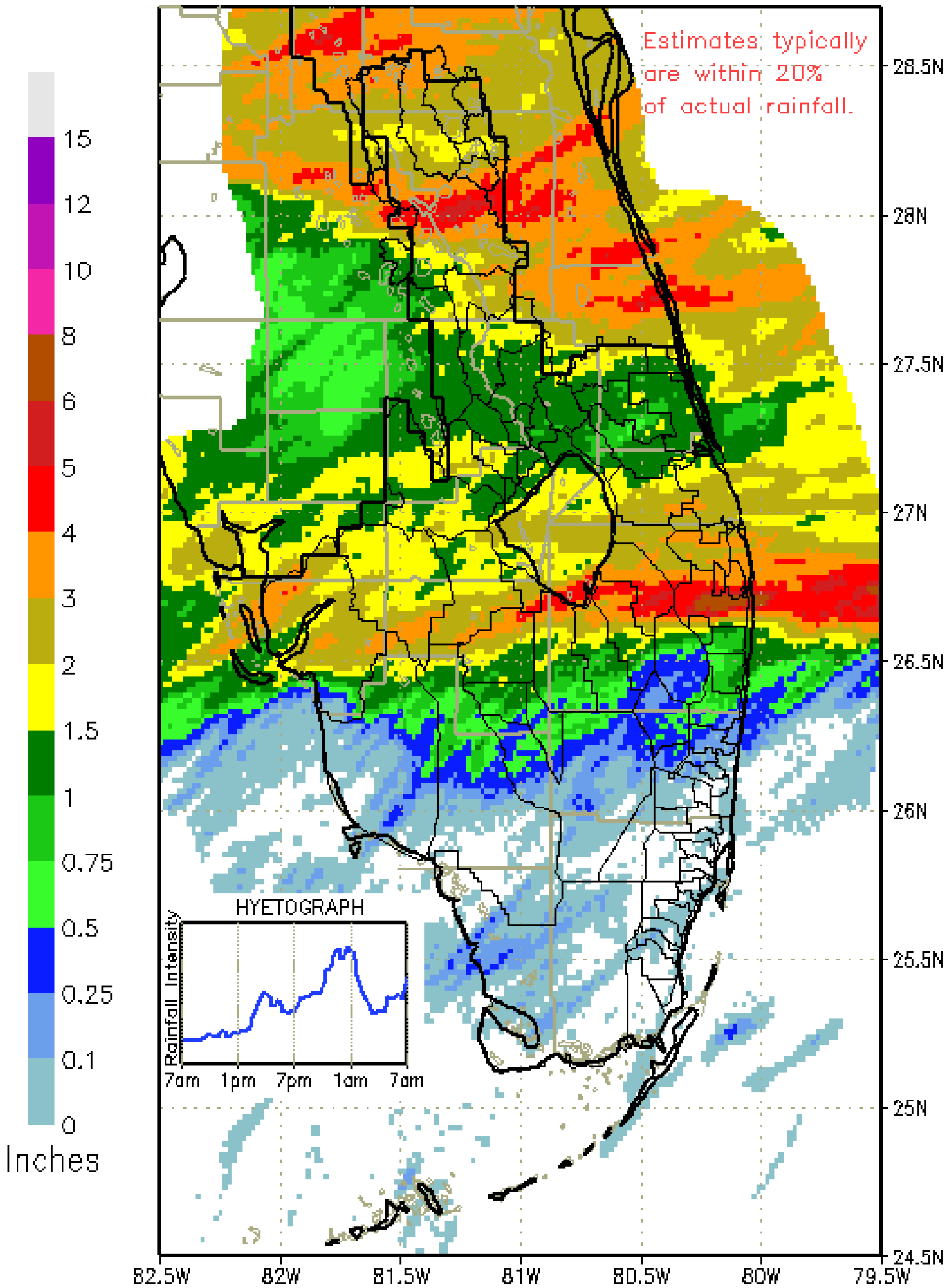


Figure 2. Twenty-Four hour (0700 03/12 to 0700 03/13/2010) rainfall