Settlement Agreement
January-March 2002 Report

Prepared for the
Technical Oversight Committee
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ARTHUR R. MARSHALL LOXAHATCHEE NATIONAL WILDLIFE REFUGE

The 1991 Settlement Agreement ended the Everglades lawsuit and was entered into by the federal government, the State of Florida and the South Florida Water Management District. The subsequent Consent Decree, as modified in 1995, specified that interim and long-term phosphorus concentration levels for the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) must be met by Feb. 1, 1999, and Dec. 31, 2006, respectively. The concentration levels vary monthly because they are calculated as a function of water stage measured at gaging stations 1-7, 1-8C and 1-9 within the Refuge. The stage range within which the interim and long-term concentration levels are applicable is 15.42 to 17.14 feet (mean sea level). The monthly total phosphorus concentrations are determined from water samples collected at 14 interior marsh stations (LOX 3 through LOX 16). As required in the Consent Decree, the concentrations are converted to a geometric mean, which is compared to the interim and long-term concentration levels.

Average stages in the Refuge were 16.69, 16.63 and 16.50 feet in January, February and March 2002, respectively (**Figure 1, Table 1)** The geometric means, calculated from total phosphorus concentrations measured in water samples collected in January, February and March, were 6.4, 7.8 and 7.3 ppb, respectively (**Table 1**). These concentrations were all less than their respective interim and long-term limits.

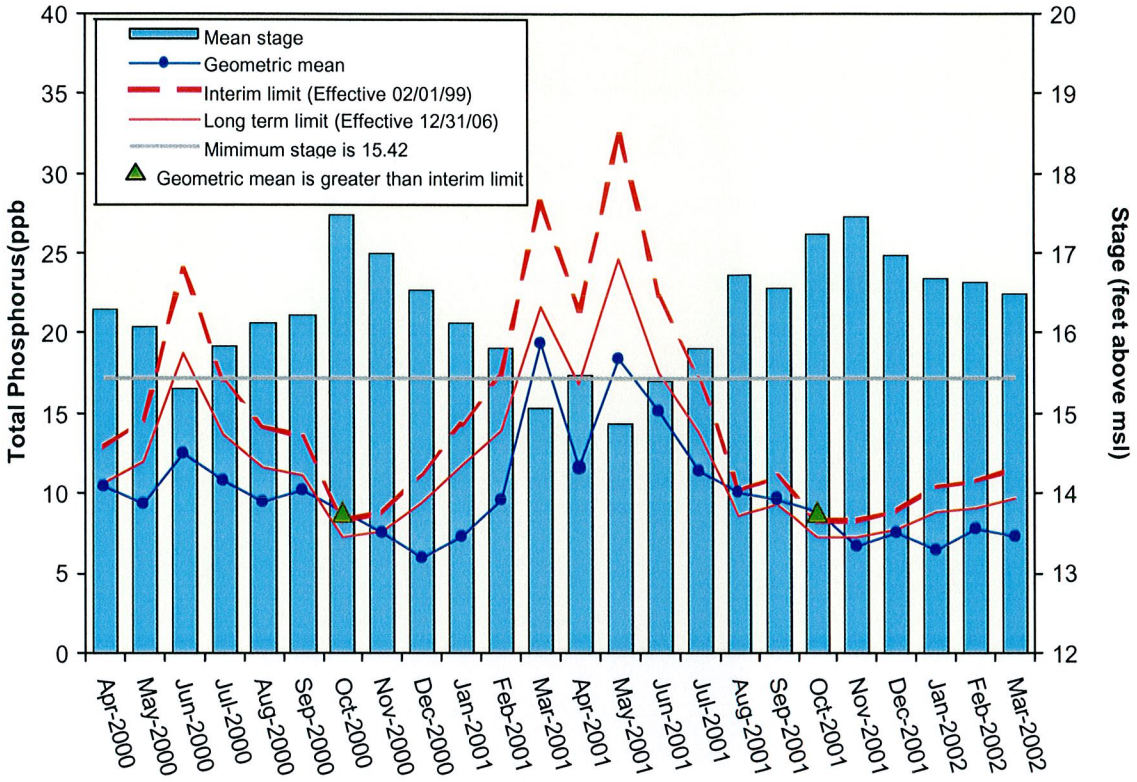

Figure 1. Monthly total phosphorus geometric mean concentrations for the A.R.M. Loxahatchee National Wildlife Refuge compared to the interim and long-term limits. The calculated limit concentrations are adjusted for fluctuations in water level.

