Chapter 3: Phosphorus Controls for the Basins Tributary to the Everglades Protection Area

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SUMMARY

This chapter provides an update on the progress of the Everglades Program as mandated by the Everglades Forever Act (EFA), for controlling phosphorus (P) in discharges tributary to the Everglades Protection Area (EPA). The South Florida Water Management District (District or SFWMD) is responsible for specific compliance requirements stipulated in permits issued by the Florida Department of Environmental Protection (FDEP), which are mechanisms for assuring that the District complies with the EFA. The permits associated with this program are the Everglades Construction Project (ECP) and non-Everglades Construction Project (non-ECP) permits. Each permit includes basins with both urban and agricultural land uses that ultimately discharge to the EPA, and adopts a comprehensive approach of controlling phosphorus at the source utilizing regulatory, voluntary, and educational programs.

The ECP permit requires the District to construct, maintain, and operate the ECP in the Everglades Agricultural Area (EAA) and the C-139 basins, the largest tributary sources to the EPA. The ECP provides reasonable assurance for compliance with the EFA through a combination of phosphorus source control programs using mandatory Best Management Practices (BMPs) and downstream treatment within Stormwater Treatment Areas (STAs). The BMP program is known as the Everglades Regulatory Program, and is detailed in *Section I* of this chapter. Performance of the STAs is detailed in Chapter 4 of this volume.

Of the remaining basins discharging into the EPA, the non-ECP basins are those that have voluntary or cooperative source control programs and discharge directly to the EPA (there is no downstream treatment through the STAs). The non-ECP permit was issued to the District by the FDEP for the operation and maintenance of discharge structures within the control of the District, and that discharge into, within, or from the EPA but are not included in the ECP. There are eight non-ECP basins discharging to the EPA and regulated under the non-ECP permit including the ACME Improvement District, North Springs Improvement District (NSID), C-11 West,

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North New River Canal (NNRC), Feeder Canal, L-28, Boynton Farms, and C-111 basins. The affected entities within these basins are primarily local governments and municipalities, special drainage districts, the Seminole Indian Tribe of Florida and the Miccosukee Tribe of Indians of Florida, and federal agencies. The phosphorus source control program using BMPs in the non-ECP basins is detailed in *Section II* of this chapter. Total phosphorus (TP) data collected during WY2005 for each basin represented in the ECP and non-ECP permits are summarized in **Table 3-1**.

Table 3-1. Summary of Everglades Construction Project and non-Everglades Construction Project (ECP and non-ECP) basin discharge total phosphorus (TP) concentrations and loads for Water Year 2005 (WY2005).

Basin[1]	ECP or Non-ECP	Primary Land Use	TP Concentration (flow-weighted mean, ppb)	TP Load (metric tons)
Everglades Agricultural Area (EAA)	ECP	Agricultural	124	182
C-139	ECP	Agricultural	195	40.3
ACME Improvement District	Non-ECP	Urban/Equine	171	5.0
North Springs Improvement District (NSID)	Non-ECP	Urban	20	0.01
North New River	Non-ECP	Urban	(no flow)[2]	(no flow)[2]
C-11 West	Non-ECP	Urban	16	3.0
C-111	Non-ECP	Urban	8	1.0
L-28	Non-ECP	Agricultural	42	7.2
Feeder Canal	Non-ECP	Agricultural	97	11.3
Boynton Farms	Non-ECP	Agricultural	(n/a)[3]	(n/a)[3]

[1] ECP basin discharges receive further treatment downstream through the STAs prior to discharge to the EPA.

[2] There were no discharges from the North New River Canal basin to the EPA during WY2005.

[3] There is no instrumentation in place for flow monitoring from this area.

The EAA basin under the ECP permit is the largest, both in acreage and TP contribution, of the basins ultimately discharging to the EPA. The EAA basin has been in compliance with the Everglades Regulatory Program of BMPs since the first compliance year, Water Year 1996 (WY1996) (May 1, 1995 through April 30, 1996). The EAA basin is required to reduce TP loads by 25 percent when compared to the pre-BMP baseline period. Over the 10 years since the program's initiation, the EAA's annual percentage load reduction average is greater than 50 percent.

The remaining ECP basin, the C-139 basin, is the second largest tributary source to the EPA. WY2005 is only the third compliance year in which the BMP program was implemented in the C-139 basin. Unlike the EAA basin's goal of achieving a 25 percent reduction of TP loads from historical baseline levels, the goal of the C-139 basin is to maintain TP loads at or below historical baseline levels. As such, the C-139 basin's initial level of effort for BMP implementation was not required to be at the same level as the EAA basin. In fact, it will not be until WY2006 that the C-139 basin will have an equivalent level of effort for BMP implementation to that of the EAA basin.

The initial compliance determination period for the C-139 basin was WY2003. The basin was determined to be out of compliance for WY2003, WY2004, and WY2005. Although the basin was determined to be out of compliance, WY2005 marked the first time in six years that the flow-weighted mean (FWM) TP concentration for the water year was below 200 parts per billion (ppb). Because of the time sequence of the regulatory requirements in this basin, the impact of BMPs on water quality was not expected to be realized immediately, but the lower TP concentration realized in WY2005 may be an indicator that effects are now occurring. Since the C-139 basin was found to be out of compliance for WY2005, the action plan has been revised to (1) increase the level of BMP implementation, (2) extend existing funding programs to accelerate the implementation of BMPs on individual farms, (3) provide training to landowners on effective implementation of BMPs, and (4) utilize BMP demonstration projects at the farm and regional levels to ensure a holistic approach to improving water quality.

In addition to the Everglades Regulatory Program, the EFA and Chapter 40E-63, Florida Administrative Code (Rule 40E-63), includes other source control initiatives such as:

- requiring the District to monitor the effects of BMPs on hydroperiod. Originally, it was anticipated that the implementation of BMPs in the EAA would decrease flows to the EPA by as much as 20 percent. In response, the EFA directed the District to annually evaluate the amount of EAA runoff and provide replacement water volumes to the EPA if necessary to "make-up" for any reductions in flow. Recent evaluations of EAA runoff, through more comprehensive modeling exercises, have indicated, however, that the anticipated flow reduction has not occurred and therefore, the replacement water initiative should be revisited.
- requiring EAA landowners, through the Everglades Agricultural Area - Everglades Protection District (EAA-EPD), to sponsor a BMP research program. This program is conducted through a contract between the EAA-EPD and the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) with the goal to establish a schedule of BMP research, testing, and implementation to identify water quality parameters that are not significantly improved by the STAs and the current level of BMPs being implemented throughout the EAA, and to identify strategies to address such parameters.
- expanding the BMP program to the EFA-specified Chapter 298 diversion areas under the ECP. The 298 diversion areas are basins that previously discharged directly to Lake Okeechobee but are now mandated to have at least

80 percent of their annual flow and TP load diverted to the STAs through the EAA. Four of the five diversion project basins, Closter Farms (715 Farms), East Beach Water Control District (EBWCD), East Shore Water Control District (ESWCD) and South Shore Drainage District (SSDD), are currently operational. The fifth, South Florida Conservancy District (SFCD), is scheduled to be operational in early WY2006.

In contrast to the ECP permit basins' mandatory BMP program, the non-ECP permit, as outlined by the EFA, allows for a more flexible adaptive approach to water quality improvement. The EFA requires development of schedules and strategies for achieving and maintaining water quality standards for the eight non-ECP basins discharging to the EPA. This requirement involves evaluating existing programs, permits, and water quality data, acquiring lands and constructing and operating water treatment facilities, if appropriate, together with developing funding mechanisms and a regulatory program designed to improve water quality. These schedules, source control strategies, monitoring plans, and funding mechanisms are discussed in *Section II* of this chapter and described in detail in the District's Regulatory Action Strategies (RAS) Report referenced by the permit and implemented through the District's program, known as the Everglades Stormwater Program (ESP). Land use in these basins is typically urban, with the exception of the Feeder Canal, L-28, and Boynton Farms, which are agricultural areas. During WY2005, these agricultural areas contributed approximately 67 percent of the total load from the non-ECP basins to the EPA.

Each non-ECP basin initially underwent a thorough assessment using the available information and data to develop scientifically sound water quality improvement strategies. The initial assessment steps of data collection and evaluation, followed by development of action plans for each basin, have been completed. Water quality improvement plans are in place to control TP at the source and include a combination of voluntary BMPs, requirement or modification of permits to include water quality criteria, construction projects, cooperative agreements, basin-specific regulatory programs, and public education.

Unlike the ECP basins that are required to decrease TP levels in discharges based on historical loads, there is no specific phosphorus requirement established at the point of discharge for the non-ECP basins. It is anticipated that the implementation of the water quality improvement plans for the non-ECP basins will significantly contribute to achieving long-term water quality standards in the EPA. Water quality data are tracked for increasing and decreasing trends, so that the water quality improvement plan may be modified as necessary through an adaptive management process to ensure optimization measures for TP reduction at the source.

The non-ECP permit requires District monitoring of all discharges for phosphorus, the parameter of primary concern, in addition to general water quality parameters. An evaluation of the non-ECP basin data indicates that the quality of water discharging into the EPA is generally acceptable. However, there are exceptions for phosphorus, dissolved oxygen, and occasional excursions from standards for pH, un-ionized ammonia, and turbidity. Water quality considerations and excursions in the EPA are further discussed in Chapter 2A of this volume.

Analysis of TP concentrations in WY2005 continues to indicate significant differences between non-ECP basins. Phosphorus is categorized as a concern (above 50 ppb) for the ACME Improvement District and Feeder Canal basins; a potential concern (10 ppb < TP < 50 ppb) for the L-28, C-11 West, North New River Canal, and North Springs Improvement District basins; and no concern (< 10 ppb) for the C-111 basin.

In addition to the original EFA source control programs implemented through the ECP and non-ECP permits, the EFA amendments of 2003 reference the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area (Long-Term Plan). The Long-Term Plan

identifies supplemental water quality improvement projects for ultimately achieving long-term water quality standards in the EPA. For the ECP and non-ECP basins, the Long-Term Plan identifies tasks that implement incremental optimization measures for existing phosphorus source control programs, including improvements, where practicable, in urban and agricultural BMPs and integration with congressionally authorized components of the Comprehensive Everglades Restoration Plan (CERP) and/or other federal projects. The Long-Term Plan also includes cost estimates, funding mechanisms, and implementation schedules of the proposed supplemental projects. All of the water quality improvement or investigative projects specified in the Long-Term Plan for the ECP and non-ECP basins have been initiated and are within the proposed budgets. Additional information on the Long-Term Plan can be found in Chapters 8 and 13 of this volume.

WY2005 was characterized by an unprecedented active hurricane season. Although the 2004 hurricanes did not have major effects on the Everglades source control programs as a whole, they did affect water quality results in specific areas. It appears that the effects were caused by higher-than-average rainfall in those specific areas.

An overall evaluation of the Everglades source control programs indicates that they are successfully reducing phosphorus at its sources, although there continue to be opportunities for optimizing the programs for water quality improvement benefits. The program in the EAA basin has reduced the amount of phosphorus by more than 50 percent over historical levels since the implementation of BMPs in the basin 10 years ago. The BMP program in the C-139 basin has only been in effect for three years and is just beginning to show improvements as indicated in the 25–30 percent reductions in TP concentration since the BMP program was initiated. However, the TP loads leaving the C-139 basin continue to exceed acceptable levels. In response, the action plan for this basin has been revised to consider projects at both the farm and the regional level for a more holistic approach to water quality improvement. Source controls have been successfully implemented in the non-ECP basins since WY1998 through water quality action plans that include effective implementation of BMPs, public outreach, capital improvement projects, and integration with CERP and/or other federal projects. For WY2005, four of the eight non-ECP basins had either no discharge to the EPA or had TP concentrations below 20 ppb. The overall TP load from non-ECP basins into the EPA during WY2005 was 10 percent less than in WY2004.

Future direction in the ECP and non-ECP basins requires continued implementation of the original EFA mandated source control programs along with supplemental projects described by the applicable portions of the Long-Term Plan. Investigative projects outlined in the Long-Term Plan will continue to identify areas of opportunity for added water quality benefits through optimizing existing programs or through adaptive management of the existing programs. Where adaptive management results in modifications to the existing programs, the District will follow the revision process described in the Long-Term Plan including requesting approval from the FDEP.

SECTION I: EVERGLADES REGULATORY PROGRAM – ECP BASINS

OVERVIEW

The South Florida Water Management District (District or SFWMD) is responsible for carrying out the programs mandated by the Everglades Forever Act (EFA) through compliance requirements stipulated in permits issued by the Florida Department of Environmental Protection (FDEP). The permits, which are currently issued for Stormwater Treatment Areas 1 East, 1 West, 2, 3/4, 5, and 6 (STA-1E, 1W, 2, 3/ 4, 5, and 6), are referred to as the "EFA permits." The EFA permits require the District to construct, maintain, and operate the STAs in the Everglades Agricultural Area (EAA) in accordance with the EFA. Aside from the requirements related to the STAs (discussed in Chapter 4 of the *2006 South Florida Environmental Report – Volume I*), the EFA permits require the District to continue to implement the Best Management Practice (BMP) program for total phosphorus (TP) reduction in accordance with Rule 40E-63 in areas discharging to the STAs. The tributaries to the ECP and their associated STAs are summarized in **Table 3-2**[2]. The EFA includes other source control initiatives such as: District monitoring of the effects of BMPs on EPA hydroperiod, landowner sponsored BMP research, and expansion of the BMP program to the EFA specified Chapter 298 diversion area basins. The permit also requires that an annual report describing the Everglades Program performance is submitted to the FDEP for review, and allows for it to be consolidated into the South Florida Environmental Report (SFER).

The EAA and the C-139 basins, referred to as the "ECP basins," are the largest tributary sources to the Everglades Protection Area (EPA). Agriculture is the predominant land use in both the EAA and the C-139 basins. The EAA basin covers approximately 500,000 acres located south of Lake Okeechobee within eastern Hendry and western Palm Beach counties, an area of approximately 1,122 square miles of highly productive agricultural land comprised of rich organic peat or muck soils. The area is considered to be one of Florida's most important agricultural regions, with approximately 77 percent of the EAA devoted to agricultural production. The major crops in the EAA basin include sugar cane, vegetables, and sod, with secondary crops in rice and citrus.

The C-139 basin covers approximately 170,000 acres of sandy mineral soils located southwest of Lake Okeechobee entirely within eastern Hendry County west of the EAA basin. The primary land uses in the C-139 basin were historically almost exclusively pasture, although land uses in the basin during the last few years have included vegetables and nursery operations.

[2] Based on information provided in the Long-Term Plan (October 27, 2003) and the Everglades Protection Project Conceptual Design document (February 15, 1994).

Table 3-2. Basins tributary to the ECP and their associated Stormwater Treatment Areas (STAs).

EFA ECP Basins	Chapter 40E-63, F.A.C., Hydrologic Sub-basins	Receiving STA
EAA		
	S-5A	STA-1W, STA-1E[1,2]
	S-6	STA-2
	S-7/S-2	STA-3/4[4]
	S-8/S-3	STA-3/4[4], STA-6[1]
	Diversion Projects	
	East Beach Water Control District	STA-1W, STA-1E[1,2]
	East Shore Water Control District	STA-2
	Closter Farms	STA-2
	South Shore Drainage District	STA-3/4[4]
	South Florida Conservancy District	STA-3/4[4]
C-139		STA-5, STA-3/4[3]

[1] Proposed configuration. This STA is not operational yet.

[2] Under construction by the U.S. Army Corps of Engineers, STA-1E is planned to receive a portion of the flows coming from the S-5A basin.

[3] G-136 discharges to the Miami Canal from the C-139 Basin. Once the plug at G-373 was completed the Miami Canal primarily discharged to STA-3/4.

[4] With the completion of STA-3/4, all flow leaving the EAA will discharge to an STA prior to entering the EPA under normal operating conditions.

Other surface water sources tributary to the ECP (STA inflows) include diversions of EFA-specified Chapter 298, Florida Statutes (F.S.), designated water control district (298 District) flows from Lake Okeechobee including the agricultural lease 3420 (the 715 Farms, or Closter Farms); and normal environmental, water supply, and regulatory releases from Lake Okeechobee. These areas are depicted in **Figure 3-1**. To accurately assess the performance of the phosphorus reduction efforts and compliance in the EAA basin, the District measures flows and TP concentrations at each of the structures entering and leaving the EAA. From these values, TP loads are calculated and used in the rule-adopted model that determines basin performance relative to the base period.

The 1994 EFA defined that STAs and BMP implementation for the ECP basins are the best available technology for achieving interim phosphorus water quality goals for the EPA. In order to carry out these activities, the EFA mandated the creation of an Everglades Program, including a regulatory component to oversee implementation of BMPs to control TP at the source. The District promulgated Chapter 40E-63, Florida Administrative Code (F.A.C.) ("Rule 40E-63"), which details the scope of the Everglades Regulatory Program for the EAA and the C-139 basins. In this rule, the District describes the implementation procedures and compliance measures for the BMP program including (1) enforcing implementation of BMPs, (2) conducting a water quality monitoring program, and (3) developing a mandatory BMP research program for phosphorus and other water quality parameters of concern.

The EFA also requires the District to oversee the implementation of BMPs in the 298 District diversion projects [Subparagraph 373.4592(4)(f)(2), F. S.]. The 298 Districts are areas within the EFA-defined EAA boundaries that have historically discharged to Lake Okeechobee, and are regulated under Chapter 40E-61, F.A.C, which establishes a program to protect the water quality of the lake (discussed in Chapter 10 of this volume). The EFA requires that these areas divert at least 80 percent of their flow and load to the EAA once the construction of the receiving STA is complete. As each 298 District diverts its discharges to the EPA, it must obtain a Rule 40E-63 permit for BMP implementation and discharge monitoring plans similar to those required for EAA dischargers. Evaluations are currently underway to determine whether additional rules are necessary in the 298 Districts to regulate water quality. In addition, the diversion basins are required to submit to the District TP flow and load data from Lake Okeechobee and EAA discharge structures to verify that the 80 percent diversion requirements are met on an annual basis. However, Chapter 40E-61 permits and other Lake Okeechobee requirements continue to apply, as these areas maintain their ability to discharge to the lake.

Once all diversion projects are complete, flows from approximately 28,500 acres that previously discharged only to Lake Okeechobee will combine with flows from the EAA (500,000 acres) and will be routed to the ECP. Diversion of flows from Closter Farm, East Beach Water Control District (EBWCD), and East Shore Water Control District (ESWCD) began in 2002. The Closter Farms diversion actually flows into the East Shore Water Control District and subsequently into the EAA. The South Shore Drainage District (SSDD) began diverting flows in 2004, and the South Florida Conservancy District (SFCD) will initiate diversion of their flows and loads in mid-2005.

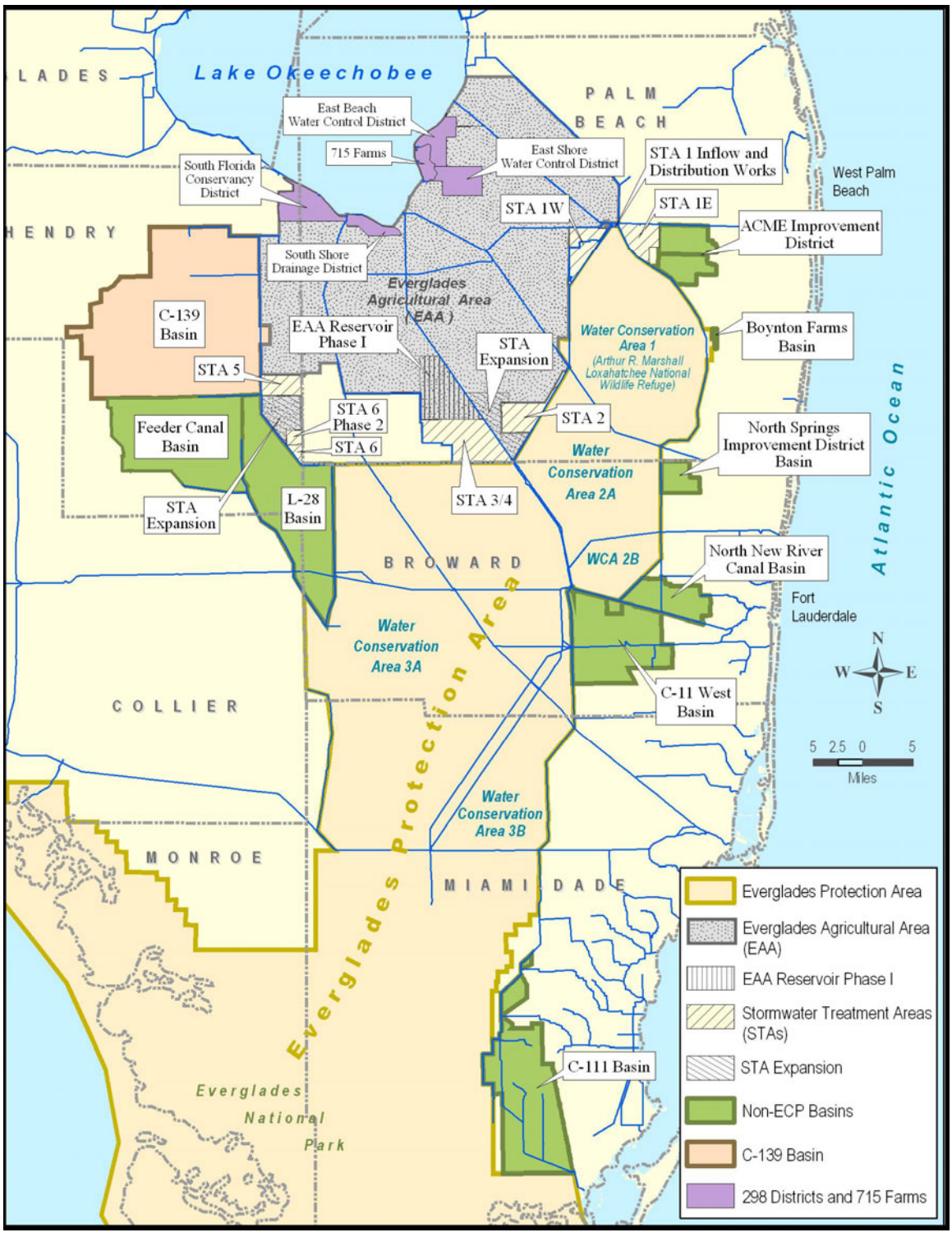


Figure 3-1. Basins tributary to the Everglades Protection Area (EPA).

In addition to the ECP permit, the recently amended EFA (2003) references the Long-Term Plan for Achieving Water Quality Goals in the Everglades Protection Area (Long-Term Plan). The Long-Term Plan identifies supplemental projects in the ECP and other areas discharging into the EPA that must be completed prior to December 31, 2006 (see Chapters 4 and 8 of this volume) as well as a variety of projects that will be completed prior to 2016. The Long-Term Plan was developed in full recognition of the substantive remaining scientific uncertainties surrounding the objective to achieve compliance with the TP criterion, and it is predicated upon maximizing water quality improvements through an adaptive implementation process. The planning goal during the initial phase of the Long-Term Plan (2003–2016 inclusive) is that permits issued by the FDEP to meet water quality standards in the EPA shall be based on Best Available Phosphorus Reduction Technology (BAPRT). BAPRT consists of the combination of BMPs and STAs, which includes a continuing research and monitoring program to reduce outflow TP concentrations. The BMP programs identified in the ECP permit, the non-ECP permit (as described in Section II of this chapter), and the Long-Term Plan identify and implement incremental optimization measures for phosphorus reduction including improvements, where practicable, in urban and agricultural BMPs, and integration with congressionally authorized components of the Comprehensive Everglades Restoration Plan (CERP).

The EFA-mandated ECP and Long-Term Plan projects are primarily financed through the Everglades Trust Fund. The fund's primary sources include the Everglades agricultural privilege tax, the C-139 agricultural privilege tax, *ad valorem* revenues (the "1/10 mil"), and the Alligator Alley toll revenues. Among the available funding sources, the agricultural privilege tax represents the direct contribution from permittees in the EAA and C-139 basins. The tax is paid by landowners and operators of all real estate property that is zoned or used for agricultural purposes including state lands. The current annual tax rate applicable for the EAA is $31 per acre except for vegetable acreage, which is taxed at the minimum rate of $24.89 per acre. The EFA provides for an incentive credit based on the performance of BMPs in the EAA. The credit reduces the applicable rate to a minimum of $24.89 per acre based on the phosphorus load reductions achieved in excess of the required 25 percent. Since the program's inception, EAA landowners have qualified for the minimum tax. The EAA agricultural privilege tax credits are detailed in Appendix 3-1a, Table 3, of this volume.

The annual agricultural privilege tax rate per acre currently applicable to the C-139 basin is $4.30 per acre. This EFA does not provide for a tax incentive in the C-139 basin, and applies to all crops. Originally, the EFA defined a variable tax rate to be computed by dividing $654,656 by the number of acres included on the C-139 agricultural privilege tax roll for each year. The 2003 EFA amendments fixed the tax rate at $4.30 per acre by basing the calculation on the number of agricultural acres listed in the 2001 tax roll. The amendment prevents tax increases on agricultural taxpayers as land use changes occur, such as large tracts of land in the C-139 basin being taken out of agricultural production and restored to wildlife habitat.

In accordance with the EFA, permittees (landowners and/or operators) within the EAA and C-139 basins who are in full compliance with their Everglades Program permits are not required to implement additional water quality measures prior to December 31, 2006. The EFA also establishes that the Everglades Program constitutes the foundation for building a long-term program to ultimately achieve restoration and protection of the EPA. In implementing the program, the Florida legislature found it important to recognize in the EFA that the EAA and adjacent areas provide a base for an agricultural industry, which in turn provides important products, jobs, and income both regionally and nationally. As stated in the EFA [Paragraph 373.4592(1)(e), F.S.], "it is the intent of the legislature to preserve natural values in the Everglades while maintaining the quality of life for all residents of South Florida, including those in agriculture, and to minimize the impact on South Florida jobs, including agricultural, tourism, and related jobs, all of which contribute to a robust economy."

EVERGLADES REGULATORY PROGRAM: EAA BASIN

The goal of the Everglades Regulatory Program in the EAA basin under Rule 40E-63 is to reduce the TP loads discharged from the basin by 25 percent. Details of the different aspects of compliance with the rule are described below and include (1) permit-level site-specific activities identified in a BMP Plan and a Discharge Monitoring Plan, and (2) basin-level TP load reduction requirements.

Rule 40E-63 states that the use of Everglades Works of the District (EWOD) within the EAA basin requires a permit. Rule 40E-63 permits approve a permittee-implemented BMP plan and discharge monitoring plan for each sub-basin or farm. Compliance with the permit level plans is based on annual implementation and monitoring reports and on site verifications.

Rule 40E-63 also requires the District to collect monitoring data from the EAA basin for the purpose of determining primary compliance with the TP load reduction requirement. The EAA regulated area that is monitored is defined by the multiple hydrologic drainage sub-basins summarized in **Table 3-2**. Although the boundaries of these sub-basins remain static, the acreage contributing flow and used in the rule-adopted compliance model for determining EAA basin TP load varies from year to year as areas are converted to STAs.

Based on the District collected data, if the EAA basin is determined to be out of compliance, then the permit-level data collected under the permittee discharge monitoring plan is to be used to determine individual farm TP load contributions. This information would be used to identify which permittee BMP Plans would require enhancement. There is no provision in the rule for use of the permit level regulatory data as long as the basin-level data shows that the TP load reduction requirement is met. All sample data, at both the permit and the EAA basin level, must be analyzed by laboratories certified by the Florida Department of Health for phosphorus analysis and sample collectors must have field sampling procedures approved by the FDEP. Both agencies and the District perform performance audits to ensure proper quality control practices are followed. Sample data are not accepted in cases where audits and certifications are not acceptable. More information about the FDOH and FDEP programs can be obtained at http://www.dep.state.fl.us/labs/.

Currently, there are 33 EAA basin EWOD permits, including approximately 205 sub-basins and 286 privately owned water control structures discharging into the District canals in the EAA, encompassing an area of approximately 500,000 acres (**Figure 3-2**). Most of the sub-basins have muck soils and a highly managed drainage system using pumps. The areas represented by single permits vary substantially between 120 and 92,000 acres. The total permitted acreage varies from year to year as areas are converted from agricultural production to STAs, thereby removing that acreage from the permit.

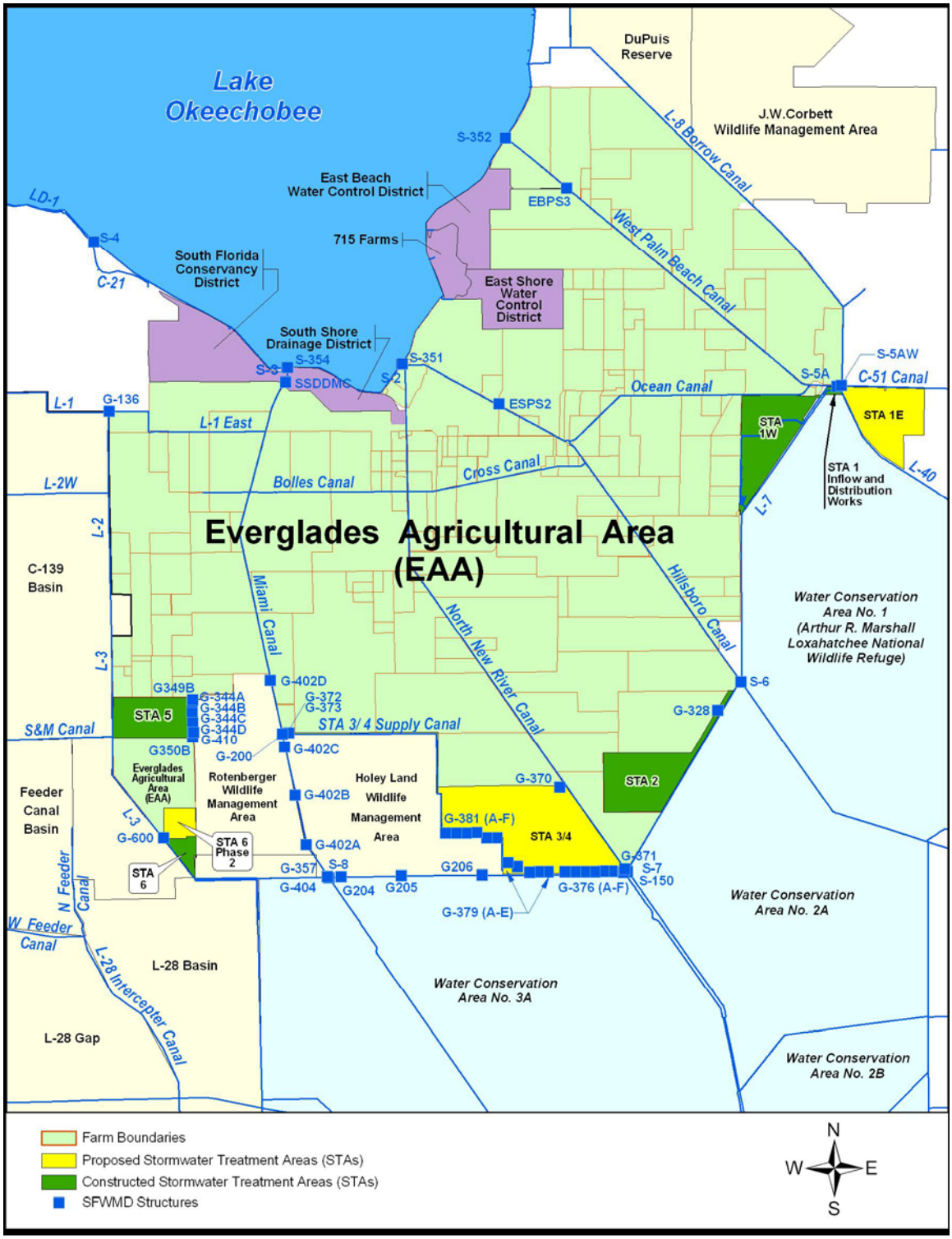


Figure 3-2. The EAA basin and primary compliance water control structures within the ECP boundary.

