Chapter 4: Nutrient Source Control Programs[1]

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SUMMARY

The state legislature has acknowledged that the Southern and Northern Everglades watersheds depicted in **Figure 4-1** are critical water resources, and that changes in these watersheds over time have resulted in adverse effects to the hydrology and water quality of the Greater Everglades ecosystem. Legislative directives for restoration efforts have led to regulatory and voluntary programs for controlling nutrient sources (primarily phosphorus) and their pathways to protected water bodies in the watersheds. In particular, the regulatory permitting programs of the South Florida Water Management District (District or SFWMD) have a long-standing record of success based on the nutrient reductions measured at representative monitoring locations since the programs were initiated. The permits provide reasonable assurance of adequate protection of water quality within their waterways by requiring comprehensive best management practices (BMP) and discharge monitoring plans.

The District programs strive to optimize nutrient reductions at the source to levels that are consistently achievable over the long term. However, source controls like the BMP programs have a maximum achievable water quality benefit, and therefore regional construction projects are generally needed downstream to fully meet the water quality goals for an ecosystem. BMPs are cost-effective, on-site practices that generally involve optimized water and nutrient management and soil conservation. The District has demonstrated that regulatory BMP programs can successfully reduce nutrients at the inflows to these regional projects, thereby potentially reducing the project scope and costs. Defining levels of nutrients at the source affected by BMPs is a key consideration in the design of regional construction projects. A graphic illustrating the treatment train approach to ecosystem restoration is shown in **Figure 4-2**. This chapter and related appendices (Appendices 4-1 through 4-3 of this volume) provide the update on the District regulatory source control programs for Water Year 2015 (WY2015) (May 1, 2014–April 30, 2015).

[1] Table 4-2 and Figure 4-35 were updated on March 9, 2016.

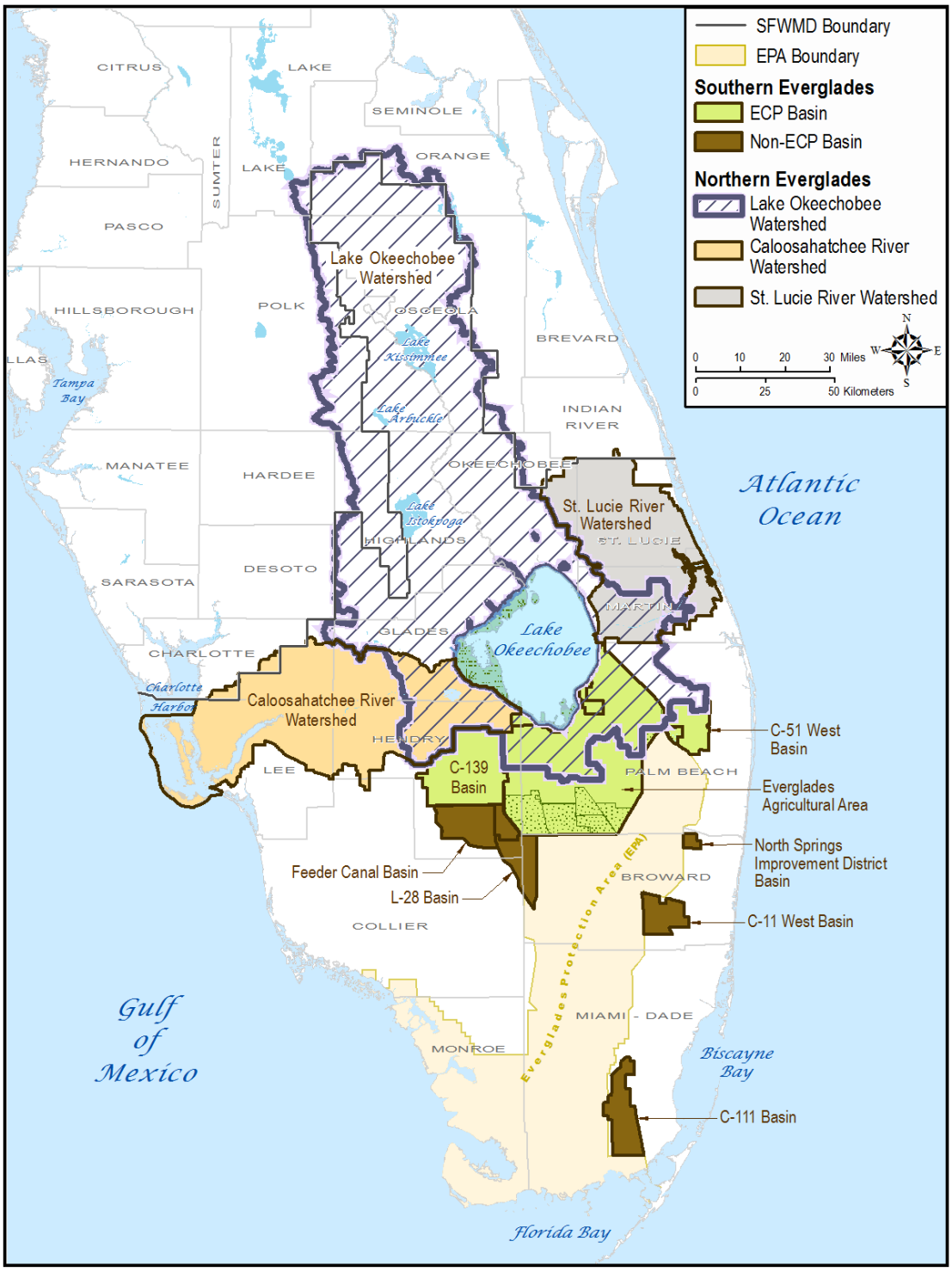

Figure 4-1. The Southern Everglades and Northern Everglades source control program implementation areas. [Notes: Watershed areas overlap and are based on most recent hydrologic boundaries and may differ from areas shown in previous reports. ECP – Everglades Construction Project; EPA – Everglades Protection Area; and Non-ECP – Non-Everglades Construction Project.]

Figure 4-2. The treatment train process from source controls to ecosystem restoration.

In the Southern Everglades, the 1994 Everglades Forever Act (EFA) [Section 373.4592, Florida Statutes (F.S.)] directs the District to implement the Works of the District (WOD) regulatory source control permitting program adopted under Chapter 40E-63, Florida Administrative Code (F.A.C.), for the Everglades Agricultural Area (EAA) and the C-139 basins. These basins discharge to regional construction projects known as the Everglades Stormwater Treatment Areas (STAs; see Chapter 5B of this volume), which are large constructed wetlands designed to reduce nutrient concentrations in stormwater runoff before flowing south to the Everglades Protection Area (EPA). The EPA is made up of three Water Conservation Areas and Everglades National Park. Source control strategies for other basins discharging into the EPA were approved by the Florida Department of Environmental Protection (FDEP) via permits issued to the District for its structures. The EAA and C-139 basins, in addition to the C-51W basin, discharge to STAs and together are generally known as Everglades Construction Project (ECP) basins. Additionally, there are five basins that discharge directly to the EPA and are referred to as the Non-Everglades Construction Project (Non-ECP) basins. In time, follow-up planning and supplemental activities have been added to the original strategies defined in the EFA such as the Long-Term Plan for Achieving Water Quality Goals in the EPA (Long-Term Plan) (Burns and McDonnell 2003) and its amendments, and the Restoration Strategies Regional Water Quality Plan (SFWMD 2012).

In the Northern Everglades, the WOD regulatory source control permitting program under Chapter 40E-61, F.A.C., was adopted in 1989, to encompass the Lake Okeechobee Watershed boundary defined at that time. Subsequently, the WOD program was incorporated into the Lake Okeechobee Pollutant Control Program as part of the Lake Okeechobee Protection Act (LOPA) as a means of reducing nutrient loads to the lake. In 2007, the LOPA was significantly revised and is now the Northern Everglades and Estuaries Protection Program (NEEPP). The NEEPP mandates the consistent implementation of nonpoint source BMPs in the Pollutant Control Programs across the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds (Subparagraphs 373.4595(3)(c), and (4)(a)2 and (4)(b)2, F.S.). The NEEPP also directed the District, the Florida Department of Agriculture and Consumer Services (FDACS), and FDEP to implement their respective programs with coordination as detailed in a memorandum of understanding among the agencies. Accordingly, the agencies' respective programs have specific rules promulgated based on statutory mandates.

The latest source control program planning is incorporated into the Lake Okeechobee Watershed Protection Plan (Bertolotti et al. 2014), and the Caloosahatchee River and St. Lucie River watershed protection plans (Buzzelli et al. 2015). As discussed in detail in Chapter 8 (page 8-12), FDEP has developed basin management action plans (BMAPs), or is developing BMAPs, for the Lake Okeechobee, St. Lucie River and Caloosahatchee River watersheds. These

BMAPs build upon the decade-plus of work already completed under the Northern Everglades protection plans and are developed collaboratively with existing and new stakeholders. The BMAPs serve as the overarching regulatory authority for water quality issues in the watershed.

Additional information on the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watershed protection plan updates, including the status of the related construction projects, is covered in Chapters 8 and 10 of this volume, respectively, and permit-specific annual reports are provided in Volume III.

WATER YEAR 2015 NUTRIENT SOURCE CONTROL HIGHLIGHTS

An overview of nutrient source control program activities during WY2015 is presented below and refers to areas shown in **Figure 4-1**. A summary of the Southern and Northern Everglades WY2015 total phosphorus (TP) and, where applicable, total nitrogen (TN) in discharge by basin, is provided in **Tables 4-1** and **4-2**, respectively.

Everglades Agricultural Area Basin

- **Basin-Level Water Quality Compliance.** The EAA discharged 39 metric tons (mt) of TP and surpassed the basin-level, EFA-mandated TP load reduction requirement of 25 percent by achieving a 79 percent TP load reduction for WY2015 as compared to a pre-BMP program period. The total cumulative reduction in TP load from the EAA permittees' runoff in the 20 years since the program started is 3,001 mt, which represents a long-term average reduction of 56 percent.
- **Permit-Level Compliance**
    - BMP Implementation – Report submittals and field inspections are core program activities for ensuring implementation of the permitted BMP plans and discharge monitoring plans under the WOD Program. Field inspections in WY2015 covered 43 percent of the total EAA acreage.
    - Permittee Water Quality Monitoring – Permit-level water quality data are key indicators of the impact of on-site activities to water quality in discharges. Data were reviewed with permittees for consideration of adaptive management of operations relative to improving water quality. The District conducted quality assurance audits of permittees' sampling procedures to ensure that field data collection and laboratory procedures met appropriate legally defensible standards.
- **Outreach, Research, and Demonstration**
    - EAA Everglades Protection District (EAAEPD) Master Research Permit – WY2015 was the fifth year of the research project proposed by permittees to meet legislative requirements and to improve BMP effectiveness through the control of floating aquatic vegetation (FAV). This research is conducted by the University of Florida Institute of Food and Agricultural Services (IFAS) in Belle Glade under contract with the EAAEPD. A permit application to renew this permit was received on April 20, 2015. A workshop to solicit public comment on the proposed research project scope was held on September 9, 2015. The District will receive comments at the public workshop and provide a written determination by November 8, 2015, on whether the proposal provides reasonable assurance that rule provisions will be met. Outreach elements of the scope, include two BMP workshops per year.

Table 4-1. Summary of WY2015 TP runoff by basin.
[Note: A direct measure of concentration is not always available as indicated by concentration values in *italics*. These individual basin values are approximated based on the basin's portion of the combined flow and load from multiple sources. SLRW – St. Lucie River Watershed; CRW – Caloosahatchee River Watershed; LOW – Lake Okeechobee River Watershed; ECP – Everglades Construction Project; Non-ECP – Non-Everglades Construction Project.]

Basin	Notes	TP Concentration (µg/L)[1]	TP Load (metric tons)[1]	Area (acres)[2]	TP Unit Area Load (pounds per acre)[1]	Watershed
C-23		442	57	110,874	1.14	SLRW
Indian Prairie	3	*388*	70	276,577	0.56	LOW
Taylor Creek/Nubbin Slough		373	77	196,732	0.86	LOW
C-24	3	*323*	42	83,373	1.11	SLRW
C-44	3	*250*	38	132,705	0.64	LOW/SLRW
C-25	3	*213*	32	99,726	0.70	SLRW
C-139	4	206	27	168,450	0.35	ECP
Ten Mile Creek		192	21	40,327	1.16	SLRW
West Caloosahatchee	3	*178*	98	350,114	0.62	CRW
EAA 298 and 715 Farms Diversion Basins	4	165	10	30,848	0.75	ECP/LOW
S-4/Industrial Canal	3	*161*	12	42,146	0.65	LOW/CRW
Fisheating Creek/Nicodemus Slough		122	27	318,042	0.19	LOW
Feeder Canal		108	5	68,883	0.17	Non-ECP
Lower Kissimmee	3	*106*	70	429,188	0.36	LOW
Remaining St. Lucie Tributaries	5	101	NA[6]	170,515	NA[6]	SLRW
East Caloosahatchee	3	*96*	22	204,093	0.24	LOW/CRW
Tidal Caloosahatchee		91	NA[6]	264,705	NA[6]	CRW
Lake Istokpoga		78	43	394,203	0.24	LOW
L-28		74	10	71,790	0.30	Non-ECP
Upper Kissimmee		63	91	1,028,421	0.19	LOW
Everglades Agricultural Area	3,4	*47*	39	463,030	0.19	ECP/LOW
Coastal Caloosahatchee		45	NA[6]	229,322	NA[6]	CRW
C-51 West	4,7	29	0.3	51,080	NA[7]	ECP
C-11 West to EPA	7	13	2	45,728	NA[7]	Non-ECP
C-111 to EPA	7	5	1	72,902	NA[7]	Non-ECP
L-8	3,8	*NA*[8]	NA[8]	106,440	NA[8]	LOW
North Springs Improvement District to EPA	7	-	0	7,022	NA[7]	Non-ECP

Cell shading indicates the relative magnitude of each value.

[1] Water Year data (annual computed values) in the following units: 1 metric ton=1,000 kg; 1 pound per acre=1.12 kilograms per hectare; µg/L (micrograms per liter)=ppb (parts per billion).

[2] Watershed area based on most recent hydrologic boundaries and may differ from previous reports and other chapters. 1 acre=0.4047 hectares.

[3] Direct measurement of nutrient concentration in basin runoff exclusive of influence from pass-through is not possible for basins which convey flow from external sources through the waterway system. Annual flow-weighted mean concentration values for these basins are approximated from the computed flow and nutrient load attributed to the basin.

[4] Most discharges from the Everglades Construction Project (ECP) basins are directed to the STAs to receive further treatment prior to discharge to the Everglades Protection Area (EPA). Diversion flows into the EPA from these basins as well as runoff flows from the EAA to Lake Okeechobee is included when it occurs.

[5] Includes tributaries representing the North Fork (excluding Ten Mile Creek), South Fork, North Mid-Estuary, South Mid-Estuary, Basin 4-5-6, and South Coastal basins. The composite nutrient concentration is estimated using land use runoff coefficients and nutrient concentrations from the tributary monitoring sites when flow was observed and salinity concentrations were below tidally influenced levels.

[6] NA – not available. No instrumentation is in place for flow and/or water quality monitoring.

[7] The North Springs Improvement District, C-11 West, and C-111 loads only represent the loads to the EPA and these basins can also discharge to tide; the C-51 West loads only represent the loads to the STAs and diversion flows into the EPA and this basin could also discharge to tide and to the L-8 basin. Monitoring to compute nutrient load is not performed for all discharges so UAL is not provided.

[8] The annual basin runoff load was negative (-2 metric tons) as a result of more daily TP loads entering the basin than leaving and a single annual TP concentration cannot be determined and load and unit area load are not reported.

Table 4-2. Summary of WY2015 TN runoff by basin.
[Note: A direct measure of concentration is not always available as indicated by concentration values in *italics*. These individual basin values are approximated based on the basin's portion of the combined flow and load from multiple sources.]
[This table was updated on March 9, 2016.]

Basin	Notes	TN Concentration (µg/L)[1]	TN Load (metric tons)[1]	Area (acres)[2]	TN Unit Area Load (pounds per acre)[1]	Watershed
S-4/Industrial Canal[3]	[3]	2,275	175	42,146	9.15	LOW/CRW
C-23		1,533	198	110,874	3.95	SLRW
C-24[3]	[3]	1,452	188	83,373	4.97	SLRW
C-25[3]	[3]	1,407	209	99,726	4.62	SLRW
Coastal Caloosahatchee		1,208	NA[4]	229,322	NA[4]	CRW
West Caloosahatchee[3]	[3]	1,177	651	350,114	4.10	CRW
East Caloosahatchee[3]	[3]	1,149	261	204,093	2.82	LOW/CRW
C-44[3]	[3]	1,138	175	132,705	2.91	LOW/SLRW
Ten Mile Creek		871	96	40,327	5.26	SLRW
Remaining St. Lucie Tributaries[5]	[5]	795	NA[4]	170,515	NA[4]	SLRW
Tidal Caloosahatchee		716	NA[4]	264,705	NA[4]	CRW

Cell shading indicates the relative magnitude of each value.

[1] Water Year data (annual computed values) in the following units: 1 metric ton=1,000 kg; 1 pound per acre=1.12 kilograms per hectare; µg/L (micrograms per liter)=ppb (parts per billion).

[2] Watershed area based on most recent hydrologic boundaries and may differ from previous reports and other chapters. 1 acre=0.4047 hectares.

[3] Direct measurement of nutrient concentration in basin runoff exclusive of influence from pass-through is not possible for basins which convey flow from external sources through the waterway system. Annual flow-weighted mean concentration values for these basins are approximated from the computed flow and nutrient load attributed to the basin.

[4] NA – not available. No instrumentation is in place for flow and/or water quality monitoring.

[5] Includes tributaries representing the North Fork (excluding Ten Mile Creek), South Fork, North Mid-Estuary, South Mid-Estuary, Basin 4-5-6, and South Coastal basins. The composite nutrient concentration is estimated using land use runoff coefficients and nutrient concentrations from the tributary monitoring sites when flow was observed and salinity concentrations were below tidally influenced levels.

- **West Palm Beach Canal Data Collection and Analysis.** The District is collecting water quality and flow data within the West Palm Beach Canal under a three-year contract, initiated in November 2012 to further the understanding of phosphorus sources, transport mechanisms, and sinks within the S5A subbasin. Studying the phosphorus interactions within the S-5A subbasin, which sees the highest concentration of phosphorus in both Lake Okeechobee inflow and permittee discharge, is a priority for guiding subregional source control project efforts within the Eastern Flow Path and could provide knowledge for better understanding of phosphorus transport throughout the EAA canals.
- **East Beach Water Control District (EBWCD) Canal Cleaning BMP Demonstration and Implementation.** The District partnered with EBWCD within the S-5A subbasin to enhance canal cleaning and FAV control practices. EBWCD volunteered to implement practices that were in accordance with IFAS methods for particulate matter and sediment removal to complement the EAAEPD Master Research Permit scope by providing farm-scale results through an upstream synoptic monitoring component. The three-year project started May 2013. Quarterly reports are provided by EBWCD. This project is part of the efforts focused on the Eastern Flow Path in the EAA.

C-139 Basin

- **Basin-level Water Quality Compliance.** The C-139 Basin discharged 27 mt of TP, which is below the pre-BMP target load of 30 mt and therefore met the legislative requirement to maintain TP loads at or below historical levels. This was welcome news following an exceedance of the target in WY2014.
- **Permit-Level Compliance**
    - **BMP Implementation.** Regular contact with the permittees through report submittals and field inspections is essential to verify optimal implementation of BMPs required by permits under the WOD program. BMP verifications conducted in WY2015 covered 99 percent of the basin acreage.
    - **District Water Quality Monitoring.** Upstream monitoring by the District provides data for use by permittees if basin-level water quality compliance is not met. The data are also routinely reviewed to identify opportunities for program optimization. Monitoring changes were implemented during WY2015 to improve the data collection process for the upstream monitoring sites.
- **Outreach.** Training was provided to assist permittees in satisfying the BMP training requirements of Rule 40E-63.435(4), F.A.C., and to supplement their existing training programs. The training is an opportunity to ensure proper BMP implementation methods and exchange new information.

Non-ECP Basins

- **Basin-level Water Quality.** TP levels in discharges to the EPA from the Feeder Canal, L-28, North Springs Improvement District (NSID), C-11 West, and C-111 basins are monitored to track trends. These trends are an indicator of the success of water quality improvement plans (WQIPs) toward achieving established water quality standards in the EPA, although basin-specific TP limits have not been established by the non-ECP permit for discharges to the EPA. The C-111 basin complied with the TP concentration limit of 11 micrograms per liter (µg/L) established by the federal Everglades Settlement Agreement (Settlement Agreement dated July 26, 1991, Case No. 88 1886-CIV-MORENO, United States District Court for the Southern District of Florida, as modified by the Omnibus Order entered in the case on April 27, 2001). Strategies to improve water quality and divert flows are effectively reducing TP contribution from the NSID, C-111, and C-11 West basins east of the EPA. During WY2015, no discharge from the NSID Basin into the EPA occurred, while TP levels to the EPA from the C-111 and C-11 West basins were 5 and 12 µg/L, respectively. WY2015 TP levels to the EPA from the L-28 and Feeder Canal basins west of the EPA (74 µg/L and 108 µg/L, respectively) were higher than recent years.
- **Permit-level Compliance.** Mandatory implementation of BMPs and water quality requirements are incorporated into Environmental Resource Permits (ERP) in the NSID Basin and certain areas within the Feeder Canal Basin. The Long-Term Plan describes a phosphorus concentration requirement of 50 µg/L in discharges from the North Feeder Canal Subbasin. The WY2015 TP flow-weighted mean concentration (FWMC) in discharges from the North Feeder Canal Subbasin was 228 µg/L. The Long-Term Plan indicates initiation of rulemaking for implementation of a mandatory source control program in the Feeder Canal Basin in response to landowners not achieving 50 µg/L. The District is considering alternatives for improving water quality in this area. The Western Basins Water Resources Evaluation Project, which began in May 2015 and will be completed in February 2016, is expected to update and expand the evaluation of water quality management measures in the Western Basins including the North Feeder Canal Basin.

- **Outreach and Integration with Other District and Federal Projects**
    - **Outreach.** A web site provides outreach and education information for stakeholders within C-11 West and NSID basins.
    - **Integration with Other District and Federal Projects.** Ongoing District and local projects in support of water quality improvements in discharges to the EPA include the Seminole Tribe Water Conservation Plan Project in the Big Cypress Seminole Reservation, a flow equalization basin and restoration plan in the C-139 Annex, the L-28 Weir Demonstration Project, the C-111 South Dade Project, the C-11 Impoundment, and the Hillsboro Site 1 Impoundment.

Lake Okeechobee, Caloosahatchee River and St. Lucie River Watersheds

- **Basin Water Quality**
    - **Water Quality Monitoring.** The District monitors the Northern Everglades watersheds at the basin-level and the upstream-level (e.g., Lake Okeechobee Watershed Assessment or LOWA) in accordance with statutory requirements, and serves as the basis of interagency coordination and development of action plans for priority areas. The basin-level data are presented in **Figures 4-14** through **4-37** in this chapter and the upstream-level data are presented in Appendix 4-3 of this volume.
    - **LOWA Water Quality Monitoring Optimization.** Data from the LOWA network is continuously reviewed through the District's optimization program to maximize the efficiency and quality of the data collection. Preliminary preparations have been made to incorporate the synoptic St. Lucie and Caloosahatchee River watershed sampling sites into the LOWA upstream water quality monitoring network, thus allowing for interagency coordination and development of action plans for these areas as well. The NEEPP mandates a consistent source control approach in the Northern Everglades watersheds. Data from the LOWA network is presented in Appendix 4-3.
    - **Synoptic Water Quality Sampling in River Watersheds.** The first year of a two-year, wet season water quality sampling program was completed in WY2015. The program examined both TP and TN at 11 sites in the St. Lucie River Watershed and 15 sites in the Caloosahatchee River Watershed. The synoptic sites will provide the information necessary for prioritizing and optimizing resources.
    - **St. Lucie River Watershed Non-point Source Analysis.** The District completed technical analysis of water quality data in the St. Lucie River Watershed to identify potential influences associated with septic tanks, which are a nutrient source of concern for restoration strategies.
- **Permit-level Compliance**
    - **BMP Implementation.** The WOD program currently regulates 2,039,367 acres of the Northern Everglades as described under the 1989 Chapter 40E-61, F.A.C. Of that area, approximately 86 percent have WOD permits approving BMP and phosphorus control plans. These plans are focused on nutrients in stormwater discharges to WODs to enable the District to meet statutory mandates.
    - **Rule Amendments.** Updates to Chapter 40E-61, F.A.C., will be necessary in consideration of FDEP's approach to source control programs under the BMAPs.
    - **Interagency Coordination to Identify and Respond to Priority Areas of Water Quality Concern.** The District reviewed water quality data and BMP

implementation information to identify priority areas of water quality concern. The District, FDEP, and FDACS held meetings quarterly to develop action plans for priority areas of water quality concern. Action plans include, but are not limited to agency follow-up with landowners and continued agency review of water quality monitoring data for trends.

- **Outreach and Demonstration.** District-Owned Lands Supplemental BMP Program – A program to optimize the use of BMPs to reduce nutrients in stormwater runoff from District-owned lands was developed. The District's Real Estate and Regulation Divisions work to enhance BMP implementation as District lands are prepared to be leased. Besides meeting the FDACS Notice of Intent BMP criteria, new leases are considered to include additional BMPs at levels comparable to the District's Regulatory BMP requirements, and looks for opportunities for supplemental BMP enhancements. In WY2015, ten properties were visited for enhanced BMP implementation: two in the Lake Okeechobee Watershed and eight in the St. Lucie River Watershed. Construction began in spring 2015 to implement supplemental BMPs at sites such as the Yates Marsh and the Indian River Lagoon - South Cypress Creek/Trail Ridge properties.

A summary of nutrient levels in runoff from the different basins is presented in **Tables 4-1** and **4-2**. In reviewing these data, note that nutrient levels in runoff from a basin are the result of many factors including, but not limited to, land uses, regional water management features, soils, historic uses of the land, source control activities, and rainfall variability from year to year. Additionally, there may be complexities associated with the hydrology of each basin that may require the need for additional assumptions to estimate nutrient levels in runoff (e.g., calculation of nutrient concentration in runoff for individual basins that receive pass through flows, tidally influenced basins, and basins that have boat locks). A direct measure of concentration is not always available as indicated by concentration values in italics. These individual basin values are approximated based on its portion of the combined flow and load from multiple sources. When considering these data summaries, it must be acknowledged that the Kissimmee River, Lake Okeechobee, the St. Lucie River and Estuary, the Caloosahatchee River and Estuary, and the Southern Everglades are an interconnected system such that the impacts to any one area within the overall system, such as the upstream tributaries, may affect areas downstream.

OVERVIEW OF SOUTHERN EVERGLADES SOURCE CONTROL PROGRAMS

Carlos Adorisio

The Southern Everglades source control programs are a critical component of the water quality improvement strategies in the Everglades restoration program. The source control programs include implementation of TP reduction BMPs through regulatory programs as well as integration of state, local, and regional water quality projects. The EFA, Section 373.4592, F.S., outlines the District's responsibilities and the schedules to implement basin-specific solutions in the Southern Everglades to control phosphorus at the source. FDEP issues EFA permits to the District to ensure implementation of these strategies, including source controls, to ensure phosphorus levels in discharges are conducive to achieving water quality standards for the EPA.

Chapter 40E-63, F.A.C., also known as the District's Everglades WOD program, was adopted in 1992 establishing the source control program for the EAA, and amended in 2002 to include a source control program for the C-139 Basin. These programs establish permitting criteria for approval of a BMP plan for new and existing activities to ensure that water quality in stormwater discharges to WOD enables the District to meet its statutory mandates. The WOD program is

unique to South Florida as it combines cost-effective, technology-based remedies (BMPs) with prescribed deadlines for action, requirements for controlling phosphorus levels, water quality monitoring, and compliance methodologies. The WOD program continues to adapt to address water quality issues that may arise. In 2010, Chapter 40E-63, F.A.C., was amended to include additional requirements to ensure that the EFA objectives for the C-139 Basin are consistently met. Additionally, unnecessary rules have been repealed in recent years in accordance with the Florida Governor's expressed goal in Executive Order 11-211 of reducing the size and scope of the F.A.C.

For other basins that discharge to the EPA, FDEP requires implementation of WQIPs under EFA long-term compliance permits issued to the District. See **Figure 4-1** for general basin and EPA locations. The District is required to report annually on each basin's progress in accordance with the EFA. This chapter and related Volume I and Volume III appendices serve as the reporting mechanisms to fulfill this requirement.

Continued implementation of mandatory WOD BMP programs in the EAA and C-139 basins and WQIPs in Non-ECP basins, and achievement of the required levels of performance in TP loads and concentrations from these basins are necessary for the District to achieve the TP criterion in the EPA established in Rule 62-302.540, F.A.C., and to fulfill its obligations under the EFA, FDEP Permit Number 06, 502590709, and the federal Everglades Settlement Agreement (Settlement Agreement dated July 26, 1991, Case No. 88-1886-CIV-MORENO, United States District Court for the Southern District of Florida, as modified by the Omnibus Order entered in the case on April 27, 2001). Additionally, the Long-Term Plan (Burns and McDonnell 2003), and its amendments, and the Restoration Strategies Regional Water Quality Plan (SFWMD 2012) rely on the levels of water quality performance accomplished by these programs. Detailed updates on the District program are provided next and in Appendices 4-1 and 4-2, while the status of the Long-Term Plan and Restoration Strategies Regional Water Quality Plan is presented in Appendix 5B-3 and Chapter 5A of this volume, respectively.

STATUS OF SOURCE CONTROL PROGRAMS IN THE ECP BASINS

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BACKGROUND

For the EAA and C-139 basins, the EFA mandates the Everglades WOD regulatory program to implement BMPs through permits to achieve specified TP loads at a regional level by controlling phosphorus at the source. A monitoring network is maintained to assess program performance and make adjustments when necessary to assure compliance. The EFA further mandates that Chapter 40E-63, F.A.C., is to outline the specific compliance methodology based on historical data or pre-BMP baseline periods defined in the EFA. Achieving TP load requirements from these tributary basins is critical to the success of the ECP because the Everglades STAs were designed based on historical data and an expected range of inflow TP loads. The source control program's mandated implementation of BMPs in the EAA and C-139 basins is the primary regulator of TP loads in discharges from the basins prior to inflow to an STA. Along with the design characteristics of the STAs, performance of an STA in reducing TP concentrations to meet EPA water quality standards is dependent on the level of phosphorous discharged to the STA for treatment.

The EAA Basin is required to achieve a 25 percent reduction of the TP loads discharged when compared to the pre-BMP baseline period while the C-139 Basin is to not exceed the historical loads observed during the baseline period, as defined in the EFA. The specific compliance methodology to assess whether these goals are being met is described in Chapter 40E-63, F.A.C., and this year results are provided in the *Water Year 2015 Phosphorus Results* headings of the EAA and C-139 basins' subsections below.