estimates from the South Florida Water Management District's RAINDAR

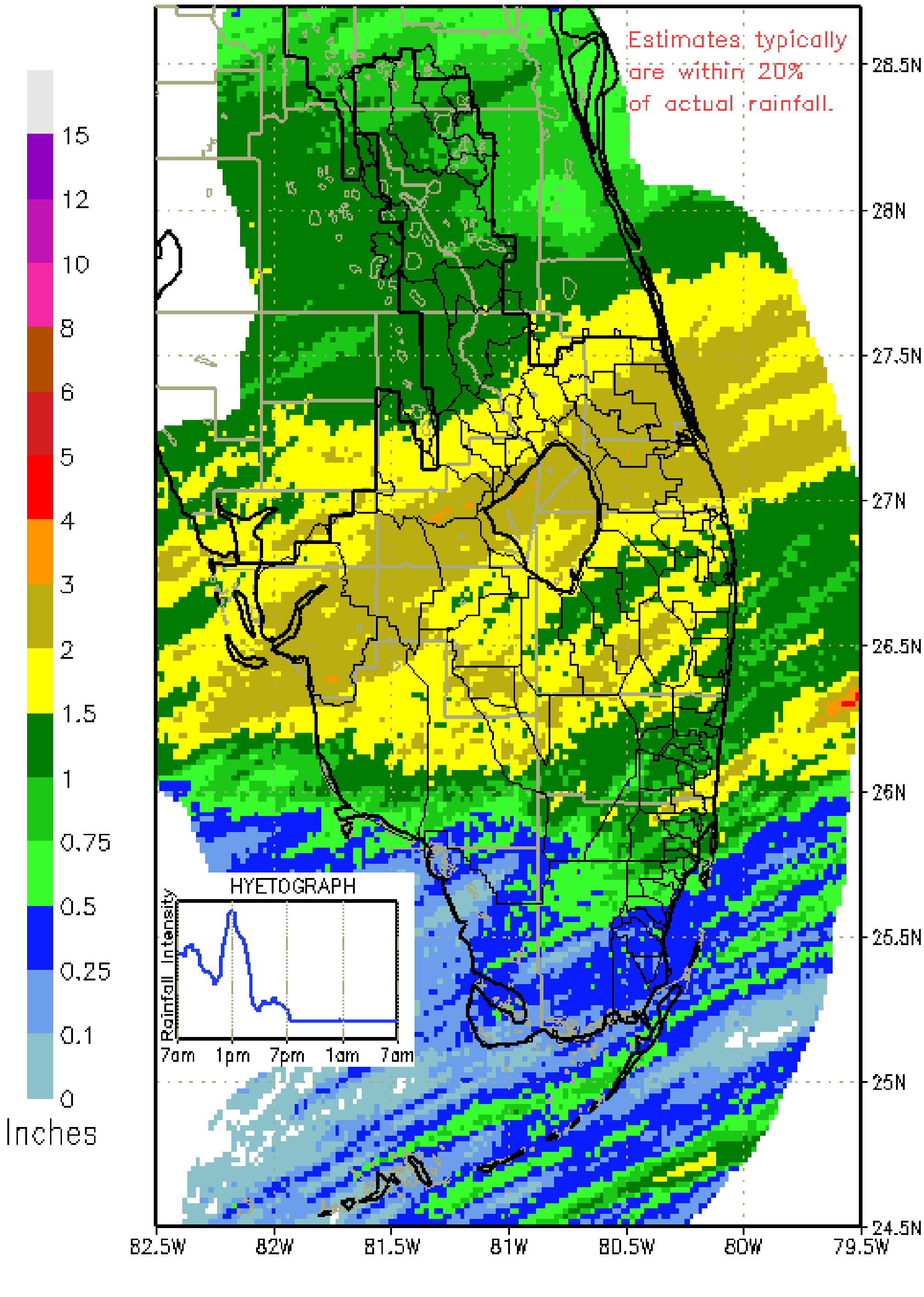