EAA Best Management Practice Plans

Each EWOD permit approves an onsite implementation plan for BMPs (BMP plan) in accordance with the EFA [Subparagraph 373.4592(4)(f)(2)(c), F.S.], which states that permits issued under the Everglades Regulatory Program require BMPs for varying crops and soil types. The BMP plan includes operational programs or physical enhancements designed to reduce phosphorus levels in water discharged to the EWOD.

The District is responsible for ensuring that a base level of BMPs is established for each permit area, and that BMP plans between different permittees are consistent and comparable for a balanced compliance strategy. To accomplish this task, a system of BMP "equivalents" was developed by assigning points to BMPs. The BMP equivalent points system was originally based on the review of reports and publications produced by UF/IFAS, on the best professional judgment of District staff, and on extensive cooperative workshops conducted among affected landowners, consultants, and the general public. The equivalents system was created to provide for a balanced compliance strategy in light of the many uncertainties surrounding BMP effectiveness at the time of program inception and to provide for an equitable level of effort among permittees for determining permit compliance. Since the program inception, much has been learned and BMPs have proven to be effective in reducing TP loads in discharges; however, quantifying the effectiveness of individual BMPs remains a challenge because of the inability to isolate the effects of an individual BMP from the many other variables affecting water quality in the field. The equivalents system has been successful with respect to providing a balanced approach and adequate safeguards to account for the uncertainties that still exist.

All EAA permittees are required to implement a comprehensive plan that includes selection of BMPs from the primary categories known to contribute to phosphorus in runoff: water management, nutrient management and particulate controls. This method allows a farm that does not have the same flexibility with water management because of site conditions (e.g., shallower soils and less water tolerant crops) to create an "equivalent" BMP plan by providing a higher level of effort in another category such as particulate controls. The equivalents weigh in the level of effort for each type of BMP as well as effectiveness even though effectiveness is not quantifiable.

The example in **Table 3-3** below compares BMP plans for two different circumstances and how the equivalents system of points provides for a balanced compliance effort. The example shows how one farm with different site conditions is implementing what was originally assumed to be a higher level of effort for the water management BMP by retaining 1 inch of rainfall runoff in soil storage as compared to a farm with shallow soils that is only able to provide 0.5 inch of rainfall runoff in soil storage but still has a comparable BMP plan because of additional particulate controls being implemented. As a result, a permittee receiving credit for fewer equivalents under one type of BMP (e.g., water management) must strengthen or balance their BMP plan in other areas (nutrient management or particulate control BMPs.)

By using the BMP equivalents approach, each permittee has the flexibility to develop a BMP plan that is best suited for site-specific soil types, hydrology, and crop conditions. For each proposed BMP, the permittee must consider how the BMP will be implemented, how staff responsible for BMP implementation will be trained, and how BMP implementation will be documented. Appendix 3-1 of this volume provides a listing of the most commonly implemented BMP practices and the equivalent points for each. Selection of BMPs is not limited to this listing. Alternative BMPs may be proposed with justification for achieving water quality improvements, along with a description of how it will be implemented, documented, and training will be provided.

Table 3-3: Example of comparable Best Management Practice (BMP) plans.

Example Sugarcane Farm - Deep Soils		Example Sugarcane Farm – Shallow Soils	
BMP	Points	BMP	Points
1" Rainfall Detention	10	½" Rainfall Detention	5
Controlled Fertilizer Application	2.5	Controlled Fertilizer Application	2.5
Fertilizer Spill Prevention	2.5	Fertilizer Spill Prevention	2.5
Soil Testing	5	Soil Testing	5
Four Particulate Controls	5	Six Particulate Controls	10
Total	25	Total	25

Note: A BMP plan is required for each land use or crop, and shall be implemented across the entire farm acreage (drainage area).

The rule requires an initial minimum level of BMP implementation of 25 points for the EAA. Additional levels of BMP practices to further reduce TP loads are required if the basin is shown to be out of compliance. Because the EAA basin has remained in compliance with the load reduction requirement, the permittees continue to implement the rule required minimum of 25 points in BMP practices.

There are many challenges associated with pinpointing the effectiveness of BMPs in real practice. Similar BMP plans can be associated with very different concentrations and loads because of site-specific conditions or incidental factors. Experience suggests that *how* a BMP is implemented can be as important as *which* BMP is selected.

Post-permit compliance activities include verification of the implementation of the approved BMP plans by review of BMP implementation reports prepared by the permittee and in-field visual observations and review of documentation. BMP effectiveness and optimization is continuously under review as site verifications are performed. Site verifications are the most productive method for optimizing how a BMP is implemented because it is the only method for determining the many site specific conditions affecting the implementation and therefore the relative effectiveness of the BMP. Additionally, there will be continued review of BMP effectiveness, in terms of regional application, through research as mandated by the EFA and carried out through the Everglades Agricultural Area Master Permit for BMP Research, Testing and Implementation. In partnership with UF/IFAS, the District is increasing the level of one-on-one contact with the permittees to evaluate how the BMPs are implemented under site specific conditions and how refining existing methods of implementing BMPs will improve their relative effectiveness. Considering the success of the current system of equivalents in meeting the

intended purpose, compelling evidence would be necessary to significantly revise the equivalents system, including the basis for the approach.

EAA Load Compliance Determination

To evaluate compliance with the EAA basin-level TP load reduction requirements, the ECP permits require that the District annually evaluate BMP performance in areas upstream of the STAs, consistent with Rule 40E-63 and Paragraph 373.4592(4)(f), F.S. The methodology presented in the rule consists of a primary and a secondary load compliance determination.

For primary compliance, the EAA basin must demonstrate a 25 percent reduction in load annually compared to the pre-BMP base period. Data from District structures are used to calculate the measured TP load discharged from each EAA sub-basin. Primary compliance is determined by aggregating the TP load from each of the sub-basins into a basin-wide total TP load. A secondary method of program compliance measurement is through individual permit-level ("farm-level") water quality monitoring conducted by the permittee. In the EAA basin and in accordance with Rule 40E-63, F.A.C., this on-farm or permittee-level water quality monitoring will only be used for compliance determination if the basin does not meet the 25 percent TP load reduction requirement. The permittee water quality monitoring results are not used to calculate the phosphorus reduction at the EAA basin level. The District currently conducts EAA basin-level monitoring at all inflow and outflow structures for this purpose as described above. Because the EAA basin has met and exceeded the 25 percent reduction requirement each year since the program's inception, the secondary method of load compliance measurement has not been utilized.

In developing the compliance methodology, load was determined to be a more effective measure of compliance for the entire basin than concentration alone because it accounts for both concentration and volume. Basin-level monitoring for primary compliance includes both inflow and outflow structures from the EAA at which TP concentrations and flows are measured

Phosphorus load reduction calculations are conducted and reported annually. The EFA specifically mandates a method to measure and calculate the annual basin export of phosphorus in surface water runoff from EAA lands (farms, cities, and industry). These calculations are made using an adjustment for the hydrologic variability associated with rainfall and surface water discharges over time. These adjusted equations, calibrated to WY1980–WY1988 within the base period (May 1, 1979 through April 30, 1988), attempt to predict what the average annual TP load would have been for the EAA basin if the current water year's rainfall amount and monthly distribution had occurred during the baseline period. Compliance is determined by comparing the observed TP loads for the current year to the predicted loads from the baseline period. Because rainfall distribution is a factor in the primary compliance calculations, differences in distribution can significantly affect the relative contribution of TP load by sub-basin (S-5A, S-6, S-7, etc.) A relative increase in load from one sub-basin when compared to another may simply be the result of variations in rainfall rather than a difference in agricultural practices or BMP implementation.

EAA BASIN-LEVEL MONITORING RESULTS

Discharge quantity is recorded at all current inflow and outflow points defining the boundary of the EAA basin. Fifty-three water control structures defined this boundary for the EAA at the beginning of WY2005. As of January 8, 2005, the number of structures defining the boundary was reduced to 25 as a result of hydraulic conveyance alterations brought about by the construction of diversion structures (G-371 and G-373) meant to redirect surface water flows for treatment in STA-3/4. Flow estimates are determined for every structure and TP samples are collected at those structures in the EAA where the concentrations are deemed to be representative (surrogate sampling sites) of discharges for all boundary structures. All monitoring locations in

the EAA basin are equipped with automatic samplers. During discharge events, TP samples are collected primarily by automatic samplers, which are programmed to collect samples on a flow proportional basis. The samples are collected regularly from the auto-samplers (generally every seven days), and the samples are composited at the end of the collection period. Grab samples are also collected at the end of each period as a backup source of data for the auto-samplers.

The inflow and outflow structures that were monitored during the first part of WY2005 include the S-2/351 complex, S-3/354 complex, S-352, S-5A/S-5AW complex, S-6, S-7, S-150, S-8, G-136, G-200, G-328, G-344(A–D), G-349B, G-350B, G-600, G-410, G-402(A–C), G-404, G-357, EBPS3, ESPS2, SSDDMC, G-204, G-205, G-206, G-370, G-372, G-376(A–F), G-379(A–E), G-380(A–F), and G-507 structures (**Figure 3-2**). As of January 8, 2005, the S-7, S-150, S-8, G-404, G-357, G-402(A–C), G-204, G-205, G-206, G-380(A–F), G-376(A–F), and G-379(A–E) structures were no longer relevant for EAA basin load compliance calculations since these structures were now downstream of the G-371 and G-373 diversion structures. The placement of these diversion structures constituted a change in the compliance modeling boundary associated with the S-3/S-8 and S-2/S-7 sub-basins.

During WY2005, 687 TP samples were collected by auto-samplers, and 1,136 TP samples were collected by grab method for the EAA basin. All samples are collected and preserved in the field using methods specified and approved by the FDEP and adopted by the District for use in the EAA. All samples are collected by District personnel or by contractors trained in District sampling techniques and are transported to the District lab for analysis using analytical methods specifically approved for Everglades TP samples. A summary of the TP concentration measurements for all monitored sites is presented in Appendix 3-1b, Table 1 of this volume. Additionally, the quality level [as defined by the U.S. Geological Survey (USGS) guidelines] of the flow equation used to derive discharge at each structure is provided.

From these measurements, the District calculates TP loads entering and leaving the EAA at the modeling boundary on a daily basis and thus is able to infer the runoff volume and TP load from the EAA. The annual load, flow and flow-weighted mean TP concentration recorded at each of the inflow and outflow structures indicated above is presented in Appendix 3-1b, Table 2.

EAA BASIN-LEVEL PHOSPHORUS MEASUREMENTS AND CALCULATIONS

Since the implementation of BMPs required by the Everglades Regulatory Program, TP loads from the surface water runoff attributable to the lands within the EAA basin have generally declined. To interpret phosphorus measurements taken at inflow and outflow water control structures for the EAA basin, it is important to recognize that water leaving the EAA basin through these structures is a combination of EAA farm- and urban-generated runoff and water passing through the EAA basin canals from external basins. This “pass through” water includes discharges from Lake Okeechobee and 298 District diversion areas. When compared on a water-year-by-water-year basis since the full implementation of BMPs in WY1996, Lake Okeechobee discharges to the EAA typically have had higher TP concentrations than EAA basin discharges. Within the EAA basin, variations in rainfall and lake inflows also exhibited significant variances from east to west, making a complex and obscure picture even more difficult to interpret the impact when considering individual phosphorus sources within the basin. For example, the S-5A basin was the only basin in the EAA that received above average rainfall, primarily because of the 2004 hurricane effects.

Inflow sources into the EAA influence the water quality within the basin, although the extent of the influence is generally difficult to interpret. Therefore, separate accounting of TP loads from various sources is required to develop conclusions about TP loads originating from the EAA basin. The accounting of tributary sources and flow configurations to the Everglades is complex,

and the reported TP loads attributed to the farms, cities, and industries within the EAA basin should not be confused with the total load being delivered to the Everglades.

The first year of the 25 percent reduction compliance measurement mandated by statute occurred during WY1996 (May 1, 1995 through April 30, 1996). The EAA basin TP loads and concentrations are determined in accordance with procedures specified in the Everglades Regulatory Program (Rule 40E-63, Appendix A, F.A.C.) and the EFA [Subparagraph 373.4592(4)(c)(2), F.S.]. The predicted TP loads for the EAA basin are calculated using a regressed relationship between historical annual rainfall and runoff TP load observed during a baseline period covering a nine-year period, WY1980–WY1988. The EAA regression relationship was constructed to account for rainfall variation in both a spatial (Thiessen) and temporal (monthly distribution statistics) domain. Based on the temporal domain, statistical coefficients for the first three moments were developed from the historical rainfall to develop predictors of load. The process of calculating a predicted EAA TP load in any given water year, (post-baseline) consists of (1) tabulating current rainfall amounts for each compliance monitoring network rain gauge (nine gauges) on a monthly basis, (2) applying Thiessen weights to derive a basin-wide weighted monthly rainfall amount, and (3) plugging the weighted monthly rainfall amount into the regression relationship, along with baseline predictors, to derive a predicted TP load. If rainfall amounts are approximately the same from one year to the next (i.e., 52 inches), then the predicted TP load could vary significantly between years depending on the temporal distribution of the monthly rainfall. More information on the specific equations and the model used to calculate the EAA basin TP load can be found by accessing the District's web site at http://www.sfwmd.gov/org/reg/rules/40e-63.pdf, and navigating to Appendix A.

Summaries of the flows and TP loads for each sub-basin are presented in **Table 3-4a**. A summary of the inflow and outflow TP concentrations, which contrasts the concentration of incoming flows from Lake Okeechobee with the total outflow concentration from each sub-basin, is presented in **Table 3-4b**. More detailed information on flows and TP loads and concentrations for each sub-basin inflow and outflow structure is presented in Appendix 3-1b, Table 2. The sub-basin flow and load summary provided in **Table 3-4a** generally describes the mass balance of inflows and outflows from the EAA sub-basins. A summary of the WY2005 compliance calculation for the total observed and predicted TP loads is provided in **Table 3-5**.

Table 3-4a. EAA sub-basin flows and TP loads by source for WY2005.

S5A Sub-basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA		86.77		332.41
Lake	39.46	14.34	132.33	51.46
East Beach WCD	11.91	11.91	21.55	21.55
Total	**51.37**	**113.02**	**153.88**	**405.42**

S2/S6 Sub-basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA		41.81		277.45
Lake	20.38	2.52	102.75	11.99
East Shore WCD	5.98	5.98	34.33	34.33
Total	**26.36**	**50.31**	**137.08**	**323.78**

S2/S7 Sub-basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA		35.55		304.83
Lake	38.11	16.09	192.14	72.95
STA3/4 (recycle)	4.02	4.02	221.03	221.03
Total	**42.13**	**55.66**	**413.17**	**598.81**

S3/S8 Sub-basin	Load (mt)		Flow (kac-ft)	
Source	Inflow	Outflow	Inflow	Outflow
EAA		18.13		216.28
Lake	34.94	16.74	183.34	81.88
C-139	5.21	5.21	17.37	17.37
Rotenberger	0.92	0.92	34.05	34.05
South Shore DD	2.17	2.17	10.98	10.98
STA5	12.22	12.22	121.43	121.43
STA3/4 (recycle)	3.72	3.72	257.91	257.91
Total	**59.18**	**59.12**	**625.09**	**739.91**

Note: Loads and flows leaving the sub-basins represent pass through volumes as well as volumes originating within the basin. With the exception of lake inflows, it is assumed that 100% of all other inflow sources to the EAA sub-basins pass through the main EAA conveyance canals directly to the outlet of each sub-basin. These assumptions are mandated in the model developed under Rule 40E-63 for determining EAA basin phosphorus load reductions.

Table 3-4b. EAA sub-basin inflow and outflow TP concentrations for WY2005.

EAA Sub-basin	**Lake Inflow Conc. (ppb)**	**Total Outflow Conc. (ppb)**
S5A	242	226
S2/S6	161	126
S2/S7	161	75
S2/S8	154	65

Table 3-5. Results of WY2005 EAA basin TP compliance calculations.

WY2005 EAA TP Load	
Estimated TP load from the EAA during the base period years adjusted for WY2005 rainfall amount and distribution (WY1979–WY1988)[1]	444 mt
Actual WY2005 TP load from the EAA with BMPs implemented	182 mt
WY2005 TP load reduction (relative difference)	59 %
Three-year average TP load reduction	57 %

WY2005 EAA TP Concentration (ppb)	
Actual annual average EAA TP concentration prior to BMP implementation (WY1979–WY1988)[1]	172 ppb
Actual WY2005 TP concentration from the EAA with BMPs implemented	124 ppb
Three-year flow-weighted mean TP concentration	89 ppb

[1] The baseline period of record is October 1978–September 1988 in accordance with the 1991 federal consent decree that guided the Everglades Restoration requirements. Compliance under Rule 40E-63 bases compliance on the Water Year periods from May 1 to April 30 that fall within the October 1978–September 1988 range, that is WY1980–1988.

The compliance related data for all calculated years are summarized in **Tables 3-6** and **3-7**. The observed and predicted (base period rainfall adjusted) data for the EAA TP calculations and annual rainfall and flow measurements are presented in **Table 3-7**. The TP values presented in **Tables 3-6** and **3-7** are attributable only to the EAA basin (farms, cities, and industry), and do not represent the cumulative TP being discharged to the Everglades from all sources. Although the data include TP concentrations, only load is used to determine compliance.

Figures 3-3 through **3-7** represent the data graphically. Each bar in **Figure 3-3** represents the percent TP load reduction for each water year, including the base period years. In **Figure 3-4**, each bar represents the actual measured (observed) annual TP tonnage from the EAA basin in each water year, and the solid line represents the annual TP tonnage predicted (rainfall adjusted) by the rule-mandated model. The annual percent reduction of TP is calculated as the relative difference between the actual measured (bar) EAA basin TP load and the predicted (line) base period TP load (adjusted for rainfall). The EAA basin percent TP load reduction trend is presented in **Figure 3-5**. The solid line shows the three-year trend of percent load reduction. The "♦" symbol represents the annual measurements. An upward trend in the solid line in **Figure 3-5** denotes a reduction in loads, that is, an improvement in the water quality of EAA discharges. **Figure 3-6** shows the cumulative observed TP load that BMPs prevented from being discharged from the basin, as well as the cumulative TP load at the EFA mandated 25 percent reduction levels. As this chart indicates, the EAA basin has consistently outperformed its mandated goal. For the 10 years that the program has been fully implemented, discharges of 1,617 metric tons (mt) of TP were prevented from leaving the EAA basin as runoff, compared to what would have been expected under the same hydrologic conditions during the baseline period. This exceeds the annual mandated 25 percent load reduction, equating to a cumulative reduction of more than 720 metric tons since WY1996, if just the minimum level of load reduction had been achieved annually.

TP concentrations are calculated in addition to load. However, concentration levels are not evaluated to determine EAA basin compliance, but flow-weighted concentrations allow for relative comparisons between years. The annual concentrations and three-year trends presented are true "annual flow-weighted" values calculated by dividing the total annual cumulative TP load by the total annual cumulative flow. **Figure 3-7** shows the TP concentration trends for the EAA discharges.

Table 3-6. Summary of historical TP compliance calculations for the EAA basin.

	WY80 ↓ WY91 Pre-BMPs	WY92[2] ↓ WY93	WY94	WY95	WY96	WY97	WY98	WY99	WY00	WY01	WY02	WY03	WY04	WY05
Three-Year[1] Average Phosphorus Load % Reduction	n/a	n/a	39 %	36 %	47 %	51 %	55 %	44 %	48 %	57 %	59 %	57 %	55 %	57%
Phosphorus[5] Concentration (ppb)	173 12-yr avg	166 2-yr avg	121	130	109	106	100	107	114	107	92	69	71	89
			← 3-year flow-weighted mean →											
% Acres[3] Implemented with BMPs per the Everglades BMP Program	0	0[2]	15	63	100	100	100	100	100	100	100	100	100	100
WY Annual Phosphorus Concentration (ppb)	173 12-yr avg	166 2-yr avg	112	116	98	100	102	124	119	64	77	66	69	124
WY Annual Calculated Phosphorus Load % Reduction	n/a	n/a	17%	31%	68%	49%	34%	49%	55%	73%	55%	35%	64%	59%
80% Confidence Interval in %[4]	n/a	n/a	-26–46	-4–54	54–78	32–62	6–54	29–64	38–68	62–82	43–68	15–55	54–75	43-74

[1]Three-Year Average Phosphorus Load % Reduction represents a weighted three-year average of the observed and predicted annual loads. The weighted equation is % Reduction = [1 – ∑ (Observed Load) / ∑ (Predicted Load)] x 100, where the summation covers three successive water years consisting of the current water year and prior two water years.

[2]Lake Okeechobee SWIM BMP Program, 1992-1993, gave BMP credit for: Initiation of deep-well injection of domestic wastewater from Belle Glade, South Bay, and Pahokee; and Pump BMPs in S-2 and S-3 basins

[3]WY96 was the first year in which 100% of the EAA acreage was to have BMPs implemented. Previous years were permitting and initial implementation phases.

[4] Load is calculated using measured flow and concentrations. When comparing loads between the water year (WY) and the base period, there is a confidence interval for the percent reduction value associated with the adjustment for rainfall variability. This confidence interval represents the uncertainty relative to the prediction model.

[5]Three-Year Flow-Weighted Mean Phosphorus Concentration is computed from equation: FWM TP Conc = [∑ (Observed Load) / ∑ (Observed Flow)] x Conversion Factor, where the summation covers three successive water years consisting of the current water year and prior two water years.

Table 3-7. WY1980 through WY2005 EAA basin TP measurements and calculations.

Water Year	Observed TP (mt)	Predicted[1] TP (mt)	%[2] TP Reduction	Annual Rain (in)	Annual Flow (k ac-ft)	Base Period	Pre-BMP Period	LOK SWIM BMPs	Evrglds Rule BMPs
80	167	154	-9%	53.50	1162				
81	85	98	13%	35.05	550				
82	234	255	8%	46.65	781				
83	473	462	-2%	64.35	1965				
84	188	212	11%	49.83	980				
85	229	180	-27%	39.70	824				
86	197	240	18%	51.15	1059				
87	291	261	-12%	51.97	1286				
88	140	128	-9%	43.43	701				
89	183	274	33%	39.68	750				
90	121	120	-1%	40.14	552				
91	180	219	17%	50.37	707				
92	106	179	41%	47.61	908				
93	318	572	44%	61.69	1639				
94	132	160	17%	50.54	952				
95	268	388	31%	67.01	1878				
96	162	503	68%	56.86	1336	First Compliance Year			
97	122	240	49%	52.02	996				
98	161	244	34%	56.12	1276				
99	128	249	49%	43.42	833				
00	193	425	55%	57.51	1311				
01	52	195	73%	37.28	667				
02	101	227	55%	49.14	1071				
03	81	125	35%	45.55	992				
04	82	229	64%	46.76	961				
05	182	444	59%	50.98	1190				

Note: The dashed vertical line indicates the period for which BMPs were not fully implemented (WY1992–WY1995).

[1] "Predicted TP" represents the base period load, adjusted for rainfall variability.

[2] "%TP Reduction" values for WY1980–WY1989 represent the model calibration period.

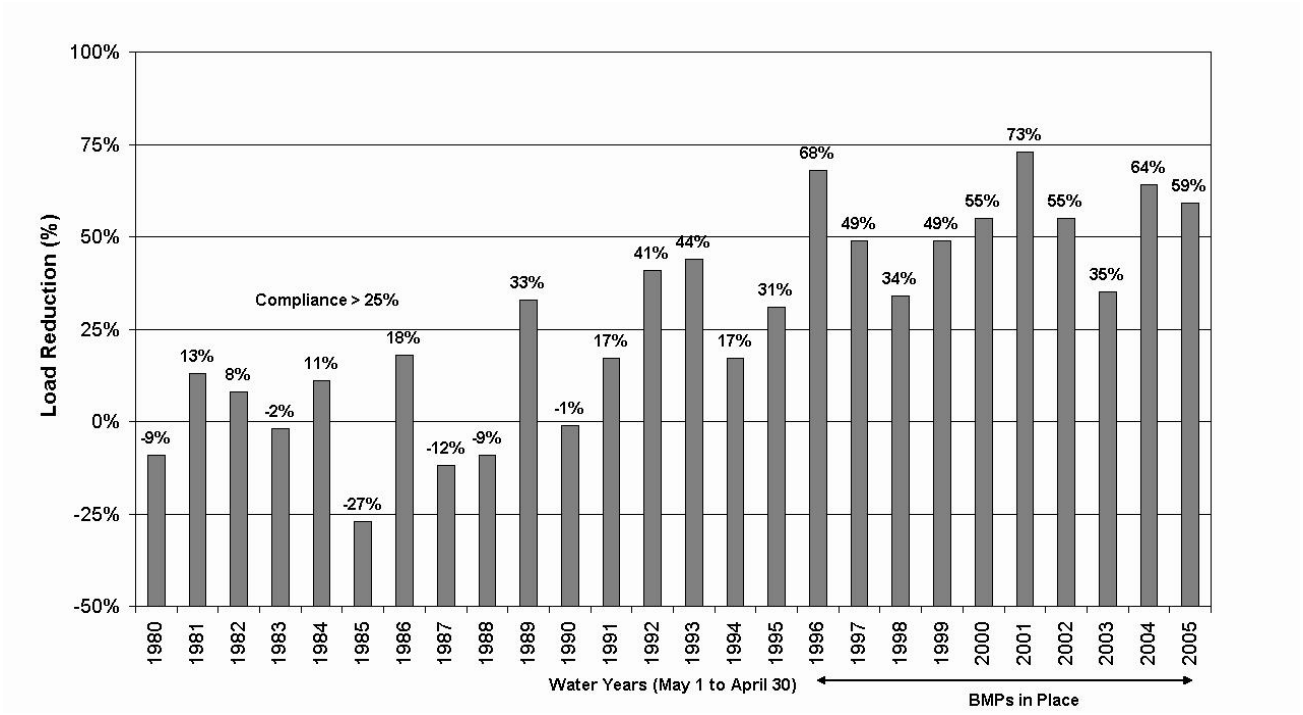


Figure 3-3. EAA basin percent TP load reduction.

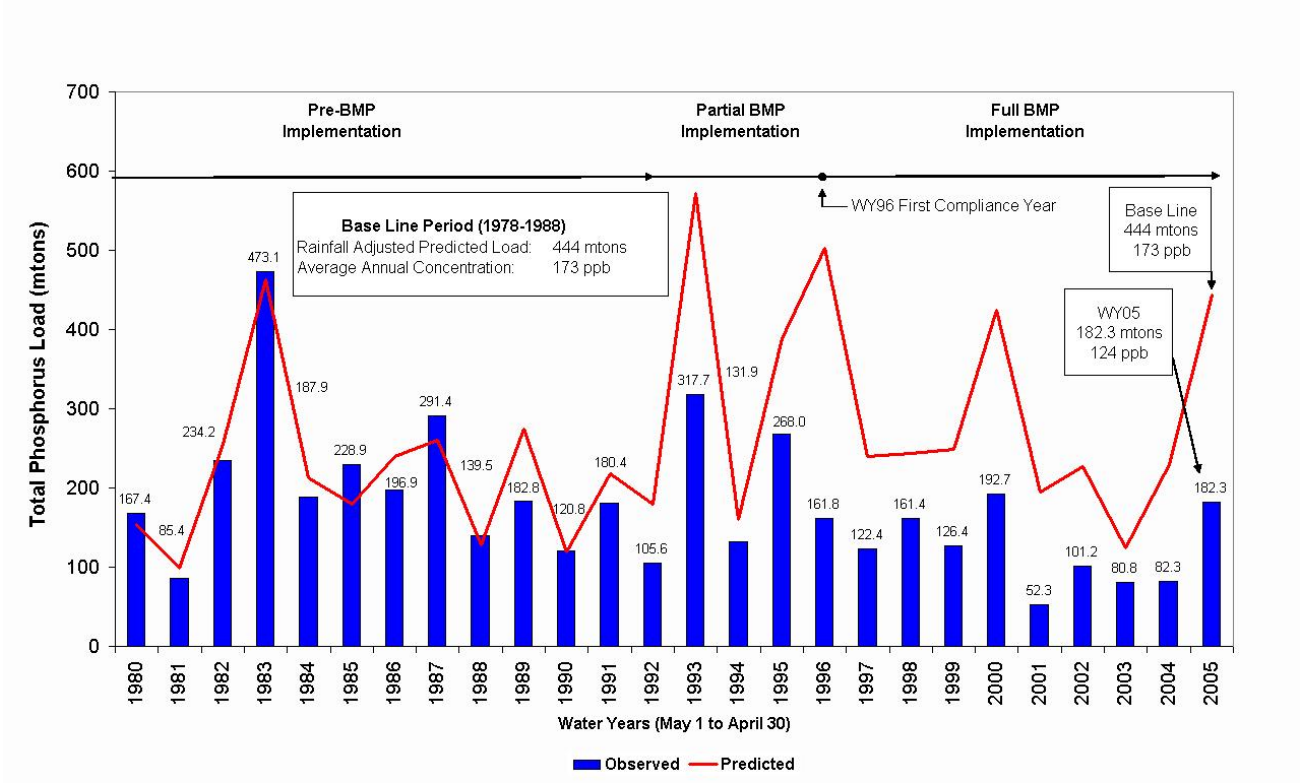


Figure 3-4. EAA basin TP loads observed (measured) and predicted (calculated).