Table 1. Loxahatchee National Wildlife Refuge Total Phosphorus Compliance Tracking.

Month Year	Geometric Mean	Interim limit	Long Term Limit	Average Stage	Number of TP Samples	Number of Stage Measurements
	(ppb)			(ft,NGVD)		
Apr-2000	10.4	12.9	10.6	16.30	14	3
May-2000	11.0	15.0	12.2	16.05	14	3
Jun-2000	12.4	NA	NA	15.31	6	3
Jul-2000	10.8	17.0	13.7	15.84	6	3
Aug-2000	9.4	14.1	11.6	16.14	10	3
Sep-2000	10.2	13.5	11.1	16.22	11	3
Oct-2000	8.8	8.3	7.2	17.49	13	3
Nov-2000	7.5	8.8	7.6	17.01	14	3
Dec-2000	6.0	11.2	9.4	16.55	9	3
Jan-2001	7.2	14.3	11.7	16.13	8	3
Feb-2001	9.6	17.2	13.8	15.82	9	3
Mar-2001	19.3	NA	NA	15.08	2	3
Apr-2001	11.5	21.4	16.9	15.48	6	3
May-2001	18.3	N/A	N/A	14.88	2	3
Jun-2001	15.1	N/A	N/A	15.42	9	3
Jul-2001	11.4	17.2	13.8	15.82	11	3
Aug-2001	10.0	10.1	8.6	16.74	14	3
Sep-2001	9.6	11.1	9.3	16.57	14	3
Oct-2001	8.8	8.3	7.2	17.24	14	3
Nov-2001	6.6	8.3	7.2	17.46	14	3
Dec-2001	7.5	8.9	7.7	16.99	14	3
Jan-2002	6.4	10.4	8.8	16.69	14	3
Feb-2002	7.8	10.7	9.1	16.63	14	3
Mar-2002	7.3	11.5	9.7	16.50	14	3

Notes:

(1) Average Stage is calculated using stage elevations at three stations on the sampling date

(2) Highlighted values indicate months when exceedances occurred

EVERGLADES NATIONAL PARK

Shark River Slough

The Consent Decree of 1995 specified that interim and long-term total phosphorus concentration limits for discharges into the Everglades National Park through Shark River Slough be met by October 1, 2003, and December 31, 2006, respectively. The limits apply to the water year ending September 30. The long-term total phosphorus concentration limit for inflows to Shark River Slough through structures S12A, S12B, S12C, S12D and S333 represents the concentrations delivered during the Outstanding Florida Waters baseline period of March 1, 1978 to March 1, 1979, and is adjusted for variations in flow. In addition, it is required that phosphorus concentrations be presented as 12-month moving flow-weighted means.

Inflow concentrations of total phosphorus through Shark River Slough are compared to the interim and long-term limits at the end of each water year from 1991 to 2001 (**Figure 2a**). The 12-month moving flow-weighted mean total phosphorus concentration ending September 2001 was 15.0 ppb. Corresponding interim and long-term limits were 12.2 and 10.8 ppb, respectively. This was the second consecutive year that both limits were exceeded for the water year ending in September. Both the 2000 and 2001 water years were very dry, resulting in lower volumes of flow with higher total phosphorus concentrations entering the Park than those observed in wetter years.

The Consent Decree stipulates that the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb from each sampling event in any 12-month period must not exceed an allowable value based on flow into Shark River Slough for the same 12-month period. For the 12-month periods ending January, February and March 2002, the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb were 52.6, 45.0 and 40.9, respectively (**Table 2**). Only the January percentage exceeded the allowable percentage for the three 12-month periods. The individual sampling events and the 12-month moving average are presented in **Figure 2b**

Table 2 also presents the moving flow-weighted mean concentrations for each 12-month period beginning in April 2000 as well as the corresponding interim and long-term total phosphorus concentration limits, calculated using the 12-month period flow.

