



SOUTH FLORIDA WATER MANAGEMENT DISTRICT

3301 Gun Club Road, West Palm Beach, Florida 33406 • (561) 686-8800 • FL WATS 1-800-432-2045 • TDD (561) 697-2574
Mailing Address: P.O. Box 24680, West Palm Beach, FL 33416-4680 • www.sfwmd.gov

PRO ERG

May 5, 2000

Mr. Robert Barron
Regulatory Branch
U.S. Army Corps of Engineers
P. O. Box 4970
Jacksonville, FL 32232-0019

Dear Mr. Barron:

SUBJECT: Fourth Quarter 1999 Report to Technical Oversight Committee and Quality Assessment Report for Water Quality Monitoring, October -December 1999

Enclosed please find the figures and tables for the fourth quarter 1999 displaying:

- 1) the geometric mean of the total phosphorus (TP) concentration levels measured from Oct. 1998 through Feb. 2000 at the marsh stations within the Arthur R. Marshall Loxahatchee National Wildlife Refuge compared to the interim and long-term TP concentration levels (**Figure 1**); individual total phosphorus concentrations (mg/L) collected in the Refuge from Jan. 1999 through Feb. 2000 (**Table 1**) and a summary of the TP interim limit excursions in the Refuge in 1999 (**Table 2**);
- 2) the Shark River Slough 12-month moving flow-weighted mean TP concentration data for water years 1989 through 1999 compared to the interim and long-term discharge limits (**Figure 2a**) and, for the last 24 months, the 12-month moving average with the composite TP sample concentrations for each sampling event (**Figure 2b**); and
- 3) the Taylor Slough and Coastal basins 12-month moving flow-weighted mean TP concentration data for water years 1989 through 1999 compared to the long-term 11 ppb discharge limit (**Figure 3a**) and, for the last 24 months, the 12-month moving average with the composite TP sample concentrations for each sampling event (**Figure 3b**). Flow data in the L31W Canal related to the operation of pump station S332D from the beginning of August 1999 through March 2000 are presented in **Figures 4 and 5**.

Copies of individual TP sample data from all sites and daily average flow data for Shark River Slough and Taylor Slough/Coastal Basin structures are enclosed. The effect of Hurricane Irene on inflows to the Everglades National Park, as presented in the District's April 2000 issue of the Water Quality Conditions Quarterly Report, is included for general interest. Also included is the Quality Assessment Report for Water Quality Monitoring for October through December 1999.

Loxahatchee National Wildlife Refuge

The geometric means calculated from TP concentrations measured in water samples collected in the Refuge in October, November and December 1999 were 10.3, 9.0 and 9.1 ppb, respectively (**Figure 1**). These geometric mean concentrations were greater than the calculated interim and long-term levels for October and November (**Figure 1**). The interim and long-term levels for both October and November were 8.3 and 7.2 ppb, respectively.

GOVERNING BOARD

Michael Collins, *Chairman*
Michael D. Minton, *Vice Chairman*
Mitchell W. Berger

Vera M. Carter
Gerardo B. Fernandez
Patrick J. Gleason

Nicolas J. Gutierrez, Jr.
Harkley R. Thornton
Trudi K. Williams

EXECUTIVE OFFICE

Frank R. Finch, P.E., *Executive Director*
James E. Blount, *Chief of Staff*

The interim and long-term levels for December were 9.1 and 7.9 ppb, respectively. The October and November results were the third and fourth times the interim level was exceeded since the compliance date of February 1, 1999. The long-term level becomes effective on December 31, 2006. The average stages were 17.28, 17.25 and 16.94 feet in October, November and December, respectively.

Shark River Slough

The 12 month flow-weighted mean TP concentration of waters entering Shark River Slough for Water Year 1999 was 9.5 ppb (Figure 2a). This concentration was less than the interim limit of 9.8 ppb, but greater than the long-term limit of 8.2 ppb. The 12-month moving flow-weighted mean TP concentrations for October, November and December 1999 were 9.2, 8.9 and 9.2 ppb, respectively (Figure 2b). These values were below the corresponding interim discharge limits of 9.4, 10.1 and 9.8 ppb, but above the long-term limits of 7.7, 7.6 and 7.6 ppb for these same months, respectively. The interim limit becomes effective on October 1, 2003, and the long-term limit becomes effective on December 31, 2006.

Taylor Slough and the Coastal Basins

The 12-month flow-weighted mean TP concentration of waters entering Taylor Slough and the Coastal Basins for Water Year 1999 was 6.7 ppb in comparison to the long-term limit of 11 ppb. (Figure 3a). The 12-month moving flow-weighted mean TP concentrations for October, November and December 1999 were 7.0, 7.2 and 7.1 ppb, respectively (Figure 3b). Inflows to the L31W Canal from the beginning of August 1999 through March 25, 2000 are presented in Figure 4 to indicate when pump station S332D was operating. S174, the adjacent spillway to S332D, is normally closed while the pumps are operating. Comparison of L31W inflows with outflows indicates that outflows exceed inflows by several hundred cubic feet per second (Figure 5). These data indicate that significant seepage is entering the L31W canal during periods of high flow, but inflows exceed outflows during low flow periods as in March 2000. The long-term limit becomes effective on December 31, 2006.

Frequency of Composite Samples Exceeding 10 ppb

The frequency of composite samples for each sampling event exceeding 10 ppb within a given 12-month period was included in the Settlement Agreement as an additional aid in tracking compliance. For Shark River Slough, a frequency or percentage limit for samples greater than 10 ppb is based on observed flow. Taylor Slough and the Coastal Basins have a fixed limit of 53.1%. The following table presents the actual frequency exceedance and the calculated frequency limits for Shark River Slough and Taylor Slough.

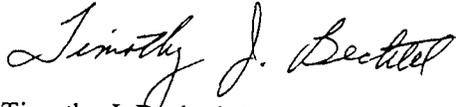
<u>Year</u> <u>Ending</u>	<u>Shark River Frequency Exceedance</u>		<u>Taylor Slough Frequency Exceedance</u>	
	<u>Actual</u>	<u>Limit</u>	<u>Actual</u>	<u>Limit</u>
Jan 1999	55.6*	45.0	28.6	53.1
Feb 1999	55.6*	45.3	25.0	53.1
Mar 1999	51.9*	45.7	21.4	53.1
Apr 1999	51.9*	47.7	25.0	53.1
May 1999	48.0	49.9	28.6	53.1
Jun 1999	40.9	49.7	28.6	53.1
Jul 1999	41.7	46.7	25.0	53.1
Aug 1999	39.1	44.9	16.7	53.1
Sep 1999	39.1	42.9	12.1	53.1
Oct 1999	33.3	40.3	9.4	53.1
Nov 1999	33.3	40.1	8.1	53.1
Dec 1999	33.3	40.1	8.1	53.1

*exceeded frequency limit

TOC Report
May 5, 2000
Page 3

If you have questions regarding the reported results, please call me at 561-682-6392.

Sincerely,



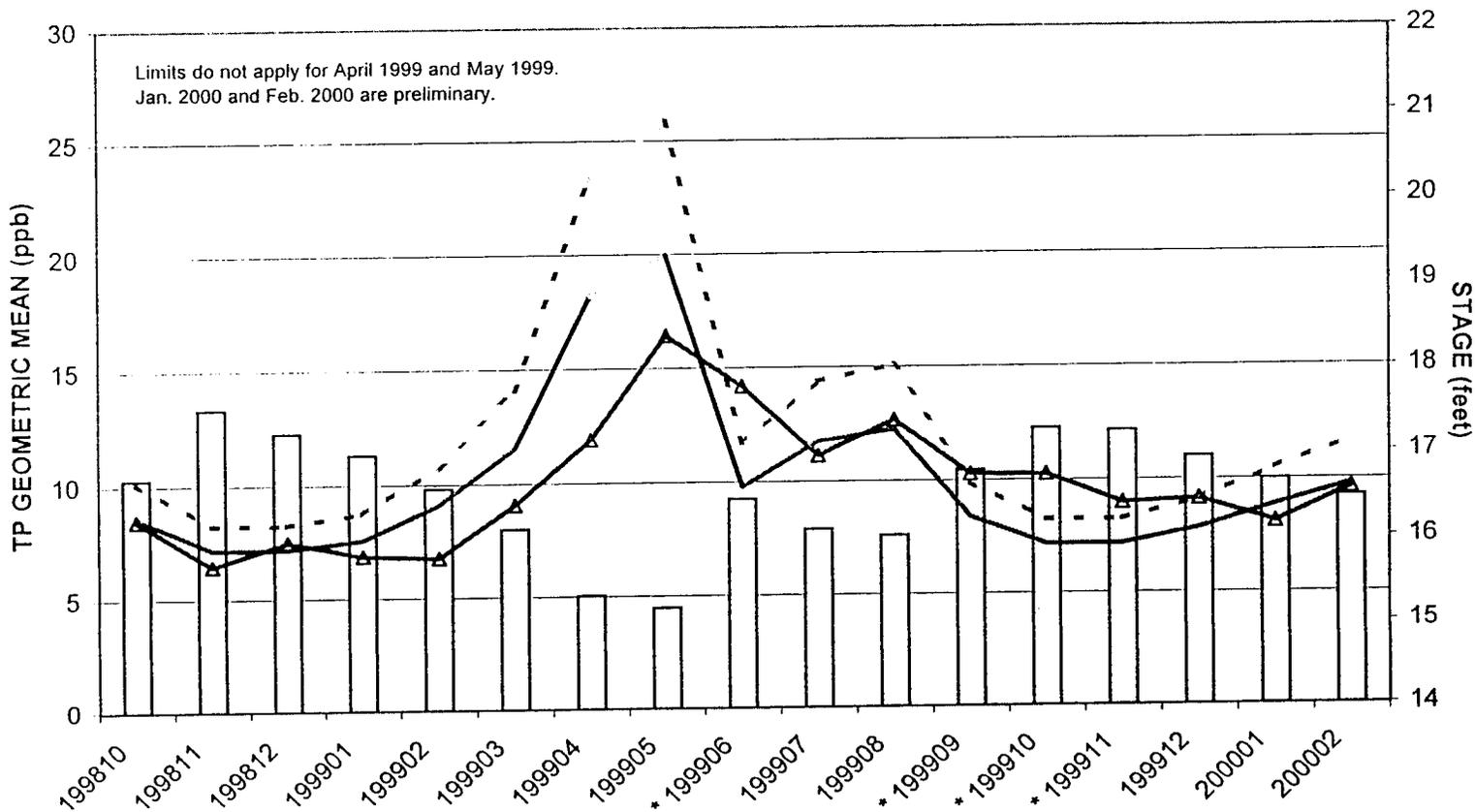
Timothy J. Bechtel, Ph.D.
Senior Supervising Environmental Scientist
Hydro Information Systems and Assessment Division
Environmental Monitoring and Assessment Department

