

Appendix 4-3: Water Year 2011 Supplemental Evaluations for Regulatory Source Control Programs in Non-Everglades Construction Project Basins

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INTRODUCTION

For the seven non-Everglades Construction Project (non-ECP) basins, the Florida Department of Environmental Protection Permit No. 06,502590709 requires that the South Florida Water Management District (District or SFWMD) reports on the status of required water quality monitoring to evaluate progress toward achieving established water quality standards and the effectiveness of the source control strategies. The data collection requirements for structures associated with the non-ECP basins are outlined in the non-ECP permit. Chapter 3A of this volume and Volume III, Appendix 3-2, provide the Water Year 2011 (WY2011) (May 1, 2010–April 30, 2011) update on the District’s data collection efforts for non-ECP structures. This appendix summarizes the flow, total phosphorus (TP) load, and flow-weighted mean (FWM) TP concentration at each non-ECP basin discharge structure for WY1998 through WY2011.

NON-ECP BASIN SUPPLEMENTAL EVALUATION

BASIN-LEVEL MONITORING DATA

During WY2011, eight structures served as direct or indirect discharge points from the non-ECP basins into the Everglades Protection Area (EPA). While seven of these structures are within the control of the District and are referred to as “into” structures under the non-ECP permit, this appendix also incorporates flow and TP data for the remaining private structure, NSID1. It should be noted that due to the incorporation of a more accurate flow calculation equation, the S-190 flow data were revised for the period from January 1, 1984 through May 9, 2010. Historical TP concentration and flow data presented in this appendix now reflect the revised flow values. Since December 2006, all runoff from the Acme Improvement District (Acme) Basin has been discharged into the C-51 West canal and then generally directed to Stormwater Treatment Area 1E (STA-1E). Direct untreated flows from the ACME1 and ACME2 structures into Water Conservation Area 1 (WCA-1) no longer occur. The Acme Basin is now designated as an ECP basin; however, this appendix includes the historical discharge information for this basin.

Table 1 of this appendix summarizes the annual total flow [in thousand acre-feet (kac-ft)], total TP load, and FWM TP concentration for each structure. The individual aggregated structure summaries represent the collective discharge into a given receiving water body. The receiving water bodies include Water Conservation Areas 1, 2A, and 3A (WCA-1, WCA-2A, and WCA-3A), and Everglades National Park. The individual and aggregated structure summaries for non-ECP basins are presented for each water year and for the period of record. It should be noted that the 15 parts per billion (ppb) FWM TP concentration for WY2011 at structure S-332D is the highest annual FWM TP reported at this structure during the period of record. This value reflects inclusion of a single daily discrete automatic sampler result collected on July 27, 2010 of 1,020 ppb, which substantially deviates from historically established concentration ranges at this structure. However, support for eliminating this sample from the dataset is not evident. As an indication of its impact, removing this sample would change the annual FWM TP concentration at S-332D from 15 ppb to 8 ppb for WY2011, and the TP load for WY2011 would change from 1.89 metric tons (mt) to 1.06 mt. Volume III, Appendix 3-2, presents WY2011 water quality sampling statistics for these non-ECP basin discharge structures.

BASIN-LEVEL WATER QUALITY SUMMARY

This section summarizes the water quality results for the non-ECP basins. These basins include the Feeder Canal, L-28, C-111, C-11 West, North New River Canal, and North Springs Improvement District. Historical water quality results for the Acme Basin are also included. Since December 2006, this basin has discharged to the C-51 West canal and is now designated as an ECP basin. Each figure in this section includes daily, monthly, and annual data for each basin. **Figures 1, 3, 5, 7, 9, 11 and 13** summarize daily rainfall [in inches (in)] and monthly TP load, FWM TP concentration, rainfall, and flow volume in WY2010. **Figures 2, 4, 6, 8, 10, 12 and 14** summarize the annual TP load, FWM concentration, rainfall, and flow volume through WY2011 for each basin. The water quality summary for each basin is discussed in further detail in Chapter 4 of this volume.

UPSTREAM (SUB-BASIN) LEVEL WATER QUALITY SUMMARY

Water quality, particularly TP concentrations, in Everglades non-ECP basins and the Acme Basin is monitored at the upstream sampling sites to identify high phosphorus areas within each basin. This section includes maps summarizing the water quality data for grab and auto-sampler sampling sites for each non-ECP basin. Water quality data is included for sampling sites within the North Springs Improvement District Basin; C-11 West Basin consisting of South Broward Drainage District, Central Broward Water Control District, and Indian Trace Development District; the North New River Canal Basin; Boynton Farms Basin; Feeder Canal Basin (West Feeder sites, PC-17A, G-108, and WWeir); and L-28 Basin (USSO and L-28U). Removal of the G-108 structure eliminated discharges to the North Feeder Canal at its location in April 2010. **Figures 15 through 20**, summarize the annual TP load, FWM TP concentration, and flow volume for upstream structures in the North Springs Improvement District, C-11 West (South Broward Drainage District, Central Broward Water Control District, and Indian Trace Drainage District), North New River Canal (west and east), respectively. **Figures 21 through 25** summarize the annual TP load, FWM TP concentration, and flow volume for upstream structures in the Feeder Canal Basin. **Figures 26 through 28** summarize the annual TP load, FWM TP concentration, and flow volume for upstream structures in the L-28 Basins. **Figures 29 through 31** summarize the annual TP load, FWM TP concentration, and flow volume for upstream structures in the Boynton Farms, C-111, and Acme basins, respectively.

Table 1. Water Years 1998 through 2011 (WY1998–WY2011) (May 1, 1997–April 30, 2011) non-Everglades Construction Project (non-ECP) basins structure total flow volume, total phosphorus (TP) load, and TP flow-weighted mean concentration (FWMC) to the Everglades Protection Area by tributary basin.

Non-ECP Basin Structures into Water Conservation Area 1																
	Water Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008*	2009*	2010*	2011*	Total
ACME1	Flow Volume (kac-ft)	26.39	19.79	19.22	6.25	15.67	8.81	10.02	12.32	14.16	13.61	0	0	0	0	146.25
	TP Load (mt)	2.87	3.66	3.63	0.50	1.72	0.87	0.96	2.02	1.40	1.97	0	0	0	0	19.59
	TP FWMC (ppb)	88	150	153	65	89	80	77	133	80	117	NF	NF	NF	NF	109
ACME2	Flow Volume (kac-ft)	20.90	16.94	19.79	7.70	17.52	9.47	9.87	11.25	12.77	12.71	0	0	0	0	138.91
	TP Load (mt)	2.60	3.62	3.32	1.11	3.29	1.39	1.23	2.95	1.83	2.22	0	0	0	0	23.55
	TP FWMC (ppb)	101	173	136	117	152	119	101	212	116	141	NF	NF	NF	NF	137
Total (WCA-1)	Flow Volume (kac-ft)	47.29	36.73	39.01	13.95	33.19	18.28	19.89	23.56	26.93	26.32	0	0	0	0	285.16
	TP Load (mt)	5.47	7.28	6.95	1.61	5.01	2.25	2.18	4.97	3.24	4.18	0	0	0	0	43.14
	TP FWMC (ppb)	94	161	144	94	122	100	89	171	97	129	NF	NF	NF	NF	123

Non-ECP Basin Structures into Water Conservation Area 2A																
	Water Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
NSID1 Total (WCA-2A)	Flow Volume (kac-ft)	7.36	6.76	9.88	2.41	2.49	0.69	0	0.354	0	0	0	0	0	0	29.96
	TP Load (mt)	0.30	0.15	0.33	0.05	0.05	0.025**	0	0.009	0	0	0	0	0	0	0.91
	TP FWMC (ppb)	33	18	27	16	16	NDF	NF	20	NF	NF	NF	NF	NF	NF	25

* Pump stations ACME1 and ACME 2 stopped operation in December 2006

** Load calculated from arithmetic mean concentration

NF No flow for period

NDF No data with flow

Table 1. Continued.

Non-ECP Basin Structures into Water Conservation Area 3A																
	Water Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
S-190	Flow Volume (kac-ft)	66.89	44.99	92.47	35.32	81.22	83.47	111.50	89.58	142.47	67.03	24.02	83.09	86.35	40.24	1,048.64
	TP Load (mt)	6.64	4.22	12.55	7.01	8.86	8.99	13.65	10.69	27.20	17.77	2.99	14.06	7.79	2.24	144.64
	TP FWMC (ppb)	80	76	110	161	88	87	99	97	155	215	101	137	73	45	112
S-140	Flow Volume (kac-ft)	155.85	94.54	180.01	62.97	109.99	136.42	136.15	137.98	203.58	88.52	90.34	136.31	136.94	77.69	1,747.28
	TP Load (mt)	6.92	6.41	15.54	11.19	6.46	10.44	7.02	7.22	12.51	5.12	4.05	6.65	9.21	3.77	112.50
	TP FWMC (ppb)	36	55	70	144	48	62	42	42	50	47	36	40	55	39	52
G-123	Flow Volume (kac-ft)	ND	ND	ND	38.38	52.05	0.00	2.30	0	0	0	0	0	0	0	92.73
	TP Load (mt)	ND	ND	ND	0.62	1.06	0.00	0.05	0	0	0	0	0	0	0	1.72
	TP FWMC (ppb)	ND	ND	ND	13	16	NF	16	NF	NF	NF	NF	NF	NF	NF	15
S-9	Flow Volume (kac-ft)	250.35	221.59	273.61	172.05	283.62	264.30	149.71	93.40	128.47	42.46	52.63	54.68	119.30	58.17	2,164.33
	TP Load (mt)	5.25	5.19	10.13	4.88	6.72	5.58	3.39	2.14	3.06	1.00	1.28	1.30	2.95	0.97	53.83
	TP FWMC (ppb)	17	19	30	23	19	17	18	19	19	19	20	19	20	13	20
S-9A	Flow Volume (kac-ft)	NO	NO	NO	NO	NO	NO	107.61	56.58	61.35	81.35	87.80	88.50	56.05	90.05	629.28
	TP Load (mt)	NO	NO	NO	NO	NO	NO	1.74	0.83	1.21	1.31	1.52	1.26	0.91	1.36	10.14
	TP FWMC (ppb)	NO	NO	NO	NO	NO	NO	13	12	16	13	14	12	13	12	13
Total (WCA-3A)	Flow Volume (kac-ft)	476.52	363.63	551.21	310.68	530.64	488.69	513.47	382.54	543.75	279.36	254.79	362.57	398.63	266.14	5,722.63
	TP Load (mt)	19.20	16.06	38.91	24.82	23.56	25.13	26.60	21.48	45.49	25.19	9.84	23.27	20.86	8.35	328.75
	TP FWMC (ppb)	33	36	57	65	36	42	42	46	68	73	31	52	42	25	47

ND No data
 NF No flow for period
 NO Structure not operational for period

Table 1. Continued.