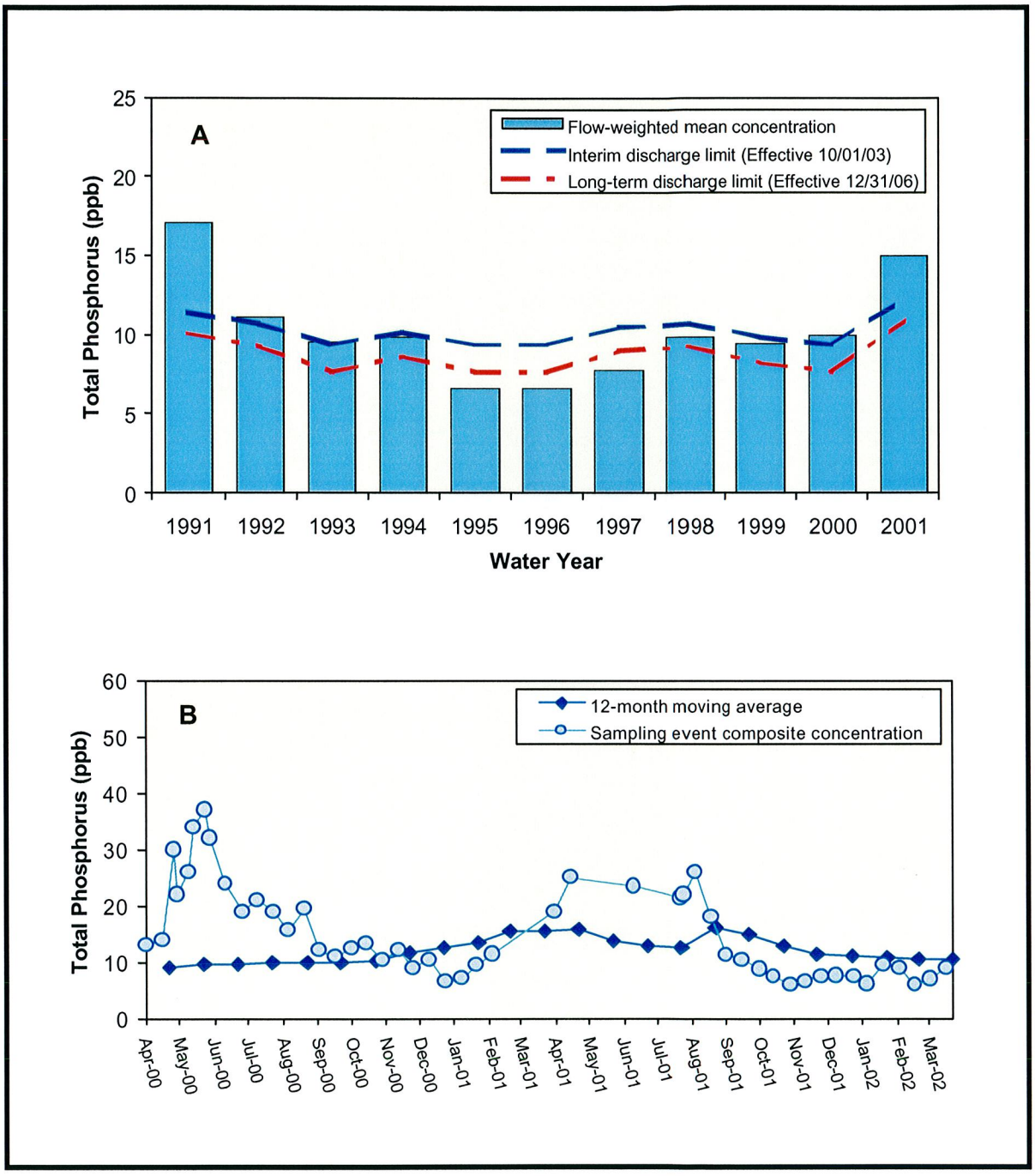

Figure 2. Total phosphorus flow-weighted mean concentrations (fwmc) in inflows to Everglades National Park through Shark River Slough. **A**. The 12-month moving average fwmc at the end of each water year compared to the total phosphorus interim and long-term limits. **B**. The 12-month moving average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

