Appendix 8B-1: Annual Permit Compliance Monitoring Report for Non-ECP Discharge Structures

Shi Kui Xue, Steven Hill, Richard Pfeuffer
and Cheol Mo

INTRODUCTION

The non-Everglades Construction Project (non-ECP) permit (FDEP No. 06,502590709) authorizes the South Florida Water Management District (SFWMD or District) to operate and maintain structures (currently 38) in compliance with the reporting requirements stated in Specific Conditions 5 and 12 of the non-ECP Permit.

METHODS

WATER QUALITY AND HYDROLOGIC DATA

The water quality and hydrologic data evaluated in this appendix were retrieved from the District's DBHYDRO database. Before water quality data are entered into the database, the District follows strict quality assurance/quality control (QA/QC) procedures outlined in the Florida Department of Environmental Protection (FDEP)-approved Comprehensive Quality Assurance Plan (CompQAP, No. 870166G). The CompQAP (SFWMD, 1999a) provides assurances that the water quality monitoring program is providing accurate data and that sufficient progress is being made toward achieving water quality standards.

Methods for hydrological data collection are documented in the Guidelines for the Collection of Hydrologic and Meteorologic Data (SJRWMD et al., 1994). Procedures for QA/QC of hydrological data are found in Guidelines for Quality Control and Quality Assurance of Hydrologic and Meteorological Data (SJRWMD et al., 1999).

PERMIT SAMPLING SITES

In addition to authorizing the operation and maintenance of non-ECP structures, the permit requires a routine water quality monitoring program to characterize the quality of water discharged through District structures. Currently, the non-ECP permit requires monitoring at four additional C-111 basin structures (upstream) that are controlled by the District, two structures that are controlled by the Village of Wellington (VOW), and one structure that is controlled by the North Springs Improvement District (NSID).

The District typically collects water quality samples on the upstream side of a structure or at a nearby location representative of the quality of water flowing through a structure. Structure locations are shown in **Figure 1**. In accordance with Specific Condition 16, the District previously submitted a Monitoring Locations Report to the FDEP on July 15, 1998 that included detailed information on the specific locations for sample collection for 44 structures. On August 9, 2001 the District submitted a minor modification to the non-ECP permit to include phase I of the Western C-11 Basin Critical Restoration Project (including operation and maintenance of the S-9A pump station). The current monitoring program encompasses 38 locations that provide the representative information to characterize the quality of water discharged through the 45 structures. The structure names, representative water quality monitoring location names, and sampling frequencies of the various categories of chemical constituents and physical properties required by the monitoring schedule denoted in the permit are shown in **Appendix 8B-1a**, **Table 1**.

PERMIT DATA ANALYSIS PERIODS

Specific Condition 12 requires the District to submit annual monitoring reports providing updates on water quality data and associated comparisons with state water quality standards. The water quality characterization includes an evaluation of compliance with Class III criteria for each monitoring location representative of a non-ECP structure.

Appendix 8B-1 provides the annual update of the non-ECP permit monitoring program (Specific Condition 12) and a comparison of water quality data at non-ECP structures to state water quality standards from May 1, 2001 to April 30, 2002 (non-ECP fifth year's data). The year ending April 30, 2002 corresponds to Water Year 2002 (WY02). These comparisons fulfill non-ECP permit requirements to measure progress toward achieving and maintaining compliance with state water quality standards.

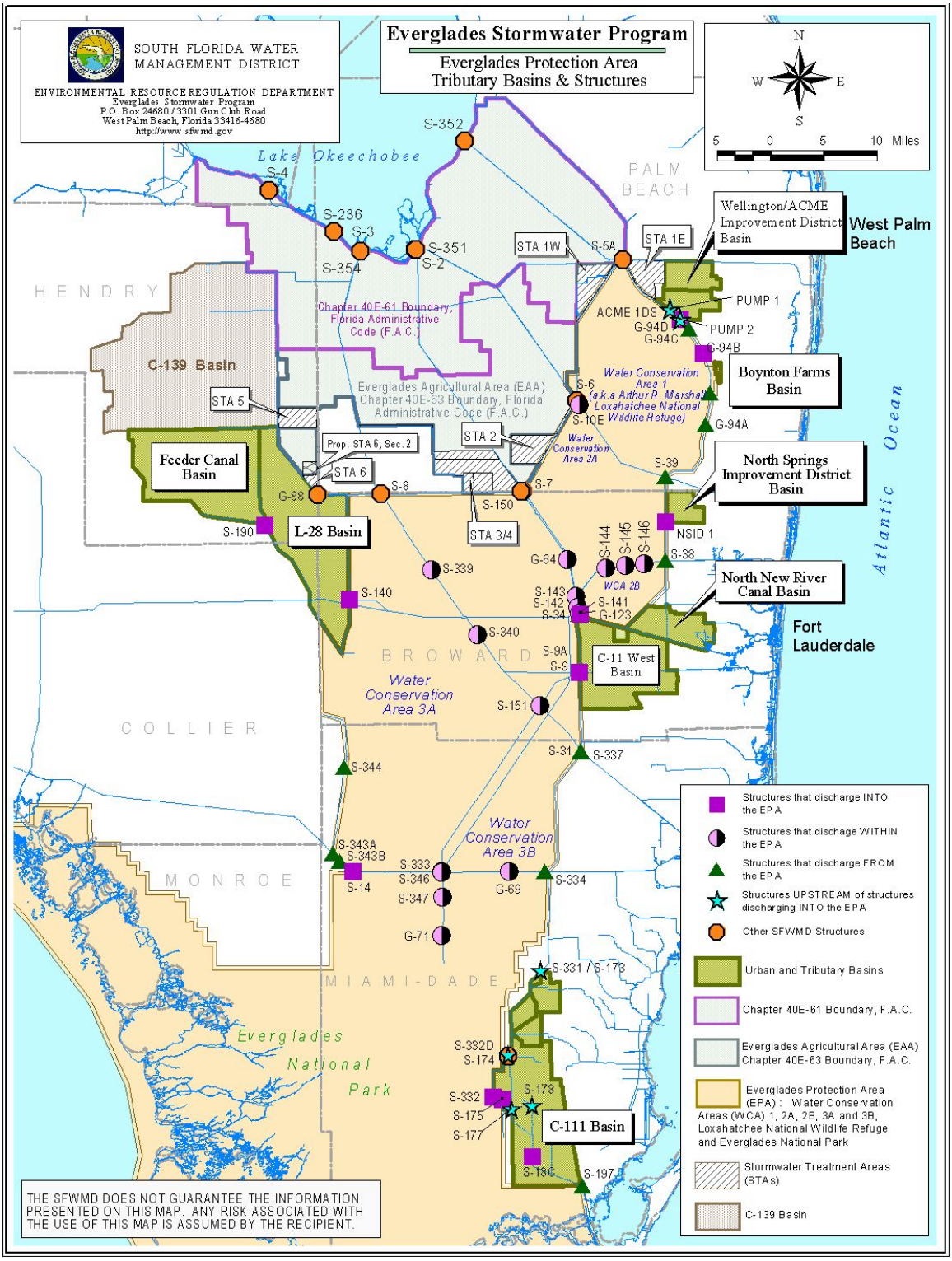


Figure 1. Non-ECP discharge structures and additional upstream structures

Method Detection Limits

Each water quality constituent has a Method Detection Limit (MDL) that essentially defines the minimum concentration, or level, at which the constituent can be quantified. The MDL is usually twice the background noise level associated with a test and represents that level at which the presence of the analyte can be reliably determined. The MDL does not represent a level at which an exact measurement can be determined. The Practical Quantitation Limit (PQL) represents the lowest level achievable among laboratories within specified limits during routine laboratory operations and for which a measurement can be considered quantifiably reliable for a constituent. Generally, the PQL is four times the MDL, although different laboratories may establish PQLs at two to five times the MDL. In **Appendix 8B-1**, trace metal data that were reported to be less than the MDL were assigned a value of the MDL. Total phosphorus (TP) data that were less than the MDL of 4.0 parts per billion (ppb) were assigned a value of 4.0 ppb to provide a conservative basis for statistical analysis. For pesticide detections, concentrations greater than the PQL were considered reliable.

EXCURSION ANALYSIS FOR CLASS III CONSTITUENTS AND PESTICIDES

To evaluate compliance with water quality criteria in Water Year 2002 (WY02), constituent concentrations were compared to their respective Class III numeric criteria. If a constituent concentration exceeded the numeric criteria, then an excursion was recorded and the total number of excursions and the percent of excursions for the non-ECP structures were tabulated.

Trace Metals and Un-ionized Ammonia

The un-ionized portion of dissolved ammonia measured in a water sample was calculated and compared to the 0.02-mg/L criterion only if temperature and pH had been recorded for that sample. For trace metals, the most recent trace metal criteria were used for evaluating the data even if the criteria had changed over time. When comparing the calculated criteria with trace metal concentrations, only water samples wherein hardness was determined from the same sample as the trace metal were used, i.e., no extrapolations were made to samples without hardness data. The equations used in this appendix for calculated criteria for trace metals and un-ionized ammonia were derived from the equations listed in Rule 62-302.503 of the Florida Administrative Code (F.A.C.).

Total Phosphorus

The data for total phosphorus (TP) are presented in time series plots and statistical box plots. For TP, any site with data > 50 ppb would be viewed as a concern; any site with data > 10 ppb would be viewed as a potential concern; and any site with data < 10 ppb would be of no concern. This approach is consistent with the Federal Settlement Agreement (1991), which indicates that the District's Stormwater Treatment Areas are located and sized to deliver a uniform, long-term, annual flow-weighted mean TP concentration of 50 ppb or less at each inflow point to the Everglades Protection Area (EPA). Additionally, the Everglades Forever Act (EFA) mandates that the P criterion shall be 10 ppb in the EPA in the event the FDEP does not adopt by rule such a criterion by December 31, 2003. There are additional TP concentration compliance limits for inflows to Everglades National Park (ENP or Park) by way of Shark River Slough (S-12S and S-333), Taylor Slough (S-332 and S-175) and the coastal basin (S-18C) outlined in Appendix A of

the Settlement Agreement (1991). However, **Appendix 8B-1** does not track compliance with the interim or long-term TP concentration limits set forth in the Settlement Agreement.