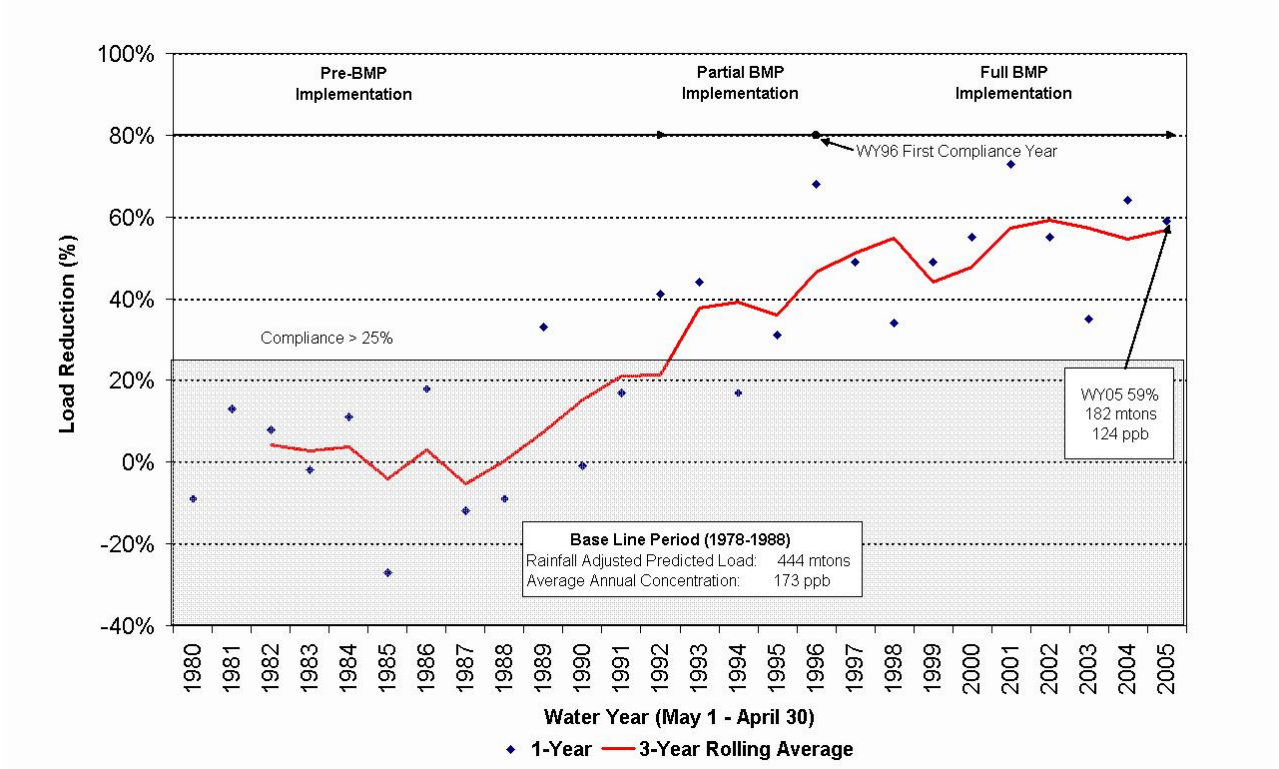


Figure 3-5. EAA basin percent TP load reduction trend.

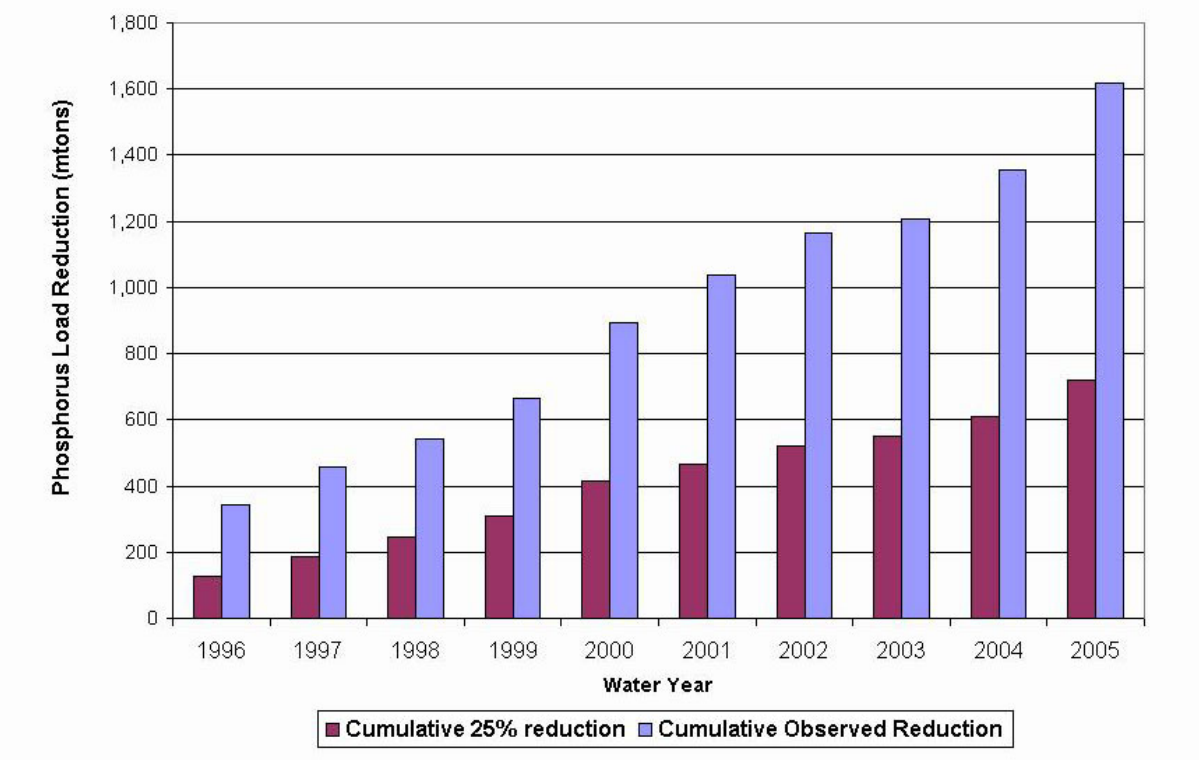


Figure 3-6. EAA basin cumulative percent TP load reduction.

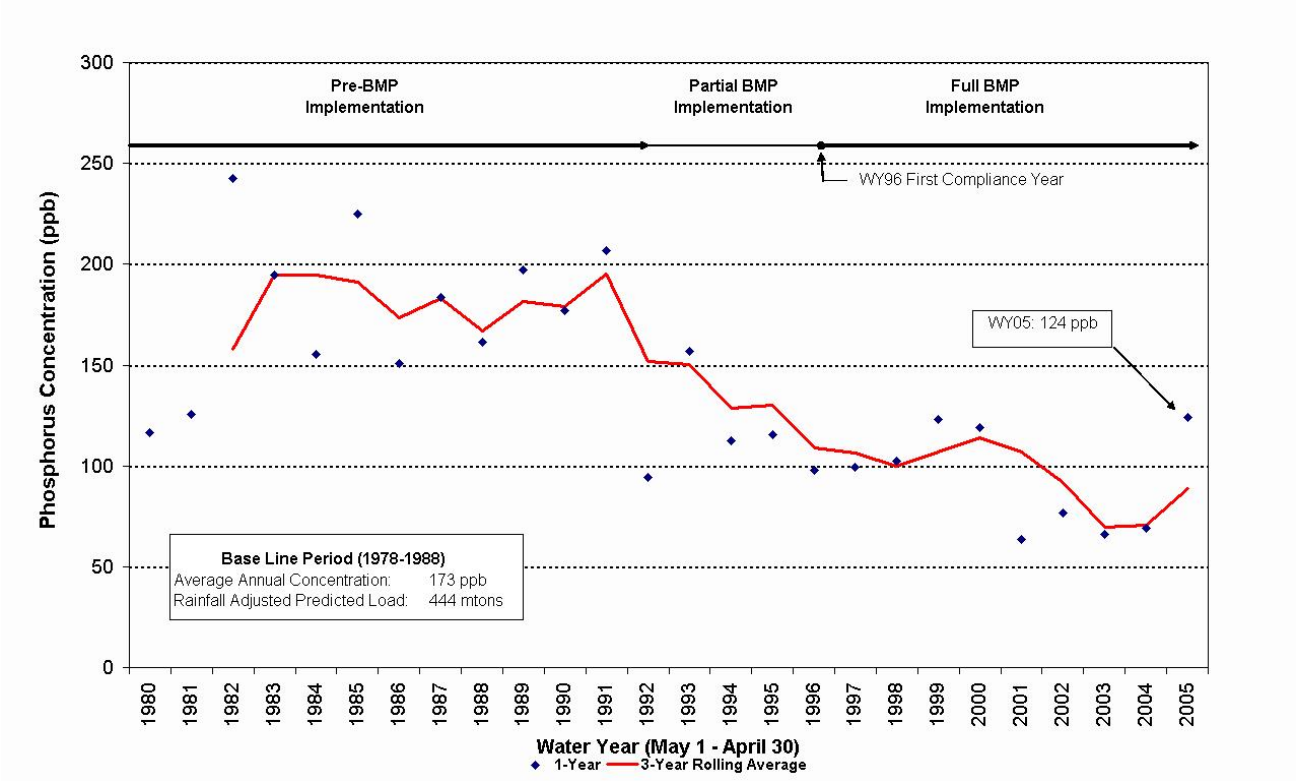


Figure 3-7. EAA basin flow-weighted TP concentrations.

EAA PERMIT-LEVEL MONITORING RESULTS

A secondary method of program compliance measurement is through individual permit-level ("farm-level") water quality monitoring conducted by the permittee. In the EAA basin and in accordance with Rule 40E-63, F.A.C., this on-farm or permittee-level water quality monitoring will only be used for compliance determination if the basin does not meet the 25 percent TP load reduction requirement. The permittee water quality monitoring results are not used to calculate the phosphorus reduction at the EAA basin level. The District currently conducts EAA basin-level monitoring at all inflow and outflow structures for this purpose.

In addition to a BMP Plan, each applicant for a Rule 40E-63 EAA permit is required to propose a Discharge Monitoring Plan for individual drainage basins within the permitted area. Permit-level monitoring plans consist of flow measurements, collection, and compositing of discharge water samples for TP analysis. Discharges are generally quantified using site-specific calibration equations. Water quality samples are generally collected daily during discharge by automatic samplers collecting flow-weighted aliquots, and are composited for a sampling period of up to 21 days prior to being transported to a laboratory for analysis. Daily TP load is calculated by multiplying the TP concentration for the sampling period by each daily flow. Rule 40E-63 requires data to be submitted in an electronic format.

All permit-level monitoring is performed by sampling organizations using FDEP-approved and District-specified sampling and sample preservation techniques and laboratories using approved analytical techniques. The District performs independent audits on all permittee-hired sampling organizations to assure compliance with specified field sampling and preservation methods. All laboratories performing analyses are required to participate in the Everglades Round Robin laboratory performance evaluation program conducted by the FDEP to assure that comparable results are obtained from all laboratories submitting data directly related to EFA activities. Sample data are not accepted in cases where approved sampling and analytical techniques are not utilized.

Annual average flow-weighted TP concentrations (parts per billion, or ppb) and load discharges (pounds per acre, or lb/ac) have been calculated from permittees' daily water quality monitoring data reported during WY2005. **Figures 3-8** and **3-9** present frequency distributions of WY2005 permittees' drainage basin TP loads and concentrations, respectively. Appendix 3-1 of this volume presents WY2005 data in tabular form and as spatial distributions of TP loads and concentrations discharged by permit drainage basins.

The EAA basin-level data verify that the individual farms have collectively reduced TP loads coincident with BMP implementation. An analysis of the data obtained from permit level monitoring indicates that the average annual cumulative total volume of water discharged from the 300+ permittee or farm-level pump stations is greater than the observed volume attributable to the EAA being released from the District water control structures surrounding the EAA. This is because EAA basin canal water (including rainfall, Lake Okeechobee discharges, and 298 District diversions from Lake Okeechobee) and the surface water discharged from any one of the given 200+ defined permittee drainage sub-basins (farms) may be drawn back into the farm for irrigation or freeze protection by another farm. Each year, a tremendous amount of water is recycled in this manner within the EAA prior to discharge to the Everglades. Because of these factors, permittee-level water quality monitoring cannot be used to determine the measure of TP discharged to the Everglades without taking into consideration many other complex (physical, chemical, and biological) parameters affecting the relationship between the water quality and flow data from an individual EAA farm or subset of farms and the EAA basin as a whole.

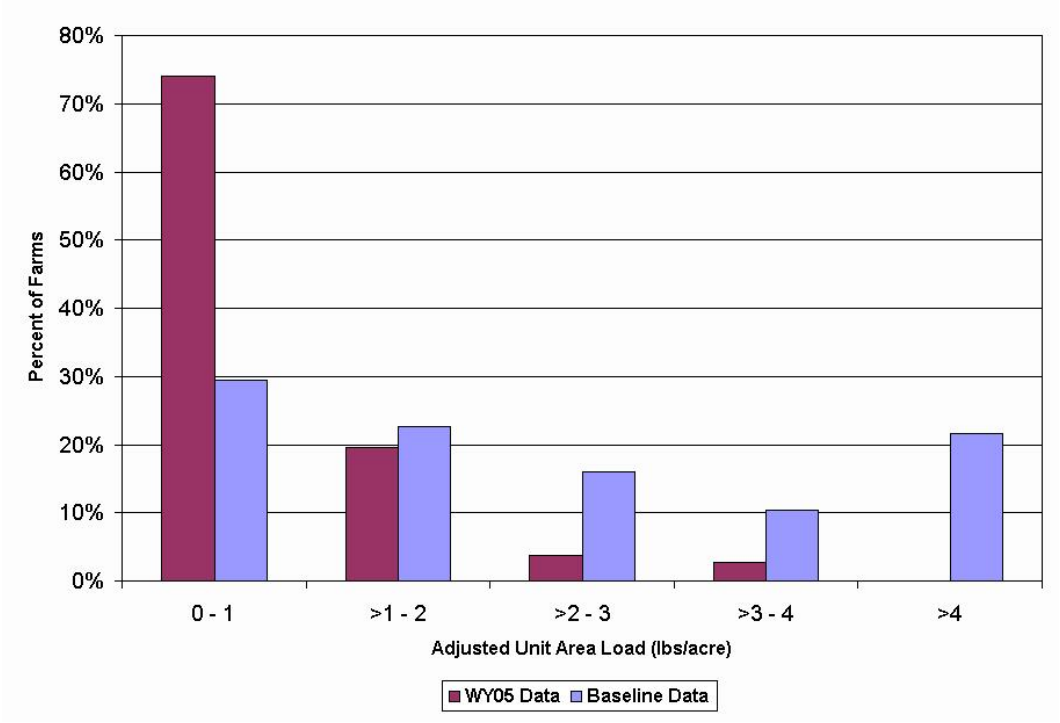


Figure 3-8. WY2005 EAA permit-level TP load frequency distribution.

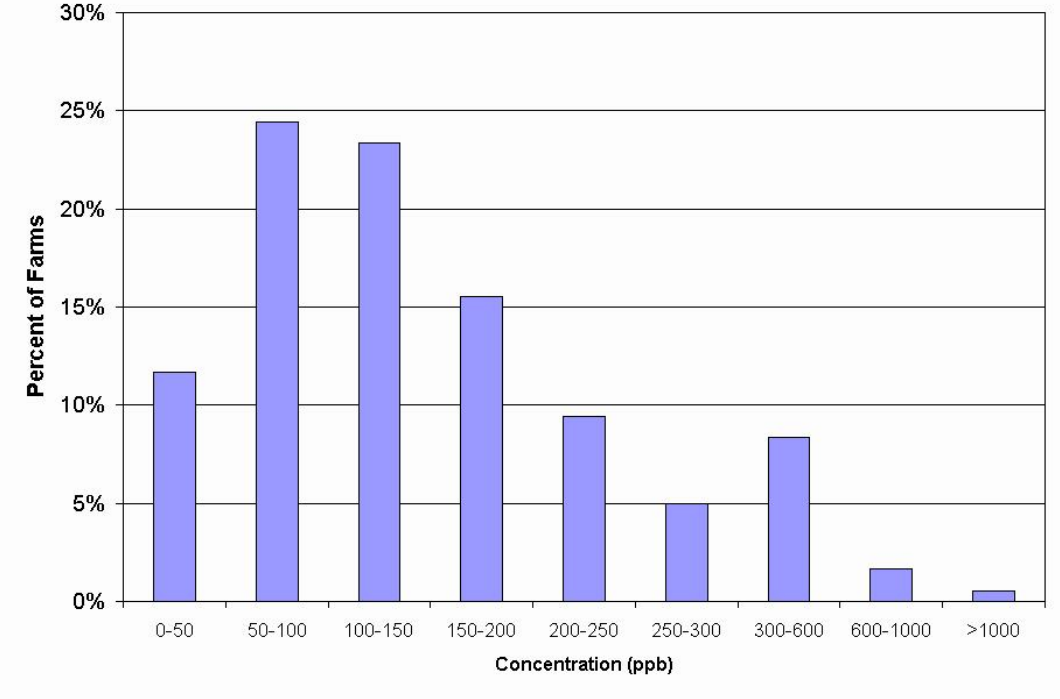


Figure 3-9. WY2005 EAA permit-level TP concentration frequency distribution.

Permit-level data have limited usefulness for making comparisons between farms. The data can, however, be used for making relative comparisons between water years for the same farm only when they are used in conjunction with in-depth knowledge of unique farm characteristics. The District currently uses such relative comparisons when discussing individual farm performance and BMP optimization with permittees.

There are several factors affecting TP load at the farm level, making it difficult to compare the level of BMP performance between farms and draw meaningful conclusions concerning any differences. Consideration must be given to the minimum phosphorus levels required to support the agricultural production of specific crops. This and other factors such as variations related to historical and existing land use, fertilizer practices, soil characteristics, hydrology, land area, and geographic location may create differences in BMP effectiveness between sites, preventing a direct comparison. This type of detailed, farm-specific information is not available to the Everglades Regulation program. The data routinely submitted to the District under the regulatory program only include daily flow and 14 to 21-day composite TP concentration data for each farm's discharge. Variables affecting individual farms' TP loads in discharge include:

1. **Weather Patterns.** Timing and distribution of rainfall can affect an individual farm load. The model used to calculate the rainfall-adjusted unit area load for an individual permittee farm is dependent on District rainfall data collected for each EWOD sub-basin (e.g., S-5A, S-6, S-7, and S-8) within the EAA. Adjacent farms can be located in different EWOD sub-basins and therefore can have a significantly different rainfall adjustment.
2. **Cropping Patterns.** The history of cropping patterns on a farm can affect loads by creating a phosphorus "sink," or accumulation. The implementation of nutrient application control BMPs should correct this situation over time.
3. **Hydrology.** The hydrology of a farm affects loads in many ways. Examples include the size of the farm relative to the discharge pump capacity, or the effects of seepage from an adjacent STA. Gradually, permittees are rebuilding or replacing older pumps to improve the relationship between the farm area and the pump capacity.
4. **Soil Characteristics.** Soil depth and composition can also have a significant impact on a farm's performance. As one example, a farm may have high levels of calcium carbonate present in its soil, resulting in a high soil pH and precipitation of phosphorus which would then be retained in the soil, while an adjacent farm may have much lower levels of calcium carbonate present in its soil and would therefore have a lower soil pH which would allow leaching and discharge of more phosphorus.
5. **Location.** The location of a farm within a specific sub-basin and within the EAA may result in potential impacts. As discussed above, rainfall adjustments are very location dependant. In addition, a farm's location relative to Lake Okeechobee outfalls, the STAs, reservoirs or other hydrologic features or sources of TP may have significant impact on the quality and quantity of water coming onto the farm.

These examples illustrate how each farm can be unique with respect to BMP selection and effectiveness, making it difficult to make comparisons between farms. Permittees recognize these factors and may voluntarily adjust their operations and monitor the effects of these changes on water quality from water year to water year on the same farm.

BMP Replacement Water

The EFA mandated hydroperiod restoration and the replacement of reduced flows to the EPA as a result of BMP implementation. Initially, BMP implementation in the EAA was anticipated to result in a reduction in flow from the EAA to the EPA, possibly by as much as 20 percent. As a result, the District was directed by the EFA to develop a model to quantify the amount of replacement water needed with a consideration for timing and distribution of this replaced water to the EPA to maximize the natural balance of the ecosystem. Rule 40E-63 was amended effective November 1995 to implement the model. In addition, the EFA specified that if flow reductions greater than 20 percent did occur, then the District was to follow the legislative intent outlined in the EFA to rectify the higher volumes of flow reduction and reduce to under 20 percent. The District has applied the model on an ongoing annual basis (1995–2004) to calculate the amount of replacement water necessary to meet these requirements. The current model generates estimates that indicate that the long term average reductions in volumes from EAA BMP implementation are occurring on the order of about 5–7 percent. However, other more comprehensive District model projections indicate reductions have not occurred and, as a result, replacement water may not be needed for delivery to the EPA.

As a result of these evaluations, the District has determined that the original assumption of reductions in EAA runoff volumes of up to 20 percent from BMP implementation must be reconsidered. In the coming year, the District will review the methodology for determining the replacement volumes, the existing model to determine if revisions are necessary, and the conditions under which releases are currently made.

298 Diversion Projects

There are five basins that historically discharged primarily to Lake Okeechobee but are now subject to diversion projects under the ECP: Closter Farms (discharging to Lake Okeechobee through Culvert 12A), East Beach Water Control District (Culvert 10), East Shore Water Control District (Culvert 12), the South Shore Drainage District (Culvert 4A), and the South Florida Conservancy District (S-236). These basins are located around the south and east shore of Lake Okeechobee, as indicated on **Figure 3-1**, and are areas within the EFA-defined EAA boundaries that are regulated under Chapter 40E-61, F.A.C. These areas are required to divert 80 percent of their flow and load to the EAA once the construction of the receiving STA is complete. As each 298 District diverts its discharges to the EPA, it must obtain a Rule 40E-63 permit for implementation of approved BMPs and discharge monitoring plans. Evaluations are currently underway to determine whether rule amendments are necessary to address the potential water quality impacts of the 298 District diverted flows through the EAA basin. To date, the diversion discharges have been considered just as Lake Okeechobee discharges, that is, as pass-through water that is directed to the STAs for treatment but is not added to the EAA discharges for the purposes of EAA load determinations.

Currently, diversion projects are in place for the Closter Farms (715 Farms), East Beach Water Control District (EBWCD), and East Shore Water Control District (ESWCD). Effective dates for these diversion projects, loads and flows for the diversions, and total loads and flows for the basins since 2001 (the first year any of the diversion projects came online) are indicated in **Table 3-8**. The diversion project for the South Shore Drainage District (SSDD) was completed in June 2004. The diversion for the South Florida Conservancy District (SFCD) was completed in August 2005 and it is anticipated that information will be included in next year's report. According to data collected by the District and reported in **Table 3-8**, more than 95 percent of the TP load from the 298 District sub-basins where diversion projects have been operating is being diverted from the lake through the EAA to the STAs.

Table 3-8. EAA 298-District ECP diversion project flows and TP data.

Description	Structure	Discharge to	Water Year 2002*			Water Year 2003*			Water Year 2004*			Water Year 2005*		
			Flow	TP Load	TP Conc	Flow	TP Load	TP Conc	Flow	TP Load	TP Conc	Flow	TP Load	TP Conc
			acre-ft	kg	FWM ppb	acre-ft	kg	FWM ppb	acre-ft	kg	FWM ppb	acre-ft	kg	FWM ppb
East Beach Water Control District	C10	Lake O	8,006	5,499	556	536	455	687	265	49	150	1,715	241	114
	EBPS3	EAA	10,020	3,193	258	16,166	6,158	308	19,090	7,045	299	21,545	11,913	448
Closter Farms	C12A	Lake O	6,940	787	92	68	7	88	0	0	N/A	187	20	88
	HC18.5TN01	EAA	5,900	766	105	16,600	2,255	110	15,400	2,957	155	18,200	3,853	171
East Shore Water Control District	C12	Lake O	9,851	1,690	139	18	2	98	470	37	63	6,696	847	102
	ESPS2	EAA	4,894	395	65	32,608	3,609	90	29,813	2,983	81	34,328	5,978	141
South Shore/So. Bay WCD	C4A	Lake O										0	0	N/A
	SSDDMC	EAA										10,985	2169.1	160

(*) All data are presented in water years (i.e. Water Year 2002 represents data collected from May 1, 2001 to April 30, 2002). Where diversions began during the water year, the Lake Okeechobee structure data only represents the portion of the water year that the EAA diversion structure was operating. EBPS3 began operating on July 1, 2001, however, the permittee reports that diversion pumping did not start until June 21, 2002, after canal improvements connecting to the new diversion areas were completed. HC18.5TN01 began operating on January 2, 2002. ESPS2 began operating in June 2001; however, the permittee reports limited diversion until January 2002 due to drought conditions that required discharges to Lake Okeechobee. SSDDMC began operating on June 1, 2004. South Florida Conservancy District diversion began after WY2005 ended (April 30, 2005).

Compliance with 80 percent diversion is incorporated as a special condition in the ERP permit. This 80 percent compliance is based on a calendar year using permittee submitted water quality data whereas the data presented in this table is based on a water year using district collected water quality data. The water year presentation is provided as an effort to ensure reporting consistency.

Long-Term Plan Update for the EAA Basin

Supplemental to the original EFA source control projects, the Long-Term Plan objectives for the EAA basin are to (1) identify urban and agricultural discharges that are candidates for cost effective implementation of source controls, (2) characterize the management practices on lands or processes contributing to those discharges, and (3) implement voluntary cost effective source controls in concert with landowners and municipalities, and (4) identify existing combinations of BMPs in agricultural basins with either high or low TP discharge. These tasks were initiated in 2004 and are anticipated to continue until 2009 with an annual project budget of $50,000. The annual Long-Term Plan budget does not include staff time, which is a substantial portion of the project costs. The initial year for implementation of the Long-Term Plan in the EAA basin was Fiscal Year 2004 (FY2004). As indicated in the Long-Term Plan, the success of the plan rests on its ability to implement cost-effective voluntary source controls with the main uncertainty being obtaining cooperation from landowners and special interests for effective implementation.

A plan is under way to assess the usefulness of the permit-level regulatory data in identifying opportunities to maintain and improve on the performance of the source control program. It is expected that the regulatory data will be of limited use beyond its original intended purpose. However, if supported by additional datasets, such as the UF/IFAS research dataset discussed in the next section, it may be possible to identify opportunities to further optimize existing BMPs.

Update on BMP Research

In addition to the Everglades Regulatory Program, the EFA and Chapter 40E-63, F.A.C., require EAA landowners, through the Everglades Agricultural Area - Everglades Protection District (EAA-EPD), to sponsor a program of BMP research, testing, and implementation to monitor the efficacy of established BMPs in improving water quality in the EPA. Specific water quality issues addressed by the research included phosphorus fertilizer application processes, particulate matter and its relationship to phosphorus, pesticide application practices, and other water quality components, specifically including specific conductance. BMP effectiveness has been demonstrated at different scales, in the EAA basin as a whole, and through farm-level research projects in the EAA basin. To encourage BMP optimization, as data become available, research results are provided to the industry through outreach programs sponsored by UF/IFAS, EAA-EPD, FDEP, and the District.

The UF/IFAS has conducted a research program to test BMP effectiveness in the EAA basin for the last 10 years, with funding primarily by the EAA-EPD, with supplemental monetary contributions from the FDEP and the District. Detailed information on the BMP research can be found in the UF/IFAS Phase 12 Annual Report on Implementation and Verification of BMPs for Reducing P Loading in the EAA and EAA BMPs for Reducing Particulate P Transport (Daroub et al., 2004a). The final report on specific conductance was issued March 2004 (Daroub et al., 2004b). A final report on the EAA BMPs for reducing particulate phosphorus transport was submitted to the FDEP in June 2005 (Daroub et al., 2005).

With regard to BMP efficacy, the research results have shown that various water management and crop rotation practices have the greatest impact on TP loads and concentrations of farm discharges. Water management practices that proved most effective included making internal drainage improvements to the farm to allow more uniform drainage.

The particulate P research was conducted on three farms from 2000 to early 2005. Studies have shown that particulate P accounted for 20–70 percent of TP exported from the farms studied and that particulate P was frequently the cause of spikes in TP loads. A significant fraction of particulate P in the EAA originates from in-stream biological growth (Stuck, 1996). Management practices that were recommended by the study to control particulate P in discharges included

practices to control aquatic plant growth and to reduce flow velocity in the main canals to be able to control sediment transport (Daroub et al., 2004a; 2005).

Prior research has produced sufficient data to allow the program to progress to the next phase, the evaluation of the collected data to determine future directions. The UF/IFAS acknowledges that there are benefits yet to be realized by improving implementation of existing BMPs. Detailed evaluation of existing research and monitoring data and individual attention to the site specific BMP implementation of each grower in the EAA may serve to further improve water quality basinwide. A proactive program on the part of the growers that includes onsite one-on-one consultation with UF/IFAS personnel may serve to better disseminate knowledge acquired through the years and provide a tailored approach to optimal BMP implementation. Growers are provided with the opportunity to address site specific needs and receive customized strategies that best fit their operations. A new EAA-EPD scope of work approved by the District was initiated by UF/IFAS in March 2005 with these concepts in mind and includes the following:

- Conduct a comprehensive basinwide evaluation of existing farm data including permit level regulatory data to assess parameters affecting farm P discharge. An attempt will be made to correlate salient parameters and use results to improve selection and application of existing BMPs. Activities for the first two years include the creation of an EAA farm BMP database and statistical analysis.
- Enhance the dissemination of existing BMP "lessons-learned" to all growers in the EAA. This objective will be met through two activities, the regular on-going seminar and training workshops and a new program that includes individual one-to-one BMP consultations. The BMP workshops and seminars will be conducted for groups of growers. These venues emphasize the importance of correct and site specific BMP implementation and introduce new and effective implementation techniques as they become available. The BMP consultation service will be provided by UF/IFAS to all EAA growers. The goal is to reach 20 percent of the grower community in year 1 and 100 percent by year 5. During the first year, outreach will focus on S-5A basin permittees, as it has been identified as a significant tributary to the ECP.
- Based on the results from these two tasks, the research will determine and track changes in farm/basin loads as an indicator of the success of the program.

To date, the UF/IFAS has completed development of the extension materials, BMP verification checklist, and scheduling plan. Field reports of all consultations will be compiled and included in the annual report produced by the UF/IFAS as part of their permit.

Pesticide training will be continued through the UF/IFAS extension office in Belle Glade. Judicial use of all pesticides, specifically ametryn and atrazine, two of the most widely used herbicides for sugar cane, sweet corn, and other crops in the EAA, is also emphasized during the phosphorus BMP workshops.

The work plan is anticipated to remain in effect for a period of five years, or until conclusions have been reached, submitted and accepted by the District. Specific BMP effectiveness research, e.g., short term field investigations, may be required as a result of the comprehensive data evaluation. The UF/IFAS provides an annual report to the EAA-EPD and the District. Annual adjustments to the work plan and permit scope of work depend upon these findings.

EVERGLADES REGULATORY PROGRAM: C-139 BASIN

In contrast to the EAA basin where an annual 25 percent reduction in TP loads is required, the goal of the Everglades Regulatory Program in the C-139 basin is to maintain TP loads at or below historical levels. The EFA mandates that landowners within the C-139 basin not collectively exceed the annual average TP load observed during the period extending from October 1, 1978 to September 30, 1988 after historical rainfall adjustments. As in the EAA basin, the District is required to collect monitoring data from the C-139 basin for the purpose of determining compliance with the TP load limitations. The EFA established that if the basin was determined to be out of compliance, then a BMP program must be implemented. These EFA requirements were incorporated in the FDEP-issued ECP permit for STA-5 (the STA serving the C-139 basin) when the permit was issued in November 1997. Subsequently, Rule 40E-63 was amended in 2002 to create the C-139 Basin Regulatory Program in accordance with the EFA and ECP permit requirements.

Rule 40E-63 states that use of EWOD within the C-139 basin requires a permit that approves a permittee-implemented BMP Plan. The rule allows for the option of a permit-level discharge monitoring plan. For those permittees electing to implement the optional on-farm discharge monitoring plan, a release from implementation of additional BMPs may be requested when the C-139 basin is out of compliance with the TP load limitations. None of the permits issued to date include the optional discharge monitoring plan. Compliance with the permit-level BMP and discharge monitoring plan, as applicable, is based on annual implementation and monitoring reports and on-site verifications.

