Everglades Agricultural Area Regional Feasibility Study

Deliverable 1.3.2 – Historic Inflow Volumes and Total Phosphorus Concentrations by Source (Final Report)

(Contract No. CN040912-WO04 Phase 2)

Prepared for:

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June 2005

June 27, 2005

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EAA Regional Feasibility Study
ADA Contract No. CN040912-WO04 Phase 2
Historic Inflow Volumes and Total Phosphorus Concentrations by Source
B&McD Project No. 38318

Dear Mr. Vazquez:

Burns & McDonnell is pleased to submit this Final report titled "Historic Inflow Volumes and Total Phosphorus Concentrations by Source". This document constitutes Deliverable 1.3.2 under ADA Engineering, Inc. Task Order No. BM-05WO04-02 dated April 27, 2005.

We gratefully acknowledge the valuable contributions of both your staff and that of the South Florida Water Management District in the development of the information presented herein.

Certification

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1. INTRODUCTION

This report documents the work completed to characterize the anticipated total phosphorus (TP) concentrations in future inflows to the stormwater treatment areas (STAs). This report is the principal deliverable under Task 1.3 in Phase 2 of the Everglades Agricultural Area (EAA) Regional Feasibility Study (RFS).

1.1. Background

Under the Everglades Construction Project (ECP), the South Florida Water Management District (District) has constructed several STAs to help improve the quality of waters released to the Everglades Protection Area (EPA). In addition to the existing STAs, the District is planning certain STA expansions and enhancements, EAA canal improvements, construction of the EAA Storage Reservoir Project, and other EAA improvements. With recognition of these planned improvements, the EAA RFS will evaluate alternatives for redistributing inflow volumes and phosphorus loads to the various STAs to optimize phosphorus removal performance. This study is not intended to define the final arrangement, location or character of these proposed projects but is a fact-finding exercise to develop the information necessary for the subsequent planning, design and construction of these future projects.

1.2. Scope of Work

The EAA RFS, Phase 2 is being performed under Contract CN040912, Work Order No. 4 (CN040912-WO04), which was issued March 27, 2005, between the District and ADA Engineering Inc (ADA). ADA has subcontracted portions of the work under this Phase 2 study, including the current Task 1.3, to Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell). Burns & McDonnell's portion of the work under Phase 2 has been authorized by ADA under Task Order BM-05WO04-02, issued April 27, 2005.

The work for Phase 2 is segregated into eight primary tasks. The first of these tasks, Task 1, involves the collection of baseline data for the principal drainage basins of the EAA. Task 1 is further divided into five subtasks, which are outlined below:

- Task 1.1 – Evaluate 2006 hydrologic simulation results
- Task 1.2 – Evaluate 2010 and 2015 hydrologic simulation results
- Task 1.3 – Develop inflow volumes, and total phosphorus concentrations and loads
- Task 1.4 – Define methodology to develop STA inflow datasets
- Task 1.5 – Develop inflow datasets for STAs

For Task 1.3, Burns & McDonnell developed inflow volumes, and total phosphorus concentrations and loads to the STAs, segregated by source, from District-supplied data. These historic volumes, concentrations and loads were developed for the 10-year period May 1, 1994, through April 30, 2004, or water years (WY) 1995–2004. From these data on inflows and phosphorus loads, relationships between inflows and phosphorus loads were then investigated.

1.3. Source Data

Most of the base data used in Task 1.3 were supplied directly by the District. These data included daily estimates of the historic discharge, TP concentration, and TP load at each pertinent water control structure or other monitoring location within or adjacent to the EAA. These estimates of TP concentration and load were developed using the District's EAATPLD program. This computer program was developed to provide a standardized procedure for estimating TP loads from the EAA basin. This procedure and the source code for the EAATPLD program are codified in the District's administrative rule titled *Everglades Regulatory Program: Everglades Agricultural Area (EAA) Basin* (Chapter 40E-63, F.A.C.). In subsequent sections, this administrative rule is referred to as Rule 40E-63.

The data described above were delivered to ADA and Burns & McDonnell in an electronic format, as Microsoft Excel workbook files. The general contents of these workbook files are described below.

- Control Data: The first worksheet in each workbook file contains control parameters for the EAATPLD program.
- DBKEYs: All of the discharge data supplied as input to the EAATPLD program were obtained from DBHYDRO, the District's corporate environmental database. The specific retrieval keys (DBKEYs) for each discharge record and associated periods of

record are documented in the same worksheet as the control data or in a second worksheet.

- Excluded Outliers: The EAATPLD program contains a simple statistical test to identify outliers — TP sampling results that are outside of the normal range of values (too low or too high). These outliers are considered to be unreliable and were not used in estimating TP loads at the associated monitoring point. The next worksheet in each workbook identifies any outliers that were excluded by the EAATPLD program.
- Daily Flow and TP Load Estimates: In a separate worksheet for each location, the daily estimates of flow, TP load, and TP concentrations are provided. For those structures where the flow is bidirectional, separate estimates of flow and TP loads are provided for each flow direction. The periods of record for these data varies, with data at some locations covering WY 1990–2004 although any data supplied prior to WY 1995 were excluded from the analyses conducted in Task 1.3. As a result of the Everglades Construction Project, many new control structures have been built within the EAA in recent years and other control structures or monitoring locations have become obsolete; therefore, many of these structures do not have data available for the entire 10-year study period.

Twelve separate workbook files, each with the same general format described above, were provided by the District. The names of these files and a brief description of their contents are listed below:

- eaa_rule_mod1_WY90_WY04.xls: This first workbook file contains the majority of the supplied data. All of the estimates in this file follow the original conventions that are described in Rule 40E-63.
- eaa_reverse&flowthru_WY90_WY04.xls: This supplementary file contains estimates for reverse flows — flow into the EAA Basin from the EPA or Lake Okeechobee — at several of the major pump stations and other control structures. Also in this file are revised estimates of the TP load in basin flow-through volumes — water released from Lake Okeechobee that flows through the EAA basin on its way to the EPA.
- s5a_complex_WY90_WY04.xls: This workbook file contains flow and TP load estimates for additional control structures at the S5A complex, including documentation of flow out of and into the L-8 Basin.

- c51_s5ae_sr7.xls: Flow volumes and TP load data for structure S-5A East and the C-51 Canal at State Route 7 are contained in this workbook.
- acme_basin b_data.xls: This workbook contains data for the two pump stations from the ACME Basin B area.
- lake_o_298_district.xls: This workbook contains discharge volume and TP data for the Chapter 298 drainage districts on the east and south shores of Lake Okeechobee.
- EPD-07.xls: Additional data for the EPD-07 (P-5-W) pump station are included in the workbook, which supplement that provide in the prior file for the South Florida Conservancy District.
- l3_confusioncorner.xls: This workbook contains data for the L-3 Borrow Canal.
- sta5_g342abcd_g406.xls: Discharge volume and TP load data for the new structures associated with STA-5 are included in this workbook.
- usso_data Cheol Mo.xls: This workbook contains discharge data for the U.S. Sugar outflow from the C-139 Annex basin.
- SSDD.xls: Discharge and phosphorus load data for the South Bay pumping station are included in this workbook file.
- Rotenberger_g402A.xls: This final workbook contains daily data for the G-402A, which is one of the discharge structures from the Rotenberger tract to the Miami Canal.

Supplemental flow and TP sampling data, used to extend the record at certain control structures through WY 2005, were provided by Gary Goforth, Inc; however, these data did not include actual estimates of TP load at these same structures as were provided by the District. The data obtained from Gary Goforth, Inc. were contained in the three Excel workbook files listed below:

- STA 5 flow and tp data.xls
- STA 6 wy2005.xls
- USSO 4 05 water-quality.xls:

Regardless of source, nearly all of the base data used in these analyses are available from the District's DBHYDRO database. The specific data retrieval keys (DBKEYs) for flow data and monitoring station names for water quality data used to extract this information from DBHYDRO are listed in Appendix A. At some structures, more than one set of flow data are

available from DBHYDRO. When and where available, preference was given to the Regional Modeling flow dataset (coded as type MOD1 in DBHYDRO).

1.4. Basin Flow and TP Balances

Flow and TP balances were developed for each of the primary drainage basins in the EAA for a 10-year period that includes WY 1994–2004. These balances show the magnitude of any volumetric or phosphorus inflow or outflow at the available water control structures and other monitoring locations. Any net discharge from or depletions within a particular basin that are unaccounted for in the monitoring data are assumed to be basin runoff or water supply depletions, respectively. These net runoff/depletion values are actually an agglomeration that can include water and associated phosphorus loads from or to any of the following sources:

- Factors contributing to increases in net basin discharge
  - Stormwater runoff
  - Field drainage other than in response to rainfall
  - Direct precipitation on basin drainage canals
  - Decrease in canal storage due to lowering stages
  - Groundwater discharge or seepage
- Factors contributing to reductions in net basin discharge
  - Water supply (irrigation) withdrawals
  - Direct evaporation from basin drainage canals
  - Increase in canal storage due to rising stages
  - Groundwater recharge

The specific methods and assumptions used to develop the flow and TP balances for each basin are presented in subsequent chapters in this report.

* * * * *

2. S-5A BASIN

The S-5A drainage basin is located in northwestern Palm Beach County and the principal drainage canals in this basin are the L-10/L-12 Borrow Canal (West Palm Beach Canal) and the Ocean Canal (L-13 Borrow Canal). The L-10/L-12 Borrow Canal connects Lake Okeechobee at control structure S-352 with the S-5A complex. From this complex, water can be conveyed to the L-8 or C-51 West basins, or to STA-1W, STA-1E or Water Conservation Area (WCA) No. 1 (also known as the Arthur R. Marshall Loxahatchee National Wildlife Refuge). The Ocean Canal joins the S-5A Basin with the S-6 Basin to the west but interbasin flows in this canal are not monitored and considered to be relatively insignificant (Cooper, 1989). A block diagram, which shows the principal structures that control the flow of water into and out of the S-5A Basin and adjacent basins, is included as Figure 2.1.

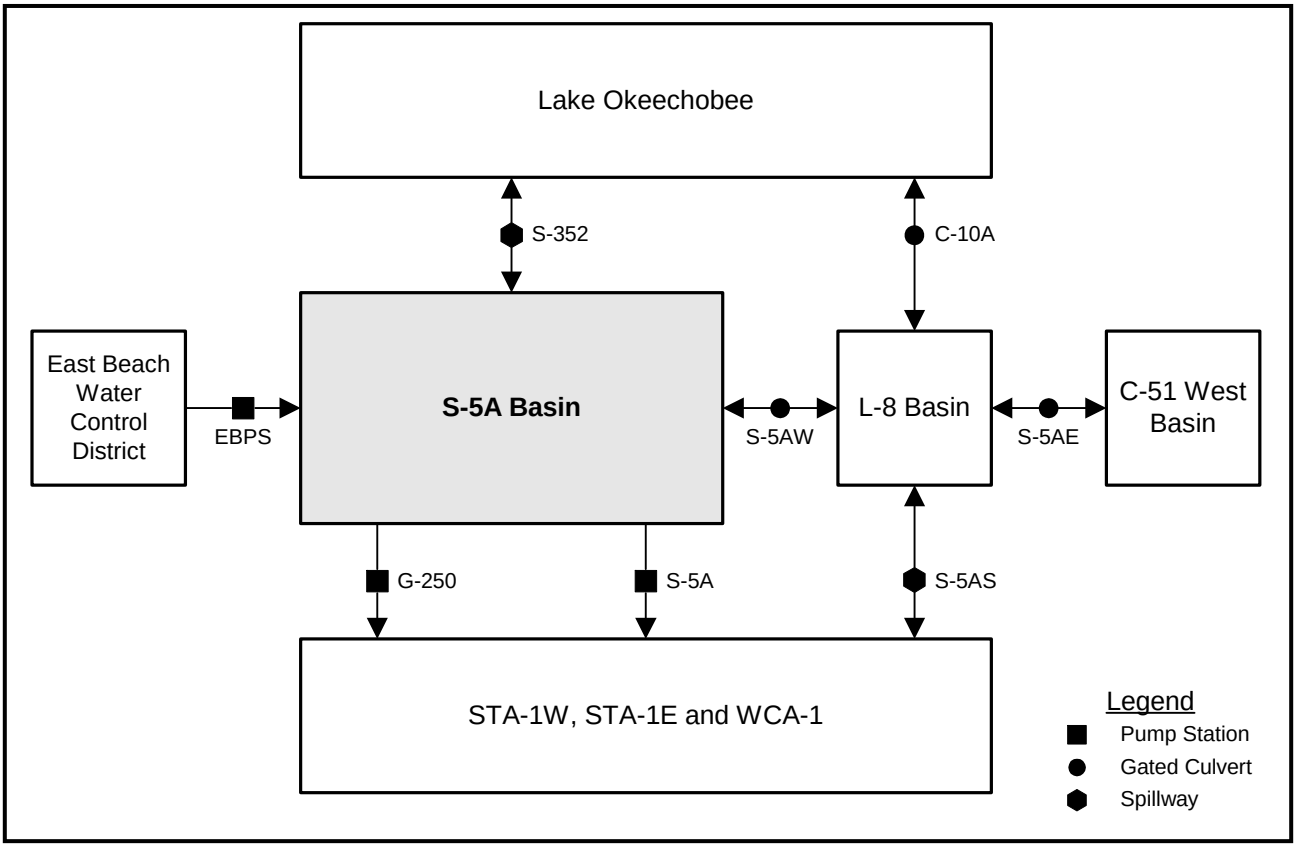

Figure 2.1: S-5A Basin Schematic

The flow and TP load through each of the principal control structures in this basin are discussed in the following sections.

2.1. S-352 Spillway

S-352 is a gated spillway that controls flow between Lake Okeechobee and the northern end of the L-10/L-12 Borrow Canal. Current District policy discourages discharges from the basin to Lake Okeechobee so the predominant flow direction in the basin is from north to south. In fact during the study period (WY 1995–2004), there was only one day when water was discharged to Lake Okeechobee. This occurred on October 5, 2000, when the average discharge rate, total TP load and average TP concentration were 53 cubic feet per second (cfs), 32 kilograms (kg), and 247 parts per billion (ppb), respectively. Table 2.1 summarizes the volumetric and TP discharges between Lake Okeechobee and the S-5A Basin by water year. Listed at the bottom of this table are minimum, maximum and average annual values for these discharges. A summary of average monthly discharge volumes, and TP loads and concentrations for this same structure is shown in Table 2.2.

Table 2.1: Annual Discharge Summary at S-352

Water Year	From Lake Okeechobee to S-5A Basin				From S-5A Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	171,193	211.16	27,419	130	0	0.00	0	---
1996	242,912	299.63	43,919	147	0	0.00	0	---
1997	121,904	150.37	23,829	158	0	0.00	0	---
1998	109,438	134.99	32,311	239	0	0.00	0	---
1999	262,772	324.12	63,083	195	0	0.00	0	---
2000	164,604	203.04	45,571	224	0	0.00	0	---
2001	128,561	158.58	31,371	198	105	0.13	32	247
2002	63,813	78.71	15,236	194	0	0.00	0	---
2003	427,018	526.72	100,999	192	0	0.00	0	---
2004	87,737	108.22	21,159	196	0	0.00	0	---
Min.	63,813	78.71	15,236	---	0	0.00	0	---
Max.	427,018	526.72	100,999	---	105	0.13	32	---
Avg.	177,995	219.55	40,490	184	11	0.01	3	247

Table 2.2: Average Monthly Discharge Summary at S-352

Month	From Lake Okeechobee to S-5A Basin				From S-5A Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	19,460	24.00	5,839	243	0	0.00	0	---
Feb	14,260	17.59	3,931	223	0	0.00	0	---
Mar	13,768	16.98	3,327	196	0	0.00	0	---
Apr	25,468	31.41	5,831	186	0	0.00	0	---
May	23,522	29.01	4,695	162	0	0.00	0	---
Jun	8,850	10.92	1,804	165	0	0.00	0	---
Jul	4,205	5.19	694	134	0	0.00	0	---
Aug	7,914	9.76	1,799	184	0	0.00	0	---
Sep	8,923	11.01	1,397	127	0	0.00	0	---
Oct	18,091	22.31	3,275	147	11	0.01	3	247
Nov	16,080	19.83	3,775	190	0	0.00	0	---
Dec	17,455	21.53	4,123	191	0	0.00	0	---
Ann	177,995	219.55	40,490	184	11	0.01	3	247

The water that is released from Lake Okeechobee at S-352 may include supplies for the S-5A Basin, regulatory releases from the lake to keep its stage within target levels, and supplies for the EPA or other areas downstream of the S-5A basin. These latter two release components are called flow-through releases because they are conveyed through the basin to the EPA via the S-5A complex. The estimated annual and average monthly volumes and TP loads in these flow-through releases are summarized in Tables 2.3 and 2.4, respectively.

Tables 2.3 and 2.4 contain two different estimates of the TP load and concentrations in the flow-through releases. The first estimate uses TP concentrations collected in samples taken at S-352 and the second uses the results of TP sampling at S-5A. The first method, using concentrations at S-352, is more appropriate for estimating the TP load that enters the S-5A Basin but the second method is considered better for estimating the TP load that these flow-through releases contribute to the EPA or STAs. Using this second method, the TP load in these releases is estimated to be nearly 25 percent less. Also worthy of note is that on average a little over half, approximately 57 percent, of the total lake releases at S-352 are flow-through releases. The remaining 43 percent of these lake releases are to satisfy water supply demands within the S-5A Basin.

Table 2.3: Annual Summary of Lake Flow-through Releases in S-5A Basin

Water Year	Volume		Concentrations at S-352		Concentrations at S-5A	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	115,466	142.43	17,688	124	16,671	117
1996	169,866	209.53	30,213	144	41,049	196
1997	54,883	67.70	12,528	185	6,003	89
1998	66,814	82.41	21,070	256	16,384	199
1999	125,461	154.75	31,770	205	18,020	116
2000	91,261	112.57	25,638	228	13,869	123
2001	29,254	36.08	5,865	163	2,433	67
2002	2,420	2.99	555	186	258	86
2003	322,080	397.28	76,034	191	54,444	137
2004	36,547	45.08	8,818	196	4,427	98
Min.	2,420	2.99	555	---	258	---
Max.	322,080	397.28	76,034	---	54,444	---
Avg.	101,405	125.08	23,018	184	17,356	139

Table 2.4: Average Monthly Summary of Lake Flow-through Releases in S-5A Basin

Month	Volume		Concentrations at S-352		Concentrations at S-5A	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
Jan	14,472	17.85	4,428	248	3,039	170
Feb	7,544	9.31	1,956	210	1,418	152
Mar	5,284	6.52	1,073	165	704	108
Apr	9,336	11.52	2,132	185	1,441	125
May	7,560	9.33	1,485	159	966	104
Jun	1,638	2.02	352	174	159	79
Jul	1,746	2.15	350	163	179	83
Aug	5,869	7.24	1,351	187	1,223	169
Sep	8,112	10.01	1,294	129	1,290	129
Oct	16,215	20.00	2,995	150	2,317	116
Nov	11,237	13.86	2,506	181	2,399	173
Dec	12,392	15.29	3,095	202	2,223	145
Ann	101,405	125.08	23,018	184	17,356	139

2.2. East Beach Pump Station (EBPS)

The East Beach Water Control District (EBWCD) is located along the eastern shore of Lake Okeechobee. The drainage from the EBWCD is discharged to both Lake Okeechobee at

Culvert #10 and the West Palm Beach Canal via the EBPS. EBPS is a relatively new pump station, with its first recorded discharges occurring on July 2, 2001, but there was another pump station (Pump Station 2) at this same general location for many years prior. Discharges from Pump Station 2 were not monitored. A summary of the recorded discharges and TP loads from pump station EBPS is included in Table 2.5.

Table 2.5: Discharge Summary at Pump Station EBPS

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	762	0.94	174	186
1996	---	---	---	---	Feb	947	1.17	215	184
1997	---	---	---	---	Mar	391	0.48	91	189
1998	---	---	---	---	Apr	525	0.65	110	169
1999	---	---	---	---	May	776	0.96	164	171
2000	---	---	---	---	Jun	2,760	3.40	1,268	372
2001	---	---	---	---	Jul	1,863	2.30	814	354
2002<	10,018	12.36	3,187	258	Aug	3,268	4.03	1,462	363
2003	16,165	19.94	6,153	309	Sep	2,550	3.15	990	315
2004	19,088	23.54	7,039	299	Oct	895	1.10	299	271
Min.	16,165	19.94	6,153	---	Nov	661	0.81	136	167
Max.	19,088	23.54	7,039	---	Dec	872	1.08	213	198
Avg.	17,627	21.74	6,596	303	Ann	16,269	20.07	5,936	296

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

2.3. S-5A and G-250 Pump Stations

The S-5A pump station is located south of the L-10/L-12 Borrow Canal and discharges water from this canal to the STA-1 Inflow and Distribution works. From these works, water can be directed to STA-1W, STA-1E, or directly to WCA-1. The G-250 structure was the inflow pump station for the Everglades Nutrient Removal (ENR) Project, which has now been incorporated into STA-1W. This pump station, which is no longer in operation, also conveyed water from the L-10/L-12 Borrow Canal to the ENR Project. This pump station was operated from May 1994 through July 1999. Tables 2.6 and 2.7 summarize the

volumetric and TP discharges at these two structures from the S-5A Basin to the south into STA-1W, STA-1E and WCA-1.

Table 2.6: Discharge Summary for S-5A Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)	Month	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)
1995	545,566	672.95	105,891	157	Jan	18,345	22.63	3,524	156
1996	388,994	479.82	78,806	164	Feb	15,482	19.10	2,933	154
1997	185,296	228.56	33,421	146	Mar	14,422	17.79	2,994	168
1998	306,061	377.52	74,168	196	Apr	12,432	15.34	2,378	155
1999	237,271	292.67	45,869	157	May	11,860	14.63	2,043	140
2000	413,882	510.52	82,651	162	Jun	32,764	40.41	6,666	165
2001	182,919	225.63	29,471	131	Jul	30,141	37.18	5,181	139
2002	267,789	330.31	34,249	104	Aug	48,837	60.24	9,553	159
2003	639,499	788.81	121,936	155	Sep	48,800	60.19	8,381	139
2004	314,173	387.53	52,740	136	Oct	58,307	71.92	9,809	136
Min.	182,919	225.63	29,471	---	Nov	32,056	39.54	6,817	172
Max.	639,499	788.81	121,936	---	Dec	24,698	30.46	5,642	185
Avg.	348,145	429.43	65,920	154	Ann	348,145	429.43	65,920	154

2.4. S-5AW Culvert

Water control structure S-5AW is a gated culvert located immediately east of the S-5A pump station that controls flow between the L-10/L-12 and L-8 borrow canals, and correspondingly the S-5A and L-8 drainage basins. Water that is discharged eastward through this structure can travel north into the L-8 Basin, through S-5AE into the C-51 West Basin, or south through S-5AS into the EPA. These eastward (positive) discharges are rare but negative (westward) flows through this structure are more common. An annual summary of the recorded discharges and TP loads through this control structure is included in Table 2.8. Table 2.9 presents average monthly data for this same water control structure.

Table 2.7: Discharge Summary at G-250 Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year*	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)	Month	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)
1995	92,365	113.93	15,453	136	Jan	9,199	11.35	1,372	121
1996	182,671	225.32	24,464	109	Feb	7,652	9.44	1,109	117
1997	118,780	146.51	14,357	98	Mar	6,465	7.97	788	99
1998	80,301	99.05	11,524	116	Apr	11,736	14.48	1,691	117
1999	88,532	109.20	11,023	101	May	7,095	8.75	961	110
2000<	9,966	12.29	1,339	109	Jun	4,988	6.15	601	98
2001	---	---	---	---	Jul	7,009	8.65	911	105
2002	---	---	---	---	Aug	8,037	9.91	1,416	143
2003	---	---	---	---	Sep	10,323	12.73	1,168	92
2004	---	---	---	---	Oct	14,188	17.50	1,973	113
Min.	80,301	99.05	11,023	---	Nov	11,490	14.17	1,576	111
Max.	182,671	225.32	24,464	---	Dec	12,523	15.45	1,573	102
Avg.	112,530	138.80	15,364	111	Ann	110,705	136.55	15,137	111

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

Table 2.8: Annual Discharge Summary at Culvert S-5AW

Water Year	Eastward Flow Out of S-5A Basin				Westward Flow Into S-5A Basin			
	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)
1995	0	0.00	0	---	62,955	77.65	19,392	250
1996	0	0.00	0	---	88,578	109.26	9,792	90
1997	0	0.00	0	---	16,998	20.97	605	29
1998	0	0.00	0	---	9,271	11.44	271	24
1999	0	0.00	0	---	9,745	12.02	588	49
2000	0	0.00	0	---	39,538	48.77	5,102	105
2001	553	0.68	56	82	21,482	26.50	1,361	51
2002	476	0.59	133	227	11,672	14.40	775	54
2003	0	0.00	0	---	16,315	20.12	1,781	88
2004	0	0.00	0	---	5,387	6.64	368	55
Min.	0	0.00	0	---	5,387	6.64	271	---
Max.	553	0.68	133	---	88,578	109.26	19,392	---
Avg.	103	0.13	19	149	28,194	34.78	4,004	115

Table 2.9: Average Monthly Discharge Summary at Culvert S-5AW

Month	Eastward Flow Out of S-5A Basin				Westward Flow Into S-5A Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	0	0.00	0	---	228	0.28	8	30
Feb	0	0.00	0	---	320	0.40	11	27
Mar	55	0.07	6	82	562	0.69	31	45
Apr	0	0.00	0	---	536	0.66	20	30
May	0	0.00	0	---	1,198	1.48	237	160
Jun	48	0.06	13	227	472	0.58	56	96
Jul	0	0.00	0	---	571	0.70	34	49
Aug	0	0.00	0	---	2,922	3.60	576	160
Sep	0	0.00	0	---	4,553	5.62	634	113
Oct	0	0.00	0	---	11,916	14.70	1,460	99
Nov	0	0.00	0	---	3,865	4.77	666	140
Dec	0	0.00	0	---	1,052	1.30	270	208
Ann	103	0.13	19	149	28,194	34.78	4,004	115

2.5. S-5A Basin Runoff

The runoff from the S-5A Basin is defined as the total discharge from the basin at the various control points less any contributions to this discharge from outside sources. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

- S-5A pump station discharge
- Plus G-250 pump station discharge
- Plus net eastward flow at S-5AW (westward flows are more common so this term is often negative)
- Plus discharge to Lake Okeechobee at S-352
- Minus EBPS discharge
- Minus flow-through releases from Lake Okeechobee

The resulting runoff estimates are summarized by water year and month in Tables 2.10 and 2.11, respectively.

Table 2.10: Annual Runoff Summary for S-5A Basin

Water Year	Volume		Flow-through Concentrations at S-352		Flow-through Concentrations at S-5A	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	465,812	574.57	86,423	150	92,177	160
1996	315,220	388.82	64,909	167	61,256	158
1997	236,581	291.82	35,623	122	39,257	135
1998	313,851	387.13	65,353	169	70,517	182
1999	190,764	235.30	26,669	113	38,327	163
2000	294,467	363.22	54,609	150	62,998	173
2001	152,643	188.28	23,843	127	26,924	143
2002	257,435	317.54	31,340	99	33,251	105
2003	290,241	358.01	38,917	109	62,602	175
2004	255,239	314.83	37,185	118	44,397	141
Min.	152,643	188.28	23,843	---	26,924	---
Max.	465,812	574.57	86,423	---	92,177	---
Avg.	277,225	341.95	46,487	136	53,171	155

Table 2.11: Average Monthly Runoff Summary for S-5A Basin

Month	Flow-through Concentrations at S-352			Flow-through Concentrations at S-5A, G-250, and S-5AW		
	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)
Jan	9,495	2,028	173	8,104	1,436	144
Feb	15,770	3,093	159	11,258	2,166	156
Mar	16,881	3,500	168	12,299	2,681	177
Apr	19,903	4,118	168	8,598	1,966	185
May	15,669	2,899	150	8,169	1,641	163
Jun	41,242	8,161	160	33,356	6,731	164
Jul	31,642	5,179	133	31,642	5,316	136
Aug	43,438	7,931	148	43,438	8,359	156
Sep	40,815	6,793	135	40,815	6,931	138
Oct	46,178	8,664	152	38,536	6,843	144
Nov	25,106	5,065	164	23,455	4,864	168
Dec	34,070	7,622	181	17,554	4,237	196
Ann	340,209	65,052	155	277,225	53,171	155

As discussed above, the discharge at EBPS has been monitored only since July 2001; therefore, the S-5A Basin runoff estimates for earlier periods will include this component of the drainage from the EBWCD in addition to actual basin runoff.

The method used to estimate the TP load in flow-through releases from Lake Okeechobee has a significant impact on the estimated TP load in basin runoff. Using TP concentrations at S-352 for lake flow-through, basin runoff TP concentrations are estimated at 136 ppb but using lower flow-through concentrations at S-5A, the average concentration in basin runoff increases to 155 ppb.

Because of uncertainty in the TP load estimates, the calculated TP load in basin runoff is sometimes negative, which indicates that phosphorus is being retained in the basin although water is not. This is an unlikely scenario so any month when the total TP load was estimated to be negative was excluded from the calculation of average monthly flows, loads and concentrations. These negative TP load estimates typically occurred in months with little runoff so excluding the data for these months typically resulted in higher average flow volumes and TP loads.

The variability of TP loads and concentrations by month in basin runoff, using flow-through concentrations at S-5A, is shown graphically in Figure 2.2.

2.6. S-5A Basin Discharge to Everglades Protection Area and STAs

Virtually all of the discharge from the S-5A Basin passes through the S-5A pump station and is delivered to the EPA via STA-1W or STA-1E. This discharge originates primarily from basin runoff and flow-through releases from Lake Okeechobee. The other sources of this discharge to the EPA include water that enters the basin through structure S-5AW from the L-8 Basin, and discharge from the EBWCD at EBPS. Summaries of the historic annual and average monthly discharge volumes from this basin to the EPA and STAs by source are included in Tables 2.12 and 2.13. Similar summaries for TP discharge are provided in Tables 2.14 and 2.15.

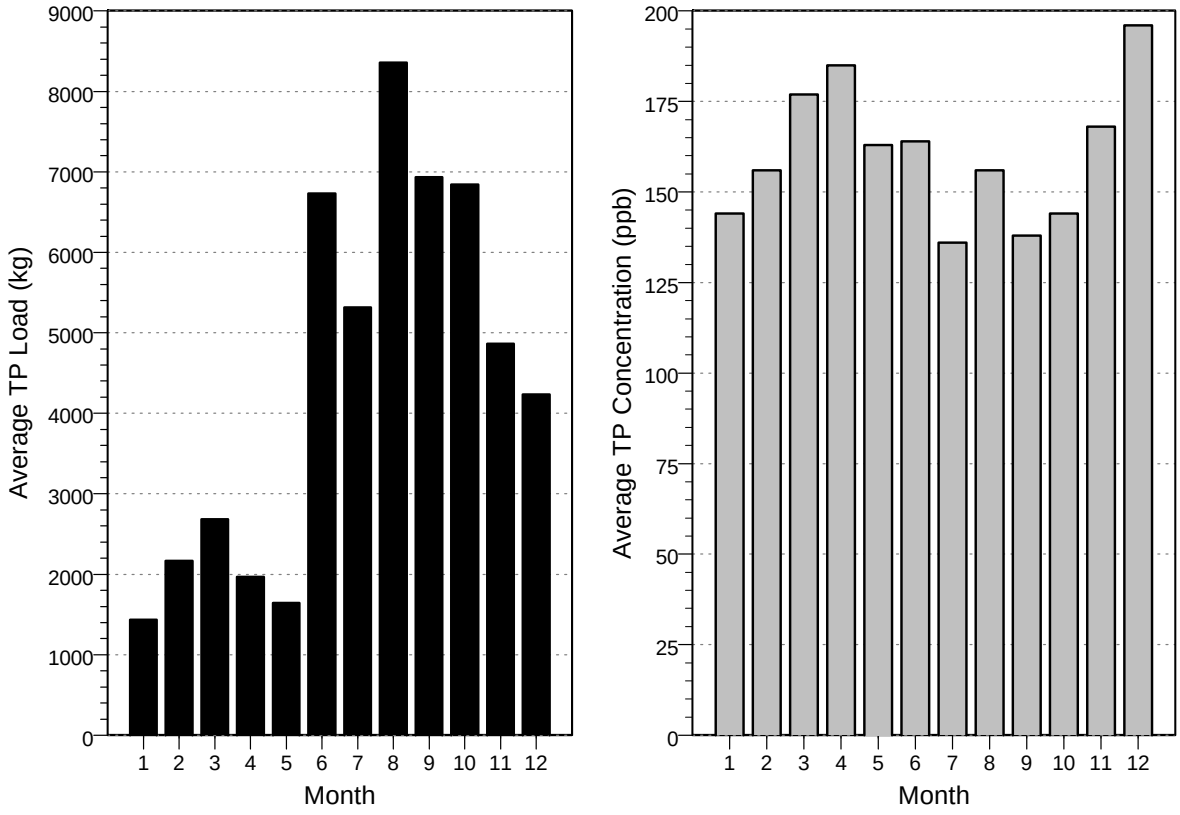

Figure 2.2: Average Monthly TP Loads and Concentrations in S-5A Basin Runoff

Table 2.12: Annual Summary of S5-A Basin Discharge Volumes to EPA and STAs by Source*

Water Year	Lake Okeechobee Flow-through		S-5A Basin Runoff		Other (EBPS+S5AW)		S-5A Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
1995	115,432	142.38	465,812	574.57	56,688	69.92	637,932	786.88
1996	170,015	209.71	315,220	388.82	86,429	106.61	571,664	705.14
1997	55,062	67.92	236,581	291.82	12,432	15.33	304,076	375.07
1998	66,304	81.78	313,851	387.13	6,208	7.66	386,363	476.57
1999	125,789	155.16	190,764	235.30	9,250	11.41	325,803	401.87
2000	90,408	111.52	294,467	363.22	38,972	48.07	423,848	522.81
2001	28,270	34.87	151,985	187.47	2,665	3.29	182,919	225.63
2002	1,823	2.25	256,959	316.95	9,007	11.11	267,789	330.31
2003	320,905	395.83	290,241	358.01	28,352	34.97	639,499	788.81
2004	36,447	44.96	255,239	314.83	22,487	27.74	314,173	387.53
Min.	1,823	2.25	151,985	187.47	2,665	3.29	182,919	225.63
Max.	320,905	395.83	465,812	574.57	86,429	106.61	639,499	788.81
Avg.	101,046	124.64	277,112	341.81	27,249	33.61	405,407	500.06

* Total discharge to EPA at S-5A and G-250 pump stations.