Enclosure
TB/hm

c: T. Fontaine
M. Cheesman
L. Lindstrom
J. Merriam
R. Startzman

Figure 1. LNWR Monthly TP Concentrations and Limits

□ average stage



Asterisk indicates interim limit was exceeded.

h/

15

	LOX3	LOX4	LOX5	LOX6	LOX7	LOX8	LOX9	LOX10	LOX11	LOX12	LOX13	LOX14	LOX15	LOX16
1/4/1999	0.014	0.01	0.009	0.006	0.005	0.005	0.01	0.009						
1/5/1999														
2/16/1999			0.007	0.007	0.006	0.009	0.006		0.005	0.006	0.006	0.005	0.005	0.007
2/17/1999														
3/15/1999				0.01	0.011	0.011			0.007	0.006	0.007	0.006	0.007	0.007
3/16/1999														
4/12/1999						0.014			0.011	0.007	0.008	0.007	0.008	0.01
4/13/1999													0.011	
5/10/1999										0.011			0.011	
6/21/1999		0.046	0.011	0.016	0.009	0.017	0.015	0.016		0.018			0.015	
6/22/1999														
7/19/1999			0.012	0.01	0.016	0.012	0.012		0.011	0.013	0.015	0.014	0.009	0.012
7/20/1999														
8/16/1999				0.011	0.013	0.016			0.012	0.009		0.011	0.01	0.009
8/17/1999														
9/27/1999	0.01	0.012	0.009	0.01	0.013	0.011	0.008	0.007	0.015	0.011		0.012	0.01	0.015
9/28/1999														
10/12/1999	0.01	0.014	0.009	0.011	0.011	0.009	0.009	0.007	0.014	0.009	0.01	0.017	0.009	0.009
10/13/1999														
11/15/1999	0.013	0.008	0.011	0.006	0.007	0.009	0.012	0.006	0.015	0.014	0.011	0.009	0.009	0.009
11/16/1999														
12/6/1999	0.011	0.011	0.012	0.009	0.009	0.013	0.011	0.008	0.014	0.007	0.013	0.007	0.009	0.009
12/7/1999														
1/3/2000	0.01	0.008	0.012	0.008	0.008	0.008	0.008	0.008	0.01	0.007	0.009	0.006	0.008	0.007
1/4/2000														
2/14/2000		0.01	0.023	0.007	0.009	0.012	0.011	0.011	0.009	0.006	0.011	0.006	0.007	0.007
2/15/2000									0.013	0.006	0.011	0.007	0.006	0.008

Table 1. Individual Total Phosphorus Concentrations (mg/L) Collected in LNWR from Jan. 1999 through Feb. 2000.

Table 2. LNWR Total Phosphorus Interim Limit Excursions in 1999.

Month	Geometric Mean (ppb)	Interim Limit (ppb)	Long Term Limit (ppb)	Average Stage (ft)
June	14.211	11.71	9.791	16.47
Sept.	10.294	9.868	8.417	16.79
Oct.	10.272	8.26	7.202	17.28
Nov.	8.989	8.26	7.202	17.25
Dec.	9.142	9.127	7.859	16.94

Discharge Limits for Shark River Slough (S12A, S12B, S12C, S12D, and S333)

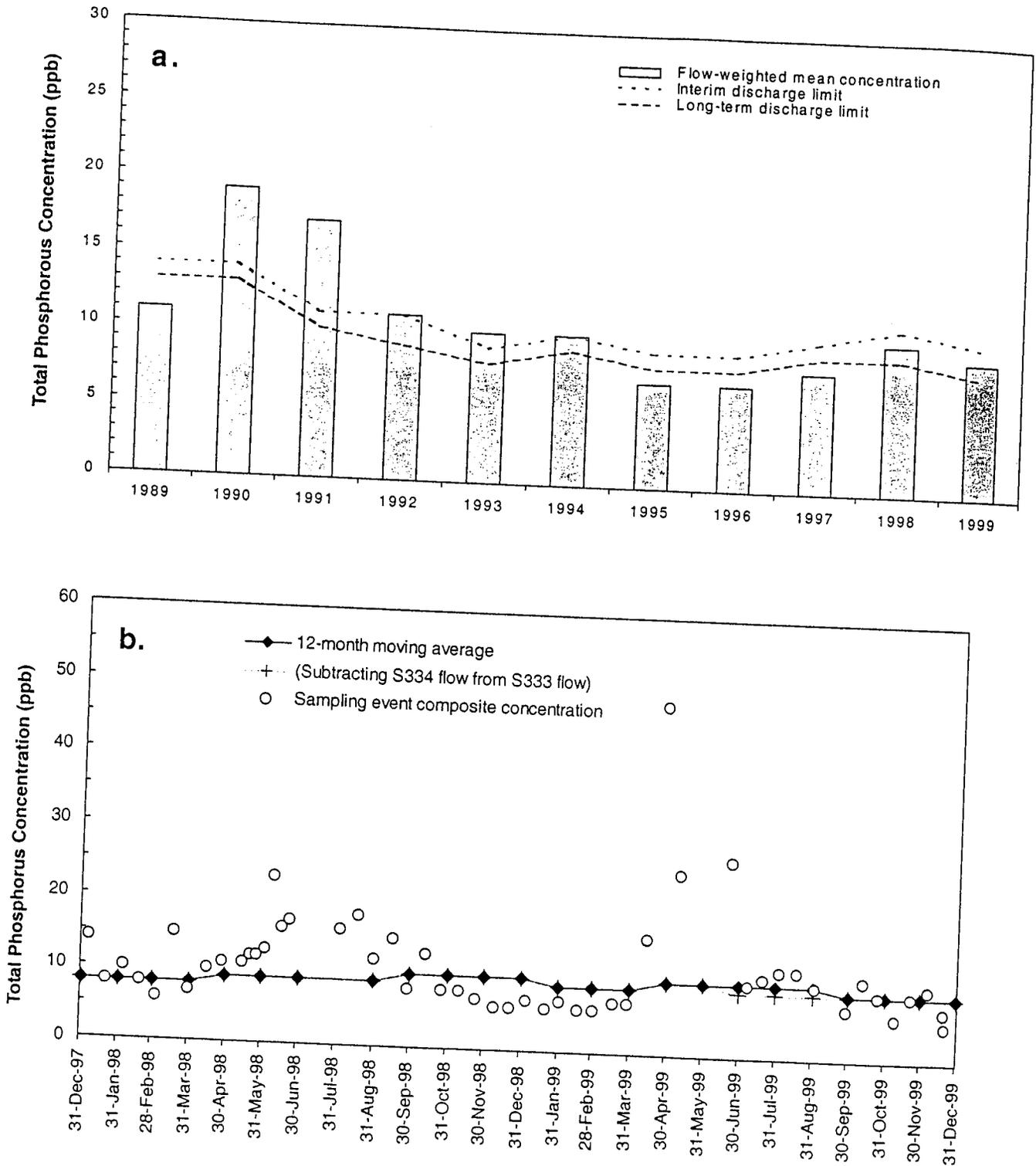


Figure 2. 12-month moving flow-weighted mean total phosphorus concentrations in the inflows to Everglades National Park (ENP) through Shark River Slough compared to the interim and long-term targets. **a.** Concentrations at the end of each water year. **b.** 12-month moving average concentration at the end of each month and the composite concentration for each sampling event.