The District's categories of concern, potential concern, and no concern are based on a common-sense understanding of water resources protection. These terms, however, are not intended to be interpretations of state water quality standards or state water quality law. The FDEP, not the District, is responsible for interpreting whether a given constituent violates the numeric criterion, the narrative criterion, a water body's designated uses, or the antidegradation policy.

Pesticides

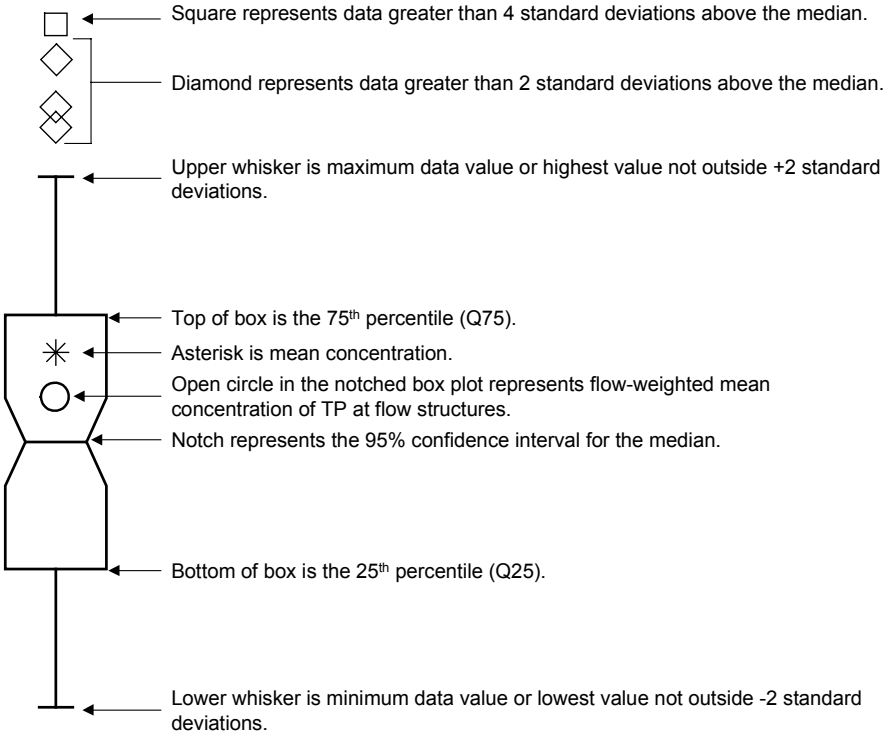
The EPA pesticide monitoring program includes non-ECP permitted structures. For purposes of **Appendix 8B-1**, the WY02 surface water pesticide analyses are presented in tables for the non-ECP structures only. The sediment pesticide analyses for WY02 are presented in a separate table. Five upstream structures in the C-111 basin are included in the pesticide monitoring program and represent potential warning sites for pesticides that might be discharged into the Park.

DESCRIPTION OF NOTCHED BOX AND WHISKER PLOTS

Notched box and whisker plots were created to summarize data for each constituent that exceeded its numerical criteria. These plots also summarize the TP data collected at all monitoring locations. A notched box and whisker plot summarizes selected statistical properties of the data sets. Notched box and whisker plots can be used to test for statistical significance between data sets at roughly a 95 percent confidence interval, to detect changes in constituent concentration variability over time, and to determine if trends exist. The notched box and whisker plots used for these summaries follows McGill et al., 1978 (**Table 1**).

It is recognized that using notched box and whisker plots to determine differences between data sets with large differences in sample size may cause significant findings that are artifacts of the number of samples and the amount of variation in the data sets. The objective of providing the plots was to compare the current water year (2002) to previous individual permit water years (1998, 1999, 2000 and 2001) and previously established baseline data sets for the non-ECP discharge structures.

Table 1. Description of notched box and whisker plots used in Appendix 8B-1



1. Notches surrounding the medians provide a measure of the significance of differences between notched box plots. If the notches about two medians do not overlap, the medians are significantly different at about a 95-percent confidence level.
2. At times, the variability in a data set may be quite high. When highly variable data are presented in a notched box and whisker plot, the width of the notch may be greater than the 25th or 75th percentile. When this occurs, the box plot appears as if it is folded from the end of the notch back towards the median. This is done automatically by the statistics program to save space within the figure being presented.
3. Notches are calculated using the following equation:

$$Notch = Median \pm \frac{1.58(Q75 - Q25)}{\sqrt{n}}$$

Where: n = number of data points

RESULTS: WATER QUALITY EVALUATION AND EXCURSION ANALYSIS

In accordance with Specific Conditions 5 and 12(h) of the non-ECP permit, this section presents an update of constituent concentrations and physical properties measured during WY02 (May 1, 2001 through April 30, 2002), the fifth year of permit monitoring. For standards with numeric criteria, the data from the structures were assessed for compliance with those standards using the procedures in Rule 62-4.246, F.A.C. For parameters that have narrative water quality criteria, the concentrations obtained at each structure were reported using plots and summary statistics.

MONITORING OF PHYSICAL PARAMETERS, NUTRIENTS, MAJOR IONS AND TRACE METALS

Descriptive Statistics

A summary of the data begins with a presentation of descriptive statistics for all water quality constituent concentrations and physical properties (excluding pesticides and priority pollutants) measured for non-ECP monitoring locations during WY02 (**Appendix 8B-1b**, **Table 2**). The descriptive statistics (summary tables) are presented by monitoring location for each water quality parameter collected for the site. A reference is also provided in **Appendix 8B-1b**, **Table 1** reflecting current state Class III criteria.

The statistical summary tables report the range of constituent concentrations, median values, the number of sample observations, selected data percentiles (25th and 75th) and flag parameters exhibiting excursions from Class III numeric criteria. Concentrations observed to be less than the lower limit of the analytical method (MDL) were set equal to the MDL for statistical analysis.

For parameters, such as nutrients, that have only narrative criteria, the tables provide basic information to assist with identifying water quality constituents that might be of concern. The nutrient deemed to be of particular concern for the non-ECP structures is TP. Additional discussion is provided in this section.

Excursions from Class III Criteria (Numeric)

Further analysis of excursions from Class III criteria was accomplished by summarizing the excursions, plotting the data for parameters exhibiting the excursions, discussing the parameters, and noting which ones are a concern. The excursion analysis is based on 11 water quality parameters (with a numeric criteria), shown in **Table 2**, that were collected for the non-ECP monitoring program and can be compared with applicable Class III water quality criteria listed in Rule 62-302.530, F.A.C.

Table 2. Summary of total number of excursions from state Class III criteria for all non-ECP monitoring sites during WY02 (May 1, 2001 through April 30, 2002) and previous periods

Parameter	WY02	WY01	WY00	WY99	WY98	non-ECP baseline	EFA baseline
Total Alkalinity	(0:475)	(0:490)	(0:559)	(0:502)	(0:525)	(0:2845)	(1:2677)
Dissolved Oxygen	(456:597)	(455:637)	(558:697)	(485:581)	(459:551)	(2177:3018)	(1694:2615)
Specific Conductance	(0:600)	(2:637)	(5:698)	(0:589)	(3:551)	(12:3058)	(59:2615)
pH	(1:611)	(1:637)	(1:698)	(10:589)	(12:551)	(37:3008)	(6:2586)
Turbidity	(2:479)	(1:489)	(3:645)	(4:504)	(0:527)	(12:2842)	(10:2637)
Un-Ionized Ammonia	(0:478)	(3:485)	(1:622)	(20:501)	(7:448)	(10:2661)	(12:2548)
Total Iron	(0:74)	(1:186)	(0:270)	(1:244)	(0:261)	(5:1655)	(5:836)
Total Cadmium	(0:30)	(0:101)	(0:133)	(0:126)	(1:127)	(4:785)	(9:362)
Total Lead	(nd)	(0:77)	(0:119)	(0:112)	(0:120)	(2:785)	(1:364)
Total Copper	(0:29)	(0:101)	(0:132)	(0:126)	(0:127)	(0:779)	(1:373)
Total Zinc	(0:25)	(0:100)	(0:129)	(0:125)	(0:127)	(2:786)	(3:363)

Note: 1st number in parentheses indicates number of excursions; 2nd number in parentheses indicates total number of samples collected

nd = no data

WY02 (May 1, 2001 through April 30, 2002); WY01 (May 1, 2000 through April 30, 2001); WY00 (May 1, 1999 through April 30, 2000); WY99 (May 1, 1998 through April 30, 1999); WY98 (May 1, 1997 through April 30, 1998); non-ECP Baseline (October 1, 1988 through April 30, 1997); EFA Baseline (October 1, 1978 through September 30, 1988)

Of the 11 parameters listed in **Table 2**, dissolved oxygen (DO), pH, and turbidity exhibited excursions at one or more locations during WY02. Previous non-ECP annual monitoring reports provided summary tables showing the total number of excursions by individual monitoring location (SFWMD 2002, 2001, 2000, 1999b, and 1999c). **Table 2** summarizes the previously reported information and compares the results with the current water year. A summary of observed excursions from Class III criteria for individual non-ECP monitoring locations during WY02 is presented in **Table 3**. The monitoring locations are categorized in the table as either "into," "within," "from," or "C-111 basin" locations as defined by the non-ECP permit.

