Appendix 4-2: Annual Permit Report for the Taylor Creek Stormwater Treatment Area

Permit Report (May 1, 2011–April 30, 2012)
Permit Number: 0194485

Odi Villapando

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SUMMARY

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

Table 1. Key permit-related information.

Project Name:	Taylor Creek Stormwater Treatment Area
Permit Number:	0194485-002-GL
Issue and Expiration Dates:	Issued: 6/9/2006; Expires: 6/9/2016
Project Phase:	Stabilization Phase
Permit Specific Condition Requiring Annual Report:	Specific Condition 16
Relevant Period of Record:	May 1, 2011 – April 30, 2012
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Table 2. Attachments included with this report.

Attachment	Title
A	Specific Conditions and Cross-References
B	Water Quality Data

INTRODUCTION

The Taylor Creek Stormwater Treatment Area (TC-STA) operating permit 0194485-002-GL was issued under the authority of the Lake Okeechobee Protection Act (LOPA), Chapter 373.4595, Florida Statutes (F.S.); Title 62, Florida Administrative Code (F.A.C.); and pursuant to Section 373.4595(7) of the LOPA, the FDEP's authority under Chapters 373 and 403, F.S. LOPA was subsumed by the Northern Everglades and Estuaries Protection Program (NEEPP) in 2007. This permit was originally issued to the South Florida Water Management District (SFWMD or District) on June 9, 2006, but did not take effect until the TC-STA project was transferred to the District by the U.S. Army Corps of Engineers (USACE), the federal sponsor of the project, on May 5, 2011. The permit was modified in July 2011 and October 2011 to extend the period of STA operation through June 9, 2016, and to eliminate pesticide monitoring effective October 7, 2011, respectively. The latest modification to the existing permit was issued on December 6, 2011, authorizing the District to construct a public facility boardwalk and associated pavilion and sitting area within the STA. Construction of the boardwalk is currently on hold until funding becomes available.

The Taylor Creek STA is one of two pilot-scale STAs being implemented north of Lake Okeechobee as part of the Lake Okeechobee Watershed Construction Project (Phase 1). Constructed in April 2006, this two-celled STA has an effective treatment area of only 118 acres, which is relatively small compared to the Everglades STAs that range in size from 7,045 to 16,535 acres (see Volume I, Chapter 5 and & Volume III, Appendix 3-1). An inflow pump station lifts water from Taylor Creek at the north end of the STA. Treatment occurs through natural biogeochemical processes as the water slowly flows by gravity southeasterly through the 41-acre Cell 1 and subsequently through the 77-acre Cell 2 prior to discharge back into Taylor Creek. Water levels and flow rates through the treatment cells are controlled by individual gated structures located at the southerly end of each cell (**Figure 1**) (Goforth, 2005). The predominant grade within the STA creates flow northwest to southeast, but the general slope of each cell is from east to west, making the water on the west side of the cells deeper than on the east. Deep zone trenches at the inflow and outflow of each cell are designed to help distribute flow evenly throughout the cell. The goal of the STA is to capture and reduce the mass of total phosphorus (TP) from the Taylor Creek drainage basin, prior to discharge back into Taylor Creek and eventually into Lake Okeechobee. The STA was projected to remove an average of 2.02 metric tons (mt) of TP per year, or about 9 percent of the TP load of Taylor Creek at the project location (Stanley Consultants, Inc., 2003).

Flow-through operations at Taylor Creek STA were initiated on June 26, 2008. After that time, the facility continued operating in a discharge mode until February 24, 2009, when pumping and discharge activities were suspended due to culvert failure at the outfall structure (S-392). Construction repairs to the failed culvert kept the STA out of flow-through operations for almost 20 months. Following completion of the repairs on August 23, 2010, and a demonstration of compliance with pre-discharge requirements, flow-through operations at Taylor Creek STA were resumed on September 8, 2010. The TC-STA has been in flow-through mode since that date. This report summarizes TC-STA performance, operation and maintenance, and permit compliance

efforts during Water Year 2012 (WY2012) (May 1, 2011 –April 30, 2012) in accordance with Specific Condition 16, Annual Monitoring Reports, of the above-referenced permit. The TC-STA was in the stabilization phase during this period.

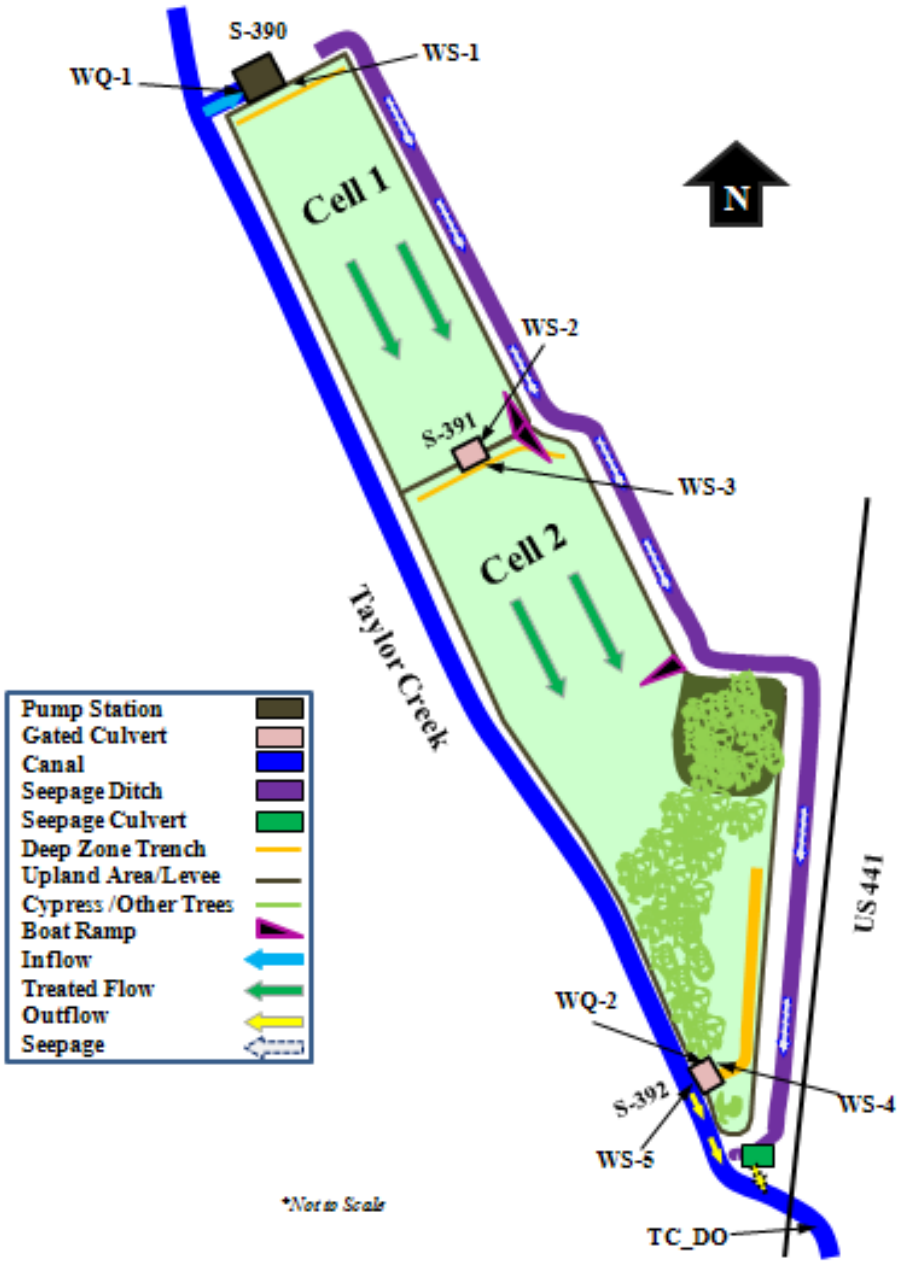


Figure 1. Schematic of Taylor Creek Stormwater Treatment Area (TC-STA), showing structures, flow, and water quality monitoring stations (WS - water stage sensor; WQ - water quality sample station; S-390 and S-392 are the permitted stations; TC_DO is Taylor Creek downstream).

