Lake Okeechobee Protection Plan

UPDATE

Florida Department of Agriculture and Consumer Services

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2011 Lake Okeechobee Protection Plan Update

March 2011

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Acronyms and Abbreviations

ac-ft	acre-feet
AFO	animal feeding operation
AGI	above-ground impoundments
AGNMA	Agriculture Nutrient Management Assessment
ASR	Aquifer Storage and Recovery
AWS	Alternative Water Supply
AWSD	Alternative Water Storage/Disposal
BMAP	Basin Management Action Plan
BMP	Best Management Practice
BOD	biochemical oxygen demand
BOR	Basis of Review for Environmental Resource Permit Applications
BRECC	BMP Research and Extension Coordinating Council
CAFO	concentrated animal feeding operation
CERP	Comprehensive Everglades Restoration Plan
CERPRA	Comprehensive Everglades Restoration Plan Regulatory Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeters
CPUE	catch per unit effort
CWSRF	Clean Water State Revolving Fund
DBAT	Dairy Best Available Technology
DFCC	ditch fencing and culvert crossing
District	South Florida Water Management District
DO	dissolved oxygen
DRI	Development of Regional Impact
EAA	Everglades Agricultural Area
EAR	Evaluation and Appraisal Report
EBCWD	East Beach Water Control District
ECP	Everglades Construction Project
EQIP	Environmental Quality Incentive Program
ERP	Environmental Resource Permit
ESWCD	East Shore Water Control District
F.A.C.	Florida Administrative Code
F.S.	Florida Statutes
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FDOH	Florida Department of Health
FFL	Florida-Friendly LandscapingFLUCCS Florida Land Use, Cover, and Forms Classification Systems
FRESP	Florida Ranchlands Environmental Services Project
ft	feet
FWC	Florida Fish and Wildlife Conservation Commission
FWRA	Florida Watershed Restoration Act
FY	Fiscal Year
FYN	Florida Yards and Neighborhoods
GI-BMP	Green Industry Best Management Practice
ha	hectare
HWTT	Hybrid Wetland Treatment Technology
IMWID	Istokpoga Marsh Watershed Improvement District
IWR	Impaired Waters Rule
KBMOS	Kissimmee Basin Modeling and Operations Study
kg	kilograms
KRRP	Kissimmee River Restoration Project
lbs	pounds
LF	linear feet
LOFT	Lake Okeechobee Fast Track
LOPA	Lake Okeechobee Protection Act
LOPP	Lake Okeechobee Protection Plan
LORS 2008	Lake Okeechobee Regulation Schedule
LOWA	Lake Okeechobee Watershed Assessment
LOWCP	Lake Okeechobee Watershed Construction Project
LOWPP	Lake Okeechobee Watershed Protection Program
Mg	megagrams
mg/L	milligrams per liter
mgd	million gallons per day
mi^2	square miles

mm	millimeters
MS4	municipal separate storm sewer system
MSGP	Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity
mt	metric tons
NATA	New Alternative Technology Assessment
NECTP	Northern Everglades Chemical Treatment Pilot
NEEPP	Northern Everglades and Estuaries Protection Program
NE-PES	Northern Everglades – Payment for Environmental Service
NGP	noticed general permit
NGVD	National Geodetic Vertical Datum of 1929
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resource Conservation Service
NWRCA	National Wildlife Refuge and Conservation Area
OAWP	Office of Agricultural Water Policy
P2TP	Lake Okeechobee Watershed Construction Plan – Phase II Technical Plan
PES	Payment for Environmental Services
ppb	parts per billion
PRB	Permeable Reactive Barrier
PSR	phosphorus saturation ratio
R/D	retention/detention
RASTA	reservoir-assisted stormwater treatment area
RFP	request for proposal
RRPP	Reserved Rights Pilot Program
RWSP	Regional Water Supply Plans
SAV	submerged aquatic vegetation
SFWMD	South Florida Water Management District
SLER	Submerged Lands and Environmental Resources
SPSC	soil phosphorus storage capacity
SSWCD	South Shore Water Control District
STA	stormwater treatment area
SWIM	Surface Water Improvement and Management
t/ac	tons per acre
TIITF	Board of Trustees of the Internal Improvement Trust Fund
TMDL	Total Maximum Daily Load
TN	total nitrogen
TP	total phosphorus
TSS	total suspended solids
UF/IFAS	University of Florida/Institute of Food and Agricultural Sciences
µg/L	micrograms per liter
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
UTF	Urban Turf Fertilizer
WAM	Watershed Assessment Model
WBID	water body identifications
WMA	water management alternatives
WMD	water management district
WOD	Works of the District
WREP	Wetlands Reserve Enhancement Program
WRP	Wetlands Reserve Program
WSP	water soluble phosphorus
WTR	water treatment residual
WWR	wetland water retention
WWTP	wastewater treatment plant
yd	yards

SECTION 1: INTRODUCTION

1.1 Document Purpose

Lake Okeechobee, the largest lake in the southeastern United States, is a shallow, eutrophic lake that represents the central component of the hydrology and environment of South Florida. The lake provides flood control and water supply for nearby towns and surrounding areas, including agricultural lands and downstream estuarine ecosystems. It serves as an important back-up water supply for urban areas along the lower east coast of Florida and also is used for navigational purposes. Lake Okeechobee supports a multimillion-dollar recreational and commercial fishery and provides important habitat for migratory water fowl, wading birds, and several threatened and endangered plant and animal species.

For the past four decades, Lake Okeechobee has been subjected to various forms of environmental degradation, including (1) excessive phosphorus loads, (2) extreme high and low water-level fluctuations, and (3) rapid spread of exotic and nuisance plants within the lake's littoral zone. Three Coordinating Agencies, the South Florida Water Management District (District or SFWMD), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS), are working cooperatively to address these interconnected issues to rehabilitate the lake and enhance the ecosystem services that it provides while maintaining its contributions to the regional water supply and flood control.

This document fulfills the requirement for a three-year update of the Lake Okeechobee Protection Plan (LOPP). It focuses on the progress of the three Coordinating Agencies in reducing phosphorus loads consistent with the Total Maximum Daily Load (TMDL)[1] established for the lake as well as increasing storage to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. The document provides (1) an introduction detailing the purpose of the LOPP Update, legislative requirements, and a description of the Lake Okeechobee Watershed; (2) an overview of the Lake Okeechobee Protection Program, including a description of its components; (3) information on the current status of Lake Okeechobee; (4) challenges in the watershed; (5) a review of past and current activities with summaries of completed and ongoing projects and activities; and (6) strategies for moving forward to reduce phosphorus loads to the lake and increase storage, including funding requirements over the next three years, and other project planning elements.

[1] A TMDL is the maximum amount of a given pollutant that a water body can absorb and still maintain its designated uses (e.g., drinking, fishing, swimming, shellfish harvesting). The Lake Okeechobee TMDL is based on a five-year rolling average to account for variations in rainfall, water flow, and loads.

1.1.1 Legislative Mandate

In 1987 the Florida legislature enacted the Surface Water Improvement and Management (SWIM) Act, which required the state's water management districts to develop restoration plans for priority water bodies. In 1989, The SFWMD developed a SWIM Plan to control phosphorus loading to Lake Okeechobee. Despite the plan, no substantial phosphorus reductions were achieved during the 1990s. As a result, the Florida legislature passed the Lake Okeechobee Protection Act (LOPA) (Section 373.4595, Florida Statutes [F.S.]) in 2000 to establish the Lake Okeechobee Protection Program to restore and protect the lake. In 2007, the legislature amended the LOPA in Chapter 373.4595, F.S., and enacted the Northern Everglades and Estuaries Protection Program (NEEPP). The NEEPP expanded Lake Okeechobee restoration efforts to include downstream estuaries (Caloosahatchee and St. Lucie River watersheds).

NEEPP includes the Lake Okeechobee Watershed Protection Program (LOWPP), which consists of the (1) Lake Okeechobee Watershed Protection Plan, (2) Lake Okeechobee Watershed Construction Project, (3) Lake Okeechobee Watershed Phosphorus Control Program, (4) Lake Okeechobee Watershed Research and Water Quality Monitoring Program, (5) Lake Okeechobee Exotic Species Control Program, (6) Lake Okeechobee Internal Phosphorus Management Program, and (7) annual progress reports. Section 2 of this report provides an overview of the Lake Okeechobee Watershed Protection Program and its seven elements.

The LOPA (now NEEPP) mandates a TMDL of 140 metric tons (mt) of total phosphorus (TP) per year to the lake be met by January 1, 2015. This TMDL was adopted by the FDEP in 2001 and was established in accordance with Section 403.067, F.S., and consists of 105 mt per year of TP from the watershed and 35 mt per year from atmospheric deposition (e.g., rainfall and wind). NEEPP also requires an aggressive program to control exotic plants and a long-term program of water quality and ecological assessment, research, and predictive model development to address the problem of phosphorus loading.

In addition, NEEPP requires the LOWPP to be reevaluated every three years to identify if further phosphorus load reductions are necessary to achieve compliance with the Lake Okeechobee TMDL pursuant to Section 403.067, F.S. The Coordinating Agencies have previously produced evaluation reports in 2004 and 2007 (SFWMD et al. 2004, SFWMD et al. 2007). NEEPP promotes a comprehensive and interconnected watershed approach to protection of the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The Lake Okeechobee Watershed Construction Plan – Phase II Technical Plan (P2TP) was submitted to the Florida legislature in February 2008 as required by NEEPP (SFWMD et al. 2008). The P2TP identifies construction projects and onsite measures that prevent or reduce pollution at the source, such as agricultural and urban Best Management Practices (BMPs), needed to achieve the TMDL for total phosphorus established for Lake Okeechobee. In addition, the P2TP includes other projects for increasing water storage north of Lake Okeechobee to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries.

This report, the *Lake Okeechobee Protection Plan Update*, provides a three-year re-evaluation of the P2TP with the most recent information available and addresses the three Coordinating Agencies' efforts in meeting defined phosphorus reduction and storage goals. This report also defines current and future proposed phosphorus reduction and storage projects that will require future funding for implementation and identifies the lead agencies for implementing each activity or project.

1.2 Physical Description of Lake Okeechobee

Lake Okeechobee covers more than 427,500 acres, with an average depth of about 8.9 feet (ft) and a maximum depth of 18 ft (James et al. 1995). The lake's watershed extends from just south of Orlando to agricultural areas around the lake's perimeter. The watershed spans 10 counties and 5,400 square miles (mi^2) (**Figure 1-1**). The Lake Okeechobee Watershed includes the Upper Kissimmee Chain of Lakes, the Kissimmee River, Taylor Creek/Nubbin Slough, Lake Istokpoga/Indian Prairie, Fisheating Creek, portions of the Everglades Agricultural Area (EAA), and other smaller basins on the lake's eastern and western sides.

The lake discharges water to the south to the Everglades Protection Area, to the east via the C-44 canal to the St. Lucie Estuary and Atlantic Ocean, and to the west via the C-43 canal to the Caloosahatchee River and Estuary and Gulf of Mexico. Lake Okeechobee functions as the central part of a large interconnected aquatic ecosystem located in South Florida and represents a major surface water body of the U.S. Army Corps of Engineers' (USACE) Central and Southern Florida Flood Control Project.

1.3 Land Use

Nutrient levels in surface water runoff are directly related to land use and land management practices within the watershed (Hiscock et al. 2003, Zhang et al. 2002). The Lake Okeechobee Watershed is dominated by agricultural land uses that account for 51.2 percent of the total area (1.7 million acres); followed by natural areas including wetlands, upland forests, and water bodies (35.7 percent or 1.2 million acres); and urban areas (11.9 percent or ~410,000 acres), the majority of which lie within the Upper Kissimmee and Lake Istokpoga sub-watersheds (**Figure 1-2** and **Table 1-1**). Agricultural land uses can be further classified as improved pasture (19.7 percent) for beef cattle grazing and unimproved pasture/rangeland (9.4 percent) north of the lake; sugarcane production (11.6 percent) south of the lake within the EAA; citrus groves (7.1 percent) located primarily within the eastern portion of the watershed and Lake Istokpoga Basin; and sod farms, row crops, dairies, and "other areas" make up the remaining (3.4 percent) land uses within the watershed. Although dairy farms in the northern basins cover less than 1 percent of the land use area, they represent a considerable source of phosphorus to some tributaries and up to 5 percent of the total external loading to the lake (Bottcher 2006).

The SFWMD uses the Florida Land Use, Cover, and Forms Classification System (FLUCCS) to define land use types. The SFWMD's minimum mapping unit standards for land cover and land use are 5 acres for upland and 2 acres for wetlands. For example, a wetland area less than 2 acres located within pastures will not be counted as wetland and will be included in the pasture total. The 2006 land use data were updated in 2008 as part of the Watershed Assessment Model enhancement project and minor revisions were made, such as the addition of "abandoned dairies" and fixing problems with low density residential in the S-133 basin. These updates are reflected in **Table 1-1**.

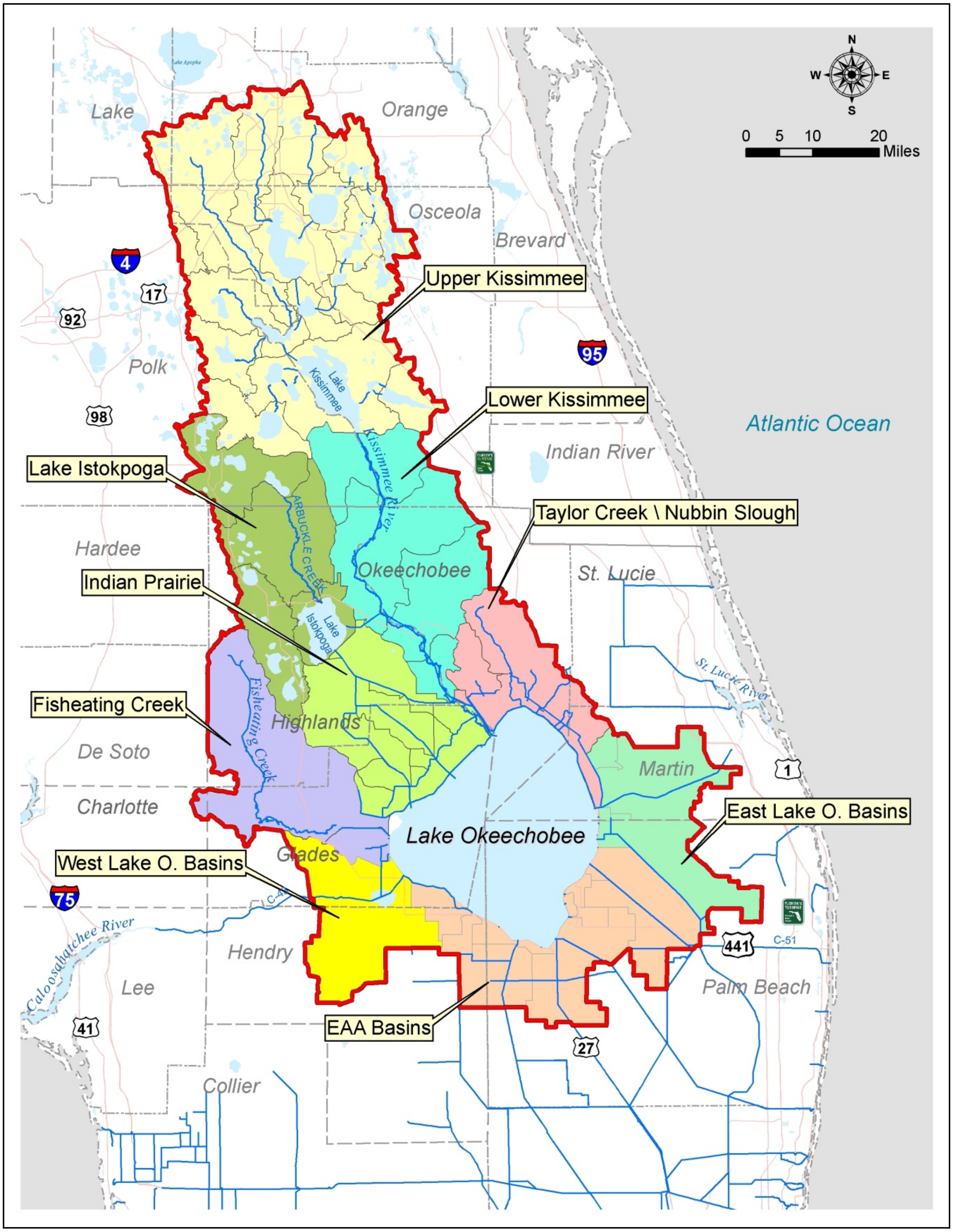

Figure 1-1. Lake Okeechobee Protection Plan boundaries and sub-watersheds.

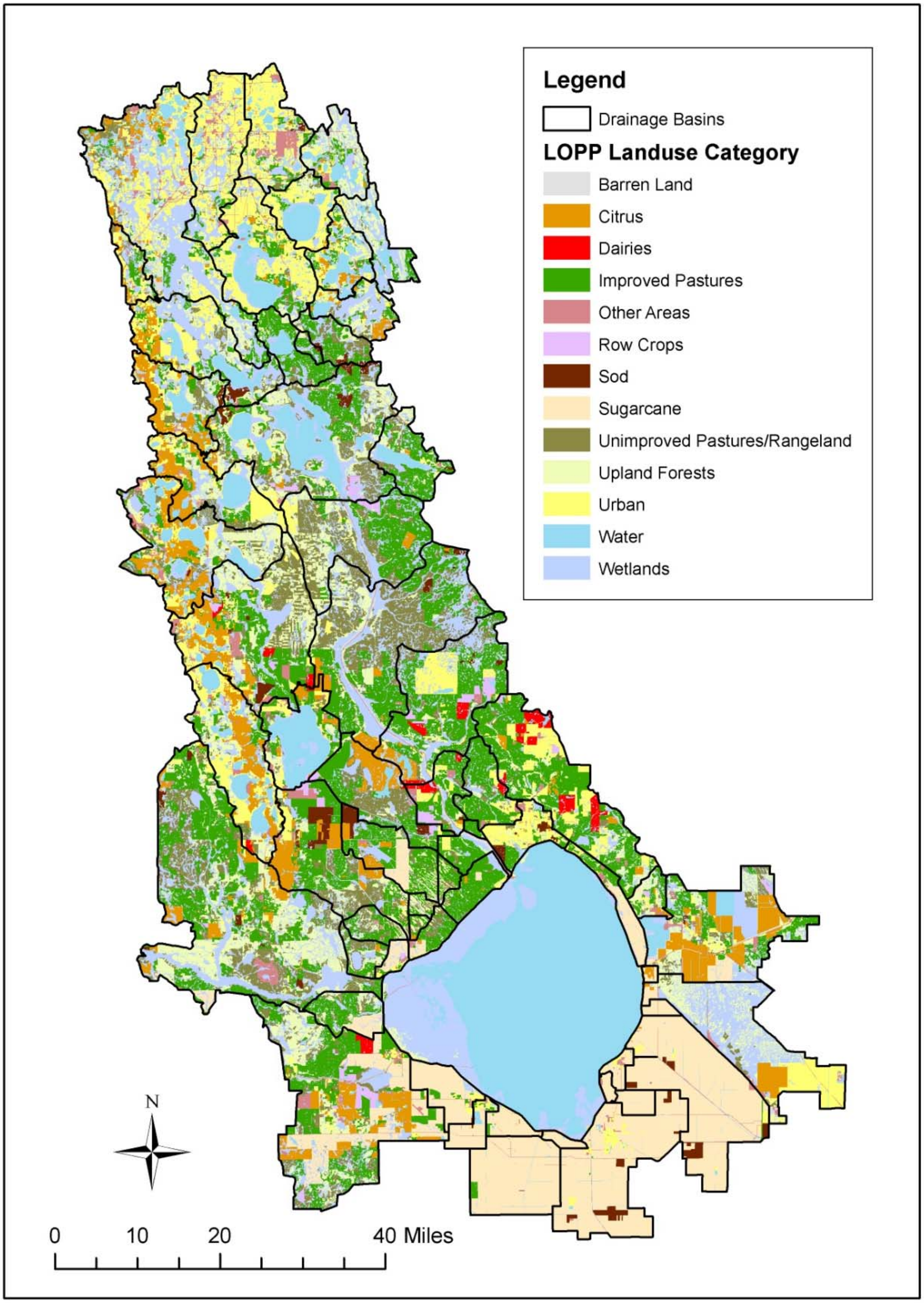

Figure 1-2. Land use distribution in the Lake Okeechobee Watershed (2006).

Table 1-1. Land use data for the Lake Okeechobee Protection Plan area.

Land Use	Area (acres) 2008	Percent
Barren Land	41,318	1.2%
Citrus	245,790	7.1%
Dairies	23,361	0.7%
Improved Pastures	676,991	19.7%
Other Areas	30,935	0.9%
Row Crops	23,238	0.7%
Sod	38,425	1.1%
Sugarcane	399,213	11.6%
Unimproved Pastures/ Rangeland	325,064	9.4%
Upland Forests	392,200	11.4%
Urban	410,397	11.9%
Water Bodies	220,127	6.4%
Wetlands	615,081	17.9%
LOPP Total Acreage	**3,442,141**	**100.0%**

1.4 Lake Okeechobee Sub-Watersheds

The Lake Okeechobee Watershed consists of four distinct tributary systems: the Kissimmee River Valley, Lake Istokpoga–Indian Prairie/Harney Pond, Fisheating Creek, and Taylor Creek/Nubbin Slough. With the exception of Fisheating Creek, all major inflows to Lake Okeechobee are controlled by gravity-fed or pump-driven water control structures. These four major tributary systems are generally bounded by the drainage divides of the major water bodies and are further divisible into smaller sub-watersheds based on the hydrology and geography shown in **Figure 1-3**.

The nine sub-watersheds of the Lake Okeechobee Watershed are:

- Upper Kissimmee
- Lower Kissimmee
- Taylor Creek/Nubbin Slough
- Lake Istokpoga
- Indian Prairie
- Fisheating Creek
- Eastern Lake Okeechobee (C-44/L-8 Basin)
- Western Lake Okeechobee (C-43 Basin)
- Southern Lake Okeechobee (includes EAA and Chapter 298 Districts)

Each of these sub-watersheds is further divisible into basins based on hydrologic and/or geographic divides. The entire Lake Okeechobee Watershed can be divided into 61 such drainage basins, each draining downhill into a body of water, such as a river or lake.

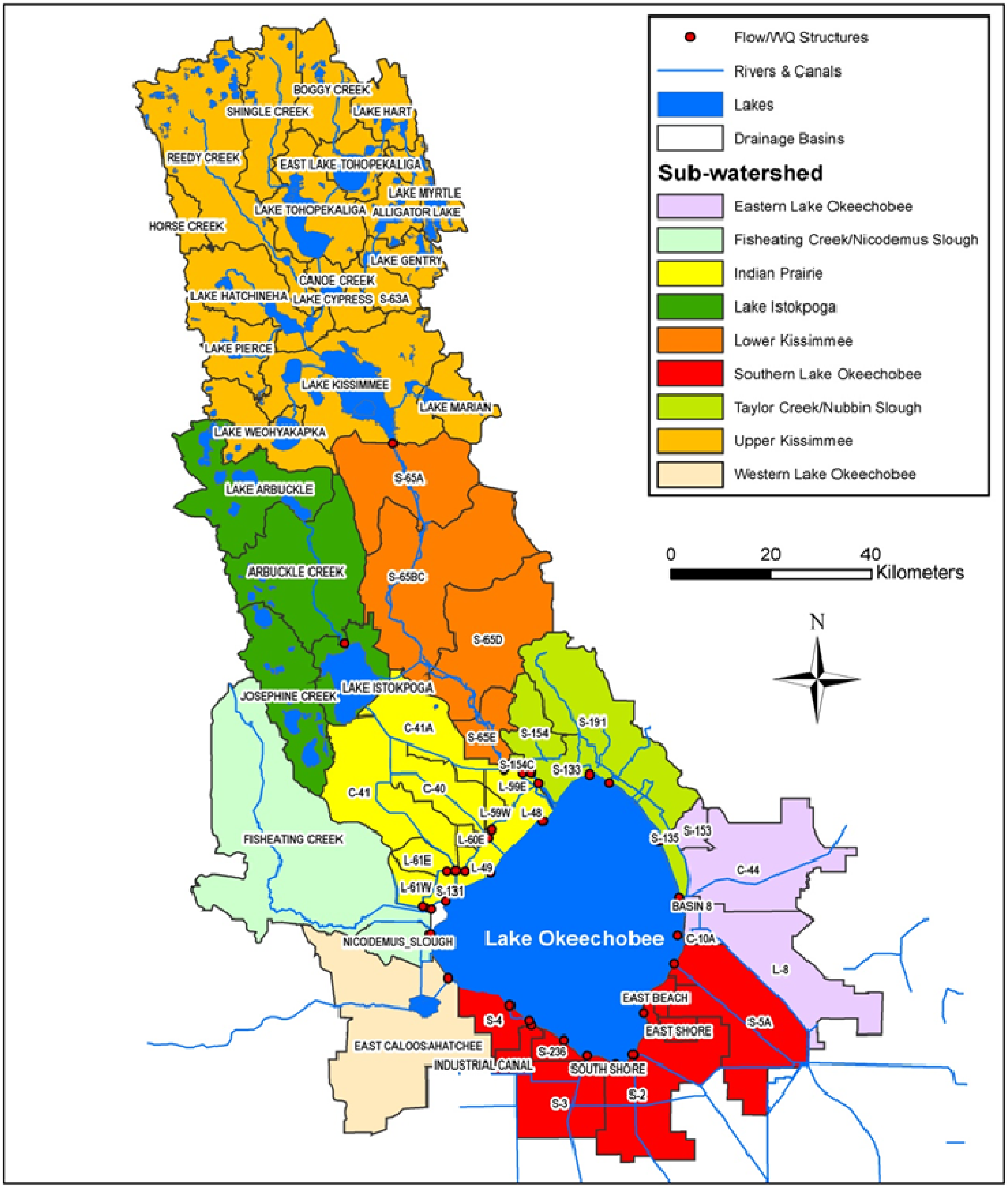

Figure 1-3. The Lake Okeechobee Watershed detailing sub-watershed and structure locations.

The Upper Kissimmee, Lower Kissimmee, Taylor Creek/Nubbin Slough, Lake Istokpoga, Indian Prairie, and Fisheating Creek sub-watersheds primarily drain into Lake Okeechobee by gravity. The S-133 basin (part of the Taylor Creek/Nubbin Slough Sub-watershed) and other urban areas can also pump into the lake from the north when the lake stage is high. The East and West Lake Okeechobee sub-watersheds contribute flow by gravity, but only when Lake Okeechobee water levels are below 14.5 ft and 11.5 ft in relation to the National Geodetic Vertical Datum of 1929 (NGVD), respectively. When high lake stages make gravity flows impossible, urban areas north of the lake are drained via pumps.

The South Lake Okeechobee Sub-watershed, which includes a portion of the EAA, contributes flow through pumping into the lake for flood control purposes under certain specific circumstances.

Upper and Lower Kissimmee Sub-Watersheds

The Upper and Lower Kissimmee sub-watersheds comprise the Kissimmee River Basin, which includes most of the areas that drain into Lake Okeechobee from the north and northwest through the Kissimmee River (C-38 canal). The Upper Kissimmee Sub-watershed covers approximately 1,633 mi^2 and includes Lake Kissimmee and the Chain of Lakes area in Orange and Osceola counties. The 758 mi^2 Lower Kissimmee Sub-watershed includes the tributary watersheds of the Kissimmee River that lie between the Lake Kissimmee outlet and the Kissimmee River inlet to Lake Okeechobee. The Kissimmee River Basin contributes the largest surface inflow to Lake Okeechobee. According to data from the baseline period of record (1991–2005), the Kissimmee River accounted for approximately 50 percent of the total inflow and 30 percent of total phosphorus loads to Lake Okeechobee (see Section 3).

The S-65 sub-basins (S-65A, S-65BC, S-65D, and S-65E) are located along the length of the C-38 canal and form four pools (**Figure 1-3**). Structure S-65B was removed as a part of the first phase of Kissimmee River Restoration Project and reduced the number of pools from five to four. The final phase of the restoration project (scheduled to be completed in 2012) will include removal of S-65C to form pool S-65BCD. Water levels in each of the pools are regulated according to interim regulation schedules.

Monitoring stations are located at each S-65 structure (at the downstream boundary of each sub-basin) and at station S-65, which is at the outlet from Lake Kissimmee to the Kissimmee River. The S-65 structures are gated spillways and locks that provide flood protection within their respective sub-basins and upstream basins. Each structure provides a minimum of 3,000 cubic feet per second (cfs) flow-through capacity for flood control in the Upper Kissimmee River Basin, irrespective of local runoff conditions.

Taylor Creek / Nubbin Slough Sub-Watershed

The Taylor Creek Sub-watershed (104 mi^2) and Nubbin Slough Sub-watershed (84 mi^2) are interconnected and drain into Lake Okeechobee from the north and northeast. The Nubbin Slough Sub-watershed includes three tributaries: Lettuce Creek, Henry Creek, and Mosquito Creek, which along with Nubbin Slough are intercepted by canals (L-63, L-64, and C-59) and enter Lake Okeechobee through flow-control structure S-191. The unmonitored boat locks at S-193 are used for gravity flows into and out of the lake. The lower reaches of Taylor Creek, downstream of S-192, flow into the lake through structure S-193. Additional flow into the lake is provided by the S-133 pump station, which is primarily operated for flood protection.

Lake Istokpoga Sub-Watershed

The 613 mi^2 Lake Istokpoga Sub-watershed is located to the west and north (upstream) of Lake Istokpoga and is largely characterized by natural lands. It is the source of all inflows to Lake Istokpoga. The primary outlet from Lake Istokpoga is through the S-68 structure, which releases water through a series of canals southeastward to both Lake Okeechobee and the Kissimmee River.

Indian Prairie Sub-Watershed

The 622 mi^2 Indian Prairie Sub-watershed drains the area between Lake Istokpoga and Lake Okeechobee. It includes the C-41, C-40, S-84, L-49, L-59, and S-131 sub-basins.

Fisheating Creek Sub-Watershed

The Fisheating Creek Sub-watershed drains into Lake Okeechobee from the west and is the only sub-watershed with an uncontrolled "natural" discharge. It covers approximately 440 mi^2 and originates in western Highlands County and flows south through a large cypress swamp into Glades County with an average gradient of 0.5 feet per mile. From central Glades County, water leaves the creek channel and flows east through Cowbone Marsh into Lake Okeechobee. Levees have been constructed roughly parallel to the creek near its outlet to the lake.

Southern Lake Okeechobee Sub-Watershed

As shown in **Figure 1-1**, the northern portion of the Everglades Agricultural Area is included in the Lake Okeechobee Watershed. This area can potentially contribute flows to the lake through pumping. This sub-watershed includes portions of the EAA and several Chapter 298 districts (named for Chapter 298, F.S., which established them), including the S-2, S-3, S-6, S-5A, S-236, South Shore, 715 Farms, East Beach, East Shore, and Culvert 10A sub-basins. A 2007 Lake Okeechobee Operating Permit allows the District to pump waters into the lake at S-2 and S-3 for flood control purposes when EAA Canal stages reach 12.5 ft NGVD. Historically, these urban areas adjacent to lake have relied on S-2 and S-3 to provide flood protection by pumping into the lake. Under normal circumstances, the majority of runoff from the EAA is discharged into the Water Conservation Areas. In addition, the S-4 structure discharges for flood control purposes to Lake Okeechobee because no alternative discharge is available.

East and West Lake Okeechobee Sub-Watersheds

The East Lake Okeechobee Sub-watershed (S-153, C-44, and L-8 basins and Basin 8) is primarily farmed for sugarcane. The West Lake Okeechobee Sub-watershed includes the East Caloosahatchee basin.

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SECTION 2: OVERVIEW OF LAKE OKEECHOBEE WATERSHED PROTECTION PROGRAMS

The Lake Okeechobee Protection Act (LOPA) (Section 373.4595, Florida Statutes [F.S.]) was enacted in 2000 by the Florida legislature to establish a restoration and protection program for the lake. This program addresses the reduction of total phosphorus (TP) loading to the lake from both internal and external sources. In 2007, the legislature amended the LOPA to also include protection of the Caloosahatchee River and St. Lucie River watersheds. Section 373.4595, F.S., is now known as the Northern Everglades and Estuaries Protection Program (NEEPP), and it promotes a comprehensive, interconnected watershed approach to protecting these water bodies (SFWMD et al. 2008). The NEEPP includes the Lake Okeechobee Protection Plan (LOPP), now incorporated into the Lake Okeechobee Watershed Protection Program (LOWPP), and the Caloosahatchee and St. Lucie River Watershed Protection Plans completed in January 2009. The relationship among the NEEPP, the LOWPP, the Caloosahatchee and St. Lucie River Watershed Protection Programs, and their associated elements and projects is illustrated in **Figure 2-1**.

These programs address the reduction of pollutant loadings, restoration of natural hydrology, and compliance with applicable state water quality standards. Three Coordinating Agencies, the South Florida Water Management District (SFWMD or District), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS), are charged with carrying out the protection program.

The LOWPP includes the following seven key elements:

- Lake Okeechobee Protection Plan
- Lake Okeechobee Watershed Construction Project (Phase I and Phase II)
- Lake Okeechobee Watershed Phosphorus Control Program
- Lake Okeechobee Watershed Research and Water Quality Monitoring Program
- Lake Okeechobee Exotic Species Control Program
- Lake Okeechobee Internal Phosphorus Management Program
- Progress reports published annually in the *South Florida Environmental Report*

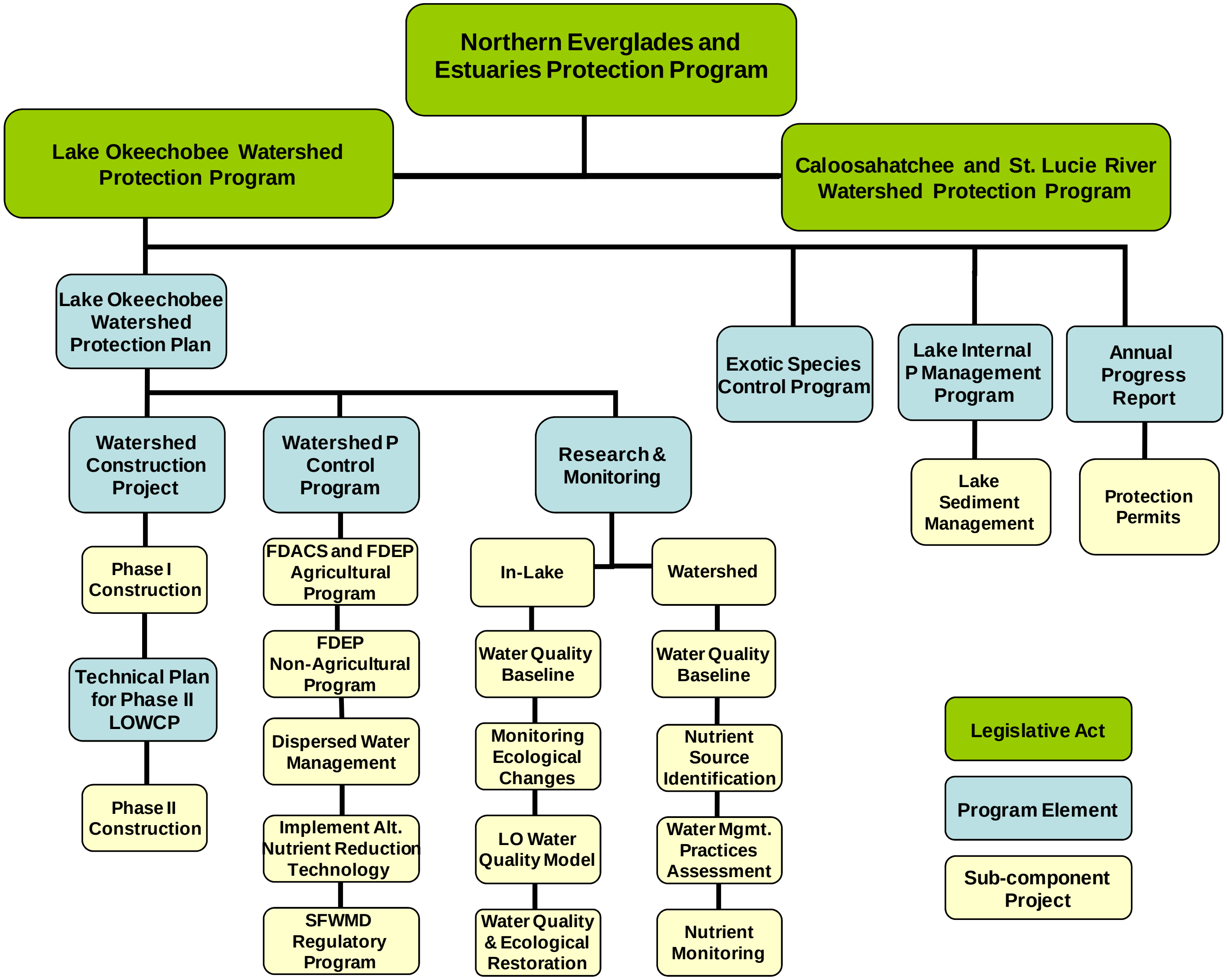

Figure 2-1. The Northern Everglades and Estuaries Protection Program structure, detailing the Lake Okeechobee Watershed Protection Program, its elements, and projects (P: phosphorus; LOWCP: Lake Okeechobee Watershed Construction Project; LO: Lake Okeechobee).

2.1 Lake Okeechobee Protection Plan

The LOPP was delivered to the legislature in 2004 and an update was submitted in February 2007. The LOPP contains an integrated management strategy that is based on implementation of phosphorus source control programs including Best Management Practices (BMPs) at parcel, sub-basin and regional levels, flow attenuation projects, and in-lake remediation activities. The LOPP also contains elements of exotic species control and research and water quality monitoring. Since the LOPA was enacted, the coordinating agencies have collectively implemented a large number of total phosphorus load reduction projects in the Lake Okeechobee Watershed. These include phosphorus source control grants for agricultural landowners, Dairy Best Available Technology (DBAT) pilot projects, soil amendment projects, isolated wetland restoration projects, remediation of former dairies, and regional public/private partnerships. A comprehensive Lake Okeechobee monitoring program has also been initiated that regularly monitors water quality and ecological indicators in the lake. Research and model applications have been instituted that continue to provide predictive understanding necessary to evaluate the effectiveness of water management alternatives.

2.2 Lake Okeechobee Watershed Construction Project

2.2.1 Phase I

The Lake Okeechobee Watershed Construction Project (LOWCP) is being implemented in two phases. Phase I was intended to bring immediate TP load reductions to the lake. The project features are designed to improve hydrology and water quality of Lake Okeechobee and downstream receiving waters, consistent with recommendations included in the South Florida Ecosystem Restoration Working Group's Lake Okeechobee Action Plan (Harvey and Havens 1999). Phase I included projects identified as the Lake Okeechobee Water Retention Phosphorus Removal Critical Project that was authorized in the Water Resources Development Act of 1996.

Phase I projects within the Taylor Creek and Nubbin Slough basins included two pilot stormwater treatment areas (STAs) and a sediment removal pilot project. The sediment removal pilot project was completed in 2004; however, no significant removal of particulate phosphorus was observed. The STAs at Taylor Creek and Nubbin Slough, areas of water quality concern for nutrients in the Lake Okeechobee Watershed, are fully constructed. Details on the status of the Taylor Creek and Nubbin Slough STAs can be found in Section 5.2, whereas ongoing challenges with operations and other issues are described in Section 4.

2.2.2 Phase II Technical Plan

The NEEPP required the development of the LOWCP – Phase II Technical Plan (P2TP). The P2TP was developed by the SFWMD in coordination with the FDEP and the FDACS with extensive input from stakeholders and was submitted to the Florida legislature on February 1, 2008 (SFWMD et al. 2008). To achieve the restoration goals outlined in the NEEPP, the Coordinating Agencies evaluated various alternatives using the best available technology and scientific information including significant public involvement and review. The resulting plan identifies construction projects and onsite measures that prevent or reduce pollution at the source, such as agricultural or urban BMPs, needed to achieve the total maximum daily load (TMDL) target established for Lake Okeechobee. The P2TP also includes projects for increasing water storage north of the lake to achieve healthier water levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. Components of the P2TP include:

- Implementing BMPs on more than 1.7 million acres of farm and urban lands
- Adopting new regulations that will reduce the impacts of development on water quality and flow
- Building treatment wetlands to clean water flowing into the lake
- Using other nutrient control technologies to reduce phosphorus loads from the watershed
- Creating between 900,000 and 1.3 million acre-feet of water storage north of the lake through a combination of aboveground reservoirs, underground storage, and alternative water storage projects on public, private, and tribal lands

Since the delivery of the P2TP to the Florida legislature in February 2008, numerous projects and engineering components have begun. Section 5 provides more details on the results and status of these projects.

2.3 Lake Okeechobee Watershed Phosphorus Control Program

The Lake Okeechobee Watershed Phosphorus Control Program consists of a multifaceted approach that includes (1) continued implementation of existing regulations and voluntary agricultural and non-agricultural BMPs, (2) development and implementation of improved BMPs, (3) improvement and restoration of the hydrologic functions of natural and managed systems, and (4) utilization of alternative technologies for nutrient reduction. The SFWMD, FDEP, and FDACS entered into a memorandum of agreement in 2001, which was subsequently amended in 2002, that addresses how this program is implemented and coordinated with existing regulatory programs, including the SFWMD Works of the District Permitting Programs (Chapters 40E-61 and 40E-63 F.A.C.), the SFWMD Environmental Resource Permitting Program (Chapter 40E-4. F.A.C), the FDEP's Dairy Rule (Rule 62-670.500, F.A.C.), and the Everglades Forever Act (Section 373.4592[4], F.S.).

Under the NEEPP, each Coordinating Agency is responsible for certain program aspects. The FDACS is charged with implementing an incentive-based BMP program on all agricultural lands within the Lake Okeechobee Watershed. The FDEP is responsible for developing non-agricultural and agricultural programs. The SFWMD is responsible for implementing phosphorus reduction projects including sub-regional and large-scale regional projects, and for enforcing existing regulatory source control programs. An overview of the various watershed phosphorus control programs that have been established within the Lake Okeechobee Watershed is provided below and more details are available in Sections 5.1.2 and 6.2.1.

2.3.1 FDACS Agricultural Programs

Pursuant to the NEEPP, the FDACS has adopted a comprehensive BMP program by rule that requires agricultural producers in the Lake Okeechobee Watershed to implement nutrient management and other applicable BMPs to address identified environmental resource challenges on their lands. The FDACS-adopted BMP programs cover citrus, beef cattle operations, containerized nurseries, sod, and vegetable and agronomic crop production. More details concerning the status of the FDACS Agricultural BMP Program are presented in Section 5.1.2.

2.3.2 FDEP Agricultural Programs

The FDEP permits and inspects active dairies and other concentrated animal feeding operations (CAFOs) within the Lake Okeechobee Watershed pursuant to the National Pollutant Discharge Elimination System (NPDES) permit program under the Clean Water Act. CAFOs are facilities where large numbers of poultry, swine, cattle, or other livestock are confined within a much smaller area than traditional pasture operations. The FDEP currently permits 23 facilities in the Lake Okeechobee Watershed pursuant to Chapter 62-670, F.A.C. These permitted facilities are frequently inspected and farm managers are educated to prevent environmental impacts that could result from improper management of wastes. Manure and wastewater from these facilities have the potential to contribute pollutants, including nitrogen, phosphorus, organic matter, sediments, pathogens, heavy metals, and hormones, to the environment. The dairies permitted in the Lake Okeechobee Watershed reuse their wastewater to fertilize crops and avoid offsite discharges.

Domestic wastewater residuals, also known as sewage sludge or biosolids, are the solids from municipal wastewater treatment facilities. If properly treated, biosolids may be beneficially used as a soil amendment or fertilizer. About 60 percent of Florida’s biosolids are land-applied as Class B biosolids, primarily through surface application to pastures. Class B biosolids are treated to reduce pathogens, but a number of site restrictions must be met to minimize potential human exposure while any remaining pathogens die off after application. In contrast, Class AA biosolids have been treated to eliminate pathogens and may be sold to farmers and the public. About 25 percent of Florida’s biosolids are distributed and marketed as Class AA.

The FDEP adopted amendments to Chapter 62-640, F.A.C., which the Environmental Regulation Commission approved on May 20, 2010, to improve site accountability and management and to address public concerns. The new rule became effective on August 29, 2010. The spreading of Class B biosolids in the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds is anticipated to cease by 2013 because of the difficulty with showing compliance with the nutrient balance demonstration required by Section 373.4595, F.S. The amendments primarily added site permitting, nutrient management plans, and additional requirements for Class AA biosolids, in addition to revising other site requirements. However, Class AA biosolids distributed and marketed as a fertilizer product are currently exempted from the nutrient balance demonstration of the statute. Class AA biosolids are fertilizer products subject to FDACS fertilizer regulations. Regulations require residuals to be applied at an agronomic rate to minimize or prevent nitrogen leaching. Application rates are based on the nutrient content of the residuals and the needs of the crops. Florida also requires phosphorus to be considered in certain geographic areas, including the Lake Okeechobee Watershed. More information is also included in Sections 5.1.2.7 and 6.2.1.2.

2.3.3 FDEP Non-Agricultural Programs

The size of urban land that drains to Lake Okeechobee is minimal compared to agricultural lands. As a result, the percent of the total nutrient load flowing into Lake Okeechobee from urban areas is relatively small (12 percent) in comparison to agricultural lands (51 percent). However, the higher per-acre nutrient contribution from urban areas prompted the FDEP and stakeholders to continue their comprehensive approach to reducing nutrient loads flowing into Lake Okeechobee. The largest contributors of TP from non-agricultural areas to the lake are nonpoint sources, such as runoff from residential lawns that carries fertilizers, pet wastes, and effluent from septic tanks.

The FDEP uses regulatory and incentive methods to enhance and protect the Lake Okeechobee Watershed and provides grants for municipalities and others to construct projects that treat storm water before it enters surface waters. The two primary regulatory programs that address urban point-source stormwater and nonpoint-source inflows to Lake Okeechobee tributaries are the NPDES Stormwater Permitting Program and the Submerged Lands and Environmental Resources Program respectively. The FDEP also issues other permits for restoration activities in the Lake Okeechobee Watershed and NPDES permits for wastewater. In addition to permitting activities, the FDEP is responsible for numerous other programs and activities designed to improve water quality in the Lake Okeechobee Watershed and the rest of the state (e.g., rulemaking efforts pertaining to the statewide stormwater rule and numeric nutrient criteria).

Another key responsibility of the FDEP is to administer the TMDL program for the U.S. Environmental Protection Agency (USEPA). The TMDL program is a surface water assessment and restoration program intended to bring all states' surface water bodies into compliance with respective water quality standards. Lake Okeechobee and its tributaries have TMDLs established for total phosphorus. Once a TMDL is established, a Basin Management Action Plan (BMAP) may be created to direct restoration efforts to meet the TMDL. BMAPs identify and describe various projects, programs, and activities (such as those mentioned in the previous paragraphs) planned to reduce pollutant loading, restore beneficial uses, and meet water quality standards. Currently, the Lake Okeechobee Protection Plan fulfills the role of a BMAP for Lake Okeechobee and its tributaries.

2.3.4 SFWMD Source Control Programs

The SFWMD Lake Okeechobee Watershed Regulatory Source Control Program began with the enactment of the Surface Water Improvement Management Act in 1987 (Section 373.4595, F.S.), which became the LOPA in 2000, and subsequently the NEEPP in 2007. The original act authorized the creation of the Lake Okeechobee Works of the District Program, which became effective in 1989. The LOPA established and the NEEPP now contains source control program requirements for the Lake Okeechobee Watershed, with specific and varying levels of responsibility accorded to the SFWMD, FDACS, and FDEP. The NEEPP specifies that the Coordinating Agencies operate in concert through an interagency agreement so that resources, responsibilities, and efforts can be properly coordinated and aligned. Source control planning for the Lake Okeechobee Watershed is incorporated into the P2TP (see Section 2.2.2). The update on the status of the Lake Okeechobee Watershed phosphorus source control programs identified in the P2TP is provided in Section 5.1.

The measures included in the source control programs are intended to: (1) minimize the amount of nutrients used onsite to the greatest extent possible, (2) ensure that when nutrients are applied that it is in an effective manner that minimizes nutrient discharge into local runoff, and (3) ensure that local runoff is detained onsite to minimize discharge of nutrients into the regional drainage system. The measures may take the form of structural or non-structural actions intended to minimize or eliminate nutrient impacts to receiving water bodies. Structural source control measures include creating physical changes in the landscape to reroute local discharges, erecting fences and barriers to prevent introduction of nutrients in runoff, and installing water control structures to detain runoff onsite as long as possible. Non-structural source control measures include education and operational changes. The measures are implemented and enforced through permit requirements under existing regulatory programs, such as the SFWMD Works of the District and Environmental Resource Permitting Programs.

The current objective of the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program is to establish criteria that ensure that runoff to the tributaries and canals that discharge into Lake Okeechobee allow the District to meet the legislative policies established in Chapter 373, F.S. The District is updating the rule criteria to be compatible with current initiatives and amendments to the statute. Section 5.1.2.3 provides a more detailed summary of the District's Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program.

2.4 Lake Okeechobee Research and Water Quality Monitoring Program

A research and water quality monitoring program requires the District, in cooperation with other coordinating agencies, to: (1) collect data to establish long-term water-quality trends in the Lake Okeechobee Watershed, (2) develop a water quality model for the lake, (3) continue to identify and quantify phosphorus sources in the watershed, (4) assess water management practices within the watershed, (5) evaluate the feasibility of alternative nutrient removal technologies, and (6) assess the relationship between water volumes and timing from the Lake Okeechobee Watershed, water level changes in Lake Okeechobee, and the timing and volume of water delivered to the estuaries.

The District, in cooperation with FDACS, FDEP, University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS), and other agencies and interested parties, has been implementing a comprehensive research and assessment program for the Lake Okeechobee Watershed. Research and assessment projects are assessed and prioritized each year by the Northern Everglades Interagency Team, which expanded and includes participants from local governments in the Northern Everglades Planning Area, including the Upper Kissimmee Region and the Caloosahatchee and St. Lucie River watersheds. This team works to ensure that key issues and information needs are being addressed and it is an integral component of the overall restoration program. Research, demonstration, and assessment projects that are under way or have been completed since the previous update in 2007 are summarized in Section 5.3.

2.5 Exotic Species Control Program

The Exotic Species Control Program is required to: (1) identify the exotic species that threaten native flora and fauna within the Lake Okeechobee Watershed, and (2) develop and implement measures to protect native species. The exotic plants and animals identified as threats to native species will require management of the existing invasion, or in the case of some animal species, monitoring of possible future invasions.

The species lists were compiled based on discussions of interagency staff and current management efforts within the watershed. Plants and animals will be added as new threats are discovered or as minor exotic species become more dominant. In addition, while other exotic species within the watershed threaten agriculture and warrant additional focus, the costs associated with the protection plan only attempt to address exotic species that pressure native flora and fauna.

The approach to implementation of the exotic species plan within the Lake Okeechobee Watershed has been and will continue to be through the cooperative efforts of state and federal agencies. In March 1989, a letter of operation procedures for aquatic management in Lake Okeechobee was signed by the U.S. Army Corps of Engineers (USACE), FDEP, Florida Fish and Wildlife Conservation Commission (FWC), and SFWMD to formalize the operational avenue through which the agencies advise and provide exotics treatment. This agreement stipulates bimonthly interagency meetings, chaired by the USACE, to visually inspect affected areas prior to potential treatment. Impacts on upcoming fishing tournaments and similar events are discussed and evaluated.

The program goal of each primary exotic plant species is maintenance control, which is defined as "a method of managing exotic plants in which control techniques are utilized in a coordinated manner on a continuous basis in order to maintain a plant population at the lowest feasible level." Maintenance control results in the use of less herbicides, less organic deposition in aquatic environments, less overall environmental impacts from the weeds and their management, and reduced management costs (SFWMD 2002).

2.6 Internal Phosphorus Management Program

Phosphorus-rich sediments have been accumulating in Lake Okeechobee for many years. Currently, it is estimated that more than 300 square miles of lake bottom are covered by roughly 260 million cubic yards of mud sediments. This sediment will exchange phosphorus with the water column of the lake under certain circumstances. Therefore, there is a general scientific consensus that if internal phosphorus loading from these mud sediments is not addressed, the lake may not fully respond to reductions in external phosphorus loading that are expected to result from the numerous projects in the Lake Okeechobee Watershed under the NEEPP and other local efforts.