Table 2.13: Monthly Summary of S5-A Basin Discharge Volumes to EPA and STAs by Source*

Month	Lake Okeechobee Flow-through		S-5A Basin Runoff		Other (EBPS+S5AW)		S-5A Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
Jan	14,438	17.81	8,104	10.00	402	0.50	22,945	28.30
Feb	7,547	9.31	11,258	13.89	503	0.62	19,308	23.82
Mar	5,307	6.55	12,243	15.10	105	0.13	17,655	21.78
Apr	9,339	11.52	8,598	10.61	364	0.45	18,300	22.57
May	7,521	9.28	8,169	10.08	427	0.53	16,116	19.88
Jun	1,659	2.05	33,308	41.09	789	0.97	35,756	44.10
Jul	1,760	2.17	31,642	39.03	945	1.17	34,347	42.37
Aug	5,867	7.24	43,438	53.58	3,550	4.38	52,855	65.20
Sep	8,122	10.02	40,815	50.34	5,025	6.20	53,962	66.56
Oct	16,027	19.77	38,526	47.52	10,849	13.38	65,401	80.67
Nov	11,133	13.73	23,455	28.93	3,213	3.96	37,801	46.63
Dec	12,326	15.20	17,554	21.65	1,079	1.33	30,959	38.19
Ann	101,046	124.64	277,112	341.81	27,249	33.61	405,407	500.06

* Total discharge to EPA at S-5A and G-250 pump stations.

Table 2.14: Annual Summary of S5-A Basin TP Discharge to EPA and STAs by Source[1]

Water Year	Lake Okeechobee Flow-through[2]		S-5A Basin Runoff		Other (EBPS+S5AW)		S-5A Basin Total	
	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)
1995	17,227	121	92,177	160	11,939	171	121,343	154
1996	29,312	140	61,256	158	12,703	119	103,270	146
1997	6,630	98	39,257	135	1,891	123	47,778	127
1998	13,834	169	70,517	182	1,341	175	85,692	180
1999	16,823	108	38,327	163	1,742	153	56,892	142
2000	13,951	125	62,998	173	7,042	146	83,990	161
2001	2,346	67	26,868	143	257	78	29,471	131
2002	174	77	33,118	104	958	86	34,249	104
2003	54,359	137	62,602	175	4,976	142	121,936	155
2004	4,413	98	44,397	141	3,930	142	52,740	136
Min.	174	---	26,868	---	257	---	29,471	---
Max.	54,359	---	92,177	---	12,703	---	121,936	---
Avg.	15,907	128	53,152	155	4,678	139	73,736	147

1. Total discharge to EPA at S-5A and G-250 pump stations.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-5A.

Table 2.15: Monthly Summary of S5-A Basin TP Discharge to EPA by Source[1]

Month	Lake Okeechobee Flow-through[2]		S-5A Basin Runoff		Other (EBPS+S5AW)		S-5A Basin Total	
	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)
Jan	2,696	151	1,436	144	78	157	4,210	149
Feb	1,211	130	2,166	156	110	177	3,487	146
Mar	684	104	2,676	177	28	221	3,388	156
Apr	1,213	105	1,966	185	45	99	3,223	143
May	930	100	1,641	163	49	93	2,620	132
Jun	162	79	6,718	164	147	150	7,026	159
Jul	259	120	5,316	136	152	131	5,728	135
Aug	1,223	169	8,359	156	679	155	10,261	157
Sep	1,210	121	6,931	138	825	133	8,965	135
Oct	2,219	112	6,843	144	1,733	130	10,795	134
Nov	2,122	155	4,864	168	619	156	7,605	163
Dec	1,979	130	4,237	196	213	160	6,429	168
Ann	15,907	128	53,152	155	4,678	139	73,736	147

1. Total discharge to EPA at S-5A and G-250 pump stations.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-5A.

Review of these tables shows that Lake Okeechobee flow-through releases account for an average of approximately 25.0 percent of the total discharge volume and 21.6 percent of the total TP load discharged from this basin to the EPA. The respective percentages contributed by S-5A Basin runoff are 68.3 and 72.1 percent. The other sources, S-5AW and EBPS, account for between 6 and 7 percent of both the volumetric and TP discharges at this location. Diversions from the EBWCD to the S-5A Basin at EBPS have been monitored only since July 2001. Prior to this time, these diversions are included in the estimated contributions from basin runoff. Therefore, as a percentage, the contributions from the EBWCD would be expected to increase over time and contributions from basin runoff decrease. For the last three years of the study period, WY 2002–2004, EBPS contributed about 3.2 percent of the discharge volume but approximately 7.0 percent of the TP loads discharged from this basin to the EPA.

* * * * *

3. S-6/S-2 BASIN

In this report, the S-6 Basin has been combined with that portion of the S-2 Basin that is tributary to the Hillsboro Canal (L-14 and L-15 borrow canals). The Hillsboro, Ocean and Cross (L-16 borrow) canals are the principal drainage canals in the combined S-6/S-2 Basin. In its original configuration, the Hillsboro Canal connected Lake Okeechobee, at the S-2 pump station and S-351 spillway, with WCA-1 at the S-6 pump station. With the construction of STA-2, most of the drainage from this basin is now diverted to this stormwater treatment area and then discharged to WCA-2A. The initial filling of STA-2 began in June 1999 and full operation commenced in July 2001. The Ocean Canal joins the S-6/S-2 Basin with the S-5A Basin to the northeast and the Cross Canal connects this basin to the S-7/S-2 Basin to the west. Interbasin flows in these canals are not monitored and are considered to be relatively insignificant for this analysis. A block diagram, which shows the principal structures that control the flow of water into and out of the S-6/S-2 Basin, is included as Figure 3.1.

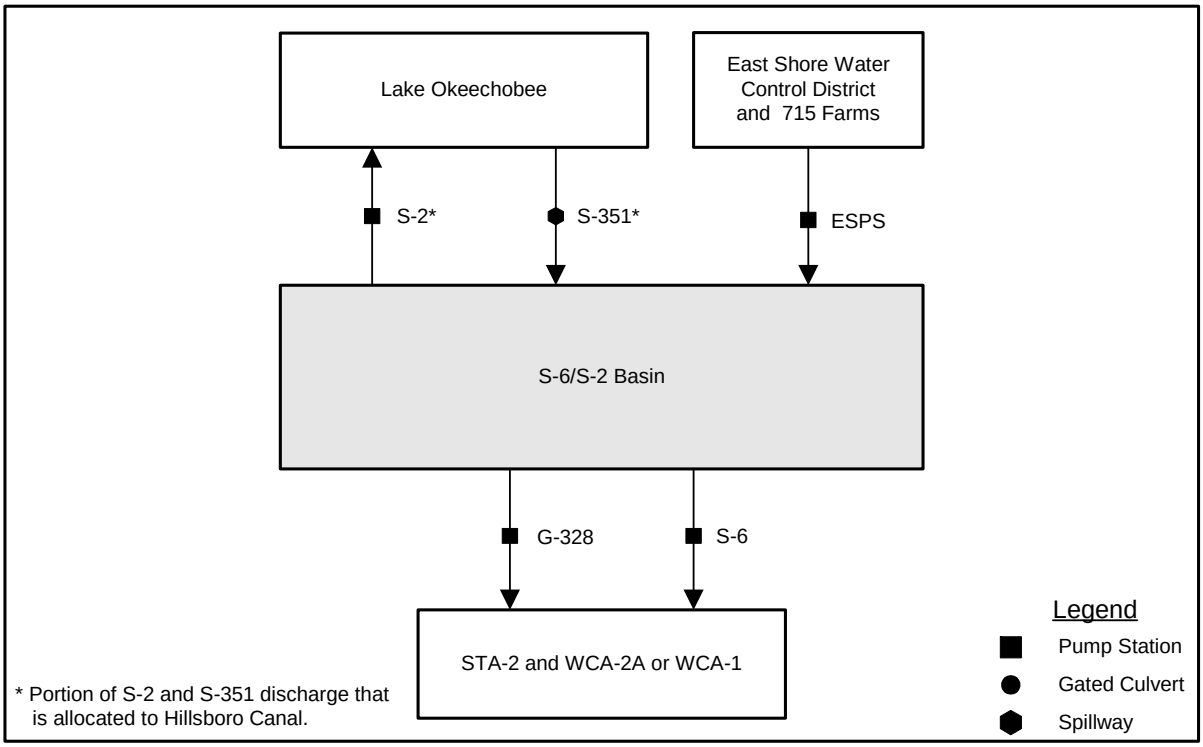

Figure 3.1: S-6/S-2 Basin Schematic

The flow and TP load through each of the principal control structures in this basin are discussed in the following sections.

3.1. S-2 Pump Station and S-351 Spillway

The S-2 pump station and S-351 spillway control the flow of water between Lake Okeechobee and the northern ends of the Hillsboro and North New River (L-18/L-19/L-20 borrow) canals. The preferred flow direction within the basin is from north to south to mimic pre-development conditions within the Everglades so water is generally pumped to Lake Okeechobee only when absolutely necessary to prevent flooding. The EAATPLD computer model allocates a fixed percentage of the flow at these two structures, approximately 34.8 percent, to the Hillsboro Canal (Rule 40E-63) so the data received from the District maintains this fixed flow distribution between the Hillsboro and North New River canals. Tables 3.1 and 3.2 summarize the annual and average monthly volumetric and TP discharges between Lake Okeechobee and the S-6/S-2 Basin.

Table 3.1: Annual Discharge Summary at S-2 and S-351

Water Year	Lake Okeechobee to S-6/S-2 Basin				S-6/S-2 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	102,608	126.57	9,994	79	21,662	26.72	5,598	210
1996	108,907	134.34	16,051	119	16,425	20.26	3,098	153
1997	54,792	67.59	5,913	87	1,996	2.46	385	156
1998	29,541	36.44	3,108	85	3,888	4.80	826	172
1999	107,096	132.10	13,440	102	16,143	19.91	4,270	214
2000	63,297	78.08	12,398	159	13,603	16.78	3,796	226
2001	74,564	91.97	14,783	161	11,206	13.82	2,916	211
2002	24,358	30.04	3,220	107	73,090	90.15	9,511	105
2003	89,287	110.13	9,541	87	325	0.40	80	200
2004	62,483	77.07	7,335	95	74	0.09	18	199
Min.	24,358	30.04	3,108	---	74	0.09	18	---
Max.	108,907	134.34	16,051	---	73,090	90.15	9,511	---
Avg.	71,693	88.43	9,578	108	15,841	19.54	3,050	156

Table 3.2: Average Monthly Discharge Summary at S-2 and S-351

Month	Lake Okeechobee to S-6/S-2 Basin				S-6/S-2 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	8,036	9.91	1,146	116	15	0.02	3	176
Feb	5,112	6.31	816	129	73	0.09	18	195
Mar	7,451	9.19	1,109	121	206	0.25	43	170
Apr	15,219	18.77	1,980	105	241	0.30	50	168
May	13,161	16.23	1,722	106	0	0.00	0	---
Jun	4,861	6.00	628	105	874	1.08	137	127
Jul	1,175	1.45	124	86	2,317	2.86	275	96
Aug	652	0.80	70	88	3,335	4.11	486	118
Sep	580	0.72	54	76	1,885	2.33	274	118
Oct	4,886	6.03	462	77	3,208	3.96	802	203
Nov	4,628	5.71	484	85	2,388	2.95	672	228
Dec	5,930	7.31	981	134	1,299	1.60	290	181
Ann	71,693	88.43	9,578	108	15,841	19.54	3,050	156

A portion of the water released from Lake Okeechobee at S-351 is basin flow-through. The estimated volume and TP loads in these flow-through releases are summarized in Tables 3.3 and 3.4.

Tables 3.3 and 3.4 contain two different estimates of the TP load and concentrations in the flow-through releases. The first estimate uses TP concentrations collected in samples taken at S-351 and the second uses the results of TP sampling at S-6. The first method, using concentrations at S-351, is more appropriate for estimating the TP load that enters the basin but the second method is considered better for estimating the TP load that these flow-through releases contribute to STA-2 and potentially to the EPA. Using this second method, the TP load in these releases is estimated to be about 3.8 percent less. On average, approximately 40 percent of the total lake releases at S-351 are flow-through releases.

Table 3.3: Annual Summary of Lake Flow-through Releases in S-6/S-2 Basin

Water Year	Volume		Concentrations at S-351		Concentrations at S-6	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	81,211	100.17	6,185	62	6,881	69
1996	61,516	75.88	7,152	94	4,326	57
1997	6,988	8.62	715	83	753	87
1998	22,920	28.27	2,136	76	2,505	89
1999	27,375	33.77	2,804	83	2,650	78
2000	28,346	34.96	5,164	148	3,310	95
2001	11,445	14.12	1,842	130	1,168	83
2002	2,262	2.79	319	114	59	21
2003	44,195	54.51	4,594	84	2,711	50
2004	7,357	9.08	816	90	326	36
Min.	2,262	2.79	319	---	59	---
Max.	81,211	100.17	7,152	---	6,881	---
Avg.	29,362	36.22	3,173	88	2,469	68

Table 3.4: Average Monthly Summary of Lake Flow-through Releases in S-6/S-2 Basin

Month	Volume		Concentrations at S-351		Concentrations at S-6	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
Jan	5,294	6.53	697	107	416	64
Feb	1,981	2.44	218	89	171	70
Mar	2,235	2.76	253	92	129	47
Apr	5,101	6.29	489	78	402	64
May	2,255	2.78	258	93	233	84
Jun	1,081	1.33	144	108	105	79
Jul	57	0.07	7	99	6	79
Aug	151	0.19	17	90	8	43
Sep	261	0.32	20	63	34	104
Oct	3,798	4.68	300	64	419	89
Nov	3,512	4.33	312	72	294	68
Dec	3,637	4.49	459	102	253	56
Ann	29,362	36.22	3,173	88	2,469	68

3.2. East Shore Pump Station (ESPS)

The East Shore Water Control District (ESWCD) and 715 Farms area are located along the southeastern shore of Lake Okeechobee. Until recently, all of the drainage from these two drainage districts was discharged directly to Lake Okeechobee. In order to reduce these discharges to the lake, a new canal and pump station (ESPS) has been constructed that diverts some of this drainage to the Hillsboro Canal and the S-6/S-2 Basin. The first recorded discharges from this pump station occurred on December 27, 2001. A summary of the recorded discharges and TP loads from this pump station is included in Table 3.5.

Table 3.5: Discharge Summary at ESPS

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	867	1.07	58	54
1996	---	---	---	---	Feb	2,282	2.81	188	67
1997	---	---	---	---	Mar	760	0.94	91	97
1998	---	---	---	---	Apr	987	1.22	76	63
1999	---	---	---	---	May	1,715	2.11	133	63
2000	---	---	---	---	Jun	6,115	7.54	657	87
2001	---	---	---	---	Jul	4,454	5.49	660	120
2002<	4,894	6.04	393	65	Aug	7,302	9.01	787	87
2003	32,607	40.22	3,606	90	Sep	2,020	2.49	269	108
2004	29,811	36.77	2,980	81	Oct	719	0.89	84	94
Min.	29,811	36.77	2,980	---	Nov	1,573	1.94	127	65
Max.	32,607	40.22	3,606	---	Dec	1,609	1.98	102	51
Avg.	31,209	38.50	3,293	86	Ann	30,403	37.50	3,232	86

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

3.3. S-6 Pump Station

The S-6 pump station is located at the southeastern end of the basin where the Hillsboro Canal enters WCA-1. During the early portion of the study period, this pump station served to pump water into WCA-1 but it now serves as the inflow pump station for STA-2. Discharges from STA-2 are normally conveyed into WCA-2A but can still be delivered to

WCA-1 if desired. Table 3.6 summarizes the annual and average monthly volumetric and TP discharges at this control structure.

Table 3.6: Discharge Summary at S-6

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	623,415	768.97	68,305	89	Jan	14,079	17.37	972	56
1996	429,597	529.90	39,589	75	Feb	14,890	18.37	1,411	77
1997	251,547	310.28	33,006	106	Mar	13,894	17.14	1,966	115
1998	351,268	433.28	43,150	100	Apr	12,674	15.63	1,930	123
1999	215,752	266.13	26,535	100	May	12,817	15.81	1,266	80
2000	327,663	404.17	57,035	141	Jun	35,360	43.62	3,438	79
2001	154,610	190.71	23,244	122	Jul	29,793	36.75	3,497	95
2002	191,550	236.27	18,605	79	Aug	40,953	50.51	4,350	86
2003	276,753	341.37	21,422	63	Sep	41,965	51.76	5,615	108
2004	245,526	302.85	23,754	78	Oct	43,654	53.85	5,824	108
Min.	154,610	190.71	18,605	---	Nov	25,688	31.69	2,764	87
Max.	623,415	768.97	68,305	---	Dec	21,001	25.90	2,433	94
Avg.	306,768	378.39	35,464	94	Ann	306,768	378.39	35,464	94

3.4. G-328 Pump Station

Structure G-328 is a pump station that is located just north of STA-2 and discharges directly into the STA-2 inflow canal, which runs between the S-6 pump station and STA-2. This pump station, which began operation in April 2000, conveys drainage from an area north of STA-2 that was formally tributary to the L-6 Borrow Canal and S-6 pump station. Prior to the STA-related construction in this vicinity, the drainage from this same area is reflected in the discharge data at S-6. Table 3.7 summarizes the annual and average monthly volumetric and TP discharges at the G-328 pump station.

3.5. S-6/S-2 Basin Runoff

The runoff from the S-6/S-2 Basin is defined as the total discharge from the basin at the various control points less any contributions to this discharge from outside sources. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

Table 3.7: Discharge Summary at G-328

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	0	0.00	0	---
1996	---	---	---	---	Feb	696	0.86	24	28
1997	---	---	---	---	Mar	973	1.20	46	38
1998	---	---	---	---	Apr	860	1.06	35	33
1999	---	---	---	---	May	257	0.32	9	29
2000<	3,838	4.73	159	34	Jun	315	0.39	17	45
2001	17,273	21.31	714	33	Jul	3,257	4.02	167	42
2002	21,258	26.22	1,055	40	Aug	2,975	3.67	156	43
2003	5,978	7.37	287	39	Sep	2,079	2.56	85	33
2004	11,413	14.08	497	35	Oct	2,980	3.68	122	33
Min.	5,978	7.37	287	---	Nov	183	0.23	5	21
Max.	21,258	26.22	1,055	---	Dec	151	0.19	4	21
Avg.	13,981	17.24	638	37	Ann	14,725	18.16	669	37

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

- S-6 pump station discharge
- Plus G-328 pump station discharge
- Plus discharge to Lake Okeechobee at S-2 and S-351 (S-6/S-2 basin portion only)
- Minus ESPS discharge
- Minus flow-through releases from Lake Okeechobee

The resulting runoff estimates are summarized by water year and month in Tables 3.8 and 3.9, respectively. The method used to estimate the TP load in flow-through releases from Lake Okeechobee has only a modest impact on the estimated TP load in basin runoff. Referring back to Tables 3.3 and 3.4, readers will note that TP concentrations are sometimes higher at S-351 and sometimes higher at S-6. The net effect of these varying concentrations is that the estimated average TP concentration in basin runoff is slightly higher (99 vs. 97 ppb) when using S-6 sampling data to estimate the TP loads in lake flow-through releases.

Table 3.8: Annual Runoff Summary for S-6/S-2 Basin

Water Year	Volume		Flow-through Concentrations at S-351		Flow-through Concentrations at S-6	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	563,865	695.52	66,917	96	67,100	96
1996	384,506	474.28	34,446	73	38,468	81
1997	246,556	304.12	32,633	107	32,640	107
1998	332,236	409.81	41,569	101	41,472	101
1999	204,520	252.27	27,669	110	28,153	112
2000	316,758	390.71	55,044	141	57,680	148
2001	171,643	211.72	25,002	118	25,705	121
2002	279,177	344.36	28,490	83	28,758	84
2003	209,646	258.59	13,830	53	16,741	65
2004	223,500	275.68	20,856	76	21,461	78
Min.	171,643	211.72	13,830	---	16,741	---
Max.	563,865	695.52	66,917	---	67,100	---
Avg.	293,241	361.71	34,646	96	35,818	99

Table 3.9: Average Monthly Runoff Summary for S-6/S-2 Basin*

Month	Flow-through Concentrations at S-351			Flow-through Concentrations at S-6		
	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)
Jan	9,318	445	39	8,575	554	52
Feb	13,856	1,286	75	12,592	1,211	78
Mar	15,136	2,463	132	12,027	1,878	127
Apr	11,928	2,521	171	7,965	1,575	160
May	14,821	1,419	78	10,448	1,017	79
Jun	34,068	3,310	79	34,068	3,378	80
Jul	32,624	3,715	92	32,624	3,762	93
Aug	43,970	4,736	87	43,970	4,756	88
Sep	44,021	5,846	108	44,021	5,850	108
Oct	44,149	6,329	116	44,149	6,250	115
Nov	26,099	3,427	106	24,475	3,137	104
Dec	21,803	2,859	106	18,327	2,449	108
Ann	311,793	38,355	100	293,241	35,818	99

* Calculated TP load in basin runoff is negative in some months because of uncertainties in TP load estimates. Months with negative TP load are excluded from calculation of average monthly data; therefore, average monthly runoff volumes will vary based on flow-through concentration assumptions.

The variability of TP loads and concentrations by month, using flow-through concentrations at S-6, is shown in Figure 3.2.

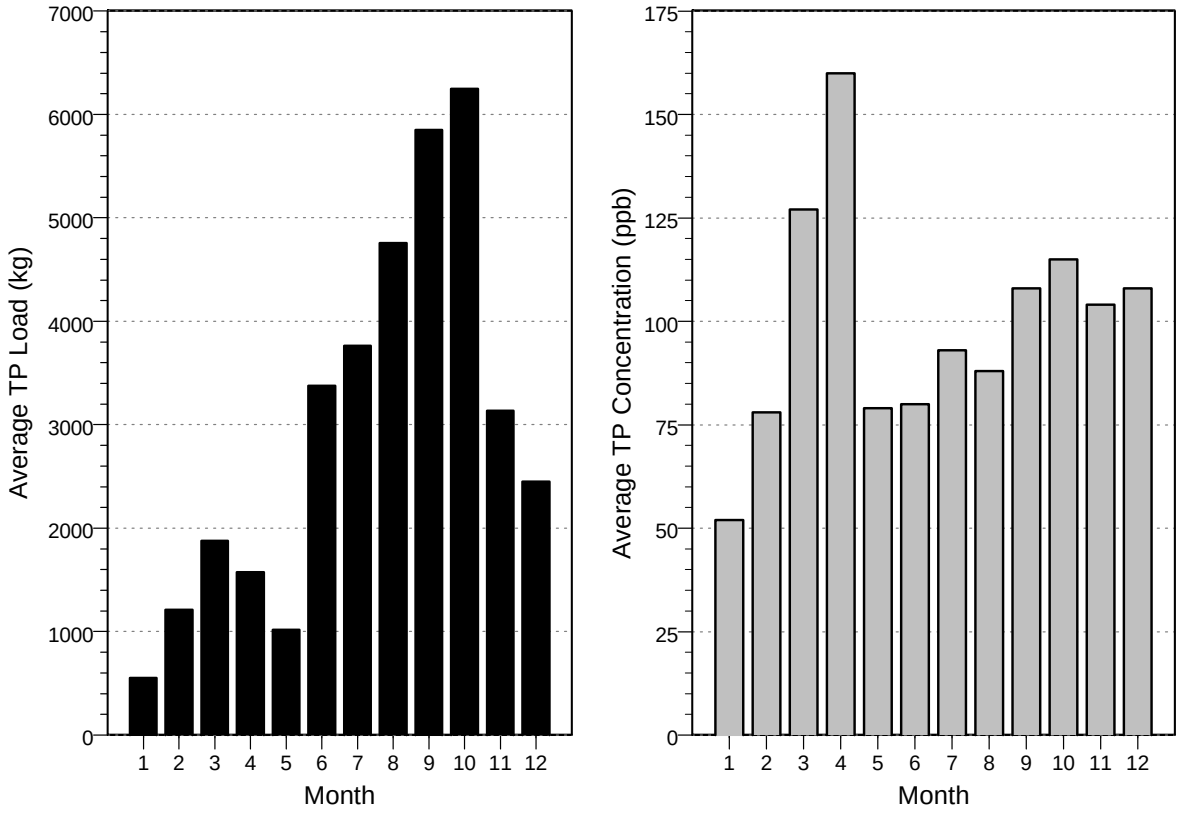

Figure 3.2: Average Monthly TP Loads and Concentrations in S-6/S-2 Basin Runoff

3.6. S-6/S-2 Basin Discharge to Everglades Protection Area and STAs

Now that STA-2 has been completed, virtually all of the discharge from the S-6/S-2 Basin passes through the S-6 pump station and is delivered to the EPA via STA-2. Most of the historic discharge from the basin back to Lake Okeechobee has been discontinued (Table 3.1). The discharge to the EPA at S-6 originates either from basin runoff, flow-through releases from Lake Okeechobee, or from drainage from the ESWCD and 715 Farms area. Summaries of the historic annual and average monthly discharge volumes from this basin to the EPA and STAs by source are included in Tables 3.10 and 3.11, respectively. Similar summaries for TP discharge are provided in Tables 3.12 and 3.13.

Table 3.10: Annual Summary of S-6/S-2 Basin Discharge Volumes to EPA and STAs by Source*

Water Year	Lake Okeechobee Flow-through		S-6/S-2 Basin Runoff		ESWCD and 715 Farms		S-6/S-2 Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
1995	81,211	100.17	542,203	668.80	---	---	623,415	768.97
1996	61,516	75.88	368,081	454.02	---	---	429,597	529.90
1997	6,988	8.62	244,560	301.66	---	---	251,547	310.28
1998	22,920	28.27	328,348	405.01	---	---	351,268	433.28
1999	27,375	33.77	188,376	232.36	---	---	215,752	266.13
2000	28,346	34.96	303,155	373.94	---	---	331,501	408.90
2001	11,445	14.12	160,437	197.90	---	---	171,882	212.01
2002	2,262	2.79	206,227	254.38	4,319	5.33	212,808	262.50
2003	44,297	54.64	209,591	258.53	28,844	35.58	282,732	348.74
2004	7,357	9.08	223,426	275.59	26,155	32.26	256,939	316.93
Min.	2,262	2.79	160,437	197.90	4,319	5.33	171,882	212.01
Max.	81,211	100.17	542,203	668.80	28,844	35.58	623,415	768.97
Avg.	29,372	36.23	277,440	342.22	19,773	24.39	312,744	385.76

* Total discharge to EPA or STA-2 at S-6 and G-328 pump stations.

Table 3.11: Monthly Summary of S-6/S-2 Basin Discharge Volumes to EPA and STAs by Source[1]

Month	Lake Okeechobee Flow-through		S-6/S-2 Basin Runoff		ESWCD and 715 Farms[2]		S-6/S-2 Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
Jan	5,295	6.53	8,560	10.56	747	0.92	14,079	17.37
Feb	1,981	2.44	12,534	15.46	2,176	2.68	15,168	18.71
Mar	2,243	2.77	11,821	14.58	734	0.91	14,284	17.62
Apr	5,103	6.29	7,724	9.53	924	1.14	13,104	16.16
May	2,255	2.78	10,448	12.89	723	0.89	12,920	15.94
Jun	1,081	1.33	33,193	40.94	4,038	4.98	35,486	43.77
Jul	57	0.07	30,331	37.41	2,362	2.91	31,096	38.36
Aug	151	0.19	40,636	50.12	4,520	5.58	42,143	51.98
Sep	261	0.32	42,138	51.98	1,324	1.63	42,797	52.79
Oct	3,798	4.68	40,941	50.50	357	0.44	44,845	55.32
Nov	3,512	4.33	22,087	27.24	543	0.67	25,761	31.78
Dec	3,637	4.49	17,028	21.00	1,323	1.63	21,061	25.98
Ann	29,372	36.23	277,440	342.22	19,773	24.39	312,744	385.76

1. Total discharge to EPA or STA-2 at S-6 and G-328 pump stations.
2. The East Shore pump station has less than 29 months of available data so the average monthly data for this source cannot be added directly to those for the other sources which cover the entire 10-year study period.

Table 3.12: Annual Summary of S-6/S-2 Basin TP Discharge to EPA and STAs by Source[1]

Water Year	Lake Okeechobee Flow-through[2]		S-6/S-2 Basin Runoff		ESWCD and 715 Farms		S-6/S-2 Basin Total	
	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)
1995	6,803	68	61,501	92	---	---	68,305	89
1996	4,218	56	35,371	78	---	---	39,589	75
1997	751	87	32,255	107	---	---	33,006	106
1998	2,504	89	40,646	100	---	---	43,150	100
1999	2,651	79	23,884	103	---	---	26,535	100
2000	3,310	95	53,885	144	---	---	57,194	140
2001	1,168	83	22,789	115	---	---	23,958	113
2002	59	21	19,256	76	345	65	19,660	75
2003	2,716	50	16,708	65	2,285	64	21,709	62
2004	326	36	21,443	78	2,481	77	24,251	77
Min.	59	---	16,708	---	345	---	19,660	---
Max.	6,803	---	61,501	---	2,481	---	68,305	---
Avg.	2,451	68	32,774	96	1,704	70	35,736	93

1. Total discharge to EPA or STA-2 at S-6 and G-328 pump stations.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-6.

Table 3.13: Monthly Summary of S-6/S-2 Basin TP Discharge to EPA and STAs by Source[1]

Month	Lake Okeechobee Flow-through[2]		S-6/S-2 Basin Runoff		ESWCD and 715 Farms[3]		S-6/S-2 Basin Total	
	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)	Load (kg)	Conc. (ppb)
Jan	410	63	551	52	35	38	972	56
Feb	171	70	1,195	77	183	68	1,421	76
Mar	129	47	1,835	126	67	73	1,985	113
Apr	399	63	1,525	160	78	69	1,948	120
May	233	84	1,017	79	63	71	1,269	80
Jun	105	79	3,240	79	332	67	3,445	79
Jul	6	79	3,492	93	222	76	3,564	93
Aug	8	43	4,270	85	448	80	4,412	85
Sep	34	104	5,577	107	126	77	5,648	107
Oct	414	88	5,448	108	34	77	5,872	106
Nov	292	67	2,465	90	27	40	2,766	87
Dec	249	56	2,158	103	89	55	2,434	94
Ann	2,451	68	32,774	96	1,704	70	35,736	93

1. Total discharge to EPA or STA-2 at S-6 and G-328 pump stations.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-6.
3. The East Shore pump station has less than 29 months of available data so the average monthly data for this source cannot be added directly to those for the other sources that cover the entire 10-year study period.

Review of these tables shows that Lake Okeechobee flow-through releases account for an average of approximately 9.4 percent of the total discharge volume and 6.9 percent of the total TP load discharged from this basin to the EPA. The respective percentages contributed by S-6/S-2 Basin runoff are 88.7 and 91.3 percent. The East Shore pump station accounts for approximately 1.9 and 1.8 percent of the volumetric and TP discharges at this location, respectively. Diversions from the ESWCD and 715 Farms area were active for about the last 2-1/3 years of the study period so, as a percentage, the contributions from this source would be expected to increase over time. Considering only the last two years of the study period (WY 2003 and 2004) when the ESPS was fully operationally, this source contributed about 10.2 percent of the discharge volume and approximately 12.9 percent of the TP loads discharged from this basin.