OPERATION AND MAINTENANCE

OPERATIONS

During WY2012, the TC-STA operated without any interruptions for the first time since flow-through operations were initiated on June 26, 2008. Water depths across the TC-STA during this period were kept within limits of normal operations described in the water control plan (USACE, 2009). Mean stages in Cells 1 and 2 during WY2012 were 24.36 and 23.35 ft NGVD, respectively (**Figure 2**).

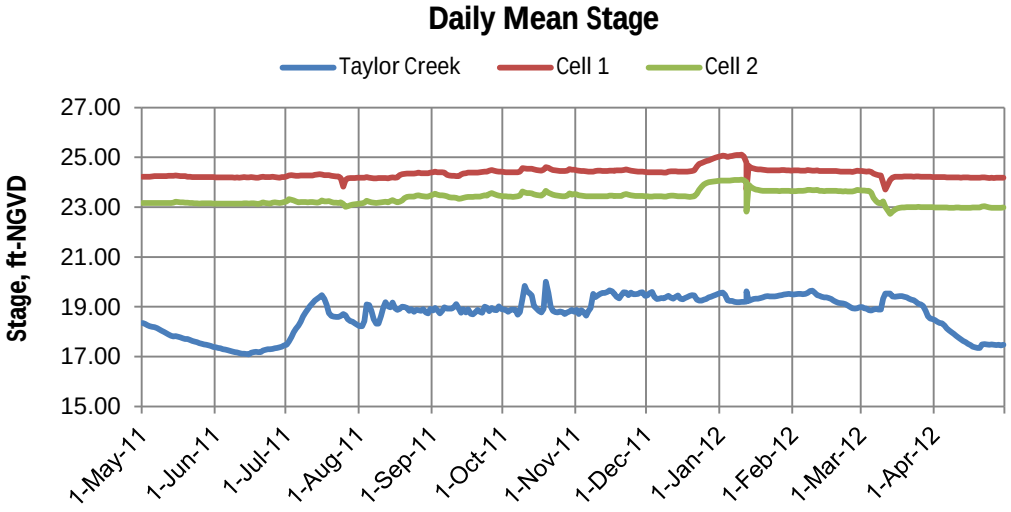


Figure 2. Daily mean stage (feet National Geodetic Vertical Datum, or ft NGVD) in Cells 1 and 2 of the TC-STA in relation to Taylor Creek during Water Year 2012 (WY2012) (May 1, 2011–April 30, 2012).

Few operational changes were made in WY2012. The pumping rate was increased from 12 to 24 cubic feet per second (cfs) in mid-August 2011 as the STA continued to show reversals in weekly TP concentrations. The goal was to purge old water out of the STA and reestablish "steady state" conditions within the STA. This adaptive management measure seemed to help the STA rebound and sustain a net reduction in TP concentration initially through the first week of November 2011, but subsequently weekly TP concentrations became unpredictable. With the rainy season winding down, the pumping rate was restored to 12 cfs on December 20, 2011, in an effort to improve system performance by increasing hydraulic retention time within the STA. As this operational change did not seem to have any measurable effect on performance, weir gates at the interior (S-391) and outfall (S-392) structures were lowered on March 5, 2012, to achieve average water depths of 1.5 and 1.2 ft in Cells 1 and 2, respectively, while holding the pumping rate constant at 12 cfs.

Operational challenges during WY2012 included management of water levels to facilitate plantings of giant bulrush on September 8-9, 2011. Also, the monitoring well at S-390 headwater was reported to have failed in October 2011, prompting estimation of the upstream headwater elevation using the tailwater elevation at S-392 until repairs were completed. In May 2011, active nests of black-necked stilts (*Himantopus mexicanus*)

were first spotted in the TC-STA, and their presence continued through June 2011. No actions were taken to actively increase water levels in the STA during this time.

VEGETATION MANAGEMENT

The tracer study conducted in WY2011 identified short-circuiting down the western levee in Cell 1 of the STA (DB Environmental, 2010). Short-circuits result in a portion of the influent water reaching the outflow of the system before the calculated hydraulic residence time, thereby reducing the TP removal efficiency of the system. Although the hydraulic efficiency was high in Cell 1, it was suggested that a marginal improvement might be achieved if a densely vegetated strip is deployed perpendicular to the western levee about one-third to one-half down the length of Cell 1. This would divert some of the preferential flow from along the western levee towards the eastern levee in order to achieve a more uniform distribution of flow throughout Cell 1. To this end, several strips of giant bulrush (*Schoenoplectus californicus*) were planted on September 8-9, 2011 (**Figure 3**, left). Additional plantings were done in several open areas of the STA in an effort to increase emergent vegetation coverage in both cells. Plant control efforts for WY2012 focused on the elimination of undesirable floating vegetation, mostly water lettuce (*Pistia stratiotes*) in both cells while continuing to control the cattail (*Typha* spp.) population in Cell 2. The location and extent of areas in the STA sprayed with diquat and glyphosate are depicted in **Figure 3** (right). During WY2012, the District treated 133 acres and applied 58.2 gallons of diquat to eradicate water lettuce in both cells and 16.2 gallons of glyphosate to control mostly cattail in Cell 2 (**Table 3**), using ground-based equipment. This information is being provided in accordance with Specific Condition 16D of the existing permit.