The LOPA required a study to examine the engineering, ecological, and economic feasibility of removing or treating internal phosphorus loading. If treating this loading was determined to be feasible, the SFWMD would be positioned to pursue design, funding, and permitting of such a project. The feasibility study was completed in 2003 and determined that sediment removal would not be effective in reducing internal phosphorus loading. Also, there was no acceptance of the use of alum or any similar chemical treatment of lake sediments since the cost was estimated to be about $500 million every 15 years or so. Under the assumption that watershed inflows to the lake would improve to meet the TMDL by the January 2015 deadline, it would still be almost 50 years before the lake water would meet the phosphorus target concentration of 40 parts per billion (ppb) due to internal loading.

During the intervening years, new possibilities have emerged that may impact the conclusions and recommendations of the 2003 study. First, there may be an unwillingness to wait decades after the completion of watershed improvements to experience restored water quality conditions in the lake. There is greater recognition that even if the phosphorus is eventually leached from the sediments, the sediments themselves will still be present, leading to continuing turbidity and light penetration issues for submerged plants and potential impacts to downstream water bodies. Finally, there is also recognition that additional improvements to the quality of water entering the Everglades downstream of the Everglades Agricultural Area will also be difficult to achieve without improving the quality of water from the lake. Several in-lake sediment management options are proposed under Section 6 to address this problem.

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SECTION 3: CURRENT STATUS OF LAKE OKEECHOBEE

3.1 Ecological Status

3.1.1 Water Levels

Water levels in Lake Okeechobee during 2007–2009 fluctuated from extreme drought conditions to highs related to tropical storms. In July 2007, the lake level fell to a record low of 8.82 feet (ft) relative to the National Geodetic Vertical Datum of 1929 (NGVD). A high water level of 15.16 ft NGVD was reached in September 2008 after the passing of Tropical Storm Fay (**Figure 3-1**). Water levels returned to near-average levels (14.2 ft NGVD) during the last half of 2009. Average, in this case, is defined by a simulation of the Lake Okeechobee Regulation Schedule (LORS) 2008 for the years 1965–2000.

During the 2007–2008 drought, lake levels fell into the water shortage management band. This lasted until Tropical Storm Fay passed over the region in August 2008. After the storm, lake stage increased 3.9 ft in one month and water levels rose out of the water-shortage management band (**Figure 3-1**). The storm was followed by the driest six-month period on record and water levels slowly declined but remained above the water shortage management band through the end of 2009.

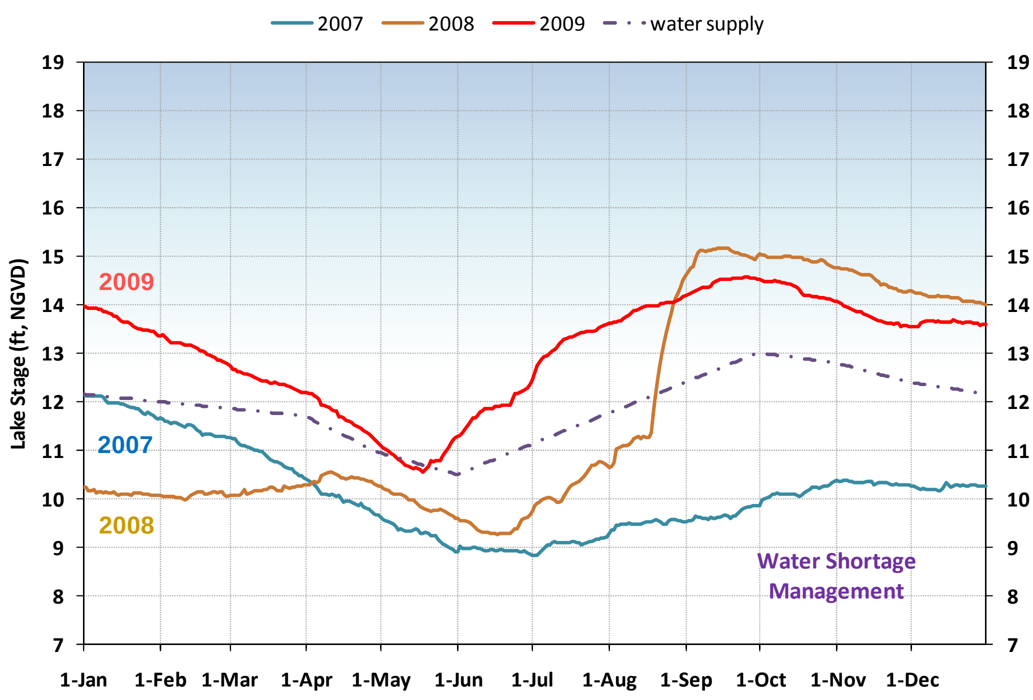

Figure 3-1. Lake Okeechobee stage and water supply management trigger lines, 2007–2009.

3.1.2 Nearshore Phosphorus and Turbidity Levels

Phosphorus levels and light conditions in nearshore areas of the lake have improved since the hurricanes of 2004–2005 resuspended phosphorus-laden sediments and raised lakewide turbidity. As lake levels slowly declined and drought conditions intensified, less of the phosphorus-laden, highly turbid pelagic water was transported into nearshore areas of the lake. Both total phosphorus (TP) concentrations and total suspended solids (TSS) in the nearshore areas have declined to pre-hurricane levels (**Figures 3-2** and **3-3**).

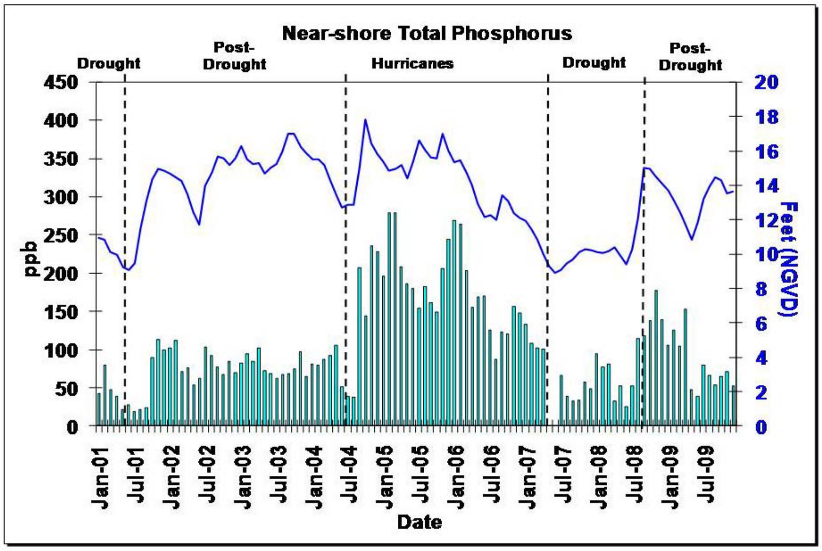

Figure 3-2. Nearshore total phosphorus levels in Lake Okeechobee related to lake stage, 2001–2009.

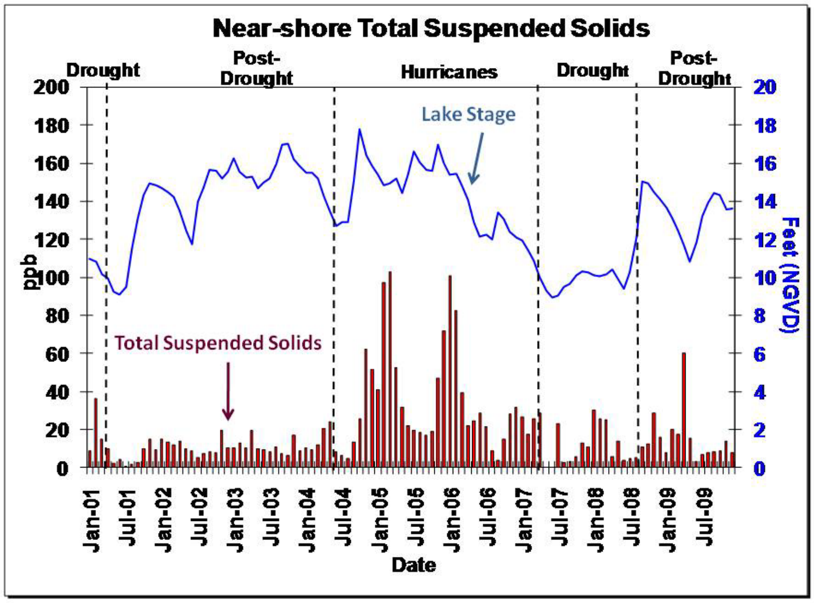

Figure 3-3. Nearshore total suspended solids concentrations and lake stage, 2001–2009.

3.1.3 Algal Blooms

Although the above described conditions have the potential to favor algal blooms, no major algal bloom events (i.e., chlorophyll *a* concentrations greater than 40 parts per billion [ppb]) were observed during this reporting period (**Figure 3-4**). In the summer of 2005, many water bodies within the South Florida Water Management District (SFWMD or District) boundaries, including Lake Okeechobee, experienced substantial blue-green algal blooms. After Hurricane Wilma in October 2005, only minor isolated surface blooms have occurred. Additionally, the levels of microcystin, a toxin associated with blue-green algal blooms, have been below the analytical limit of detection (0.2 ppb) since October 2005 (**Figure 3-4**).

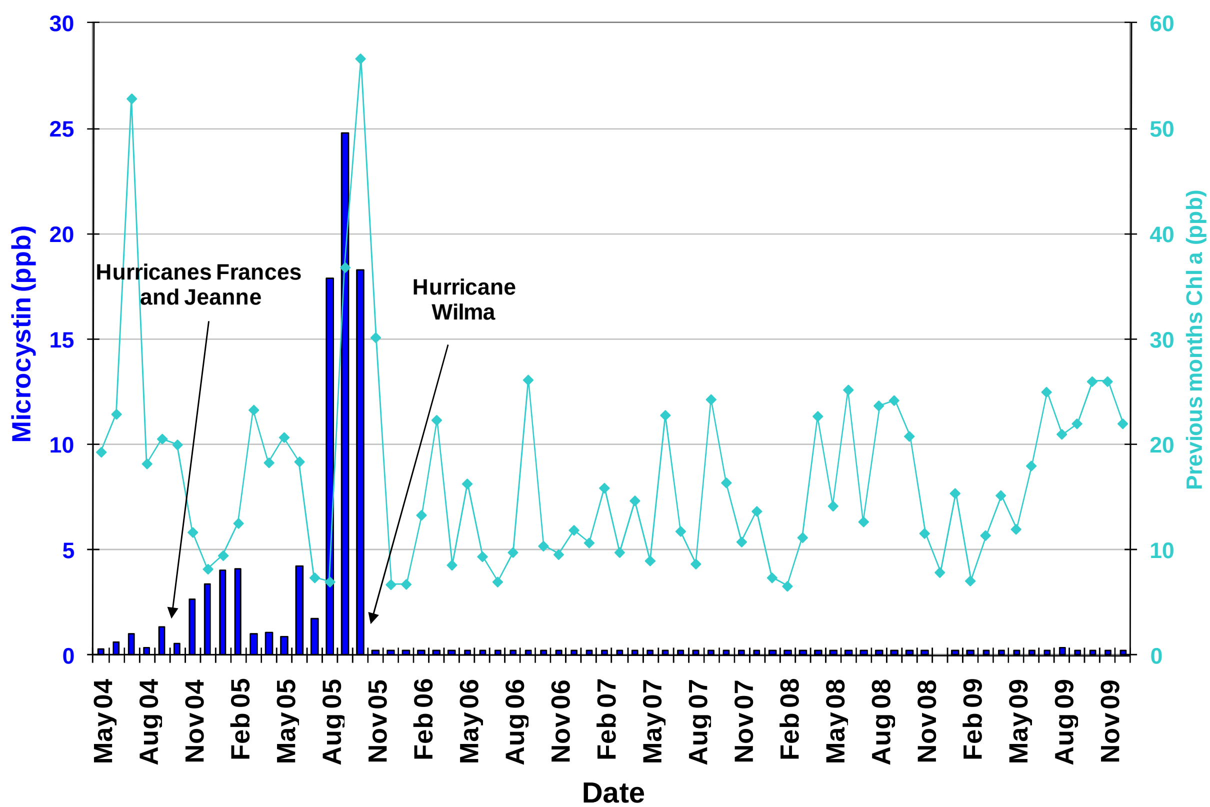

Figure 3-4. Average chlorophyll *a* and microcystin concentrations in Lake Okeechobee from May 2004–December 2009. Chlorophyll *a* values greater than 40 ppb indicate bloom conditions.

3.1.4 Littoral Vegetation

Plant communities in Lake Okeechobee's littoral zone continue to recover from recent hurricanes and drought. After the 2004–2005 hurricanes, lakewide coverage of submerged aquatic vegetation (SAV) decreased to about 3,000 acres (**Figure 3-5A**). As water levels slowly declined during the drought, light levels improved within nearshore areas and SAV coverage increased from 28,180 acres in 2007 to 35,834 acres in 2008. While much of the initial increase was due to the growth of musk grass (*Chara* sp.), a non-vascular macroalga, vascular species including eelgrass (*Vallisneria americana*), coontail (*Ceratophyllum* sp.), the exotic *Hydrilla verticillata*, and southern naiad (*Najas guadalupensis*) expanded across the western and northern shoreline. By August 2009, SAV coverage increased to 46,418 acres, which is comparable to pre-hurricane levels documented in 2004 (**Figure 3-5A**).

Additionally, vascular species, which provide young fish with better foraging areas and protection than non-vascular species, accounted for almost 65 percent of the total SAV (**Figure 3-5B**). The current SAV coverage meets the Lake Okeechobee restoration goal (CERP 2007) of greater than 40,000 acres of total SAV, with at least half being comprised of vascular species.

Based on comparisons of emergent vegetation maps from 2003 and 2007, significant changes occurred across the marsh landscape. Some of the reported changes were caused by extreme differences in hydrologic conditions that occurred prior to the evaluation dates. In 2003 the marsh was inundated as lake stage remained above 14.5 ft NGVD. In contrast, a regional drought that started in 2006 exposed the lake's 100,000-acre western marsh when water levels fell below 10.5 ft NGVD for more than one year (**Figure 3-6**).

Between 2003 and 2007, the abundance and spatial distribution of a number of plant species changed. Cattail (*Typha* spp.) coverage decreased from nearly 24,000 acres to less than 3,500 acres and fragrant water lily (*Nymphaea odorata*) decreased from greater than 10,000 acres to less than 5 acres. Most of the nearly 7,000-acre increase in spikerush (*Eleocharis cellulose*) coverage occurred along or near the outside edge of the marsh. Smartweed (*Polygonum hydropiperoides*) and knotgrass (*Polygonum aviculare*) each increased by more than 12,000 acres.

In addition to the hydrologic influences previously discussed, multiple fires burned nearly all of the littoral zone marsh in 2007 and 2008. This widespread burning created additional changes in the plant community across much of the landscape. Following these fires and persistent dry conditions, dog fennel (*Eupatorium capillifolium*), a species not observed in 2003, expanded to cover nearly 8,000 acres of exposed marsh in 2007 (**Figure 3-7**). Other more terrestrial species, including American cupscale (*Sacciolepic striata*) and barnyard grass (*Echinochloa* spp.), also became common in dry regions of the marsh. Managed fire has been a valuable tool for controlling exotic and invasive vegetation and returning affected areas to more natural and productive plant communities; however, the lake, as currently constrained by the Herbert Hoover Dike, does not encompass any true fire sub-climax vegetative communities.

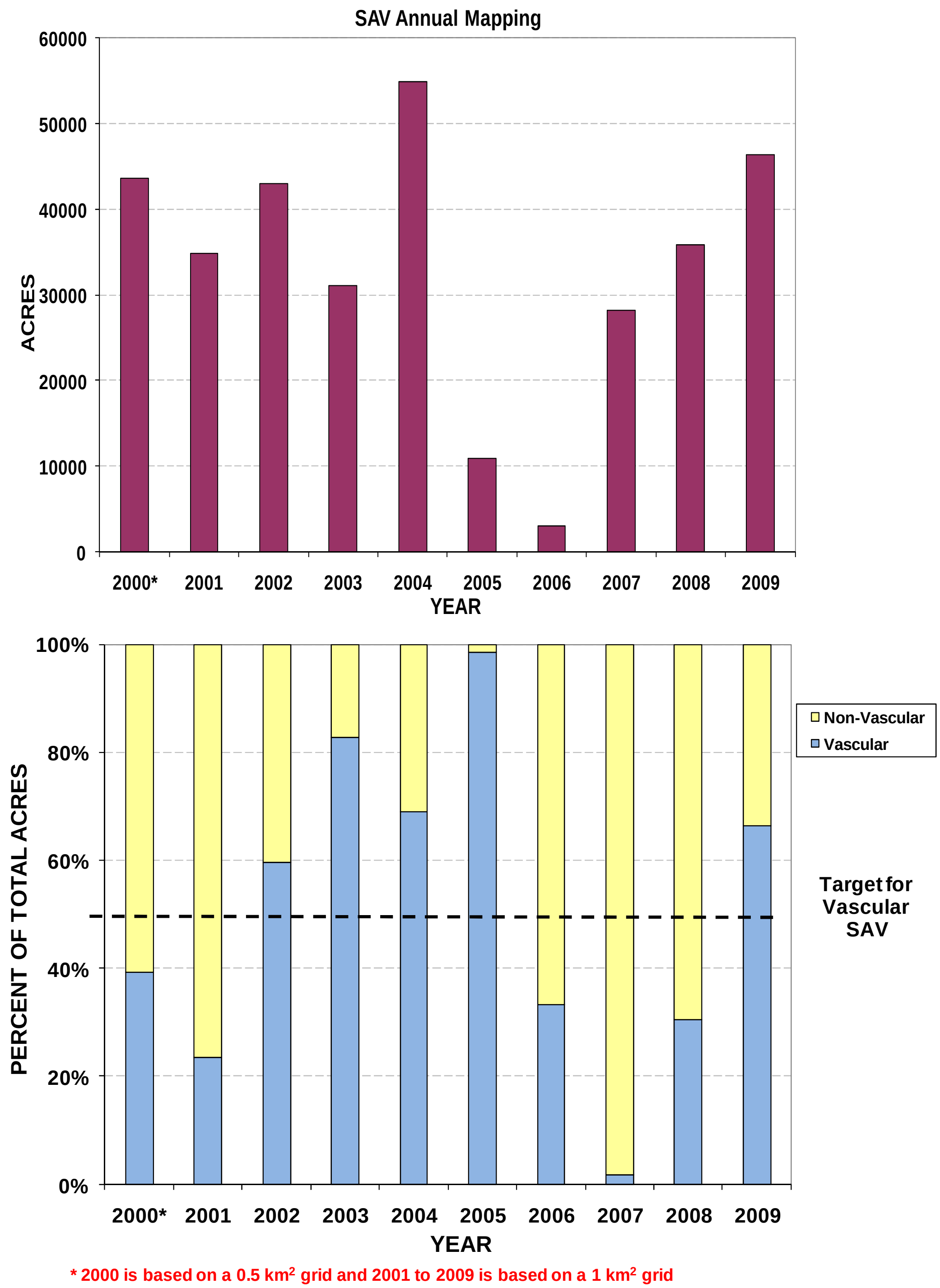

Figure 3-5. (A) Acres of total SAV (vascular and non-vascular species). **(B)** Percent of total acres of vascular and non-vascular species from the annual Lake Okeechobee SAV mapping results, 2000–2009.

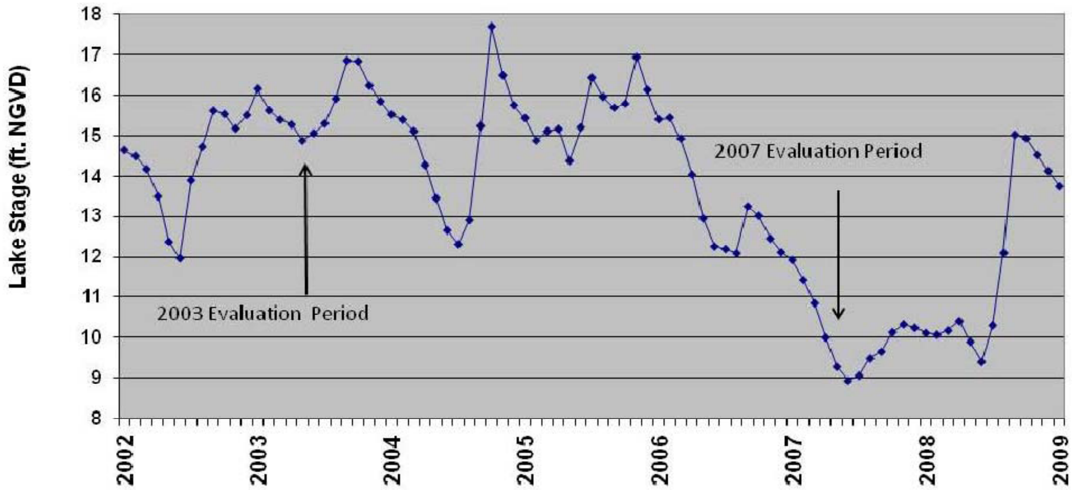

Figure 3-6. Lake Okeechobee stages from 2002–2009 showing water levels consistent with marsh inundation versus marsh dry out.

Figure 3-7. Dry marsh conditions south of Indian Prairie Canal (July 2008). Dog fennel and other terrestrial species became dominant across much of the marsh landscape.

Historically, bulrush (*Scirpus californicus*) was common along the lakeward edge of the western marsh (Pesnell and Brown 1977). Bulrush is an important feature of the marsh landscape: it provides beneficial habitat for fish and wildlife and attenuates wave energy and stabilizes bottom sediments, creating favorable conditions for the growth of desirable SAV and emergent plants. The areal coverage of bulrush had declined to less than 600 acres in 2003 and no bulrush was observed during 2007. In 2009, bulrush responded to relatively shallow (less than 3.3 ft) and clear water conditions by rapidly colonizing much of the western shoreline from Mayaca Cut to north of Indian Prairie Canal (**Figure 3-8**).

Although the extent of bulrush has not been quantified, it has become a dominant feature of the marsh landscape. Bulrush should continue expanding provided hydrologic conditions remain favorable. Maintaining an abundant, healthy emergent bulrush community is important for sustaining the lake's sports fishery, which has been in decline during this reporting period (McCormick et al. 2010).

Figure 3-8. New bulrush growth along the lakeward edge of the marsh near Indian Prairie Canal (August 2009).

3.1.5 Control of Exotic Vegetation

The dry marsh conditions over the past three years have allowed for aggressive treatment of exotic vegetation in Lake Okeechobee. For example, more than 10,000 acres of torpedograss were treated during 2004–2006 as compared to 20,000 acres treated during 2007–2009. Wildfires that burned the marsh in 2007 and 2008 removed thousands of acres of dead torpedograss and other dead plant material. Although torpedograss is still present in many areas, its coverage has decreased dramatically. Native plant communities have colonized some of the treated sites and monthly wading bird surveys conducted in 2010 have documented thousands of birds foraging in shallow open water areas previously overgrown by torpedograss.

Luziola subintegra, a South American watergrass, has recently become a serious problem in Lake Okeechobee. The plant was first observed near the mouth of Fisheating Creek in 2007, which represented the first documented occurrence of this plant in the United States (Kunzer and Bodle 2008). The pathway for introduction of Luziola to South Florida is unknown. It grows rapidly in shallow water to form dense mats several acres in size that appear to exclude other plant species. Herbicide applications near the mouth of Fisheating Creek were mixed in their effectiveness to control Luziola. An initial application of glyphosate effectively controlled mature plants but had little effect on immature plants. Mixtures of different herbicides were tested and improved control was achieved with a combination of glyphosate and imazapyr. Nearly 600 acres of watergrass were treated in the Fisheating Bay region of the lake in 2009 (**Figure 3-9**). It is anticipated that repeated treatments will be required to successfully eradicate this species.

The floating exotic plants water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) continue to pose significant ecological harm to the marsh. The coverage of these plants rapidly expanded during the summer and fall of 2009 in response to increased water levels. During that time, more than 11,000 acres of water hyacinth and 4,000 acres of water lettuce were treated. Because dense mats of water hyacinth often were entangled in bulrush, the treatments caused significant non-target damage to bulrush. Much of the damage to bulrush appears to be short-term as the plants have shown signs of recovery. Monitoring of the treated bulrush continued throughout summer 2010.

Figure 3-9. South American watergrass (*Luziola subintegra*) treatment in Fisheating Bay.

3.1.6 Benthic Invertebrate Communities

The benthic invertebrate community is important to Lake Okeechobee's food web, and has slowly recovered from recent hurricanes and drought. Benthic invertebrates were monitored at long-term sampling locations between August 2005 and February 2009 (Warren et al. 2008). Species richness and diversity indices were low compared to the 1987–1997 period and were dominated by pollution-tolerant taxa. The poor community quality that characterized the 2005–2006 study year (**Table 3-1**) appears related to the impact of the 2004 and 2005 hurricanes. Wave action during these major storm events scoured and displaced bottom sediments, severely affecting the benthic communities. During drought conditions, as external organic loading and transport of mud sediments from the center of the pelagic zone declined, the density of benthic invertebrate species increased. The recovery was fastest within sand and peat substrate zones and slowest in the mud zone located within the center of the lake.

Table 3-1. Pelagic benthic macroinvertebrate community health indices for 2005–2008 (Warren et al. 2008).

Descriptor	Study Year		
	2005–2006	2006–2007	2007–2008
Total Taxa	48	68	94
Mean Species Richness	5.7^{a}	8.9^{b}	11.8^{c}
Mean Diversity	1.54^{a}	1.88^{b}	2.18^{c}
Mean Evenness	0.69^{a}	0.66^{a}	0.66^{a}
Mean Total Organisms per Square Meter	$3{,}338^{a}$	$7{,}591^{b}$	$12{,}678^{c}$

Note: Means with same letter superscript are not significantly different.

The Florida apple snail (*Pomacea paludosa*), a common component of Lake Okeechobee's benthic invertebrate community, represents the primary food source for the endangered Everglade snail kite (*Rostrhamus sociabilis*). This snail species is capable of tolerating brief periods of drying (e.g., less than 12 weeks), but appears to be unable to survive significant drawdown events such as a prolonged drought.

In the spring of 2008, a survey was conducted to determine the extent that extreme drought conditions had on Lake Okeechobee's apple snail population. The survey identified one remaining local population of Florida apple snails, confirming expectations that the native snail population had been depleted due to extreme low water levels within most of the littoral zone.

As a result, a feasibility study was initiated to determine if Florida apple snails grown in captivity could be used to increase apple snail populations within the lake (**Figure 3-10**). Initial growth and reproduction experiments showed some promise; however, reproductive success of snails reared in captivity was lower than observed in the wild.

An experiment that varied the diet fed to laboratory-reared snails showed that commercial catfish chow significantly increased snail growth rate and survival compared to a diet of romaine lettuce. This short experiment did not determine the effect of diet on reproduction, but diet clearly is an important variable to be considered in future snail-rearing efforts.

Two controlled release experiments were conducted in Eagle Bay marsh, a wetland area adjacent to Lake Okeechobee, to determine the success of captive-reared snail releases as a means of augmenting natural population recovery processes (**Figure 3-11**). Analysis of data from these experiments is currently under way.

Figure 3-10. The Florida apple snail (*Pomacea paludosa*) laying eggs at the aquaculture facility at Harbor Branch Oceanographic Institute, provided under SFWMD contract.

A

B

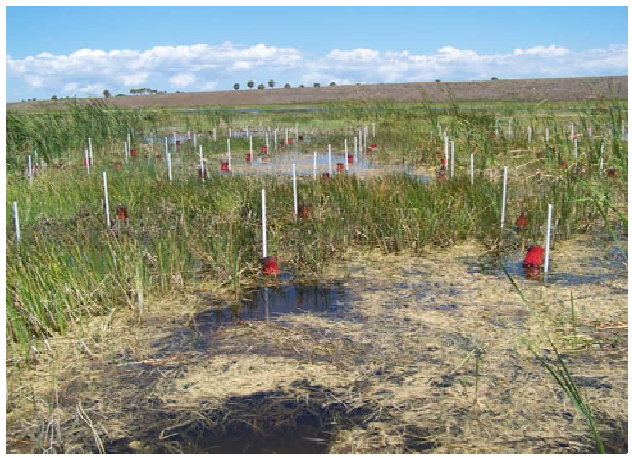

Figure 3-11. (A) Captive-reared apple snails with numeric markers. **(B)** Release site in the Eagle Bay marsh located on the northern end of Lake Okeechobee showing transect design and pyramid trap placement.

3.1.7 Amphibian and Reptile Communities

Amphibians and reptiles are an important component of Lake Okeechobee's wetland food web. With the exception of the American alligator (*Alligator mississippiensis*), these species have not been well inventoried or monitored within the lake. Consequently, little information exists on their response to changes in lake stage, extreme water level events (droughts and hurricanes), and marsh habitat management practices. SFWMD staff completed a study in July 2010 to determine suitable sampling protocols for these species that can be used to better understand their distribution and abundance in the lake. Following the study, SFWMD staff initiated a monitoring effort to track changes in habitat and amphibian and reptile populations in response to seasonal and lake stage changes.

3.1.8 Fish Communities

During the late 1990s, the largemouth bass and black crappie populations within Lake Okeechobee were depressed due to high lake levels and subsequent loss of primary and secondary production. Following the 2001 drought, a substantial increase the areal coverage of SAV provided additional fish habitat and produced strong year classes in 2002 for both populations. However, high lake levels in 2003 negated some of the ecological gains observed in 2001–2002 and fish population size, as depicted by catch per unit effort, declined due to the lack of recruitment of young fish and mortality (natural and fishing pressure) of adults. Hurricanes in 2004 and 2005 further hastened the decline of the largemouth bass and black crappie populations (**Figure 3-12**).

After the hurricanes, the catch rates for largemouth bass were the second lowest observed since the monitoring program began in 1992, and very little recruitment of young-of-the-year largemouth bass occurred in 2005 (**Figure 3-12**). The black crappie population also experienced a significant decline. Only five adult fish (longer than 200 millimeters [mm]) were collected from 27 predetermined sampling sites following 540 minutes of trawling. The decline in the black crappie population in 2005 exceeded 99 percent when compared to the average annual catch reported in 1988–1991 (2,037 fish). A similar decline (97 percent) also was reported for the threadfin shad, a primary forage fish for adult black crappie in Lake Okeechobee.

The largemouth bass population has recovered more quickly than the black crappie population following damaging effects from hurricanes and prolonged periods of high water levels. In 2009, a strong largemouth bass year class was produced, but there was little evidence of recruitment of young-of-the-year black crappie (**Figure 3-12**). This finding is partly attributed to largemouth bass's robust feeding and reproduction habits. Largemouth bass tend to eat a greater variety of forage from the time they hatch through adulthood. In contrast, black crappie forage primarily on zooplankton (rotifers) after hatching. They eventually move offshore where they eat invertebrates before switching to young-of-year shad when they reach a length of about 200 mm. The hurricanes in 2004 and 2005 resuspended flocculent bottom sediments, creating turbid conditions within open water areas of the lake that persisted for several years. These events depressed phytoplankton and zooplankton production, which have negatively affected black crappie and threadfin shad populations.

The bluegill and redear sunfish populations have also undergone major changes over the past four years. In 2005 (following Hurricane Wilma) there was almost no recruitment of these species; the populations consisted mostly of adult fish. Following improvements in habitat and water quality in 2008, both species have showed strong signs of production and recovery.

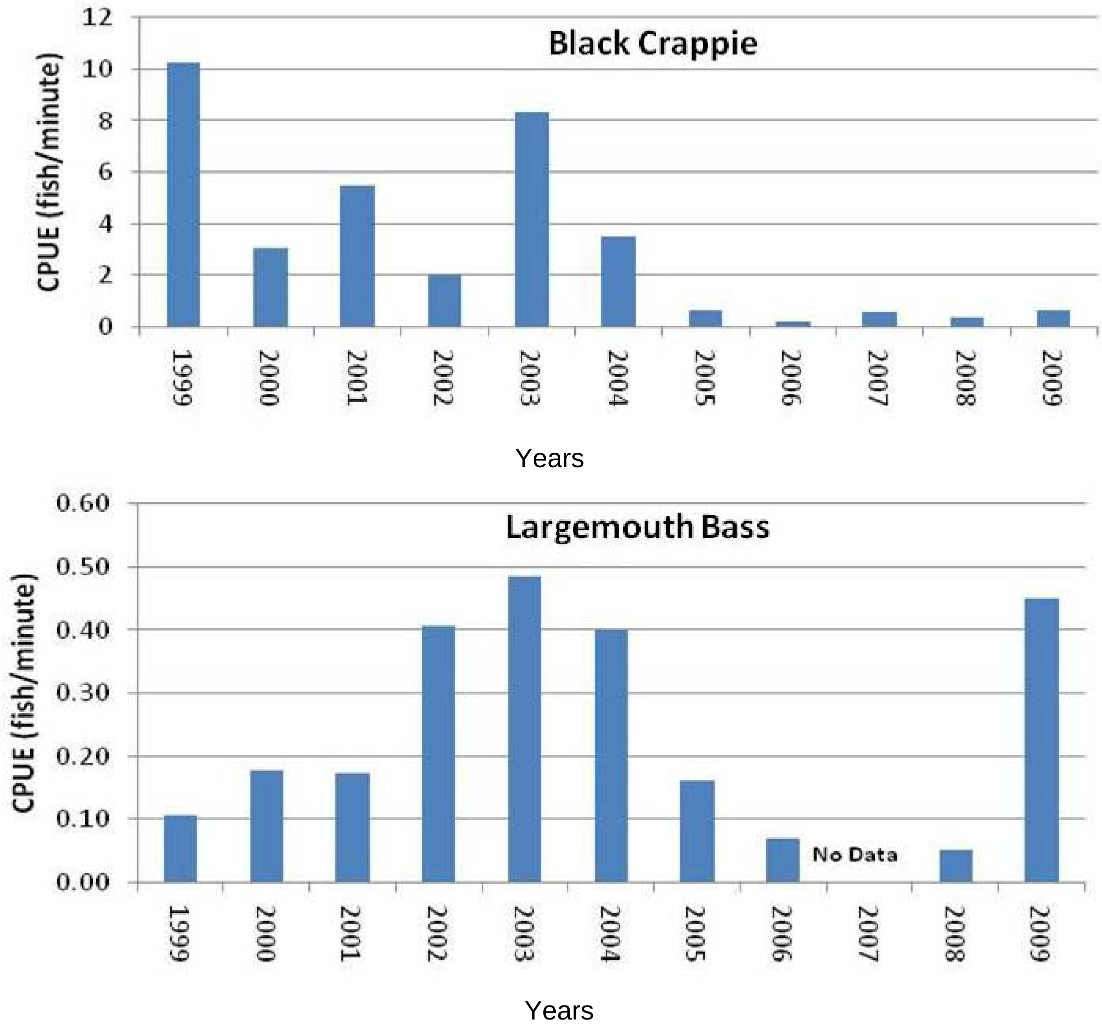

Figure 3-12. Abundance of black crappie and largemouth bass based on catch per unit effort (CPUE) data.

3.2 Current Water Quality Trends (2001–2009)

3.2.1 Lake Phosphorus Reduction Goal

The Total Maximum Daily Load (TMDL) for total phosphorus for Lake Okeechobee was adopted by the Florida Department of Environmental Protection (FDEP) and approved by the U.S. Environmental Protection Agency in 2001 (FDEP 2001). A TMDL is defined as the maximum loading of a particular pollutant (in this case TP) that can be discharged into a surface water and still maintain its designated uses (e.g., drinking water, fishing, swimming, shellfish harvesting) and applicable water quality standards.

The TMDL establishes an annual load of 140 metric tons (mt) of phosphorus to Lake Okeechobee to achieve a target phosphorus concentration of 40 ppb in the pelagic (open water) zone of the lake. The target was developed using chlorophyll *a* as an indicator of algal biomass, which acts as a surrogate for indicating excessive nutrient concentrations.

The FDEP (2001) report states that the TMDL will be evaluated using a five-year rolling average of monthly loads calculated from measured flow and concentration values. The 40 ppb target for the entire pelagic zone is considered a conservative goal that introduces an implicit margin of safety into the TMDL. This is because TP concentrations are relatively homogeneous across the open-water region under high lake conditions. When water stages are low, TP in the nearshore area is considerably lower than in the open-water zone. Hence, if 40 ppb is met at the pelagic stations, the TP concentrations should be below 40 ppb in the nearshore area during most years. This restoration target will support a healthy lake system, restore the designated uses of Lake Okeechobee, and allow the lake to meet applicable water quality standards (FDEP 2001).

3.2.2 Tributary Nutrient Loading Trends

Trends of five parameters—mean monthly flow (acre-feet [ac-ft]), TP load (mt), TP concentration (µg/L), total nitrogen (TN) load (mt), and TN concentration (milligrams per liter [mg/L])—from 2001 to 2009 (calendar year) for the nine Lake Okeechobee sub-watersheds were analyzed with a Seasonal Kendall Tau test (**Table 3-2**, **Figure 3-13**). This non-parametric test is frequently used to detect trends for water quality time series data. It is a rank-order statistic that can be applied to time series data exhibiting seasonal cycles, missing and censored data, and indications of non-normality (Yu and Zou 1993). When data are collected over time, significant autocorrelation may exist between data values. The Seasonal Kendall Tau test provides an adjusted p-value for data that exhibit a significant level of dependence (Reckhow et al. 1992). An alpha (α) level of 0.05 or less was considered statistically significant in these tests. The test also produces a Sen slope value, which is an estimate of the amount of change in the measured value (e.g., metric tons, mg/L) per year.

Each sub-watershed consists of one or more drainage basins that ultimately flow into the lake through designated water control structures (**Figure 3-13**). Two sub-watersheds (Lower Kissimmee and Indian Prairie) included in this analysis do not have well-defined groundwater drainage boundaries and can be influenced over shorter data intervals (e.g.., monthly) by seepage through the structure and groundwater interactions. The program normally used to calculate annual loads for these two sub-watersheds involves subtracting out upstream sub-basins to obtain more reliable annual flow values. Since this method could not be employed for this analysis when computing the monthly basin-level flow, TP, and TN using structure measurements in these two sub-watersheds, monthly data represented by structure S-65E for the Lower Kissimmee and S-70, S-71, and S-84 for Indian Prairie, respectively, were used.

The Western Lake Okeechobee Sub-watershed is represented by inflows through the S-77 structure located at the interface of the Caloosahatchee River with Lake Okeechobee. Lake water is primarily discharged through this structure. However, flow to the lake can occur through S-77 during periods of extreme drought or extreme, isolated rainfall events within the Caloosahatchee Basin when the lake is at a low stage. This infrequent level of flow to the lake was not sufficient to produce mean monthly values to calculate a trend using this statistic over the past nine years, so the Western Lake Okeechobee Sub-watershed was excluded from this analysis. Annual loadings are available for this sub-watershed in the annual South Florida Environmental Report[2].

While the presence of significant trends provides the most valuable management tool for determining how a sub-watershed is reacting to regulatory or restoration measures or other influencing factors, other statistics presented in **Table 3-2** can be used to assess apparent trends and help focus resources on the most efficient ways to achieve water quality improvements for the Lake Okeechobee Watershed. For instance, the Sen slope indicates the change in annual concentration for a constituent, which taken into consideration with the p-value, can indicate if the sub-watershed is more likely to continue to follow its current direction within the upcoming years and if these changes will be significant. Sub-watersheds with highly negative or positive slopes with p-values close to 0.05, though not showing a statistically significant trend, could still be targeted for in-depth investigations to help evaluate success stories, or identify areas where more intense nutrient control measures are required.

Four of the eight sub-watersheds analyzed revealed significant trends for one or more of the five parameters (**Table 3-2**, **Figures 3-14, 3-15**, **3-16**, **3-17**, and **3-18**). The only sub-watershed with a statistically significant trend not related to flow was the Southern Lake Okeechobee Sub-watershed (Everglades Agricultural Area [EAA]). The EAA showed a decreasing trend in both the TN load ($p = 0.04$) and the TN flow-weighted mean concentration ($p < 0.001$). Given that the flow from this sub-watershed was not significantly trending and due to the presence of a highly significant decreasing trend in TN for concentration, it is likely that nitrogen is either being managed better, regulated more rigorously, or generally being used less in this area. Significant decreasing trends of flow, TN load, and TP load were found for the Taylor Creek/Nubbin Slough Sub-watershed (**Table 3-2**, **Figures 3-14**, **3-15**, and **3-17**). The Sen slope for TP (-6.00) and TN (-0.01) concentrations show negatively trending values even though they are not statistically significant. This may be a reflection of the sub-watershed having the largest Best Management Practice (BMP) implementation rate and the completion of many TP source control projects.

The Lake Istokpoga Sub-watershed exhibited significant decreasing trends for flow and TP load (**Figures 3-14** and **3-17**). However, concentrations of TP and TN had a positive Sen slope (**Table 3-2**).

The Indian Prairie Sub-watershed displayed a significant decreasing trend for flow and TN load (**Figures 3-14** and **3-15**). Again, a positive Sen slope for TP concentrations was found (**Table 3-2**).

[2] www.sfwmd.gov/sfer

For the Fisheating Creek and Eastern Lake Okeechobee sub-watersheds, no significant trends were found among the five parameters. Concentrations for TP at these two sub-watersheds showed a negative Sen slope.

Although BMPs have been initiated to a certain degree, a large percentage of the watershed still needs dedicated resources to realize the full level of BMP implementation for nutrient reduction. The high levels of legacy phosphorus in the soils play a role in the delayed response of the watershed to reduced TP concentrations. Increased levels of water management, including stormwater recycling would assist with reducing the legacy phosphorus contributions to downstream water bodies. Nevertheless, more aggressive nutrient control measures must be implemented in all the surrounding basins that discharge to the lake to reach the TMDL goal of 140 mt of phosphorus per year (FDEP 2001). To assess the success or deficiencies of restoration efforts in the Lake Okeechobee Watershed, many years of continued evaluation of these sub-watersheds for statistically significant trends is critical. The highly variable nature of the data from these sub-watersheds and the influence of storm events on the data make continuous evaluations necessary. Evaluations that show no significant trends over several years can also be useful to determine if the system has stabilized and what measures need to be taken if the lake does not meet water quality goals.

Table 3-2. Seasonal Kendall Tau trend analyses of flow, TP, and TN for 2001–2009. Bolded, italicized parameters indicate significant changes.

Sub-Watershed	Parameter (unit)	Number of Samples (Total / NA / Zero Values) [2]	Kendall's Tau	Sen Slope	Intercept	P-Value	Significant Trend
Upper Kissimmee (S65)	Flow (acre-feet)	108 / 0 / 12	-0.081	-1,526	43,108	0.67	No
	Total Nitrogen Load (metric tons)	108 / 0 / 12	-0.104	-2.86	69.5	0.57	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 12 / 0	0.044	0.005	1.27	0.78	No
	Total Phosphorus Load (metric tons)	108 / 0 / 12	-0.060	-0.10	4.29	0.45	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 12 / 0	0.106	1.00	71.5	0.22	No
Lower Kissimmee (S65E)	Flow (acre-feet)	108 / 0 / 10	-0.120	-5,554	81,473	0.52	No
	Total Nitrogen Load (metric tons)	108 / 0 / 10	-0.130	-8.13	121	0.46	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 10 / 0	0.121	0.015	1.11	0.42	No
	Total Phosphorus Load (metric tons)	108 / 0 / 10	-0.130	-0.48	7.58	0.46	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 10 / 0	0.039	0.42	67.9	0.73	No
Lake Istokpoga (S68)	***Flow (acre-feet)***	***108 / 0 / 8***	***-0.266***	***-1,972***	***23,658***	***<0.001***	***Yes***
	Total Nitrogen Load (metric tons)	108 / 0 / 8	-0.169	-2.47	38.4	0.35	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 8 / 0	0.198	0.060	1.26	0.32	No
	Total Phosphorus Load (metric tons)	***108 / 0 / 8***	***-0.188***	***-0.11***	***1.77***	***0.02***	***Yes***
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 8 / 0	0.046	0.75	70.3	0.59	No
Indian Prairie[1]	***Flow (acre-feet)***	***108 / 0 / 1***	***-0.194***	***-1,357***	***25,717***	***0.01***	***Yes***
	Total Nitrogen Load (metric tons)	***108 / 0 / 1***	***-0.185***	***-3.49***	***59.4***	***0.02***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 1 / 0	-0.026	-0.006	1.92	0.87	No
	Total Phosphorus Load (metric tons)	108 / 0 / 1	-0.148	-0.14	3.71	0.06	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 1 / 0	0.127	4.25	150	0.11	No
Fisheating Creek	Flow (acre-feet)	108 / 0 / 0	-0.139	-531	11,901	0.08	No
	Total Nitrogen Load (metric tons)	108 / 0 / 0	-0.106	-0.54	19.3	0.18	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 0 / 0	0.097	0.019	1.52	0.62	No
	Total Phosphorus Load (metric tons)	108 / 0 / 0	-0.100	-0.065	1.72	0.21	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 0 / 0	-0.118	-3.63	149	0.13	No
Taylor Creek/ Nubbin Slough	***Flow (acre-feet)***	***108 / 0 / 17***	***-0.197***	***-282***	***4,184***	***0.01***	***Yes***
	Total Nitrogen Load (metric tons)	***108 / 0 / 17***	***-0.192***	***-0.55***	***8.15***	***0.01***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 17 / 0	-0.089	-0.01	1.85	0.49	No
	Total Phosphorus Load (metric tons)	***108 / 0 / 17***	***-0.222***	***-0.11***	***1.47***	***0.004***	***Yes***
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 17 / 0	-0.117	-6.00	379	0.23	No
Southern Lake Okeechobee (EAA)	Flow (acre-feet)	108 / 0 / 3	-0.241	-271	3,955	0.07	No
	Total Nitrogen Load (metric tons)	***108 / 0 / 3***	***-0.287***	***-1.38***	***15.7***	***0.04***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	***108 / 3 / 0***	***-0.319***	***-0.13***	***3.65***	***<0.001***	***Yes***
	Total Phosphorus Load (metric tons)	108 / 0 / 3	-0.162	-0.04	0.62	0.18	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 3 / 0	0.208	7.49	120	0.17	No
Eastern Lake Okeechobee (S308C)	Flow (acre-feet)	108 / 0 / 20	0.132	93.9	1,304	0.47	No
	Total Nitrogen Load (metric tons)	108 / 0 / 20	0.113	0.10	3.70	0.51	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 20 / 0	-0.076	-0.018	1.98	0.45	No
	Total Phosphorus Load (metric tons)	108 / 0 / 20	0.086	0.01	0.26	0.63	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 20 / 0	-0.131	-8.00	213	0.37	No
Western Lake Okeechobee	Flow (acre-feet)	108 / 0 / 80					
	Total Nitrogen Load (metric tons)	108 / 0 / 80					
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 80 / 0	Insufficient data to perform trend analysis				
	Total Phosphorus Load (metric tons)	108 / 0 / 80					
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 80 / 0					

[1] Structures used to calculated Indian Prairie sub-watershed flows, loads and flow-weighted means: L59W, L60E, L60W, S127, S129, S131, L59E, S71, S72 a

[2] NA - not available due to zero values of flow and load.

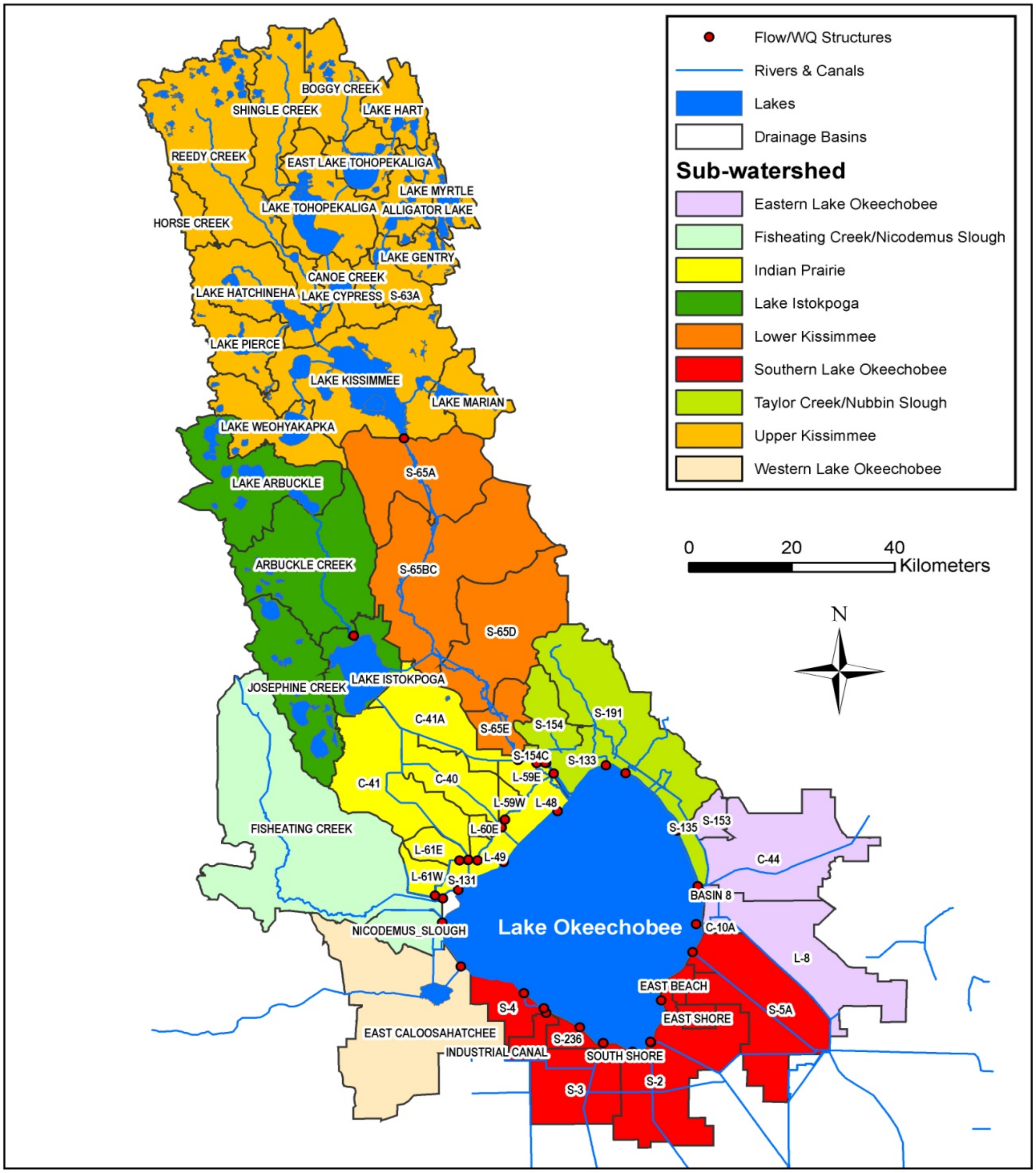

Figure 3-13. The Lake Okeechobee Watershed, detailing sub-watershed and water management structure locations.