The District collects data at the boundary structures of the EAA and C-139 basins to calculate runoff and evaluate the overall effectiveness of the BMPs in achieving and maintaining compliance with the basin-level TP load requirements. If the EAA Basin is determined to be out of compliance, then, in accordance with the rule, the data collected by the individual permittees under approved discharge monitoring plans are evaluated using a secondary compliance method that assesses individual permittee compliance based on their TP load contributions. For the C-139 Basin to be in compliance, it must also meet phosphorus levels relative to the EFA-defined baseline period using specific methods defined within Chapter 40E-63, F.A.C. The EFA states that if the C-139 Basin is out of compliance, actions required from individual permittees are conditioned on the proportional share of the TP load discharged from the basin. The proportional share is based on a secondary compliance determination (specified in Chapter 40E-63, F.A.C.) using upstream monitoring data. Upstream monitoring can be individual permittee collected data representing their discharges or District collected data representing subregional areas. However, because permittees in the C-139 Basin have declined to collect water quality and quantity data to characterize their permit-level discharges, a water quality and quantity monitoring network for upstream subregional areas throughout the basin would be used by the District to differentiate the relative contribution of the hydrologic subbasins to support the secondary compliance methodology, if necessary. The specific procedures for determining EAA and C-139 Basin compliance, basin-level and subbasin-level data collection efforts, and permit-level discharge monitoring results are outlined in Appendix 4-1 of this volume.

The EFA mandates an agricultural privilege tax for both the EAA and C-139 basins to be used towards the funding of the ECP. Taxes received contribute toward the Everglades Trust Fund managed by the District consistent with the EFA, Subsection 373.4592(6), F.S. Monies in the trust fund are expended to implement the EFA, protecting natural resources and improving water quality in the EPA and EAA. House Bill 7065, passed in 2013, amended the EFA to include a revised Agricultural Privilege Tax rate schedule. For notices mailed out from November 2014 to November 2026, the tax rate will not include incentive credits and will be $25 per acre. For notices mailed November 2027 to November 2029 the rate will be $20 per acre, November 2030 to November 2035 will be $15 per acre, and November 2036 and after will be $10 per acre. For the C-139 Basin, the tax rate from 2003 to November 2013 was set at $4.30 per acre, which reduced to $1.80 per acre for tax notices mailed out November 2014 and thereafter.

Additional revenue and expenditure detail is contained in Appendix 1-5 of this volume. As a performance incentive for the EAA, the EFA provided a tax incentive credit against the EAA agricultural privilege tax for any phosphorous load reductions achieved in excess of 25 percent, thus encouraging BMP performance and maximizing load reductions. The minimum tax rate for the EAA with incentive credits was $24.89 per acre for notices mailed out from 1994 through November 2013. Based upon phosphorus reductions for Water Year 1993 (WY1993) through WY2012 (May 1, 1992–April 30, 2012), over 521 credits were earned and 180 credits were used. Historical annual tabulation of EAA Agricultural Privilege Tax credits earned and credits used is presented in Appendix 4-2 of the *2014 South Florida Environmental Report (SFER) – Volume I* (Pescatore and Wang 2014). The incentive credits set forth in the EFA expired at the end of WY2012, which is associated with the tax notice mailing in November 2013.

An effective source control program can substantially reduce the magnitude and cost of regional construction projects. Based on the 20 years of implementation of the regulatory source control program in the EAA and C-139 Basin, more than half of the TP that would have otherwise entered the District construction projects was prevented at a District program implementation cost of less than $5 per pound of TP. The District program implementation costs, however, do not consider the permittee's cost to implement the BMPs. Data on the permittee's cost to implement BMPs is not available. Without BMPs, removing this TP may have required expanding the capacity of regional construction projects at a higher cost.

EVERGLADES AGRICULTURAL AREA BASIN UPDATE

EAA Basin Source Control Strategy

The source control strategy for the EAA Basin (**Figures 4-3** and **4-4**) relies primarily on a mandated regulatory program for BMP implementation for which compliance determinations began in WY1996. Chapter 40E-63, F.A.C., requires a permit for a BMP plan for each crop or land use within each subbasin or farm. In addition, through an adaptive management process, the regulatory program ensures that mandatory BMP implementation and performance measures continue to be applicable in response to regional changes.

The permit-required BMP plans are comprehensive; they address both nutrient input to the system and transport from the system and generally consist of nutrient management, water management, and particulate matter and sediment controls. Investigation to improve the selection, design criteria, and implementation of BMPs is ongoing and occurs through different mechanisms based on the factors specific to each basin. BMP plans are required for each land use, crop, and combination of crops or farming units. The EAA land use distribution from the most current District land use data set (2008–2009) is shown in **Table 4-3**. A District land use data set update (2011–2013) is currently in production, but is unavailable for the EAA at this time.

Table 4-3. Land use distribution (2008–2009) for the EAA and C-139 basins.

Land Use (2008–2009)[a]	EAA	C-139
Sugar Cane	96.08%	7.48%
Citrus	0.00%	6.88%
Institutional, Urban, & Industrial	1.79%	1.04%
Other Agriculture	0.33%	0.98%
Pasture & Natural Areas	0.83%	75.82%
Rock Mining	0.22%	0.00%
Row Crops	0.02%	7.40%
Water	0.73%	0.40%

a. The 2008–2009 SFWMD land use is the most recent data set available. A 2011–2013 data set is currently in production.

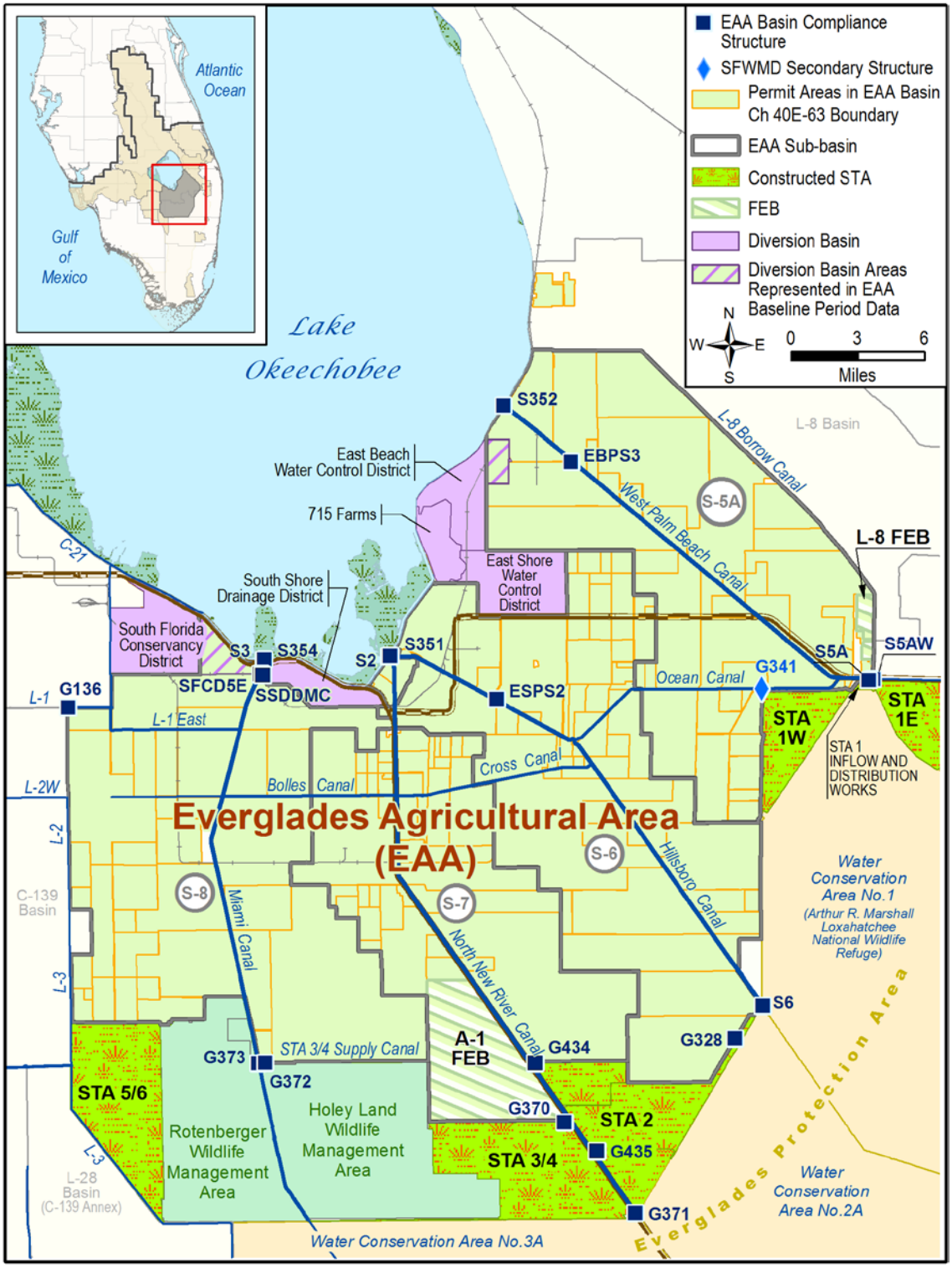

Figure 4-3. WY2015 EAA Basin boundaries and primary compliance water control structures. [Notes: FEB – Flow Equalization Basin; STA 1E – STA 1 East; and STA 1W –STA 1 West.]

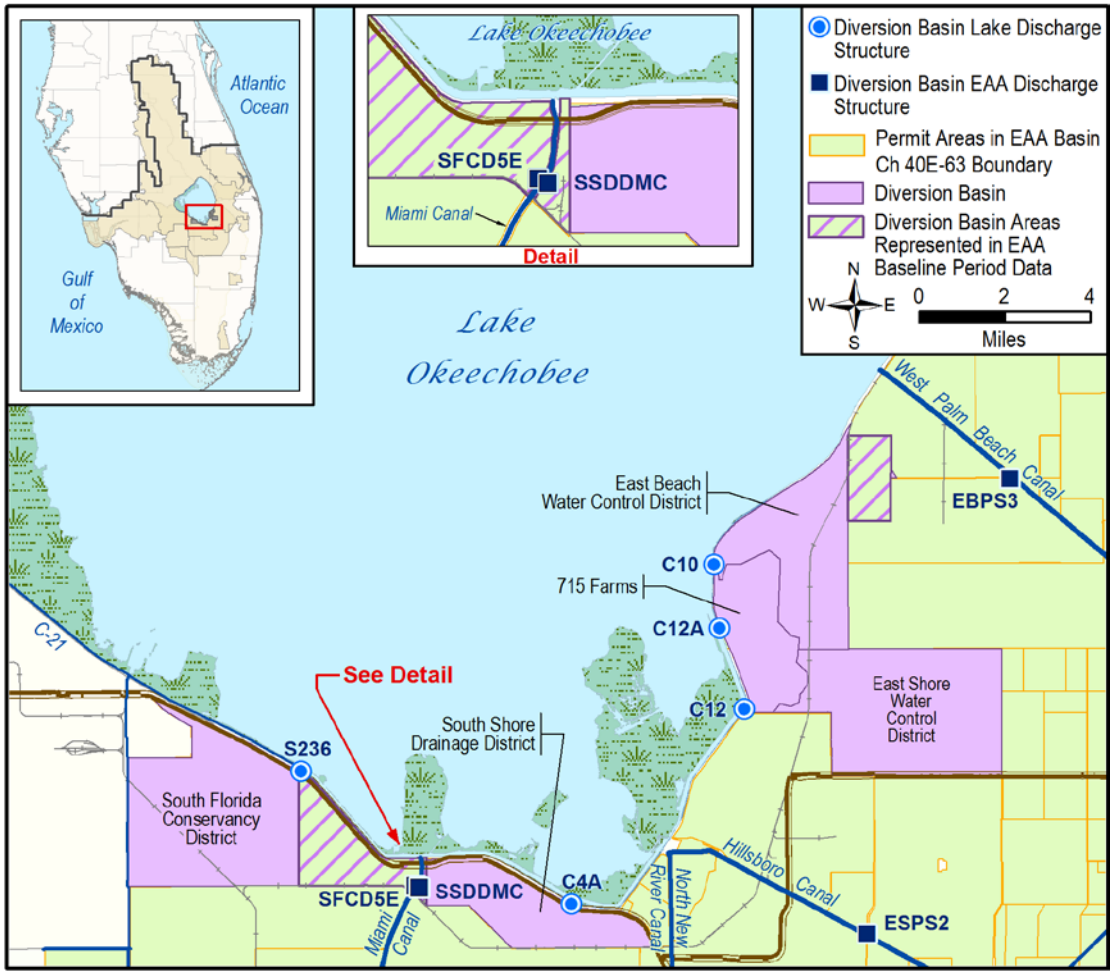

Figure 4-4. EAA diversion basins boundaries and their discharge structures to Lake Okeechobee and the EAA.

Changes to the BMP plans require the District's approval. More information on comprehensive BMP plans and BMP plan examples are available in the 2009 SFER – Volume I, Appendix 4-1 (Gomez and Bedregal 2009). Permittees are also required to collect water quality and quantity data at farm discharges (permit-level) through approved discharge monitoring plans. Resulting permit-level water quality and quantity data for each water year are reported in the respective appendix of each year SFER. This water year's results are presented in Appendix 4-1. Water quality data collected at the permit level are used as general indicators of individual BMP plan effectiveness and are used as a secondary means of compliance if the EAA is not in compliance at the basin level. Additionally, permit-level data cannot be considered in isolation of other potential factors affecting performance.

The original guidance document for BMP design and plan implementation in the EAA is the Procedural Guide for the Development of Farm-Level Best Management Practice Plans for Phosphorus Control in the EAA, Version 1.1, developed by the University of Florida IFAS (Bottcher et al. 1997). Pursuant to the EFA and Chapter 40E-63, F.A.C., requirements, additional research has been conducted by IFAS via the EAAEPD Master Research Permit to improve BMP effectiveness and design. Investigation to improve the selection, design criteria, and

implementation of BMPs is ongoing. Updates to IFAS BMP technical references are available at http://edis.ifas.ufl.edu. Searching this site for "EAA BMP" provides documents including design criteria for construction (as applicable), operation of BMPs, and farm management applicable to the EAA. The District refers to these updated technical sources when conducting BMP field verifications, advising permittees on improving BMP plans, and reviewing applications for permit renewals every five years. The update on source control activities below describes the current investigations intended to enhance the body of knowledge on BMPs in the EAA. The District's current emphasis is on providing oversight on the research scope proposed by the EAAEPD under an EFA-mandated research permit. The current focus proposed by the permittees is to evaluate the effectiveness of a comprehensive canal maintenance program combining sediment and FAV controls.

As indicated in the IFAS procedural guide, the industry definition for a BMP is an "on-farm operational procedure designed to reduce phosphorus losses in drainage waters to an environmentally acceptable level while simultaneously maintaining an economically viable farming operation for the grower" (Bottcher et al. 1997). Based on Chapter 40E-63, F.A.C., permittees are required to revise their BMP plans to enhance performance if the basin as a whole is not in compliance and the secondary performance measure at the individual farm level is not met. Because the EAA Basin has been in compliance each year since the program's inception, the secondary performance measure methodology has not been utilized. However, permittees have revised their BMP plans for specific on-site conditions.

In addition, the strategy in the EAA Basin includes supplemental source control and voluntary demonstration projects for enhancing the current source control strategy. The District conducts upstream data collection at tributaries and supplementary analyses of non-agricultural and agricultural sources with the potential to affect basinwide performance in an effort to determine the most effective adaptive management strategies. Cooperation of landowners and other interested parties is necessary for the successful implementation of such voluntary activities.

Water Year 2015 Phosphorus Results

This subsection details the performance measure data evaluation for WY2015 to determine if the EFA-mandated load requirements as defined by Chapter 40E-63, F.A.C., are met. During WY2015, the TP loads discharged from the EAA Basin decreased by 79 percent compared to the pre-BMP baseline period load adjusted for hydrologic variability associated with rainfall. This represents the twentieth consecutive year the EAA Basin was in compliance with a 20-year average reduction of 56 percent. Because the EAA Basin has been in compliance each year since the program's inception, application of the secondary compliance method at the permit level has not been necessary. Representative monitoring locations for determining WY2015 compliance with the TP load reduction requirement are shown in **Figure 4-4**. **Table 4-4** provides a summary of the EAA WY2015 results for the runoff TP loads and load performance measures in metric tons (mt). The runoff load is based on flow and water quality data measured during the water year. The predicted load is established through a base period regression model using the current water year rainfall characteristics to account for the hydrologic variability between the current year and the baseline period, and the target load is the predicted load reduced by 25 percent to reflect the EFA load reduction requirement. Runoff loads are assessed based on exceeding the target loads for three consecutive years to verify noncompliance at a theoretical confidence level of 87.5 percent. The single-year limit load is calculated based on the 90th percentile confidence level of the target load. This provides for a higher theoretical confidence level to verify noncompliance based on exceeding the limit load in a single year.

Table 4-4. Results of WY2015 EAA Basin TP compliance calculations.

	TP Load
Predicted TP load (adjusted for WY2015 rainfall amounts and monthly distribution relative to baseline period)[a]	185 mt
Target TP load (predicted TP load reduced by 25 percent)	139 mt
Limit TP load (upper 90th percentile confidence level for target load)	187 mt
WY2015 runoff TP load from the EAA with BMPs implemented	39 mt
WY2015 TP load reduction (relative difference between runoff and predicted TP loads)	79%

a. The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Under Chapter 40E-63, F.A.C., compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

A summary of the data for all calculated water years is provided in **Table 4-5**. The table presents annual runoff and predicted TP loads, and annual rainfall and runoff flow measurements. The predicted load is based on applying a WY2015 rainfall adjustment to the base period to allow for comparison of the two periods. If the current water year runoff load is 25 percent less than the predicted load, it signifies that applied BMPs are successful at achieving levels of performance for the EAA Basin to be determined in compliance. The TP values presented are attributable only to EAA Basin runoff (farms, cities, and industries) based on computed data collected at the EAA basin-level monitoring locations. The compliance methodology factors out sources external to the EAA basin such as Lake Okeechobee pass-through TP Loads; C-139 Basin TP loads into the EAA; and EAA 298 and 715 Farms Diversion Basins TP loads into the EAA. The Lake Okeechobee loads during pass-through operation are variable from year to year and are based on conditions both upstream and downstream of the EAA. For instance, inflows from external sources were much lower during the baseline period defined by the EAA Chapter 40E-63, F.A.C., regulatory model. Because flow and load leaving the EAA at its boundary structures represent the combination of EAA basin runoff and these other sources, the TP concentrations directly attributable to EAA basin runoff cannot be directly measured. Therefore, the TP FWMC presented herein is derived from the computed annual runoff TP load and flow attributable to the EAA.

In WY2015, pass-through operation flow from Lake Okeechobee carried 107 mt of TP at a concentration of 134 µg/L into the EAA, which is higher than the base period average annual TP load of 9 mt and concentration of 82 µg/L. For additional detail on annual flow distribution throughout the District, refer to Chapter 2 of this volume and for TP loading from Lake Okeechobee refer to Chapter 8 of this volume. Based on data collected at the EAA Basin boundary from Lake Okeechobee, the measured TP FWMC of lake inflows during pass-through operation was 134 µg/L. The WY2015 TP FWMC of all discharges from the EAA boundary to the STAs, including a blend of pass-through, permittee runoff, and other sources, was 93 µg/L based on data collected at the EAA Basin boundary. The annual TP FWMC representing permittee runoff was 106 µg/L based on the permit-level data collected at each off-site discharge structure. WY2015 TP in discharges from EAA permittees is lower than the long-term average taken since WY1996 when BMPs were initially implemented. The computed WY2015 EAA Basin runoff load of 39 mt was the lowest load recorded for the EAA since the beginning of the period of record in WY1980. The effects of the unprecedented pass-through operation in WY2015, the improved water quality of WY2015 EAA permittee runoff, and other factors contributed to the water quality leaving the EAA basin in WY2015 compared to the base period.

Table 4-5. WY1980–WY2015 EAA Basin TP measurements and calculations.

Water Year	Runoff TP Load[a] (mt)	Predicted TP Load[b] (mt)	Percent TP Load Reduction[c]	Rainfall (inches)[d]	Runoff Flow (10^3 acre-feet)[d]	Baseline and BMP Status Timeline[e]	
1980	167	154	-9%	53.5	1,162	Baseline Period	Pre-BMP Period
1981	85	98	13%	35.1	550		
1982	234	255	8%	46.7	781		
1983	473	462	-2%	64.4	1,965		
1984	188	212	11%	49.8	980		
1985	229	180	-27%	39.7	824		
1986	197	240	18%	51.2	1,059		
1987	291	261	-12%	52.0	1,286		
1988	140	128	-9%	43.4	701		
1989	183	274	33%	39.7	750		
1990	121	120	-1%	40.1	552		
1991	180	219	17%	50.4	707		
1992	106	179	41%	47.6	908		Partial BMPs
1993	318	572	44%	61.7	1,639		
1994	132	160	17%	50.5	952		
1995	268	388	31%	67.0	1,878		
1996[e]	162	503	68%	56.9	1,336		Everglades Rule BMPs (Full BMP Implementation)
1997	122	240	49%	52.0	996		
1998	161	244	34%	56.1	1,276		
1999	128	249	49%	43.4	833		
2000	193	425	55%	57.5	1,311		
2001	52	195	73%	37.3	667		
2002	101	227	55%	49.1	1,071		
2003	81	125	35%	45.6	992		
2004	82	229	64%	46.8	961		
2005	182	444	59%	51.0	1,190		
2006	153	270	44%	50.1	1,035		
2007	150	182	18%	37.2	727		
2008	94	167	44%	47.0	619		
2009	129	407	68%	43.7	877		
2010	169	288	41%	61.9	1,079		
2011	45	219	79%	42.0	517		
2012	63	217	71%	44.4	546		
2013	154	263	41%	53.5	884		
2014	105	285	63%	53.4	899		
2015	39	185	79%	44.4	670		

a. TP values are attributable only to the EAA Basin (farms, cities, and industries) and do not represent the cumulative TP being discharged through the EAA boundary structures from all sources such as Lake Okeechobee and the 298 Districts.

b. Predicted TP load represents the baseline period load adjusted for WY2015 rainfall variability.

c. Percent TP load reduction values for WY1980–WY1988 represent the compliance model calibration period.

d. 1 inch = 2.54 centimeters; 10^3 ac-ft = thousands of acre-feet; 1 acre-foot = 1,233.5 cubic meters; and 1 microgram per liter (µg/L) = 1 part per billion (ppb).

e. 1996 was the first year of compliance measurement for the EAA Basin. BMPs were not fully implemented from WY1992 to WY1995.

Table 4-6 presents a summary of the EAA inflow and outflow TP concentrations for WY2015, which contrasts the concentrations entering each subbasin from Lake Okeechobee with the total outflow concentrations exiting each subbasin. The annual TP FWMCs at the Lake Okeechobee inflow points (S-351, S-352, and S-354) to the EAA subbasins for WY2015 ranged between 103 and 188 µg/L. Subbasin outflow annual TP FWMC's ranged between 62 and 144 µg/L.

Table 4-6. Lake inflow and total outflow TP FWMC by EAA Subbasin for WY2015.

EAA Subbasin	Lake Inflow TP FWMC (µg/L)	Total Outflow TP FWMC (µg/L)
S-5A (West Palm Beach Canal)	188	144
S-2/S-6 (Hillsboro Canal)	122	78
S-2/S-7 (North New River Canal)	122	62
S-3/S-8 (Miami Canal)	103	81

The EAA Basin percent TP load reduction trend is presented in **Figure 4-5**. The red line shows the five-year trend of percent load reduction. The diamond (♦) symbols represent the annual measurements. A downward trend in the red line in **Figure 4-5** denotes a reduction in loads; that is, an overall long-term improvement in the water quality of EAA runoff discharged from the basin.

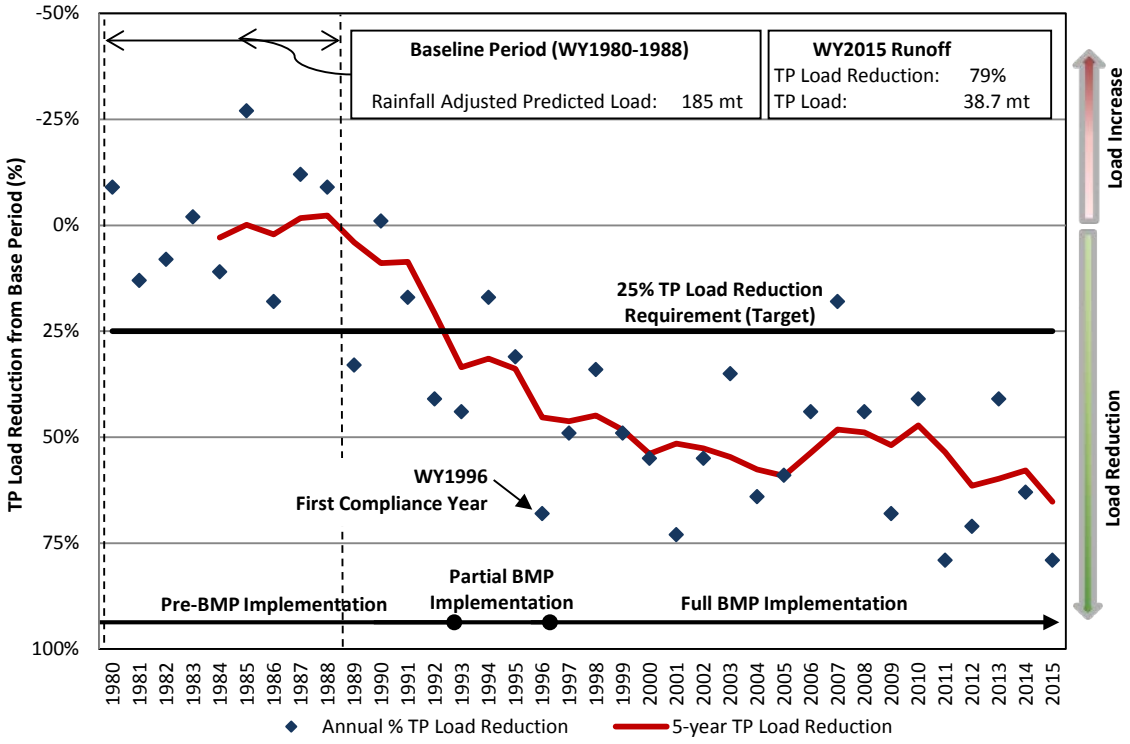

Figure 4-5. WY1980–WY2015 EAA Basin percent TP load change from baseline period.

As discussed above, permit-level data collected by the EAA permittees as conditions of their permits for the secondary compliance methodology also serve to corroborate EAA basinwide compliance results and enable permittees to review individual trends at the permit basin level.

These data may become more important to substantiate basinwide results in the case that external TP load increases from sources that flow through the basin or are used for irrigation, as was shown in WY2015.

Permittees are required to demonstrate that their discharge monitoring plans provide reasonable assurance that annual water discharge and TP load are accurately documented, as such an average of 94 percent of the permitted acreage in the EAA has been represented by data meeting the required assurance levels during the life of the program. The EAA permittee annual unit area TP load (load per acre) has shown a decreasing trend over the 20 years since full BMP implementation (**Figure 4-6**). During the first five years of full BMP implementation (WY1996–WY2000), the total permittee unit area TP load averaged 1.233 pounds per acre [lbs/acre; 0.559 kilograms per acre (kg/acre)], while the most recent five-year period (WY2011–WY2015) had an average of 0.639 lbs/acre (0.290 kg/acre), and the intermediate period was consistent with the decreasing trend. The trend in permittee data used to compute unit area load (UAL) matches the trend observed in the District data collected at the EAA basin level for compliance calculations. Similarly, the EAA permittee's annual TP FWMC have been decreasing over the 20-year period since full BMP implantation from an average of 148 µg/L during the first five years of full BMP implementation to an average of 107 µg/L during the most recent five-year period, with a consistent decreasing trend in the intermediary periods. The difference in magnitude in the decreasing trends of the EAA annual permit-level UALs and the TP FWMC is consistent with the magnitude in trends at the EAA basin compliance level. Overall, the EAA permit-level annual data supports the EAA Basin compliance calculations.

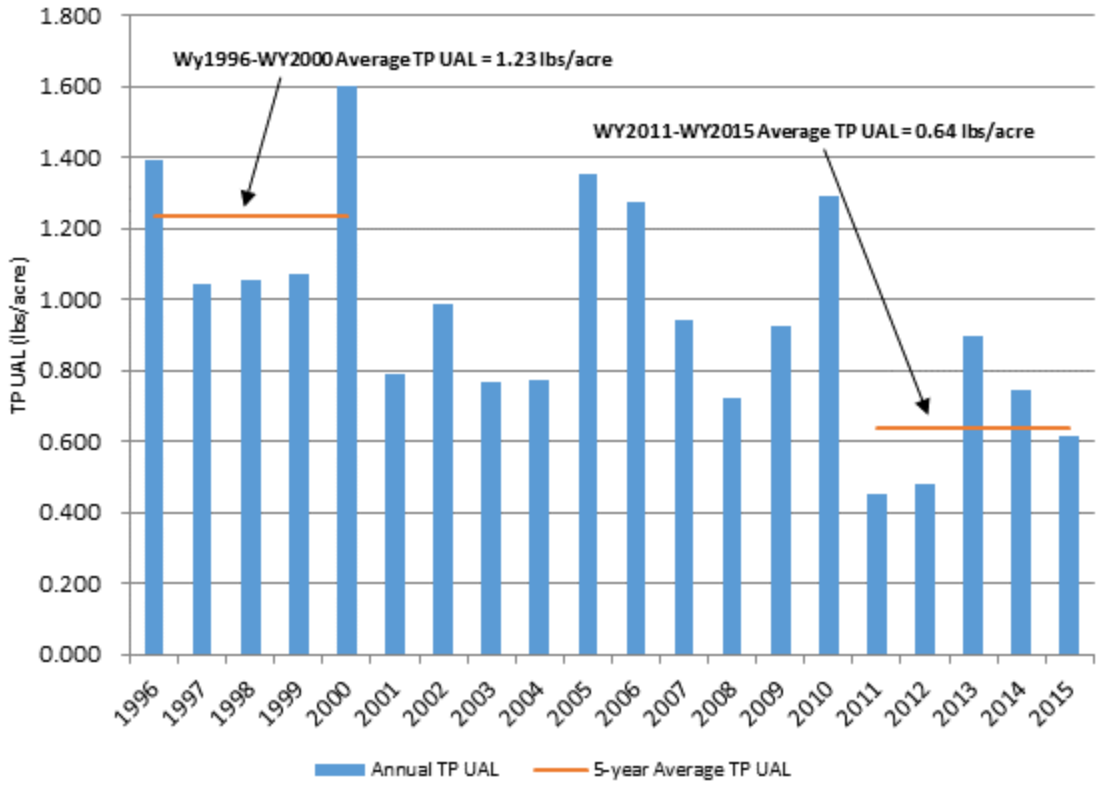

Figure 4-6. EAA annual permittee TP UAL data.