* * * * *

4. S-7/S-2 BASIN

The S-7/S-2 Basin is defined as the entire S-7 Basin plus that portion of the S-2 Basin that drains to the North New River Canal (L-18, L-19 and L-20 borrow canals). The North New River (NNR), Cross and Bolles (L-21 borrow) canals are the principal drainage canals in the combined S-7/S-2 Basin. The NNR Canal connected Lake Okeechobee, at the S-2 pump station and S-351 spillway, with WCA-2A at the S-7 pump station and WCA-3A at structure S-150. The Cross Canal joins the S-7/S-2 Basin with the S-6/S-2 Basin to the east and the Bolles Canal connects this basin to the S-8/S-3 Basin to the west. Interbasin flows in these canals are not monitored and are considered to be relatively insignificant for this analysis.

A block diagram, which shows the principal structures that control the flow of water into and out of the S-7/S-2 Basin, is included as Figure 4.1. Flow paths in the southern end of this basin have been altered significantly from that shown in this schematic with the development of STA-3/4 and its associated new control structures; however, this stormwater treatment area became fully operational after the end of the study period for this Task 1.3.

The flow and TP load through each of the principal control structures in this basin are discussed in the following sections.

4.1. S-2 Pump Station and S-351 Spillway

The S-2 pump station and S-351 spillway control the flow of water between Lake Okeechobee and the northern ends of the Hillsboro and North New River canals. The preferred flow direction within the basin is from north to south to mimic pre-development conditions within the Everglades so water is generally pumped to Lake Okeechobee only when absolutely necessary to prevent flooding. The EAATPLD computer model allocates a fixed percentage of the flow at these two structures, approximately 65.1 percent, to the NNR Canal (Rule 40E-63) so the data received from the District maintains this fixed flow distribution between the Hillsboro and North New River canals. Tables 4.1 and 4.2 summarize the volumetric and TP discharges between Lake Okeechobee and the S-7/S-2 Basin by water year and month.

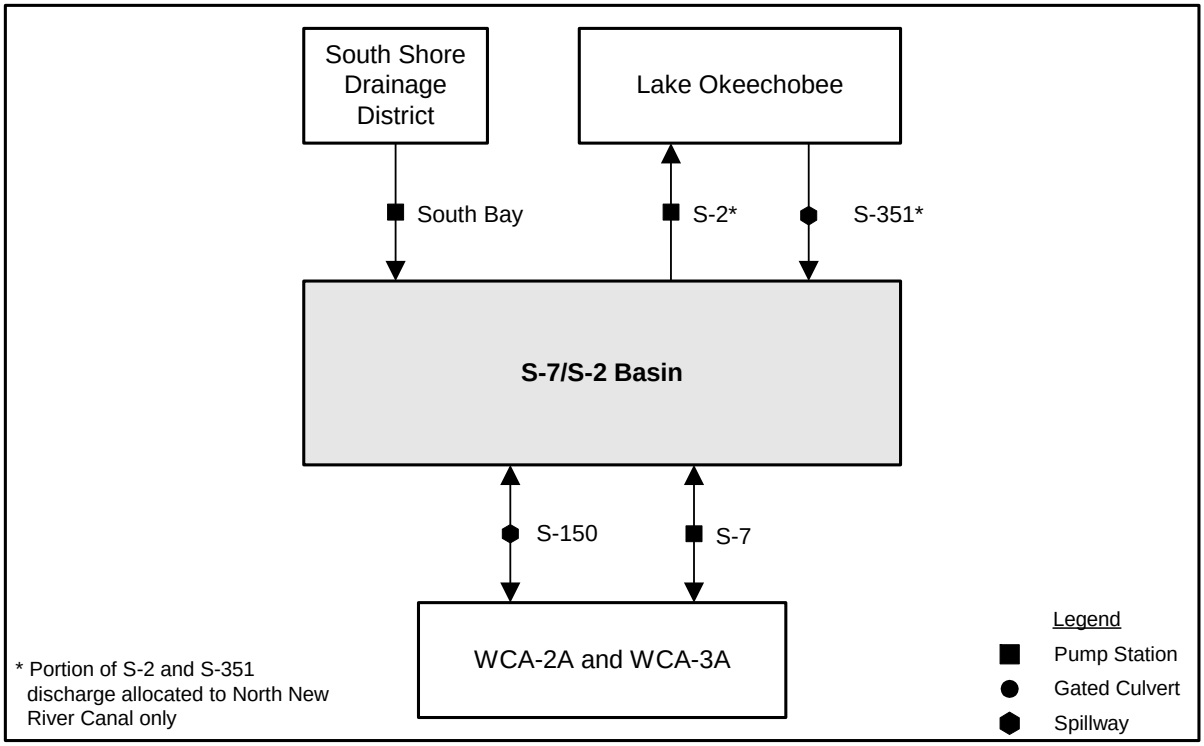

Figure 4.1: S-7/S-2 Basin Schematic

Table 4.1: Annual Discharge Summary at S-2 and S-351

Water Year	Lake Okeechobee to S-7/S-2 Basin				S-7/S-2 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	191,872	236.67	18,688	79	40,508	49.97	10,469	210
1996	203,652	251.20	30,016	119	30,714	37.89	5,792	153
1997	102,461	126.38	11,056	87	3,732	4.60	720	156
1998	55,240	68.14	5,812	85	7,270	8.97	1,545	172
1999	200,269	247.03	25,132	102	30,188	37.24	7,984	214
2000	118,365	146.00	23,183	159	25,436	31.37	7,098	226
2001	139,435	171.99	27,644	161	20,957	25.85	5,453	211
2002	45,549	56.18	6,021	107	136,675	168.59	17,785	105
2003	166,965	205.95	17,840	87	607	0.75	150	200
2004	116,842	144.12	13,717	95	137	0.17	34	200
Min.	45,549	56.18	5,812	---	137	0.17	34	---
Max.	203,652	251.20	30,016	---	136,675	168.59	17,785	---
Avg.	134,065	165.37	17,911	108	29,623	36.54	5,703	156

Table 4.2: Average Monthly Discharge Summary at S-2 and S-351

Month	Lake Okeechobee to S-7/S-2 Basin				S-7/S-2 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	15,028	18.54	2,142	116	27	0.03	6	176
Feb	9,561	11.79	1,526	129	137	0.17	33	196
Mar	13,933	17.19	2,074	121	385	0.48	81	170
Apr	28,460	35.11	3,703	105	451	0.56	93	168
May	24,610	30.36	3,220	106	0	0.00	0	---
Jun	9,091	11.21	1,174	105	1,635	2.02	256	127
Jul	2,198	2.71	232	86	4,332	5.34	513	96
Aug	1,219	1.50	132	88	6,236	7.69	909	118
Sep	1,085	1.34	101	76	3,525	4.35	512	118
Oct	9,137	11.27	864	77	5,999	7.40	1,499	203
Nov	8,653	10.67	906	85	4,466	5.51	1,257	228
Dec	11,089	13.68	1,835	134	2,430	3.00	543	181
Ann	134,065	165.37	17,911	108	29,623	36.54	5,703	156

A portion of the water released to the S-7/S-2 Basin from Lake Okeechobee is comprised of flow-through releases. The estimated volume and TP loads in these flow-through releases are summarized in Table 4.3 by water year and Table 4.4 by month.

Tables 4.3 and 4.4 contain two different estimates of the TP load and concentrations in the flow-through releases. The first estimate uses TP concentrations collected in samples taken at S-351 and the second uses the results of TP sampling at S-7. The first method, using concentrations at S-351, is more appropriate for estimating the TP load that enters the basin but the second method is considered better for estimating the TP load that these flow-through releases contribute to the EPA (and potentially to STA-3/4). Using this second method, the TP load in these releases is estimated to be only about 51.5 percent of those calculated using S-351 data. On average, approximately 34 percent of the total lake releases at S-351 are flow-through releases.

Table 4.3: Annual Summary of Lake Flow-through Releases in S-7/S-2 Basin

Water Year	Volume		Concentrations at S-351		Concentrations at S-7	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	105,473	130.10	12,827	99	8,373	64
1996	99,656	122.92	23,598	192	11,149	91
1997	34,754	42.87	5,634	131	2,642	62
1998	1,461	1.80	234	130	123	68
1999	89,404	110.28	15,500	141	8,285	75
2000	38,930	48.02	9,021	188	6,990	146
2001	27,341	33.72	9,347	277	1,305	39
2002	231	0.29	36	125	6	23
2003	46,900	57.85	4,659	81	2,861	49
2004	13,011	16.05	1,388	86	627	39
Min.	231	0.29	36	---	6	---
Max.	105,473	130.10	23,598	---	11,149	---
Avg.	45,716	56.39	8,224	146	4,236	75

Table 4.4: Average Monthly Summary of Lake Flow-through Releases in S-7/S-2 Basin

Month	Volume		Concentrations at S-351		Concentrations at S-7	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
Jan	7,520	9.28	1,203	130	659	71
Feb	4,556	5.62	1,065	190	405	72
Mar	5,034	6.21	939	151	318	51
Apr	11,232	13.85	2,072	150	1,107	80
May	5,132	6.33	903	143	704	111
Jun	233	0.29	40	141	21	73
Jul	100	0.12	17	141	9	70
Aug	133	0.16	25	151	7	40
Sep	455	0.56	52	93	44	79
Oct	3,829	4.72	448	95	354	75
Nov	3,153	3.89	401	103	267	69
Dec	4,340	5.35	1,059	198	341	64
Ann	45,716	56.39	8,224	146	4,236	75

4.2. South Bay Pump Station

The City of South Bay is located on the south shore of Lake Okeechobee, immediately west of the North New River Canal, and is located within the South Shore Drainage District.

Drainage from the City is discharged to the North New River Canal via the South Bay pump station. A summary of the recorded discharges and TP loads from this pump station is included in Table 4.5.

Table 4.5: Discharge Summary at South Bay Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	2,516	3.10	288	93	Jan	159	0.20	13	68
1996	1,967	2.43	225	93	Feb	182	0.22	17	76
1997	1,456	1.80	331	184	Mar	122	0.15	26	171
1998	1,977	2.44	562	230	Apr	85	0.10	22	211
1999	1,996	2.46	333	135	May	128	0.16	17	108
2000	3,464	4.27	460	108	Jun	305	0.38	36	96
2001	809	1.00	151	152	Jul	244	0.30	33	109
2002	2,197	2.71	192	71	Aug	236	0.29	32	111
2003	2,931	3.62	367	102	Sep	242	0.30	39	131
2004	2,098	2.59	145	56	Oct	164	0.20	24	121
Min.	809	1.00	145	---	Nov	121	0.15	18	122
Max.	3,464	4.27	562	---	Dec	152	0.19	27	144
Avg.	2,141	2.64	305	116	Ann	2,141	2.64	305	116

4.3. S-7 Pump Station

Control structure S-7 is a pump station and gated spillway located at the point where the NNR Canal enters WCA-2A. The original purpose of this structure was to convey water from the S-7 Basin to WCA-2A but, with the construction of STA-3/4, it now serves as an outflow pump station for STA-3/4. Tables 4.6 and 4.7 summarize the annual and average monthly volumetric and TP discharges at this control structure from the S-7/S-2 Basin, respectively. These discharges represent potential or actual inflow to STA-3/4. Historically, there have also been water supply releases from WCA-2A into the S-7/S-2 basin at S-7 although these releases are not common. These releases are also summarized in Tables 4.6 and 4.7.

Table 4.6: Annual Discharge Summary at S-7

Water Year	S-7/S-2 Basin to WCA-2A				WCA-2A to S-7/S-2 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	433,676	534.93	46,954	88	1,434	1.77	285	161
1996	285,856	352.60	26,275	75	142	0.17	10	56
1997	148,645	183.35	18,580	101	1,412	1.74	101	58
1998	198,561	244.92	19,623	80	10,326	12.74	690	54
1999	188,409	232.40	25,590	110	3,517	4.34	1,102	254
2000	264,461	326.21	23,412	72	0	0.00	0	---
2001	145,652	179.66	13,125	73	6,115	7.54	216	29
2002	98,119	121.03	5,783	48	69,021	85.14	4,432	52
2003	142,924	176.29	9,634	55	17,175	21.18	1,097	52
2004	156,157	192.62	8,572	45	2,007	2.48	51	21
Min.	98,119	121.03	5,783	---	0	0.00	0	---
Max.	433,676	534.93	46,954	---	69,021	85.14	4,432	---
Avg.	206,246	254.40	19,755	78	11,115	13.71	798	58

4.4. S-150 Culvert

Structure S-150 is a gated culvert that was constructed to convey flow from the NNR Canal to WCA-3A. With construction of the STA-3/4 complex, the function of this structure is largely unchanged but it will be operated primarily during periods of STA-3/4 bypass. Historically, there have also been times when water was released from WCA-3A to the S-7/S-2 Basin through S-150. The discharge at this structure, both positive (southward) and negative (northward) is summarized in Tables 4.8 and 4.9.

Table 4.7: Average Monthly Discharge Summary at S-7

Month	S-7/S-2 Basin to WCA-2A				WCA-2A to S-7/S-2 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	7,780	9.60	672	70	951	1.17	46	39
Feb	9,647	11.90	773	65	36	0.04	7	147
Mar	11,536	14.23	778	55	862	1.06	46	43
Apr	10,304	12.71	969	76	154	0.19	8	44
May	10,188	12.57	1,347	107	1	0.00	0	165
Jun	24,869	30.68	2,615	85	0	0.00	0	---
Jul	22,236	27.43	2,104	77	656	0.81	42	52
Aug	21,653	26.71	1,653	62	2,646	3.26	190	58
Sep	26,193	32.31	2,186	68	717	0.88	57	64
Oct	28,005	34.54	2,328	67	1,660	2.05	166	81
Nov	18,099	22.33	2,555	114	2,347	2.90	171	59
Dec	15,736	19.41	1,777	92	1,085	1.34	66	49
Ann	206,246	254.40	19,755	78	11,115	13.71	798	58

Table 4.8: Annual Discharge Summary at S-150

Water Year	S-7/S-2 Basin to WCA-3A				WCA-3A to S-7/S-2 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	21,261	26.23	1,891	72	852	1.05	73	69
1996	51,081	63.01	4,454	71	934	1.15	120	104
1997	87,281	107.66	4,520	42	382	0.47	34	71
1998	23,419	28.89	1,810	63	1,611	1.99	431	217
1999	64,163	79.14	4,859	61	554	0.68	44	64
2000	58,317	71.93	6,113	85	0	0.00	0	---
2001	39,367	48.56	2,280	47	84	0.10	7	64
2002	21,267	26.23	956	36	25	0.03	2	64
2003	68,669	84.70	4,070	48	0	0.00	0	41
2004	10,275	12.67	454	36	0	0.00	0	---
Min.	10,275	12.67	454	---	0	0.00	0	---
Max.	87,281	107.66	6,113	---	1,611	1.99	431	---
Avg.	44,510	54.90	3,141	57	444	0.55	71	130

Table 4.9: Average Monthly Discharge Summary at S-150

Month	S-7/S-2 Basin to WCA-3A or STA-3/4				WCA-3A to S-7/S-2 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	4,761	5.87	178	30	6	0.01	2	257
Feb	6,003	7.40	419	57	25	0.03	8	264
Mar	3,430	4.23	291	69	68	0.08	11	132
Apr	7,562	9.33	695	75	0	0.00	0	41
May	5,070	6.25	480	77	6	0.01	0	58
Jun	4,838	5.97	334	56	134	0.17	16	96
Jul	5,649	6.97	352	50	16	0.02	2	106
Aug	2,220	2.74	136	50	97	0.12	16	133
Sep	619	0.76	29	38	8	0.01	1	71
Oct	979	1.21	54	45	17	0.02	4	206
Nov	686	0.85	22	26	13	0.02	4	240
Dec	2,694	3.32	151	46	55	0.07	7	101
Ann	44,510	54.90	3,141	57	444	0.55	71	130

4.5. S-7/S-2 Basin Runoff

The runoff from the S-7/S-2 Basin is defined as the total discharge from the basin at the various control points less any contributions to this discharge from outside sources. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

- S-7 pump station discharge
- Plus S-150 culvert discharge
- Plus discharge to Lake Okeechobee at S-2 and S-351 (S-7/S-2 basin portion only)
- Minus South Bay pump station discharge
- Minus flow-through releases from Lake Okeechobee to S-7/S-2 basin

The resulting runoff estimates are summarized by water year and month in Tables 4.10 and 4.11, respectively. The method used to estimate the TP load in flow-through releases from Lake Okeechobee has a moderate impact on the estimated TP loads in basin runoff.

Table 4.10: Annual Runoff Summary for S-7/S-2 Basin

Water Year	Volume		Flow-through Concentrations at S-351		Flow-through Conc. at S-7/S-150	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	387,698	478.22	50,043	105	50,683	106
1996	266,237	328.40	19,669	60	25,560	78
1997	203,356	250.84	19,708	79	21,884	87
1998	225,939	278.69	22,262	80	22,626	81
1999	191,891	236.69	26,921	114	30,640	129
2000	306,384	377.92	29,724	79	30,158	80
2001	178,030	219.60	12,961	59	19,491	89
2002	225,046	277.59	22,322	80	20,995	76
2003	163,399	201.55	8,945	44	11,126	55
2004	152,587	188.21	7,612	40	8,415	45
Min.	152,587	188.21	7,612	---	8,415	---
Max.	387,698	478.22	50,043	---	50,683	---
Avg.	230,057	283.77	22,017	78	24,158	85

Table 4.11: Average Monthly Runoff Summary for S-7/S-2 Basin*

Month	Flow-through Concentrations at S-351			Flow-through Conc. at S-7/S-150		
	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)
Jan	5,518	279	41	4,966	243	40
Feb	12,918	858	54	11,143	834	61
Mar	13,133	1,027	63	10,251	824	65
Apr	8,666	534	50	7,046	766	88
May	12,253	1,705	113	10,048	1,185	96
Jun	30,834	3,145	83	30,834	3,157	83
Jul	31,556	2,912	75	31,556	2,899	74
Aug	27,624	2,494	73	27,624	2,435	71
Sep	29,219	2,619	73	29,219	2,603	72
Oct	34,279	3,943	93	30,953	3,516	92
Nov	19,999	3,538	143	19,999	3,551	144
Dec	26,361	3,511	108	16,417	2,144	106
Ann	252,361	26,565	85	230,057	24,158	85

* Calculated TP load in basin runoff is negative in some months because of uncertainties in TP load estimates. Months with negative TP load are excluded from calculation of average monthly data; therefore, average monthly runoff volumes will vary based on flow-through concentration assumptions.

The variability of TP loads and concentrations by month in basin runoff, using flow-through concentrations at S-7, is shown graphically in Figure 4.2.

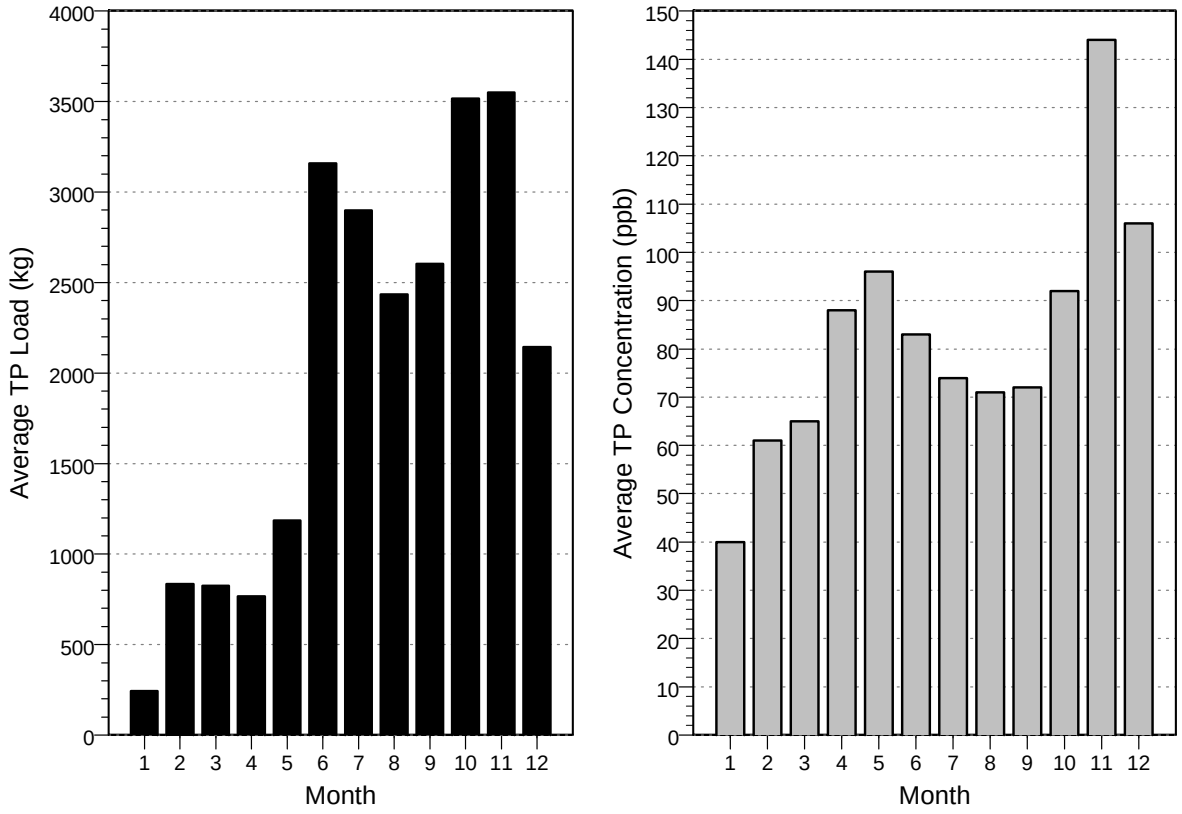

Figure 4.2: Average Monthly TP Loads and Concentrations in S-7/S-2 Basin Runoff

4.6. S-7/S-2 Basin Discharge to Everglades Protection Area

Prior to completion of STA-3/4, virtually all of the discharge from the S-7/S-2 Basin was delivered to WCA-2A via S-7 or WCA-3A via S-150. This discharge originates either from basin runoff or flow-through releases from Lake Okeechobee. A summary of the historic discharge volumes from this basin to the EPA by source is included in Tables 4.11 and 4.12. Similar summaries for TP discharge are provided in Tables 4.13 and 4.14.

Table 4.12: Annual Summary of S7/S-2 Basin Discharge Volumes to EPA by Source*

Water Year	Lake Okeechobee Flow-through		S-7/S-2 Basin Runoff		South Shore Drainage District		S-7/S-2 Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
1995	105,473	130.10	347,519	428.66	1,584	1.95	454,937	561.16
1996	99,656	122.92	235,820	290.88	1,154	1.42	336,937	415.61
1997	34,759	42.87	199,719	246.35	1,172	1.45	235,926	291.01
1998	1,461	1.80	218,785	269.87	1,320	1.63	221,980	273.81
1999	89,405	110.28	162,108	199.96	1,009	1.24	252,572	311.54
2000	38,929	48.02	281,413	347.12	2,436	3.00	322,779	398.14
2001	27,341	33.72	157,196	193.90	398	0.49	185,019	228.22
2002	231	0.29	118,405	146.05	429	0.53	119,386	147.26
2003	47,648	58.77	162,864	200.89	1,031	1.27	211,592	261.00
2004	13,011	16.05	152,449	188.04	971	1.20	166,431	205.29
Min.	231	0.29	118,405	146.05	398	0.49	119,386	147.26
Max.	105,473	130.10	347,519	428.66	2,436	3.00	454,937	561.16
Avg.	45,791	56.48	203,628	251.17	1,150	1.42	250,756	309.30

* Total discharge to EPA at S-7 and S-150.

Table 4.13: Monthly Summary of S-7/S-2 Basin Discharge Volumes to EPA by Source*

Month	Lake Okeechobee Flow-through		S-7/S-2 Basin Runoff		South Shore Drainage District		S-7/S-2 Basin Total	
	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)	(ac-ft)	(hm^3)
Jan	7,521	9.28	4,947	6.10	73	0.09	12,541	15.47
Feb	4,556	5.62	11,013	13.58	81	0.10	15,650	19.30
Mar	5,034	6.21	9,873	12.18	53	0.07	14,966	18.46
Apr	11,232	13.85	6,609	8.15	25	0.03	17,866	22.04
May	5,132	6.33	10,048	12.39	72	0.09	15,258	18.82
Jun	233	0.29	29,226	36.05	202	0.25	29,707	36.64
Jul	100	0.12	27,613	34.06	162	0.20	27,885	34.40
Aug	133	0.16	23,525	29.02	150	0.19	23,873	29.45
Sep	455	0.56	26,200	32.32	149	0.18	26,812	33.07
Oct	3,904	4.82	24,992	30.83	83	0.10	28,985	35.75
Nov	3,153	3.89	15,567	19.20	44	0.05	18,785	23.17
Dec	4,340	5.35	14,014	17.29	55	0.07	18,430	22.73
Ann	45,791	56.48	203,628	251.17	1,150	1.42	250,756	309.30

* Total discharge to EPA at S-7 and S-150.

Table 4.14: Annual Summary of S-7/S-2 Basin TP Discharge to EPA by Source[1]

Water Year	Lake Okeechobee Flow-through[2]		S-7/S-2 Basin Runoff		South Shore Drainage District		S-7/S-2 Basin Total	
	(kg)	(ppb)	(kg)	(ppb)	(kg)	(ppb)	(kg)	(ppb)
1995	8,365	64	40,299	94	160	82	48,845	87
1996	10,787	88	19,821	68	92	65	30,730	74
1997	1,762	41	21,181	86	117	81	23,100	79
1998	140	78	21,106	78	146	89	21,433	78
1999	7,613	69	22,743	114	89	71	30,449	98
2000	6,166	128	23,165	67	193	64	29,524	74
2001	1,289	38	14,066	73	40	82	15,404	67
2002	12	43	6,698	46	19	37	6,739	46
2003	2,640	45	10,994	55	69	54	13,704	53
2004	595	37	8,381	45	50	42	9,026	44
Min.	12	---	6,698	---	19	---	6,739	---
Max.	10,787	---	40,299	---	193	---	48,845	---
Avg.	3,937	70	18,846	75	98	69	22,895	74

1. Total discharge to EPA at S-7 and S-150.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-7.

Table 4.15: Monthly Summary of S-7/S-2 Basin TP Discharge to EPA by Source[1]

Month	Lake Okeechobee Flow-through[2]		S-7/S-2 Basin Runoff		South Shore Drainage District		S-7/S-2 Basin Total	
	(kg)	(ppb)	(kg)	(ppb)	(kg)	(ppb)	(kg)	(ppb)
Jan	607	65	239	39	3	38	850	55
Feb	382	68	803	59	6	61	1,191	62
Mar	320	51	744	61	4	63	1,069	58
Apr	986	71	676	83	3	91	1,664	76
May	631	100	1,185	96	10	111	1,827	97
Jun	20	71	2,904	81	19	77	2,949	80
Jul	9	69	2,432	71	15	74	2,456	71
Aug	7	41	1,767	61	10	55	1,789	61
Sep	44	79	2,159	67	11	58	2,215	67
Oct	349	73	2,026	66	6	55	2,382	67
Nov	268	69	2,303	120	4	70	2,576	111
Dec	313	59	1,607	93	7	99	1,928	85
Ann	3,937	70	18,846	75	98	69	22,895	74

1. Total discharge to EPA at S-7 and S-150.
2. TP load in Lake Okeechobee flow-through releases calculated using sample data at S-7.

Review of these tables shows that Lake Okeechobee flow-through releases account for an average of approximately 18.2 percent of the total discharge volume and 18.5 percent of the total TP load discharged from this basin to the EPA. The respective percentages contributed by S-7/S-2 Basin runoff are 81.8 and 81.5 percent.

* * * * *

5. S-8/S-3 BASIN

The S-8 and S-3 drainage basins are located in southwestern Palm Beach County and northeastern Hendry County. These two drainage basins are treated as a single unit in this study because they are both drained primarily by the Miami Canal (L-23, L-24 and L-25 borrow canals). Prior to completion of STA-3/4 and it associated new control structures, the Miami Canal connected Lake Okeechobee, at the S-3 pump station and S-354 spillway, directly with WCA-3A at the S-8 pump station. A block diagram, which shows the principal flow monitoring locations for the S-8/S-3 Basin, is included as Figure 5.1. Now that STA-3/4 is complete, the flow paths in the southern portion of this basin have been altered significantly but this stormwater treatment area did not become operational until after the study period. The flow and TP load through each of the structures shown in Figure 5.1 are discussed below.

5.1. S-3 Pump Station and S-354 Spillway

The S-3 pump station and S-354 spillway control the flow of water between Lake Okeechobee and the northern end of the Miami Canal. The preferred flow direction within the basin is from north to south so water is generally pumped to Lake Okeechobee only when absolutely necessary to prevent flooding. Table 5.1 summarizes the annual volumetric and TP discharges between Lake Okeechobee and the S-8/S-3 Basin by water year. Table 5.2 presents these same data in an average monthly format.

The water that is released from Lake Okeechobee at S-354 may include supplies for the S-8/S-3 Basin, regulatory releases from the lake to keep its stage within target levels, and supplies for the EPA or other areas downstream of this basin. These latter two release components are called flow-through releases. The estimated volume and TP loads in these flow-through releases are summarized in Tables 5.3 and 5-4. These tables contain two different estimates of the TP load and concentrations in the flow-through releases. The first estimate uses TP concentrations collected in samples taken at S-354 and the second uses the results of TP sampling at S-8. Using this second method, the TP load in these releases is estimated to be about 13.5 percent less. On average, approximately 39 percent of the total lake releases at S-354 are flow-through releases.

