

# Appendix 2-2: Annual Permit Report for the North Palm Beach County - Part 1 Project, L-8 Reservoir

Permit Report (May 1, 2009–April 30, 2010)  
Permit Number: 0188365-012-EM

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## SUMMARY

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This Annual Water Quality Assessment Report for the L-8 Reservoir Project (L8RP) was prepared in compliance with the annual reporting requirement in Specific Condition 11 of Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) Permit 0188365-012-EM to evaluate the results of the reservoir project's monitoring program, and most importantly, to determine whether any significant water quality degradation occurred as a result of utilizing the reservoir project cells for temporary water storage. This report covers the period during Water Year 2010 (WY2010) (May 1, 2009–April 30, 2010). The L8RP, which covers approximately 1,000 acres with an average depth of 40 feet, is a series of interconnected rock pits from the mined portions of a limestone quarry in western Palm Beach County. The project scope included data compilation, screening and analysis, and a characterization of the water quality impacts from the L8RP. After the data screening and analyses were completed, trends were reviewed and conclusions drawn based on the final data set. Based on the information presented, it is the opinion of the South Florida Water Management District (SFWMD or District) that no degradation in water quality has occurred to date or will occur in the L-8 Canal or Basin due to L8RP operation.

During this reporting period, water from the cells and canals were sampled and tested for physical parameters, nutrients, gross alpha, and mercury. Sampling was conducted at six reservoir cells (Class III waters), three sites in the L-8 Canal (Class III waters), and one site in the M Canal (Class I waters). The point at which compliance with the narrative and numerical Class III Water Quality Standards (WQS) is assessed is the outfall from the L8RP to the L-8 Canal (SW-6OUT). The exceptions are the Class I WQS for chloride and the Class III WQS for specific conductance, for which compliance is assessed at the edges of the Florida Department of Environmental

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Protection (FDEP)-approved mixing zone at L8MZBN and L8MZBS. Specific conductance was the only parameter that exceeded Class III standards at the outflow structure. Water quality data indicate that chlorides and specific conductance are higher in the cells than in the L-8 and M canals.

During this reporting period, the L-8 and M canal sites contained higher concentrations of nutrients (mainly nitrogen and phosphorus species) than the reservoir project cells. Reported nutrient concentrations within the L8RP since test-phase operations began in December 2001 have frequently been lower than samples collected from the L-8 and M canals. The L8RP cells are not a source of nutrients and no other major contributing sources of nutrients are believed to exist other than the L-8 Canal.

Gross alpha was significantly higher at the outflow structure than the inflow structure and M Canal. In past water years, the cells routinely contained values above the Class III criteria. In WY2010, gross alpha values in the L-8 and M canals were very low, and there were no values above the Class III criteria. It has been shown in the past and currently that the higher gross alpha concentrations from the reservoir do not affect the concentrations of gross alpha in the L-8 or M canals.

Mercury analyses were performed during this reporting period on water and fish samples. Water samples were collected from the reservoir and one location in the L-8 Canal. The canal site is approximately 7.5 miles north of the reservoir. Fish samples were collected from each cell and in the L-8 Canal adjacent to cell 3. There is a numerical total mercury Water Quality Criterion (WQC) of 12 ng/L for Class III surface waters. However, at the present there is no methylmercury WQC for surface waters. There is also a U.S. Environmental Protection Agency (USEPA) recommended methylmercury fish tissue human consumption criterion of 0.3 mg/kg for the edible portions of all fish species. Florida is proposing a 0.2 mg/kg human consumption criterion based on the higher rates of marine and freshwater fish consumption in the state, but it has not yet been promulgated by the Environmental Regulation Commission (ERC). Mercury concentrations in largemouth bass in Water Conservation Areas (WCAs) 1, 2, and 3 have declined by up to 80 percent from the early 1990s to 1998, but remain relatively high with a mean of 0.5 mg/kg. The results demonstrate that all the samples collected during this reporting period for water and fish were below all of these administrative thresholds.

This report presents water quality, stage, flow, and continuous specific conductance monitoring results for the reporting period. **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 in the annual report. **Attachment B** lists flows for WY2010. **Attachment C** presents L-8 Reservoir Project piezometer depth for water data for WY2010. Detailed data for water quality, stage, specific conductance, and chloride are presented in **Attachment D**.

**Table 1.** Permit-specific conditions referenced in the permit.

Permit Conditions	Permit Reference (0188365-005)
Annual Monitoring Reports	Specific Condition 11, page 8

**Table 2.** Key permit-related information.

<b>Project Name</b>	<b>L-8 Reservoir Project</b>
<b>Permit Number</b>	0188365-012-EM
<b>Issue and Expiration Date</b>	Issue: March 30, 2007 Expiration: March 30, 2012
<b>Project Phase</b>	Completed
<b>Relevant Period of Record</b>	May 1, 2009–April 30, 2010
<b>Report Generator</b>	Guy Germain <a href="mailto:ggermain@sfwmd.gov">ggermain@sfwmd.gov</a> 561-682-6732
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<b>Date</b>	October 1, 2010

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## INTRODUCTION

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Water quality sampling for the L-8 Reservoir Project began in November 2001. In February 2003, the FDEP executed a Consent Agreement (OGC File No. 030272-50 RO) that allowed the connection of pits C and D (cell 1) to the reservoir project pits. In March 2003, the SFWMD submitted the First Annual Monitoring Report to the FDEP. On March 30, 2007, CERPRA Permit 0188365-005 was issued to the SFWMD which allows the District to operate the reservoir as described in the permit.

This report presents the results of the L-8 Reservoir Project's monitoring program. The objective is to ensure that the discharge water meets water quality standards, and that water quality is suitable for water supply and environmental deliveries through the City of West Palm Beach M Canal. The assessment is required by the permit to ensure that the collection and analysis of the water quality data complied with FDEP-approved quality assurance/quality control (QA/QC) procedures.

### DESCRIPTION OF REGIONAL SYSTEM

The L-8 Basin encompasses approximately 170 square miles, with the majority located in northwestern Palm Beach County and approximately 2 square miles in southwestern Martin County (**Figure 1**). The majority of the land in the Upper L-8 Basin is comprised of the J.W. Corbett Wildlife Management Area, owned and managed by the Fish and Wildlife Conservation Commission, and DuPuis Reserve, owned and managed by SFWMD. However, there are areas in close proximity to Lake Okeechobee that consist of agricultural land. The Lower L-8 Basin, located downstream of the M Canal includes the Indian Trail Improvement District (ITID) service area and several square miles of agricultural and rural land.

The regional flow in the L-8 Basin (**Figure 2**) is complex and has several operating procedures that affect the flow into and out of the system. The upstream water source is Lake Okeechobee via SFWMD's Culvert 10A. Culvert 10A is a structure consisting of five 10 ft diameter corrugated metal pipe (CMP) culverts with inverts at elevation 5.5 ft related to the National Geodetic Vertical Datum (NGVD). Four of the culverts have flap gates on the lake side, and the center barrel has a 10 ft by 10 ft operable slide gate. Therefore, the flow into the L-8 Canal through Culvert 10A is a function of the head difference between the lake and canal water levels. Throughout the L-8 Basin, water is discharged into the L-8 Canal for drainage as well as withdrawn for water use. The current water use consists of both public water supply and irrigation.

The water used for public water supply is pumped using the City of West Palm Beach's Control 2 Pump Station located on the M Canal. The water then flows east through the M Canal and eventually to the city's water supply lakes, Lake Mangonia and Clear Lake, where it is withdrawn for treatment.

Water in the L-8 Canal is withdrawn from and discharged to the L-8 Canal during the operation of the L-8 Reservoir Project. The withdrawal/discharge location is south of the confluence of the L-8 and M canals. The reservoir is used for storage of excess runoff from the basin to reduce discharges from the basin to the C-51 Canal and ultimately to tide. The water stored can then be either discharged during the dry season for water supply for the city of West Palm Beach or for environmental purposes. During the wet season, the water can be discharged back into the L-8 Canal between storm events at relatively lower rates, once the stage in the L-8 Canal has dropped to within normal operating range to recover storage capacity in the reservoir.