Discharge Limits for Taylor Slough (S332 and S175) and the Coastal Basins (S18C)

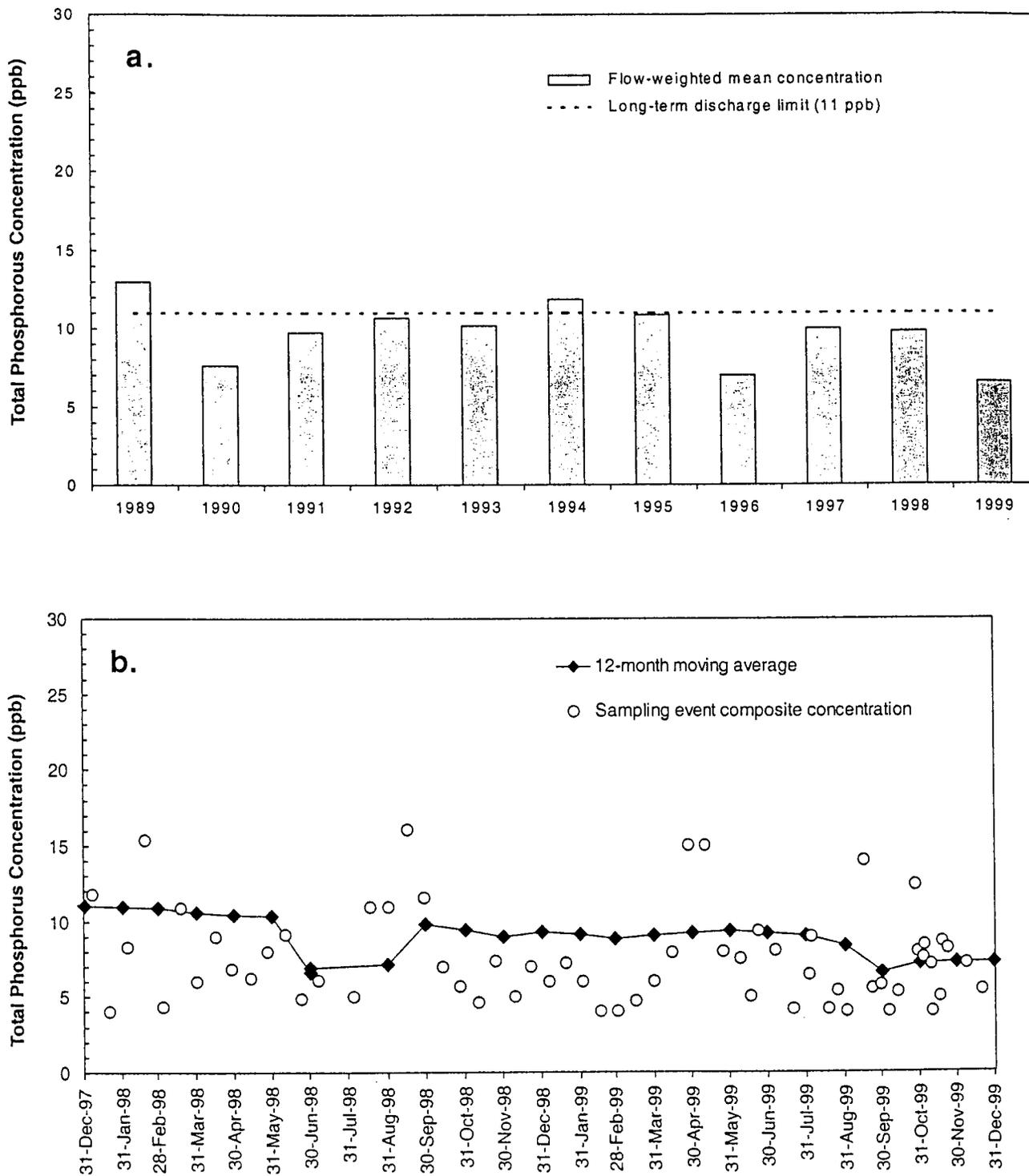


Figure 3. 12-month moving flow-weighted mean total phosphorus concentrations in the inflows to Everglades National Park (ENP) through Taylor Slough and the Coastal Basins compared to the long-term target. **a.** Concentrations at the end of each water year. **b.** 12-month moving average concentration at the end of each month and the composite concentration for each sampling event.

Figure 4. Inflows to the L31W Canal from August 1999 through March 2000.

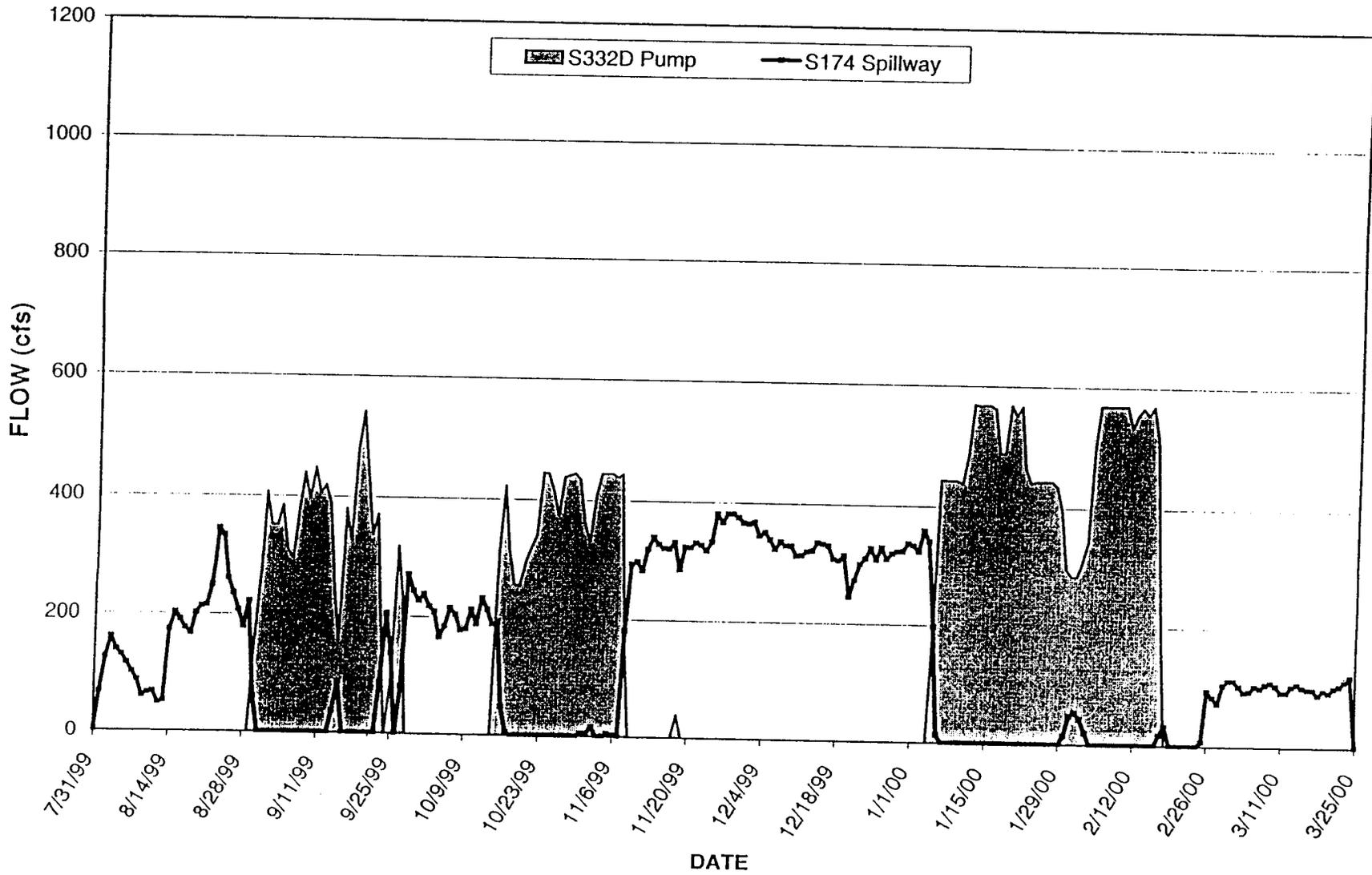
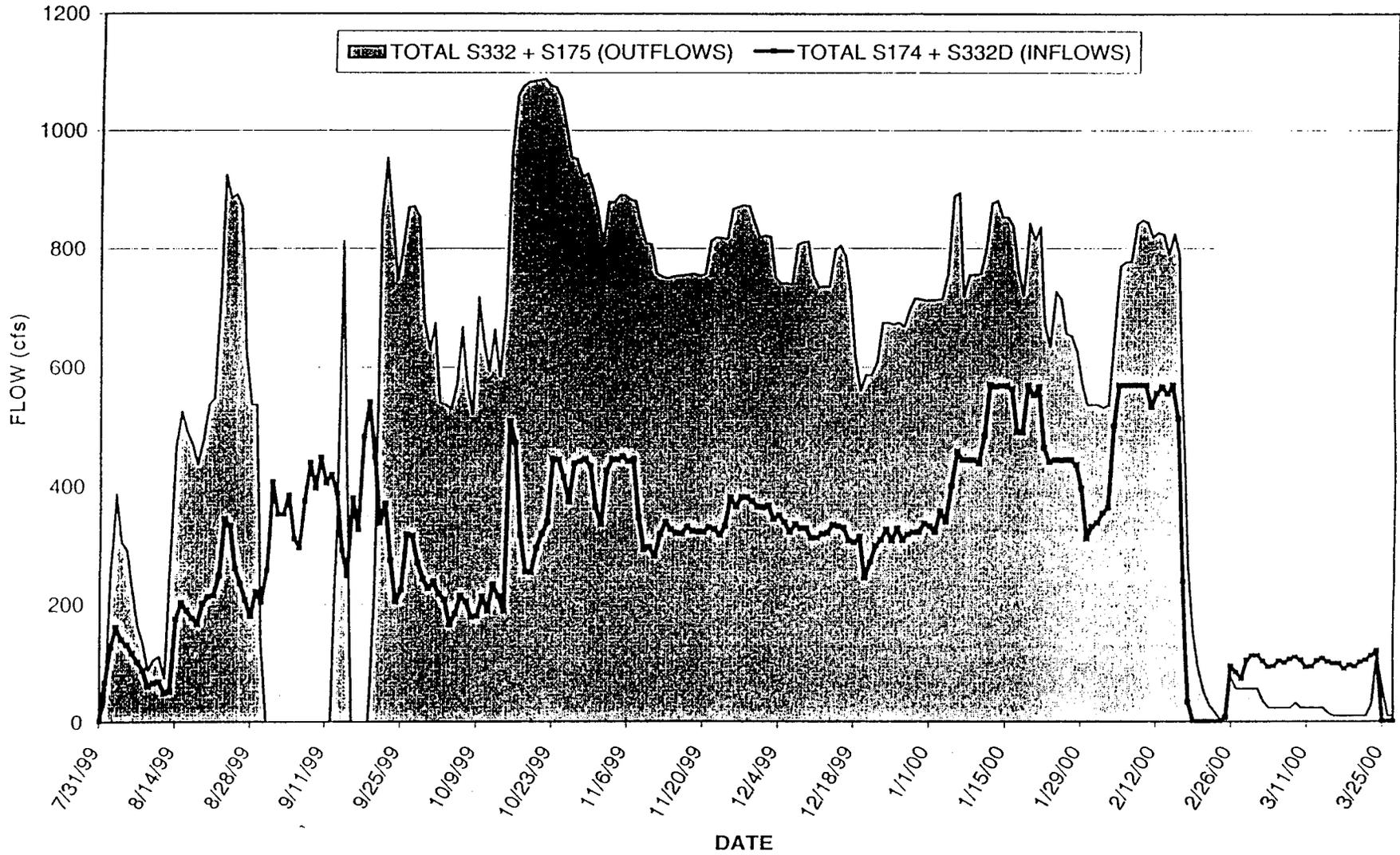


Figure 5. Comparison of L31W Canal Inflows and Outflows from August 1999 through March 2000.