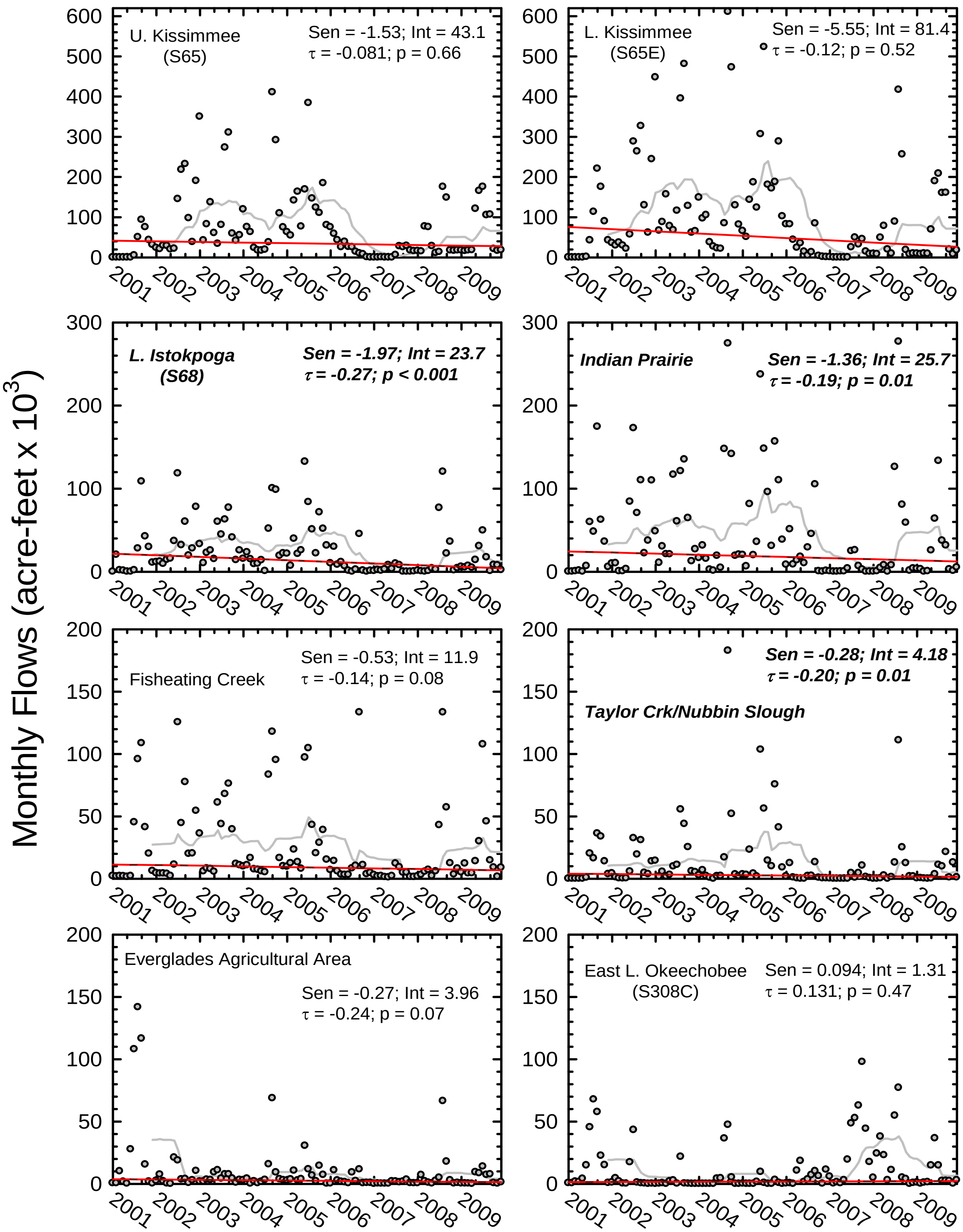

Figure 3-14. Monthly sub-watershed flows for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.

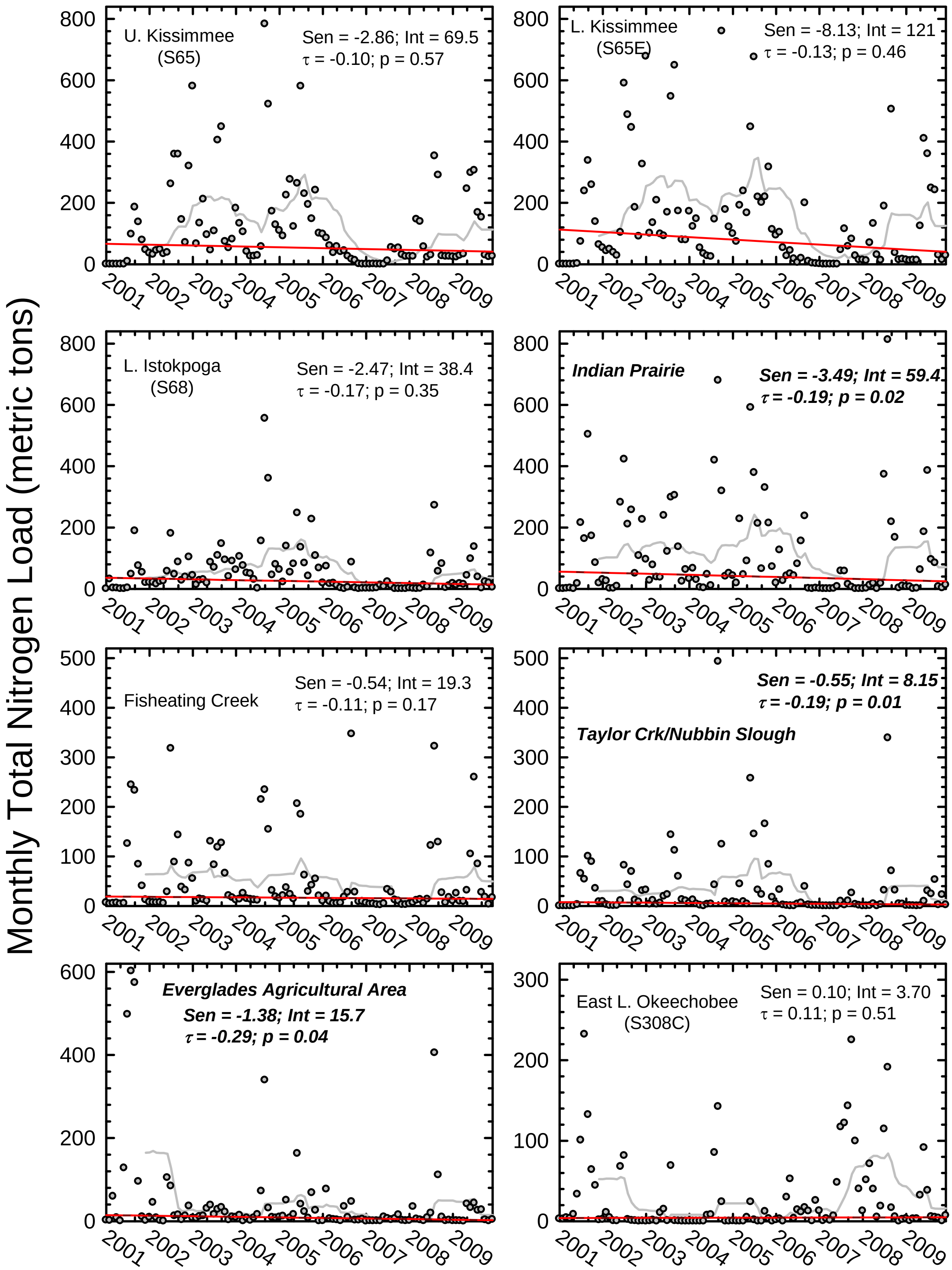

Figure 3-15. Monthly sub-watershed TN loads for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.

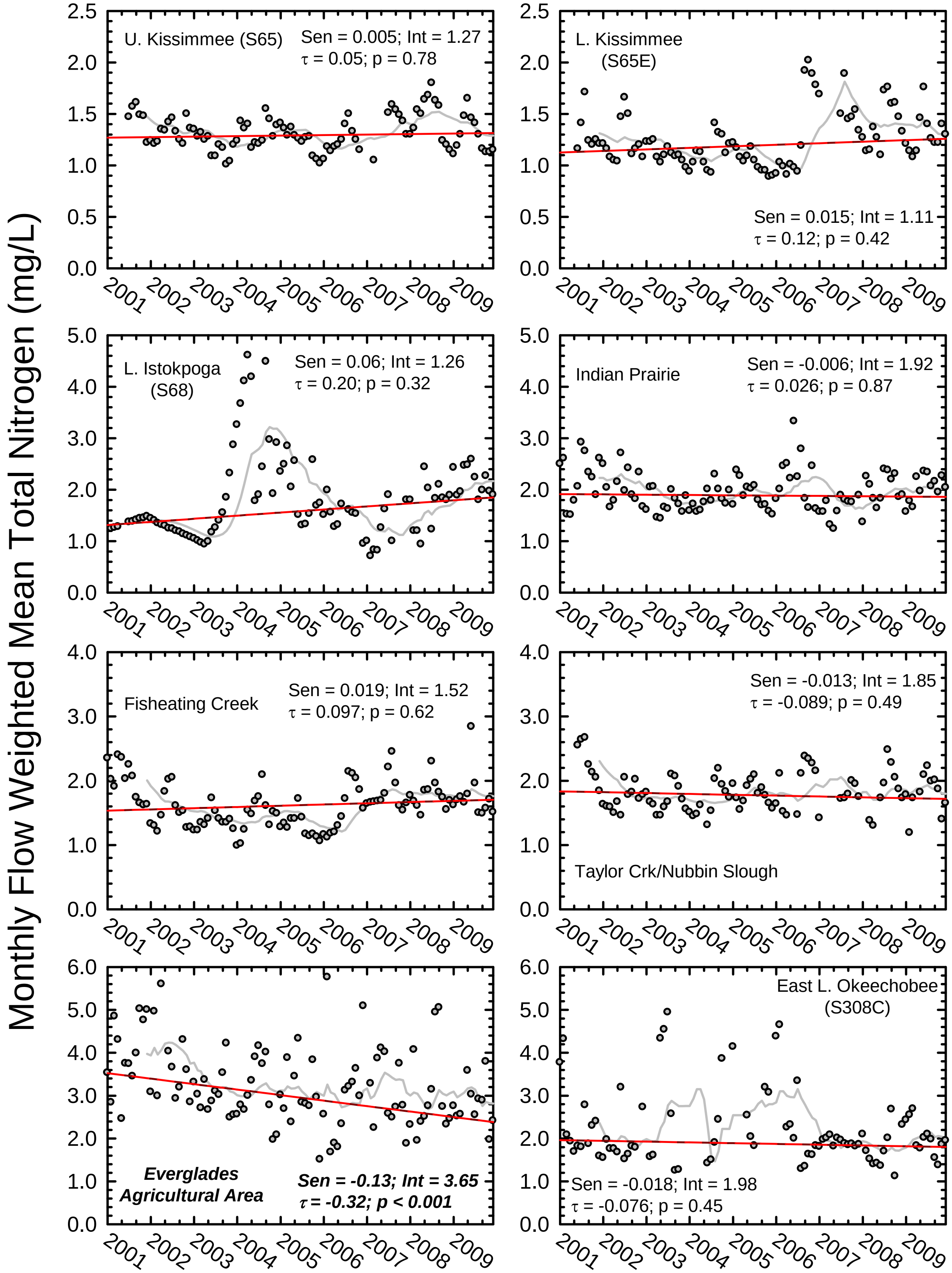

Figure 3-16. Monthly sub-watershed TN flow-weighted mean concentrations for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.

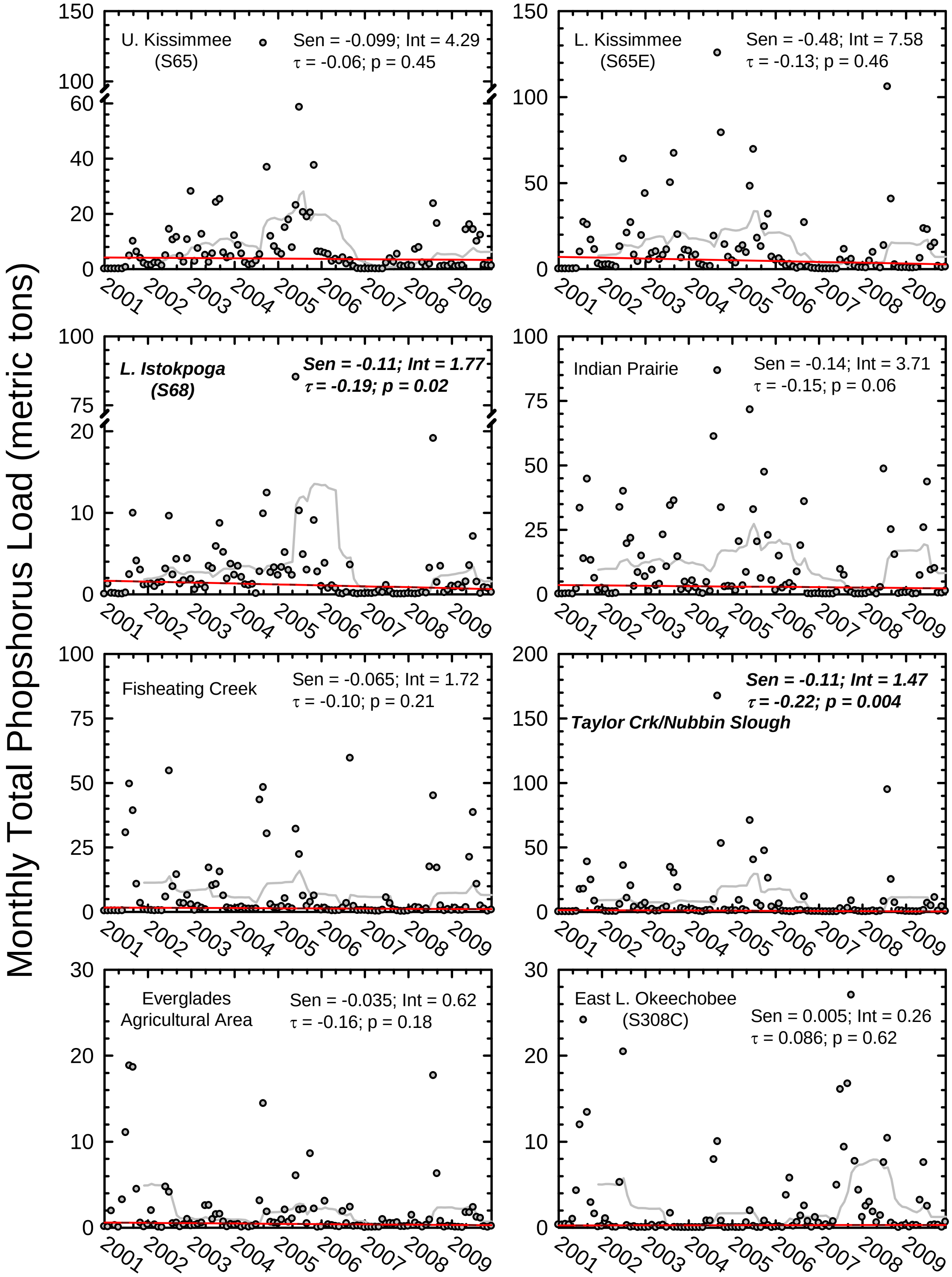

Figure 3-17. Monthly sub-watershed TP loads for 2001–2009. Gray dots represent monthly values, gray line represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.

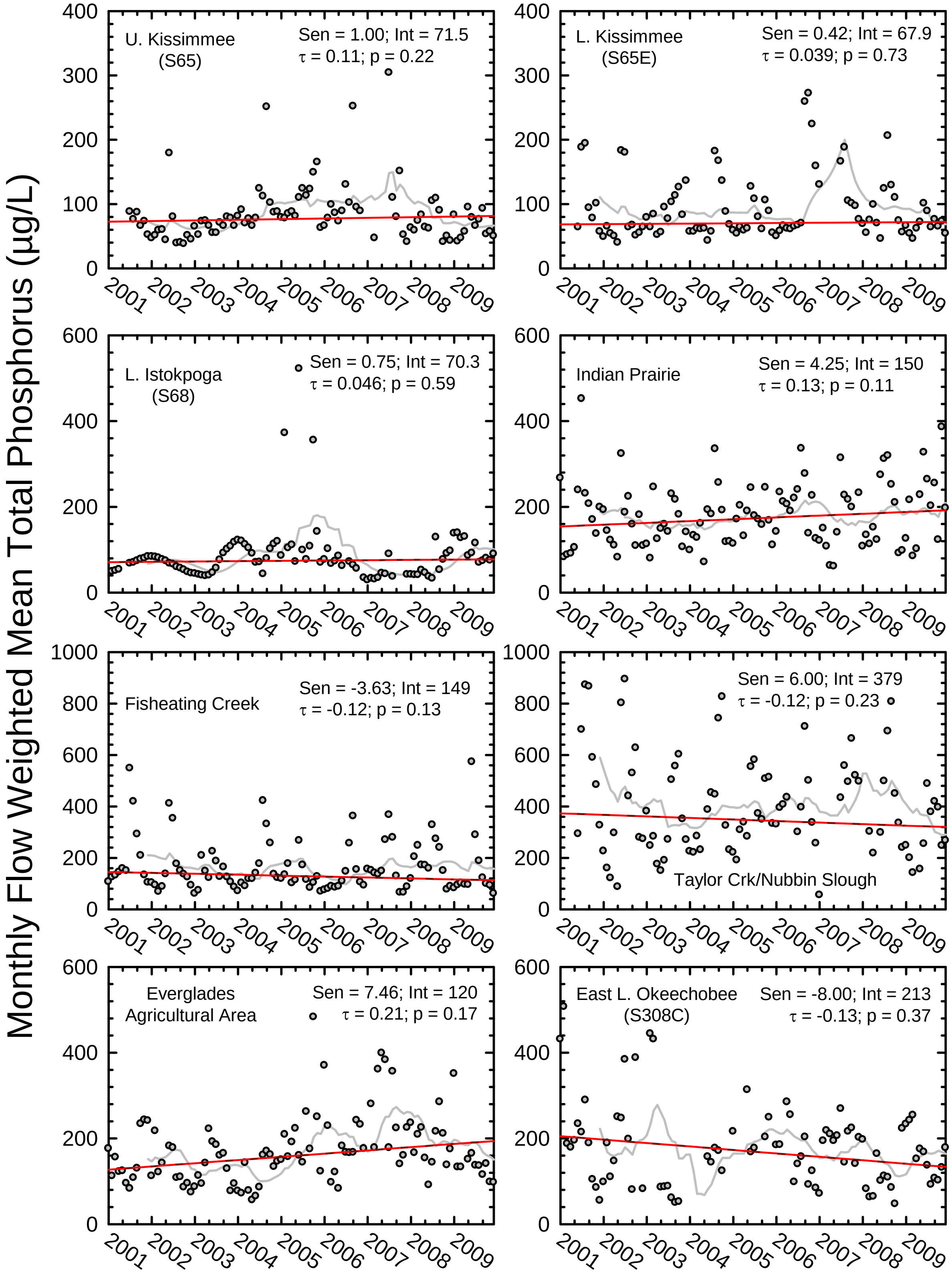

Figure 3-18. Monthly sub-watershed TP flow-weighted mean concentrations for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines.

3.2.3 Inflow Phosphorus Loading Trends and In-Lake Phosphorus Concentrations

3.2.3.1 Lake Okeechobee Inflows (2001–2009)

Inflow TP loads are calculated by multiplying the TP concentration times the measured flow. As a result, TP loads are strongly related to surface water inflows. Inflows to Lake Okeechobee have varied greatly over the past nine years (2001–2009) with three years of drought (2001, 2006, 2007) and three years with major storms (2004—Hurricanes Frances and Jeanne, 2005—Hurricane Wilma, and 2008—Tropical Storm Fay)(**Figure 3-19A**). The maximum annual inflow to the lake was 4.0 million ac-ft in 2005 and the minimum was 0.7 million ac-ft during 2007, one of the driest periods on record. The average inflow over the past decade—2.35 million ac-ft—is slightly less than the baseline period (1990–2005) average of 2.52 million ac-ft. Lake discharges ranged from 0.30 million ac-ft in 2001 to 3.75 million ac-ft in 2005 (**Figure 3-19B**).

Average lake volume was greatest in 2003 at 4.30 million ac-ft and least in 2007 at 2.06 million ac-ft (**Figure 3-19C**). Review of monthly average volumes clearly document the seasonal variability of water within the lake, with lowest values typically occurring in winter and spring months and highest values occurring in summer and fall (**Figure 3-19D**). The minimum average monthly lake level was 8.94 ft at the height of the drought in June 2007, while the maximum average monthly lake level was 17.7 ft in October 2004, one month after Hurricanes Frances and Jeanne passed over Lake Okeechobee.

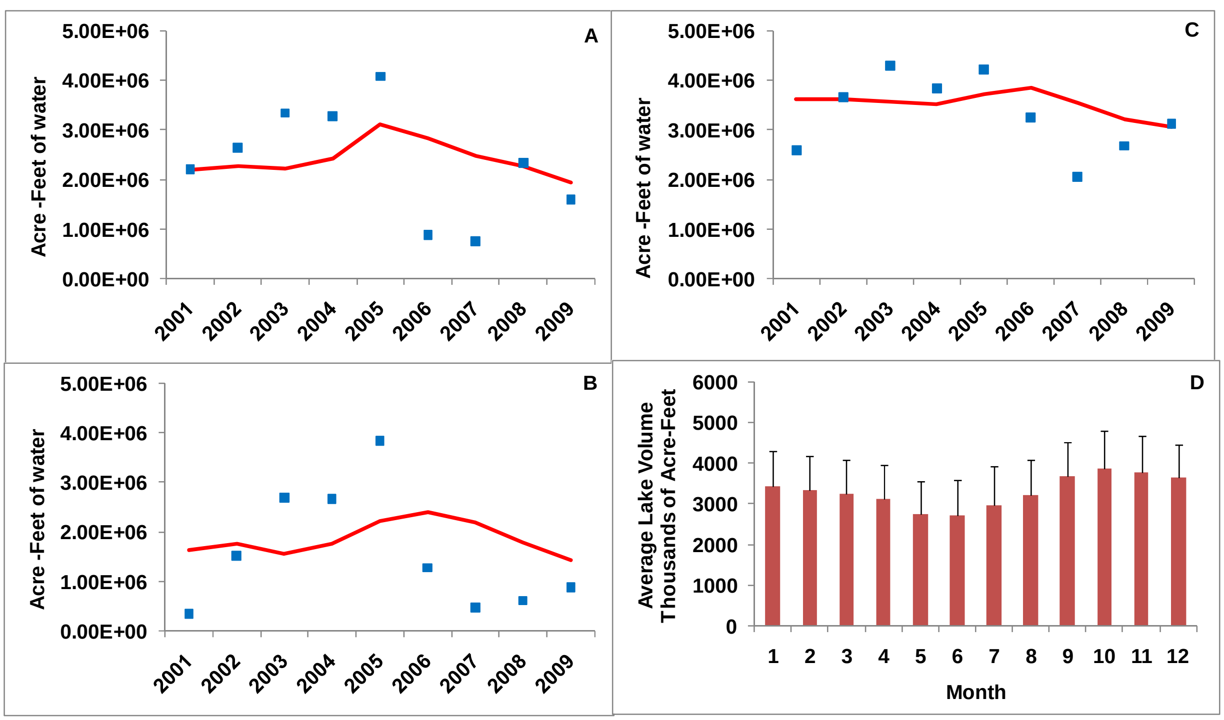

Figure 3-19. (A) Annual surface inflow to Lake Okeechobee (blue squares) and five-year moving average (redline). **(B)** Annual discharge (blue squares) and five-year moving average (redline). **(C)** Annual average lake volume (blue squares) and five-year moving average (redline). **(D)** Monthly average lake volume and one-standard error for 2001–2009.

3.2.3.2 Inflow TP Loads and In-Lake TP Concentrations (1973–2009)

Over the 37-year period of record (1973–2009), both the maximum and minimum TP loads to Lake Okeechobee by calendar year (including 35 mt per year derived from atmospheric deposition [FDEP 2001]) occurred in the last decade: the minimum was 156 mt in 2000 and maximum was 1,102 mt in 2004 (**Figure 3-20A**). The five-year rolling average in the past nine years ranged from 465 mt to 719 mt per year. This average is well above the TMDL of 140 mt to be met by 2015. No significant trend for inflow phosphorus loads was found in either the 2001–2009 period or 1973–2009 period (**Table 3-3**). Inflow-weighted TP concentrations ranged from a high of 313 ppb in 1988 and a low of 105 ppb in 1996 (**Figure 3-20B**). Over the 37-year period of record, there has been a significant decline in inflow concentration (**Table 3-3**). However, after 1996, this trend did not continue. For 2001–2009, there were no significant trends for inflow TP concentration despite the variation from a minimum of 133 ppb in 2003 to a maximum of 299 ppb in 2004 (**Table 3-3**).

Annual average in-lake TP concentrations increased significantly from below 50 ppb in 1974 to over 100 ppb after 1988 (**Figure 3-20B**). From 1989 to 1999 values continued to increase but remained below 120 ppb. The highest annual average in-lake concentrations of 223 ppb and 208 ppb occurred in 2005 and 2006, respectively. These years were also the first time that in-lake concentrations exceeded inflow concentrations. The most probable cause of these high concentrations is sediment resuspension and nutrient flux driven by hurricane impacts in the preceding years (James et al. 2008). After 2006, the annual average concentrations have declined, falling below 120 ppb in 2009.

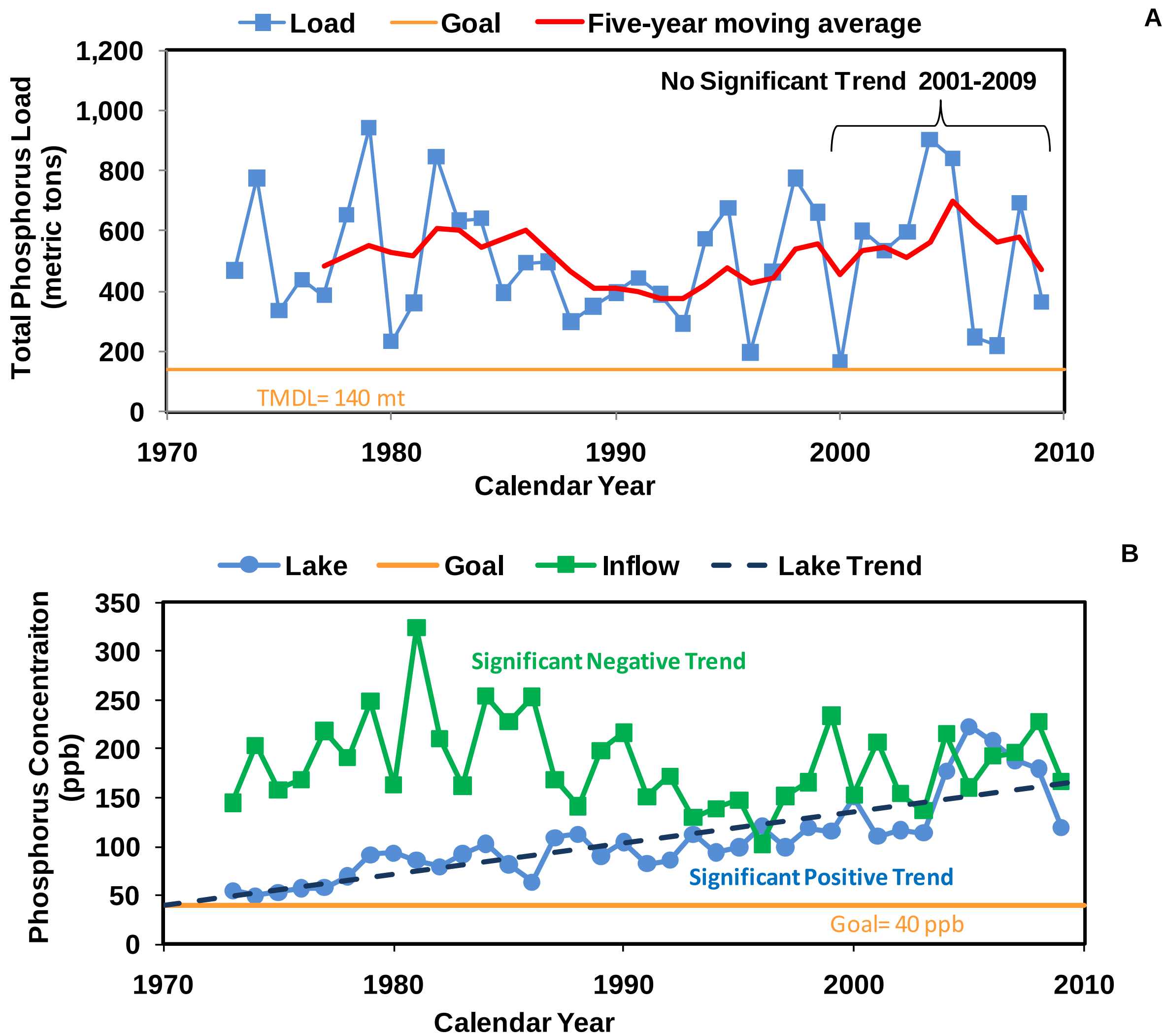

Figure 3-20. (A) Annual phosphorus load (mt) to Lake Okeechobee (blue squares), five-year moving average (red line), and the phosphorus TMDL (gold line). **(B)** Annual inflow phosphorus flow-weighted concentration (µg/L) to Lake Okeechobee (green squares), annual average in-lake concentrations (blue circles), in-lake concentration goal (gold line), and linear trend of in-lake concentration (dashed blue line: R2=0.67).

Table 3-3. Kendall's Tau trend analysis of Lake Okeechobee phosphorus and water flow.

	2001-2009			Period of Record (1973–2009)		
Parameters	**Tau Statistic**	**Slope**	**P value**	**Tau Statistic**	**Slope**	**P value**
Inflow (ac-ft/yr)	-0.153	-7870.80	0.338	-0.030	-342.47	0.574
Outflow (ac-ft/yr)	-0.116	-3062.60	0.578	0.114	872.17	0.109
Loads to the lake (mt)	-0.181	-1.18	0.195	-0.086	-0.146	0.092
Discharge loads from the lake (mt)	-0.093	-0.39	0.641	0.230	0.269	0.002
Inflow TP concentration (µg/L)	0.079	1.26	0.517	-0.169	-1.298	0.008
In lake TP concentration (µg/L)	0.269	5.95	0.169	0.553	2.496	<0.001
Outflow TP concentration (µg/L)	0.069	1.40	0.628	0.330	1.683	<0.001

3.2.4 Lake Discharge Phosphorus Trends

Average discharge TP loads from the lake were less than loads into the lake for the 2001–2009 period. The discharge loads ranged from 58 mt in 2001 to 827 mt in 2005 (**Figure 3-21A**). No significant trends were found for the 2001–2009 period; however, significant increasing trends of discharge loads and outflow TP concentration occurred over the 1973–2009 period (**Table 3-3**). Net loads (loads minus discharge) were overall positive (the lake is a net sink for TP), with the exception of 2005 and 2006 when there was a net export of TP (**Figure 3-21B**). Sediment loads were mostly negative, indicating that TP was absorbed into the sediments; however, in 2005 and 2007 sediments released more TP than they absorbed (**Figure 3-21C**). Total flow-weighted outflow TP concentrations ranged from 100 µg/L in 2003 to 196 µg/L in 2006 (**Figure 3-21D**). Over the period of record (1973–2009) the estimated accumulation of TP into the sediments has been over 11,000 mt (**Figure 3-22**). This is an increase in the sediment TP load of approximately 300 mt per year, which is the difference between the inflow and discharge loads.

The majority of the discharge from Lake Okeechobee occurred through structures S-77 and S-308 into the Caloosahatchee and St. Lucie rivers, respectively (**Table 3-4**). These are the largest discharge structures on the lake and are used when water levels exceed the stage regulation schedule (USACE 2008). The next four largest discharges during 2001–2009 were through S-351, S-352, S-354, and L-8 (C10A). These primarily provide water supply to the EAA and provide backup water supply for the southeastern coast. Of the remaining structures, all but S-135 provide some local water supply to the northwestern basins of Lake Okeechobee during dry periods. Discharge is small and outflow TP concentrations are lower than at other discharge structures because the waters pass through marshes where TP is removed by vegetation.

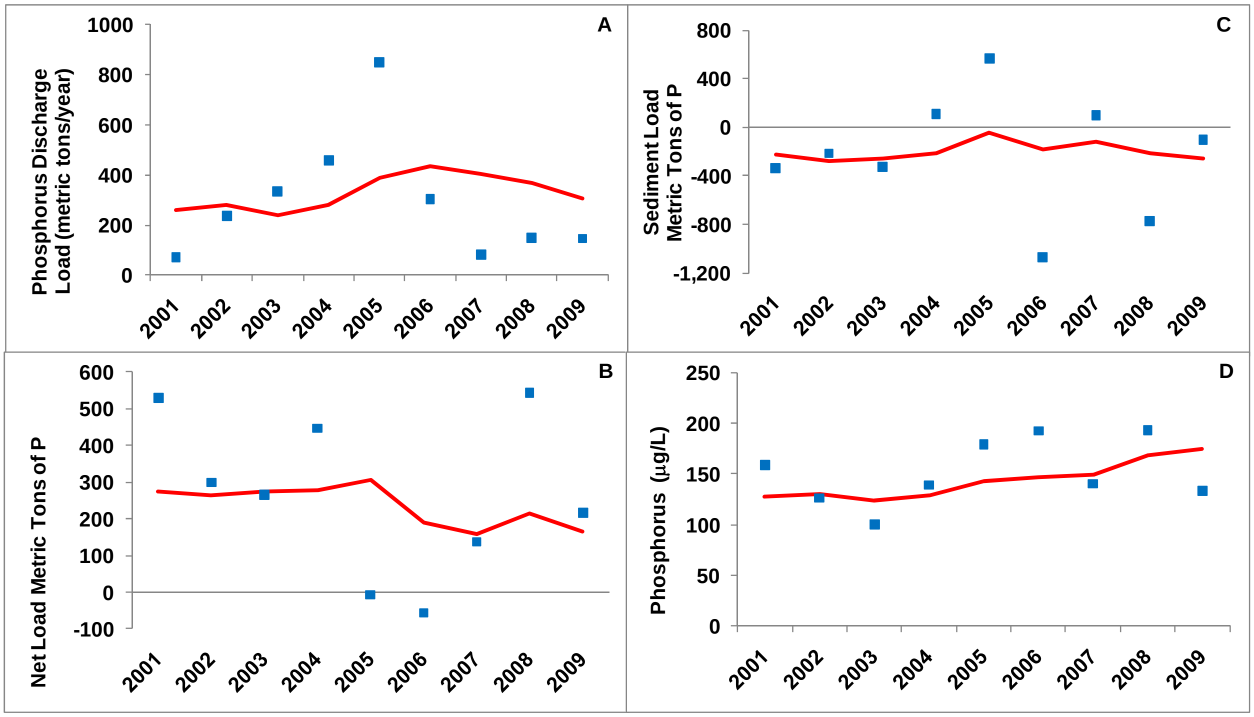

Figure 3-21. (A) Annual phosphorus load (mt) discharged from Lake Okeechobee (blue squares) and five-year moving average (redline). **(B)** Net (inflow-discharge) phosphorus load (mt) to Lake Okeechobee (blue squares) and five-year moving average (redline). **(C)** Net calculated sediment load (change in water column mass – net load) to Lake Okeechobee (blue squares) and five-year moving average (redline). **(D)** Annual discharge phosphorus flow-weighted mean concentration (blue squares) and five-year moving average (redline).

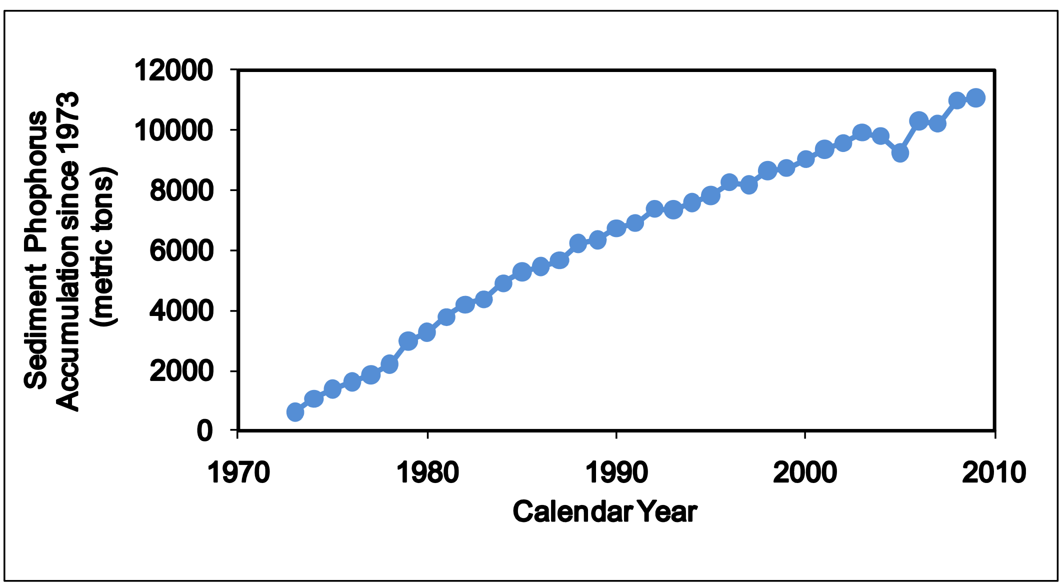

Figure 3-22. Estimated accumulation of phosphorus into Lake Okeechobee sediments since 1973 based on annual loads to and from the lake.

Table 3-4. Discharge by structure from Lake Okeechobee from 2001 to 2009.

Structure	Discharge (ac-ft/yr)	Annual TP Discharge (metric tons)	Flow Weighted Mean Concentration (mg/L)
C5*	24	0.005	169
S135	256	0.03	90
S129	542	0.03	45
S131	1,339	0.1	59
S127	2,066	0.3	98
G207	2,913	0.4	110
G208	4,338	0.7	135
INDS(S310)	30,353	3.9	105
C5A	56,255	8.2	118
L8(C10A)	92,802	26.1	228
S354	109,199	16.8	125
S352	120,928	31.6	212
S351	176,829	30.8	141
S308	303,925	79.2	211
S77	691,810	93.8	110
Total	**1,593,582**	**291.8**	**148**

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SECTION 4: CHALLENGES IN THE WATERSHED

4.1 Background

For the past decade, the coordinating agencies—the South Florida Water Management District (SFWMD or District), the Florida Department of Agriculture and Consumer Services (FDACS), and the Florida Department of Environmental Protection (FDEP)—have diligently worked to reduce phosphorus loads into Lake Okeechobee. This effort was initiated after the Florida legislature enacted the Lake Okeechobee Protection Act in 2000, which requires state water quality standards including the Total Maximum Daily Load (TMDL) to be achieved by January 1, 2015.

Despite these efforts water quality remains a serious challenge in Lake Okeechobee and its watershed. This section describes the main challenges to achieving the TMDL goal. They include (1) existing phosphorus in the watershed that has the potential to reach the lake, known as legacy phosphorus; (2) annual nutrient inputs from agricultural and urban land uses; (3) in-lake phosphorus loading from resuspension of nutrient laden sediments; (4) challenges with Northern Everglades Stormwater Treatment Areas (STAs); (5) cost share issues with the water quality improvement features of the Comprehensive Everglades Restoration Plan (CERP) Lake Okeechobee Watershed Project; and (6) funding constraints in the current economic climate.

4.2 Legacy Phosphorus

Legacy phosphorus is defined as any phosphorus in the watershed that is present as the result of anthropogenic activities and has transport potential to Lake Okeechobee. Phosphorus in the watershed is primarily from animal feeds, fertilizers, and domestic products that are either generated locally or imported (SWET 2007). The amount of legacy phosphorus was determined based on the difference between concentrations of total phosphorus for the impacted soil and total phosphorus for the non-impacted soil (native soil). The accumulation of legacy phosphorus within the Lake Okeechobee Watershed as the result of anthropogenic activities poses the biggest challenge to implementing an effective watershed-scale nutrient management program. Using soil test data from various studies and routine sampling programs, legacy phosphorus was quantified for various land uses that were then spatially distributed and summed across the entire watershed using the 2006 land use data (SWET 2008). About 170,000 metric tons (mt) of legacy phosphorus currently exists in the uplands (91 percent) and isolated wetlands (9 percent). The legacy phosphorus in the sloughs, streams, and canals represents about another 860 mt, while the larger lakes would have possibly another 5,000 mt. This means there are about 176,000 mt of legacy phosphorus within the studied basins that is potentially available for transport to Lake Okeechobee (SWET 2008).

Initial assumptions for planning purposes were that up to 50 percent of the legacy phosphorus could be mobile or easily released into surface waters. Based on recent work, it is now estimated that approximately 35 percent of total phosphorus in soils is non-reactive and is not biologically available based on chemical fractionation of soil phosphorus (Reddy et al. in press). The remaining 65 percent is reactive and may be available for release at different time scales. To put this into perspective, assuming 10 to 25 percent of the reactive phosphorus is available for release (Reddy et al., in press), legacy phosphorus would support the current 500 mt of phosphorus per year load to Lake Okeechobee for the next 23 to 57 years, assuming phosphorus imports and exports were immediately balanced. If phosphorus imports and exports were immediately balanced, the size of the legacy phosphorus pool should decrease over time. These studies show that enough legacy phosphorus is in the watershed to maintain elevated levels in inflows to Lake Okeechobee for many years.

The reduction of new sources of phosphorus and its mobility to the lake through abatement practices is expected to be the only means of addressing this large-scale problem and must include upland, wetland, and stream sources (SWET 2008). The abatement plan (SWET 2008) outlines specific phosphorus control practices and strategies at different spatial scales, anticipated phosphorus reduction performances, and implementation costs. The phosphorus control practices used in the plan were categorized into one of the following spatial groupings that define the scale and type of phosphorus source to be addressed: (1) in-field—practices that address legacy phosphorus and its mobility within the soil/plant environment, (2) edge-of-field/farm—practices that treat and/or retain runoff as it is leaving a field or farm, (3) residential—practices applied within residential areas, (4) urban—practices applied within transportation, urban, commercial, and industrial areas, (5) facility—practices used in non-soil-based areas that potentially discharge phosphorus into runoff, such as industrial sites, packing houses, and old landfills, and (6) regional—practices that treat and/or retain stream flows within the tributary system where multiple upstream landowners drain to the system. The projects and other activities (source control, regional STAs, sub-regional projects) being implemented by the coordinating agencies (the SFWMD, FDACS, and FDEP) and described in Section 5 will help address legacy, as well as new sources, of phosphorus in the watershed.

The approach taken for the abatement plan was to first meet the Lake Okeechobee tributary TMDL targets followed by regional treatment to obtain the additional reductions needed to meet the Lake Okeechobee TMDL. The Lake Okeechobee TMDL for the total phosphorus (TP) load has been set at 140 mt/year based on a five year rolling average (105 mt from the Lake Okeechobee Watershed and 35 mt from atmospheric deposition) (FDEP 2001), and the tributary TMDL for the TP concentration has been set at 113 parts per billion (ppb) for the northern Lake Okeechobee Watershed by the U.S. Environmental Protection Agency (USEPA)[3]. The Upper Kissimmee and Lake Istokpoga sub-watersheds do not have set TMDLs and therefore they were assumed to be 55 ppb for the purposes of this assessment based on historic discharge phosphorus concentrations for Lake Kissimmee and Lake Istokpoga.

The method of applying phosphorus control practices was to apply the most cost-effective practice first and then to add practices as needed to meet the TMDL targets for each land use. The implementation of a typical Best Management Practice (BMP) program was found to be the most cost-effective initial phosphorus control practice for the Lake Okeechobee Watershed, and therefore was applied first. To keep the logistics of BMP implementation to a manageable level, field-level BMPs were applied as a suite because they were previously identified as the most appropriate combination (Bottcher 2006). The next control practice implemented was stormwater retention, which includes wetland restoration and water recycling, as well as standard urban retention and detention systems. Finally, chemical treatment was added to the retention-based

[3] http://www.epa.gov/region4/water/tmdl/florida

systems if the first two practices were not sufficient to meet TMDL targets. Costs for the combined technologies to meet both the tributary and Lake TMDLs are also included in the abatement plan (SWET 2008).

4.3 Annual Nutrient Imports

The nutrient budget analysis included a detailed material budget of both TP and total nitrogen (TN) imports and exports in the Lake Okeechobee Watershed (**Figure 4-1**). This budget analysis utilized current land use data, and more recent rainfall and runoff values. It integrated all imports including fertilizer, feed, and animals, and exports including nutrient loads in surface water runoff, milk, harvested crops, and animals for the entire Lake Okeechobee Watershed. Based on data collected from 2009, approximately 6,088 mt of total net phosphorus was imported into the lake’s watershed annually for anthropogenic land use activities and 5,047 mt of the total net phosphorus imported was stored onsite in upland soils (HDR Team 2010) (**Table 4-1**).

The current phosphorus budget results by land use were compared to the previous data (Mock Roos Team 2002, Hiscock et al. 2003, Mock Roos Team 2003, Zhang et al. 2004a, 2004b). The net phosphorus import decreased by 25 percent from the previous budget, from 8,085 mt to 6,088 mt. This is primarily due to changes in phosphorus import from two land uses: row crop and sugarcane (**Table 4-2**).

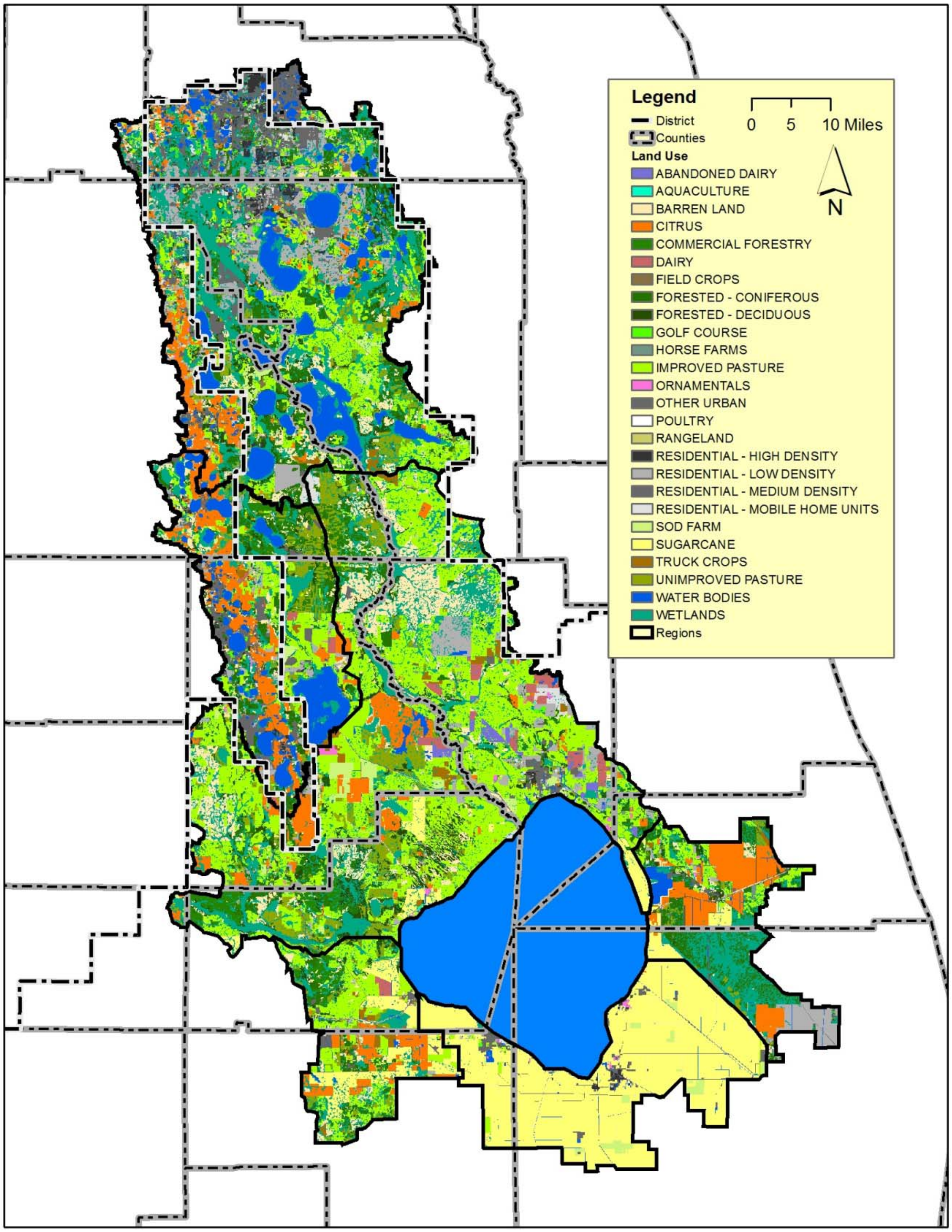

Figure 4-1. Aggregated land use in the Lake Okeechobee Watershed.

Table 4-1. TP budget results by sub-watershed (in mt/year).

Sub-watershed	Area (ha)	Imports	Exports	Net Imports	Rainfall	Source Discharge	Onsite Storage	Outlet Discharge	Attenuated
East Lake Okeechobee	96,635	576.8	205.5	371.4	21.3	56.3	336.4	36.9	19.4
Fisheating Creek	115,037	463.0	269.3	193.6	26.6	70.7	149.6	15.2	55.5
Indian Prairie	117,443	896.5	508.1	388.4	21.3	97.1	312.5	23.9	73.2
Lake Istokpoga	157,837	1,029.6	382.4	647.2	32.9	132.4	547.7	31.2	101.2
Lower Kissimmee	171,692	1,064.8	489.8	575.1	38.8	119.8	494.1	52.4	67.4
South Lake Okeechobee	147,327	2,749.3	2,329.2	420.1	31.9	146.3	305.7	109.3	37.0
Taylor Creek/ Nubbin Slough	80,076	1,059.7	424.2	635.5	16.1	119.1	532.5	79.6	39.6
Upper Kissimmee	416,556	2,360.4	544.1	1,816.3	100.9	464.1	1,453.1	122.4	341.7
West Lake Okeechobee	90,270	1,604.8	563.8	1,041.1	21.5	146.8	915.8	83.7	63.0
Total	**1,392,873**	**11,804.9**	**5,716.3**	**6,088.5**	**311.5**	**1,352.5**	**5,047.4**	**554.6**	**798.0**

Table 4-2. Comparison of phosphorus (P) budget analyses.

	Previous 2002–2003 P Budget Analysis				Current P Budget Analysis			
Land Use	Area (acre)	Percent	Net P Import (mt)	Percent	Area (acre)	Percent	Net P Import (mt)	Percent
Barren Land	64,092	1.9%	—	0.0%	41,318	1.2%	—	0.0%
Citrus	250,755	7.3%	285	3.5%	245,790	7.1%	1,274	20.9%
Dairies	28,256	0.8%	504	6.2%	23,361	0.7%	470	7.7%
Improved Pastures	714,245	20.8%	1,672	20.7%	676,991	19.7%	1,916	31.5%
Other Areas	52,853	1.5%	434	5.4%	30,935	0.9%	170	2.8%
Row Crops	22,699	0.7%	1,845	22.8%	23,238	0.7%	309	5.1%
Sod	32,823	1.0%	(493)	(6.1%)	38,425	1.1%	(256)	(4.2%)
Sugarcane	399,836	11.6%	1,562	19.3%	399,213	11.6%	543	8.9%
Unimproved Pastures/ Rangeland	337,385	9.8%	2	0.0%	325,064	9.4%	(84)	(1.4%)
Upland Forests	416,214	12.1%	(14)	(0.2%)	392,200	11.4%	(36)	(0.6%)
Urban	281,633	8.2%	2,288	28.3%	410,397	11.9%	1,783	29.3%
Water Bodies	226,650	6.6%	—	0.0%	219,847	6.4%	—	0.0%
Wetlands	614,701	17.9%	—	0.0%	615,081	17.9%	—	0.0%
Total Acreage	**3,442,141**	**100.0%**	**8,085**	**100.0%**	**3,441,861**	**100.0%**	**6,088**	**100.0%**

The net phosphorus imports for improved pasture increased by 15 percent. This is primarily due to the incorporation of residuals in the land application calculation, which were not included in previous reports. If residuals were removed from the budget, there would actually be a 22 percent decrease in improved pasture, which suggests that the efforts by the coordinating agencies and local ranchers to reduce the use of phosphorus in feed and fertilizers appear to be successful. Other factors, such as changes in land application rates of fertilizers and changes in farm types from pasture to sod may also be influencing the results.

Other significant reductions occurred in truck crops and sugarcane. The reduction in truck crops may be attributable to the economy. The change in sugarcane, however, may reflect a more accurate calculation of imports and exports that were compared to fertilizer sales and crop reports.

By contrast, the net import of phosphorus for citrus increased. This is due primarily to changed coefficients in the Lake Istokpoga and Upper Kissimmee basins where citrus was previously calculated as a net phosphorus exporter (as opposed to an importer as calculated previously in the other regions). In the current analysis, citrus was found to be a net phosphorus importer in all of the regions with fertilizer rates in the mid-range of University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) recommendations.

The net import of nitrogen from anthropogenic land use activities was 42,513 mt (HDR Team 2010) (**Table 4-3**). The contribution from the East, West, and South Lake Okeechobee sub-watersheds is 6,219 mt (15 percent). The TN budget results at the sub-watershed level show that, of the 8,593 mt of nitrogen discharged at the source in runoff, 5,695 mt discharges to Lake Okeechobee from the Northern Lake Okeechobee Sub-watershed. The remaining 2,898 mt are from the East, West, and South Lake Okeechobee sub-watersheds, which have the potential to discharge into the lake, but the majority of their flows discharge away from the lake. When comparing measured flows to the lake to the total basins flows as modeled, it is estimated that 63 percent, 25 percent, and 13 percent of the runoff reached Lake Okeechobee from the East, South, and West Sub-watersheds, respectively from 2003 to 2008. It should be noted that sub-watershed flow directions that occurred during this period may not be representative of long-term conditions.