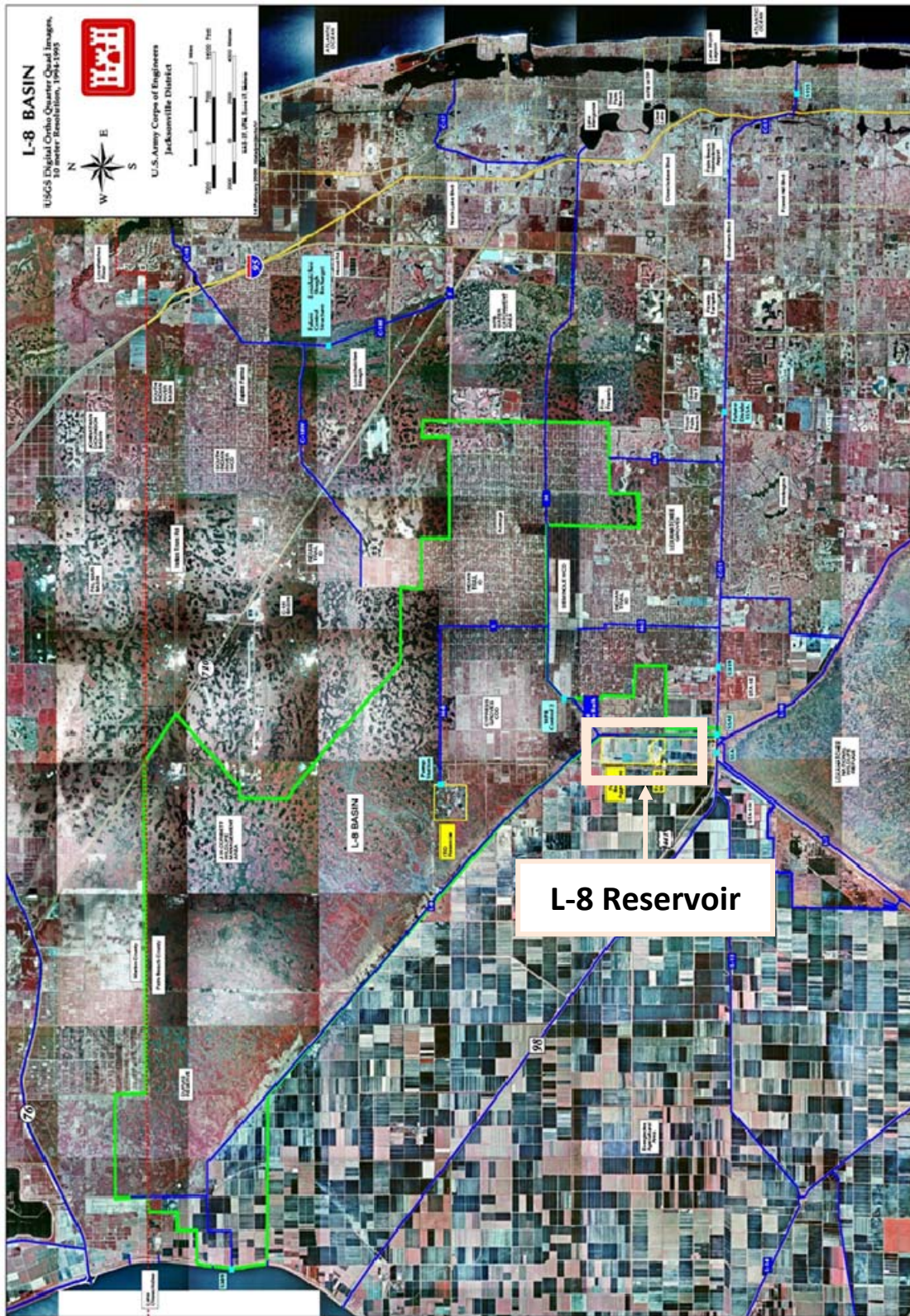


Figure 1. L-8 Basin and location of the L-8 Reservoir.

Discharges into the L-8 Canal, excluding Lake Okeechobee and the L-8 Reservoir at Palm Beach Aggregates, Inc. (PBA), include the ITID and Water Conservation Area 1 (WCA-1). The water discharged from ITID consists of the stormwater runoff from the 19,000-acre M-1 Basin. Water is discharged from the ITID M-1 Basin Impoundment Area through its L-8 outfall structure located approximately 11 miles north of State Road 80. The discharges from WCA-1 are dependent on the operating criteria of SFWMD's structures S-5AS, S-5AE, and S-5AW.

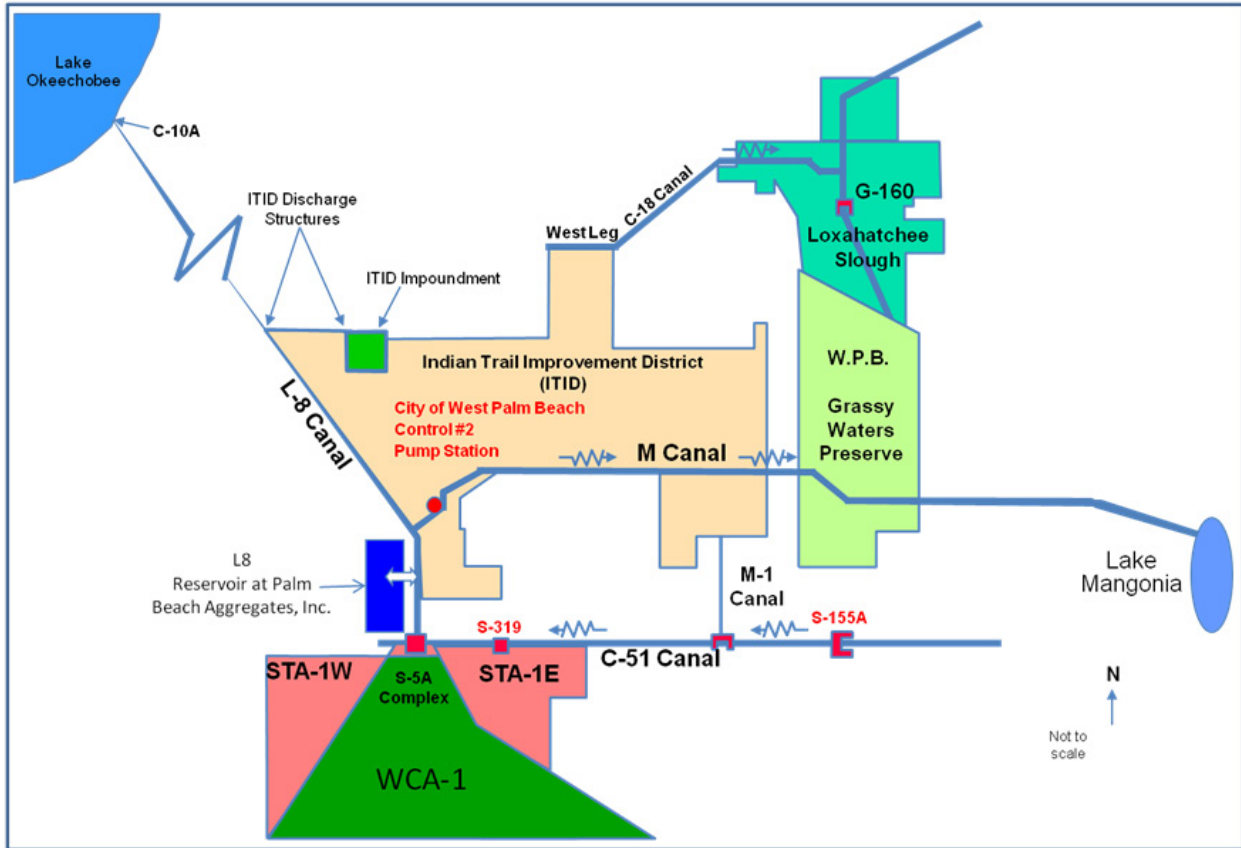


Figure 2. L-8 Reservoir Project connections to the regional system.