20

Loxahatchee water quality sampling dates and TP concentrations

yyyymmdd	LOX3	LOX4	LOX5	LOX6	LOX7	LOX8	LOX9	LOX10	LOX11	LOX12	LOX13	LOX14	LOX15	LOX16
10/13/98			0.008	0.009	0.009	0.006	0.009							
10/14/98														
11/16/98	0.009	0.010	0.005	0.006	0.005	0.005	0.005			0.009	0.010	0.008	0.007	0.011
11/17/98								0.007						
12/07/98	0.008	0.008	0.009	0.008	0.011	0.008	0.007	0.007	0.006	0.006	0.006	0.008	0.006	0.009
12/08/98														
01/04/99	0.014	0.010	0.009	0.006	0.005	0.005	0.010	0.009	0.010	0.006	0.006	0.006	0.006	0.007
01/05/99														
02/16/99			0.007	0.007	0.006	0.009	0.006		0.005	0.006	0.006	0.005	0.005	0.007
02/17/99														
03/15/99				0.010	0.011	0.011			0.007	0.006	0.007	0.006	0.007	0.007
03/16/99														
04/12/99									0.011	0.007	0.008	0.007	0.008	0.010
04/13/99						0.014								
05/10/99														
06/21/99		0.046	0.011	0.016	0.009	0.017	0.015	0.016		0.011			0.011	
06/22/99										0.018			0.015	
07/19/99			0.012	0.010	0.016	0.012	0.012		0.011	0.013	0.015	0.014	0.009	0.012
07/20/99														
08/16/99				0.011	0.013	0.016			0.012	0.009		0.011	0.010	0.009
08/17/99														
09/27/99	0.010	0.012	0.009	0.010	0.013	0.011	0.008	0.007	0.015	0.011		0.012	0.010	0.015
09/28/99														
10/12/99	0.010	0.014	0.009	0.011	0.011	0.009	0.009	0.007	0.014	0.009	0.010	0.017	0.009	0.009
10/13/99														
11/15/99	0.013	0.008	0.011	0.006	0.007	0.009	0.012	0.006	0.015	0.014	0.011	0.009	0.009	0.009
11/16/99														
12/06/99	0.011	0.011	0.012	0.009	0.009	0.013	0.011	0.008	0.014	0.007	0.013	0.007	0.009	0.009
12/07/99														
01/03/00	0.010	0.008	0.012	0.008	0.008	0.008	0.008	0.008	0.010	0.007	0.009	0.006	0.008	0.007
01/04/00														
02/14/00		0.010	0.023	0.007	0.009	0.012	0.011	0.011	0.009	0.006	0.011	0.006	0.007	0.007
02/15/00									0.013	0.006	0.011	0.007	0.006	0.008

21

Shark River Slough TP data in mg/L

yyyymmdd	S12A	S12B	S12C	S12D	S333	S334
10/12/98	0.013	0.009	0.009	0.02	0.01	
10/26/98	0.006	0.006	0.01	0.008	0.01	
11/9/98	0.01	0.006	0.007	0.008	0.008	
11/23/98	0.005	0.006	0.007	0.008	0.009	
12/8/98	0.005	0.007	0.006	0.007	0.008	
12/21/98	0.006	0.005	0.006	0.006	0.006	0.009
1/4/99	0.007	0.007	0.007	0.007	0.01	
1/20/99	0.007	0.009	0.006	0.006	0.006	
2/1/99	0.01	0.009	0.007	0.007	0.007	
2/16/99	0.008	0.006	0.006	0.006	0.007	
3/1/99	0.009	0.008	0.006	0.006	0.006	
3/17/99	0.011	0.008	0.008	0.009	0.007	0.008
3/29/99	0.012	0.011	0.01	0.008	0.007	
4/13/99	0.023	0.018	0.013	0.016	0.016	
4/26/99	0.06	0.03	0.027	0.028	0.048	
5/10/99	0.029	0.021	0.018	0.017	0.025	
6/22/99	0.021	0.019	0.027	0.027		
7/7/99	0.007	0.008	0.011	0.011	0.011	
7/20/99	0.008	0.01	0.011	0.013	0.017	
8/2/99	0.011	0.012	0.01	0.013	0.016	
8/17/99	0.009	0.01	0.013	0.013	0.023	
9/1/99	0.01	0.009	0.01	0.012	0.008	
9/28/99	0.007	0.007	0.007	0.007	0.008	
10/12/99	0.013	0.009	0.012	0.011	0.015	
10/25/99	0.009	0.009	0.005	0.012	0.011	
11/8/99	0.008	0.006	0.005	0.006	0.006	
11/22/99	0.008	0.01	0.007	0.011	0.01	0.011
12/6/99	0.021	0.006	0.006	0.008		
12/20/99	0.01	0.006	0.008	0.008	0.008	0.008

Shark River Slough Flow Data in cfs

yyyymmdd	S12A	S12B	S12C	S12D	S333	S334
10/1/99	492	508	820	673	0	0
10/2/99	487	504	810	676	0	0
10/3/99	490	506	809	684	0	0
10/4/99	504	518	820	701	0	0
10/5/99	540	548	864	743	0	0
10/6/99	551	554	867	760	0	0
10/7/99	551	554	864	773	0	0
10/8/99	571	570	891	810	0	0
10/9/99	621	601	944	848	0	0
10/10/99	628	607	952	859	0	0
10/11/99	621	604	934	862	0	0
10/12/99	615	601	924	866	0	0
10/13/99	603	595	908	864	0	0
10/14/99	634	620	957	921	0	0
10/15/99	967	800	1240	1180	0	0
10/16/99	1110	950	1520	1530	3	0
10/17/99	1100	943	1510	1560	3	0
10/18/99	1120	955	1520	1590	3	0
10/19/99	1130	960	1520	1610	3	0
10/20/99	1140	970	1530	1640	3	0
10/21/99	1160	983	1550	1680	6	0
10/22/99	1180	1000	1590	1760	8	0
10/23/99	1180	1000	1590	1790	8	0
10/24/99	1190	1000	1600	1820	8	0
10/25/99	1210	1010	1600	1840	8	0
10/26/99	1220	1010	1610	1870	12	0
10/27/99	1240	1020	1630	1910	12	0
10/28/99	1250	1020	1630	1930	12	0
10/29/99	1260	1020	1620	1940	12	0
10/30/99	1260	1020	1610	1950	12	0
10/31/99	1260	1010	1610	1970	12	0
11/1/99	1250	1000	1600	1980	12	0
11/2/99	1270	1030	1640	2040	20	0
11/3/99	1330	1070	1710	2160	24	0
11/4/99	1360	1080	1700	2150	24	0
11/5/99	1370	1080	1690	2130	20	0
11/6/99	1390	1090	1700	2140	20	0
11/7/99	1400	1100	1710	2140	20	0
11/8/99	1380	1090	1680	2120	20	0
11/9/99	1380	1090	1660	2090	16	0
11/10/99	1370	1090	1650	2080	16	0
11/11/99	1370	1090	1650	2090	16	0
11/12/99	1370	1100	1640	2090	20	0
11/13/99	1370	1090	1620	2060	20	0
11/14/99	1340	1090	1600	2050	20	0
11/15/99	1310	1070	1570	2010	16	0
11/16/99	1270	1050	1550	1970	12	0
11/17/99	1260	1040	1520	1920	12	0
11/18/99	1250	1030	1500	1860	8	0
11/19/99	1240	1020	1490	1810	8	0
11/20/99	1220	1000	1470	1780	6	0
11/21/99	1200	988	1450	1730	6	0

11/22/99	1180	973	1440	1700	6	0
11/23/99	1160	958	1420	1660	3	0
11/24/99	1140	940	1400	1620	3	0
11/25/99	1120	921	1380	1580	0	0
11/26/99	1120	924	1390	1580	0	0
11/27/99	1110	914	1380	1540	0	0
11/28/99	1100	896	1350	1500	0	0
11/29/99	1070	877	1320	1450	0	0
11/30/99	1070	865	1320	1420	0	0
12/1/99	1050	858	1310	1400	0	0
12/2/99	1030	836	1280	1350	0	0
12/3/99	983	817	1230	1270	0	0
12/4/99	957	804	1200	1220	0	0
12/5/99	932	794	1170	1180	0	0
12/6/99	904	785	1140	1150	0	0
12/7/99	891	784	1130	1130	0	0
12/8/99	873	777	1110	1090	0	0
12/9/99	860	775	1090	1060	0	0
12/10/99	843	773	1070	1040	0	0
12/11/99	820	764	1050	1010	0	0
12/12/99	795	752	1020	969	0	0
12/13/99	767	741	984	937	0	0
12/14/99	749	735	962	916	0	0
12/15/99	739	733	951	900	0	0
12/16/99	409	738	942	890	0	0
12/17/99	0	749	958	890	0	0
12/18/99	0	744	954	888	0	0
12/19/99	0	742	956	887	0	0
12/20/99	0	740	959	891	0	0
12/21/99	0	733	951	890	0	0
12/22/99	0	731	950	893	0	0
12/23/99	0	727	950	893	0	0
12/24/99	0	725	953	904	0	0
12/25/99	0	714	938	902	0	56.02
12/26/99	0	703	928	897	0	130.78
12/27/99	0	689	906	884	0	55.97
12/28/99	0	680	895	881	0	0
12/29/99	0	269	905	888	0	0
12/30/99	0	0	919	896	0	0
12/31/99	0	0	924	901	0	0