Non-ECP Basin Structures into Everglades National Park																
	Water Year:	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	Total
S-174	Flow Volume (kac-ft)	NA	NA	NA	8.92	13.97	6.34	5.48	30.06	9.20	0.001	0 ⁺	0 ⁺	0 ⁺	0 ⁺	73.97
	TP Load (mt)	NA	NA	NA	0.08	0.12	0.07	0.04	0.45	0.16	0.00	0 ⁺	0 ⁺	0 ⁺	0 ⁺	0.91
	TP FWMC (ppb)	NA	NA	NA	7	7	8	6	12	14	5	NF ⁺	NF ⁺	NF ⁺	NF ⁺	10
S-175	Flow Volume (kac-ft)	28.49	17.05	97.54	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	143.07
	TP Load (mt)	0.28	0.13	0.96	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1.37
	TP FWMC (ppb)	8	6	8	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	8
S-18C	Flow Volume (kac-ft)	226.42	127.27	193.26	151.70	172.84	134.93	158.81	100.69	188.51	80.36	124.38	173.10	249.36	130.13	2,211.74
	TP Load (mt)	2.79	1.88	1.91	1.68	1.53	1.20	1.85	0.99	3.30	0.69	1.16	1.55	1.95	1.21	23.69
	TP FWMC (ppb)	10	12	8	9	7	7	9	8	14	7	8	7	6	8	9
S-332	Flow Volume (kac-ft)	160.03	107.19	199.95	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	467.17
	TP Load (mt)	1.38	0.93	1.73	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	4.03
	TP FWMC (ppb)	7	7	7	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	7
S-332D	Flow Volume (kac-ft)	NO	NO	NO	NO	144.18	90.24	128.00	76.48	153.80	45.05	32.69	144.49	181.20	105.08	1,101.22
	TP Load (mt)	NO	NO	NO	NO	0.94	0.68	0.91	0.59	2.06	0.30	0.26	1.28	1.82	1.89	10.71
	TP FWMC (ppb)	NO	NO	NO	NO	5	6	6	6	11	5	6	7	8	15	8
Total (Everglades National Park)	Flow Volume (kac-ft)	414.94	251.50	490.74	160.61	330.99	231.51	292.30	207.23	351.51	125.41	157.07	317.59	430.55	235.21	3,997.16
	TP Load (mt)	4.46	2.94	4.60	1.76	2.58	1.94	2.79	2.02	5.51	0.99	1.42	2.83	3.77	3.10	40.72
	TP FWMC (ppb)	9	9	8	9	6	7	8	8	13	6	7	7	7	11	8

* Structure S-174 was plugged in September 2007

N/A Not applicable; flow and load calculation at S-175 and S-332 replaced in WY2001 with S-174 and S-332D

NF No flow for period

NO Structure not operational for period

Feeder Canal Basin

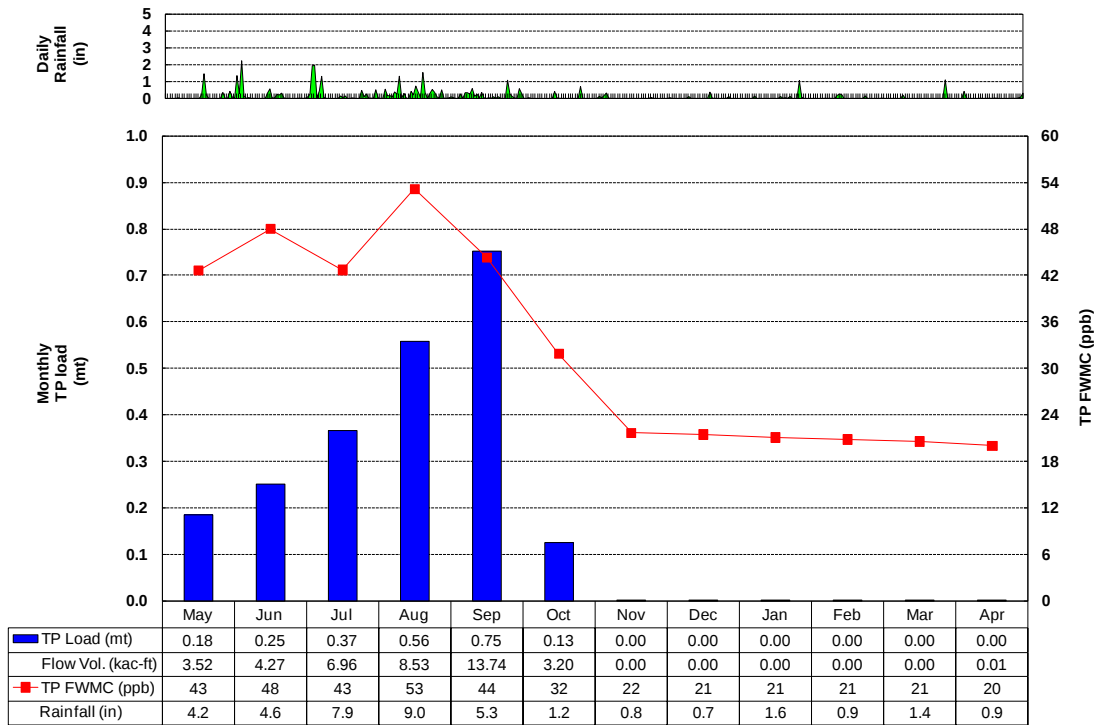


Figure 1. Feeder Canal Basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom).

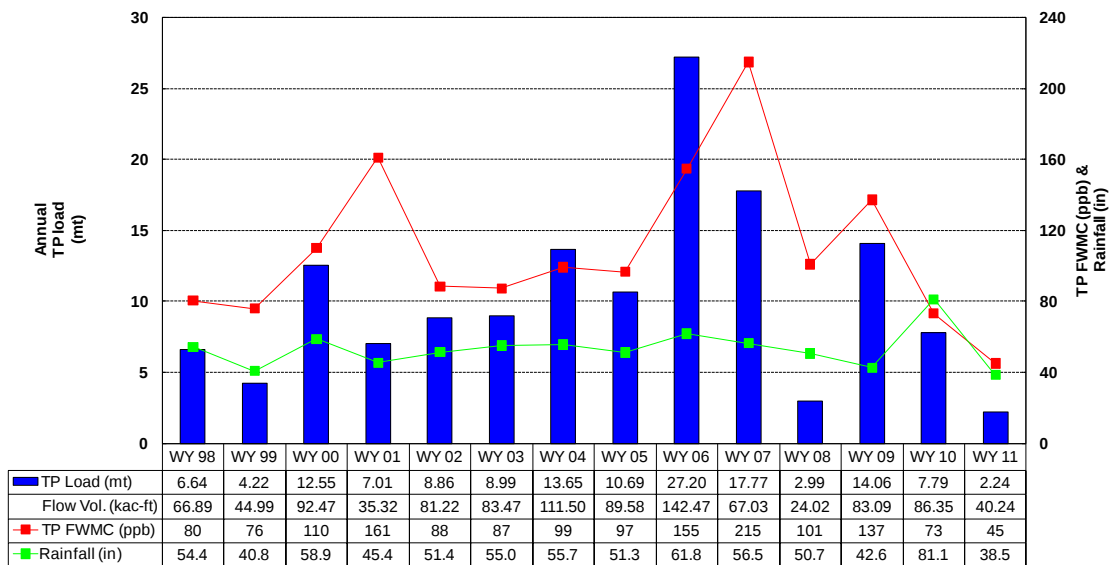


Figure 2. Feeder Canal Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011.

L-28 Basin

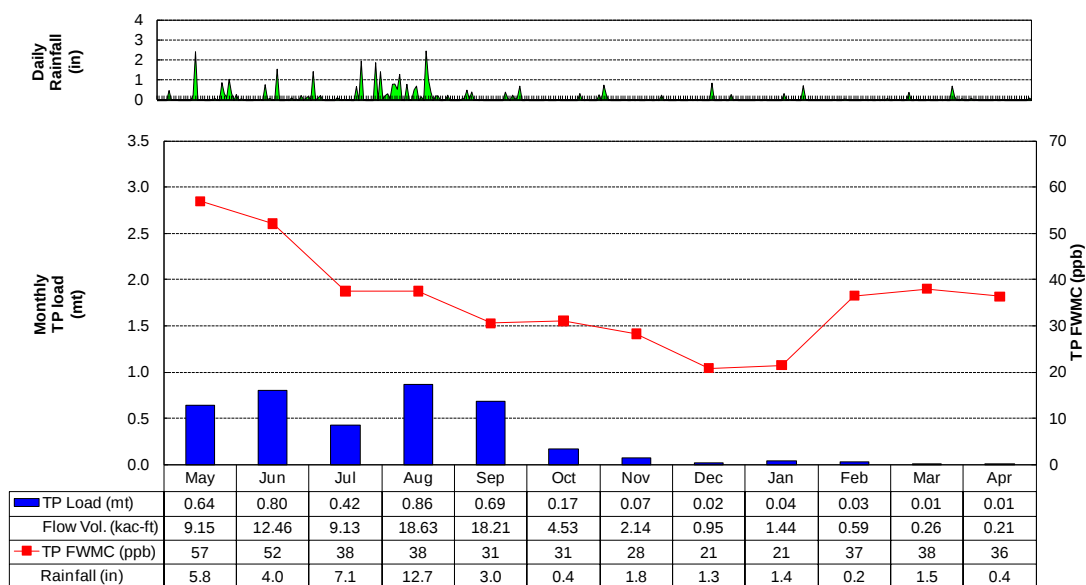


Figure 3. L-28 Basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom).

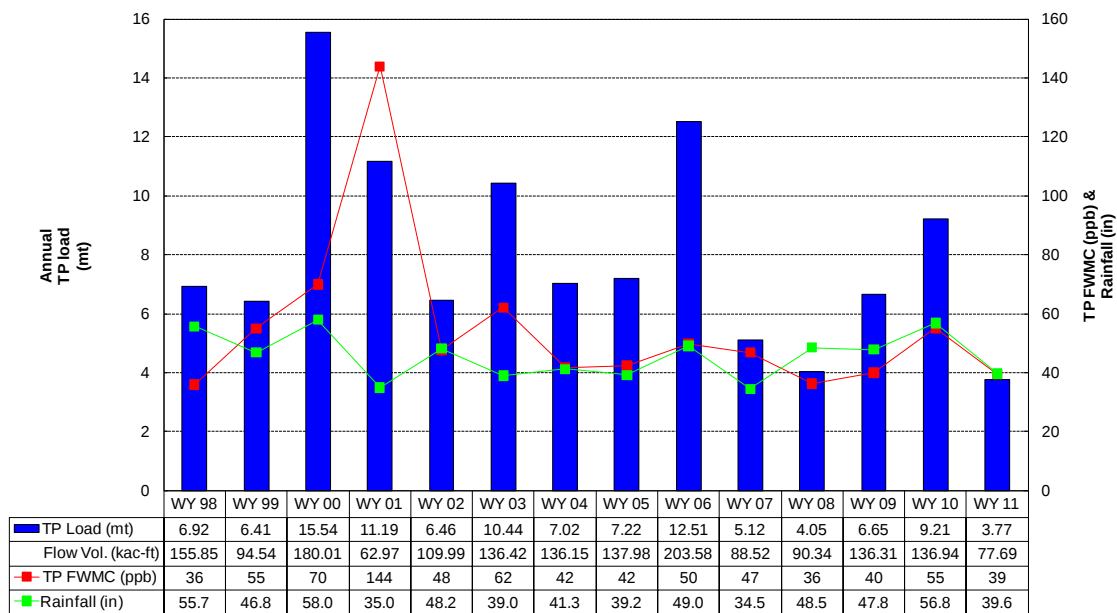


Figure 4. L-28 Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011.

C-111 Basin

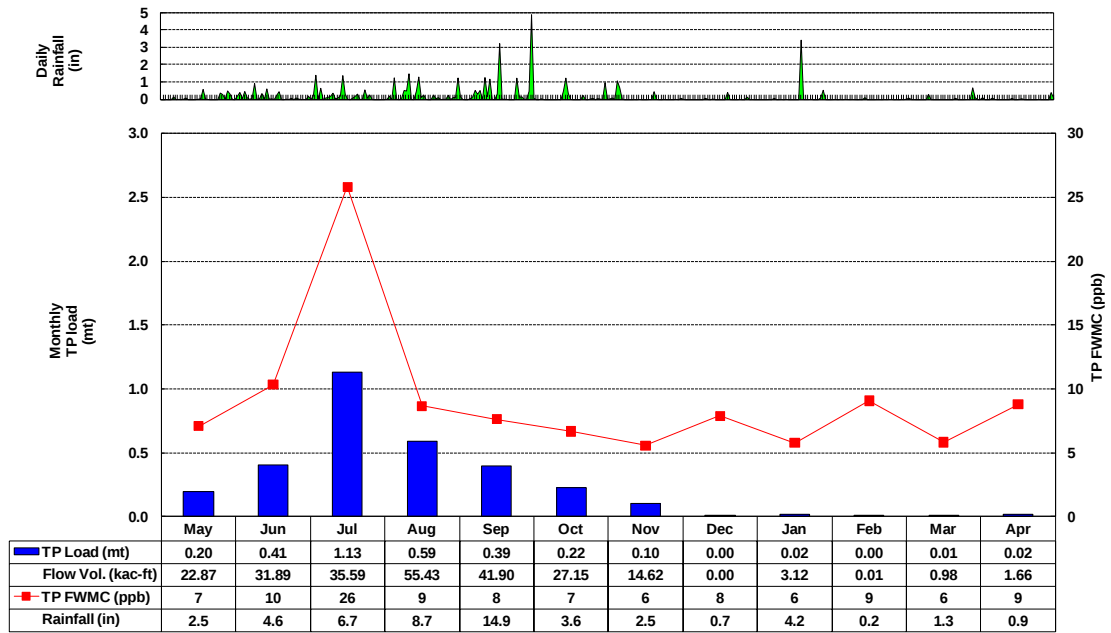


Figure 5. C-111 Basin daily rainfall (top) and the monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom).