Table 2. Shark River Slough Total Phosporus Concentration Compliance Tracking

12-Month Period Ending On	Total Period Flow	Flow Weighted Mean Total Phosphorus	Limits		Percent of Sampling Events Greater than 10 ppb	
			(ppb)		(%)	
	(Kac-ft)	(ppb)	Interim	Long Term	Allowed	Observed
04/30/00	1385.1	9.1	9.4	7.6	40.1	***52.2***
05/31/00	1401.5	9.6	9.4	7.6	40.1	***57.7***
06/30/00	1395.9	9.8	9.4	7.6	40.1	***60.7***
07/31/00	1294.6	9.8	9.4	7.6	40.1	***64.3***
08/31/00	1214.6	9.8	9.4	7.6	40.1	***65.5***
09/30/00	1096.1	10.0	9.4	7.6	40.1	***69.0***
10/31/00	925.0	10.3	9.9	8.3	43.2	***72.4***
11/30/00	642.1	11.7	11.1	9.8	50.8	***79.3***
12/31/00	464.0	12.7	12.0	10.8	56.4	***82.8***
01/31/01	367.0	13.5	12.5	11.3	59.8	***80.0***
02/28/01	298.4	15.5	12.9	11.7	62.2	***85.7***
03/31/01	275.9	15.6	13.0	11.9	63.1	***84.6***
04/30/01	250.4	15.8	13.2	12.0	64.0	***84.6***
05/31/01	230.9	13.7	13.3	12.1	64.7	***81.8***
06/30/01	221.0	12.8	13.3	12.2	65.1	***80.0***
07/31/01	212.8	12.5	13.4	12.2	65.4	***78.9***
08/31/01	324.0	16.0	12.8	11.6	61.3	***78.9***
09/30/01	419.7	15.0	12.2	11.0	57.9	***78.9***
10/31/01	502.4	13.0	11.8	10.5	55.2	***68.4***
11/30/01	599.2	11.5	11.3	10.0	52.1	***57.9***
12/31/01	677.9	11.0	10.9	9.6	49.8	***52.6***
01/31/02	695.1	10.9	10.8	9.5	49.3	***52.6***
02/28/02	728.3	10.7	10.7	9.3	48.3	45.0
03/31/02	779.2	10.5	10.5	9.0	46.9	40.9

Note: ***Italicized values exceeded allowed percentage***

For the 12-month periods ending in January, February and March 2002, the flow-weighted mean total phosphorus concentrations were 10.9, 10.7 and 10.5 ppb, respectively. The January flow-weighted mean concentration was greater than the interim and long-term limits, whereas the February and March concentrations equaled the interim limits but exceeded the long-term limits.

The daily flows through the individual Shark River Slough structures and S334 from April 2000 through March 2002 are presented in **Figure 3a**. A sharp increase in flow began on July 31, 2001, ending an essentially six-month no flow period. Beginning in mid-December, the majority of the inflow was shifted to Northeast Shark River Slough through S333 by closing the S12A, B and C structures. During this period, some flow was routed through S334.

The relationship between the sum of the daily flows at Shark River Slough structures and the corresponding flow-weighted mean total phosphorus concentration for individual sampling events is presented in **Figure 3b.**