There are currently 26 C-139 basin EWOD permits, which include approximately 48 sub-basins encompassing an area of approximately 170,000 acres (**Figure 3-10**). Water is discharged from the sub-basins primarily by gravity discharge through sandy soils. The areas represented by single permits vary from 194 to 60,491 acres; approximately 17,000 acres are not permitted for various reasons. Exempt areas include aquaculture operations, non-agricultural operations that have exempt water use permits and small residential plots.

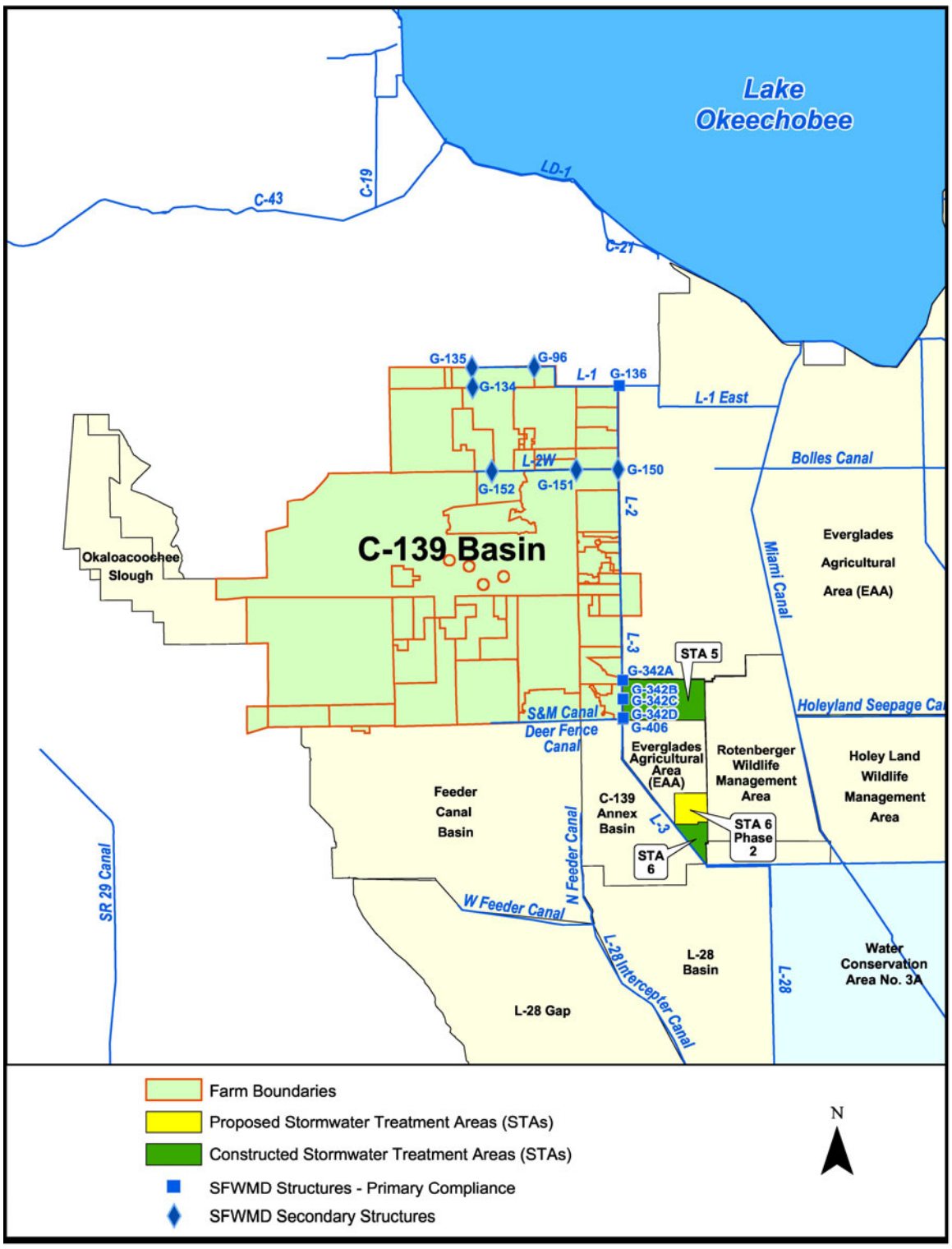


Figure 3-10. The C-139 basin and primary compliance water control structures within the ECP boundary.

C-139 Best Management Practice Plans

Each EWOD permit in the C-139 basin includes four specific levels of implementation, defined as Levels I, II, III, and IV. Level I is the initial level for BMP plan implementation and requires the selection of 15 BMP points for implementation as a condition of permit issuance. Level II is triggered after the first determination that the C-139 basin is out of compliance. The rule does not require additional BMPs to be implemented under Level II but does require on-site inspections to verify BMP implementation. If there is a second determination that the C-139 basin is out of compliance, then Level III is initiated. This level requires an increase from 15 to 25 BMP points. If the C-139 basin is out of compliance a third time, then Level IV is initiated. This level also requires an increase from 25 to 35 BMP points. If the C-139 basin is out of compliance a fourth time, then the District must initiate amend the rule establish an action plan to bring the C-139 basin into compliance.

WY2005 was the third year of BMP implementation in the C-139 basin. Permittees continued implementation of the 15 point BMP plans from the beginning of the water year (May 1, 2004) to August 2004. In August 2004, permittees were notified that the basin was out of compliance with TP load requirements during WY2004, thus, they were required to increase BMP implementation to 25 points. The rule provides for a 90-day implementation period for increased BMP requirements, thus, full implementation of the 25 point plan was initiated in November 2004 and continues to date. Inspections have been conducted to verify implementation of required BMPs. Field verification and records review indicate that permittees have significantly improved their understanding of regulatory requirements and know-how on BMP implementation. Continued verifications are necessary to clarify specific aspects of BMP implementation and ensure that BMPs are implemented consistently and systematically. A major component of BMP implementation is education and outreach. As BMP levels increase, new concepts require clarification. Significant staff time is dedicated to clarifying BMP implementation and recordkeeping. Field verification and technical assistance are proportionally enhanced to meet these needs including discussing optimization of BMP practices one-on-one with farm personnel responsible for the day-to-day implementation of BMPs.

In contrast with water years 2003 and 2004, where a single BMP level was implemented during the entire year, WY2005 had a minimal level of BMP implementation (Level II, 15 points) during the core wet months (six months, May through October) and a mid-level of implementation (Level II, 25 points) during the dry period of the year (November through April of the following calendar year). As such, it could be assumed that Level III BMPs are minimally reflected in the annual TP loading observed from the basin in the past water year. For instance, basin discharge flows during the active 2004 hurricane season occurred before the deadline for Level III BMP implementation. WY2005 loadings from the C-139 basin may be most representative of implementation of Level II BMP requirements (15 points) and the inspections and education efforts conducted in winter and spring 2004, prior to the WY2005 wet season.

Gradual implementation of the permitted BMP plans will determine the future level of effort required to meet the EFA target. As exemplified above, however, realizing the benefits of the increased BMP requirements may be delayed by the learning curve that each permittee is subject to and the compliance schedules originally set by the rule. The rule provides permittees with up to 90 days from the date they are officially notified to complete implementation of BMPs, which, in addition to the period necessary for the District to process and calculate the annual water quality loading, results in a lag of up to six months every year. Official notifications for WY2005 results were to be provided to permittees at the beginning of August 2005; thus, Level IV BMPs are not required to be implemented basinwide until November 2005. This timing is not only significant in terms of the delay, but also in terms of water quality impact for the following year's discharges, as WY2006 TP loads will incorporate discharges from the wet season months of May 2005

through October 2005, prior to implementation of the next level of BMPs. In addition, the BMPs may not yield results in one-year cycles. Efforts are under way to ensure that discharges from the C-139 basin meet established TP load targets and limits prior to discharge to STA-5 for further treatment in order to ultimately reduce the nutrient loading contribution to the northern Everglades.

C-139 Load Compliance Determination

To evaluate compliance with the C-139 basin-level TP load limits, the ECP permits require that the District annually evaluate data from District monitored structures to calculate the measured TP load discharged from the C-139 basin.

This primary method of compliance determination is based on the C-139 basin annual load not exceeding a baseline period average annual load. While the annual load is an observed value, the baseline-derived annual load is a value adjusted to reflect rainfall levels comparable to those of the evaluated period. The determination requires annual calculation of the TP load leaving the outflow structures from the C-139 basin based on discharge phosphorus concentrations and water flow recorded at all outflow points.

C-139 BASIN-LEVEL MONITORING RESULTS

Discharge quantity is recorded at all current outflow points defining the boundary of the C-139 basin. Six water control structures define this boundary for C-139 in WY2005, including G-136, G-342A, G-342B, G-342C, G-342D, and G-406. As in the EAA basin, the TP loads measured at these structures collectively determine primary compliance for all C-139 EWOD permits. Discharge TP samples are collected at these structures, where the concentrations are deemed to be representative of discharges for all boundary structures. All monitoring locations in the C-139 basin are equipped with automatic samplers. During discharge events, TP samples are collected primarily by automatic samplers which are programmed to collect samples on a flow proportional basis. The samples are collected regularly from the auto-samplers (generally every seven days), and the samples are composited at the end of the collection period. Grab samples are also collected at the end of each period as a backup source of data for the auto-samplers. During WY2005, 127 composite TP samples were collected by auto-sampler, and 268 TP samples were collected by grab method for the C-139 basin. A statistical summary of TP for each sample station is presented in Appendix 3-1b, Table 1 of this volume. Additionally, the quality level (as defined by USGS guidelines) of the flow equation used to derive discharge at each structure is provided.

C-139 BASIN-LEVEL PHOSPHORUS MEASUREMENTS AND CALCULATIONS

As in the EAA, TP load measurements are calculated and reported annually. The EFA specifically mandates a method to measure and calculate the annual basin export of phosphorus in surface water runoff and Rule 40E-63 was amended to include flows from the C-139 basin. These calculations are made using a simple adjustment for the rainfall calibrated to the base period WY1980–WY1988 (May 1, 1979 through April 30, 1988). Compliance is determined by comparing the observed TP loads for the current year to the predicted loads from the base period based on that rainfall adjustment. Using the rainfall adjustment, target loads are calculated based on the 50^{th} percentile value for predicted loads under the year's rainfall conditions, while limit loads are calculated based on the 90^{th} percentile.

The predicted TP loads for the C-139 basin are based on an exponential regression of paired sets of annual rainfall and TP load data observed during the baseline period. Temporal variation in the regression is not considered within a year (i.e. monthly) when predicting TP loads, but was a factor in choosing the baseline (temporal) period to assure a range of hydrologic regimes (wet,

average, and dry) were considered for model calibration. The process of calculating a predicted C-139 TP load in any given water year, (post-baseline) consists of (1) tabulating current rainfall amounts for each compliance monitoring network rain gauge (three gauges) on an annual basis, (2) applying Thiessen weights to derive a basin wide weighted annual rainfall amount, and (3) plugging the weighted annual rainfall amount into the regression relationship to derive a predicted TP load. Therefore, predicted annual TP load varies directly with annual rainfall amount in any given year, and widely varying TP load predictions do not occur due to exclusion of monthly temporal distribution factors.

TP load leaving the C-139 basin, in contrast to the EAA, is primarily from agricultural sources within the basin. The TP load delivered to the Everglades is not the same as the TP loads leaving the outflow structures from the C-139 basin, because some flows discharge into other water bodies. Outfall structure G-136 discharges to the L-1 canal, which flows into the EAA basin. Outfall structures G-342A, G-342B, G-342C, and G-342D flow into STA-5. Outfall structure G-406 discharges only into the L-3 canal when STA-5 cannot receive additional discharges.

The hurricanes in August–September 2004 had minimal effects on the compliance conditions of the C-139 basin. The C-139 basin received less than an inch of additional rainfall during WY2005 when compared to the prior year, despite the unusual hurricane season. However, total TP load and discharge flow were reduced from the prior year by 42 and 20 percent, respectively.

WY2005 marked the third year of compliance measurement for the C-139 basin. A summary of the WY2005 compliance calculation for the observed load, predicted target load, and the limit load is provided in **Table 3-9**. The overall TP loads, flows, and flow-weighted concentrations at the six primary basin outflow structures are summarized in **Table 3-10**. The C-139 basin TP loads and concentrations are determined in accordance with procedures specified in the Everglades Regulatory Program (Rule 40E-63, Appendix B, F.A.C.) and the EFA. More information on the specific equations and the model used to calculate the C-139 basin TP load can be found on the District's web site at http://www.sfwmd.gov/org/reg/rules/40e-63.pdf, and navigating to Appendix B.

The data for all calculated years (pre-compliance and initial compliance) are summarized in **Tables 3-11** and **3-12**. The observed, predicted target, and limit data for the C-139 TP calculations, along with the annual rainfall and flow measurements are presented in **Table 3-12**. The TP values presented in **Tables 3-11** and **3-12** are attributable only to the C-139 basin, and do not represent the cumulative TP being discharged to the Everglades after treatment through STA-5.

Figures 3-11 and **3-12** represent the data graphically. In **Figure 3-11**, each bar represents the actual measured (observed) annual TP tonnage from the C-139 basin in each water year, and the lines represent the annual TP target and limit loads predicted, after being adjusted for rainfall, by the rule mandated method. **Figure 3-12** represents the annual FWM TP concentration of discharge from the C-139 basin shown by both individual yearly concentration values represented by the diamond symbols, and the three-year rolling average FWM concentration represented by the solid line. As with **Figure 3-11**, WY2005 was the third year of compliance. Compliance in the C-139 basin is determined by TP load discharged from the basin, not concentration.

Table 3-9. Results of WY2005 C-139 basin TP compliance calculations.

WY2005 C-139 TP Load (mt)	
Estimated TP Target load (adjusted for WY2005 rainfall amount and distribution)	27.1 mt
Estimated TP Limit load (Target load at the upper 90% confidence interval)	48.3 mt
Actual WY2005 TP load from the C-139 with partial BMP implementation	40.3 mt

WY2005 C-139 TP Concentration (ppb)	
Actual annual average C-139 TP concentration prior to BMP implementation (WY1979 to WY1988)	227 ppb
Actual WY2005 TP concentration from the C-139 with minimum BMP implementation	195 ppb
Three-year flow-weighted mean TP concentration	247 ppb

Table 3-10. Summary of C-139 basin TP calculations for WY2005, including flows and loads at each structure leaving the C-139 basin.

C-139 Related Loads by Structure

Water Year 2005

C-139 to EAA					
Structure	Load (mtons)	Flow (ac-ft)	Conc. (ppb)	% of Total Load	% of Total Flow
G136	**5.21**	**17,381**	**243**	**12.9%**	**10.4%**
C-139 to STA5					
Structure	Load (mtons)	Flow (ac-ft)	Conc. (ppb)	% of Total Load	% of Total Flow
G342A	7.20	41,432	141	17.9%	24.7%
G342B	7.10	37,380	154	17.6%	22.3%
G342C	5.55	24,512	183	13.8%	14.6%
G342D	4.73	16,595	231	11.7%	9.9%
STA5	**24.58**	**119,919**	**166**	**61.0%**	**71.6%**
C-139 to WCA3					
Structure	Load (mtons)	Flow (ac-ft)	Conc. (ppb)	% of Total Load	% of Total Flow
G406	**10.49**	**30,167**	**282**	**26.0%**	**18.0%**
	Load (mtons)	Flow (ac-ft)	Conc. (ppb)	% of Total Load	% of Total Flow
Total for Basin	**40.28**	**167,467**	**195**	**100.0%**	**100.0%**

Table 3-11. Summary of historical C-139 basin TP concentrations.

	WY80 ↓ WY88 Pre-BMPs	WY94	WY95	WY96	WY97	WY98	WY99	WY00	WY01	WY02	WY03	WY04	WY05
3-year Flow Weighted Mean Phosphorus Concentration (ppb)	227 9-yr avg	131	163	166	188	185	202	197	216	240	270	267	247
WY Annual Phosphorus Concentration (ppb)	227 9-yr avg	129	184	167	226	170	212	210	246	267	279	274	195

Note: This table shows the historical TP concentrations; however, the C-139 basin compliance determination is not based on concentration limits. First year of compliance measurement for required load limits is WY2003.

Table 3-12. WY1980 through WY2005 C-139 basin TP measurements and calculations (UPDATE).

Water Year	Observed TP (mt)	Predicted[1] Target TP (mt)	Predicted[1] Limit TP (mt)	Annual Rain (in)	Annual Flow (Kac-ft)	Base Period	Pre-BMP Period
80	34.7	42.1	76	56.39	172	↑	↑
81	4.1	3.6	7	31.06	51		
82	6.1	8.8	16	38.61	44		
83	148.1	115.2	222	71.98	344		
84	40.4	20.2	36	47.19	156		
85	14.6	19.6	35	46.88	63		
86	17.0	19.3	34	46.71	110		
87	37.7	55.0	101	60.19	149		
88	28.2	21.6	38	47.96	94	↓	
89	14.2	11.0	20	40.69	73		
90	5.5	9.8	18	39.62	46		
91	5.0	20.8	37	47.53	45		
92	12.3	27.9	50	51.04	100		
93	26.3	39.4	71	55.49	137		
94	21.8	30.2	54	52.03	136		
95	61.9	53.8	98	59.85	272		
96	48.5	55.2	101	60.24	236		
97	45.9	40.1	72	55.74	165		
98	35.6	42.9	77	56.65	170		
99	35.6	29.9	53	51.92	136		
00	52.4	36.4	65	54.46	202		
01	17.1	6.4	12	35.70	56		
02	65.9	35.8	64	54.23	200		
03[2]	77.3	39.1	70	55.40	224		
04	69.0	25.4	45.3	49.90	204		
05	40.3	27.1	48.3	50.68	168		↓

[1] Using the rainfall adjustment, target loads are calculated based on the 50th percentile value for predicted loads under the year's rainfall conditions, while limit loads are calculated based on the 90th percentile.

[2] First year of compliance measurement is WY2003.

Note: WY2003 and WY2004 only required the minimum level of 15 points in BMPs. WY2005 is when the 25-point BMP level was initiated with full implementation to be represented in WY2006.

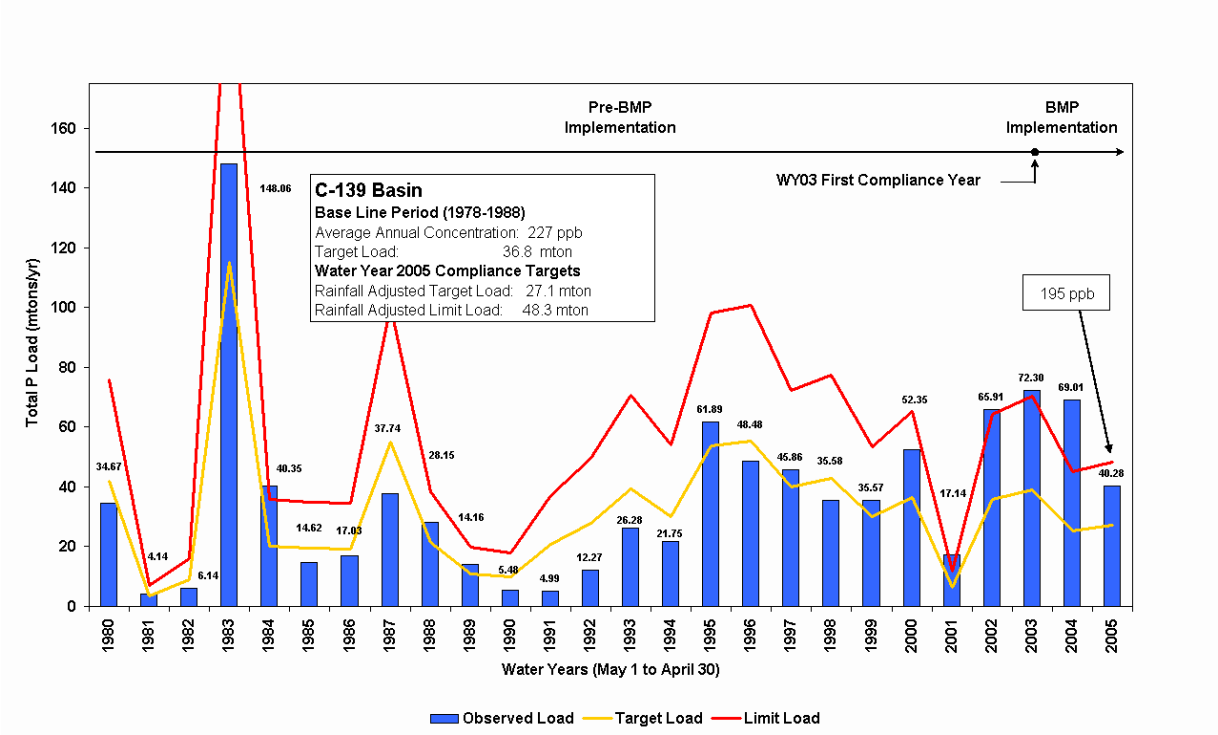


Figure 3-11. C-139 basin TP measured and calculated loads.

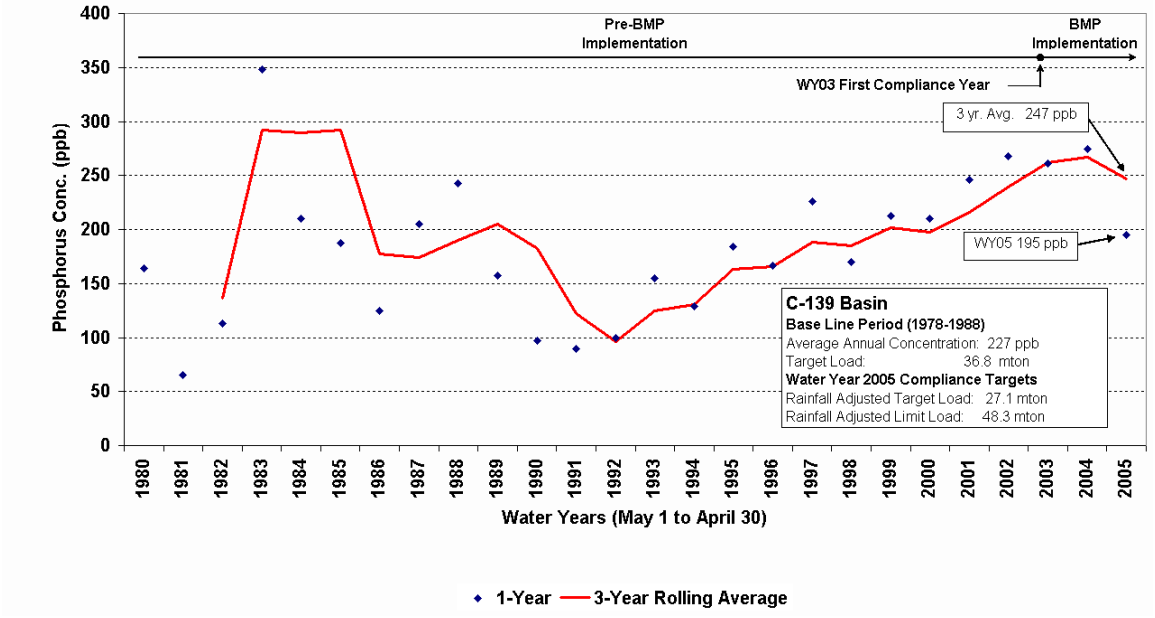


Figure 3-12. C-139 basin flow-weighted TP concentrations.

C-139 Permit-Level Monitoring Results

The rule allows an optional secondary method of compliance for the C-139 basin determined through individual sub-basin (permit-level or farm-level) water quality monitoring conducted by the permittee. Under the Optional On-Farm Discharge Monitoring Program, owners/operators of private water control structures discharging within the C-139 basin may voluntarily monitor the discharge from their farms or sub-basins. Participants may also elect to discontinue voluntary participation at any time by submitting an application to modify their permit. In the event that the C-139 basin is found to be out of compliance, participants in the optional program will not be required to perform additional BMPs, as long as the District determines that they have not exceeded their proportional share of the total C-139 basin phosphorus load.

At this time, permit-level monitoring does not occur in the C-139 basin. No owners/operators of private water control structures discharging within the C-139 basin have elected to participate in the Optional On-Farm Discharge Monitoring Program.

Long-Term Plan Update for the C-139 Basin

The Long-Term Plan objectives for the C-139 basin are to (1) identify urban and agricultural discharges that are candidates for cost-effective implementation of source controls; (2) characterize the management practices on lands or processes contributing to those discharges; (3) implement cost-effective source controls in concert with landowners and municipalities; and (4) identify existing combinations of BMP practices in agricultural basins with either high or low TP discharges. These tasks were initiated in 2004, and are anticipated to continue until 2014. The annual project budget allocated to Long-Term Plan activities is $250,000 from FY2004 through FY2006, and $100,000 thereafter. During WY2005, the state also appropriated $500,000 to fund Long-Term Plan WQ initiatives in the C-139 and Western basins. The annual Long-Term Plan project budget does not include staff time which is a significant portion of total project costs.

In November 2004, the District held a workshop directed at C-139 basin landowners and permittees to identify regional and farm-level alternatives to achieve compliance with the phosphorus load requirements established in the rule. These alternatives would support and strengthen the mandated program. Landowners and permittees expressed concern over factors that are perceived as having an influence on their ability to comply with phosphorus loading requirements. These factors include land use intensification, C-139 basin irrigation needs, and permitting requirements associated with surface water, water use, and environmental resource permits. In response to these issues, during WY2005 the District initiated a comprehensive plan including:

- Performing a C-139 Basin Phosphorus Water Quality and Hydrology Analysis, designed to set-up the basis for a water quality and quantity monitoring network and to evaluate regional and farm-level source control ideas. Using this basis, the District is establishing a water quality and quantity monitoring network to gather continued P concentration and flow data to develop and prioritize cost effective source control strategies.
- Funding of the C-139 and Western Basins Grant Program to promote BMP implementation for phosphorus reduction. The District launched the BMP grant program in 2002. Since the grant program's inception, the Everglades Program has contributed almost $1.3 million for BMP implementation in eligible basins. The sources of these funds are Everglades program funds and Long-Term Plan funds, of which, almost $830,000 has been committed to landowners in the C-139 basin, with the balance dedicated to the Feeder Canal basin. The Natural

Resources Conservation Service (NRCS) and the Florida Department of Agriculture and Consumer Services (FDACS) have partnered with the District to increase the funding provided to landowners and stakeholders with the funds being administered by the Hendry Soil and Water Conservation District. A detailed description of the grant program and projects funded since 2002 can be found in the April 2005 report titled "C-139 and Western Basins Best Management Practices Grant Program," presented on the District's web site at www.sfwmd.gov/org/reg/esp/pdfs/c139_bmp_annrpt_2005.pdf.

- Funding innovative BMP demonstration projects to optimize existing BMPs or to characterize processes or practices contributing to TP loads from the basin. Results and recommendations of the demonstration projects are expected by late 2006 and are anticipated to be reported in the 2007 SFER.
- Strengthening coordination between programs and agencies by pursuing partnering opportunities between District staff, UF/IFAS, landowners and state and federal agencies. These exchanges of information are intended to provide insights into cost effective BMP practices that are resulting in improved water quality, and identify those priority areas for BMP optimization.

EVERGLADES REGULATORY PROGRAM FINDINGS AND FUTURE DIRECTIONS

During WY2005 the Everglades Regulatory Program continued to reduce phosphorus at its sources, although there is much that remains to be done. The program in the EAA basin has resulted in TP reductions by more than 50 percent over historical levels since BMP implementation in the basin. Although the District was affected by the unusual hurricane season of WY2005, the hurricanes had minimal effect on the compliance conditions of the EAA. The model that determines TP load compliance is adjusted for rainfall and the additional rainfall due to the storms did not exceed the maximum range of the model.

Future directions in the EAA basin require further implementation of the applicable portions of the Long-Term Plan in the basin. The UF/IFAS has initiated an analysis based on data collected for the EAA-EPD Research Permit, with results anticipated in 2007. The BMP program in the C-139 basin has just begun to show reductions in concentrations resulting in reduced TP loads although these have fallen short of the mandated levels. Future directions for the C-139 basin require implementation of additional BMPs to bring the basin into compliance, and may require additional rulemaking in the basin. For both basins, public education and outreach is a critical program component for improving water quality, and the District will continue to develop more effective methods to accomplish this goal.

SECTION II: EVERGLADES STORMWATER PROGRAM – NON-ECP BASINS

OVERVIEW

The District is responsible for carrying out the programs mandated by the EFA through compliance requirements stipulated in permits issued by the FDEP. On April 20, 1998, the FDEP issued the non-ECP permit (FDEP File No. 06, 502590709), pursuant to Section 9(k) of the Everglades Forever Act. The permit authorized the continued operation of water control structures that are operated, maintained, and controlled by the District, that discharge waters "into," "within," or "from" the EPA, and which were not included in the permits issued for the ECP. Water quality at the "within" and "from" structures relative to the EPA is addressed in Chapters 2A and 2B of this volume. The purpose of this section is to address water quality at the "into" structures, that is, those discharging directly into the EPA. There are eleven "into" structures located in eight non-ECP basins discharging to the EPA and regulated under the non-ECP permit. These basins are the ACME Improvement District, North Springs Improvement District (NSID), C-11 West, North New River Canal (NNRC), Feeder Canal, L-28, Boynton Farms, and C-111 basins. The non-ECP basins encompass a wide range of land uses: three (NSID, NNRC and C-11 West) are primarily urban; two (ACME Improvement District and C-111) have both urban and agricultural or equestrian areas; and the remaining three (Feeder Canal, L-28 and Boynton Farms) are exclusively agricultural. The location of non-ECP structures, the boundaries of the respective hydrologic contributing basins, and the EPA boundaries are indicated in **Figure 3-13**. The affected entities within these basins are primarily local governments and municipalities, special drainage districts, the Seminole Indian Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and federal agencies.

The non-ECP permit requires that the District implement a program that has become known as the Everglades Stormwater Program, (ESP) that includes schedules and strategies for the following purposes: (1) achieve and maintain water quality standards; (2) evaluate existing programs, permits and water quality data; (3) develop a regulatory program, where needed, to improve water quality; and (4) develop a monitoring program to track progress toward achieving compliance with water quality standards to the maximum extent practicable.

As required by Specific Condition 5 of the non-ECP permit, the District is required to submit an annual report that includes a description and evaluation of the implementation of schedules and strategies contained in the permit, as appropriate. The annual report must also include results of the evaluation of water quality data and updates on the implementation of the Regulatory Action Strategy (RAS) and the Mercury Screening Program. Information contained in this chapter and other chapters of the *2006 South Florida Environmental Report* fulfills the reporting requirements of the non-ECP permit, as detailed in the specific conditions of the non-ECP permit. The requirements are summarized in **Table 3-13**. This information was previously described in detail in Chapter 11 of the 2000 Everglades Consolidated Report (SFWMD, 2001). Additional information regarding the Everglades Stormwater Program is available on the District's web site at www.sfwmd.gov/org/reg/esp/.

Figure 3-13. Non-ECP basins and primary water control structures within the Everglades Stormwater Program (ESP).

Table 3-13. Non-ECP permit reporting requirements.