Additional detailed information on the EAA basin-level monitoring program and summaries of subbasin flows, related TP loads, target and limit load calculations, and TP FWMC are presented in Appendix 4-1 of this volume. This appendix also includes supplemental information for the EAA at basin and permit levels, such as basin-level compliance calculation details, basin-level monitoring data and a water quality summary, discussion of short-term and long-term variations in basin-level loads, and permit-level monitoring data.

EAA Basin Source Control Activities

During WY2015, the District implemented the ongoing EFA-mandated regulatory BMP program and made progress on supplemental projects as listed below.

Water Year 2015 Activities

- **Permit-Level Compliance**
    - **BMP Regulatory Program**. At the end of WY2015, 467,565 acres were under Everglades WOD permits in the EAA. Permit compliance activities continued through monitoring report submittals and on-site BMP verifications. Field inspections in WY2015 covered 43 percent of the EAA acreage and were selected based on permit-level water quality data, date of previous inspection, BMP implementation requirements and history, operational changes, and location within the EAA.
    - **298 District and 715 Farms Diversion Project Permits.** BMP verification activities for these basins during WY2015 were carried out consistent with the rest of the EAA. Prior to Calendar Year 2001, areas within the South Florida Conservancy District, South Shore Drainage District, East Shore Water Control District, East Beach Water Control District (EBWCD), and 715 Farms (**Figure 4-4**) discharged to Lake Okeechobee. Landowners within these basins were required to implement specific phosphorus reduction credit projects under a management plan master permit issued in 1992 pursuant to Chapter 40E-61, F.A.C. In accordance with EFA requirements, diversion projects were completed between 2001 and 2005 to direct a portion of flows from these areas to the south for treatment in the EAA STAs and eventual discharge to the EPA. Upon completion of the diversion projects, these areas were able to discharge to Lake Okeechobee and the STAs, and thus were to be subject to the additional water quality and permitting requirements of the EFA. Accordingly, WOD permits were issued requiring BMP implementation and permit-level discharge monitoring requirements. However, these basins are not included in the EAA Chapter 40E-63, F.A.C., regulatory model boundary and are not represented by the baseline period data used to determine compliance with the 25 percent TP load reduction requirement for the EAA. Currently, two post-diversion phosphorus reduction measures are required for discharges from these areas: diversion of at least 80 percent of historical flows and TP loads from Lake Okeechobee to the STAs and a 25 percent TP load reduction. Chapter 40E-63, F.A.C., is included in the District's regulatory plan filed with the Office of Fiscal and Regulatory Reform in order to make the necessary changes. For interaction with the Northern Everglades, see the update under "South Lake Okeechobee Watershed Master Permit Requirements" bullet point in the *Northern Everglades Watersheds Activities* section below.

- **Research, Demonstration and Outreach**
  - **West Palm Beach Canal Data Collection.** In November 2015, the District will complete a water quality and flow data collection effort within the West Palm Beach Canal (see **Figure 4-4**) with the objective of further understanding phosphorus sources, phosphorus transport mechanisms, and sinks affecting TP loading from the EAA at the subbasin level. Water quality samples continue to be collected along the canal between the S-352 and S-5A structures, including three intermediate canal locations where stream gauging is performed for flow estimation. Analysis of the data is ongoing and is expected to be completed by the end of WY2016.
  - **EAAEPD BMP Research Permit.** In addition to BMP implementation requirements, the EFA, Chapter 40E-63, F.A.C. and Chapter 40E-61, F.A.C., require EAA landowners, through the EAAEPD, to sponsor a program of BMP research, testing, and implementation that monitors the efficacy of BMPs in improving water quality. The findings are disseminated to the permittees so that they may take an adaptive management approach to making improvements to their operations from a water quality perspective. The master permit for BMP research, testing, and implementation is the mechanism through which the District implements research and outreach requirements. Meaningful findings that can be incorporated into agricultural practices are essential to meet and maintain the performance of BMPs. Findings are disseminated to the permittees through IFAS and District outreach efforts, primarily providing BMP implementation options for their consideration. The master permit is issued to the EAAEPD, and research is conducted by IFAS in Belle Glade. The last permit modification was approved in January 2010 and is valid for five years. The approved scope of work proposes to focus on the management of FAV. The main objectives of the research are to (1) evaluate the impact of alternate management practices for the control of FAV in EAA farm canals on permit-level TP load, and (2) develop improved BMP techniques for FAV management for use in the EAA. The activities under the EAAEPD master permit for WY2015 included data collection (water quality and quantity, sediment sampling, FAV sampling, etc.). The results were reported in the 2015 IFAS annual report (Daroub et al. 2015) and presented at the EAA Landowners annual meeting in July 2015. The report, as well as relevant information related to this permit is available on the District's e-permitting web site. An application to renew the current permit was received on April 20, 2015. The proposed scope is a continuation of the preceding 2010–2015 scope and contains both research and outreach components. A workshop to solicit public comment will be held on September 9, 2015, before the District can take final action on the application.
  - **Outreach.** BMP training workshops were conducted in September 2014 and April 2015 for growers in the EAA with a total of 175 participants. The April 2015 workshop was conducted in Spanish and attended by 67 participants. The presentations included topics pertinent to the EAA Basin, including updates provided by the District on BMP implementation requirements, site verification visits, basin compliance, etc. Feedback received via evaluations collected after training workshops was positive and was used to modify and improve future training topics, content, and speaker selections. The BMP workshop presentations are available at http://erec.ifas.ufl.edu/research/index_soil_and_water.shtml.
  - **Restoration Strategies Subregional Source Control Projects.** As part of the April 27, 2012, Restoration Strategies Regional Water Quality Plan (SFWMD

2012), the District is directed to build upon the success of the existing mandatory BMP regulatory program by focusing on subregional areas and projects with the greatest potential to further reduce phosphorus loads to the STAs. The existing regulatory program focuses on BMPs at the source, minimizing pollution leaving the permittee site (basin-ID level). Through the Restoration Strategies effort, the intent is to design subregional source control projects, primarily downstream of where BMPs are implemented, as a safety factor to further enhance the ability of the STAs to improve water quality. The S-5A subbasin within the EAA Basin was selected as a priority subbasin based on the inflow concentrations from Lake Okeechobee into the S-5A, the water quality of the permit-level discharges within the S-5A, the potential to affect the inflow to the STAs, and potential positive impact to the Arthur R. Marshall Loxahatchee National Wildlife Refuge. During WY2015, the District made progress on the following projects:

- **EBWCD Canal Cleaning BMP Demonstration and Implementation.** The District partnered with EBWCD to implement some of the BMP vegetation control concepts supported by IFAS research and simultaneously monitor water quality for trends. The three-year project started in WY2014 and, through the end of WY2015, approximately 10 miles of canals have been cleaned and water quality samples have been collected on 39 trips to 8 sites. Quarterly canal cleaning progress updates have been provided by EBWCD.
- **Conceptual Project Formulation.** Analysis of historical water quality and quantity data for areas with higher relative TP contributions was summarized to aid planning of future project efforts within the S-5A basin in relation to potential to reduce phosphorus loads. The District initiated discussion with stakeholder representatives of conceptual ideas for subregional source control projects.

Anticipated Activities

- **Permit-Level Compliance**
  - **BMP Regulatory Program.** Permit compliance activities are continuing, as necessary, to provide assurance that the BMP implementation criteria are consistently being met. The regulatory WOD program is the basis for complying with the water quality performance requirements established in the EFA and the Settlement Agreement, as well as maintaining the current levels of performance, which surpass original requirements, and are the basis for the Long-term Plan and the Restoration Strategies projects. Additionally, the operational nature of the BMPs implemented in the EAA further underscore the importance of training and communication to ensure continued BMP implementation.
  - **298 District and 715 Farms Diversion Projects.** The District's regulatory plan, which was filed with the Office of Fiscal and Regulatory Reform, has proposed amendments to Chapter 40E-63, F.A.C., as required by 120.74, F.S. Through a stakeholder public participation process, the District will develop the technical and regulatory details needed to meet regulatory requirements for these areas, while ensuring consistency with NEEPP-related Lake Okeechobee water quality goals.
- **BMP Research.** A workshop to solicit public comment will be held on September 9, 2015, before the District takes final action on the renewal application of the permit. As of August 2015, the EAAEPD is proposing continuation of their study of phosphorus loading from EAA farms and the impact of improved FAV and canal management practices. The proposed work plan includes activities to be conducted for a period of five years or until

conclusions have been reached, submitted, and accepted by the District. The final report summarizing the study results, conclusions, and recommendations for additional activities to be conducted during the 2018–2020 period will be submitted to the District in December 2017. The EAAEPD will also continue to sponsor BMP training workshops in addition to the following activities in Calendar Years 2015 and 2016: (1) sediment analyses for the eight farms will be conducted in November and April, (2) phosphorus-fraction analyses will be conducted on sediment samples [0–2.5 centimeters (cm)] for phosphorus species characterization, (3) biweekly sampling of ambient canal and drainage waters, (4) survey and composition analysis of FAV biomass every two months, (5) treatment farms will be inspected every two weeks and FAV will be spot sprayed for complete control of its growth, (6) two BMP training workshops, and (7) an annual report and presentation at the EAAEPD Landowners Annual Meeting in July 2015.

- **EBWCD BMP Demonstration Project.** A canal cleaning BMP demonstration and implementation project is planned to continue through 2016. The collected data will be analyzed to determine the effectiveness of enhanced BMP vegetation control concepts.
- **Subregional Source Control Projects.** Conceptual projects to be developed in conjunction with stakeholders will be evaluated to determine their potential water quality benefits. As projects are deemed feasible, contracts with willing participants for project design and implementation will be initiated.

C-139 BASIN UPDATE

C-139 Basin Source Control Strategy

Development of the C-139 Basin (**Figure 4-7**) source control strategy was modeled after the regulatory program in the EAA except that it initially allowed more flexible and less comprehensive BMP plans. Those plans were to be modified, incrementally increasing levels of BMP implementation through a system of BMP equivalent points, based on the compliance status with basin phosphorus load levels (targets and limits). BMP equivalent points are a regulatory tool used by the District to ensure a level playing field among permittees. Each Everglades WOD permit approves a BMP plan. The BMP plan includes operational programs or infrastructure enhancements designed to reduce phosphorus levels in discharges. 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. To accomplish these goals, a system of BMP "equivalents" was developed by assigning points to BMPs within three basic categories consisting of water management practices, nutrient management practices, and control of sediment and particulate matter. Points were originally based on the review of reports and publications produced by IFAS, on the best professional judgment of District staff, and extensive cooperative workshops conducted among affected landowners, consultants, and other interested stakeholders. At the time that the literature was reviewed, information suggested that certain practices could reduce phosphorus in discharges, thus providing the basis for their inclusion. The level of points within each of the categories gives an indication of relative performance. This approach was developed considering that both flow and concentration are targeted through a comprehensive plan. With these objectives in mind, the number of points assigned to each BMP was developed as a negotiated solution in a regulatory context. The BMP point system has proven successful in ensuring implementation of a consistent level of BMPs among permittees with different site conditions. The C-139 Basin was unable to meet the historical phosphorus load levels for the first four consecutive years from WY2003 through WY2006.

In 2007, basin-specific constraints were reconsidered. In order to address these challenges, the District conducted technical investigations that included water quality analyses, hydrology evaluations, and demonstration projects.

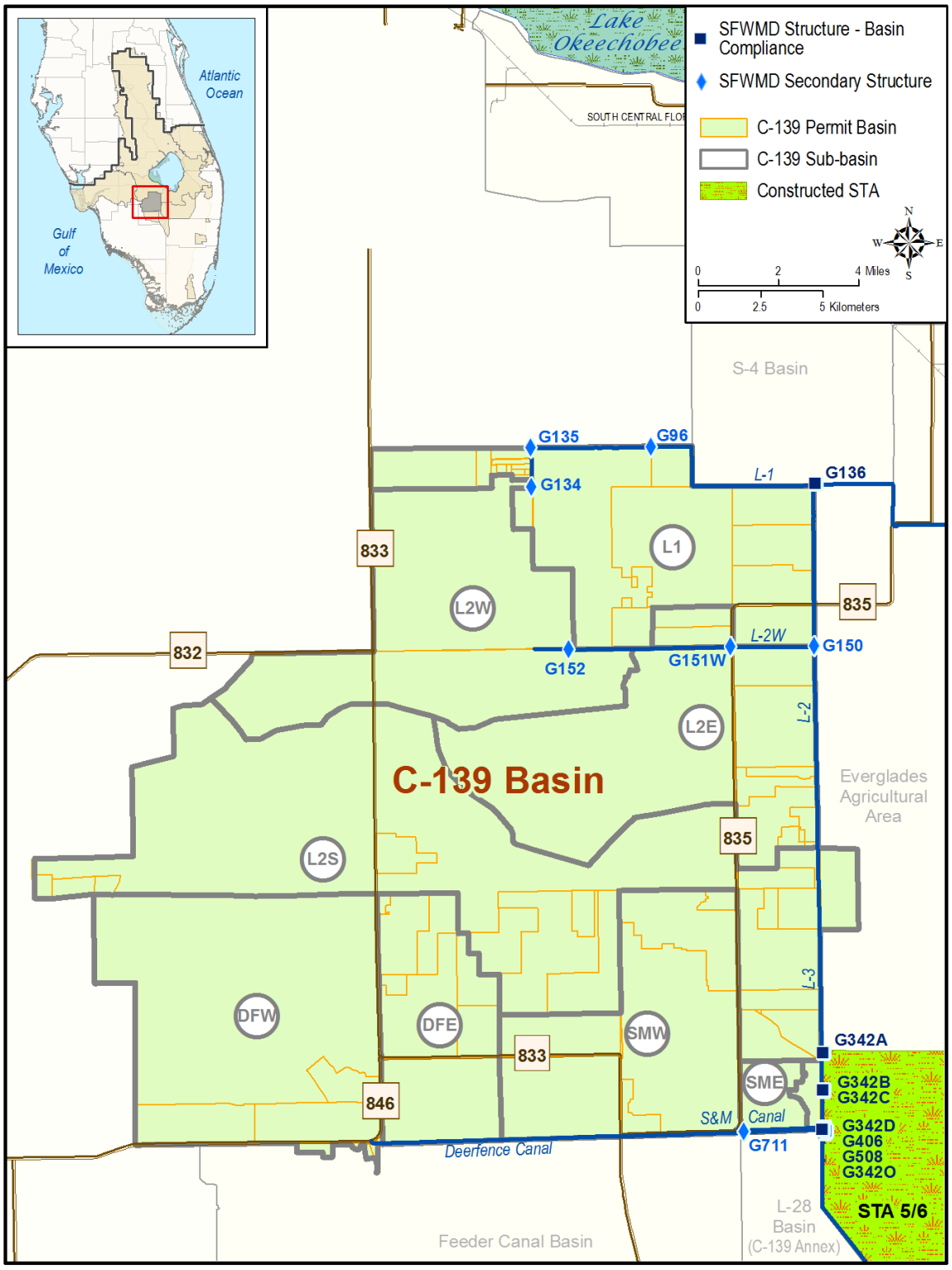

Figure 4-7. WY2015 C-139 Basin boundary and primary compliance water control structures. [Note: Structure G-151 was replaced by structure G-151W in the second half of 2014.]

The District has (1) cost-shared implementation of higher cost technologies, (2) improved the water quality monitoring network, (3) conducted integrated regulatory approaches with consumptive water use and stormwater management system permitting groups within the agency, (4) enhanced stakeholder interaction and outreach, and (5) utilized the Watershed Assessment Model (WAM) to evaluate the feasibility and TP reduction potential of BMPs and source control infrastructure projects.

The results from the activities conducted above and lessons learned from the regulatory program were incorporated into the rule (adopted on November 9, 2010) for a more comprehensive and effective program. The amended rule includes requirements for implementation of a comprehensive BMP plan, that is, includes all defined categories of BMPs (nutrient management, water management, and sediment controls) for all land uses, as applicable. A comprehensive BMP plan will serve to control the different types of phosphorus species (particulate or dissolved), sources, and off-site transport mechanisms. **Table 4-7** provides a chronology of BMP requirements, water quality-based performance measure determinations, and rule-mandated compliance actions. BMP requirements and compliance actions were implemented in accordance with the schedules. As can be seen in the table, water quality-based performance measures were met in only six of the 13 years that the program has been in place. These occurrences, however, were prior to the rule being amended in WY2011 to include more stringent comprehensive BMP plans. Although basin performance has been computed and reported annually since WY2003, WY2012 was the first water year of compliance determination under the amended rule.

In addition, the District continues to verify BMP implementation by conducting annual field inspections. The field inspections allow the District to discuss alternative BMP strategies and optimization of current BMP practices with permittees.

Because permittees in the C-139 Basin are not required to collect water quality and quantity data to characterize permit-level discharges, the water quality and quantity monitoring network for upstream areas will be used by the District to differentiate the relative contribution of the hydrologic subbasins within the C-139 Basin, the timing of releases, and phosphorus species. This information is crucial for developing effective source control strategies into the future. This subregional monitoring and data analysis will support water quality improvement activities as needed to achieve consistent compliance with the EFA requirements.

Representative monitoring locations for determining WY2015 TP load performance are shown in **Figure 4-7**. The C-139 Basin land use distribution from the most current District land use data set (2008–2009) is shown in **Table 4-3**. A District land use data set update (2011–2013) is currently in production, but is unavailable for the C-139 Basin at this time.

Table 4-7. WY2003–WY2015 C-139 Basin BMP implementation summary.

Compliance Water Year	BMP Level[a]	Met Performance	Compliance Action
WY2003	Initial Implementation of Level I – 15 points	No	Go to Level II Implementation
WY2004	Implement Level II – 15 points with BMP site verifications	No	Go to Level III Implementation
WY2005	Implement Level III – 25 points with BMP site verifications	No	Go to Level IV Implementation
WY2006	Implement Level IV – 35 points with BMP site verifications	No	Initiate Rule Development
WY2007	Continue Level IV	No	Continue Rule Development Process
WY2008	Continue Level IV	Yes	Continue Rule Development Process
WY2009	Continue Level IV	No	Continue Rule Development Process
WY2010	Continue Level IV	Yes	Continue Rule Development Process
WY2011	Comprehensive BMP Plan	Yes[b]	Initiate Comprehensive BMP Plans
WY2012	Comprehensive BMP Plan	Yes[b]	Comprehensive BMP Plans
WY2013	Comprehensive BMP Plan	Yes[c]	Comprehensive BMP Plans
WY2014	Comprehensive BMP Plan	Yes	Comprehensive BMP Plans
WY2015	Comprehensive BMP Plan	Yes	Comprehensive BMP Plans

a. Increasing BMP levels/points correspond to increased source control implementation

b. WY2011 and WY2012 performance is shown for reference only. Initial performance measure determination period under amended methodology set forth in amended Chapter 40E-63, F.A.C., is WY2013.

c. First water year of performance determination under amended Chapter 40E-63, F.A.C.

Water Year 2015 Phosphorus Results

Table 4-8 provides a summary of the C-139 Basin WY2015 results for the runoff and performance measure TP loads. The runoff load is based on flow and water quality data measured during the water year. The target load is the pre-BMP baseline period load predicted considering the current water year rainfall characteristics. The target load applies a base period regression model to the current water year rainfall characteristics to account for the hydrologic variability between WY2015 and the base period. The target load model was developed to meet the EFA requirement of maintaining pre-BMP baseline period loading rates. Therefore, the target load is the predicted load. The WY2015 runoff TP load discharged from the C-139 Basin was below the target load from the pre-BMP baseline period adjusted for rainfall. As with the EAA Basin, noncompliance with target loads is evaluated based on exceeding the target load for three consecutive years to verify a theoretical confidence level of 87.5 percent. The single-year limit load is calculated based on the 90th percentile confidence level of the target load. The limit load provides for a higher theoretical confidence level to verify noncompliance based on an exceedance in a single year. Details of target and limit load calculations and performance evaluation are provided in Appendix 4-1 of this volume and Chapter 40E-63, F.A.C.

Table 4-8. Results of WY2015 C-139 Basin TP compliance calculations.

	TP Load
Target (predicted) TP load (adjusted for WY2015 rainfall amounts and monthly distribution relative to the baseline period[a])	30 mt
Limit TP load (upper 90th percentile confidence level for target load)	69 mt
WY2015 runoff TP load from the C-139 Basin with full implementation of comprehensive BMP plans	27 mt

a. The baseline period of record is October 1978–September 1988 in accordance with EFA requirements. Under Chapter 40E-63, F.A.C. compliance is based on whole water year periods (May 1–April 30) that fall within the October 1978–September 1988 range, that is, WY1980–WY1988 (May 1, 1979–April 30, 1988).

Chapter 40E-63, F.A.C., allows for the option of a permit-level discharge monitoring plan to be considered as a secondary performance methodology should the C-139 Basin be determined to not meet overall load performance. None of the permits issued to date include an optional discharge monitoring plan; therefore, only C-139 Basin-level data are reported in this chapter.

Supplemental evaluation of the C-139 Basin data is presented in Appendix 4-1 of this volume. The supplemental evaluation includes performance calculation details, monitoring data, and a water quality summary, as well as a discussion of short-term and long-term variations in basin loads. Individual structure flows, related TP loads, and FWMCs are also presented as an aid to focus BMP source control efforts.

Table 4-9 summarizes data for all calculated water years. This table presents runoff and target (predicted) TP data and annual rainfall and flow measurements. The TP values presented in the table are attributable only to the C-139 Basin. **Figure 4-8** shows annual and five-year rolling average trends in TP loads and associated load targets since WY1980. Load targets from WY1980–WY2010 are based upon the equations adopted in January 2002, and load targets from WY2011 through present reflect amendments in November 2010 to Chapter 40E-63, F.A.C. The TP values presented in this figure are attributable only to the C-139 Basin.

Table 4-9. WY1980–WY2015 C-139 Basin TP measurements and calculations.

Water Year	Runoff TP Load[a] (mt)	Target TP Load[b] (mt)	Limit TP Load (mt)	Annual Rainfall (inches)[c]	Annual Flow (10^3 ac-ft)[c]	Baseline and BMP Status Timeline
1980	37	42	76	56.4	172	Baseline Period; Pre-BMP Period
1981	4	4	7	31.1	51	
1982	6	9	16	38.6	44	
1983	154	115	222	72	345	
1984	41	20	36	47.2	156	
1985	15	20	35	46.9	63	
1986	18	19	34	46.7	110	
1987	38	55	101	60.2	149	
1988	29	22	38	48	94	
1989	15	11	20	40.7	73	
1990	6	10	18	39.6	46	
1991	5	21	37	47.5	45	
1992	13	28	50	51	100	
1993	27	39	71	55.5	137	
1994	23	30	54	52	137	
1995	65	54	98	59.8	272	
1996	48	55	101	60.1	236	
1997	46	40	72	55.7	165	
1998	36	43	77	56.6	170	
1999	36	30	53	51.4	136	
2000	52	36	65	54.4	202	
2001	17	6	12	35.6	57	
2002	66	36	64	53.5	200	
2003	76	39	70	54.6	224	Increasing BMP Implementation Refer to Table 4-7
2004	69	25	45	49.1	204	
2005	41	27	48	50	168	
2006	107	35	62	54.8	333	
2007	29	7	13	36.2	77	
2008	5	12	22	41.6	39	
2009	52	14	25	43	165	
2010	43	54	98	59.8	202	
2011	20	13	31	41	106	
2012	15	32	74	44.5	78	40E-63[d]
2013	10	22	55	49.9	73	
2014	28	17	41	46.5	127	
2015	27	30	69	49.5	107	

a. TP values attributable only to the C-139 Basin.
b. Target (predicted) TP load represents the baseline period load adjusted for rainfall variability. For WY1980–WY2010, Rule 40E-63, F.A.C., January 2002, and for WY2011–current, Amended Rule 40E 63, F.A.C., November 2010.
c. 1 inch = 2.54 centimeters; 103 ac-ft = thousands of acre-feet; 1 acre-foot = 1,233.5 cubic meters; and 1 microgram per liter (µg/L) = 1 part per billion (ppb).
d. C-139 Basin compliance determinations under Chapter 40E-63, F.A.C.:
- WY2003 first compliance determination as adopted January 2002.
- WY2012 first compliance determination as amended November 2010.

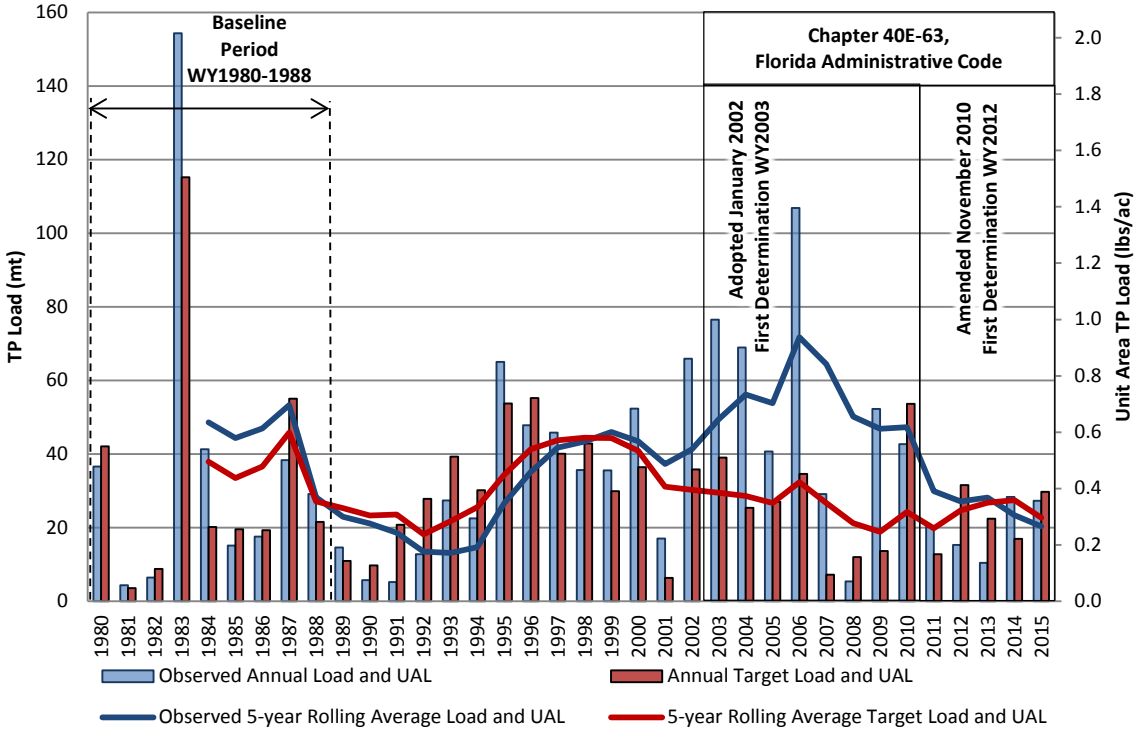

Figure 4-8. WY1980–WY2015 C-139 Basin runoff and target annual TP load and UAL and five-year rolling averages.

C-139 Basin Source Control Activities

Water Year 2015 Activities

During WY2015, the District implemented the ongoing EFA-mandated regulatory BMP program and made progress on supplemental projects as listed below.

- **Permit-Level Compliance**
  - **BMP Regulatory Compliance Program.** At the end of WY2015, 163,693 acres (29 permits) were under WOD phosphorus control permits in the C-139 Basin. On-site BMP verifications covering 99 percent (161,978 acres) of the basin were conducted in WY2015. Additionally, the District provided a BMP training session on May 19, 2015, to the C-139 Basin permittees. This training was provided to assist them in satisfying BMP training requirements of Rule 40E-63.435(4), F.A.C., or to supplement their existing training programs.
  - **C-139 Basin Monitoring Network.** Eight automatic sampling stations collecting TP concentration and flow data were installed in the C-139 Basin to represent runoff from the subregions identified in the November 2010 revisions to Chapter 40E-63, F.A.C. Monitoring changes to improve the data collection process were implemented at two of the sites during WY2015. Monitoring changes and WY2015 phosphorus load calculations for the C-139 subbasins are summarized in Appendix 4-1 of this volume.

Anticipated Activities

Through the rule amendment process, post-permit compliance activities and other supplementary projects that have encouraged awareness, the C-139 Basin has been overcoming the lag between source control implementation and achieving TP loading performance levels. Planned activities for the upcoming year include the following:

- **Post-permit Compliance Activities.** BMP site verifications are an essential component of the program to ensure long-term compliance through consistent and thorough implementation of comprehensive BMP Plans. Site inspections will focus on the lessons learned during program implementation as well as technical findings on water quality analysis, hydrology, and modeling.
- **Funding of BMP Demonstration Projects.** Based on funding availability, the direction continues to be toward providing incentives to spearhead landowner-driven BMP demonstration projects to improve effectiveness. It is the intent to maximize the use of funds available for the greatest basinwide benefits.
- **Data Collection.** As part of monitoring initiatives, the District plans to resume in WY2016 its C-139 Basin Upstream Synoptic Monitoring (C139B) Project, which was suspended at the end of 2012. The goal of the project is to develop a better understanding of upstream contributions and program effectiveness, and to assist with focused remedial action when necessary.

C-51 WEST BASIN UPDATE

This section discusses source control efforts in the C-51 West Basin. The basin is located in east-central Palm Beach County. While a portion of stormwater runoff from this basin is discharged to tide through the S-155A structure via the C-51 East Basin, stormwater runoff is also discharged directly to STA-1 East (STA-1E) via the S-319 structure, or to STA-1 West (STA-1W) via an adjacent basin. The Pine Tree Water Control District (PTWCD), a.k.a. Rustic Ranches, is a subbasin of the C-51 West Basin and discharges directly into STA-1E via the STA's seepage canal and the S-361 structure. The PTWCD is located within the boundaries of the Village of Wellington (VOW). Also, the VOW Acme Improvement District is a subbasin of the C-51 West Basin; further background information on this subbasin are available in previous SFERs.

C-51 West Basin Source Control Strategies and Activities

The District monitors water quality in the C-51 West Basin to ensure phosphorus loads generated within this basin do not affect the performance of STA-1W and STA-1E. The water quality monitoring programs include monitoring of TP concentration and flows at discharge locations to the C-51 West Canal, as required by the VOW Acme Improvement District's ERP, and upstream monitoring associated with the VOW's phosphorus source control programs. Appendix 4-2 of this volume includes a summary of TP concentration data for the VOW Acme Improvement District. The PTWCD's ERP issued in January 2010 also requires monitoring of TP concentration at the discharge locations to the STA-1E seepage canal.

In addition to its upstream water quality monitoring program, the VOW has been administering numerous phosphorus source control activities within the Acme Improvement District since WY1998 and within the PTWCD since WY2012. These activities, which include enforcement of VOW-enacted phosphorus source control ordinances regulating equestrian activities within these subbasins, remain ongoing.

The District will continue to monitor water quality from the C-51 West Basin and develop future strategies as necessary based on results.

FUTURE DIRECTIONS FOR THE ECP BASINS

District activities as described above will continue in the ECP basins, including BMP site verifications, water quality monitoring, research and demonstration projects, and subregional projects as outlined in the Restoration Strategies Regional Water Quality Plan (SFWMD 2012).