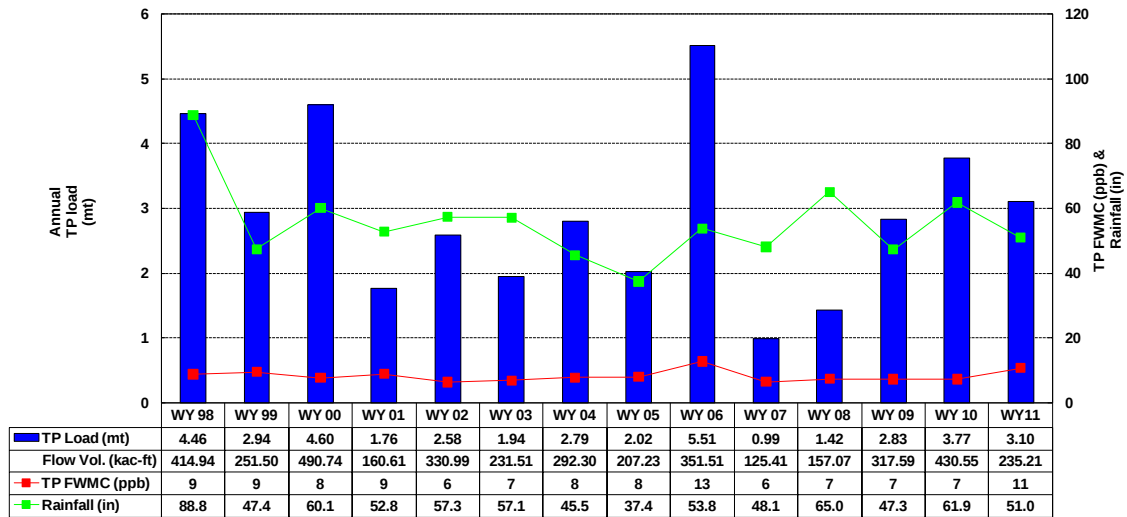


Figure 6. C-111 Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011.

[Notes: WY1998–WY2000 represented by structures S-18C, S-175, and S-332;
WY2001–WY2009 represented by structures S-18C, S-174, and S-332D;
Structure S-174 was plugged in September 2007.]

C-11 West Basin

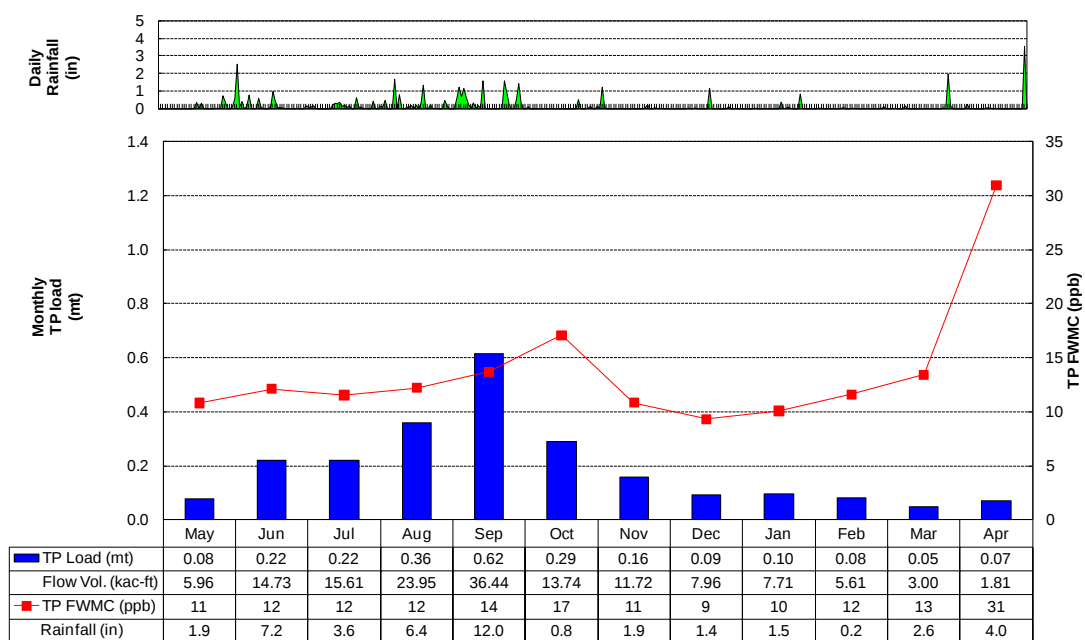


Figure 7. C-11 West Basin daily rainfall (top) and the monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom).

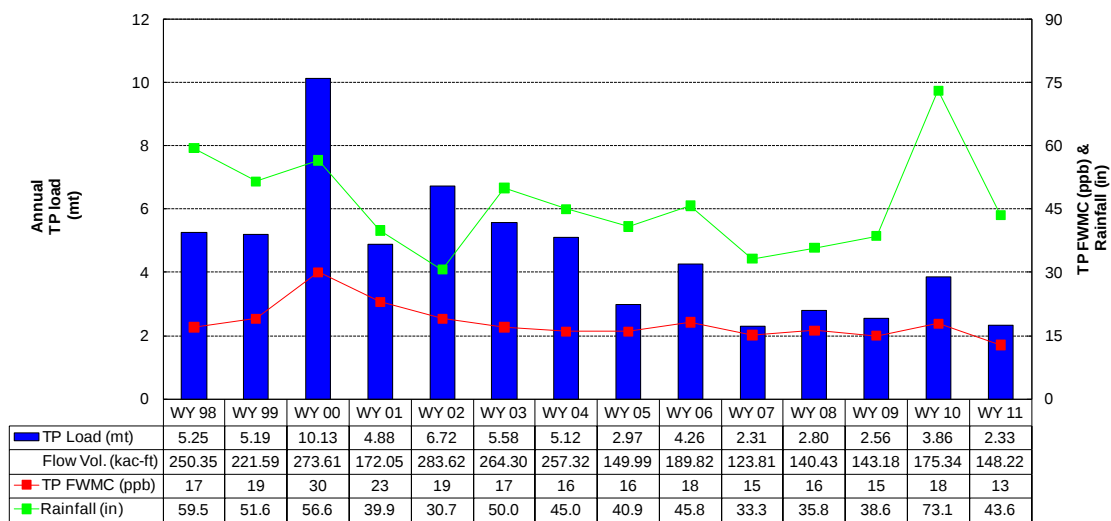


Figure 8. C-11 West Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011.

North New River Canal Basin

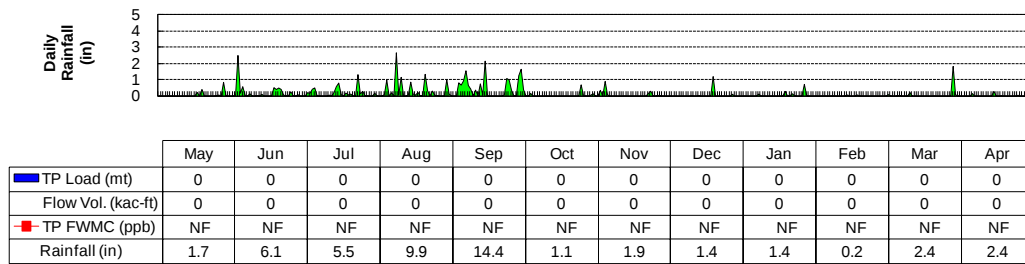


Figure 9. North New River Canal Basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom). [Note: NF = no flow for period.]

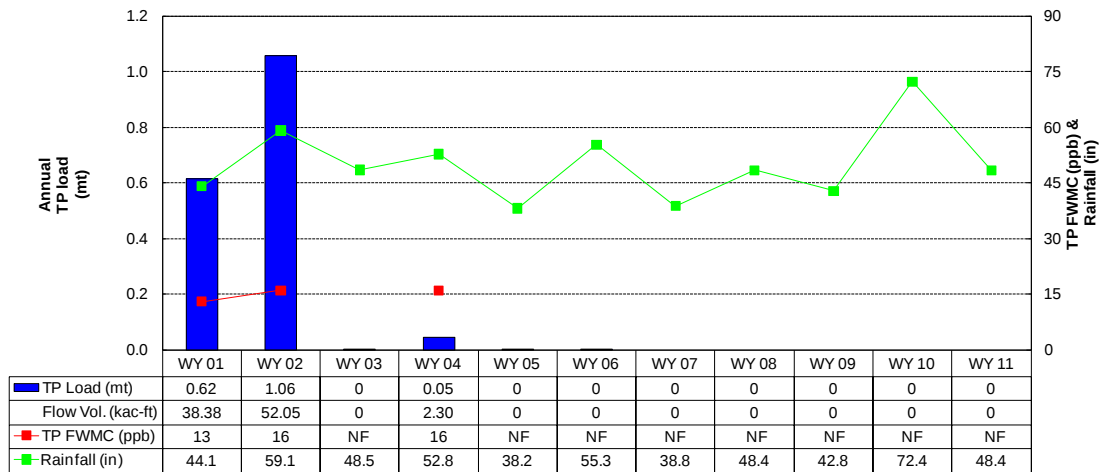


Figure 10. North New River Canal Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2001–WY2011. [Notes: NF = no flow for period; G-123 flow and water quality data incomplete prior to WY2001.]

North Springs Improvement District Basin

NF = no flow for period

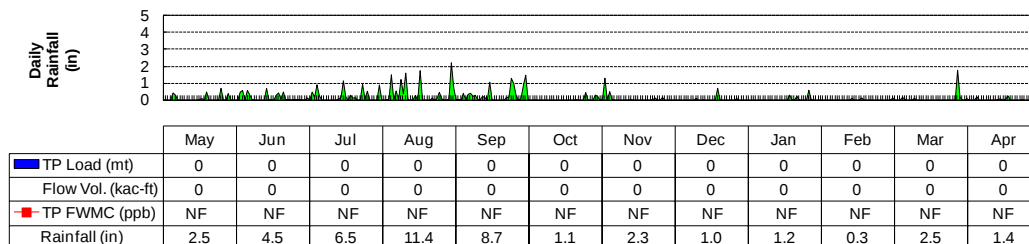
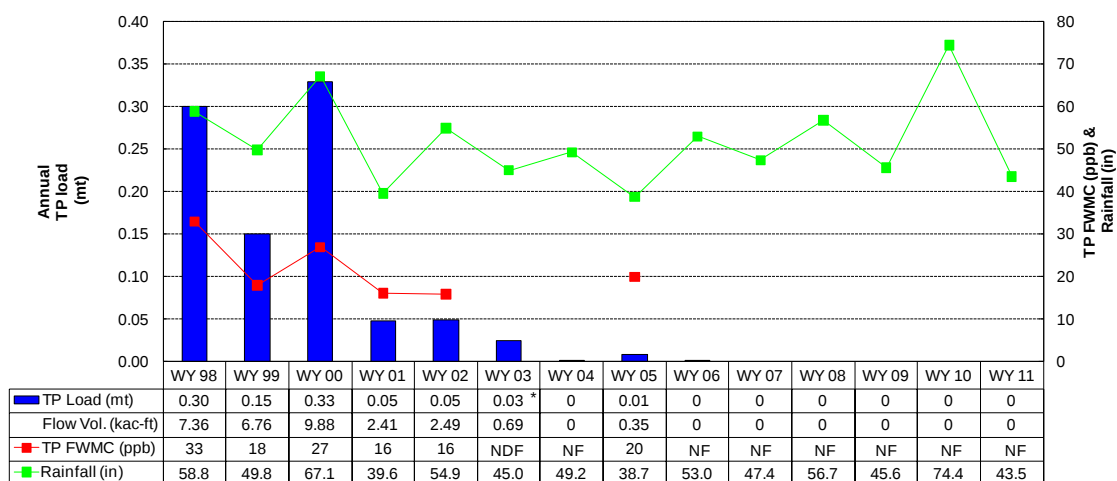


Figure 11. North Springs Improvement District Basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY2011 (bottom). [Note: NF = no flow for period.]



* calculated with annual flow and arithmetic mean concentration

Figure 12. North Springs Improvement District Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011. [Notes: NF = no flow for period; NDF = no data with flow available.]