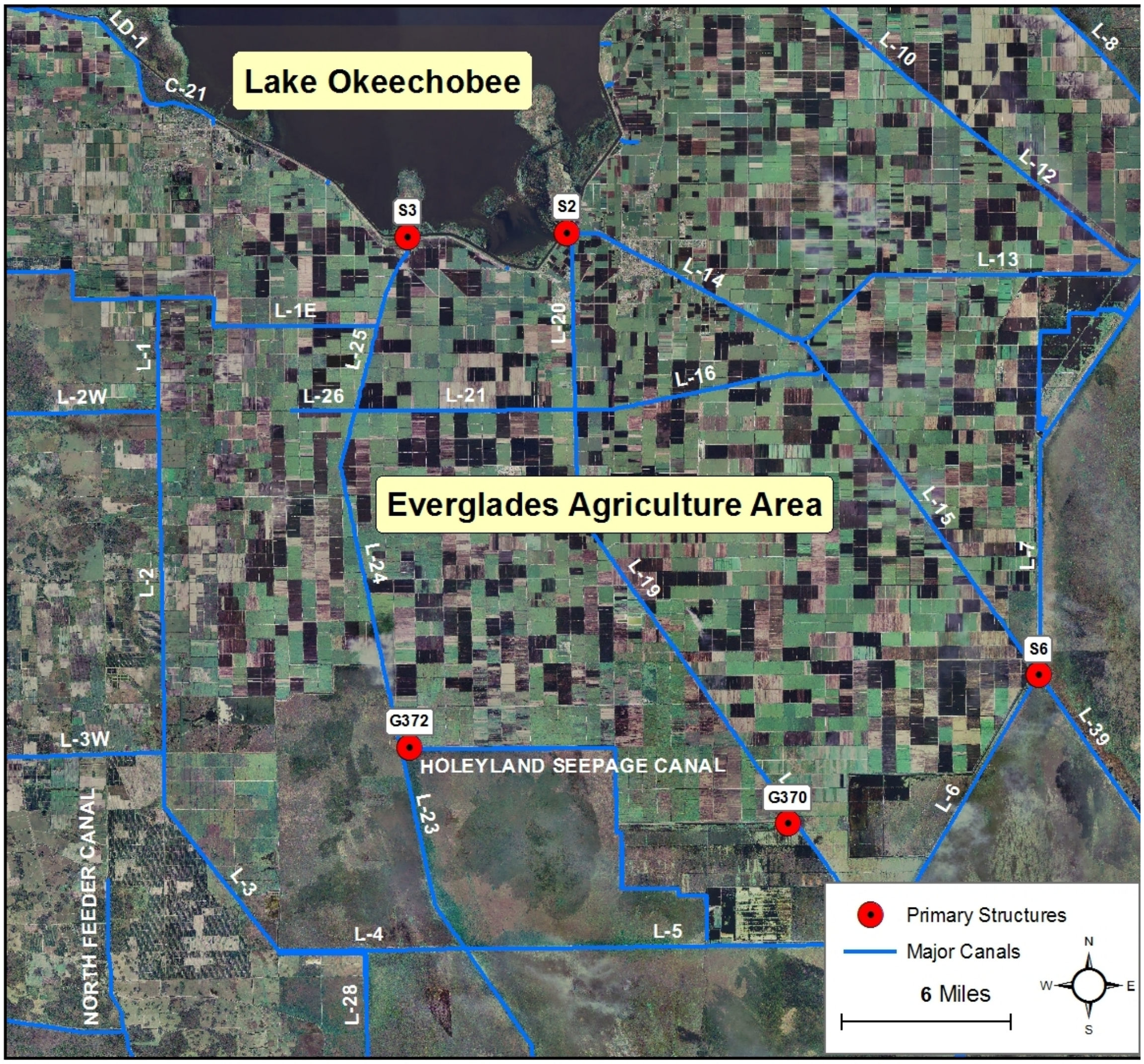


Figure 3. Map of Primary Everglades Agricultural Area structures.