## L-8 RESERVOIR PROJECT

### LOCAL HYDROLOGY

During the life of the reservoir project, the local hydrology of the cells and surrounding mining operation has been in a constant state of change. The mining operation in the cells associated with the L-8 Reservoir Project is complete and no longer influences the project operation. Mining operations continue on other areas of the PBA property.

The inflow structure from the L-8 Canal to cell 1/2 consists of two 72 inch x 472 linear feet (lf) of reinforced concrete pipe (RCP) culverts with invert elevations of +7.5 ft NGVD, each with a 6 ft x 6 ft sluice gate, and another 100 lf of 72-inch CMP culvert. The discharge structure is equipped with one 75 cubic feet per second (cfs) capacity pump that discharges to the water control structure box, and out of the twin 72-inch RCP culverts to the L-8 Canal. In May 2008, two additional 37.5 cfs diesel pumps were added to the discharge location to aid in the drawdown

for a seepage test. The successful seepage test was conducted in February 2009, after which the two diesel pumps were removed. The seepage test was part of the acquisition agreement between the SFWMD and PBA before final payment to PBA could occur. Flow data are provided in Attachment B.

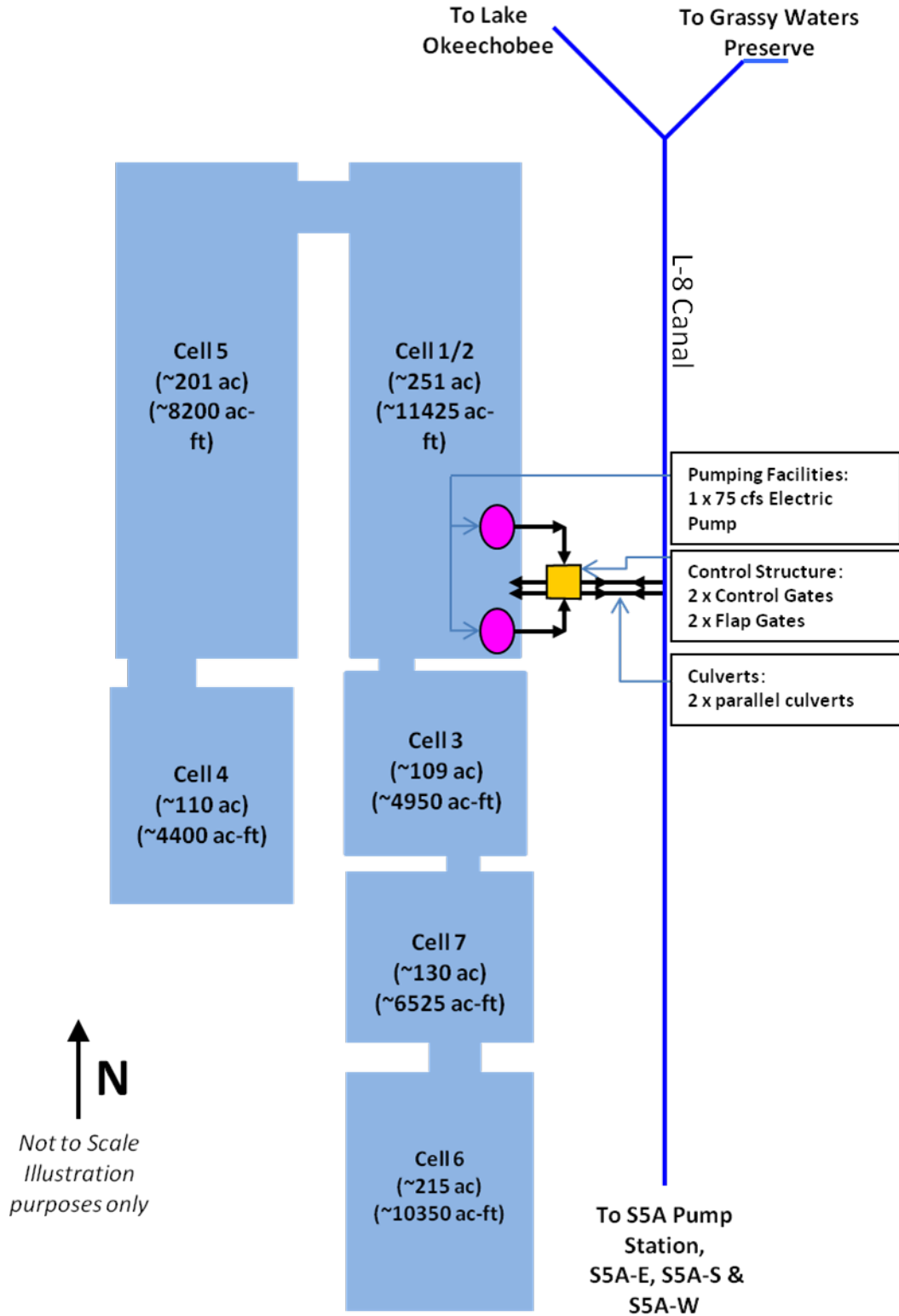
## **GEOLOGY**

The PBA rock quarry is located in central Palm Beach County, Florida, and is centered approximately 2 miles north of SR 80, near 20-Mile Bend. The area surrounding PBA was historically used for agriculture, and to some extent continues to be utilized for growing sugar cane and turf. Within the last decade or so, PBA and its predecessor (GKK, Inc.) have mined soil and rock materials for the purpose of building and road construction. The quarry is subdivided into six pits, and each pit is dewatered by pumping from sumps and perimeter rim ditches. Each pit was originally excavated to approximately 30 feet below surrounding grade for mining purposes. Each pit has been excavated further to approximately 50 feet below surrounding grade for the reservoir project.

Based upon review of the U.S. Geological Survey (USGS) Loxahatchee, Florida quadrangle map, dated 1971 and photo-revised in 1984, the PBA site has a natural ground surface elevation of approximately +15 ft NGVD. Research of the Soil Survey of Palm Beach County Area, Florida, published by the U.S. Department of Agriculture, Soil Conservation Service (SCS) indicates the site is masked by the soil association Holopaw fine sand. This is nearly level, poorly drained sand that has loamy subsoil at a depth of 40 to 72 inches. Under natural conditions, the water table (i.e., absent drainage improvements) is near the ground surface.

According to Brooks (1981), the site lies near the somewhat gradual transition between the Eastern Flatwoods District (Green Ridge-Loxahatchee Karst) and the Gold Coast and Florida Bay District (Everglades, Andytown Ridges and Sloughs). The Green Ridge-Loxahatchee Karst is described as poorly drained open flatwoods with cypress strands and heads, while the Andytown Ridges and Sloughs is a freshwater marsh with varying thickness of peat. Brooks (1981) maps the site as Qftg, the Fort Thompson Group. This area consists of clastic and shell deposits associated with the middle and early Pleistocene stands of sea level.

Geologic conditions at the PBA site consist of thin depths of surficial peat and sands over a relatively thick deposit of well-cemented sand and shell of marine origin. The cemented layer is referred to as the "carbonate rich" zone. It has been reported that the South Florida peninsula formerly existed with sea stands considerably higher than those that currently exist (LBFH and DE&T, 2005). A series of shallow inland tidal channels was home for thousands of marine animals. These and other life forms accumulated over time into reefs, which later lithified into the cemented sand and shell Carbonate Rich zone. Beneath this layer, a thick deposit of sand and gravel with some cemented zones is common to this geologic area.



**Figure 3.** L-8 Reservoir Project facilities.



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## WATER QUALITY

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### MONITORING LOCATIONS

Surface water sampling locations are listed in **Table 3** and shown on **Figure 4**.