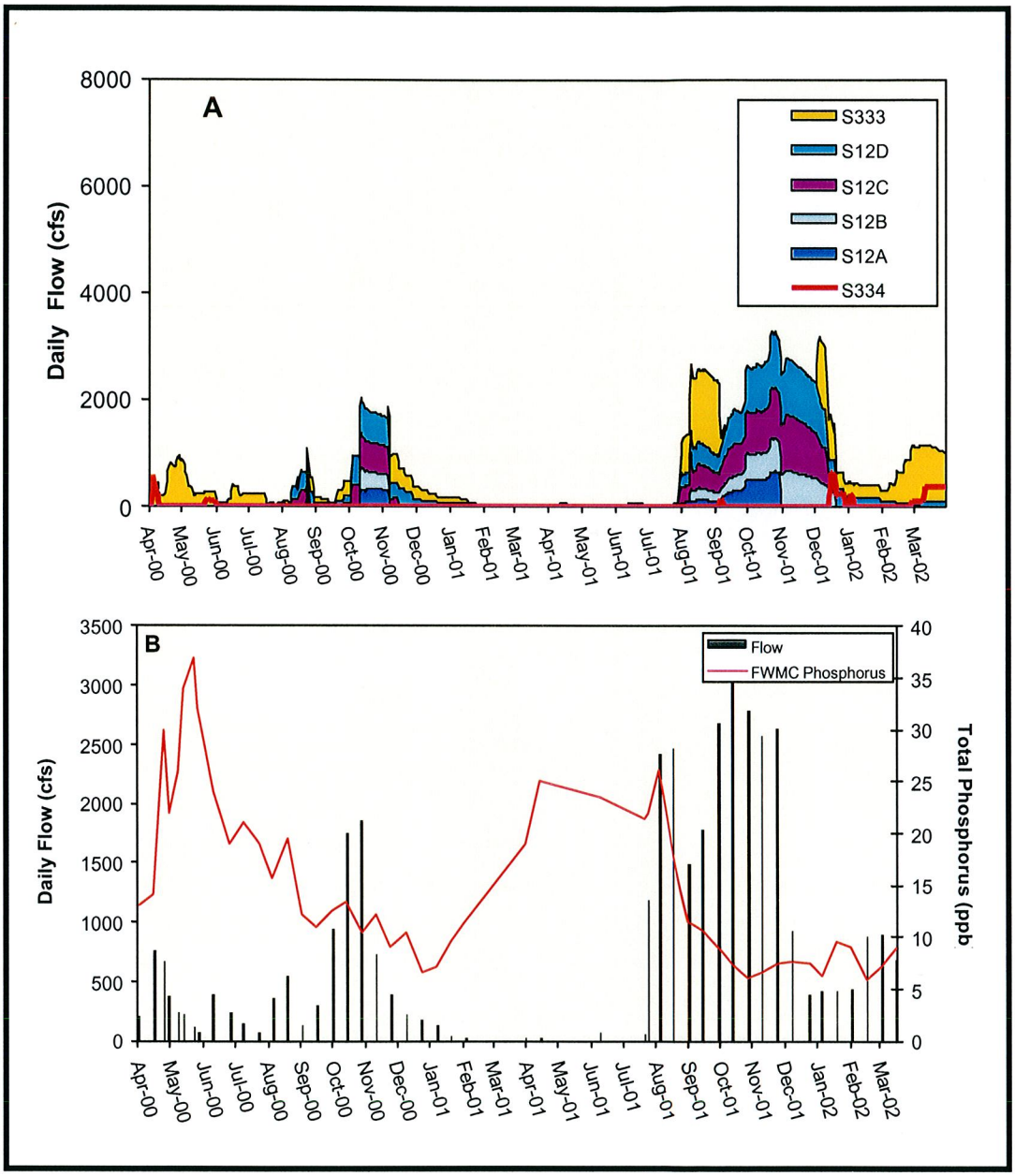

Figure 3. **A**. Daily flows into Shark River Slough by structure. **B**. The relationship between daily flow at Shark River Slough structures and the corresponding flow-weighted mean total phosphorus concentrations for individual sampling events.

Taylor Slough and The Coastal Basins

Under the Consent Decree, a single total phosphorus long-term limit of 11 ppb, to be met by December 31, 2006, was set for the two points of inflow to Taylor Slough (S332 and S175) and the inflow point to the Coastal Basins (S18C). The 11 ppb limit applies to the water year ending September 30. Beginning in August 1999, structure S332D, a new pump station constructed by the U.S. Army Corps of Engineers, began operation. The structure is adjacent to spillway S174 and pumps water from the L31N canal into the L31W canal. The S332D and S174 structures became the new inflow compliance monitoring sites for Taylor Slough on October 1, 1999, replacing S332 and S175. However, the Settlement Agreement's Technical Oversight Committee requested that data from both the old and new pairs of inflow structures to Taylor Slough be presented for one year. This request was made to determine if the differences between the two data sets observed from August 1999 through March 2000 would continue throughout a complete wet season/dry season cycle and what implications this might have on future compliance with the 11 ppb limit.