Specific Condition	Reporting Requirement	Location in 2006 SFER [2]
4[1]	New permit or permit modifications	Renewal in April 21, 2008
5	Submittal of Annual Report	Chapters 1, 2A, 2B, 3, 4, 7, and 8
6	Land acquisition and water treatment facility status update	2006 SFER – Volume II
7	First and second data evaluation reports	Completed in 1998 Annual Report
8	Regulatory Action Report	Chapter 3
9	Update on implementation of schedules and strategies	Chapters 1, 2A, 2B, 3, 4, 7, 8
10	Laboratory Quality Assurance Manual	Current FDEP-approved manual
11	Mercury Screening Program Report	Chapter 2A and 2B
12	Annual Report, data requirements	See below
12 (b)	Dates of sampling	Appendix 3-2
12 (c)	Field Quality Assurance Manual	Current FDEP-approved manual
12 (d)	Map of sampling locations	Chapter 3, Figure 3-13
12 (e)	Statement of sampling authenticity	Appendix 4-3
12 (f)	Quality Assurance Manual	Current FDEP-approved manual
12 (g) (I-v)	Water quality data and associated information	Appendix 3-2
12 (g) (iv)	Monthly flow volumes	Appendix 3-2
12 (h)	Water quality data evaluation	Appendix 3-2
12(I)	Recommendations for improving WQ monitoring	Completed in 1998 Annual Report
12 (j)	Implementation of strategies	Chapters 1, 2A, 2B, 3, 4, 7, 8
16	Monitoring Locations Report	Submitted to FDEP in 1998
19	Additional strategies (if developed)	Not applicable at this time

[1] Specific conditions 1–3 do not deal with reporting requirements and therefore are not referenced in this table.

[2] All cross-referenced chapters and appendices are applicable to the 2006 SFER – Volume I unless noted otherwise.

The RAS, which was incorporated into the non-ECP permit, is the initial 10-step plan that was developed to provide a thorough assessment of each basin, using available information and data to develop scientifically sound water quality improvement strategies. Action plans were developed for each basin, and included a combination of voluntary BMPs, requirement for and/or modification of permits to include water quality criteria, construction projects, cooperative agreements, and/or public education. These plans also provided for coordination with other projects implemented through CERP, the Long-Term Plan, and other governmental agency programs that related to controlling loads discharged from the basins. An option not utilized in the non-ECP basins to date is a mandatory regulatory program. This option will be considered for implementation if the original action plans do not result in the desired improvements in water quality.

The first five steps of the RAS focus on the "into" structures directly discharging to the EPA. Steps 6 through 10 focus on the discharges upstream of the "into" structures that may be contributing to the TP loads. Steps 1 through 3 of the RAS required an inventory of all "into" structures discharging directly into the EPA (step 1), the characterization of available water quality data (step 2) and, when needed, an expanded monitoring program at "into" structures (step 3). Steps 1 through 3 have been completed for all non-ECP basins (also referred to as ESP basins). Auto-sampling equipment for flow-proportional TP sampling have been installed at the "into" structures in the ACME Improvement District, NSID, NNRC, L-28, Feeder Canal, and C-11 West basins. Auto-sampling equipment for flow-proportional TP sampling has also been installed at the S-18C "into" structure in the C-111 basin.

Step 4 included evaluating data from all "into" structures. This is ongoing as additional data continues to be collected. The data analyzed by the District dates back to 1978. These historical data were presented as part of the non-ECP permit in the Non-ECP Structures First Annual Monitoring Report (SFWMD, 1999).

Step 5, which requires a shift of monitoring responsibilities from the District to the structure owner/operator for non-District structures, has been completed at the ACME Improvement District and NSID basins. The only other discharge points not owned or operated by the District are the Boynton Farms pumps. The District is continuing to monitor these points to ensure collection of data.

The RAS focus turns to discharges upstream of "into" structures under steps 6 and 7 requiring that discharges that are upstream of the "into" structures and have potential water quality concerns must be identified and any existing data must be characterized. Steps 6 and 7 have been completed in all non-ECP basins, where applicable. Currently, the basins are at varying stages of steps 8, 9, and 10. These steps require monitoring of upstream discharge locations, evaluating the data obtained and taking appropriate remedial actions, and shifting the monitoring burdens for upstream structures to local governing bodies or property owners, respectively. The District has executed cooperative/cost-share agreements with local governments for upstream water quality monitoring within the ACME Improvement District, NSID, C-11 West, and NNRC Canal basins. Additional agreements will be pursued within these and other basins as needed. District personnel are conducting upstream sampling within the C-111, NNRC, L-28, and Feeder Canal basins.

Relevant RAS historical information for each of the non-ECP basins is presented in the Everglades Stormwater Program Regulatory Action Strategy Status Report, available on the District's web site at www.sfwmd.gov/org/reg/esp/pdfs/rasrpt2002/rasrpt2002.htm. A summary is presented in **Table 3-14**. The data in this table indicate basin area, cooperative agreements in place in each basin, and how each basin interfaces with the relevant portions of CERP and/or other federal projects. Each basin action plan is detailed below.

Table 3-14. Regulatory Action Strategy (RAS) summary table.

EFA Non-ECP Basins	Structures ID and Type*	County	Area (acres)	Receiving Area	Cooperative Agreements	CERP and Other Federal Projects
ACME Improvement District	ACME1DS (pump 1), Type 3 G94D (pump 2), Type 1	Palm Beach	18,894	WCA 1	WQ monitoring WQ improvement plans	ACME Basin B Discharge (CERP)
Boynton Farms	Several Private Pumps Types 3 & 4	Palm Beach	341 (421 through August 2005)	EPA	None	Palm Beach County Agricultural Reserve Water Reservoir (CERP)
North Springs Improvement District	NSID1 Type 3	Broward	7,064	WCA 2A	WQ monitoring & improvement	Site 1 Impoundment (CERP)
North New River Canal	G-123 Type 1	Broward	17,904	WCA 3A	OPWCD WQ monitoring & Improvement PAID WQ monitoring & improvement BDD WQ monitoring & improvement City of Sunrise WQ improvement plan	Divert Flows from WCA-2 to Central Lake Belt (CERP)
C-11 West	S-9 S-9A All Type 1	Broward	45,701	WCA 3A	SBDD WQ monitoring & improvement CBWCD WQ monitoring & improvement ITDD (Weston) WQ monitoring & improvement C-11 West Basin Nursery BMP Grant Program	C-11 West Impoundment / Diversion (CERP) C-11 West Critical Project
C-111	S-332 S-175 S-18C All Type 1	Miami-Dade	62,776	ENP	UF-TREC BMP Research Agreements	IOP CSOP C-111 Project C-111 Spreader Canal (CERP)
Feeder Canal	S-190 Type 1	Hendry	68,883	WCA 3A	C-139 and Western Basins BMP Grant Program	Tribal Critical Projects CERP Components
L-28	S-140 Type 1	Hendry, Collier & Broward	71,790	WCA 3A	C-139 and Western Basins BMP Grant Program	Tribal Critical Projects CERP Components

* Structure Types:

Type 1 – structures that are owned and operated by the SFWMD

Type 2 – structures that are not owned but are operated by the SFWMD

Type 3 – structures that are not owned or operated by SFWMD but are permitted by the SFWMD

Type 4 – structures that are not owned or operated by SFWMD and not permitted by the SFWMD

WATER QUALITY IMPROVEMENT PLANS

The 10-step RAS basically outlined the initial data collection and evaluation phase of the ESP schedules and strategies for achieving compliance. From the RAS evaluations, water quality improvement plans or strategies were developed. These plans include:

- Cooperative agreements for monitoring as well as implementation of BMPs
- Educational programs relating to BMPs and water quality impacts to the Everglades
- Evaluation of construction projects
- Requirement for and/or modification to permits to address water quality concerns
- Development of local ordinances to manage nutrient sources within a basin

The District later conducted the Basin-Specific Feasibility Studies (BSFS) to integrate information from research, regulation and planning studies to evaluate alternative combinations of basin-level source controls, regional treatment, and advanced treatment technologies.

The results of the BSFS were used to develop what is known as the District's Long-Term Plan, which was submitted to the FDEP in December 2003 as supplemental information for the application for the Long-Term Compliance Permit, as required by the amended EFA (Section 9(l)). To achieve the long-term water quality goals for discharges from the non-ECP basins, the plan proposes a combination of source controls and integration with diversion and construction activities planned as part of the CERP and/or other federal projects. The plan also includes cost estimates, funding mechanisms, and implementation schedules of the proposed water quality improvements plan. Additional information regarding the Long-Term Plan is discussed in Chapter 8 of this volume.

Previously-referenced cooperative/cost-share agreements executed by the District with local governments (municipalities and water control districts) within the ACME Improvement District, NSID, C-11 West, and NNRC basins require the development and implementation of BMPs. The District has provided in-kind services, expertise, and funding to aid these initiatives. Also, a BMP Grant Program that provides funds for landowners who meet specific requirements to implement BMPs continues within the C-139, L-28, and Feeder Canal basins. This program is being conducted in cooperation with the Hendry Soil and Water Conservation District and the National Resources Conservation Service (NRCS). Also, in April 2005 the District established the C-11 West Basin Nursery BMP Grant Program in partnership with the Florida Department of Agriculture and Consumer Services (FDACS) and the Palm Beach Soil and Water Conservation Service District (PBSWCD). This three-year grant program will assist nursery owners in the C-11 West basin with the implementation of BMPs. The FDACS is matching the District's $500,000 in District funding over the three-year period. Additional agreements and coordination with agencies and landowners in other basins are being pursued.

A major component of the water quality improvement plans is public education. District staff has developed an educational web site (www.sfwmd.gov/everglades4ever) targeting residents in general. This web site provides some insight to the history of the Everglades, current issues, and how residents can help to meet water quality goals. The web site also includes links to relevant BMP documents such as the Turf and Landscape BMP Manual for the C-11 West Basin (www.sfwmd.gov/org/exo/broward/c11bmp/index.html), the Equine BMPs (www.sfwmd.gov/images/pdfs/good_horse_sense.pdf), and the Urban Stormwater BMPs (www.sfwmd.gov/org/reg/esp/pdfs/bmp_manual.pdf).

District staff has prepared a Public Outreach Plan for the non-ECP basins (www.sfwmd.gov/org/reg/esp/pdfs/pop_esp_112004.pdf) that includes both new components and

enhancements to the existing public outreach initiatives being implemented in the C-11 West basin. The plan also coordinates public outreach initiatives being conducted by other District departments and governmental agencies to maximize resources and target audiences. Implementation of the Public Outreach Plan began in October 2004. The Public Outreach Plan will benefit all non-ECP basins, but it will focus primarily on those located in Broward County because three of the eight basins (C-11 West, NNRC, and NSID) are located within Broward County and face similar water quality challenges. Public outreach strategies that are specific to the non-ECP basins within Broward County are described below.

Broward County staff and stakeholders worked with District staff to enhance the District's existing stormwater system management education program called "Know-the-Flow" so that it included turf and landscape BMP components. The "Know-the-Flow" seminar presents information about primary, secondary, and tertiary stormwater management systems as well as plant diversity, fertilization and irrigation practices in lay-man terms. The goal is to have the more than 10,000 property managers in Broward County take this enhanced seminar to earn continuing education credits to maintain their licenses. Enhanced "Know-the-Flow" seminars for Broward County property managers have been offered monthly since April 2004. The District is planning to increase the number of seminars offered per month by January 2006 and to more intensively promote the seminars within Broward County's non-ECP basins.

District staff and stakeholders in Broward County have also formed working groups to develop and implement voluntary nursery and equine BMPs. The purpose of these working groups is to develop area-specific BMPs for these industries, and to disseminate this information to the local business owners. FDACS assisted in the development of these BMPs by providing facilitation, coordination, organization, expertise, and publication resources. The nursery BMPs have been developed and FDACS is currently adopting them through the state rulemaking process. The equine BMPs have also been developed and its publication is being actively promoted and disseminated.

In 2005, the District produced five educational videos, each lasting 30 seconds, focusing on how fertilizer application, maintenance of swales, and soil erosion protection/prevention can affect the Everglades. Comcast Cable Network and the District partnered to air the videos as public service announcements (PSAs) in the south Broward area. Approximately 850 PSAs were aired between July and October 2005 on the TBS, TNT, TWC, and USA Network channels. The District is planning to make these videos available to community access channels for cities within Broward County's non-ECP basins.

As recommended in the Long-Term Plan, the District has partnered with the Broward County Environmental Protection Department (formerly know as the Department of Planning and Environmental Protection) in coordinating a county-wide working group to develop a comprehensive pollution prevention plan with specific water quality goals and milestones. The working group, known as Broward Everglades Working Group, was established in May 2004. The Working Group members include representatives from government agencies, water management authorities (special drainage districts), local municipalities, and other stakeholders. The District will pursue pollution prevention activities such as erosion and sedimentation control enforcement during construction, promotion of turf and landscape BMPs for golf courses, adoption of pollution prevention ordinances, and support and coordination of the District's Public Outreach Plan. A comprehensive pollution prevention plan is expected to be completed by December 2005.

SCHEDULES AND STRATEGIES OF WATER QUALITY IMPROVEMENT PLANS IN NON-ECP BASINS

This section presents comprehensive water quality improvement plans developed for each non-ECP basin. The water quality improvement plans include the combination of source controls, diversion strategies, and capital improvement projects implemented and/or proposed in each of the basins to meet the phosphorus criterion in the EPA. It includes structural and non-structural best management practices and public outreach activities by each stakeholder, as well as the timelines for their implementation. A brief basin description, including water quality monitoring results is included for each basin.

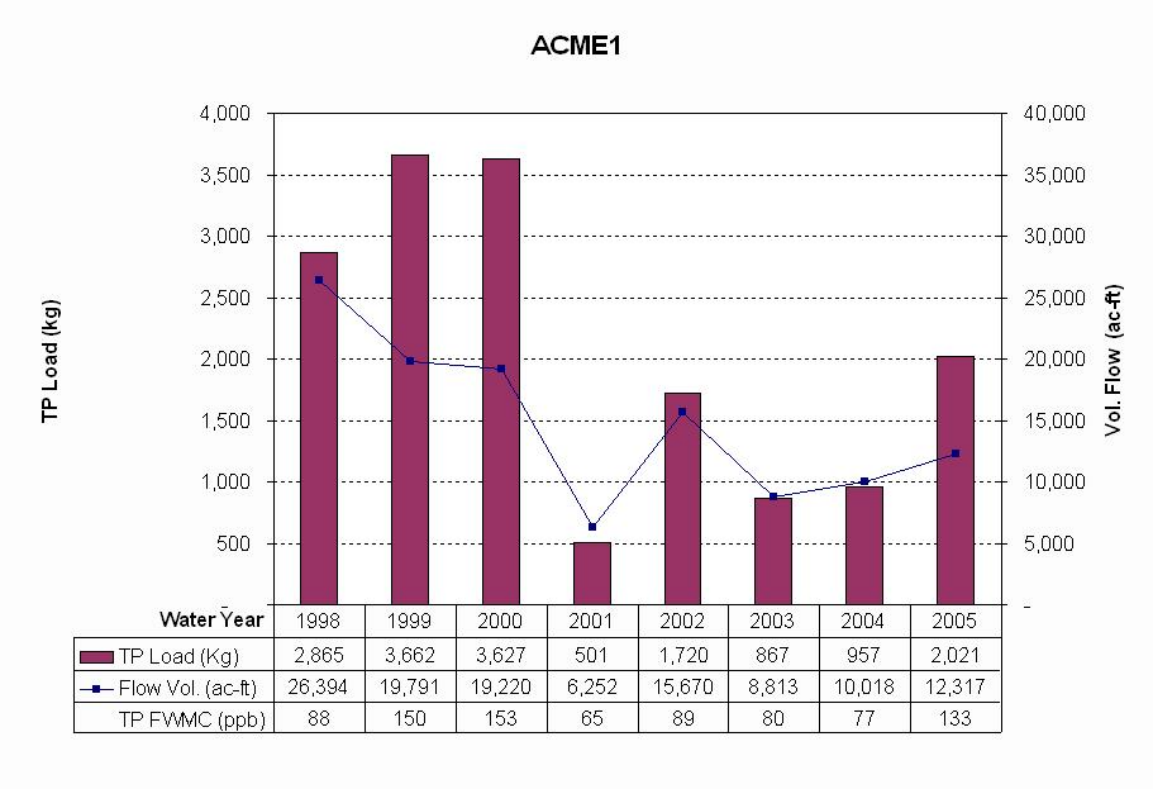
The non-ECP basins water quality improvement plans, schedules, and strategies are a result of close coordination between the District and stakeholders (including local governments, special drainage districts, the Miccosukee and Seminole Indian tribes, environmental interest groups, agricultural and urban communities, and other state and federal agencies) and are consistent with the Long-Term Plan.

ACME Improvement District Basin (Village of Wellington)

The ACME Improvement District is a dependent district of the Village of Wellington (VOW). The VOW occupies approximately 30 square miles and is located west of State Road 7, south of State Road 80, and east of Water Conservation Area 1 (WCA-1) in Palm Beach County. Land use within this basin is mostly residential in the northern portion (Basin A). Rural/agricultural areas are predominant in the southern portion (Basin B). There are also a number of horse farms and other equestrian facilities in Basin B. The major portion of Basin B, totaling 8,680 acres, and some drainage overflows from Basin A discharge via two pumps to the L-40 borrow canal within WCA-1. These two pump stations are known as ACME1 (VOW1) and ACME2 (VOW2). The discharges from ACME1 and ACME2 flow through the culvert structures ACME1DS and G94D, respectively, into the L-40 borrow canal.

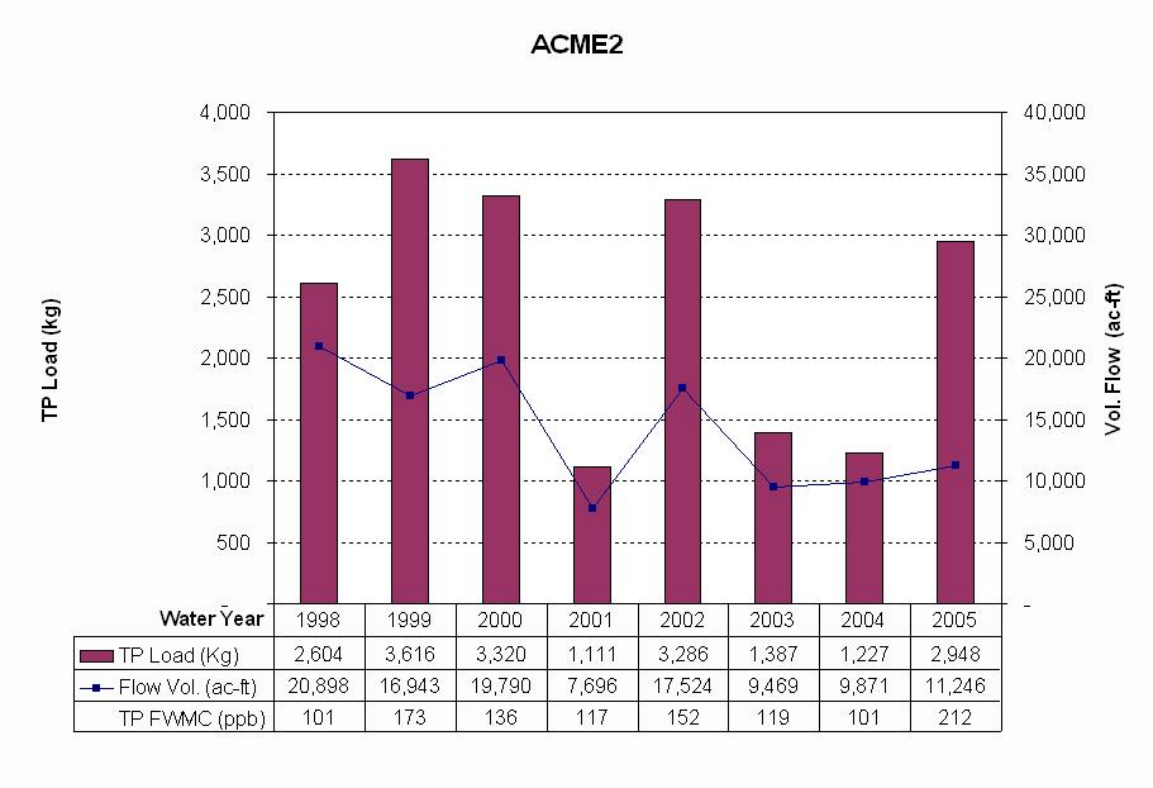
The District has been collecting grab samples for water quality at the two main discharge points into the WCA-1 (ACME1DS and G94D) since early 1997. In March 1999, the District and the VOW entered into a water quality monitoring agreement that included the installation of composite auto-samplers and flow recorders with telemetry at the ACME1 and ACME2 pump stations. The annual TP load, flow volume, and TP flow-weighted mean concentration for ACME1 and ACME2 from WY1998–WY2005 are summarized in **Figures 3-14** and **3-15**. It should be noted that the above average tropical storm activity during WY2005 appears to have negatively affected water quality at these discharge locations as the VOW experienced large volumes of stormwater runoff from August–October 2004. The FWM TP concentrations during September–October 2004 were 153 ppb at ACME1 and 258 ppb at ACME2, while the remaining months of WY2005 were at 69 ppb and 92 ppb, respectively. Furthermore, 75 percent of the total WY2005 flows for this basin occurred in these two months.

The 1999 agreement also provided for upstream water quality monitoring (grab samples) at representative land use sites during flow events. A summary of the upstream water quality data and a map of the ACME Improvement District basin showing these data are included in Appendix 3-2f of this volume. Results from upstream monitoring reveal TP concentrations generally ranging from 20–200 ppb. TP concentrations below 50 ppb are associated with areas where permitted surface water management systems with substantial lake areas exist. Concentrations higher than 100 ppb are primarily associated with areas that have predominantly agricultural, nursery, and equine land uses within Basin B. For WY2005, the TP concentration measurements were higher than the average computed for the period from WY2001–WY2004.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	2,865	3,662	3,627	501	1,720	867	957	2,021
Flow Vol. (ac-ft)	26,394	19,791	19,220	6,252	15,670	8,813	10,018	12,317
TP FWMC (ppb)	88	150	153	65	89	80	77	133

Figure 3-14. Structure ACME1 TP and flow data from WY1998 through WY2005.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	2,604	3,616	3,320	1,111	3,286	1,387	1,227	2,948
Flow Vol. (ac-ft)	20,898	16,943	19,790	7,696	17,524	9,469	9,871	11,246
TP FWMC (ppb)	101	173	136	117	152	119	101	212

Figure 3-15. Structure ACME2 TP and flow data from WY1998 through WY2005.

The VOW and the District executed a second cooperative agreement in May 2000 for the implementation of a water quality improvement plan. The plan included the implementation of BMPs, operational changes in the local water management system, and development of several alternatives to resolve water quality concerns in the Basin B area. As a result of this agreement, VOW has implemented a BMP ordinance, adopted September 26, 2000, that addresses the storage, handling, and transport of livestock waste, the proper use, storage and application of fertilizer (requiring the application of low phosphorus fertilizer only), and irrigation practices. The VOW has implemented an education campaign regarding water quality and BMPs, and has a dedicated staff member to oversee compliance with the BMP ordinance and other environmental related ordinances. The VOW has also implemented several maintenance BMPs within its canal right-of-ways, including raised inlets, sediment sumps, sediment removal, and canal vegetation harvesting.

The District entered into a third cooperative agreement with the VOW on September 2003 that will provide a District's cost share of up to $50,000 toward the remediation of "hot spots" within Basin B through a BMP implementation plan. The District has approved under this agreement a BMP Implementation Plan for a project known as Race Track Lake Expanded Water Quality Treatment Marsh. Implementation of BMPs under this agreement is expected to be completed by September 2006.

To assist the VOW, the District has enhanced requirements for water quality treatment and BMPs in Environmental Resource Permit applications for the area, and has been successful in issuing permits that exceed the minimum required water quality treatment criteria, including permits for innovative BMPs designed to reduce discharges of nutrients into the VOW canal system. The District has dedicated staff members to oversee increased compliance and enforcement activities in Basin B.

For this basin, the Long-Term Plan relies on the implementation of source controls and the ACME Basin B Discharge CERP Project that will divert all Basin B stormwater flows to the STA-1E by way of the C-51 West canal. It should be noted that this project is now part of the Acceler8 program. The most current project details can be found within the Acceler8 web site (www.evergladesnow.org). The District has purchased 374 acres within Section 24, west of the VOW, for future use in the CERP project as a wetland area with floodwater storage capability and environmental feature. To complement the CERP project, the VOW's conveyance system will be substantially modified to enable the diversion of flows from Basin B into Basin A, and then into the C-51 West canal. Once these modifications are built, the VOW1 and VOW2 pumps will no longer discharge stormwater flows to WCA-1 under normal conditions, and the VOW2 pump would be expected to discharge to WCA-1 only during emergency flooding conditions. Representatives from the District, VOW, U.S. Army Corps of Engineers (USACE), and other agencies are part of the Project Delivery Team (PDT), and are pursuing the completion of this project by the end of 2006.

The Long-Term Plan recommends the allocation of $100,000 to assist the VOW in developing, evaluating, and implementing source controls or BMPs (Project Bc75 for FY2005–FY2006). A fourth cooperative agreement between the VOW and the District was executed in July 2005 for cost sharing up to $24,800 toward further developing BMP implementation plans for the basin. It is anticipated that this agreement will be amended in FY2006 to increase the total two year period cost share funds to $99,600 for implementation of source controls or BMPs.

North Springs Improvement District Basin

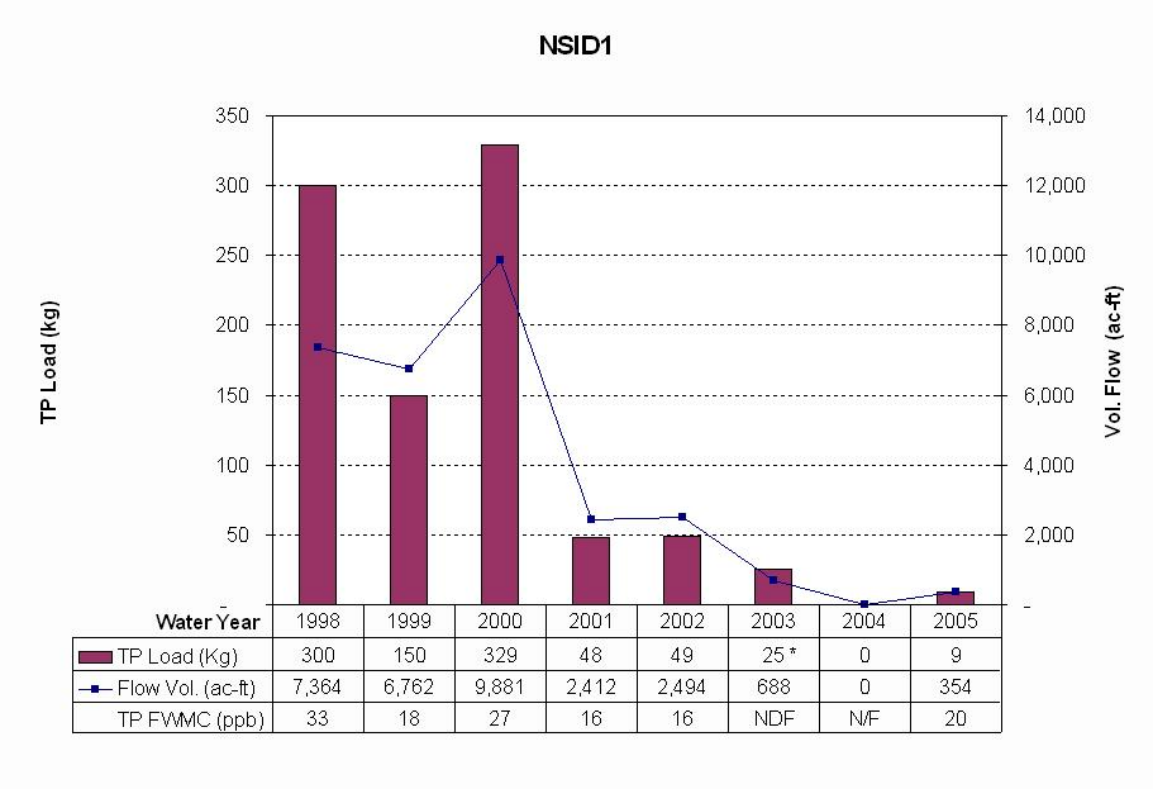
The North Springs Improvement District (NSID) basin has an area of approximately 11 square miles, or 7,064 acres. It is located in northern Broward County along the eastern border of WCA-2A. The northern boundary is the Broward-Palm Beach county line. The Sawgrass Expressway transects the area, entering from the east and turning south as it exits along the western border. The basin is completely within the NSID, and includes the northern portion of the City of Coral Springs (north of Wiles Road), and the western portion of the City of Parkland (generally west of University Drive). Agricultural lands in the northern part of NSID are being converted into residential development.

Two pump stations, NSID Pump Stations 1 and 2, are used to discharge storm water north along the L-36N borrow canal to the Hillsboro canal, which discharges to tide. The NSID is included in the ESP because NSID Pump Station 1 (NSID1) is permitted to pump into WCA-2A when the L-36N borrow and Hillsboro canals are not capable of accepting additional flows. Annual flow volumes to the EPA have been significantly reduced by modification of pump operation practices, due to coordination between the ESP and NSID.

In September 2000, the District and the NSID entered into a cooperative agreement that provided a District's cost share of $50,000 to address water quality and quantity concerns. The intended objective of this agreement was for local programs to more effectively monitor and improve water quality to meet the objectives of the EFA. The NSID surface water management master permit was modified to require both discharge and upstream monitoring of water quality during flow, in accordance with the steps in the RAS.

The District and NSID have been monitoring the water quality at NSID Pump Station 1 since 1990. A composite auto-sampler was installed at this pump station in 2001. **Figure 3-16** summarizes the annual TP load, flow volume, and FWM TP concentration for NSID Pump Station 1 from WY1998–WY2005. The discharge volumes from the NSID Pump Station 1 have been reduced significantly, due to the operational changes implemented by the NSID, with none or insignificant flow volumes in the last three water years.

In accordance with the cooperative agreement, monitoring at upstream sites was initiated to identify possible sources of phosphorus. A summary of the upstream water quality data and a map of the NSID basin showing these data are included in Appendix 3-2f of this volume. The average TP concentration at NSID Pump Station 2 (NSIDNP02) has decreased from 43 ppb in WY2002 to 23 ppb in WY2005. The inputs from the eastern basin, through site NSIDEC02, show levels of TP at 20 ppb, lower than WY2002's 28 ppb. The unique characteristics of this relatively small eastern basin versus other areas in NSID are that the control elevation is 9 feet National Geodetic Vertical Datum (ft NGVD) and it is completely developed, whereas the western basin has a control elevation of 7 ft NGVD and it has ongoing development activities and operating golf courses. Historically, the highest upstream levels of TP were found in the discharges from the northern sub-basin currently monitored at site NSIDNC01 with a TP average of 27 ppb for WY2005 and 40 ppb over the period of record (June 2001 to the present). This region was previously an agricultural area, but it is in the process of being converted to residential and commercial uses over the next few years. The development plans for these areas will include water management provisions that will exceed the minimum permit criteria and provide additional storage and water quality treatment. It is expected that 95 percent of the currently undeveloped areas in the northern part of the basin will be developed by December 2006. Based on sample results, the best water quality in the entire basin is at NSID "into" structure, Pump Station 1, which has a large attenuation lake directly preceding it.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	300	150	329	48	49	25 *	0	9
Flow Vol. (ac-ft)	7,364	6,762	9,881	2,412	2,494	688	0	354
TP FWMC (ppb)	33	18	27	16	16	NDF	N/F	20

Figure 3-16. Structure NSID1 TP and flow data from WY1998 through WY2005 (Note: N/F represents “no flow”; NDF represents “no data with flow available”; and * represents “calculated with annual flow and arithmetic mean concentration”).