Appendix A.

Water quality analysis of samples collected at S2 and S3
March 12 to 15, 2010

SAMPLE ID	STATION	DATE COLLECTED	RECEIVE DATE	PROGRAM TYPE	SAMPLE TYPE NEW	MATRIX	COLLECT METHOD
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-2	S2	3/12/10 17:13	3/15/10 11:57	MON	SAMP	SW	G
P44576-1	S2	3/12/10 17:29	3/15/10 12:07	MON	SAMP	SW	ACF
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-2	S2	3/13/10 11:29	3/15/10 11:45	MON	SAMP	SW	G
P44577-1	S2	3/13/10 12:03	3/15/10 11:45	MON	SAMP	SW	ACF
P44577-1	S2	3/13/10 12:03	3/15/10 11:45	MON	SAMP	SW	ACF
P44577-1	S2	3/13/10 12:03	3/15/10 11:45	MON	SAMP	SW	ACF
P47570-4	S2	3/15/10 15:01	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-4	S2	3/15/10 15:01	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-4	S2	3/15/10 15:01	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-3	S2	3/15/10 15:09	3/16/10 13:29	MON	SAMP	SW	G
P47570-3	S2	3/15/10 15:09	3/16/10 13:29	MON	SAMP	SW	G
P47570-3	S2	3/15/10 15:09	3/16/10 13:29	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-5	S3	3/13/10 13:05	3/15/10 11:45	MON	SAMP	SW	G
P44577-4	S3	3/13/10 13:35	3/15/10 11:45	MON	SAMP	SW	ACF
P44577-4	S3	3/13/10 13:35	3/15/10 11:45	MON	SAMP	SW	ACF
P44577-4	S3	3/13/10 13:35	3/15/10 11:45	MON	SAMP	SW	ACF
P47570-9	S3	3/15/10 13:25	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-9	S3	3/15/10 13:25	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-9	S3	3/15/10 13:25	3/16/10 13:29	MON	SAMP	SW	ACF
P47570-8	S3	3/15/10 13:39	3/16/10 13:29	MON	SAMP	SW	G
P47570-8	S3	3/15/10 13:39	3/16/10 13:29	MON	SAMP	SW	G
P47570-8	S3	3/15/10 13:39	3/16/10 13:29	MON	SAMP	SW	G

SAMPLE ID	SAMPLE TYPE	DISCHARGE	UP DOWN STREAM	WEATHER CODE	COLLECTION AGENCY	COLLECTION SPAN	FIRST TRIGGER DATE	DEPTH (m)
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-2	0	1	1	4	WMD			0.5
P44576-1	24	0	0	0	WMD			
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-2	0	1	1	1	WMD			0.5
P44577-1	24	0	1	0	WMD	1	3/12/10 15:39	
P44577-1	24	0	1	0	WMD	1	3/12/10 15:39	
P44577-1	24	0	1	0	WMD	1	3/12/10 15:39	
P47570-4	24	0	1	0	WMD	2	3/13/10 12:28	
P47570-4	24	0	1	0	WMD	2	3/13/10 12:28	
P47570-4	24	0	1	0	WMD	2	3/13/10 12:28	
P47570-3	0	2	1	2	WMD			0.5
P47570-3	0	2	1	2	WMD			0.5
P47570-3	0	2	1	2	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-5	0	1	1	1	WMD			0.5
P44577-4	24	0	1	0	WMD	1	3/12/10 19:23	