One calculation for nitrogen is onsite balance (**Tables 4-3**). Like the TP tables, this value equals the difference between the sum of net imports (imports-exports) and rainfall minus the source discharge. Unlike TP, it does not represent estimated nutrient storage in the soils because there are atmospheric losses of TN due to denitrification and ammonia volatilization. Rather, the onsite balance reflects the TN that is converted to nitrate and nitrite, which are subject to denitrification. A negative balance indicates a depletion of nitrogen in the soils as a result of the uptake being greater than the import. This is most prevalent in the nitrogen-rich muck soils of the Everglades Agricultural Area that can mineralize up to 200 pounds per acre per year of nitrogen as the soil organic matter oxidizes/mineralizes (subsidence).

Overall, urban land uses, while comprising only 12 percent of the watershed, represent 29 percent of the total net phosphorus import (**Table 4-2** and **Figure 4-2**). This warrants additional study of ways to reduce nutrient imports onto these land uses. An offsetting factor, however, is that most of the urban land uses are located in the Upper Kissimmee region, which includes an extensive lake system that provides a significant amount of nutrient retention. The continued accumulation of nutrients have resulted in increased nutrients in the lakes' water columns, which could lead to higher nutrients in discharges to the Kissimmee River and ultimately to Lake Okeechobee. The Northern Everglades Interagency Team (see Section 2.4) will continue to emphasize the implementation of urban BMPs and also rely heavily on revised regulatory programs (e.g., proposed Statewide Stormwater Rule and proposed Works of the District Rule revisions) to address these phosphorus loads. This is the first nitrogen budget analysis in the watershed and, therefore, cannot be compared to previous analyses. The findings for nitrogen show that citrus is the primary source of net TN import (**Figure 4-2**).

Table 4-3. TN budget results by sub-watershed (in mt/year).

Sub-watershed	Area (ha)	Imports	Exports	Net Imports	Rainfall	Source Discharge	Onsite Balance	Outlet Discharge	Attenuated
East Lake Okeechobee	96,635	6,040.3	552.3	5,488.1	615.2	542.5	5,560.8	423.7	118.8
Fisheating Creek	115,037	2,895.7	1,157.1	1,738.6	766.4	331.9	2,173.1	244.5	87.5
Indian Prairie	117,443	5,454.5	2,062.2	3,392.3	611.6	684.4	3,319.5	373.2	311.2
Lake Istokpoga	157,837	8,968.8	1,150.8	7,818.0	948.3	888.8	7,877.4	397.9	491.0
Lower Kissimmee	171,692	5,465.8	2,359.5	3,106.4	1,119.7	667.9	3,558.1	194.3	473.7
South Lake Okeechobee	147,327	5,564.2	11,049.8	-5,485.7	920.6	1,820.7	-6,385.7	1,639.6	181.1
Taylor Creek/ Nubbin Slough	80,076	6,531.9	2,133.0	4,399.0	463.9	601.1	4,261.8	405.6	195.4
Upper Kissimmee	416,556	17,518.8	1,679.5	15,839.3	2,910.8	2,520.9	16,229.2	1,434.1	1,086.8
West Lake Okeechobee	90,270	8,473.0	2,256.2	6,216.8	620.4	534.8	6,302.4	463.8	71.0
Total	**1,392,873**	**66,913.1**	**24,400.2**	**42,512.7**	**8,976.8**	**8,593.0**	**42,896.5**	**5,576.7**	**3,016.4**

Note: Discharge in the table does not necessarily refer to discharge to Lake Okeechobee.

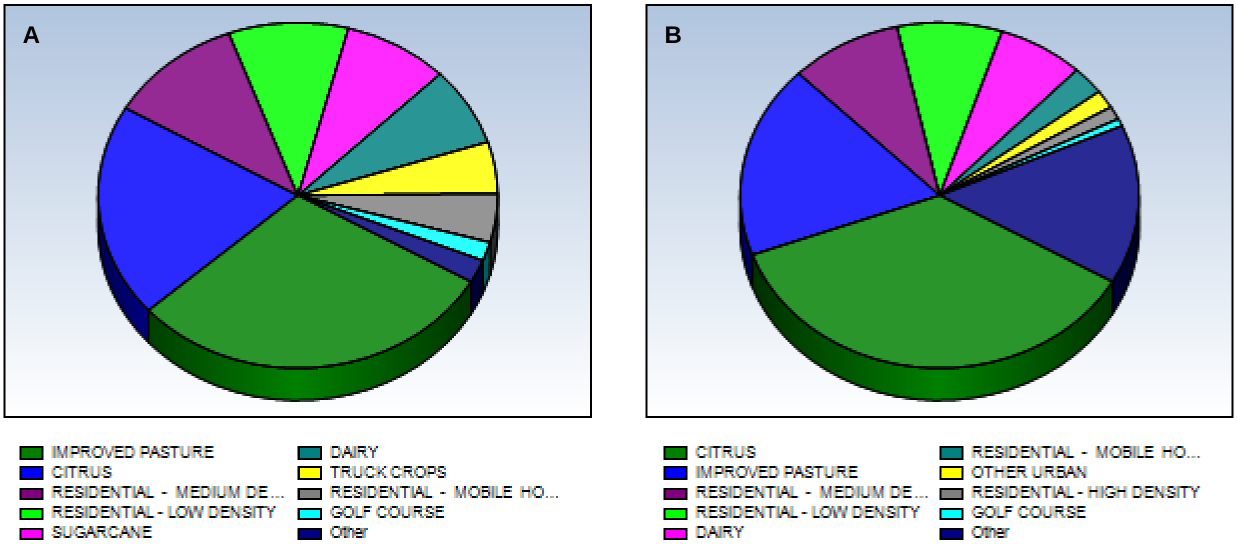

Figure 4-2. (A) Net phosphorus and **(B)** net nitrogen imports by land use.

4.4 In-Lake Phosphorus Loading

Excessive phosphorus loads to Lake Okeechobee have led to a large pool of the nutrient accumulating in the lake's sediments (Brezonik and Engstrom 1998, Engstrom et al. 2006, Schottler and Engstrom 2006). The upper 10 centimeters (cm) of all sediments within the lake (mud, sand, and peat) contain an estimated 28,700 mt of phosphorus (Reddy et al. 1995). This surface sediment is a primary source of dissolved inorganic phosphorus to the water column, which is roughly equivalent to the external loads of total phosphorus. Both internal and external loads of inorganic phosphorus stimulate algal growth (**Figure 4-3**). While this internal loading is quite large, more phosphorus, in organic or sorbed forms, settles out than returns as dissolved inorganic phosphorus (James et al. 2005). This deposition and burial of sediments has maintained some ability of the sediments to remove phosphorus from the water column. Over time, however, this net phosphorus sink has declined (Havens and James 2005) resulting in increased phosphorus concentrations in the water column.

The passing of hurricanes Frances and Jeanne in 2004 and Wilma in 2005 scoured much of the bottom of the lake, which increased the amount of suspended material and therefore reduced light conditions and algal and aquatic plant growth. These effects resulted in very high TP concentrations in the lake and a high proportion of inorganic phosphorus in the water column (James et al. 2008). In the past few years, as water levels have declined and aquatic vegetation has recovered, the TP and suspended solids concentrations have returned to pre-hurricane values (see Section 3.1.2).

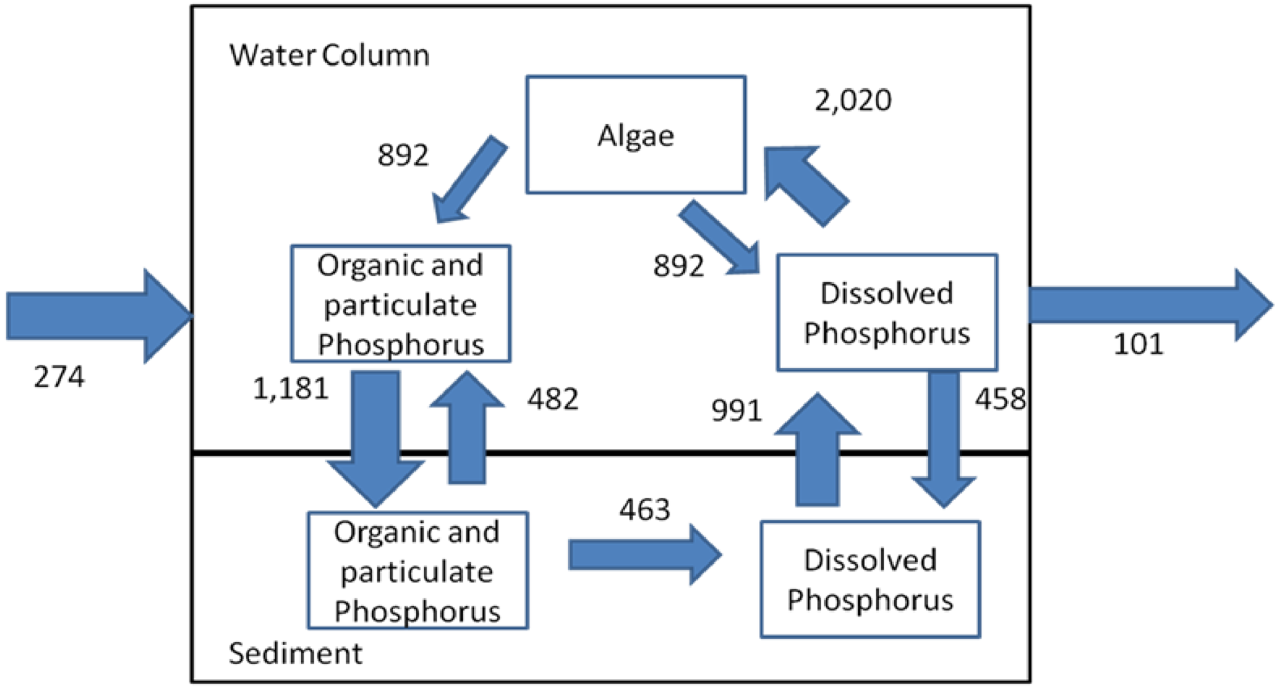

Figure 4-3. Phosphorus flux estimates (in milligrams per square meter per year) predicted from the Lake Okeechobee Water Quality Model (James et al. 2005).

Concerns of in-lake phosphorus loading led the District to study the feasibility of managing the sediments of Lake Okeechobee (Blasland, Bouck and Lee, Inc. 2001). This three-year study, which began in 2000, developed numerous alternatives in three categories: goals, objectives, and performance measures (Blasland, Bouck and Lee, Inc. 2003). These alternatives could be grouped into three categories: (1) no in-lake action—reduce external loads to the lake to meet the phosphorus TMDL by 2015, (2) chemical treatment—add a chemical lakewide to sequester available phosphorus into sediments, and (3) dredging—remove as much of the mud sediments as possible. Expert opinion, economic analysis, and water quality models were used to evaluate these alternatives. In addition, a pilot dredging study was undertaken to determine if the mud sediments could be effectively removed (EA Engineering Science and Technology Inc. 2002).

A major conclusion of the study was that the phosphorus TMDL must be met for any alternative to achieve and maintain TP concentrations within the lake water column at 40 ppb. Without the TMDL, chemical treatment or dredging would have to be continued beyond a single application (Blasland, Bouck and Lee, Inc. 2003). Water quality modeling indicated that a chemical treatment scenario could reach the in-lake goal 12 years after initiation of a lakewide project and within 2 years of application. Dredging would take much longer: 15 years to initiate and 15 years to complete and would achieve only minor improvements over the chemical treatment. Costs for alternatives were estimated to be approximately $500 million for chemical treatment and $3 billion for dredging (in 2002 U.S. dollars). The study recommended that the District focus on reducing loads to the lake.

Since the study was completed, drought conditions after the 2004 and 2005 storms provided another alternative—removing mud sediments from nearshore regions. As lake levels declined, the District, local governments, and the Florida Fish and Wildlife Conservation Commission

(FWC) deployed heavy equipment to scrape away the sediment in selected locations. The result was the removal of over 2 million cubic yards (yd^3) of detrital sediment from 2,000 acres of the lake's nearshore bottom (James and Zhang 2008), which resulted in the removal of approximately 237 mt of phosphorus. As these locations have been rehydrated, water quality has improved and a healthy aquatic plant community has returned (James and Zhang, in prep.). However, it should be recognized that the resuspension of sediments and phosphorus could occur due to a hurricane or tropical storm.

4.5 Stormwater Treatment Areas in the Northern Everglades

The pilot stormwater treatment areas constructed in Lake Okeechobee Watershed have had their own challenges in the past and some of these problems are continuing today. For example, although the construction of the Nubbin Slough STA was completed in September 2006, mechanical problems have delayed its operations. Repairs were completed in June 2010. However, the Nubbin Slough basin does not produce a sufficient amount of runoff in a normal rainfall year to supply the STA for full-time operation (Stanley Consultants, Inc. 2003). The USACE and the District explored ideas to provide additional water to the STA and how to address the sediment maintenance issues; however, provision of additional water was too costly. Currently, the USACE and the District are exploring how to operate the system as a retention area and achieve comparable water quality improvements.

Flow-through operations of Taylor Creek STA began on June 26, 2008, and continued on a discharge mode until February 24, 2009, when a failure of the culvert at the outfall structure was detected. From June 2008 to February 2009, the system removed 1.35 mt of phosphorus from the Taylor Creek drainage basin. Repairs were completed on August 23, 2010. Following a demonstration of compliance with pre-discharge requirements as laid out in the permit, flow-through operations were resumed on September 8, 2010. Once all flow-through phase requirements are satisfied, the District will officially take control of the project and begin the long-term operational phase of the project. More details on these projects and their status are included in Section 5.

4.6 CERP – Lake Okeechobee Watershed Project — Cost Share of Water Quality Improvement Features

The amount of water that can be released from Lake Okeechobee to the south and treated in Everglades Construction Project (ECP) STAs for release into the Water Conservation Areas is a function of TP concentrations in the Lake Okeechobee discharge, conveyance capacity of the canals leading to the ECP STAs, and flow volumes of local Everglades Agricultural Area drainage. When Lake Okeechobee water levels rise and require flood control regulatory releases, the high phosphorus concentration in the lake is one of the major reasons why the water cannot be discharged south to the ECP STAs but has to be diverted via the C-44 canal (St. Lucie River) and C-43 canal (Caloosahatchee River) to the estuaries. High flows and the resulting decline in salinity levels and habitat quality in and near the estuaries occur because this water could not otherwise be directed south to the Everglades and is lost to tide.

Water quality features within the Lake Okeechobee Watershed are essential to Everglades restoration. Project features improve inflows to Lake Okeechobee and further Comprehensive Everglades Restoration Plan (CERP) goals related to water reclamation and expanded spatial extent of habitat. Improved quality of water delivered to Lake Okeechobee from its tributaries would improve lake water quality, providing for more water that can be treated and delivered to the southern Everglades (increased water quantity is essential to restoration). Less water would be lost to tide via the estuaries and the reclaimed water would improve habitat south of the lake and reduce harmful flows to the east and west, improving habitat in the estuaries. In addition, cleaner water will improve degraded habitat within the lake.

Currently, the state is working with the USACE on the Lake Okeechobee Watershed Project Implementation Report to obtain Congressional authorization to share costs of construction of water quality improvement features identified in the tentatively selected plan. In addition, the operation, maintenance, repair, replacement, and rehabilitation of water quality improvement features in the tentatively selected plan can be cost shared in accordance with Congressional authority and to sustain the long-term benefits produced in the Lake Okeechobee Watershed project area and the downstream Everglades.

4.7 Funding Constraints

Funding is the critical determinant in the timely implementation of Lake Okeechobee Watershed projects to achieve the water quality and storage goals. There is a reliance on both state and federal funding to implement the array of projects identified in the LOPP. To provide a source of state funding for continued restoration of the South Florida ecosystem, the 2007 Northern Everglades and Estuaries Protection Program expanded the use of the Save Our Everglades Trust Fund to include Northern Everglades restoration and extended the State of Florida's commitment through the year 2020. Since the enactment of the Lake Okeechobee Protection Act (LOPA) in 2000 and through 2010, approximately $315 million has been invested through state appropriations and District contributions for Lake Okeechobee Watershed restoration.

The costs of source control construction projects other than CERP features, research, and water quality monitoring projects and other elements of the Lake Okeechobee Protection Plan (e.g.., exotic species management, internal phosphorus management) will continue to be primarily borne by the coordinating agencies and the state. There is also a concern regarding allocation of state funds for Lake Okeechobee projects due to other competing large-scale restoration activities and ongoing litigation that may continue to divert funds away from Lake Okeechobee Watershed projects. While authorized CERP-related costs are eligible for up to a 50 percent cost share with the federal government, federal funding is dependent on many factors including the U.S. Army Corps of Engineers nationwide policies and must compete against other large-scale restoration and public works projects nationwide. Recently, federal funding for wetland restoration projects in the watershed has come from the Natural Resource Conservation Service, which will help achieve some plan benefits and, like CERP funding, is subject to annual appropriations from Congress.

Agricultural BMP implementation continues to expand throughout the watershed and across all agricultural commodities. Typical owner-implemented BMPs are now in place on approximately 1.3 million of the 1.7 million acres of agricultural lands in the watershed. These owner-implemented BMPs include nutrient management, irrigation management, and rotational grazing. The design, engineering and construction of more capital-intensive water management BMPs such as wetland restoration and edge-of-farm retention/detention and treatment facilities is slowed by the current multi-year economic downturn and the shortfall of state funding necessary to cost-share these projects.

SECTION 5: PAST AND CURRENT ACTIVITIES

5.1 Watershed Phosphorus Source Control Program

5.1.1 Overview and Background

Reducing the phosphorus load to reach the Total Maximum Daily Load (TMDL) requirements necessitates integrated actions at the source (onsite and sub-regional) and at regional scales. Source control is integral to the success of the restoration program, thus the integrated management strategy of this plan is based on a foundation of phosphorus source control programs, including Best Management Practices (BMPs) on an individual operator's site (onsite measures) and water quality improvement projects at the sub-regional level (measures that extend to several individual operator's sites for collective storage or treatment). The sub-regional water quality improvement projects included in the source control programs are intended to further reduce nutrient levels to acceptable limits for discharge into the regional system. The load remaining after implementation of the source control programs will be addressed with downstream regional water quality improvement measures as described in Section 5.2. The BMP measures included in the source control programs are intended to: (1) minimize the amount of nutrients used onsite, (2) when used, ensure that nutrients are effectively applied to minimize discharges into local runoff, and (3) minimize the offsite runoff that transports nutrients into the regional drainage system.

This section provides the status of source control programs implemented in the Lake Okeechobee Watershed by the South Florida Water Management District (SFWMD or District), the Florida Department of Agriculture and Consumer Services (FDACS), and the Florida Department of Environmental Protection (FDEP), also referred to jointly as the coordinating agencies. Source control programs have evolved and expanded through cooperative efforts by the coordinating agencies and stakeholders, whereby the agencies implement their respective programs through specific rules promulgated by each agency based on statutory authorizations. The coordinating agencies operate in concert through an interagency memorandum of understanding so that resources, responsibilities, and efforts can be properly coordinated and aligned. The memorandum was originally signed by the coordinating agencies in March 2001 and amended in April 2002. The memorandum is currently being revised to include the requirements of the NEEPP.

Source control programs were first recognized as a critical element for reducing phosphorus loads in the Lake Okeechobee Watershed in 1987 with the enactment of the Surface Water Improvement and Management (SWIM) Act (Section 373.4595, Florida Statutes [F.S.]). The FDEP Dairy Rule (Rule 62-670.500 F.A.C.), adopted in 1987, and the Lake Okeechobee Works of the District (WOD) Rule (Chapter 40E-61, F.A.C., see Section 5.1.2), adopted in 1989, were limited in focus and geographic area. The Dairy Rule is technology-based while the WOD Rule presumes landowners are in compliance, unless monitoring data indicates otherwise, and is limited to specific basins.

In response to continued ecological concerns with Lake Okeechobee, the SWIM Act was revised by the legislature and became the Lake Okeechobee Protection Act ("LOPA") in 2000.

LOPA expanded the geographic boundary and the authority of the coordinating agencies to further develop the source control programs. The LOPA recognized the need for expanding and strengthening the WOD regulatory source control program, directed the FDACS to complement the existing regulatory programs by leading the development and implementation of an incentive-based agricultural BMP program, and directed the FDEP to further develop and implement non-agricultural BMPs.

The LOPA was revised in 2005 to encompass areas upstream of Lake Kissimmee and the Lake Istokpoga Watershed. In 2007, the statute was further amended to include the St Lucie River and Estuary Watershed and the Caloosahatchee River and Estuary Watershed, thus becoming the Northern Everglades and Estuaries Protection Program (NEEPP)(Section 373.4595, F.S.), as described in Section 2. Additionally, the NEEPP defined additional source control program requirements for the Lake Okeechobee Watershed.

In addition to the regulatory and incentive-based programs being employed by the coordinating agencies described below, the agencies are also employing one of the most cost-effective methods to protect surface water, the use of educational outreach and partnering with local agencies to encourage changes in citizen behavior. Public education offers a means to promote common sense, low-cost measures for reducing phosphorus that enters stormwater.

5.1.2 Regulatory and Incentive-Based Programs

As noted in the statutes, the regulatory and incentive-based programs of the coordinating agencies are essential for controlling phosphorus in the Lake Okeechobee Watershed. Several widely implemented regulatory programs affect water quality in discharges and reduce phosphorus loading to the lake. The programs collectively cover both point and nonpoint sources of phosphorus runoff.

In developing this collective approach to source controls, certain assumptions were made in formulating phosphorus reduction estimates (BMP and project performance and implementation rates), the amount of water that could be retained on various agricultural land uses, lag effects, and overall schedules and funding. Several uncertainties existed and continue to exist in estimating project and BMP performance. Some of the uncertainties associated with the performance of BMPs include the impacts of different soils and hydrologic conditions, residual phosphorus in soils, land use changes, and the rate of implementation of BMPs. Because of these uncertainties, conservative estimates were used for the phosphorus reductions associated with BMP implementation. The BMP performance estimates were based on best professional judgment and take into account the uncertainties described above, information available from literature, and actual performance data observed in the Lake Okeechobee Watershed.

It should be noted that the Office of the Governor issued Executive Order No. 11-01 on January 4, 2011, which suspends all rulemaking and states that no agency may notice the development of proposed rules, amendment of existing rules, or adoption of new rules, except at the direction of the Office of Fiscal Accountability and Regulatory Reform, which was established in the Executive Order. Consequently, meetings and activities associated with any rulemaking efforts may be rescheduled. The coordinating agencies are committed to working with the Office of Fiscal Accountability and Regulatory Reform on the rulemaking process and will keep communities and stakeholders informed on the status of any rulemaking efforts described in this plan.

5.1.2.1 SFWMD's Environmental Resource Permit Program and FDEP's Submerged Lands and Environmental Resources Program

Under Part IV of Chapter 373, F.S., the District and FDEP were granted authority to implement Environmental Resource Permit (ERP) Programs. The ERP Program regulates activities involving the alteration of surface water flows. This includes activities in uplands that alter stormwater runoff, as well as dredging and filling in wetlands and other surface waters. ERP applications are processed by either the FDEP or the water management districts (WMD), in accordance with the division of responsibilities specified in operating agreements between the FDEP and the WMDs. The division of responsibilities between FDEP and SFWMD can be found in the "Operating Agreement Concerning Regulation under Part IV, Chapter 373, F.S., between South Florida Water Management District and Department of Environmental Protection". This agreement was signed by the two agencies on May 10, 2007, and became effective on July 1, 2007.

The two complementary programs regulate activities involving the alteration of surface-water flows, including (1) new upland activities that generate stormwater runoff from construction and (2) dredging and filling in wetlands and other surface waters. The program ensures that new activities or modifications of existing facilities do not degrade water quality, compromise flood protection, or harm wetland systems. For more information on the Submerged Lands and Environmental Resources Program see Appendix A

This ERP program generally focuses on three main elements: water quality, water quantity, and environmental impacts, which are further discussed below.

Water Quality

The District and FDEP implement the ERP rules to prevent further degradation and net improvement of impaired waters, or other water bodies that do not meet state water quality standards, as a result of new activities that may alter stormwater discharges.

Current ERP rules require that activities be designed and operated so that offsite discharges will not violate state water quality standards. These rules specify a more detailed evaluation by District and FDEP staff for new activities which outfall to sensitive receiving waters, including Lake Okeechobee. The rules require that reasonable assurance be provided both for short term (during construction) and long term (during operation) that state water quality standards will not be violated.

The SFWMD's ERP review criteria and information used by SFWMD staff when reviewing ERP applications are set forth in its "Basis of Review for Environmental Resource Permit Applications within the South Florida Water Management District." The District requires additional protective measures if ambient water quality for a particular site does not meet state water quality standards. In cases where a project is discharging to an impaired water body, the applicant must demonstrate that the proposed activity will not contribute to the existing violation.

Additionally, the cumulative impact analysis, set forth in Florida statutes and District rules, requires that impacts to water quality be evaluated to determine that the proposed activity, in conjunction with past activities, existing activities, and future activities, must not result in a violation of state water quality standards.

Importantly, where the applicant is unable to meet water quality standards because existing ambient water quality does not meet standards, Section 373.414(1)(a)3, F.S., requires the District and FDEP to "consider mitigation measures proposed by the applicant that cause net improvement of the water quality in the receiving body of water for those parameters which do not meet standards."

Therefore, under this statutory provision, the District and FDEP require a net improvement where a project will discharge to an impaired water body. This requirement for net improvement is currently applied to the water bodies included in the NEEPP to assure a net improvement in discharges from new development for parameters that do not meet standards.

While the existing ERP rules require an applicant to provide reasonable assurance to demonstrate that a proposed activity will not contribute causative pollutants to an impaired water body the existing ERP rules do not provide design or operational criteria for the types of additional measures to be incorporated into the design to provide the requisite reasonable assurance. Therefore, the FDEP, in coordination with the five water management districts and a Technical Advisory Committee, was working on the development of a proposed unified statewide stormwater rule to provide updated water quality criteria, concentrating on nutrient load reduction, and to provide consistent water quality protection throughout the state (see Section 5.1.2.2). However, as previously noted, all rulemaking activities have been suspended per Executive Order No. 11-01.

In the interim, the SFWMD has developed guidance on additional measures that may be considered on an activity-by-activity basis as necessary to provide reasonable assurance that an activity will not contribute additional causative pollutants to an impaired water body or other water body that does not meet state water quality standards and net improvement for those parameters which do not meet standards.

Hydrology

Under current ERP criteria, applicants must provide reasonable assurances that the construction, alteration, operation, maintenance, removal, or abandonment of a surface water management system will not cause adverse water quantity impacts to receiving waters and adjacent lands. Therefore, in water bodies included in the NEEPP, applicants must show that hydrology is not adversely affected by any proposed new activities.

Section 373.4595, F.S., contains a statement of legislative intent that improving the hydrology within the Lake Okeechobee Watershed, the Caloosahatchee River Watershed, and the St. Lucie River Watershed is essential to the protection of the greater Everglades ecosystem. Section 373.414(1), F.S., requires applicants to demonstrate that proposed new activities will not be inconsistent with the overall objectives of the District. Therefore, to demonstrate that an activity is not inconsistent with the District's overall objectives with regard to the improvement in hydrology in these watersheds, applicants must, at a minimum, demonstrate that the post-development average annual discharge volume is no greater than the pre-development average annual discharge volume, where the pre-development condition is the existing site condition at the time the application is submitted.

District staff is currently finalizing a guidance memorandum that is intended to provide District staff and applicants with information, tools, and examples of a reasonable method to demonstrate average annual discharge volumes are no greater than the pre-development average annual discharge volume, meaning that there will be no negative impact to hydrology. The result of the application of the methodologies in this memo will be no increase in the volume of runoff from new development on an average annual basis discharging to downstream water bodies within the NEEPP.

The previous version of the LOPP included development of an ERP basin rule to address the potential for new activities to impact hydrology within the NEEPP. District staff developed a methodology to be included in a basin rule to demonstrate no impact to hydrology. During rule discussions, it was determined that this methodology can be applied utilizing existing ERP criteria. Therefore, an ERP basin rule is not necessary and the guidance memorandum described above will be used to provide a technical method for District staff to review and applicants to demonstrate reasonable assurance that their activities will not cause adverse impacts to hydrology. The goal is to begin implementation of these guidelines within the Northern Everglades Watershed by mid 2011.

Environmental Impacts

The environmental conditions for issuance also require applicants to provide reasonable assurance that:

- the proposed activities will not adversely impact the value of functions provided to fish and wildlife and listed species provided by wetlands and other surface waters
- the proposed activities will not be contrary to the public interest, or if such an activity significantly degrades or is located within an Outstanding Florida Water, that the activity be clearly in the public interest
- the proposed activities will not adversely affect the quality of receiving waters so that water quality standards and any anti-degradation provisions will be violated
- the activity located in, adjacent to, or in close proximity to Class II waters or located in waters classified by the FDEP as approved or restricted for shellfish harvesting will comply with additional criteria described in the SFWMD's Basis of Review for Environmental Resource Permit Applications (BOR)
- the construction of vertical seawalls in estuaries and lagoons will comply with additional criteria described in the BOR
- the activity will not cause unacceptable cumulative impacts upon wetlands or other surface waters
- the activity will not cause unacceptable secondary impacts to the water resources

This is accomplished by first reducing or eliminating impacts to wetlands and other surface waters. The ERP criteria require that applicants make practicable design modifications to their projects to eliminate dredging, filling, or other alterations of wetlands and other surface waters. If impacts cannot be completely eliminated, then applicants must provide mitigation that offsets the proposed impacts. Mitigation is most often accomplished through enhancement, restoration, creation, or preservation of native wetlands and upland communities.

The amount of mitigation required is determined using the Uniform Mitigation Assessment Method (UMAM) pursuant to Chapter 62-345, F.A.C. SFWMD or FDEP staff evaluates the value of functions provided by a wetland or other surface waters, and evaluates the value of functions provided by the mitigation plan, considering time lag and risk factors. The applicant must offset the adverse impacts to wetland and surface water functions caused by the proposed activity.

Impacts to fish and wildlife habitat sometimes cannot be mitigated, particularly for listed species. The ERP criteria give protection to nesting and denning sites for wetland-dependent species in uplands and wetlands and require consultation with the wildlife agencies (Florida Fish and Wildlife Conservation Commission and the U.S. Fish and Wildlife Service) when listed species are observed or known to use a site, or designated critical habitat for a species exists on a site. Mitigative measures such as wildlife crossings, changing the timing of the activities so that nesting is not disturbed, and/or additional preservation are often the result of this coordination.

In determining whether a proposed activity in, on, or over surface waters or wetlands is not contrary to the public interest, or if such an activity significantly degrades or is within an Outstanding Florida Water, that the activity is clearly in the public interest, the SFWMD considers and balances, and the applicant must address whether the activity will:

- affect the public health, safety, or welfare or the property of others,
- adversely affect the conservation of fish and wildlife or their habitats,
- adversely affect navigation or the flow of water, or cause harmful erosion or shoaling,
- adversely impact fishing or recreational values or marine productivity in the vicinity of the activity,
- be of a temporary or permanent nature,
- adversely affect or enhance significant historic or archaeological resources,
- affect the current condition and relative function being performed by the areas affected by the proposed activity.

5.1.2.2 Statewide Stormwater Rule

The FDEP, in coordination with the five WMDs, is working to adopt the Statewide Stormwater Rule to address the growing problem of nutrient enrichment of Florida's surface waters. Rulemaking efforts are currently under way (Chapter 62-347, F.A.C.). In 2008, a technical advisory committee was established to assist the FDEP and the WMDs in developing the first versions of the draft rule and the applicant's handbook. Since then, numerous public meetings have been conducted, and the staffs from FDEP and the WMDs continue to refine the draft rule and the applicant's handbook to address public comments and reflect information learned from additional research. Rule adoption was originally anticipated to be completed by the end of 2011; however all rulemaking has been suspended, pursuant to Executive Order No. 11-01. More information and the revised documents are available at the FDEP's web site[4].

[4] http://www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/index.htm

The proposed rule will provide statewide regulatory criteria for new stormwater treatment systems, which are designed and constructed to control stormwater pollutant loads. Stormwater treatment systems usually are components of a surface water management system. Together these systems may incorporate methods to collect, convey, store, absorb, inhibit, treat, use, or recycle water to prevent or reduce flooding, over-drainage, environmental degradation and pollution, or otherwise affect the quality and quantity of discharges. The proposed rule will increase the level of nutrient removal required of stormwater treatment systems serving new development.

The proposed draft rule is technology-based and includes the following components:

- Performance standards or goals (for the minimum level of treatment for nutrients)
- Design criteria for BMPs used to treat storm water that will achieve the performance standard
- A rebuttable presumption that a stormwater treatment system designed in compliance with the BMP design criteria within this rule will not cause or contribute to violations of surface water standards
- Periodic review and updating of BMP design criteria as more information becomes available to increase their effectiveness in removing pollutants

Once adopted, the FDEP, the SFWMD, and the four other WMDs will implement the rule under their respective programs.

5.1.2.3 SFWMD Regulatory Phosphorus Source Control Programs

Lake Okeechobee Works of the District Rule

The SWIM Act authorized the creation of the Lake Okeechobee WOD Rule (Chapter 40E-61, F.A.C.), which became effective in 1989. The goal of the program was to address nonpoint sources of phosphorus in runoff. The original rule applied to specific land uses (improved pasture, vegetable farms, hog farms, poultry farms, goat farms, urban stormwater, golf courses, sugar cane, horse farms, nurseries, land spreading of sludge, and sod farms) within the Lake Okeechobee Watershed boundary defined by the statute at the time (see **Figure 5-1** for Lake Okeechobee WOD Permits). Landowners were presumed to be in compliance with the rule unless water quality monitoring indicated otherwise. A permit applicant was required by rule to provide a simple phosphorus control statement that served the purpose of getting a written commitment but lacked detail on methods. Therefore, its effectiveness to reduce phosphorus from the permitted property could not be determined. Enforcement was based on District synoptic monitoring data for concentrations in discharges. The rule set a discharge target concentration limitation for the permittee based on land use, and target concentrations were based on Technical Publication 81-2, designed to achieve a 360 metric tons (mt) discharge limit to the lake and ranged from 180 to 1200 parts per billion (ppb). Farm-level grab sample monitoring was required and funded by the District. Monitoring funds were limited, and few landowners were required to implement additional BMPs for not meeting the phosphorus concentration limit. Because performance was measured at the parcel level for select sites, it was difficult to determine the overall program performance in reducing phosphorus loading.

With the establishment of the latest statutory amendments, the objective of the District's Regulatory Source Control Program has evolved. The current objective is to establish criteria and performance metrics that ensure runoff to the tributaries and canals that discharge into Lake Okeechobee allow the District to meet the legislative policies established in Chapter 373, F.S. The SFWMD's current initiatives are focused on developing the technical support documents to meet this objective, and include the following:

- Implement a phosphorus source control program utilizing BMPs within the Lake Okeechobee Watershed.
- Recognize agricultural land uses that are participating in the FDACS BMP program under Chapter 5M-3, F.A.C., by a certain deadline as meeting the intent of the District's rule to prevent duplication of effort.
- Establish a timeline for implementation of BMPs within the Lake Okeechobee Watershed.
- Establish load- or concentration-based performance measures for the collective source control programs implemented by the coordinating agencies in the Lake Okeechobee Watershed.
- Define the monitoring network necessary to monitor compliance with the established performance measures, to identify priority areas of water quality concern and BMP improvement, and to provide data to evaluate and enhance performance of downstream treatment facilities.
- Establish a plan for improving the collective source control programs implemented by the coordinating agencies should the expected water quality criteria not be met.
- Ensure that the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program is consistent with the Lake Okeechobee Protection Plan (LOPP).
- Include incentives for permittees to participate in total phosphorus (TP) reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program as necessary.

It must be noted that this rulemaking effort is also currently on hold, pursuant to Executive Order No. 11-01. Over the last three years, the District has conducted public workshops to collect public input and consulted with stakeholders to identify area-specific issues. A technical evaluation and the development of an optimization methodology for the monitoring sites in the Taylor Creek/Nubbin Slough Sub-watershed are complete and will be used to optimize the remaining sites in the Lake Okeechobee Watershed Assessment monitoring network.

Currently, the District is developing technical documents in support of establishing performance measures to ultimately replace the current rule's outdated discharge target concentrations. A preliminary review of the available data suggests that the primary performance measures will be based on sub-watershed boundaries and criteria. These criteria and metrics are critical for ensuring consistent implementation of BMPs, to measure actual phosphorus reductions, and to have a mechanism for requiring improvements should the water quality goals not be achieved. The performance measures will also allow the collective programs by the coordinating agencies to identify where additional resources and efforts are needed. This will allow an adaptive management strategy for the coordinating agencies to continually make improvements.

Everglades Regulatory Source Control Program

In addition to the Lake Okeechobee WOD Rule, the SFWMD also implements the Everglades Regulatory Source Control Program under Chapter 40E-63, F.A.C., which became effective in 1992 and was part of the Everglades Construction Project required under the Everglades Forever Act. The goal of this program is to reduce phosphorus in discharges from lands located in the Southern Everglades Watershed by mandating BMPs through permits. A portion of the Southern Everglades Watershed overlaps the Lake Okeechobee Watershed boundary (the South Lake Okeechobee Sub-watershed, **Figure 5.1**). The Everglades Construction Project also required construction of projects (298 Diversion Projects) that diverted loads away from Lake Okeechobee. The majority of those loads are redirected south for treatment in stormwater treatment areas prior to discharging to the Everglades Protection Area. These projects were completed and have resulted in substantially reduced loads to the lake from those areas.

Additionally, the success of source controls depends on verification of BMP implementation through inspections and through a research/extension program that continuously provides feedback to permittees. Information exchange and sharing the latest phosphorus source control strategies, as they become available, will enable permittees to apply timely adaptive management to their BMPs.

5.1.2.4 FDACS BMP Program

The FDACS utilizes incentive-based methods to encourage enrollment in their agricultural nonpoint-source BMP programs. Incentives for agricultural operations to enroll in FDACS BMP programs include a presumption of compliance with state water quality standards and eligibility to participate in cost-share programs that provide monetary assistance with the implementation of BMPs. Pursuant to the NEEPP, where agricultural nonpoint-source best management practices or interim measures have been adopted by rule by the FDACS, the owner or operator of an agricultural nonpoint source addressed by such rule shall either implement interim measures or BMPs or demonstrate compliance with the District’s Works of the District program in Chapter 40E-61, by conducting monitoring prescribed by the FDEP or the District.

In accordance with the NEEPP, the FDACS has been developing and implementing agricultural BMPs to reduce the movement of TP from agricultural lands into Lake Okeechobee and its tributaries. All FDACS-adopted BMP programs (citrus, cow/calf, containerized nursery, sod, and vegetable and agronomic crops) require agricultural producers in the watershed to implement a nutrient management program (that includes soil and plant tissue testing to justify phosphorus applications), as well as other applicable BMPs to address environmental resource challenges identified on their property. For some agricultural land uses, dairies for example, farm-specific conservation plans including comprehensive nutrient and waste management elements have been developed and implemented.

As of December 2010, approximately 1.3 million acres (77%) of agricultural lands within the Lake Okeechobee Watershed were enrolled in an FDACS-adopted BMP program and were applying typical owner-implemented BMPs such as nutrient and irrigation management (including soils and tissue testing) and pasture management. The percentage of agricultural acreage by sub-watershed is shown in **Table 5-1**. Estimated total acres on which Office of Agricultural Water Policy (OAWP) BMPs are fully implemented within the Lake Okeechobee Watershed is also shown in **Table 5-2**. Almost two-thirds of the agricultural acreage implementing typical owner-implemented BMPs (838,780 acres) have completed implementation of all BMPs including those that typically require cost-share assistance. The FDACS will continue to work cooperatively with the coordinating agencies to accelerate the rate of BMP enrollment and implementation.

The FDACS anticipates that virtually all agricultural lands within the Lake Okeechobee Watershed will be enrolled in a FDACS-adopted BMP program and will be employing typical owner-implemented BMPs by the end of 2015. Implementation of more intensive alternative BMP practices, such as extensive wetland restoration and engineering design and construction of edge–of-farm retention/detention/treatment facilities, will take longer to complete for all agricultural acreage due, in part, to the lack of adequate funding for NEEPP implementation associated with the current multi-year economic downturn. As funding is made available, these projects will be prioritized and installed as envisioned in the Notice of Intent (NOI) filed with FDACS as part of enrolling in the BMP program.

Table 5-1. Acres and estimated percentage of agricultural land enrolled in BMP programs by sub-watershed[1].

Sub-Watersheds	Sub-Watershed Agricultural Acres (2006/07 Land Use/Land Cover)	Total Adjusted Enrolled Acres within Sub-Watershed	% Agricultural Acres Enrolled[2]
EAA Basins	335,347.25	320,561.58	95.59%
East Lake Okeechobee	100,796.59	45,367.73	45.01%
Fisheating Creek	167,197.41	190,421.55	113.89%*
Indian Prairie	220,124.79	178,365.93	81.03%
Lake Istokpoga	134,948.59	118,584.00	87.87%
Lower Kissimmee	203,397.84	241,750.50	118.86%*
Taylor Creek/Nubbin Slough	146,825.81	120,817.21	82.29%
Upper Kissimmee	275,463.35	49,864.38	18.10%
West Lake Okeechobee	131,907.81	51,399.87	38.97%
Grand Total	**1,716,009.44**	**1,317,132.75**	**76.76%**

[1] Estimated acreage is based on the lesser of the enrolled NOI acres or the calculated parcel acres, to determine an approximate percentage of land mass enrolled in each of the sub-watersheds within the Lake Okeechobee Watershed.

[2] Percentage is derived from calculated acres and total agricultural acres from the following land use/land cover GIS shapefiles: SJRWMD 2004, SFWMD 2004, and SWFWMD 2006.

* Percentage of agricultural acreage enrollment exceeds 100% due to inclusion of grazed silvopasture that is not included in the agricultural codes in the land use/land cover data.

Table 5-2. Estimated total acres[1] by BMP implementation categories.

OAWP BMP Manual/Program	Total Adjusted Enrolled Acres within Sub-Watershed	Fully Implemented NOI Acres	Owner Implemented NOI Acres
Cow/Calf and Conservation Plans	833,431.03	391,927.53	441,503.50
Indian River Citrus	62,899.12	55,351.23	7,547.89
Ridge Citrus	42,124.66	39,597.18	2,527.48
Gulf Citrus	10,255.45	9,398.09	857.36
Sod	8,894.72	7,115.78	1,778.94
Vegetable & Agronomic Crops	357,350.00	334,301.73	23,048.27
Container Nurseries	2,177.77	1,088.89	1,088.89
Grand Total	**1,317,132.75**	**838,780.43**	**478,352.32**

[1] Estimated acreage is based on the lesser of the enrolled NOI acres or the calculated parcel acres, to determine an approximate percentage of land mass enrolled in each of the sub-watersheds within the Lake Okeechobee Watershed.

Fully implemented acres for the citrus programs are based on the percentage of full compliance with BMPs determined by the Implementation Assurance program. Reference: OAWP 2007/08 and 2008/09 Implementation Assurance Reports.

The Implementation Assurance process is currently under way for the Vegetable & Agronomic Crop program, but the enrolled acreage within the EAA is fully implemented and the numbers above reflect that acreage. The Sod and Container Nurseries programs will undergo the Implementation Assurance process in coming years. Current implementation percentages are based on a review of NOIs and OAWP staff estimates.

The FDACS is also responsible for ensuring that BMPs are implemented as described on NOIs. The OAWP has a dedicated staff person in the Okeechobee Office to visit the operations within the watershed that have submitted an NOI. To date, site visits have been made to the dairy and cow-calf operations that have implemented conservation plans. Operations that submit NOIs under FDACS-adopted BMP manuals will receive, about every five years, a written survey that contains questions about management actions they conduct. These actions correspond to specific nutrient and irrigation management BMPs. As staff resources allow, nursery, vegetable, citrus, and other agricultural commodities ultimately will also receive formal site inspections.

The overall approach to the site inspection component of implementation assurance in the watershed is summarized below:

- Each operation is visited upon completion of cost-shared structural BMPs, to ensure these BMPs have been properly installed prior to receiving state cost-share funds. Site inspections in the EAA are conducted by SFWMD staff.
- Overall implementation assurance site inspections by OAWP staff are conducted generally in order of when an NOI is completed and implemented.
- OAWP staff fills out a review/checklist form and assigns an overall rating of satisfactory, conditional, or unsatisfactory.

- For operations that receive a satisfactory rating, no follow-up visit is necessary. However, OAWP staff will conduct "routine" site visits as workload allows. At this time, maintenance of structural BMPs will be reviewed and rated.
- For a rating of unsatisfactory or conditional, there will be a scheduled follow-up inspection, usually within 120 days, to check on progress.
- Additional follow-up site visits will be scheduled as circumstances warrant.

The BMPs commonly reviewed by OAWP staff during site inspections are:

Structural BMPs	**Management BMPs**
✓ Culverts/Culvert risers	✓ Nutrient management
✓ Fences	✓ Maintenance of structural BMPs
✓ Water troughs/ well capping	✓ Record keeping

As of December 31, 2010, approximately 156,276 acres had been inspected. This is equivalent to about 16 percent of the total enrolled acres in the watershed. Results of the inspections are contained in the first two OAWP Implementation Assurance reports, which can be found online[5]. The next OAWP Implementation Assurance report will be published in early 2011. The enrolled acres within the EAA are not included in the total enrolled acres used to calculate the percent of total enrolled acres inspected since the SFWMD is responsible for the EAA inspections.

5.1.2.5 Urban Turf Fertilizer Rule

In 2007, the FDACS adopted a statewide Urban Turf Fertilizer (UTF) rule in Chapter 5E-1, F.A.C. The rule limits the phosphorus and nitrogen content of fertilizers used for urban turf and lawns. This rule is intended to reduce nutrient loads by requiring that all fertilizer products labeled for urban use (turf, sports turf, and lawns) only contain the amount of phosphorus and nitrogen that is actually needed to support healthy turfs and lawns. The rule requires that application rates for phosphorus not exceed an application rate of 0.25 pounds (lbs) of phosphorus oxide (P_2O_5) per 1,000 square feet (ft^2) per application and not exceed 0.50 lbs of P_2O_5 per 1000 ft^2 per year.

The rule also requires that application rates for nitrogen not exceed 0.7 lbs of readily available nitrogen per 1000 ft^2 per application, with no more than 1.0 lb of total nitrogen (TN) per 1,000 ft^2 per application. Under this rule, FDACS expects a 20 to 25 percent reduction in nitrogen and a 15 percent reduction in phosphorus in every bag of fertilizer sold to the public. The UTF Rule will continue to be enforced in the marketplace by FDACS field inspectors.

[5] http://www.floridaagwaterpolicy.com/ImplementationAssurance.html

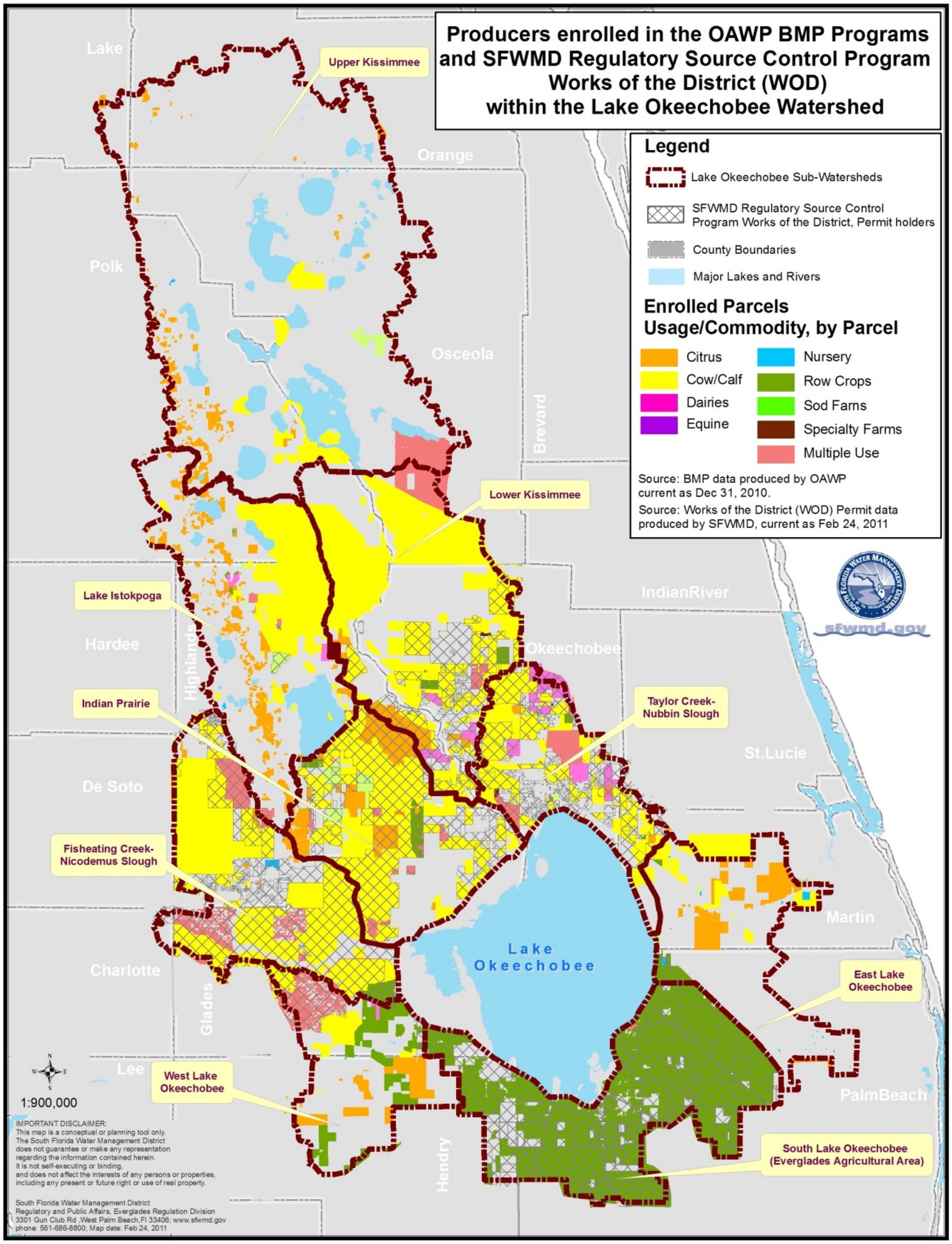

Figure 5-1. Lake Okeechobee Watershed producers enrolled in Office of Agricultural Water Policy (OAWP) BMP Programs and SFWMD Regulatory Source Control Program Works of the District.

5.1.2.6 National Pollutant Discharge Elimination System Permitting Program

The National Pollutant Discharge Elimination System (NPDES) is a federal program established by Section 402 of the Clean Water Act. The NPDES program requires dischargers to obtain permits that place limits on the type and quantity of pollutants that can be released into the nation's waters. NPDES permits and the associated regulatory activities aim to reduce or eliminate nutrient and other contamination loads to Lake Okeechobee and its tributaries.

The U.S. Environmental Protection Agency (USEPA) developed the NPDES Stormwater Permitting Program in two phases. Phase I, which went into effect in 1990, addresses "large" and "medium" municipal separate storm sewer systems (MS4s) located in incorporated areas and counties with populations of 100,000 or more and eleven categories of industrial activity, including large construction activity that disturbs five or more acres of land. Phase II, promulgated in 1999, addresses additional sources, including MS4s not regulated under Phase I and small construction activity that disturbs between one and five acres. In October 2000, the USEPA authorized the FDEP to implement the NPDES Stormwater Permitting Program in all areas of Florida except Indian Country lands. The FDEP's authority to administer the NPDES program is set forth in Section 403.0885, F.S.

The NPDES Stormwater Program regulates discharges from construction activities, industrial activities (fertilizer and animal feed facilities [see Section 5.1.2.7]), MS4s, and other point-source discharges. As the NPDES stormwater permitting authority, FDEP is responsible for promulgating rules and issuing permits, managing and renewing permit applications, and performing compliance and enforcement activities. Additional information may be found in Appendix A.