Because the NSID basin preferentially discharges to the Hillsboro Canal via the L-36N borrow canal and only pumps to WCA-2A during times of potential flooding, significant reductions in discharges to WCA-2A may be possible through additional storage in the basin or redirection of excess flows. Operational BMPs (more effective management of pump regimes) have been implemented which have reduced discharges from this basin into WCA-2A. As a result, the last two confirmed discharges from NSID Pump Station 1 into WCA-2A occurred in July 2002 and September 2004.

The NSID has installed an inter-basin transfer pump station, with a capacity of 25,000 gallons per minute, which will move water to the east during times of high water in the western basin. This will serve to further reduce the need to pump to WCA-2A. Telemetry with remote pump control, level sensors, pump discharge adjustment, and other important operational appurtenances will be installed and utilized to maximize pumping efficiencies and further reduce the need to pump into WCA-2A. The telemetry installation is expected to be completed by December 2006.

The NSID currently requires the renewal of surface water permits every five years to ensure the stormwater management systems are working appropriately. District staff is coordinating with Coral Springs and Parkland, which have areas within NSID basin boundaries, to pursue public outreach activities, develop water quality improvement and pollution prevention activities, and facilitate BMP implementation designed to reduce the flows and TP concentrations in their stormwater discharges. Much of the drainage infrastructure in this basin is under the control of local homeowner's associations. As part of the District's efforts, NSID stakeholders and many others are included in the District's Public Outreach Plan and the Broward Everglades Working Group.

For this basin, the Long-Term Plan relies on the implementation of source controls and the diversion of current NSID releases made to WCA-2A to the CERP Hillsboro Site 1 Project. The CERP Hillsboro Site 1 Project, currently scheduled for completion in 2009, consists of a 1,600-acre impoundment located on the north side of the Hillsboro Canal just east of WCA-1. The project also includes planned conveyance improvements to structure S-39A, located at the north end of L-36N borrow canal where flows enter the Hillsboro Canal, and improvements to a section of the Hillsboro Canal. It must be noted that this project is now part of the Acceler8 program. The Long-Term Plan assumed this project was to be completed by December 2007, but the Acceler8 schedule for project completion is currently 2009. More detail on this project is available at the CERP web site (www.evergladesplan.org/pm/projects/proj_40_site_1_impoundment.cfm) and the Acceler8 web site (www.evergladesnow.org).

The Long-Term Plan allocated funds to conduct a hydraulic/hydrologic evaluation of storm events in the NSID basin to determine if there would be any negative impacts to the Hillsboro Canal from redirecting storm water away from WCA-2A to the CERP Hillsboro Site 1 Project (Project Bc71). This evaluation was to include an assessment of the potential for connecting adjacent lake areas to the NSID water management system for additional surface water storage (i.e., water management operations will be evaluated to determine how more water may be retained within the basin or discharges could be more tightly regulated to minimize the need to pump into WCA-2A, except under extreme circumstances). The District hired a consultant to perform this evaluation, which was completed in July 2004. The evaluation predicted the water elevations on the Hillsboro Canal would increase during large storm events. The District is performing further analysis to evaluate potential mitigation measures. The District expects to complete this evaluation by October 2005. If mitigation measures are determined unfeasible, then it is possible that during a large storm event NSID flow would have to be discharged to the EPA to avoid flooding impacts in the Hillsboro Canal basin. Because of these impacts, the Long-Term Plan recommendation of redirecting all NSID flows away from the EPA may not be feasible. If necessary, the District will evaluate the potential TP loads that could be expected to enter the

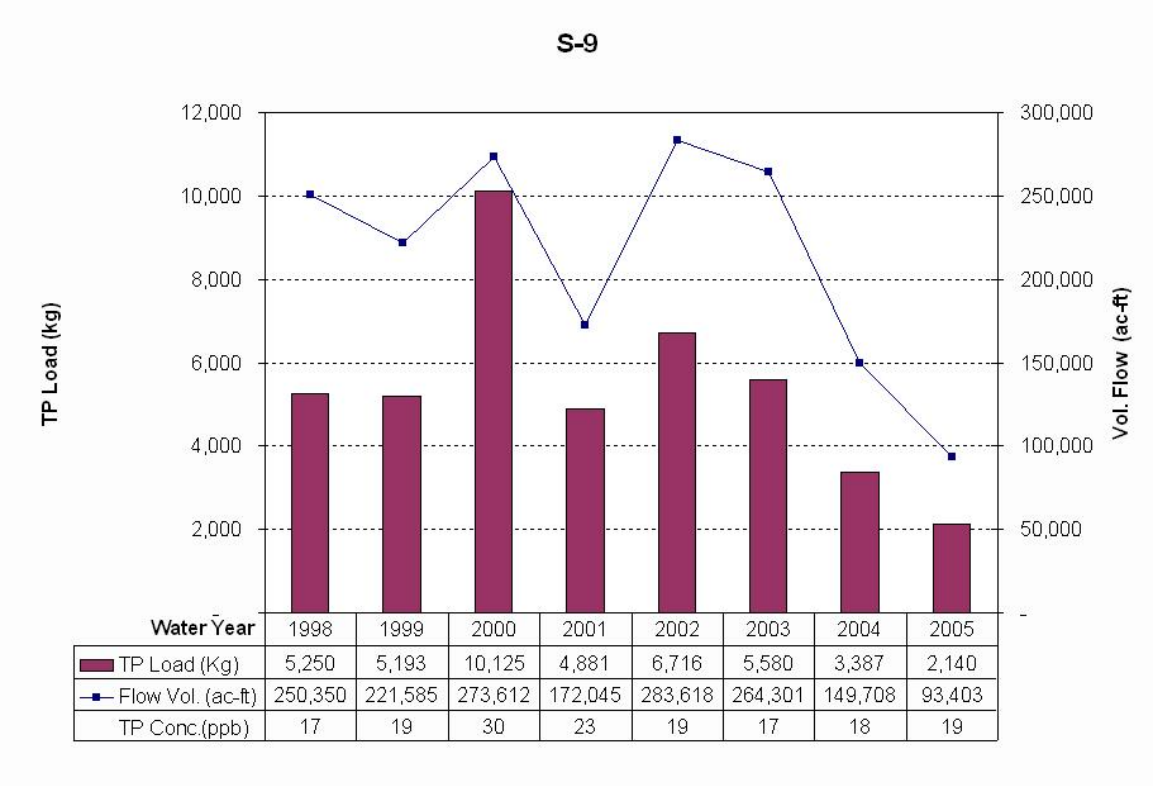
EPA during large storm events. Based on the results of the mitigation measures evaluation, the District will submit a recommendation to the FDEP to revise the Long-Term Plan for this basin.

C-11 West Basin

The C-11 West Basin is a rapidly urbanizing basin located in south central Broward County west of Fort Lauderdale that drains into the current Everglades system. This basin has an area of approximately 72 square miles, approximately 61 percent of which has been developed. Sixteen percent of the basin area is used for a combination of agriculture and nursery operations. The remaining areas are wetlands, rangelands, or forested uplands. The excess water in this basin, comprised of stormwater runoff and ground water seepage from the EPA, is pumped from the C-11 West Canal via the S-9 and S-9A pump structures into WCA 3A. The S-9A pump structure was put into operation in early 2003.

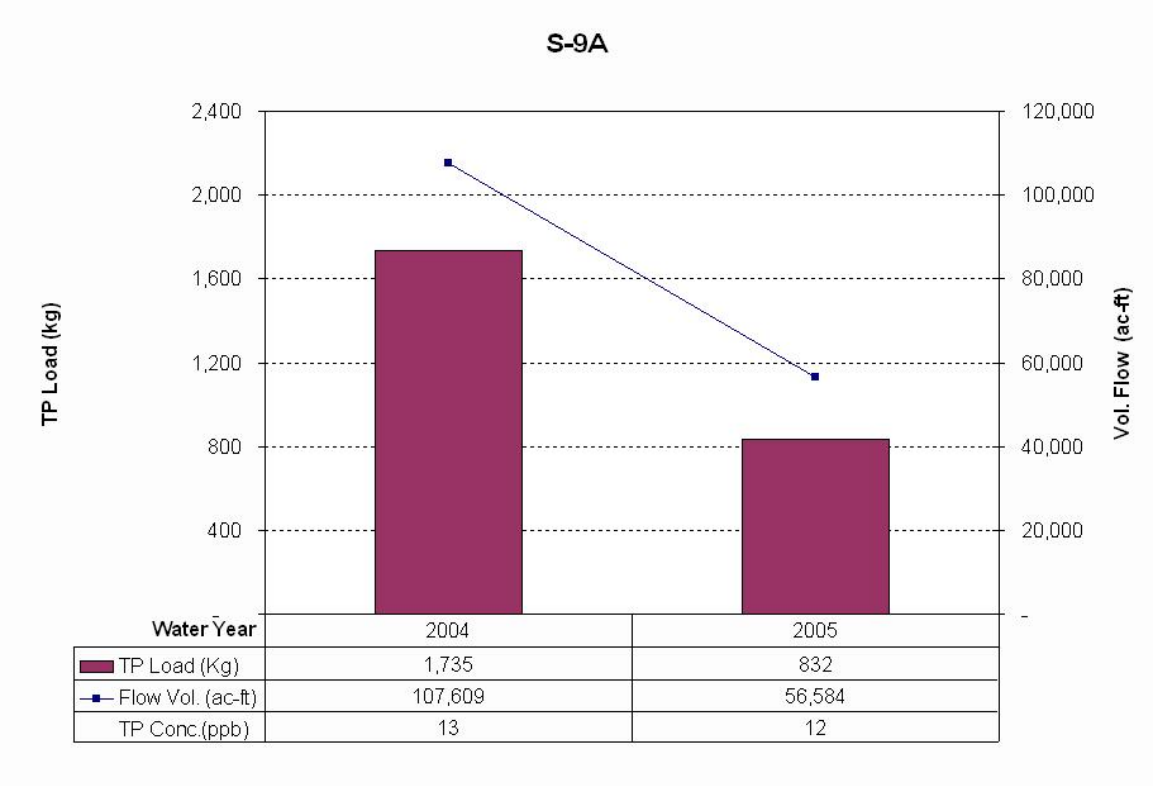
The C-11 West basin covers most or parts of the cities of Weston, Sunrise, Cooper City, Pembroke Pines, the towns of Davie and Southwest Ranches, and unincorporated areas of south central Broward County. There are three drainage districts within the C-11 West Basin: Indian Trace Development District (ITDD), South Broward Drainage District (SBDD), and Central Broward Water Control District (CBWCD). These drainage districts operate and maintain the secondary canals draining into the C-11 West canal.

There has been extensive water quality monitoring at the primary discharge structure, the S-9 pump station. The District has been collecting grab samples for water quality data at this structure since December 1977 and a composite auto-sampler began collecting samples at S-9 in December 1996. **Figure 3-17** summarizes the annual TP load, flow volume, and FWM TP concentration for S-9 from WY1998–WY2005. **Figure 3-18** summarizes the annual TP loads, flow volume, and FWM TP concentration for S-9A from WY2004–WY2005. The S-9A pump station discharges mostly seepage returns into WCA-3A and, therefore, it is expected to show lower TP concentrations.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	5,250	5,193	10,125	4,881	6,716	5,580	3,387	2,140
Flow Vol. (ac-ft)	250,350	221,585	273,612	172,045	283,618	264,301	149,708	93,403
TP Conc.(ppb)	17	19	30	23	19	17	18	19

Figure 3-17. Structure S-9 TP and flow data from WY1998 through WY2005.



Water Year	2004	2005
TP Load (Kg)	1,735	832
Flow Vol. (ac-ft)	107,609	56,584
TP Conc.(ppb)	13	12

Figure 3-18. Structure S-9A TP and flow data from WY2004 through WY2005.

Pursuant to the RAS, the District entered into cooperative and cost share agreements with all three drainage districts within the C-11 West Basin (**Table 3-15**). The purpose of the agreements is to implement local water quality monitoring and improvement programs that will help meet the objectives of the EFA. The tasks include establishing public involvement activities, monitoring programs for upstream structures, and implementing appropriate BMPs designed to reduce nutrient loads being discharged in stormwater flows. The agreements include stipulations that require remedial actions be taken where hot spots are identified and may require construction of capital improvement projects.

Table 3-15. Agreements with local drainage districts in C-11 West basin.

Drainage District	Amount of Agreement	Date of Agreement
CBWCD	$50,000	September 2000
SBDD	$50,000	October 2000
ITDD	$4,567	May 2002

Upstream water quality monitoring has yielded a significant amount of data indicating the TP concentrations in the basin. A summary of the upstream water quality data and a map of the C-11 West basin showing these data are included in Appendix 3-2f of this volume. Results from upstream monitoring reveal TP concentrations generally ranging from 7 to 50 ppb. TP concentrations between 7 to 25 ppb are associated with areas where permitted surface water management systems exist. TP concentrations between 25 to 50 ppb are associated with older residential areas lacking permitted surface water management systems. It has also been observed that TP concentrations increase during periods of construction due to sediment erosion. Concentrations higher than 50 ppb are primarily associated with areas that have predominantly agricultural and/or nursery land uses.

Several public involvement activities are being implemented in the C-11 West basin that include a variety of strategies aimed at educating stakeholders and the public. The aim of these educational programs is to motivate the residents and stakeholders in the basin to implement changes that will result in enhanced water quality and reduced phosphorus levels in stormwater discharges. To initiate the campaign, the District and the Broward County Extension Education Division hosted the first C-11 West Canal Basin Working Group in early 2000. The 36-member working group included representatives of landscaping interests, fertilizer industries, government agencies, colleges, universities, special interest groups, and environmental organizations. The group developed turfgrass and landscaping BMPs that will help residents reduce pollution without sacrificing the basin's urban landscapes. The Turf and Landscape Best Management Practices Manual was incorporated into a "mini-web site" that was posted on each of the working group member web sites.

The District has been instrumental in forming the Freddy's Friends Club and the Teddy's Friends Club, the District's and CBWCD's mascots, respectively, at elementary schools in the basin. The program has also posted interpretive signs along the C-11 West canal and selected secondary canals. The signs communicate the canal's role in flood protection, its connection to the Everglades and the concept that residents' activities affect water quality.

The C-11 West basin includes a regulatory component to source controls. The District's Environmental Resource Permits within this basin have been required, when necessary, to

provide additional pretreatment facilities/features to offset adverse water quality impact from new developments.

For the C-11 West basin, the Long-Term Plan relies on the implementation of source controls and CERP projects as the primary means of reducing TP discharges to WCA-3A from the C-11 West basin. The Western C-11 Impoundment and Diversion Canal CERP Project, currently scheduled for completion in 2009, consists of a 1,600-acre impoundment within the C-11 West basin, and approximately 8 miles of canal that will divert flood waters to other CERP storage areas. This impoundment will be located north of the C-11 West canal and east of U.S. Highway 27. It should be noted that this project is now part of the Acceler8 program. The Long-Term Plan assumed this project was to be completed by January 2006, but the Acceler8 schedule for project completion is currently 2009. The Western C-11 Impoundment and Diversion Canal Project has been complemented by the recently completed C-11 West Basin Critical Project, which includes structural and operational changes to the water management system by isolating WCA-3A seepage from C-11 West basin runoff. The combination of a divide structure (S-381) and the S-9A pump station will contain and return seepage to WCA-3A. It is expected that the TP levels going into WCA-3A will be reduced by back-pumping clean seepage water, and by decreasing operation of the larger S-9 pumps, which cause scour and drawdown. In addition, the North Lake Belt Storage CERP Project, scheduled for completion in June 2036, will further reduce to a minimum the stormwater flows pumped into WCA-3A through S-9.

The Long-Term Plan allocated funds to conduct an evaluation of potential internal enhancements to the impoundment for water quality improvements (Project Bc73; FY2004–FY2005). The District hired a consultant to complete an evaluation of the stormwater treatment potential of the proposed Western C-11 impoundment. The consultant determined that an additional TP reduction of 3 to 5 percent could be achieved if excess stormwater inflows are routed through the impoundment. The District hired another consultant to perform a more detailed analysis of modifications to the impoundment design to accommodate the routing of excess flows and to investigate impoundment operation alternatives that would minimize the stormwater flows pumped into WCA-3A through S-9. These studies are expected to be completed by December 2005.

The Long-Term Plan also allocated funds to assist local communities in developing, evaluating and implementing source controls or BMPs (Project Bc73; FY2005–FY2006). These funds have been used to fund the C-11 West Basin Nursery BMP Grant Program and the production and airing of education videos. The funds will continue being used for these activities and the implementation of other Public Outreach Plan activities.

The sections below present source control schedules and strategies for each of the drainage districts within the C-11 West basin.

SOUTH BROWARD DRAINAGE DISTRICT

Non-Structural BMPs: South Broward Drainage District (SBDD) is now requiring the renewal of surface water permits every 5 years to ensure the stormwater management systems are working appropriately. Owners renewing a permit for their property must have it inspected and certified by a professional engineer. If the inspection reveals a problem, then this must be corrected prior to the certification.

SBDD personnel perform regular inspections and maintenance of canals. If livestock manure on or near a canal is determined to be a potential problem, then the property owner is given a copy of the equine BMP publication and is advised to take the appropriate corrective action. Property owners failing to take corrective actions would be referred to the Town of Southwest Ranches for appropriate action.

Structural BMPs and Operational Changes: Drainage facilities for the S-9 and S-10 sub-basins of the SBDD are being modified to provide additional stormwater treatment. Both basins, totaling about 10 square miles, will be interconnected and control structures will provide 1.5 inches of stormwater runoff detention prior to discharging into the C-11 West canal. Three control structures are planned to replace six unrestricted outfalls, which presently do not provide for any detention within these basins. Currently, one of the control structures has been completed and the additional two structures are expected to be completed by December 2006. The District's CERP division has contributed $1 million toward the cost of this $3.6 million project.

The SBDD is also in the process of closing three more unrestricted outfalls located within S-8 sub-basin. Stormwater runoff currently draining through these unrestricted outfalls will be rerouted through the existing SBDD S-8 pump station. A total of $30,000 has been contributed by the District under its agreement with the SBDD toward the cost of rerouting the flows through the S-8 pump station. The closing of the unrestricted outfalls is expected to be completed by December 2005. In addition, the surface water permit for this pump station will be modified to provide 1.5 inches of stormwater detention prior to discharge. This would provide an additional 0.5-inch detention over the current permit conditions. It is expected that operational changes associated with the permit modification will be implemented by December 2006.

Public Outreach: The SBDD has developed a website that has links to all BMP documents and manuals produced for this area. In addition, the SBDD is an active participant of working groups that develop BMPs.

CENTRAL BROWARD WATER CONTROL DISTRICT

Non-Structural BMPs: Central Broward Water Control District's (CBWCD) surface water permits for construction include added special requirements such as:

- construction of littoral shelves in new lakes
- renewal of surface water permits every 5 years
- floodplain encroachment analysis
- more stringent criteria, if deemed necessary

In addition, development of single family properties not served by a surface water management system is required to maintain 30 percent of the parcel undeveloped at its natural elevation and erect a berm to retain a 25-year, three-day storm event. The CBWCD ensures these requirements are met prior to issuing any permits to the single family property. The CBWCD also has authority to require any property owners to correct existing and potential problems, if deemed necessary. When maintaining canals, CBWCD personnel advise livestock owners if manure is determined to be a potential pollution problem for the canal and provide to the property owners a copy of the equine BMP publication.

Structural BMPs and Operational Changes: CBWCD is continuing the implementation of the $1.1-million capital improvement projects for flood and water quality control for the CBWCD western basin recommended by the CBWCD's C-11 West Basin Comprehensive Facilities Report Update of December 2003. These capital improvement projects are currently under way and expected to be completed by December 2006. They include new canals and culverts to redirect runoff from basins with limited storage to basins with excess storage capacity. Taking advantage of excess basin storage capacity reduces flood levels, improves water quality, increases aquifer recharge, and reduces the volume of runoff discharged by the CBWCD into the C-11 West canal. These capital improvement projects were complemented in October 2004 by the CBWCD's Western C-11 Water Quality Improvement Project. The District, under its agreement with CBWCD, contributed $39,000 to pay for the cost of preliminary design is this project, which proposes infrastructure improvements for three CBWCD canals just upstream of their discharge

points into the C-11 West canal. The infrastructure improvements are intended to further increase storage and retention capacity within the secondary canal system prior to discharge into the C-11 West canal. The infrastructure improvements will attenuate runoff, which will allow pollutants to settle out of the water column or be absorbed through biological processes. The project is currently in the detailed design phase and is expected to be completed by December 2006. The CBWCD's Western C-11 Water Quality Improvement Project is estimated to cost an additional $1 million, bringing the total cost of water quality improvement projects for the CBWCD western basin up to $2.1 million. In February 2005, the District and CBWCD signed an agreement that would provide up to $1 million in District funds to cost-share the $2.1 million projects.

Public Outreach: The CBWCD has a website with links to the C-11 West Turf and Landscape BMP site, and to all BMP documents and manuals produced. Also, CBWCD does water quality presentations at local elementary schools, and has established Freddy's and Teddy's Friends clubs. The drainage district does water quality presentations for local homeowners associations and at public meetings in the towns of Davie and Southwest Ranches, and sponsors and participates in the town of Davie Annual Waterway Cleanup, in which the CBWCD also distributes fliers and brochures that deal with water quality problems and pollution prevention. In addition, CBWCD has installed six interpretive signs at their secondary canals N-32, N-27, N-18, S-7, S-22, and S-35. CBWCD has been and is an active participant of working groups that develop BMPs.

INDIAN TRACE DEVELOPMENT DISTRICT (CITY OF WESTON)

The City of Weston has direct control of Indian Trace Development District (ITDD) and Bonaventure Development District (BDD). The BDD is located within the NNRC basin, which is another non-ECP basin. Therefore, the initiatives and strategies listed under the *Non-Structural BMPs* and *Public Outreach* sections below also apply to the BDD.

Non-Structural BMPs: The City of Weston employs a contractor to sweep 114 miles of curb on main roads three to four times per year. The city has inventoried all of the approximate 600 catch basins within the city's right-of-ways using a computerized system, and contracts to have these areas cleaned at least once every 18 months, or as needed. The city also does aquatic control of the canals and lakes. City crews also perform the following maintenance activities:

- Inspect catch basins regularly and after storms (French drains are maintained and inspected more often)
- Inspect and maintain water control structures (culverts, weirs, and pumps)
- Remove from lakes floating trash, garbage and large items (bikes, shopping carts)

The city has landscaping contractors (two for the ITDD area and one for the BDD area) and each may subcontract pest control or fertilizing activities. Contracts are for three to five years and include city right-of-ways (medians and swales), public parks, public facilities (fire stations, public utilities, etc), and in certain areas, road maintenance extending from "edge of water to edge of water" (i.e., the maintenance goes beyond the swale to the edge of water). Contracts require that the amount of fertilizer be limited to what plants can use based on soil testing; phosphorus content on fertilizers used varies between 2 to 5 percent; pest control is based on a certain threshold before pesticides are applied and a log is kept for each application: (1) irrigation is limited for 1 to 1.5 inches per cycle (twice per week on sandy areas and once per week on mucky areas), (2) grass clippings on hard surface must be blown back onto grass, and (3) leaves must be removed.

A consultant in charge of the City of Weston Engineering Department does the permit approvals for construction and performs the construction inspections. During these inspections, it is ensured that erosion and sedimentation control measures are in place and working properly.

Structural BMPs and Operational Changes: Most of the ITDD is served by a pump system. The District and the city's consultant is investigating the possibility of modifying the ITDD's operational criteria to increase the stormwater detention to 1.5 inches prior to discharging into the C-11 West Canal. A preliminary investigation is expected to be completed by December 2005.

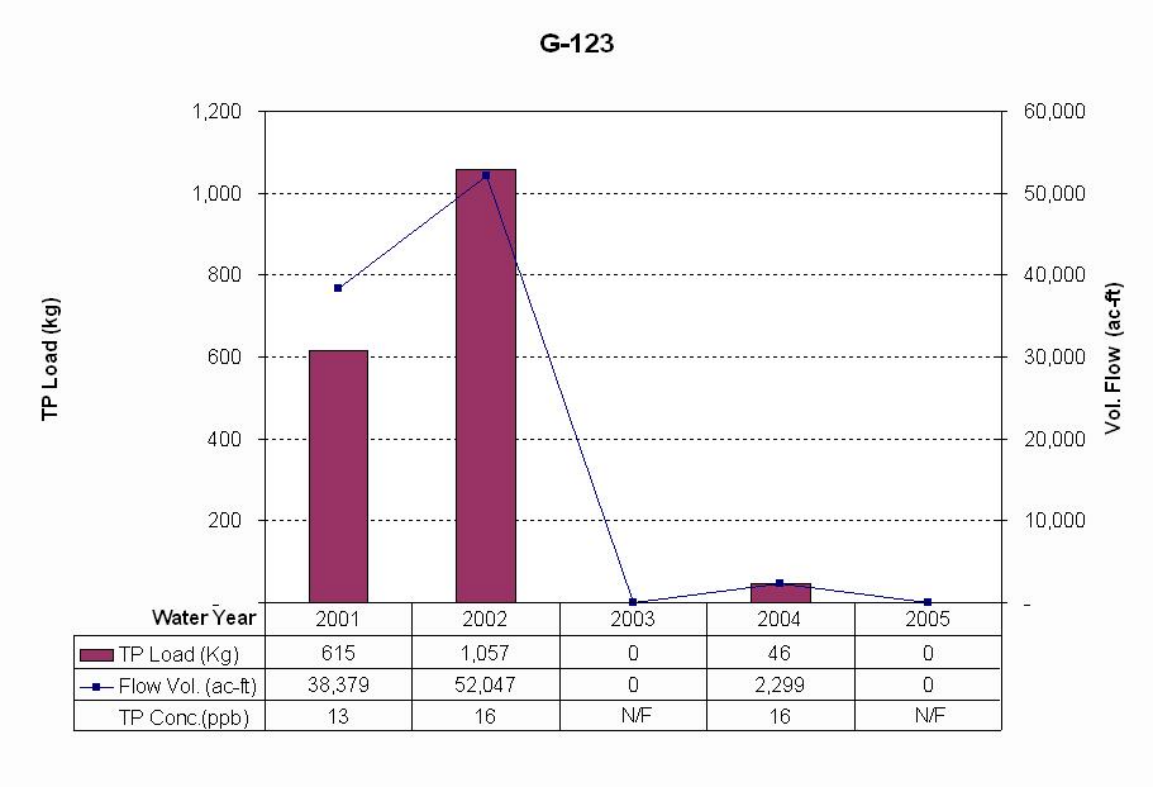
Public Outreach: The city has included general pollution prevention information in its quarterly newsletter. The newsletter is mailed to every household within the city, and is also available for pick up at city facilities. The city has a webpage, public access channel and radio, and a public information staff for outreach purposes. The city also has a database listing of all homeowner associations including the management companies. Educational seminars on Turf and Landscape BMP have been organized and held by the city.

North New River Canal Basin

The NNRC basin occupies an area just under 30 square miles, and is located southeast of WCA-2B in Broward County, west of the Florida Turnpike. The bulk of the basin lies immediately north of I-595, covering most or part of the cities of Plantation, Sunrise, and Weston. The NNRC basin is almost completely developed with predominantly residential and commercial land uses. There are eight sub-basins within the NNRC basin: Old Plantation Water Control District (OPWCD), Plantation Acres Improvement District (PAID), Bonaventure Development District within the City of Weston (BDD), the City of Sunrise, the City of Plantation (area not within a drainage district), and Markham Park. The outfalls of the two remaining sub-basins (Lago-Mar Country Club and the Sunshine trailer park) are privately owned.

The "into" structure serving this basin and discharging into WCA-3A is G-123, located at U.S. 27 and I-75. This structure is mainly used for water supply to WCA-3A and is not intended to be used for flood control. However, during large storm events, the pumps at G-123 may be turned on to provide some flood relief for the basin when storage capacity is available in the WCAs. Operation of these pumps is not on any regular schedule, and varies significantly with rainfall and water stage. Flood relief for this basin is mainly provided by the G-54 structure located on the North New River Canal, just west of the Florida Turnpike, which discharges to tide.

The District has been collecting grab samples for water quality data at the G-123 structure since December 1982. A composite auto-sampler was installed at G-123 in October 2000. **Figure 3-19** summarizes the annual TP load, flow volume, and FWM TP concentration for G-123 from WY2001–WY2005. The flow volume discharges from the G-123 pump station have been reduced significantly, due to the operational changes implemented by the District, with no flow or insignificant flow volumes in the last three water years.



Water Year	2001	2002	2003	2004	2005
TP Load (Kg)	615	1,057	0	46	0
Flow Vol. (ac-ft)	38,379	52,047	0	2,299	0
TP Conc.(ppb)	13	16	N/F	16	N/F

Figure 3-19. Structure G-123 TP and flow data from WY2001 through WY2005 (Note: N/F represents “no flow”).

Pursuant to the RAS, the District entered into cooperative and cost share agreements with four of the eight entities within the NNRC (**Table 3-16**). The agreements outline procedures to implement local water quality monitoring and improvement programs that will help meet the requirements of the EFA. The tasks considered in the agreements include the continuation of monitoring programs for upstream structures and implementation of appropriate BMPs designed to reduce nutrient loads being discharged in stormwater flows. The agreements include stipulations that require remedial actions be taken where hot spots are identified and may require construction of capital improvement projects. Agreements with the remaining sub-basins were either not possible or not practical. The District will pursue implementation of non-structural BMPs in these sub-basins.

Table 3-16. Agreements with local drainage districts and cities in the NNRC basin.

Drainage District/City	Amount of Agreement	Date of Agreement
OPWCD	$25,000	September 2001
PAID	$50,000	March 2002
BDD	$3,591	May 2002
CITY OF SUNRISE	$15,000	December 2003

Upstream water quality monitoring has yielded data indicating that TP concentrations found in the basin generally range from 10 to 80 ppb. A summary of the upstream water quality data and a map of the NNRC basin showing these data are included in Appendix 3-2f of this volume. TP concentrations between 10 and 25 ppb are associated with areas where permitted surface water management systems exist. TP concentrations between 25 and 50 ppb are associated with older residential areas that lack permitted surface water management systems. Areas where TP concentrations exceed 50 ppb are associated with golf courses or ongoing construction.

Public outreach initiatives for PAID, OPWCD, BDD, and the cities of Sunrise and Plantation have been developed as part of the ESP Public Outreach Plan and are being done in coordination with stakeholders and landowners in the basin.

For this basin, the Long-Term Plan relies on the implementation of source controls and the discontinuation in use of the G-123 pump station after December 31, 2006, other than as may be absolutely necessary for water supply, until completion of the CERP project as the primary means of reducing TP discharges to WCA-3A from the NNRC basin. The WCA-2 and WCA-3 Diversion Project (CERP component YY4) is to be completed after 2020, and includes the construction of a new basin divide structure across the North New River Canal at Markham Park and canals to reroute urban runoff from the Bonaventure pump stations to the North New River Canal downstream (east) of the new divide structure. The new divide structure will effectively eliminate urban runoff from the NNRC basin from discharging to the WCA-3A. Seepage from WCA-2B that is collected in the L-35A borrow canal will be redirected into new canals, which will convey it south to the Everglades National Park (ENP or Park).