**Table 3.** Surface water quality sampling locations.

Sampling Station	Station Location	Coordinates	
		Latitude	Longitude
SW-1B	L-8 Canal, approximately 6.6 miles northwest of its junction with the M Canal	264849.34	802600.575
SW-3	M Canal at the west side of the Seminole Pratt Whitney Road bridge	264553.918	801825.728
SW-6IN	Inflow Structure Southeast corner of Cell 1/2	264338.836	802149.982
SW-6OUT	Outflow Structure Southeast corner of Cell 1/2	264339.412	802154.419
L8MZBN	L-8 Canal 800 meters north of the discharge location	264404.689	802147.253
L8MZBS	L-8 Canal 800 meters south of the discharge location	264313.305	802148.492

Note: Latitude and Longitude coordinates are in Degrees Minutes and Decimal Seconds

### SAMPLING PROTOCOL

Surface water samples were collected from five of the six sampling locations on a weekly basis only during inflow or outflow events (**Figure 4**). Gross alpha is sampled monthly only during inflow and outflow events at SW-6OUT. The sixth site (SW-1B) is only sampled for mercury on a quarterly basis (**Figure 8**) (see Mercury Monitoring section for more details). SW-3 is a downstream reference site sampled weekly when water is discharged from the reservoir. During this reporting period, all monitoring was conducted by District staff. The samples were obtained from a depth of 0.5 meters (m) below the water surface. Specific conductivity, pH, dissolved oxygen, and temperature were measured in the field for all samples.

### Water Quality Standards

Review of the Florida Administrative Code (F.A.C.) Chapter 62-302.530, Criteria for Surface Water Quality Classifications, indicates the following water quality criteria for Class I (Potable Water Supply) and Class III (Predominantly Fresh Waters) waters for selected analytical parameters (**Table 4**).

**Table 4.** Surface water quality criteria.

Parameter	Units	Surface Water Criteria	
		Class I	Class III
Chlorides	mg/L	≤ 250	NA
Specific Conductance	μS/cm	≤ 1275*	≤ 1275*
Dissolved Oxygen	mg/L	≥ 5.0	≥ 5.0
pH	Standard	6.0 < pH < 8.5	
Total Mercury	μg/L	< 0.012	< 0.012
Gross Alpha	pCi/L	≤ 15	≤ 15

**Notes:**

μS/cm = μS/cm = microSiemens per centimeter

μg/L = micrograms per liter

mg/L = milligrams per liter

pCi/L = picoCuries per liter

\* 1,275 μS/cm or 50% above background, whichever is greater.

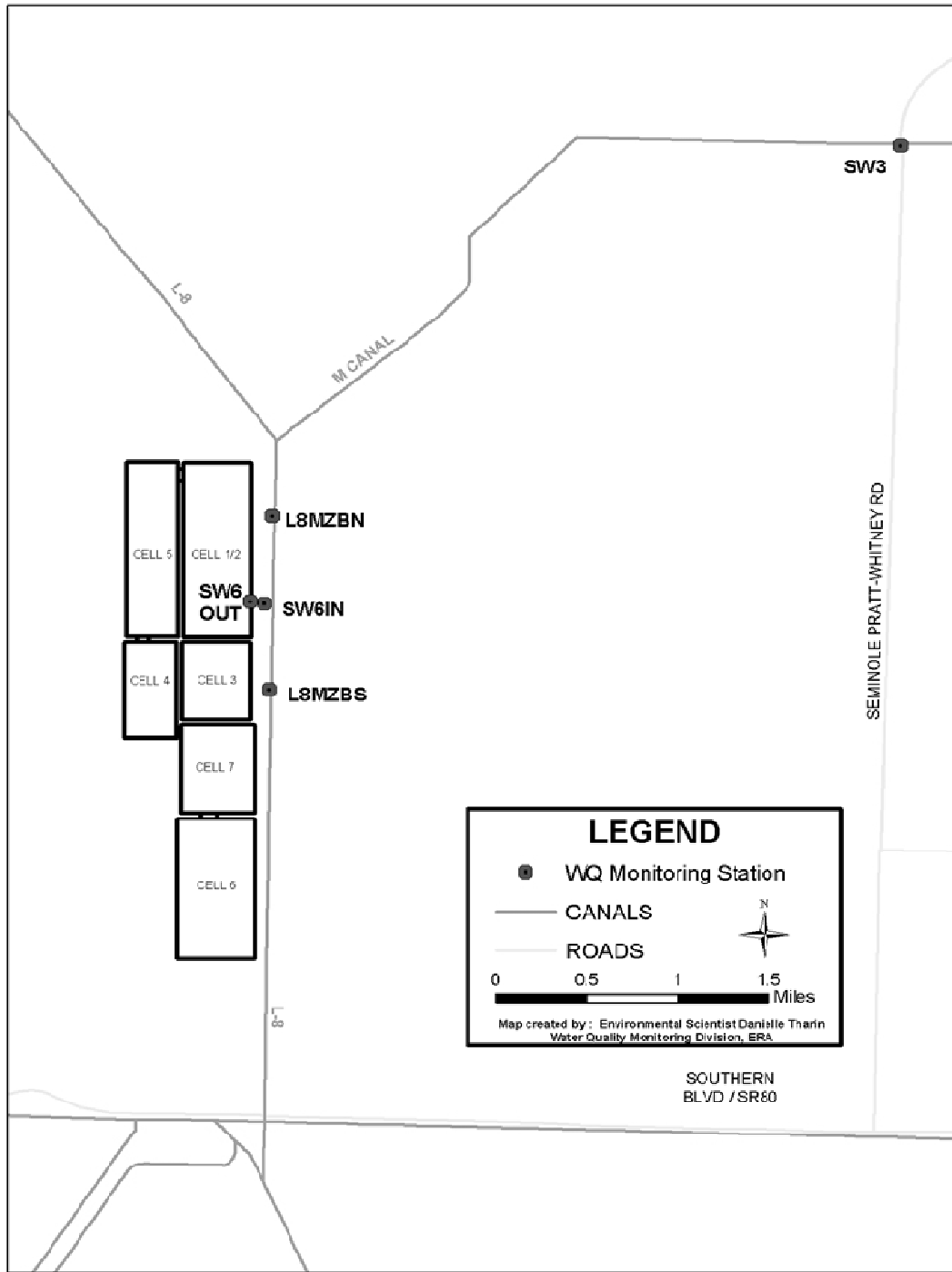


Figure 4. L-8 Reservoir Project water quality sampling locations.

## Data Summary Tables

**Table 5.** Statistical summary of physical parameters monitoring in M and L-8 canals and L-8 Reservoir during WY 2010.

Temperature (°C)						pH (units)					
Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS	Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal		M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	20	27	28	---	---	Count	20	27	28	---	---
Avg	25.4	24.1	25.0	---	---	Avg	7.56	7.73	8.29	---	---
STD	6.2	5.7	5.3	---	---	STD	0.18	0.37	0.31	---	---
Min	13.1	11.9	15.4	---	---	Min	7.20	7.00	7.90	---	---
25%	21.6	20.3	20.9	---	---	25%	7.45	7.50	8.00	---	---
Median	26.6	26.1	26.2	---	---	Median	7.60	7.60	8.30	---	---
75%	30.5	29.3	30.2	---	---	75%	7.70	7.98	8.40	---	---
Max	32.9	31.6	31.9	---	---	Max	7.80	8.50	9.50	---	---

Dissolved Oxygen (mg/L)						Specific Conductance (µS/cm)					
Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS	Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal		M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	19	25	26	---	---	Count	20	27	28	22	22
Avg	6.67	6.19	7.96	---	---	Avg	441.4	844.6	1819.9	536.1	800.1
STD	1.85	2.57	1.18	---	---	STD	94.9	414.3	293.0	188.1	217.3
Min	4.37	2.38	5.72	---	---	Min	359	380	516	321	496
25%	5.11	4.43	7.08	---	---	25%	395	543.5	1743.5	398.0	596
Median	6.31	5.61	7.88	---	---	Median	408	703	1890	493	773.0
75%	8.02	8.27	8.80	---	---	75%	469	1156	1975.0	617.0	993
Max	9.98	10.80	10.00	---	---	Max	791	1689	2130	1076	1201

Sulfate (mg/L)							Calculated Chloride (mg/L) <sup>a</sup>					
Statistics	SW-1B	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS	SW-1B	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	L-8 Canal	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal	L-8 Canal	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	4	20	27	31	---	---	---	---	---	28	22	22
Avg	26.3	21.7	59.0	144.8	---	---	---	---	---	349.5	69.7	127.2
STD	9.0	9.1	38.2	25.4	---	---	---	---	---	63.9	41.0	47.4
Min	17.1	11.3	18.2	32.9	---	---	---	---	---	65.3	22.8	60.9
25%	20.1	13.2	33.2	135.0	---	---	---	---	---	332.9	39.6	82.7
Median	24.8	20.4	44.0	154.0	---	---	---	---	---	364.8	60.2	121.3
75%	32.5	25.6	91.1	157.0	---	---	---	---	---	383.4	87.3	169.3
Max	38.5	45.3	147.0	184.0	---	---	---	---	---	417.1	187.4	214.6

Note:

<sup>a</sup> Chlorides were calculated from specific conductance using the equation specified in CERPRA Permit No. 0188365-008:

Chloride = 0.218(Specific Conductance) - 47.2. Chloride equation has a specific conductance range limit of 270 - 3847 µS/cm.