Stormwater

Construction Activities

Regulated construction site operators (e.g., the entity that owns or operates the project and has authority to ensure compliance) must obtain an NPDES stormwater permit and implement appropriate pollution prevention techniques to minimize erosion and sedimentation and properly manage stormwater. Under Rule 62-621.300(4), F.A.C., the FDEP adopted the Generic Permit for Stormwater Discharge from Large and Small Construction Activities, which is applicable to Phase I large construction and Phase II small construction. This permit is separate from the Environmental Resource Permit required under Chapter 373, F.S., a stormwater discharge permit required under Chapter 62-25, F.A.C., or any local government's stormwater discharge permit for construction activity. Each year, the FDEP issues permits for these activities throughout the Lake Okeechobee Watershed.

Industrial Activities

Florida adopted the federal stormwater general permit for industrial activities (comprising the original September 29, 1995, issuance and subsequent modifications) as specified in Rule 62-621.300(5)(a), F.A.C., and operates the permit as the State of Florida Multi-Sector Generic Permit for Stormwater Discharge Associated with Industrial Activity (MSGP).

MS4s

An MS4 is a publicly owned conveyance or system of conveyances designed or used for discharging stormwater, which can include streets, curbs, gutters, ditches, and storm drains. These water conveyance systems are permitted through the statewide MS4 permitting program, and they receive an NPDES permit (Chapter 62-624, F.A.C.). The purpose of the MS4 permit program is to develop, implement, and enforce stormwater management plans to reduce the discharge of pollutants to the maximum extent practicable, protect water quality, and comply with the water quality requirements of the Clean Water Act. These permits are issued for five years.

Phase I MS4s

Phase I MS4s are regulated through an individual NPDES permit that addresses:

- Implementation of a stormwater master plan to reduce pollutants to the maximum extent possible
- Development and maintenance of an inventory and map of the stormwater sewer system
- Implementation of a monitoring plan
- Calculation of event mean concentrations and seasonal pollutant loadings at least once per permit term (usually in year three of five years)
- Post-construction runoff control (met through state stormwater permitting requirements [ERP] under Part IV, Chapter 373, F.S., as a qualifying alternative program)
- Pollution prevention/good housekeeping

Currently, the Lake Okeechobee Watershed has two Phase I MS4 permits in Orange County, one in Palm Beach County, and one in Polk County.

Phase II MS4s

Phase II MS4s are regulated under an NPDES generic permit that requires implementation of BMPs to meet the following minimum control measures:

- Education and outreach (e.g., Florida Yards and Neighborhoods Program)
- Public participation
- Illicit discharge detection and elimination
- Construction site runoff control
- Post-construction runoff control (met through state stormwater permitting requirements [ERP] under Part IV, Chapter 373, F.S., as a qualifying alternative program)
- Pollution prevention/good housekeeping

As of March 2010, the NPDES Stormwater Section was in the process of permitting Glades County, Hendry County, Okeechobee County, and the City of Clewiston. All of these municipalities were designated based on their discharge to Lake Okeechobee because it has an adopted TMDL.

Once these permits are issued, the NPDES Stormwater Section will determine if any other municipalities are interconnected to those that are already permitted. If it is determined that there is interconnectivity between the stormwater systems, then the FDEP will look into officially designating the interconnected municipalities.

Wastewater Facilities

In 1995, the FDEP received authorization from the USEPA to administer the NPDES Wastewater Program in Florida. Since that time, federal NPDES permit requirements for most wastewater facilities or activities (e.g., domestic or industrial) that discharge to surface waters are incorporated into a state-issued permit, thus giving the permittee one set of permitting requirements rather than one for state and one for federal. For purposes of permitting, wastewater facilities or activities are categorized as either industrial or domestic based on the type of wastewater the facility handles. Domestic wastewater is wastewater from dwellings, business buildings, and institutions. Meanwhile, sources of industrial wastewater include large and small facilities and activities, such as manufacturing, commercial businesses, mining, agricultural production and processing, and wastewater discharge from cleanup of petroleum and contaminated sites. The FDEP issues individual permits, generic permits, and general permits. **Table A-3** in Appendix A identifies all active NPDES permits issued by the FDEP.

5.1.2.7 Biosolids Rule

The new rule (Chapter 62-640, F.A.C.), which became effective on August 29, 2010, includes changes to site permitting, changes related to the NEEPP, prohibitions on land application in the Lake Okeechobee Watershed unless the nutrient balance demonstration is completed by the permittee as required under the NEEPP, requirement of nutrient management plans, and additional requirements for distribution and marketing of biosolids to be distributed as fertilizer. The nutrient balance demonstration would be required to be submitted with the site's nutrient management plan at the time of permit application for the site. Also, record keeping and reporting requirements to document compliance with the nutrient balance demonstration would be added to the biosolids regulations.

To address stakeholders' concerns about Class AA biosolids spreading in the Lake Okeechobee Watershed, various measures were adopted during rulemaking efforts, including the prohibition of having more than one dry ton of unapplied Class AA biosolids on one's property without proper storage and more stringent reporting requirements.

5.1.2.8 FDEP Dairy Rule / Concentrated Animal Feeding Operations

Chapter 62-670, F.A.C., identifies feedlot and dairy wastewater treatment and management requirements. Agricultural operations regulated under Chapter 62-670, F.A.C., include concentrated animal feeding operations (CAFOs) (Rule 62-670.400, F.A.C), dairy farms in the Lake Okeechobee Drainage Basin (see Rule 62-670.500, F.A.C), and commercial egg production facilities (see Rule 62-670.600 F.A.C.).

In 1987, the FDEP adopted the Requirements for Dairy Farms in the Lake Okeechobee Drainage Basin (Rule 62-670.500, F.A.C.), also known as the FDEP Dairy Rule, to establish treatment requirements to reduce TP concentrations in runoff and wastewater from dairy farms in the area covered by the rule. Waste treatment systems were to be constructed to treat runoff and wastewater from barns and high-intensity milk herd holding areas.

According to the FDEP Dairy Rule, all 49 dairies in the Lake Okeechobee Drainage Basin were required to sell and remove their cattle or comply with the rule by 1991. In 1989, a Dairy Buy-Out Program was established at the request of the dairy industry for farmers who were unable or unwilling to comply with the FDEP Dairy Rule. As a result, 23 dairies were eliminated and 26 came into compliance due to the FDEP Dairy Rule, Dairy Buy-Out Program, and the Save Our Rivers Program. Dairy buyouts only removed the dairy cattle from the land. Many of the former dairy buyout properties later converted to cow-calf operations.

In 2003, the USEPA adopted the NPDES Permit Regulation and Effluent Limitation Guidelines and Standards for CAFOs (Title 40 Code of Federal Regulations [CFR] Parts 9, 122, 123, and 412). The FDEP is responsible for determining which facilities require permit coverage as a CAFO and for permitting and regulating these facilities. The FDEP issued the first USEPA-mandated CAFO permits in early 2004. This rule (Chapter 62-670.400, F.A.C.) has the same requirements as the FDEP Dairy Rule and it also regulates nitrogen loads from the permitted facilities.

In December 2008, the USEPA revised the NPDES requirements for CAFOs. The FDEP has amended Rule 62-620.100, F.A.C., to incorporate by reference the current federal CAFO requirements.

The FDEP's Feedlot and Dairy Wastewater Treatment and Management Requirements (Chapter 62-670, F.A.C.) define animal feeding operations (AFOs) and CAFOs. There are 22 large CAFOs (over 699 milk cows on average) and one medium AFO (600 milk cows on annual average)(see Appendix 5 for a map [**Figure A-1**] and table [**Table A-4**] of current CAFOs in the Lake Okeechobee Watershed). As part of the permitting requirements, each CAFO submits an annual report to the FDEP, which includes permitted herd size, average herd size, and nutrient-balance summary (e.g., lists all nutrient imports and exports from the facility over the calendar year). All dairy CAFOs and one medium dairy AFO in the Lake Okeechobee Watershed are permitted under the NPDES program. However, the medium and small AFOs are not required to obtain NPDES permits under the CAFO rules.

5.1.2.9 Other FDEP Permitting Programs

The FDEP also administers the Comprehensive Everglades Restoration Plan Regulatory Act in Section 373.1502, F.S., the TMDL program pursuant to Section 303(d) of the Clean Water Act, Section 403.067, F.S. (the Florida Watershed Restoration Act), and the rules promulgated there under in Chapter 62-303, F.A.C. (Impaired Waters Rule), as well as specified programs within the NEEPP. More information on these programs can be found in Appendix A.

5.1.2.10 Florida Department of Health Source-Control Programs

According to Section 373.4595(3)(c)(7), F.S., the Florida Department of Health (FDOH) must require all entities disposing of septage within the Lake Okeechobee Watershed to develop and submit to FDOH an agricultural use plan that limits applications based upon phosphorus loading. The NEEPP also mandated that by July 1, 2005, phosphorus concentrations originating from these application sites shall not exceed the limits established in the SFWMD WOD Program.

As of April 16, 2010, one FDOH-regulated application site remains in the Lake Okeechobee Watershed. The site was not approved for use in 2009 pending the results of testing to see if phosphorus concentrations originating from the site exceed the limits of the SFWMD WOD Program.

5.1.3 Watershed Phosphorus Control Projects

The SFWMD, in coordination with the FDACS and the FDEP, continues to develop and implement TP reduction projects. These include innovative nutrient control technologies such as the Taylor Creek Algal Turf Scrubber Nutrient Recovery Facility, Hybrid Wetland Treatment Technology, and chemical treatment, as well as Dairy Best Available Technology pilot projects, soil amendments projects, isolated wetland restoration projects, remediation of former dairies, cow/calf BMP optimization, and regional public/private partnerships (**Figure 5-2**). All of these projects have performance monitoring to aid in their evaluation and to determine their potential for future use. They may be focused on advanced BMPs, sub-regional approaches, or research. The following sub-sections describe the projects that have been implemented and operated over the last three years and the results of the project's monitoring. It also includes ongoing research projects on phosphorus management in the Lake Okeechobee Watershed undertaken by the University of Florida.

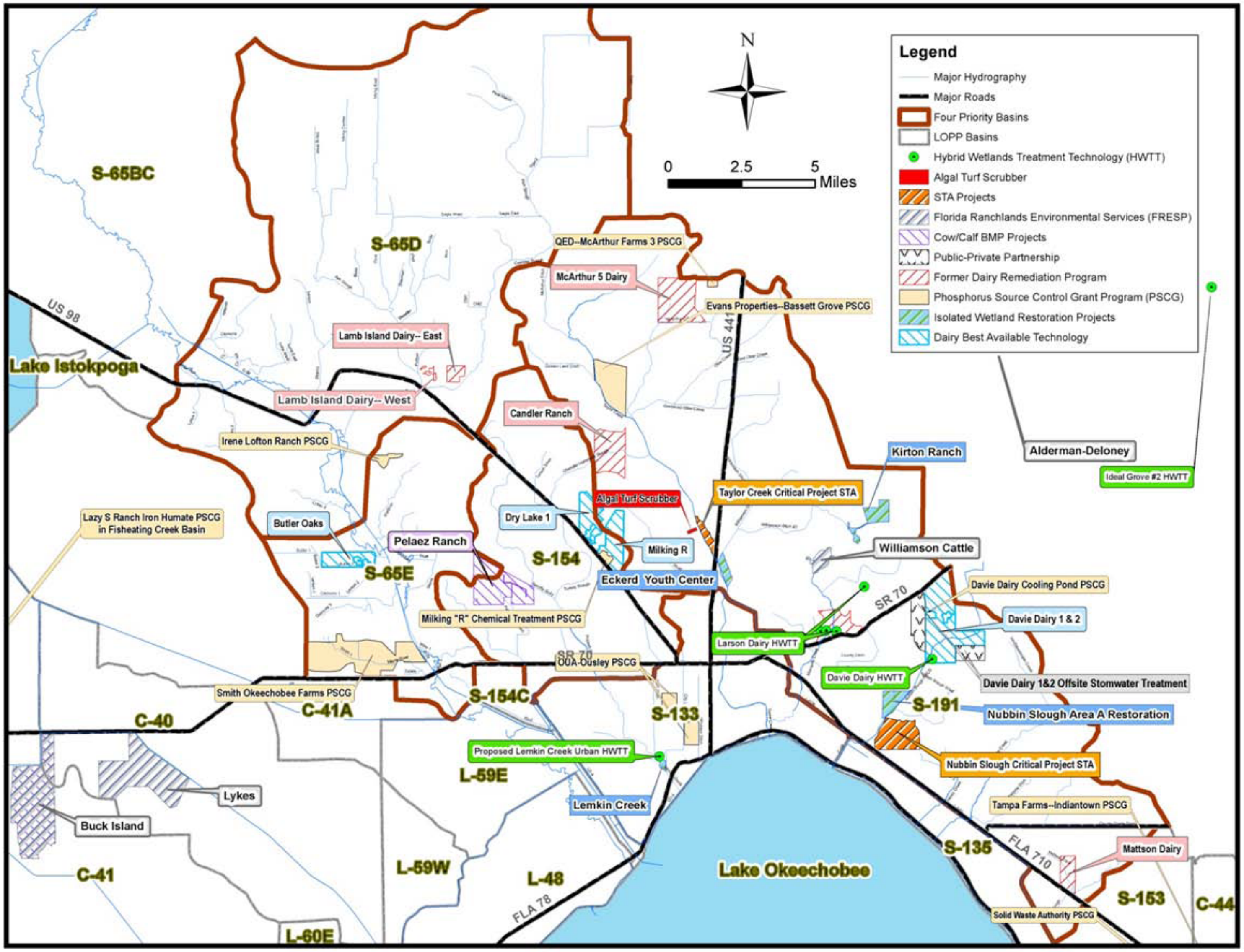

Figure 5-2. Locations of phosphorus control projects in the Lake Okeechobee Watershed.

5.1.3.1 Hybrid Wetland Treatment Technology

Hybrid Wetland Treatment Technology (HWTT) is a combination of wetland and chemical treatment technologies within a wetland system to remove phosphorus at the sub-basin and farm scales (**Figure 5-3**). Chemical coagulants are added, either continuously or intermittently, to the front end of the wetland treatment system, which contains one or more deep-water zones to capture the resulting floc material. A fundamental concept of HWTT is that the floc resulting from coagulant addition generally remains active for some time and has the capability of additional phosphorus sorption. The HWTT system was developed to maximize nutrient removal per unit of chemical coagulant by incorporating novel design and multiple operational strategies. In addition to passive and active recycling/reuse of chemical floc, other optimization includes the sequencing and configuring of wetland unit processes to provide desirable nitrogen and phosphorus species transformations.

In 2008, four HWTT systems were constructed and operated, and optimization efforts were initiated. Three of the facilities, the 0.7-acre Ideal 2 Grove system, the 1.7-acre Nubbin Slough system, and the 1.4-acre Mosquito Creek system are continuous-flow systems (subject to water flow availability), while the fourth, Larson Lagoon, is adjacent to a dairy lagoon and was used for batch treatment of waters with high nutrient levels. This system is no longer operational.

Average inflow and outflow nutrient concentrations for the continuous-flow systems are listed in **Table 5-3**. These systems show promising results with TP concentration reductions ranging between 87 and 95 percent. This technology is being demonstrated under a joint effort between the District and FDACS in the Lake Okeechobee Watershed.

Two additional systems were constructed on Wolff Ditch and Lemkin Creek and began operations in late 2009. The five systems currently in operation are being managed for phosphorus load reduction and evaluated for cost effectiveness through March 2011. Another system is expected to be built by March 2011 at the District's Taylor Creek/Grassy Island property.

Figure 5-3. Nubbin Slough HWTT. The mixing chamber and inflow manifold are in the foreground and the outflow riser is at the upper right of site.

Table 5-3. HWTT average inflow and outflow TP and TN concentrations.

HWTT Site	Sampling Station	TP (µg/L)	TN (mg/L)
Nubbin Slough	Inflow	883	2.77
	Outflow	140	1.91
Mosquito Creek	Inflow	485	2.37
	Outflow	47	1.41
Ideal Groves	Inflow	337	1.68
	Outflow	21	0.75
Lemkin Creek	Inflow	63	1.40
	Outflow	23	1.21
Wolff Ditch	Inflow	77	1.37
	Outflow	25	1.25

Period of record (POR) for Nubbin, Mosquito and Ideal: March 2008-December 2010. POR for Lemkin Creek and Wolff Ditch: September 2009 – December 2010.

5.1.3.2 Chemical Treatment

Chemical treatment with aluminum sulfate (alum), polyaluminum chloride (PACl), ferrous sulfate, or ferric chloride has been used for many years to reduce phosphorus levels in lakes and stormwater runoff (Wanielista 1979, Wanielista et al. 1981, Harper et.al. 1982, Lind 1997). Currently, multiple types of chemical treatment technologies exist that can be applied both in-stream and in off-line treatment systems. Chemical treatment is not just a stand-alone method, it is anticipated that chemical treatment can also be used with other control strategies that reduce water discharge volumes and/or phosphorus concentration, thus achieving further phosphorus load reductions. Treatment costs vary depending upon influent water quality, volume of water treated, and level of treatment desired. The location of chemical addition (pre-treatment versus polishing) also plays a major part in determining total treatment cost.

One example that shows the effectiveness of chemical treatment is the Dairy Best Available Technology Project (Section 5.1.3.3), which was completed in June 2008. Results from three dairies showed that retention and reuse followed by chemical treatment can achieve 66 to 100 percent phosphorus load reduction rates. Based on these promising results, the District is moving forward to identify potential sites within the Lake Okeechobee Watershed where a larger scale chemical treatment facility could be constructed.

The Northern Everglades Chemical Treatment Pilot (NECTP) Project Phase I was completed in July 2009 and was conducted to: (1) investigate available information on chemical treatment technologies that have been tested within other water bodies to reduce TP loads in stormwater runoff, and (2) identify technologies appropriate for use within the Lake Okeechobee Watershed. Results of the study concluded that various chemical treatment technologies are viable and represent effective options for reducing phosphorus loads to the lake (Bottcher et al. 2009).

Following the Phase I study, the District conducted Phase II of this project, which included implementation costs and site identification analysis for chemical treatment technologies in the Northern Everglades. Phase II was completed in October 2010 (Soil and Water Engineering Technology, Inc. 2010). The overall objective of this phase was to identify and rank sites within the Northern Everglades Watershed that would be most suitable for the implementation of chemical treatment technologies. The phosphorus reduction potential and costs for the chemical treatment systems were used to determine the relative cost effectiveness of the identified systems. A combination of cost effectiveness and net phosphorus load reductions to Lake Okeechobee were used to establish rankings.

The Watershed Assessment Model (WAM) calculated flow weighted concentrations and monitoring data from the DBHYDRO and STORET databases were used to identify TP loading hotspots using GIS analysis and visual spatial correlation techniques. This resulted in the selection of 60 potential chemical treatment sites. These 60 sites were entered into a priority ranking matrix that compared sites to each other by assigning a numerical score to each and ranking them based on their cost effectiveness related to phosphorus removal.

The report recommended that follow-up detailed engineering assessments be done on sites that include: additional landowner contacts, site-specific monitoring, topographic surveys, detailed engineering designs, small scale testing for efficacy of chemical dosing, and development of operation and maintenance plans. This analysis provided valuable information for possible future implementation of chemical treatment at various spatial scales.

5.1.3.3 Dairy Best Available Technology

Dairy Best Available Technologies (DBATs) were implemented as edge-of-farm stormwater treatment using retention/detention (R/D) ponds and chemical treatment systems (advanced BMPs) to reduce the export of phosphorus from dairy operations into Lake Okeechobee and its tributaries. These systems were designed to collect and divert as much surface and groundwater flow as possible from the high phosphorus source areas of a dairy to a stormwater R/D pond and chemically treat offsite discharges. The R/D ponds provide some wetland treatment, but primarily store excess runoff that can then be reused on the farm or chemically treated prior to offsite discharge. Offsite discharge may occur when the storage capacity of the system is exceeded or to recover storage capacity prior to a storm event.

The three participating dairies during the initial phase of the project (Butler Oaks, Davie Dairy, and Dry Lake Dairy) conducted performance monitoring from May 2004 to December 2007. The FDEP provided funds from the 2002–2003 state general revenue to design and implement a fourth site, Milking R Dairy. The performance monitoring phase for the Milking R Dairy was initiated in December 2005 and completed in June 2008.

Results from this study show considerable phosphorus reductions at three of the study farms (**Table 5-4**). The annual TP load reductions ranged from 0.19 mt to 1.62 mt (SWET 2008), representing a phosphorus load reduction of 66 to 100 percent due to water retention and reuse on the farms. Drought conditions in three of the four evaluation years contributed to the high phosphorus load observed at the farms that implemented R/D ponds. Of note, the Dry Lake Dairy was sold for development in 2005. However, the retention pond and lift pump continued to be operated by the developers through 2007 when the pond was modified to accommodate the new ERP for the community’s stormwater system.

Davie Dairy is participating in the DBAT and other phosphorus reduction programs. The TP load reduction from this dairy averaged 0.19 mt/year, with 0.10 mt/year attributed to the DBAT program. The low phosphorus removal efficiency observed in the flow-through design at Davie

Dairy was due to the system's high dependency on chemical treatment for removing phosphorus, which only functioned approximately 20 percent of the time. The flow-through system accounted for less than 3 percent flow reduction due to downstream water supply requirements as compared to over 80 percent flow reduction for the other three systems due to increased evaporation from the pond surface and the reuse of the stored water for irrigation. During early 2008, the Davie DBAT facility was retrofitted with the HWTT to increase the phosphorus load reduction of the facility. Butler Oaks and Milking R continue to operate as DBATs today.

Table 5-4. Dairy Best Available Technology project overview.

Project Site	Annual Phosphorus Load from Surface Runoff (lb)	Total Load Reduction Since Operation (lb)	Years of Operation	Average Annual Reduction (lb)	Annual Reduction Due to Retention (lb)	Annual Reduction Due to Treatment (lb)	Average Annual Reduction (mt)	Overall Efficiency (%)
Butler Oaks	4,449	13,439	3.8	3555	2,965	586	1.62	80
Dry Lake	4,212	10,536	3.8	2,787	2,511	275	1.27	66
Davie Dairy	4,594	1,713	4.2	412	3	409	0.19	9
Milking R	3,527	3,527	1.0	3,527	3,527	—	1.60	100

5.1.3.4 Former Dairy Remediation Projects

Remediation of former dairies was initiated by the SFWMD to reduce their stormwater TP load. The District implemented one or more remedial alternatives identified in the Agriculture Nutrient Management Assessment (AGNMA) plans that were developed for these former dairies. Three privately owned former dairies (Mattson, McArthur 5, and Candler) and one District-owned property (Lamb Island East and West), which are currently cow/calf operations, were selected for this project. Based on the AGNMA plans, the following site-specific remediation practices were implemented: (1) runoff was retained from old high-intensive areas, (2) soil amendments were applied to areas high in phosphorus, (3) onsite wetlands were rehydrated, and (4) stormwater flow was reduced via minor impoundments. The implementation of the different remedial management practices was completed from 2004–2008. Water quality monitoring for TP concentration reductions during flow events was conducted for one year following construction of the project.

The annual TP load reductions due to water retention within the former dairies ranged from 63.5 percent at Matson to 100 percent in Candler and McArthur 5. Severe drought conditions in South Florida contributed to the high phosphorus load reductions from surface water retention during the performance monitoring periods. For example, at Candler Ranch and McArthur 5 no offsite outflows were recorded during the monitoring period, resulting in 100 percent phosphorus load reduction through surface runoff retention. Similarly, Lamb Island reported only four discharge events from the property during the monitoring period, which based on pre-load condition estimates resulted in 5,142 lbs of phosphorus (99.5 percent) being retained within the property (**Table 5-5**) (HSA Engineers & Scientists 2006). Other benefits from these projects included replanting of waste pond areas, hay production, and replacement of existing culverts to increase runoff retention and reduce flooding of the farms (HSA Engineers & Scientists 2009). Long-term water quality improvements attributed to the BMPs may be reflected in the downstream Works of the District stations for which routine water quality monitoring is available.

Table 5-5. Summary of former dairy remediation projects.

Project Site	Phosphorus Inactivated in Waste Pond Water (lbs)	Phosphorus Inactivated in Waste Pond Solids (lbs)	Annual Phosphorus Load from Surface Runoff (lbs)	Annual Reduction Due to Water Retention (lbs)	Phosphorus Reduction Due to Water Retention (%)
Mattson	—	—	1,269†	805	63.5
McArthur 5	—	14,076	2,307‡	2307	100.0
Candler	204	447	250§	250	100.0
Lamb Island	299	17,010	5,165	5142	99.5

† A hydrology-based water and phosphorus budget analysis was developed to estimate the annual reduction in offsite phosphorus discharge. This approach was used because drought conditions resulted in no discharges from the site during the monitoring period (Royal Consulting Services 2007).

‡ Assuming a 10 inch/year runoff with an average phosphorus concentration of 0.79 mg/L. No discharges from the property were recorded during the monitoring period (Professional Service Industries, Inc. 2009).

§ Assuming a 10 inch/year runoff with an average phosphorus concentration of 1.32 mg/L from the high-intensive areas (SWET 2002). It is assumed that phosphorus loading from the rest of the property is less significant. No discharges from the property were recorded during the monitoring period (HSA Engineers & Scientists 2009).

5.1.3.5 Wetland BMP Research and Restoration Projects

Long-term monitoring is required to determine the effect of restoration on the phosphorus assimilation capacity of isolated wetlands because it takes time for wetland components (vegetation) to respond to hydrologic restoration. Vegetation is the source material for plant litter, which in turn is the source material for soil organic matter and is considered critical for long-term phosphorus storage. An isolated wetland at the Larson Dixie Ranch is being used as a model system to demonstrate the long-term efficacy of these wetlands to retain phosphorus. The study objectives are to:

- Demonstrate and determine the efficacy of isolated wetlands located in land areas used for dairy and cow/calf operations on phosphorus assimilation and storage
- Determine the effect of hydrologic restoration on water storage and flow paths
- Determine the change in phosphorus storage in wetland and surrounding upland soils and vegetation as a result of restoring hydrology

- Determine the composition and stability of soil organic phosphorus in the Lake Okeechobee Watershed
- Validate hydrologic and phosphorus models for adaptation to the Lake Okeechobee Watershed and use these models to simulate phosphorus retention capacity

In an effort to restore hydrology and increase storage of both water and phosphorus, a dam was constructed in the ditch of one wetland and compared to a neighboring undammed wetland (**Figure 5-4**).

These two wetlands have been intensively studied with regard to soil and vegetative nutrient characteristics, surface water TP concentration, and wetland stage from 2004–2007 (pre-restoration) and again from 2009–2010 (post-restoration). Anticipated results of increased water storage after damming the wetland have not been observed (**Figure 5-5**). In these small (1.1 hectares [ha] and 2.2 ha) wetlands, backflow from the ditches contributes to increased stage; therefore, decreased water storage was observed in the dammed wetland. It is possible that this occurred because of the small size of the watershed that supports these wetlands and that backflow contributes more to wetland stage than overland flow does.

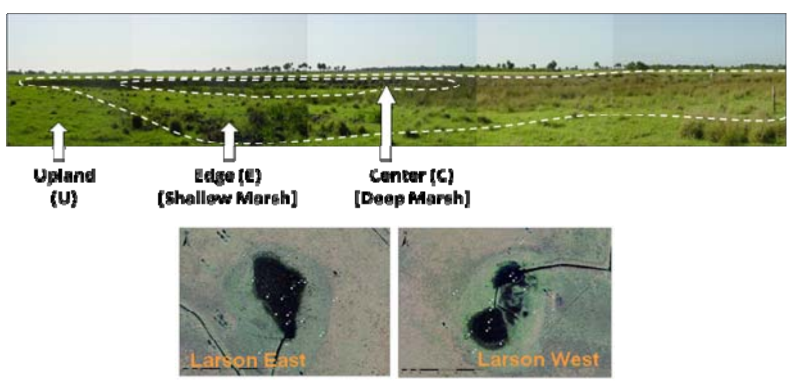

Figure 5-4. Isolated wetlands used in the study to determine long-term effectiveness to retain phosphorus.

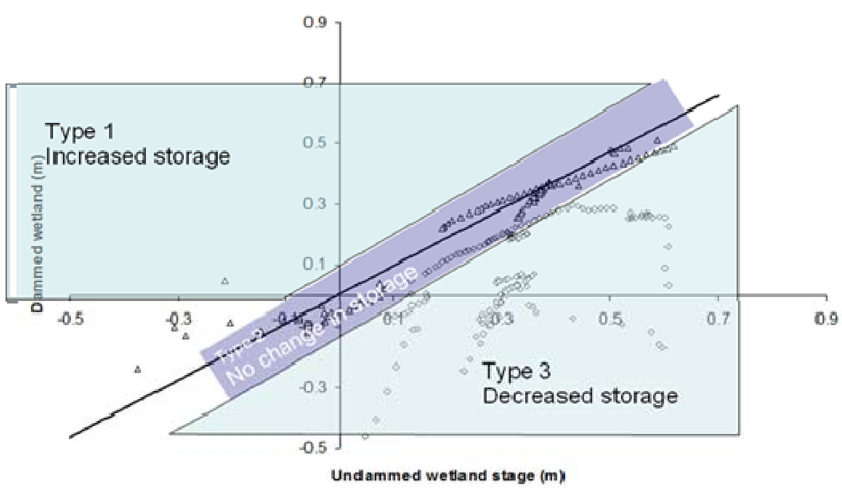

Figure 5-5. Anticipated water storage resulting from hydrologic wetland restoration.

To determine its long-term stability, phosphorus stored in soils was classified as reactive or non-reactive phosphorus. Reactive phosphorus is quantified by extracting it from soils using acid (inorganic phosphorus) and alkali (organic phosphorus) reagents. Phosphorus not extracted by these chemicals is considered residual or non-reactive. The non-reactive phosphorus pool is considered stable and represents long-term phosphorus storage in wetland soils.

In the most recent soil sampling (January 2010), surface soils from the center portion of the wetland contained 28 percent of the TP stored in the stable non-reactive pool (Residue P, **Figure 5-6**). Monitoring soils for the past few years suggests that phosphorus stored in the non-reactive pool ranged from 15 to 47 percent of TP with a high degree of annual variability. At this time there is not a good understanding of the factors regulating the stability of non-reactive phosphorus in wetland soils. Additional studies will be conducted during the 2010–2011 period to determine the stability of non-reactive phosphorus under a range of hydrologic and reduction-oxidation conditions.

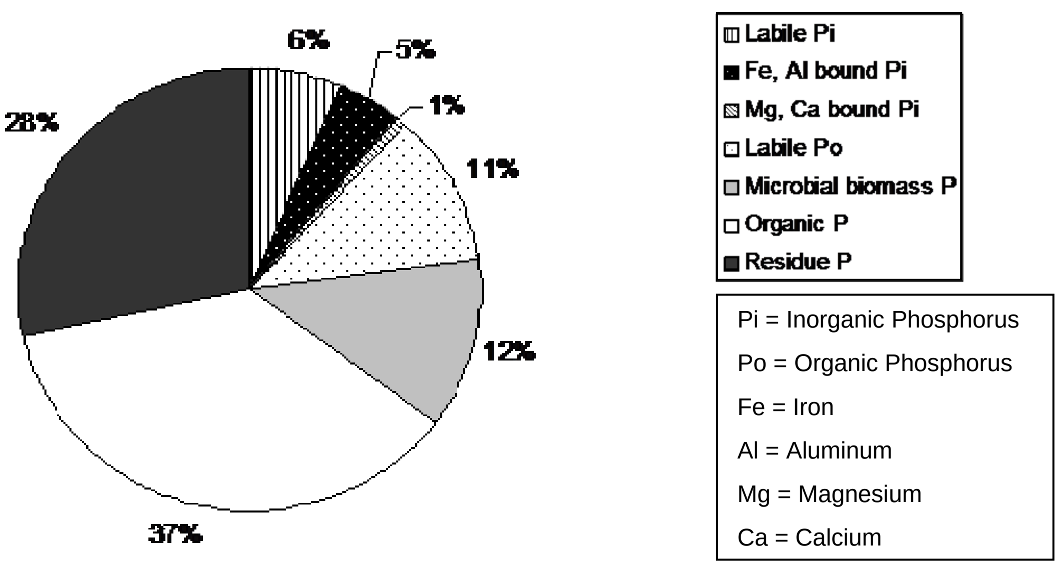

Figure 5-6. Distribution of reactive and non-reactive phosphorus in surface soils of the center portion of the Larson wetland (soil samples taken on January 10, 2010).

5.1.3.6 Cow/Calf BMP Optimization

This project was part of a collaborative effort by various stakeholders to provide recommendations for the development and implementation of environmentally and economically sustainable cow/calf practices in the Lake Okeechobee Watershed. Earlier research (Bohlen 2009) indicates that changes in cattle stocking density are unlikely to produce measurable effects on nutrient loads in the short term, and that phosphorus loads may be related to nutrient accumulation in soils due to past fertilization practices in improved pastures. Given these results, a water management study was initiated in 2004 to evaluate the feasibility of on-farm retention/detention of water to control phosphorus losses from beef cattle ranches. The specific objectives of the project were to:

- Document the effects of water storage and reduced flow on the quality of water leaving the pastures
- Evaluate forage yield and quality and animal performance as influenced by water retention treatments
- Determine nutrient load reductions from the pastures by integrating flow, vegetation, water quality, and animal performance data

The study was conducted on eight 50-acre plots in a block of improved pastures at the Buck Island Ranch in the C-40 basin. Two water treatments were evaluated: reduced and uninterrupted flow. Reduced flow involved holding water back in the pastures while maintaining a desired water table depth. This treatment was imposed on four plots by installing flashboard riser control structures in the ditches, one close to the existing flume and another at the midsection of the ditch. The remaining four plots were subjected to uninterrupted flow treatment, allowing water to flow freely in the pastures. The plots were grazed at an optimal stocking rate except for two plots that served as long-term grazing controls. This project was completed in March 2009.

Pasture water retention significantly reduced TN loads from the pastures. Overall annual TN loads were 11.28 kilograms per hectare (kg/ha) in pastures with uninterrupted flow and 6.28 kg/ha in pastures with reduced flow, a 44 percent reduction. Effects of water retention on TP loads were equivocal. In 2005, the reduced flow treatment increased TP loads by 39 percent, due to increased TP concentration, but in 2006 it reduced TP loads by 37 percent. In 2007, an extremely dry year, TP loads were negative due to backflow exceeding forward flow. In 2008, TP loads were 16 percent lower in reduced flow pastures, but the difference was not significant. If 2005 and 2007 results are removed, the average reduction in TP loads due to water retention was 27 percent (Bohlen 2009, Bohlen and Villapando 2010).

5.1.3.7 Demonstration of Water Quality BMPs for Beef Cattle Ranching in the Lake Okeechobee Watershed

The goal of this project was to demonstrate the effectiveness of the cow-calf BMPs that appear most promising for ranches in the Lake Okeechobee Watershed, and to evaluate the change in nutrient loads to surface waters and groundwater resulting from implementing these practices. These BMPs included the use of soil amendments to retain phosphorus, ditch fencing and culvert crossing (DFCC) to keep cattle out of waterways, and wetland water retention (WWR) to increase storage of water and nutrients on ranches. The last two BMPs were implemented at Pelaez and Sons Ranch, a commercial cow-calf ranch in Okeechobee (**Figure 5-7**). DFCC was implemented by fencing a 170-meter section of the ranch's principal drainage ditch and installing a culvert crossing to provide a way for the cattle to cross the ditch. WWR was implemented at two wetlands (wetlands 1 and 4) within the ranch by installing riser board structures at the outlets of the wetlands and adding boards until the desired water retention levels were met. The effectiveness of the BMPs was evaluated by comparing TP and TN loads and concentrations between pre- and post-BMP periods.

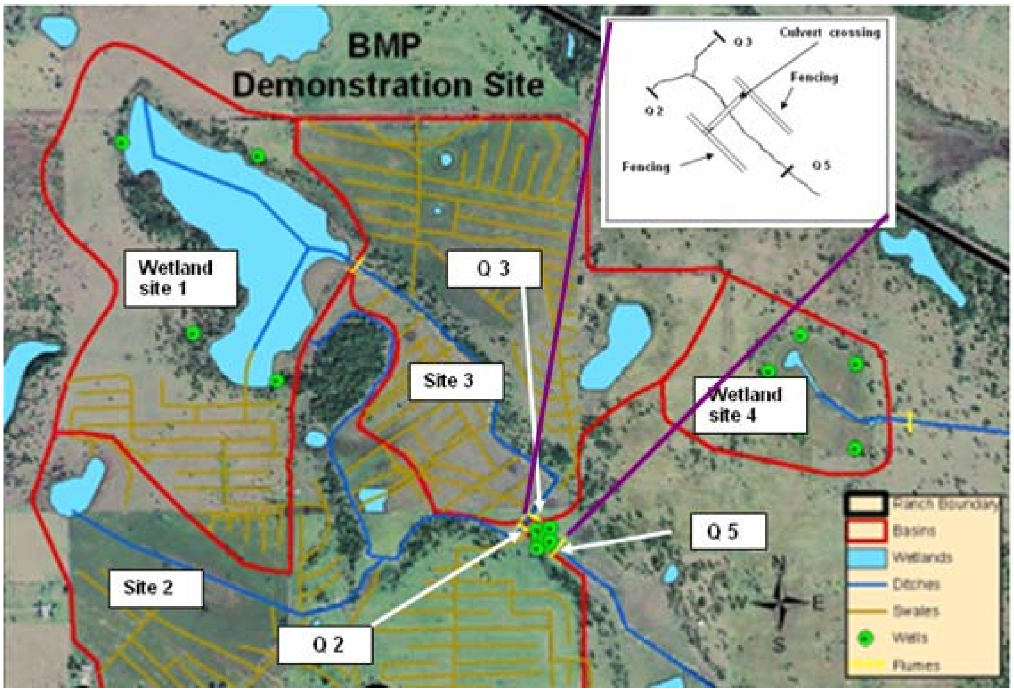

Figure 5-7. BMP test project site at Pelaez Ranch.

Soil Amendment Evaluations – Research Project

A systematic evaluation of numerous soil amendments using standard protocols was conducted to provide directly comparable results upon which to judge their effectiveness. The protocols included standard total elemental analysis of each amendment, short-term laboratory equilibrations, small column leaching studies, and simulated rainfall studies. Amendments included water treatment residuals (WTRs) (Fe-, Al-, and Ca-based WTRs), industrial by-products produced or marketed in Florida (slag, silica-rich, and humate materials), and agricultural amendments (lime and gypsum).

WTRs are the waste products of the water purification industry and are produced during the sedimentation-flocculation process. They consist of sediments, metal hydroxides, activated carbon, and polymers that remove turbidity, color, taste, and odor from raw water and speed sedimentation. Land application of these types of soil amendments can be a cost-effective treatment for effectively binding excess levels of mobile phosphorus in soils, and can significantly reduce phosphorus runoff from agricultural fields. Aluminum (Al)-WTRs provide rapid, highly efficient removal of phosphorus in soils, and phosphorus that is immobilized by Al-WTRs is shown to be stable and persists for a long time, irrespective of changes in soil pH.

Results of the evaluation protocols led to elimination of most amendments from further study, and identified two amendments (Manatee and Okeechobee Al-WTRs) worthy of field investigation. Manatee and Okeechobee Al-WTRs were effective phosphorus sorbers, but ineffective at controlling phosphorus leaching when soluble phosphorus was below the zone of amendment incorporation. The Okeechobee material was uniformly better when applied at 1 percent, whereas the Manatee material requires a 2.5 percent application rate. The Okeechobee material is locally available, but its low solids content (~9 percent) creates handling and transportation problems. Total annual production of the Okeechobee residual is estimated at only 250 to 300 megagrams (Mg), which limits its use at the 1 percent (10 tons/acre [t/ac]) rate.

Relatively high rates (~25 t/ac) of the Manatee material are needed to be effective, but the material's dry condition makes handling and application easy, and large quantities are available (~4,000 Mg/year). Thus, field evaluation of the Manatee Al-WTR at the 2.5 percent was recommended for study of surface application on one plot and incorporated (to 5 cm) on the other plot. The application of Manatee Al-WTR (at 2.5 percent of soil weight), whether surface applied or mixed within the profile, decreased the loss of soluble phosphorus from manure-impacted soil. Surface applied Al-WTR was more effective in reducing soluble phosphorus in runoff than when incorporated. However, incorporated Al-WTR was more effective in reducing soluble phosphorus in subsurface flow and leachate than was surface application. Care must be taken to ensure complete incorporation of Al-WTR throughout the phosphorus-impacted layer, as Al-WTR was only effective in reducing soluble phosphorus concentrations when it was in contact with the impacted soil.

To best reduce phosphorus loss in both surface runoff and subsurface flow and leachate from highly impacted soils, Al-WTR should be first mixed throughout the impacted soil depth and then added to the soil surface. For an unimpacted area with low initial soil phosphorus concentration intended for manure application, surface application of Al-WTR would likely minimize phosphorus loss. Application of Al-WTR did not adversely affect forage yield or quality of stargrass; however, field-scale forage studies are recommended to validate the box-scale results.

Ditch Fencing and Culvert Crossing – Research Project

The ditch fencing and cattle crossing BMPs (DFCC) are employed to keep cattle out of waterways and reduce direct phosphorus input. For the DFCC BMP, the wet period (June–October) of 2005 was the pre-BMP period and the wet periods of 2006–2008 were the post-BMP periods (post-BMP 1, post-BMP 2, and post-BMP 3 periods, respectively). During the pre-BMP period (2005), downstream TP loading was 123 kg higher than the upstream TP loading, which indicated addition of phosphorus at the fencing site. During the post-BMP 1 and 3 periods, downstream TP loadings were 17 kg and 88 kg lower, respectively, than the upstream TP loadings. This indicated reduction and retention of TP in the ditch section in contrast to the observed addition of phosphorus during the pre-BMP period. Downstream TP loading was 35 percent higher than the upstream loading during the pre-BMP period while it was 32 percent and 11 percent lower during post-BMP periods 1 and 3, respectively. Reduction in TN loading was also measured at the site during the 2006 and 2008 wet seasons.

The post-BMP 2 period (2007) was an exception to the results from 2006 and 2008. Unusually dry conditions during 2007 resulted in the addition of nitrogen and phosphorus at the BMP site, which was likely due to the mineralization of resident phosphorus and nitrogen from soil and aquatic vegetation in the 170-meter ditch section. Although nitrogen and phosphorus were added during 2007, when the data for all three post-BMP periods were averaged, it showed a net reduction in nitrogen and phosphorus.

Overall, average upstream and downstream TP loadings were 295 kg and 264 kg respectively for the three post-BMP periods indicating a 10 percent reduction in TP at the BMP site. Likewise, average upstream and downstream TN loadings from the BMP site were 675 kg and 601 kg, respectively, for the three post-BMP periods indicating an 11 percent reduction in nitrogen.

To account for the variability in rainfall and flow during the study period, three scenarios of post-BMP phosphorus reductions were considered. The liberal, moderate, and conservative scenarios considered the highest reduction (during post-BMP 3 period)(0.58 kg/day), average of post-BMP periods 1 and 3 when reduction in phosphorus loadings were observed (0.34 kg/day), and the average of all three periods of post-BMP phosphorus loading reductions (0.20 kg/day), respectively. Average phosphorus removal costs based on the liberal, moderate, and conservative estimates were $7.74, $12.93, and $22.05 per kg of phosphorus, respectively.

Wetland Water Retention (WWR) – Research Project

Historically, wetlands covered a considerable area of the sub-basins within the Lake Okeechobee Watershed. These wetlands captured stormwater runoff and reportedly retained phosphorus. Many of these wetlands were drained to increase the amount of land in agricultural production, which increased phosphorus discharge to the lake. Conceptually, the enhancement and restoration of wetlands may reduce both phosphorus discharge and peak stormwater runoff by increasing regional water storage. The Wetland Water Retention project evaluates the effectives of this BMP in the Lake Okeechobee Watershed.

The effectiveness of the WWR BMP at wetland 1 was evaluated using two years of pre-BMP data (June 2005–May 2006 [pre-BMP1] and June 2006–May 2007 [pre-BMP2]) and two years of post-BMP data (June 2007–May 2008 [post-BMP1] and June 2008–May 2009 [post-BMP2]). For wetland 4, June 2005–May 2006 was used as the pre-BMP period while the post-BMP periods were June 2006–May 2007 (post-BMP1), June 2007–May 2008 (post BMP-2), and June 2008–May 2009 (post BMP-3).

At wetland 1, the TN and TP loads for post-BMP1 were less than those during the two pre-BMP periods. However, the reductions during post-BMP1 (June 2007–May 2008) could not be attributed entirely to the BMP since record drought conditions in 2007 caused low flow volume during the period. For post-BMP2 (June 2008–May 2009), TN and TP loads were almost two times higher than those during pre-BMP1. Unusually high phosphorus loadings were likely due to a combination of high runoff volume and availability of phosphorus within the drainage area. Drought conditions in 2007 resulted in mineralization of soil and plant phosphorus, which was available to move with overland flow in 2008. Several consecutive rainfall events in July 2008 followed by Tropical Storm Fay in August 2008 resulted in large flows and phosphorus loadings from the wetland. The average TN (304 kg) and TP (93 kg) loads for the two post-BMP periods were higher than the average TN (161 kg) and TP (47 kg) loads for the two pre-BMP periods. The available data does not provide enough evidence to conclude that WWR reduced nitrogen and phosphorus loads since large rainfall variability masked the BMP results. Longer term data will be needed to better evaluate this BMP at wetland 1.

For wetland 4, individual TN and TP loads during the three post-BMP periods were less than those during the pre-BMP period. Due to relatively low rainfall during post-BMP1 and post-BMP2, both flow volume and nutrient loads were less than those observed during the pre-BMP period. Due to this marked difference in rainfall, it was difficult to evaluate the BMP based on post-BMP1 and post-BMP2 periods. In contrast, the pre-BMP and post-BMP3 periods had similar rainfall and flow volumes, therefore providing a better comparison for BMP evaluation. The nitrogen and phosphorus loads were lower during post-BMP3 compared to pre-BMP, indicating that WWR may have reduced both the flow volume and the TN and TP loadings.

Taking into account all three post-BMP periods, the average TN (97 kg) and TP (57 kg) loads were lower than the TN (319 kg) and TP (182 kg) loads during the pre-BMP period.

Average combined TN and TP loadings for both wetlands were calculated based on average loadings from all pre- and post-BMP periods for the sites. This showed net reductions of nitrogen and phosphorus during the post-BMP period. On average there was a 16 percent reduction in TN loadings (Pre-BMP: 214 kg and post-BMP: 180 kg) and a 23 percent reduction in TP loadings (pre-BMP: 92 kg and post-BMP: 71 kg).

Due to large variability in pre- and post-BMP period rainfall, flow, and other variables, results from the WWR study are not conclusive. The effects of weather-related variability are likely to be more pronounced for the WWR BMP than the DFCC BMP. The WWR BMP affects flow as well as nutrient dynamics. Furthermore, the WWR BMP changes the subsurface movement of water and nutrients as opposed to mainly surface movement of nutrients for the DFCC BMP. Collection of long-term flow and nutrient data is critical for evaluating the WWR BMP and monitoring is ongoing at the site to better evaluate the effects of the two BMPs. This is expected to eliminate the masking effects of other factors.

5.1.3.8 Soil Phosphorus Storage Capacity Study — A Threshold Phosphorus Saturation Indicator for Risk Assessment of Wetland Soils – Research Project

Different parameters related to soil phosphorus sorption capacity or to measurements of labile phosphorus pools have been used to predict environmental phosphorus losses in upland soils. This study used the same approach in an attempt to define a threshold phosphorus saturation ratio (PSR) that can be used to predict phosphorus release from wetland soils. Preliminary evaluation of this concept using soil phosphorus data from the southeastern United States suggests that the threshold PSR might be a practical indicator of nutrient enrichment in wetland soil systems.

PSR is the molar ratio of extractable phosphorus to the sum of extractable iron and aluminum in the soil. It was originally developed for upland soils using oxalate-extractable phosphorus, iron, and aluminum; however, PSRs can be also calculated using Mehlich 1- or Mehlich 3-extractable phosphorus (P), iron (Fe), and aluminum (Al), as shown in **Equation 5-1**.

$$PSR = (\text{Extractable -P}/31)/[(\text{Extractable-Fe}/56) + (\text{Extractable-Al}/27)] \qquad \textbf{[Equation 5-1]}$$

PSRs for wetland soils in the Lake Okeechobee Watershed were calculated using Mehlich 1-extractable phosphorus, iron, and aluminum. Air-dry based water soluble phosphorus (WSP) concentrations in the soils were regressed against calculated PSRs and the “change point” in the fitted segmented line model was determined statistically using a non-linear equation. The “change point,” also called the threshold PSR, is the point in the WSP/PSR graph where phosphorus concentration in the soil solution abruptly increases, and it is the point at which a soil becomes a phosphorus source to the environment. A threshold PSR_{M1} value of 0.11 with a 95 percent confidence interval of 0.06–0.15 was obtained (**Figure 5-8**).

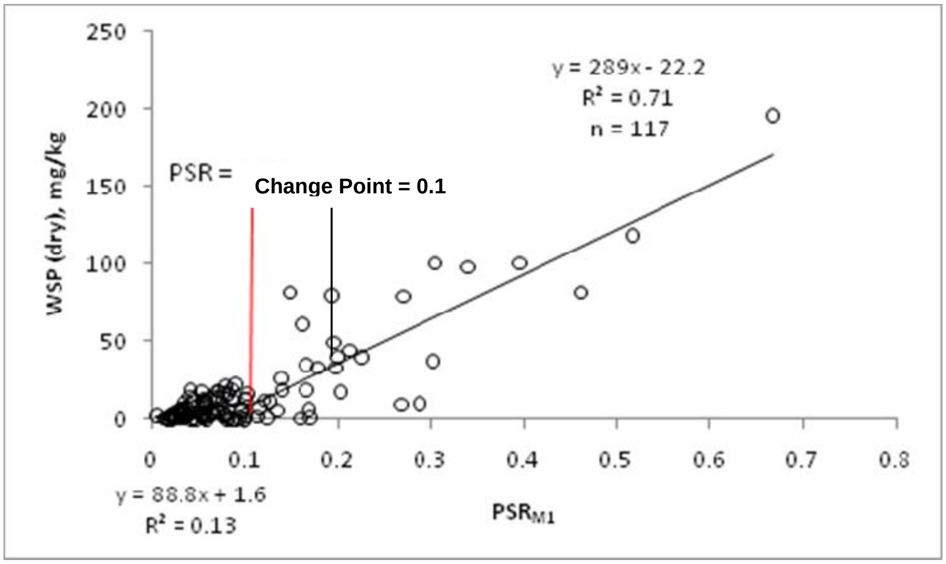

Figure 5-8. Relationship between air-dry based water soluble phosphorus and Mehlich 1 based PSR for wetland soils from various locations in the Lake Okeechobee Watershed.

Since phosphorus concentrations in the soil solution are related to phosphorus losses from a field via surface and subsurface flow, the PSR can be used to determine the point of phosphorus loading at which phosphorus release begins to abruptly increase and become an environmental concern. However, the use of PSR as an environmental indicator of phosphorus loss from a field has the shortcoming of failing to indicate the capacity of a soil to retain added phosphorus. For this purpose, the University of Florida Soil and Water Science Department introduced the PSR-based calculation of the soil phosphorus storage capacity (SPSC) that would take into account impacts of previous phosphorus loading as well as the soil's inherently low phosphorus sorption capacity. SPSC provides a direct estimate of the amount of phosphorus a soil can retain before exceeding a threshold soil equilibrium concentration, such as before the soil becomes an environmental risk.

Using the threshold PSR value of 0.11, the SPSC values of wetland soils from the Lake Okeechobee Watershed were calculated using **Equation 5-2**.

$$\text{SPSC (mg/Kg)} = (\text{Threshold } PSR_{M1} - \text{Soil } PSR_{M1}) * \text{Mehlich 1-}[(Fe/56) + (Al/27)] *31*1.3$$

[**Equation 5-2**]

When the SPSC is positive, the soil provides a sink for phosphorus and does not pose an environmental risk. However, soil with a negative SPSC is a source of phosphorus and an environmental concern. The environmental risk increases as the SPSC becomes more negative (**Figure 5-9**).