Calculated criteria for the parameters were derived from the equations listed in Rule 62-302.530, F.A.C. When comparing the calculated criteria with trace metal or major ion concentrations, the only samples used were those in which hardness was determined in the same sample as that of the trace metal or major ion.

For parameters that exceeded Class III criteria during WY02, time series plots and box whisker plots are provided in **Appendix 8B-1c**. These plots report the range of the data and the magnitude of the excursions and assist with detecting whether there are any increasing or decreasing trends observed in the data. To assess how far a physical parameter, major ion, or trace metal deviated above or below a Class III numeric criteria, a percent-departure line was added to the time series plots and box and whisker plots. These departure lines indicate whether a parameter value ranges more than 1, 10 or 100 percent beyond the numeric criteria. The physical parameters appear as horizontal lines across the plots. For the major ions and trace metals, the criteria change from sample to sample, because the criteria for each parameter for a particular sample were calculated based on the hardness data calculated from the same sample. For data values that show an excursion, the percentage departure is annotated on the plot above the data value.

Dissolved Oxygen

Dissolved oxygen (DO) concentrations exhibited consistent excursions from Class III criteria during WY02 (**Table 3**). About 76 percent (456 out of 597) of DO concentrations measured at non-ECP monitoring locations were less than the minimum criterion of 5.0 mg/L. The DO concentrations measured for WY02 are consistent with concentration levels and the frequency of excursions seen in previous water years. The DO excursions occurred at all locations except NSID-1 of the "into" structures and S-144 and S-146 of the "within" structures. The DO time series and box and whisker plots are shown in **Appendix 8B-1c**.

Specific Conductance

Specific conductance was measured in 600 samples taken from the monitoring sites. None of the analyses of the 600 samples exhibited an excursion exceeding the Class III criteria. This was an improvement when compared with WY01, during which two sites were observed to be an excursion exceeding the Class III criteria. The criteria for Class III waters requires that specific conductance not exceed a level greater than 50 percent above background, or 1,275 µmhos/cm, whichever is greater. Specific conductance is not a parameter of concern for the non-ECP monitoring locations.

pH

The pH of a solution is defined as the negative base-10 logarithm of the hydrogen ion activity and can range from 0 (very acidic) to 14 (very alkaline). For freshwater systems the Class III criteria for pH ranges from 6.0 to 8.5 units. For WY02, excursions from the pH criterion occurred for less than 1 percent (1 out of 611) of samples collected. As shown in **Table 3**, only one excursion with a value greater than 8.5 pH units was observed at the S-145 site. The pH data for S-145 are plotted in **Appendix 8B-1c**. This parameter is not a concern for structures going into the EPA.

Table 3. Summary of excursions from state Class III criteria for individual non-ECP monitoring sites during WY02 (May 1, 2001 through April 30, 2002)

AREA	STRUCTURE	SAMPLING SITE	PARAMETERS										
			Alkalinity	DO	Specific Conductance	pH	Turbidity	Un-Ionized Ammonia	Iron	Cadmium	Lead	Copper	Zinc
INTO	ACME1DS	ACME1DS	(0 : 16)	**(9 : 16)**	(0 : 16)	(0 : 16)	(0 : 16)	(0 : 16)	(0 : 4)	(0 : 2)	.	(0 : 1)	(0 : 1)
	ACME1 (Upstream of ACME1DS)	VOW1	-ND-	**(3 : 3)**	(0 : 3)	(0 : 3)	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
	G-94D	G94D	(0 : 16)	**(11 : 16)**	(0 : 16)	(0 : 16)	(0 : 16)	(0 : 16)	(0 : 4)	(0 : 2)	.	(0 : 1)	(0 : 1)
	ACME2 (Upstream of G94D)	VOW2	-ND-	**(3 : 3)**	(0 : 3)	(0 : 3)	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-	-ND-
	G-123	G123	(0 : 14)	**(11 : 14)**	(0 : 13)	(0 : 14)	(0 : 14)	(0 : 14)	(0 : 3)	(0 : 1)	.	(0 : 1)	(0 : 1)
	S-9	S9	(0 : 18)	**(49 : 51)**	(0 : 51)	(0 : 52)	(0 : 18)	(0 : 18)	(0 : 3)	(0 : 1)	.	(0 : 1)	(0 : 1)
	S-14	S14						(0 : 0)	(0 : 1)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-18C	S18C	(0 : 21)	**(16 : 26)**	(0 : 27)	(0 : 27)	(0 : 21)	(0 : 21)	(0 : 6)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-140	S140	(0 : 17)	**(11 : 15)**	(0 : 17)	(0 : 17)	(0 : 17)	(0 : 16)	(0 : 4)	(0 : 2)	.	(0 : 1)	(0 : 1)
	S-175	S175	(0 : 11)	**(13 : 25)**	(0 : 26)	(0 : 26)	(0 : 12)	(0 : 12)	(0 : 5)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-190	S190	(0 : 15)	**(4 : 16)**	(0 : 16)	(0 : 16)	(0 : 15)	(0 : 15)	(0 : 4)	(0 : 2)	.	(0 : 1)	(0 : 1)
	S-332	S332	(0 : 11)	**(16 : 25)**	(0 : 26)	(0 : 26)	(0 : 12)	(0 : 12)	(0 : 4)	(0 : 2)	.	(0 : 2)	(0 : 2)
	NSID1	S38B	(0 : 4)	**(3 : 4)**	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 2)	.	(0 : 1)	(0 : 1)
		NSIDSP01	(0 : 3)	**(0 : 5)**	(0 : 5)	(0 : 5)	(0 : 4)	(0 : 4)			.	(0 : 4)	
WITHIN	G-64	G64	(0 : 4)	**(4 : 4)**	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 4)			.		
	G-69	G69	No Data (Structure Closed)										
	G-71, S-346, S-347	S12D	(0 : 22)	**(23 : 27)**	(0 : 27)	(0 : 27)	(0 : 22)	(0 : 22)			.		
	S-10E	S10E	(0 : 12)	**(11 : 12)**	(0 : 12)	(0 : 12)	**(1 : 12)**	(0 : 12)	(0 : 1)		.		
	S-141	S34	Same as Data for S34 Shown Below										
	S-142	S142	(0 : 15)	**(14 : 15)**	(0 : 14)	(0 : 15)	(0 : 15)	(0 : 15)			.		
	S-143	S11A	(0:15)	**(4:14)**	(0:13)	(0:15)	(0:15)	(0:15)					
	S-144	S144	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)			.		
	S-145	S145	(0 : 17)	**(10 : 15)**	(0 : 16)	**(1 : 17)**	(0 : 17)	(0 : 17)			.		
	S-146	S146	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)			.		
	S-151	S151	(0 : 18)	**(16 : 17)**	(0 : 18)	(0 : 18)	(0 : 18)	(0 : 18)			.		
	S-333	S333	(0 : 18)	**(24 : 27)**	(0 : 27)	(0 : 27)	(0 : 18)	(0 : 18)	(0 : 5)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-339, S-340	C123SR84	(0 : 13)	**(9 : 13)**	(0 : 12)	(0 : 13)	(0 : 13)	(0 : 13)			.		
FROM	G-94A, G-94B, G-94C	G94B	(0 : 12)	**(11 : 12)**	(0 : 12)	(0 : 12)	(0 : 12)	(0 : 12)	(0 : 4)		.		
	S-31, S-337	S31	(0 : 13)	**(10 : 12)**	(0 : 13)	(0 : 13)	(0 : 13)	(0 : 13)			.		
	S-34	S34	(0:14)	**(8:14)**	(0:13)	(0:14)	(0:14)	(0:14)					
	S-38	S38	(0 : 12)	**(9 : 12)**	(0 : 11)	(0 : 12)	(0 : 12)	(0 : 12)			.		
	S-39	S39	(0 : 18)	**(7 : 18)**	(0 : 17)	(0 : 17)	(0 : 18)	(0 : 17)	(0 : 1)		.		
	S-197	S197	(0 : 1)	**(1 : 1)**	(0 : 1)	(0 : 1)	(0 : 1)	(0 : 1)			.		
	S-334	S334	(0 : 13)	**(7 : 12)**	(0 : 13)	(0 : 13)	(0 : 13)	(0 : 13)			.		
	S-343A, S-343B	US41-25	(0 : 20)	**(26 : 26)**	(0 : 26)	(0 : 26)	(0 : 20)	(0 : 19)			.		
	S-344	S344	(0 : 4)	**(3 : 4)**	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 4)	(0 : 4)		.		
C-111 BASIN	S-174	S176	(0 : 14)	**(14 : 14)**	(0 : 15)	(0 : 15)	(0 : 14)	(0 : 14)	(0 : 5)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-177	S177	(0 : 19)	**(15 : 20)**	(0 : 21)	(0 : 21)	(0 : 19)	(0 : 19)	(0 : 4)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-178	S178	(0 : 11)	**(12 : 12)**	(0 : 12)	(0 : 12)	**(1 : 11)**	(0 : 12)	(0 : 3)	(0 : 2)	.	(0 : 2)	(0 : 2)
	S-331, S-173	S331-173	(0 : 24)	**(23 : 24)**	(0 : 23)	(0 : 24)	(0 : 24)	(0 : 24)			.		
	S-332D	S332D	(0 : 18)	**(45 : 50)**	(0 : 50)	(0 : 51)	(0 : 19)	(0 : 19)	(0 : 5)	(0 : 2)	.	(0 : 2)	(0 : 2)
Totals			(0 : 475)	**(456 : 597)**	(0 : 600)	**(1 : 611)**	**(2 : 479)**	(0 : 478)	(0 : 74)	(0 : 30)	nd	(0 : 29)	(0 : 25)

Note: 1st number in parenthesis indicates number of excursions. 2nd number in parenthesis indicates total number of samples collected. -ND- indicates that no data collected

Turbidity

The criterion for Class III waters requires that turbidity not exceed 29 nephelometry turbidity units (NTU) above natural background conditions. In general, the median value can be used to determine the average background levels on a site-to-site basis for the non-ECP monitoring locations to compare the measured turbidity at a site with Class III criteria. For instance, if background levels at a particular location indicate a median turbidity level of around 3 NTU, and a turbidity measurement of 30 NTU was measured, this would indicate that the measurement is 27 NTU above background levels. This measurement would not be considered an excursion, although the 30-NTU measurement might be construed as an excursion of the criterion in the absence of sufficient background data to calculate a median value for comparison.