Total phosphorus and flow data from both sets of structures presented in prior editions of this report through December 2001 (April 2002 report) showed that, beginning October 2000, the 12-month moving total flow data for S332D/S174/S18C was consistently greater than flow at S332/S175/S18C. There was also a shift in flow-weighted mean total phosphorus concentration data whereby S332D/S174/S18C concentrations became equal to and then consistently lower than the concentrations at S332/S175/S18C. These changes reflected the switch made from S332 to S332D for water delivery to Taylor Slough between July 3 and July 5, 2000. Consequently, as of this report, only S332D/S174/S18C data will be presented with the exception of data in **Figure 4a**.

Inflow concentrations of total phosphorus to the Everglades National Park through Taylor Slough and the Coastal Basins are compared to the 11 ppb limit at the end of each water year using data from both the old (S175, S332, S18C) and new (S174, S332D, S18C) combinations of structures (**Figure 4a**). The bars in **Figure 4a** represent the flow-weighted mean total phosphorus concentrations from S332, S175 and S18C for water years 1989 through 2001. The diamond point values for water years 1999, 2000 and 2001 represent the new combination of structures. **Figure 4b** presents the 12-month moving average and individual sampling event flow-weighted mean total phosphorus concentrations at the S174, S332D and S18C structures.

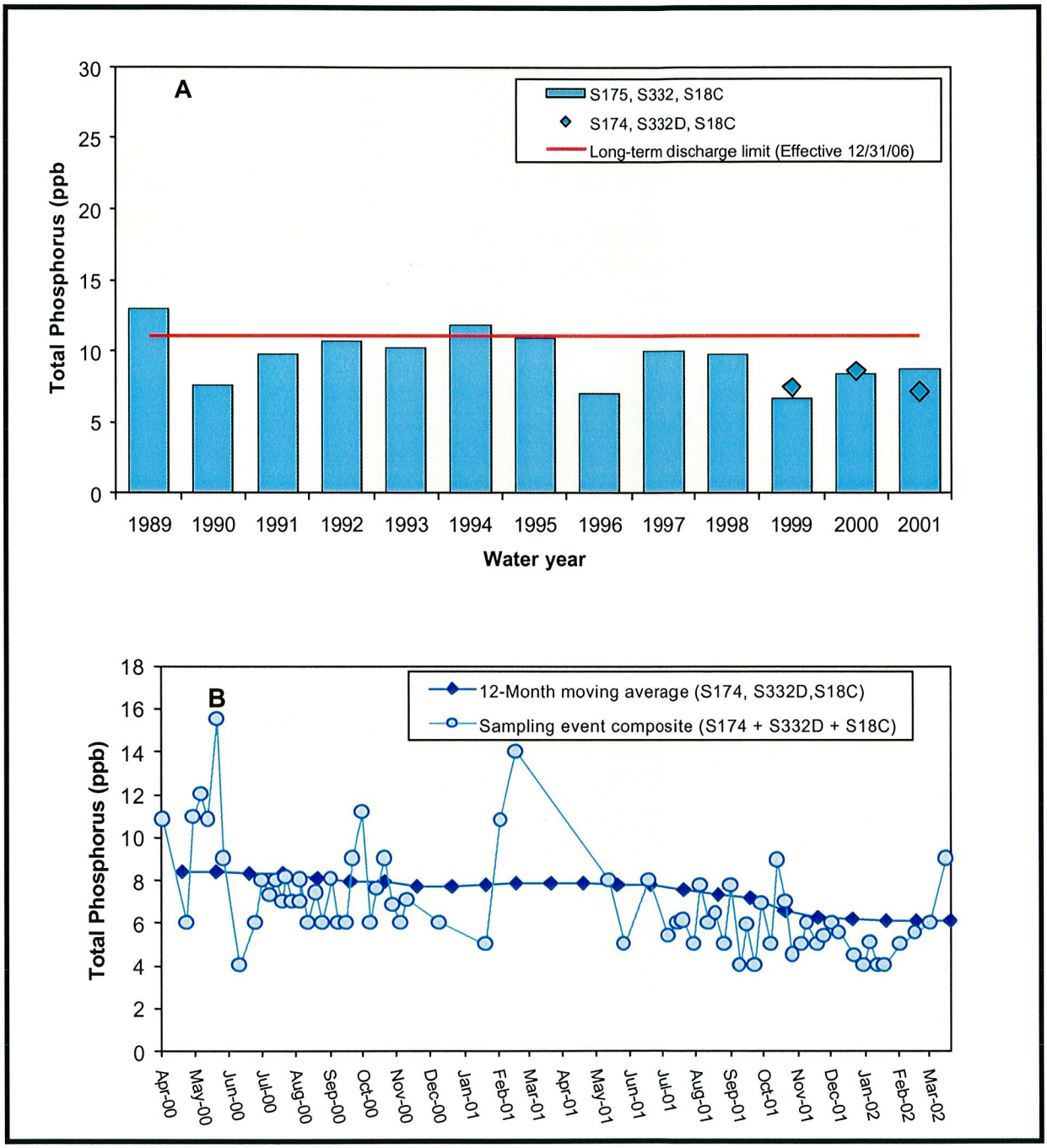

Figure 4. Total phosphorus flow-weighted mean concentrations (fwmc) in inflows to Everglades National Park through Taylor Slough and the Coastal Basins. **A.** The 12-month moving average fwmc at the end of each water year compared to the 11 ppb long-term total phosphorus limit. **B**. The 12-month moving average fwmc at the end of each month and the composite total phosphorus concentration for each sampling event.

Table 3. Taylor Slough and the Coastal Basins Total Phosphorus Concentration Compliance Tracking