P44577-4	24	0	1	0	WMD	1	3/12/10 19:23	
P44577-4	24	0	1	0	WMD	1	3/12/10 19:23	
P47570-9	24	0	1	0	WMD	2	3/13/10 13:22	
P47570-9	24	0	1	0	WMD	2	3/13/10 13:22	
P47570-9	24	0	1	0	WMD	2	3/13/10 13:22	
P47570-8	0	2	1	1	WMD			0.5
P47570-8	0	2	1	1	WMD			0.5
P47570-8	0	2	1	1	WMD			0.5

SAMPLE ID	TEST NUMBER	TEST NAME	TEST GROUP	STORET CODE	FLAG	REMARK CODE	VALUE	UNITS	PQL
P44576-2	7	TEMP	F	00010			19.7	Deg C	
P44576-2	8	DISSOLVED OXYGEN	F	00299			1.96	mg/L	
P44576-2	9	SP CONDUCTIVITY, FIELD	F	00094			1100	uS/cm	
P44576-2	10	PH, FIELD	F	00400			7.4	UNITS	
P44576-2	18	NITRATE+NITRITE-N	N	00631			3.391	mg/L	0.1
P44576-2	21	KJELDAHL NITROGEN, TOTAL	N	00625			4	mg/L	0.2
P44576-2	25	PHOSPHATE, TOTAL AS P	N	00665			0.361	mg/L	0.008
P44576-1	225	NO BOTTLE SAMPLE	MIS				0	Units	
P44577-2	7	TEMP	F	00010			19.6	Deg C	
P44577-2	8	DISSOLVED OXYGEN	F	00299			4.51	mg/L	
P44577-2	9	SP CONDUCTIVITY, FIELD	F	00094			917	uS/cm	
P44577-2	10	PH, FIELD	F	00400			7.3	UNITS	
P44577-2	18	NITRATE+NITRITE-N	N	00631			6.2	mg/L	0.2
P44577-2	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.64	mg/L	0.2
P44577-2	25	PHOSPHATE, TOTAL AS P	N	00665			0.243	mg/L	0.008
P44577-1	18	NITRATE+NITRITE-N	N	00631			4.915	mg/L	0.2
P44577-1	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.73	mg/L	0.2
P44577-1	25	PHOSPHATE, TOTAL AS P	N	00665			0.242	mg/L	0.008
P47570-4	18	NITRATE+NITRITE-N	N	00631			5.419	mg/L	0.2
P47570-4	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.28	mg/L	0.2
P47570-4	25	PHOSPHATE, TOTAL AS P	N	00665			0.191	mg/L	0.008
P47570-3	18	NITRATE+NITRITE-N	N	00631			4.631	mg/L	0.2
P47570-3	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.77	mg/L	0.2
P47570-3	25	PHOSPHATE, TOTAL AS P	N	00665			0.18	mg/L	0.008
P44577-5	7	TEMP	F	00010			19.4	Deg C	
P44577-5	8	DISSOLVED OXYGEN	F	00299			4.67	mg/L	
P44577-5	9	SP CONDUCTIVITY, FIELD	F	00094			710	uS/cm	
P44577-5	10	PH, FIELD	F	00400			7.3	UNITS	
P44577-5	18	NITRATE+NITRITE-N	N	00631			7.243	mg/L	0.2
P44577-5	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.27	mg/L	0.2
P44577-5	25	PHOSPHATE, TOTAL AS P	N	00665			0.202	mg/L	0.008
P44577-4	18	NITRATE+NITRITE-N	N	00631			6.808	mg/L	0.2
P44577-4	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.01	mg/L	0.2
P44577-4	25	PHOSPHATE, TOTAL AS P	N	00665			0.175	mg/L	0.008
P47570-9	18	NITRATE+NITRITE-N	N	00631			6.575	mg/L	0.2