Because basin stakeholders had expressed concerns that discontinuing use of the G-123 pump station may reduce flood protection in the basin, the Long-Term Plan allocated funds to perform a flood impact analysis to ensure that the NNRC basin's current level of flood protection is

maintained (LTP Project Bc72). The District hired a consultant to perform this analysis, which was completed in September 2005. The analysis predicted that discontinuing use of the G-123 pump station would reduce flood protection in the basin. The analysis included an evaluation of potential mitigation measures to offset the potential flood impacts and the District is currently evaluating the mitigation measures alternatives. If mitigation measures are determined unfeasible, then it is possible that during a large storm event NNRC basin flows would have to be discharged to the EPA to avoid flooding impacts in the basin. Because of these possible negative effects, the Long-Term Plan recommendation of discontinuing use of the G-123 pump station may not be feasible. If necessary, the District will evaluate the potential TP loads that could be expected to enter the EPA during large storm events. The District will submit a recommendation to the FDEP to revise the Long-Term Plan for this basin as a result of the findings of the flood impact analysis.

The sections below present initiatives and strategies for each of the drainage districts and cities within the NNRC basin.

PLANTATION ACRES IMPROVEMENT DISTRICT

Plantation Acres Improvement District (PAID) has a continuous inspection program which may revoke private stormwater management system permits older than five years if it is determined the private system is not working appropriately. In addition, PAID crews clean and spray canals to keep them free from excessive vegetation.

PAID is continuing the upgrades to all six pump stations discharging into the C-42 Canal. The upgrades include replacement of pumps and motors as well as automation and remote control of operations. The cost of this project is estimated to be about $462,000, and is expected to be completed by 2006. Also, PAID has an ongoing program to improve road side swales and install catch basins and drainage pipes. The District will contribute $44,000 under its agreement with PAID toward the cost of these capital improvement projects.

OLD PLANTATION WATER CONTROL DISTRICT

The Old Plantation Water Control District (OPWCD) requires the renewal of surface water permits every five years to ensure stormwater management systems are working appropriately. In addition, the OPWCD uses a harvester to remove excessive aquatic vegetation, and performs regular canal maintenance.

The OPWCD has added remote sensing equipment to its four pump stations to allow for collection of real time information. This information will allow reduction of pump discharges from the two pump stations that discharge to the North New River canal west of the G-54 structure, and redirection of some of the discharge through the other two pump stations, which discharge to tide.

BONAVENTURE DEVELOPMENT DISTRICT (CITY OF WESTON)

The City of Weston has direct control of the Bonaventure Development District (BDD) and the ITDD. The ITDD is located within the C-11 West basin, which is another non-ECP basin. Therefore, the schedules and strategies listed under the *Indian Trace Development District* section also apply to the BDD.

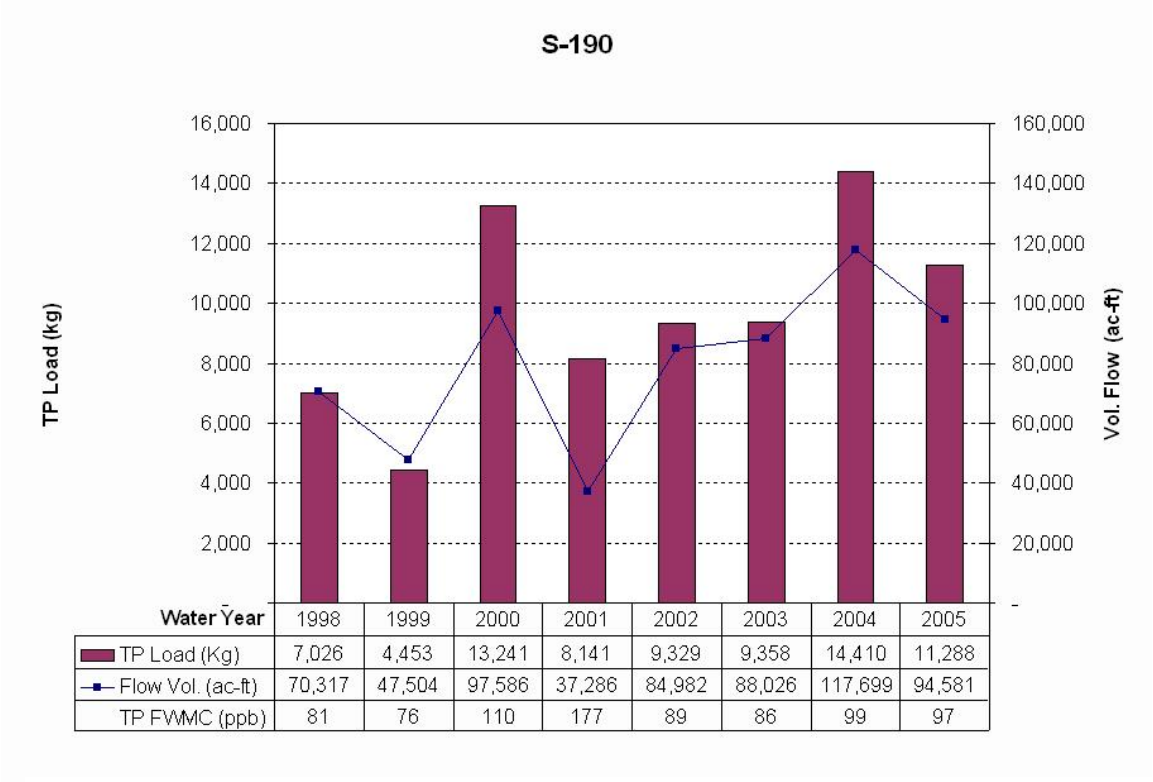
Feeder Canal Basin

The Feeder Canal basin, located in Hendry County, is largely agricultural and has an area of approximately 107 square miles (or 68,883 acres). The canals and structures within this basin provide flood protection and drainage within three sub-basins in addition to conveying excess runoff to WCA-3A for water supply and environmental use. The two major canals associated

with the Feeder Canal basin are the North Feeder and the West Feeder canals. These two canals merge in the lower southeastern corner of the basin, and discharge south through the S-190 structure into the L-28 Interceptor canal, and eventually into WCA-3A. These major canals provide drainage for the western portion of the Big Cypress Seminole Indian Reservation, plus privately owned agricultural land lying north and west of the reservation. Two secondary canals also exist in the Feeder Canal basin located upstream of the West Feeder canal.

Of the three major sub-basins within the Feeder Canal basin, the North Feeder sub-basin, consisting of approximately 23,150 acres, is under the operation of a single family enterprise (known as the McDaniel Ranch). Land uses within this basin include cattle on unimproved and improved pastures, sugar cane, row crops, and large tracts of undeveloped natural areas. Another sub-basin, a section of the Big Cypress Seminole Indian Reservation, is about 13,850 acres. Seminole land uses are similar to the North Feeder sub-basin, as they include cattle on unimproved and improved pastures, citrus, and large tracts of undeveloped natural area. There are approximately 28 private property owners in the third major sub-basin, the West Feeder sub-basin. Approximately 31,900 acres of the West Feeder sub-basin is the headwater tributary to the West Feeder Canal, with the primary surface water drainage system consisting of two canals, the Lard Can and the Wingate Mill canals. Land use in this sub-basin includes cattle on unimproved and improved pastures, citrus, row crops, and natural areas.

The District has been collecting grab samples for water quality data at the S-190 structure since 1987, and a composite auto-sampler began collecting samples in August 2000. **Figure 3-20** summarizes the annual TP load, flow volume, and FWM TP concentration for S-190 from WY1998–WY2005.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	7,026	4,453	13,241	8,141	9,329	9,358	14,410	11,288
Flow Vol. (ac-ft)	70,317	47,504	97,586	37,286	84,982	88,026	117,699	94,581
TP FWMC (ppb)	81	76	110	177	89	86	99	97

Figure 3-20. Structure S-190 TP and flow data from WY1998 through WY2005.

Upstream water quality sampling is well established in two of the three sub-basins through a variety of permit conditions and/or landowner agreements. In the North Feeder sub-basin, water quality monitoring is detailed within Environmental Resource Permit (ERP) No. No. 26-00623-P, issued to the McDaniel Ranch for their internal detention areas and final discharge locations (District's structures PC-17A and G-108) into the North Feeder canal. In addition, the landowner's agreement between the McDaniel Ranch and the Seminole Indian Tribe of Florida identifies the same two discharge locations (PC-17A and G-108) as water quality monitoring points, and enumerates the "target level" for this discharge at 50 ppb. TP concentrations and loads are summarized and reported at the end of the water year. Appendix 3-2f of this volume includes a summary of TP concentrations and loads for the McDaniel Ranch structures from WY1999–WY2005. The summary also combines flows and loads for both outfall structures (PC-17A and G-108). The combined FWM TP concentrations from WY1999–WY2004 have decreased from about 500 ppb to about 120 ppb. However, in WY2005, the combined FWM TP concentration increased to 204 ppb. There is no apparent relationship between the increase in concentration and the very active hurricane season, as total flow during WY2005 was less than the flow in WY2004.

The landowner's agreement between the District and the Seminole Indian Tribe of Florida stipulates water quality monitoring within the Big Cypress Seminole Indian Reservation. Under this agreement, water quality for discharges into the Seminole reservation land from the West Feeder sub-basin is monitored at the WWEIR. Water quality at the WWEIR monitoring location is representative of the entire West Feeder sub-basin. The L28IN station is located downstream of S-190 and is representative of water quality leaving the Seminole Reservation by way of the L-28 Interceptor Canal. Water quality monitoring data within the Big Cypress Seminole Indian Reservation are summarized by the District in progress reports entitled Total Phosphorus Load Calculations for Sites Stipulated in the SFWMD/Seminole Tribe Agreement. These reports can be found online at www.sfwmd.gov/org/reg/esp/pdfs/seminole/index.htm. Appendix 3-2f of this volume includes a summary of TP concentrations and loads for the WWEIR station from WY1998–WY2005 and the L28IN station from WY2002-WY2004.

Upstream water quality monitoring within the West Feeder sub-basin has been less intense. However, information from a past water quality sampling survey conducted by the District did not demonstrate high TP levels (generally below 32 ppb). This grab sampling was considered a synoptic survey because it was conducted for only a brief period of time (from June 26, 1996 through October 31, 1997), and it did not attempt to quantify any other inputs, such as flow, rainfall, or land use. A summary of the grab sampling survey and a map of the Feeder Canal basin showing these data are included in Appendix 3-2f of this volume. In 2005, the District will start a new water quality monitoring program in the West Feeder sub-basin. This water quality monitoring program will include samples from six sites along three canals, the Lard Can, Tony Strand, and Wingate Mill canals. The sampling will be conducted once a week during the months of April through October for three years (2005–2007). The objective of this program is to confirm the level of success from existing BMPs or highlight the need for additional BMPs.

A major component of the source control strategies in this basin includes the District's C-139 and Western Basins BMP Grant Program (Feeder Canal, L-28, and C-139 basins). Within these basins, the Everglades Program has contributed 1.3 million dollars since FY2002 in support of projects that would implement water quality improvement BMPs. Approximately $470,000 has been awarded to projects within the Feeder Canal basin. The Natural Resources Conservation Service (NRCS) and the Florida Department of Agriculture and Consumer Services (FDACS) have partnered with the District to increase the funding provided to landowners and stakeholders with the funds being administered by the Hendry Soil and Water Conservation District. A detailed description of the grant program and projects funded since 2002 can be found in the

C-139 and Western Basins Best Management Practices Grant Program Report dated April 2005. The report can be found online at www.sfwmd.gov/org/reg/esp/pdfs/c139_bmp_annrpt_2005.pdf.

For the Feeder Canal basin, the Long-Term Plan recommended the implementation of source controls. The Long-Term Plan allocated funds to continue implementation of voluntary source controls or BMPs in the West Feeder sub-basin (Project Bc74; FY2004–FY2006) as part of the C-139 and Western Basins BMPs Grant Program. To identity additional BMPs that could be implemented by West Feeder sub-basin's landowners on a voluntary basis and aided by the BMP grant program, the District has planned several activities. They include conducting a BMP and land use survey, sponsoring a workshop, reviewing existing Environmental Resources Permits, and conducting field visits. The District sponsored a workshop for overall strategy to achieve water quality goals in the West Feeder sub-basin on June 9, 2005, in Hendry County. The District is coordinating these activities with NRCS, the Hendry Soil and Water Conservation District, and FDACS.

The Long-Term Plan also recommended the accelerated completion (by 2009) of the Big Cypress/L-28 Interceptor Modifications CERP Project as the primary means of reducing TP discharges to WCA-3A from the Feeder Canal basin. The Big Cypress/L-28 Interceptor Modifications CERP Project, scheduled for completion in June 2015, will degrade the west berm along the L-28 interceptor canal to allow for sheet flow of storm waters into the Big Cypress National Preserve, and then into WCA-3A. The project also includes the conversion of the S-190 structure from a gated spillway to a pump station, and the construction of two STAs within the Feeder Canal basin, to meet applicable water quality standards in downstream receiving waters. The District has determined that the Big Cypress/L-28 Interceptor Modification CERP Project cannot be accelerated and completed by 2009. This CERP project is currently planned to be completed after 2015. The District also met with stakeholders in early 2004 to discuss the benefits of an interim pump at S-190, with an associated downstream plug to encourage sheetflow into Big Cypress National Preserve. However, after further investigation, it was determined the interim project was not feasible, primarily because of the Preserve's concerns with the level of phosphorus concentrations.

For this area, the Long-Term Plan relies on the implementation of the Seminole Tribe Big Cypress Reservation Water Conservation Plan, a Federal Critical Restoration Project being funded by the USACE under Section 528 of the 1996 Water Resources Development Act. The project, scheduled to be completed by December 2006, involves improvements designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the reservation.

The Long-Term Plan also relies on the completion of the surface water management system for the McDaniel Ranch (located within the North Feeder sub-basin). The McDaniel Ranch surface water management system was permitted under ERP No. 26-00623-P in January 1999, to serve 21,596.8 acres of the property. The system is being built pursuant to the landowner's agreement between the McDaniel Ranch and the Seminole Indian Tribe of Florida, which also requires BMP implementation within the McDaniel Ranch. The entire system is divided into three sub-drainage systems: A/B, C, and D. This system, originally scheduled to be completed by December 2006, would provide stormwater detention and pre-treatment of agricultural runoff prior to discharge. However, per recent communications with the landowner, some changes to the planned system may occur. The sub-drainage system D is still scheduled to be constructed by December 2006. The sub-drainage systems A/B and C may not be constructed because of potential land development in these areas that would change the land use from agricultural to low density residential. It is expected McDaniel Ranch will apply for a permit modification to reflect these changes. The ERP modification for the areas planned to be developed will require a surface water management system that would address any water quality concerns from the proposed land

use. Completion of the drainage systems for these areas (A/B and C) is expected to be after December 2006.

As part of the refurbishing of the PC-17A gated structure in 2004, the District incorporated various BMP improvements (e.g., adding non-removable sediment boards, replacing wood boards with metal material, digging a sediment sump upstream of the structure, and improving vegetation barriers) to improve water quality at the structure. When possible at the time of scheduled maintenance for other structures, the District will optimize their design and operation to reduce nutrient loading.

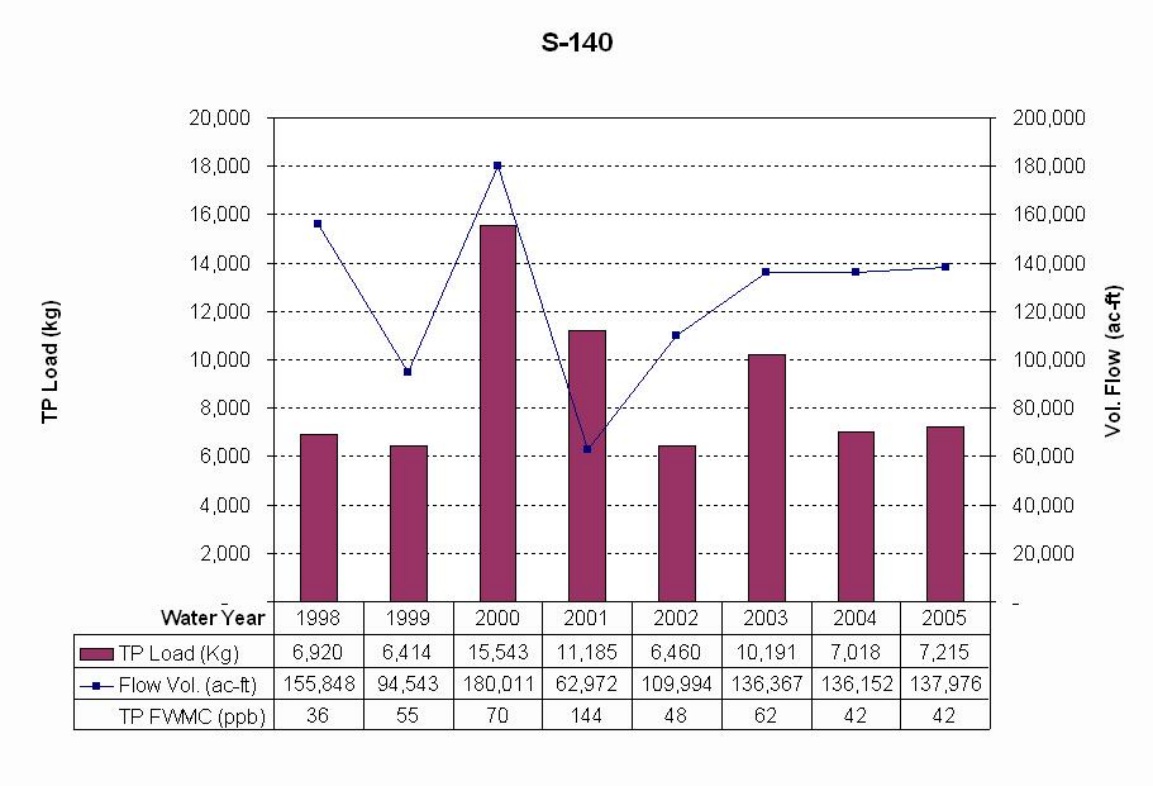
L-28 Basin

The L-28 basin has an area of approximately 113 square miles and is located within portions of Broward, Hendry, and Collier counties. The L-28 basin is entirely occupied by four landowners. The C-139 Annex (approximately 25 percent of the basin) is comprised of the U.S. Sugar Corporation's Southern Division Ranch, Unit 1. The Big Cypress Seminole Indian Reservation occupies approximately 34 percent of the basin. Approximately 28 percent of the basin is situated in the Miccosukee Indian Reservation. The remaining 13 percent of the basin is within the Big Cypress National Preserve. Wetland and agricultural land uses account for approximately 96 percent of the basin area. Land uses with the Big Cypress Seminole Indian Reservation include cattle on unimproved and improved pastures, citrus, sugar cane, and large tracts of undeveloped natural area. The Miccosukee Indian Reservation includes largely native areas with only a single cattle operation and a commercial fuel facility. There are also additional lands that have been converted to citrus or sugar cane and crops.

The surface water management system in the L-28 basin provides drainage and flood protection in addition to providing water to WCA-3A when necessary for water supply purposes. The L-28 borrow canal is the primary drainage canal, running north and south for a distance of approximately 10 miles along the eastern border of the basin. The L-28 borrow canal conveys stormwater runoff to the S-140 pump station, which discharges it directly into WCA-3A. The L-28 interceptor canal, which borders the basin on the southwest, conveys discharges from the S-190 structure (Feeder Canal basin) to WCA-3A, and is separated from the L-28 basin by a levee.

The C-139 Annex presently drains to the L-28 borrow canal at the north line of the Big Cypress Seminole Indian Reservation. Runoff from the C-139 Annex will be diverted to STA-6 in concert with the presently planned construction of STA-6, Section 2 (scheduled for completion by December 31, 2006). Upon completion of the diversion, the total area of the L-28 basin will be effectively reduced to approximately 85 square miles.

The District has been collecting grab samples for water quality data at the S-140 structure since 1987, and a composite auto-sampler began collecting samples in August 2000. **Figure 3-21** summarizes the annual TP load, flow volume, and FWM TP concentration for S-140 from WY1998–WY2005.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	6,920	6,414	15,543	11,185	6,460	10,191	7,018	7,215
Flow Vol. (ac-ft)	155,848	94,543	180,011	62,972	109,994	136,367	136,152	137,976
TP FWMC (ppb)	36	55	70	144	48	62	42	42

Figure 3-21. Structure S-140 TP and flow data from WY1998 through WY2005.

The landowner's agreement between the District and the Seminole Indian Tribe of Florida stipulates water quality monitoring within the Big Cypress Seminole Indian Reservation. Under this agreement, water quality for discharges into and from the Seminole reservation land within the L-28 basin is monitored at USSO, G-409 and L28U. Water quality monitoring data within the Big Cypress Seminole Indian Reservation are summarized by the District in progress reports entitled Total Phosphorus Load Calculations for Sites Stipulated in the SFWMD/Seminole Tribe Agreement. These reports can be found online at www.sfwmd.gov/org/reg/esp/pdfs/seminole/index.htm. Appendix 3-2f of this volume includes a summary of TP concentrations and loads for the USSO station from WY1998–WY2005, and for the L28U station from WY2002–WY2004.

The NRCS has several programs that provide assistance to landowners in the L-28 basin. These programs support implementation water quality improvement projects. NRCS has provided cost share dollars through their EQIP, Wetland Restoration Program, and their Resource Conservation Plans. Workshops that provide education about BMPs, landowner assistance programs, and developing on-farm conservation plans are ongoing.

The work necessary to re-route C-139 Annex flows to STA-6 by December 2006 will be done as part of the STA-6, Section 2 Project. This project is now part of the Acceler8 program. The District has completed 30 percent of design for this project. It is anticipated that a TP load limit will be developed for the C-139 Annex to assure that discharges do not exceed historical levels.

For the L-28 basin, the Long-Term Plan relies on the implementation of the Miccosukee Water Management Plan, which is a critical project to construct a managed wetland on the Miccosukee Indian Reservation. The project will convert approximately 900 acres of tribally owned cattle pastures into wetland retention/detention to provide water storage capacity, as well as water quality enhancement for discharges to WCA-3A through the S-140 pump station. This project is being designed to accommodate flows and loads from Miccosukee Indian Reservation lands only. The Long-Term Plan recommended the accelerated completion (by 2010) of the Miccosukee Water Management Plan project. However, funding for this project has not been authorized and the project is currently scheduled to be completed after 2015.

The Long-Term Plan also relies on the Seminole Tribe Big Cypress Reservation Water Conservation Plan to be implemented under the NRCS PL-83-566 Small Watershed Project Program. This project proposes construction of 3,835 acres of retention areas designed to improve water quality for flows from the Seminole Reservation lands only. The entire system will be divided into three sub-systems, WRA5, WRA6, and WRA7. WRA5 discharges to the south native land. WRA6 discharges to the south native land. WRA7 discharges to the L-28 Canal. The feasibility study for the overall watershed project is ongoing. The detailed engineering design of the project will be completed in 2006, with construction completion projected for 2010.

Another project affecting the L-28 basin is the CERP Project Component RR4. This CERP Project, expected to be completed after 2015, includes the relocation and enlargement of the S-140 pump structure to improve hydro-period restoration to the northwest corner of WCA-3A and increase flows to the region. It is assumed that the water quality of discharges from the relocated pump structure will be sufficient to meet applicable water quality standards in downstream receiving waters (WCA-3A).

As recommended by the Long-Term Plan, the completion of the above projects requires close cooperation between tribal, state, and federal agencies and stakeholders.

Boynton Farms Basin

The Boynton Farms Basin is the smallest non-ECP basin at approximately 341 acres, or slightly over 0.53 square miles. It is located in southern Palm Beach County, along the eastern border of the Arthur R. Marshall Loxahatchee National Wildlife Refuge (Refuge) Headquarters property, which is on the eastern side of WCA-1A. Land use in this basin is agricultural, and structures and drainage canals in this area are associated with agricultural water usage and drainage needs. Currently, there are two farms within this basin, and both fall between the west boundary of State Road 7 and the east boundary of the Refuge. The northern farm is owned by Palm Beach County, which purchased this 216 acre property in August 2004. The property was farmed under a lease that ended in May 2005. The property is on the market for lease again. There are five structures on this property that discharge toward the Refuge. The southern property of the basin is privately owned and includes four pump structures that discharge to the west. One of the pumps discharge directly to the Refuge, and the other three pumps discharge into on-site natural areas with possible sheet-flow onto the Refuge. A significant easement for overhead electrical transmission lines is located on both the Refuge and farm properties; therefore, Florida Power and Light may be involved in upcoming activities for this basin. Other stakeholders in this basin include governmental entities such as the Refuge, the Lake Worth Drainage District (LWDD), and the Florida Department of Transportation.

An 80-acre farm located north of the property owned by Palm Beach County had two discharge structures that used to discharge toward the Refuge. These structures were voluntarily relocated in September 2005, and the farm now drains to the Lake Worth Drainage District's E-1 canal east of State Road 7. The Boynton Farms Basin boundaries have been revised to exclude the property as it no longer discharges to the EPA.

No cooperative agreements are in place with these landowners. The Refuge headquarters property, which is considered part of the EPA although outside the boundaries of WCA-1, receives discharges from this basin but no discharges from this basin reach WCA-1.

Although overall basin boundaries have been finalized, there are still issues of dispute. It is unclear whether some of the discharge structures are actually pumping onto Refuge property or are discharging onto the farmers' property bordering the Refuge, then sheet-flowing onto the Refuge. Refuge water quality data have established that elevated nutrient levels on the Refuge property are linked to these discharges.

Currently, the District has limited access to sampling sites. Water quality sampling for the discharges from this basin has been conducted by the District from April 2000 to the present on a limited number of flow events. A summary of the water quality data and a map of the Boynton Farms Basin showing these data are included in Appendix 3-2f of this volume. Monitoring results show the basin's farm discharges have similar levels of TP concentrations. The average TP concentration for all monitoring sites in this basin is slightly below 1,000 ppb. Information regarding flow data from these properties is not available to the District at this time.

The District continues to offer technical support to help landowners comply with water quality criteria through contact with landowners, Refuge staff, and the LWDD personnel. The Williams Nursery pump on the north side of the Refuge headquarters property was voluntarily removed in 2002. As a result, discharges from this nursery into the Refuge property no longer occur, and the property was removed from the Boynton Farms Basin boundaries.

The entire Boynton Farms Basin is currently within the footprint of the Palm Beach County Agriculture Reserve Water Reservoir CERP Project (which is also part of the East Coast Buffer Project). Currently, the CERP project is scheduled to be completed after 2015.

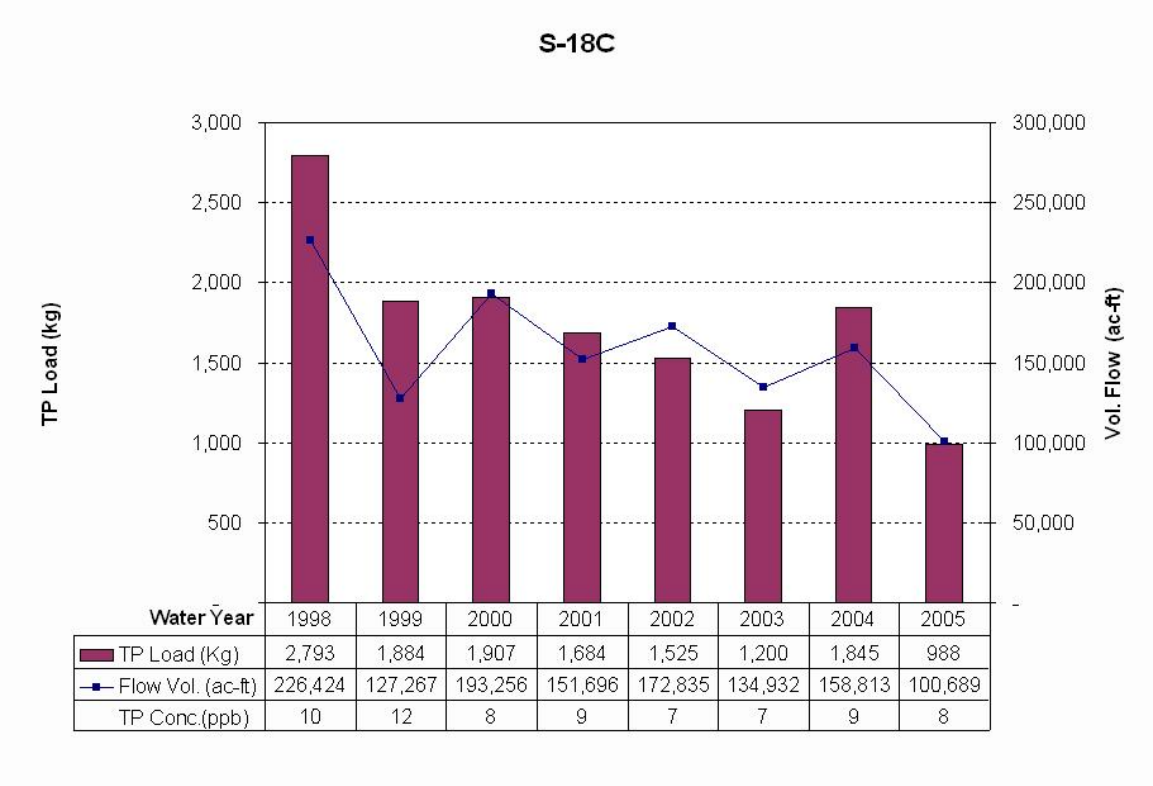
Landowners within the basin whose properties are not purchased as part of the CERP project and continue discharging onto the Refuge property, may need to implement capital improvement projects or other remedies to redirect all discharges away from the Refuge property. The District has initiated an alternative study for discharges to the west from the two referenced properties. The objective of this study is to compile existing basin characteristics and provide landowners and stakeholders with schematic design and cost alternative options for eliminating high nutrient discharges to the EPA. The kick-off meeting for this project was held on July 15, 2005, at the Refuge Headquarters and was attended by most of the stakeholders involved and several farmers interested in leasing the Palm Beach County Property. Completion of the alternatives study is anticipated in January 2006. The LWDD has been apprised of the issues and is working on expanding the stormwater system capacity to the east to accept additional flows.

C-111 Basin

The C-111 basin is located in the southernmost portion of Miami-Dade County adjacent to the Everglades National Park. The predominant land use in this basin is agricultural, although portions of Florida City and Homestead lie within the basin. The C-111 basin is under the jurisdiction of Miami-Dade County - Department of Environmental Resources Management.