Turbidity was measured in 479 samples taken during WY02. The majority of the data are characterized by low values for turbidity. Out of 479 samples, S-178 had one sample value (30.6 NTU) flagged as a potential excursion. The median turbidity value for this site was 1.54 NTU (**Table 3** of **Appendix 8B-1b**). S-10E had one sample value (36.7 NTU) flagged as a potential excursion. The median turbidity for this site was 3.285 NTU. Turbidity does not appear to be a parameter of concern, since excursions have only occurred on a few occasions during the past several water years.

Un-Ionized Ammonia

The Class III surface water quality criterion for ammonia was established for the un-ionized portion of dissolved ammonia. The un-ionized portion of dissolved ammonia measured in a water sample can be calculated and compared to the Class III criterion only if temperature and pH have been recorded for that sample. None of the 485 samples analyzed for ammonia at all locations during WY02 had concentrations that exceeded the un-ionized criterion of 0.02 mg/L. During WY01, three of 30 samples collected at S-142 exceeded the criterion. That situation improved in WY02, and no excursions were observed in the surface waters discharging to the Park through non-ECP structures. In previous non-ECP monitoring reports, this parameter was identified as a potential concern for structures discharging “into” the Park and the upstream structures in the C-111 basin. Because no excursions were evident in the data for WY02, un-ionized ammonia is not a concern in the upstream C-111 basin structures and the “into” structures discharging to the Park from the basin, indicating a significant improvement when compared with WY01.

Trace Metals and Total Iron

Quarterly monitoring for total iron and the trace metals cadmium, copper, lead and zinc is conducted in accordance with the monitoring requirements of the non-ECP permit. There were no observed iron or trace metal concentrations in WY02 that exceeded their respective Class III criteria. These parameters have not been viewed as an area of concern.

Evaluation of Total Phosphorus

The non-ECP permit established the monitoring schedule shown in **Appendix 8B-1a** for the collection of TP at non-ECP structures. Sample collection is accomplished mainly through a grab-sample collection program. Grab samples are collected biweekly for a majority of the structures when flow is occurring at the structure; otherwise, collection is conducted at least once a month. A few exceptions exist for some non-ECP structures, where sampling is conducted biweekly only during flow events. Nutrients are the most frequently sampled parameters in the non-ECP monitoring program.

During WY02, autosamplers collected TP samples weekly at the ACME1, ACME2, S-190, S-140 and G-123 pump structures. Deployment of the autosamplers at these locations was previously identified as an improvement in the monitoring program for collecting TP at "into" structures. Autosamplers also collected samples at the S-332D structures located in the C-111 basin that discharge water into the S-332D detention area east of Everglades National Park (Park).

The TP concentration data collected for all monitoring locations during WY02 (the fifth year of permit monitoring) are plotted in time series and notched box and whisker plots in **Appendix 8B-1d**. The plots are designed to provide a comparison of TP concentration data between WY02 and previous periods (WY01, WY00, WY99, WY98, EFA and non-ECP baseline) to detect changes and trends in TP concentrations at non-ECP monitoring locations. To assist with evaluation of the TP concentration data for a particular location discharging "into," "within," or "from" the EPA, horizontal lines representing the 10 ppb and 50 ppb concentration levels were added to the TP time series and notched box and whisker plots. TP concentrations are reported in parts per billion (ppb) or micrograms per liter (µg/L) unless otherwise noted.

For WY02, a statistical comparison of TP concentration data for all monitoring locations is presented as notched box and whisker plots in **Figure 2**. The figures represent "into" (**Figure 2a**), "within" (**Figure 2b**), and "from" (**Figure 2c**) monitoring locations. Additionally, notched box and whisker plots were constructed for TP concentration data for the upstream C-111 basin monitoring locations (**Figure 2d**). Summary statistics of TP data collected for all monitoring locations are presented as a separate table in **Appendix 8B-1b**, **Table 4** (grab and autosampler data are reported separately). A discussion of the TP concentration data observed during WY02 is provided below.

"Into" Structures

Some of the highest TP concentrations for non-ECP structures discharging directly to the EPA during WY02 were observed for the monitoring locations at the ACME1DS and G-94D culverts and the upstream pump stations (**Figure 2a**). Weekly autosampler collection and biweekly grab samples at the respective upstream monitoring locations VOW1 (ACME pump station 1) and VOW2 (ACME pump station 2) were initiated in July 2000 based on a monitoring agreement between the District and the Village of Wellington (VOW).

The ACME1DS and G-94D culverts, operated by VOW, remain open at all times and discharge to the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) when upstream pump stations ACME1 or ACME2 are operating. Sixteen District data collection trips to the culvert monitoring locations resulted in only nine sampled flow events. The monitoring agreement with VOW resulted in a sufficient number of samples (114) collected by both grab and autosamplers upstream of the pump stations to cover a broad range of flows observed during pumping events and to adequately characterize the TP concentrations.

More than 75 percent of the data collected at the upstream VOW1 monitoring sites were below 105 ppb, with median TP values ranging between 69 and 85 ppb. More than 75 percent of the data collected at the upstream VOW2 monitoring sites were below 160 ppb, with median TP values ranging between 125 and 130 ppb. Discharge data were not available for the ACEM1DS and G-94D culverts, although discharge data from the upstream pump stations during WY02 (15,670 ac-ft for ACME1 and 17,524 ac-ft for ACME2, respectively) can be used as an indication of the magnitude and occurrence of flow through the downstream culverts.

Additional high TP concentrations were observed for structures S-190 (feeder canal basin) and S-140 (L-28 basin), with median TP concentrations of 41 ppb and 37 ppb, respectively. During WY02, structure S-190 discharged 84,982 ac-ft, and S-140 discharged 109,994 ac-ft into the western portion of WCA-3A.

The lowest TP concentrations were observed at structures in the C-111 basin at S-18C, S-174, S-177, S-331, S-173 and S-332D. These structures discharge to the southeastern portion of the Park by way of the C-111 canal and Taylor Slough. The TP data for these monitoring locations had an observed median concentration of 6 ppb for S-18C, S-175 and S-332, with 75 percent of the samples having concentrations below 10 ppb for S-18C, S-175 and S-332. During WY02, the S-175 and S-332 structures were operated infrequently, discharging only 6 ac-ft for S-175 and none for S-332 to the Everglades National Park. The S-18C structure discharged approximately 172,835 ac-ft to the lower C-111 canal. S-178 had a flow-weighted mean concentration of 93 ppb, the highest TP concentration in the C-111 basin, with a discharge of 4,398 ac-ft.

Structures S-9 (C-11 West basin) and G-123 (North New River basin) discharge directly to the eastern side of WCA-3A. The notched box and whisker plot for S-9, which is based on grab-sampled data, indicates a TP concentration of less than 18 ppb for 75 percent of the data, a median concentration of 15 ppb, and a maximum of 73 ppb (**Figure 2a**). In contrast, 75 percent of the data collected by the autosampler at S-9 are under 18 ppb, with a median concentration of 15 ppb and a maximum of 100 ppb. G-123 exhibits a maximum concentration of 41 ppb. The monitoring schedule for structure G-123 requires biweekly grab sampling during flow events; otherwise, the samples are collected monthly. An autosampler collected samples every seven days, resulting in 48 autosamples and 13 grab samples collected during this period. During WY02, procedures were also instituted to allow the determination of the volume of water discharged from the North New River canal into the Everglades Protection Area. Previously, only an annual volume could be estimated. The structure discharged approximately 52,047 ac-ft over the entire period. The autosampler and grab sample TP values at G-123 were similar and had a median concentration of 14 ppb for grab and 16 ppb for auto samples. Seventy-five percent of the data ranged from 17 to 18 ppb, with a maximum of 41 ppb for grab samples and 31 ppb for auto samples.

The North Springs Improvement District (NSID) operates several pump stations to remove excess runoff from the basin. The flow-proportional autosampler, headwater pressure sensor, and calibrated flow monitoring equipment with telemetry that monitor NSID's pump station discharges into WCA-2A are functioning for the NSID basin. The surface water quality monitoring program has continued at NSID pump station S-38B. As the result of a cooperative agreement, a significant number of upstream water quality monitoring samples has been collected at NSIDSP01 during times of flow. Results from S-38B, and upstream data from NSIDSP01, are reported in **Chapter 8B**, **Table 8B-1** in the *2003 Everglades Consolidated Report*. A more complete presentation of the results from these stations can be found in **Table 3** of **Appendix 8B-1b** and **Table 3** of **Appendix 8B-1e**. Operation of the autosampler and telemetry equipment used to collect the data was delayed due to unforeseen pump repairs. The repairs have since been completed, and pump testing was performed. Pump curves were developed and programmed into the equipment. All systems are now operational and should provide flow-weighted, proportional sampling data results for WY03 in next year's compliance report.

Pump station no. 1 (NSID1) has the capability to discharge directly to WCA-2A, though discharges occur relatively infrequently. The NSID1 pump discharged approximately 2,494 ac-ft to WCA-2A during WY02. The sampling location, designated S-38B, is on the WCA-2A side of the structure. During WY02, no samples were collected at S-38B during a flow event. The TP concentrations for the four samples ranged from 12 to 26 ppb. Autosampling equipment for flow-proportional TP sampling has been installed at the NSID for WY02 but no sampling has yet been conducted. The TP concentrations for grab samples ranged from 21 to 34 ppb for 10 samples collected (six during flow event) at the NSIDSP01 site during WY02.