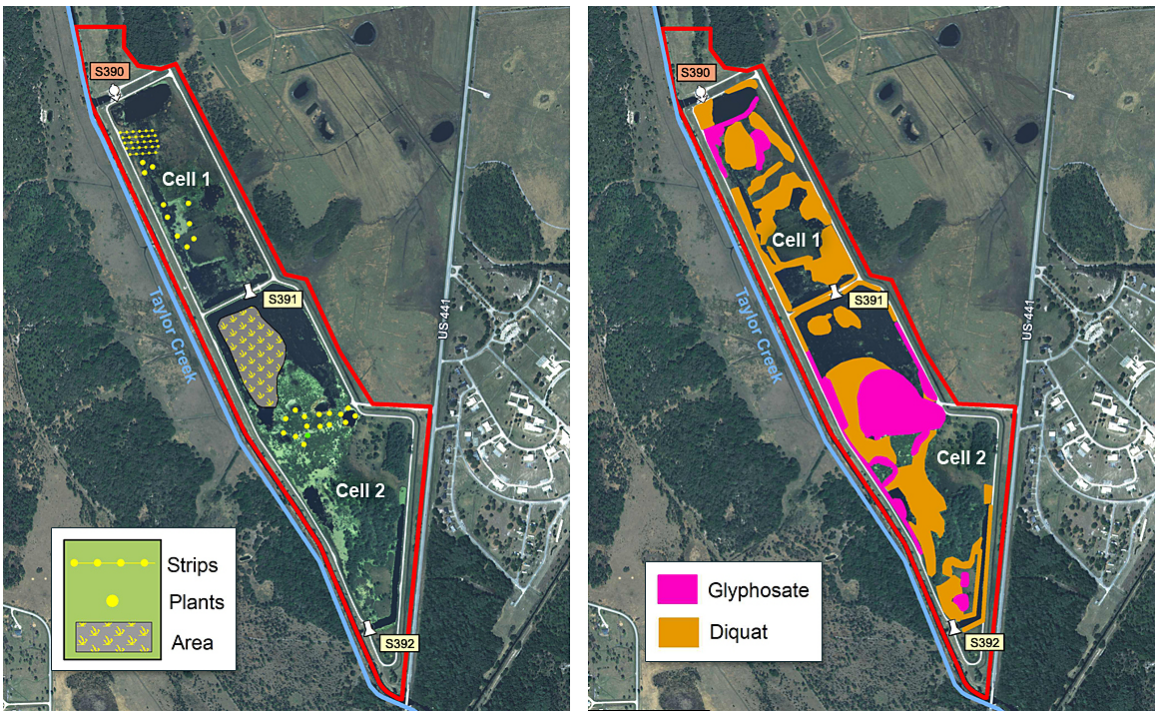


Figure 3. TC-STA in WY2012 showing areas planted with giant bulrush (left) and areas sprayed with herbicides (right).

Table 3. Herbicide usage for routine control and maintenance of undesirable vegetation within the TC-STA during WY2012.

Spray Date	Herbicide Name	Application Rate[a]	Acres Sprayed	Total Quantity Applied[b]	Targeted Vegetation	Cell
04-Aug-11	Glyphosate	3.75	2.3	9	Cattail	2
	Diquat	2.00	3.5	7	Water lettuce	1&2
11-Aug-11	Diquat	2.00	16	32	Water lettuce	1&2
31-Aug-11	Glyphosate	3.75	7	26	Cattail	2
	Diquat	2.00	5	10	Water lettuce	1
01-Sep-11	Glyphosate	3.75	8	30	Cattail	2
	Diquat	2.00	7	14	Water lettuce	1&2
14-Sep-11	Diquat	2.00	10	20	Water lettuce	1&2
24-Oct-11	Diquat	2.00	4.5	9	Water lettuce	1
25-Oct-11	Diquat	2.00	12	24	Water lettuce	1
26-Oct-11	Diquat	2.00	14	28	Water lettuce	1
09-Nov-11	Diquat	2.00	7.5	15	Water lettuce	1&2
16-Nov-11	Glyphosate	3.75	0.5	1.9	Cattail	2
	Diquat	2.00	6.5	13	Water lettuce	1&2
19-Nov-11	Diquat	2.00	9	18	Water lettuce	1&2
09-Feb-12	Diquat	2.00	1	2	Water lettuce	2
29-Feb-12	Diquat	2.00	19	38	Water lettuce	1&2

[a] Recommended application rate – quarts/acre
[b] Application rate x acres sprayed

Future vegetation management activities will focus on the implementation of an updated vegetation enhancement and maintenance plan for the TC-STA, which is designed to establish a reliable and sustainable treatment system with maximum phosphorus uptake capability (Toth, 2012). The plan will address three main issues: (1) elimination of plant species that do not contribute to the primary goal of phosphorus uptake and removal, and on species that can impact cover of desirable species for water quality treatment or STA function (e.g., water lettuce); (2) aggressive conversion of Hydrilla-dominated areas of Cell 1 to an emergent plant community with plantings of giant bulrush; and (3) elimination of hydraulic short circuits in Cell 2 (not identified by the tracer study) by transplanting giant bulrush and spikerush from existing stands within the cell.

WILDLIFE ISSUES

The TC-STA was surveyed for wildlife activities within the treatment cells during WY2012. Surveys were conducted in order to protect migratory birds that typically nest from February to mid-July in the area. Active nests of black-necked stilts (*Himantopus mexicanus*) were first spotted in May 2011 and their presence continued through June 2011 (**Table 4**). Nesting by other avian species, such as Florida sandhill cranes (*Grus canadensis pratensis*) and common moorhens (*Gallinula chloropus*), was also observed within TC-STA during WY2012. Two different pairs of cranes were observed with chicks several times from March–April 2012. These cranes likely nested during February within unobservable portions of the tree island in Cell 2 of TC-STA. While bird surveys are performed to help guide STA operations during the 2012 breeding season, no operational changes were required in response to wildlife presence. Water depth in the STA was maintained at approximately 1.7 ft. During late 2011, two small sections of the fence along the eastern side of TC-STA were adjusted to allow flightless juvenile Florida sandhill cranes to follow adult sandhill cranes into nearby pastures to the east. These two areas of the fence were opened in March 2012.

Table 4. Results of migratory birds surveys conducted at the TC-STA during WY2012.

Survey Date	Observations
16-May-11	· Four black-necked stilts nesting in Cell 1 and two black-necked stilts nesting in Cell 2 · A pair of adult sandhill cranes with two chicks in Cell 2
13-Jun-11	· Four black-necked stilts nesting in Cell 1 and one black-necked stilt nesting in Cell 2
11-Jul-11	· No nesting birds observed in TC-STA · Precocial black-necked stilt fledglings in both Cell 1 and 2
10-Feb-12	· No nesting birds observed in TC-STA
16-Mar-12	· No nesting birds observed in TC-STA · A pair of adult Florida sandhill cranes with two newly-hatched chicks in Cell 2
13-Apr-12	· No nesting birds observed in TC-STA · Two pairs of adult Florida sandhill cranes in Cell 2 (each pair had two chicks)

PERMIT MONITORING REQUIREMENTS AND COMPLIANCE

This section summarizes results of monitoring activities conducted during WY2012 while the TC-STA was in a period of stabilization, and evaluates compliance with discharge requirements specified in Specific Conditions 8 and 12 of Taylor Creek permit 0194485-002-GL. All monitoring activities were performed in accordance with Chapter 62-160, F.A.C., and the approved Water Quality Monitoring Plan (SFWMD, 2005) per Specific Condition 14 of the above-referenced permit.

TOTAL PHOSPHORUS

Compliance with the above-referenced permit for total phosphorus (TP) concentrations measured at the inflow and outflow points of the TC-STA was evaluated as follows: "After start-up operations have ended and flow-through operations and discharges have begun, the permittee shall operate and monitor the STA allowing for a stabilization period. The stabilization period for the Taylor Creek STA shall end when 12-month flow-weighted average total phosphorus concentrations at outflow does not exceed, or is equal to, the 12-month flow-weighted mean total phosphorus concentrations." Since the TC-STA was transferred to the District by the USACE on May 5, 2011, the 12-month period used to assess the inflow and outflow concentrations began in May 2011.