Taylor Slough and Coastal Plain TP data in mg/L

	S175	S332	S18C	S332D
10/13/98	0.006	0.005	0.01	
10/27/98	0.009	0.007	0.004	
11/10/98		0.005	0.004	
11/24/98	0.006	0.007	0.008	
12/9/98	0.005	0.005	0.011	
12/22/98	0.012	0.007	0.005	
1/5/99	0.006	0.006	0.006	
1/19/99	0.005	0.007	0.008	
2/2/99	0.005	0.006	0.004	
2/16/99	0.006	0.004	0.006	
3/2/99	0.004	0.004	0.004	
3/16/99	0.006	0.005	0.004	
3/31/99	0.008	0.006	0.006	
4/14/99	0.011	0.01	0.007	
4/28/99	0.013	0.015	0.014	
5/11/99	0.013	0.015	0.013	
5/26/99	0.013	0.008	0.01	
6/8/99	0.006	0.007	0.008	
6/16/99		0.005		0.005
6/22/99		0.005		0.006
6/23/99	0.011	0.008	0.008	
6/29/99		0.004		0.004
7/6/99	0.008	0.011	0.007	
7/8/99		0.006		0.004
7/13/99		0.006		0.005
7/20/99				
7/21/99	0.004	0.006	0.004	
7/22/99		0.006		0.005
7/27/99	0.005	0.006		
7/28/99		0.005		0.005
8/2/99	0.006	0.005	0.008	
8/4/99		0.009		0.007
8/11/99	0.009	0.006		0.004
8/17/99				
8/18/99	0.006	0.004	0.005	0.004
8/25/99	0.006	0.005		0.005
8/30/99	0.005	0.005		
8/31/99	0.004	0.004		0.005
9/1/99	0.005	0.004	0.004	
9/2/99	0.006	0.006		
9/3/99	0.006	0.009		
9/6/99	0.01	0.007		
9/7/99	0.007	0.006		
9/8/99	0.006	0.007		0.005
9/9/99	0.007	0.008		
9/10/99	0.006	0.016		
9/13/99	0.007	0.01		
9/16/99	0.008	0.009	0.014	
9/20/99	0.012	0.022		
9/21/99		0.006		0.007
9/22/99	0.005	0.006		

9/29/99	0.004	0.005	0.007	
9/30/99		0.004		0.005
10/6/99		0.004		0.005
10/13/99	0.004	0.005	0.006	0.004
10/19/99		0.035		0.056
10/21/99	0.015	0.017		
10/26/99				
10/27/99	0.01	0.009	0.016	0.006
10/29/99	0.008	0.008		
11/3/99	0.007	0.008		0.008
11/4/99	0.006	0.01		
11/9/99	0.005	0.007	0.01	
11/10/99		0.004		0.005
11/16/99	0.005	0.005		
11/18/99	0.008	0.009		
11/23/99	0.008	0.008	0.009	
12/8/99		0.006	0.011	
12/21/99	0.005	0.005	0.007	

Taylor Slough and Coastal Plain Flow data in cfs

yyyymmdd	S175	S332	S18C	S332D	S174
8/30/99	0	134.48	273	140.96	62.15
8/31/99	0	0	173	257.26	0
9/1/99	0	0	97	407.52	0
9/2/99	0	0	134	353.52	0
9/3/99	0	0	269	353.39	0
9/4/99	0	0	119	385.14	0
9/5/99	0	0	0	312.04	0
9/6/99	0	0	88	296.96	0
9/7/99	0	0	175	375.78	0
9/8/99	0	0	229	440.2	0
9/9/99	0	0	382	396.59	0
9/10/99	0	0	287	448.77	0
9/11/99	0	0	392	406.27	0
9/12/99	0	0	497	419.55	0
9/13/99	332.82	0	606	388.79	0
9/14/99	497.49	314.9	646	253.47	38.64
9/15/99	250.79	114.15	388	160.16	88.28
9/16/99	0	0	325	380.61	0
9/17/99	0	0	354	327.22	0
9/18/99	0	0	369	483.03	0
9/19/99	0	0	417	541.21	0
9/20/99	210.99	0	465	448.58	0
9/21/99	510.8	337.46	592	338.78	0
9/22/99	416.83	536.28	682	371.72	0
9/23/99	345.68	515.77	508	188.09	87.21
9/24/99	373.23	373.15	531	0	204.78
9/25/99	351.45	456.73	733	86.68	138.05
9/26/99	346.77	523.71	882	319.18	-0.97
9/27/99	337.78	533.76	904	234.73	82.85
9/28/99	322.23	531.43	728	0	270.69
9/29/99	171.72	506.42	544	0	242.84
9/30/99	93.54	537.46	455	0	227.08
10/1/99	146.14	527.74	394	0	237.7
10/2/99	20.35	519.6	377	0	217.2
10/3/99	0	537.5	374	0	207.88
10/4/99	0	529.91	371	0.39	165.97
10/5/99	49.95	521.52	369	0	184.78
10/6/99	129.65	537.44	343	0	214.31
10/7/99	61.42	509.36	313	0	203.85
10/8/99	0	520.89	306	0	178.55
10/9/99	180.51	537.49	437	0	180.47
10/10/99	110.22	533.73	503	0	212.64
10/11/99	57.2	536.65	460	0	189.5
10/12/99	125.61	537.31	350	0	232.93
10/13/99	48.02	537.3	360	0	212.98
10/14/99	158.91	537.14	545	0	189.5
10/15/99	434.38	525.41	1250	314.5	193.31
10/16/99	534.62	524.9	2030	422.26	49.57
10/17/99	537.65	539.16	2070	314.13	5.36
10/18/99	544.4	539.12	1990	254.53	-1.06
10/19/99	546.49	539	1920	253.87	-0.23
10/20/99	547.82	538.86	1840	297.01	0
10/21/99	550.2	538.73	1670	320.47	0
10/22/99	538.98	538.59	1480	340.25	0

10/23/99	536.16	538.44	1190	444.81	0
10/24/99	516.76	538.19	1080	444.32	0
10/25/99	471.19	537.82	897	415.38	0
10/26/99	417.79	537.39	857	374.38	0
10/27/99	416.94	534.7	796	438.29	0
10/28/99	390.15	532.61	709	442.01	0
10/29/99	389.69	537.43	557	444.65	0
10/30/99	364.62	537.32	433	434.27	0
10/31/99	326.27	537.46	427	361.46	4.28
11/1/99	342.96	465.56	436	331.91	5.34
11/2/99	353.15	526.17	470	408.85	16.76
11/3/99	341.29	537.58	434	444.81	-0.03
11/4/99	352.48	537.47	376	444.68	0.01
11/5/99	353.83	537.34	340	444.75	4.67
11/6/99	346.28	537.22	333	439.41	2.77
11/7/99	343.54	537.15	307	444.5	0.2
11/8/99	303.83	537.09	250	168.2	180.74
11/9/99	271.91	537.09	242	0	294.37
11/10/99	271.52	536.02	242	0	298.47
11/11/99	277.93	479.98	229	0	282.9
11/12/99	234.13	518.12	222	0	319.76
11/13/99	212.47	537.31	217	0	339.79
11/14/99	214.67	537.32	215	0	328.16
11/15/99	216.54	537.24	222	0	321.85
11/16/99	217.18	537.32	220	0	321.28
11/17/99	218.64	537.32	214	0	332.34
11/18/99	219.52	537.34	201	40.4	285.38
11/19/99	217.1	537.31	208	0	324.37
11/20/99	218.94	537.31	194	0	323.96
11/21/99	277.44	536.35	232	0	331.59
11/22/99	282.42	536.98	270	0	328.51
11/23/99	281.21	536.97	271	0	319.34
11/24/99	279.64	536.98	229	0	333.95
11/25/99	331.32	536.11	252	0	380.82
11/26/99	333.82	536.97	235	0	366.74
11/27/99	336.97	536.97	208	0	381.62
11/28/99	334.88	536.97	183	0	381.12
11/29/99	308.19	536.99	179	0	375.49
11/30/99	282.5	537.11	159	0	366.64
12/1/99	285.37	537.09	149	0	365.35
12/2/99	282.82	537.04	139	0	367.8
12/3/99	293.63	456.77	156	0	346.25
12/4/99	202.87	537.17	153	0	351.53
12/5/99	203.68	537.16	188	0	339.79
12/6/99	201.46	537.1	203	0	324
12/7/99	270.06	536.19	178	0	336.31
12/8/99	273.81	536.86	182	0	329.89
12/9/99	274.9	536.86	185	0	329.68
12/10/99	217.44	536.31	195	0	313.59
12/11/99	197.16	537.04	194	0	314.05
12/12/99	198.71	537.07	212	0	320.67
12/13/99	197.29	537.07	224	0	322.3
12/14/99	261.09	535.87	240	0	335.56
12/15/99	267.99	536.8	223	0	333.46
12/16/99	249.37	536.83	203	0	331.01
12/17/99	186.6	536.9	207	0	309.29
12/18/99	90.36	527.37	200	0	306.5

12/19/99	23.81	537.36	178	0	315.46
12/20/99	49.97	537.13	181	0	245.23
12/21/99	49.66	537.09	173	0	271.61
12/22/99	71.03	537.31	221	0	300.78
12/23/99	137.05	537.27	225	0	310.9
12/24/99	137.77	537.32	205	0	328.01
12/25/99	134.9	537.2	193	0	309.3
12/26/99	137.58	537.29	195	0	329.73
12/27/99	132.22	536.12	202	0	310.61
12/28/99	159.15	537.21	211	0	319.65
12/29/99	178.33	537.2	196	0	323.42
12/30/99	177.2	537.17	194	0	324.1
12/31/99	176.29	536	186	0	337.25

Effects of Hurricane Irene

Total phosphorus data in **Figure 24b** and **Figure 25b** (**Figure 2b** and **Figure 3b** in the TOC report) do not indicate any effects of Hurricane Irene (Oct. 14-16) because of the biweekly nature of the grab sampling program mandated by the Settlement Agreement. Samples were collected on October 12 and 25 at the Shark River Slough structures and October 13 and 27 at the Taylor Slough and Coastal Basins structures. Although no grab samples were collected while Irene was over South Florida, some samples were obtained after the hurricane and close to the dates of peak flows.