P47570-9	21	KJELDAHL NITROGEN, TOTAL	N	00625			2.56	mg/L	0.2
P47570-9	25	PHOSPHATE, TOTAL AS P	N	00665			0.109	mg/L	0.008
P47570-8	18	NITRATE+NITRITE-N	N	00631			6.625	mg/L	0.2
P47570-8	21	KJELDAHL NITROGEN, TOTAL	N	00625			3.11	mg/L	0.2
P47570-8	25	PHOSPHATE, TOTAL AS P	N	00665			0.135	mg/L	0.008

SAMPLE ID	MDL	RDL	NDEC	SIGFIG VAL	SOURCE	LIMS NUMBER	MEASURE DATE	METHOD	OWNER
P44576-2			1	19.7	WMD	18182002	3/12/10 17:25		WMD
P44576-2			1	2.0	WMD	18182002	3/12/10 17:25		WMD
P44576-2			0	1,100	WMD	18182002	3/12/10 17:25		WMD
P44576-2			2	7.40	WMD	18182002	3/12/10 17:25		WMD
P44576-2	0.025	0.025	3	3.391	WMD	18182002	3/15/10 15:45	SM4500NO3F	WMD
P44576-2	0.05	0.05	1	4.00	WMD	18182002	3/15/10 15:09	EPA 351.2	WMD
P44576-2	0.002	0.002	3	0.361	WMD	18182002	3/15/10 15:33	SM4500PF	WMD
P44576-1			0	0	WMD	18182001	3/16/10 12:19		WMD
P44577-2			1	19.6	WMD	18183002	3/13/10 11:44		WMD
P44577-2			1	4.5	WMD	18183002	3/13/10 11:44		WMD
P44577-2			0	917	WMD	18183002	3/13/10 11:44		WMD
P44577-2			2	7.30	WMD	18183002	3/13/10 11:44		WMD
P44577-2	0.05	0.05	3	6.20	WMD	18183002	3/15/10 15:23	SM4500NO3F	WMD
P44577-2	0.05	0.05	1	3.64	WMD	18183002	3/15/10 14:57	EPA 351.2	WMD
P44577-2	0.002	0.002	3	0.243	WMD	18183002	3/15/10 15:24	SM4500PF	WMD
P44577-1	0.05	0.05	3	4.92	WMD	18183001	3/15/10 15:22	SM4500NO3F	WMD
P44577-1	0.05	0.05	1	3.73	WMD	18183001	3/15/10 14:59	EPA 351.2	WMD
P44577-1	0.002	0.002	3	0.242	WMD	18183001	3/15/10 15:23	SM4500PF	WMD
P47570-4	0.05	0.05	3	5.42	WMD	22179004	3/17/10 14:11	SM4500NO3F	WMD
P47570-4	0.05	0.05	1	3.28	WMD	22179004	3/17/10 13:45	EPA 351.2	WMD
P47570-4	0.002	0.002	3	0.191	WMD	22179004	3/17/10 7:44	SM4500PF	WMD
P47570-3	0.05	0.05	3	4.63	WMD	22179003	3/17/10 14:09	SM4500NO3F	WMD
P47570-3	0.05	0.05	1	3.77	WMD	22179003	3/17/10 13:44	EPA 351.2	WMD
P47570-3	0.002	0.002	3	0.180	WMD	22179003	3/17/10 8:04	SM4500PF	WMD
P44577-5			1	19.4	WMD	18183005	3/13/10 13:23		WMD
P44577-5			1	4.7	WMD	18183005	3/13/10 13:23		WMD
P44577-5			0	710	WMD	18183005	3/13/10 13:23		WMD
P44577-5			2	7.30	WMD	18183005	3/13/10 13:23		WMD
P44577-5	0.05	0.05	3	7.24	WMD	18183005	3/15/10 15:42	SM4500NO3F	WMD
P44577-5	0.05	0.05	1	3.27	WMD	18183005	3/15/10 15:03	EPA 351.2	WMD
P44577-5	0.002	0.002	3	0.202	WMD	18183005	3/15/10 15:29	SM4500PF	WMD
P44577-4	0.05	0.05	3	6.81	WMD	18183004	3/15/10 15:26	SM4500NO3F	WMD