STATUS OF SOURCE CONTROL IN THE NON-ECP BASINS

Steve Sarley, Youchao Wang and Carlos Adorisio

Contributor: Cordella Miessau

BACKGROUND

The five basins that discharge directly to the EPA and are not part of the ECP are referred to as Non-ECP basins. Four of these basins have discharge structures that are operated and maintained by the District and are permitted by FDEP under the Non-ECP permit (FDEP Permit Number 06, 502590709). These discharge structures (and basins) are the S-9 and S-9A (C-11 West), S-190 (Feeder Canal), S-140 (L-28), and S-18C and S-332D (C-111). The NSID basin is a Non-ECP basin capable of discharging directly to the EPA through a pump structure (NSID1) owned and operated by NSID, formed pursuant to the provisions of Chapter 298, F.S. The location of the Non-ECP basins and the associated structures that discharge into the EPA are depicted in **Figure 4-9**.

As required by the EFA, these basins have adhered to source control programs and water quality monitoring since WY1998. Specifically, the Non-ECP permit requires the implementation of basin-specific WQIPs to ensure progress toward achieving established water quality standards in discharges from each of the Non-ECP basins. The WQIPs are consistent with the EFA and are outlined in the Long-Term Plan (Burns and McDonnell 2003), its amendments, and the Restoration Strategies Regional Water Quality Plan (SFWMD 2012). The WQIPs include the following source control strategies: (1) BMPs, (2) training and educational initiatives, (3) cooperative agreements, (4) modification of stormwater management system permits to include water quality and operational criteria, (5) basin-specific regulatory programs, and (6) full integration with ongoing and future Comprehensive Everglades Restoration Plan (CERP) and other District and local construction projects.

Also as required by the EFA, the District submitted a long-term compliance permit application to FDEP in December 2003 that included the 2003 Long-Term Plan. Although the long-term compliance permit has not yet been issued, the EFA requires the District to implement the Long-Term Plan, its amendments, and the Restoration Strategies Regional Water Quality Plan (SFWMD 2012). The District continues to implement the WQIPs for these basins.

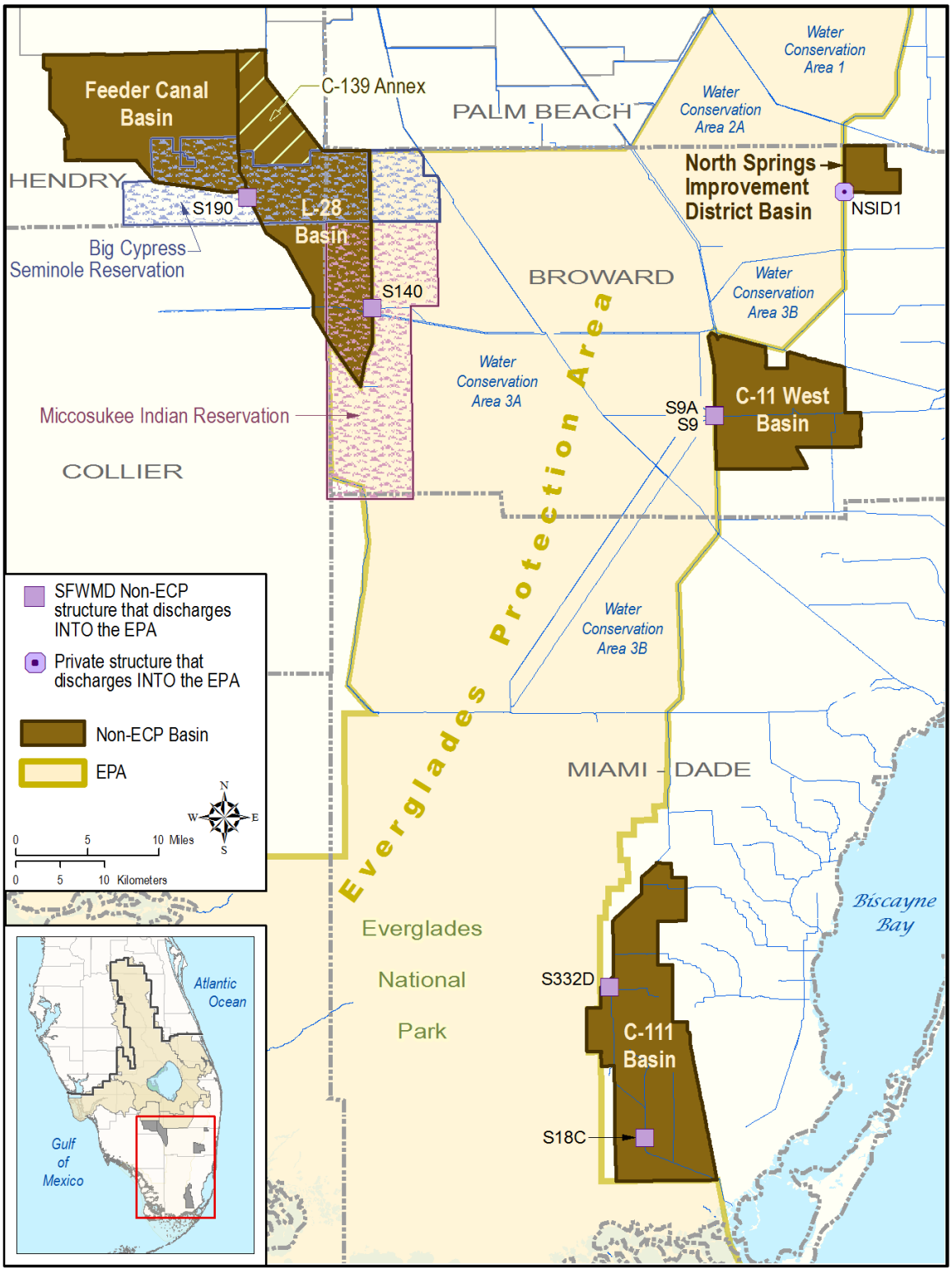

Figure 4-9. The Non-ECP basins and structures discharging into the EPA.

WATER QUALITY SUMMARIES

The water quality of Non-ECP basin discharges is monitored to track the success of the WQIPs in each basin with regard to achieving established water quality standards. The distribution of loads from the Non-ECP basins to the EPA by water year is presented in **Figure 4-10**. A total TP load of 18 mt was discharged to the EPA from the Non-ECP basin structures during WY2015 including 1 mt from the C-111 Basin, 5 mt from the Feeder Canal Basin, 10 mt from the L-28 Basin, and 2 mt from the C-11 West Basin. The NSID basin did not discharge to the EPA during WY2015. Appendix 4-2 of this volume provides additional information on TP loads discharged to the EPA from the Non-ECP basins. It should be noted that the C-11 West and C-111 TP loads presented above only represent the TP loads to the EPA and not their discharges to tide. In addition, TP concentration results reported as part of the federal Everglades Settlement Agreement (Settlement Agreement dated July 26, 1991, Case Number 88-1886-CIV-MORENO, United States District Court for the Southern District of Florida, as modified by the Omnibus Order entered in the case on April 27, 2001) for the C-111 Basin discharges are available at www.sfwmd.gov/techpubs, under *Settlement Agreement and Companion Reports*.

SOURCE CONTROL STRATEGIES AND ACTIVITIES

During WY2015, the source control strategies for each of the non-ECP basins continued as summarized below. Additional details on these strategies are available in previous SFERs.

Feeder Canal Basin

Water Year 2015 Activities

- **Basin-Level Compliance**
  - **Rulemaking.** The Long-Term Plan relies on initiation of rulemaking for implementation of a mandatory source control program in this basin should the TP concentration in discharges not achieve a 50 µg/L level. The TP concentration level in discharges from this basin for WY2015 was 108 µg/L (see Appendix 4-2). The District continued to track water quality trends in WY2015 and consider alternatives for implementing source controls such as incentive-based and regulatory programs. The long-term compliance permit renewal application under review by FDEP may have a bearing on the selected alternative.
- **Permit-Level Compliance**
  - **North Feeder Canal Subbasin.** The Long-Term Plan relies on compliance with the 1996 landowners' agreement between McDaniel Ranch and the Seminole Tribe, which mandates the continued implementation of BMPs on the McDaniel Ranch and meeting a 50 µg/L TP concentration target in stormwater discharges. The agreement has been incorporated into conditions of applicable ERP permits. The TP level in discharges from this subbasin for WY2015 was 228 µg/L (see Appendix 4-2). The landowners implemented comprehensive BMP plans as conditions of their ERP and in WY2015 started a two-year pilot study associated with the operation of the shared surface water management system. The pilot study objectives are to optimize operation and ensure no potential impacts on water quality.

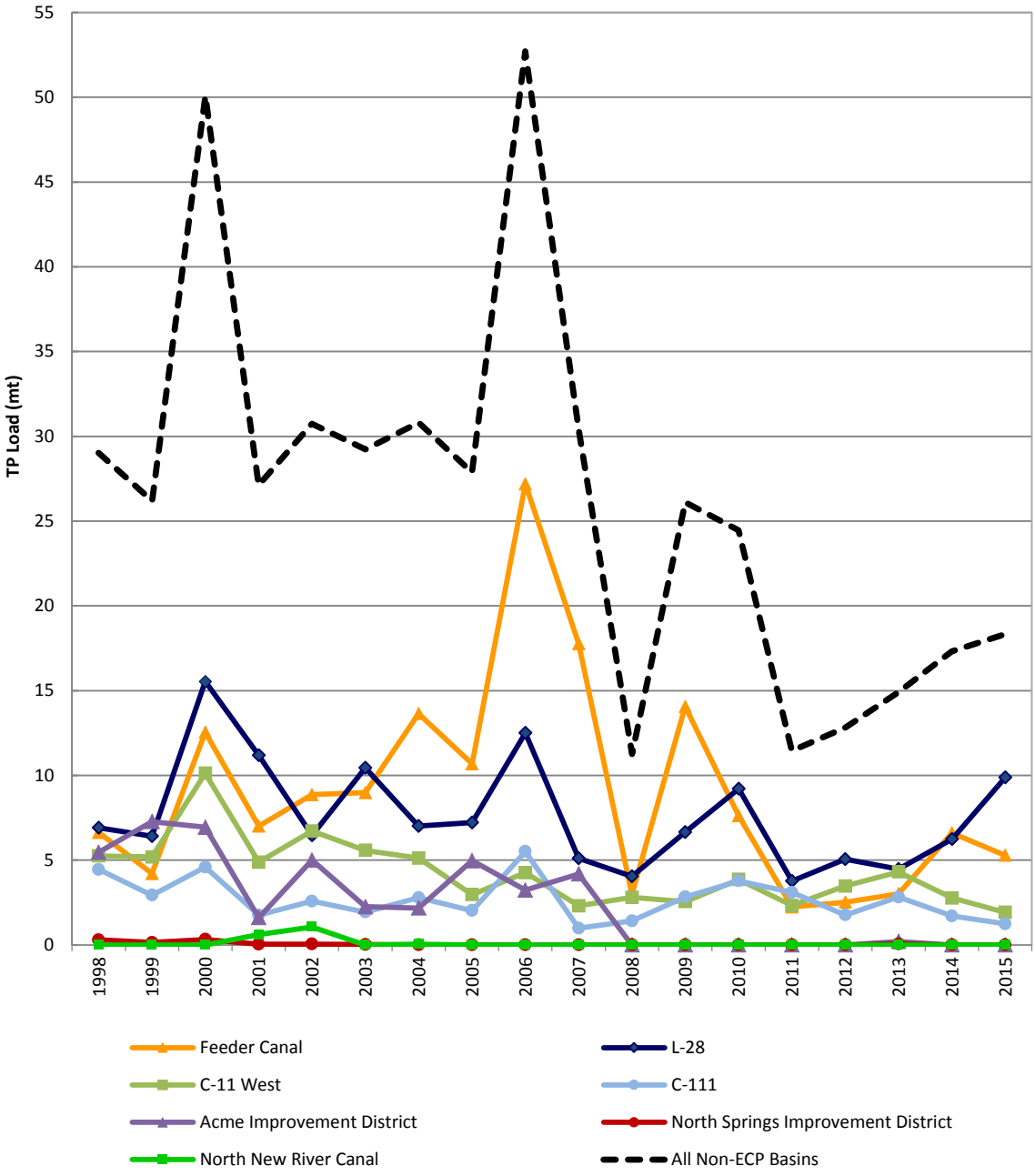

Figure 4-10. Non-ECP basin TP load into the EPA for WY1998–WY2015. [Notes: Acme Improvement District Basin discharges have been diverted to C-51 West Canal since December 2006; however, 0.2 mt of TP load discharged to the EPA in WY2013 as a result of flood protection measures associated with Tropical Storm Isaac. North New River Canal Basin has not discharged to the EPA since WY2004 and pumps were removed circa 2008.]

- **West Feeder Canal Subbasin.** The Long-Term Plan relies on implementation of BMPs and water quality requirements through ERP conditions to achieve the 50 µg/L TP concentration level for this subbasin. The TP concentration level in discharges from this subbasin for WY2015 was 47 µg/L (see Appendix 4-2). Not all properties within the subbasin are required to have an ERP. In those cases, the District is working cooperatively with landowners to improve water quality through existing requirements under permits and agreements.

- **Integration with Other District and Federal Projects**
  - **Western Basins Water Resources Evaluation Project.** The Western Basins Water Resources Evaluation Phase I provides the foundation for a broader evaluation of possible hydrologic and water quality improvements for the entire Western Basins area including potential future CERP features or projects. The focus of this work is concentrated on characterizing and potentially improving hydrology and water quality (TP concentrations and/or loads) in the upstream flows entering the West Feeder and North Feeder canals consistent with the intent of CERP projects and in parallel with the EFA. The first phase of the project was initiated in May 2015 and is anticipated to be completed in July 2016. The final deliverable will consist of a comprehensive basin watershed management plan that meets the United States Environmental Protection Agency's (USEPA) nine-point criteria for an effective nonpoint source management program and watershed plan (USEPA 2008). The management plan should enable the District to qualify for available Clean Water Act Section 319 grant funding for the identified management measures. The proposed management measures will be part of the District "toolbox" of Everglades restoration strategies for the Western Basins.
  - **Seminole Tribe Water Conservation Plan Project.** This project, being constructed by the United States Army Corps of Engineers (USACE), is sponsored by the Seminole Tribe of Florida and is one of the local projects the Long-Term Plan relies on to improve water quality in discharges from the Big Cypress Seminole Reservation into the North Feeder and West Feeder canals. The project is designed to improve water quality, restore wetland hydrology, increase water storage capacity, and enhance flood protection within the Big Cypress Seminole Reservation. Basins 1, 2, and 4 were completed in August 2008, November 2015, and August 2013, respectively. Construction of Basin 3 is on hold until further notice.
  - **Big Cypress/L-28 Interceptor Modifications CERP Project.** The Long-Term Plan relies on implementation of this project to improve hydrologic conditions in the western Everglades. Conceptually, the project would provide for additional storage and allow discharges from the basin to pass as sheetflow into the L-28 Gap Basin prior to discharge into the EPA (see http://141.232.10.32/pm/projects/proj_10_big_cypress.aspx).

Anticipated Activities

- **North Feeder Canal Subbasin.** The District will continue working with area owners to improve water quality in discharges through existing permits and the landowner agreement. The District plans to verify the ongoing BMP implementation in all areas of this subbasin and evaluate water quality data to identify opportunities for improvement. It is anticipated that the implementation of a two-year pilot study will be initiated.

L-28 Basin

Water Year 2015 Activities

- **Permit-Level Compliance**
  - **C-139 Annex Subbasin:** The C-139 Annex property (17,918-acres) was a citrus grove that was purchased by the District in October 2010, and leased back to the previous landowner (Southern Garden Groves Corporation). The lease was amended in April 2013 to include only 9,148 acres of remaining citrus groves where Southern Garden Groves Corporation continued implementing BMPs during WY2015. The other 8,770 acres include abandoned citrus groves, stormwater management areas, and natural areas. 5,444 acres of the 8,770 acres are currently controlled by the District, while 3,326 acres are still under the control of Southern Garden Groves Corporation. The entire property continues discharging via the USSO structure to the L-28 borrow canal and ultimately to the Miccosukee Federal Indian Reservation (Alligator Alley Reservation) area via the S-140 structure within Water Conservation Area (WCA-) 3A. The TP concentration level in discharges from this subbasin for WY2015 was 139 µg/L (see Appendix 4-2).
- **Integration with Other District and Federal Projects**
  - **C-139 Flow Equalization Basin and Restoration Plan:** The April 2012 Restoration Strategies Regional Water Quality Plan (SFWMD 2012) included two projects within this property: (1) a 2,800-acre flow equalization basin (FEB) on the northern portion of the property that will receive flows from the C-139 Basin for detention prior to being discharged to STA-5/6 for water quality treatment; and (2) a restoration plan for the southern portion of the property that will restore historical Everglades hydrologic conditions to the greatest extent possible. The restoration project for the southern portion is no longer part of a Restoration Strategies Program; however, the project, now known as the Sam Jones/Abiaki Prairie, is being conducted as mitigation for wetland impacts associated with Lake Belt mining in Miami-Dade County, consistent with the goals of the Restoration Strategies Program. Additional information on these projects is presented in the Restoration Strategies Regional Water Quality Plan (SFWMD 2012) and in Chapter 5A of this volume. The design phase of the FEB is expected to start in 2019, with construction expected to be completed by 2024. Phase I restoration of the Sam Jones/Abiaki Prairie started in July 2014 and includes 3,449 acres. Phase II restoration of the Sam Jones/Abiaki Prairie is expected to start in July 2018 when the lease with Southern Garden Groves Corporation ends and the remaining 9,148 acres of citrus groves are removed. The C-139 Annex is also part of the Western Basins Water Resources Evaluation Project described above.
  - **Miccosukee Tribe Water Management Plan Project.** The Miccosukee Tribe of Indians of Florida is the local sponsor for this CERP Project. The 2003 Long-Term Plan recommended the accelerated completion of the Miccosukee Water Management Plan by 2010; however, as of August 2015, funding for this project had not been authorized. The project includes construction of a 900-acre managed wetland within the Miccosukee Federal Indian Reservation (Alligator Alley Reservation) and will be designed to accommodate flows and loads from reservation lands only (for more information on this project see http://141.232.10.32/pm/projects/proj_90_miccosukee.aspx).
  - **Seminole Tribe Water Conservation Plan Project.** The Seminole Tribe is the local sponsor for this project. The basic nature of the overall plan on the Big

Cypress Reservation was originally defined in a February 6, 1995, Conceptual Water Conservation System Design, prepared for the Seminole Tribe of Florida by AMS Engineering and Environmental of Punta Gorda, Florida (AMS Engineering and Environmental 1995). This document suggested the development of three water resource areas (WRAs) within that portion of the Big Cypress Reservation lying in the L-28 Basin. Those areas (WRA-5, WRA-6, and WRA-7) were intended to treat the runoff from reservation lands. The 2003 Long-Term Plan recommended modification of the plan to convert WRA-7 to an STA by 2010 at a cost of approximately $20 million; however, as of August 2015, this modification had not been authorized.

- **L-28 Weir Demonstration Project.** The Miccosukee Tribe of Indians of Florida, in cooperation with the District, designed and constructed this demonstration project, which was completed in September 2009. Results of the demonstration project are on track to be evaluated by the Tribe and the District through 2015 to assess the hydrologic and environmental changes that result from the weir construction and hydroperiod enhancements. The associated report and details will be available upon evaluation of the final results.

C-111 Basin

Water Year 2015 Activities

- **Integration with Other District and Federal Projects**
  - **C-111 South Dade Project.** The District and USACE amended the cost-share agreement for the C-111 South Dade Project in August 2014. Among the provisions, the amended agreement will enable construction of the North Detention Area and plugging the L-31W Canal (Contracts 8 and 9). The USACE plans to initiate construction of the North Detention Area in September 2015 and complete construction by March 2017. USACE expects to complete plans and specifications for plugging the L-31W Canal in December 2015 and begin construction in October 2016.

Broward County C-11 West and North Springs Improvement District Basins

Water Year 2015 Activities

- **Basin-Level Compliance**
  - **NSID ERP Requirements.** In 2009, the District issued a modified ERP to NSID requiring implementation of a BMP plan to improve upstream water quality within the basin through public outreach and NSID's surface water management permit requirements and operational changes at the NSID1 pump station to allow discharges to the EPA only after significant rainfall event. The ERP also required water quality monitoring. These requirements continued through WY2015 and no discharges to the EPA were necessary.
- **Outreach and Integration with Other District and Federal Projects**
  - **Public Outreach and Education:** Links to the District's Everglades (www.sfwmd.gov/everglades/) and water conservation (www.sfwmd.gov/watersip/) information web sites and Broward County's NatureScape website (www.broward.org/NaturalResources/NatureScape/) continue to be provided on the web sites of most Broward County stakeholders.

- **Broward County Water Preserve Area CERP Project.** The Long-Term Plan relies on implementation of this project, which is expected to significantly reduce flows to WCA-3A and consequently reduce the C-11 West TP load to WCA-3A. The project was authorized in the Water Resources Reform and Development Act of 2014 and the C-11 impoundment is currently under design. For more details on this project, see http://141.232.10.32/pm/projects/proj_45_broward_wpa.aspx.
- **Hillsboro Site 1 Impoundment (Fran Reich Preserve) CERP Project.** The Long-Term Plan relies on implementation of this project, which is expected to significantly enhance the capacity of the Hillsboro Canal to receive runoff after storm events and consequently reduce the need for NSID to discharge to the EPA. Phase I construction of this project started in 2012 and is expected to be completed in 2015. Implementation of Phase II construction activities is pending additional congressional authorization. For more details on this project, see http://141.232.10.32/pm/projects/proj_40_site_1_impoundment.aspx.

FUTURE DIRECTIONS FOR NON-ECP BASINS

Consistent with the EFA, the District will continue to track WQIP implementation and work cooperatively with local governments, the Seminole Tribe of Florida, the Miccosukee Tribe of Indians of Florida, and other state and federal agencies to ensure essential components of the WQIPs are completed as scheduled. Because the schedules of some CERP and other local construction projects have changed as a result of resource constraints, the Long-Term Plan does not reflect the new schedules. The District will work with the FDEP to ensure these changes are incorporated in the long-term compliance permit. This permit, when issued, is expected to supersede the Non-ECP permit and may establish additional compliance requirements for the Non-ECP basins.

OVERVIEW OF NORTHERN EVERGLADES SOURCE CONTROL PROGRAMS

Jeffrey Iudicello, Steffany Olson and Pamela Wade

Contributor: Lacramioara Ursu

In the Northern Everglades and Estuaries Protection Program (NEEPP) statute, the legislature found that the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds are critical water resources; that watershed changes have resulted in adverse changes to the hydrology and water quality of Lake Okeechobee, and the Caloosahatchee and St. Lucie rivers and their estuaries; and that improvement to the hydrology, water quality, and associated aquatic habitats within the watersheds is essential to the protection of the Greater Everglades ecosystem. Many of these same conclusions were echoed more recently in a comprehensive water resources study of the Lake Okeechobee Watershed (UFWI 2015). To address these issues, the NEEPP includes a phased, comprehensive, and innovative protection program composed of integrated approaches such as source control programs, construction projects, and research and water quality monitoring programs.

This chapter contains the annual progress report for the District's Lake Okeechobee, Caloosahatchee and St. Lucie River watershed source control programs. Discharge data for phosphorus and nitrogen, as applicable, in runoff from the Northern Everglades subwatersheds up to WY2015 are provided in this section. Supplemental data, including information on the Lake

Okeechobee Watershed Assessment (LOWA) upstream monitoring network, land use maps, and other supporting information is provided in Appendix 4-3 of this volume. Pursuant to the NEEPP, specified components of the watershed protection plans must be evaluated every three years and any needed modifications identified. The most recent three-year river watershed protection plan updates are presented in the 2015 SFER – Volume I, Chapter 10 (Buzzelli et al. 2015), while the most recent three-year update of the Lake Okeechobee Watershed Protection Plan was presented in Chapter 8 of the 2014 SFER (Bertolotti et al. 2014). Additional information on Lake Okeechobee and the river watersheds are covered in Chapters 8 and 10 of this volume, respectively.

The District, FDEP, and FDACS (the coordinating agencies) are directed by the NEEPP to implement pollution control programs that are designed to be multifaceted approaches to reducing pollutant loads to the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The pollutants of concern in the Northern Everglades are phosphorus in the Lake Okeechobee Watershed and both phosphorus and nitrogen in the river watersheds. The programs include implementation of regulations and BMPs, development and implementation of improved BMPs, improvement and restoration of the hydrologic function of natural and managed systems, and utilization of alternative technologies for pollutant reduction.

The coordinating agencies perform their responsibilities in concert, through an interagency memorandum of understanding (MOU), which was updated in April 2011 and will be revisited in light of FDEP's overarching authority in Northern Everglades restoration through the development and implementation of BMAPs. The MOU establishes the role of each agency in accordance with the statutory authority of the NEEPP. **Table 4-10** identifies the coordinating agency (or other entity), program name, and type of programs (non-point or point) in place or being developed to address nutrients in the Northern Everglades. All programs listed are ongoing except for the Dairy remediation projects and Best Available Technologies Project, which were both completed in 2008. The success of the nutrient control strategies is dependent upon a comprehensive source control approach and consistency in program application between watersheds while factoring in the unique needs and characteristics of each region.

Table 4-10. Nutrient control programs within the Northern Everglades.

Lead Agency	Program[1]	Non-Point	Point
SFWMD	WOD BMP Program[2] – Chapter 40E-61, F.A.C.	√	√
	ERP Program – Chapter 373, F.S., Part IV	√	
	Dairy remediation projects[3]		√
	Dairy Best Available Technologies Project[3]		√
FDACS	Agricultural BMP Program – Chapter 5M-3, F.A.C.	√	
	Animal Manure Application – Chapter 5M-3, F.A.C.	√	
	Urban Turf Fertilizer Rule – Chapter 5E-1, F.A.C.	√	
FDEP	Dairy Rule/Confined Animal Feeding Operation (CAFO) – Chapter 62-670, F.A.C.		√
	Environmental Resource Permitting Program – Chapter 373, F.S. Part IV	√	
	Stormwater Infrastructure Updates and Master Planning – Chapter 187, F.S.	√	
	Municipal Separate Storm Sewer System Permit Program – Chapter 62-624, F.A.C.		√
	Comprehensive Planning – Land Development Regulations – Chapter 163, F.S. Part II	√	
	Biosolids Rule – Chapter 62-640, F.A.C.	√	
FDOH[d]	Application of Septage – Section 373.4595, F.S.	√	
IFAS	Florida-Friendly Landscaping™ Program – Section 373.185, F.S.	√	

a. Applicable to all three watersheds except where noted in the other footnotes below.
b. The rule currently applies to the Lake Okeechobee Watershed. However, as directed by NEEPP, the rule will be amended to include the river watersheds.
c. Applicable only to the Lake Okeechobee Watershed.
d. Florida Department of Health
[4] Partially funded by the FDEP.

While nutrient control programs within the Northern Everglades include point and nonpoint source control programs by the coordinating agencies, the focus of this chapter is implementation of source control BMP programs by the District in the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. Regulatory source control programs have historically been demonstrated as the foundation for cost-effective strategies for reducing nutrient loads in runoff. An effective source control program can substantially reduce the magnitude and cost of regional construction projects. For example, based on the 20 years of implementation of the regulatory source control program in the EAA and C-139 basins, more than half of the TP that would have otherwise entered the District construction projects was prevented at a District program implementation cost of less than $5 per pound of TP. Alternatively, removing this TP may have required expanding the capacity of regional construction projects at a higher cost.

The District's existing WOD program under Chapter 40E-61, F.A.C., was in place in 1989 prior to establishment of the NEEPP and ensures that the use of or connection to the works or lands specified within SFWMD's boundaries are compatible with the District's ability to carry out the water quality objectives of the legislative declarations. WOD permits protect District works by approving a mandatory BMP plan that controls nutrients in discharges from all existing and proposed land uses so that water quality-based limits can be met in downstream receiving bodies. The WOD permits provide reasonable assurance through permit conditions that include deadlines for BMP implementation, water quality monitoring, and reporting. The rule defines the WOD as "canals, water control structures, rights-of-way, lakes and streams and other water resources for which the District has responsibility or owns." When considering the watershed restoration activities, it must be acknowledged that the Kissimmee River, Lake Okeechobee, the St. Lucie River and Estuary, the Caloosahatchee River and Estuary, and the Southern Everglades are an interconnected system such that the impacts to any one area within the overall system, such as the upstream tributaries may affect areas downstream. This interconnection was exemplified during WY2015 when 41 percent of the phosphorus loading from ECP basins to the STAs and downstream tributaries was associated with Lake Okeechobee pass-through flows.

Chapter 40E-61, F.A.C., post-permit compliance activities include water quality monitoring, prioritizing areas of water quality concern, inspections to verify compliance with permit conditions, and providing incentives to users of WOD to implement additional water quality improvement activities. The majority of the Chapter 40E-61, F.A.C., WOD permits renew automatically every three years unless the District notifies the permittee otherwise. The only exception is the Management Plan Master Permit for which the permittees south of Lake Okeechobee in the EAA and S-4 basins must apply for renewal of the permit every five years for their discharges going to Lake Okeechobee. Chapter 40E-61, F.A.C., includes water quality monitoring requirements at the parcel level. Subsequent to the adoption of Chapter 40E-61, F.A.C., the NEEPP directed that the coordinating agencies develop BMPs and programs that complement the existing regulatory programs and specify how those BMPs will be implemented and verified.

Refinements to Chapter 40E-61, F.A.C., were anticipated to incorporate the supplemental requirements under the NEEPP to modify the geographic boundary affected by the WOD program through the inclusion of the Upper Kissimmee Basin, Lake Istokpoga Basin, Caloosahatchee River Watershed, and St. Lucie River Watershed (**Figure 4-11**), and to address the nutrients of concern for the river watersheds, which may include nitrogen as well as phosphorus. The Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds are presented in **Figures 4-12** through **4-14**, respectively. Subsequently, with the adoption of BMAPs and the revised agency roles under the BMAP regulatory framework, the anticipated refinements to the WOD program are undefined at this time.