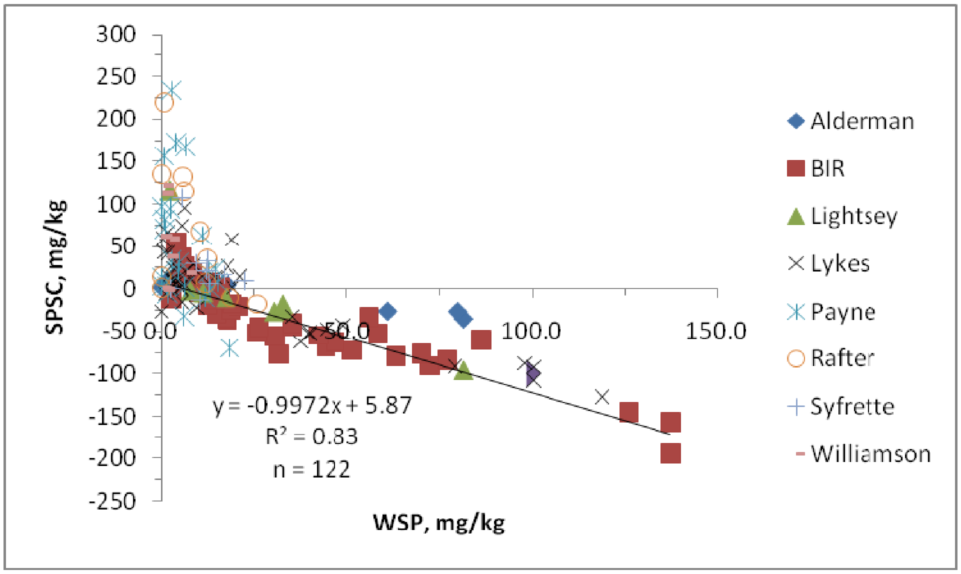

Figure 5-9. Relationship of SPSC calculated using a threshold PSR value of 0.11 and WSP as determined on air-dried wetland soils in the Northern Everglades Watershed (BIR is Buck Island Ranch).

While results of this study look encouraging, they should be regarded as preliminary. Further investigations evaluating the larger scale interpretation and application of SPSC to infer edge-of-field/surface water-phosphorus concentrations (including more intensive catchment area soil with deeper soil sampling, water sampling, and use of SPSC in models) are highly recommended.

5.1.3.9 Permeable Reactive Barrier Technology

In the continued effort to meet the state TMDL for Lake Okeechobee, the SFWMD is working with the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) to test and implement Permeable Reactive Barrier (PRB) technology to effectively sequester soluble phosphorus from areas with high phosphorus loads.

PRBs are a proven technology for groundwater remediation that includes sorbents such as aluminum and iron WTRs, which have been shown to be effective for long-term sequestration of phosphorus. The general concept of the PRB technology is depicted in **Figure 5-10**. Several Al-WTRs from water treatment facilities across South Florida have already been tested for properties such as phosphorus sorption capacity, phosphorus sorption kinetics, and hydraulic properties of the materials that will enable adequate water flow through the barrier. Groundwater and soil properties from the selected pilot site have also been characterized to determine the effectiveness and lifespan of the PRBs as well as the appropriate location for installation in the field.

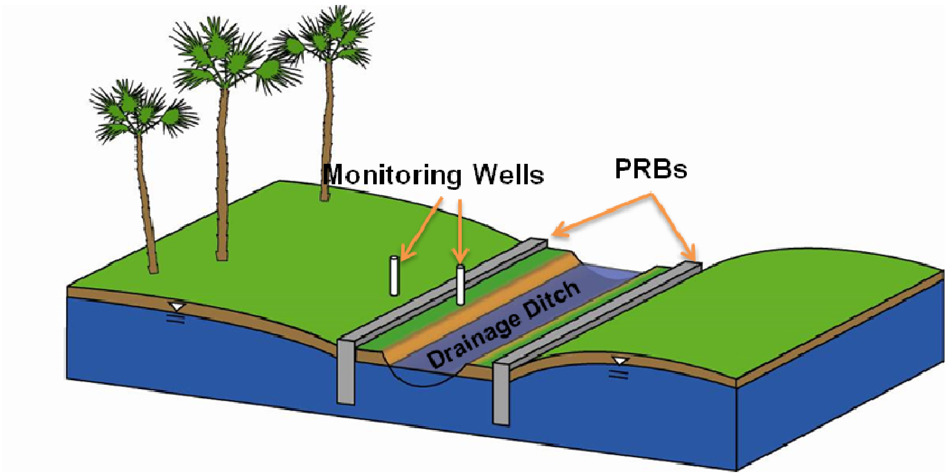

Figure 5-10. Concept of the Permeable Reactive Barrier technology.

This project evaluates the use of PRBs in the Lake Okeechobee Watershed before phosphorus enters the water conveyances into the lake. The project objectives are to (1) assess the spatial distribution of phosphorus sources and availability of Al-WTRs; (2) Characterize various chemical, physical, and hydraulic properties of Al-WTRs to assess the suitability of the materials for use in a PRB design and test their phosphorus removal capacity at the laboratory scale; and (3) perform a pilot-scale testing of a buried-wall PRB design in the Lake Okeechobee Watershed.

The feasibility study of using PRB technology to reduce phosphorus loads to Lake Okeechobee was initiated by the SFWMD in July 2009 and was completed in December 2009. The location for this study was the 85-acre, former high intensive area of the Candler Ranch, formerly known as Rofra Dairy, which is in the S-191 (Taylor Creek) basin in Okeechobee County. This is a former dairy that participated in the SFWMD buy-out program in the late 1980s. At the site, wells and pressure transducers have been installed where the groundwater phosphorus concentration has been measured to be greater than 4 mg/L. Groundwater hydraulic gradients are being assessed to determine the groundwater discharge into nearby ditches.

Testing of the suitable materials for PRB design and their phosphorus removal capacity at the laboratory scale was completed in September 2010. Construction of the pilot PRB project is expected to start in 2011 based on funding availability. Post-monitoring will commence after installation.

5.1.3.10 Taylor Creek Algal Turf Scrubber Nutrient Recovery Facility

This is a scaled-up demonstration of a proprietary water treatment technology that uses algae to remove pollutants from impaired waters. The process design for this facility was based upon the successful implementation of a single Algal Turf Scrubber treatment system in the S-154 basin. Constructed and operated by HydroMentia, Inc. from January 2007 to January 2009, the facility was projected to remove 4,000 lbs of phosphorus per year. However, TP removal based upon water quality was only 236 lbs, which is less than 2 percent of the projected performance (**Figure 5-11**).

Initial evaluations of the system performance revealed no substantial evidence related to physical operational and design issues or analytical/sampling error. There were also no discernible impacts from growth factor deficiencies, grazing, external nutrient sources, or excessive evapotranspiration. However, a toxic influence was present that was removed by activated carbon. Formal toxicity testing using the USEPA's Toxicity Identification Evaluations procedure applied to green algae found toxicity in the Taylor Creek source water, which was concentrated within the associated foam. Gas chromatography and mass spectrometry analyses showed comparatively large spikes that resemble signatures associated with organic solvent-type compounds such as dipropylene glycol—a common surfactant/adjuvant and solvent used in agriculture. Complementary to efforts associated with the identification of the toxins, several investigations related to the attenuation or elimination of deleterious impacts of the toxins were conducted. Positive results were obtained from the use of a water hyacinth scrubber, a constructed wetland, and alum precipitation. However, foam fractionation, which was selected because of the Toxicity Identification Evaluations testing, was shown to be ineffective in mitigating for the toxins.

HydroMentia, Inc. proposed a more focused investigation of the sources and mitigation of the documented toxicity in year four of Algal Turf Scrubber operations; however, the project officially concluded on May 31, 2010.

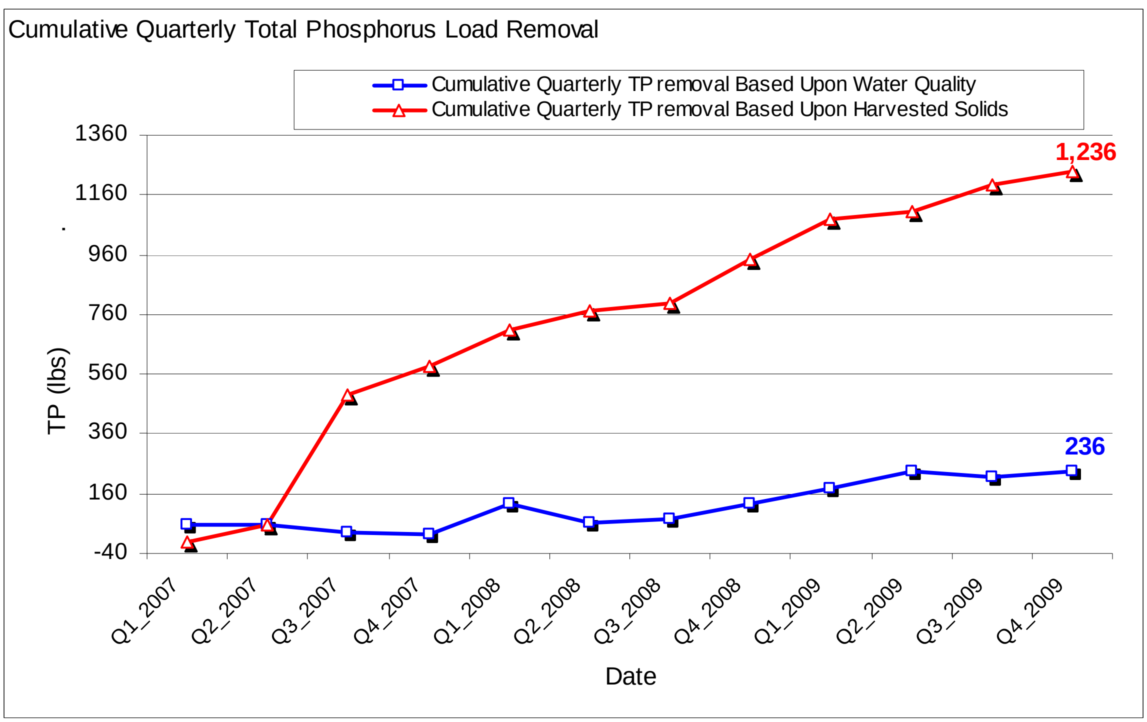

Figure 5-11. Cumulative quarterly TP mass removal rates based on water quality and solids recovered for the Algal Turf Scrubber.

5.1.4 Local Planning and Green Industry Programs

5.1.4.1 Comprehensive Planning

The Florida Department of Community Affairs is the primary state agency involved with local government comprehensive planning. In addition, the FDEP's Office of Intergovernmental Programs and the SFWMD's Department of Intergovernmental Programs coordinate each agency's involvement in statewide planning activities, although the nature and level of participation varies. While local government comprehensive plans have already been adopted, hundreds of plan amendments are reviewed by the FDEP's Office of Intergovernmental Programs and the SFWMD's Department of Intergovernmental Programs each year. In addition, local governments must update their comprehensive plans every seven years through the Evaluation and Appraisal Report (EAR) process. The FDEP and SFWMD have the opportunity to review proposed amendments that are based upon the local government's EAR to ensure they are consistent with the agencies' statutory and regulatory authorities.

In addition to these formal review processes, the FDEP and SFWMD informally communicate issues and concerns to the Florida Department of Community Affairs, the Regional Planning Councils, local governments, and other stakeholders.

In 2009, the FDEP, in collaboration with the SFWMD, finalized the *Nutrient Loading Considerations for Planning Decisions in Northern Everglades and Estuaries Protection Program Watersheds* report (a.k.a., "white paper"). The document provides guidance to the FDEP and SFWMD when working with local governments to meet NEEPP requirements and explains how existing growth management processes can further the restoration and water quality objectives of the NEEPP. It also identifies existing regulatory programs that can provide the basis for agency objections or comments on various planning documents and upon which local land planning entities can base additional resource protection measures that will benefit their communities and meet applicable statutory requirements.

5.1.4.2 Green Industry BMP Program

The Green Industry BMPs for Protection of Water Resources in Florida Training Program is a science-based educational program developed to provide Green Industry professionals with the knowledge, tools, and skills to minimize the environmental impacts of nonpoint sources of pollution related to their business practices. This program is currently delivered statewide by the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) and training dates can be found on their web site[6].

5.1.5 Watershed Phosphorus Source Control Program Summary

The collective source control programs will utilize an adaptive management approach to optimize their effectiveness as additional information becomes available through BMP implementation, demonstration and research projects, and watershed monitoring. As the various

[6] http://fyn.ifas.ufl.edu/professionals/bmp_training_schedule.htm

programs continue to develop and become more widely and consistently implemented, it is anticipated that there will be greater improvements in water quality.

5.2 Status of Lake Okeechobee Watershed Construction Project – Phase II Technical Plan

This section describes the current status of ongoing construction features included in the Lake Okeechobee Watershed Construction Project – Phase II Technical Plan (P2TP).

5.2.1 Stormwater Treatment Areas and Projects

The stormwater treatment areas (STAs) are constructed wetlands that remove and store nutrients through plant growth and the accumulation of dead plant material in a layer of peat (**Figure 5-12**). Levees and canals ring the perimeter of the treatment areas, which are divided into several cells. Some have open water with submerged and floating vegetation, and others have dense cattail growth. The variety provides for varying degrees of water quality treatment to maximize nutrient removal from the water column. Currently, there are three STAs in the Lake Okeechobee Watershed, which are described below; two are complete and one is under construction. In addition, Lemkin Creek Stormwater Project feasibility analyses are recently completed and design is expected to be initiated in 2011 based on funding availability.

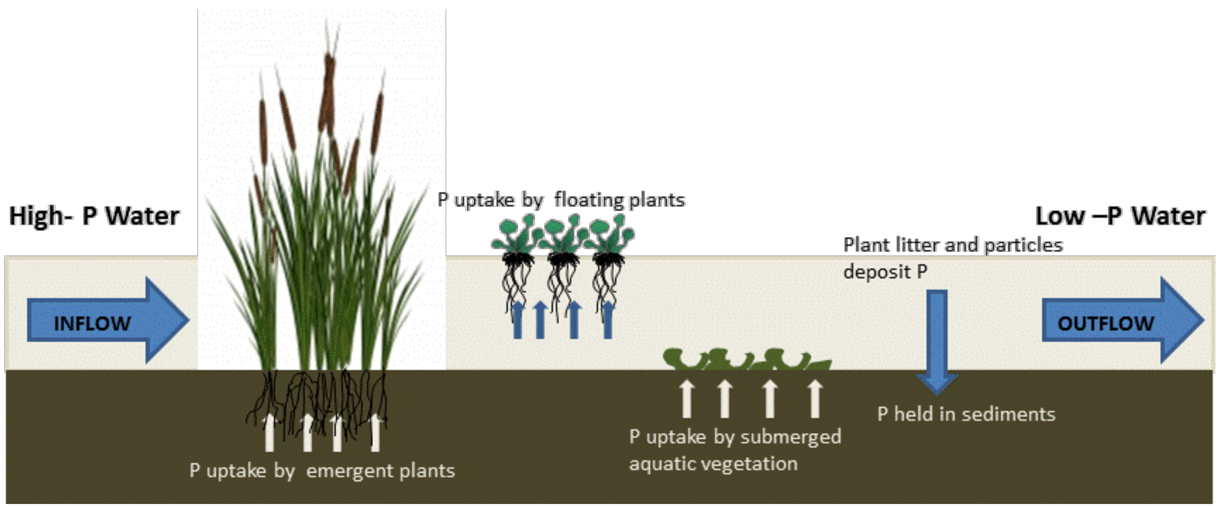

Figure 5-12. Typical stormwater treatment area with emergent and submerged vegetation.

5.2.1.1 Taylor Creek STA

The Taylor Creek STA (**Figure 5-13**), located in the Taylor Creek/Nubbin Slough Sub-watershed, is one of the two pilot-scale STAs being implemented north of the lake as part of the Lake Okeechobee Watershed Construction Project – Phase 1. The U.S. Army Corps of Engineers (USACE) is the federal sponsor of the project and is responsible for the design, construction, and preliminary operations. The District is the local project sponsor and is responsible for operation and maintenance of the facility as a contractor to the USACE until the project is transferred over to the District as described in the Project Cooperation Agreement.

Built in April 2006, the Taylor Creek STA is a long, narrow enclosure located about 2 miles north of the city of Okeechobee in central Okeechobee County. It is bordered on the east by US 441 and by Taylor Creek on the west. The STA is approximately 142 acres with an effective treatment area of 118 acres[7]. It is divided into two cells in series and is expected to treat about 10 percent of the water flow in Taylor Creek. The expected annual average TP removal performance of the Taylor Creek Pilot STA was estimated at 2.08 mt/year (Stanley Consultants, Inc. 2003).

Flow-through operations at Taylor Creek STA commenced on June 26, 2008. The facility continued to operate on discharge mode until February 24, 2009, when pumping and discharge activities were suspended after a failure of the culvert at the outfall structure was detected. From June 2008 to February 2009, the system removed 1.35 mt of phosphorus from the Taylor Creek drainage basin. Repairs were completed on August 23, 2010. Following a demonstration of compliance with pre-discharge requirements as laid out in the Taylor Creek Permit, flow-through operations resumed on September 8, 2010. Once all flow-through (discharge) requirements are satisfied, the District will officially take control of the project and begin the long-term operational phase of the project. The USACE is expected to transfer the project to the District in April 2011.

Figure 5-13. The Taylor Creek STA.

[7] The effective treatment area is the acreage within the flow path that contains the treatment vegetation, while total area of the project site includes canals, levees, control structures, and all other areas that are not directly removing TP.

5.2.1.2 Nubbin Slough STA

The goal of the Nubbin Slough STA (**Figure 5-14**) is to capture and reduce the mass of TP from the Nubbin Slough Basin prior to discharge back into Nubbin Slough and Lake Okeechobee. The USACE is the federal sponsor of the project and is responsible for the construction and preliminary operations of the STA. The District is the local project sponsor and is responsible for operation and maintenance of the facility as a contractor to the USACE until the project is transferred to the District as described in the Project Cooperation Agreement. The long-term average TP removal rate within the STA was estimated during the design phase to be over 5 mt/year or about 85 percent of the phosphorus load of Nubbin Slough at the project location.

The Nubbin Slough STA is approximately 6.5 miles southeast of the city of Okeechobee, adjacent to Nubbin Slough, immediately north of State Road 710, and just east of the bridge that spans Nubbin Slough. The STA is approximately 809 acres with an effective treatment area of 773 acres. An inflow pump station lifts water from Nubbin Slough at the western edge of the STA and delivers it through a 48-inch diameter underground force main to a 30-acre storage pond located in the north-central portion of the STA. Treatment occurs through natural biogeochemical processes as the water slowly flows by gravity south and westerly through cell 1 (263 acres) and subsequently through cell 2 (546 acres) before being discharged back to Nubbin Slough (**Figure 5-15**). Water levels and flow rates through the treatment cells are controlled by individual gated structures located at the western boundaries of each cell.

Construction of the Nubbin Slough STA was completed in September 2006. However, operations have not been initiated due to a series of mechanical problems uncovered during pump tests. Construction of the repairs was completed in June 2010. A remaining major source of concern though is that the Nubbin Slough basin does not produce enough runoff in a normal rainfall year to supply the STA with sufficient water for full-time operation (Stanley Consultants, Inc. 2003). Shoaling and sediment maintenance are also identified as concerns. The USACE and the District explored ideas to provide additional water to the STA and how to address the sediment maintenance issues; however, provision of additional water to the STA from L-63S was too costly. Currently, the USACE and the District are exploring how to operate the system as a retention area and achieve comparable water quality improvements.

Figure 5-14. The Nubbin Slough STA.

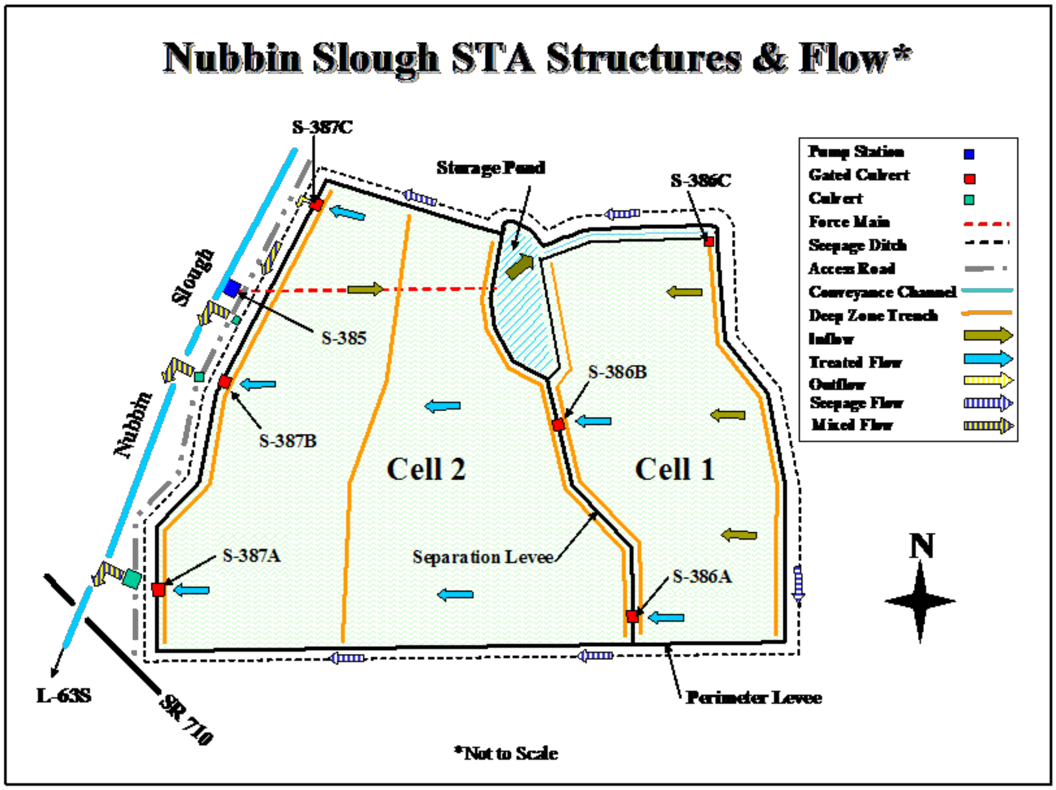

Figure 5-15. The Nubbin Slough STA, detailing the flow direction and structure locations.

5.2.1.3 Lakeside Ranch STA

The Lakeside Ranch STA is in the Taylor Creek/Nubbin Slough Sub-watershed, which is considered a nutrient hot spot in the Lake Okeechobee Watershed. This project is being expedited under the NEEPP and involves construction of a 2,700-acre STA site, with 1,707 acres of effective treatment area, adjacent to Lake Okeechobee in western Martin County (**Figure 5-16**). This STA will provide up to 19 mt of phosphorus reduction annually. The STA is also capable of recirculating water from Lake Okeechobee for additional phosphorus removal. This effort is anticipated to be one component of the tentatively selected plan chosen for the Lake Okeechobee Watershed Comprehensive Everglades Restoration Plan (CERP) project. The Lakeside Ranch STA project is divided into the following two phases (**Figure 5-17**):

- **Phase 1: STA – North, S-650 Pump Station, and Canal Improvements.** This phase of the project, which was permitted in 2009 by the FDEP, is currently being constructed. It includes a 250-cubic feet per second (cfs) inflow pump station, the northern section of the treatment area (919 acres), and canal improvements along the L-63 and L-64 levees. It is expected to remove 9 mt of phosphorus per year. Existing state appropriations are being used to implement Phase 1.
- **Phase 2: STA – South and S-191A Pump Station.** This phase includes construction of a southern treatment area (788 acres), a new pump station at S-191, and a discharge canal. It is expected to remove 10 mt of phosphorus per year. Implementation of Phase 2 will be subject to future funding.

The construction of the northern STA has achieved several milestones with an investment of $7.8 million in construction to date, including: (1) constructed 6.9 miles of canals and seepage ditches, (2) built 5 miles of levees, (3) planted 35 acres of sod on the levees, (4) cleared 700 acres of land, (5) constructed six control structures, and (6) hauled 700,000 cubic yards (35,000 dump trucks) of material.

Construction of the northern STA and the S-650 pump station is expected to be complete in January 2012 and February 2012, respectively. Pre-final design of the southern STA was completed in August 2010. The final design will be completed in March 2011. The pre-final design for the S-191A pump station (Phase 2) was completed in September 2010. Final design for this component will be submitted in April 2011.

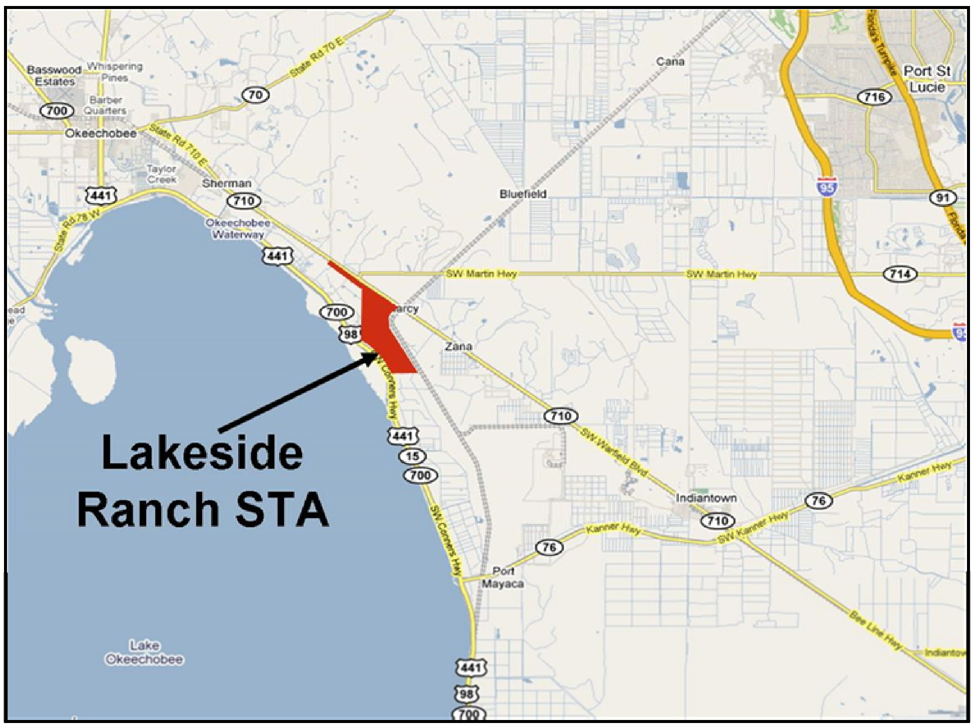

Figure 5-16. Location of the Lakeside Ranch STA.

Figure 5-17. Lakeside Ranch STA Phase 1 and Phase 2.

5.2.1.4 Lemkin Creek Stormwater Project

The Lemkin Creek Stormwater Improvement Project (Lemkin Creek Project) is located northwest of Lake Okeechobee in a sub-basin known as the Southwest Corridor within the Lemkin Creek Watershed. The sub-basin consists of both agricultural areas and urban areas in Okeechobee County and the city of Okeechobee that have experienced persistent flooding. The SFWMD is pursuing this project to store and treat stormwater in this area that ultimately discharges to Lake Okeechobee through the District's S-133 pump station.

The proposed project area consists of 93 acres of abandoned rock mining pits and previously cleared and filled land. The District has purchased the land for water management purposes. An aboveground impoundment project was considered for the site, but it was rejected following a feasibility study. In 2009 and 2010 the District, in cooperation with Okeechobee County and the city of Okeechobee, conducted an analysis of the following three potential project alternatives for the area:

1) A shallow impoundment with the existing ground scraped down and the fill placed in the existing mining pits. The bottom of the impoundment would be 6 inches above the normal wet season water elevation. Discharges into and out of the impoundment would be conveyed by operable gates.
2) A shallow impoundment with the existing ground scraped down and the fill placed in the existing mining pits. The bottom of the impoundment would be 6 inches above the

normal wet season water elevation. Flow into the impoundment would be conveyed by operable gates or a pump. Discharges would be conveyed by operable gates.

3) A shallow wetland treatment system with the existing ground scraped down and the fill placed in the existing mining pits. The bottom of the impoundment would be 12 inches below the normal wet season water elevation. Discharges into and out of the impoundment would be conveyed by operable gates

The project site is located just east of the District's Lemkin Creek HWTT Pilot Project (**Figure 5-18**, Section 5.1.3.1). All three alternatives have the potential to provide supplemental water to the HWTT project.

Analysis of the three options compared conceptual-level designs for TP removal potential, flood protection benefits, costs, recreation benefits, and habitat benefits. This information will be used to determine how the District will proceed with the project. Options being considered include: (1) the District building, operating, and maintaining the selected project; (2) Okeechobee County building, operating, and maintaining the selected project; or (3) a combination of these options. The estimated TP removals for the three alternatives are 6 kg/year to 28 kg/year for alternatives 1 and 2 since they are similar in design and 302 kg/year to 333 kg/year for alternative 3. A summary of the analysis results is provided in **Table 5-6**. The current goal is to initiate the design in 2011. Future phases of the project depend on the available funding.

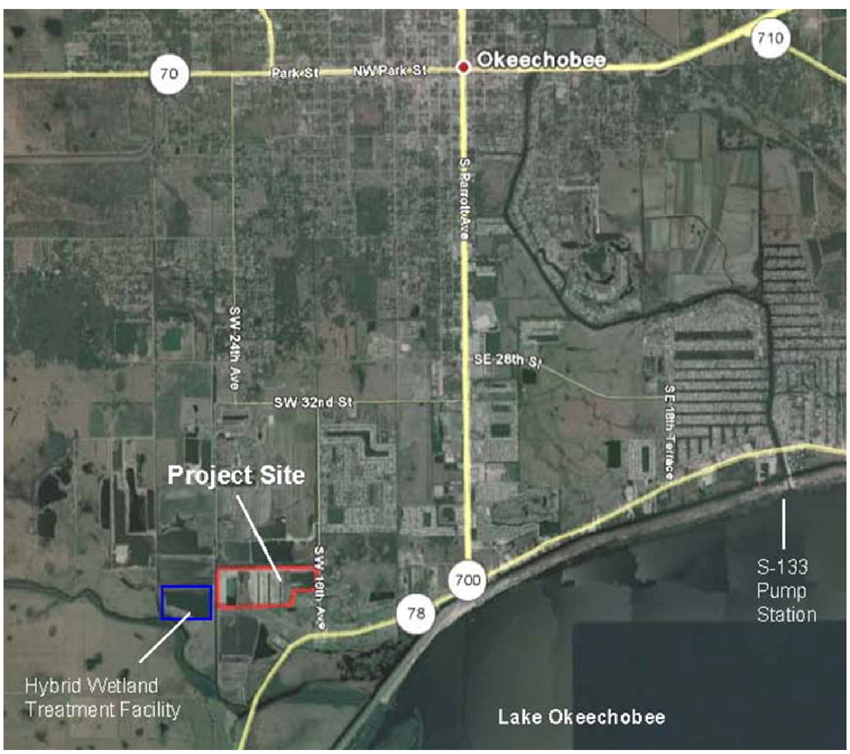

Figure 5-18. Location of the Lemkin Creek Stormwater Project.

Table 5-6. Summary of alternative analyses for Lemkin Creek Stormwater Project.

	Benefits				Estimated Costs	
	Stormwater Quantity	Water Quality	Ecological	Recreational	Construction (with 30% contingency)	Operations & Management Range
Alternative 1	Slight improvement in 7th Avenue Area (0.25-1.05 ft peak stage reduction); No notable difference among alternatives	Phosphorus removal range of approximately 6-28 kg/yr	No notable benefits	No notable benefits	$3.70 Mil	$19 K– $222 K
Alternative 2	Slight improvement in 7th Avenue Area (0.25-1.05 ft peak stage reduction); No notable difference among alternatives	Phosphorus removal range of approximately 6-28 kg/yr	No notable benefits	No notable benefits	$4.37 Mil	$19 K– $262 K
Alternative 3	Slight improvement in 7th Avenue Area (0.25-1.05 ft peak stage reduction); No notable difference among alternatives	Phosphorus removal range of approximately 302-333 kg/yr	Creation of approximately 80 acres of aquatic wetland habitat	Potential for bird watching, education, and hiking	$4.40 Mil	$16 K– $320 K

5.2.2 Aquifer Storage and Recovery Projects

Both the CERP and the P2TP (SFWMD et al. 2008) recommend the construction of a large number of Aquifer Storage and Recover (ASR) wells (**Figure 5-19**) within and near the Lake Okeechobee Watershed to store excess water for later recovery when it is needed. This additional storage is needed to help manage lake stages and reduce the frequency of high volume freshwater releases that damage the St. Lucie and Caloosahatchee estuaries. Some of this recovered water would also be available to support agriculture and protect urban wellfields near the coast from saltwater intrusion. Further, the CERP ASR Component for Lake Okeechobee (the 1999 "Yellow Book") included construction of up to 200 ASR wells adjacent to Lake Okeechobee as a feature for management of lake level, water quality, reduction of high capacity discharges to the estuaries, and water supply. Each of the wells is anticipated to have a per-well capacity of 5 million gallons per day (15 acres per foot per day) and most of the wells are conceptually sited north of Lake Okeechobee. The CERP ASR regional study is currently constructing groundwater and ecological models to evaluate the physical and biological feasibility of this full-scale component, the results of which will be published by 2013 in a technical data report.

The following provides an update on the District's efforts to construct and operate a series of CERP ASR well systems. These pilot projects have been constructed in various locations (**Figure 5-20**) and are being evaluated for implementation.

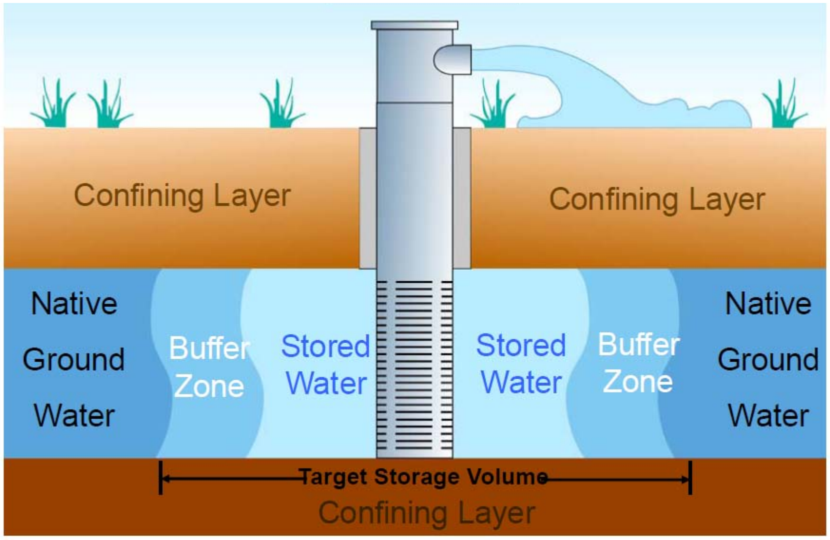

Figure 5-19. Typical Aquifer Storage and Recovery (ASR) well system.

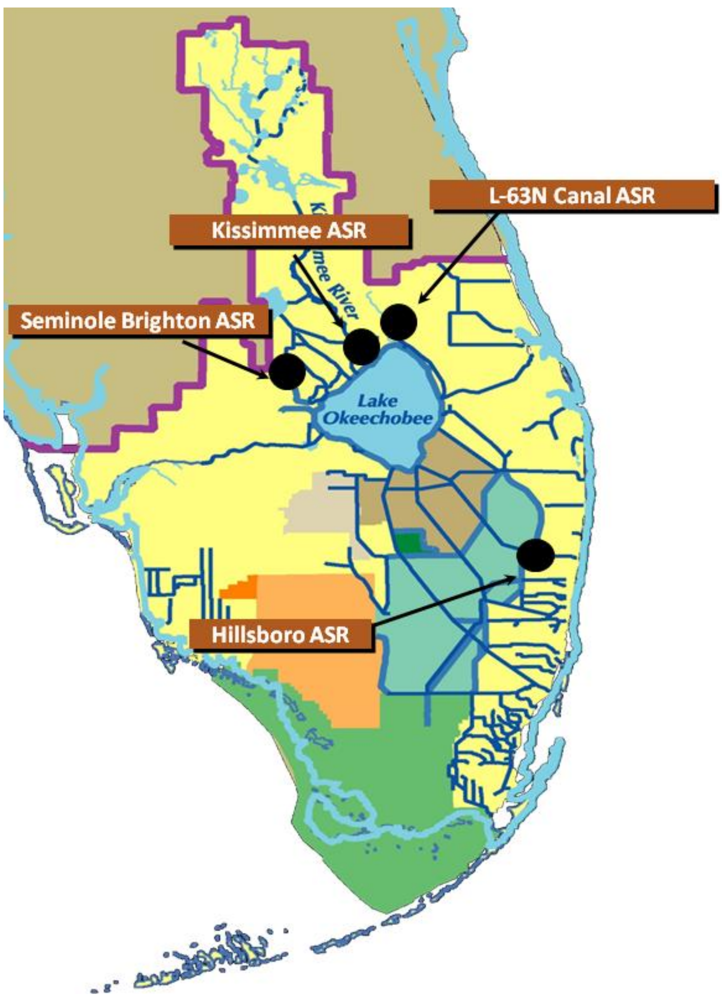

Figure 5-20. Locations of ASR projects.

5.2.2.1 Lake Okeechobee ASR Pilot Project

The Lake Okeechobee pilot project provides the necessary platform for the ASR Regional Study team to evaluate technical and regulatory uncertainties associated with ASR technology within the Lake Okeechobee Watershed. Construction of the Kissimmee River ASR facility is complete and cycle testing operations began in January 2009. Results from the first two cycles (with recharge and recovery durations of 30 and 90 days, respectively) indicated a relatively high recovery efficiency (greater than 90 percent), apparent nutrient reduction during storage, and no toxicity to aquatic life. Some arsenic was present in the recovered water in amounts exceeding the drinking water standard of 10 ppb during the first cycle; however, during the second cycle, the arsenic concentrations declined to less than the applicable standard. Continued monitoring of this constituent will take place during cycles 3 and 4, through 2011. The system is currently undergoing the third cycle of testing.

Due to funding constraints, the proposed Port Mayaca and Moore Haven ASR pilot facilities will not be constructed until subsequent phases of the ASR program are authorized as part of CERP.

5.2.2.2 Hillsboro ASR Pilot

The Hillsboro ASR Pilot Project provides the necessary platform for the ASR Regional Study team to evaluate technical and regulatory uncertainties in ASR technology near the Loxahatchee National Wildlife Refuge. Construction of the facility was completed in late 2009. Cycle testing operations began in January 2010. As of August 2010, the ASR system just initiated recovery of water during cycle 1.

5.2.2.3 CERP Aquifer Storage and Recovery Regional Study

The ASR Regional Study is designed to address regional technical issues associated with the CERP ASR Program beyond the scope of the pilot projects. Regional information is being collected on hydrology, geology, water quality, and other areas to: (1) adequately extrapolate information collected at the pilot sites and from other non-CERP ASR facilities in South Florida, and (2) collect information from areas where there is little or minimal information to address ASR uncertainties. A vast hydrogeologic database has been developed into a comprehensive framework of the Floridan aquifer system in South Florida. Preliminary findings of the first five years of data are summarized in the 2008 ASR Interim Report (SFWMD and USACE 2008). The findings indicate that ASR will work to some degree in most areas of South Florida, although local variations in hydrogeologic conditions will impact well flow rates and recovery efficiencies. A "fatal flaw," such as recovered water exhibiting high toxicity, has yet to be found in the technology as it applies to Everglades restoration (SFWMD and USACE 2008)

Hydrology, water quality, engineering, and ecotoxicological data have been collected at each of the originally proposed pilot facility locations. Study planners continue to obtain a better understanding of the complex geochemical and biological reactions that can occur within the Floridan aquifer as a result of recharge, storage, and recovery of treated water. Development of a comprehensive, South Florida-wide groundwater model is also under way, which will be used to predict impacts to the groundwater system under various CERP ASR operation scenarios. Results from these studies will be integrated into an ecological risk assessment with data obtained during pilot project cycle testing over the next few years. Results of future studies will be incorporated into the final ASR Program Technical Data Report, which is expected to be available by 2013.

5.2.2.4 Non-CERP Aquifer Storage and Recovery Projects

In addition to the CERP ASR projects, two SFWMD-funded ASR projects are ongoing. A pilot project is under way at the Seminole Tribe Brighton Reservation. To date, an exploratory well has been constructed, permitting has been initiated, and preliminary design and geotechnical studies have taken place. A final system design will be developed through the remainder of 2010.

The SFWMD is also reactivating the L-63N Canal ASR System, which was originally constructed and tested during the 1980s as a demonstration project. To date, permitting has been initiated and redesign of the updated system has been completed.

5.2.3 Dispersed Water Management Projects

Lake Okeechobee Watershed restoration efforts are not only in the form of large-scale publicly owned and operated projects. They also include partnerships with landowners participating in a variety of programs that spread excess water across the landscape and distribute it at shallow depths. This type of project optimizes the use of existing facilities and requires little new construction to retain cumulatively larger volumes of water. Low installation and maintenance costs associated with dispersed water management and nutrient reduction projects make them a cost-effective complement to the larger regional storage and treatment projects. Since October 2005, 89,664 acre-feet (ac-ft) of water storage on 145,593 acres has been achieved from the partnership programs (**Table 5-7**) in the Lake Okeechobee Watershed. Overall, since 2005, 129,143 ac-ft of total storage has been achieved in the Northern Everglades and connected watersheds from all of the partnership programs that implement water management alternatives.

Landowners have participated in dispersed water management under three types of approaches. The dispersed water management approaches include easements, cost-sharing, and other studies. Once a landowner has successfully participated in one type of program, there is often willingness to participate in other, longer-term programs with the potential to retain and reduce nutrients in even larger amounts of runoff.

Table 5-7. Dispersed water management projects status.

I. Operational – as of February 1, 2011

Project Name	Project Area (ac)	Estimated Storage (ac-ft)
A: Onsite subtotal	**120,526**	**21,968**
AVON PARK AIR FORCE RANGE (APAFR) WATER STORAGE PROJECT	3,600	10,000
BEST MANAGEMENT PRACTICES (BMP) - FDACS	86,331	2,225
DAVID WILLIAMS	502	134
FOUR K RANCH, ROTHERT FARMS STORMWATER RECYCLING SYSTEM	650	25
FRESP: BUCK ISLAND RANCH PILOT PROJECT	2,942	967
FRESP: C.M. PAYNE & SONS PILOT PROJECT	432	932
FRESP: LIGHTSEY CATTLE COMPANY PILOT PROJECT	14,080	135
FRESP: LYKES WEST WATERHOLE LEASE AND PILOT PROJECT	2,500	5,000
FRESP: RAFTER T RANCH PILOT PROJECT	1,623	1,145
FRESP: SYFRETT RANCH WEST PILOT PROJECT	280	140
HAYNES WILLIAMS - 101 RANCH	201	25
KCOL WETLAND RESTORATION - OTTER SLOUGH (Upper Kissimmee)	550	71
KCOL WETLAND RESTORATION - ROUGH ISLAND (Upper Kissimmee)	1,000	215
LAKE WALES RIDGE W E A RESTORATION (ROYCE UNIT) (Upper Kissimmee)	120	20
LYKES BASINGER GROVE AND BOATRAMP NURSERY FLOOD PROTECTION	350	50
NORTH FLORIDA PARKWAY FLOOD CONTROL IMPROVEMENTS (Upper Kissimmee)	3	1
RAULERSON AND SON RANCH ALTERNATIVE WATER STORAGE PROJECT	670	300
STORMWATER IMPROVEMENTS TO CONROY POND (Upper Kissimmee)	1	1
WETLAND RESERVE PROGRAM (WRP) PROJECTS - NRCS (in Lake Okeechobee Watershed)	4,541	362
WETLAND RESERVE PROGRAM (WRP) PROJECTS - NRCS (in Upper Kissimmee)	700	220
B: Regional subtotal	**25,067**	**67,696**
INDIANTOWN CITRUS GROWERS ASSOCIATION WATER STORAGE PROJECT - PHASES 1, 2, & 3	492	3,550
KISSIMMEE RIVER FLOODPLAIN RESTORATION PHASE I AND IVA (Upper Kissimmee)	-	47,783
KISSIMMEE RIVER TEST ASR (Upper Kissimmee)	4	2,250
LAKE OKEECHOBEE CRITICAL PROJECT: TAYLOR CREEK STA	142	519
LAKE OKEECHOBEE CRITICAL PROJECT: NUBBIN SLOUGH STA	658	1,501
LAKE OKEECHOBEE PROTECTION PROGRAM PROJECTS	8,771	4,593
LYKES BASINGER GROVE	15,000	7,500
Subtotal A & B:	**145,593**	**89,664**

II. Projects Funded through Construction – as of February 1, 2011

Project Name	Project Area (ac)	Total Estimated Storage (ac-ft)
A. Preliminary Design	**59,596**	**12,175**
FDACS BMP: TRIPLE A RANCH	2,860	30
FDACS BMP: WILLAWAY CATTLE COMPANY AKA CALLAWAY CATTLE COMPANY	6,937	300
ISTOKPOGA MARSH DRAINAGE DISTRICT (IMDD)*	19,209	11,155
WRP: FISHEATING CREEK	26,000	TBD
WRP: GOLDSTEIN RANCH	40	15
WRP: LOXAHATCHEE SLOUGH	1,699	TBD
WRP: MYRTLE ISLAND RANCH	438	100
WRP: SANTA ROSA RANCH	1,785	500
WRP: TURNPIKE DAIRY	96	15
WRP: WILLLIAMSON CATTLE COMPANY	532	60
B. Designed and/or Permitted	**4,652**	**2,329**
CLEWISTON SITE	724	1,448
FDACS BMP: REYNOLDS FARMS, INC./ROZIER ROAD GROVE	1,473	TBD
SUMICA TRACT	1,920	281
THREE LAKES WILDLIFE MANAGEMENT AREA: G-113 STRUCTURE	535	600
C. Under Construction	**27,729**	**2,137**
FDACS BMP: BAR CRESCENT S	4,030	100
FDACS BMP: CLEGHORN	766	150
FDACS BMP: HAZELIEF	988	11
FDACS BMP: INDIAN PRAIRIE CATTLE CO (JOE PEARCE)	1,750	600
FDACS BMP: OKEECHOBEE PARTNERSHIP	5,800	50
FDACS BMP: SY HYARTT RANCH	6,000	9
FDACS BMP: TILTON	800	191
LAKE OKEECHOBEE PROTECTION PROGRAM (LOPP) PROJECTS	248	202
LAKE WALES RIDGE STATE FOREST / LAKE KISSIMMEE SITE	142	220
SOR - GARDNER COBB MARSH RESTORATION	2,000	TBD
WRP: ARCHBOLD EXPERIMENT STATION	1,194	255
WRP: C A THOMAS 66-4209-5-611	217	TBD
WRP: CONSERVATION FUND WRP 66-4209-5-211	645	53
WRP: LAZY O RANCH	2,594	250
WRP: WINDING WATERS NATURAL AREA	555	46
Subtotal: A - C (Construction Funded)	**91,977**	**16,641**

* Federal funds being pursued for construction

III. Potential Projects, Construction Unfunded – as of February 1, 2011

Project Name	Project Area (ac)	Total Estimated Storage (ac-ft)
A. Feasibility Study Complete	**58,234**	**19,771**
BUCKHEAD RIDGE PROPERTY (TIITF)	38	27
CALOOSAHATCHEE AREA LAKES RESTORATION (LAKE HICPOCHEE)	4,730	2,290
FISHEATING CREEK PROPERTY (TIITF, FWC)	702	867
FISHEATING CREEK MARSH WATERSHED PL-566	50,000	16,500
HARNEY POND PROPERTY (TIITF)	33	30
INDIAN PRAIRIE PROPERTY (TIITF)	2,708	52
OKEECHOBEE PROPERTY (TIITF)	23	5
B. Feasibility Study in Progress	**42,837**	**35,722**
FOUR CORNERS PROJECT	16,593	TBD
LEMKIN CREEK URBAN STORM WATER TREATMENT FACILITY	133	133
MOTTLED DUCK PRODUCTION AREA (TIITF)	TBD	TBD
NICODEMUS SLOUGH ALTERNATIVE WATER STORAGE	15,129	33,860
TAYLOR CREEK (GRASSY ISLAND) INTERIM PROJECT	10,982	1,729
C. Preliminary Design	**10,406**	**12,872**
DUPUIS RESERVE	2,830	4,500
OKEECHOBEE COUNTY EAST/WEST STORMWATER CONVEYANCE	1,000	500
PEARCE / HARTMAN PROPERTY	3,997	1,786
PUTNAM GROVES PROPERTY	2,577	1,595
SEMINOLE BRIGHTON ASR PILOT	2	4,491
D. Designed and/or Permitted	**400**	**4,700**
ROLLING MEADOWS/CATFISH CREEK RESTORATION	400	2,000
TAYLOR CREEK ASR REACTIVATION	TBD	2,700
Subtotal: A - D	**111,877**	**73,065**

5.2.3.1 Easements

The U.S. Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) Wetlands Reserve Program (WRP[8]) offers technical and financial support to land owners who voluntarily agree to protect, restore, and enhance wetlands on their property by placing them in a long-term or permanent conservation easement. To be considered for a WRP easement, the restoration area must be free of any other easements or encumbrances. The District has acquired easements from landowners for restoration projects, such as the Lake Okeechobee Isolated Wetland Program or as the local sponsor for the USACE with the Kissimmee River Restoration Project.

In watersheds where there is an agreement with the NRCS, the area is eligible for participation in the Wetlands Reserve Enhancement Program (WREP). Under this program, the Reserved Rights Pilot Program (RRPP) allows the landowner to reserve grazing rights if it is compatible with the land and consistent with the intended restoration. In the Fisheating Creek

[8] www.NRCS.USDA.gov/programs/wrp

Sub-watershed, the Nature Conservancy and NRCS have been working collaboratively to identify landowners interested in participating in WRP/WREP. There is significant interest and a substantial opportunity in Fisheating Creek to restore hydrology in the basin through WRP. Florida received approximately $29.4 million for annual easement programs in 2010 with an additional $89 million for the Fisheating Creek Wetland Reserve Special Project for the purchase of almost 26,000 acres in easement. Since October 2005, an estimated 582 ac-ft of storage has been created over 5,241 acres on projects under the WRP and another 1,165 ac-ft of storage over 6,543 acres of land is either under construction or in the design phase.

5.2.3.2 Cost-Share

Historically, most cooperative landowner efforts have fallen under the cost-share agreement approach. With this approach, a portion of the project is funded by the landowner and the other portion by another entity. Typically, the landowner assumes responsibility for the long-term operation and maintenance of the cost-shared water management facilities. Cost-share partners typically have included landowners, the FDACS[9], NRCS, local governments, and WMDs.

NRCS Environmental Quality Incentive Program

Implementation of certain FDACS BMPs has resulted in an increase in water storage within the watershed. The NRCS Environmental Quality Incentive Program (EQIP) promotes environmental quality and agricultural production as compatible goals. In the Lake Okeechobee Watershed, the FDACS and NRCS work closely together and improvements are often jointly funded under the FDACS BMP program. Since October 2005, an estimated 1,718 ac-ft of storage has been created over 58,675 acres on projects participating with FDACS and another 2,273 ac-ft of storage over 70,883 acres is either under construction or in the design phase.

Alternative Water Storage / Disposal

The District's cost-share programs, including Alternative Water Storage/Disposal (AWSD) projects, make physical or operational modifications to existing surface water management systems to detain, retain, and recycle excess runoff. The retained water is reduced by evapotranspiration and infiltration into the soil where it recharges aquifers. Since October 2005, an estimated 23,300 ac-ft of storage has been created over 19,096 acres on AWSD projects and another 16,732 ac-ft of storage over 23,777 acres of land is either under construction or in the design phase. Federal funding for NRCS cost-share is still available, although state funding is reduced.

Alternative Water Supply

Alternative Water Supply (AWS) projects reduce reliance on traditional ground and surface water supply sources by utilizing storm water and other water sources. Several projects have received AWS grants for retaining excess surface water runoff and recycling it for irrigation. Typically, the accompanying consumptive use permit specifies that the storm water should be used first, when available, before traditional sources.

[9] www.floridaagwaterpolicy.com

5.2.3.3 Payment for Services

The statutory intent of the NEEPP includes encouraging and supporting the development of creative partnerships to facilitate the further restoration and protection of Lake Okeechobee and the St. Lucie and Caloosahatchee River estuaries.. Therefore, several state agencies are expanding opportunities for Dispersed Water Management whereby private landowners manage water on parts of their property to provide two different water management services: water retention or nutrient (TP or TN) load reduction. These opportunities include the Florida Ranchlands Environmental Services Project, the Northern Everglades – Payment for Environmental Services (NE-PES), and other payment for services opportunities to store and/or dispose of excess surface water.