During WY2012, monthly flow-weighted mean (FWM) TP concentrations ranged from 81 to 659 micrograms per liter (µg/L) at the inflow and from 54 to 495 µg/L at the outflow (**Table 5**). Water year average inflow and outflow FWM TP concentrations were 341 and 292 µg/L, respectively. Since the 12-month FWM TP concentration at the inflow was higher than the 12-month FWM TP concentration at the outflow, discharges from the TC-STA during WY2012 are deemed in compliance with Specific Condition 8.A.1 of the permit. Therefore, the TC-STA has passed stabilization during WY2012, and has transitioned into post-stabilization (Specific Condition 8.A.2) for WY2013.

Table 5. Monthly summary of flow-weighted mean (FWM) total phosphorus (TP) concentrations (micrograms per liter, or µg/L) at inflow (S-390) and outflow (S-392) stations of the TC-STA during WY2012.

Date	S-390	S-392
May-2011	81	54
Jun-2011	99	85
Jul-2011	526	329
Aug-2011	450	495
Sep-2011	367	308
Oct-2011	659	463
Nov-2011	428	417
Dec-2011	215	207
Jan-2012	152	160
Feb-2012	193	188
Mar-2012	263	193
Apr-2012	246	177
WY2012	**341**	**292**

DISSOLVED OXYGEN

In order to ensure that the project is not responsible for degradation of dissolved oxygen (DO) levels in downstream receiving waters, DO data were evaluated as defined in the permit:

1. If the annual average outflow concentration is not less than applicable criteria (5 mg/L), then the STA shall be deemed in compliance with this condition;

2. If the annual average outflow concentration is less than applicable criteria (5 mg/L) but is greater than or equal to average inflow concentration, then the STA is deemed in compliance with this condition;
3. If the annual average outflow concentration is less than applicable criteria (5 mg/L) and is not greater than average inflow concentration, but a demonstration can be made that the project results in a net DO benefit in receiving waters as a result of decreased nutrients and/or oxygen demand, then the STA is deemed in compliance with this condition; or
4. If the annual average outflow concentration is less than applicable criteria and is not greater than the average inflow concentration, but the aforementioned demonstration cannot be made, then adaptive management measures (e.g., operational or structural modifications) should be taken to ensure that DO conditions are not degraded in receiving waters.

To determine whether the STA contributed to the degradation of oxygen in downstream receiving waters, DO concentrations measured at designated locations were compared using this four-part assessment. A notched box plot of the data was constructed to show differences in DO concentrations among locations for the following: smallest observation (sample minimum), lower quartile (Q1 or 25 th percentile), median (Q2 or 50 th percentile), upper quartile (Q3 or 75 th percentile), and largest observation (sample maximum) (**Figure 4**).

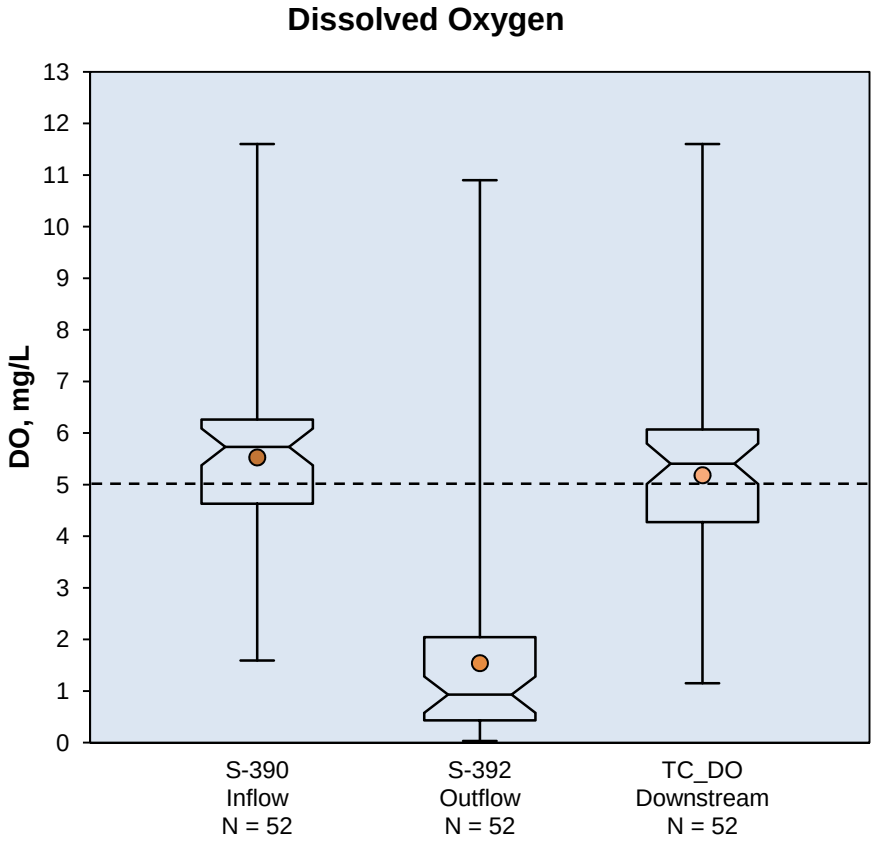


Figure 4. Notched box plot showing dissolved oxygen (DO) concentrations measured at the TC-STA in WY2012. Bottom and top of box are 25th and 75th percentiles, respectively, and line inside box is 50th percentile (median). Ends of whiskers represent minimum and maximum values; dashed line represents lower limit of the Florida Class III criteria for predominantly fresh, surface water (5.0 milligrams per liter, or mg/L) and solid orange dots represent mean DO concentrations.

Percentile values were highest at the inflow structure, with 50 percent of the observations (median or 50th percentile) having DO concentrations of ≥5.73 milligrams per liter (mg/L). Compared to DO concentrations at the inflow station, DO concentrations at the downstream location were lower, with 50 percent of the observations having DO concentrations of ≥5.40 mg/L. DO concentrations at the outflow station were much lower, with a median value (50th percentile) of only 0.93 mg/L. In the notched box plots (**Figure 4**), if the notches of two boxes do not overlap, there is a statistically significant difference between medians. As such, the median DO value at the inflow point of the STA was significantly higher than the median DO concentration at the outflow structure but not at the downstream location. The calculated mean DO values (solid orange dots in **Figure 4**) were slightly lower than the median DO values at the inflow and downstream locations but were higher than the median value at the outflow station. Mean DO levels at the inflow (5.53 mg/L) and downstream (5.18 mg/L) locations are above the lower limit of the Florida Class III criteria for predominantly fresh, surface water (5.0 mg/L, as specified in Section 62-302.530, F.A.C.; see **Table 6**) (dashed line in **Figure 4**). The reduction in DO levels from inflow to outflow can be attributed to periodic spraying of cattail in Cell 2 as part of an effort to establish a healthy mixed marsh and to eradicate undesirable vegetation such as water lettuce. The subsequent decomposition of dead biomass creates a condition conducive to increased oxygen consumption. The persistent "egg rotten smell" at the outfall structure indicates that sulfate is being reduced to sulfide by sulfate-reducing bacteria under low-oxygen conditions.