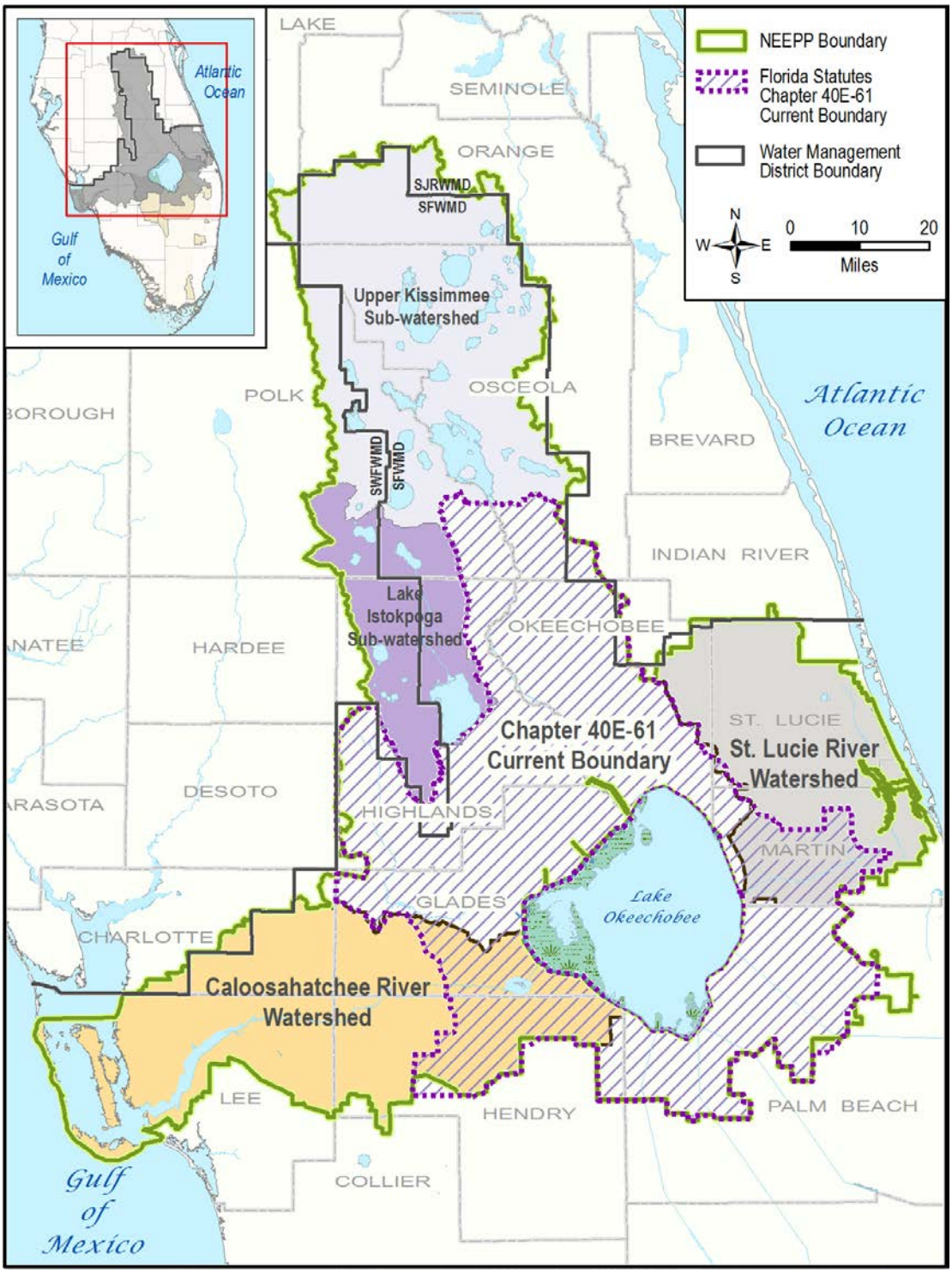

Figure 4-11. Boundary changes resulting from NEEPP.
[Note: SJRWMD – St. John's River Water Management District and SWFWMD – Southwest Florida Water Management District.]

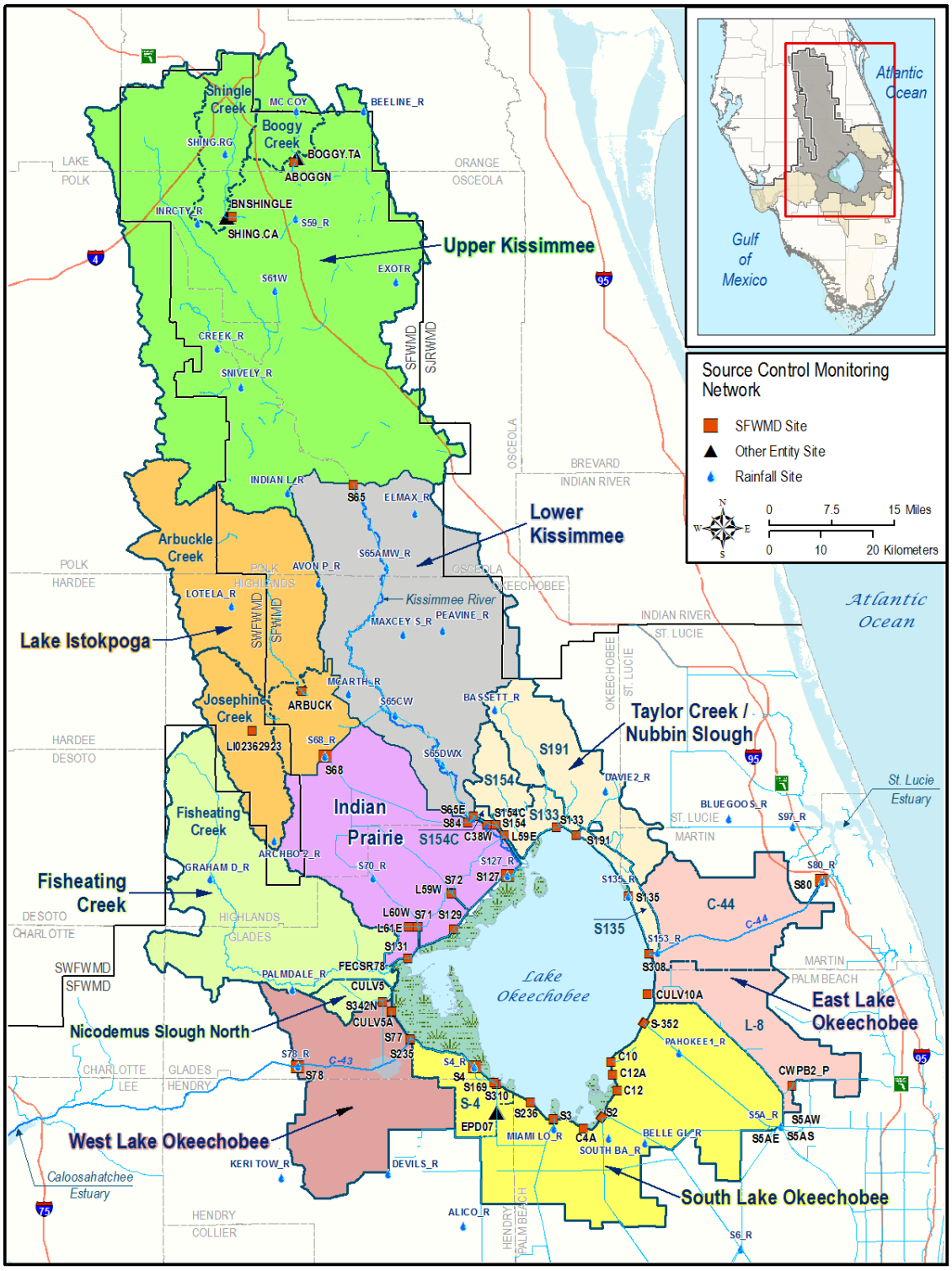

Figure 4-12. Lake Okeechobee Watershed source control program implementation area.

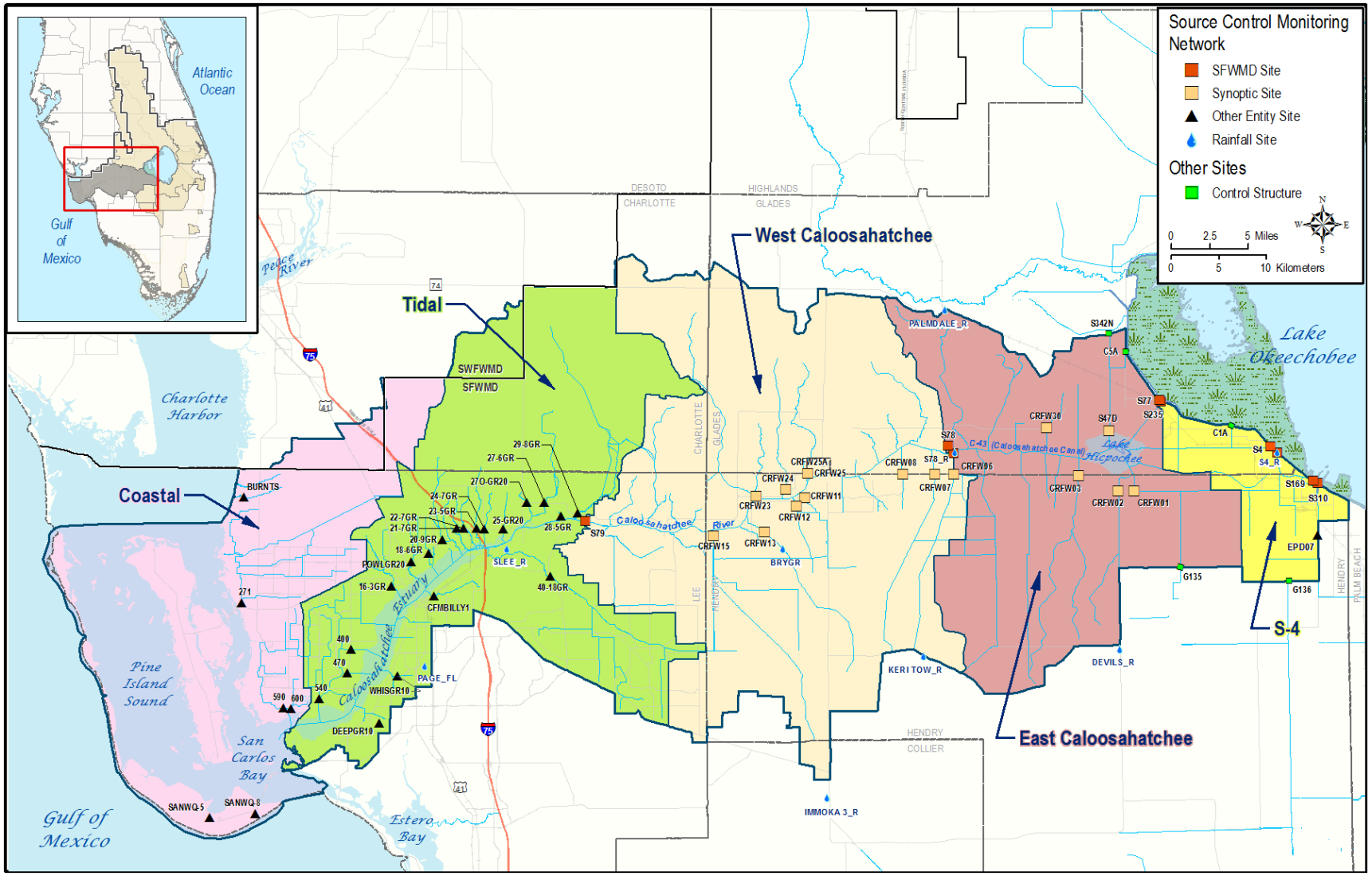

Figure 4-13. Caloosahatchee River Watershed source control program implementation area. [Note: EPD – Everglades Protection District.]

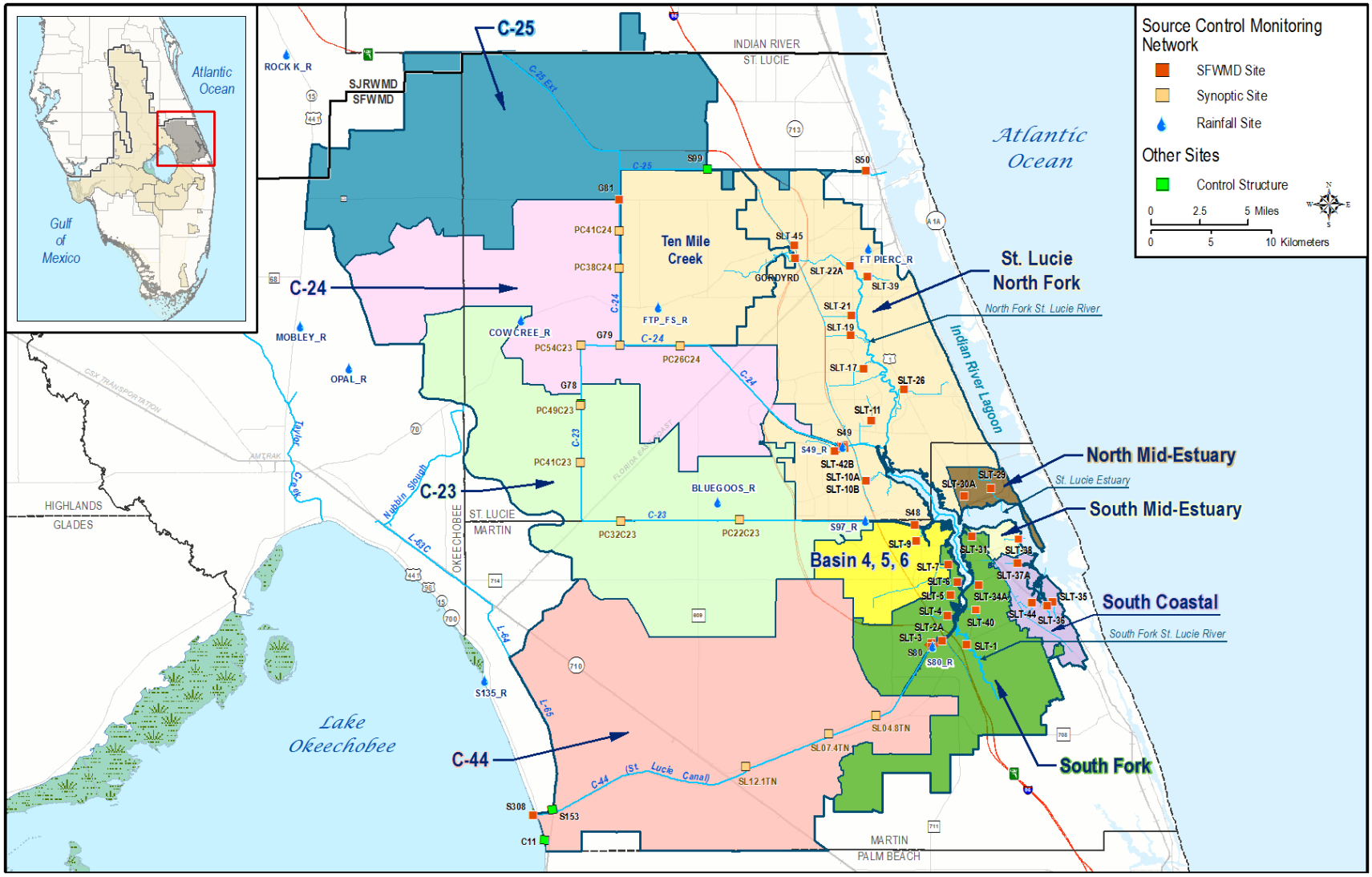

Figure 4-14. St. Lucie River Watershed source control program implementation area.

The 1989 rules require that each agricultural and non-agricultural discharger meet water quality criteria at the point of discharge from their property. Additionally, the District implements a water quality monitoring network encompassing representative sites within the Northern Everglades watersheds to review compliance with the water quality criteria established in Chapter 40E-61, F.A.C. It is through District monitoring of these discharges that water quality problems are currently being detected, and any issues are addressed by the appropriate agency. The coordinating agencies meet routinely to discuss source control implementation and areas of water quality concern. The NEEPP requires the coordinating agencies to institute a reevaluation of the BMPs and make appropriate changes to the rule where water quality problems are detected despite BMP implementation to assure an adaptive management approach to achieving water quality goals.

STATUS OF SOURCE CONTROLS IN THE NORTHERN EVERGLADES WATERSHED

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BACKGROUND

Implementation of mandatory BMPs for control of nutrients occurs through the District's Regulatory Nutrient Source Control Program and through the ERP Program for areas with delegated authority from FDEP, and are implemented on both agricultural and non-agricultural lands.

The objective of the Regulatory Nutrient Source Control Program is to establish permitting criteria for approval of a BMP plan for new and existing activities to ensure that water quality in stormwater discharges to WOD is compatible with the District's ability to implement statutory mandates and meet regulatory requirements posed on the District by FDEP. FDEP requirements are established in the permits issued for operation of District structures into Lake Okeechobee (0174552-001-GL). Additionally, Lake Okeechobee pass-through flows into the EAA are also directed into the ECP and are subject to additional FDEP permitting requirements as discussed earlier in this chapter.

The regulatory program (also known as the WOD Program) is unique to South Florida in that it combines cost-effective, technology-based remedies (BMPs) with watershed-specific water quality monitoring requirements. The program prescribes deadlines for action, requirements for controlling phosphorus, water quality monitoring, and compliance methodologies. It is the water quality monitoring requirements and implementation deadlines that set the WOD Program apart from other source control programs utilizing BMPs. Compliance with permit conditions is verified through review of water quality data and periodic on-site inspections and records review. Permits are renewed automatically every three years; however, the District has the ability to update existing permitted implementation approaches, as needed to ensure consistent compliance with District criteria, by notifying the permittee prior to the permit expiration date.

In parallel, the statewide ERP Program requires that new activities provide reasonable assurances that they will not "adversely affect the quality of receiving waters such that state water quality standards will be violated." Currently, in the case of the Northern Everglades basins, where the existing ambient water quality does not meet standards due to phosphorus impairment, an applicant must implement mitigation measures that are proposed by or acceptable to the applicant

that will cause net improvement of the water quality in the receiving waters for those parameters that do not meet standards. Additionally, applicants must demonstrate that their activities will not cause "adverse water quality impacts to receiving waters or adjacent lands" or "flooding to on-site or off-site properties" (see Rule 62-330.301, F.A.C.). However, not all activities are required to obtain ERPs. For example, certain agricultural activities may be exempt pursuant to Section 373.406, F.S. Other exemptions are set forth in Sections 373.4145(3) and 403.813(1), F.S., and Rule 62-330.051, F.A.C. For example, based on the exemptions listed above, most lands used for improved pasture do not have ERPs, which is approximately 20 percent of the Lake Okeechobee Watershed, 11 percent of the Caloosahatchee River Watershed, and 21 percent of the St. Lucie River Watershed. Additionally, depending on when the stormwater management system was permitted, the water quality design criteria may differ—that is, older stormwater system design criteria may be less stringent. BMP plans are even more important in these situations. Approximately 51 percent of the Lake Okeechobee Watershed, 47 percent of the Caloosahatchee River Watershed, and 75 percent of the St. Lucie River Watershed are covered by ERPs, which include water quality and quantity criteria in effect at the time of issuance.

The ERP and WOD programs were intended to supplement each other by addressing water quality issues with the enforceable regulatory tools the District has at its disposal. This strategy has not been fully implemented for various reasons. This section provides the annual update for the District's Regulatory Source Control Program for the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds.

NORTHERN EVERGLADES WATERSHEDS UPDATE

Lake Okeechobee, St. Lucie and Caloosahatchee Source Control Strategies

The District currently implements a Regulatory Source Control Program for phosphorus as adopted under Chapter 40E-61, F.A.C., within the majority of the Lake Okeechobee Watershed. The Chapter 40E-61, F.A.C., regulatory boundary is approximately 2,039,367 acres and of that approximately 86 percent is permitted (individual, general, and no notice permits). Permitted acreage includes all areas contributing runoff, which may include natural areas. In the most recent years, post-permitting efforts within the rule-defined area were scaled back because of limited resources and to allow staff to focus on technical analysis in support of rulemaking. During this transition period of rule development efforts, the District has relied upon FDACS to enroll landowners in the statewide voluntary agricultural BMP program. The WOD rule currently does not address the Upper Kissimmee and Lake Istokpoga basins, or the river watersheds. The NEEPP directs that the WOD Program be expanded to include the entire Lake Okeechobee and river watersheds, and that it also encompass nitrogen in the St. Lucie River and Caloosahatchee River watersheds. The existing MOU mandated by NEEPP will be amended incorporating roles and responsibilities associated with implementation of the NEEPP. Currently, agency roles are being clarified given the overarching authority of FDEP under the BMAPs and the MOU update will follow. More information on the role of BMAPs is provided in Chapter 8 (see *Summary* and *Overview of the Lake Okeechobee Watershed Protection Program* sections).

WY2015 highlights include ongoing core post-permit compliance activities required under Chapter 40E-61, F.A.C.; LOWA water quality monitoring; identification of priority areas in quarterly meetings with FDACS and FDEP; and enhancing BMP implementation to reduce nutrient loads in runoff from District-owned leased lands, as described in the *SFWMD Activities* section below. In addition, statistical optimization analyses are being conducted for the LOWA upstream monitoring network to identify stations that could be relocated to incorporate upstream monitoring sites within the river watersheds, as described in the *SFWMD Anticipated Activities* section below.

Water quality updates for each of the basins that make up the three watersheds in the Northern Everglades are also presented in the *Water Year 2015 Water Quality Update* section below.

Northern Everglades Watersheds Activities

During WY2015, the District implemented the ongoing NEEPP-mandated regulatory BMP program and made progress on supplemental projects as listed below.

Basin Water Quality

- **Water Quality Monitoring.** This monitoring is conducted at Northern Everglades water quality sites (**Figures 4-12** through **4-14**) for tracking trends. The sites include both basin-level monitoring and upstream level monitoring. The upstream level monitoring (e.g., LOWA) site locations are presented in Appendix 4-3. The WY2015 basin-level monitoring data, along with the upstream monitoring network data (TP concentration only) were used to meet the compliance monitoring requirements under Chapter 40E-61, F.A.C., and to highlight areas of concern within the watersheds to the coordinating agencies during quarterly meetings. These basin level data are presented in the *Water Year 2015 Water Quality Update* section below.
- **LOWA Water Quality Monitoring Optimization.** The District is conducting a statistical optimization analyses for the LOWA upstream monitoring network to identify stations that could be relocated to incorporate upstream monitoring sites within the river watersheds.
- **Synoptic Water Quality Sampling in River Watersheds.** A two-year synoptic upstream water quality monitoring project at locations within the river watersheds, specifically the C-23, C-24, and C-44 basins, and the East and West Caloosahatchee basins, began in the wet season of WY2015. The data collected is presented in Appendix 4-3. At the end of the project, priority upstream monitoring stations within the river watersheds will be identified to incorporate them into LOWA and be used in a similar manner as described above.
- **St. Lucie River Watershed Non-Point Source Analysis.** The District completed technical analysis on water quality data in the St. Lucie River Watershed to identify potential influences associated with septic tanks.

Permit-level Compliance

- **BMP Implementation.** The District continued permitting and post-permit compliance activities under Chapter 40E-61, F.A.C. As permit applications were received, source control plans were required to include a comprehensive BMP plan. This is consistent with the criteria required for the Southern Everglades under Chapter 40E-63, F.A.C. Permit applications were processed and issued in accordance with mandated regulatory deadlines.
- **Rule Amendments.** The District's regulatory plan, which was filed with the Office of Fiscal and Regulatory Reform, was updated to include amendments to Chapter 40E-61, F.A.C., as required by Section 120.74, F.S. The District must amend the WOD Program for the Northern Everglades watersheds in accordance with legislative mandates, and compatible with FDEP's approach to evaluate water quality under the BMAPs.
- **Interagency Coordination to Identify and Respond to Priority Areas of Water Quality Concern.** The District reviewed water quality data and BMP implementation information to identify priority areas of water quality concern. The District, FDEP, and FDACS held meetings quarterly to develop action plans for priority areas. Action plans include, but are not limited to agency follow-up with landowners and continued agency review of water quality monitoring data for trends.

- **South Lake Okeechobee Watershed Master Permit Requirements (Permit Number 50-00001-Q).** The District continued to monitor discharges to ensure compliance with the unique requirements described under Chapter 40E-61, F.A.C., the Long-term Plan, and the Everglades Conceptual Design documents for discharges to the lake and the EAA from these basins. The District administers the Lake Okeechobee Management Plan Master Permit for discharges to the lake from areas south of Lake Okeechobee, primarily in the EAA basin. The permit historically required implementation of point and nonpoint phosphorus control activities in the EAA, L-8, and S-4/Industrial Canal basins to reduce the average annual phosphorus loading to Lake Okeechobee. The permitted area in the EAA is as described in the *Everglades Agricultural Area Basin Update* section of this chapter because of the ECP requirement to divert the discharges from the lake, south to the EAA STAs and to meet the additional requirements of Chapter 40E-63, F.A.C. The diversion projects were completed between 2001 and 2006.

Outreach and Demonstration

- **District-Owned Lands Supplemental BMP Program.** A program to optimize the use of BMPs to reduce nutrients in stormwater runoff from District-owned lands was developed. The District's Real Estate, Land Management, and Regulation divisions worked to enhance BMP implementation as District lands are prepared to be leased. The affected leases include requirements to implement BMPs at levels comparable to those in the District's BMP rules and above based on site-specific conditions. Opportunities for these supplemental BMPs are evaluated based on multiple factors, such as no adverse conflicts with the operation or other uses of the land, location and respective water quality levels, acreage, and lease duration. Potential projects are under consideration or have been implemented in the Lake Okeechobee and St. Lucie River watersheds. Opportunities have yet to be identified in the Caloosahatchee River Watershed. In WY2015, ten properties were visited for supplemental BMP implementation, two in the Lake Okeechobee Watershed and eight in the St. Lucie River Watershed.

Water Year 2015 Water Quality Update

Analyses of water quality trends were conducted for individual hydrologic basins, and at individual tributaries and upstream sites where water quality and flow are monitored for tracking progress throughout the Northern Everglades, as shown in **Figures 4-12** through **4-14**. Additionally, Appendix 4-3 of this volume provides flow schematics depicting hydrologic basin boundaries, flow transfers between basins, water control structures associated with the water quality and flow data used for nutrient load calculations, and the water quality tributary stations.

Tables 4-1 and **4-2** provide a summary of the data for WY2015 including runoff load, UAL, and nutrient concentrations for each basin. To assist in the review and interpretation of each basin's water quality, the following sections provide data such as TP and TN loads, land use distribution, and major source control activities over the period of record presented, when applicable. Summaries for basins in the Lake Okeechobee Watershed are presented in **Figures 4-15** through **4-27**, the Caloosahatchee River Watershed data are presented in **Figures 4-28** through **4-32**, and the St. Lucie River Watershed data are presented in **Figures 4-33** through **4-38**. The individual tributaries and upstream sites are presented in Appendix 4-3.

Please note the following considerations when reviewing the data summaries presented in **Figures 4-15** through **4-38**:

- For the plots showing annual and five-year rolling average TP and TN load, and annual FWMC, the loading calculations are based on a methodology that estimates the nutrients in runoff generated within each basin, and thus excludes

pass-through flows (external sources), if applicable. For example, the Lake Kissimmee basin pass-through flows are excluded from the Lower Kissimmee basin calculation, the Lake Istokpoga basin pass-through flows are excluded from the Indian Prairie basin calculation, the East Caloosahatchee pass-through flows are excluded from the West Caloosahatchee Basin calculation, and the Lake Okeechobee pass-through flows are excluded from the L-8 basin calculation, the East Caloosahatchee basin calculation, and the C-44 basin calculation. There were no data available to represent the observed load from Nicodemus Slough, which can flow both to Lake Okeechobee and the Caloosahatchee River watersheds.

- The timelines presenting major source control activities may be refined in the future as additional information on events assisting in the interpretation of the water quality data come to light.
- The comparison of land use distribution presents a historical data set and the most recent period for which District land use data are available (2008–2009 for the Lake Okeechobee Watershed and 2011–2013 for the Caloosahatchee River and St. Lucie River watersheds).

A key consideration when evaluating trends of pollutants in runoff is the effect of hydrologic variability (rainfall and distribution) from year to year. There are various methods to address the uncertainty that results from the variability, and their appropriateness may vary based on the characteristics of each watershed and the data that are available. For example, see the discussion under the *Water Year 2015 Phosphorus Results* section within the *Everglades Agricultural Area Basin Update* section of this chapter, where a model is used to account for differences in annual rainfall intensity and distribution. For the Northern Everglades Watershed, a five-year rolling average is used as presented in **Figures 4-15** through **4-27**, which provides a sense of the hydrologic variability when analyzing long-term trends. Note, however, that a five-year rolling average approach may not realistically incorporate hydrologic variability in all cases. For example, it may underestimate the effect on annual nutrient load of short duration high intensity events, or the distinct weather patterns during certain years (e.g., the 1990 to 1994 rapid succession of El Niño events). Additionally, the rollover effect of this methodology may cause delays in responding to changes in basin conditions and sources. Appendix 4-3 presents supplementary analyses using algorithms that account for hydrologic variability, as available for each basin. The figures presented in Appendix 4-3 are for informational purposes, and are illustrative of the supplementary analysis described here. This method of calculating trends in pollutant loads has not been adopted by rule, and is not intended for any regulatory purpose.

Lake Okeechobee Watershed

The Lake Okeechobee Watershed source control program monitoring network provides water quality and flow data to estimate phosphorus nutrient loading for the Boggy Creek, Shingle Creek, Lower Kissimmee, Fisheating Creek, Arbuckle Creek, Josephine Creek, Indian Prairie, S-133, S-154, S-191, S-135, S-154C, and L-8 basins.

For more information on the projects and programs included in the historical timelines in **Figures 4-15** through **4-27**, see the 2011 Lake Okeechobee Protection Plan Update (SFWMD et al. 2011); Surface Water Improvement and Management (SWIM) Plan – Update for Lake Okeechobee (SFMWD 2002); Chapter 10 of the 2006, 2007, and 2008 SFERs – Volume I (James et al. 2006, Zhang et al. 2007, James and Zhang 2008); Chapter 8 of this volume; and the Florida Administrative Code (e.g., Chapters 62-670, 5M-3, 40E-4, and 40E-61, F.A.C.).

Caloosahatchee River Watershed

The Caloosahatchee River Watershed source control program monitoring network provides water quality and flow data to estimate nutrient loading for the S-4/Industrial Canal, East Caloosahatchee, and West Caloosahatchee basins, which represent approximately 55 percent of the Caloosahatchee River Watershed. The remaining 45 percent of the Caloosahatchee River Watershed, which includes the Tidal Caloosahatchee and Coastal Caloosahatchee basins, are represented by water quality data monitored by local entities at 18 tributary stations in the Tidal Caloosahatchee Basin and four tributary stations in the Coastal Caloosahatchee Basin. These tributaries are not consistently monitored for flow.

St. Lucie River Watershed

The St. Lucie River Watershed source control program monitoring network provides water quality and flow data to estimate nutrient loading for the C-23, C-24, C-44, C-25, and Ten Mile Creek basins, which represent approximately 73 percent of the St. Lucie River Watershed. The remaining 27 percent of the St. Lucie River Watershed, representing the six basins of North Fork, South Fork, Basin 4-5-6, North Mid-Estuary, South Mid-Estuary, and South Coastal, are not monitored for flow. These six basins are referred to herein as the composite area, and are represented by water quality data monitored at 29 tributary stations. Twelve of these 29 tributary stations were added in May 2013, resulting in a shorter historical data set for these twelve tributaries. These tributaries are not monitored for flow.