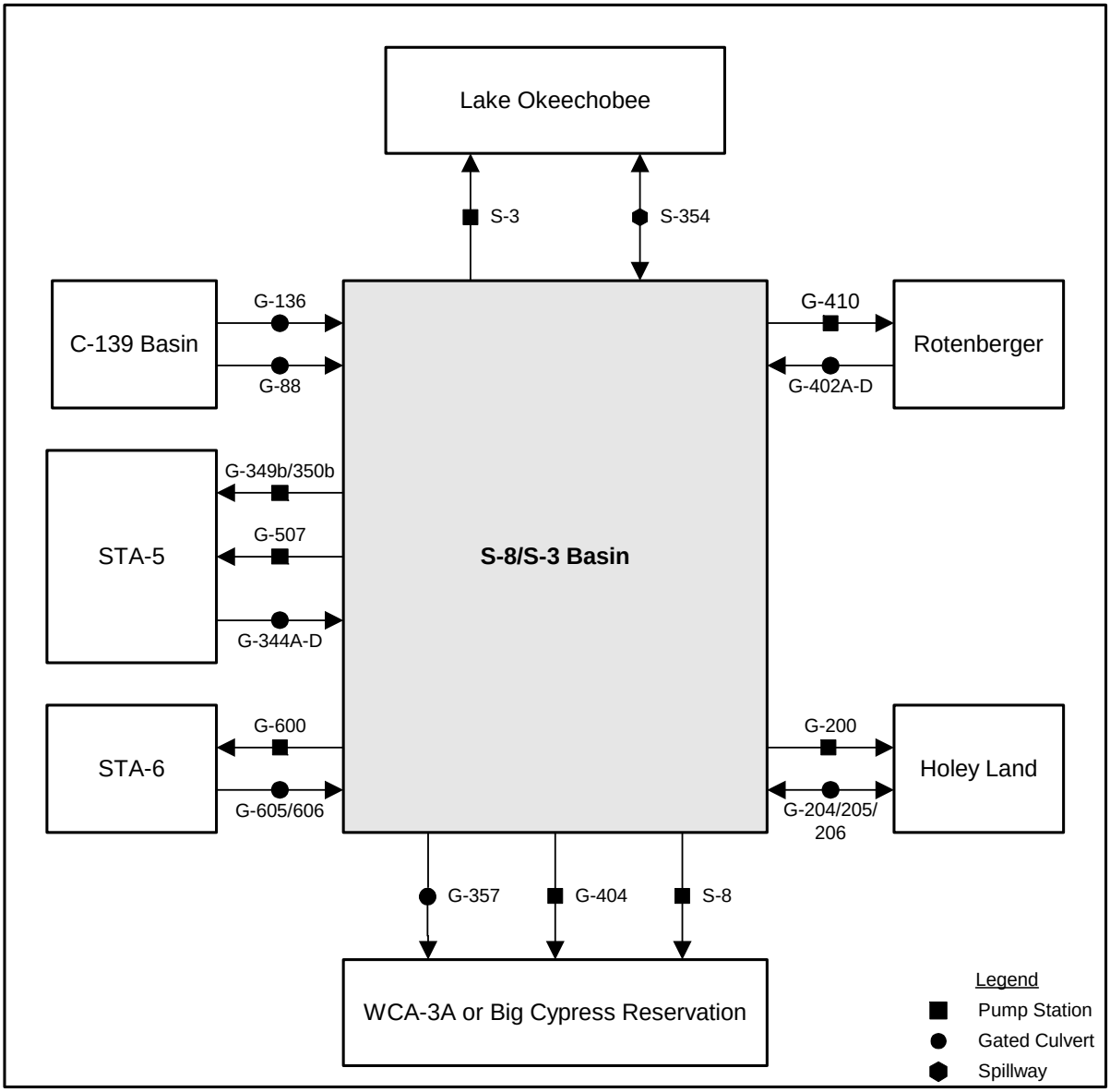

Figure 5.1: S-8/S-3 Basin Schematic

Table 5.1: Annual Discharge Summary for S-3 and S-354

Water Year	S-8/S-3 Basin to Lake Okeechobee				Lake Okeechobee to S-8/S-3 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	12,785	15.77	2,742	174	92,254	113.79	9,292	82
1996	20,198	24.91	3,577	144	84,765	104.56	12,254	117
1997	7,196	8.88	760	86	114,907	141.74	10,138	72
1998	4,457	5.50	955	174	48,621	59.97	5,158	86
1999	22,026	27.17	9,301	342	242,831	299.53	23,829	80
2000	7,746	9.56	1,255	131	102,771	126.77	19,590	155
2001	11,597	14.30	2,061	144	158,281	195.24	16,940	87
2002	133,492	164.66	14,868	90	62,063	76.55	6,327	83
2003	1,900	2.34	395	168	70,090	86.45	6,805	79
2004	261	0.32	91	282	105,840	130.55	12,898	99
Min.	261	0.32	91	---	48,621	59.97	5,158	---
Max.	133,492	164.66	14,868	---	242,831	299.53	23,829	---
Avg.	22,166	27.34	3,600	132	108,242	133.52	12,323	92

Table 5.2: Average Monthly Discharge Summary at S-3 and S-354

Month	S-8/S-3 Basin to Lake Okeechobee				Lake Okeechobee to S-8/S-3 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	61	0.08	12	157	5,065	6.25	579	93
Feb	16	0.02	3	170	4,450	5.49	542	99
Mar	317	0.39	30	77	11,858	14.63	1,487	102
Apr	201	0.25	26	105	25,315	31.23	3,063	98
May	266	0.33	36	109	27,989	34.52	3,198	93
Jun	1,468	1.81	171	95	11,751	14.49	1,225	84
Jul	4,344	5.36	354	66	3,573	4.41	349	79
Aug	4,883	6.02	699	116	2,120	2.62	282	108
Sep	5,146	6.35	772	122	2,690	3.32	308	93
Oct	2,161	2.67	320	120	1,536	1.89	159	84
Nov	2,698	3.33	1,050	316	5,390	6.65	492	74
Dec	604	0.75	127	170	6,505	8.02	640	80
Ann	22,166	27.34	3,600	132	108,242	133.52	12,323	92

Table 5.3: Annual Summary of Lake Flow-through Releases in S-8/S-3 Basin

Water Year	Volume		Concentrations at S-354		Concentrations at S-8	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	29,273	36.11	2,766	77	3,659	101
1996	38,263	47.20	5,515	117	3,713	79
1997	54,004	66.61	4,577	69	3,954	59
1998	16,545	20.41	1,509	74	1,179	58
1999	136,621	168.52	13,150	78	14,297	85
2000	37,754	46.57	7,296	157	4,511	97
2001	53,021	65.40	6,294	96	6,234	95
2002	3,924	4.84	428	88	154	32
2003	12,510	15.43	1,260	82	647	42
2004	40,017	49.36	4,385	89	2,484	50
Min.	3,924	4.84	428	---	154	---
Max.	136,621	168.52	13,150	---	14,297	---
Avg.	42,193	52.04	4,718	91	4,083	78

Table 5.4: Average Monthly Summary of Lake Flow-through Releases in S-8/S-3 Basin

Month	Volume		Concentrations at S-354		Concentrations at S-8	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
Jan	2,494	3.08	253	82	177	58
Feb	1,108	1.37	132	96	63	46
Mar	2,678	3.30	302	91	151	46
Apr	8,322	10.27	983	96	694	68
May	10,757	13.27	1,314	99	1,275	96
Jun	5,846	7.21	598	83	640	89
Jul	1,805	2.23	190	85	188	85
Aug	1,199	1.48	144	98	153	104
Sep	1,397	1.72	166	97	178	103
Oct	988	1.22	114	93	152	125
Nov	2,487	3.07	222	72	210	68
Dec	3,112	3.84	300	78	201	52
Ann	42,193	52.04	4,718	91	4,083	78

5.2. Culverts G-136 and G-88

Historically, the S-8/S-3 Basin has received inflow from the C-139 Basin at G-136 and G-88. G-136 is a gated culvert that regulates flow between the L-1 and L-1 East borrow canals. This culvert is normally closed but is opened during high runoff events to help alleviate flooding within the northern part of the C-139 basin. Under these conditions, the drainage from the upper Basin is diverted east through the L-1E Borrow Canal to the Miami Canal. Drainage from the southern part of the basin under flood conditions and all of the drainage under normal flow conditions travels south through the L-2 and L-3 borrow canals. Structure G-88 is located at the intersection of the L-3 and L-4 borrow canals and controls the amount of flow that is conveyed east toward the S-8 pump station. G-136 is still operated as described above but G-88 is no longer used to divert flow into the L-4 Borrow Canal. The annual and average monthly inflow volumes and TP loads through these two structures to the S-8/S-3 Basin are summarized in Tables 5.5 and 5.6, respectively.

Table 5.5: Annual Discharge Summary at G-88 and G-136

Water Year	S-8/S-3 Basin Inflow at G-88				S-8/S-3 Basin Inflow at G-136			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	79,324	97.85	21,253	217	35,986	44.39	5,336	120
1996	80,083	98.78	22,237	225	20,790	25.64	3,381	132
1997	10,067	12.42	4,127	332	13,091	16.15	2,459	152
1998	2,500	3.08	406	132	20,776	25.63	5,327	208
1999	6,641	8.19	1,126	138	13,732	16.94	4,165	246
2000	35,273	43.51	12,143	279	24,859	30.66	7,948	259
2001	1,653	2.04	191	94	3,294	4.06	244	60
2002	0	0.00	0	---	17,061	21.04	4,239	201
2003	0	0.00	0	---	15,155	18.69	4,965	266
2004	0	0.00	0	---	13,221	16.31	3,335	205
Min.	0	0.00	0	---	3,294	4.06	244	---
Max.	80,083	98.78	22,237	---	35,986	44.39	7,948	---
Avg.	21,554	26.59	6,148	231	17,797	21.95	4,140	189

Table 5.6: Average Monthly Discharge Summary at G-88 and G-136

Month	S-8/S-3 Basin Inflow at G-88				S-8/S-3 Basin Inflow at G-136			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	1,164	1.44	235	163	566	0.70	58	84
Feb	15	0.02	2	113	673	0.83	111	134
Mar	57	0.07	9	124	249	0.31	43	141
Apr	29	0.04	4	124	79	0.10	6	66
May	178	0.22	22	98	244	0.30	20	66
Jun	384	0.47	172	364	1,844	2.27	436	192
Jul	1,716	2.12	555	262	3,134	3.87	954	247
Aug	1,619	2.00	565	283	3,030	3.74	832	223
Sep	5,783	7.13	1,833	257	2,975	3.67	603	164
Oct	7,171	8.85	1,992	225	2,678	3.30	592	179
Nov	1,582	1.95	321	165	1,241	1.53	377	246
Dec	1,858	2.29	439	192	1,084	1.34	106	80
Ann	21,554	26.59	6,148	231	17,797	21.95	4,140	189

5.3. Rotenberger Tract Structures

The G-410 pump station and culverts G-402A through G-402D control flow into and out of the Rotenberger Tract. Structure G-410 is an inflow pump station that draws water from the STA-5 outflow canal and discharges this water into the western part of the Rotenberger Tract. This pump station was constructed in conjunction with the development of STA-5 so it has been in operation only since July 2001. The four G-402 culverts are located along the eastern boundary of the Rotenberger Tract and control the discharge from this tract to the Miami Canal. The first recorded discharge through these culverts was in December 2001. Tables 5.7 and 5.8 summarize the inflow and outflow from the Rotenberger Tract through these structures.

5.4. G-200 Pump Station and Culverts G-204, G-205 and G-206

The G-200 pump station is used to supply water to the Holey Land tract. It draws water from the Miami Canal and discharges to the distribution canal at the northern end of this tract. Table 5.9 summarizes the annual and average monthly discharge at this structure.

Table 5.7: Annual Discharge Summary for G-410 and G402A – G402D*

Water Year	G-410				Total for G402A – G402D			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	---	---	---	---	---	---	---	---
1996	---	---	---	---	---	---	---	---
1997	---	---	---	---	---	---	---	---
1998	---	---	---	---	---	---	---	---
1999	---	---	---	---	---	---	---	---
2000	---	---	---	---	---	---	---	---
2001	---	---	---	---	---	---	---	---
2002<	33,169	40.91	2,386	58	12,799	15.79	344	22
2003	54,307	66.99	6,561	98	25,406	31.34	771	25
2004	16,849	20.78	930	45	353	0.44	28	64
Min.	16,849	20.78	930	---	353	0.44	28	---
Max.	54,307	66.99	6,561	---	25,406	31.34	771	---
Avg.	35,578	43.88	3,746	85	12,879	15.89	399	25

* Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.

Table 5.8: Average Monthly Discharge Summary at G-410 and G402A – G402D

Month	G-410				Total for G402A – G402D			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	7,193	8.87	571	64	329	0.41	9	21
Feb	2,324	2.87	160	56	41	0.05	3	63
Mar	65	0.08	2	27	61	0.08	4	58
Apr	16	0.02	1	32	29	0.04	2	69
May	16	0.02	2	85	0	0.00	0	---
Jun	1,276	1.57	466	296	1	0.00	0	22
Jul	4,720	5.82	405	70	3,910	4.82	117	24
Aug	3,186	3.93	327	83	1,981	2.44	53	22
Sep	5,281	6.51	464	71	2,466	3.04	82	27
Oct	4,712	5.81	514	88	4,019	4.96	109	22
Nov	2,399	2.96	211	71	11	0.01	1	62
Dec	4,020	4.96	327	66	4	0.00	0	61
Ann	35,205	43.43	3,449	79	12,853	15.85	381	24

Table 5.9: Discharge Summary at G-200

Annual Data					Average Monthly Data				
Water Year	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)	Month	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)
1995	61,831	76.27	11,961	157	Jan	3,336	4.11	245	59
1996	15,560	19.19	1,005	52	Feb	1,682	2.07	163	79
1997	60,509	74.64	4,190	56	Mar	1,780	2.20	122	56
1998	55,199	68.09	7,486	110	Apr	4,962	6.12	317	52
1999	52,951	65.31	5,704	87	May	4,988	6.15	962	156
2000	33,072	40.79	3,486	85	Jun	4,318	5.33	377	71
2001	47,329	58.38	5,301	91	Jul	2,153	2.66	298	112
2002	8,475	10.45	435	42	Aug	2,912	3.59	778	217
2003	45,889	56.60	4,326	76	Sep	2,264	2.79	260	93
2004	20,956	25.85	1,898	73	Oct	2,009	2.48	207	84
Min.	8,475	10.45	435	---	Nov	5,076	6.26	466	74
Max.	61,831	76.27	11,961	---	Dec	4,697	5.79	385	66
Avg.	40,177	49.56	4,579	92	Ann	40,177	49.56	4,579	92

A brief analysis was conducted to identify the possible sources of the water supplied to the Holey Land at G-200. For each day during the study period with discharge at G-200, an estimate of net water supply releases was made. Net water supply releases were defined as total releases from Lake Okeechobee less any flow-through amounts. Comparing these net water supply releases with pumping demands at G-200 showed that less than 17 percent of these demands had potentially been supplied by Lake Okeechobee releases. Therefore, it was concluded that most of the water supplied to the Holey Land tract must originate either from S-8/S-3 Basin runoff or other basin inflow, such as discharge from STA-5.

There are also three gated culverts located along the southern boundary of the Holey Land (G-204, G-205 and G-206) that control discharge between this area and the L-5 Borrow Canal. Discharges through these structures are relatively infrequent but can flow in either direction. The discharge through these culverts is summarized in Tables 5.10 and 5.11. The data provided by the District did not contain any discharge volumes or TP load estimates for these structures so flow and grab sampling data for these structures were retrieved directly from the District's DYHYDRO database. The TP load estimates that are summarized in Tables 5.10 and 5.11 were developed by Burns & McDonnell from these data.

Table 5.10: Annual Discharge Summary for G204, G-205 and G-206

Water Year	Holey Land to S-8/S-3 Basin				S-8/S-3 Basin to Holey Land			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	2	0.00	0	13	111	0.14	7	55
1996	0	0.00	0	---	542	0.67	41	61
1997	0	0.00	0	---	6	0.01	0	62
1998	0	0.00	0	---	0	0.00	0	---
1999	0	0.00	0	---	45	0.06	3	51
2000	299	0.37	84	227	585	0.72	51	71
2001	136	0.17	17	102	187	0.23	8	34
2002	47	0.06	3	44	0	0.00	0	45
2003	0	0.00	0	---	0	0.00	0	---
2004	0	0.00	0	---	0	0.00	0	---
Min.	0	0.00	0	---	0	0.00	0	---
Max.	299	0.37	84	---	585	0.72	51	---
Avg.	48	0.06	10	173	148	0.18	11	61

* Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.

Table 5.11: Average Monthly Discharge Summary at G-204, G-205 and G-206

Month	Holey Land to S-8/S-3 Basin				S-8/S-3 Basin to Holey Land			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	1	0.00	0	106	0	0.00	0	13
Feb	0	0.00	0	135	0	0.00	0	---
Mar	0	0.00	0	33	0	0.00	0	---
Apr	25	0.03	8	254	0	0.00	0	---
May	4	0.01	1	250	0	0.00	0	---
Jun	5	0.01	0	47	1	0.00	0	62
Jul	0	0.00	0	185	0	0.00	0	---
Aug	0	0.00	0	180	0	0.00	0	---
Sep	2	0.00	0	70	3	0.00	0	44
Oct	7	0.01	0	26	125	0.15	10	62
Nov	0	0.00	0	---	8	0.01	1	61
Dec	5	0.01	1	90	11	0.01	1	55
Ann	48	0.06	10	173	148	0.18	11	61

5.5. STA-5 Structures

There are several water control structures that regulate flow between the S-8/S-3 Basin and STA-5. G-349B and G-350B are pump stations that return seepage to this stormwater treatment area. The G-507 pump station is used to supply water to the eastern half of STA-5. This pump station draws water from the STA-5 outflow canal. The inflow to STA-5 through G-349B and G-350B has been combined and is summarized in Table 5.12. The data for G-507 is summarized in Table 5.13.

Table 5.12: Discharge Summary for G-349B and G-350B

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	8	0.01	1	60
1996	---	---	---	---	Feb	89	0.11	5	41
1997	---	---	---	---	Mar	164	0.20	9	45
1998	---	---	---	---	Apr	273	0.34	15	46
1999	---	---	---	---	May	424	0.52	35	66
2000<	0	0.00	0	---	Jun	352	0.43	27	63
2001	4,503	5.55	326	59	Jul	16	0.02	1	53
2002	29	0.04	2	70	Aug	38	0.05	3	59
2003	14	0.02	1	56	Sep	10	0.01	1	51
2004	1,499	1.85	86	47	Oct	2	0.00	0	83
Min.	14	0.02	1	---	Nov	0	0.00	0	65
Max.	4,503	5.55	326	---	Dec	0	0.00	0	59
Avg.	1,511	1.86	104	56	Ann	1,377	1.70	96	57

Water that has been treated in STA-5 is discharged through four gated culverts, G-344A through G-344D. These four culverts are located at the eastern boundary of this treatment area and discharge to the STA-5 outflow canal. This outflow canal conveys the discharge from this treatment area to the Miami Canal, less any water delivered to the Rotenberger tract via G-410. The discharge through these four culverts has been totaled and these totals are summarized in Table 5.14.

Table 5.13: Discharge Summary for G-507 Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	0	0.00	0	---
1996	---	---	---	---	Feb	0	0.00	0	---
1997	---	---	---	---	Mar	262	0.32	13	41
1998	---	---	---	---	Apr	2,336	2.88	148	51
1999	---	---	---	---	May	---	---	---	---
2000	---	---	---	---	Jun	---	---	---	---
2001	---	---	---	---	Jul	---	---	---	---
2002	---	---	---	---	Aug	---	---	---	---
2003	---	---	---	---	Sep	---	---	---	---
2004<	3,064	3.78	170	45	Oct	---	---	---	---
Min.	---	---	---	---	Nov	---	---	---	---
Max.	---	---	---	---	Dec	466	0.58	9	16
Avg.	---	---	---	---	Ann	3,064	3.78	170	45

Table 5.14: Discharge Summary for G-344A – G-344D

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	2,588	3.19	362	113
1996	---	---	---	---	Feb	1,832	2.26	225	100
1997	---	---	---	---	Mar	532	0.66	73	111
1998	---	---	---	---	Apr	8	0.01	1	106
1999	---	---	---	---	May	178	0.22	23	104
2000<	13,343	16.46	2,741	167	Jun	7,677	9.47	1,077	114
2001	39,977	49.31	4,921	100	Jul	19,784	24.40	2,696	110
2002	131,006	161.59	13,136	81	Aug	24,919	30.74	3,764	122
2003	160,519	198.00	26,523	134	Sep	27,912	34.43	3,365	98
2004	136,466	168.33	16,405	97	Oct	18,872	23.28	2,520	108
Min.	39,977	49.31	4,921	---	Nov	3,971	4.90	406	83
Max.	160,519	198.00	26,523	---	Dec	4,082	5.04	418	83
Avg.	116,992	144.31	15,246	106	Ann	112,357	138.59	14,930	108

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

5.6. STA-6 Structures

Structure G-600 is the inflow pump station for STA-6. This pump station conveys the drainage from the area north of this treatment area to STA-6. The contributing area to G-600, which is also known as Compartment C, is also bounded on the east by the Rotenberger tract, the north by STA-5 and the west by Levee 2. It is anticipated that this Compartment C area will some day be converted into additional treatment area, as part of an expanded STA-5 or merged STA-5/6, and no longer contribute to S-8/S-3 Basin runoff. The historic discharge at G-600 is summarized in Table 5.15.

Table 5.15: Discharge Summary for G-600 Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	2,571	3.17	124	39
1996	---	---	---	---	Feb	2,802	3.46	151	44
1997<	2,040	2.52	59	24	Mar	2,586	3.19	177	55
1998	48,194	59.45	2,517	42	Apr	943	1.16	63	54
1999	40,120	49.49	3,088	62	May	743	0.92	65	71
2000	59,847	73.82	5,374	73	Jun	5,128	6.33	495	78
2001	39,395	48.59	6,821	140	Jul	5,903	7.28	599	82
2002	53,437	65.91	4,506	68	Aug	6,282	7.75	417	54
2003	56,251	69.39	5,474	79	Sep	7,117	8.78	606	69
2004	52,673	64.97	3,428	53	Oct	6,946	8.57	1,146	134
2005	34,075	42.03	3,259	78	Nov	4,554	5.62	357	64
Min.	34,075	42.03	2,517	---	Dec	4,199	5.18	231	45
Max.	59,847	73.82	6,821	---	Ann	49,775	61.40	4,433	72
Avg.	47,999	59.21	4,308	73					

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

G-605 and G-606 are outflow control structures from Cell 1 in this treatment area that were used as a temporary outlet for this treatment area during its development. These outflow structures discharged to the L-4 Borrow Canal but have now been replaced by structures G-354 and G-393. All of the discharge from STA-6 now passes through these structures directly into WCA-3A. The outflows from STA-6 to the S-8/S-3 Basin are summarized in Table 5.16.

Table 5.16: Discharge Summary for Culverts G-605 and G-606

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	1,480	1.83	26	14
1996	---	---	---	---	Feb	1,763	2.18	48	22
1997	---	---	---	---	Mar	1,758	2.17	41	19
1998<	24,790	30.58	507	17	Apr	192	0.24	6	26
1999	24,039	29.65	657	22	May	0	0.00	0	---
2000	59,260	73.10	1,090	15	Jun	3,819	4.71	86	18
2001<	0	0.00	0	---	Jul	4,996	6.16	151	25
2002	---	---	---	---	Aug	6,082	7.50	140	19
2003	---	---	---	---	Sep	7,039	8.68	127	15
2004	---	---	---	---	Oct	9,667	11.92	164	14
Min.	24,039	29.65	657	---	Nov	4,771	5.89	98	17
Max.	59,260	73.10	1,090	---	Dec	3,723	4.59	59	13
Avg.	41,650	51.37	873	17	Ann	45,291	55.87	945	17

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

5.7. S-8 Pump Station

S-8 is a pump station and gated spillway located at the point where the Miami Canal enters WCA-3A at the Palm Beach-Broward County line. Historically, this structure has served as the primary outlet from the S-8/S-3 Basin. Water supply deliveries from WCA-3A to the S-8/S-3 Basin have also been made at S-8 but these deliveries are infrequent and of relatively small magnitude. The outflows and inflows to this basin at S-8 are summarized in Tables 5.17 and 5.18. The flood control function of S-8 have now been largely replaced by G-372, one of the new inflow pump stations associated with STA-3/4; however, STA-3/4 and this new pump station did not become fully operational until after the end of the study period for Task 1.3.

Table 5.17: Annual Discharge Summary at S-8

Water Year	S-8/S-3 Basin to WCA-3A				WCA-3A to S-8/S-3 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	535,265	660.24	79,299	120	93	0.11	22	188
1996	473,494	584.05	69,114	118	0	0.00	0	---
1997	345,433	426.09	39,010	92	966	1.19	86	72
1998	387,441	477.90	24,992	52	1,333	1.64	142	86
1999	305,523	376.86	39,432	105	480	0.59	82	138
2000	445,122	549.05	64,347	117	0	0.00	0	---
2001	168,950	208.40	18,277	88	0	0.00	0	---
2002	136,120	167.90	10,019	60	4,194	5.17	753	146
2003	291,688	359.79	29,410	82	0	0.00	0	82
2004	350,172	431.93	30,838	71	19	0.02	2	70
Min.	136,120	167.90	10,019	---	0	0.00	0	---
Max.	535,265	660.24	79,299	---	4,194	5.17	753	---
Avg.	343,921	424.22	40,474	95	709	0.87	109	124

Table 5.18: Average Monthly Discharge Summary at S-8

Month	S-8/S-3 Basin to WCA-3A				WCA-3A to S-8/S-3 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	8,930	11.01	657	60	1	0.00	0	44
Feb	12,991	16.02	739	46	0	0.00	0	---
Mar	8,267	10.20	484	47	0	0.00	0	82
Apr	11,178	13.79	1,060	77	17	0.02	2	95
May	18,032	22.24	1,702	77	4	0.00	0	50
Jun	44,651	55.08	4,229	77	9	0.01	1	123
Jul	43,998	54.27	6,302	116	180	0.22	19	87
Aug	46,922	57.88	5,453	94	164	0.20	39	193
Sep	56,285	69.43	7,602	109	91	0.11	13	116
Oct	53,166	65.58	7,660	117	21	0.03	3	104
Nov	19,792	24.41	2,914	119	147	0.18	17	93
Dec	19,708	24.31	1,672	69	75	0.09	14	152
Ann	343,921	424.22	40,474	95	709	0.87	109	124

5.8. G-357 Culvert and G-404 Pump Station

G-357 is a gated culvert and G-404 is a pump station that are both located at the intersection of the L-4 borrow and Miami canals, immediately upstream of the S-8 pump station. The

purpose of these control structures is to convey water to the L-4 Borrow Canal for distribution to WCA-3A or eventual delivery to the Big Cypress Reservation. G-357 can also serve to convey L-4 basin runoff to the Miami Canal for irrigation use although no negative flows have been recorded to date. A summary of the discharge at these two structures is shown in Tables 5.19 and 5.20.

Table 5.19: Annual Discharge Summary for G-357 and G-404*

Water Year	G-357 to WCA-3A				G-404 to WCA-3A			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	---	---	---	---	---	---	---	---
1996	---	---	---	---	---	---	---	---
1997	---	---	---	---	---	---	---	---
1998	---	---	---	---	---	---	---	---
1999	---	---	---	---	---	---	---	---
2000	---	---	---	---	---	---	---	---
2001<	0	0.00	0	---	0	0.00	0	---
2002	0	0.00	0	---	0	0.00	0	---
2003	0	0.00	0	---	98,284	121.23	5,874	48
2004	983	1.21	32	26	144,295	177.99	7,469	42
Min.	0	0.00	0	---	0	0.00	0	---
Max.	983	1.21	32	---	144,295	177.99	7,469	---
Avg.	328	0.40	11	26	80,860	99.74	4,448	45

* Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.

5.9. S-8/S-3 Basin Runoff

The runoff from the S-8/S-3 Basin is defined simply as the net discharge from the basin at the various control points listed above. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

- S-8 pump station discharge to WCA-3A
- Plus G-404 pump station discharge to WCA-3A or Big Cypress Reservation
- Plus G-357 culvert discharge to WCA-3A or Big Cypress Reservation
- Minus the discharge from STA-6 to the L-4 Borrow Canal at G-605 and G-606
- Plus the discharge at pump stations G-349B, G-350B and G-507 to STA-5

Table 5.20: Average Monthly Discharge Summary for G-357 and G-404

Month	G-357 to WCA-3A				G-404 to WCA-3A			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	0	0.00	0	---	8,557	10.55	407	39
Feb	0	0.00	0	---	7,244	8.94	288	32
Mar	0	0.00	0	---	3,916	4.83	201	42
Apr	6	0.01	0	30	2,221	2.74	107	39
May	319	0.39	10	26	1,648	2.03	72	35
Jun	0	0.00	0	---	6,522	8.05	334	41
Jul	0	0.00	0	---	2,632	3.25	167	51
Aug	0	0.00	0	---	4,224	5.21	370	71
Sep	0	0.00	0	---	8,334	10.28	594	58
Oct	0	0.00	0	---	7,068	8.72	476	55
Nov	0	0.00	0	---	3,906	4.82	119	25
Dec	0	0.00	0	---	4,372	5.39	202	37
Ann	326	0.40	10	26	60,645	74.80	3,336	45

- Minus the discharge from STA-5 at culverts G-344A through G-344D
- Minus the discharge from C-139 Basin at culverts G-88 and G-136
- Plus discharge to Lake Okeechobee at S-3 and S-354
- Plus G-410 pump station discharge to Rotenberger tract
- Minus discharge from Rotenberger tract at culverts G-402A through G-402D
- Plus G-200 pump station discharge to Holey Land
- Minus discharge from the Holey Land at structures G-204, G-205 and G-206
- Minus flow-through releases from Lake Okeechobee to S-8/S-3 basin

As discussed in Section 5.6, the contributing area to the G-600 pump station (Compartment C) will likely be converted into additional treatment area some day. Therefore, the discharge at G-600 has been specifically excluded from the estimates of S-8/S-3 Basin runoff.

The resulting runoff estimates are summarized by water year and month in Tables 5.21 and 5.22, respectively. The method used to estimate the TP load in flow-through releases from Lake Okeechobee has a very modest impact on the estimated TP load in basin runoff.

Table 5.21: Annual Runoff Summary for S-8/S-3 Basin

Water Year	Volume		Flow-through Concentrations at S-354		Flow-through Concentrations at S-8	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	465,406	574.07	64,654	113	63,760	111
1996	370,658	457.20	42,604	93	44,405	97
1997	335,982	414.43	32,799	79	33,422	81
1998	382,487	471.79	25,685	54	26,015	55
1999	199,513	246.10	35,342	144	34,194	139
2000	315,737	389.46	37,838	97	40,624	104
2001	134,484	165.88	14,305	86	14,365	87
2002	146,449	180.64	9,561	53	9,835	54
2003	278,492	343.51	13,048	38	13,662	40
2004	348,023	429.28	17,361	40	19,262	45
Min.	134,484	165.88	9,561	---	9,835	---
Max.	465,406	574.07	64,654	---	63,760	---
Avg.	297,723	367.24	29,320	80	29,954	82

Table 5.22: Average Monthly Runoff Summary for S-8/S-3 Basin*

Month	Flow-through Concentrations at S-354			Flow-through Concentrations at S-8		
	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)
Jan	13,162	568	35	13,162	652	40
Feb	21,396	1,055	40	18,772	959	41
Mar	12,152	625	42	12,152	698	47
Apr	14,469	1,266	71	10,107	840	67
May	19,182	2,105	89	17,114	1,944	92
Jun	41,148	3,352	66	45,719	3,758	67
Jul	36,230	4,301	96	36,230	4,303	96
Aug	40,839	4,565	91	40,839	4,555	90
Sep	45,152	5,012	90	45,152	5,001	90
Oct	38,284	4,517	96	38,284	4,479	95
Nov	23,537	3,823	132	26,486	4,317	132
Dec	31,610	2,187	56	27,213	2,013	60
Ann	337,160	33,376	80	331,230	33,518	82

* Because of uncertainties in the TP load estimates, the calculated phosphorus load in basin runoff is negative in some months. Months with negative total TP load were excluded from the calculation of average monthly data; therefore, average monthly flow volumes and loads and concentrations may vary depending on the assumed flow-through concentrations.

The variability of TP loads and concentrations by month in basin runoff, using flow-through concentrations at S-8, is shown graphically in Figure 5.2.

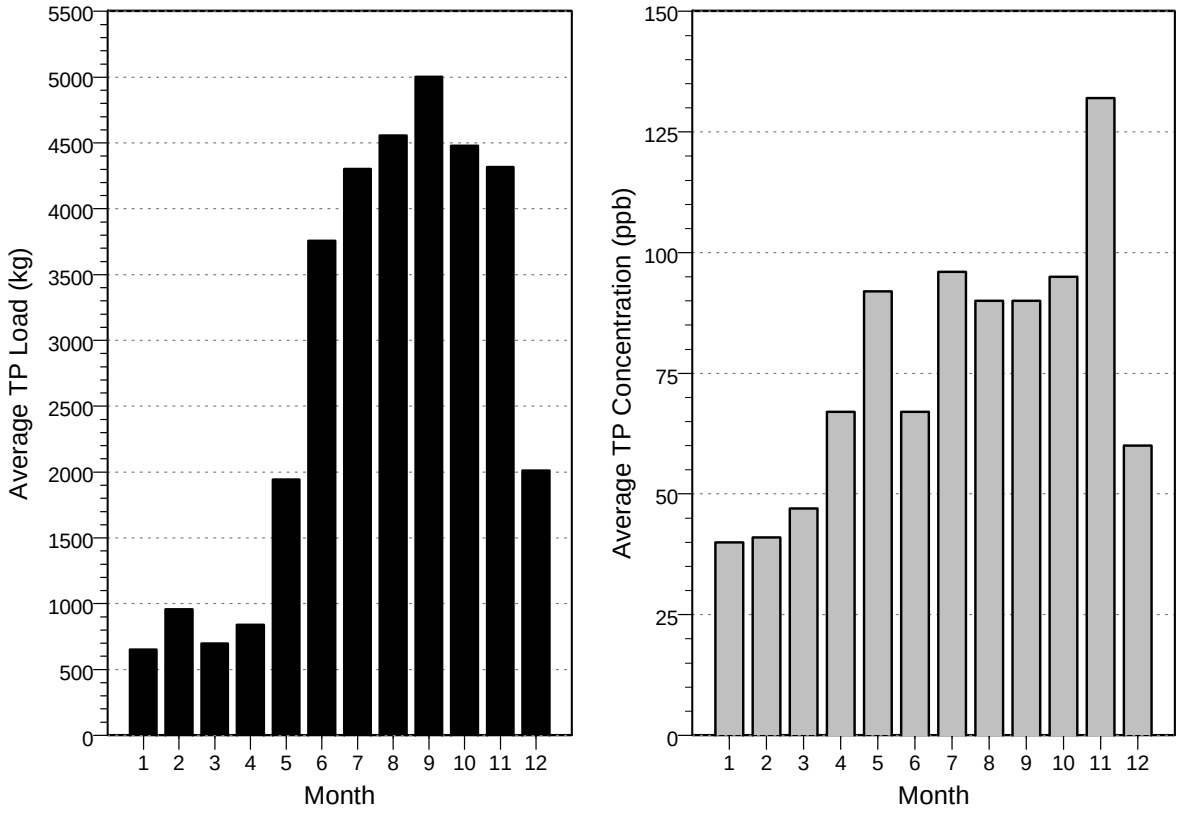

Figure 5.2: Average Monthly TP Loads and Concentrations in S-8/S-3 Basin Runoff

* * * * *

6. L-8 BASIN

The L-8 drainage basin is located primarily in northwestern Palm Beach County but a small portion of the basin is located in southwestern Martin County. The principal drainage canal in this basin is the L-8 Borrow Canal, which follows the southwestern border of the basin for most of its length. This canal connects Lake Okeechobee with WCA-1 at the S-5A complex. A block diagram, which shows the principal flow monitoring locations for the L-8 Basin, is included as Figure 6.1. The flow and TP load through each of these structures are discussed below.