P44577-4	0.05	0.05	1	3.01	WMD	18183004	3/15/10 15:02	EPA 351.2	WMD
P44577-4	0.002	0.002	3	0.175	WMD	18183004	3/15/10 15:27	SM4500PF	WMD
P47570-9	0.05	0.05	3	6.58	WMD	22179009	3/17/10 14:17	SM4500NO3F	WMD
P47570-9	0.05	0.05	1	2.56	WMD	22179009	3/17/10 14:20	EPA 351.2	WMD
P47570-9	0.002	0.002	3	0.109	WMD	22179009	3/17/10 7:50	SM4500PF	WMD
P47570-8	0.05	0.05	3	6.62	WMD	22179008	3/17/10 14:15	SM4500NO3F	WMD
P47570-8	0.05	0.05	1	3.11	WMD	22179008	3/17/10 13:49	EPA 351.2	WMD
P47570-8	0.002	0.002	3	0.135	WMD	22179008	3/17/10 7:49	SM4500PF	WMD

SAMPLE ID	ANALYST	DTIM ENTERED	DTIM MOD	WQ RESULT DATA ID	WORK LAB	PREP DATE	CAS NUMBER
P44576-2	shen	3/17/10 13:46	3/17/10 13:46	91249715	E46077		2030
P44576-2	shen	3/17/10 13:46	3/17/10 13:46	91249717	E46077		1880
P44576-2	shen	3/17/10 13:46	3/17/10 13:46	91249716	E46077		1610
P44576-2	shen	3/17/10 13:46	3/17/10 13:46	91249718	E46077		1900
P44576-2	chja	3/17/10 13:46	3/17/10 13:46	91249723	E46077		1820
P44576-2	jdni	3/17/10 13:46	3/17/10 13:46	91249719	E46077	3/15/10 12:00	1790
P44576-2	agre	3/17/10 13:46	3/17/10 13:46	91249714	E46077	3/15/10 13:04	1910
P44576-1	rwal	3/17/10 13:46	3/17/10 13:46	91249753	E46077		
P44577-2	shen	3/17/10 13:46	3/17/10 13:46	91249726	E46077		2030
P44577-2	shen	3/17/10 13:46	3/17/10 13:46	91249728	E46077		1880
P44577-2	shen	3/17/10 13:46	3/17/10 13:46	91249729	E46077		1610
P44577-2	shen	3/17/10 13:46	3/17/10 13:46	91249727	E46077		1900
P44577-2	chja	3/17/10 13:46	3/17/10 13:46	91249750	E46077		1820
P44577-2	jdni	3/17/10 13:46	3/17/10 13:46	91249731	E46077	3/15/10 12:00	1790
P44577-2	agre	3/17/10 13:46	3/17/10 13:46	91249730	E46077	3/15/10 13:04	1910
P44577-1	chja	3/17/10 13:46	3/17/10 13:46	91249749	E46077		1820
P44577-1	jdni	3/17/10 13:46	3/17/10 13:46	91249725	E46077	3/15/10 12:00	1790
P44577-1	agre	3/17/10 13:46	3/17/10 13:46	91249724	E46077	3/15/10 13:04	1910
P47570-4	chja	3/19/10 8:58	3/19/10 8:58	91270653	E46077		1820
P47570-4	jlab	3/19/10 8:58	3/19/10 8:58	91270655	E46077	3/17/10 7:45	1790
P47570-4	agre	3/19/10 8:58	3/19/10 8:58	91270654	E46077	3/16/10 16:44	1910
P47570-3	chja	3/19/10 8:58	3/19/10 8:58	91270651	E46077		1820
P47570-3	jlab	3/19/10 8:58	3/19/10 8:58	91270652	E46077	3/17/10 7:45	1790
P47570-3	agre	3/19/10 8:58	3/19/10 8:58	91270650	E46077	3/16/10 16:44	1910
P44577-5	shen	3/17/10 13:46	3/17/10 13:46	91249738	E46077		2030