Florida Ranchlands Environmental Services Project

The Florida Ranchlands Environmental Services Project (FRESP) is a five-year pilot project to field-test and develop a Payment for Environmental Services (PES) program. FRESP partners include eight ranchers, the World Wildlife Fund, the Florida Cattlemen's Association, the FDACS, the FDEP, the UF/IFAS, the NRCS, the MacArthur Agro-ecology Research Center, and the District. The concept consists of working ranches retaining excess stormwater runoff or providing water quality improvement for contracted payments. The PES model program includes a negotiated fixed-term contract with the ranch for a water retention or nutrient reduction service provided above and beyond any other water management efforts such as under the FDACS BMP program. In exchange for the documented service provided by the ranch, the management of water can become a new revenue opportunity for ranchers. This program provides a variety of indirect benefits: retaining water at shallow depths results in native habitat protection and enhancement, paying the ranchers maintains the local tax rolls, and rural employment sustains communities. Using market-like concepts, FRESP has demonstrated the potential of dispersed water management on ranchlands to contribute to the delivery of essential environmental services while encouraging ranchers to maintain cattle production.

Currently, FRESP collaborators are field-testing program elements for producing and documenting water and phosphorus retention services through the implementation of water management alternatives (WMA) on eight volunteer ranches in the Lake Okeechobee Watershed. These eight demonstration WMAs (**Table 5-8**), as well as other FRESP activities, are providing valuable information to demonstrate proof-of-concept and PES program viability, establish roles and responsibilities for implementation on a wider scale, and guide refinement of the PES program, including contracting and pricing of services. Using data collected from the eight demonstration sites, FRESP will be providing analysis of how expanding the number of projects on ranchlands throughout the Northern Everglades can complement existing and planned regional water storage and treatment projects.

Two FRESP pilot participants are in the process of converting to a permanent WRP easement. The WRP design will utilize many of the facilities constructed under FRESP, and it is anticipated that a greater quantity of water management and treatment will be provided.

Table 5-8. Annual average estimate of FRESP water management alternative acres, water retention, and phosphorus retention.

	WMA Inundated Area (acres)	WMA Service Area (Including Inundated Influenced Acres) (acres)	PWRM Estimate of Incremental Retention Post WMA (ac-ft)	Annual Estimated Phosphorus Reductions Post WMA (lbs)	Annual Estimated Phosphorus Reductions Post WMA (mt)
Rafter T Ranch	942	1624	850	795	—
Lightsey XL Ranch	364	364	227	295	—
Payne & Sons Ranch	367	367	164	295	—
Syfrett Ranch	521	2197	939	878	—
Williamson Ranch	241	659	303	139	—
Alderman – Deloney Ranch	49	322	138	40	—
Buck Island Ranch	3,748	3,748	2,411	3,434	—
Total Across Water Retention WMAs	**6,232**	**9,281**	**5,032**	**5,876**	**2.7**
Lykes West Waterhole Pasture	2,500	2,500	NA	7,220	
Total Across P Reduction WMA	**2,500**	**2,500**	**5,600**	**7,220**	**3.3**
Total All WMAs	**8,732**	**11,781**	**10,632**	**13,096**	**6**

Source: World Wildlife Fund and SFWMD.

Northern Everglades – Payment for Environmental Services

The Northern-Everglades – Payment for Environmental Services (NE-PES) Dispersed Water Management Solicitation Program is an innovative approach to delivering environmental services that has emerged from the FRESP. Now expanded in the Northern Everglades, the NE-PES program will offer eligible cattle ranchers the opportunity to compete for contracts for water and nutrient retention. The goal of the NE-PES is to establish relationships via contracts with private landowners to obtain the water management services of water retention and nutrient retention to reduce flows and nutrient loads to Lake Okeechobee and the estuaries from the watersheds. The NE-PES is a working program that keeps ranchers working. Benefits of the program include:

- **Cost effective for the public.** Payment for environmental services encourages innovation in the provision of needed ecosystem services from working cattle ranches as a complement to the construction of public works projects.
- **Economic sustainability for ranchers.** By creating a new commodity that ranchers can produce together with cattle and other activities, it helps strengthen the overall economic stability for cattle ranches – keeping private lands in private hands.

- **Good for the environment.** In addition to helping meet Northern Everglades water retention and phosphorus reduction goals, enhanced profitability reduces the pressure to convert ranchlands to development or other agricultural uses that could exacerbate water problems and habitat loss. On-ranch implementation also provides for earlier environmental results, ahead of public works construction schedules.
- **Practical to implement and administer.** An open and competitive process, fixed-term contracts, and clear documentation procedures ensure that, if selected, participating ranchers have the opportunity to demonstrate positive environmental stewardship while receiving payment for such valued services.

The NE-PES dispersed water management program will:

- Reduce volume and rate of flow to Lake Okeechobee to help keep the lake within a preferred stage envelope in both wet and dry years and reduce damaging discharges to the estuaries
- Contribute to achievement of the Lake Okeechobee TMDL for total phosphorus and meeting other water quality criteria
- Reduce nutrients entering the estuaries
- Provide for habitat enhancement for multiple species at a watershed scale
- Contribute to the financial viability of cattle ranching as a more extensive working agricultural land use.

The District is responsible for administering this program in coordination with FDACS, FDEP, and NRCS. Additional information is included in Section 6.3.1.

5.2.3.4 Other Studies

The District continues to identify other opportunities to store and/or dispose of excess surface water until the planned regional facilities become operational. From a cost-benefit perspective, the most promising projects are evaluated under the Dispersed Water Storage and Treatment Initiative. Many projects have been assessed and can be found in **Table 5-7**.

5.2.4 Development of Sub-Watershed Conceptual Plans

5.2.4.1 Fisheating Creek Feasibility Study

The objective of this study is to identify the best mix of storage and water quality features to improve the hydrology and water quality within the Fisheating Creek Sub-watershed. The study's preferred plan is anticipated to contribute towards meeting the Lake Okeechobee total phosphorus TMDL and support the holistic restoration of Lake Okeechobee.. Fisheating Creek drains into Lake Okeechobee from the west and is the only sub-watershed with an uncontrolled, native discharge to the lake. The sub-watershed is characterized by extremely flashy flows and is one of the major sources of phosphorus loading to Lake Okeechobee.

The Phase I investigation of available information and work plan development were completed in March 2009. The report included the historic and existing site conditions of the

Fisheating Creek Sub-watershed study area to depict its overall characteristics for development of the feasibility report.

The District is currently working on the formulation and evaluation and selection of a preferred plan. Through extensive involvement with stakeholder groups and interagency coordination, preliminary planning targets for achieving storage and water quality improvements (phosphorus load reduction) have been identified by the planning team. These targets were based on an analysis of output from Watershed Assessment Model simulations of pre-drainage and existing conditions in the Fisheating Creek Sub-watershed. Also a conceptual inventory of local and sub-regional project features to address phosphorus load reduction and storage targets is completed. However, multiple current activities are occurring in the project area, such as the Fisheating Creek Wetland Reserve Special Project and the Northern Everglades – Payment for Environmental Services Dispersed Water Management Solicitation Program. Furthermore, the U.S. Fish and Wildlife Service and its partners recently proposed the "Greater Everglades Partnership Initiative," which will help conserve land, water, and wildlife resources. Fisheating Creek is one of the three study areas identified under this initiative. Collectively, these programs are expected to help towards achieving the storage and water quality objectives for the Fisheating Creek Sub-watershed.

The next step for the feasibility study will be to identify areas within the sub-watershed with the greatest variation between existing and pre-drainage conditions where including a storage or treatment feature will provide the greatest return on investment. The Fisheating Creek feasibility report will document the planning process, describe the preferred plan components, identify benefits likely to result from implementation of the preferred plan, and include conceptual costs and an implementation schedule. The feasibility report is scheduled for completion in the beginning of 2012

5.2.4.2 Taylor Creek Site Feasibility Study

The objective of this study is to evaluate alternatives and develop a preferred plan for water quality and storage options for the Taylor Creek/Grassy Island property in accordance with the proposed objectives of the P2TP. Phase I of this project will evaluate existing information from previously proposed projects, such as the Taylor Creek Reservoir and the Lake Okeechobee Interim Water Storage Project, on the Taylor Creek/Grassy Island site and evaluate alternatives for development of a preferred plan to provide water quality benefits to the Taylor Creek Sub-watershed. The Phase I Draft Final Report is under development and scheduled for completion by October 2011. Phase II activities will be determined based on the results of Phase I. The contract and associated tasks of the HydroMentia Algal Turf Scrubber technology has been completed (Section 5.1.3.10). Currently, the algal turf facility is being retrofitted to implement Hybrid Wetland Treatment Technology at the site by March 2011.

5.3 Research and Water Quality Monitoring Program

Research and assessment activities completed since the 2007 update include: (1) conclusion of a pasture water management study, (2) reevaluation of sod farm phosphorus budgets, (3) completion of Phase I of the Northern Everglades Chemical Treatment Pilot, (4) implementation and evaluation of six HWTT projects, (5) application of the Lake Okeechobee WAM, (6) start-up operations at the Taylor Creek STA, and (7) the completion of additional isolated wetland restoration sites. Several parts of this program have been addressed elsewhere in this report, such as:

- The Taylor Creek STA removed 1.35 mt of phosphorus from June 2008 through February 2009; however, operations were halted due to a culvert failure. Culvert repairs were completed and flow through operations began in September 2010 (Section 5.2.1.1).
- The cow/calf research program was completed in March 2009 to provide recommendations for the development and implementation of environmentally and economically sustainable cow/calf practices in the Lake Okeechobee Watershed (Section 5.1.3.6).

Isolated Wetland Projects

Two wetland restoration projects were completed in July 2008, located at the Eckerd Youth Center, a state-owned property, and the Nubbin Slough Area A. These projects were designed to enhance and restore wetlands, reduce TP loads, and retain stormwater flows by increasing regional water storage in the Lake Okeechobee Watershed.

Six additional isolated wetland projects were implemented under various LOPP components: Lemkin Creek, Eckerd Youth, Kirton Ranch, Lofton Ranch, Lamb Island West, and Smith Okeechobee. Surveillance of these systems will continue in varying forms in the interest of obtaining additional information regarding their functioning as improved habitat, and in some cases, from the perspective of actual water storage capability.

Sod Farm Phosphorus Budget

The sod farm phosphorus budget was reevaluated to determine whether sod farms are exporters of phosphorus. This study, which was completed in 2009, determined that sod farms are net exporters of phosphorus and TN for certain soil types (muck and sand) and typical grass types (St. Augustine, Bahiagrass, Bermuda, and Zoysiagrass).

WAM Enhancement and Application in the Lake Okeechobee Watershed

This project was completed in July 2009. An assessment tool was developed to evaluate the water quality improvements in the watershed from the various phosphorus control programs (HDR and SWET 2009). As part of this study, a panel of five experts completed a peer-review of the WAM and included seven major recommendations in the final report. The overall objective of the current project is to address all of the panel's major recommendations except for recommendation 2 (sensitivity analysis) and 5 (uncertainty analysis). The sensitivity and uncertainty analyses will be completed next year if funding is available. The current study, which will be completed in April 2011, will improve documentation of the model, ensure that scientifically sound calibration and validation procedures are followed using established and objective goodness-of-fit measures, and test the model.

Research, demonstration, and assessment projects that are under way or have been completed since the previous update in 2007 are summarized in **Table 5-9**.

Table 5-9. Status of Lake Okeechobee Watershed research, demonstration, and assessment projects**.**

Project Name (Investigator)	Major Objectives and Findings	Status
Taylor Creek Algal Turf Scrubber Nutrient Recovery Facility (HydroMentia, Inc.)	This facility contains 3.6 acres of effective treatment area and was located on a 70-acre parcel owned by the District in the S-191 basin. The facility was expected to remove 1.81 mt of TP per year, but water quality data to date demonstrate only minimal phosphorus removal of 0.05 mt per year. The project concluded on May 31, 2010 (see Section 5.1.3.10).	Complete
Mike SHE/Mike 11 Application in the S-191 Basin (SFWMD)	The objective of this study was to develop a model to quantify the long-term hydraulic capacity for different water management projects. These include retention/detention ponds, STAs, and Dairy Best Available Technologies (DBATs). The model has been calibrated and validated to observed data. To date the model has simulated alternatives that include the Taylor Creek STA and Davie DBAT.	Complete
Nutrient Budget Analysis for the Lake Okeechobee Watershed (HDR)	The overall objective of this study is to determine the relative contribution and sources of TP and TN from identifiable sources and land uses. Specific tasks were to: (1) obtain the TP and TN import and export data and develop the gross import, gross export, and net import coefficients (the import or export amount per unit area) by land use; (2) upgrade the graphical user interface tool to view input data including farms, drainage basins, hydrographic features, land uses, soil types, and nutrient (TP and TN) budget results using ArcGIS; (3) perform a mass balance analysis of TP and TN for each land use and contrast the results with the 2002 study; (4) obtain the baseline data for TN at different spatial levels; and (5) obtain the relationships between net nutrient (TP and TN) imports and basin characteristics (land use type, soil type, stream type, etc) for each basin. The final project report was completed in 2010.	Complete
Watershed Assessment Model Documentation and Validation (Soil and Water Engineering Technology, Inc.)	In April 2009, a panel of five experts completed a peer-review of the Watershed Assessment Model (WAM) and included seven major recommendations in the final report. The overall objective of this project is to address all major recommendations by the panel, except recommendation 2 (sensitivity analysis) and recommendation 5 (uncertainty analysis). The sensitivity and uncertainty analyses will be completed next year if funding is available. It is also recognized that the completion of detailed documentation is necessary for future work to address these two recommendations. This study will improve documentation of the model, ensure that scientifically sound calibration and validation procedures are followed using established and objective goodness-of-fit measures, and test the model. This project will be completed in April 2011.	Ongoing
Northern Everglades Chemical Treatment Pilot Project	This project is designed to investigate available information on chemical treatment technologies that have been tested to reduce total phosphorus loads in stormwater runoff and to identify technologies appropriate for use in the Kissimmee, Okeechobee, and Everglades areas. The existing information shows the use of chemicals to control phosphorus in discharges from watersheds is well established and is a viable, cost-effective option for consideration by decision makers. The first phase was completed in July 2009 and concluded that various technologies may be viable and effective options for reducing phosphorus loads. Under Phase II, implementation costs and site selection analysis for chemical treatment technologies in the Northern Everglades were completed in October 2010	Complete

Project Name (Investigator)	Major Objectives and Findings	Status
Hybrid Wetland Treatment Technology (Watershed Technologies, LLC)	This project involves the design, deployment, and monitoring of Hybrid Wetland Treatment Technology (HWTT) facilities in the St. Lucie and Lake Okeechobee watersheds. In 2008, four HWTT systems were constructed and operational and optimization efforts were initiated. Three of the HWTT facilities – the 0.7-acre Ideal 2 Grove system, the 1.7-acre Nubbin Slough system, and the 1.4-acre Mosquito Creek system – are continuous-flow systems (subject to water flow availability), while the fourth is used for batch treatment of waters. Two additional systems were constructed on Wolff Ditch and Lemkin Creek and began operation in late 2009. These systems show promising results with TP concentration reductions ranging between 87 and 95 percent. Five systems (dairy lagoon system was discontinued) are being operated for phosphorus load reduction and evaluated for cost effectiveness through March 2011. An additional system will be constructed and begin operations by March 2011 at the District's Taylor Creek/Grassy Island property. Further implementation of these systems will be determined based on this additional information (see Section 5.1.3.1).	Ongoing
Wetland Soils Nutrient Criteria Development and Evaluation of "Safe" Soil Phosphorus Storage Capacity (UF/IFAS)	The overall objective of this project is to identify routine soil tests that can be used as indicators of phosphorus release from the soil to the water column in wetland soils across wetland locations and types. The first task involves synthesis of all relevant data available on wetland soils within the Lake Okeechobee Watershed to identify critical gaps in the dataset. A protocol for field soil sampling, laboratory analysis, and statistical interpretation of data will be developed. The validity of numeric phosphorus criteria and "safe" phosphorus levels in wetland soils will be evaluated on 200 samples from the watershed and other wetland sites in South Florida. The final report will include the accuracy of numeric phosphorus criteria that could be used for predicting phosphorus release in wetland soils. The project was completed in August 2010 (see Section 5.1.3.8).	Ongoing
Permeable Reactive Barrier Technology (UF/IFAS)	This project evaluates the incorporation of water treatment residuals or similar materials capable of interception and long-term sequestration of phosphorus into permeable reactive barriers (PRBs) in the Lake Okeechobee Basin before phosphorus enters the water conveyances into the lake. Feasibility assessment of the PRB technology in reducing loads was completed in December 2009. This effort was followed by laboratory testing of materials for construction and design and, which was completed in September 2010. Construction of the pilot PRB project is expected to start in 2011 based on funding availability. Post-BMP monitoring will then commence after installation (see Section 5.1.3.9).	Ongoing
Demonstration of Water Quality BMPs for Beef Cattle Ranching in the Lake Okeechobee Watershed (UF/IFAS)	Limited data exists on the effectiveness of the ranchland Best Management Practices (BMPs) (e.g., water retention in wetland and pasture). The goal of the project is to evaluate the cow-calf BMPs (cattle fencing and wetland/pasture water retention) with regards to water storage and flows, phosphorus loads, and economic feasibility. Specific objectives include (1) design a hydrologic and water quality monitoring network for testing the BMPs at a cow-calf ranch in the Lake Okeechobee Watershed; (2) collect and analyze the long-term baseline and post-BMP hydrologic and water quality data (surface and groundwater); (3) use the monitoring data to evaluate the selected hydrologic and water quality models for their efficacy in simulating the BMP effects; (4) use the models to refine the BMPs for optimizing ranch-scale water and phosphorus retention; and (5) disseminate the project results to ranchers and state and federal agencies. The water retention BMP is being evaluated at two BMP sites. Results from the water retention BMP are important for the basin-wide implementation of ranchland water storage projects in the watershed. This project is scheduled to continue through June 2011 (see Section 5.1.3.7).	Ongoing

Project Name (Investigator)	Major Objectives and Findings	Status
Protocol Development to Evaluate the Effect of Water Table Management on Phosphorus Release to Drainage Water (UF/IFAS)	A thorough understanding of potential phosphorus release from soils is critical for the successful implementation of water table management. A protocol for evaluating soils applied with dairy, beef, and inorganic fertilizer has been developed through this project. The protocol uses three easily determined parameters: Mehlich 1-phosphorus, iron, and aluminum. With the possible introduction of the new phosphorus risk assessment tool on a national scale, the project aims at developing the criteria for water table management (and other BMP implementations) using a Mehlich 3 solution for the ability of the risk assessment factor to be more uniform in interpretation and recommendations from state to state. The protocol using Mehlich 1 parameters will shortly be uploaded and updated when information using Mehlich 3 parameters (the new soil test for Florida) become available. The new criterion for phosphorus risk assessment needs to be extended to wetland soils to account for additional phosphorus storage in association with organic matter above and beyond the mineral fraction. This project is scheduled to continue through June 2011 (see Section 5.1.3.8).	Ongoing
Wetland BMP Research (UF/IFAS)	Long-term monitoring is required to determine the effect of restoration on phosphorus assimilation capacity of isolated wetlands. The study objectives are to: (1) demonstrate and determine the efficacy of isolated wetlands located in land areas used for dairy and cow/calf operations on phosphorus assimilation and storage; (2) determine the effect of hydrological restoration on water storage and flow paths; (3) determine the change in phosphorus storage in wetland and surrounding upland soils and vegetation, as a result of restoring hydrology; (4) determine the composition and stability of soil phosphorus (non-reactive phosphorus) under a wide range of hydrologic conditions; and (5) validate hydrologic and phosphorus models for adaptation to the Lake Okeechobee Watershed and use these models to simulate phosphorus retention capacity. Results of this study will quantify on how hydrology, nutrient cycling dynamics, and cattle affect retention and stability of phosphorus in isolated wetlands. These measurements will be extrapolated basinwide to assess phosphorus retention by isolated wetlands. The project started in 2003 and is scheduled to run through calendar year 2011 (see Section 5.1.3.5).	Ongoing
Technical Evaluation of the Lake Okeechobee Watershed Assessment Monitoring Network	The District completed the evaluation of the Lake Okeechobee Watershed Assessment (LOWA) Monitoring Network in WY2010 for the Taylor Creek/Nubbin Slough Sub-watershed. Evaluations of the remaining sub-watersheds will be completed internally during WY2011 and WY2012, resulting in a process for future ongoing annual evaluations. The purpose of this District evaluation is to analyze historical TP data to determine the most efficient system of sample collection and data analysis. Another objective of the evaluation is to develop a scientific process to identify areas of concern within the watershed and to manage the dynamic sampling network.	Ongoing
Long-term Water Quality Trends and BMPs in the Lake Okeechobee Watershed (SFWMD)	The project objectives were to: (1) obtain the baseline conditions characterizing phosphorus and nitrogen concentrations in the monitored tributaries of the Lake Okeechobee Watershed; (2) conduct the Seasonal Kendall Tau test to verify the statistical significance of the trends in the time series of monthly average total phosphorus concentrations by station, land use, and basin; and (3) evaluate the effectiveness of various BMPs implemented through the Lake Okeechobee Protection Program and other reduction programs implemented during past two decades. The project was completed in December 2008.	Complete

Project Name (Investigator)	Major Objectives and Findings	Status
Pasture Water Management for Reducing Phosphorus Loading in the Lake Okeechobee Watershed (Archbold Expeditions)	This project evaluated the technical feasibility of on-ranch pasture water retention/detention as a tool for reducing phosphorus loads from beef cattle ranches. The potential impact of this practice on cattle and forage production was also studied. Water control structures were installed in the ditches around pastures to allow for the management of water during high- and low-flow periods. Pasture water retention reduced nutrient loads from the pastures, but the effect was stronger and more consistent for TN than TP. Cattle and forage production did not appear to be affected. Pasture water management to reduce total phosphorus loads should be most successful in situations where significant reductions in flow volume can be achieved (see Section 5.1.3.7).	Complete
Watershed Assessment Model Enhancement and Application in the Lake Okeechobee Watershed (Soil and Water Engineering Technology, Inc.)	The overall goal of this project was to develop an assessment tool that evaluates various phosphorus control programs to maximize water quality improvements in the Lake Okeechobee Watershed. Specific objectives are to: (1) update WAM input datasets to the latest District land use and phosphorus control efforts; (2) add an enhanced submodel to WAM to better represent internal lake processes in the Kissimmee Upper Chain of Lakes; (3) set the hydrography of the entire northern basins into an integrated flow network; (4) complete a full recalibration and verification of WAM for all of the northern Lake Okeechobee basins using all available monitoring data; and (5) evaluate the effectiveness of the field-level BMPs and the basin/regional-level phosphorus control projects or performance measures on phosphorus load reductions to the lake. The project was completed in July 2009.	Complete
The Use of Composted Animal Waste (Cowpeat) as a Replacement for Canadian and Florida Peat in Potting Material (UF/IFAS)	With increasing attention on sustainable agriculture, the ornamentals industry is seeking alternative materials for partial or complete substitution of peat to reduce peat mining and chemical fertilizer application. The dairy industry aims to minimize dairy manure resulting in less phosphorus in runoff or leaching. Results from this project have demonstrated the mutual benefits between the ornamental and dairy industries. The results can be summarized as follows: (1) potting media containing cowpeat requires no lime materials such as dolomite to neutralize pH, which reduces the cost in potting media preparation by at least $200/acre/year; (2) when containing 30 percent cowpeat in volume, this mix reduces peat use by 50 percent (a reduction of peat use by at least 240 cubic yards/acre/year, equivalent to a saving of $4,000/acre/year); (3) potting media containing 10 to 30 percent cowpeat requires no fertilizer application, which means saving $2,000 to $4,500/acre/year; (4) plants produced from media containing 10 to 30 percent cowpeat by volume are larger and reach marketable size at least 15 days earlier than those produced with chemical fertilizers, which reduces labor cost and water use; and (5) composting dairy manures can significantly reduce environmental problems, converts the manures into useful organic materials, and provides potential income to dairy producers.	Complete
Nutrient Study for Sod Production in Lake Okeechobee Watershed (UF/IFAS)	The objective of this study was to reevaluate sod farms' phosphorus budget to determine if sod farms are net exporters of phosphorus. The study included a phosphorus use survey, soil/sod sample collection to analyze TP contents, and phosphorous budget analysis. This study also provided some understanding of TN export from sod farms. The project was completed in August 2009.	Complete
Northern Everglades Chemical Treatment Pilot Project Phase I, Literature Review	This project was designed to investigate available information on chemical treatment technologies to reduce TP loads in stormwater runoff and to identify technologies appropriate for use in the Kissimmee, Okeechobee, and Everglades areas. The existing information shows the use of chemicals to control phosphorus that discharge from watersheds is well established and is a viable, cost-effective option for consideration by decision makers. The project was completed in July 2009 (see Section 5.1.3.2).	Complete

Project Name (Investigator)	Major Objectives and Findings	Status
Legacy Phosphorus Study	About 176,000 mt of legacy phosphorus are within the studied basin that is potentially available for transport to Lake Okeechobee. At the current TP loading it would take about 350 years to wash the existing legacy phosphorus from the watershed assuming phosphorus imports and exports were immediately balanced. However, it is likely that as much as 50 percent of the legacy phosphorus would not be mobile due to soil phosphorus storage capacity and the low mobility of legacy phosphorus that has moved to lower soil layers. Even with a significant portion of the legacy phosphorus being relatively immobile, there is an abundance of legacy phosphorus in the watershed to maintain elevated phosphorus levels going to Lake Okeechobee for many years. Therefore, reduction of new sources of legacy phosphorus and its mobility to the lake through abatement practices will be the only effective means of addressing phosphorus loads to the lake and that these practices must address upland, wetlands and streams legacy phosphorus sources. A legacy phosphorus abatement plan that outlines specific control practices and strategies at different spatial scales, anticipated phosphorus reduction performances, implementation costs, and a general implementation schedule was developed. The approach for the plan was to first meet the tributaries' TMDL followed by regional treatment to obtain additional phosphorus reductions needed to meet the lake TMDL.	Complete
Northern STA Design Criteria	Dynamic Model for Stormwater Treatment Areas Version 2 modeling was used to determine the effects of various design criteria on the cost-effectiveness of phosphorus load reduction for STAs that could be constructed in the Northern Lake Okeechobee Watershed. Review of the fundamental design equations and interpretation of the modeling results demonstrate that many of the design variables are related and adjustments to one force responses in other, which may have either a positive or negative impact on phosphorus removal. The following specific STA design parameters were quantitatively evaluated: location/soils, STA wetted area, TP inflow concentration and mass loading rates, cell number and configuration, water depth, cell aspect ratio, hydraulic loading rate, hydraulic residence time, volumetric efficiency (included as a component of the aspect ratio analysis), deep zone sizing and locations, sediment accretion rate and system life expectancy, levee height considerations, wildlife habitat and public use features, and plant selection.	Complete
Taylor Creek STA Tracer Study	The overall objective of this project is to characterize the Taylor Creek STA hydraulic characteristics, such as hydraulic residence time and the internal distribution of flow, under a "typical" hydraulic loading and depth regime. The District initiated a tracer study that provides this information. The tracer test was completed in October, 2010. The final technical report was completed in 2010.	Complete

5.4 Lake Okeechobee Exotic Species Control Program

The overall goal of the Lake Okeechobee Exotic Species Control Program is discussed in Section 2.5. The District's exotic species control activities include treatment of exotic vegetation. Each year the District aggressively treats exotic vegetation in Lake Okeechobee to protect threatened native habitat and to restore impacted areas of the marsh. As a result, much of the marsh landscape has been altered by vegetation management activity. For example, more than 10,000 acres of torpedograss were treated during the 2004–2006 period, and more than 20,000 acres of torpedograss were treated during the 2007–2009 period. Historic treatment efficacy has varied, but the level of torpedograss control remains high in many areas several years after treatment. Without these treatments, dense monocultures of torpedograss covering tens of thousands of acres would be common in the upper elevation regions of the marsh. Although torpedograss is still present in many areas, its coverage has decreased dramatically. Native plant communities have colonized some of the treated sites and monthly wading bird surveys conducted in 2010 have documented thousands of birds foraging in shallow open water areas previously impacted by torpedograss. Section 3.1.5 provides more details concerning the management of exotic vegetation within Lake Okeechobee's littoral zone.

5.5 Lake Okeechobee Internal Phosphorus Management Program

As described in Section 2.6, the goal of the Lake Okeechobee Internal Phosphorus Management Program is to address internal phosphorus loading from the mud sediments. A variety of activities have been completed to address lake sediment management.

5.5.1 Eagle Bay Dredging

The Eagle Bay Island Habitat Enhancement Dredging Project was conceived to provide habitat restoration benefits and to evaluate technologies for effectiveness in removing mud sediments, utilization of cost-effective disposal options, and sediment stabilization. The project location is in the nearshore region of Lake Okeechobee, east of Eagle Bay Island. Despite intense efforts on the part of SFWMD staff and support from other agencies and multiple consultants, no reliable, cost effective means of initiating the project was found. The lowest cost estimates for removal and drying of less than 2 million cubic yards of in situ sediment exceeded $20 million, not including land costs. Perhaps most significantly, there was no means found to assure longevity of the dredging benefits. One modest-sized hurricane could move sediment onto the newly cleaned benthic surface in less than a day. Consequently, this project is no longer considered viable.

Even with this setback, the importance of managing lake sediments is still widely recognized. The ability to provide clean water to the Everglades depends on having clean lake water. Waiting for natural processes to reduce the sediment phosphorus flux and elevated phosphorus concentrations in the lake water (likely to be 40 to 50 years or more after the watershed clean-up is complete) (Blasland, Bouck & Lee, Inc. 2003) will almost certainly not be acceptable to the relevant regulatory agencies or the public.

5.5.2 Tilling Demonstration Project

Low water levels in Lake Okeechobee related to the 2007 and 2008 drought provided the opportunity to test new management techniques within the lake to help sequester sediment nutrients, improve soil substrates, and enhance desirable wetland vegetation. A demonstration project was conducted in May 2008 on a 40-acre site located adjacent to Indian Prairie Canal in the northwest littoral zone of Lake Okeechobee.

The purpose of this study was to evaluate the effectiveness of tilling the surface organic layer into the underlying sand substrate as a mechanism for: (1) reducing the surficial total and extractable phosphorus levels, and (2) reducing the internal phosphorus loading. The site was divided into eight 5-acre plots to allow for two replicate plots to be treated using two plow techniques.

The vegetation in the study was mowed and then light disking was applied to break up the thick mat of mowed vegetation to facilitate the tilling process. Two plow types (Baker-disk and moldboard) were used to either blend or flip the surface organic layer into the underlying sand substrate. Composite sediment samples were collected at three different depths (0–15 centimeters [cm], 15–30 cm, and 30–60 cm) from each plot before and after plow treatments to evaluate the effect of tilling on the reduction of TP, Mehlich-I extractable phosphorus, total organic carbon, and selected Mehlich-I extractable metals on surface sediments. Sediment samples were also collected from an adjacent untreated site (control). Intact sediment cores for phosphorus-flux studies were also collected from all experimental plots before and after plow treatments.

These results indicate that tilling the organic layer into the underlying sand substrate not only buried the main source of phosphorus to the overlying water column but also exposed a sandy layer low in total and readily available phosphorus. However, caution must be taken when interpreting these results because of the potential for phosphorus fluxes from the buried organic layer over longer periods.

5.5.3 Sediment Scraping

Low water levels on Lake Okeechobee during 2007 and 2008 provided opportunities for the District, in conjunction with the Florida Fish and Wildlife Conservation Commission (FWC), to cost-effectively remove organic sediments from near shore regions of the lake. The environmental benefits of sediment removal included improved water clarity, increased coverage of desirable emergent and submersed plants, and improved fish-spawning and wildlife-foraging habitat. In 2007, approximately 2 million cubic yards (yd^3) of sediments were scraped from six locations between Fisheating Bay and Yankee Point at a cost of about $11 million. Three areas were selected for sediment removal during 2008: (1) Northwest Marsh, (2) Worm Cove, and (3) Horse Island. Total project costs of $1.4 million were funded through state appropriations, the FWC, and the SFWMD. An estimated 369 acres were scraped to remove an estimated 348,000 yd^3 of sediments.

Other sediment management options for future funding considerations are described in Section 6.4.

5.6 Other Related Activities

5.6.1 Kissimmee River Watershed Activities

Several ecosystem restoration initiatives are under way in the Kissimmee River Watershed. The most significant of these projects is the Kissimmee River Restoration Project (KRRP), which includes the Kissimmee River Restoration Evaluation Program and the Kissimmee Basin Modeling and Operations Study

Concerns about environmental degradation and habitat loss in the Kissimmee Sub-watershed and the potential contribution of the channelized river to eutrophication in Lake Okeechobee were the impetus for the KRRP. The KRRP was authorized by the U.S. Congress in 1992 under the Water Resources Development Act. Together, these large-scale restoration projects are intended to achieve the following:

- Re-establish the river and floodplain system's ecological integrity by reconstructing the river's physical form and re-establishing pre-channelized hydrologic characteristics (stage and discharge)
- Modify the water storage and regulation schedule to approximate historical flow characteristics of the Kissimmee River system
- Increase the quantity and quality of shoreline habitat in Kissimmee, Hatchineha, Tiger, and Cypress lakes for the benefit of fish and wildlife

Structural and operational modifications for the restoration will be completed without jeopardizing existing levels of flood control in the Kissimmee Basin. The $634 million project is funded under a 50/50 cost-share agreement between the SFWMD and the USACE. Engineering and construction components of the project are the responsibility of the USACE, while the District's purview is land acquisition and ecological evaluation of the restoration project. Since 1992, the SFWMD has invested approximately $341 million to acquire nearly all 102,061 acres needed for this restoration effort.

Restoration components encompass (1) acquiring 65,603 acres of land in the Lower Kissimmee Sub-watershed, of which approximately 98 percent have been acquired to date, (2) backfilling 22 miles of the C-38 canal (over one-third of the canal's length) from the lower end of Pool D north to the middle of Pool B, (3) reconnecting the original river channel across backfilled sections of the canal, (4) recarving sections of river channel destroyed during C-38 construction, (5) removing the S-65B and S-65C water control structures and associated tieback levees, and (6) modifying operations at C-38 structures. The material used for backfilling is the same material that was dredged during construction of the C-38 canal. Composed primarily of sand and coarse shell, this material was deposited in large spoil mounds adjacent to the canal.

The KRRP is expected to restore ecological integrity to approximately one-third of the river and floodplain, modifying a contiguous area of the floodplain and river ecosystem of over 39 square miles (mi^2). More than 20 mi^2 of wetlands will be reestablished in areas that were drained by the canal, and flow will be returned to 40 miles of reconnected river channel. In the Upper Kissimmee Sub-watershed, over 7,000 acres of littoral marsh are expected to develop on the periphery of the four regulated lakes (USACE 1996).

As the restoration effort proceeds, some positive ecosystem changes already have been observed. Sandbars and sandy bottom have appeared in the river bed and in formerly isolated sections of the river as flow has returned to remnants of the river channel. Emergent and shoreline vegetation have reappeared and are thriving. Other improvements include increased dissolved oxygen levels, reductions in accumulated sediments, and increased populations of bass and sunfishes in river channels, as well as increased use of the river and floodplain by various bird species. Since the completion of Phase I construction in 2001, waterfowl have returned to the floodplain and wading bird densities have exceeded the projected restoration expectation in this area.

5.6.1.1 Kissimmee River Restoration Construction

Reconstruction of the river and floodplain's physical template is being implemented in four phases currently projected for completion in late 2014 (**Figure 5-21**). To date, 14 of 22 miles of canal have been backfilled and near-continuous water flow has been reestablished in the project area.

Phase I construction of the KRRP was completed in February 2001. Approximately 7.5 miles of the canal were backfilled in Pool C and the southern portion of Pool B, nearly 1.3 miles of river channel that had been obliterated during canal construction were recarved, and water control structure S-65B was demolished. These efforts reestablished flow to 14 miles of continuous river channel and allowed for intermittent inundation of 5,792 acres of floodplain.

The second construction phase (Phase IVA) was completed in September 2007. This phase extends north into Pool B from the northern terminus of the Phase I project area. Phase IVA reconnected four miles of historical river channel by backfilling 2 miles of C-38, and is expected to recover 512 acres of floodplain wetlands.

Phase IVB continued upstream of Phase IVA and was finished in December 2009.

Phase II/III, the last phase of construction, will extend from the southern terminus of Phase I downstream into Pool D. It will involve backfilling 8.5 miles of canal, removing one water control structure, and extending the length of reconnected river channel by 16 miles. It is scheduled to begin in 2012 and be complete by late 2014.

While the restoration phases were originally named in the order of expected completion, the sequence has changed over the years for logistical reasons (i.e., budgetary considerations, coordination with land acquisition, or ease of access). Other KRRP construction recently completed or ongoing includes the following:

- **S-68 Spillway Addition.** When Kissimmee River floodplain water levels restrict Lake Istokpoga Basin discharges via the Istokpoga Canal, the S-68 spillway addition, located at the main outlet of Lake Istokpoga, will offset the loss of discharge capacity by allowing more flow through the C-41A canal located between Lake Istokpoga and the C-38 canal. Construction is scheduled for completion in 2010.

- **S-83/S-84 Spillway Additions.** The S-83/S-84 spillway additions (located along the C-41A canal between Lake Istokpoga and Pool E of the Kissimmee River) increased the conveyance capacity of the C-41A canal. These additions were completed in 2008.
- **Istokpoga Canal Improvements.** An old, deteriorating structure was replaced with a new water control structure (S-67) that has a 400-cfs capacity with culverts and riser gates. In addition, the canal was dredged to a 30-ft bottom width, a spoil mound was removed, a tieback levee to the new structure was built, and a new public boat ramp and parking facility was constructed. Construction was completed in 2010.
- **C-37 Canal Widening.** The USACE's contract to widen the C-37 canal was selected under the American Recovery and Reinvestment Act of 2009 for federal funding. This project will widen and deepen the C-37 canal between Lake Hatchineha and Lake Kissimmee by removing 780,000 to 1,000,000 yd^3 of material from C-37. The project will provide greater water conveyance capacity between the two lakes to maintain the same level of flood control once the KRRP is completed.
- **River Acres Flood Reduction.** This construction will include dredging, widening, and lengthening of the River Acres navigation canal and construction of a water control structure to protect this residential development along the river and to allow some flow through the canal. A new bridge also will be built over the canal to maintain River Acres residents' access to their property.
- **CSX Bridge Replacement.** The existing CSX railroad will be modified by providing an elevated single track railroad bridge and removing the embankment and culverts. This will allow restoration of the historic Kissimmee River channel near the boundary between Highlands and Okeechobee counties. Construction should begin in September 2010 with an expected completion in September 2012.
- **Pool D Oxbow Excavation and Embankment.** Several historic oxbows in Pool D will be dredged and reconnected to form a continuous river channel. An embankment will be built along the C-38 canal in this area to help with headwater elevations at S65DX1. Construction will begin in September 2010 with an expected completion in March 2012.
- **Rolling Meadows/Catfish Creek Wetland Restoration.** Rolling Meadows Ranch lies along the south shore of Lake Hatchineha. The property was purchased by the SFWMD and FDEP as part of the KRRP. Approximately 2,300 acres of wetlands will be restored, possibly fed by water from Lake Hatchineha when lake stage exceeds a certain elevation and from Catfish Creek, which flows through the property. The wetland will be managed to mimic the natural hydroperiod of the lake and will provide enhanced wetland habitat for wildlife. Project features are currently under design. The main feature will likely include breaches in the levee along the south side of Lake Hatchineha to allow water levels on the property to fluctuate along with the lake. A secondary feature will include restoration of the historical channel of Catfish Creek through the property.

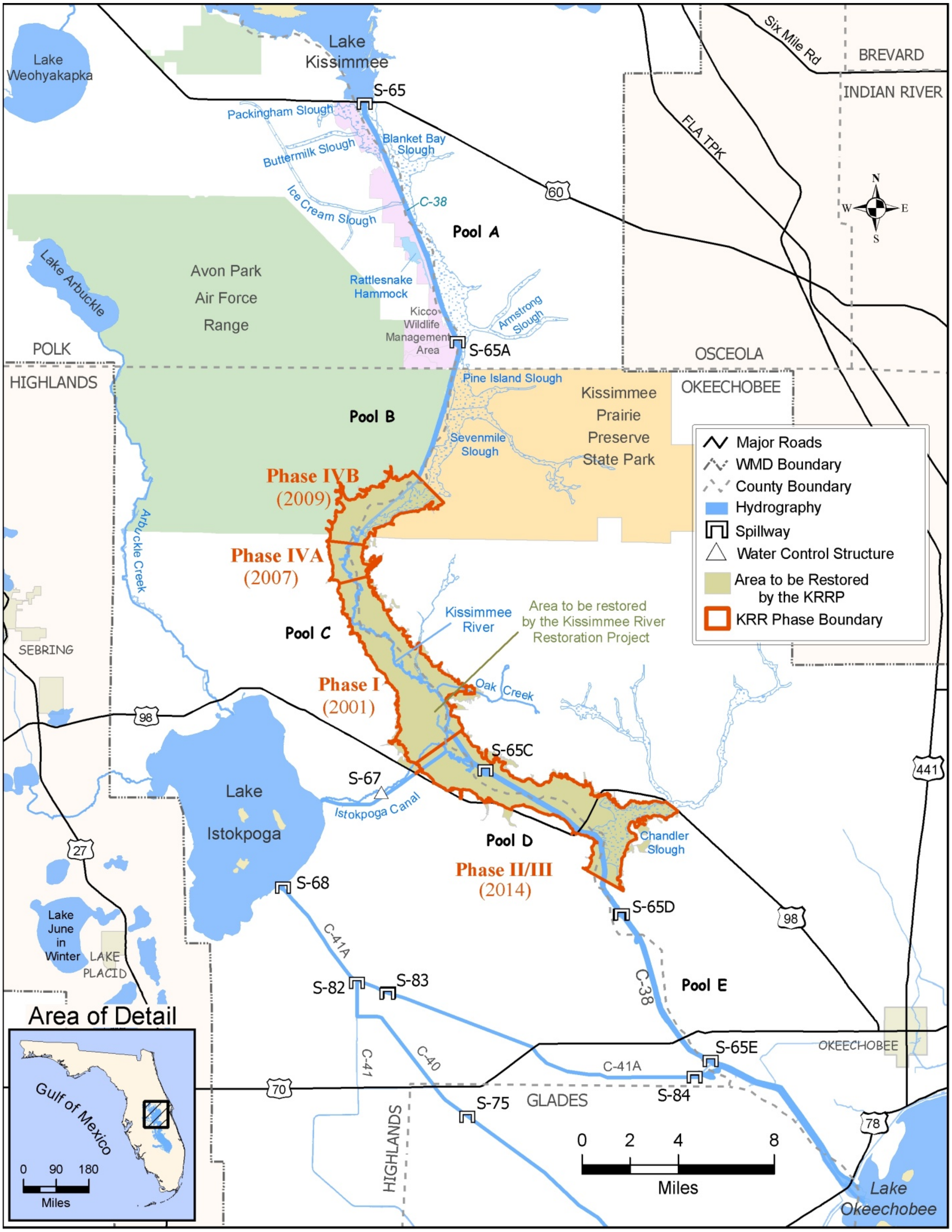

Figure 5-21. The Lower Kissimmee Basin showing the Kissimmee River Restoration Plan.

5.6.1.2 Kissimmee River Headwaters Revitalization

The KRRP is designed to provide sufficient storage in the headwater lakes in the Upper Kissimmee Basin (**Figure 5-22**) to allow water regulation to approximate historical flow and volume characteristics in the Kissimmee River. An additional expected benefit is the improvement of the quantity and quality of lake littoral zone habitat in Lakes Kissimmee, Hatchineha, Tiger, and Cypress (USACE 1996). The KRRP will culminate with the implementation of a new stage regulation schedule, called the Headwaters Revitalization Schedule, to operate the S-65 water control structure at the outlet of Lake Kissimmee. The new schedule will allow water levels to rise 1.5 ft higher than the current schedule and will increase the water storage capacity of Lakes Kissimmee, Hatchineha, Cypress, and Tiger by approximately 100,000 ac-ft. Canal and structure conveyance capacities are also being increased to accommodate increased storage volumes. Approximately 97 percent of the 36,612 acres of land surrounding these lakes that will be impacted by the higher water levels have been acquired, and all projects (with the exception of the C-37 widening project) to increase the conveyance capacity of canals and structures are in place to accommodate the larger storage volume. The Headwaters Revitalization Schedule is scheduled for implementation in 2015 when the canal backfilling and other restoration construction along the river are projected to be completed.

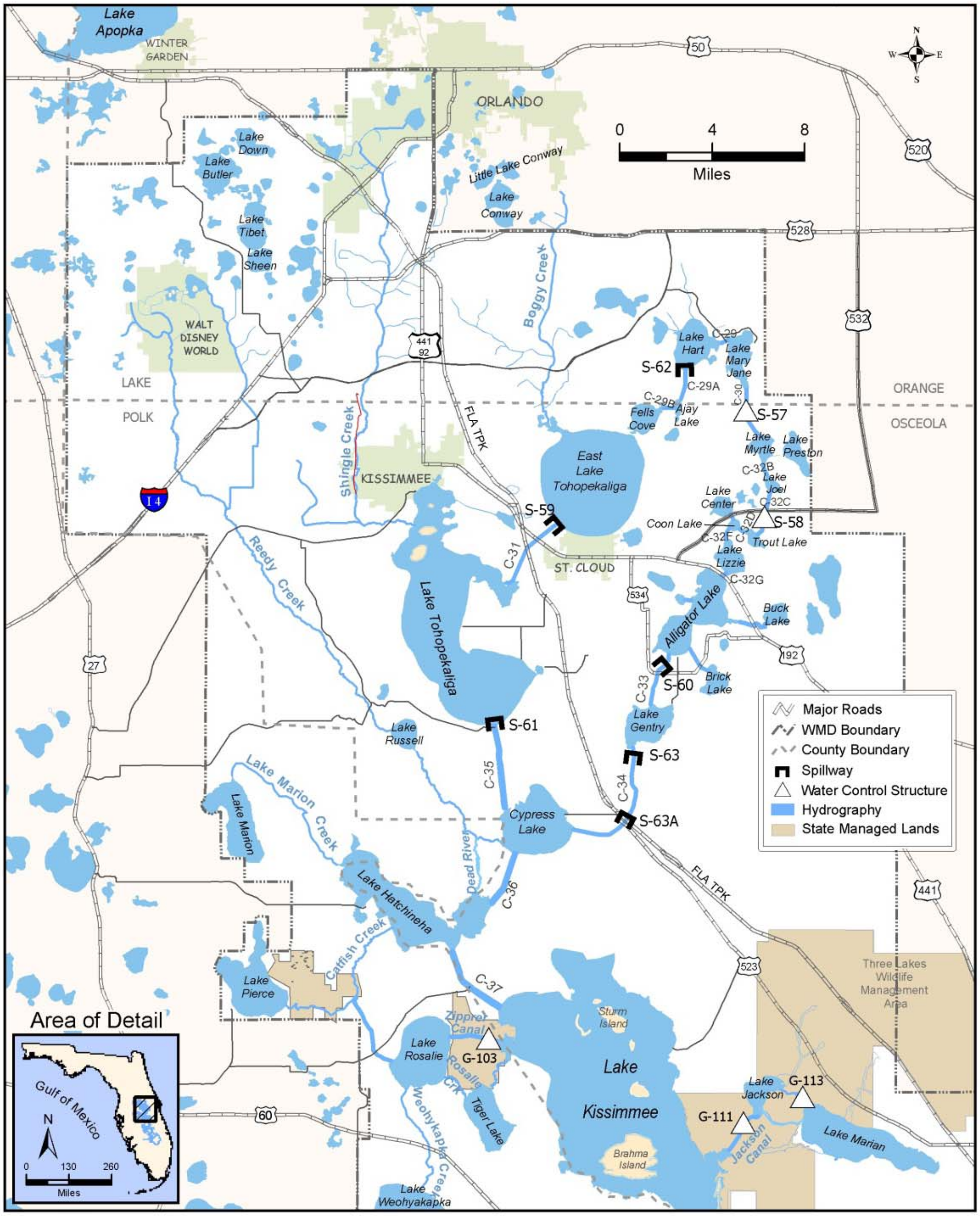

Figure 5-22. The Upper Kissimmee Basin.

5.6.1.3 Kissimmee River Restoration Evaluation Program

Evaluating the success of the KRRP is required by the District's cost-share agreement with the USACE. The Kissimmee River Restoration Evaluation Program will track restoration success using 25 performance measures (SFWMD 2005) to evaluate how well the project meets its ecological integrity goal. The performance measures were developed from reference conditions based on data from the pre-channelized Kissimmee River, published data from relatively undisturbed but similar systems elsewhere, and experimental studies.

Assessments include studies of hydrology, geomorphology, water quality, river channel and floodplain vegetation, aquatic invertebrates, herpetofauna (amphibians and reptiles), fish, and birds. Some of these ecological components are already indicating significant changes consistent with those predicted by the performance measures (SFWMD 2010). Monitoring for ecological evaluation of restoration success will continue for at least five years after construction is completed or until ecological responses have stabilized. Many of the performance measures, particularly those related to floodplain responses, depend on full implementation of the revised water regulation schedule in 2015.

Water quality monitoring conducted under the Kissimmee River Restoration Evaluation Program places special emphasis on phosphorus and dissolved oxygen. Restoration of natural filtration, aeration, and biological processes in the river and its floodplain is expected to improve water quality with respect to phosphorus and dissolved oxygen. So far, average dissolved oxygen concentrations have increased to expected levels in the river channel (SFWMD 2010), but phosphorus concentrations and loads have not yet declined. The lack of change in phosphorus is probably due in part to hydrologic conditions that have not been fulfilled. In the years since Phase I construction was completed, the restoration area has experienced several tropical storms and hurricanes and two droughts. Instead of prolonged inundation of the floodplain, which is expected after the Headwaters Revitalization Schedule is implemented, much of the floodplain has been dry for long periods with only intermittent flooding. These conditions have not allowed development of the expected mosaic of wetland plant communities or effective filtration and assimilation of phosphorus as water overflows the river banks and moves slowly over the floodplain.

5.6.1.4 Phosphorus Reduction and River Restoration

While the KRRP was not designed as a phosphorus removal project, there is considerable interest in how restoration of floodplain wetlands will influence the retention of phosphorus within the Kissimmee Basin. The SFWMD is developing a strategy to gather further information to support better estimates of the restoration project's effect on phosphorus movement and retention, and its overall benefit to phosphorus control efforts.

5.6.1.5 Kissimmee Basin Modeling and Operations Study

The Kissimmee Basin Modeling and Operations Study (KBMOS) is a District initiative to identify alternative operating criteria for the 13 structures controlling flow through the Kissimmee Chain of Lakes and Kissimmee River. The KBMOS will define the required water control structure operations needed to meet the hydrologic requirements of the river restoration project, while also achieving a more acceptable balance among water resource management objectives associated with flood control, water supply, aquatic plant management, and the natural resource requirements of the Kissimmee Chain of Lakes. In addition, the KBMOS will ensure that modified operations will not cause greater impacts to Lake Okeechobee from Kissimmee Basin inflows. These impacts will be evaluated relative to the desired stage envelope defined for Lake Okeechobee. Operating criteria will be developed to effectively meet these various objectives with complete reliance on the existing water management infrastructure and land interests of Florida and the SFWMD. The final deliverable will be a set of modified interim and long-term operating criteria for Kissimmee Basin water control structures. Further information about the KBMOS is available at the District's web site[10].

5.6.2 CERP – Lake Okeechobee Watershed Project

The project study area covers a large portion of the Lake Okeechobee Watershed (**Figure 5-23**). The primary objective of the CERP – Lake Okeechobee Watershed Project is to increase aquatic and wildlife habitat in Lake Okeechobee by providing the capability to better manage lake water levels and to reduce nutrient loading into the lake. The CERP – Lake Okeechobee Watershed Project also increases the spatial extent of wildlife habitat in South Florida by restoring hydrology and ecological function of impacted wetlands in the watershed area. Another objective of the project is to improve the ecological health and aquatic and wildlife habitat of Lake Istokpoga through modification of the regulation schedule.