--- Data was not available

**Table 6.** Statistical summary of nutrient and radiological parameters monitored in M and L-8 canals and L-8 Reservoir during WY 2010.

Total Phosphorus (mg/L)						Total Kjeldahl Nitrogen (mg/L)					
Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS	Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal		M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	20	27	25	---	---	Count	20	27	27	---	---
Avg	0.092	0.092	0.041	---	---	Avg	1.24	1.35	0.98	---	---
STD	0.051	0.039	0.029	---	---	STD	0.27	0.41	0.13	---	---
Min	0.026	0.037	0.012	---	---	Min	0.75	0.93	0.81	---	---
25%	0.064	0.068	0.019	---	---	25%	1.11	1.07	0.88	---	---
Median	0.081	0.084	0.025	---	---	Median	1.28	1.22	0.96	---	---
75%	0.107	0.105	0.063	---	---	75%	1.42	1.47	1.02	---	---
Max	0.237	0.221	0.096	---	---	Max	1.75	2.68	1.37	---	---

Nitrate + Nitrite as N (mg/L)						Total Nitrogen (mg/L)					
Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS	Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal		M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	20	27	26	---	---	Count	20	27	26	---	---
Avg	0.129	0.240	0.103	---	---	Avg	1.37	1.59	1.09	---	---
STD	0.119	0.258	0.126	---	---	STD	0.34	0.59	0.21	---	---
Min	<0.005	<0.005	<0.005	---	---	Min	0.75	1.04	0.87	---	---
25%	0.023	0.106	0.005	---	---	25%	1.20	1.26	0.96	---	---
Median	0.083	0.202	0.014	---	---	Median	1.44	1.48	1.01	---	---
75%	0.231	0.317	0.200	---	---	75%	1.52	1.63	1.11	---	---
Max	0.366	1.368	0.461	---	---	Max	1.98	4.05	1.83	---	---

Gross Alpha (pCi/L)					
Statistics	SW-3	SW-6IN	SW-6OUT	L8MZBN	L8MZBS
	M Canal	L-8 Canal	Cell 1/2	L-8 Canal	L-8 Canal
Count	7.0	2.0	10.0	---	---
Avg	1.5	1.8	9.3	---	---
STD	0.4	0.2	2.0	---	---
Min	<1.2	<1.6	6.2	---	---
25%	1.3	1.6	8.6	---	---
Median	1.6	1.8	9.3	---	---
75%	1.7	1.9	11.3	---	---
Max	2.2	1.9	12.2	---	---

Note: --- Data was not available

## ASSESSMENT OF WATER QUALITY DATA

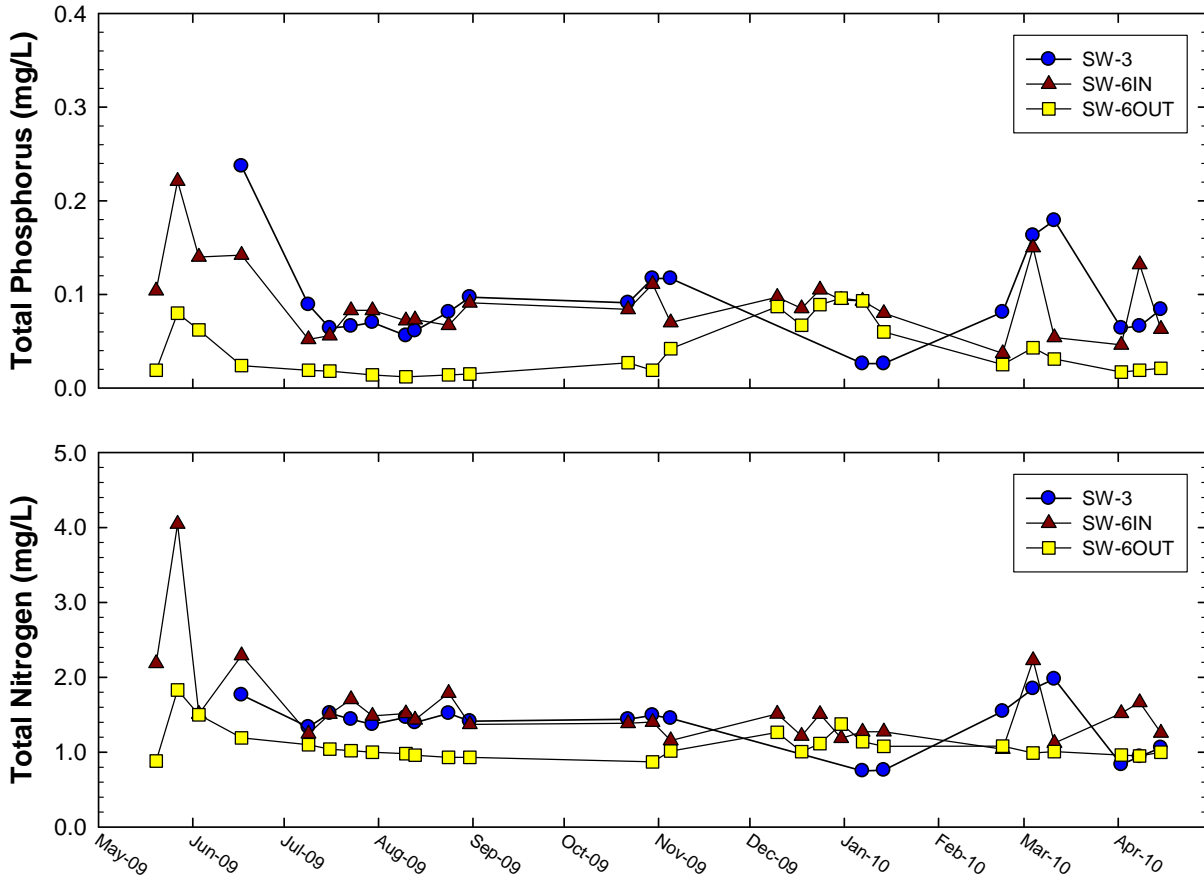
Surface water quality data for the L-8 Reservoir Project (May 2009–April 2010) are provided in **Attachment D**.

### Gross Alpha

Gross alpha is a by-product of radioactive decay and occurs naturally in the environment. It is present in varying amounts in nearly all rock, soils, and water. Gross alpha was sampled at three sites: SW-6IN, SW-6OUT, and SW-3 (**Table 6**). Gross alpha was significantly higher at SW-6OUT (reservoir site) than at SW-6IN and SW-3 (L-8 and M1 canal sites). Gross alpha at SW-6OUT ranged from 6.4 picocuries per liter (pci/L) to 12.2 pci/L. Gross alpha at SW-6IN and SW-3 ranged from less than 1.9 pci/L to 2.2 pci/L. The state criterion is less than 15 pci/L for both Class I and Class III waters. Based on the Class I and III criterion, there were no gross alpha values above the criterion at any of the monitoring locations. Therefore, the water from the L-8 Reservoir Project does not appear to cause or contribute to an increase in gross alpha in the L-8 or M canals during normal operations.