Acme Improvement District Basin

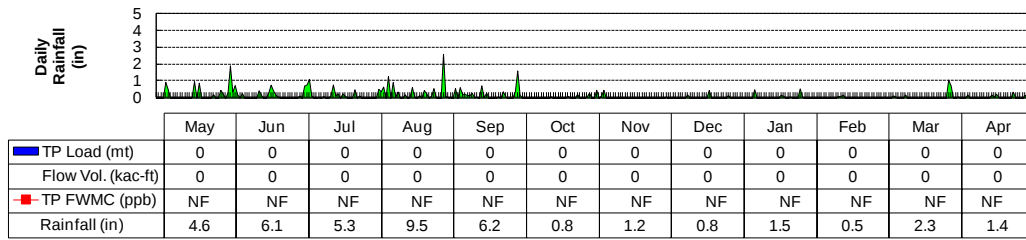


Figure 13. Acme Improvement District Basin daily rainfall (top) and monthly TP load, FWM TP concentration, rainfall, and flow volume to EPA for WY2011 (bottom). [Note: NF = no flow for period.]

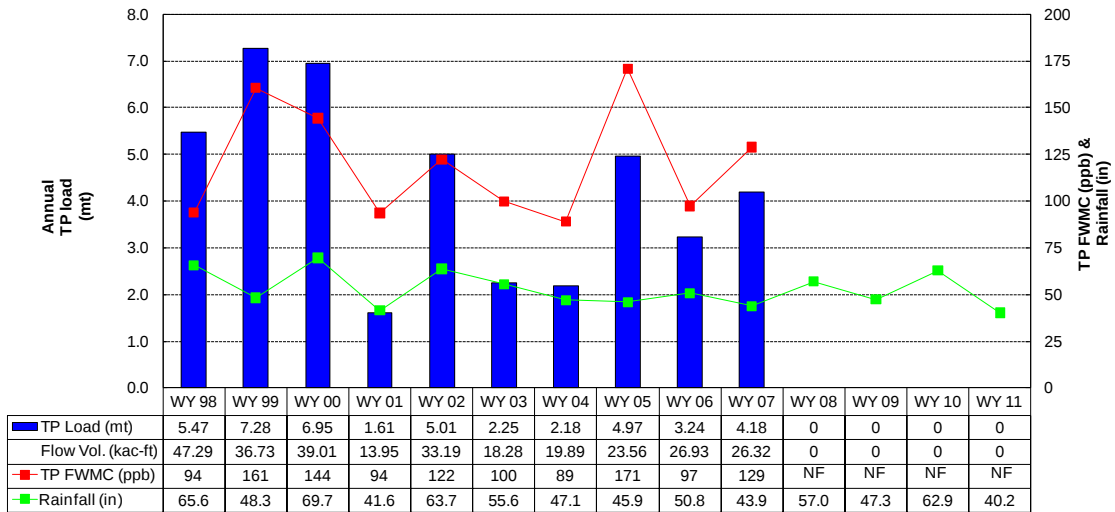


Figure 14. Acme Improvement District Basin annual TP load, FWM TP concentration, rainfall, and flow volume to the EPA for WY1998–WY2011. [Notes: NF = no flow for period; pump stations ACME1 and ACME2 stopped operation in December 2006.]

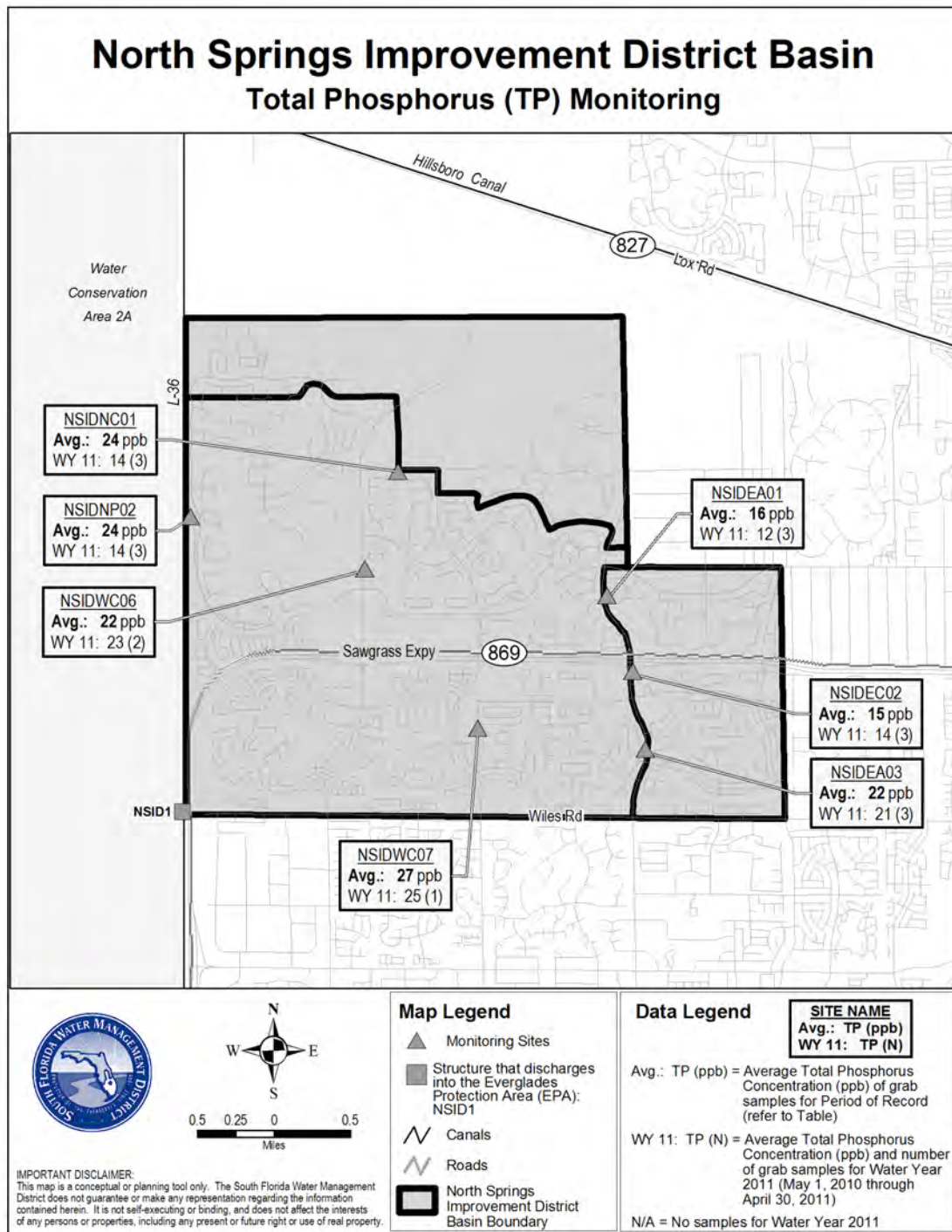


Figure 15. Summary of TP data (ppb) for North Springs Improvement District Basin upstream monitoring sites.

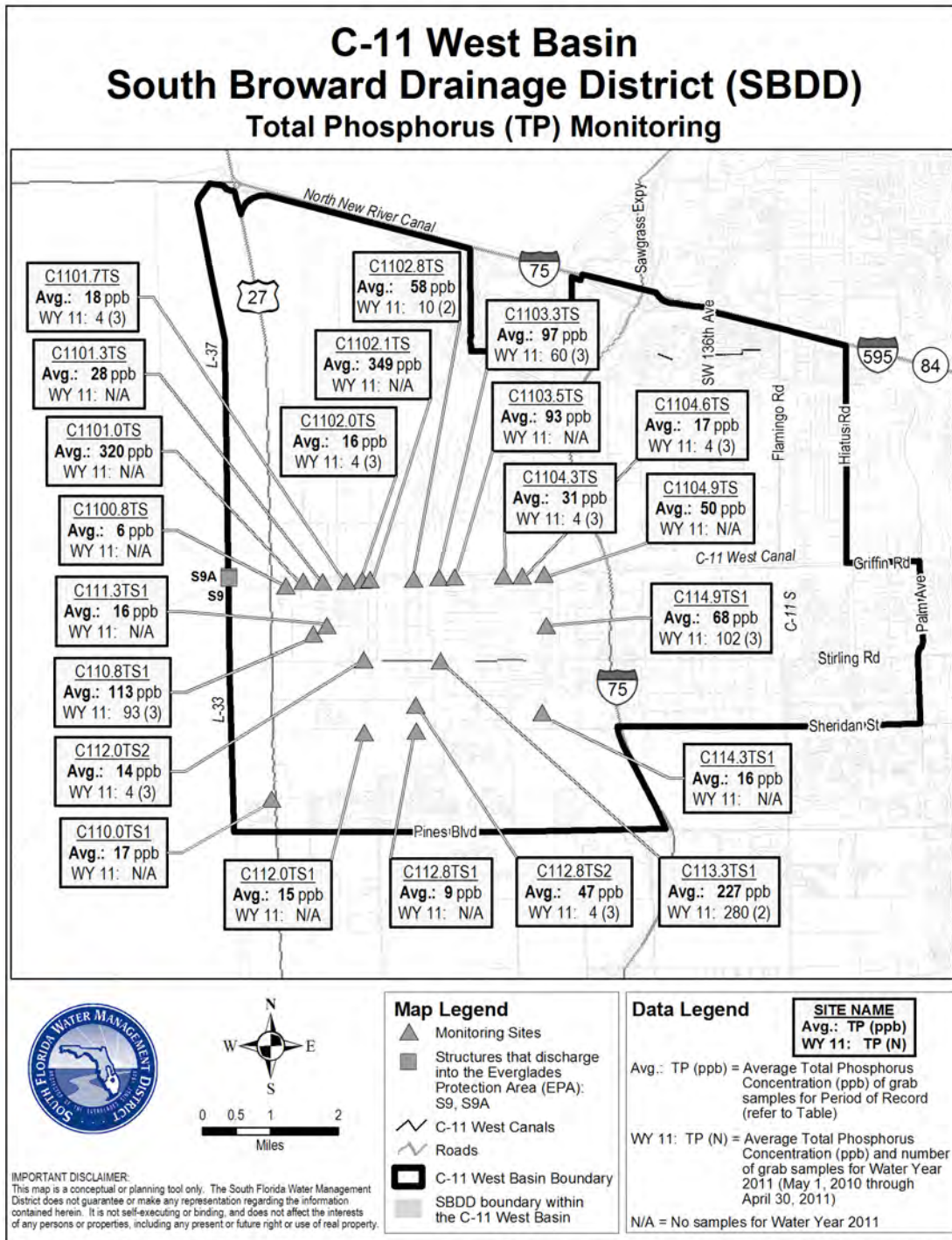


Figure 16. Summary of TP data (ppb) for South Broward Drainage District upstream monitoring sites within the C-11 West Basin.