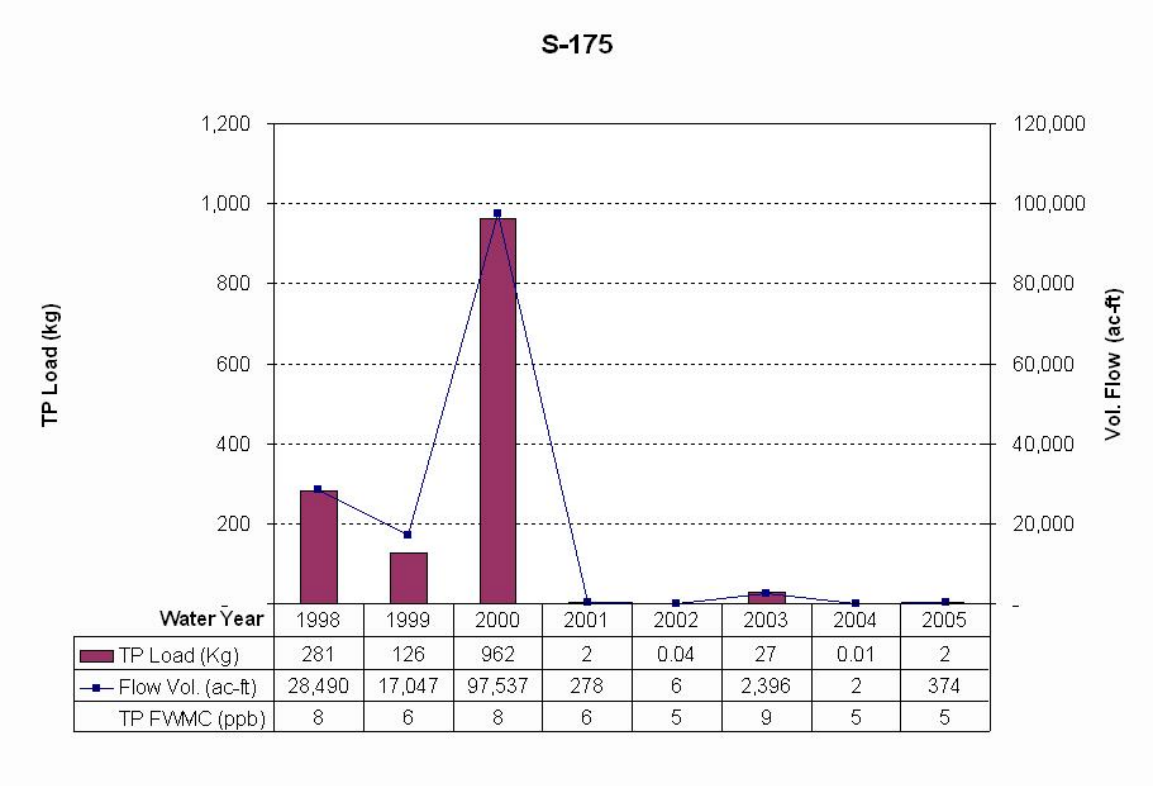
The C-111 basin covers an area of approximately 100 square miles. There are five main operational canals in this basin: C-111, C-111E, C-113, L-31N borrow, and L-31W borrow canals. These canals have three functions: (1) provide drainage and flood protection for the C-111 basin; (2) supply water to the C-111, C-102, and C-103 basins and to the Everglades National Park (ENP or Park), specifically to Taylor Slough and the park's panhandle; and (3) maintain a groundwater table elevation near the lower reach of C-111 adequate to prevent saltwater intrusion into local groundwater. Water is supplied to the C-111 basin by the South Dade conveyance system via the L-31N borrow canal.

There are three structures, S-18C, S-175 and S-332, within the C-111 basin discharging into the ENP that are included in the non-ECP permit. The S-332 and S-175 structures were used until WY2001 to make water deliveries to Taylor Slough in the ENP. However, after completion of some components of the C-111 project (described below), these two structures are only used to provide flood relief during emergency conditions. Furthermore, these structures need to be maintained regularly, and therefore are operated for short time periods during maintenance. Water is discharged to the park's panhandle through over-bank flow along the south side of the C-111 canal between S-18C and S-197. The S-18C structure is located on the C-111 canal approximately 2 miles south of the confluence of the C-111 and C-111E canals in the Southern Glades region. The S-175 and S-332 structures are in close proximity along the L-31W borrow canal along the south side of the Frog Pond, approximately 1.5 miles north of the entrance to the ENP. Water quality data has been collected at these structures since 1978 by the District and the USACE. Currently, TP concentrations in the C-111 basin are below the 10-ppb level of concern. However, monitoring at the "into" structures will continue because these concentrations may change as future projects are constructed and seepage water entering the basin from the ENP is reduced. The annual TP load, flow volume, and FWM TP concentration for S-18C, S-175, and S-332 from WY1998–WY2005 are summarized in **Figures 3-22** through **3-24**, respectively. Upstream monitoring is performed by the District at the S-174, S-176, S-178, S-332B, and S-332D structures. Results of the monitoring at the upstream structures are summarized in Appendix 3-2f of this volume.



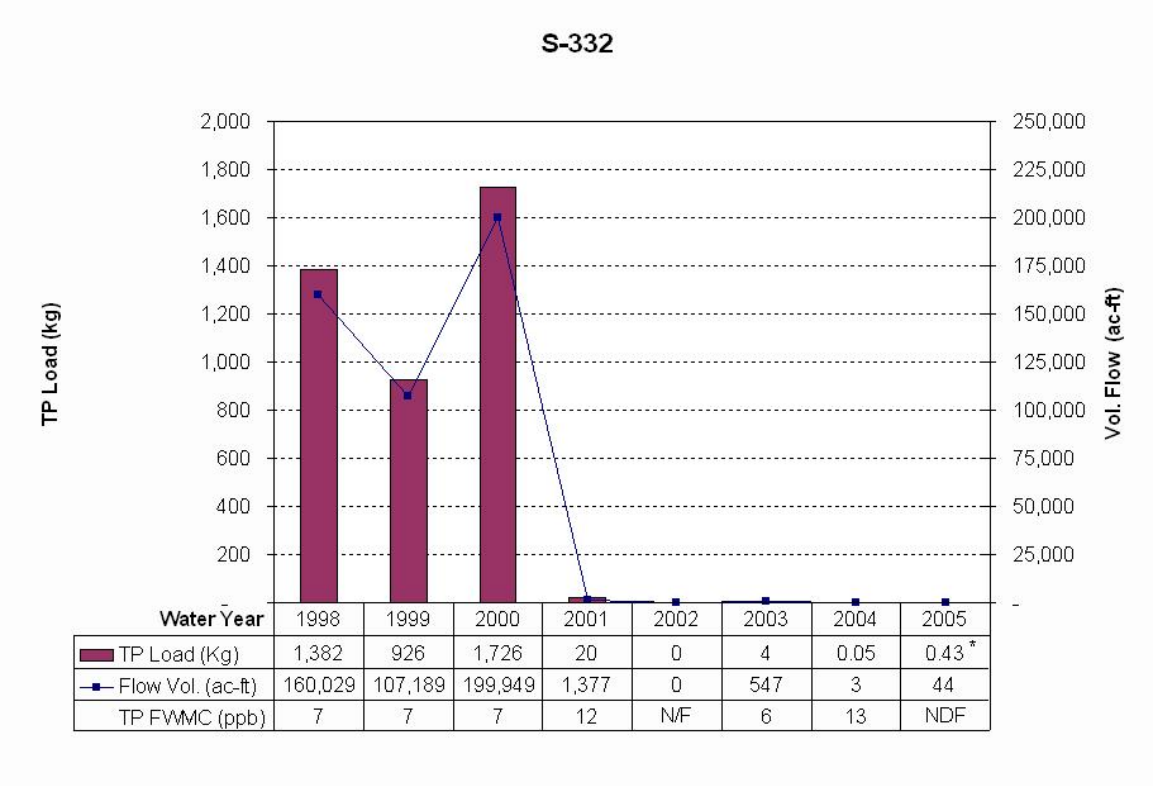
Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	2,793	1,884	1,907	1,684	1,525	1,200	1,845	988
Flow Vol. (ac-ft)	226,424	127,267	193,256	151,696	172,835	134,932	158,813	100,689
TP Conc.(ppb)	10	12	8	9	7	7	9	8

Figure 3-22. Structure S-18C TP and flow data from WY1998 through WY2005.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	281	126	962	2	0.04	27	0.01	2
Flow Vol. (ac-ft)	28,490	17,047	97,537	278	6	2,396	2	374
TP FWMC (ppb)	8	6	8	6	5	9	5	5

Figure 3-23. Structure S-175 TP and flow data from WY1998 through WY2005.



Water Year	1998	1999	2000	2001	2002	2003	2004	2005
TP Load (Kg)	1,382	926	1,726	20	0	4	0.05	0.43 *
Flow Vol. (ac-ft)	160,029	107,189	199,949	1,377	0	547	3	44
TP FWMC (ppb)	7	7	7	12	N/F	6	13	NDF

Figure 3-24. Structure S-332 TP and flow data from WY1998 through WY2005. (Note: N/F represents “no flow”; NDF represents “no data with flow available”; and * represents “calculated with annual flow and arithmetic mean concentration”).

In 2003, the U.S. Department of Agriculture (USDA), in cooperation with the University of Florida Tropical Research and Education Center (UF-TREC), completed a final report on the fate and transport of indicator pesticides, the efficacy of summer cover crops in controlling pesticide contamination of surface and ground water, and attenuation of pesticides during their transport in the upper Biscayne aquifer. This research was done under a $200,000 cooperative agreement with the District. Results from this study will contribute to the establishment of risk reduction strategies for pesticide use, enhance water quality and promote agricultural sustainability.

In 2003, the District also entered into a $73,737 cooperative agreement with the UF-TREC to perform a BMP research, using Zeolite as a soil amendment to improve water quality in C-111 basin. This research was completed in 2005. Results from this research will contribute to improve crop production, reduce nutrient leaching, and improve water quality in a sensitive ecosystem area. In addition, the District, in partnership with NRCS, has sponsored a Mobile Irrigation Lab in this area to help local growers improve their irrigation practices. The main sources of public education in this basin are the UF-TREC and UF-IFAS. The results of the studies described above will be disseminated to the southern Miami-Dade County farm community through these institutions.

In the 1960's, the C-111 basin was channelized as part of the Central & Southern Florida Project (C&SF) for flood control and other purposes. In 1994, Congress authorized modifications to the C&SF project features within the C-111 basin (C-111 project) to address problems associated with water deliveries on the east side of ENP. According to the C-111 General Re-evaluation Report, the primary purpose of the C-111 project is the restoration of the ecosystem in Taylor Slough and the Eastern Panhandle of the ENP while maintaining the existing level of flood protection prior to construction of the features associated with the C-111 Project recommended plan. The developed strategy is to provide seepage control for the ENP while maintaining flood control benefits by providing a hydraulic barrier to groundwater seepage from the ENP and rerouting seepage combined with flood flow, previously sent south to Biscayne and Florida bays, back into the ENP. The authorized C-111 project consists of the following features:

- New Taylor Slough bridge
- Five new pump stations: 332A–E
- Levee 31W tieback
- S-332D tieback levee
- Fill in L-31W borrow canal
- Concrete-lined getaway canals at S-332A–D
- S-332 connector canal
- C-111N spreader canal
- Canals 109 and 110 plugs

The majority of features, Taylor Slough Bridge, three pump stations (S-332B, S-332C, and S-332D), S-332D tieback levee, and canal C-109 plug have been constructed. A portion of detention areas and flow ways have been constructed. Canal 110 plugging is still under evaluation. Levee 31W tieback and pump station S-332A will not be constructed. The C-111N spreader canal is now a CERP component, C-111 Spreader Canal CERP project. The pump station S-332E and S-332 connector canal will also be evaluated under C-111 Spreader Canal CERP project. The remaining features are scheduled to be constructed by the end of 2006. Pump stations S-332B and S-332C pump water from L-31N and pump station S-332D pumps water from L-31W westward to detention areas then discharge to the ENP through degraded levees.

The Modified Water Deliveries (MWD) project was authorized by the Everglades National Park Expansion and Protection Act of 1989. The MWD Project is designed to restore the Shark Slough basin. A major objective of this project is to improve water deliveries to ENP by restoring

WCA-3B and Northeast Shark Slough (NESS) as a functioning component of the historical Shark Slough hydrologic system. None of features authorized under the MWD Project is located within the C-111 basin.

Because many of the problems associated with the management of water deliveries to the ENP reflect the fact that the jurisdictional ENP boundaries were not coincident with the historical drainage patterns in South Florida, the U.S. Congress authorized the establishment of "The Experimental Program of Water Deliveries to Everglades National Park," which lasted from 1984 to 1999. The goal of this experimental program was to modify the schedule of delivery of water to ENP and conduct experimental deliveries for the purpose of determining an improved schedule of water deliveries.

In February 1999, the U.S. Fish and Wildlife Service (USFWS) issued the final Biological Opinion for the MWD Project, the C-111 Project, and the Experimental Program of Water Deliveries to the ENP. The USFWS found that the hydrological impacts associated with the Experimental Program, if continued, would likely jeopardize the continued existence of the Cape Sable Seaside Sparrow (CSSS) and adversely modify its critical habitat. In response, the USACE initiated two plans designated as the Interim Structural and Operational Plan (ISOP) 2000 and 2001, followed by the Interim Operational Plan (IOP), designed to protect the endangered CSSS until completion of the MWD and C-111 projects. The IOP would allow the USACE to meet or provide the hydrologic equivalent of the USFWS Reasonable and Prudent Alternative conditions, while managing the system for purposes authorized under the C&SF project. Emergency Order No. 9, issued by the FDEP, authorized operation and monitoring of the S-332B, S-332C, and S-332D pump stations and associated detention areas.

At present, the District, USFWS, USACE, and ENP are developing the Combined Structural and Operational Plan (CSOP). The CSOP is needed to define an integrated operational plan for the MWD and C-111 projects. This plan will integrate and possibly modify the structural components of the MWD and C-111 projects into an operational plan that will maximize restoration while preserving other project purposes and explore opportunities for enhanced performance. The CSOP is scheduled to be completed by the end of December 2006 and will replace the IOP. It is expected that Emergency Order No. 9 will remain effective until CSOP is finalized.

The C-111 Spreader Canal CERP project is now part of the Acceler8 program. The goal of this project is to restore the ecological system of the Southern Glades and Model Lands including downstream estuaries by improving timing, distribution, quantity and quality of water deliveries. The C-111 Spreader Canal CERP project alters the 1994 design for the lower C-111 basin by adding the following enhancements: a conceptual footprint for a 3,200-acre STA, enlargement of Pump Station S-332E from 50 to 500 cfs, extension of the spreader canal approximately two miles to the east and under U.S. Highway 1 and Card Sound Road; and placement of culverts under the roadways to rehydrate the Model Lands Area. The C-111 Spreader Canal CERP project also proposes to fill in the southern reach of the C-111 canal below C-111 to S-197, and suggests removal of S-18C and S-197. The completion of the C-111 Spreader Canal CERP project is currently scheduled by 2008.

WATER QUALITY MONITORING AND ANALYSIS FOR WY2005

Water quality monitoring and analysis is one of the main components of the Everglades Stormwater Program. Non-ECP permit conditions require the District to document the accuracy of collected data, and to measure progress toward achieving and maintaining compliance with state water quality standards by December 31, 2006. Although phosphorus is of primary concern, the permit has specified that all state water quality standards should be met. To fulfill the requirements of the permit conditions, the District has completed an annual analysis of water quality data at non-ECP structures by comparing the data with state water quality standards. Unlike the ECP basins that are required to decrease TP levels in discharges based on historical loads, there is no phosphorus-specific requirement established at the point of discharge for the non-ECP basins.

To continue to document the accuracy of the collected data and measure progress toward achieving and maintaining compliance with state water quality standards, the District has compared WY2005 water quality data from non-ECP structures to state water quality standards. **Table 3-17** provides a summary of flow-weighted mean TP concentrations at non-ECP "into" structures for the period of record. Results of all water quality analyses are included in Appendix 3-2 of this volume.

In compliance with Specific Condition No. 12, appendices to this chapter include an annual update of the non-ECP permit monitoring program, report non-ECP program monitoring results, and provide a comparison of WY2005 water quality data from samples collected at non-ECP structures to state water quality standards. These comparisons fulfill non-ECP permit requirements to document the accuracy of the collected data and measure progress toward achieving and maintaining compliance with state water quality standards. The data for the groups of water quality parameters, including physical parameters, nutrients, major ions, and trace metals, were evaluated for WY2005. The evaluation indicated that there were very few excursions from Class III water quality standards found in samples collected at non-ECP structures, except for incidences of variations for dissolved oxygen (DO). The excursions include results for un-ionized ammonia at G-123, pH at S-178, and turbidity at S-10E and S-178. The non-ECP permit was amended on January 21, 2005, to remove the S-10E structure because it is no longer needed and has been plugged. The non-ECP permit was again amended on May 18, 2005, to remove monitoring of all trace metals and all major ions (except sulfate) and some nutrient and physical parameters. Monitoring reporting for these parameters will be discontinued in WY2006.

Previous reports, specifically Chapter 11 of the 2001 ECR, and Chapter 8B of the 2002–2004 ECRs, and Chapter 3 of the 2005 SFER – Volume I, included comparisons of state water quality standards to water quality data obtained from non-ECP structures. These historical analyses found that there were very few excursions from Class III numeric water quality criteria for any parameter in the eight non-ECP contributing basins except for DO. There were excursions from the existing standard for DO, but it should be noted that the FDEP has completed an evaluation of DO levels in the EPA. Based on this evaluation, the FDEP has developed a site-specific alternative criterion (SSAC) to formally recognize the natural background conditions in the EPA marshes. Additional information on the DO SSAC can be found in Chapter 2A of this volume.

As phosphorus is the primary parameter of concern for Everglades restoration, it is the focus of water quality considerations for the non-ECP basins. Although no load limitations have been established for the basins, TP concentrations are monitored to determine progress toward the goals established in the non-ECP permit. **Table 3-17** summarizes the FWM TP concentrations, total flow volumes, and TP loads at non-ECP "into" structures, the exit points from the basins for flow entering the EPA, during WY2005.

Table 3-17. Non-ECP basins annual flow-weighted mean TP concentrations for WY2005.

Hydrologic Basin	Structure	Water Quality Station ID	Total Flow Volume (acre-feet)	Number of Days with Positive Flow	Sample Type	Sample Size (Grab)	Arithmetic Average (Grab)(ppb)	Sample Size (Comp)	Flow-Weighted [1] Mean Concentration (ppb)	Flow-Weighted [2] Mean Concentration (ppb)	TP Load (kg)
ACME Improvement District	ACME1DS	ACME1DS	12,317 [3]	63 [3]	Grab [4]	11	64	0	119 [5]	126 [5]	1,919
	ACME1	VOW1	12,317	63	Auto [6] & Grab [4]	14	96	21	126	133	2,021
	G94D	G94D	11,246 [3]	79 [3]	Grab [4]	12	95	0	207 [5]	213 [5]	2,950
	ACME2	VOW2	11,246	79	Auto [6] & Grab [4]	16	127	16	138	212	2,948
North Springs Improvement District	NSID1	NSIDSP01	354	1	Auto [6] & Grab [4]	16	19	5	20	20	9
		S-38B (WCA-2A near NSID1)	354 [8]	1 [8]	Grab [4]	2	40	0	NDF[7]	NDF[7]	17 [9]
North New River	G-123	G123	0	0	Auto [6] & Grab [4]	51	25	3	N/F[10]	N/F[10]	0
C-11 West	S-9	S9	93,403	86	Auto [6] & Grab [4]	50	16	19	18	19	2,140
	S-9A	S9A	56,584	205	Auto [6] & Grab [4]	51	16	26	10	12	832
C-111	S-175	S175	374	24	Grab [4]	26	9	0	5	5	2
	S-332	S332	44	8	Grab [4]	26	8	0	NDF[7]	NDF[7]	0.4 [9]
	S-18C	S18C	100,689	211	Auto [6] & Grab [4]	47	5	22	8	8	988
L-28	S-140	S140	137,976	203	Auto [6] & Grab [4]	51	38	31	42	42	7,215
Feeder Canal	S-190	S190	94,581	168	Auto [6] & Grab [4]	20	51	15	101	97	11,288
Boynton Farms	Various[11]	Various[11]	N/D[12]	N/D[12]	Grab [4]	0	N/D[12]	N/D[12]	N/D[12]	N/D[12]	N/D[12]

Notes:

1) Flow-weighted mean concentration based on days of flow and monitored TP data only.

2) Flow-weighted mean concentration based on estimation algorithm to determine TP concentration on non monitored days combined with monitored days.

3) Flow data from upstream pump structures, ACME1 and ACME2, is representative of the flow through the ACME1DS and G94D culverts, respectively.

4) Grab indicates samples collected by grab sampling methodology.

5) Flow-weighted mean concentrations were calculated using the flow data at upstream structures.

6) Auto indicates that samples were collected by automatic composite samples.

7) NDF no data with flow available.

8) Flow data from upstream structure NSIDSP01 is representative of flow into the EPA at S-38B.

9) Calculated with annual flow and Arithmetic Average Concentration

10) N/F no flow.

11) Sites include BFBAFCP, BFBAFNP, BFBAFSP, BFBDFCP, BFBDFNP, BFBDFSP, BFBDFWP, BFBMFCP, BFBMFSP, BFBMFNP. These sites are pumps that have no flow recording devices attributed to them.

12) N/D no data available

Yearly TP load data are presented in **Figures 3-14** through **3-24.** Trends are difficult to assess, however, because of the limited quantity of data and the effects of non-recurring events and operational and structural changes within the basins. Trends have been particularly difficult to evaluate over the last five years as the drought period that occurred during 2000–2001 had significant effects in these basins. Rainfall was substantially reduced in some locations with associated reduction of flow. Reduced rainfall also had the effect in some areas of increasing apparent TP concentrations due to lack of rainfall dilution. In addition, the drought period also caused the increase in flows through a number of "into" structures as District operation priorities routed flows to water starved areas of the EPA.

The flows reported in **Table 3-17** from ACME Improvement District were higher in WY2005 than in WY2004, and as a result, there was an increase of the load from ACME Improvement District. Some of the highest TP concentrations for non-ECP structures discharging directly to the EPA during WY2005 were observed for the ACME Improvement District basin through monitoring locations at the ACME1DS and G-94D culverts and at the upstream pump stations: (1) ACME1 (auto-sampler VOW1), and (2) ACME2 (auto-sampler VOW2). The ACME1DS and G-94D culverts, operated by the Village of Wellington (VOW), remain open at all times and discharge to the Refuge when upstream pump stations ACME1 or ACME2 are operating. Eleven District data collection trips to the ACME1DS culvert monitoring locations resulted in only two sampled flow events; twelve District data collection trips to the G94D culvert monitoring locations resulted in only four sampled flow events. The monitoring agreement with VOW resulted in a sufficient number of samples (35 at VOW1 and 32 at VOW2 total samples) collected by both grab and auto-sampler techniques upstream of the pump stations to cover a broad range of flows (25 samples at VOW1 and 23 samples at VOW2 collected during pumping events) and adequately characterize the TP concentrations.

As shown in Appendix 3-2, Table 3, more than 75 percent of the data collected at the upstream VOW1 monitoring sites were below 130 ppb, with median TP values ranging between 82 ppb (auto) and 85 ppb (grab). More than 75 percent of the data collected at the upstream VOW2 monitoring sites were below 155 ppb, with median TP values ranging from 77 ppb (auto) to 109 ppb (grab). Discharge data were not available for the ACEM1DS and G-94D culverts, although discharge data from the upstream pump stations during WY2005 [12,317 and 11,246 acre-feet (ac-ft) for ACME1 and ACME2, respectively] can be used as an indication of the magnitude and occurrence of flow through the downstream culverts.

It appears that the above average tropical storm activity during WY2005 may have negatively affected water quality of discharges from ACME Improvement District. The flow-weighted mean TP concentrations for the months of September and October 2004 were 153 ppb at ACME1 and 258 ppb at ACME2, while the remaining months of WY2005 were 69 ppb and 92 ppb, respectively. Furthermore, 75 percent of the total WY2005 flows for this basin occurred in these two months.

A direct comparison to last year's data indicated a reduction of TP load from C-11 West, NNRC, the Feeder Canal, and C-111 through S-18C, and a slight increase from L-28 and C-111 through S-175 and S-332. The WY2005 TP load at S-332 was calculated using the arithmetic mean concentration of 8 ppb (grab) because no samples were collected during flow at this structure. The changes in loads from these basins are predominantly associated with changes in flow volumes which were lower for C-11W through S-9 and S9A, North New River Canal (NNRC) through G-123, Feeder Canal through S-190, and C-111 through S-18C. In WY2005, the flows from the NSID and L-28 basins and the C-111 basin through S-175 and S-332 increased slightly compared with those in WY2004. For WY2005, there was no discharge to the EPA from North New River Canal basin.

The FWM TP concentrations vary greatly among different basins. In WY2005, the highest TP concentrations are identified in ACME Improvement District and the Feeder Canal basin, whereas the L-28, NSID, and C-11 West basins have TP concentrations below 50 ppb. There was no change in TP concentration for the L-28 basin (flow-weighted TP of 42 ppb in WY2005). The TP concentrations observed for the Feeder Canal basin showed median TP concentrations of 35 ppb for grab samples, and 84 ppb for auto-samplers respectively; the TP concentrations observed for the L-28 basin showed median TP concentrations of 31 ppb for grab samples, and 39 ppb for auto-samplers respectively. During WY2005, the Feeder Canal basin discharged 94,581 ac-ft, and the L-28 basin discharged 137,976 ac-ft into the western portion of WCA-3A. Though many of these concentrations are relatively low, all concentrations greater than approximately 10 ppb will have to be addressed further (as discussed in Chapter 2C of this volume).

Table 3-17 also presents information for the S-9A pump station, which was built to address a specific issue in the S-9 basin. Previously, the S-9 pump station had to be operated more frequently than was necessary to return seepage water that originated in WCA-3A and seeped through the ground to canals in the C-11 West drainage basin. Because of the large capacity of the S-9 pump station, operation of those pumps caused greater drawdown of the C-11 West canal and its tributaries than was desirable. Therefore, the S-9A pump station was constructed with a lower pump capacity, and was designed to collect water from the seepage collection canals adjacent to WCA-3A within the C-11 West basin and return it to the WCA. This alteration in the hydrology of the system has been successful in improving the quality of the water entering WCA-3A. This year, the FWM TP concentration of water discharged from the S-9A pump station was 12 ppb, compared with a FWM TP concentration of 19 ppb through the S-9 pump station. The total volume of water that has been pumped through both the S-9 and S-9A stations were reduced for WY2005 (93,403 ac-ft for S-9 and 56,584 ac-ft for S-9A) compared with WY2004 (149,708 ac-ft for S-9 and 107,609 for S-9A). Furthermore, the total flow through both structures had a FWM TP concentration of 16 ppb in WY2005, which was the same value it had in WY2004.

There was little flow into the EPA that occurred at the NSID1 structure due to the operational changes implemented by the NSID. The discharge that did occur from NSID to the WCA-2A (354 ac-ft) was related to the active hurricane season dictating that NSID quickly lower the internal surface water management system to its control elevation between storms. At that time other basins downstream along the Hillsboro Canal were doing the same, and the canal's capacity was being exceeded risking flooding of areas that had no alternate outfall. NSID was directed to pump to the EPA as necessary to alleviate flooding and discharged to the EPA for about 11 hours.

The only basin that has a TP concentration below the proposed TP standard of 10 ppb is the C-111 basin where the lowest TP concentrations were observed at S-18C, S-175, and S-332, which discharge to the southeastern portion of the Everglades National Park by way of the C-111 canal and Taylor Slough. The TP data for these monitoring locations had an observed median concentration of 5 ppb (grab) and 6 ppb (auto) for S-18C; 7 ppb (grab) for S-332; 9 ppb (grab) for S-175; 75 percent of the samples having concentrations below 6 ppb (grab); 9 ppb (auto) for S-18C; 12 ppb (grab) for S-175; and 11 ppb (grab) for S-332. During WY2005, the S-175 and S-332 structures were operated infrequently, and discharged only 374 ac-ft through S-175, and 44 ac-ft through S-332 to the Park. The S-18C structure discharged approximately 100,689 ac-ft to the lower C-111 canal.

Historically, the Boynton Farms basin exhibits the highest TP concentrations (average of 973 ppb, see Chapter 3 of the 2005 SFER – Volume I) of any basin. This average is based on a total of 63 samples at 11 locations, on 18 sampling events from April 2000 to November 2003. No flow data is available for this basin and therefore, no flow-weighted mean concentrations

could be determined. The Boynton Farms basin water quality monitoring program is still ongoing, but no TP data is available for WY2005.

The hurricanes did not appear to significantly affect discharge from non-ECP basins other than as discussed above in ACME Improvement District and NSID. There was no flow at G-123 because the District is minimizing use of this station consistent with the recommendation in the Long-Term Plan to discontinue its use after December 31, 2006, other than that which may be absolutely necessary for water supply purposes.

It is anticipated that the implementation of the water quality improvement plans as recommended in the Long-Term Plan for the non-ECP basins will significantly contribute to achieving long-term water quality standards in the EPA. Water quality data is tracked for increasing and decreasing trends so that the action plan may be modified, as necessary, through an adaptive management process to ensure optimization measures for TP reduction and for other parameters of concern.

Based on the analysis provided in Appendix 3-2 of this volume, none of the pesticides detected during the quarterly surface water sampling were found to be of concern. The biannual sediment pesticide sampling indicated that DDE, an environmental dehydrochlorination product of DDT, was detected at several locations at levels of "potential concern."

EVERGLADES STORMWATER PROGRAM FINDINGS AND FUTURE DIRECTIONS

The previous subsections provide an update on each of the non-ECP components of the Long-Term Plan. All of these projects have been initiated and are on schedule and within proposed budgets. The analysis results from projects for the NNRC and NSID basins revealed the strategies recommended by the Long-Term Plan for these two basins may have to be reconsidered. The District will develop proposed revisions to the Long-Term Plan for these basins as a result of these analyses. The revision process described in the Long-Term Plan will be followed, including the public involvement component, Governing Board approval, and subsequent submittal to the FDEP for approval.

The completion schedule of some of the CERP projects and other planned capital improvement projects the Long-Term Plan had recommended has been delayed. There is a need to amend the Long-Term Plan to reflect the new estimated completion schedule or, if necessary, to amend water quality improvement plans.

Except for phosphorus levels, the quality of water discharging into the EPA is generally acceptable. The portion of the District's water quality monitoring program that has been implemented as a result of the EFA and the non-ECP permit indicates that phosphorus concentrations are greater than 10 ppb in discharges from seven of the eight non-ECP basins. The District will continue to monitor water quality in accordance with the non-ECP permit to measure progress toward achieving compliance with state water quality standards. To better characterize the quality of water discharging into the EPA, the District has implemented a plan to install flow-proportional automated samplers at all "into" structures to monitor TP concentrations.

Extensive coordination with local governments, the 298 Districts, the Seminole Indian Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and other state and federal agencies will continue to be essential for achieving the goals and requirements of the EFA, the non-ECP permit, and the future Long-Term Compliance Permit. Consequently, the District has conducted several meetings to foster coordination within the basins. The District has also executed several cooperative/cost-share agreements with local governments to implement water quality improvement plans involving BMPs and operational modifications. The public involvement element of the ESP will provide additional avenues of participation for environmental groups,

agricultural and urban communities, locally impacted industries, and the general public. Coordination efforts with CERP, ongoing critical projects within non-ECP basins, the Long-Term Plan, and local governments are also facilitating the development of long-term solutions for achieving statewide water quality standards. These efforts have resulted in detailed action plans (water quality improvement plans) which have been or are to be implemented in each non-ECP basin. The actions plans for water quality improvements are designed to meet the TP criterion in the EPA.

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