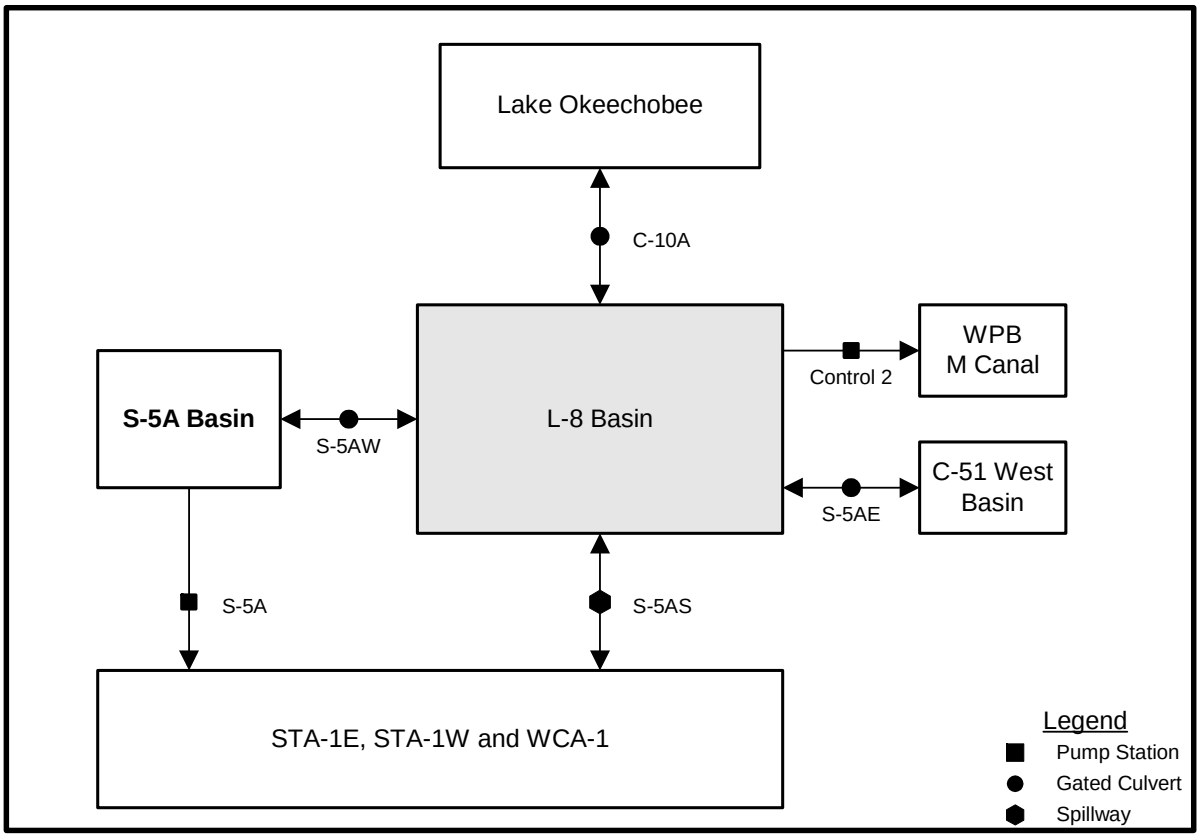

Figure 6.1: L-8 Basin Schematic

6.1. Culvert #10A

Culvert #10A (C-10A) is a gated culvert at the connection between Lake Okeechobee and the L-8 Borrow Canal. Water can be discharged to the lake at this location when canal stages are high or lake regulatory or water supply releases can be made to the basin. A summary of

the flow volumes and TP loads that pass through this structure is included in Tables 6.1 and 6.2.

Table 6.1: Annual Discharge Summary for Culvert #10A

Water Year	Lake Okeechobee to L-8 Basin				L-8 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	27,878	34.39	5,034	146	79,903	98.56	8,302	84
1996	85,373	105.31	15,936	151	32,123	39.62	4,827	122
1997	38,765	47.82	5,783	121	28,546	35.21	2,506	71
1998	2,589	3.19	711	223	97,059	119.72	9,236	77
1999	42,236	52.10	9,639	185	56,121	69.22	4,552	66
2000	100,489	123.95	30,966	250	32,097	39.59	4,682	118
2001	11,193	13.81	2,309	167	73,322	90.44	12,855	142
2002	20,599	25.41	8,273	326	132,271	163.15	16,359	100
2003	154,741	190.87	35,239	185	32,031	39.51	6,032	153
2004	181,490	223.86	39,990	179	26,521	32.71	2,139	65
Min.	2,589	3.19	711	---	26,521	32.71	2,139	---
Max.	181,490	223.86	39,990	---	132,271	163.15	16,359	---
Avg.	66,535	82.07	15,388	187	58,999	72.77	7,149	98

Table 6.2: Average Monthly Discharge Summary for Culvert #10A

Month	Lake Okeechobee to L-8 Basin				L-8 Basin to Lake Okeechobee			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	10,087	12.44	2,951	237	554	0.68	85	124
Feb	7,786	9.60	2,182	227	841	1.04	150	144
Mar	6,699	8.26	1,747	211	965	1.19	109	92
Apr	8,557	10.56	1,837	174	1,163	1.43	189	132
May	6,668	8.23	1,269	154	723	0.89	86	96
Jun	2,059	2.54	378	149	5,462	6.74	966	143
Jul	1,944	2.40	271	113	7,500	9.25	858	93
Aug	1,199	1.48	220	149	15,236	18.79	1,727	92
Sep	3,280	4.05	491	121	9,036	11.15	877	79
Oct	3,950	4.87	745	153	9,969	12.30	1,303	106
Nov	5,483	6.76	1,136	168	6,030	7.44	608	82
Dec	8,824	10.88	2,159	198	1,519	1.87	191	102
Ann	66,535	82.07	15,388	187	58,999	72.77	7,149	98

Some of the releases from Lake Okeechobee at C-10A are considered to be flow-through releases. Unlike the flow-through releases for the basins discussed previously, the District did not provide estimates of flow-through volumes and TP loads for the L-8 Basin. These data were estimated by Burns & McDonnell as the lesser of Lake Okeechobee releases to the basin at C-10A and basin discharge at structures S-5AE, S-5AS, S-5AW and Control 2 (M Canal) each day. Two estimates of the TP load in these flow-through releases were made using sampling data at C-10A and at the S-5A complex and M Canal. The volumetric and TP load in these flow-through releases are summarized in Tables 6.3 and 6.4.

Table 6.3: Annual Summary of Lake Flow-through Releases in L-8 Basin

Water Year	Volume		Concentrations at C-10A		Concentrations at South*	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	24,804	30.59	4,381	143	2,448	80
1996	77,677	95.81	14,422	151	7,187	75
1997	35,578	43.88	5,355	122	2,543	58
1998	2,111	2.60	568	218	206	79
1999	23,405	28.87	5,087	176	1,578	55
2000	85,853	105.90	26,514	250	11,437	108
2001	10,055	12.40	2,070	167	1,124	91
2002	18,947	23.37	7,874	337	6,314	270
2003	147,414	181.83	33,469	184	34,121	188
2004	170,748	210.61	37,018	176	27,527	131
Min.	2,111	2.60	568	---	206	---
Max.	170,748	210.61	37,018	---	34,121	---
Avg.	59,659	73.59	13,676	186	9,449	128

* Composite of TP concentrations in S-5AE, S-5AS, S-5AW, and M Canal discharges.

6.2. Culvert S-5AE

Structure S-5AE is a gated culvert located at the southern end of the L-8 Borrow Canal that connects it with the C-51 Canal and C-51 West Basin to the east. Tables 6.5 and 6.6 contain annual and average monthly summaries of the positive (eastward) and negative (westward) flows through this culvert. Review of these tables shows that most of the discharge through this culvert is eastward (out of the L-8 Basin).

Table 6.4: Average Monthly Summary of Lake Flow-through Releases in L-8 Basin

Month	Volume		Concentrations at C-10A		Concentrations at S-5A	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
Jan	8,690	10.72	2,529	236	1,386	129
Feb	6,793	8.38	1,845	220	1,247	149
Mar	6,375	7.86	1,659	211	1,240	158
Apr	6,893	8.50	1,475	173	1,247	147
May	5,699	7.03	1,083	154	1,003	143
Jun	1,748	2.16	320	148	193	89
Jul	1,918	2.37	267	113	277	117
Aug	1,077	1.33	204	153	218	164
Sep	3,236	3.99	485	121	402	101
Oct	3,783	4.67	710	152	488	104
Nov	5,395	6.66	1,117	168	671	101
Dec	8,053	9.93	1,983	200	1,078	108
Ann	59,659	73.59	13,676	186	9,449	128

Table 6.5: Annual Discharge Summary for Culvert S-5AE

Water Year	Eastward (L-8 Basin to C-51W Basin)				Westward (C-51W Basin to L-8 Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	230,235	283.99	21,937	77	0	0.00	0	---
1996	203,129	250.56	19,142	76	472	0.58	25	43
1997	76,696	94.60	5,879	62	0	0.00	0	---
1998	185,988	229.41	14,708	64	0	0.00	0	---
1999	112,789	139.12	10,586	76	29,379	36.24	2,946	81
2000	157,077	193.75	20,906	108	5,980	7.38	761	103
2001	16,237	20.03	2,340	117	75	0.09	12	129
2002	56,441	69.62	3,487	50	121	0.15	22	145
2003	194,737	240.20	27,001	112	0	0.00	0	---
2004	271,379	334.74	33,847	101	0	0.00	0	---
Min.	16,237	20.03	2,340	---	0	0.00	0	---
Max.	271,379	334.74	33,847	---	29,379	36.24	2,946	---
Avg.	150,471	185.60	15,983	86	3,603	4.44	377	85

Table 6.6: Average Monthly Discharge Summary for Culvert S-5AE

Month	Eastward (L-8 Basin to C-51W Basin)				Westward (C-51W Basin to L-8 Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	19,608	24.19	2,019	83	1,056	1.30	121	93
Feb	12,884	15.89	1,554	98	525	0.65	58	90
Mar	15,872	19.58	2,338	119	0	0.00	0	---
Apr	11,405	14.07	1,467	104	860	1.06	88	83
May	7,171	8.85	896	101	598	0.74	76	103
Jun	6,110	7.54	594	79	12	0.01	2	145
Jul	8,596	10.60	821	77	0	0.00	0	---
Aug	8,058	9.94	808	81	25	0.03	1	43
Sep	13,519	16.68	1,155	69	0	0.00	0	---
Oct	11,735	14.48	984	68	30	0.04	2	65
Nov	17,296	21.33	1,470	69	0	0.00	0	---
Dec	18,218	22.47	1,878	84	497	0.61	27	44
Ann	150,471	185.60	15,983	86	3,603	4.44	377	85

6.3. Culvert S-5AW

Structure S-5AW is another gated culvert located at the southern end of the L-8 Borrow Canal but this culvert connects this canal to the L-10/L-12 Borrow Canal (West Palm Beach Canal) and the S-5A Basin to the west. Annual and average monthly summaries of the discharge through this culvert are provided in Tables 6.7 and 6.8. These tables show that eastward flow through this culvert is rare but westward flow (L-8 Basin discharge) is much more common.

Table 6.7: Annual Discharge Summary for Culvert S-5AW

Water Year	Eastward (S-5A Basin to L-8 Basin)				Westward (L-8 Basin to S-5A Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	0	0.00	0	---	62,955	77.65	19,392	250
1996	0	0.00	0	---	88,578	109.26	9,792	90
1997	0	0.00	0	---	16,998	20.97	605	29
1998	0	0.00	0	---	9,271	11.44	271	24
1999	0	0.00	0	---	9,745	12.02	588	49
2000	0	0.00	0	---	39,538	48.77	5,102	105
2001	553	0.68	56	82	21,482	26.50	1,361	51
2002	476	0.59	133	227	11,672	14.40	775	54
2003	0	0.00	0	---	16,315	20.12	1,781	88
2004	0	0.00	0	---	5,387	6.64	368	55
Min.	0	0.00	0	---	5,387	6.64	271	---
Max.	553	0.68	133	---	88,578	109.26	19,392	---
Avg.	103	0.13	19	149	28,194	34.78	4,004	115

Table 6.8: Average Monthly Discharge Summary for Culvert S-5AW

Month	Eastward (S-5A Basin to L-8 Basin)				Westward (L-8 Basin to S-5A Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	0	0.00	0	---	228	0.28	8	30
Feb	0	0.00	0	---	320	0.40	11	27
Mar	55	0.07	6	82	562	0.69	31	45
Apr	0	0.00	0	---	536	0.66	20	30
May	0	0.00	0	---	1,198	1.48	237	160
Jun	48	0.06	13	227	472	0.58	56	96
Jul	0	0.00	0	---	571	0.70	34	49
Aug	0	0.00	0	---	2,922	3.60	576	160
Sep	0	0.00	0	---	4,553	5.62	634	113
Oct	0	0.00	0	---	11,916	14.70	1,460	99
Nov	0	0.00	0	---	3,865	4.77	666	140
Dec	0	0.00	0	---	1,052	1.30	270	208
Ann	103	0.13	19	149	28,194	34.78	4,004	115

6.4. Spillway S-5AS

Structure S-5AS is a gated spillway located at the southern end of the L-8 Borrow Canal. This spillway connects this canal with WCA-1. The northern end of WCA-1 has been converted into the STA-1 Inflow and Distribution Works so southward flow through this structure can be conveyed to STA-1E, STA-1W or directly to WCA-1. When stages in the STA-1 Inflow and Distribution Works may be higher than in the L-8 Borrow Canal, water can also be conveyed from the basin to the EPA by routing this water through S-5AW and the S-5A pump station. Water supply and regulatory releases from WCA-1 are also made through S-5AS. These releases can remain in the L-8 Basin, travel through the basin to Lake Okeechobee, be sent westward through S-5AW to the S-5A Basin, or flow eastward through S-5AE into the C-51 West Basin. Summaries of the annual and average monthly flow through this structure are included in Tables 6.9 and 6.10, respectively.

Table 6.9: Annual Discharge Summary for Spillway S-5AS

Water Year	Southward (L-8 Basin to WCA-1)				Northward (WCA-1 to L-8 Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	54,850	67.66	5,926	88	108,806	134.21	13,424	100
1996	10,437	12.87	1,402	109	78,940	97.37	7,594	78
1997	0	0.00	0	---	8,172	10.08	861	85
1998	1,712	2.11	308	146	86,411	106.59	7,574	71
1999	13,040	16.08	2,709	168	111,382	137.39	10,823	79
2000	34,788	42.91	7,889	184	54,711	67.49	11,361	168
2001	9,774	12.06	585	49	75,783	93.48	6,016	64
2002	12,218	15.07	888	59	39,359	48.55	3,528	73
2003	9,053	11.17	1,528	137	60,803	75.00	9,676	129
2004	5,258	6.49	1,064	164	50,068	61.76	6,387	103
Min.	0	0.00	0	---	8,172	10.08	861	---
Max.	54,850	67.66	7,889	---	111,382	137.39	13,424	---
Avg.	15,113	18.64	2,230	120	67,443	83.19	7,724	93

Table 6.10: Average Monthly Discharge Summary for Spillway S-5AS

Month	Southward (L-8 Basin to WCA-1)				Northward (WCA-1 to L-8 Basin)			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	2,050	2.53	362	143	12,865	15.87	1,489	94
Feb	879	1.08	109	100	7,740	9.55	742	78
Mar	1,332	1.64	283	172	7,488	9.24	964	104
Apr	36	0.04	7	150	6,091	7.51	823	110
May	0	0.00	0	---	5,889	7.26	595	82
Jun	56	0.07	11	162	2,215	2.73	211	77
Jul	38	0.05	8	162	2,819	3.48	490	141
Aug	2,002	2.47	242	98	3,854	4.75	487	103
Sep	3,263	4.03	384	95	3,481	4.29	502	117
Oct	1,963	2.42	353	146	3,512	4.33	285	66
Nov	3,186	3.93	434	110	4,529	5.59	395	71
Dec	309	0.38	39	103	6,961	8.59	741	86
Ann	15,113	18.64	2,230	120	67,443	83.19	7,724	93

6.5. Water Supply to City of West Palm Beach

There is one additional control structure where water is withdrawn from the L-8 Canal and L-8 Basin. These water supply withdrawals occur at the City of West Palm Beach's Control 2 pump station. This pump station delivers water into the City's M Canal. The District provided documentation on the historic discharge at this pump station but these data were provided in a different format than most of the other data provided. Through work related to the North Palm Beach County Part 1 CERP Project, Mathews Consulting has collected and organized the operations records for this pump station (Mathews Consulting, 2005). Mathews Consulting converted these records into an electronic format and a copy of the resulting spreadsheet file was provided by the District.

For much of its operating history, records at the Control 2 pump station have been kept in the form of a hand-written operations log. Starting in July 1997, daily log entries are available but prior to this time, only weekly entries were made. There are two pumps in this station, one powered by a diesel engine and the other driven by an electric motor. The pumping logs at this station include entries for the operating hours of both pumps, and stages in the L-8 and M canals. From these stage and operating hour records, Mathews Consulting

estimated total daily or weekly station discharge. In order to match the daily time step for the other data used in the study, weekly discharge data were converted to daily estimates by Burns & McDonnell by assuming these pumps were operated for the same length of time each day during the preceding week.

TP loads in the discharge at this pump station were estimated using grab sample data collected at two locations. Starting September 1996, water quality data have been collected at the intersection of the L-8 and M (L-8 Tieback) canals. These data are reported by the City of West Palm Beach for September 1996 through September 2000 (CH2M Hill, 2000) and by LBFH for November 2001 through August 2004 (LBFH, 2005). Prior to this time sampling data at S-5AS were used. After screening out samples collected on days with no pumping at the Control 2 pump station and those yielding a non-detect result for TP, a total of 49 samples were available. The TP concentrations and corresponding loads in the discharge at this pump station were estimated by linear interpolation between sample dates. The resulting discharge estimates at this pump station are summarized in Table 6.11.

Table 6.11: Discharge Summary for Control 2 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	33,544	41.38	3,601	87	Jan	4,160	5.13	698	136
1996	39,672	48.93	3,321	68	Feb	3,663	4.52	671	149
1997	36,202	44.65	2,441	55	Mar	4,019	4.96	758	153
1998	9,076	11.20	498	44	Apr	4,617	5.69	970	170
1999	45,825	56.52	2,329	41	May	6,389	7.88	1,058	134
2000	35,967	44.36	3,032	68	Jun	3,525	4.35	480	110
2001	67,478	83.23	6,783	81	Jul	3,106	3.83	419	109
2002	30,047	37.06	10,648	287	Aug	2,586	3.19	369	116
2003	59,938	73.93	22,663	307	Sep	2,137	2.64	323	123
2004	55,306	68.22	11,354	166	Oct	1,798	2.22	289	130
Min.	9,076	11.20	498	---	Nov	2,688	3.32	328	99
Max.	67,478	83.23	22,663	---	Dec	2,618	3.23	303	94
Avg.	41,306	50.95	6,667	131	Ann	41,306	50.95	6,667	131

6.6. L-8 Basin Runoff

The runoff from the L-8 Basin is defined as the total discharge from the basin at the various control points less any flow-through discharges from Lake Okeechobee and structure S-5AS. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

- Discharge to Lake Okeechobee at C-10A
- Plus net S-5AE culvert discharge to east
- Plus net S-5AS spillway discharge to south (northward flows are more common so this term is often negative; irrigation supplies to L-8 Basin are excluded)
- Plus net S-5AW culvert discharge to west
- Plus discharge to M Canal at Control 2 pump station
- Minus Lake Okeechobee flow-through releases

The resulting runoff estimates are summarized in Tables 6.12 and 6.13. The variability of average TP loads and concentrations by month in basin runoff, using flow-through concentrations at S-5A complex, are shown graphically in Figure 6.2.

Table 6.12: Annual Runoff Summary for L-8 Basin

Water Year	Volume		Flow-through Concentrations at C-10A		Flow-through Conc. at S-5AE, S-5AS, S-5AW	
	(ac-ft)	(hm^3)	TP Load (kg)	TP Conc. (ppb)	TP Load (kg)	TP Conc. (ppb)
1995	330,857	408.11	41,681	102	43,889	108
1996	217,311	268.05	21,044	79	23,392	87
1997	114,722	141.51	6,488	46	8,218	58
1998	215,860	266.26	17,319	65	18,152	68
1999	144,950	178.79	11,582	65	13,608	76
2000	158,672	195.72	13,180	67	22,733	116
2001	102,473	126.40	15,441	122	14,275	113
2002	184,279	227.30	19,861	87	21,834	96
2003	103,862	128.11	11,631	91	17,241	135
2004	143,747	177.31	7,186	41	14,092	79
Min.	102,473	126.40	6,488	---	8,218	---
Max.	330,857	408.11	41,681	---	43,889	---
Avg.	171,673	211.76	16,541	78	19,743	93

Table 6.13: Average Monthly Runoff Summary for L-8 Basin*

Month	Flow-through Concentrations at C10A			Flow-through Concentrations at S-5AE, S-5AS, S-5AW and M Canal		
	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)	Volume (ac-ft)	TP Load (kg)	TP Conc. (ppb)
Jan	7,685	783	83	7,042	718	83
Feb	7,071	661	76	6,079	647	86
Mar	10,260	1,439	114	8,966	1,346	122
Apr	5,489	593	88	4,374	596	111
May	4,116	538	106	3,805	515	110
Jun	11,694	1,607	111	11,694	1,688	117
Jul	15,102	1,296	70	15,102	1,573	84
Aug	25,878	2,995	94	25,878	3,005	94
Sep	25,806	2,377	75	25,806	2,645	83
Oct	30,056	3,455	93	30,056	3,514	95
Nov	24,502	2,349	78	23,211	2,514	88
Dec	11,392	1,011	72	9,660	982	82
Ann	179,049	19,103	86	171,673	19,743	93

* Because of uncertainties in TP load estimates, calculated TP load in basin runoff is negative in some months. These months were excluded from calculations of average monthly data; therefore, average monthly runoff volumes do not match between the two methods for estimating flow-through loads in every month.

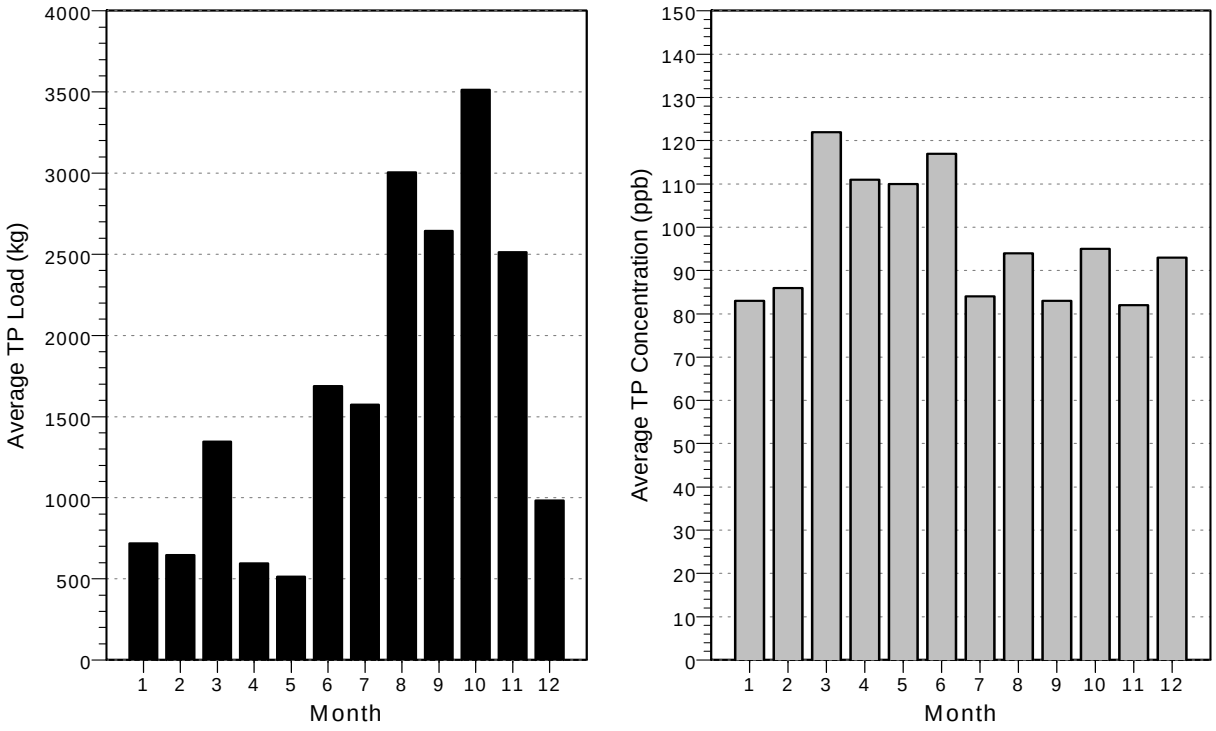

Figure 6.2: Average Monthly TP Loads and Concentrations in L-8 Basin Runoff

6.7. L-8 Basin Discharge Distribution

The L-8 Basin is one of more complex basins included in this study because of its multiple inlets and outlets. For the daily discharge volume and TP load at each basin outlet, the amount contributed from each potential source was estimated. These estimates were prepared by first balancing flow volumes within the basin. The distribution of basin inflow volumes to each outlet was based on relative proximity (that is, the inflow at one structure was allocated to the nearest discharging structure first before flowing to more distant structures). For any day when the total discharge at a structure exceeded the available supply from basin inflow, then the difference was assumed to be contributed by basin runoff.

After the flow balance at each structure was developed, a similar balance for TP load was prepared. The TP load contributed from each inlet to each outlet was estimated from the corresponding flow volume and inlet TP concentration on each day. The sum of the TP loads contributed by each of these inlets to a particular outlet did not typically match the corresponding TP discharge estimates at that structure on the same day. Any differences were again assumed to come from basin runoff. These daily TP runoff estimates were sometimes negative, which implies that phosphorus was being retained within the basin although water was not. This apparent phosphorus retention could be real (perhaps due to sediment deposition) but more likely results from inaccuracies in the TP load estimates at the relevant structures.

These flow volume and TP load distributions are summarized in the following series of tables: Tables 6.14 through 6.31. Each of these tables summarizes the total annual and average monthly discharges for a particular outlet and source combination. Recognizing that all of the runoff discharged from the southern end of the L-8 Basin will likely be managed in a similar fashion in the future, Table 6.32 provides a summary of the combined discharges at structures S-5AE, S-5AS and S-5AW that are derived from basin runoff.

* * * * *

Table 6.14: Lake Okeechobee Discharge at C-10A Contributed by S-5AE Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	0	0.00	0	---	Feb	0	0.00	0	---
1997	0	0.00	0	---	Mar	0	0.00	0	---
1998	0	0.00	0	---	Apr	0	0.00	0	---
1999	0	0.00	0	---	May	0	0.00	0	---
2000	0	0.00	0	---	Jun	0	0.00	0	---
2001	74	0.09	12	129	Jul	0	0.00	0	---
2002	0	0.00	0	---	Aug	0	0.00	0	---
2003	0	0.00	0	---	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	7	0.01	1	129
Min.	0	0.00	0	---	Nov	0	0.00	0	---
Max.	74	0.09	12	---	Dec	0	0.00	0	---
Avg.	7	0.01	1	129	Ann	7	0.01	1	129

Table 6.15: Lake Okeechobee Discharge at C-10A Contributed by S-5AS Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	421	0.52	39	75	Jan	89	0.11	10	88
1996	96	0.12	8	67	Feb	6	0.01	1	78
1997	238	0.29	27	91	Mar	64	0.08	4	53
1998	426	0.53	45	86	Apr	27	0.03	3	95
1999	977	1.20	63	52	May	45	0.06	5	85
2000	0	0.00	0	---	Jun	12	0.01	1	60
2001	19,894	24.54	1,492	61	Jul	77	0.09	6	66
2002	19,605	24.18	2,098	87	Aug	1,475	1.82	122	67
2003	0	0.00	0	---	Sep	860	1.06	116	109
2004	0	0.00	0	---	Oct	1,274	1.57	96	61
Min.	0	0.00	0	---	Nov	172	0.21	8	39
Max.	19,894	24.54	2,098	---	Dec	65	0.08	5	60
Avg.	4,166	5.14	377	73	Ann	4,166	5.14	377	73

Table 6.16: Lake Okeechobee Discharge at C-10A Contributed by S-5AW Inflow*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	0	0.00	0	---	Feb	0	0.00	0	---
1997	0	0.00	0	---	Mar	0	0.00	0	85
1998	0	0.00	0	---	Apr	0	0.00	0	---
1999	0	0.00	0	---	May	0	0.00	0	---
2000	0	0.00	0	---	Jun	0	0.00	0	---
2001	0	0.00	0	85	Jul	0	0.00	0	---
2002	0	0.00	0	---	Aug	0	0.00	0	---
2003	0	0.00	0	---	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	0	0.00	0	---
Min.	0	0.00	0	---	Nov	0	0.00	0	---
Max.	0	0.00	0	---	Dec	0	0.00	0	---
Avg.	0	0.00	0	85	Ann	0	0.00	0	85

*There was a contribution of 0.2 acre-feet from S-5AW to Lake Okeechobee in WY 2001.

Table 6.17: Lake Okeechobee Discharge at C-10A Contributed by L-8 Basin Runoff

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	79,482	98.04	8,240	84	Jan	465	0.57	72	126
1996	32,026	39.50	4,815	122	Feb	835	1.03	149	145
1997	28,309	34.92	2,480	71	Mar	901	1.11	103	92
1998	96,633	119.19	9,185	77	Apr	1,135	1.40	186	133
1999	55,144	68.02	4,459	66	May	678	0.84	79	94
2000	32,097	39.59	4,682	118	Jun	5,450	6.72	964	143
2001	53,354	65.81	11,219	170	Jul	7,424	9.16	852	93
2002	112,667	138.97	14,260	103	Aug	13,761	16.97	1,597	94
2003	32,031	39.51	6,032	153	Sep	8,177	10.09	759	75
2004	26,521	32.71	2,139	65	Oct	8,687	10.72	1,205	112
Min.	26,521	32.71	2,139	---	Nov	5,858	7.23	600	83
Max.	112,667	138.97	14,260	---	Dec	1,454	1.79	185	103
Avg.	54,826	67.63	6,751	100	Ann	54,826	67.63	6,751	100

Table 6.18: L-8 Basin Discharge at S-5AE Contributed by Lake Okeechobee from C-10A

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	9,655	11.91	1,591	134	Jan	5,241	6.46	1,432	221
1996	47,642	58.77	8,029	137	Feb	3,685	4.55	892	196
1997	14,195	17.51	2,203	126	Mar	3,426	4.23	907	215
1998	1,631	2.01	480	238	Apr	3,412	4.21	707	168
1999	10,745	13.25	2,203	166	May	1,770	2.18	342	157
2000	53,117	65.52	16,681	255	Jun	853	1.05	150	143
2001	668	0.82	108	131	Jul	1,272	1.57	181	115
2002	4,204	5.19	2,286	441	Aug	499	0.62	98	160
2003	83,635	103.16	19,772	192	Sep	2,249	2.77	338	122
2004	120,740	148.93	25,731	173	Oct	1,797	2.22	351	159
Min.	668	0.82	108	---	Nov	4,177	5.15	862	167
Max.	120,740	148.93	25,731	---	Dec	6,242	7.70	1,648	214
Avg.	34,623	42.71	7,908	185	Ann	34,623	42.71	7,908	185

Table 6.19: L-8 Basin Discharge at S-5AE Contributed by S-5AS Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	94,014	115.96	11,912	103	Jan	10,215	12.60	1,157	92
1996	73,131	90.21	7,135	79	Feb	5,407	6.67	491	74
1997	6,607	8.15	685	84	Mar	6,514	8.04	894	111
1998	81,272	100.25	7,066	70	Apr	5,675	7.00	770	110
1999	53,147	65.56	5,249	80	May	4,019	4.96	406	82
2000	51,407	63.41	10,583	167	Jun	1,600	1.97	157	80
2001	13,411	16.54	1,282	77	Jul	2,445	3.02	464	154
2002	14,523	17.91	1,003	56	Aug	1,516	1.87	295	158
2003	60,543	74.68	9,639	129	Sep	2,122	2.62	327	125
2004	47,759	58.91	6,120	104	Oct	1,016	1.25	113	90
Min.	6,607	8.15	685	---	Nov	3,483	4.30	345	80
Max.	94,014	115.96	11,912	---	Dec	5,569	6.87	648	94
Avg.	49,581	61.16	6,067	99	Ann	49,581	61.16	6,067	99

Table 6.20: L-8 Basin Discharge at S-5AE Contributed by L-8 Basin Runoff*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	126,566	156.12	8,489	54	Jan	2,976	3.67	245	67
1996	82,356	101.58	4,921	48	Feb	3,834	4.73	403	85
1997	55,893	68.94	3,218	47	Mar	7,833	9.66	1,223	127
1998	103,085	127.15	7,344	58	Apr	3,701	4.57	266	58
1999	48,898	60.31	3,592	60	May	1,471	1.81	177	97
2000	52,553	64.82	-1,416	-22	Jun	3,657	4.51	278	62
2001	2,158	2.66	332	125	Jul	4,630	5.71	274	48
2002	37,714	46.52	426	9	Aug	6,043	7.45	418	56
2003	50,560	62.36	-134	-2	Sep	8,836	10.90	603	55
2004	102,881	126.90	3,064	24	Oct	8,922	11.01	558	51
Min.	2,158	2.66	-1,416	---	Nov	9,115	11.24	478	43
Max.	126,566	156.12	8,489	---	Dec	7,334	9.05	346	38
Avg.	66,266	81.74	2,984	37	Ann	68,351	84.31	5,269	62

* TP load for this outlet/source combination is sometimes negative because of uncertainty in TP load estimates, which results in negative annual totals in some years. Months with negative total TP load have been excluded from calculations of average monthly data so the average annual totals may not match the annual totals of the monthly averages.