The remaining structure, S-14, is in the northwest corner of Shark River Slough in Everglades National Park. The structure is situated a short distance to the west of structure S-12A. According to operational records, the S-14 structure remained closed during WY02. Operational records also indicate the structure has been closed since 1986. Therefore, routine sampling for TP was not conducted at this location in accordance with the "biweekly if flowing" sampling schedule required by the permit. In the event that this structure was operated, it would convey some of the discharge from WCA-3A outflow structures S-343A and S-343B, and some overland runoff from the southeastern portion of Big Cypress National Preserve to the Park.

During WY02, the water quality monitoring program has been ongoing in the Boynton Farm Basin. Although access limitations and other boundary issues still exist, surface water quality samples for most of the identified "into" structures have been obtained during times of flow. Recently, the Williams Nursery pump on the north side of the Refuge was voluntarily removed. As part of the expansion work for State Road 7 to the east of the remaining farm properties, the Lake Worth Drainage District is continuing its efforts to provide sufficient capacity to allow all discharges from the remaining farms to flow east. This would eliminate the need for these farms to pump west into the Refuge.

The headquarters property is owned and operated by the U.S. Fish and Wildlife Service (USFWS) and is bordered by several farms immediately east of the property boundary that discharge onto the property. The headquarters property is identified in the EFA as being within the EPA boundary, but the property is east of the protective levee, has no connection to discharge westward to WCA-1, and stands alone as an isolated parcel. Data collected during WY02 for Amestory Farm include sites BFBAFCP, BFBAFNP and BFBAFSP; Dubois Farm data include BFBDFCP, BFBDFNP, BFBDFSP and BFBDFWP; Mecca Farm data include BFBMFCP, BFBMFSP and BFBMFNP; Williams Nursery data include BFBWNCP. These are event-driven

grab samples that have no associated flow measurements. The data are provided in **Table 4,** which shows extremely high TP concentrations (mean concentration of 310 to 1,781 ppb).

"Within" Structures

For structures discharging "within" the EPA during WY02, low TP concentrations were observed for structures S-12D and S-333, which convey discharges from WCA-3A to the Park (**Figure 2b**). The monitoring location for S-12D serves as a surrogate monitoring location for non-ECP permit structures G-71, S-346 and S-347. The median TP concentration at these monitoring locations was 11 ppb at both S-12D and S-333, with 75 percent of the data falling below 20 ppb for S-12D and below 21 ppb for S-333. The maximum concentrations observed were 36 ppb (S-12D) and 40 ppb (S-333). The discharge volumes for the period were 225,330 ac-ft for S-12D, and 250,001 ac-ft for S-333.

Higher concentrations were observed at structures S-144, S-145 and S-146, which convey discharges from WCA-2A to WCA-2B. The structures usually operate simultaneously. Maximum concentrations ranged from 34 ppb (S-144) to 33 ppb (S-145). Median values ranged from 9 ppb (S-145) to 34 ppb (S-144), and 75 percent of the data (17 samples) was below 18 ppb for these locations. Discharge volumes ranged from 22,766 ac-ft at S-146, to 37,731 ac-ft at S-145.

In addition to monitoring the water quality at structure S-34, the data from the location are representative of the water quality conditions for structure S-141, which conveys discharges from WCA-2B to the North New River canal just upstream of S-34. The TP concentrations from the S-34 location ranged from 8 ppb to 42 ppb, with a median value of 16 ppb.

The highest TP concentrations were observed at structures S-10E and S-151 and at the C123SR84 monitoring site, the surrogate location for structures S-339 and S-340. The S-10E structure conveys discharges from the Refuge to the northern portion of WCA-2A downstream of pump station S-6. Sampling at the S-10E location occurs upstream of the structure and is near the western rim canal in the Refuge. During WY02, the S-10E structure remained closed (**Appendix 8B-1a, Table 2**). The TP concentrations (non-flow event) for S-10E ranged from 24 to 103 ppb, with a median concentration of 37 ppb. Structure S-151 discharged approximately 189,305 ac-ft during WY02. Phosphorus concentrations ranged from 9 ppb to 52 ppb, with a median value of 14 ppb. Structures S-339 and S-340, located upstream of S-151 in the Miami Canal, discharged about 40,375 ac-ft for S-339 and 30,404 ac-ft for S-340. Phosphorus concentrations at C123SR84 ranged from 11 ppb to 44 ppb, with a median value of 25 ppb.

"From" Structures

The TP concentrations collected for the structures classified as "from" are summarized in the box and whisker plot shown in **Figure 2c**. Structure G-94B exhibited the highest TP concentrations, which ranged from 18 ppb to 129 ppb. The median TP concentration was 34 ppb, with 75 percent of the data falling below 77 ppb. G-94B is also the surrogate sampling site for structures G-94A and G-94C. All three structures are located in the L-40 levee on the eastern side of the A.R.M. Loxahatchee National Wildlife Refuge (Refuge) and provide water supply releases from the Refuge to the Lake Worth Drainage District (LWDD). Additionally, the District owns and maintains the structures, but the LWDD operates them.

The G-94A and G-94B structures, when open, allow interior LWDD canals to fill. The direction of flow has always been toward the LWDD canal system. The G-94C structure is operated similarly.

The G-94C structure was used intermittently for water supply purposes. The total discharge from the Refuge to the LWDD system was approximately 21,267 ac-ft (**Appendix 8B-1a**, **Table 2**). Operational records were unavailable to determine the frequency and magnitude of water supply releases to LWDD canals during WY02 by way of the G-94A and G-94B structures.

The next-highest TP concentrations were observed at S-39, with phosphorus concentrations ranging from 14 ppb to 72 ppb, with a median value of 20 ppb. The structure discharged approximately 103,132 ac-ft during WY02. During that period, four samples were collected at S-344. The TP concentrations ranged from 12 ppb to 36 ppb and the median concentration for the four samples was 28 ppb.

For the remainder of the "from" structure monitoring locations (S-31, S-34, S-38, S-197, S-334, S-337, S-343A and S-343B), 75 percent of the observed TP concentrations were below 29 ppb, with median values ranging from 10 ppb to 15 ppb.

C-111 Basin Upstream Structures

Structures S-176, S-177, S-178, S-331 and S-173, shown in **Figure 2d**, are C-111 basin structures located upstream of "into" structures S-18C, S-332 and S-175. Seventy-five percent of the TP concentration data collected for these structures was below 71 ppb, with the median values ranging between 6 ppb and 35 ppb. The maximum TP at S-178 is 168 ppb, with a median TP concentration of 35 ppb, which was significantly higher than the rest of the C-111 basin upstream structures.