Figure 26 and **Figure 27** present the mean daily flows and the total phosphorus grab sample data for each Shark River Slough structure plus S-334. The vertical line in each figure indicates the period that Hurricane Irene passed through Everglades National Park.

Flows through the S-12 structures began increasing rapidly on October 14 and continued increasing until the peak flows were reached at S-12D on November 3 and at S-12A, B and C on November 7 (**Figure 26**). As indicated in **Figure 27**, total phosphorus concentrations measured in samples collected at the S-12 structures on Oct. 25 and Nov. 8 were the same or lower than the pre-hurricane data collected on Oct. 12.

Figure 28 and **Figure 29** present the mean daily flows, total phosphorus grab sample data for each Taylor Slough and Coastal Basins structure. Additional total phosphorus data were collected several days after Hurricane Irene by the U.S. Army Corps of Engineers using grab sampling and seven-day time composite samples at S-175, S-332 and S-332D.

Flows through S-175 and S-18C increased rapidly as Hurricane Irene entered the Park. Flows peaked on October 17 at S-18C and on October 21 at S-175 (**Figure 28**). Flow through S-332 had been high prior to the hurricane, peaked on October 17, and remained high for the remainder of 1999. Prior to the hurricane, flow into the L-31W canal had been through S-174. The pumps at S-332D were started on Oct. 15. The combined flow through these structures peaked on October 16 and then decreased slowly after Irene passed through the area. The bi-weekly total phosphorus grab sample data as well as the data collected by the U.S. Army Corps of Engineers are presented in **Figure 29**.

At S-175 a total phosphorus concentration of 15 ppb was measured from a grab sample on Oct. 21. Grab samples collected at S-332 and S-332D on Oct. 19 had total phosphorus concentrations of 35 and 56 ppb, respectively. No samples were collected at S-18C between Oct. 13 and 27. The seven-day time composite samples collected on Oct. 19 at S-332 and S-332D had total phosphorus concentrations of 51 and 10 ppb, respectively.

Shark River Slough Flows

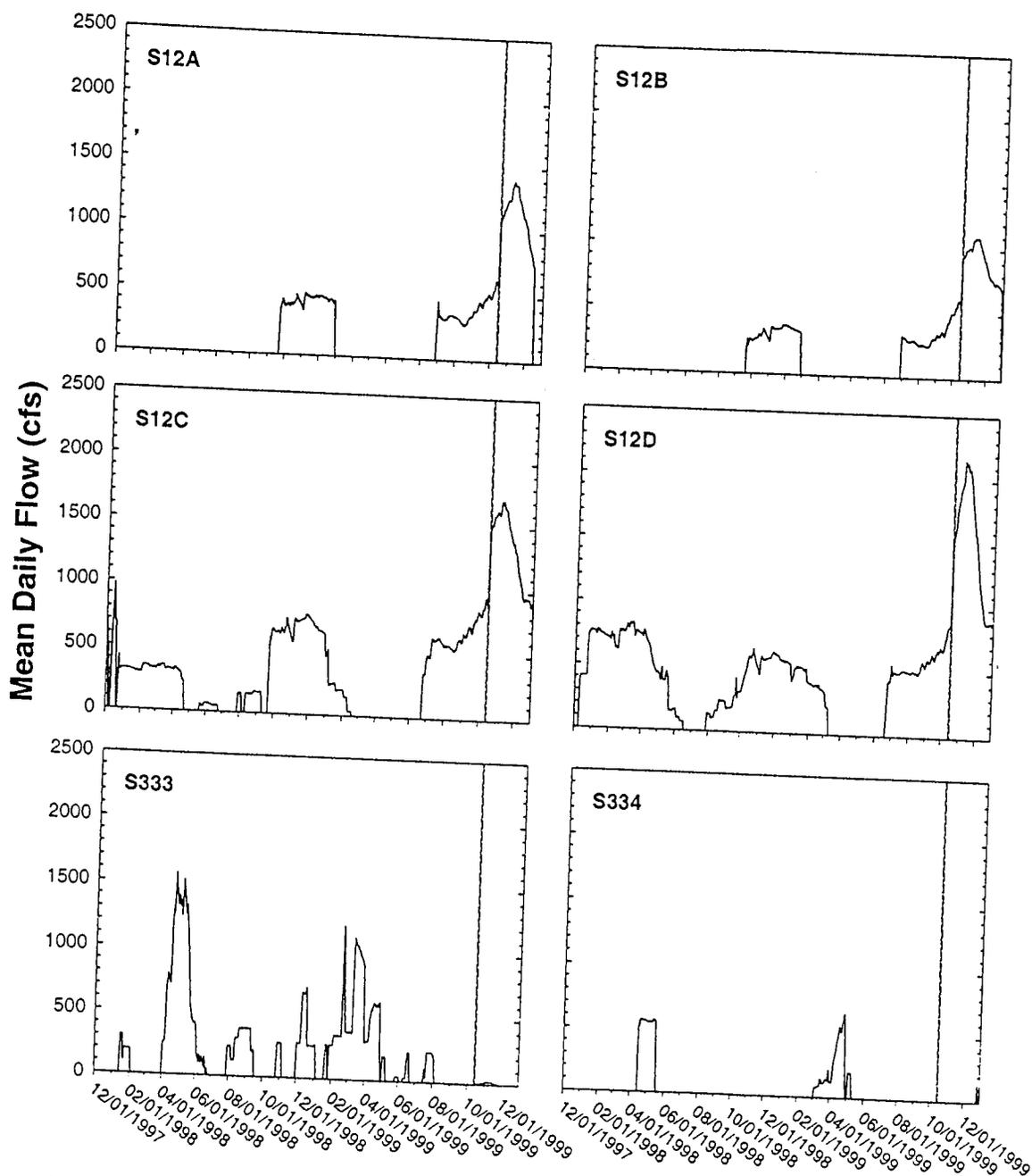


Figure 26. Mean daily flows for the Shark River structures and S-334. Vertical line indicates the period Hurricane Irene passed through the Everglades National Park on October 16, 1999.

Shark River Total Phosphorus Concentrations

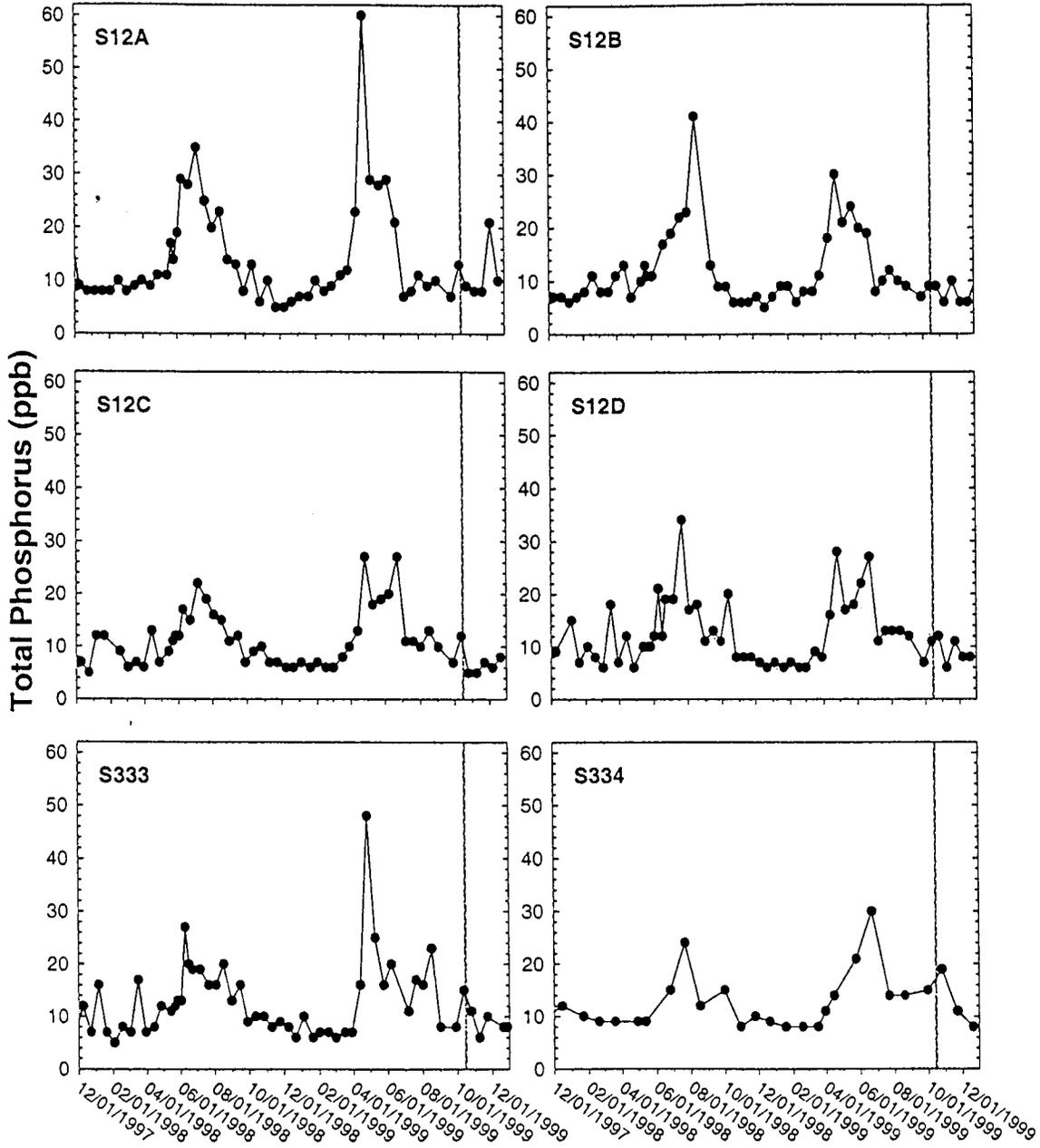


Figure 27. Total phosphorus concentrations for the Shark River Slough structures and S-334. Vertical line indicates the period Hurricane Irene passed through the Everglades National Park on Oct. 16, 1999.