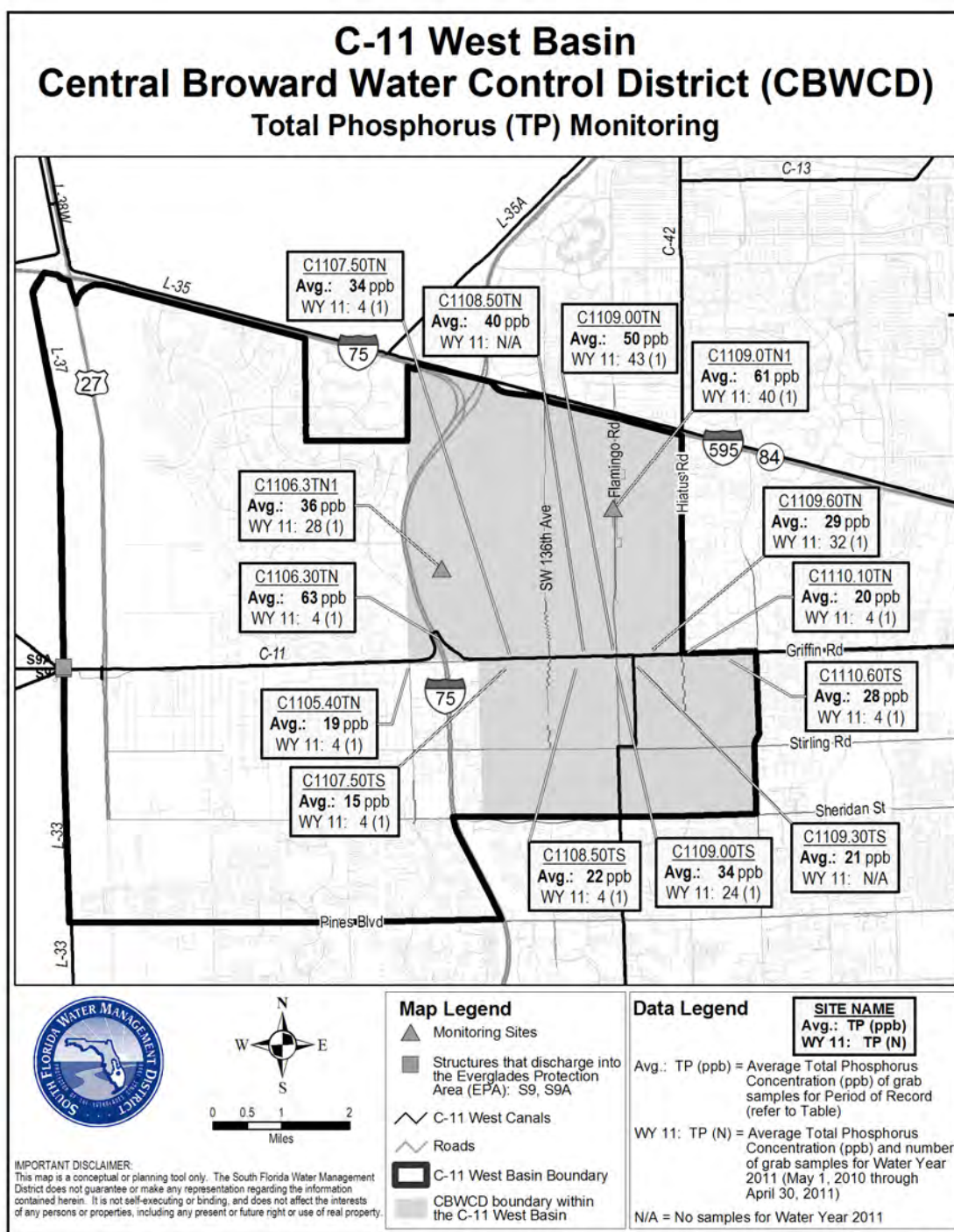


Figure 17. Summary of TP data (ppb) for Central Broward Water Control District upstream monitoring sites within the C-11 West Basin.

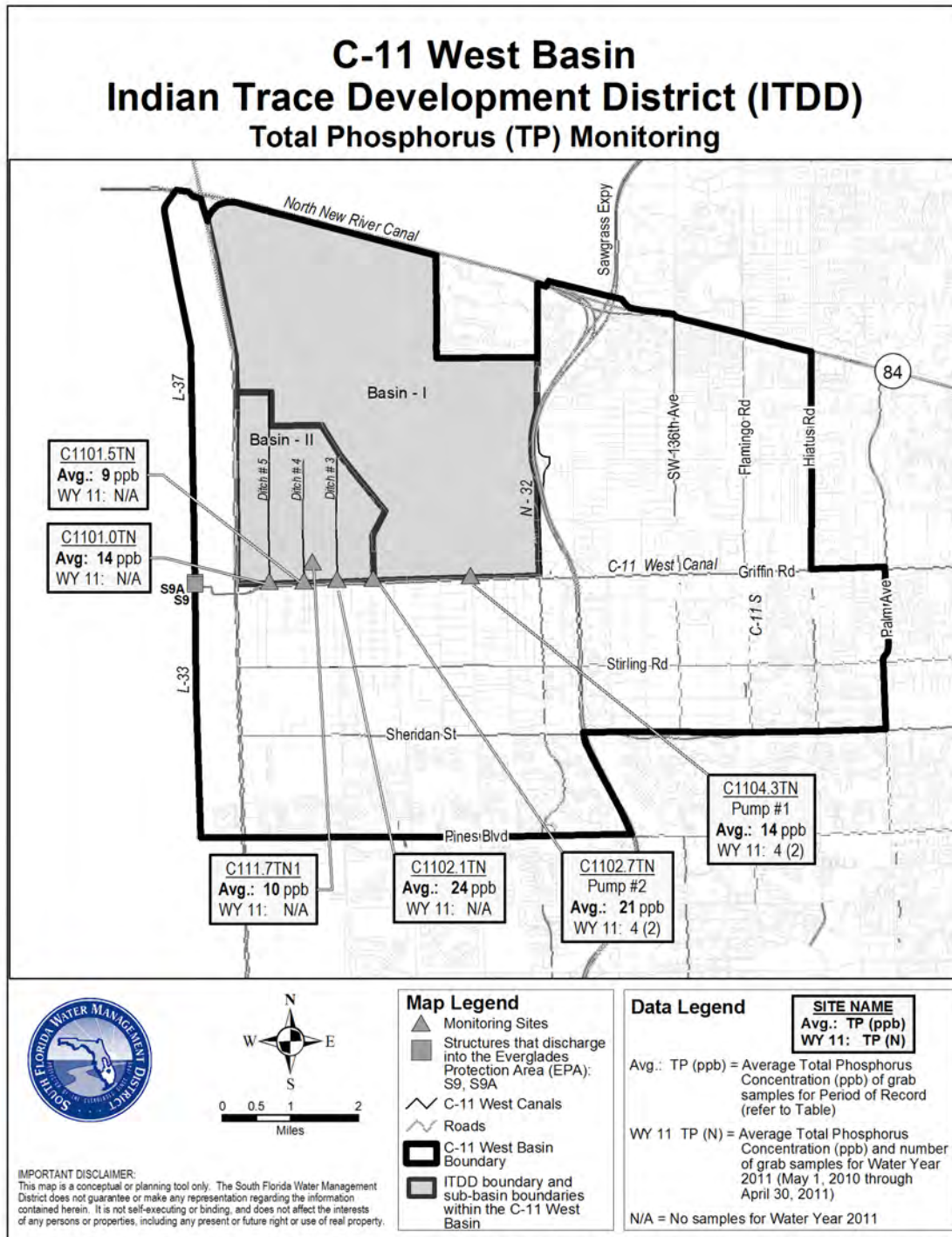


Figure 18. Summary of TP data (ppb) for Indian Trace Drainage District upstream monitoring sites within the C-11 West Basin.

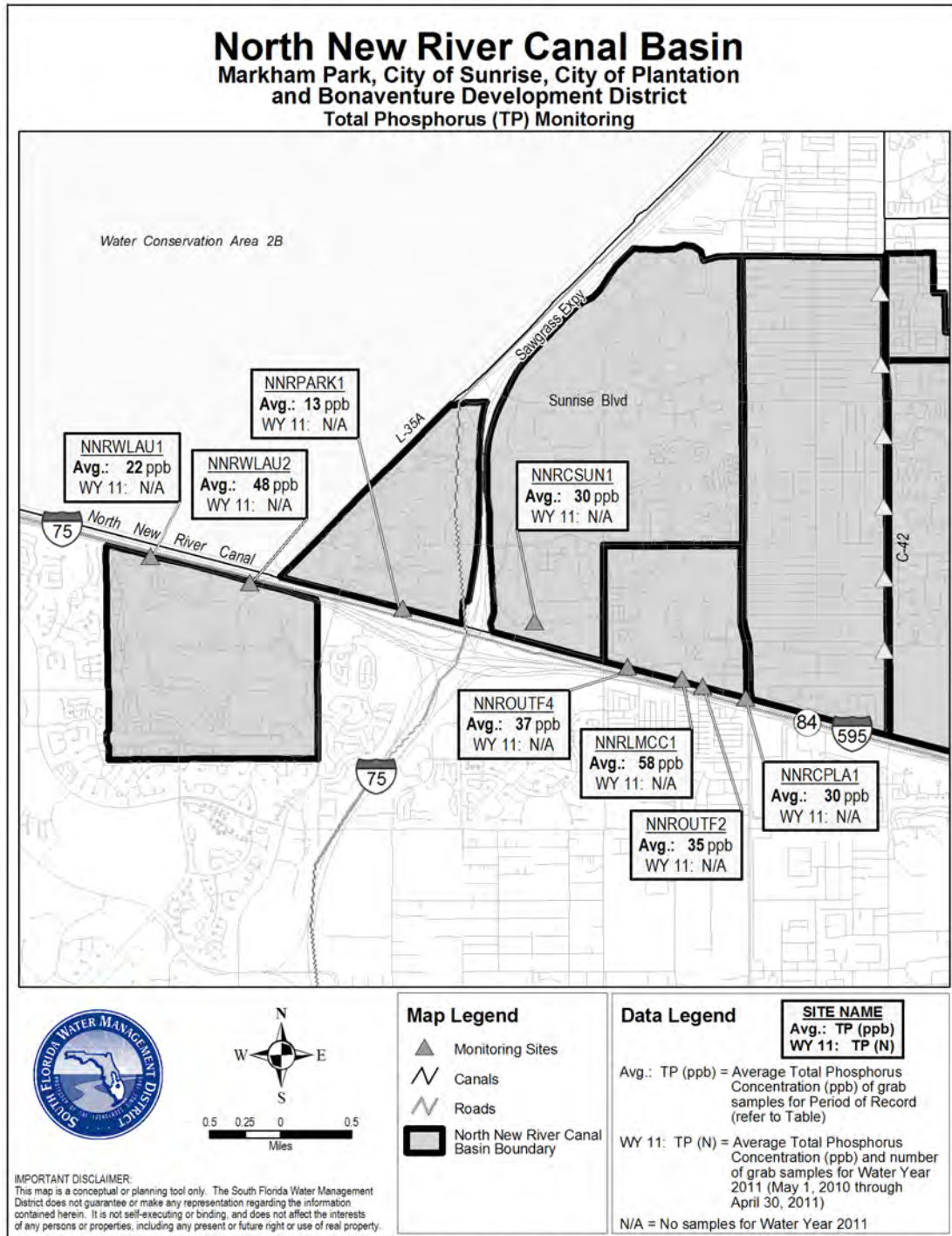


Figure 19. Summary of TP data (ppb) for North New River Canal Basin (west) upstream monitoring sites.

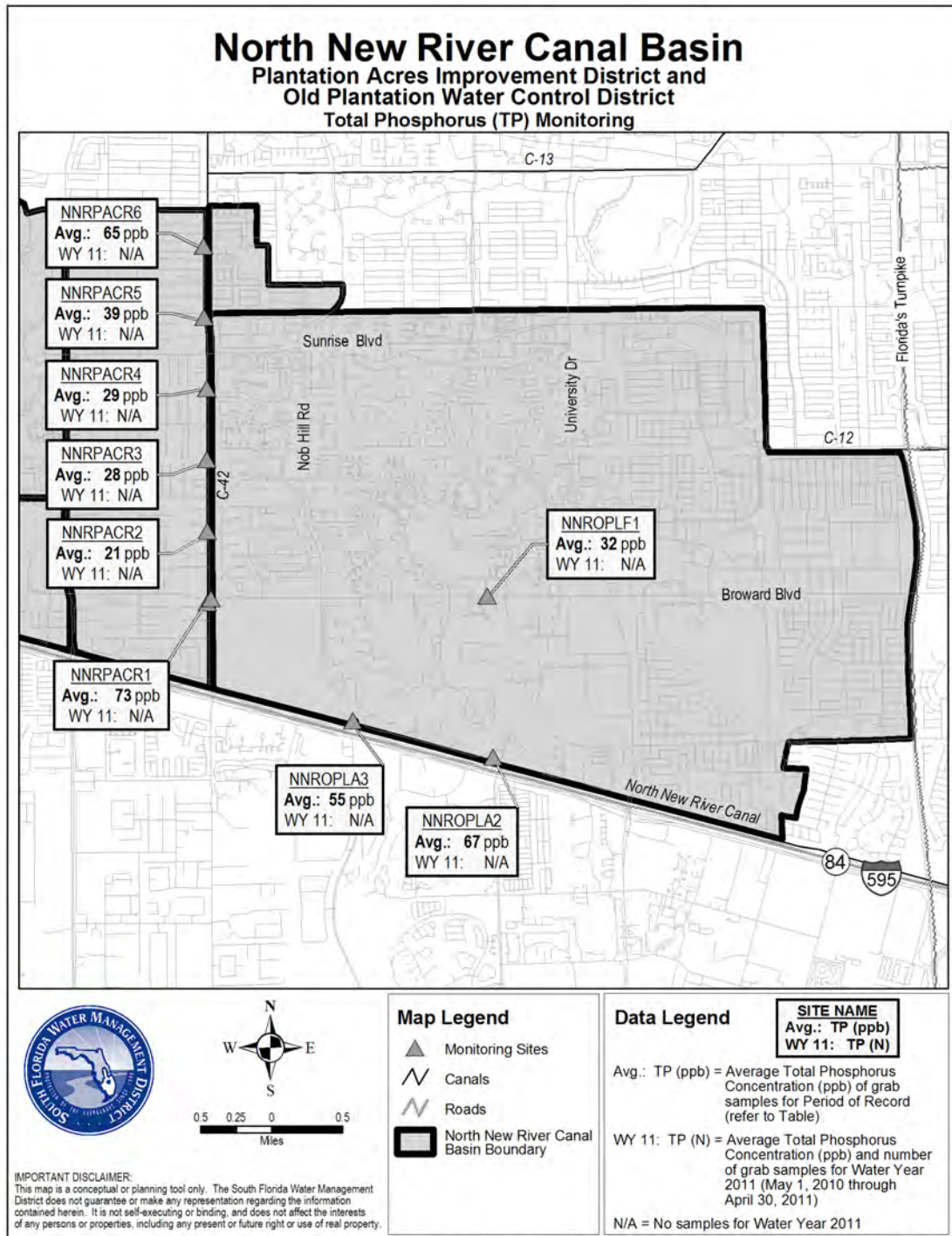


Figure 20. Summary of TP data (ppb) for North New River Canal Basin (east) upstream monitoring sites.