Overall, while mean DO concentration at the outflow was not greater than mean DO concentration at the inflow, the mean DO concentration of 5.18 mg/L at the downstream location, and the resulting net reduction in TP concentrations put the TC-STA in compliance with Specific Condition 8B.

OTHER WATER QUALITY PARAMETERS

Water quality parameters other than TP and DO were monitored at the inflow and outflow stations of the TC-STA during WY2012 in accordance with Table 1 of permit 0194485-002-GL. Monitoring results for all water quality parameters with and without Florida Class III standards are summarized in **Table 7**. Permit compliance for water quality parameters other than TP and DO was evaluated as defined in the permit:

1. If the average outflow concentration does not exceed applicable criteria, then the STA is deemed in compliance;
2. If the average outflow concentration causes or contributes to an exceedance of applicable criteria, but does not exceed or is equal to, the average inflow concentration, then the STA is deemed in compliance;
3. If the average outflow concentration causes or contributes to an exceedance of applicable criteria, and also exceeds the average inflow concentration, then the STA is deemed out of compliance.

Table 6. Water quality parameters with Florida Class III surface water criteria specified in Section 62-302.530, F.A.C.

Parameter	Unit*	Class III Criteria
Dissolved Oxygen	mg/L	Greater than or equal to 5.0 mg/L
Specific Conductivity	µS/cm	Not greater than 50% of background or greater than 1,275 µS/cm, whichever is greater
pH	SU	Not less than 6.0 or greater than 8.5
Turbidity	NTU	Less than or equal to 29 NTU above background conditions
Alkalinity	mg/L	Not less than 20 mg/L
Unionized Ammonia	mg/L	Less than or equal to 0.02 mg/L

*mg/L – milligrams per liter
µS/cm – microSiemens per centimeter
SU – standard units
NTU – nephelometric turbidity unit

To determine whether the STA contributed to a violation for a specific parameter, the water year average inflow concentration was compared to the average outflow concentration for each parameter, respectively (**Table 7**). Average specific conductivity at the outflow (689 microsiemens per centimeter, or µS/cm) was slightly higher than the average conductivity at the inflow (678 µS/cm) but both are well below the Florida Class III standard of 1,275 µS/cm. Average turbidity values of 4.4 and 2.6 nephelometric turbidity units (NTUs) at the inflow and outflow stations, respectively, were several-fold lower than the allowable turbidity value of 29 NTUs. Water pH averaged 7.1 at the inflow and 7.0 at the outflow, which are within the pH limits of 6.0-8.5. Alkalinity values were markedly greater than Class III minimum standard of 20 mg/L, with a mean of 97 mg/L at the inflow and 100 mg/L at the outflow. Sulfate levels at the inflow and outflow stations averaged 64.6 and 60.9 mg/L, respectively. There was a substantial reduction in nitrate+nitrite-N (N represents nitrogen) from inflow to outflow, but slight increases in orthophosphorus (OP) and total ammonia concentrations at the outflow were noted. Average unionized ammonia concentrations of 0.64 µg/L at the inflow and 1.5 µg/L at the outflow were well below the Class III standard of 20 µg/L. Total nitrogen (Total Kjeldahl N + nitrate+nitrite-N) averaged 1.70 and 1.61 mg/L at the inflow and outflow, respectively, for a 5 percent reduction. Chloride concentrations were similar at both the inflow and outflow. As none of the water quality parameters with Class III standards caused or contributed to an exceedance of applicable water quality standards in terms of average outflow concentrations, the TC-STA is deemed in compliance with Specific Condition 8C of the permit.

Table 7. Summary of other water quality parameters measured at the TC-STA during WY2012. [Note: Includes number of excursions for parameters with Florida Class III surface water criteria, Section 62-302.530, F.A.C.]

Parameter[a]	# of Obs.	Mean[b]	Std Dev[c]	Min	Percentiles			Max	Excursions[d]
					25th	50th	75th		
Inflow (S-390)									
Water Temperature (°C)	52	24.2	3.9	15.8	21.5	24.2	28.2	30.6	
Water pH	52	7.1	0.3	6.2	6.9	7.0	7.3	7.7	0(52)
Specific Conductivity (µS/cm)	52	678	319	162	494	642	762	1520	4(52)
Total Suspended Solids (mg/L)	25	5.5	2.1	1.5	4.0	5.0	6.0	12.0	
Turbidity (NTU)	25	4.4	1.4	2.0	3.2	4.4	5.4	8.1	0(25)
Total Dissolved Solids (mg/L)	25	438	169	222	336	394	478	866	
Total Alkalinity (mg/L)	25	97	40	45	64	87	129	186	0(25)
Chloride (mg/L)	25	112	72	40	68	88	117	289	
Total Ammonia-N (mg/L)	26	0.095	0.104	0.005	0.019	0.054	0.150	0.441	
Unionized Ammonia (µg/L)	26	0.64	0.61	0.06	0.22	0.35	1.04	2.32	0(26)
Nitrate+Nitrite (mg/L)	26	0.178	0.212	0.005	0.005	0.014	0.290	0.672	
Total Nitrogen (mg/L)	52	1.697	0.486	0.930	1.266	1.586	2.119	2.663	
Orthophosphorus (mg/L)	26	0.239	0.218	0.026	0.090	0.159	0.311	0.867	
Sulfate (mg/L)	14	64.6	25.0	15.9	52.4	67.0	88.5	95.9	
Outflow (S-392)									
Water Temperature (°C)	52	23.4	3.8	14.4	21.3	23.3	27.2	28.9	
Water pH	52	7.0	0.4	6.5	6.8	7.0	7.2	8.3	0(52)
Specific Conductivity (µS/cm)	52	689	307	240	468	659	767	1498	4(52)
Total Suspended Solids (mg/L)	25	1.5	0.0	1.5	1.5	1.5	1.5	1.5	
Turbidity (NTU)	25	2.6	1.8	0.7	1.2	2.3	3.4	6.6	0(25)
Total Dissolved Solids (mg/L)	25	427	177	172	296	392	467	842	
Total Alkalinity (mg/L)	25	100	34	57	76	96	122	180	0(52)
Chloride (mg/L)	25	114	85	43	65	88	107	404	
Total Ammonia-N (mg/L)	26	0.195	0.178	0.029	0.060	0.106	0.378	0.577	
Unionized Ammonia (µg/L)	26	1.51	1.66	0.11	0.56	1.13	1.89	8.47	0(26)
Nitrate+Nitrite (mg/L)	26	0.014	0.016	0.005	0.005	0.008	0.016	0.080	
Total Nitrogen (mg/L)	51	1.607	0.406	0.977	1.216	1.585	1.905	2.496	
Orthophosphorus (mg/L)	26	0.258	0.196	0.019	0.118	0.201	0.377	0.779	
Sulfate (mg/L)	14	60.9	25.4	11.8	41.4	63.9	84.2	92.0	
Downstream Monitoring Station (TC_DO)									
Water Temperature (°C)	52	24.3	4.0	15.0	21.7	24.0	28.4	30.9	
Water pH	52	7.2	0.4	6.3	6.9	7.1	7.4	8.2	0(52)
Specific Conductivity (µS/cm)	52	739	386	187	433	687	868	1672	7(52)