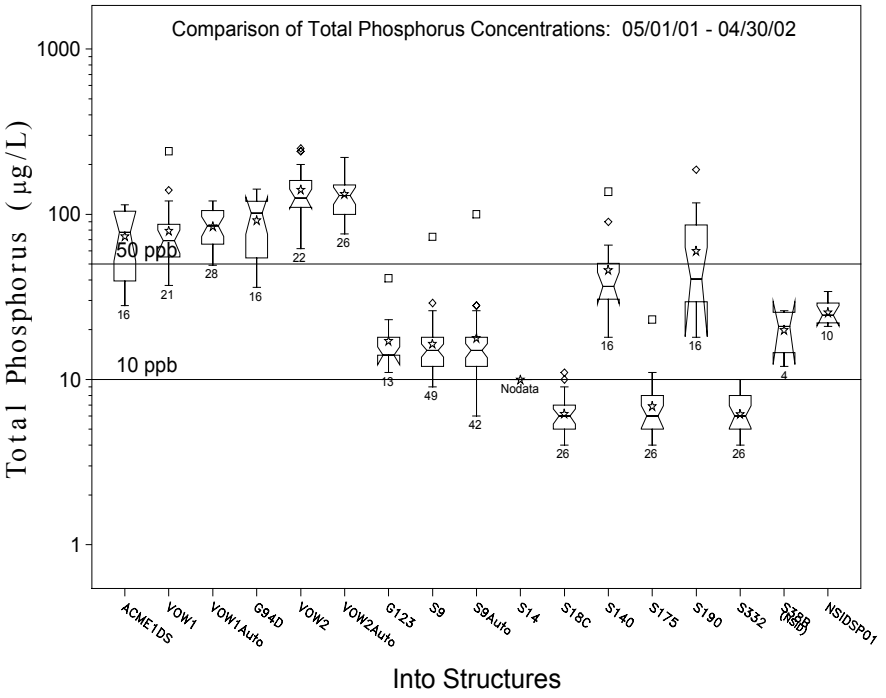


Figure 2a. "Into" structures

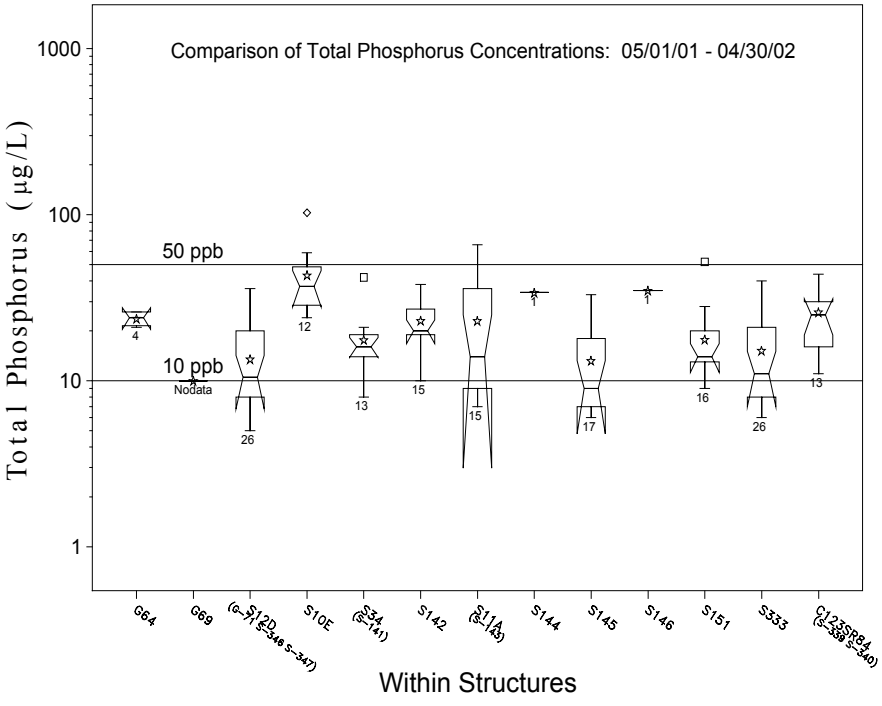


Figure 2b. "Within" structures

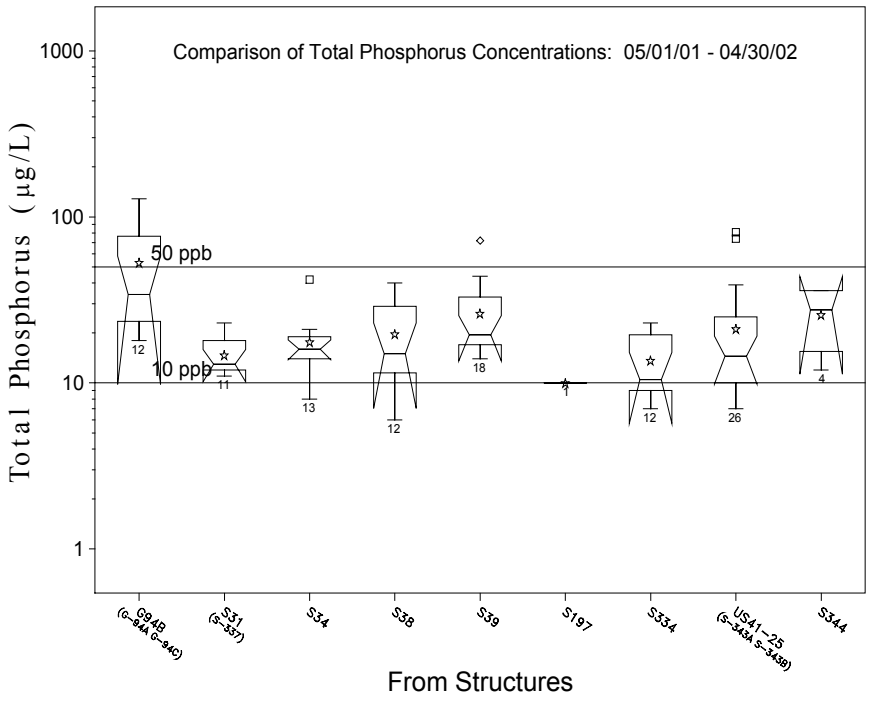


Figure 2c. "From" structures

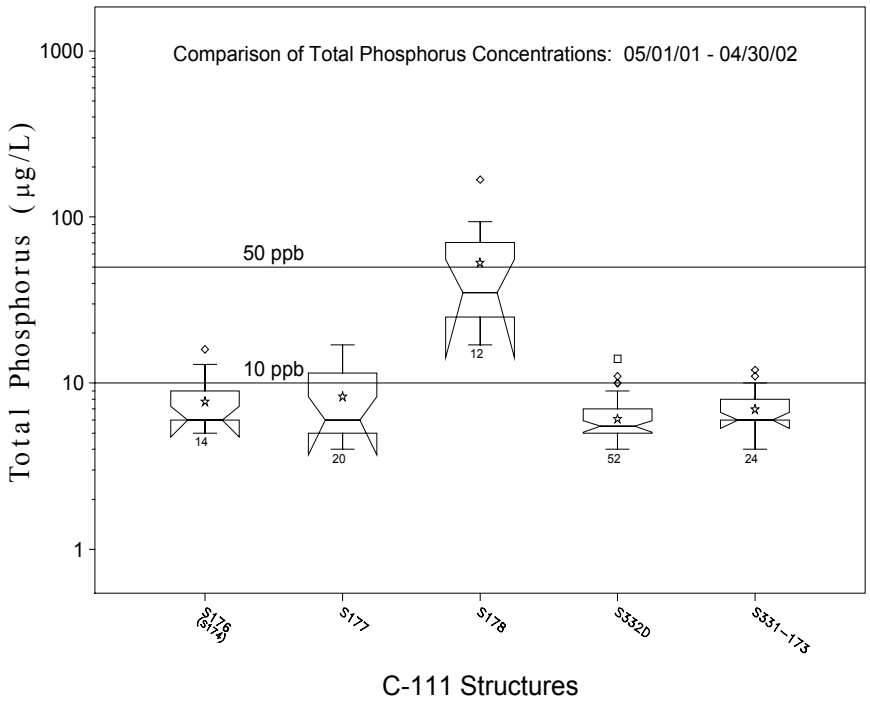


Figure 2d. C-111 upstream structures

Flow-Weighted Mean TP Concentrations for All Structures

Extending the analysis from previous water years, flow-weighted mean TP concentrations were calculated for all the structures during WY02. The non-ECP permit does not require an annual flow-weighted mean concentration to be calculated. However, the analysis is useful for determining whether additional sampling is required during flow events and provides a more accurate depiction of expected concentrations during flow events. The calculation for flow-weighted mean TP concentrations was accomplished for structures having sufficient TP and available flow data for WY02.

There are several common methods that can be used to calculate a flow-weighted mean. The most common method is to multiply the concentration data by the flow data on days with available flow and concentration values, add the results to obtain total daily loads, and then divide the sum by the total accumulated flow for those days. This method uses only the data that were collected and does not involve estimating concentration data for other days when flow occurred. The annual flow-weighted mean TP concentrations, and monthly and annual flow volumes for the "into," "within," "from," and "C-111 basin" structures during WY02 are provided in **Appendix 8B-1a**, **Table 2**.

A more detailed analysis of the WY02 annual flow-weighted mean TP concentration (fwmc) data for each "into" structure is shown in **Table 4**. The calculations were based on two methods for determining flow-weighted mean concentrations. The first method calculates the fwmc for TP using only days of flow and associated TP data. The second method uses an estimation algorithm to determine TP concentrations on all days with positive flow for which no observed values are available.

The two methods resulted in similar calculations for the fwmc at most of the "into" structures. The calculation methods yielded slightly different results for the G-94D (92 ppb versus 118 ppb) and the S-140 (47 versus 48 ppb) sites. In the *2002 Everglades Consolidated Report*, **Table 4**, **Appendix 8B-1** presented the results for the fwmc TP values at "into" sites during WY01. The highest fwmc TP value for the "into" structures during WY02 was observed at the ACME2 pump station, followed by G-94D, ACME1DS, ACME1, the S-190 and the S-140 pump stations. These sites are designated as a concern for TP.

The lowest fwmc TP values were observed at the S18C, S175 and S332 monitoring locations. These locations are the subject of interim and long-term compliance limits stipulated in the Federal Settlement Agreement; therefore, these are viewed as a potential concern for TP.

Table 4. Annual flow-weighted mean TP concentrations for WY02 (May 1, 2001 through April 30, 2002)

Hydrologic Basin	Structure	Water Quality Station Id	Total Flow Volume (acre-feet)	Sample Size (Grab)	Number of Days with Positive Flow	Arithmetic Average (Grab)(µg/L)	Sample Size (Comp)	Sample Type	Total Samples Collected During Flow	Flow-Weighted [2] Mean Concentration (µg/L)	Flow-Weighted [3] Mean Concentration (µg/L)	TP Load (kg)
ACME (Basin B)	ACME1DS	ACME1DS	15,670 [6]	16	102 [6]	74	0	Grab [4]	9	96 [7]	95 [7]	1836
	ACME1	VOW1	15,670	21	102	80	27 [8]	Auto [5] & Grab [4]	114	90	89	1720
	G94D	G94D	17,524 [6]	16	106 [6]	92	0	Grab [4]	9	92 [7]	118 [7]	2551
	ACME2	VOW2	17,524	22	106	142	26 [8]	Auto [5] & Grab [4]	116	155	152	3286
North Springs Improv. District	NSID1	NSIDSP01	2,494	10	14	26	0 [9]	Grab [4]	6	26	26	80
		S-38B (WCA-2A near NSID1)	2,494	4	14	20	0	Grab [4]	0	ND[1]	16	49
North New River	G-123	G123	52,047	13	101	17	48 [8]	Auto [5] & Grab [4]	106	16	16	1057
C-11 West	S-9	S9	283,618	48	227	17	42	Auto [5] & Grab [4]	224	19	19	6716
C-111	S-175	S175	6	26	2	7	0	Grab [4]	2	7	5	0
	S-332	S332	0	26	0	6	0	Grab [4]	0	ND [1]	ND [1]	0
	S-18C	S18C	172,835	26	296	6	0	Grab [4]	21	5	7	1525
L-28	S-140	S140	109,994	16	189	46	52 [8]	Auto [5] & Grab [4]	201	47	48	6460
Feeder Canal	S-190	S190	84,982	16	223	60	53 [8]	Auto [5] & Grab [4]	236	90	89	9314
Boynton Farms	Various[10]	Various[10]	ND[1]	32	ND[1]	310-1781	ND[1]	Grab [4]	ND[1]	ND[1]	ND[1]	ND[1]

Notes:

1) ND - no data available

2) Flow-weighted Mean Concentration based on days of flow and monitored TP data only.