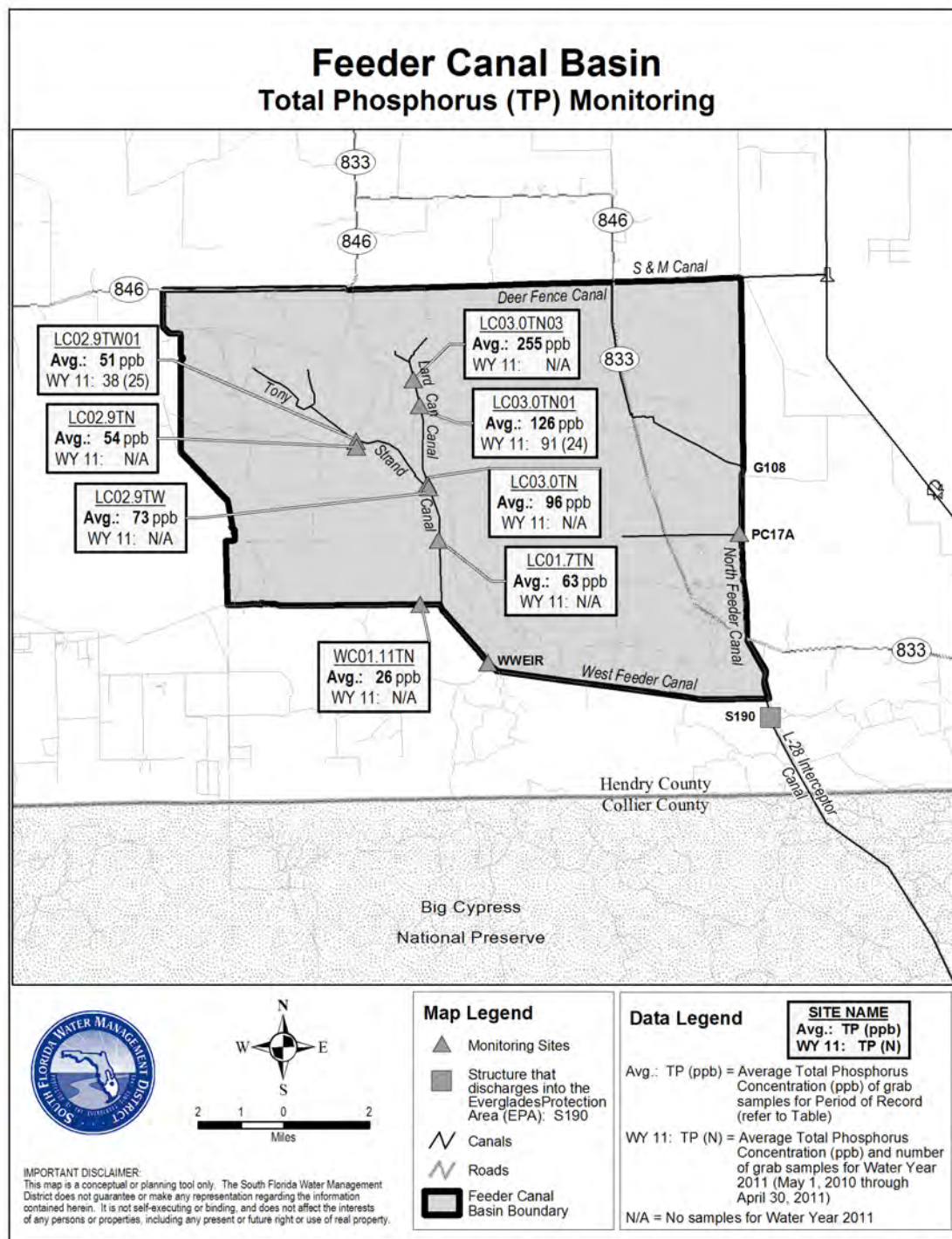


Figure 21. Summary of TP data (ppb) for Feeder Canal Basin upstream monitoring sites. [Note: Synoptic survey data available in the 2006 SFER – Volume I, Appendix 3-2f.]

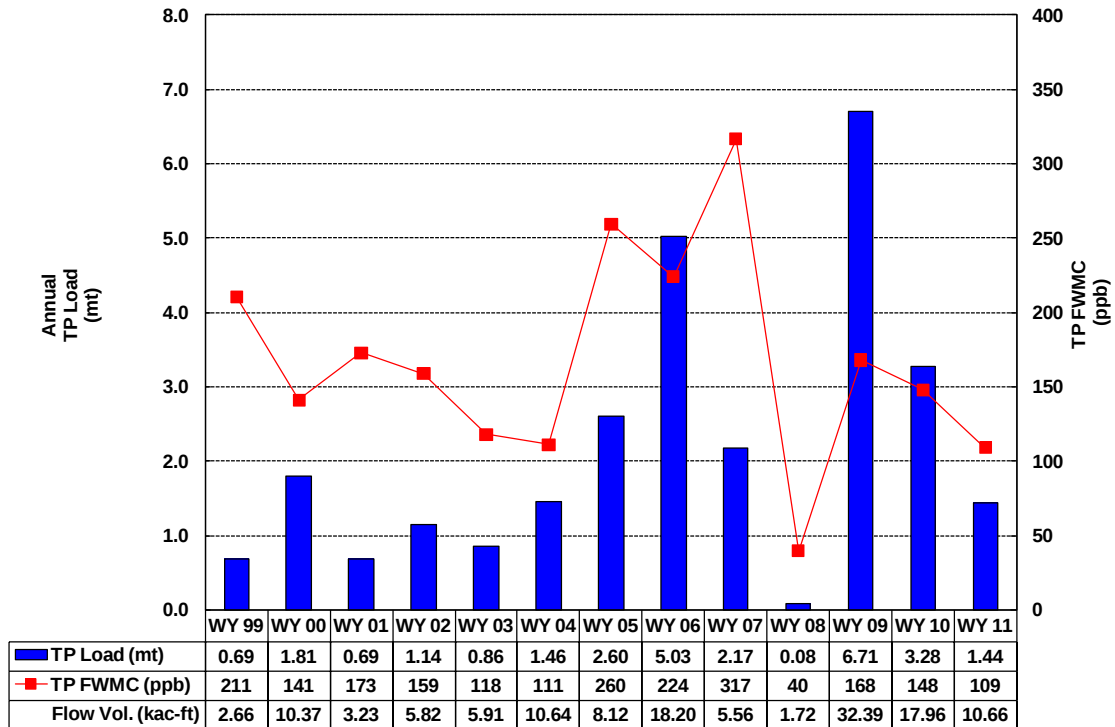


Figure 22. TP load, TP FWMC, and flow volume for upstream structure PC-17A in the Feeder Canal Basin from WY1999–WY2011.

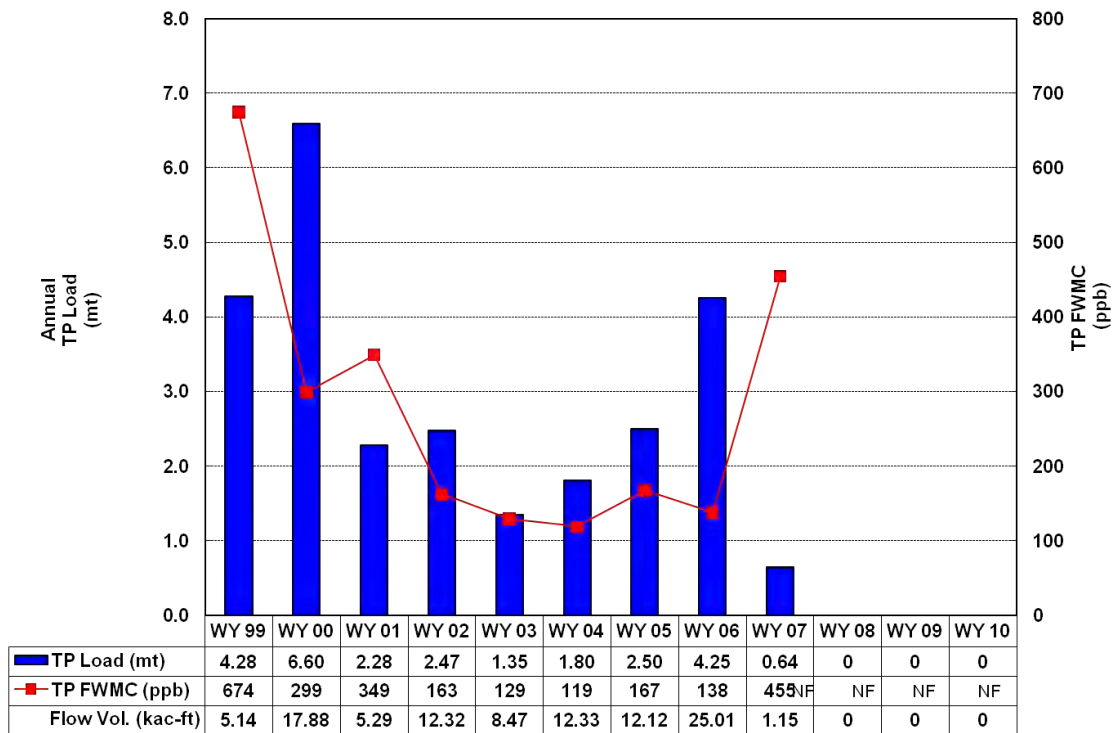


Figure 23. TP load, TP FWMC, and flow volume for upstream structure G-108 in the Feeder Canal Basin from WY1999–WY2010 [Notes: NF = no flow for period; structure G-108 was removed in April 2010.]