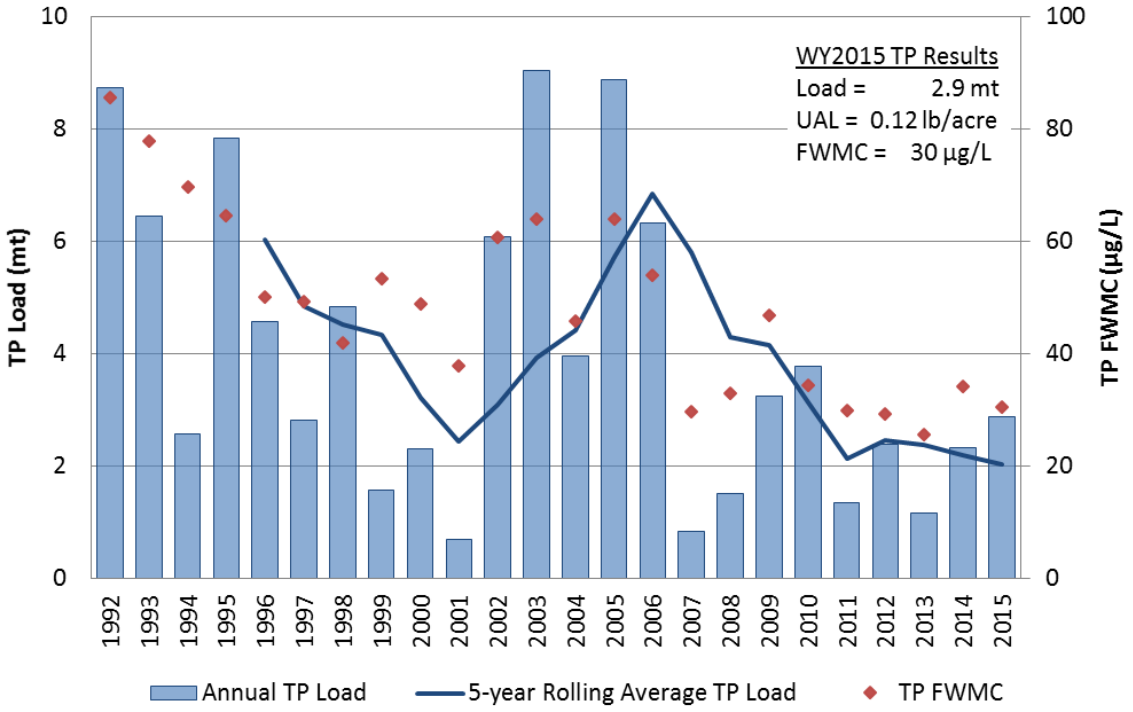
SFWMD Anticipated Activities

BMP Regulatory Program

- The District Regulatory Program for the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds are dependent on the coordinating agencies' development of water quality improvement strategies in the Northern Everglades. FDEP has developed BMAPs, or is developing BMAPs, for the Lake Okeechobee, St. Lucie River and Caloosahatchee River watersheds. These BMAPs build upon the decade plus of work already completed under the Northern Everglades Protection Plans and work in combination with the existing regulatory programs. The District approach during this transition consists of tracking water quality trends, identifying areas of water quality concern, relying on FDACS for implementing their agricultural BMP program, and addressing permit compliance, as needed, and will continue until adoption of amendments to Chapter 40E-61, F.A.C.
- The District will continue to optimize the use of BMPs to reduce nutrients in stormwater runoff from District-owned lands. Enhanced BMP implementation is accomplished as District lands are prepared to be leased, through identifying lessee required BMPs at levels comparable to the District's Regulatory BMP Program to be included in the lease contract, and reviewing opportunities for supplemental BMPs above and beyond what is required.
- Optimization of the monitoring networks at the basin-level monitoring sites and the upstream sites within the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds will continue, as necessary, to meet the requirements of Chapter 40E-61, F.A.C., and other program needs.

Rule Development

- Initiation of the rule development process will be necessary to amend Chapter 40E-61, F.A.C., to encompass the remaining Lake Okeechobee Watershed (Upper Kissimmee and Lake Istokpoga basins) and the St. Lucie River and Caloosahatchee River watersheds.

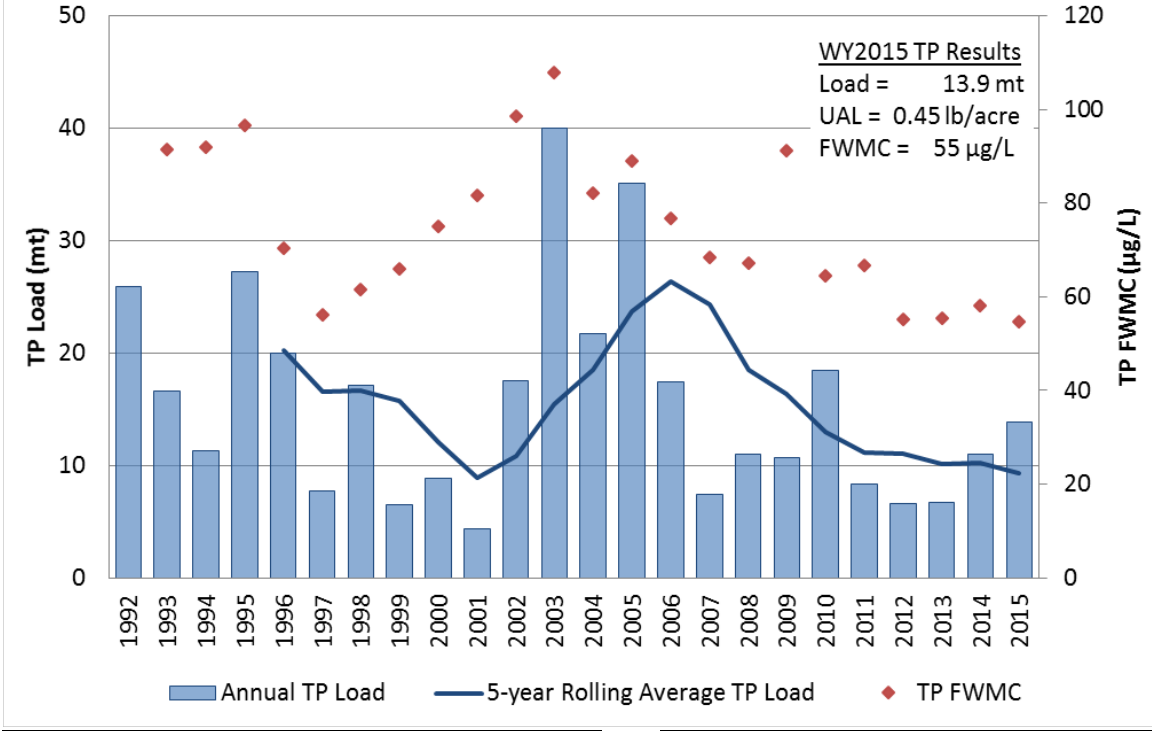


Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1995	ERP Program adopted – introduced wetland and water quality requirements
1996	Phase I MS4 permits issued for Orange County, Belle Isle, and Edgewood
1997	Phase I MS4 permit issued for Orlando
2007	FDACS Urban Turf Rule adopted

Land Use	1995	2008–2009[a]
Natural Area	26%	21%
Improved Pasture	9%	4%
Unimproved Pasture	2%	1%
Citrus	2%	0%
Tree Plantation	0%	0%
Row Crops	0%	0%
Dairies	0%	0%
Urban	36%	46%
Others	25%	28%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-15. Boggy Creek Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 SFWMD data sets.
[Note: MS4 – Municipal Separate Storm Sewer System.]



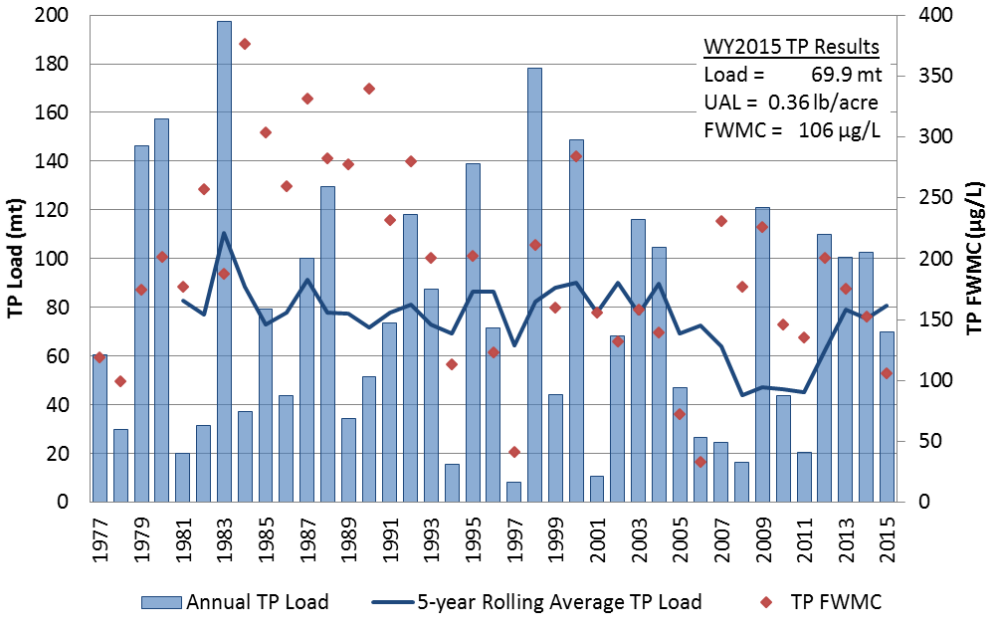
Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1995	ERP Program adopted – introduced wetland and water quality requirements
1996	Phase I MS4 permits issued for Orange County
2007	FDACS Urban Turf Rule adopted
2012	Phase I MS4 permit issued for Osceola County

Land Use	1995	2008–2009[a]
Natural Area	36%	30%
Improved Pasture	6%	4%
Unimproved Pasture	1%	0%
Citrus	2%	0%
Tree Plantation	1%	0%
Row Crops	0%	0%
Dairies	0%	0%
Urban	37%	49%
Others	17%	17%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-16. Shingle Creek Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

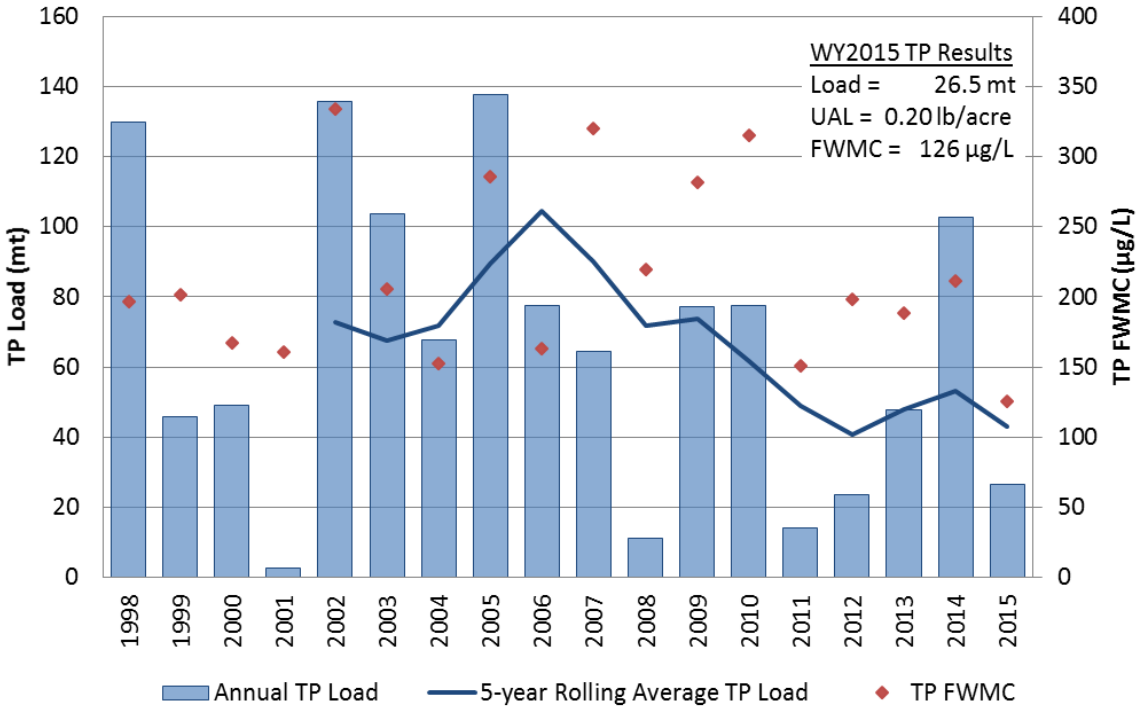
Date	Major Source Control Activities
1987	FDER/FDEP Dairy Rule adopted
1989	Okeechobee WOD Rule adopted requiring noticed permits in the S-65D and S-65E basins and no-notice for remaining areas
1989	Dairy Buyout Program implemented
1995	ERP Program adopted; introduced wetland and water quality requirements
1995	Phase I MS4 permit issued for Polk County
2002	FDACS Agricultural Nutrient Management Plans for Priority Basin Dairies (S-65D and S-65E)
2003	FDACS Rule adopted for Lake Okeechobee Priority Basins and Land Application of Animal Waste
2003	Phase II MS4 permit issued for Osceola County
2004	FDER/FDEP Dairy Rule becomes part of CAFO Permitting Program
2004-2007	Butler Oaks Dairy BAT Project
2004-2008	Phosphorus Source Control Grant projects (2)
2006	FDACS BMP Rule for non-priority basins
2006	FDACS Tailwater Recovery Project
2006	FDACS Dairy Composting Project
2008	Lamb Island Dairy Remediation (S-65D)
2008	FDACS Dairy Stormwater Management Systems (2)
2012	Phase II MS4 permit issued for Okeechobee County
2014	Phase II MS4 permit issued for Highlands County



	1995	2008–2009[a]	Land Use	1995	2008–2009
Natural Area	35%	22%	Row Crops	1%	1%
Improved Pasture	31%	30%	Dairies	1%	0%
Unimproved Pasture	5%	10%	Urban	1%	13%
Citrus	3%	2%	Others	20%	21%
Tree Plantation	3%	0%	-	-	-

a. The 2008–2009 District land use is the most recent dataset available. A 2011–2013 dataset is currently in production.

Figure 4-17. Lower Kissimmee Basin: (a) plot of annual TP load, five-year rolling average TP load, and FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets. [Note: BAT – Best Available Technology; CAFO – Concentrated Animal Feeding Operation; and FDER – Florida Department of Environmental Resources.]



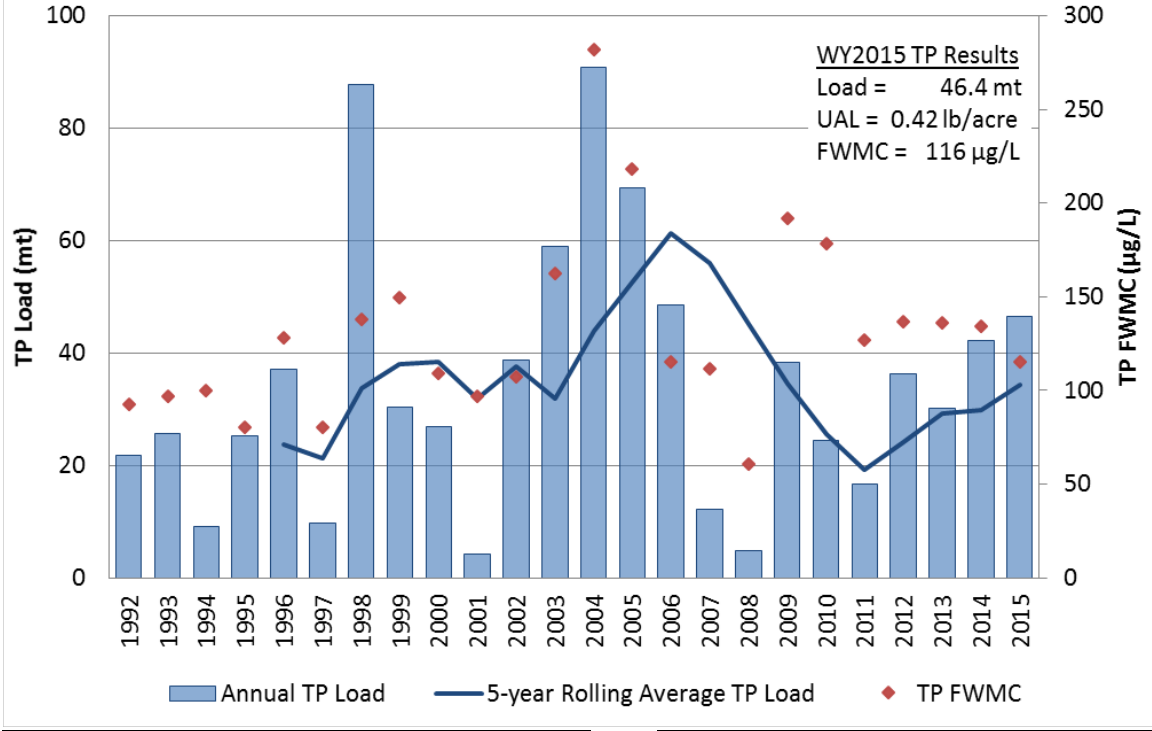
Date	Major Source Control Activities
1989	WOD Rule required individual and general permits in Fisheating Creek
1995	ERP Program adopted – introduced wetland and water quality requirements
2004-2008	Phosphorus Source Control Grant projects (2)
2006	FDACS BMP Rule for non-priority basins
2010	Phase II MS4 permit issued for Glades County
2014	Phase II MS4 permit issued for Highlands County

Note: The flow data set used for the period of record load calculations was from the FISHCR site, which began collecting data in WY1998.

Land Use	1995	2008–2009[a]
Natural Area	40%	32%
Improved Pasture	27%	32%
Unimproved Pasture	7%	12%
Citrus	4%	3%
Tree Plantation	8%	7%
Row Crops	0%	0%
Dairies	0%	0%
Urban	1%	1%
Others	13%	14%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-18. Fisheating Creek Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

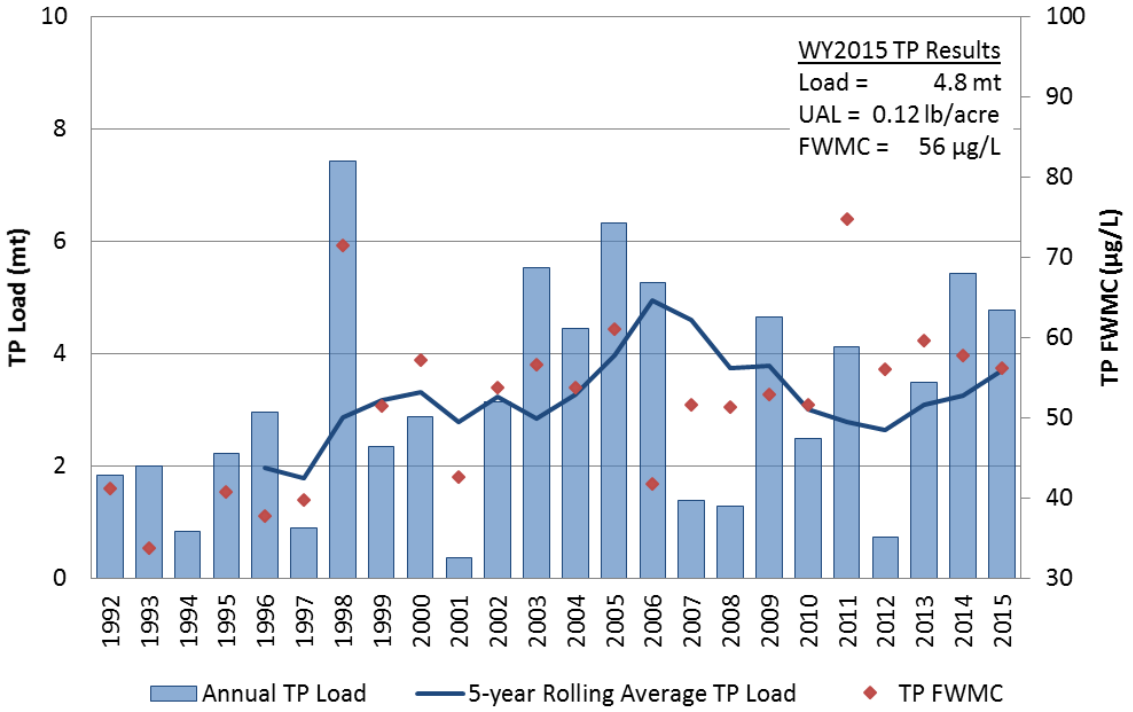


Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1995	ERP Program adopted – introduced wetland and water quality requirements
1995	Phase I MS4 permit issued to Polk County and City of Frostproof
2004	CAFO permitting program begins, but the basin was not designated as part of the Lake Okeechobee Drainage Basin
2006	FDACS BMP Rule for Lake Okeechobee non-priority basins
2007	FDACS Urban Turf Rule
2014	Phase II MS4 permit issued for Highlands County, Sebring, and Avon

Land Use	1995	2008–2009[a]
Natural Area	32%	44%
Improved Pasture	11%	15%
Unimproved Pasture	9%	5%
Citrus	3%	13%
Tree Plantation	5%	0%
Row Crops	0%	0%
Dairies	0%	1%
Urban	7%	9%
Others	33%	13%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-19. Arbuckle Creek Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

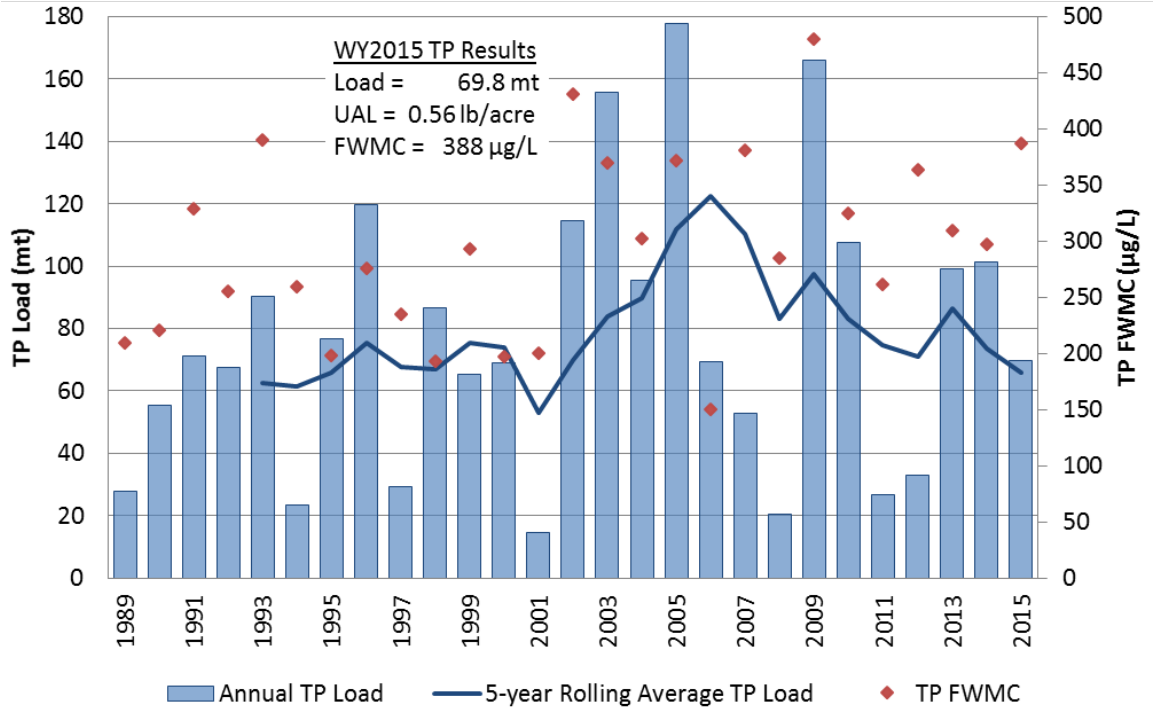


Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1995	ERP Program adopted; introduced wetland and water quality requirements
2006	FDACS BMP Rule for lake Okeechobee non-priority basins
2007	FDACS Urban Turf Rule
2014	Phase II MS4 permit issued for Highlands County and Sebring

Land Use	1995	2008–2009[a]
Natural Area	31%	32%
Improved Pasture	5%	4%
Unimproved Pasture	2%	1%
Citrus	20%	17%
Tree Plantation	0%	0%
Row Crops	0%	0%
Dairies	0%	1%
Urban	18%	23%
Others	24%	22%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-20. Josephine Creek Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

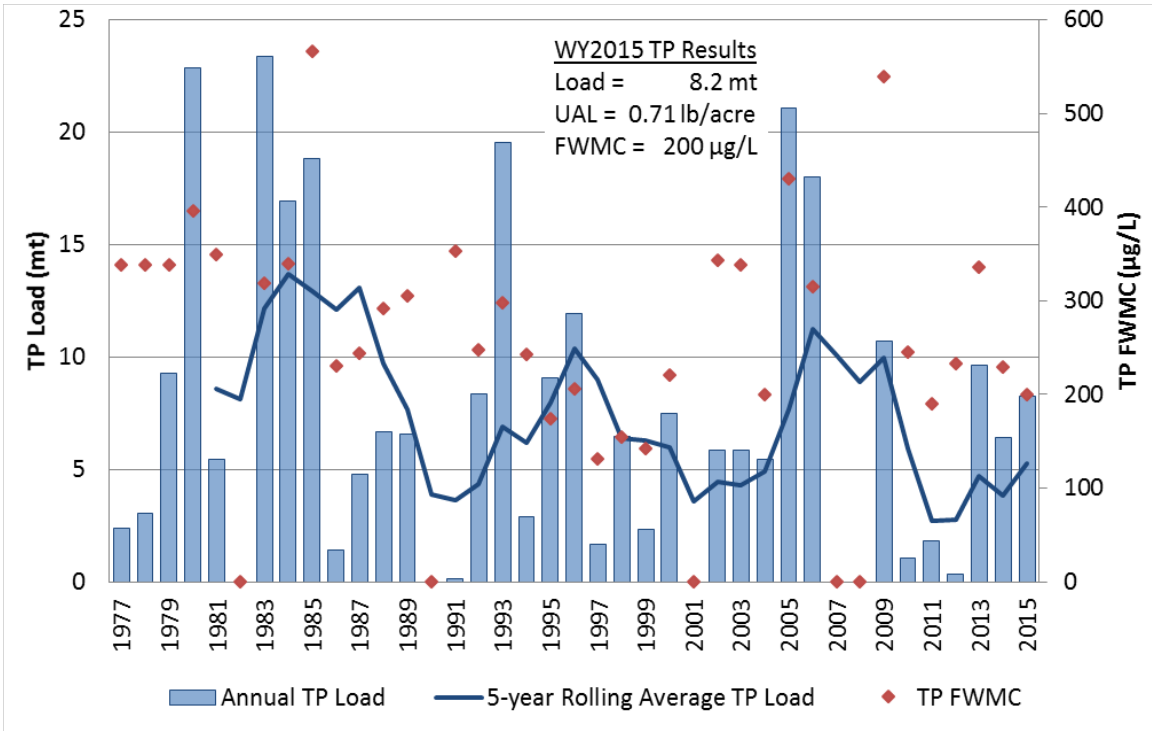


Date	Major Source Control Activities
1989	WOD Rule required individual and general permits in S-71, S-72, and S-127 Basins and no-notice in remaining areas
1995	ERP Program adopted; introduced wetland and water quality requirements
2005	FDACS citrus variable rate fertilizer
2006	FDACS BMP Rule for Lake Okeechobee non-priority basins
2010	Phase II MS4 permit issued for Glades County
2014	Phase II MS4 permit issued for Highlands County

Land Use	1995	2008–2009[a]
Natural Area	23%	16%
Improved Pasture	44%	44%
Unimproved Pasture	11%	9%
Citrus	11%	11%
Tree Plantation	0%	0%
Row Crops	1%	0%
Dairies	0%	0%
Urban	1%	1%
Others	9%	19%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-21. Indian Prairie Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

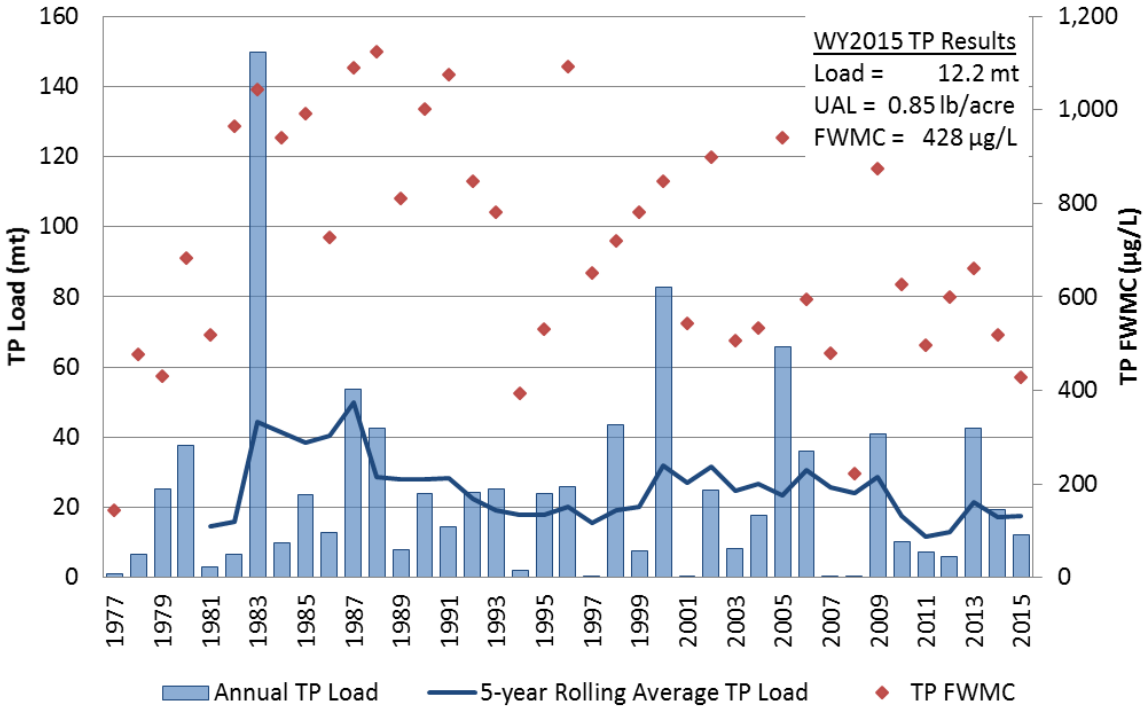


Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1987	FDER/FDEP Dairy Rule adopted
1989	WOD Rule required individual and general permits in the S-133 basin
1989	Dairy Buyout Program implemented
1995	ERP Program adopted; introduced wetland and water quality requirements
2004	FDER/FDEP Dairy Rule becomes part of CAFO permitting program
2004–2007	Phosphorus Source Control Grant Projects (1)
2006	FDACS BMP Rule for Lake Okeechobee non-priority basins
2007	FDACS Urban Turf Rule
2012	Phase II MS4 permit issued for Okeechobee County

Land Use	1995	2008–2009[a]
Natural Area	18%	13%
Improved Pasture	43%	33%
Unimproved Pasture	3%	4%
Citrus	1%	0%
Tree Plantation	0%	0%
Row Crops	0%	0%
Dairies	0%	0%
Urban	27%	28%
Others	8%	21%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-22. S-133 Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

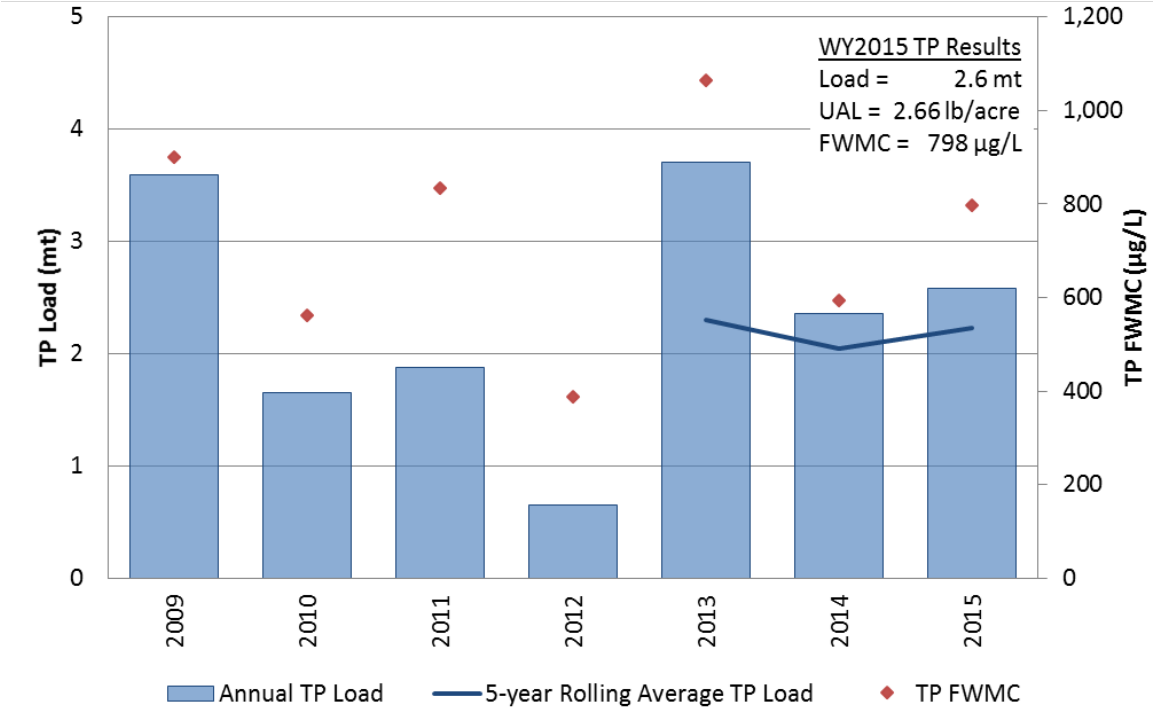


Date	Major Source Control Activities
1987	FDER/FDEP Dairy Rule adopted
1989	WOD Rule required individual and general permits in the S-154 basin
1989	Dairy Buyout Program implemented
1995	ERP Program adopted; introduced wetland and water quality requirements
2002	FDACS Agricultural Nutrient Management Plan for Priority Basin Dairies
2003	FDACS BMP Rule for Lake Okeechobee priority basins (S-154)
2004	FDER/FDEP Dairy Rule becomes part of CAFO permitting program
2004–2007	Dry Lake Dairy BATs Project
2005–2008	Milking R Dairy BATs Project
2012	Phase II MS4 Permit issued for Okeechobee County

Land Use	1995	2008–2009[a]
Natural Area	19%	17%
Improved Pasture	54%	56%
Unimproved Pasture	1%	7%
Citrus	0%	0%
Tree Plantation	0%	0%
Row Crops	1%	0%
Dairies	5%	2%
Urban	8%	8%
Others	12%	10%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 dataset is currently in production.