12-Month Period Ending On	Total Period Flow	Flow Weighted Mean Total Phosphorus	Long Term Limit	Percent of Sampling Events Greater Than 10 ppb (%)	
	(ac-ft x 1000)	(ppb)	(ppb)	Allowed	Observed
04/30/00	358	8.4	11.0	53.1	20.0
05/31/00	363	8.4	11.0	53.1	23.7
06/30/00	349	8.3	11.0	53.1	23.7
07/31/00	364	8.3	11.0	53.1	20.5
08/31/00	389	8.1	11.0	53.1	20.5
09/30/00	399	7.9	11.0	53.1	17.5
10/31/00	399	7.9	11.0	53.1	16.3
11/30/00	375	7.7	11.0	53.1	14.6
12/31/00	351	7.7	11.0	53.1	15.0
01/31/01	308	7.8	11.0	53.1	15.4
02/28/01	282	7.9	11.0	53.1	21.6
03/31/01	269	7.9	11.0	53.1	22.9
04/30/01	260	7.9	11.0	53.1	20.6
05/31/01	254	7.8	11.0	53.1	12.9
06/30/01	248	7.8	11.0	53.1	10.0
07/31/01	243	7.5	11.0	53.1	10.7
08/31/01	237	7.3	11.0	53.1	11.5
09/30/01	235	7.2	11.0	53.1	11.5
10/31/01	235	6.5	11.0	53.1	8.0
11/30/01	270	6.3	11.0	53.1	7.4
12/31/01	296	6.2	11.0	53.1	6.7
01/31/02	316	6.1	11.0	53.1	5.9
02/28/02	321	6.1	11.0	53.1	0.0
03/31/02	326	6.1	11.0	53.1	0.0

The 12-month flow-weighted mean concentrations for January, February and March 2002 were 6.1 ppb for each month at the S174, S332D and S18C structures (**Table 3**). The Consent Decree stipulates that the percent of flow-weighted mean total phosphorus concentrations greater than 10 ppb from each sampling event in any 12-month period must not exceed a fixed value of 53.1 percent. The percentage of flow-weighted mean total phosphorus concentrations greater than 10 ppb for the S174, S332D and S18C structures was 5.9, 0 and 0 for the periods ending January, February and March, respectively, (**Table 3**).

The daily flows into Everglades National Park through Taylor Slough structures and S18C are presented in **Figure 5a**. **Figure 5b** shows the daily flows at S18C, S174 and S332D and the corresponding flow-weighted mean total phosphorus concentrations for each sampling event. As the data indicate, there is no linear relationship between daily mean flow and flow-weighted mean total phosphorus concentrations at these structures.