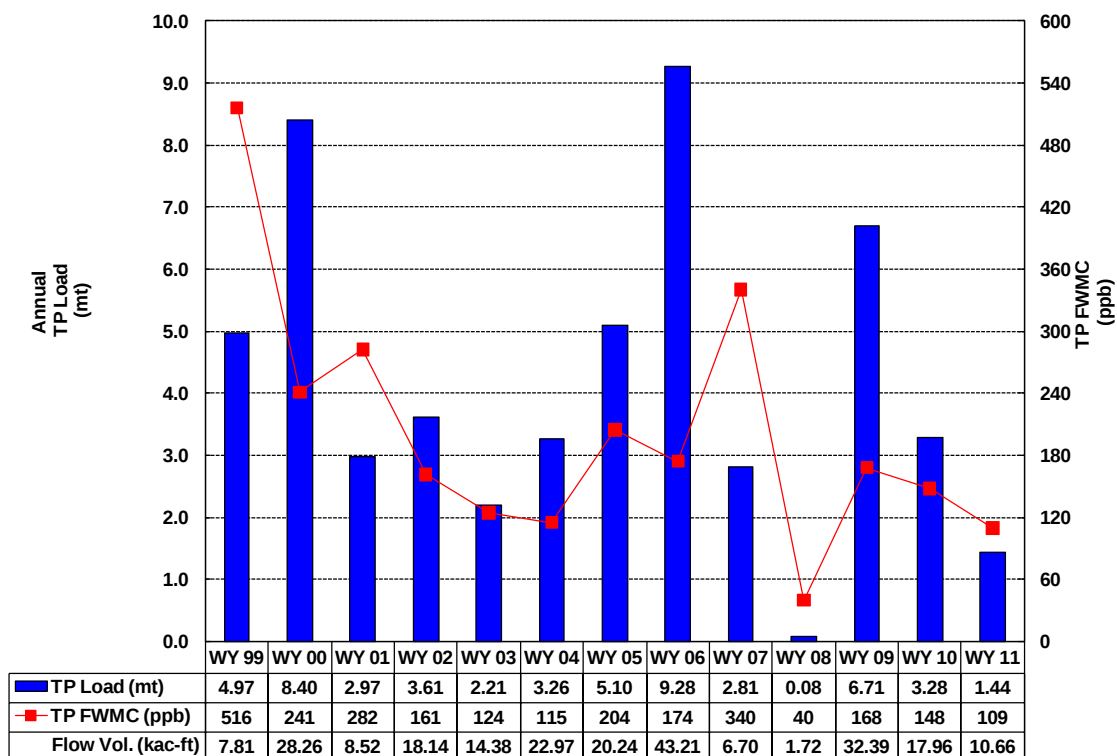


Figure 24. TP load, TP FWMC, and flow volume for upstream combined structures PC-17A and G-108 in the Feeder Canal Basin from WY1999–WY2011.

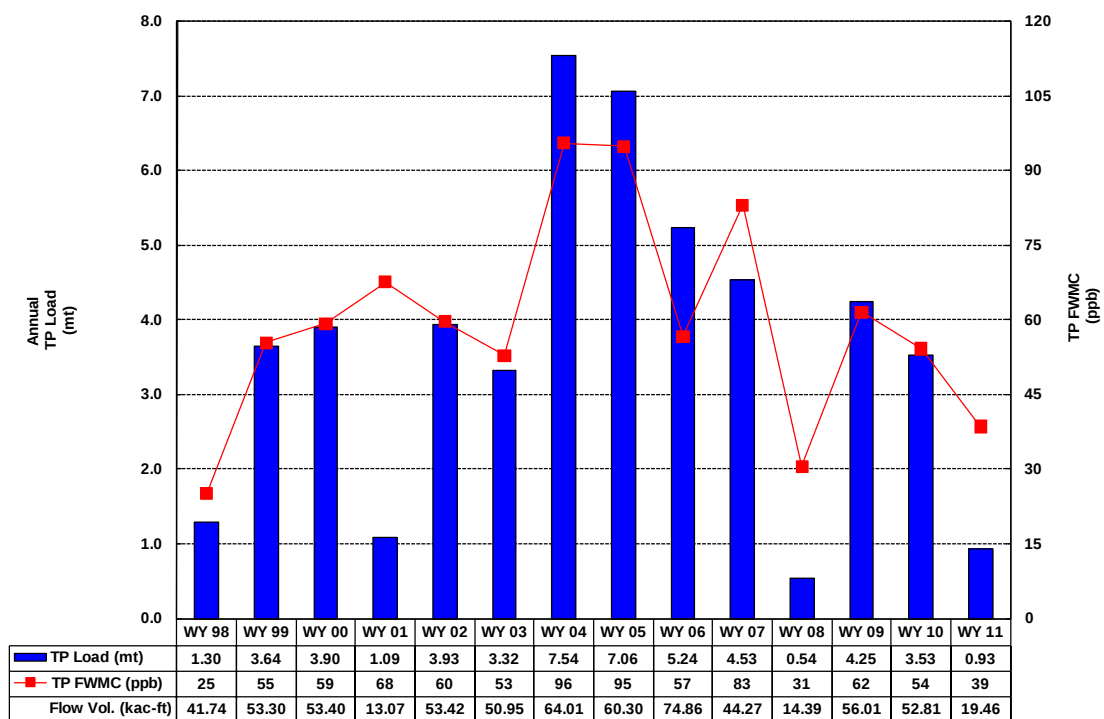


Figure 25. TP load, TP FWMC, and flow volume for upstream structure WWEIR in the Feeder Canal Basin from WY1999–WY2011.

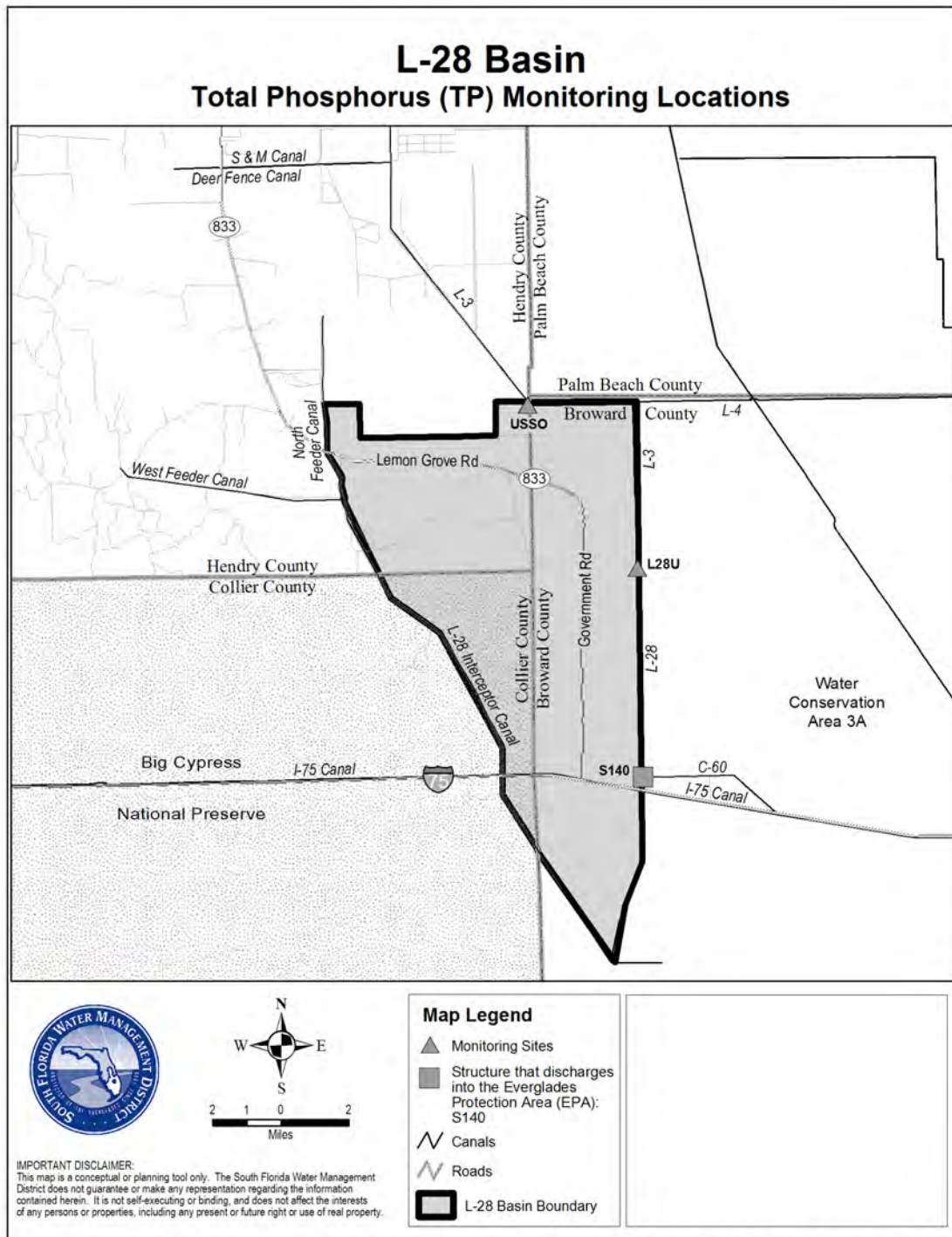


Figure 26. Location map of L-28 Basin upstream monitoring sites.

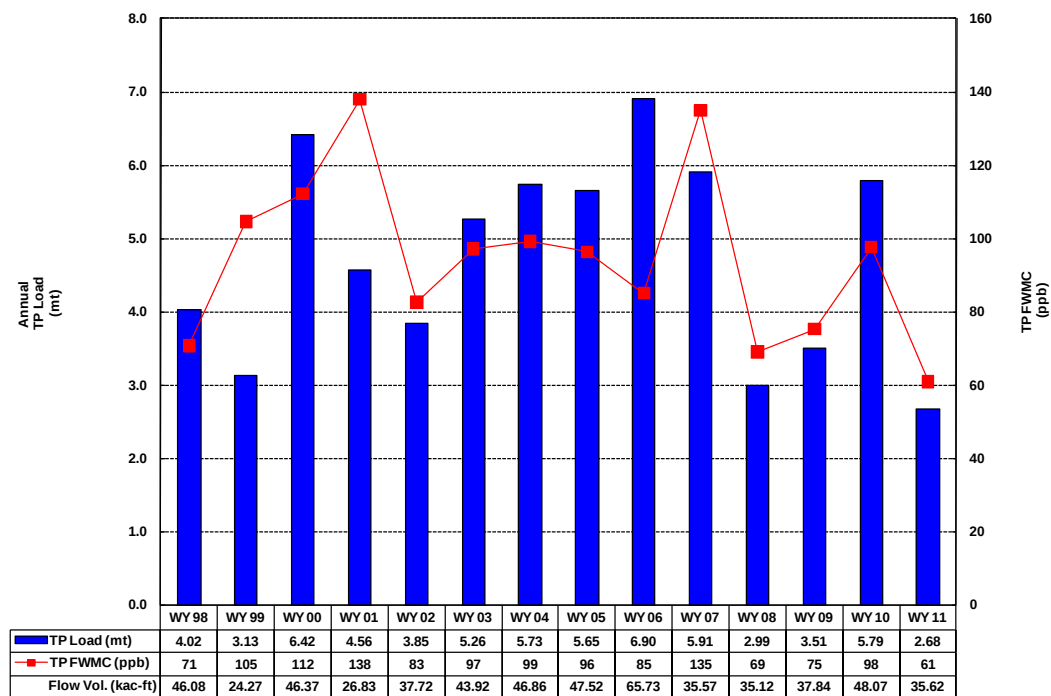


Figure 27. TP load, TP FWMC, and flow volume for upstream structures USSO in the L-28 Basin from WY1998–WY2011.

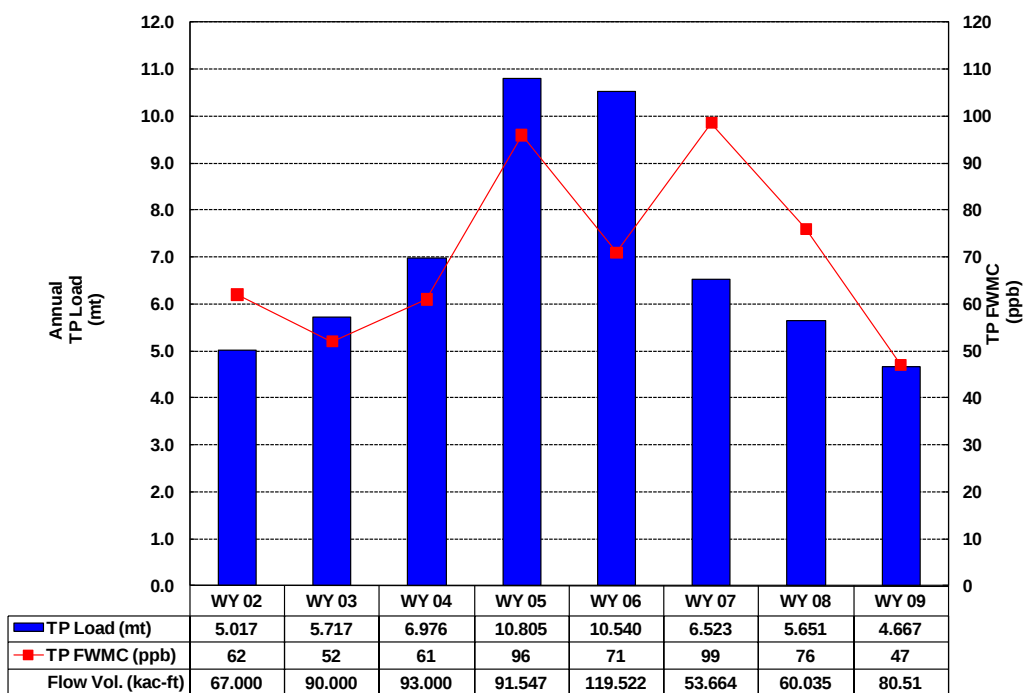


Figure 28. TP load, TP FWMC, and flow volume for upstream structures L28U in the L-28 Basin from WY2002–WY2009. [Note: L28U data subsequent to WY09 not processed at the time of this report.]