Figure 4-23. S-154 Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; b) basin timeline; and c) land use distribution from 1995 and 2008–2009 District data sets.

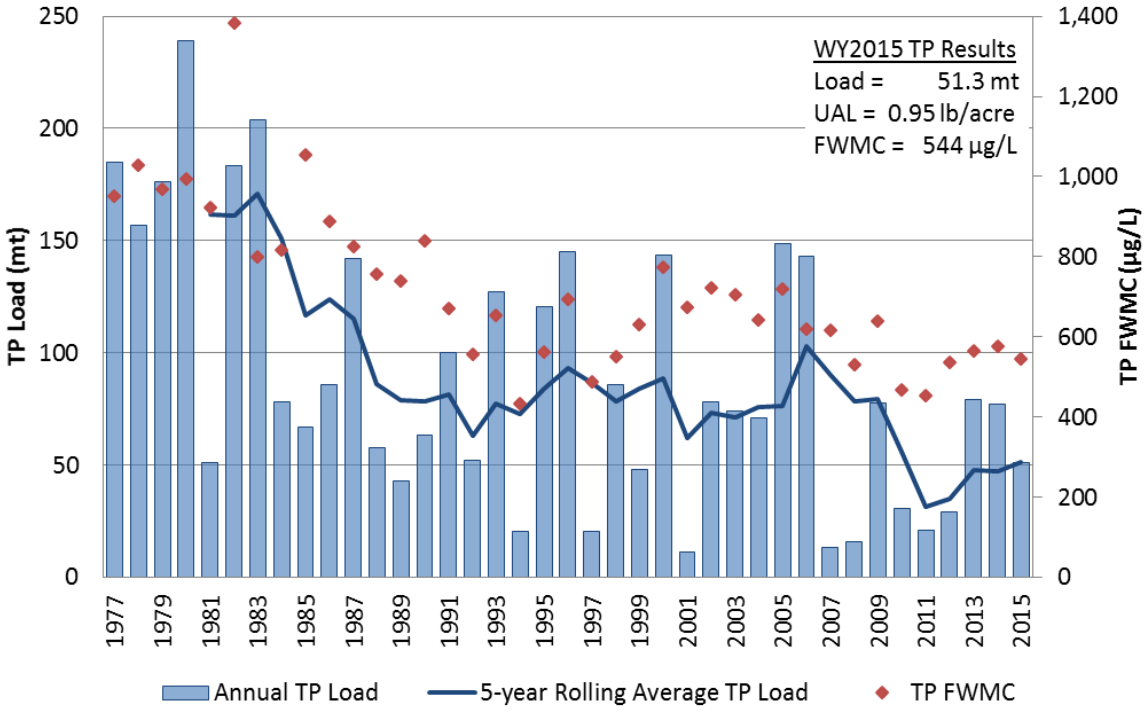


Date	Major Source Control Activities
1989	WOD Rule required individual and general permits
1995	ERP Program adopted; introduced wetland and water quality requirements
2006	FDACS BMP Rule for non-priority basins
2012	Phase II MS4 permit issued for Okeechobee County

Land Use	1995	2008-2009[a]
Natural Area	18%	8%
Improved Pasture	81%	82%
Unimproved Pasture	0%	0%
Citrus	0%	0%
Tree Plantation	0%	0%
Row Crops	0%	0%
Dairies	0%	0%
Urban	0%	0%
Others	1%	10%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-24. S-154C Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

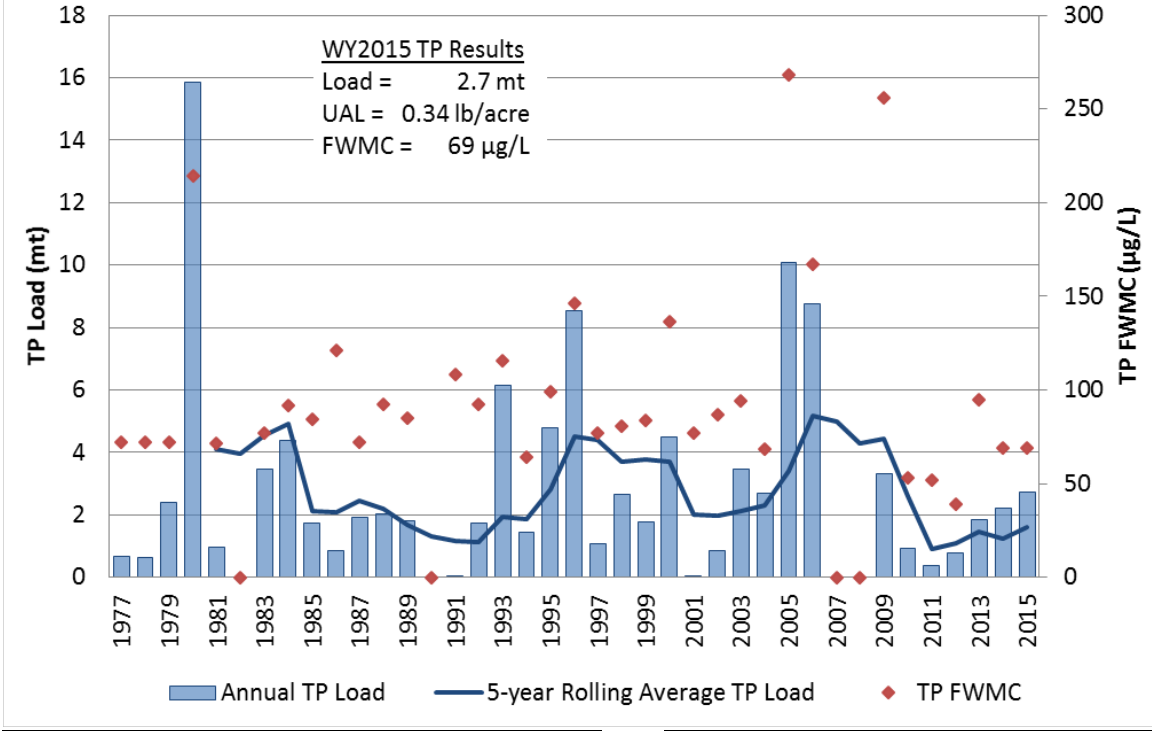


Date	Major Source Control Activities
1987	FDER/FDEP Dairy Rule adopted
1989	WOD Rule required individual and general permits in the S-191 basin
1989	Dairy Buyout Program implemented
1995	ERP Program adopted – introduced wetland and water quality requirements
2002	FDACS Agricultural Nutrient Management Plan for Priority Basin Dairies
2003	FDACS BMP Rule for Lake Okeechobee priority basins (S-191)
2004	FDER/FDEP Dairy Rule becomes part of CAFO permitting program
2004-2007	Davie Dairy BATs
2004-2008	Phosphorus Source Control Grant Project
2004-2008	Former Dairy Remediation Projects (3)
2012	Phase II MS4 Permit issued for Okeechobee County

Land Use	1995	2008–2009[a]
Natural Area	23%	13%
Improved Pasture	50%	57%
Unimproved Pasture	6%	6%
Citrus	2%	2%
Tree Plantation	0%	0%
Row Crops	1%	0%
Dairies	6%	3%
Urban	5%	5%
Others	7%	14%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-25. S-191 Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.

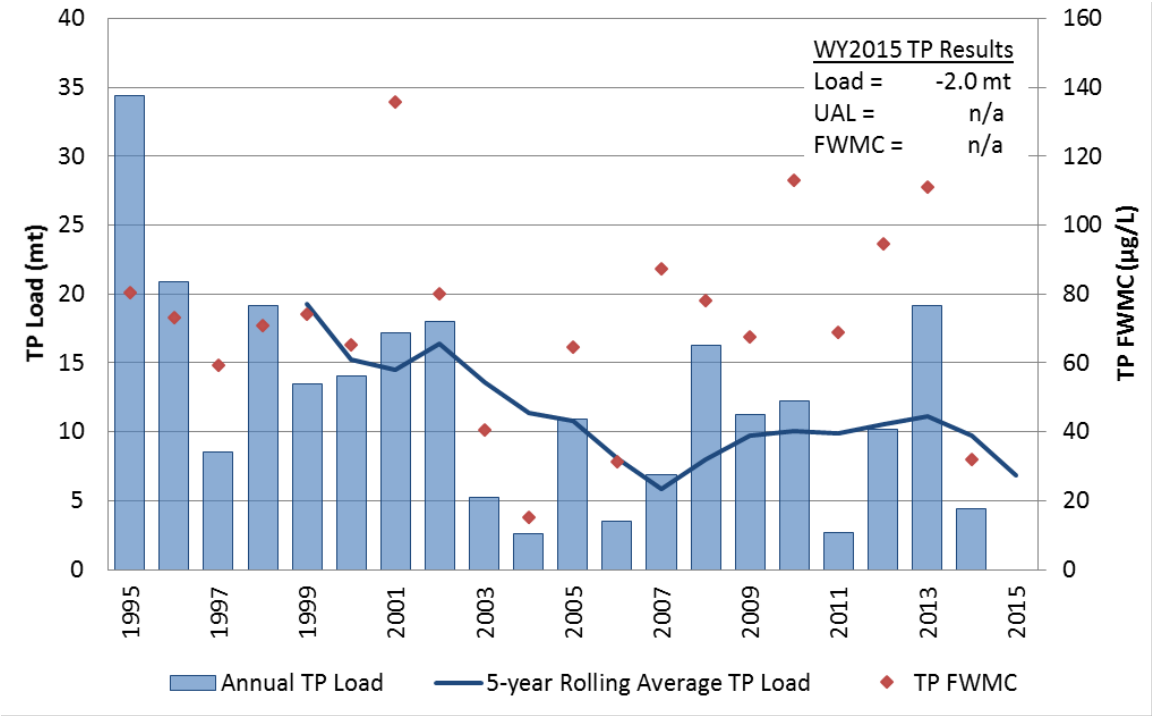


Date	Major Source Control Activities
1989	WOD Rule no-notice permits required
1995	ERP Program adopted; introduced wetland and water quality standards
2003	Phase II MS4 permit issued for Martin County
2006	FDACS BMP Rule for non-priority basins
2012	Phase II MS4 permit issued for Okeechobee County

Land Use	1995	2008–2009[a]
Natural Area	15%	12%
Improved Pasture	27%	23%
Unimproved Pasture	2%	3%
Citrus	3%	3%
Tree Plantation	0%	0%
Row Crops	5%	0%
Dairies	0%	0%
Urban	5%	6%
Others	43%	53%

a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-26. S-135 Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.
[Note: A negative load (stored) was observed during WY2015.]

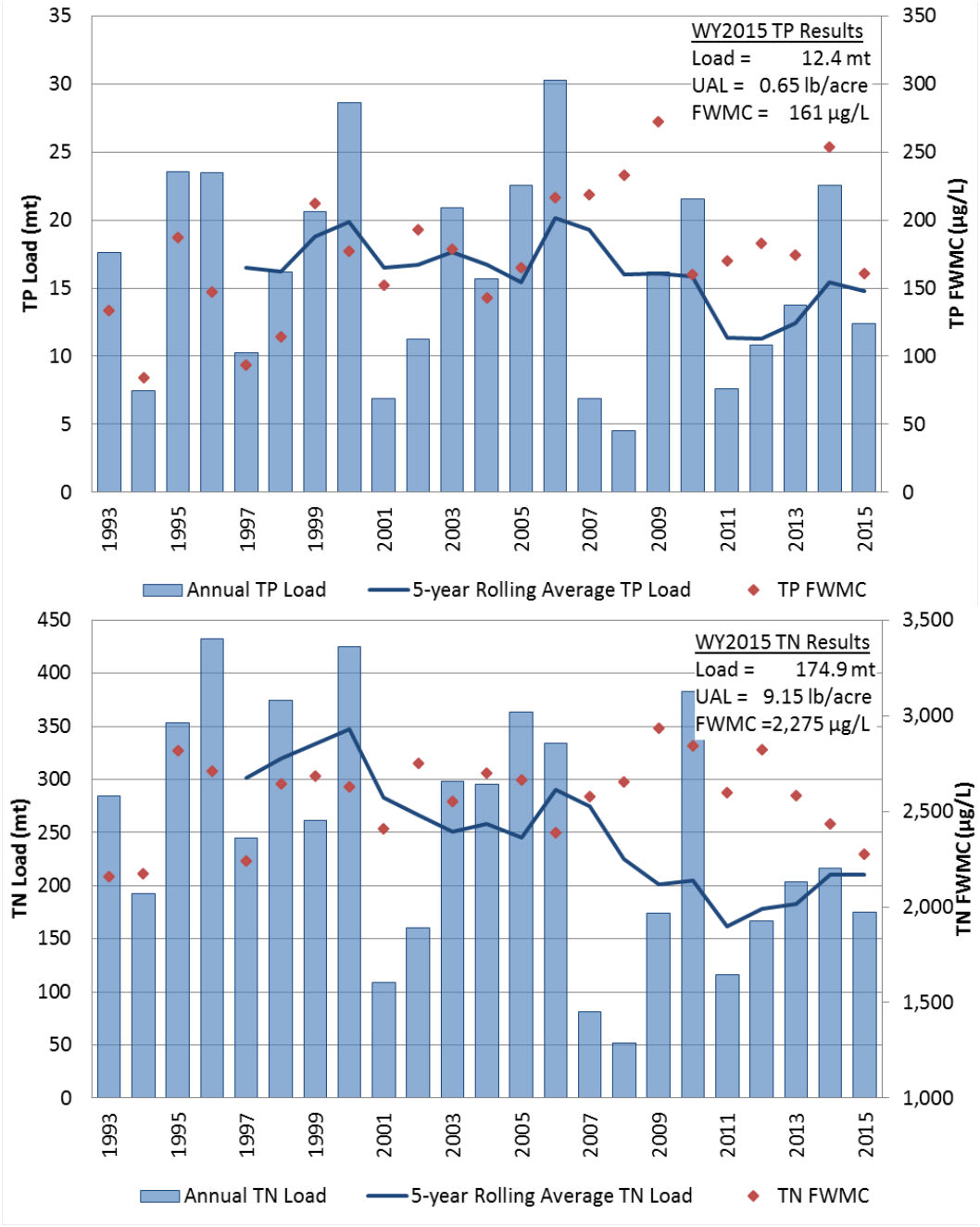


Date	Major Source Control Activities
1981	Florida State Stormwater Rule adopted requiring retention ponds for new developments
1995	ERP Program adopted; introduced wetland and water quality requirements
2002	Phase I MS4 permit issued for Palm Beach County
2006	FDACS BMP Rule for Lake Okeechobee non-priority basins
2007	FDACS Urban Turf Rule adopted

Land Use	1995	2008–2009[a]
Natural Area	62%	59%
Improved Pasture	0%	0%
Unimproved Pasture	2%	0%
Citrus	8%	0%
Tree Plantation	0%	0%
Row Crops	0%	0%
Dairies	0%	0%
Urban	18%	19%
Others	10%	22%

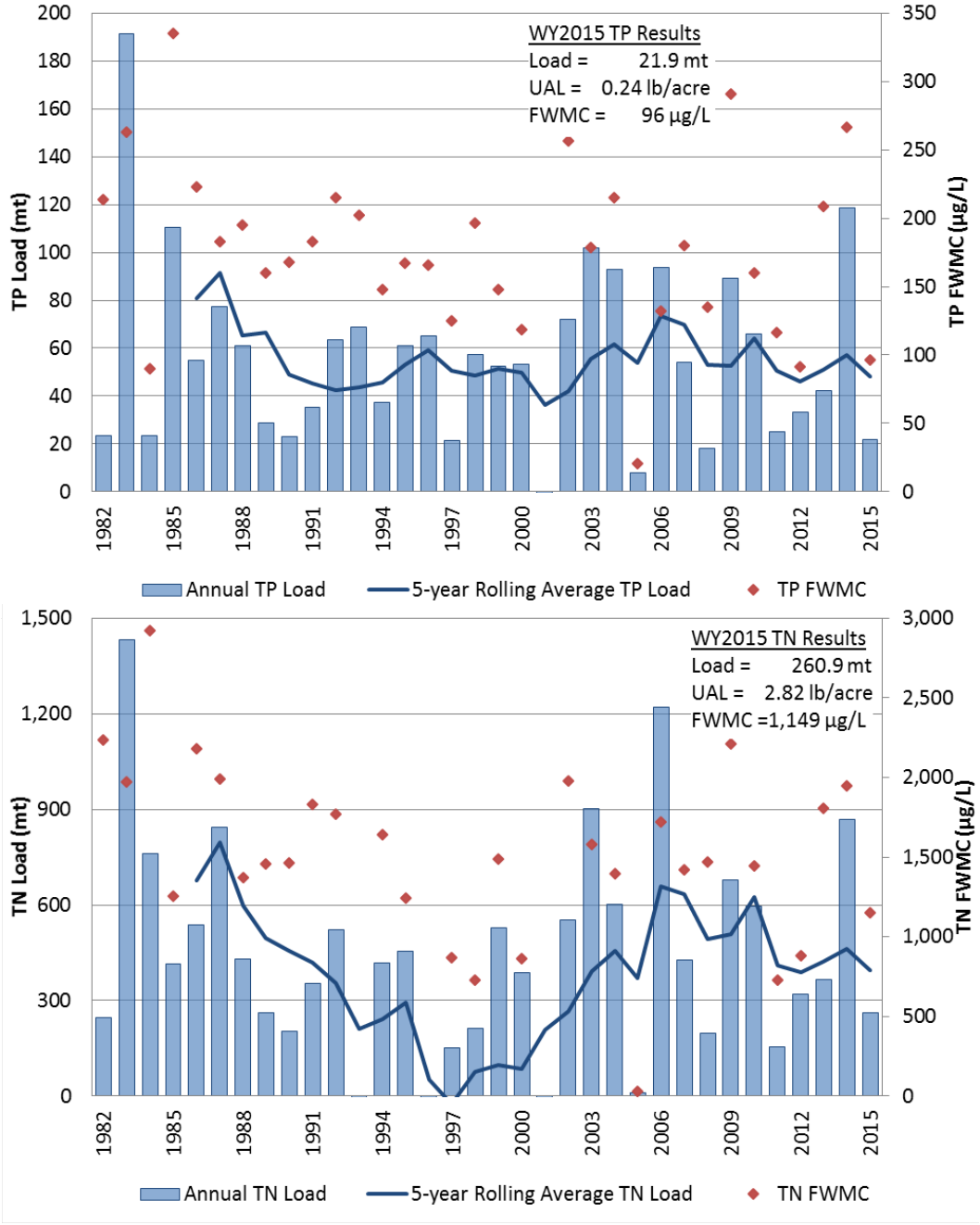
a. The 2008–2009 District land use is the most recent data set available. A 2011–2013 data set is currently in production.

Figure 4-27. L-8 Basin: (a) plot of annual TP load, five-year rolling average TP load, and annual FWMC; (b) basin timeline; and (c) land use distribution from 1995 and 2008–2009 District data sets.
[Note: The WY2015 basin runoff load was negative (-2 mt) as a result of more daily TP loads entering the basin than leaving; therefore, a single annual TP concentration cannot be determined, and load and unit area load are not reported.]



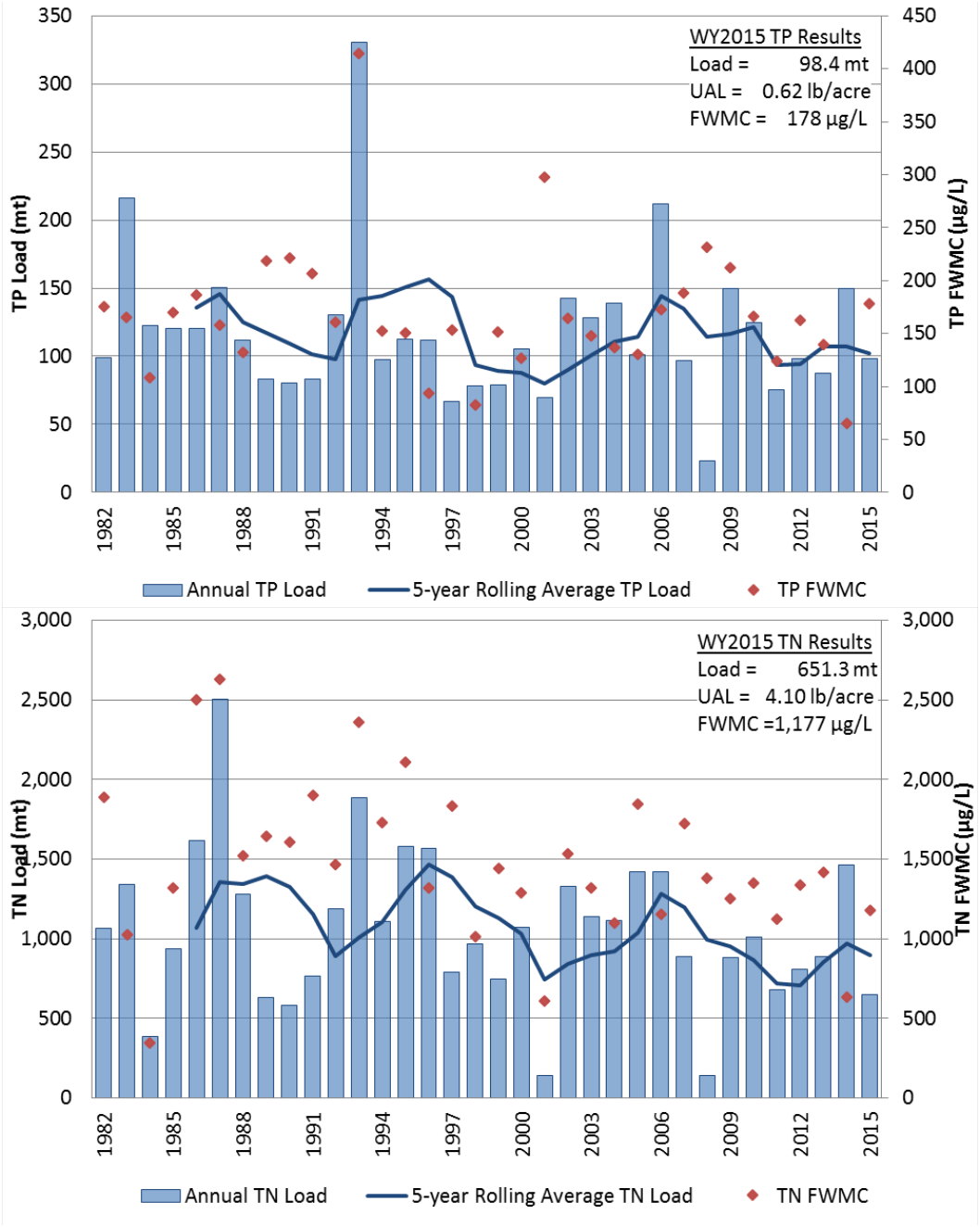
Land Use	1995	2011–2013	Land Use	1995	2011–2013
Sugar Cane	76%	76%	Water	3%	2%
Natural Areas	5%	5%	Transportation	1%	3%
Residential Medium Density	4%	4%	Other Agriculture	0.5%	2%
Improved Pasture	4%	2%	Others	3.5%	3%
Other Urban	3%	3%	-	-	-

Figure 4-28. S-4 Industrial Canal Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 1995 and 2011–2013 District data sets.



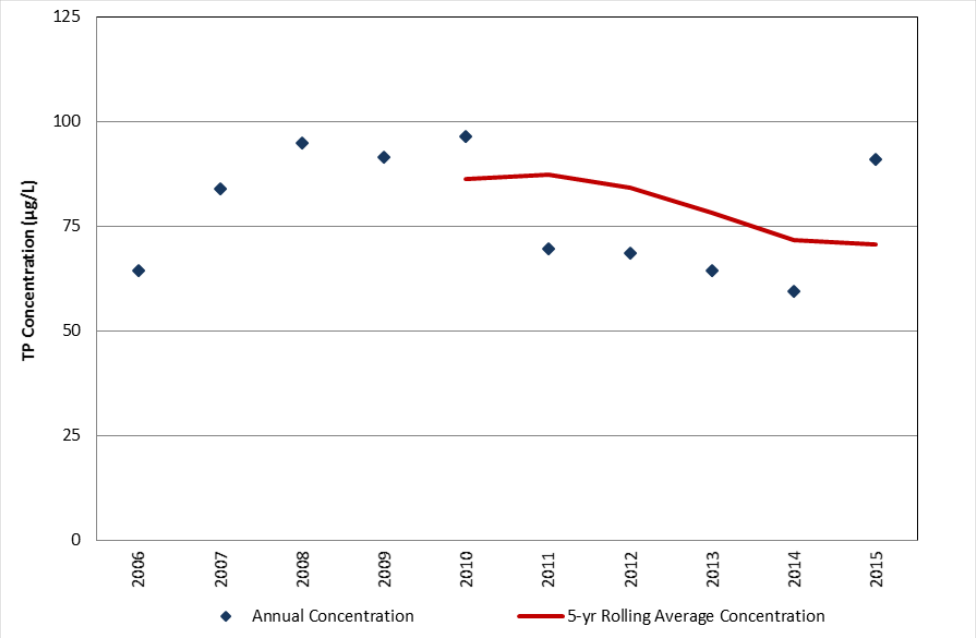
Land Use	2004	2011–2013	Land Use	2004	2011–2013
Sugar Cane	28%	29%	Tree Plantation	6%	6%
Natural Areas	21%	20%	Unimproved Pasture	3%	2%
Improved Pasture	18%	18%	Other Agriculture	0.4%	4%
Citrus	13%	9%	Others	5.6%	6%
Rangeland/Woodland	5%	6%	-	-	-

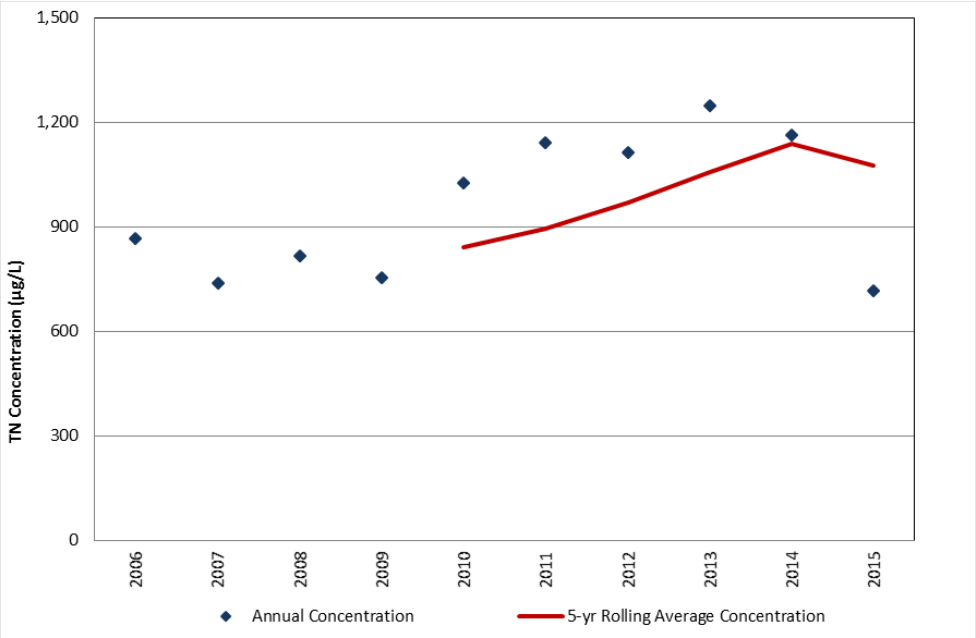
Figure 4-29. East Caloosahatchee Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 2004 and 2011–2013 District data sets.
[Note: A negative load (stored) was observed during WY2001 for TP and during WY1993, WY1996, and WY2001 for TN.]