Table 6.21: L-8 Basin Discharge at S-5AS Contributed by Lake Okeechobee at C-10A

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	664	0.82	279	341
1996	0	0.00	0	---	Feb	290	0.36	108	303
1997	0	0.00	0	---	Mar	362	0.45	93	208
1998	0	0.00	0	---	Apr	0	0.00	0	---
1999	0	0.00	0	---	May	0	0.00	0	---
2000	8,562	10.56	3,035	287	Jun	0	0.00	0	---
2001	8	0.01	5	514	Jul	0	0.00	0	---
2002	1,279	1.58	726	460	Aug	0	0.00	0	---
2003	4,587	5.66	1,306	231	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	0	0.00	0	---
Min.	0	0.00	0	---	Nov	86	0.11	18	169
Max.	8,562	10.56	3,035	---	Dec	41	0.05	9	168
Avg.	1,444	1.78	507	285	Ann	1,444	1.78	507	285

Table 6.22: L-8 Basin Discharge at S-5AS Contributed by L-8 Basin Runoff*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	54,850	67.66	5,926	88	Jan	1,378	1.70	114	67
1996	10,437	12.87	1,402	109	Feb	609	0.75	9	12
1997	0	0.00	0	---	Mar	1,193	1.47	242	164
1998	1,712	2.11	308	146	Apr	36	0.04	7	150
1999	13,040	16.08	2,709	168	May	0	0.00	0	---
2000	26,226	32.35	4,938	153	Jun	56	0.07	11	162
2001	9,766	12.05	581	48	Jul	38	0.05	8	162
2002	10,939	13.49	163	12	Aug	2,002	2.47	242	98
2003	4,467	5.51	371	67	Sep	3,263	4.03	384	95
2004	5,258	6.49	1,064	164	Oct	1,963	2.42	353	146
Min.	0	0.00	0	---	Nov	3,101	3.82	418	109
Max.	54,850	67.66	5,926	---	Dec	268	0.33	31	94
Avg.	13,669	16.86	1,746	104	Ann	13,905	17.15	1,817	106

* TP load for this outlet/source combination is sometimes negative because of uncertainty in TP load estimates. Months with negative total TP load have been excluded from calculations of average monthly data so the average annual totals may not match the annual totals of the monthly averages.

Table 6.23: L-8 Basin Discharge at S-5AW Contributed by Lake Okeechobee at C-10A

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	1,187	1.46	213	146	Feb	8	0.01	3	299
1997	933	1.15	106	92	Mar	25	0.03	11	348
1998	0	0.00	0	---	Apr	109	0.13	20	152
1999	406	0.50	106	212	May	128	0.16	21	136
2000	75	0.09	28	299	Jun	0	0.00	0	---
2001	758	0.93	110	118	Jul	0	0.00	0	---
2002	232	0.29	108	377	Aug	28	0.03	3	100
2003	6,842	8.44	1,010	120	Sep	61	0.08	7	88
2004	0	0.00	0	---	Oct	664	0.82	99	121
Min.	0	0.00	0	---	Nov	13	0.02	2	132
Max.	6,842	8.44	1,010	---	Dec	8	0.01	2	174
Avg.	1,043	1.29	168	131	Ann	1,043	1.29	168	131

Table 6.24: L-8 Basin Discharge at S-5AW Contributed by S-5AE Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	472	0.58	25	43	Feb	0	0.00	0	---
1997	0	0.00	0	---	Mar	0	0.00	0	---
1998	0	0.00	0	---	Apr	0	0.00	0	---
1999	0	0.00	0	---	May	0	0.00	0	---
2000	0	0.00	0	---	Jun	0	0.00	0	---
2001	0	0.00	0	---	Jul	0	0.00	0	---
2002	0	0.00	0	---	Aug	25	0.03	1	43
2003	0	0.00	0	---	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	23	0.03	1	43
Min.	0	0.00	0	---	Nov	0	0.00	0	---
Max.	472	0.58	25	---	Dec	0	0.00	0	---
Avg.	47	0.06	3	43	Ann	47	0.06	3	43

Table 6.25: L-8 Basin Discharge at S-5AW Contributed by S-5AS Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	5,415	6.68	543	81	Jan	22	0.03	1	49
1996	2,049	2.53	126	50	Feb	0	0.00	0	---
1997	1,211	1.49	136	91	Mar	228	0.28	10	36
1998	2,315	2.86	250	87	Apr	121	0.15	14	91
1999	15	0.02	1	46	May	747	0.92	78	84
2000	27	0.03	5	149	Jun	39	0.05	4	80
2001	18,879	23.29	1,153	50	Jul	2	0.00	0	82
2002	2,369	2.92	111	38	Aug	353	0.43	28	64
2003	34	0.04	2	51	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	1,085	1.34	68	51
Min.	0	0.00	0	---	Nov	608	0.75	28	38
Max.	18,879	23.29	1,153	---	Dec	27	0.03	2	48
Avg.	3,231	3.99	233	58	Ann	3,231	3.99	233	58

Table 6.26: L-8 Basin Discharge at S-5AW Contributed by L-8 Basin Runoff*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	57,541	70.98	17,991	253	Jan	206	0.25	7	28
1996	84,870	104.69	9,372	90	Feb	313	0.39	10	25
1997	14,854	18.32	458	25	Mar	309	0.38	10	27
1998	6,956	8.58	167	19	Apr	351	0.43	6	14
1999	9,325	11.50	509	44	May	341	0.42	75	177
2000	39,436	48.64	5,090	105	Jun	433	0.53	46	86
2001	1,846	2.28	153	67	Jul	569	0.70	34	49
2002	9,070	11.19	555	50	Aug	2,517	3.10	546	176
2003	9,439	11.64	798	69	Sep	4,921	6.07	699	115
2004	5,387	6.64	368	55	Oct	10,144	12.51	1,297	104
Min.	1,846	2.28	153	---	Nov	3,244	4.00	637	159
Max.	84,870	104.69	17,991	---	Dec	1,017	1.26	268	213
Avg.	23,872	29.45	3,546	120	Ann	24,364	30.05	3,634	121

* TP load for this outlet/source combination is sometimes negative because of uncertainty in TP load estimates. Months with negative total TP load have been excluded from calculations of average monthly data so the average annual totals may not match the annual totals of the monthly averages.

Table 6.27: L-8 Basin Discharge to M Canal Contributed by Lake Okeechobee at C-10A

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	15,149	18.69	2,790	149	Jan	2,785	3.43	818	238
1996	28,848	35.58	6,179	174	Feb	2,810	3.47	841	243
1997	20,450	25.22	3,047	121	Mar	2,561	3.16	648	205
1998	479	0.59	88	150	Apr	3,373	4.16	748	180
1999	12,254	15.12	2,778	184	May	3,801	4.69	720	153
2000	24,099	29.73	6,771	228	Jun	895	1.10	170	154
2001	8,622	10.64	1,846	174	Jul	645	0.80	87	109
2002	13,231	16.32	4,755	291	Aug	550	0.68	102	150
2003	52,350	64.57	11,381	176	Sep	925	1.14	140	122
2004	50,008	61.68	11,287	183	Oct	1,321	1.63	259	159
Min.	479	0.59	88	---	Nov	1,120	1.38	235	170
Max.	52,350	64.57	11,381	---	Dec	1,761	2.17	325	150
Avg.	22,549	27.81	5,092	183	Ann	22,549	27.81	5,092	183

Table 6.28: L-8 Basin Discharge to M Canal Contributed by S-5AE Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	0	0.00	0	---	Feb	0	0.00	0	---
1997	0	0.00	0	---	Mar	0	0.00	0	---
1998	0	0.00	0	---	Apr	427	0.53	44	83
1999	4,266	5.26	439	83	May	280	0.35	36	106
2000	2,799	3.45	364	106	Jun	12	0.01	2	145
2001	1	0.00	0	129	Jul	0	0.00	0	---
2002	121	0.15	22	145	Aug	0	0.00	0	---
2003	0	0.00	0	---	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	0	0.00	0	129
Min.	0	0.00	0	---	Nov	0	0.00	0	---
Max.	4,266	5.26	439	---	Dec	0	0.00	0	---
Avg.	719	0.89	83	93	Ann	719	0.89	83	93

Table 6.29: L-8 Basin Discharge to M Canal Contributed by S-5AS Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	5,977	7.37	651	88	Jan	542	0.67	62	93
1996	3,202	3.95	282	72	Feb	303	0.37	25	66
1997	87	0.11	9	87	Mar	556	0.69	43	62
1998	1,122	1.38	128	93	Apr	238	0.29	32	109
1999	10,762	13.27	692	52	May	887	1.09	87	80
2000	709	0.87	173	197	Jun	474	0.59	42	72
2001	23,045	28.43	2,044	72	Jul	268	0.33	17	52
2002	2,350	2.90	259	89	Aug	479	0.59	39	66
2003	223	0.27	34	123	Sep	485	0.60	58	96
2004	1,597	1.97	185	94	Oct	137	0.17	8	45
Min.	87	0.11	9	---	Nov	195	0.24	9	37
Max.	23,045	28.43	2,044	---	Dec	343	0.42	24	57
Avg.	4,907	6.05	446	74	Ann	4,907	6.05	446	74

Table 6.30: L-8 Basin Discharge to M Canal Contributed by S-5AW Inflow

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	0	0.00	0	---	Jan	0	0.00	0	---
1996	0	0.00	0	---	Feb	0	0.00	0	---
1997	0	0.00	0	---	Mar	46	0.06	5	83
1998	0	0.00	0	---	Apr	0	0.00	0	---
1999	0	0.00	0	---	May	0	0.00	0	---
2000	0	0.00	0	---	Jun	46	0.06	13	227
2001	461	0.57	47	83	Jul	0	0.00	0	---
2002	456	0.56	128	227	Aug	0	0.00	0	---
2003	0	0.00	0	---	Sep	0	0.00	0	---
2004	0	0.00	0	---	Oct	0	0.00	0	---
Min.	0	0.00	0	---	Nov	0	0.00	0	---
Max.	461	0.57	128	---	Dec	0	0.00	0	---
Avg.	92	0.11	17	155	Ann	92	0.11	17	155

Table 6.31: L-8 Basin Discharge to M Canal Contributed by L-8 Basin Runoff*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	12,418	15.32	1,036	68	Jan	925	1.14	199	174
1996	7,622	9.40	535	57	Feb	777	0.96	109	114
1997	15,665	19.32	332	17	Mar	838	1.03	82	80
1998	7,474	9.22	315	34	Apr	379	0.47	175	376
1999	18,543	22.87	313	14	May	1,558	1.92	391	203
2000	8,361	10.31	-114	-11	Jun	2,063	2.54	345	136
2001	35,349	43.60	3,157	72	Jul	2,193	2.70	221	82
2002	13,889	17.13	4,457	260	Aug	1,556	1.92	191	100
2003	7,365	9.09	4,565	502	Sep	726	0.90	76	85
2004	3,701	4.56	552	121	Oct	340	0.42	42	100
Min.	3,701	4.56	-114	---	Nov	1,373	1.69	100	59
Max.	35,349	43.60	4,565	---	Dec	341	0.42	77	183
Avg.	13,039	16.08	1,515	94	Ann	13,068	16.12	2,009	125

* TP load for this outlet/source combination is sometimes negative because of uncertainty in TP load estimates, which results in negative annual totals in some years. Months with negative total TP load have been excluded from calculations of average monthly data so the average annual totals may not match the annual totals of the monthly averages.

Table 6.32: L-8 Basin Discharge from S-5A Complex Contributed by L-8 Basin Runoff*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	238,957	294.75	32,405	110	Jan	5,256	6.48	320	49
1996	177,663	219.14	15,694	72	Feb	4,349	5.36	419	78
1997	70,747	87.27	3,676	42	Mar	9,595	11.84	1,548	131
1998	111,752	137.84	7,818	57	Apr	3,668	4.52	230	51
1999	71,262	87.90	6,810	77	May	2,087	2.57	254	99
2000	118,215	145.82	8,612	59	Jun	4,146	5.11	335	66
2001	13,770	16.98	1,065	63	Jul	5,305	6.54	321	49
2002	57,723	71.20	1,144	16	Aug	10,561	13.03	1,206	93
2003	64,465	79.52	1,035	13	Sep	17,453	21.53	1,726	80
2004	113,525	140.03	4,495	32	Oct	21,028	25.94	2,207	85
Min.	13,770	16.98	1,035	---	Nov	16,467	20.31	1,572	77
Max.	238,957	294.75	32,405	---	Dec	8,933	11.02	718	65
Avg.	103,808	128.05	8,276	65	Ann	108,849	134.26	10,856	81

* S-5A Complex discharge is the combined basin discharge at S-5AE, S-5AS and S-5AW. There are some months when calculated TP load contributed by runoff is negative. These months have been excluded from the calculations of average monthly data.

7. C-51 WEST BASIN

The C-51 West drainage basin is located in east-central Palm Beach County. The C-51 Canal (West Palm Beach Canal), which bisects this basin from west to east, is the principal drainage canal in this basin. Figure 7.1 is a schematic that shows the primary flow monitoring locations in this basin. The flow volumes and TP discharge through these structures are discussed below.

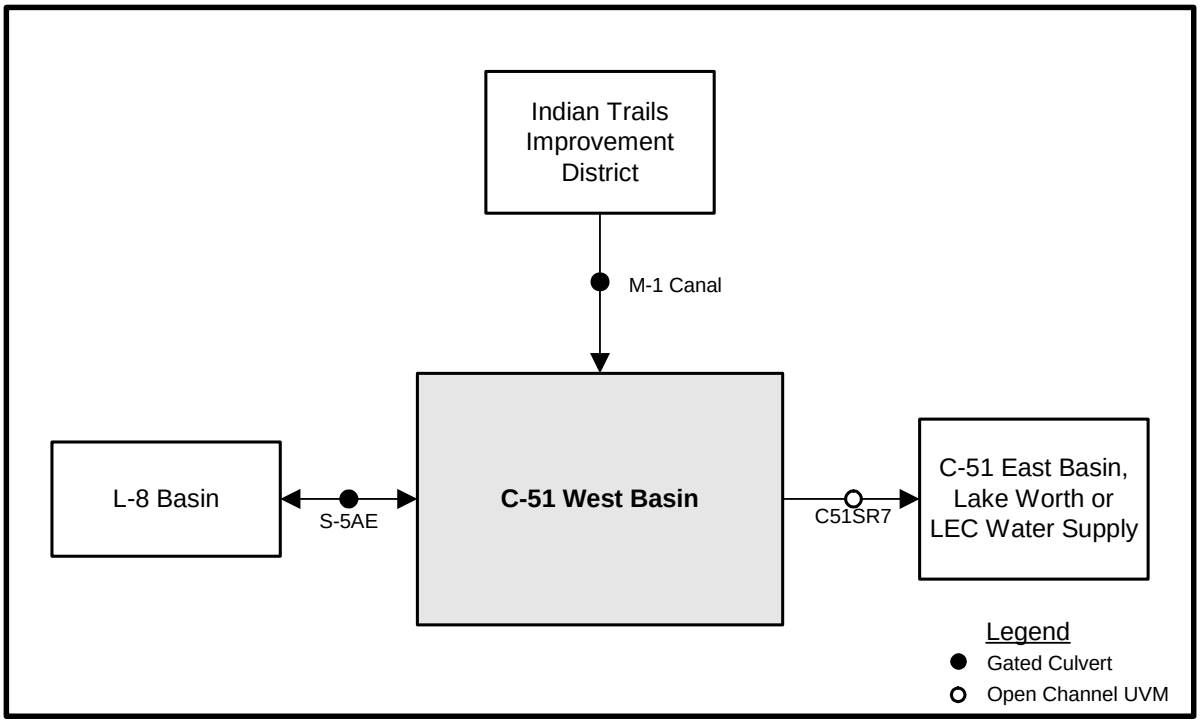

Figure 7.1: C-51 West Basin Schematic

7.1. Culvert S-5AE

Structure S-5AE is a gated culvert located at the western end of the C-51 Canal that connects it with the L-8 Borrow Canal and L-8 Basin to the west. Tables 7.1 and 7.2 are summaries of the positive (eastward) and negative (westward) flows through this culvert. Review of Table 7.1 shows that most of the discharge through this culvert is eastward (into the C-51 West Basin). Some of this eastward flow at S-5AE travels through this basin into the C-51 East Basin to meet the water supply needs of the Lower East Coast and can be classified as flow-through. The flow-through portion of the flow at S-5AE is summarized in Table 7.3.

Table 7.1: Annual Discharge Summary for Culvert S-5AE

Water Year	L-8 Basin to C-51 West Basin				C-51 West Basin to L-8 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
1995	230,235	283.99	21,937	77	0	0.00	0	---
1996	203,129	250.56	19,142	76	472	0.58	25	43
1997	76,696	94.60	5,879	62	0	0.00	0	---
1998	185,988	229.41	14,708	64	0	0.00	0	---
1999	112,789	139.12	10,586	76	29,379	36.24	2,946	81
2000	157,077	193.75	20,906	108	5,980	7.38	761	103
2001	16,237	20.03	2,340	117	75	0.09	12	129
2002	56,441	69.62	3,487	50	121	0.15	22	145
2003	194,737	240.20	27,001	112	0	0.00	0	---
2004	271,379	334.74	33,847	101	0	0.00	0	---
Min.	16,237	20.03	2,340	---	0	0.00	0	---
Max.	271,379	334.74	33,847	---	29,379	36.24	2,946	---
Avg.	150,471	185.60	15,983	86	3,603	4.44	377	85

Table 7.2: Average Monthly Discharge Summary for Culvert S-5AE

Month	L-8 Basin to C-51 West Basin				C-51 West Basin to L-8 Basin			
	Volume		TP Load (kg)	TP Conc. (ppb)	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)			(ac-ft)	(hm^3)		
Jan	19,608	24.19	2,019	83	1,056	1.30	121	93
Feb	12,884	15.89	1,554	98	525	0.65	58	90
Mar	15,872	19.58	2,338	119	0	0.00	0	---
Apr	11,405	14.07	1,467	104	860	1.06	88	83
May	7,171	8.85	896	101	598	0.74	76	103
Jun	6,110	7.54	594	79	12	0.01	2	145
Jul	8,596	10.60	821	77	0	0.00	0	---
Aug	8,058	9.94	808	81	25	0.03	1	43
Sep	13,519	16.68	1,155	69	0	0.00	0	---
Oct	11,735	14.48	984	68	30	0.04	2	65
Nov	17,296	21.33	1,470	69	0	0.00	0	---
Dec	18,218	22.47	1,878	84	497	0.61	27	44
Ann	150,471	185.60	15,983	86	3,603	4.44	377	85

Table 7.3: C-51 West Basin Flow-through Summary

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	14,417	17.78	2,103	118
1996	---	---	---	---	Feb	7,438	9.17	794	87
1997	---	---	---	---	Mar	11,849	14.62	1,112	76
1998<	184,010	226.97	22,152	98	Apr	7,114	8.77	906	103
1999	101,887	125.68	13,905	111	May	7,223	8.91	1,063	119
2000	141,899	175.03	23,664	135	Jun	2,267	2.80	259	93
2001	10,698	13.20	2,052	155	Jul	3,487	4.30	743	173
2002<	2	0.00	1	250	Aug	3,442	4.25	557	131
2003	---	---	---	---	Sep	10,328	12.74	1,489	117
2004	---	---	---	---	Oct	7,017	8.66	1,076	124
Min.	10,698	13.20	2,052	---	Nov	15,763	19.44	2,520	130
Max.	141,899	175.03	23,664	---	Dec	18,408	22.71	2,637	116
Avg.	84,828	104.63	13,207	126	Ann	108,752	134.14	15,258	114

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

7.2. C-51 Canal at State Route 7

The District has established a flow monitoring station in the C-51 Canal at State Route (SR) 7. This location defines the eastern extent of the C-51 West Basin. The discharge rate at this location is monitored using an ultrasonic velocity meter (UVM). Unfortunately, the period of record for the data at this station only covers portions of WY 1998–2002 (July 1997–July 2001). Positive (eastward) discharge at this station is summarized in Table 7.4. There have also been occasional negative discharges recorded at this station but these are infrequent and generally of small magnitude.

Table 7.4: Discharge Summary for C-51 Canal at State Route 7

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	26,647	32.87	3,573	109
1996	---	---	---	---	Feb	20,006	24.68	2,158	87
1997	---	---	---	---	Mar	17,602	21.71	1,822	84
1998<	346,106	426.92	45,413	106	Apr	10,210	12.59	1,509	120
1999	244,451	301.53	34,435	114	May	9,032	11.14	1,294	116
2000	247,480	305.26	44,744	147	Jun	11,739	14.48	2,663	184
2001	59,687	73.62	9,657	131	Jul	9,468	11.68	1,645	141
2002<	13,371	16.49	3,080	187	Aug	23,934	29.52	3,706	126
2003	---	---	---	---	Sep	26,062	32.15	4,054	126
2004	---	---	---	---	Oct	20,549	25.35	3,518	139
Min.	59,687	73.62	9,657	---	Nov	22,526	27.79	4,159	150
Max.	247,480	305.26	44,744	---	Dec	27,631	34.08	3,821	112
Avg.	183,873	226.80	29,612	131	Ann	225,407	278.04	33,921	122

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

7.3. M-1 Canal

There is also a connection between the Indian Trail Improvement District's (ITID) M-1 Canal and the C-51 Canal. The ITID is located within the L-8 Basin and drainage from this district is normally routed to the north and west where it is eventually discharged to the L-8 Borrow Canal. However, under emergency conditions the ITID may be allowed to discharge into the C-51 Canal and has done so occasionally in the past. No data on the timing and magnitude of these historic discharges were provided by the District.

7.4. C-51 West Basin Runoff

The apparent runoff from the C-51 West Basin was calculated as the net basin discharge (inflow minus outflow) for the available period of record. For this basin, daily runoff estimates were calculated from discharge measurements at the following control structures:

- Discharge to west at S-5AE
- Plus net eastward discharge in C-51 Canal at SR7

- Minus basin flow-through

The period of record for these runoff estimates matches the available period of record for the SR7 monitoring station in the C-51 Canal (July 1997–July 2001). These data are summarized in Table 7.5.

Table 7.5: C-51 West Basin Runoff Summary

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	14,869	18.34	1,773	97
1996	---	---	---	---	Feb	13,882	17.12	1,509	88
1997	---	---	---	---	Mar	5,753	7.10	710	100
1998<	162,097	199.94	23,261	116	Apr	5,246	6.47	824	127
1999	171,943	212.09	23,476	111	May	3,304	4.08	422	103
2000	111,561	137.61	21,841	159	Jun	9,501	11.72	2,410	206
2001	49,064	60.52	7,617	126	Jul	5,981	7.38	902	122
2002<	13,490	16.64	3,101	186	Aug	20,491	25.28	3,149	125
2003	---	---	---	---	Sep	15,734	19.41	2,565	132
2004	---	---	---	---	Oct	13,551	16.72	2,445	146
Min.	49,064	60.52	7,617	---	Nov	6,763	8.34	1,639	196
Max.	171,943	212.09	23,476	---	Dec	10,466	12.91	1,252	97
Avg.	110,856	136.74	17,645	129	Ann	125,543	154.86	19,599	127

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

The variability of TP loads and concentrations by month in C-51 West Basin runoff are shown graphically in Figure 7.2.

* * * * *

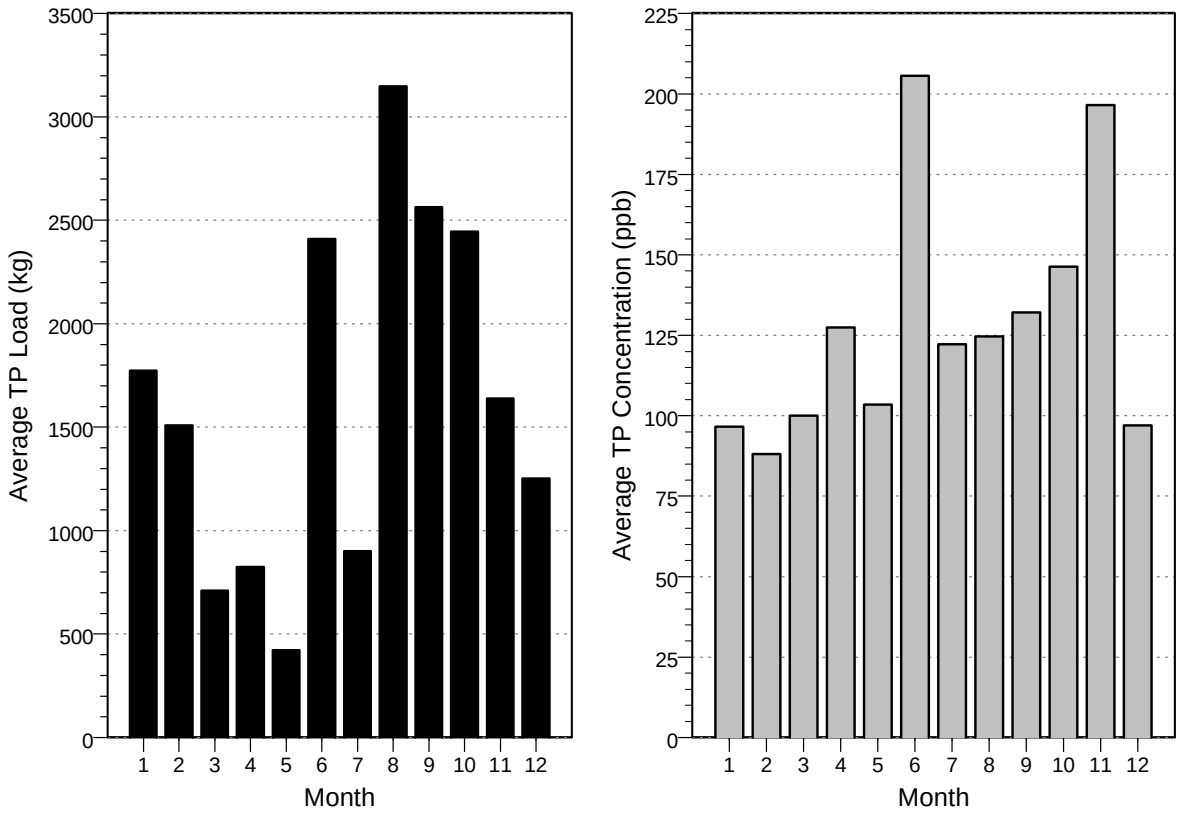

Figure 7.2: Average Monthly TP Loads and Concentrations in C-51 West Basin Runoff

8. C-139 AND C-139 ANNEX BASINS

The C-139 drainage basin is one of the Western Basins and is located in northeastern Hendry County. The primary drainage canals in this basin are the L-1, L-2 and L-3 borrow canals. The C-139 Annex Basin is located farther south adjacent to the L-3 Borrow Canal and comprises a tract owned by the United States Sugar Corporation.

8.1. C-139 Basin

In its original configuration, all of the drainage from the C-139 basin drained to the south, discharging directly to WCA-3A or east into the S-8 Basin. In response to flooding problems in the upper basin, the L-1 East Borrow Canal was built in the 1980s to divert flood waters from the upper basin to the Miami Canal. As part of the Everglades Construction Project, further changes have been made to this basin. Most drainage from this basin is now delivered to STA-5. A block diagram that shows control structures that currently regulate flow out of the C-139 Basin is included as Figure 8.1.

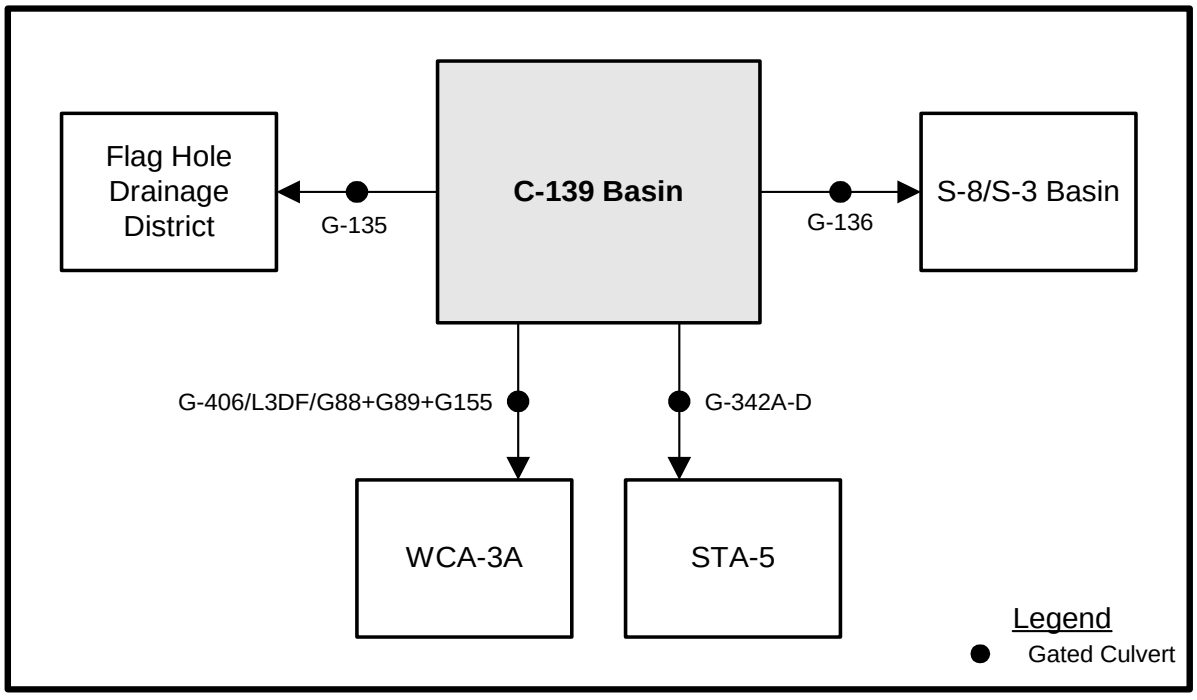

Figure 8.1: C-139 Basin Schematic

The flow volumes and TP discharge from the C-139 Basin are discussed in the following sections. For these structures, the base study period has been extended by one year to include data for WY 2005 also.

8.1.1. Culvert G-136

Structure G-136 is a gated culvert between the L-1 and L-1E borrow canals. This culvert is normally closed so all the drainage from this basin flows south via the L-1 and L-2 canals to STA-5. During high rainfall events, this culvert is opened and structure G-150, located downstream at the intersection of the L-1 and L-2 canals, is closed to divert flood waters from the upper basin east into the L-1E Canal. This latter canal conveys water into the S-8/S-3 Basin to the Miami Canal. The volumetric and TP discharge through this structure is summarized in Table 8.1. For WY 2005 only, TP loads were estimated by Burns & McDonnell from available sampling data.

Table 8.1: Discharge Summary for Culvert G-136

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	35,986	44.39	5,336	120	Jan	515	0.63	53	84
1996	20,790	25.64	3,381	132	Feb	612	0.76	101	134
1997	13,091	16.15	2,459	152	Mar	328	0.41	46	114
1998	20,776	25.63	5,327	208	Apr	72	0.09	6	66
1999	13,732	16.94	4,165	246	May	222	0.27	18	66
2000	24,859	30.66	7,948	259	Jun	1,719	2.12	399	188
2001	3,294	4.06	244	60	Jul	2,908	3.59	870	242
2002	17,061	21.04	4,239	201	Aug	3,105	3.83	844	220
2003	15,155	18.69	4,965	266	Sep	3,597	4.44	930	210
2004	13,221	16.31	3,335	205	Oct	2,568	3.17	572	181
2005	17,379	21.44	5,661	264	Nov	1,128	1.39	342	246
Min.	3,294	4.06	244	---	Dec	985	1.22	97	80
Max.	35,986	44.39	7,948	---	Ann	17,759	21.90	4,278	195
Avg.	17,759	21.90	4,278	195					

8.1.2. Culvert G-135

Structure G-135 connects the L-1 Borrow Canal with the Flaghole Drainage District and C-43 Basin to the north. This gate is intended to be opened only during emergency

conditions. Flow and sampling data records for this structure were retrieved from DBHYDRO and the corresponding TP load estimates developed by Burns & McDonnell. There are occasional periods of negative flow through this culvert (that is, flow into the C-139 Basin). Table 8.2 is a summary of the net discharges through this structure into the Flaghole Drainage District.