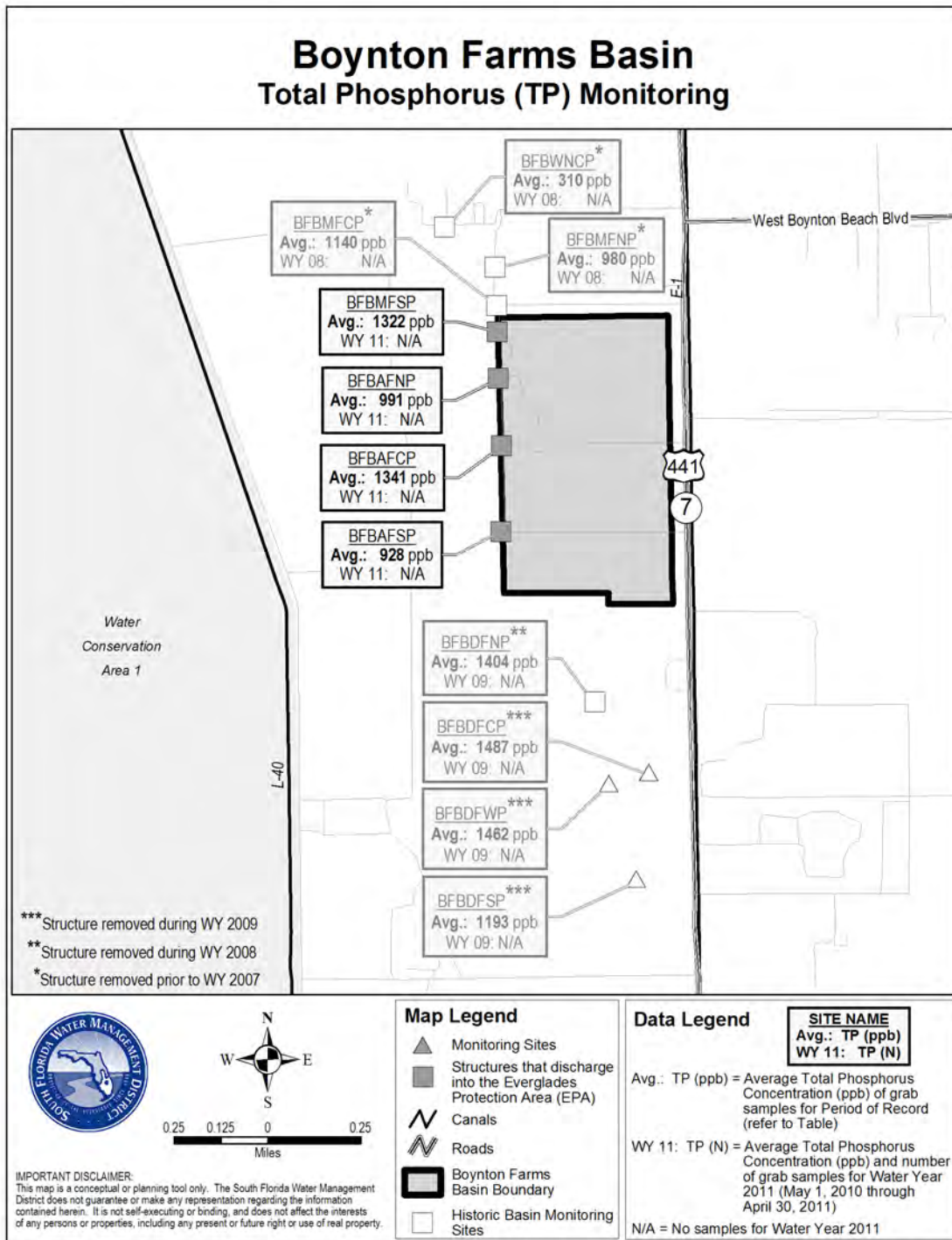


Figure 29. Summary of TP data (ppb) for Boynton Farms Basin monitoring sites.

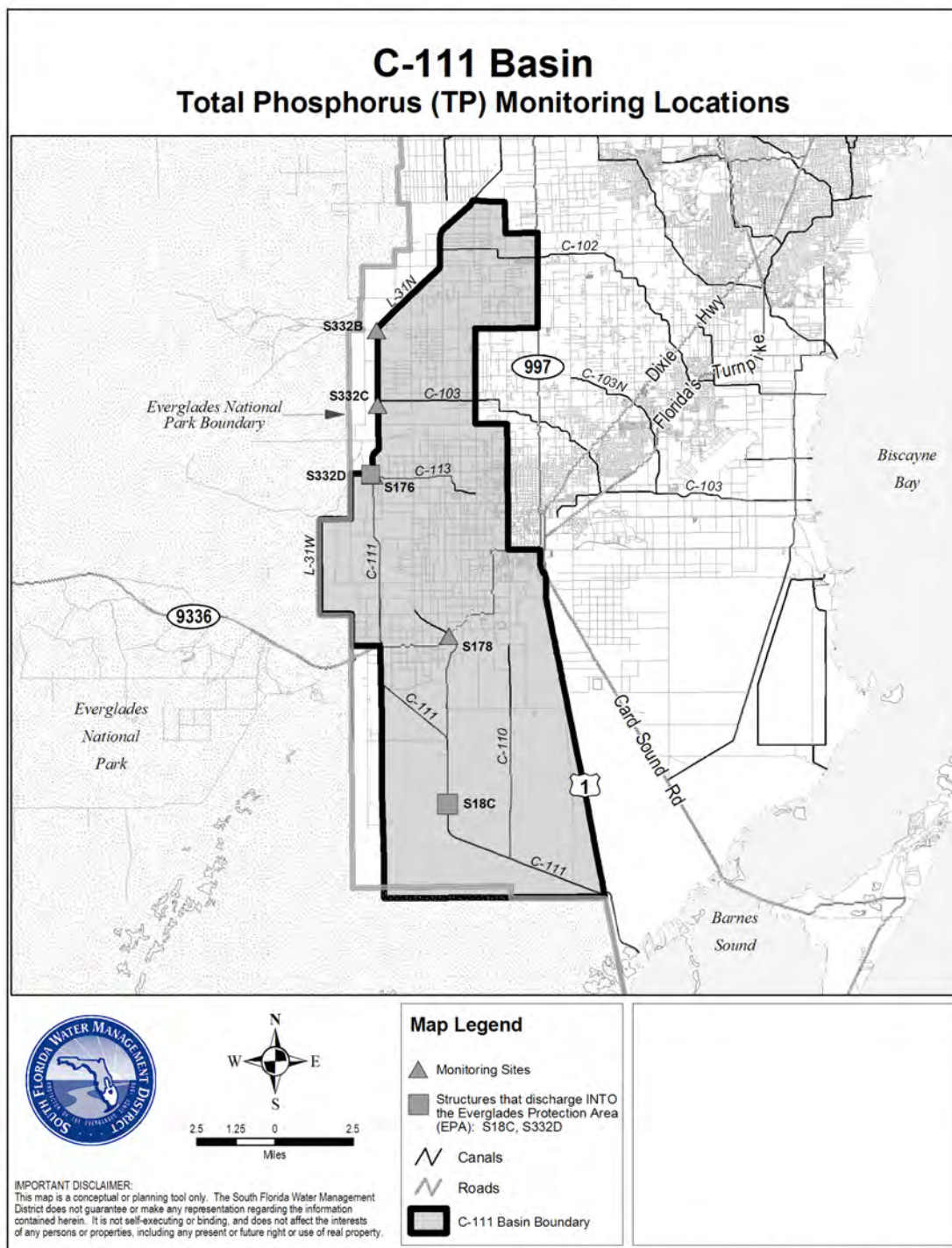


Figure 30. C-111 Basin monitoring sites
(see Appendix 3A-7 of this volume for upstream data).

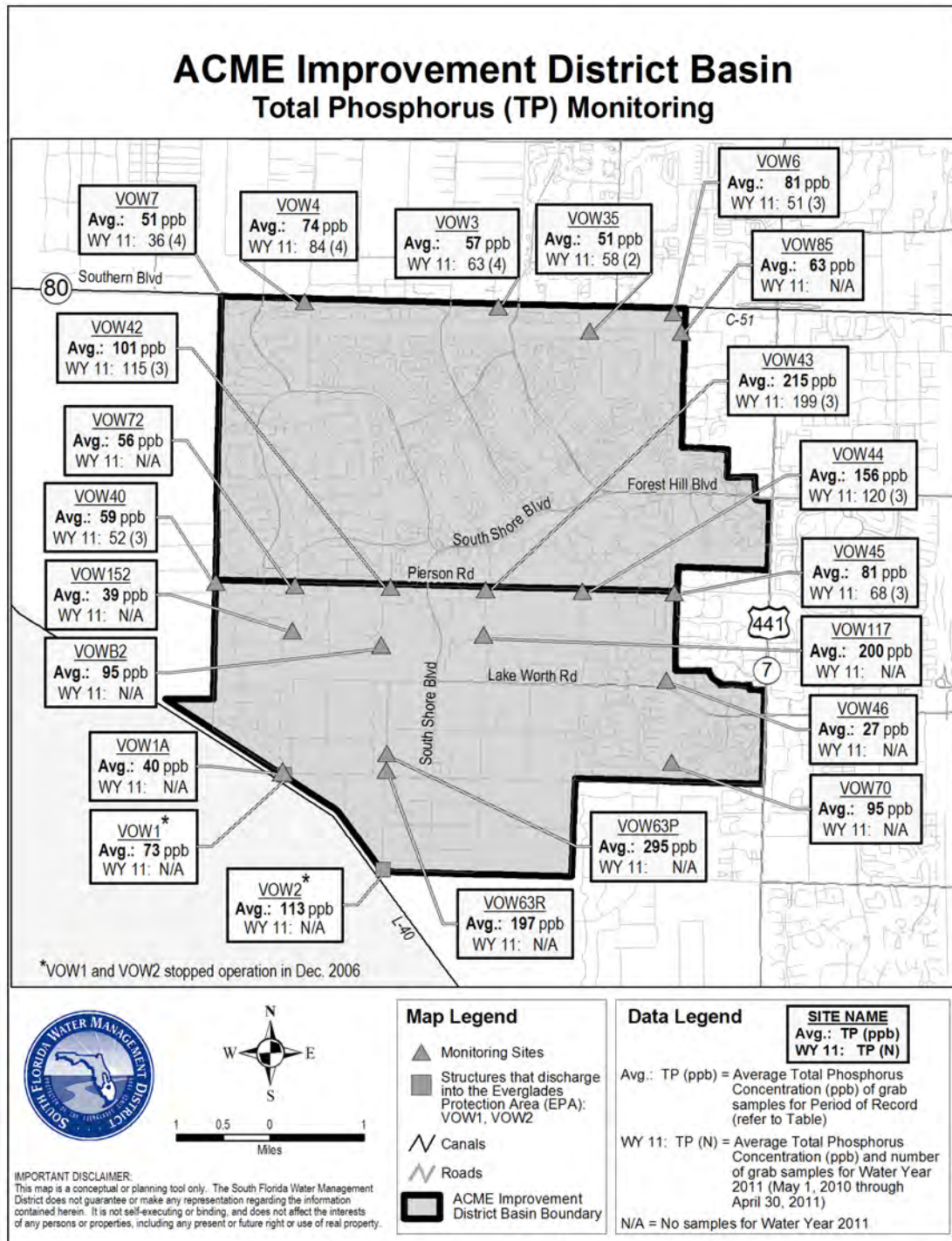


Figure 31. Summary of TP data (ppb) Village of Wellington upstream monitoring sites in the Acme Improvement District Basin.