### Nutrients

The nutrients analyzed in the canals and reservoir were total phosphorus (TP), total Kjeldahl nitrogen (TKN), nitrate+nitrite (NO<sub>x</sub>), and total nitrogen (TN). All nutrients had higher concentrations in the L-8 and M canals than in the reservoir (**Table 6** and **Figure 5**). **Table 6** also shows the highest TP concentration from the reservoir at SW-6OUT was 0.096 mg/L, while the highest in the L-8 or M canals was 0.237 mg/L. TN had the same outcome as TP with the highest concentration in the reservoir at 1.83 mg/L and the highest concentration in the L-8 and M canals at 4.05 mg/L. The L-8 Reservoir does not appear to cause or contribute to an increase of phosphorus or nitrogen in the L-8 Basin.



**Figure 5.** Time series plots of total phosphorus and total nitrogen measured at three structures during WY2010.

**Physical Parameters**

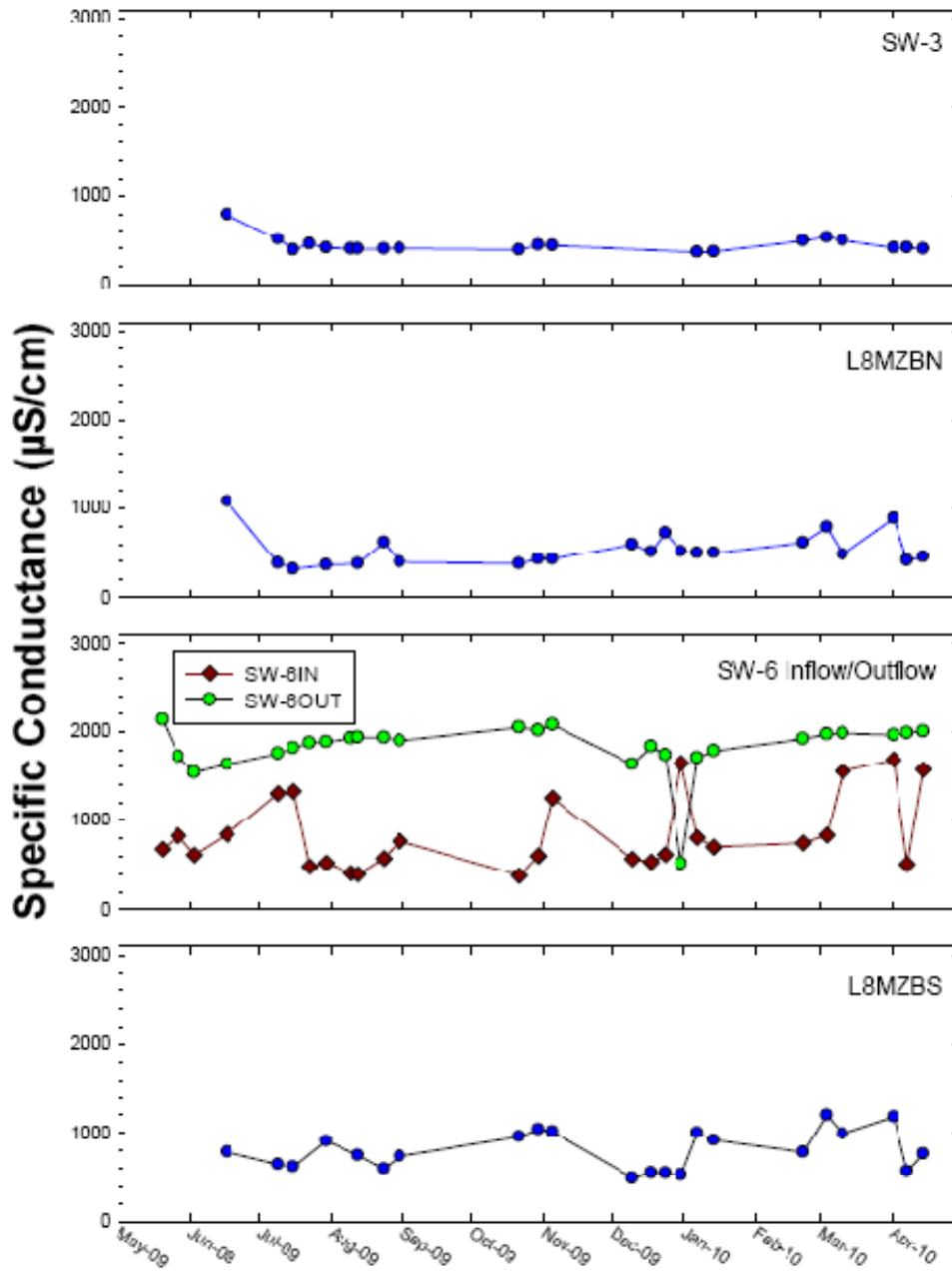
The physical parameters analyzed in the reservoir and canals were temperature, dissolved oxygen, pH, specific conductance, and calculated chloride.

As shown on **Figure 6** and in **Table 5**, specific conductance was consistently higher in the reservoir than in the canal sites. The mixing zone monitoring sites L8MZBN and L8MZBS were initiated in October 2007. These sites are located 800 meters north and south of where the discharge water enters the L-8 Canal. These sites are monitored every 15 minutes for specific conductance along with SW-6OUT when water was discharged from the reservoir. Time-weighted daily average values required by the CERPRA permit were calculated from the 15-minute values recorded and are provided in **Attachment D**. The average daily specific conductance has to be less than 1,275 microsiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) at these two locations before water can move any farther. **Figure 6** and **Table 5** show that the specific conductance concentrations recorded when routine samples were collected only during inflow and outflow events did not exceed the Class III criteria for conductivity ( $< 1,275 \mu\text{S}/\text{cm}$ ) at the two mixing zone sites or at SW-3 (Class I site) at any time during WY2010. SW-6OUT had an average concentration of 1,819.9  $\mu\text{S}/\text{cm}$  with a max of 2,130  $\mu\text{S}/\text{cm}$ . SW-6IN had an average concentration of 844.6  $\mu\text{S}/\text{cm}$  with a max of 1,689  $\mu\text{S}/\text{cm}$ . An 800-meter mixing zone for specific