[a]Measured on either weekly or biweekly grab sample; nitrate+nitrite and total Kjeldahl N were measured on biweekly auto-samples
[b]Arithmetic mean
[C]Standard deviation
[d]Excursions from Florida Class III surface water standard, Section 62-302-530, F.A.C.; those parameters with Florida Class III criteria contain number of excursions (total number of samples)

MERCURY

In accordance with Specific Condition 12 of Taylor Creek permit 0194485-002-GL, total mercury (THg) in surface water and fish samples, and methylmercury (MeHg) in surface water were monitored quarterly at designated locations in the TC-STA during WY2012 (see **Table 8a**). The monitoring at the TC-STA falls under Phase 2 - Tier 1, in accordance with FDEP's protocol for monitoring mercury and other toxicants. No surface water and fish samples were collected in the last quarter of WY2012 due to a scheduling error. Averaged over three sampling events, THg level was 3.5 nanograms per liter (ng/L) at the inflow (S-390) and 1.2 ng/L at the outflow (S-392). These values are well below the United States Environmental Protection Agency (USEPA) Class III numerical water quality standard of 12 ng/L. Average THg levels showed a net reduction of nearly 70 percent from inflow to outflow. The average MeHg concentration was 0.61 ng/L at the inflow, and 0.13 ng/L at the outflow, which represents almost an 80 percent reduction.

Table 8a. Surface water total mercury (nanograms per liter, or ng/L) and methylmercury concentrations at the inflow (S-390) and outflow (S-392) stations of the TC-STA during WY2012.

Station ID	Collection Date	THg (ng/L)	MeHg (ng/L)
S-390	17-May-11	1.2	0.19
	08-Aug-11	5.5	1.10
	08-Nov-11	3.8	0.55
S-392	17-May-11	0.7	0.11
	08-Aug-11	1.0	0.23
	08-Nov-11	2.0	0.07

Average THg concentrations for the different fish species were generally low (**Table 8b**). THg concentrations in mosquitofish (*Gambusia holbrooki*) samples were 32.3 ng/g at the interior (TCSTAC) and 31 ng/g at the downstream site (TCDS). These values are considerably below the USEPA trophic level (TL) 3 limit for fish (77 ng/g[1]) and do not exceed the 75th percentile concentration of 84 ng/g for the period of record for the Everglades Protection Area. Similarly, none of the THg concentrations in sunfish/bluegill (*Lepomis* spp.) samples from Cell 2 (TC2) and downstream location (TCDS) exceeded the USEPA TL 3 limit of 77 ng/g. Largemouth bass (*Micropterus salmoides*) samples collected at the downstream location (TCDS) showed THg concentrations also below the USEPA recommended consumption limit of 346 ng/g for TL 4 fish. THg concentrations in sunfish/bluegill and largemouth bass did not exceed the 75th percentile concentrations of 242 and 690 ng/g, respectively, for the Everglades Protection Area. In summary, no violations of USEPA water quality standards for surface water and fish were recorded for the TC-STA during WY2012.

[1] TL3 criterion is used as a surrogate for mosquitofish (*Gambusia* spp.), which is considered to be representative of fish species between TL2 and TL3.

Table 8b. Total mercury (THg) concentrations (nanograms per gram, or ng/g) in fish samples monitored at the TC-STA during WY2012. [Note: Values are on a wet weight basis.]

Station ID[a]	Collection Date	Fish Species	THg (ng/g)
TC2	29-Nov-11	Bluegill sunfish	28
TCSTAC	16-May-11	Mosquitofish	31
	08-Aug-11	Mosquitofish	41
	14-Nov-11	Mosquitofish	25
TCDS	16-May-11	Mosquitofish	31
	08-Aug-11	Mosquitofish	43
	14-Nov-11	Mosquitofish	19
	29-Nov-11	Bluegill sunfish	46
	29-Nov-11	Largemouth bass	240

[a] TC2 – TC-STA Cell 2; TCDS – Taylor Creek downstream;
TCSTAC – Composited mosquitofish sample from Cells 1 and 2.

PESTICIDES

With the approval of the SFWMD's request to eliminate pesticide monitoring at the TC-STA effective October 7, 2011 (per Specific Condition 17), collection and analysis of water and fish samples for various pesticides were conducted only during the first and second quarters of WY2012. Pesticide monitoring at the TC-STA is currently in Phase 2 - Tier 1, according to FDEP's protocol for monitoring mercury and other toxicants. Pesticide concentrations in surface water were all below detection limits, with the exception of hexazinone, which was detected at the permitted inflow point of the TC-STA on May 17, 2011 (**Table 9**). Hexazinone is a non-selective contact herbicide that inhibits photosynthesis (USDOE-BPA, 2000). Ecological effects data indicate that hexazinone is practically non-toxic to freshwater invertebrates and fish in acute exposures (USEPA, 1994). As such, the detected surface water concentration of 0.047 µg/L is not expected to have an acute or chronic detrimental effect on fish or aquatic invertebrates. Pesticide concentrations monitored in all fish samples collected at the interior (TCSTAC) and at the downstream location (TCDS) of the STA were below detection limits.

Table 9. Pesticides monitoring results for water and fish samples collected at the TC-STA during the first two quarters of WY2012.

Station ID[a]	Collection Date	Sample Type	Compound Detected	Value[b]	Unit
S-390	17-May-11	Surface water	None	0.047	µg/L
	08-Aug-11	Surface water	None	BDL	µg/L
S-392	17-May-11	Surface water	None	BDL	µg/L
	08-Aug-11	Surface water	None	BDL	µg/L
TCSTAC	16-May-11	Mosquitofish	None	BDL	µg/kg
	08-Aug-11	Mosquitofish	None	BDL	µg/kg
TCDS	16-May-11	Mosquitofish	None	BDL	µg/kg
	08-Aug-11	Mosquitofish	None	BDL	µg/kg

[a] S-390 (inflow); S-392 (outflow); TCDS – Taylor Creek downstream;
TCSTAC – Composited mosquito fish sample from Cells 1 and 2
[b] BDL – below detection limit

STA PERFORMANCE EVALUATION

This section summarizes TC-STA performance for the current reporting year and provides comparison with performance of previous years as required in Specific Condition 16B of the Taylor Creek permit 0194485-002-GL. As of April 30, 2012, the TC-STA has had nearly 28 months of flow-through operation; 8 months in WY2009 (June 26, 2008–February 24, 2009), slightly less than 8 months in WY2011 (September 8, 2010–April 30, 2011), and a full 12 months in WY2012 (May 1, 2011-April 30, 2012). The TC-STA retained 1.44 mt of TP out of 4.63 mt that was received in WY2009, for a treatment efficiency of 31 percent (**Table 10**). FWM TP concentrations at the inflow and outflow during this period averaged 408 and 295 µg/L, respectively, for a TP concentration reduction of 27 percent. The TC-STA was offline the entire WY2010; therefore, no performance data was recorded. After flow-through operations were resumed on September 8, 2010, the TC-STA removed 0.91 mt of TP through the end of WY2011 (April 30, 2011). TP treatment efficiency for WY2011 was almost 64 percent. While the STA showed high treatment efficiency, the actual TP load removed during WY2011 was much lower than the projected annual load reduction of 2.02 mt of TP per year. This was largely due to much lower TP concentrations in the source water during WY2011, which was a relatively dry year. The FWM inflow TP concentration averaged 167 µg/L, which was considerably lower than the average TP concentration of 408 µg/L recorded in WY2009. Also, as the STA was not operational during the first four months of WY2011 (May–August), there was no opportunity to capture and treat high TP runoff from the Taylor Creek drainage basin during this period, which accounted for 63 percent of the total rainfall received by the region in WY2011 (SFWMD, 2012).