P44577-5	shen	3/17/10 13:46	3/17/10 13:46	91249740	E46077		1880
P44577-5	shen	3/17/10 13:46	3/17/10 13:46	91249739	E46077		1610
P44577-5	shen	3/17/10 13:46	3/17/10 13:46	91249741	E46077		1900
P44577-5	chja	3/17/10 13:46	3/17/10 13:46	91249752	E46077		1820
P44577-5	jdni	3/17/10 13:46	3/17/10 13:46	91249742	E46077	3/15/10 12:00	1790
P44577-5	agre	3/17/10 13:46	3/17/10 13:46	91249737	E46077	3/15/10 13:04	1910
P44577-4	chja	3/17/10 13:46	3/17/10 13:46	91249751	E46077		1820
P44577-4	jdni	3/17/10 13:46	3/17/10 13:46	91249735	E46077	3/15/10 12:00	1790
P44577-4	agre	3/17/10 13:46	3/17/10 13:46	91249736	E46077	3/15/10 13:04	1910
P47570-9	chja	3/19/10 8:58	3/19/10 8:58	91270666	E46077		1820
P47570-9	jlab	3/19/10 8:58	3/19/10 8:58	91270665	E46077	3/17/10 7:45	1790
P47570-9	agre	3/19/10 8:58	3/19/10 8:58	91270667	E46077	3/16/10 16:44	1910
P47570-8	chja	3/19/10 8:58	3/19/10 8:58	91270662	E46077		1820
P47570-8	jlab	3/19/10 8:58	3/19/10 8:58	91270663	E46077	3/17/10 7:45	1790
P47570-8	agre	3/19/10 8:58	3/19/10 8:58	91270664	E46077	3/16/10 16:44	1910

SAMPLE ID	PREP PROC CODE	DILUTION	VALIDATION LEVEL	VALIDATOR	SAMPLING PURPOSE	DATA INVESTIGATION
P44576-2		1	2	WMD	PD	NO
P44576-2		1	2	WMD	PD	NO
P44576-2		1	2	WMD	PD	NO
P44576-2		1	2	WMD	PD	NO
P44576-2	SM4500NO3F	5	2	WMD	PD	NO
P44576-2	EPA 351.2	1	2	WMD	PD	NO
P44576-2	SM4500PF	1	2	WMD	PD	NO
P44576-1		1	2	WMD	PD	NO
P44577-2		1	2	WMD	PD	NO
P44577-2		1	2	WMD	PD	NO
P44577-2		1	2	WMD	PD	NO
P44577-2		1	2	WMD	PD	NO
P44577-2	SM4500NO3F	10	2	WMD	PD	NO
P44577-2	EPA 351.2	1	2	WMD	PD	NO
P44577-2	SM4500PF	1	2	WMD	PD	NO
P44577-1	SM4500NO3F	10	2	WMD	PD	NO
P44577-1	EPA 351.2	1	2	WMD	PD	NO
P44577-1	SM4500PF	1	2	WMD	PD	NO
P47570-4	SM4500NO3F	10	2	WMD	PD	NO
P47570-4	EPA 351.2	1	2	WMD	PD	NO
P47570-4	SM4500PF	1	2	WMD	PD	NO
P47570-3	SM4500NO3F	10	2	WMD	PD	NO
P47570-3	EPA 351.2	1	2	WMD	PD	NO
P47570-3	SM4500PF	1	2	WMD	PD	NO
P44577-5		1	2	WMD	PD	NO
P44577-5		1	2	WMD	PD	NO
P44577-5		1	2	WMD	PD	NO
P44577-5		1	2	WMD	PD	NO
P44577-5	SM4500NO3F	10	2	WMD	PD	NO
P44577-5	EPA 351.2	1	2	WMD	PD	NO
P44577-5	SM4500PF	1	2	WMD	PD	NO
P44577-4	SM4500NO3F	10	2	WMD	PD	NO
P44577-4	EPA 351.2	1	2	WMD	PD	NO
P44577-4	SM4500PF	1	2	WMD	PD	NO
P47570-9	SM4500NO3F	10	2	WMD	PD	NO
P47570-9	EPA 351.2	1	2	WMD	PD	NO
P47570-9	SM4500PF	1	2	WMD	PD	NO
P47570-8	SM4500NO3F	10	2	WMD	PD	NO
P47570-8	EPA 351.2	1	2	WMD	PD	NO
P47570-8	SM4500PF	1	2	WMD	PD	NO