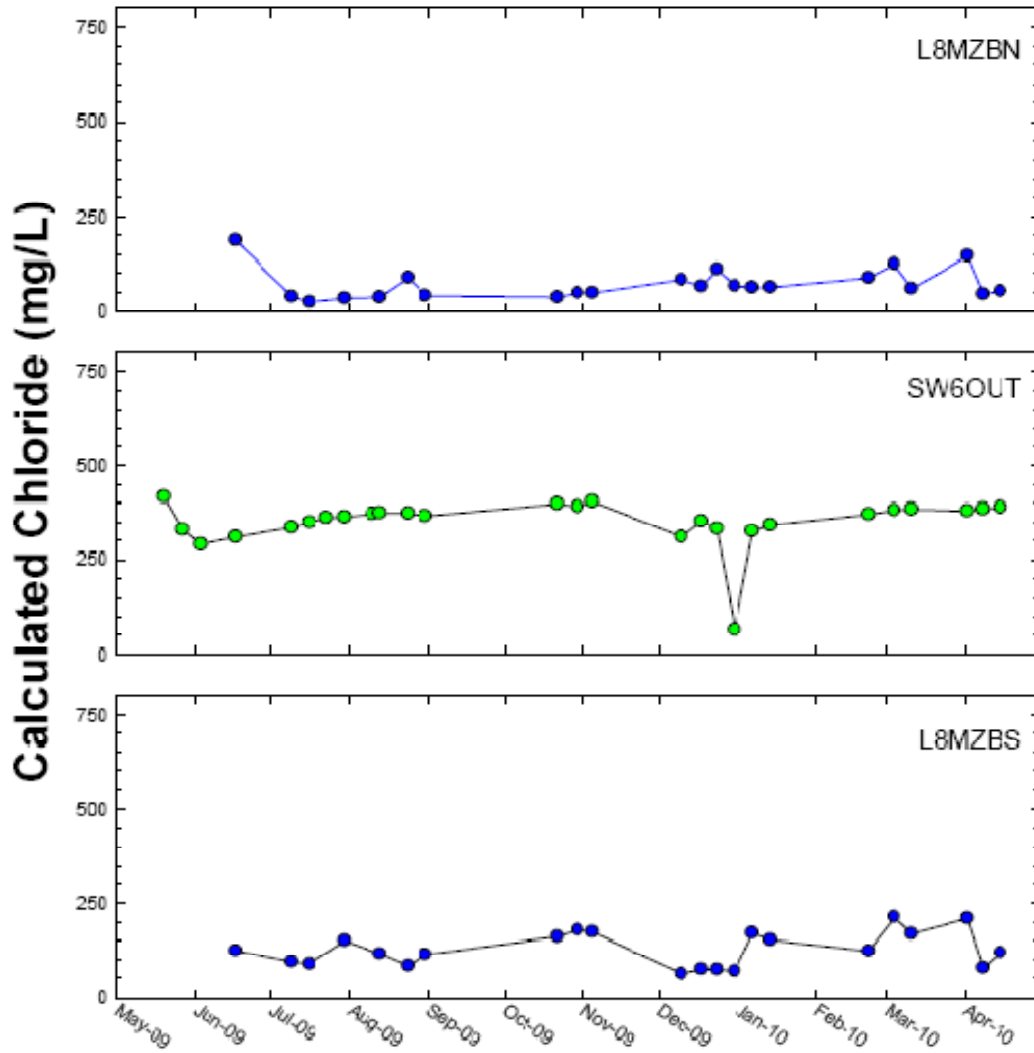
conductivity from the point of discharge of the L-8 Reservoir has been authorized through August 25, 2011 (August 25, 2009 Permit Modification Number: 0188365-011-EM).

Calculated chloride concentrations are presented in **Table 5** and **Figure 7**. Chlorides were calculated from the specific conductance values recorded when routine samples were collected only during inflow and outflow events by using the following equation specified in CERPRA Permit 0188365-008:  $[\text{Chloride} = 0.218(\text{Conductivity}) - 47.2]$ . Since chloride is derived from specific conductance, the same scenarios for specific conductance explained above apply to chloride. There is no Class III standard for chloride; however, there is a Class I standard (<250 mg/L) that only applies to site SW-3 on the M Canal. There were no occasions when the standard was exceeded at SW-3. SW-6OUT and SW-6IN exhibited the same increases mentioned above for conductivity. Daily specific conductance and calculated chloride data for the L-8 Reservoir Project are provided in **Attachment D**.





**Figure 6.** Time series plots of specific conductance levels at three structures and two mixing zone stations (L8MZBN and L8MZBS) during WY2010.



**Figure 7.** Time series plots of calculated chloride levels at the outflow structure to the L-8 Canal (SW6OUT) and mixing zone stations (LM8MZBN and L8MZBS) during WY2010.

## Mercury Monitoring

On December 31, 2009, the FDEP issued the District a minor permit modification (0188365-012-EM). The mercury monitoring for the L-8 Reservoir Project was updated to reflect the transfer from Phase 2-Tier 1 (Routine Monitoring During Stabilization Period) to Phase 3-Tier 1 (Routine Operational Monitoring from Year 4 to Year 9). In Phase 3-Tier 1, surface water sampling is discontinued, frequency of mosquitofish (*Gambusia holbrooki*) collection is reduced to semiannually, and frequency of large-bodied fish collection is reduced to one collection event every three years. This new monitoring frequency is reflected in the results shown in **Table 7** with only three sampling events during WY2010. The Phase 3-Tier 1 monitoring frequency began in January 2010. For this reporting period, Phase 2-Tier 1 was still in effect and surface water samples were collected quarterly regardless of flow at the point of discharge (SW-6OUT) and at an upstream site (SW-1B) 7.5 miles from the reservoir project. Total mercury and methylmercury are analyzed for at these locations. Also on a quarterly basis, mosquitofish are collected and combined together from all the cells and from a location adjacent to the reservoir in the L-8 Canal (L8GRC) and analyzed for total mercury. Annually sunfish (*Lepomis* sp.) and largemouth bass (*Micropetrus salmoides*) were also collected and analyzed for total mercury. Due to the absence of a littoral zone shelf and natural slopes, the reservoir cells are depauperate with respect to higher trophic level fish, so the sunfish and bass from all cells are combined into one representative sample for each species (see **Figure 8** for mercury monitoring locations).

The FDEP has a Class III water quality standard for ultra-trace total mercury (< 12 ng/L); however, there is no Class III ultra-trace methylmercury standard. There is also a USEPA recommended methylmercury fish tissue human consumption criterion of 0.3 mg/kg for bass. Florida is proposing a 0.2 mg/kg human consumption criterion based on the higher rates of marine and freshwater fish consumption in the state. Mercury concentrations in largemouth bass in WCA-1, WCA-2, and WCA-3 have declined by up to 80 percent from the early 1990s to 1998, but remain relatively high with a mean of 0.5 mg/kg.

The 75th percentiles for the period of record (1998–2008) for mosquitofish is 0.08 mg/kg, sunfish is 0.240 mg/kg, and largemouth bass is 0.674 mg/kg. **Table 7** shows that all the samples collected during this reporting period for water and fish have results well below these standards.

All fish species collected from the interior and downstream sampling locations do not show a statistical temporal increase in THg concentration between the years 2006 and 2009 (based on a statistical significance level of 0.10).

**Table 7.** Mercury results in water and fish for the L-8 Canal and Reservoir for WY2010.

Surface Water	Station	Sampling Dates			FDEP Criterion		
Ultra-trace Total Mercury (ng/L)		<u>5/13/2009</u>	<u>8/27/2009</u>	<u>12/8/2009</u>	<12		
	SW1B	2.5	3.3	1.3			
	SW6OUT	0.32	0.76	0.65			
Ultra-trace Methylmercury (ng/L)	SW1B	*	*	0.014	---		
	SW6OUT	*	*	0.13			
Mosquitofish	Station	Sampling Dates			WY1998-WY2009 75 <sup>th</sup> Percentile	FDEP Criterion	
Ultra-trace Total Mercury (mg/kg)		<u>5/19/2009</u>	<u>7/23/2009</u>	<u>10/6/2009</u>	0.08	---	
	L8GRC	0.02	0.045	0.031			
		<u>5/19/2009</u>	<u>7/23/2009</u>	<u>10/22/2009</u>			
	L8CELL1/2	0.029	0.066	0.029			
		<u>5/27/2009</u>	<u>7/23/2009</u>	<u>10/22/2009</u>			
	L8CELL3	0.027	0.039	*			
		<u>5/19/2009</u>	<u>7/23/2009</u>	<u>10/22/2009</u>			
	L8CELL4	*	0.030	*			
	<u>5/19/2009</u>	<u>7/27/2009</u>	<u>10/22/2009</u>				
L8CELL5	0.036	0.047	0.034				
	<u>5/19/2009</u>	<u>7/23/2009</u>	<u>10/22/2009</u>				
L8CELL6	0.038	0.035	*				
	<u>5/19/2009</u>	<u>7/23/2009</u>	<u>10/22/2009</u>				
L8CELL7	*	0.054	*				
Large Fish (Sunfish and Bass)	Station	No. of Samples	Sunfish	No. of Samples	Bass	WY1998-WY2009 75 <sup>th</sup> Percentile <sup>a</sup>	USEPA Criterion
Ultra-trace Total Mercury (mg/kg)	L8GRC	5	0.093	5	0.214	0.240 / 0.674	≤0.3
	L8FISH	5	0.168	5	0.082		