Table 8.2: Discharge Summary for Culvert G-135

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	1,785	2.20	90	41	Jan	740	0.91	66	72
1996	856	1.06	34	32	Feb	440	0.54	38	70
1997	4,489	5.54	1,005	181	Mar	89	0.11	16	146
1998	4,731	5.84	890	153	Apr	37	0.05	3	65
1999	4,957	6.11	1,119	183	May	71	0.09	6	72
2000	10,570	13.04	2,121	163	Jun	815	1.00	147	147
2001	386	0.48	27	56	Jul	658	0.81	171	210
2002	4,865	6.00	1,291	215	Aug	957	1.18	172	146
2003	4,834	5.96	1,284	215	Sep	1,045	1.29	147	114
2004	3,750	4.63	751	162	Oct	529	0.65	37	57
2005	25,347	31.27	938	30	Nov	414	0.51	50	97
Min.	386	0.48	27	---	Dec	726	0.90	62	69
Max.	10,570	13.04	2,121	---	Ann	6,521	8.04	915	114
Avg.	4,122	5.08	861	169					

* The annual summary data presented in this table are an algebraic sum of the discharge at this structure. Months with a net TP inflow at this structure are excluded from the average monthly calculations.

8.1.3. STA-5 Inflow Structures

There are four gated culverts that control inflow to STA-5: G-342A through G-342D. These culverts are located in Levee 2 between the L-2 Borrow Canal and STA-5. The first discharge through these culverts was in October 1999 coincident with the initial operation of STA-5. Table 8.3 is a summary of the C-139 Basin drainage delivered to STA-5 through all four of these culverts.

Table 8.3: Discharge Summary for Culverts G-342A – G342D

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	3,501	4.32	325	75
1996	---	---	---	---	Feb	2,150	2.65	185	70
1997	---	---	---	---	Mar	4,058	5.00	548	109
1998	---	---	---	---	Apr	1,446	1.78	242	136
1999	---	---	---	---	May	1,343	1.66	336	203
2000<	8,088	9.98	2,257	226	Jun	10,815	13.34	3,878	291
2001	50,460	62.24	15,669	252	Jul	17,675	21.80	6,777	311
2002	159,259	196.44	49,071	250	Aug	27,542	33.97	8,867	261
2003	170,204	209.94	57,208	272	Sep	29,547	36.45	10,543	289
2004	153,069	188.81	48,077	255	Oct	17,737	21.88	4,536	207
2005	119,665	147.60	24,762	168	Nov	4,689	5.78	751	130
Min.	50,460	62.24	15,669	---	Dec	4,610	5.69	1,022	180
Max.	170,204	209.94	57,208	---	Ann	125,114	154.33	38,012	246
Avg.	130,531	161.01	38,957	242					

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

8.1.4. Culvert G-406

Structure G-406 is a new gated culvert that has been constructed in the L-3 Borrow Canal at its northern end, just below STA-5. This culvert is normally closed to divert the flow in this canal into STA-5. Prior to construction of G-406, the flow in the L-3 Canal was monitored at station L3DF. This UVM station was located just downstream of the current location of G-406. Discharge monitoring at L3DF began in January 1996 and was suspended in June 2000 with completion of G-406. Prior to January 1996, composite data for G-88 + G-89 + G-155 were used. These data are summarized in Table 8.4.

Table 8.4: Discharge Summary for L-3 Borrow Canal below STA-5*

Annual Data					Average Monthly Data				
Water Year	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)	Month	Volume (ac-ft)	Volume (hm^3)	TP Load (kg)	TP Conc. (ppb)
1995	183,002	225.73	39,662	176	Jan	3,873	4.78	581	122
1996	181,183	223.49	40,360	181	Feb	4,016	4.95	467	94
1997	151,440	186.80	42,704	229	Mar	3,844	4.74	552	116
1998	149,152	183.98	30,211	164	Apr	1,350	1.67	217	130
1999	122,058	150.56	31,376	208	May	2,100	2.59	457	176
2000	168,779	208.19	42,160	203	Jun	7,477	9.22	2,235	242
2001	2,738	3.38	973	288	Jul	13,420	16.55	3,704	224
2002	23,349	28.80	12,450	432	Aug	14,985	18.48	4,290	232
2003	39,061	48.18	13,824	287	Sep	18,481	22.80	5,641	247
2004	37,633	46.42	16,457	355	Oct	16,248	20.04	4,481	224
2005	30,165	37.21	10,808	290	Nov	8,728	10.77	2,005	186
Min.	2,738	3.38	973	---	Dec	4,438	5.47	914	167
Max.	183,002	225.73	42,704	---	Ann	98,960	122.07	25,544	209
Avg.	98,960	122.07	25,544	209					

*. The data for this location are a composite of the following: G88+G89+G155 for 5/1994-12/1995; L3DF for 1/1996-5/2000; and G406 for 6/2000-4/2005.

8.1.5. C-139 Basin Runoff

The apparent runoff from the C-139 Basin was calculated as the total basin discharge for the available period of record and is the summation of the discharge at the following locations:

- L-3 Borrow Canal below STA-5
- STA-5 inflow at Culverts G-342A – G-342D
- Discharge to the S-8/S-3 Basin at G-136
- Discharge to Flaghole Drainage District at G-135

The resulting basin runoff estimates are summarized in Table 8.5. The variability of TP loads and concentrations by month in basin runoff is shown graphically in Figure 8.2.

Table 8.5: C-139 Basin Runoff Summary

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	220,773	272.32	45,089	166	Jan	6,910	8.52	866	102
1996	202,829	250.19	43,775	175	Feb	6,155	7.59	700	92
1997	169,020	208.48	46,167	221	Mar	6,466	7.98	912	114
1998	174,659	215.44	36,428	169	Apr	2,103	2.59	335	129
1999	140,748	173.61	36,660	211	May	3,152	3.89	663	170
2000	212,296	261.86	54,486	208	Jun	14,927	18.41	4,544	247
2001	56,877	70.16	16,912	241	Jul	25,021	30.86	7,825	254
2002	204,535	252.29	67,051	266	Aug	31,566	38.94	9,336	240
2003	229,254	282.78	77,280	273	Sep	36,554	45.09	11,511	255
2004	207,673	256.16	68,620	268	Oct	28,970	35.73	7,559	212
2005	192,556	237.51	42,169	178	Nov	12,828	15.82	2,807	177
Min.	56,877	70.16	16,912	---	Dec	8,485	10.47	1,610	154
Max.	229,254	282.78	77,280	---	Ann	183,136	225.89	48,667	215
Avg.	182,838	225.53	48,603	216					

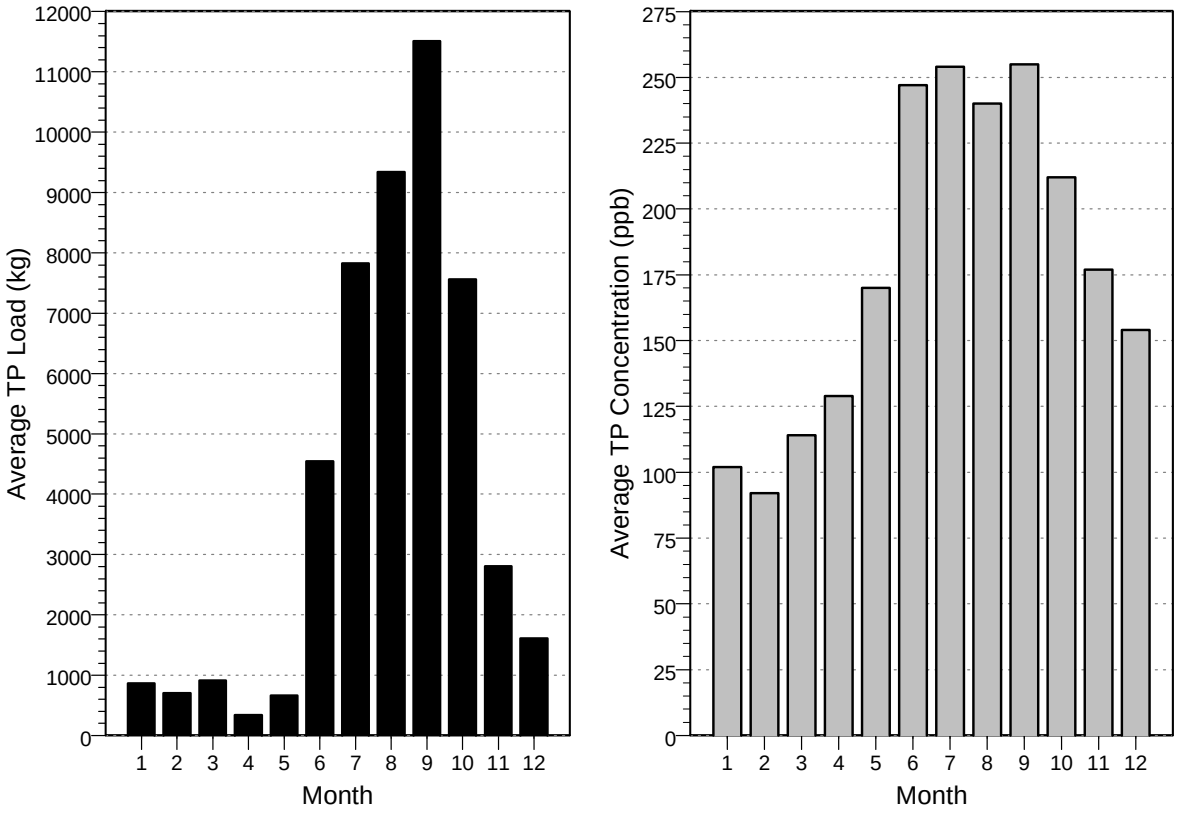

Figure 8.2: Average Monthly TP Loads and Concentrations in C-139 Basin Runoff

8.2. C-139 Annex Basin

The C-139 Annex basin is located in southeastern Hendry County. Presently, this area drains to the L-28 Borrow Canal, which conveys this drainage to WCA-3A via structure S-140. In the future, plans are that this drainage will be conveyed to STA-6 for treatment prior to being discharged to the EPA.

There is only one outlet from this basin to the L-28 Borrow Canal. The discharge at this point, known as USSO, is monitored at a UVM station in this outlet canal. The discharge records for this monitoring station begin in December 1995. Because this basin has only one outlet, the discharge at USSO is also an estimate of total basin runoff. The discharge at USSO is summarized in Table 8.6.

Table 8.6: Discharge Summary for USSO and C-139 Annex Basin Runoff

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	1,118	1.38	98	71
1996<	1,742	2.15	164	76	Feb	1,152	1.42	70	50
1997	40,196	49.58	5,107	103	Mar	1,469	1.81	121	67
1998	46,081	56.84	4,022	71	Apr	1,294	1.60	139	87
1999	24,270	29.94	3,131	105	May	1,434	1.77	146	83
2000	46,365	57.19	6,416	112	Jun	5,046	6.22	737	118
2001	26,831	33.10	4,564	138	Jul	5,363	6.62	786	119
2002	37,722	46.53	3,846	83	Aug	6,050	7.46	775	104
2003	43,921	54.18	5,261	97	Sep	6,097	7.52	791	105
2004	46,858	57.80	5,731	99	Oct	6,295	7.77	836	108
2005	49,335	60.85	5,775	95	Nov	2,667	3.29	216	66
Min.	24,270	29.94	3,131	---	Dec	1,643	2.03	114	56
Max.	49,335	60.85	6,416	---	Ann	39,627	48.88	4,830	99
Avg.	40,175	49.56	4,873	98					

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

For the C-139 Annex, the variability of TP loads and concentrations by month in basin runoff is shown graphically in Figure 8.3.

* * * * *

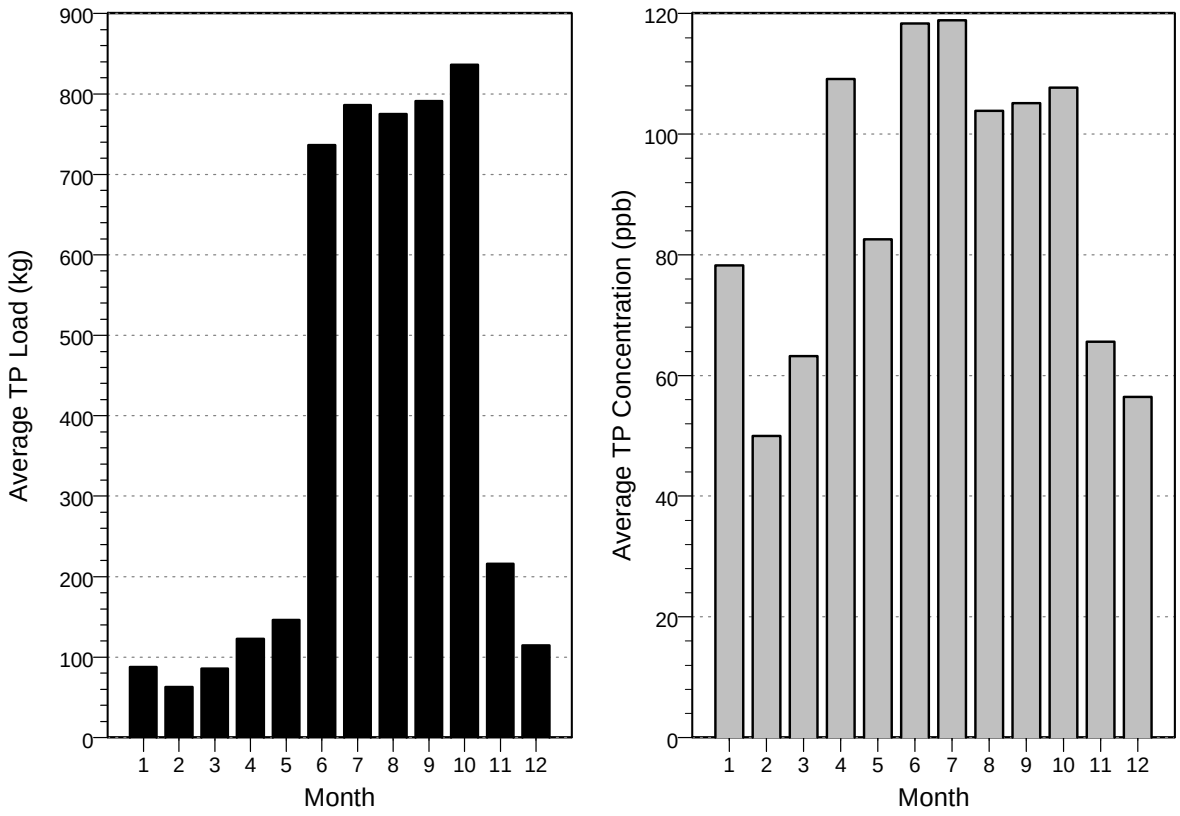

Figure 8.3: Average Monthly TP Loads and Concentrations in C-139 Annex Runoff

9. CHAPTER 298 DISTRICTS

The Everglades Agricultural Area includes a number of special drainage districts that were organized under Chapter 298 of the Florida Statutes. These Chapter 298 and similar drainage districts have historically discharged most of their drainage directly to Lake Okeechobee. The Chapter 298 districts and similar areas that are addressed in this report are listed below.

- South Florida Conservancy District, Unit 5 (S-236 Basin)
- South Shore Drainage District
- East Beach Water Control District
- East Shore Water Control District and 715 Farms

These drainage districts are situated along the east and south shores of Lake Okeechobee in Palm Beach and Hendry counties. Descriptions of these districts are included below. Figure 9.1 is a schematic that shows the principal control structures for these five drainage districts.

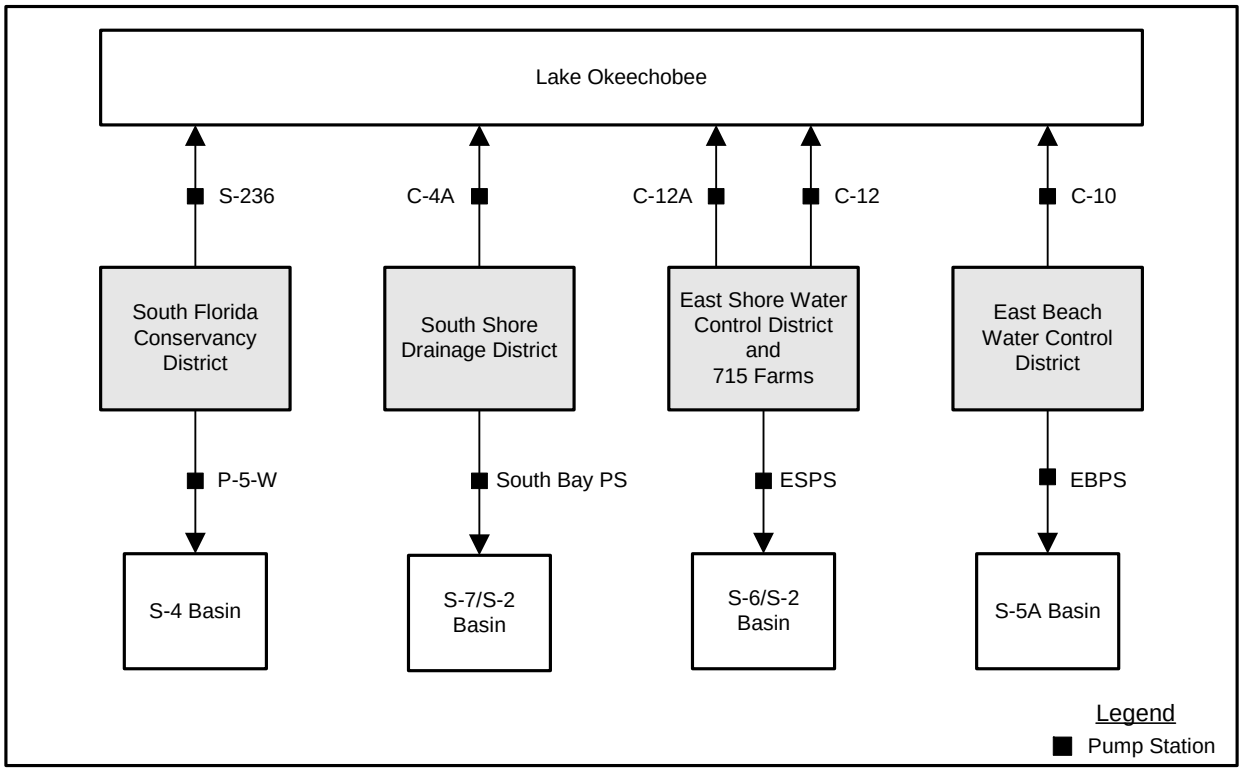

Figure 9.1: Schematic for Chapter 298 Districts

9.1. East Beach Water Control District

The East Beach Water Control District (EBWCD) is located on the east shore of Lake Okeechobee, south and west of the West Palm Beach Canal. There are two primary discharge points from the EBWCD: the C-10 pump station and East Beach pump station (EBPS). Structure C-10 is a pump station located on the east shore of Lake Okeechobee that discharges directly to the lake. The structure referred to as EBPS draws water from the C-4 Canal and discharges to the West Palm Beach Canal in the S-5A Basin. The discharge record for the EBPS monitoring location starts in July 2001 but there had been an EBWCD pump station (Pump Station 2) at this location many years prior to this time. Unfortunately, no discharge records were kept for this station before July 2001; therefore, the total drainage from this district is underreported for earlier periods. The estimated annual and average monthly volumetric and TP discharges at these two pump stations are summarized in Tables 9.1 and 9.2.

The total net runoff for the EBWCD is calculated as the sum of the data for C-10 and EBPS. The runoff estimates for this district are summarized in Table 9.3.

Table 9.1: Discharge Summary for C-10 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	12,857	15.86	8,593	542	Jan	99	0.12	42	343
1996	11,269	13.90	10,869	782	Feb	360	0.44	241	544
1997	3,551	4.38	677	155	Mar	342	0.42	144	340
1998	10,040	12.38	6,707	542	Apr	273	0.34	273	812
1999	18,596	22.94	16,643	726	May	104	0.13	39	302
2000	29,283	36.12	21,058	583	Jun	1,336	1.65	871	529
2001	5,227	6.45	6,546	1,015	Jul	991	1.22	673	551
2002	8,006	9.87	5,499	557	Aug	1,175	1.45	939	648
2003	536	0.66	455	688	Sep	1,679	2.07	1,159	559
2004	265	0.33	49	150	Oct	1,853	2.29	1,809	791
Min.	265	0.33	49	---	Nov	1,420	1.75	1,340	765
Max.	29,283	36.12	21,058	---	Dec	330	0.41	180	443
Avg.	9,963	12.29	7,710	627	Ann	9,963	12.29	7,710	627

Table 9.2: Discharge Summary for EBPS Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	762	0.94	174	186
1996	---	---	---	---	Feb	947	1.17	215	184
1997	---	---	---	---	Mar	391	0.48	91	189
1998	---	---	---	---	Apr	525	0.65	110	169
1999	---	---	---	---	May	776	0.96	164	171
2000	---	---	---	---	Jun	2,760	3.40	1,268	372
2001	---	---	---	---	Jul	1,863	2.30	814	354
2002<	10,018	12.36	3,187	258	Aug	3,268	4.03	1,462	363
2003	16,165	19.94	6,153	309	Sep	2,550	3.15	990	315
2004	19,088	23.54	7,039	299	Oct	895	1.10	299	271
Min.	16,165	19.94	6,153	---	Nov	661	0.81	136	167
Max.	19,088	23.54	7,039	---	Dec	872	1.08	213	198
Avg.	17,627	21.74	6,596	303	Ann	16,269	20.07	5,936	296

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

Table 9.3: EBWCD Runoff Summary*

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	12,857	15.86	8,593	542	Jan	328	0.40	94	233
1996	11,269	13.90	10,869	782	Feb	644	0.79	306	385
1997	3,551	4.38	677	155	Mar	460	0.57	171	302
1998	10,040	12.38	6,707	542	Apr	430	0.53	306	577
1999	18,596	22.94	16,643	726	May	260	0.32	72	224
2000	29,283	36.12	21,058	583	Jun	1,888	2.33	1,124	483
2001	5,227	6.45	6,546	1,015	Jul	1,549	1.91	917	480
2002	18,023	22.23	8,686	391	Aug	2,155	2.66	1,377	518
2003	16,701	20.60	6,608	321	Sep	2,445	3.02	1,456	483
2004	19,353	23.87	7,088	297	Oct	2,122	2.62	1,898	725
Min.	3,551	4.38	677	---	Nov	1,618	2.00	1,380	692
Max.	29,283	36.12	21,058	---	Dec	592	0.73	244	335
Avg.	14,490	17.87	9,347	523	Ann	14,490	17.87	9,347	523

* Runoff for this basin is underreported prior to July 2001.

The variability of TP loads and concentrations by month for runoff from the East Beach Water Control District is shown graphically in Figure 9.2.

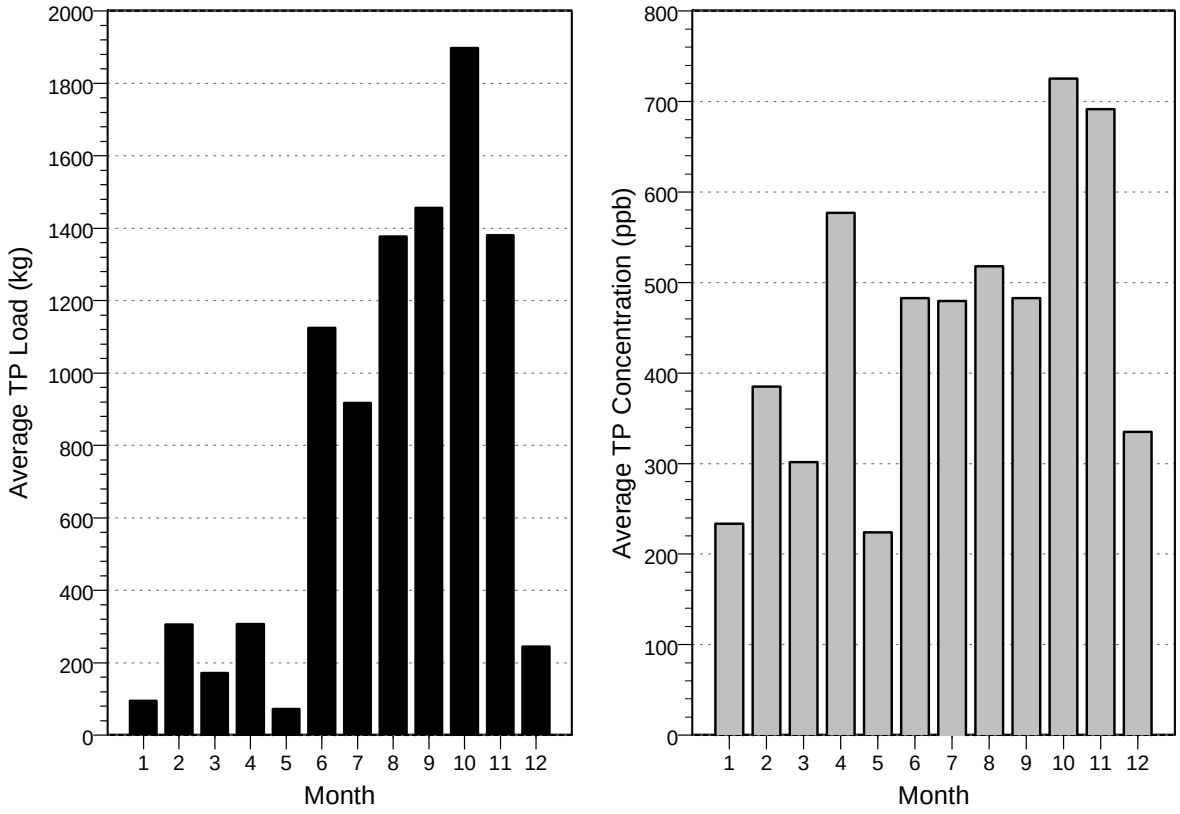

Figure 9.2: Average Monthly TP Loads and Concentrations in EBWCD Runoff

9.2. East Shore Water Control District and 715 Farms

The East Shore Water Control District (ESWCD) is located east of Lake Okeechobee between the West Palm Beach and Hillsboro canals. The 715 Farms area lies between this district and Lake Okeechobee. Currently, most of the drainage from these two areas is delivered to a common point so they are treated together in this analysis. There are three primary discharge points from these two drainage districts: the C-12, C-12A and ESPS pump stations. Structures C-12 and C-12A are pump stations located on the east shore of Lake Okeechobee that discharge directly to the lake. Structure ESPS is a relatively new pump station that has been installed on the Hillsboro Canal, approximately three miles south of these districts. A short conveyance canal connects this pump station with the two drainage districts. Drainage from both the ESWCD and 715 Farms area is discharged to the S-6/S-2

Basin through this pump station to reduce the quantities of water discharged to the lake. The first recorded discharges at this pump station occurred in December 2001. Prior to this time, all of the drainage from these two districts was discharged to Lake Okeechobee. The estimated volumetric and TP discharges at these three pump stations are summarized in Tables 9.4, 9.5 and 9.6.

Table 9.4: Discharge Summary for C-12 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	20,156	24.86	5,098	205	Jan	64	0.08	14	175
1996	16,855	20.79	3,466	167	Feb	363	0.45	67	150
1997	9,199	11.35	1,554	137	Mar	571	0.70	101	143
1998	11,283	13.92	3,806	273	Apr	316	0.39	78	199
1999	15,065	18.58	1,990	107	May	124	0.15	17	108
2000	26,025	32.10	4,658	145	Jun	1,667	2.06	366	178
2001	6,298	7.77	1,583	204	Jul	1,357	1.67	309	185
2002	9,851	12.15	1,690	139	Aug	1,546	1.91	323	169
2003	18	0.02	2	98	Sep	1,587	1.96	286	146
2004	470	0.58	36	61	Oct	1,779	2.19	421	192
Min.	18	0.02	2	---	Nov	1,526	1.88	244	129
Max.	26,025	32.10	5,098	---	Dec	623	0.77	164	213
Avg.	11,522	14.21	2,388	168	Ann	11,522	14.21	2,388	168

Table 9.5: Discharge Summary for C-12A Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	14,171	17.48	2,122	121	Jan	595	0.73	50	68
1996	14,414	17.78	2,013	113	Feb	604	0.74	58	79
1997	10,591	13.06	958	73	Mar	448	0.55	46	84
1998	15,095	18.62	1,520	82	Apr	356	0.44	49	112
1999	9,995	12.33	1,009	82	May	267	0.33	28	84
2000	19,147	23.62	2,669	113	Jun	815	1.01	99	98
2001	6,379	7.87	839	107	Jul	948	1.17	120	103
2002	6,940	8.56	787	92	Aug	1,487	1.83	199	108
2003	68	0.08	7	88	Sep	1,065	1.31	115	88
2004	0	0.00	0	---	Oct	1,578	1.95	237	122
Min.	0	0.00	0	---	Nov	774	0.96	106	111
Max.	19,147	23.62	2,669	---	Dec	744	0.92	85	93
Avg.	9,680	11.94	1,192	100	Ann	9,680	11.94	1,192	100

Table 9.6: Discharge Summary for ESPS Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	---	---	---	---	Jan	867	1.07	58	54
1996	---	---	---	---	Feb	2,282	2.81	188	67
1997	---	---	---	---	Mar	760	0.94	91	97
1998	---	---	---	---	Apr	987	1.22	76	63
1999	---	---	---	---	May	1,715	2.11	133	63
2000	---	---	---	---	Jun	6,115	7.54	657	87
2001	---	---	---	---	Jul	4,454	5.49	660	120
2002<	4,894	6.04	393	65	Aug	7,302	9.01	787	87
2003	32,607	40.22	3,606	90	Sep	2,020	2.49	269	108
2004	29,811	36.77	2,980	81	Oct	719	0.89	84	94
Min.	29,811	36.77	2,980	---	Nov	1,573	1.94	127	65
Max.	32,607	40.22	3,606	---	Dec	1,609	1.98	102	51
Avg.	31,209	38.50	3,293	86	Ann	30,403	37.50	3,232	86

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

The combined runoff from the ESWCD and 715 Farms area is estimated as the sum of the discharge at the following pump stations:

- C-12 pump station discharge to Lake Okeechobee
- C-12A pump station discharge to Lake Okeechobee
- ESPS pump station discharge to Hillsboro Canal (S-6/S-2 Basin)

The resulting runoff estimates for these two drainage districts are summarized in Table 9.7. From review of Tables 9.4 and 9.5, readers will note that annual discharges to Lake Okeechobee have been reduced dramatically since the ESPS pump station became operational.

Table 9.7: Basin Runoff Summary for ESWCD and 715 Farms

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	34,326	42.34	7,220	171	Jan	919	1.13	81	71
1996	31,269	38.57	5,479	142	Feb	1,651	2.04	182	89
1997	19,790	24.41	2,512	103	Mar	1,248	1.54	174	113
1998	26,377	32.54	5,325	164	Apr	968	1.19	150	125
1999	25,059	30.91	2,999	97	May	734	0.91	71	78
2000	45,171	55.72	7,328	132	Jun	3,705	4.57	596	130
2001	12,677	15.64	2,422	155	Jul	3,195	3.94	561	142
2002	21,685	26.75	2,870	107	Aug	4,493	5.54	679	123
2003	32,693	40.33	3,616	90	Sep	3,056	3.77	456	121
2004	30,281	37.35	3,015	81	Oct	3,500	4.32	675	156
Min.	12,677	15.64	2,422	---	Nov	2,615	3.23	375	116
Max.	45,171	55.72	7,328	---	Dec	1,849	2.28	280	123
Avg.	27,933	34.45	4,279	124	Ann	27,933	34.45	4,279	124

For the ESWCD and 715 Farms, the variability of TP loads and concentrations by month in basin runoff is shown graphically in Figure 9.3.