3) Flow-weighted Mean Concentration based on estimation algorithm to determine TP concentration on non-monitored days

4) (Grab) indicates samples collected by grab sampling methodology.

5) (Auto) indicates that samples were collected by automatic composite samples.

6) Flow data from upstream pump structures, ACME1 and ACME2, is representative of the flow through the ACMD1DS and G94D culverts, respectively.

7) Flow weighted mean concentrations for ACME1DS and G94D were calculated using the flow data at upstream structures ACME1 and ACME2, respectively.

8) Autosampler installed upstream of structure during WY2001.

9) Autosampler installed upstream of structure during WY2002, but no data are available.

10) Sites include BFBAFCP,BFBAFNP,BFBAFSP, BFBDFCP, BFBDFNP,BFBDFSP, BFBDFWP, BFBMFCP,BFBMFSP, BFBMFNP and BFBWNCP

PESTICIDE MONITORING

Pesticides in Surface Waters and Sediments

The quarterly surface water and semiannual sediment pesticide sampling at the 15 non-ECP sites (**Figure 3**) for WY02 was conducted during May, August and December 2001 and in February 2002. The pesticide analytes, representative minimum detection limits (MDL), and practical quantitation limits (PQL) are listed in **Table 5**. The Department of Environmental Protection Central Laboratory in Tallahassee, Florida performed all the analyses. Refer to the Quality Assurance Evaluation section of the individual pesticide event reports for a summary of any limitations on data validity that might influence the utility of these data. The individual reports can be found online at the following Website:

http://www.sfwmd.gov/curre/pest/pestindex.htm

To evaluate potential impacts on aquatic life due to the pulsed nature of exposure, the maximum observed concentration is compared to the Criterion Maximum Concentration published by the USEPA under Section 304 (a) of the Clean Water Act, and as promulgated in Chapter 62-302 (F.A.C.). For compounds not specifically listed, Rule 62-302.200 (F.A.C.) allows for acute and chronic toxicity standards, which are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50 percent of the test organisms in 96 hours, where the 96-hour EC_{50} or LC_{50} is the lowest value determined for a species significant to the indigenous aquatic community. **Table 6** lists representative toxicity levels for selected freshwater aquatic invertebrates and fishes.

Table 7 lists the pesticides detected in the surface water during WY02. Four samples were collected at each site and were analyzed for all parameters. Pesticides with concentrations greater than their respective Class III criterion or toxicity limit were assigned to the excursion category of "concern," whereas those higher than the PQL were assigned to the "potential concern" excursion category. Four detections were found to be of concern. The diazinon concentrations detected during the August and December 2001 sampling events at S-38B (0.097 and 0.053 µg/L, respectively) should not have an acute, detrimental impact for fish. However, for aquatic invertebrates this level is slightly greater than the calculated chronic toxicity (0.04 µg/L) for *Daphnia magna*, a sensitive indicator species for aquatic macroinvertebrates. The sampling site for S-38B is located on the WCA-3A side of the NSID1 pump station.

The chlorpyrifos (ethyl) and ethion concentrations detected during the February 2002 event at S-177 (0.056 µg/L) and S-176 (0.021 µg/L), respectively, should not have an acute, detrimental impact for fish. However, for aquatic invertebrates these levels are greater than the calculated acute toxicity for *Daphnia magna* of 0.005 and 0.003 µg/L, respectively.

For all of these compounds at these concentrations, long-term exposure can cause impacts to the macroinvertebrate populations, but the pulsed nature of urban and agricultural runoff releases to the EPA precludes drawing any conclusions about long-term average exposures.

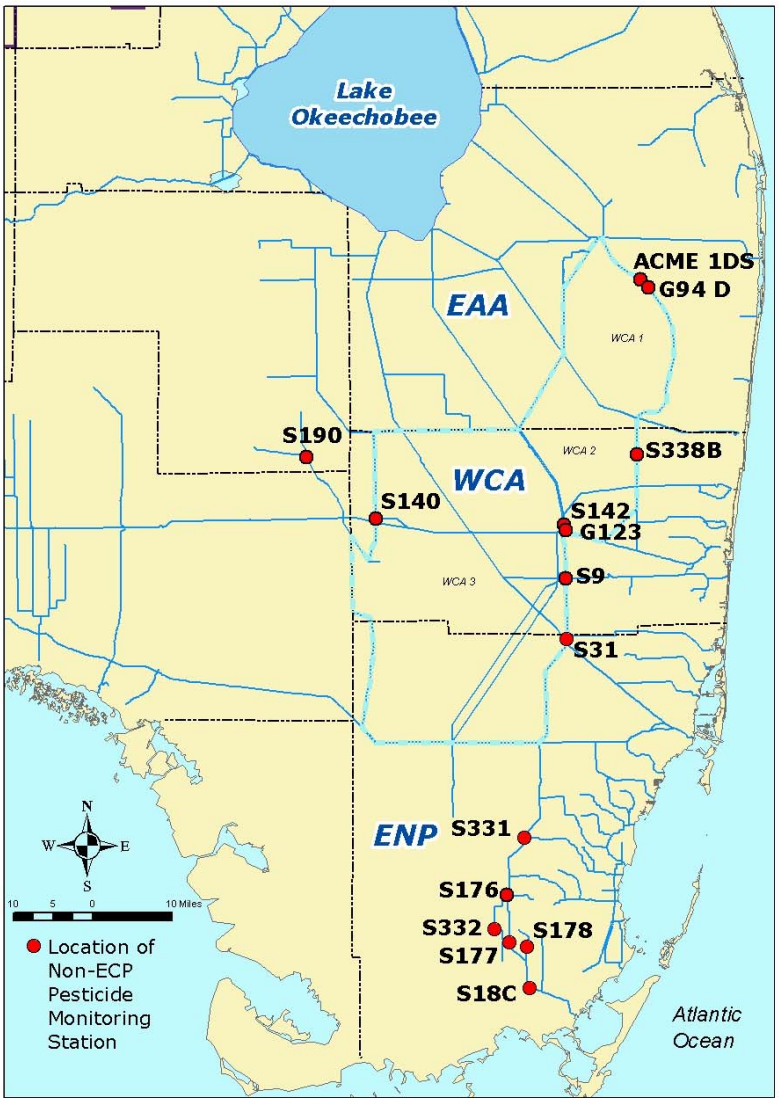


Figure 3. Pesticide monitoring network for non-ECP structures

Table 5. Minimum detection limits (MDL) and practical quantitation limits (PQL) for pesticides determined in May 2001

Pesticide or Degradation Product	Water Range of MDL-PQL (μg/L)	Sediment Range of MDL-PQL (μg/Kg)	Pesticide or Degradation Product	Water Range of MDL-PQL (μg/L)	Sediment Range of MDL-PQL (μg/Kg)
2,4-D	0.8 – 3.2	17 – 680	Endosulfan sulfate	0.0046 - 0.0236	0.98 – 32
2,4,5-T	0.8 – 3.2	17 – 680	Endrin	0.019 - 0.1	2 – 64
2,4,5-TP (silvex)	0.8 – 3.2	17 – 680	endrin aldehyde	0.0038 - 0.0216	0.98 – 32
Alachlor	0.048 - 0.248	29 – 960	Ethion	0.019 - 0.1	2.1 – 80
Aldrin	0.0019 - 0.0108	0.49 – 15.2	Ethoprop	0.019 - 0.1	4.3 – 160
Ametryn	0.0095 - 0.048	2.1 – 80	Fenamiphos (nemacur)	0.029 - 0.148	17 – 640
Atrazine	0.0094 - 0.05	2.1 – 80	Fonofos (dyfonate)	0.019 - 0.1	4.3 – 160
atrazine desethyl	0.0095 - 0.048	NA	Heptachlor	0.0023 - 0.012	0.49 - 15.2
atrazine desisopropyl	0.0095 - 0.048	NA	Heptachlor epoxide	0.0019 - 0.01	0.49 – 15.2
azinphos methyl (guthion)	0.019 - 0.1	2.1 – 80	Hexazinone	0.019 - 0.1	8.6- 320
α-BHC (alpha)	0.0021 - 0.0108	0.49 – 15.2	Imidacloprid	0.2 - 0.4	NA
β-BHC (beta)	0.0019 - 0.0168	0.49 – 15.2	Linuron	0.2 - 0.4	8.6 – 160
χ-BHC (delta)	0.00095 - 0.01	0.98 – 32	Malathion	0.029 - 0.148	6.4 – 240
δ-BHC (gamma) (lindane)	0.00095 - 0.01	0.49 – 15.2	Metalaxyl	0.048 - 0.248	NA
Bromacil	0.038 - 0.196	17 – 640	Methamidophos	NA	21 – 800
Butylate	0.019 - 0.1	NA	Methoxychlor	0.0099 - 0.052	2.4 – 80
Carbophenothion (trithion)	0.015 - 0.08	1.7 – 80	Metolachlor	0.057 - 0.296	21 – 800
Chlordane	0.0095 - 0.048	7.3 – 240	Metribuzin	0.019 – 0.1	4.3 – 160
Chlorothalonil	0.015 - 0.08	2.4 – 80	Mevinphos	0.057 - 0.296	8.6 – 320
Chlorpyrifos ethyl	0.019 - 0.1	2.1 – 80	Mirex	0.011 – 0.06	2.0 – 64
Chlorpyrifos methyl	0.0095 - 0.048	4.3 – 160	Monocrotophos (azodrin)	NA	43 – 1,600
Cypermethrin	0.019 - 0.1	NA	Naled	0.076 - 0.398	35 – 1,280
DDD-p,p'	0.0019 - 0.0216	0.98 – 32	Norflurazon	0.019 - 0.1	4.3 – 160
DDE-p,p'	0.0038 - 0.0196	0.98 – 32	Parathion ethyl	0.019 - 0.1	6.4 – 240
DDT-p,p'	0.0038 - 0.0196	1.5 – 48	Parathion methyl	0.019 - 0.1	6.4 – 240
demeton	0.11 - 0.6	43 – 1,160	PCB	0.019 - 0.1	10 – 720
diazinon	0.019 - 0.1	4.3 – 160	Permethrin	0.015 - 0.08	NA
dicofol (kelthane)	0.042 - 0.216	7.3 – 240	Phorate	0.029 - 0.148	2.1 – 80
dieldrin	0.0019 - 0.01	0.49 – 15.2	prometryn	0.019 - 0.1	6.4 – 240
disulfoton	0.019 - 0.1	4.3 – 160	simazine	0.0095 - 0.048	2.1 – 80
diuron	0.2 - 0.4	8.6 – 160	toxaphene	0.071 - 0.368	37 – 1,200
α-endosulfan (alpha)	0.0038 - 0.0196	0.49 – 15.2	trifluralin	0.0076 - 0.0396	2.0 – 64
β-endosulfan (beta)	0.0038 - 0.0196	0.49 – 15.2			