**NOTES:**

\* - No data collected or estimated value not accurate

<sup>a</sup> 75<sup>th</sup> percentile levels for Sunfish / Bass

--- Not Applicable

L8GRC = Telemetry platform in L-8 Canal east of Cell 3

L8FISH = Composite of fish from all the cells

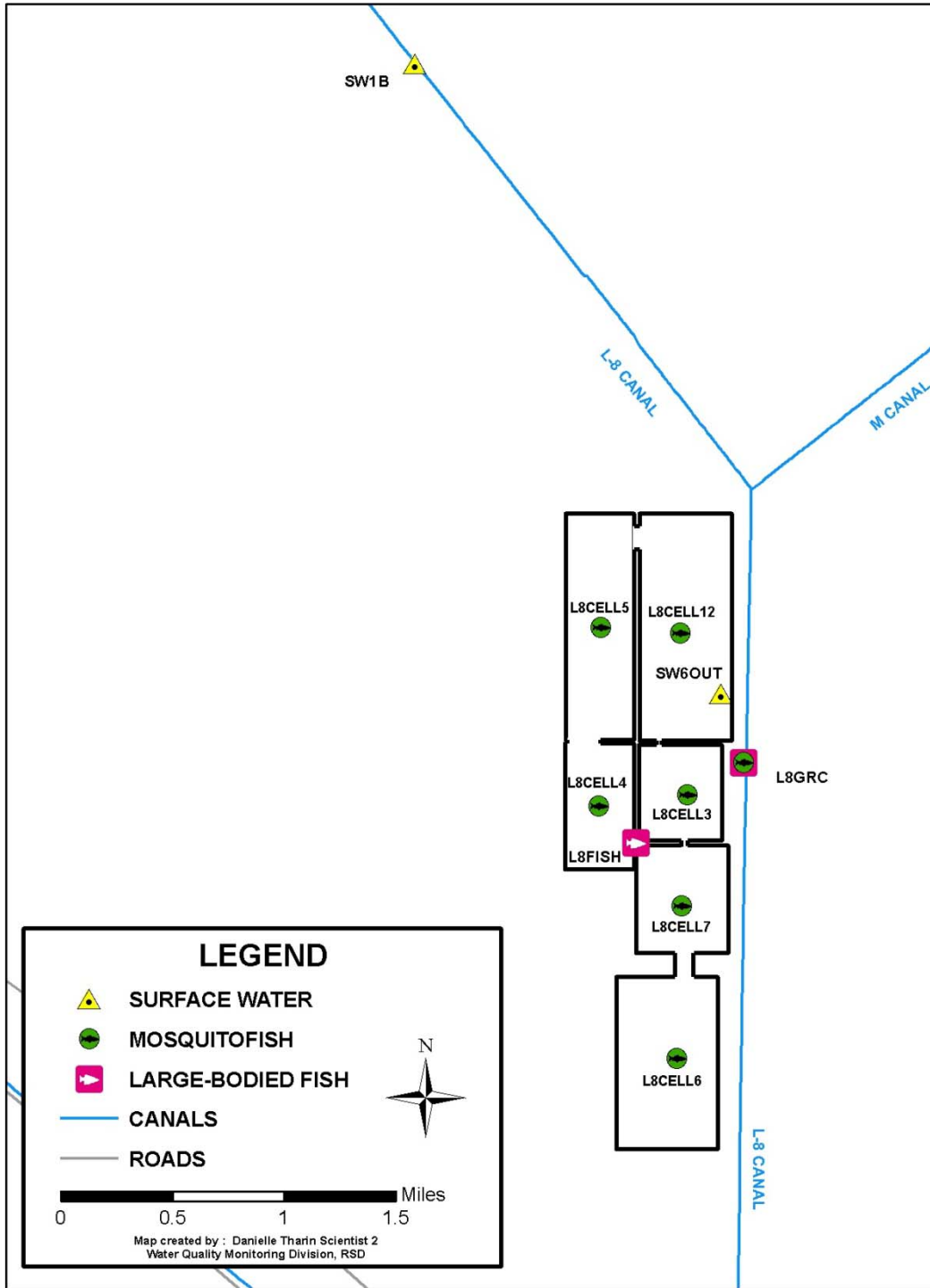


Figure 8. Mercury monitoring locations.

## Pesticide Monitoring

As per permit minor modification #0188365-010-EM, dated July 30, 2009, all pesticide monitoring has been eliminated from the L-8 Reservoir Project. No results are available for this annual report.

## WATER QUALITY CONCLUSIONS

Based on the preceding findings, conclusions, and recommendations, it is the opinion of the SFWMD that no degradation in water quality has occurred in the L-8 Canal Basin in the reporting year due to the operation of the L8RP.

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## LITERATURE CITED

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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
8. Monitoring Requirements	---	---	---	D1 to D4
9. Mercury and Pesticide Monitoring	7	App. 2-2-18 – 2-2-22	8	---
10. Daily Monitoring of Stages	---	---	---	D3
11(a)1-8. Water Quality Data	3 to 6	App. 2-2-9 – 2-2-18	4 to 7	D1
11(a)9. Flow	B-1	---	---	B
Piezometer Depth	C-1	---	---	C
Permit No. 0188365-007: Specific Condition 22	---	---	6 and 7	D2

# Attachment B:

## Total Monthly Flow at the Inflow and Outflow Points of the L-8 Reservoir for WY2010

**Table B-1.** Total monthly flow at the inflow and outflow points of the L-8 Reservoir for WY2010.

Month	Inflow <sup>1</sup> (acre-feet)	Outflow <sup>2</sup> (acre-feet)
May 2009	3821	0
June 2009	84	379
July 2009	109	4325
August 2009	352	4190
September 2009	108	264
October 2009	487	2061
November 2009	200	1522
December 2009	2268	0
January 2010	599	2017
February 2010	435	52
March 2010	362	1710
April 2010	610	2031

**Notes:**

1. The flows were computed based on the following data:
  - a) Break Point (15-minutes) readings of the L-8 Canal levels were used as head water elevations while break-point reservoir levels were used as tail water elevations.
  - b) Break-point gate openings were obtained from the operations provisional database.
  
2. The flows were computed based on the following DBHYDRO data:
  - a) The constant pump speed of the electric pump is 440 RPM.
  - b) Break Point (15-minutes) readings of the reservoir levels were used as head water elevations.



# Attachment C: L-8 Reservoir Project Piezometer Depth to Water Data for WY2010

**Table C-1.** Piezometer depth to water data.

	PZ5A	PZ5B	PZ5C	PZ5D	PZ8A	PZ8B
Piezometer Depth (feet)	15.5	35.5	55.5	75.5	20	40
Surveyed Elevation (TOC in feet) (03/29/07) ± 0.1	22.95	23.08	23.19	23.02	26.8	26.57
Actual Depth (feet) (3/29/07)	18	38.02	58.2	78.3	23.02	43.14
	Depth to Water (feet)					
Dates Measured	PZ5A	PZ5B	PZ5C	PZ5D	PZ8A	PZ8B
5/20/2009	17.26	17.41	17.52	17.35	18.96	18.73
5/27/2009	13.36	13.61	13.75	13.62	15.71	15.6
6/3/2009	12.62	12.76	12.85	12.63	15.25	15.12
6/17/2009	10.77	10.9	11.02	10.89	13.91	13.77
7/9/2009	11.22	11.55	11.7	11.52	14.41	14.42
8/10/2009	13.84	13.9	14.02	13.94	15.78	15.71
8/31/2009	14.27	14.45	14.59	14.43	16.04	15.99
10/22/2009	13.81	14.01	14.16	14.04	15.85	15.85
11/5/2009	14.6	14.74	14.88	14.77	16.34	16.26
12/10/2009	14.43	14.59	14.74	14.63	16.31	16.28
1/7/2010	12.11	12.16	12.28	12.12	14.89	14.78
2/22/2010	12.12	12.28	12.4	12.25	14.9	14.81
3/11/2010	13.11	13.25	13.36	13.17	15.44	15.58
4/2/2010	12.14	12.33	12.46	12.29	14.7	14.67

# **Attachment D: Raw Data for Water Quality and Hydrological Analyses**

In accordance with Specific Condition 11(a) of the Comprehensive Everglades Restoration Plan Regulation Act (CERPRA) Permit-Operations Authorization for the L-8 Reservoir Project, this supporting information is available upon request.