Table 10. Summary of calculated operational parameters and performance metrics for the TC-STA by water year. [Note: TC-STA was off-line for the entire WY2010.]

Parameter	WY2009	WY2011	WY2012
Period of operation, d	244	235	366
Total inflow volume, ac-ft	9,218	6,988	13,188
Hydraulic loading rate, cm/d	10.04	7.70	9.26
Inflow FWM TP conc., µg/L	408	167	341
Total inflow load, mt	4.64	1.44	5.51
TP mass loading rate, $g/m^2/d$	0.038	0.014	0.031
Total outflow volume, ac-ft	8,767	6,257	12,208
Outflow FWM TP conc., µg/L	295	68	292
Total outflow load, mt	3.12	0.52	4.40
Hydraulic residence time, d	6.34	7.75	6.52
TP mass removed, mt	1.44	0.91	1.11
TP concentration reduction, %	27.5	59.3	14.4
TP load reduction, %	31.1	63.6	20.2

WY2012 marked the first time the STA had an opportunity to operate for a full water year without any interruptions. During WY2012, the TC-STA captured and treated 13,188 ac-ft of runoff water from the Taylor Creek drainage basin, which is equal to an average hydraulic load of 9.26 cm/d (**Table 10**). The volume of treated water discharged back into Taylor Creek during the period was 12,208 ac-ft. Hydraulic retention time (HRT), the average length of time the runoff remained within the STA averaged 6.52 days, which is close to the designed HRT of 7 days. FWM TP concentrations measured at the inflow and outflow points of the STA averaged 341 and 292 µg/L, respectively, for a TP concentration reduction of just over 14 percent. TP loading over the effective treatment area of the TC-STA averaged 0.031 $g/m^2/d$, which is comparable to TP loading recorded in WY2009 and more than twice the TP loading in WY2011, an extremely dry year. A total of 5.51 mt of TP were loaded into the STA in WY2012. There were 4.40 mt of TP discharged back into Taylor Creek, giving a net TP load removal of 1.11 mt and a TP removal efficiency of 20 percent. These results are well below the projected annual TP load reduction of 2.02 mt and treatment efficiency of 38 percent.

The below projected performance of the TC-STA during WY2012 was attributed to an unprecedented number of reversals in weekly TP concentrations. Reversal simply means that the TP concentration measured at the outflow was higher than the TP concentration measured at the inflow. The TC-STA had fifteen reversals (averaging 43 µg P/L) during WY2012, nine of which were recorded from November 10, 2011–February 15, 2012 (**Figure 5**). TP load removals during this period were very low and, for the first time since the TC-STA has been operational, a net export of TP was reported in January 2012 (**Table 11**).

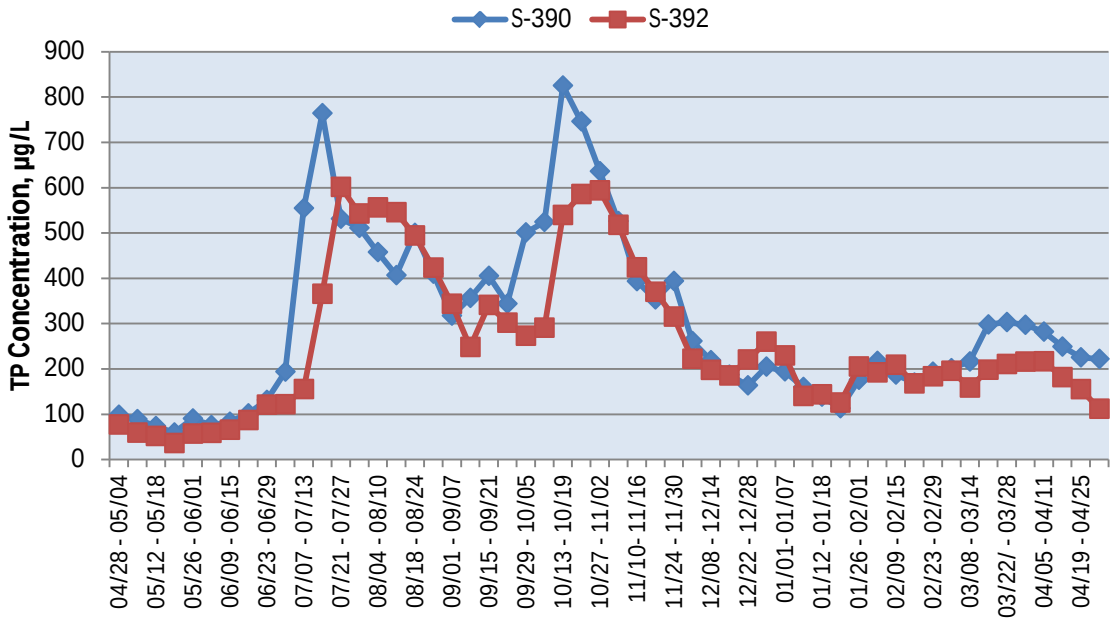


Figure 5. Weekly FWM TP concentrations at the inflow (S-390) and outflow (S-392) points of the TC-STA for WY2012.

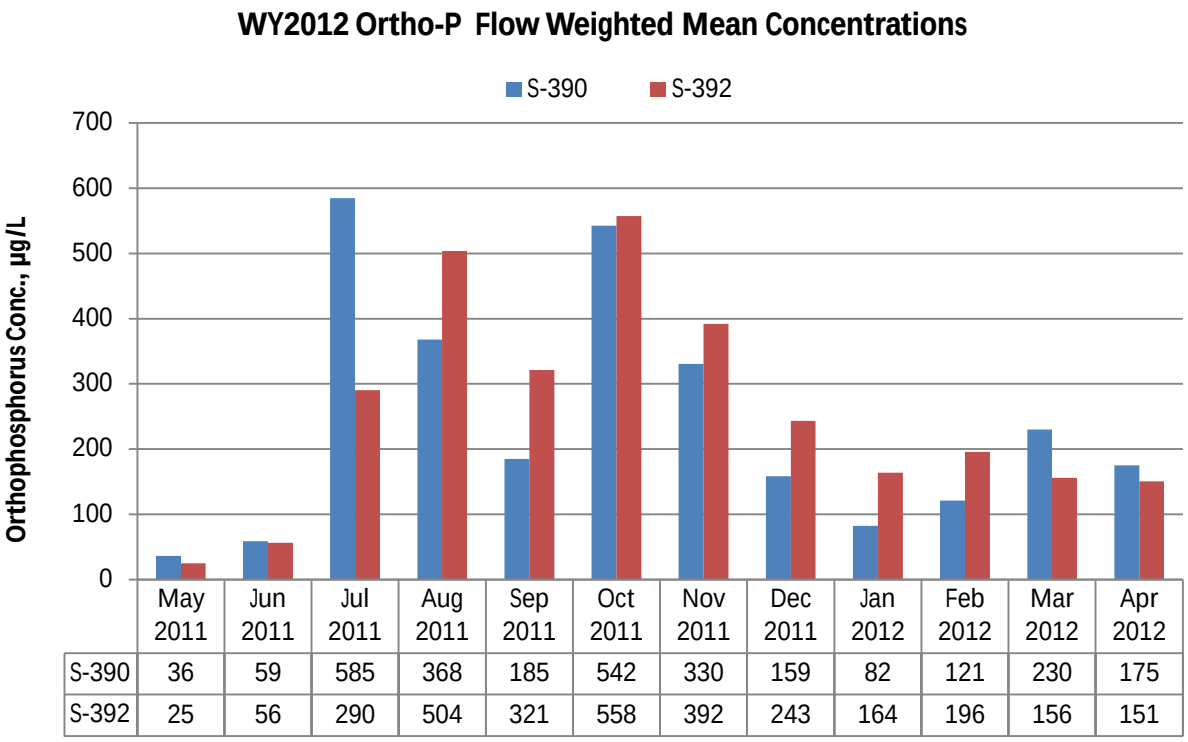
Table 11. Monthly TP loads (metric tons, or mt) at the inflow (S-390) and outflow (S-392) and TP loads removed for the TC-STA during WY2012.