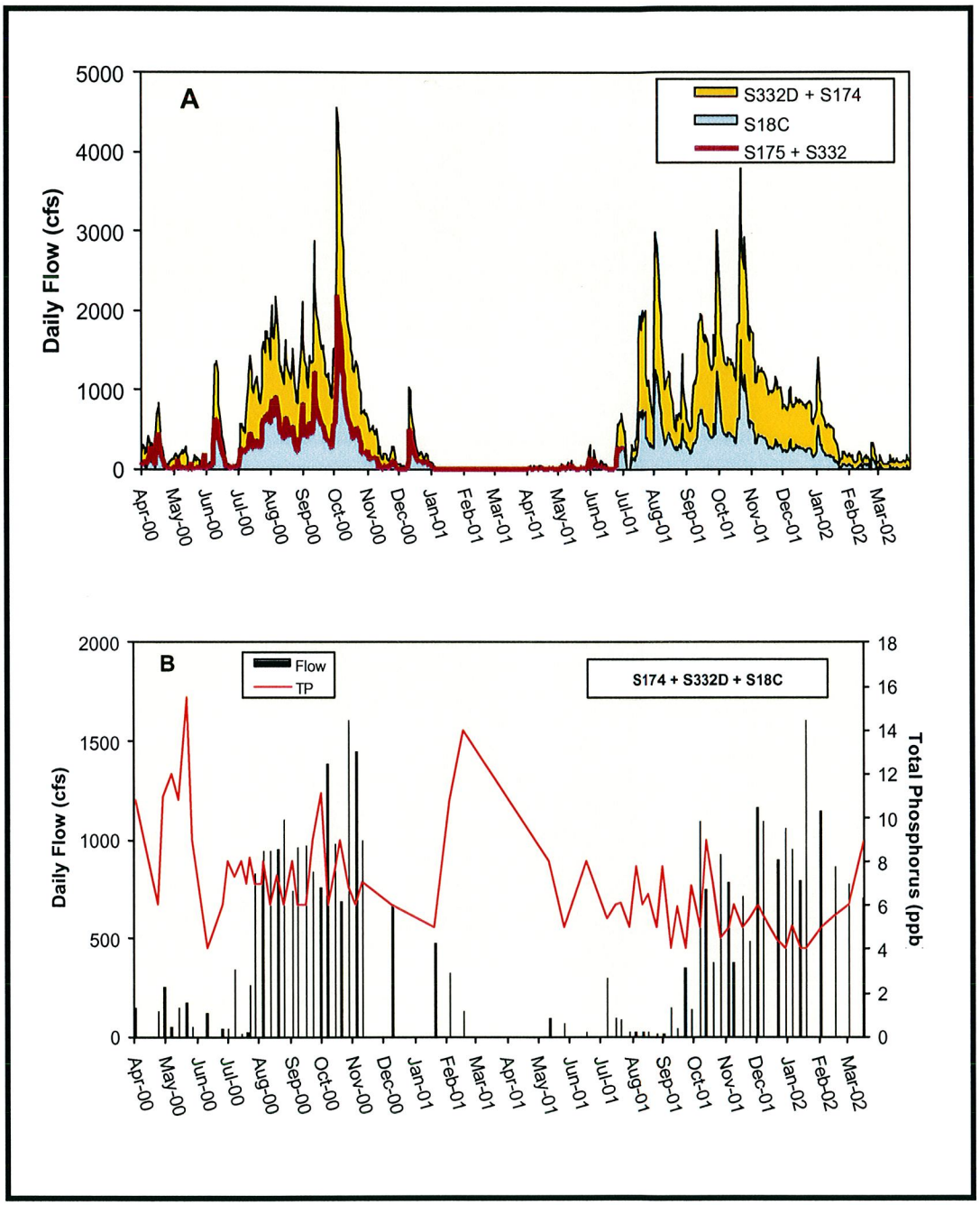

Figure 5. **A.** Daily flows into Everglades National Park through Taylor Slough and S18C. **B.** The relationship between daily flows at Taylor Slough structures and S18C and the corresponding flow-weighted mean total phosphorus concentrations for individual sampling events.