32

Taylor Slough and Coastal Basin Flows

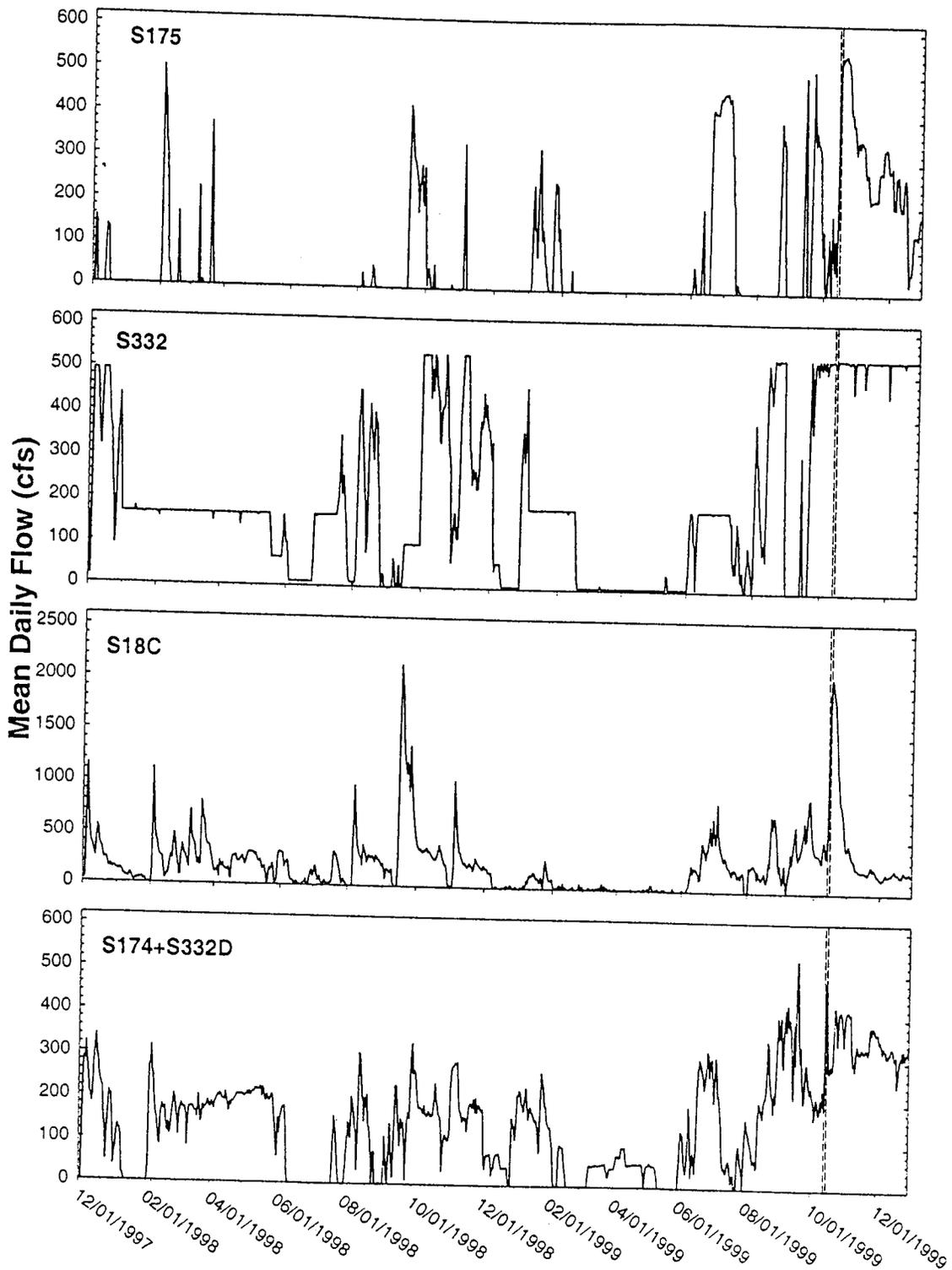


Figure 28. Mean daily flows for the Taylor Slough and coastal basin structures. Vertical line indicates the period Hurricane Irene passed through the Everglades National Park on Oct. 16, 1999.

33

Taylor Slough and Coastal Basins Total Phosphorus Concentration

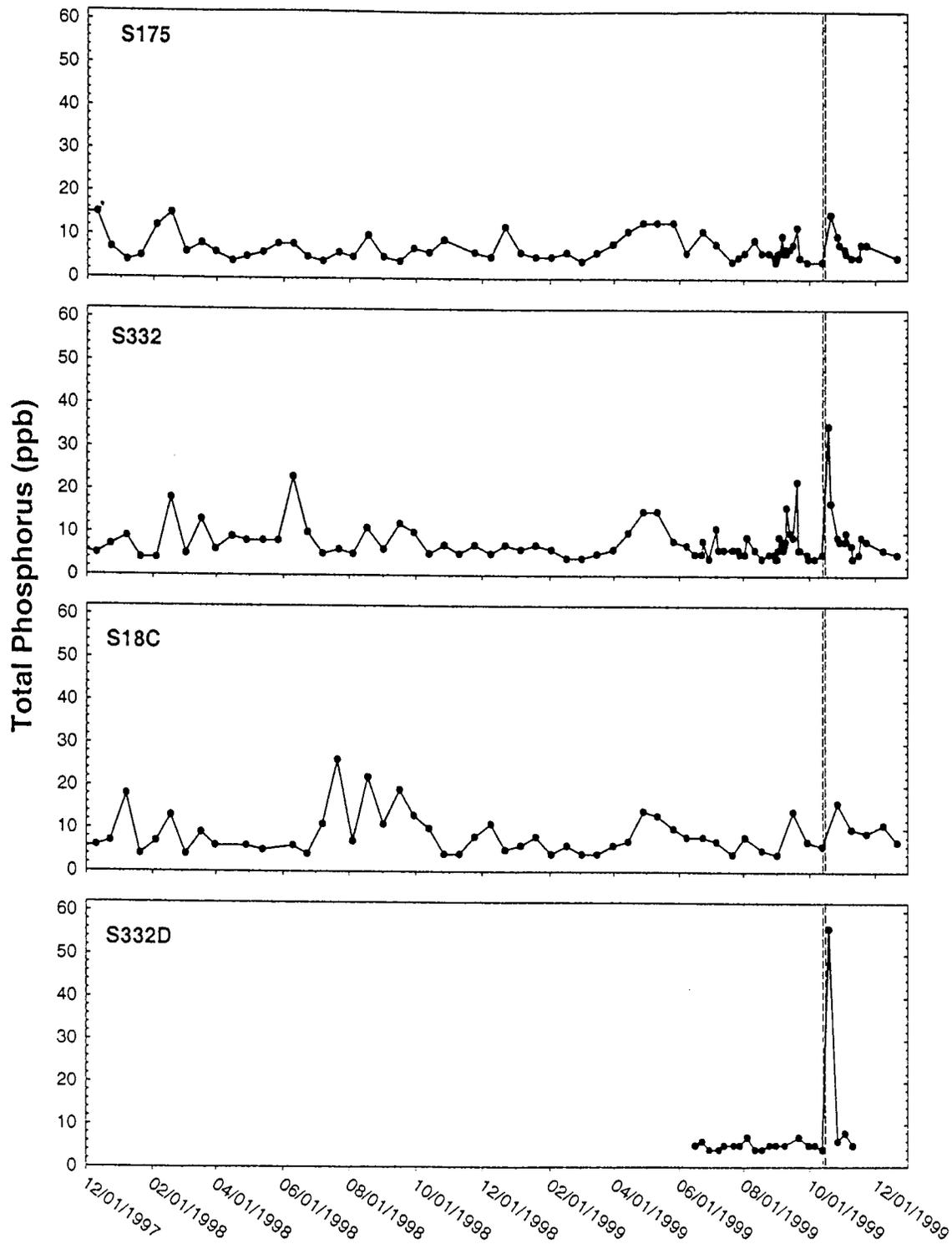


Figure 29. Total phosphorus concentrations for the Taylor Slough and coastal basin structure. The vertical line indicates the period Hurricane Irene passed through the Everglades National Park on Oct. 16, 1999.

Quality Assessment Report for Water Quality Monitoring October - December 1999



Submitted to the
Technical Oversight Committee

Prepared by:
Delia B. Ivanoff
Water Quality Monitoring Division
South Florida Water Management District
1480-9 Skees Road
West Palm Beach, FL 33411-2642

Quality Assessment Report for Water Quality Monitoring October – December 1999

This report is an assessment of the SFWMD laboratory and field sampling performance in Total Phosphorus (TP) monitoring primarily for the following projects/stations during the fourth quarter of 1999:

- Conservation Area Inflow and Outflows (CAMB)
S12A, S12B, S12C, S12D, S333
- Everglades National Park Inflow Monitoring (ENP)
S18C, S332, S175, S176, S177
- Everglades Protection Area (EVPA)
LOX3 to LOX16
- Non-Everglades Construction Project (NECP)
S334

The lists of qualified data (Table 3) and field sampling quality assessment (Table 4) also include information on stations other than those listed above or other projects since field QCs are collected for trips that included the samples for the stations of interest.