Date	S-390	S-392	TP Load Removed[a]
May-2011	0.086	0.046	0.040
Jun-2011	0.099	0.069	0.030
Jul-2011	0.549	0.318	0.231
Aug-2011	0.679	0.677	0.002
Sep-2011	0.693	0.567	0.126
Oct-2011	1.347	0.942	0.405
Nov-2011	0.856	0.791	0.065
Dec-2011	0.348	0.303	0.045
Jan-2012	0.149	0.158	-0.009
Feb-2012	0.194	0.166	0.028
Mar-2012	0.264	0.201	0.063
Apr-2012	0.252	0.163	0.086

[a]S-390 load-S-392 load; (-) indicates load reversal.

The lack of consistency in system performance during WY2012 was manifested by reversals in both TP and OP concentrations. Because OP accounts for almost 80 percent of the TP in Taylor Creek water, the net reduction in TP concentration at the STA is largely influenced by the proportion of OP at the inflow to OP at the outflow. Typically, a net reduction in TP concentration and, often times, positive TP load removals would indicate a reduction in OP from inflow to outflow. Between August 2011 and February 2012, the monthly average FWM OP concentration was higher at the outflow than the FWM OP concentration at the inflow (**Figure 6**). The magnitude of difference varied considerably from month to month. However, for the entire water year both OP concentrations and loads measured at the outflow were higher than OP concentrations and loads measured at the inflow, a trend not seen in previous water years (**Table 12**). The TC-STA removed only 20 percent of the TP load it received in WY2012, the lowest of the three water years (**Table 12**).

At this time, there is no conclusive evidence that would link any soil, vegetation, and hydrologic conditions to the lack of phosphorus treatment documented in WY2012. Vegetation enhancement and management activities are being implemented in an effort to improve system performance.



	May 2011	Jun 2011	Jul 2011	Aug 2011	Sep 2011	Oct 2011	Nov 2011	Dec 2011	Jan 2012	Feb 2012	Mar 2012	Apr 2012
S-390	36	59	585	368	185	542	330	159	82	121	230	175
S-392	25	56	290	504	321	558	392	243	164	196	156	151

Figure 6. Monthly orthophosphorus (OP) FWM concentrations at the inflow and outflow points of the TC-STA during WY2012.

Table 12. OP FWM concentrations (µg/L) and loads (mt) and STA treatment efficiency (%) by water year.

Water Year	Inflow (S-390)		Outflow (S-392)		Inflow-Outflow[a]		Percent Treatment Efficiency
	Load (mt)	**FWM** (µg/L)	**Load** (mt)	**FWM** (µg/L)	**Load** (mt)	**FWM** (µg/L)	
2009	3.880	341	2.908	269	0.972	72	31
2011	1.095	127	0.305	40	0.790	87	64
2012	4.250	263	4.498	299	-0.248	-36	20

[a] (-) indicates load or concentration reversal.

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Attachment A: Specific Conditions and Cross-References

Table A-1. Specific conditions, actions taken, and cross-references presented for the Taylor Creek Stormwater Treatment Area Project (NEEPP Permit #0194485-002-GL) in this report.

Specific Condition	Description	Applicable Phase	Action Taken	Reported in the 2013 SFER in: *(All references are to Volume III, unless otherwise noted)*			
				Narrative (page #'s)	**Figure**	**Table**	**Attachment**
8	Stabilization/Post Stabilization	Stabilization	No action needed	2			
8A1	Phosphorus/Stabilization	Stabilization	Demonstrated 12-month flow-weighted mean TP concentration was greater at inflow than outflow	7-8		5	B
8B	Dissolved Oxygen	Stabilization	Water year average concentration at downstream location above applicable criteria	8	4		B
8C	Other Water Quality Parameters	Stabilization	No water quality parameters with Class III standards contributed to exceedance of applicable water quality standards in terms of average outflow concentrations	10, 12		6-7	B
9	Vegetation Conditions	Stabilization	Continued to implement vegetation enhance and management plan	5	3		
10	Factors Outside the Permittee's Control	Stabilization	No action needed				
11	Monitoring Requirements	Stabilization	Monitoring program conducted in accordance with Table 1 and Specific Condition 16	8			
12	Mercury and Pesticide Monitoring	Stabilization	Monitoring for these parameters conducted in accordance with SFWMD's water quality monitoring plan	13-14		8a, 8b, 9	B
13	Turbidity Monitoring	Stabilization	Not applicable				
14	Quality Assurance and Quality Control	Stabilization	Sampling and analysis performed per Chapter 62-160, F.A.C., and SFWMD's water quality monitoring plan	8			
15	Method Detection Limits	Stabilization	No action needed				
16	Annual Monitoring Reports	Stabilization	Prepared and submitted annually	1-2		1	
16A	Water Quality Data	Stabilization	Water quality data collected per Chapter 62-160, F.A.C. and SFWMD's water quality monitoring plan	8-14	4	5-9	B

16B	Performance Evaluation	Stabilization	STA performance during WY2012 evaluated and compared with performance of previous years	15-18	5,6	10-12	B
16C	Hydraulic Retention Time	Stabilization	No action needed				
16D	Herbicide and Pesticide Tracking	Stabilization	Herbicide usage during WY2012 summarized in the report	6		3	
16E	Implementation Schedules	Stabilization	No action needed				
17	Removal of Parameters	Stabilization	SFWMD's request to eliminate pesticide approved by FDEP effective Oct. 7, 2011	14			
18	Addition of Parameters	Stabilization	No action needed				
20	Permit Modifications for Design Changes	Stabilization	No action needed				
21	Permit Renewal	Stabilization	Permit renewed on July 21, 2011 to extend STA operation through June 9, 2016	2			
22	Department Review and Approval	Stabilization	Mutual agreement reached on remedial actions and plan modifications				

Attachment B: Water Quality Data

This project information is required by Specific Condition 16A of the Taylor Creek STA permit (0194485-002-GL), and is available upon request.