Land Use	2004	2011–2013	Land Use	2004	2011–2013
Natural Areas	33%	25%	Residential Low Density	4%	11%
Citrus	20%	14%	Row Crops	2%	2%
Improved Pasture	16%	18%	Unimproved Pasture	4%	2%
Tree Plantation	8%	9%	Others	13%	19%

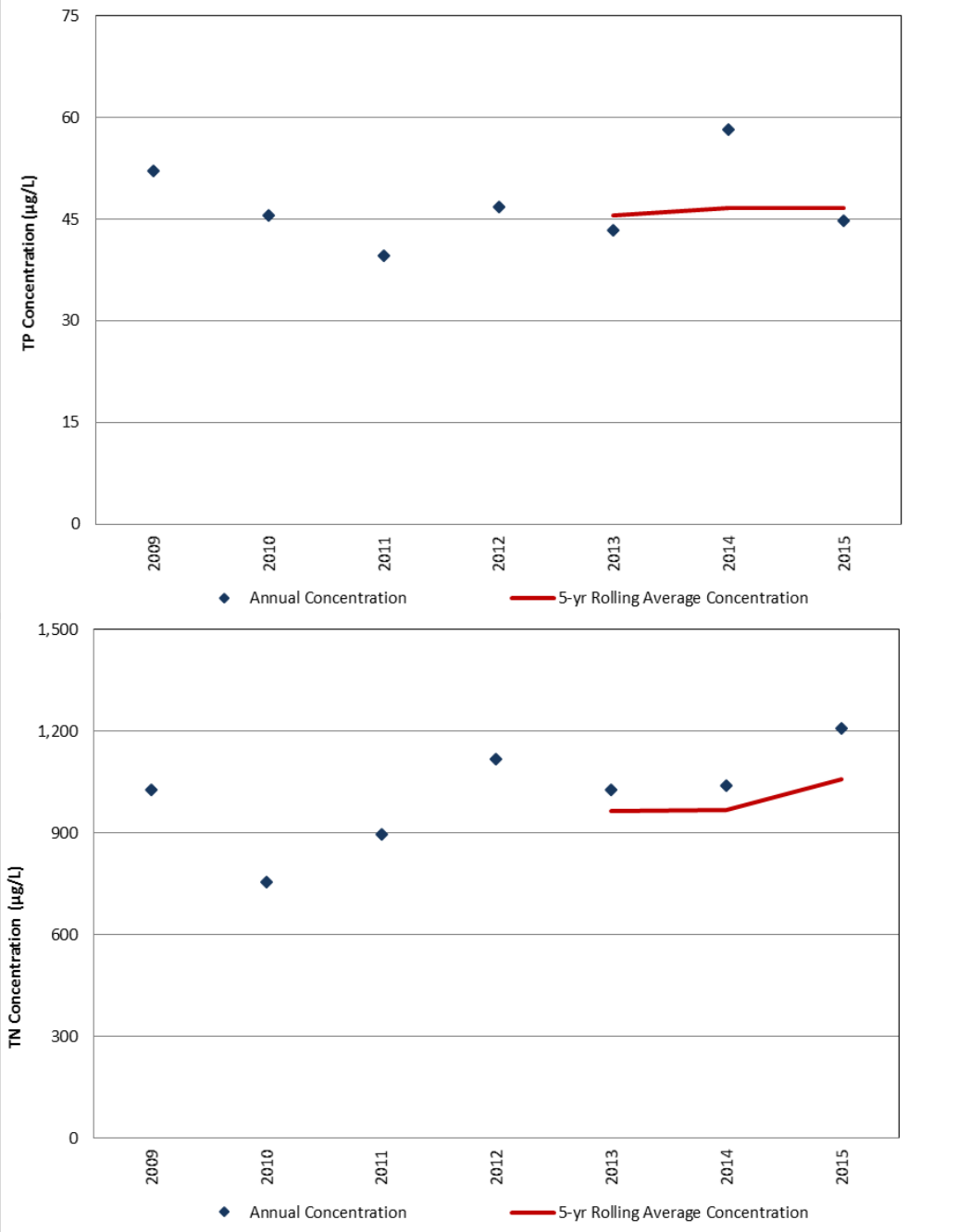
Figure 4-30. West Caloosahatchee Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 2004 and 2011–2013 District data sets.





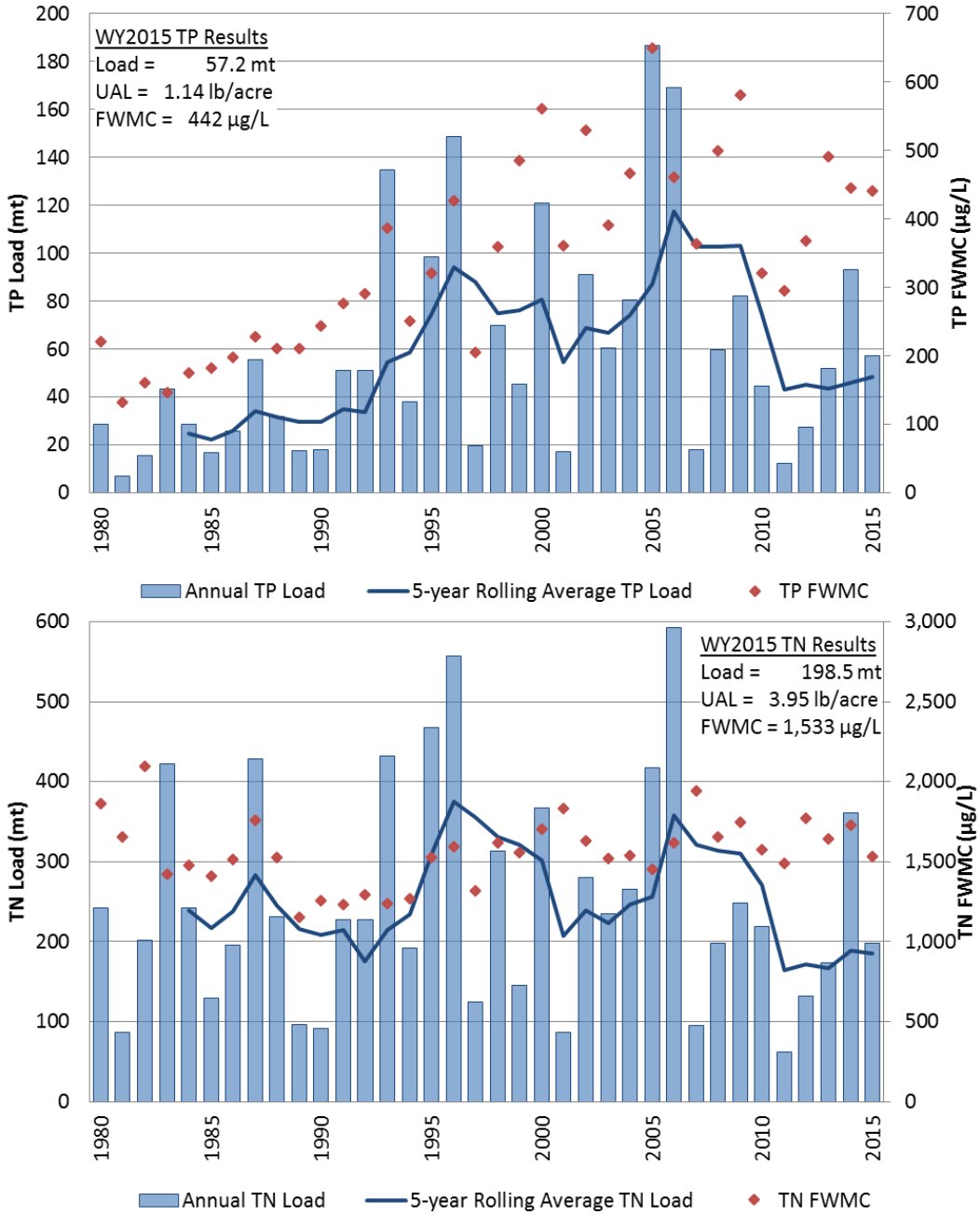
Land Use	2004	2011–2013	Land Use	2004	2011–2013
Natural Area	37%	32%	Improved Pasture	8%	10%
Residential Low Density	11%	14%	Other Urban	5%	6%
Residential Medium Density	10%	12%	Residential High Density	3%	3%
Rangeland/Woodland	9%	10%	Others	8%	5%
Water	9%	8%	-	-	-

Figure 4-31. Tidal Caloosahatchee Basin: annual TP (upper) and TN (lower) concentration and five-year rolling averages, and land use distribution from 2004 and 2011–2013 District data sets.



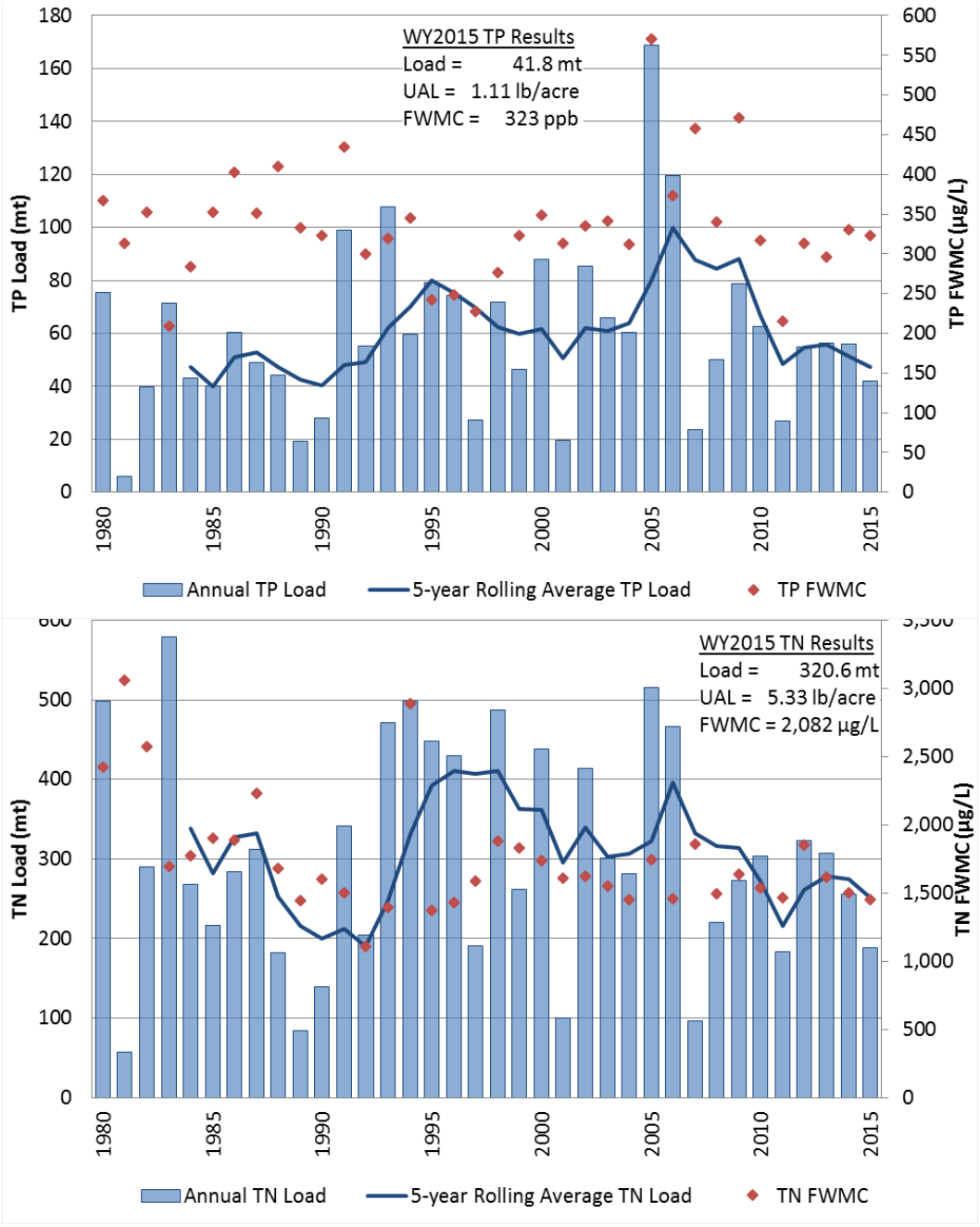
Land Use	2004	2011–2013	Land Use	2004	2011–2013
Water	44%	43%	Other Urban	2%	2%
Natural Areas	31%	34%	Other Agriculture	1%	1%
Residential Low Density	12%	12%	Others	7%	2%
Residential Medium Density	2%	5%	Improved Pasture	1%	1%

Figure 4-32. Coastal Caloosahatchee Basin: annual TP (upper) and TN (lower) concentration and five-year rolling averages, and land use distribution from 2004 and 2011–2013 District data sets.



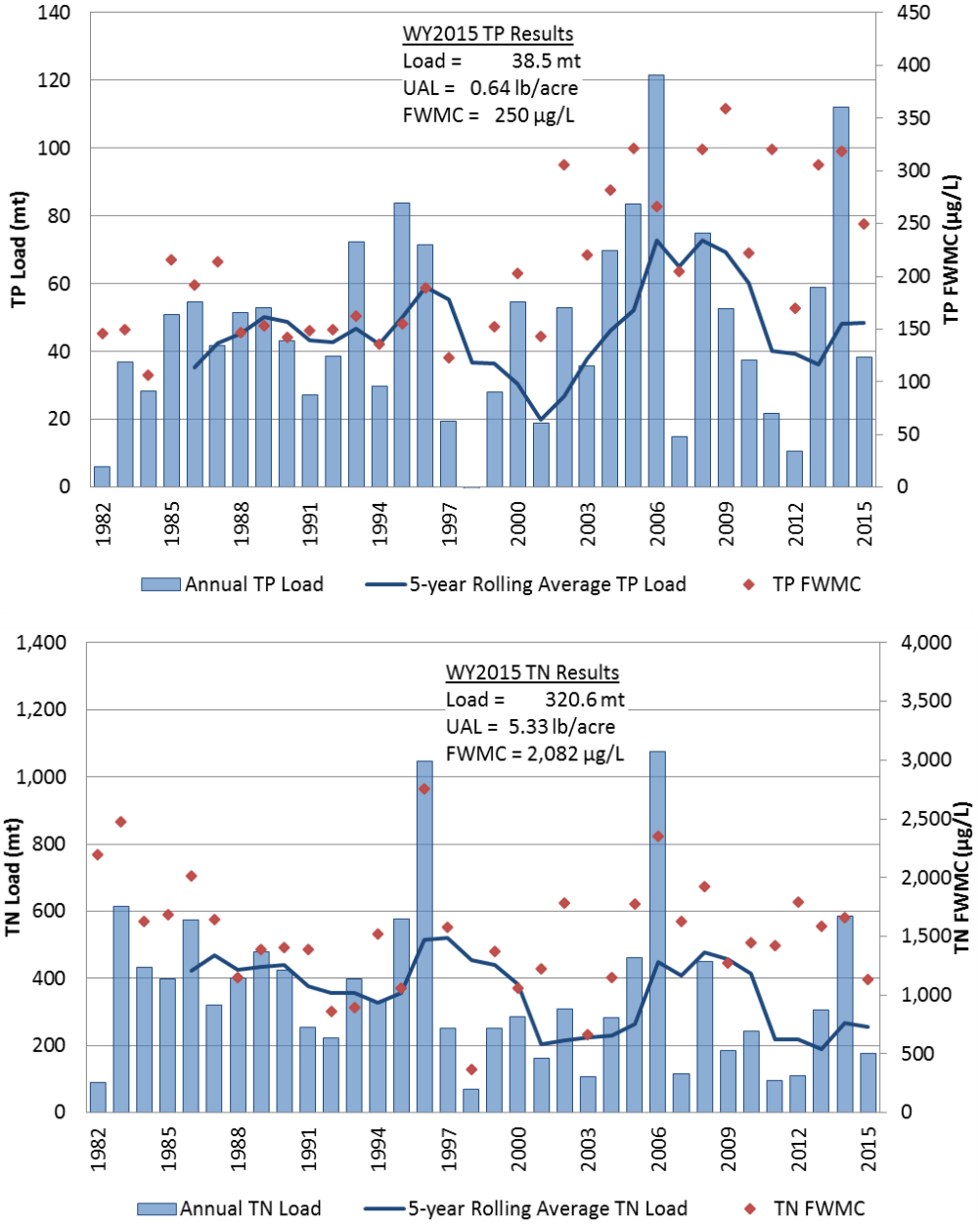
	1988	2011–2013	Land Use	1988	2011–2013
Improved Pasture	37%	30%	Residential Low Density	1%	2%
Natural Areas	32%	18%	Communication, Utilities	1%	1%
Citrus	27%	14%	Other Agriculture	0%	16%
Unimproved Pasture	2%	5%	Rangeland, Woodland Pasture	0%	9%
Water	1%	1%	Others	0%	4%

Figure 4-33. C-23 Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 1988 and 2011–2013 District data sets.



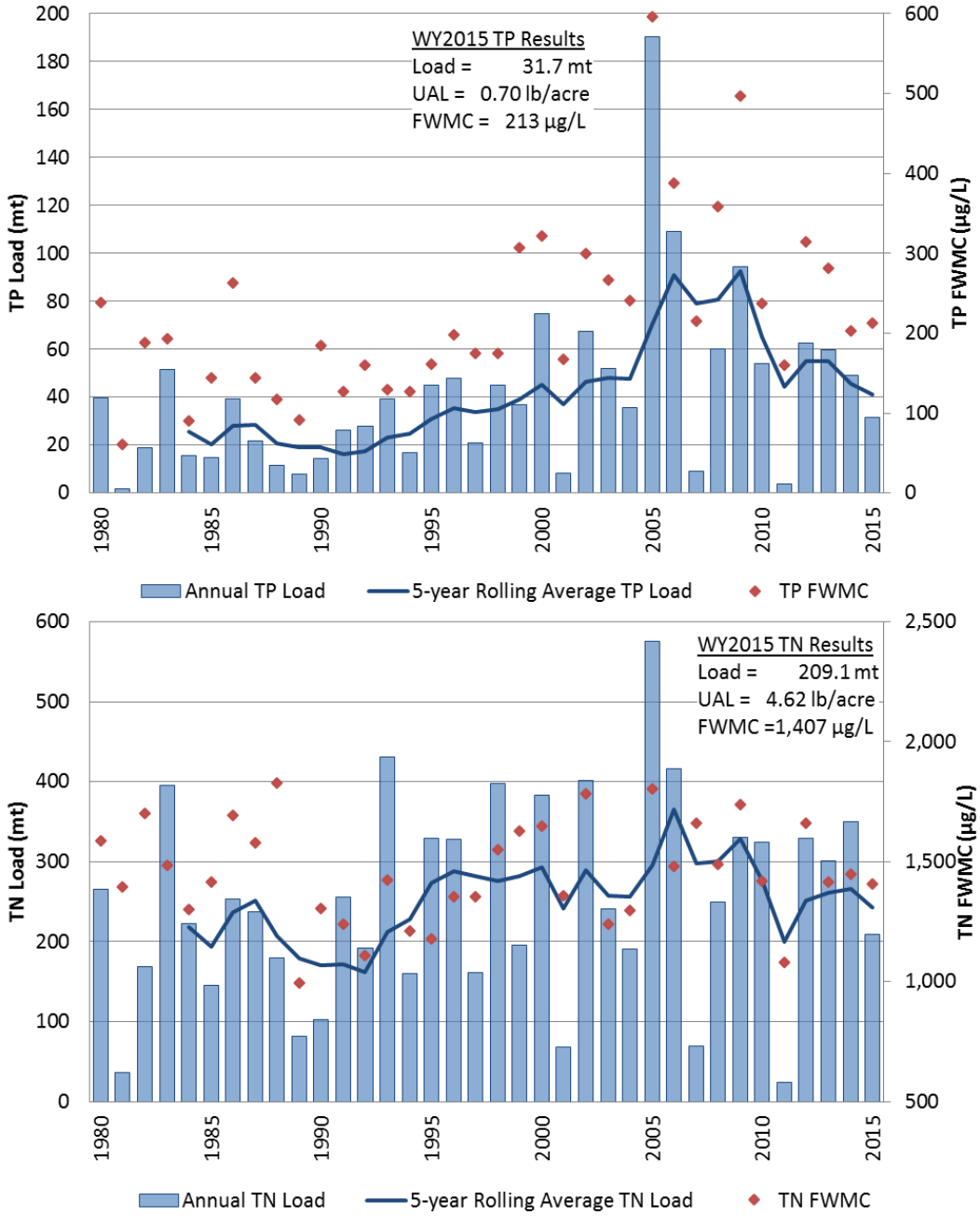
Land Use	1988	2011–2013	Land Use	1988	2011–2013
Improved Pasture	49%	40%	Row Crops	1%	1%
Natural Areas	33%	15%	Rangeland, Woodland Pasture	1%	10%
Citrus	13%	7%	Other Agriculture	0%	8%
Unimproved Pasture	3%	8%	Residential Medium Density	0%	4%
Water	1%	2%	Other	1%	5%

Figure 4-34. C-24 Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 1988 and 2011–2013 District data sets.



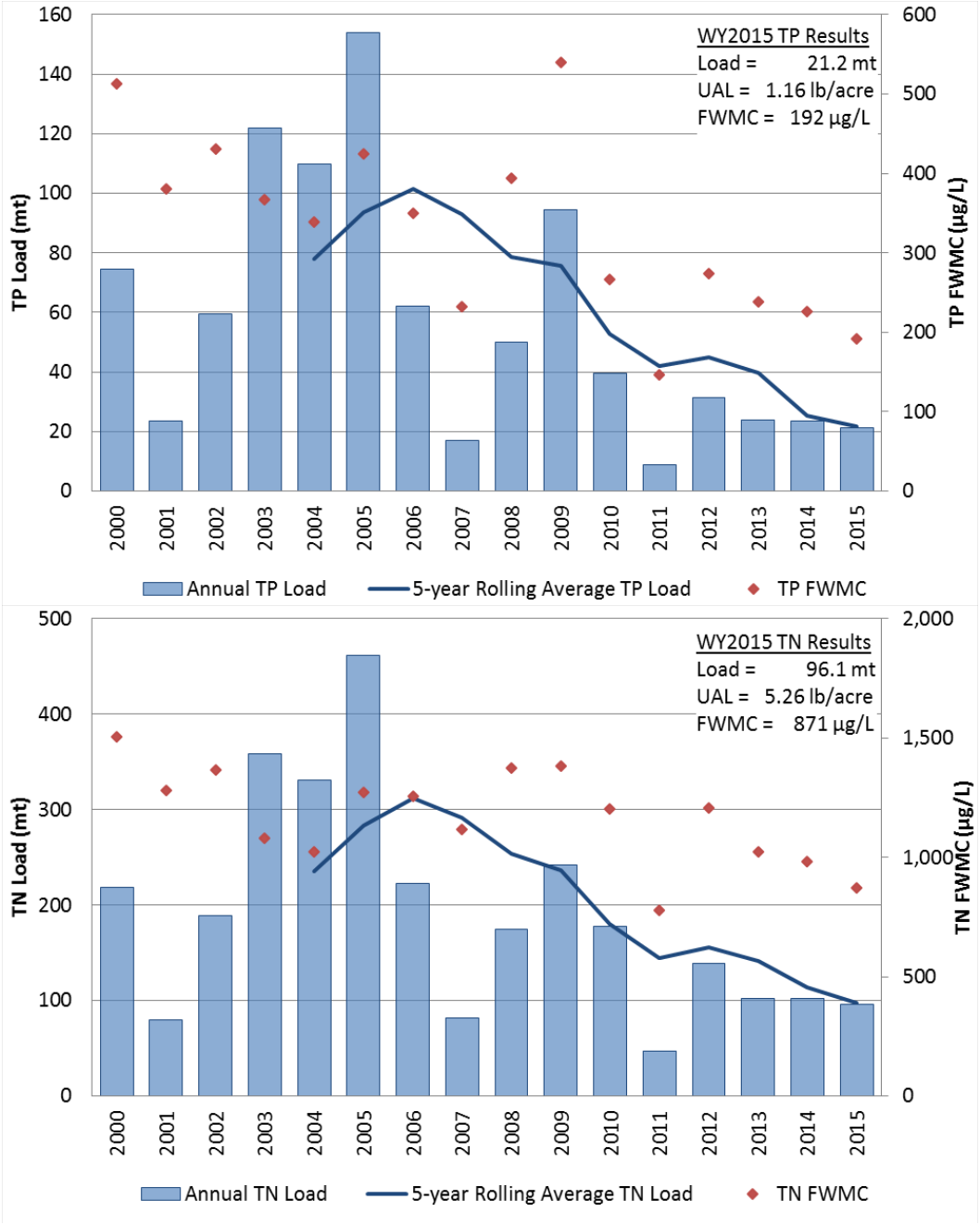
Land Use	2004	2011–2013	Land Use	2004	2011–2013
Citrus	32%	5%	Row Crops	4%	7%
Natural Areas	21%	21%	Sugar Cane	2%	1%
Improved Pasture	17%	18%	Water	2%	6%
Rangeland, Woodland Pasture	10%	10%	Other Agriculture	0%	24%
Communication, Utilities	6%	1%	Other	6%	7%

Figure 4-35. C-44 Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 2004 and 2011–2013 District data sets.
[Note: A negative load (stored) was observed for TP during WY1998.]
[This figure was updated on March 9, 2016.]



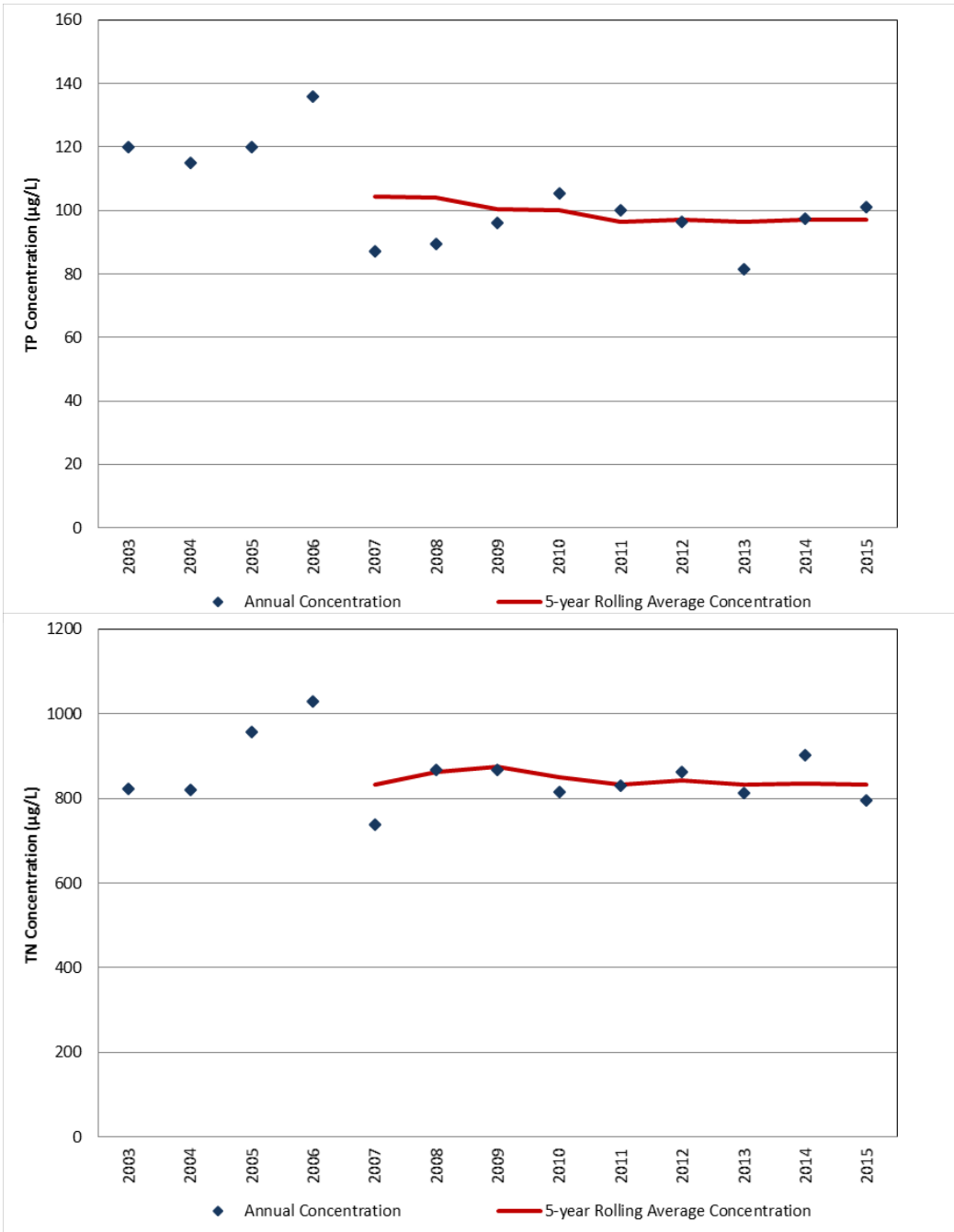
Land Use	1988	2011–2013	Land Use	1988	2011–2013
Improved Pasture	38%	21%	Communication, Utilities	1%	0%
Citrus	31%	33%	Other Agriculture	0%	19%
Natural Areas	27%	15%	Unimproved Pasture	0%	2%
Rangeland, Woodland Pasture	2%	5%	Other	0%	2%
Water	1%	3%	-	-	-

Figure 4-36. C-25 Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 1988 and 2011–2013 District data sets.



Land Use	2008	2011–2013	Land Use	2008	2011–2013
Citrus	50%	14%	Natural Areas	3%	3%
Improved Pasture	17%	25%	Row Crops	3%	2%
Residential Low Density	7%	8%	Unimproved Pasture	2%	1%
Other Agriculture	7%	36%	Ornamentals	2%	1%
Rangeland, Woodland Pasture	5%	4%	Other	4%	5%

Figure 4-37. Ten Mile Creek Basin: annual TP (upper plot) and TN (lower plot) load, five-year rolling average load, and annual FWMC, and land use distribution from 2008 and 2011–2013 District data sets.



Land Use	2008	2011–2013	Land Use	2008	2011–2013
Residential Medium Density	26%	26%	Rangeland, Woodland Pasture	5%	6%
Natural Areas	25%	24%	Water	4%	4%
Other Urban	10%	10%	Residential High Density	3%	4%
Residential Low Density	10%	10%	Transportation	3%	3%
Improved Pasture	7%	8%	Other	8%	6%

Figure 4-38. St. Lucie Tributaries Composite Area: annual composite TP (upper) and TN (lower) concentration and five-year rolling averages, and land use distribution from 2008 and 2011–2013 District data sets.

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