The South Florida Water Management District's Comprehensive Quality Assurance Plan (CQAP) requires analysis of laboratory quality control (QC) samples and the collection and analysis of field QC samples along with routine samples to assess the data quality.

Field Sampling Quality Assessment

Field QC measures consist of equipment blanks (EB), field blanks (FB), split samples (SS), and replicate samples (RS). Table 1 summarizes the field and equipment blank recoveries for all projects and Table 2 summarizes field precision recoveries. Data not meeting the set criteria are flagged using the Florida Department of Environmental Protection's (FDEP) data qualifier codes.

Table 1. Field and equipment blank recoveries

Type of Blank	# collected	% with value <0.004	% with value 0.005-.008	# of blanks with value >0.008	Action Taken
FB	115	72.2	38.6	0	-
EB	118	65.3	51.9	1	EB flagged with J4 (see flag list below)

Table 2. Field precision summary

Project Code	Field Precision		
	Number of pairs	Mean % RPD	Comments
CAMB	44	11.6	Mean sample conc=0.061
ENP	12	19.8	Mean sample conc=0.010, <PQL.
EVPA	17	16.2	Mean sample conc=0.018
NECP	7	11.4	Mean sample conc=0.017
CSS	6	27.2	Mean sample conc.=0.006, <PQL.

Notes:

- 1) All TP analyses were conducted by SFWMD laboratory.
- 2) Field precision acceptance criteria: <15%. This criteria is applied only if values >PQL.
- 3) FB and EB acceptance criteria: must be $\leq 2 \times$ MDL
- 4) Associated samples are flagged when concentrations are low enough as compared to blank values for possibility of contamination.

Field sampling precision was generally excellent, with poorer precision at or below PQL, (PQL=0.016 mg/L for TP). A comprehensive list of flagged data for all trips that included samples for CAMB, ENP, EVPA, NECP, and CSS during this quarter is presented in Table 3 below.

Table 3. List of Flagged Results

Project	Date Collected	Station	Laboratory	Result	Flag Code	Comment
CAMB	11/8/99	S5AE (Replicate sample)	SFWMD	0.031	J3	Failed field precision criteria
ENP	12/8/99	S175	SFWMD	0.008	J3	OPO4>TPO4
CAMB	12/16/99	USSO	SFWMD	0.041	J3	Possible contamination (invertebrate was found in the sample)
CAMB	10/5/99	S5A (Split Sample)	SFWMD	0.249	J5	Autosampler Malfunction (intermittent electrical flow)
CAMB	10/5/99	S5A	SFWMD	0.231	J5	Autosampler Malfunction (intermittent electrical flow)
CAMB	10/5/99	S5AU	SFWMD	0.144	J5	Autosampler Malfunction (intermittent electrical flow)
CAMB	10/5/99	S5A	SFWMD	0.051	J5	Intermittent electrical flow
CAMB	10/19/99	S9	SFWMD	0.041	J5	Not Flow Proportional (A/S had low battery)
CAMB	11/1/99	S5AU	SFWMD	0.141	J5	Not flow proportional (overfilled discrete bottles)
CAMB	11/10/99	USL3BRS	SFWMD	0.169	J5	Not flow proportional (3-day collection, missed 33 samples, A/S not started)
CAMB	12/9/99	USSO	SFWMD	0.073	J5	Not flow proportional (discrete bottles have less volume than what was expected based on set-up)
CAMB	10/19/99	S5A	SFWMD	0.168	J5	Not flow proportional (A/S took samples but did not get into the jug)
CAMB	10/19/99	S6	SFWMD	0.114	J5	Not flow proportional (A/S took samples only up to 10/16, A/S was off)
CAMB	10/26/99	S6	SFWMD	0.15	J5	Not flow proportional (A/S missed 1 sample)
CAMB	10/12/99	S5A	SFWMD	0.56	J5	Possible contamination (dead cricket in the sample)
CAMB	10/12/99	S7	SFWMD	0.052	J5	Possible contamination (dead cricket in the sample)
CAMB	10/26/99	S6 EB	SFWMD	0.015	V	Analyte detected in equipment blank

Table 4. Field Audit Summary

Project	Date of audit	Summary	Suggestions and/or Recommended Corrective Action
CAMB TAMB ENP	10/25/99	Miami-Dade DERM is responsible for sample collection for this project. DERM continues to learn and perform the programs' objectives, with little to no errors noted. Team was adept at catching their own mistakes and correcting immediately.	Remember to report conductivity values in μmhos and not mmhos .
NECP TAMB	12/6/99	Miami-Dade DERM is responsible for sample collection for this project. DERM continues to learn and perform the programs' objectives, with little to no errors noted. Effective inter-group communications.	No discrepancies were noted, therefore no corrective action was necessary.
CAMB	12/13/99	Broward County Dept. of Planning and Environmental Protection (DPEP) is responsible for performing this project. DPEP continues to learn and perform their programs' objectives. Unable to observe autosampler routine. District provided all equipment and supplies.	Acquire and use appropriate SOPs and QAPs. Use a clipboard to hold loose papers.
NECP TAMB 8SQM	12/20/99	Miami-Dade DERM is responsible for sample collection for this project. DERM continues to learn and perform the programs' objectives, with little to no errors noted.	No discrepancies were noted, therefore no corrective action was necessary.
ENP NECP	12/21/99	Miami-Dade DERM is responsible for sample collection for this project. DERM continues to learn and perform the programs' objectives, with little to no errors noted. Team was organized and efficient. They accomplished all objectives accurately.	No discrepancies were noted, therefore no corrective action was necessary.

Laboratory Quality Control Assessment

Routine laboratory QC samples include QC checks, matrix spikes, and precision checks. The charts presented on the following pages show recoveries from various levels of QC samples for TP analysis at SFWMD laboratory. Statistical evaluation of precision and matrix spike recoveries are also included. Portion of or an entire analytical run is generally rejected if QC recoveries are outside the set limits. Data is flagged accordingly if any deficiency is noted after the samples have exceeded the required holding times.

Except for QC5, recoveries for the QC samples are generally within $\pm 10\%$ from the true value, which are acceptable. QC5, with a true value of 0.008 mg/L, is less than the practical quantitation limit, and a performance range of 75-125 % for this quarter was to be expected. QC5 statistical limit based on 3*standard deviation for this quarter was 75-142%.

Organic check is a solution prepared from phytic acid, a stable form of organic phosphate. Recoveries for this check sample are between 95-105%, indicating that the digestion process was

effective. The same material is used to do matrix spikes, the mean recovery for which was 101%. There were thirteen spikes that exceeded the acceptable limits during this period. In any of these cases, the laboratory took one of the following corrective actions:

- re-spiked, re-digested then re-analyzed the same sample or other samples from the same log-in group to verify that there was no matrix interference. If lack of matrix interference was confirmed, data was accepted. If matrix interference was confirmed, affected samples were qualified in the database with a J4 code.
- Rejected the affected portion of the run and re-digested and re-analyzed the samples.

The precision target for TP analysis during this period was 5.8%, and as the report shows, mean % RPDs were 1.7 and 1.1% for low and high level analyses, respectively. The maximum RPD during this period was 7.3%. There were three instances when %RPD exceeded with 6-7% RPDs. Data from affected runs were accepted based on the following:

- the recoveries were still within reasonable limit
- the precision between a routine sample and a split sample (SS) within that portion of the run was <5.8%
- all other criteria were met in that portion of the run.

Glossary

Equipment blank (EB). Analyte-free water that is processed on-site through all sampling equipment used in routine sample processing. EB values are indicative of effectiveness of decontamination process.

Field blank (FB). Analyte free water that is poured directly into the sample container on site during routine collection, preserved and kept open until sample collection is completed for the routine sample at that site. FB values are indicative of environmental contamination on site.

Split sample (SS). A second aliquot of the same sample obtained from the same sampling device. Results for SS are compared with routine sample results; agreement between these two results is mostly an indication of laboratory precision.

Replicate sample (RS). A second sample collected from the same source as the routine sample, using the same sampling equipment. RS data are compared with routine sample to evaluate sampling precision.

Precision. The agreement or closeness between two or more results and is an indication that the measurement system is operating consistently and is a quantifiable indication of variations introduced by the analytical system over a given time period.

Accuracy. The agreement between the actual obtained result and the expected result. QC check samples having a known or "true" value are used to test for the accuracy of a measurement system.

Method Detection Limit (MDL). The smallest concentration of an analyte of interest that can be measured and reported with 99 percent confidence that the concentration is greater than zero. The MDLs are determined from the analysis of a sample in a given matrix, using accepted sampling and analytical preparation procedures, containing the analyte at a specified level. The MDL is determined by the protocol defined in section 40 CFR Part 136, Appendix B as established by the EPA.

Practical Quantitation Limit (PQL). The smallest concentration of an analyte of interest that can be quantitatively reported with a specific degree of confidence. Generally, the PQL is 12 times the standard deviation that is derived from the procedure used to determine the MDL, or can be assumed to be 4 times the MDL.

Relative Standard Deviation (RSD). A measure of precision, used when comparing more than two results. It is calculated as: $\%RSD = [\text{Std. Deviation} \div \text{Mean}] * 100$

Relative Percent Difference (RPD). A measure of precision, used when comparing two values. It is calculated as: $\%RPD = \text{Absolute}[\text{Value 1} - \text{Value 2}] \div \text{Mean} * 100$.