NA = not analyzed

Table 6. Toxicity of pesticide to selected freshwater aquatic invertebrates and fishes (μg/L)

Common name	48 hr EC50 Water flea *Daphnia magna*		acute toxicity (*)	chronic toxicity (*)	96 hr LC50 Fathead Minnow (#) *Pimephales promelas*		acute toxicity	chronic toxicity	96 hr LC50 Bluegill *Lepomis macrochirus*		acute toxicity	chronic toxicity
2,4-D	25,000	(8)	8333	1250	133,000	(8)	44333	6650	180,000	(9)	60000	9000
	-		-	-	-		-	-	900 (48 hr)	(7)	-	-
ametryn	28,000	(8)	9333	1400	-		-	-	4,100	(5)	1367	205
atrazine	6900	(8)	2300	345	15,000	(8)	5000	750	16,000	(5)	5333	800
bromacil	-		-	-	-		-	-	127,000	(8)	42333	6350
chlorpyrifos ethy	1.7	(8)	0.57	0.085	203	(8)	68	10	2.6	(5)	0.87	0.13
	0.1	(8)	0.03	0.005	-		-	-	5.8	(8)	1.93	0.29
DDD, p,p'	3,200	(7)	1067	160	4,400	(1)	1467	220	42	(1)	14	2.1
DDE, p,p'	-		-	-	-		-	-	240	(1)	80	12
diazinon	0.8	(1)	0.3	0.04	7,800	(8)	2600	390	168	(1)	56	8.4
	0.9	(4)	0.3	0.045	-		-	-	165	(3)	55	8.3
	-		-	-	-		-	-	16,000	(5)	5333	800
diuron	1,400	(8)	467	70	14,200	(8)	4733	710	5,900	(5)	1967	295
endosulfan	166	(8)	55	8	1	(1)	0.3	0.05	1	(1)	0.33	0.05
	-		-	-	-		-	-	2	(3)	0.67	0.10
	-		-	-	-		-	-	-		-	-
	-		-	-	-		-	-	-		-	-
ethion	0.06	(1)	0.02	0.003	720	(1)	240	36	210	(1)	70	11
	-		-	-	-		-	-	13	(3)	4.3	0.65
	-		-	-	-		-	-	22	(4)	7.3	1.1
hexazinone	151,600	(8)	50533	7580	274,000	(5)	91333	13700	100,000	(8)	33333	5000
metolachlor	23,500	(8)	7833	1175	-		-	-	15,000	(5)	5000	750
metribuzin	4,200	(8)	1400	210	-		-	-	80,000	(5)	26667	4000
norflurazon	15,000	(8)	5000	750	-		-	-	16,300	(8)	5433	815
simazine	1,100	(8)	367	55	100,000	(8)	33333	5000	90,000	(5)	30000	4500

(*) Florida Administrative Code (FAC) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC50 is the lowest value which has been determined for a species significant to the indigenous aquatic community.

(#) Species is not indigenous. Information is given for comparison purposes only.

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Table 6. (Cont'd). Toxicity of pesticide to selected freshwater aquatic invertebrates and fishes (μg/L)

Common name	96 hr LC50 Largemouth Bass *Micropterus salmoides*		acute toxicity	chronic toxicity	96 hr LC50 Rainbow Trout (#) *Oncorhynchus mykiss*		acute toxicity	chronic toxicity	96 hr LC50 Channel Catfish *Ictalurus punctatus*		acute toxicity	chronic toxicity
2,4-D	-		-	-	100,000	(5)	33333	5000	-		-	-
	-		-	-	110,000	(8)	36667	5500	-		-	-
ametryn	-		-	-	8,800	(5)	2933	440	-		-	-
atrazine	-		-	-	8,800	(5)	2933	440	7,600	(5)	2533	380
bromacil	-		-	-	36,000	(8)	12000	1800	-		-	-
chlorpyrifos ethy	-		-	-	11	(5)	3.7	0.55	280	(8)	93	14
	-		-	-	-		-	-	-		-	-
DDD, p,p'	42	(1)	14	2.1	70	(1)	23.3	3.5	1,500	(1)	500	75
DDE, p,p'	-		-	-	32	(1)	10.7	1.6	-		-	-
diazinon	-		-	-	90	(1)	30	4.5	-		-	-
	-		-	-	1,650	(3)	550	83	-		-	-
	-		-	-	2,900	(5)	967	145	-		-	-
diuron	-		-	-	5,600	(5)	1867	280	-		-	-
endosulfan	-		-	-	1	(1)	0.33	0.050	1	(1)	0.3	0.05
	-		-	-	3	(2)	1	0.15	1.5	(8)	0.5	0.08
	-		-	-	1	(3)	0.33	0.050	-		-	-
	-		-	-	0.3	(6)	0.10	0.015	-		-	-
ethion	173	(1)	58	9	500	(1)	167	25	7,600	(1)	2533	380
	150	(4)	50	8	193	(3)	64	10	7,500	(4)	2500	375
	-		-	-	560	(4)	187	28	-		-	-
hexazinone	-		-	-	180,000	(8)	60000	9000	-		-	-
metolachlor	-		-	-	2,000	(5)	667	100	4,900	(6)	1633	245
metribuzin	-		-	-	64,000	(5)	21333	3200	100,000	(8)	33333	5000
norflurazon	-		-	-	8,100	(8)	2700	405	>200,000	(5)	>67,000	>10,000
simazine	-		-	-	100,000	(8)	33333	5000	-		-	-

(*) Florida Administrative Code (FAC) 62-302.200, for compounds not specifically listed, acute and chronic toxicity standards are calculated as one-third and one-twentieth, respectively, of the amount lethal to 50% of the test organisms in 96 hours, where the 96 hour LC50 is the lowest value which has been determined for a species significant to the indigenous aquatic community.

(#) Species is not indigenous. Information is given for comparison purposes only.

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(2) U.S. Environmental Protection Agency (1977). Silvacultural Chemicals and Protection of Water Quality. Seattle, WA. EPA-910/9-77-036.

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Table 7. Pesticide surface water detections and excursions for samples collected from May 2001 to April 2002[1]

Compound	ACME1DS	G-94D	G-123	S-9	S-18C	S-140	S-190	S-332	S-38B	S-142	S-31	S-176	S-177	S-178	S-331/S-173
2,4-D	0:1:0*	1:0:0													
Ametryn	3:1:0	1:0:0							3:0:0	1:0:0					
Atrazine	2:2:0	2:2:0	2:2:0	0:2:0	1:0:0	0:2:0	1:0:0	0:1:0	0:4:0	2:1:0	1:2:0	0:2:0	0:1:0	2:2:0	1:1:0
Atrazine desethyl	2:0:0	2:0:0	1:0:0	1:0:0		1:0:0	1:0:0		0:4:0	1:0:0	1:0:0			1:0:0	
Atrazine desisopropyl				1:0:0					3:0:0					1:0:0	
Bromacil						1:0:0									
Chlorpyrifos, ethyl													0:0:1		
Diazinon									0:0:2						
Diuron			0:1:0							0:1:0					
Alpha endosulfan								1:0:0				1:0:0	0:1:0	1:0:0	
Beta endosulfan													1:0:0	2:0:0	
Endosulfan sulfate	1:0:0												1:0:0	0:2:0	
Ethion												0:0:1			
Hexdazinone			1:0:0			0:4:0				1:0:0					
Metolachlor														1:0:0	
Metribuzin														2:0:0	
Norflurazon						0:1:0	3:0:0								
Simazine						2:0:0									

[1] Four samples were collected for each site and analyzed for all parameters. Table cell represents only concentrations above the detection limit.

* Number of samples < = PQL (no concern); number of samples > PQL (potential concern); number of samples exceeding criterion or toxicity limit (concern)

Table 8. Pesticide sediment detections and excursions for samples collected in May 2001 and December 2001[1]

Structure	Compound							
	bromacil	DDD-p,p'	DDE-p,p'	diuron	alpha endosulfan	beta endosulfan	endosulfan sulfate	ethion
ACME1DS								
G-94D		1:0	1:0					
G-123	1:0 *			1:0				
S-9								
S-18C								
S-140								
S-190								
S-332								
S-38B								
S-142								
S-31			1:0					
S-176								1:0
S-177			0:1					
S-178			0:1		1:0	1:0	0:1	
S-331/S-173								

[1] Two samples were collected for each site and analyzed for all parameters. Table cell represents only concentrations above the detection limit.

* Number of samples < PQL (no concern); number of samples > PQL (potential concern)

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