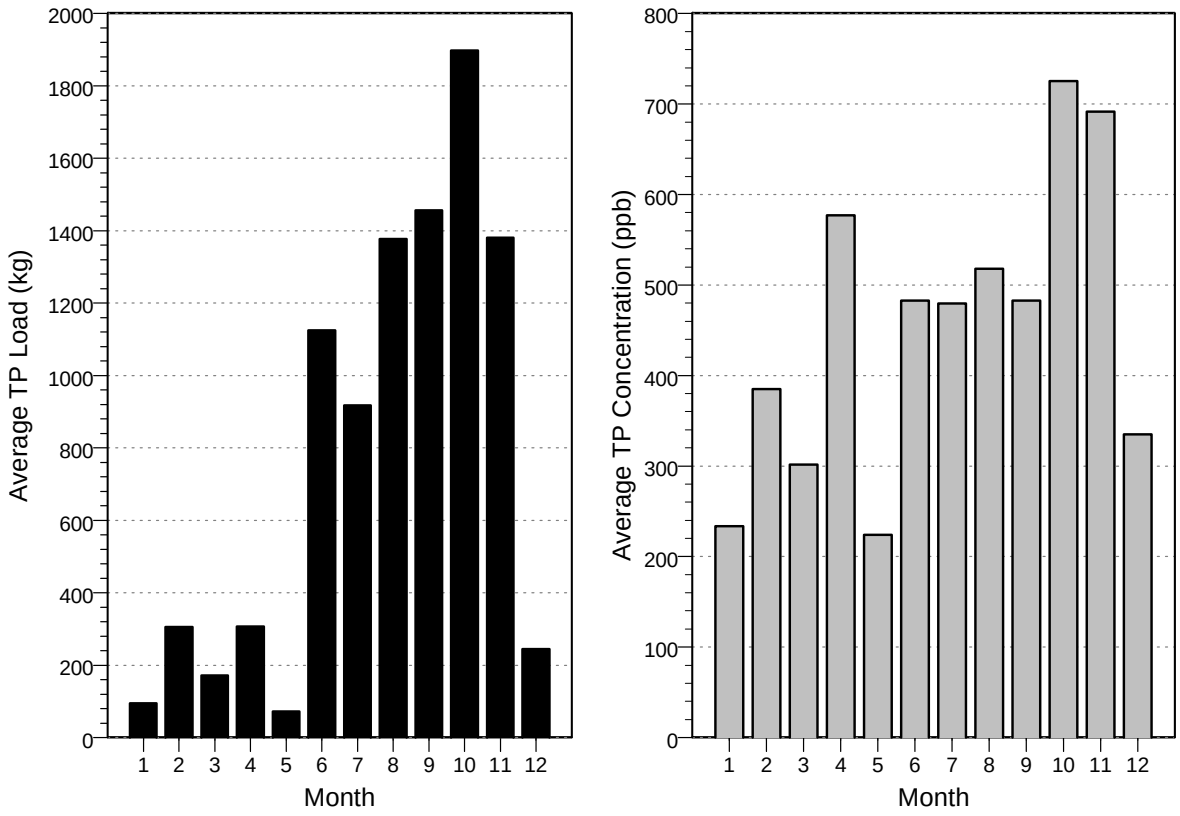

Figure 9.3: Average Monthly TP Loads and Conc. in ESWCD/715 Farms Runoff

9.3. South Shore Drainage District

The South Shore Drainage District (SSDD) is located on the south shore of Lake Okeechobee between the Miami and North New River canals. There are two pump stations in this district with available discharge data (Figure 9.1). The C-4A pump station is located on the shore of Lake Okeechobee and discharges directly to the lake. The second pump station (Structure MC25.7TE, Permit No. 50-00081-E) is located within the City of South Bay in the eastern portion of the district. This pump station, which will be referred to as the South Bay pump station, discharges to the North New River Canal. The discharge at the C-4A and South Bay pump stations are summarized in Tables 9.8 and 9.9.

Table 9.8: Discharge Summary for C-4A Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	11,331	13.98	1,375	98	Jan	182	0.22	22	96
1996	8,882	10.96	927	85	Feb	365	0.45	40	90
1997	7,471	9.22	575	62	Mar	330	0.41	36	89
1998	7,522	9.28	917	99	Apr	200	0.25	27	107
1999	7,196	8.88	1,108	125	May	304	0.37	34	90
2000	11,413	14.08	1,701	121	Jun	1,149	1.42	137	97
2001	2,968	3.66	604	165	Jul	846	1.04	106	101
2002	3,156	3.89	518	133	Aug	1,060	1.31	134	102
2003	6,695	8.26	986	119	Sep	1,191	1.47	177	120
2004	5,534	6.83	581	85	Oct	649	0.80	96	120
Min.	2,968	3.66	518	---	Nov	625	0.77	88	114
Max.	11,413	14.08	1,701	---	Dec	315	0.39	34	89
Avg.	7,217	8.90	929	104	Ann	7,217	8.90	929	104

Table 9.9: Discharge Summary for South Bay Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	2,516	3.10	288	93	Jan	159	0.20	13	68
1996	1,967	2.43	225	93	Feb	182	0.22	17	76
1997	1,456	1.80	331	184	Mar	122	0.15	26	171
1998	1,977	2.44	562	230	Apr	85	0.10	22	211
1999	1,996	2.46	333	135	May	128	0.16	17	108
2000	3,464	4.27	460	108	Jun	305	0.38	36	96
2001	809	1.00	151	152	Jul	244	0.30	33	109
2002	2,197	2.71	192	71	Aug	236	0.29	32	111
2003	2,931	3.62	367	102	Sep	242	0.30	39	131
2004	2,098	2.59	145	56	Oct	164	0.20	24	121
Min.	809	1.00	145	---	Nov	121	0.15	18	122
Max.	3,464	4.27	562	---	Dec	152	0.19	27	144
Avg.	2,141	2.64	305	116	Ann	2,141	2.64	305	116

Basin runoff from the SSDD is calculated as the sum of the discharge from the C-4A and South Bay pump stations. This basin runoff is summarized in Table 9.10.

Table 9.10: SSDD Basin Runoff Summary

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	13,847	17.08	1,663	97	Jan	341	0.42	35	83
1996	10,848	13.38	1,152	86	Feb	547	0.67	57	85
1997	8,927	11.01	906	82	Mar	452	0.56	62	111
1998	9,499	11.72	1,479	126	Apr	285	0.35	49	138
1999	9,192	11.34	1,442	127	May	432	0.53	51	95
2000	14,877	18.35	2,162	118	Jun	1,454	1.79	173	97
2001	3,777	4.66	756	162	Jul	1,090	1.35	138	103
2002	5,354	6.60	710	107	Aug	1,296	1.60	166	104
2003	9,626	11.87	1,354	114	Sep	1,433	1.77	216	122
2004	7,632	9.41	726	77	Oct	813	1.00	120	120
Min.	3,777	4.66	710	---	Nov	746	0.92	106	115
Max.	14,877	18.35	2,162	---	Dec	467	0.58	61	107
Avg.	9,358	11.54	1,235	107	Ann	9,358	11.54	1,235	107

The variability of TP loads and concentrations in runoff from the South Shore Drainage District is shown by the plots of average monthly data in Figure 9.4.

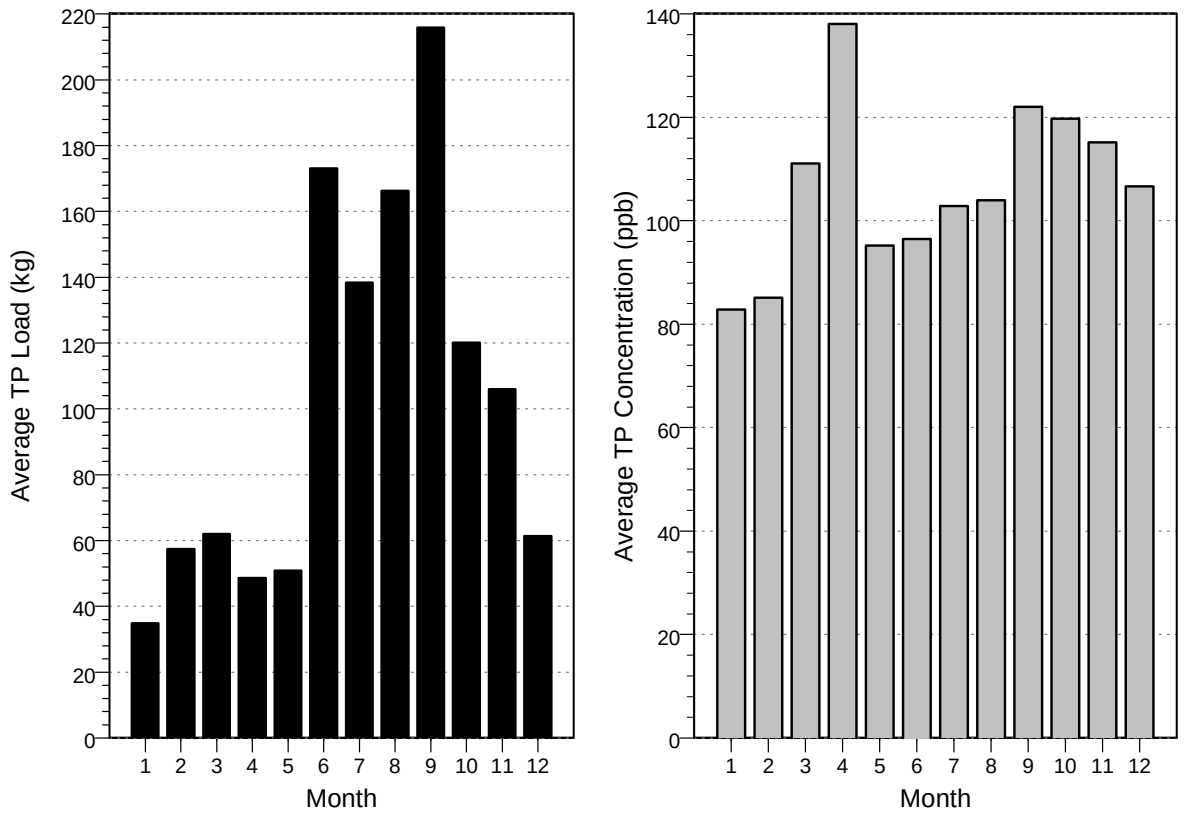

Figure 9.4: Average Monthly TP Loads and Concentrations in SSDD Runoff

9.4. South Florida Conservancy District

The South Florida Conservancy District, Unit No. 5 (SFCD) is located on the south shore of Lake Okeechobee, immediately west of the Miami Canal. There are two principal discharge structures from this drainage district: the S-236 and P-5-W pump stations. The S-236 pump station is located on the shore of Lake Okeechobee and discharges directly to the lake. Pump station P-5-W (also known as EPD-07) is located at the western boundary of this drainage district and discharges west into the Industrial Canal. This canal is located in the adjacent S-4 Basin but, under common conditions, the water discharged to this canal would also flow into Lake Okeechobee. The discharge from these two pump stations is summarized in Tables 9.11 and 9.12.

The estimated runoff from the SFCD is the sum of the discharge at the S-236 and P-5-W pump stations. These runoff estimates are summarized in Table 9.13. Figure 9.5 shows the variability of average monthly TP loads and concentrations in this runoff.

Table 9.11: Discharge Summary for S-236 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	4,651	5.74	494	86	Jan	456	0.56	50	89
1996	6,695	8.26	679	82	Feb	708	0.87	97	111
1997	5,031	6.21	363	58	Mar	332	0.41	36	87
1998	11,784	14.54	2,034	140	Apr	528	0.65	66	101
1999	21,971	27.10	3,542	131	May	669	0.82	85	103
2000	36,175	44.62	4,563	102	Jun	1,854	2.29	232	101
2001	4,762	5.87	645	110	Jul	2,093	2.58	265	103
2002	14,702	18.13	1,868	103	Aug	1,694	2.09	229	110
2003	16,740	20.65	1,773	86	Sep	1,965	2.42	279	115
2004	15,304	18.88	2,183	116	Oct	1,344	1.66	158	95
Min.	4,651	5.74	363	---	Nov	1,359	1.68	213	127
Max.	36,175	44.62	4,563	---	Dec	780	0.96	106	110
Avg.	13,782	17.00	1,814	107	Ann	13,782	17.00	1,814	107

Table 9.12: Discharge Summary for P-5-W Pump Station

Annual Data[1]					Average Monthly Data[2]				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	26,554	32.75	5,691	174	Jan	570	0.70	62	88
1996	21,037	25.95	3,086	119	Feb	798	0.98	162	165
1997	12,350	15.23	2,053	135	Mar	456	0.56	94	167
1998	7,755	9.57	1,109	116	Apr	418	0.52	55	107
1999	7,902	9.75	2,324	238	May	415	0.51	64	125
2000	6,921	8.54	1,347	158	Jun	1,223	1.51	164	108
2001	232	0.29	50	176	Jul	1,117	1.38	158	114
2002	3,008	3.71	683	184	Aug	1,193	1.47	210	143
2003	8,409	10.37	1,036	100	Sep	1,277	1.57	226	144
2004<	8,482	10.46	1,054	101	Oct	1,122	1.38	260	188
Min.	232	0.29	50	---	Nov	900	1.11	258	233
Max.	26,554	32.75	5,691	---	Dec	864	1.07	145	136
Avg.	10,463	12.91	1,931	150	Ann	10,352	12.77	1,858	146

1. Symbol "<" after water year indicates partial year data. Missing and partial year data are excluded from annual statistic calculations.
2. Average monthly statistics are calculated using all available data, including those for partial water years; therefore, annual total of monthly averages may not match average of annual totals.

Table 9.13: Runoff Summary for SFCD

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	31,205	38.49	6,184	161	Jan	1,026	1.27	112	88
1996	27,733	34.21	3,765	110	Feb	1,506	1.86	259	139
1997	17,381	21.44	2,416	113	Mar	742	0.92	120	131
1998	19,539	24.10	3,143	130	Apr	904	1.11	116	104
1999	29,873	36.85	5,865	159	May	1,084	1.34	149	111
2000	43,096	53.16	5,910	111	Jun	3,077	3.80	395	104
2001	4,995	6.16	695	113	Jul	3,210	3.96	423	107
2002	17,710	21.84	2,552	117	Aug	2,888	3.56	440	123
2003	25,149	31.02	2,809	91	Sep	3,242	4.00	505	126
2004	23,786	29.34	3,237	110	Oct	2,466	3.04	418	137
Min.	4,995	6.16	695	---	Nov	2,258	2.79	471	169
Max.	43,096	53.16	6,184	---	Dec	1,644	2.03	250	123
Avg.	24,047	29.66	3,658	123	Ann	24,047	29.66	3,658	123

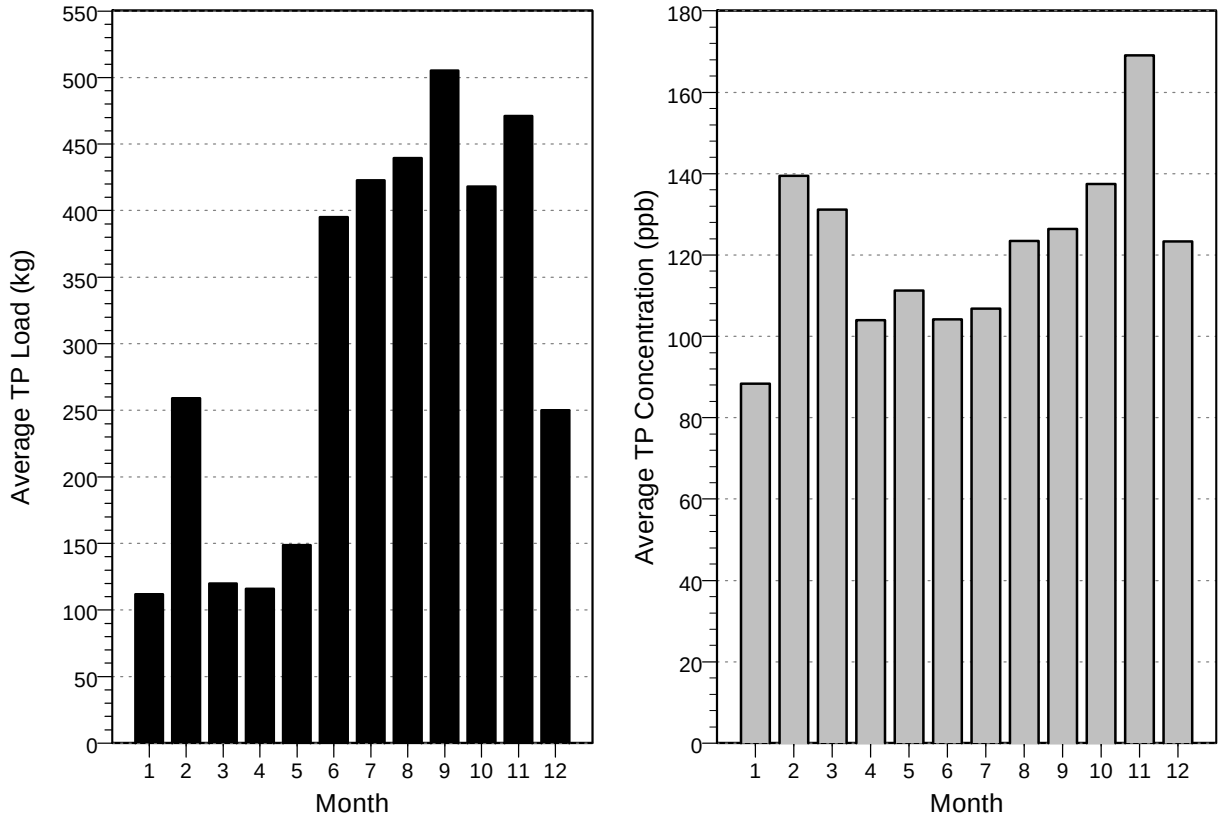

Figure 9.5: Average Monthly TP Loads and Concentrations in SFCD Runoff

10. ACME BASIN B

Basin B of the ACME Drainage District is located east of WCA-1 and south of the C-51 West Basin. The principal water control structures in this basin are two pump stations: ACME1 and ACME2. Both of these pump stations discharge directly to WCA-1. Tables 10.1 and 10.2 contain discharge summaries for these two pump stations.

Table 10.1: Discharge Summary for ACME1 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	28,317	34.93	2,415	69	Jan	560	0.69	58	84
1996	22,172	27.35	4,841	177	Feb	748	0.92	76	83
1997	17,168	21.18	1,421	67	Mar	491	0.61	54	90
1998	26,393	32.56	2,972	91	Apr	181	0.22	15	67
1999	19,776	24.39	3,579	147	May	447	0.55	46	84
2000	19,316	23.83	3,619	152	Jun	2,240	2.76	223	81
2001	5,422	6.69	436	65	Jul	2,319	2.86	246	86
2002	16,422	20.26	1,777	88	Aug	2,518	3.11	272	88
2003	8,817	10.88	915	84	Sep	2,739	3.38	339	100
2004	10,018	12.36	957	77	Oct	2,434	3.00	622	207
Min.	5,422	6.69	436	---	Nov	1,670	2.06	242	117
Max.	28,317	34.93	4,841	---	Dec	1,035	1.28	99	77
Avg.	17,382	21.44	2,293	107	Ann	17,382	21.44	2,293	107

The estimated total runoff from ACME Basin B is simply the sum of the discharges at these two pump stations. These runoff estimates are summarized in Table 10.3. The variability of TP loads and concentrations in the runoff from this basin is shown in Figure 10.1.

* * * * *

Table 10.2: Discharge Summary for ACME2 Pump Station

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	26,630	32.85	3,622	110	Jan	516	0.64	59	92
1996	22,244	27.44	4,800	175	Feb	624	0.77	85	110
1997	12,911	15.93	1,346	85	Mar	417	0.51	57	110
1998	20,898	25.78	2,597	101	Apr	285	0.35	38	109
1999	16,930	20.88	3,755	180	May	323	0.40	33	83
2000	18,725	23.10	3,137	136	Jun	2,172	2.68	273	102
2001	6,159	7.60	917	121	Jul	2,183	2.69	323	120
2002	17,531	21.62	3,286	152	Aug	2,324	2.87	325	113
2003	9,473	11.68	1,303	112	Sep	2,550	3.15	422	134
2004	9,871	12.18	1,227	101	Oct	2,302	2.84	573	202
Min.	6,159	7.60	917	---	Nov	1,539	1.90	301	159
Max.	26,630	32.85	4,800	---	Dec	901	1.11	111	100
Avg.	16,137	19.90	2,599	131	Ann	16,137	19.90	2,599	131

Table 10.3: Runoff Summary for ACME Basin B

Annual Data					Average Monthly Data				
Water Year	Volume		TP Load (kg)	TP Conc. (ppb)	Month	Volume		TP Load (kg)	TP Conc. (ppb)
	(ac-ft)	(hm^3)				(ac-ft)	(hm^3)		
1995	54,947	67.78	6,038	89	Jan	1,076	1.33	117	88
1996	44,417	54.79	9,641	176	Feb	1,373	1.69	161	95
1997	30,079	37.10	2,767	75	Mar	908	1.12	111	99
1998	47,291	58.33	5,569	95	Apr	466	0.57	53	92
1999	36,705	45.28	7,334	162	May	770	0.95	80	84
2000	38,041	46.92	6,756	144	Jun	4,413	5.44	496	91
2001	11,581	14.28	1,353	95	Jul	4,502	5.55	569	102
2002	33,953	41.88	5,064	121	Aug	4,842	5.97	597	100
2003	18,290	22.56	2,218	98	Sep	5,289	6.52	761	117
2004	19,890	24.53	2,184	89	Oct	4,736	5.84	1,195	205
Min.	11,581	14.28	1,353	---	Nov	3,208	3.96	543	137
Max.	54,947	67.78	9,641	---	Dec	1,936	2.39	210	88
Avg.	33,519	41.35	4,892	118	Ann	33,519	41.35	4,892	118

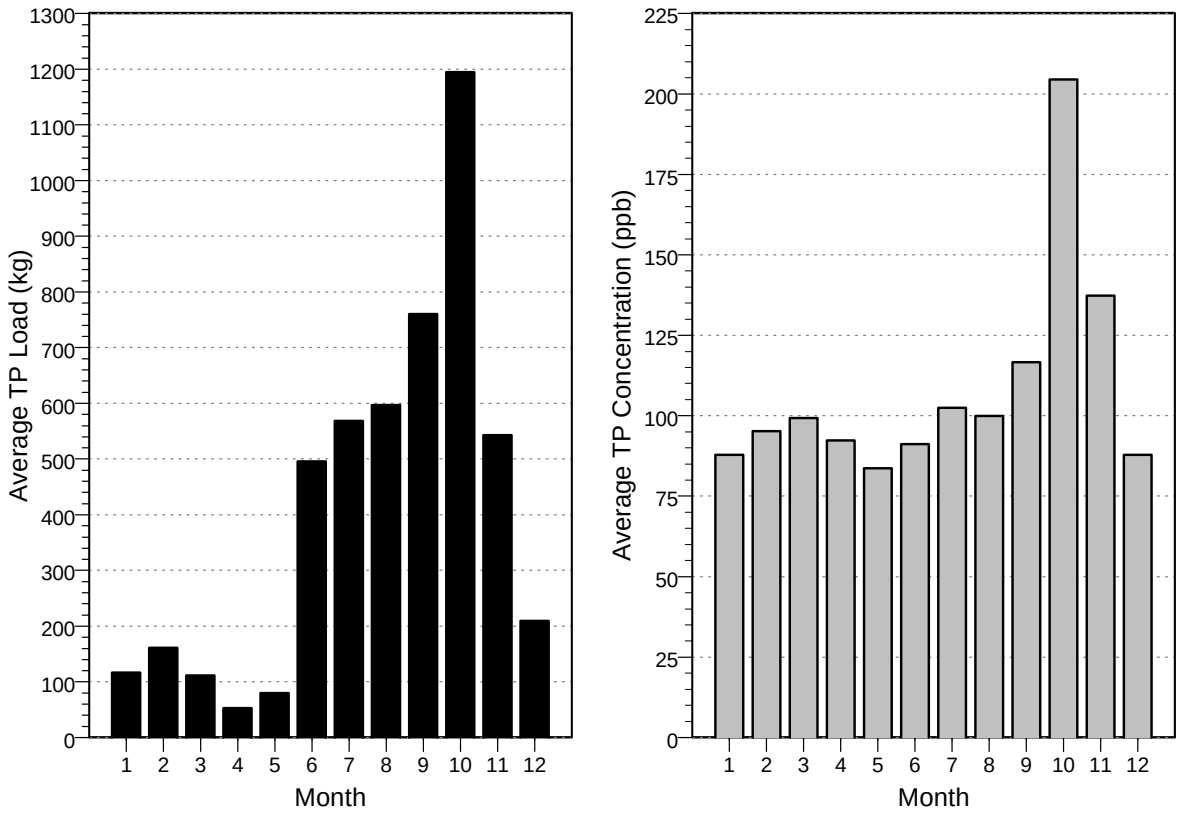

Figure 10.1: Average Monthly TP Loads and Concentrations in Acme Basin B Runoff

11. REFERENCES

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Appendix A
DBKEYs and Station Names for Data Retrieved from DBHYDRO

Basin	Structure or Station	Flow Data Source(s)			Water Quality Data Source(s)	
		DBKEY	Type	Period of Record	Station	Sample Type(s)
Acme Basin B	ACME1	OH647	PREF	5/1/1994-4/30/2004	L40-1	Grab
					ACME1DS	Grab
					VOW1	Grab, Composite
	ACME2	OH648	PREF	5/1/1994-4/30/2004	L40-2	Grab
					G94D	Grab
					VOW2	Grab, Composite
C-51 West	S-5AE	P1018	MOD1	5/1/1994-12/31/2002	S5AE	Grab
		L7443	MOSCAD	1/1/2003-4/30/2004	C51S5AE	Grab, Composite
	C51SR7	FI280	UVM	7/24/1997-7/5/2001	C51SR7	Grab, Composite
C-139	G-88	P1052	MOD1	5/1/1994-12/31/2002	L3	Grab
		15196	PREF	1/1/2003-4/30/2005		
	G-89	P1053	MOD1	5/1/1994-12/31/2003	L3	Grab
		15793	PREF	1/1/2003-4/30/2005		
	G-136	P1038	MOD1	5/1/1994-12/31/2000	G136	Grab, Composite
		15195	PREF	1/1/2003-4/30/2004		
	G-155	P1039	MOD1	5/1/1994-12/31/2002	L3	Grab
		15976	PREF	1/1/2003-4/30/2005		
	G-342A	J6406	PREF	10/1/1999-4/30/2005	G342A	Grab, Composite
	G-342B	J6398	PREF	10/1/1999-4/30/2005	G342B	Grab, Composite
	G-342C	J6407	PREF	10/1/1999-4/30/2005	G342C	Grab, Composite
	G-342D	J6405	PREF	10/1/1999-4/30/2005	G342D	Grab, Composite
	G-406	JU789	PREF	6/26/2000-4/30/2005	G406	Grab, Composite
	L3DF	16243	UVM	1/1/1996-6/26/2000	L3BRS	Grab
					C139DFC	Composite
	L3BRS	16245	UVM	6/22/1995-4/30/2004	L3BRS	Grab
					C139DFC	Composite

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Basin	Structure or Station	Flow Data Source(s)			Water Quality Data Source(s)	
		DBKEY	Type	Period of Record	Station	Sample Type(s)
C-139 Annex	USSO	TA425	PREF	12/1/1995-4/30/2005	USSO	Grab, Composite
East Beach WCD	C-10	15645	PREF	5/1/1994-4/30/2004	CULV10	Grab
	EBPS	LX274	PREF	5/1/2001-4/30/2004	EBEACH	Grab, Composite
East Shore WCD/ 715 Farms	C-12	15646	PREF	5/1/1994-4/30/2004	CULV12	Grab
	C-12A	15647	PREF	5/1/1994-4/30/2004	CULV12A	Grab
	ESPS	LX273	PREF	5/1/2001-4/30/2004	ESHORE2	
L-8	C-10A	15640	PREF	5/1/1994-4/30/2004	CULV10A	Grab
	S-5AE	P1018	MOD1	5/1/1994-12/31/2002	S5AE	Grab
		L7443	N/A	1/1/2003-4/30/2004	C51S5AE	Grab, Composite
	S-5AS	12899	COMP	5/1/1994-5/31/1999	S5AS	Grab
		L7444	TELE	6/1/1999-4/30/2004		
	S-5AW	00322	USGS	5/1/1994-9/30/1999	S5AW	Grab
		L7444	TELE	10/1/1999-4/30/2004	S5A	Grab
	Control 2 (M Canal)	(See report Sec. 6.5)				
S-5A	S-352	P0794	MOD1	5/1/1994-12/31/2002	S352	Grab, Composite
		15068	PREF	1/1/2003-4/30/2004		
	S-5A	06739	TELE	5/1/1994-6/30/1999	S5A	Grab, Composite
		JW226	PREF	7/1/1999-4/30/2004		
	S-5A+S-5AW	P1015	MOD1	5/1/1994-12/31/2003	S5A	Grab, Composite
		15031	PREF	1/1/2003-4/30/2004		
	S-5AW	00322	USGS	5/1/1994-9/30/1999	S5AW	Grab
		L7444	TELE	10/1/1999-4/30/2004	S5A	Grab
	G-250	P1046	MOD1	5/1/1994-7/10/1999	G250	Grab, Composite
	EBPS	LX274	PREF	5/1/2001-4/30/2004	EBEACH	Grab, Composite

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Basin	Structure or Station	Flow Data Source(s)			Water Quality Data Source(s)	
		DBKEY	Type	Period of Record	Station	Sample Type(s)
S-2/S-6/S-7	S-2/S-351	P0979	MOD1	5/1/1994-12/31/2002	S2	Grab, Composite
		15021	PREF	1/1/2003-4/30/2004		
	S-6	P1019	MOD1	5/1/1994-12/31/2002	S6	Grab, Composite
		15034	PREF	1/1/2003-4/30/2004		
	S-7	P1021	MOD1	5/1/1994-12/31/2002	S7	Grab, Composite
	S-7	15037	PREF	1/1/2003-4/30/2004		
	S-150	P0961	MOD1	5/1/1994-12/31/2002	S150	Grab, Composite
		15041	PREF	1/1/2003-4/30/2004		
	G-328	J0718	PREF	4/1/2000-4/30/2004	G328	Grab
	ESPS	LX273	PREF	5/1/2001-4/30/2004	ESHORE2	Grab, Composite
	South Bay	(Monitoring data for Permit 50-00081-E, Structure MC25.7TE)				Composite (TW)
S-8/S-3	S-3	P0989	MOD1	5/1/1994-12/31/2002	S3	Grab, Composite
		15018	PREF	1/1/2003-4/30/2004		
	S-8	P1024	MOD1	5/1/1994-12/31/2002	S8	Grab, Composite
		15040	PREF	1/1/2003-4/30/2004		
	G-88	P1052	MOD1	5/1/1994-12/31/2002	L3	Grab
		15196	PREF	1/1/2003-4/30/2005		
	G-136	P1038	MOD1	5/1/1994-12/31/2000	G136	Grab, Composite
		15195	PREF	1/1/2003-4/30/2004		
	G-200	P1040	MOD1	5/1/1994-12/31/2002	G200	Grab, Composite
		15736	PREF	1/1/2003-4/30/2004		
	G-204	SG578	PREF	5/1/2003-4/30/2004	G204	Grab
	G-205	SG579	PREF	5/1/2003-4/30/2004	G205	Grab
	G-206	SG580	PREF	5/1/2003-4/30/2004	G206	Grab
	G-344A	J0719	PREF	10/1/1999-4/30/2004	G344A	Grab, Composite
	G-344B	J0720	PREF	10/1/1999-4/30/2004	G344B	Grab, Composite
	G-344C	J0721	PREF	10/1/1999-4/30/2004	G344C	Grab, Composite
	G-344D	J0722	PREF	10/1/1999-4/30/2004	G344D	Grab, Composite
	G-349B	JA353	PREF	10/1/1999-4/30/2004	G349B	Grab, Composite
	G-350B	JA352	PREF	10/1/1999-4/30/2004	G350B	Grab, Composite

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Basin	Structure or Station	Flow Data Source(s)			Water Quality Data Source(s)	
		DBKEY	Type	Period of Record	Station	Sample Type(s)
S-8/S-3	G-357	LX263	PREF	1/3/2001-4/30/2004	G357	Composite
	G-402A	LX264	PREF	5/1/2001-4/30/2004	G402A	Grab, Composite
	G-402B	LX265	PREF	5/1/2001-4/30/2004	G402B	Grab, Composite
	G-402C	LX266	PREF	5/1/2001-4/30/2004	G402C	Grab, Composite
	G-402D	LX267	PREF	5/1/2001-4/30/2004	G402D	Grab, Composite
	G-404	P1976	MOD1	5/6/2000-12/31/2002	G404	Grab, Composite
		LX269	PREF	1/1/2003-4/30/2004		
	G-410	LX270	PREF	5/1/2001-4/30/2004	G410	Grab, Composite
	G-507	SJ382	PREF	12/1/2003-4/30/2004	G507	
	G-600	GG955	PREF	3/6/1997-4/30/2004	G600	Grab, Composite
	G-605	H3143	PREF	11/24/1997-6/30/2000	G600	Grab, Composite
	G-606	HD889	PREF	11/24/1997-6/30/2000	G606	Grab, Composite
South Shore DD	C-4A	15648	PREF	5/1/1994-4/30/2004	CULV4A	Grab
	South Bay	(Monitoring data for Permit 50-00081-E, Structure MC25.7TE)				
South Florida CD	S-236	15644	PRE	5/1/1994-4/30/2004	S236	Grab
	EPD-07	(Monitoring data)		5/1/1994-2/24/2004	EPD-07	Composite