The tentatively selected plan identified by the CERP – Lake Okeechobee Watershed Project delivery team consists of:

- Three above-ground reservoirs that will collectively provide a total storage capacity of approximately 272,823 ac-ft
- Two STAs that along with the reservoirs will collectively provide annual average phosphorus load reductions of approximately 74.3 mt
- A 3,730-acre isolated wetland restoration project, which includes plugging drainage ditches and building a 3-ft high berm around the Paradise Run site

The plan also includes a modified regulation schedule to provide seasonal water level fluctuations in Lake Istokpoga that are more conducive to a healthy fish and wildlife habitat.

The project delivery team presented the tentatively selected plan to the USACE in February 2007. However, the project formulation phase has been put on hold until the water quality cost-sharing policy is resolved (see Section 4.5 for more details).

[10] www.sfwmd.gov/watershed

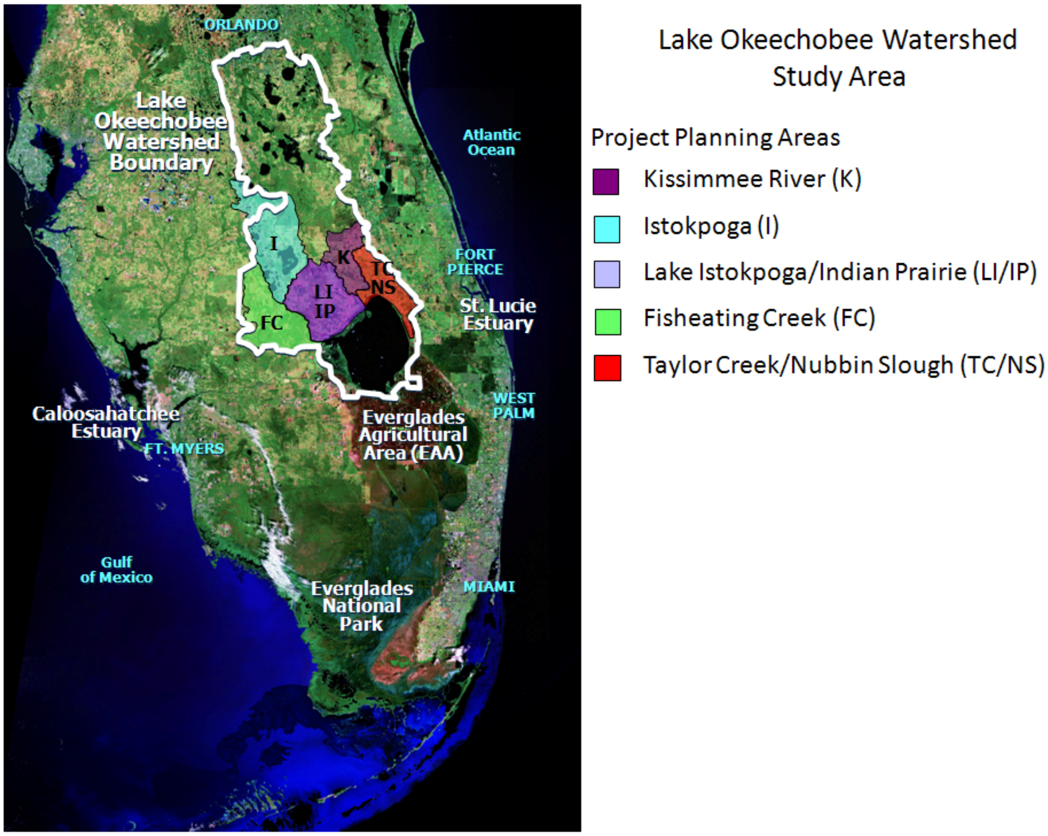

Figure 5-23. CERP – Lake Okeechobee Watershed Project locations.

5.6.3 Lake Point Restoration Project

The Lake Point Restoration Project is a public-private partnership intended to promote Everglades conservation and improve water quality for various natural habitats, while providing essential raw materials for infrastructure and restoration projects. It is a long-term project to construct water storage lakes and stormwater treatment cells for treatment of water from the C-44 canal for nutrient reduction. The 2,260 acre Lake Point site is in Martin County with its northern boundary fronting the C-44/St. Lucie Canal while its eastern boundary is adjacent to the DuPuis Management Area. Approximately 2,000 acres of the property was donated to the District for use as a stormwater management and treatment project particularly for the benefit of the St. Lucie Watershed Protection Plan with retention by Lake Point of the rock mining and farming rights for approximately 1,000 acres for the next 20 years. In May 2009, the project was approved by both the Martin County Board of County Commissioners and the District.

Given the project's strategic location, one mile from Lake Okeechobee (and the Herbert Hoover Dike), the Florida Department of Transportation-certified materials currently being excavated from the facility will provide significant transportation savings to the USACE's repair work on the Herbert Hoover Dike, to the District in their continuing Everglades restoration projects, to the Fish & Wildlife Conservation Commission on their Three Lakes Wildlife Management Area maintenance, and to Martin County/FDOT as they build the Indiantown and Indian Street Bridge.

5.6.4 Pahokee Shoreline Restoration

As a result of multiple droughts, hurricanes, man-made conditions, Everglades' restoration, Herbert Hoover Dike repairs, climate change, water release issues, and environmental impacts, Route 2 of the Lake Okeechobee Waterway has been closed for the past five years, thus creating great economic loss to the towns along the Lake's shore. Currently, larger boats cannot easily access this part of the lake because of the sediment that has accumulated in the travel route. This project is part of a larger effort by the City of Pahokee to construct a series of eco-islands along the eastern shore of Lake Okeechobee, which once completed, would benefit the Glades area by allowing the reopening of Route 2 and providing additional eco-tourism impacts, through the creation of more than 60 upland acres and 45 littoral acres of environmental restoration.

The District funded the placement of 90,000 cubic yards of riprap along 10,000 linear feet of Lake Okeechobee shoreline to the north and south of Pahokee Harbor, thereby creating a spoil containment area on the upland littoral shelf as well as a barrier to protect littoral vegetation. This area will provide storage for material dredged from the Route 2 Waterway once the improvements to the Herbert Hoover Dike are completed and the USACE approves the permits. Once water levels in Lake Okeechobee are sufficient to support the transplants, bulrush stems will be planted along the shoreline rip rap to improve native habitat in this area where no distinctive littoral zone exists. A donor site in the Lemkin Creek isolated wetland will be the source for the 13,000 bulrush stems. Plantings are expected to occur during late summer in 2011.

SECTION 6: STRATEGIES FOR MOVING FORWARD

6.1 Background and Introduction

The Lake Okeechobee Watershed Construction Project Phase II Technical Plan (P2TP) was submitted to the legislature in 2008 as required by the Northern Everglades and Estuaries Protection Program (NEEPP). The P2TP identifies construction projects and onsite measures that prevent or reduce pollution at the source, such as agricultural and urban Best Management Practices (BMPs), needed to achieve the Total Maximum Daily Load (TMDL) for total phosphorus (TP) established for Lake Okeechobee. It also identifies other projects for increasing water storage north of Lake Okeechobee to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. The P2TP is currently being implemented, and the projects and activities either completed or ongoing are described in Section 5 of this document. The NEEPP requires the coordinating agencies (South Florida Water Management District [SFWMD or District], the Florida Department of Environmental Protection [FDEP], and the Florida Department of Agriculture and Consumer Services [FDACS]) to provide updates to the Lake Okeechobee Protection Plan every three years. This 2011 Lake Okeechobee Protection Plan (LOPP) Update provides a three-year reevaluation of the P2TP with the most recent information available and describes current and future proposed projects to achieve defined phosphorus reduction and storage goals.

Figure 6-1 provides an overview of the issues affecting the health of Lake Okeechobee and its watershed and the strategic solutions identified to address these issues. Excessive phosphorus loads, legacy phosphorus, and lack of stormwater storage are all issues affecting the watershed. On the other hand in-lake issues include sediments that contribute to turbidity, internal phosphorus loading, and presence of exotic plants and animals. Each of these challenges is discussed in greater detail in Section 4.

This section outlines the Action Plan for achieving water quality and quantity improvements to benefit the lake and its watershed, with a specific focus on the projects that the coordinating agencies will be implementing in the next three years (2011–2013). The first part of the Action Plan is organized based on the strategic solutions identified in **Figure 6-1** to address the challenges. Specific strategies and promising technologies are discussed under each strategic solution. The second part of the Action Plan provides a road map of plan implementation based on a phased approach and evaluates load reductions associated with each phase. Projects are described as either current (constructed or completed), near term (2011–2013), or future (2014 and beyond). Cost estimates for the projects that are proposed for implementation during the near term, some of which require future funding, are provided, and the lead agencies for implementing each activity or project are identified.

Figure 6-1. Action Plan strategic solutions and projects.

6.2 Watershed Water Quality – Strategies and Promising Technologies

Addressing the major water quality issues (nutrient imports, legacy phosphorus) in the Lake Okeechobee Watershed and achieving the level of phosphorus load reduction required by the TMDL program requires integrated actions at the source, sub-regional, and regional scales. Source control is integral to the success of the Lake Okeechobee Protection Plan thus, the integrated management strategy of this Action Plan is based on a foundation of phosphorus source control programs, including BMPs at the parcel level and water quality improvement projects at the sub-regional and regional level.

6.2.1 Source Control

Source control refers to all activities and measures that can be undertaken on agricultural and urban lands that focus on minimizing nutrients where they are introduced (onsite) and preventing nutrients from leaving the site and entering into surface waters. Agricultural and urban BMPs are examples of efficient and effective source control measures. BMPs are the building blocks of nutrient management and are the first stage of the water quality treatment process to control the introduction of nutrients in runoff and movement into offsite drainage systems. Without onsite BMPs and sub-regional measures, the successful treatment and cost effectiveness of large regional projects such as stormwater treatment areas (STAs) will be limited.

In addition to the nonpoint source control programs utilizing BMPs, other regulatory source control programs of the coordinating agencies are essential for controlling phosphorus in the Lake Okeechobee Watershed. Several widely implemented regulatory programs affect water quality in discharges and play a role in the reduction of phosphorus loading to Lake Okeechobee. The programs collectively cover both point and nonpoint sources of phosphorus runoff and are described in detail in Section 2 and Section 5.

In summary, key source control programs and future activities with associated agency responsibility include:

6.2.1.1 FDACS Agricultural BMP Program

Currently, BMP implementation is ongoing throughout the Lake Okeechobee Watershed. As of December 2010, approximately 1,317,133 acres (77%) of agricultural lands in the watershed are enrolled in the FDACS BMP program and are implementing typical owner-implemented BMPs, such as nutrient management (including soils and tissue testing), pasture management, and irrigation management. Two-thirds of the agricultural acreage implementing typical owner-implemented BMPs (838,780 acres) have completed implementation of all BMPs including those typically requiring cost-share. By 2015, the FDACS expects to have virtually all agricultural acreage in the Lake Okeechobee Watershed enrolled in its BMP programs. Additionally, there has been a 41 percent reduction in phosphate use in the LOPP Basin between 2001 and 2010[11]. The coordinating agencies attribute a significant portion of this reduction to the implementation of nutrient management BMPs. The FDACS will continue to work cooperatively with the

[11] http://www.flaes.org/complimonitoring/past_fertilizer_reports.html

coordinating agencies, stakeholders, and landowners to identify alternative funding sources and other opportunities to accelerate the rate of BMP enrollment and implementation.

In addition, The FDACS will continue to work with the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) to evaluate the effectiveness of BMPs. As described in Section 5.1.3, numerous studies demonstrate that BMPs are effective in reducing nutrient movement offsite. These research efforts show that BMPs are effective and achieve the balance envisioned by the definition in statute. However, to measure the performance of the collective implementation of BMPs throughout the watershed, the implementation efforts must be completed across the watershed. The implementation efforts have progressed utilizing a phased approach with the more intense efforts focused on the highest priority areas. Once full BMP implementation is achieved, an adequate response time is necessary to quantify the water quality benefits at downstream points within the regional drainage system.

Measuring individual BMP effectiveness and the impact on area-wide performance results is not straightforward. Various factors must be considered, such as legacy phosphorus, variability due to site and discharge point characteristics, and physical and biological complexities within the regional drainage system.

As described in more detail below, there is an effort under way through the District's Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program (see Chapter 40E-61, F.A.C.) to develop performance metrics to measure effectiveness of collective source control programs at the basin level. This program will result in making more detailed assessments of BMP effectiveness at the basin scale. This information will be used to determine if existing BMPs need to be re-evaluated or whether additional BMP implementation will be required. However, as previously stated, all rulemaking efforts have been suspended pursuant to Executive Order Number 11-01.

6.2.1.2 FDEP Agricultural and Non-Agricultural Programs

Concentrated Animal Feeding Operations

The FDEP permits and inspects active dairies and other concentrated animal feeding operations (CAFOs) within the Lake Okeechobee Watershed via the Clean Water Act's National Pollutant Discharge Elimination System (NPDES) permits. The FDEP currently regulates 23 facilities in the watershed, and permits are issued under Chapter 62-670, F.A.C. These permitted facilities are frequently inspected, and farm managers are educated regarding methods to prevent impacts that could result from improper management of wastes. The dairies permitted in the watershed reuse their wastewater to irrigate and fertilize crops to avoid offsite discharges. All dairy CAFOs and one medium dairy animal feeding operation (AFO) in the Lake Okeechobee Watershed are permitted under the NPDES program. However, medium and small AFOs are not required to obtain NPDES permits under the CAFO rules.

Biosolids Rule

Biosolids are the treated solids from a municipal wastewater treatment facility. The FDEP adopted amendments to Chapter 62-640, F.A.C., that the Environmental Regulation Commission approved on May 20, 2010, to improve site accountability and management of Class B biosolids and to address public concerns. The new rule became effective on August 29, 2010. By 2013, no Class B biosolids application will be permitted in the Lake Okeechobee Watershed.

To address stakeholders' concerns about Class AA biosolids spreading in the Lake Okeechobee Watershed, various measures were adopted during rulemaking efforts, including the prohibition of having more than one dry ton of unapplied Class AA biosolids on one's property without proper storage and more stringent reporting requirements. Currently, Section 373.4595, Florida Statutes (F.S.), does not prohibit Class AA biosolids fertilizers. Therefore, phasing out the use of Class AA materials would likely require additional legislation. The FDEP will continue to work with stakeholders to address their comments and concerns.

Statewide Stormwater Rule

The FDEP also oversees initiatives to improve existing stormwater and wastewater infrastructure, implements pollutant reduction plans for municipal stormwater management systems, promotes improved stormwater treatment through land development regulations, and administers the NPDES permit program.

In addition to these activities, the FDEP, in coordination with the five water management districts, initiated development of the proposed Unified Statewide Stormwater Rule to increase the level of treatment required for TN and TP in storm water from new development, which is anticipated to adequately address the discharge of nutrients in general. The proposed rule is also anticipated to have an incidental effect of reducing the volume of storm water. The proposed rule was originally anticipated to be completed by the end of 2011; however, as previously stated, all rulemaking efforts have been suspended pursuant to Executive Order Number 11-01.

6.2.1.3 SFWMD Source Control Programs

The SFWMD source control programs include nonpoint source control measures to prevent or reduce pollution by tailoring those measures to the source and its onsite conditions. The measures can be on an individual operator's site (onsite measures) or extend to several sites for a collective approach (sub-regional measures). The primary difference is that onsite measures also consider control of pollutant inputs to minimize what gets into the system and sub-regional measures focus on water quality treatment (and storage) once nutrients are in the system. The regional projects as described later in this section address water quality from a more area-wide approach and when located downstream of the onsite and sub-regional source control measures in the "treatment train" can have a greater impact on improving water quality.

The onsite source control measures are implemented through the Environmental Resource Permit (ERP) program and SFWMD's Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program. Additionally several phosphorus source control reduction projects were completed in the Lake Okeechobee Watershed.

Environmental Resource Permit Program

The existing ERP program regulates activities involving the alteration of surface water flows, and it includes activities in uplands that alter stormwater runoff and dredging and filling in wetlands and other surface waters. Generally, the program's purpose is to ensure that surface water alterations do not degrade water quality, compromise flood protection, or adversely affect the function of wetland systems. See Section 5.1.2.1 for more information.

Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program

The SFWMD's Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program is currently being updated in response to the latest statutory amendments. The objective is to establish criteria and performance metrics that ensure runoff to the tributaries that discharge into Lake Okeechobee will allow the District to meet the legislative policies established in Chapter 373, F.S. The SFWMD's current initiatives are focused on developing the technical support documents to meet this objective, including:

- Establish a detailed chronology with key deadlines for implementation of source controls, including BMPs, under the collective BMP programs by the coordinating agencies throughout the Lake Okeechobee Watershed using a phased approach with the initial focus on the priority basins
- Establish load-based or concentration-based performance measures for the collective source control programs implemented by the coordinating agencies in the Lake Okeechobee Watershed to be utilized by the SFWMD to report annually on the water quality improvement results
- Define the monitoring network necessary to monitor compliance with the established area-wide (anticipated to be at the sub-watershed level) performance measures, to identify priority areas of water quality concern and source control improvement activities, and to provide data to evaluate and enhance performance of downstream treatment facilities
- Establish the monitoring requirements and a load- or concentration-based performance measures at the individual operator level to be utilized by the SFWMD to confirm that additional source controls are not needed for individual agricultural operators that elect to monitor their discharges in lieu of participating in the FDACS BMP program
- Establish an action plan specific to improving the collective source control programs implemented by the coordinating agencies should the expected water quality criteria not be met, including agency roles, timelines, activities, and rulemaking if necessary; however, it should be noted that all rulemaking efforts have been suspended pursuant to Executive Order No. 11-01
- Include incentives for permittees to participate in total phosphorus reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program as necessary

Currently, the District is developing technical documents in support of establishing performance measures to ultimately replace the current rule's outdated discharge target concentrations. A preliminary review of the available data suggests that the primary performance measures will be based on sub-watershed boundaries and criteria. These criteria and metrics are critical for ensuring consistent implementation of BMPs, to measure actual phosphorus reductions, and to have a mechanism for requiring improvements should the water quality goals not be achieved. As noted earlier, the performance measures will allow the collective programs by the coordinating agencies to identify where additional resources and efforts are needed. This will allow an adaptive management strategy for the coordinating agencies to continually make improvements.

Phosphorus Source Control Projects

The District completed construction of more than 30 phosphorus source control reduction projects in the Lake Okeechobee Watershed. These include onsite and sub-regional projects such as isolated wetland restorations, Dairy Best Available Technology projects, former dairy remediation projects, and public-private partnership projects. These projects include monitoring and evaluation of data to measure the water quality improvements that were achieved and will be continued in 2011. The potential average annual phosphorus load reduction from these projects that have been constructed is estimated at 26 metric tons.

6.2.2 Sub-regional and Regional Projects

Sub-regional projects include nutrient reduction technologies such as Hybrid Wetland Treatment Technology, chemical treatment, and Permeable Reactive Barrier technology. The implementation of such innovative projects and other best available "green" technologies to protect and improve the quality of water within the Northern Everglades is specifically referenced in the Northern Everglades and Estuaries Protection Program. A brief summary of these technologies is provided below, while more detailed information on these projects is provided in Section 5.

Hybrid Wetland Treatment Technology

Hybrid Wetland Treatment Technology (HWTT) combines beneficial attributes of treatment wetlands and chemical treatment systems. Six HWTT projects were constructed since 2008 and have been evaluated for advanced nutrient removal capabilities, which is described in detail in Section 5. Currently five systems are being operated for phosphorus load reduction (the dairy lagoon system was discontinued) and an additional system will be constructed and begin operations in 2011 at the District's Grassy Island property. Continued operation of the existing HWTT facilities will provide operational information on the various system components implemented to minimize chemical usage and cost analysis of this technology. The phosphorus load reduction estimation for the HWTT Grassy Island site is included as a near-term phosphorus reduction strategy (see **Table 6-2**). The information gained from these projects will aid decision making for possible future implementation of this advanced nutrient reduction technology.

Chemical Treatment

The Northern Everglades Chemical Treatment Project is designed to investigate available information on chemical treatment technologies that have been tested to reduce total phosphorus loads in stormwater runoff and to identify technologies appropriate for use in the Kissimmee, Okeechobee, and Everglades areas at varying scales. Chemical treatment is not only a stand-alone method, it is anticipated that chemical treatment can also be used with other control strategies that reduce water discharge volumes or phosphorus concentration, thus achieving further phosphorus load reduction. The first phase of the project was completed in July 2009 and concluded that various chemical treatment technologies may be viable and could provide effective options for reducing phosphorus loads (Bottcher et al. 2009).

Implementation costs and a site selection analyses were completed under the second phase in October 2010 (Soil and Water Engineering Technology, Inc., 2010). The phosphorus load reduction estimates from this analysis for parcels located in the LOPP sub-watersheds and application of this technology at the regional scale are included as future phosphorus reduction strategies (see **Table 6-3**). Furthermore, the District will evaluate chemical treatment in conjunction with the Lakeside Ranch Phase I project prior to proceeding with construction of Lakeside Ranch Phase II.

6.2.2.1 Permeable Reactive Barrier

Another nutrient reduction technology that will be tested in the Lake Okeechobee Watershed is called Permeable Reactive Barrier (PRB) technology. This project evaluates the incorporation of water treatment residuals or similar materials capable of intercepting and sequestering phosphorus in the Lake Okeechobee Watershed before the nutrient enters the rivers and canals leading to the lake. The feasibility study of using PRB technology to reduce phosphorus loads to the lake was completed by the SFWMD in December 2009. Testing of suitable materials for PRB construction and design for locations appropriate for the Lake Okeechobee Watershed in the laboratory was completed in October 2010. Installation of a pilot PRB project at multiple locations on Candler Ranch in the S-191 basin is included as a near-term phosphorus reduction strategy.

6.2.2.2 Regional Projects

Regional projects including STAs and reservoir-assisted stormwater treatment areas (RASTAs) will also be part of the strategies to address the water quality problems. Construction of STAs at the 2,700-acre Lakeside Ranch site is being expedited under the NEEPP initiative. Phase I of Lakeside Ranch involves creating 919 acres of treatment wetlands and is included under the near-term phosphorus reduction strategies. Phase II involves creating 788 acres of treatment wetlands and is included as a long-term strategy. Combined, these two phases are estimated to provide up to 19 metric tons (mt) of phosphorus load reduction annually. However, as noted earlier, the District will evaluate chemical treatment in conjunction with the Lakeside Ranch Phase I project prior to proceeding with construction of Lakeside Ranch Phase II. Other regional treatment projects, such as the Brady Ranch STA, Clewiston STA, S-68 STA, and Istokpoga/Kissimmee RASTA, are also included under future strategies.

6.2.3 Research Projects

6.2.3.1 SFWMD's New Alternative Technology Assessment Initiative

Assessment of new technologies is essential to success in achieving nutrient reductions goals in the Lake Okeechobee Watershed. Therefore, the District is implementing a New Alternative Technology Assessment (NATA) initiative. The NATA initiative provides a forum to explore additional alternative nutrient reduction technologies to help nutrient load reductions in the Lake Okeechobee Watershed and connected watersheds. It is designed to provide opportunities for interested parties to demonstrate potential alternative technologies for reducing nitrogen and phosphorus loading in water and sediments. While there is no dedicated funding for this effort, the District will provide a physical location for successful applicants to demonstrate their technology's potential to reduce nutrients. This arrangement allows for cutting-edge water quality research specific to South Florida ecosystems to be conducted at a reduced cost. Although the NATA process is still evolving, proposals for projects are vetted through a selection process with a predetermined set of evaluation criteria and evaluated by a team of District scientific staff.

To be considered, projects must address the removal of phosphorus and/or nitrogen from water and/or sediments (or permanent inactivation of nitrogen or phosphorus in sediments). Due to the diverse nature of the watersheds within the Greater Everglades ecosystem and the wide range of land uses and ecological tolerances for nutrient pollution, there is the potential for a large range of nutrient removal targets for technologies that might be considered for this program. Precisely because of this large variety of nutrient concentrations and nutrient treatment criteria, it is difficult to identify exact desired ranges of treatment efficacy. Generally, the focus is on the following:

- Waste streams from concentrated animal feeding operations
- Ditch runoff from cattle ranching and crop operations
- Canal discharges into Lake Okeechobee
- Lake Okeechobee discharges and local watershed runoff into the east and west coast estuaries
- Water moving south of the STAs into the Water Conservation Areas and other portions of the traditional remnant Everglades

An additional niche is available for stand-alone nitrogen removal technologies in discharges to the east and west coast estuaries. There are also niches for technologies dealing with the removal, inactivation, or immobilization of nitrogen and phosphorus in terrestrial soils, canal sediments, and Lake Okeechobee mud sediments.

The selection criteria have been designed to provide a rapid and equitable method for the initial screening of novel nutrient removal technologies that might warrant further investment by the District for demonstration projects in the form of providing appropriate siting on District and/or cooperative landowners' properties and professional review of project results. Applicants need to provide a standard set of information for their technology, which is reviewed by a panel of District experts. Those technologies that meet preestablished criteria with site requirements that can be accommodated within available District or cooperator's lands will be given the opportunity to present a detailed project plan for further review and are then permitted to demonstrate their technology to establish its efficacy and applicability. Final review of each technology will follow methods previously developed for the evaluation of alternative treatment strategies and include additional review parameters such as flexibility of the technology and a thorough cost/benefit analysis.

Currently, two technologies are being tested side-by-side in test cells within STA-1W. Both utilize proprietary clay-like materials that bind phosphorus and nitrogen.

6.2.3.2 Legacy Phosphorus Studies

Legacy phosphorus is the most daunting challenge in the Lake Okeechobee Watershed. Best estimates indicate that approximately 176,000 mt of legacy phosphorus are in the watershed soils and tributary sediments. Initial assumptions for planning purposes were that up to 50 percent of the legacy phosphorus could be mobile or easily released into surface waters. Based on recent work, it is now estimated that approximately 35 percent of total phosphorus in soils is non-reactive and is not biologically available based on chemical fractionation of soil phosphorus (Reddy et al. in press). The remaining 65 percent is reactive and may be available for release at different time scales. Even at the minimum mobility estimates, many decades worth of legacy phosphorus are available in the watershed soils for transport to Lake Okeechobee. Tightly coupled with the concept of legacy phosphorus is the determination of the total and net nutrient import into the watershed. The most recent study, completed in September 2010, indicates that about 6,000 mt of phosphorus are imported into the watershed annually. Almost all of this net import becomes legacy phosphorus and contributes to a growing problem. Research is needed to determine with a much higher degree of certainty how much of this phosphorus is mobile and what factors contribute to its mobility. Research also is needed to develop new approaches and technologies to sequester or remove the excess phosphorus entering the watershed.

In addition to legacy phosphorus estimates and nutrient import, the soil saturation of phosphorus is also incompletely understood. Watershed soils cannot absorb phosphorus indefinitely. It is believed that as soils approach the limit of their absorption capacity, the rate of absorption will decline markedly. This will make the phosphorus concentration in storm water increase. It is also possible that the most recently deposited legacy phosphorus will be more mobile. It is essential to know if such a tipping point exists in the phosphorus absorption mechanics of the watershed soils. If there is, identifying when phosphorus saturation may occur is critical. Hence, additional research is needed to understand the phosphorus storage capacity of the different soil types in the watershed.

6.2.3.3 BMP Research and Extension Coordinating Council Proposals

Source control and associated agricultural BMPs are an important strategies identified in the LOPP update. Hence, the priority areas identified by the BMP Research and Extension Coordinating Council (BRECC) to improve the agricultural BMPs are captured as part of the Action Plan. The BRECC is composed of participants from the Florida's five water management districts, the FDEP, the FDACS, and the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) Research and Extension Dean offices. The BRECC meets regularly to set priorities for research and extension programs in BMPs, to determine available funding, and to sponsor workshops on BMPs.

The UF/IFAS has identified the following research efforts as a result of the numerous BRECC discussions targeting the highest priorities for research and extension needs specific to agricultural BMPs as funding becomes available. The goal is that multiple agencies will be able to contribute to multidisciplinary projects aimed at answering the questions and objectives of these various priority areas.

Creating Farming Systems that Use Water and Fertilizers More Efficiently

Enrolling growers in existing BMP programs is essential to helping them adopt BMPs based on the best current science. However, due to increasingly stringent water quality and quantity pressures, research is required to develop the "Farming System of the Future" that can maintain productivity while meeting environmental goals. Research efforts are needed to provide the answers for the next 15 years and beyond.

The following research projects are intended to address some of the challenges that will face growers in the years to come as they face water shortages and increased regulation of agrochemicals in the waters of Florida:

- **Controlled-Release Fertilizers.** Development of controlled-release fertilizers customized for particular crops and perhaps particular horticultural systems (e.g., microspray-irrigated citrus versus drip-irrigated tomato) will give plants sufficient nutrients when they need them and prevent unintended release into the environment.
- **Information Technologies.** The UF/IFAS has extensively researched the use of soil moisture monitoring and weather monitoring for irrigation management, which can make on-farm water management more efficient. However, applied research is needed to determine the best technologies and how to integrate them into different types of horticultural operations. For example, for drip-irrigated pepper and tomato crops, a suite of soil moisture and weather monitoring would be customized for the operation and information would be delivered wirelessly to growers for decision making.
- **Ultralow Flow Drip and Open Hydroponic Systems.** These methods of irrigation and nutrient management are used in other parts of the world and offer the ability to meter water and nutrients constantly to meet plant needs, further increasing the efficiency of drip irrigation while maintaining or increasing yield. The effectiveness of these systems in Florida needs to be investigated.
- **Crop Rotations.** Information on crop rotations that would benefit horticultural growers needs more research. A group of researchers in Florida's panhandle, focusing on row crops, has pioneered a rotation system that increases organic matter in the soil, thus increasing nutrient retention (less offsite nutrient pollution) and water holding capacity (less irrigation required). Information is needed on what rotational systems might work and how central/southern Florida growers could adopt these systems for their horticultural crops.

Increasing BMP Adoption

BMPs currently exist for horticultural operations that are aimed at minimizing environmental impact while maintaining economically viable agricultural production. However, grower adoption and implementation of these BMPs lags in many parts of the state. Experience has shown that one-on-one BMP implementation efforts with growers along with in-field demonstrations of new and unfamiliar practices can achieve more widespread adoption of BMPs. Cooperative extension efforts are needed to provide the necessary one-on-one assistance to tailor an appropriate BMP plan for a particular operation and to conduct the demonstrations and education necessary for wide-scale adoption of BMPs. Efforts to increase BMP adoption would include the following:

- **Increase BMP Extension Programs.** Funding for the UF/IFAS program, which has been recognized at the national level by the Environmental Council of States as a successful model of voluntary efforts to protect and improve surface waters, has been greatly reduced in recent years due to budget shortfalls. As a result, the program's ability to achieve high grower BMP adoption in many areas of Florida has diminished.
- **Demonstration Projects.** Research into advanced farming systems needs to be backed up by extension projects to transfer new technologies to growers. These projects will be within grower production systems where possible. Two potential demonstration projects are the following:
    - **Controlled-Release Fertilizer Demonstration.** After research development, when customized controlled-release fertilizers are ready for pilot testing, grower trials will be conducted throughout the state on given crops.
    - **Information Technologies Demonstration.** Information technologies systems that will be developed through research will be used to show how incorporating such technologies in production systems enhances management and reduces inefficient water and fertilizer use.

6.3 Watershed Water Storage – Strategies and Promising Solutions

Analyses were performed under the Lake Okeechobee Phase II Technical Plan (2008) to determine the amount of water needed to be stored in the watershed to improve lake stage management and reduce excess damaging freshwater releases to estuaries while meeting other water-related needs. The analyses, which assumed that no additional lake water could be sent south through the Everglades Agricultural Area (EAA) to the Everglades, identified a Lake Okeechobee Watershed water quantity storage goal of 900,000 to 1.3 million acre-feet (ac-ft).

In 2008, Governor Crist announced a historic transaction to acquire strategically located lands within the EAA that provided opportunities for additional water storage and treatment in the EAA. These opportunities included the ability to send more water from Lake Okeechobee south to assist with Everglades restoration flow targets and reduce damaging discharges to the estuaries. As a result of this real estate acquisition, the SFWMD hosted a series of public planning workshops known as the River of Grass Phase I Public Planning Process. The process, which assumed significantly more Lake Okeechobee water could be sent south to the Everglades, identified a storage target range of 450,000–575,000 ac-ft north of the lake. This is a conceptual-level estimate that will be refined during the more detailed River of Grass Phase II planning effort. New information resulting from the second phase of planning will be used to refine the Lake Okeechobee Protection Plan storage target.

While the LOPP 2011 Update strategy to address the storage need includes a mixture of both regional and dispersed water management projects, the coordinating agencies are aggressively pursuing dispersed water management implementation and expansion in the Northern Everglades by working with other agencies, non-profits, public, private, and tribal landowners. For example, a new Northern Everglades-Payment for Environmental Services dispersed water management solicitation program is discussed in Section 6.3.1. It is widely acknowledged that the components of the dispersed management program (easements, cost-share, and payment for services) are the most promising options in the near-term to address a portion of the storage needs. The goal for the dispersed water management is to provide 450,000 ac-ft of storage throughout the Northern Everglades Watershed (Okeechobee, Caloosahatchee and St. Lucie. Regional projects (e.g., reservoirs, aquifer storage and recovery projects, deep injection wells) and other state initiatives (River of Grass) also continue to be critical to reach the storage goals for the Lake Okeechobee Watershed.

6.3.1 Watershed Shallow Storage – Dispersed Water Management Program

In the Northern Everglades, the northern watershed is approximately seven times larger than the surface area of Lake Okeechobee. Therefore, when runoff enters the lake, stages increase fairly rapidly in comparison to the capability of the control structures to discharge water from the lake. In addition, with the current concerns regarding the stability of the Herbert Hoover Dike and the efforts to optimize lake ecological conditions, the U.S. Army Corps of Engineers (USACE) sends regulatory releases to the coastal estuaries, where it is lost to tide. At the same time, water users are being asked to find alternative sources of water supply while comprehensive regional planning efforts are addressing large-scale solutions to the multiple water resources issues. Also, there is unprecedented unified stakeholder support to implement comparatively smaller-than-regional projects on public, private, and tribal lands, and pay the landowners for the services of water retention and water quality improvement. These efforts would complement the water management of the planned regional facilities and could be implemented more expeditiously.

Significant progress in dispersed water management has been made through partnerships with other agencies, local governments, and private land owners—while efforts continue to investigate the use of additional public lands, implement more projects on private and tribal lands, and optimize the projects currently in place. A total of 129,143 acre-feet of water storage has been achieved in the Northern Everglades and connected watersheds through partnerships that have provided water management alternatives since 2005. More than two-thirds or 89,664 ac-ft of this total storage is in the Lake Okeechobee Watershed. Additional storage sites are under development as part of the dispersed water management program through payment for environmental services, easements, and public-private partnerships.

6.3.1.1 Payment for Environmental Services

Northern Everglades ranchers have the opportunity to participate in a new payment for environmental service contracting program with the District to increase water retention and improve water quality on their lands. The program is being developed and implemented under the Florida Ranchlands Environmental Services Pilot Project (FRESP) in collaboration with the FDACS, the U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), and the FDEP.

The Northern Everglades – Payment for Environmental Service Program (NE-PES) dispersed water management program solicitation, released on January 7, 2011, offers eligible cattle ranchers the opportunity to compete for contracts for water and nutrient retention. The goal of the solicitation is to establish relationships via contracts with private landowners to obtain the water management services of water retention and nutrient retention to reduce flows and nutrient loads to Lake Okeechobee and the estuaries from the watersheds. The NE-PES solicitation is expected to provide over 50,000 ac-ft of estimated storage by the end of 2012.

The proposals will be evaluated and ranked based upon defined evaluation criteria. With the funding available, the top-ranked projects will be selected and move forward with final design, permitting, construction, monitoring, and service documentation. Under the solicitation, it is envisioned that during the final design of selected projects, the sites will be assessed for phosphorus release and an appropriate operational plan will be developed for start-up/close-out to minimize the risk. Also, the water quality monitoring data collected during the operation of the project will be evaluated prior to the end of contract term to determine if additional measures should be implemented under the program at project close-out to further reduce any potential water quality risks.

Since the deadline for submission in response to the NE-PES is April 12, 2011, at this time it is unknown which projects and the types of projects that will be submitted for consideration. Therefore it is not possible to quantify the phosphorus load reduction and storage benefits associated with the NE-PES. This information will be included in the next three-year update.

Through the implementation of the FRESP, service estimation tools and streamlined regulatory processes were identified as being critical to the next step of transitioning from the pilot project to a payment for environmental services program. Successful resolution of several issues is in process. These issues include what the service payment approach will be (implementing a market-driven competitive solicitation); quantification of “above and beyond” baseline required water management (estimation of amount of retention provided from Northern Everglades BMP implementation; service payment is above this amount); program federal authorization regarding expansion of wetlands and post-contract hydrologic reversion to a baseline (the USACE is developing a NE-PES General Permit), and a NE-PES U.S. Fish and Wildlife Service/NRCS consultation key for threatened and endangered species issues. It should be noted that on this last issue, listing of water management practices features and their potential affect on threatened and endangered species includes the allowance to return to baseline hydrologic conditions.

More intensive agricultural operations are being investigated through a separate pilot process to identify key issues that need to be considered that were not previously identified or applicable for low-intensity agriculture. For example, storing water on more intensively used land may require environmental assessments, which would change the tools and processes developed for ranchlands under the FRESP.

6.3.1.2 Easements

Fisheating Creek Wetland Reserve Special Project

Over the last decades, several landowners within the Fisheating Creek Sub-watershed have signed up for participation in the Wetlands Reserve Program (WRP). In July 2010, the U.S. Department of Agriculture (USDA) announced additional major wetland restoration projects that would be located on five ranches in Highlands County in the Fisheating Creek Sub-watershed. Four landowners have agreed to participate in this program, including the Westby Corporation, the Doyle Carlton family, the H.L. Clark family, and Blue Head Ranch (Atlantic Blue). Under this initiative, the USDA will provide $89 million through the WRP to acquire easements on almost 26,000 acres of land. The Nature Conservancy partnered with the Natural Resource Conservation Service (NRCS) on this project. The SFWMD has contractors and staff primarily related to agricultural engineering, but also executed a memorandum of understanding with NRCS to provide assistance related to land acquisition, permitting, land management, and monitoring activities.

Proposed plans include construction and operation of water control structures and ditch stops within the conservation area and control of exotic grasses and plants. While the landowners will retain ownership of the land, they will be required to conform to a compatible grazing plan and will be prohibited from any future development of the parcels. When the water table rises and the lands are re-flooded, it is anticipated that grasses that were introduced by ranchers will perish and eventually be replaced by native vegetation. This reflooding should provide for improved and expanded habitat for a variety of wildlife, including more than 19 threatened and endangered species that are known to occur in this portion of the sub-watershed.

The project is co-located with other existing WRP projects, which together will help connect the open spaces, sustain the biological diversity of the landscape, and restore the natural hydrology. Contiguous natural areas along the sub-watershed’s creeks and rivers, on cattle ranches, and existing conservation lands provide the large open spaces, food resources, and connectivity needed to sustain wide-ranging animals such as the Florida black bear, whooping crane, and the Florida panther. The habitat in this area can support numerous rare and federally endangered and threatened species, such as the crested caracara and the red-cockaded woodpecker. At least two rare federal candidate plant species, cutthroat grass and Edison's ascyrum, are also known to occur on the five ranches.

6.3.1.3 Public-Private Partnerships- Istokpoga Marsh Watershed Improvement District and Nicodemus Slough

Istokpoga Marsh Watershed Improvement District

The District is working with the Istokpoga Marsh Watershed Improvement District (IMWID)/Highlands County and the FDACS to initiate a Dispersed Water Management and Stormwater Recycling project through an executed three-party agreement. The project will consist of approximately 1,200 acres of aboveground impoundments to serve the approximately 19,262-acre IMWID agricultural area located in Highlands County immediately to the east/southeast of Lake Istokpoga. At completion, the project is estimated to reduce the volume of storm water and amount of phosphorus discharged by the IMWID by 60 to 70 percent. Presently, the District has directed approximately $6.5 million of Save Our Everglades Trust Fund monies through an existing cooperative agreement to IMWID/Highlands County for the assessment and acquisition of approximately 700 acres of land on which regional facilities will be constructed and operated. State and federal grant funding is being pursued to allow for the detailed design and construction of facilities on the acquired land. Project completion is dependent upon funding sources and timing.

Nicodemus Slough Water Management Project

The proposed Nicodemus Slough Water Management project consists of 15,935 acres of agricultural lands directly to the west of Lake Okeechobee and includes a 2,016-acre District perpetual flowage easement on the eastern edge (**Figure 6-2**). It would provide approximately 34,000 acre-feet of regional water storage.

The project concept is for the District, as a lessee, in partnership with the private landowner, to construct facilities and implement an operational plan to utilize the property as a regional water management facility to the benefit of the public and the environment. The project has unique technical attributes not available from any other source and working with private landowners as partners results in cost savings for the public. It also has several unique attributes including a strategic geographical location, existing water management connections, and the lease will extend District water management facilities and operations.

Water resource benefits from the project include:

- Reducing high stages in Lake Okeechobee and Fisheating Creek
- Reducing excessive freshwater discharges to the Caloosahatchee River Estuary
- Restoring hydrology to the site in a manner that is beneficial to existing drained wetlands and former creek floodplain habitat
- Improving the quality of water delivered to the Caloosahatchee River Estuary and Lake Okeechobee
- Conserving water for beneficial uses that would have otherwise been lost to tide.

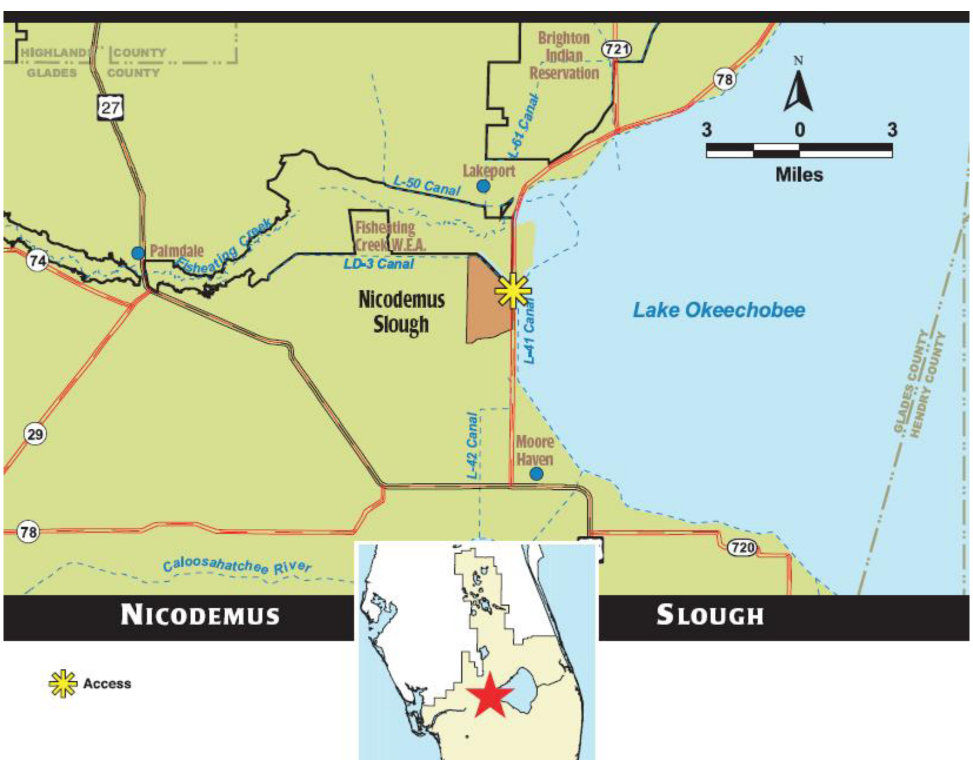

Figure 6-2. Location of the Nicodemus Slough Project.

6.3.1.4 Other Related Efforts

Proposed Greater Everglades Partnership Initiative

The U.S. Fish and Wildlife Service (USFWS) and its partners are advancing a collaborative approach to address landscape-scale land protection efforts in south-central Florida. The Greater Everglades Partnership Initiative will help conserve the land, water, and wildlife resources of the Greater Everglades landscape. This partnership initiative would help conserve a rural working ranch landscape; protect and restore habitat; protect, improve, and restore water quality and wetlands benefiting residents and visitors in South Florida; and connect a matrix of existing conservation lands and important wildlife corridors, supporting Everglades restoration efforts.

This initiative provides a framework for the USFWS to engage multiple federal agencies, state agencies, counties and other local governments, non-government organizations and land trusts, private landowners, and citizens in the process. The conservation proposal would strengthen multiple public and private conservation activities within this landscape to protect habitat for imperiled species; restore water quality and filtration functions, groundwater recharge, and hydrological systems that will materially benefit residents of South Florida; provide a new model for working with large family ranches and landowners to help sustain the rural and ranching way of life in Florida; increase opportunities for wildlife conservation education and youth engagement by establishing a new national wildlife refuge near major population centers; and promote Florida tourism and travel industries.

To facilitate analysis across the Greater Everglades landscape, this large geographic area was divided into three study areas:

- The Everglades Headwaters area
- The Fisheating Creek area
- The area around the Florida Panther National Wildlife Refuge and the Caloosahatchee River

The first phase of the Greater Everglades Partnership Initiative is the proposal to establish the Everglades Headwaters National Wildlife Refuge and Conservation Area. The other two study areas will be evaluated in future detailed planning and would likely include large-scale easements, water protection buffers, expansion of existing national wildlife refuges, and connectivity to other conserved areas.

Proposed Northern Everglades Headwaters National Wildlife Refuge and Conservation Area (NWRCA).

The proposed NWRCA is a land conservation partnership between federal, tribal, state, and local governments; ranchers and other landowners; non-governmental conservation organizations; area residents; and other stakeholders. The effort aims to protect, restore, and conserve more than 150,000 acres of natural habitat in Polk, Osceola, Indian River, Okeechobee, and Highlands counties.

The USFWS and partners plan to work with willing landowners to establish the NWRCA through several methods, including established conservation lands, fee simple purchases, conservation easements, leases, conservation and mitigation banks, lands set aside through habitat conservation plans, and/or cooperative agreements with landowners. The planning target is to work with partners and willing landowners to conserve approximately 50,000 acres in fee title acquisitions and 100,000 acres in less than fee title.

The NWRCA proposal examines a large and diverse landscape that has generated broad conceptual support from local ranchers, urban residents, and the environmental community, as well as amongst federal, state, and local partners. Establishing a NWRCA would help protect, restore, and conserve:

- Important habitat for 88 federal- and state-listed species and State Species of Greatest Conservation Need, including Florida panther, Florida black bear, Audubon's crested caracara, Florida scrub-jay, Florida grasshopper sparrow, red-cockaded woodpecker, whooping crane, Everglades snail kite, wood stork, and eastern indigo snake
- Exemplary habitats, such as wet and dry prairie, Florida sandhill and scrub, and scrubby and mesic flatwoods, as well as multiple wetland types, including cutthroat seepage slope wetlands
- The headwaters, groundwater recharge, and watersheds of the Kissimmee Chain of Lakes, Kissimmee River, and Lake Okeechobee, which will improve water quantity and quality in the Everglades Watershed

Given the widespread interest and involvement in this landscape, this project is on an accelerated schedule, with a draft document anticipated for public review and comment in the summer of 2011 and with a final document anticipated for fall of 2011. This proposed initiative and project is in its infancy with the most updated information online[12].

6.3.1.5 Publicly Owned Lands for Shallow Storage

The District also continues to evaluate the use of publicly owned lands for water management projects. Several parcels are scheduled to become part of the large-scale restoration efforts, but low-cost alterations to the existing surface water management systems could be made in the years before the designs are finalized and ready to be constructed. The parcels would then have an interim role contributing to the watershed restoration effort while waiting for the final designs to be completed and approved. If the public lands are being leased, the lessees have been asked to implement water management strategies to reduce discharges while not adversely affecting flood protection including adjacent properties and water quality. New language has been developed that notifies lessees that during excess water conditions, the District will request them to store more water. This language is being added to new and renewed leases.

6.3.2 Regional Storage Projects

Regional storage and treatment projects remain part of the solution to reach water quality and storage goals for the Lake Okeechobee Watershed. However, implementation has been delayed due to funding constraints, cost-share issues, long planning processes, and other issues. The Comprehensive Everglades Restoration Plan (CERP) – Lake Okeechobee Watershed Project is estimated to provide 273,000 ac-ft of storage and 74 mt of phosphorus reduction once

[12] www.fws.gov/southeast/greaterevergiades and www.fws.gov/southeast/greatereverglades/pdf/GreaterEvergladesFactsheet.pdf

implemented. Other regional storage options include Aquifer Storage and Recovery (ASR) projects and deep well injections. As described in Section 5, the Lake Okeechobee ASR pilot project provides the necessary platform for the ASR Regional Study team to evaluate technical and regulatory uncertainties associated with ASR technology within the Lake Okeechobee Watershed. Construction of the Kissimmee River ASR facility is complete and cycle testing operations that began in January 2009 are currently under way.

6.4 In-Lake Strategies

6.4.1 In-Lake Sediment Management Options

Internal phosphorus loading in Lake Okeechobee remains a challenge as described in Section 4.3. If internal phosphorus loading is not addressed, the lake may not fully respond to external load reductions. Everglades and estuary restoration will be more difficult without improving the quality of water discharged from the lake. To address these concerns, the ideas discusses in the following sections related to sediment management could be explored further.

The ability to investigate these ideas is limited at this time due to funding constraints. Staff will pursue these approaches within current data and skill limitations. As funding becomes available, feasibility studies should proceed rapidly. The coordinating agencies included an in-lake phosphorus management study as a near-term project. This study will review the recommendations from the 2003 feasibility study. New concepts and technologies would be evaluated and then compared against those from the previous report. Permitting requirements and potential limitations associated with these options will also be evaluated. Finally, new recommendations would be made for implementation.

6.4.1.1 Sediment Dredging

Removal of surface sediments by dredging can reduce potential phosphorus flux into the water column. However, there are water quality concerns if water from dredging operations is to be returned to the lake. Treating the water is very expensive, and significant costs savings are possible if treatment can be avoided. For example, deep-wells could be used for disposal of the water removed during dredging of sediments. If ideal rock strata can be found, even the dredged sediments could be disposed of in a deep well. This approach would eliminate almost all processing and land costs. Such a rock stratum is believed to exist on the north side of the lake.

6.4.1.2 Muck Removal, Scraping, and Tilling

Low lake levels during dry times provide opportunities to remove accumulated organic material and muck sediments from the nearshore areas of Lake Okeechobee. Mechanical tilling and/or plowing of sediment into the native soils is another option. This process consists of flipping a thick layer of consolidated muck under native sand. This process caps the accumulated sediment below the near-shore lake bed.

6.4.1.3 Creation of In-lake Islands or Littoral Zones near Outlets

Very large sumps could be excavated in the pelagic zone of the lake. The excavated sand and rock could be used to build islands or could be removed from the lake. Sediments, propelled by the natural currents of the lake, would settle into the sump and would be confined below any likely disturbance created by wind events, in essence creating a sediment trap. This could greatly reduce the surface area of the sediments contributing to phosphorus flux. A modified version of this option includes construction of a sediment impoundment (sand and rock) in the lake that would receive the dredged muck material. This area would have a top elevation similar to the existing littoral zone. Once the area is filled with the dredged muck material, it could be capped with sand and muck to create littoral habitat.

6.4.1.4 Chemical Treatment

In-lake excess phosphorus can be controlled by the addition of alum, and will suppress the turbidity potential of the sediments but the alum application must be repeated periodically. Alum treatment was one of the alternatives that was retained for full-scale evaluation under the feasibility study conducted by the District in 2003 (BBL Sediment Management Study 2003), hence could be reconsidered as an in-lake sediment management strategy.

6.4.2 Exotic Species Management

The approach to implementation of the exotic species plan within the Lake Okeechobee Watershed has been and will continue to be through the cooperative efforts of state and federal agencies. An interagency memorandum of understanding among the USACE, the FDEP, Florida Fish and Wildlife Conservation Commission (FWC), and the District formalized the operational avenue through which the agencies advise and provide exotics treatment. Most of the District efforts on exotic species management have been focused on exotic vegetation (e.g.., torpedograss, South American watergrass, water hyacinth, water lettuce) in collaboration with the FWC. More information on exotic species management program as well as control of exotic vegetation can be found in Section 2 and Section 5.

The exotic apple snail is another concern for recovery of Lake Okeechobee. To date, there is little quantitative data available on the exotic apple snail and its interaction and effects on native snails and endangered snail kites. Mostly anecdotal evidence suggests that the exotic snail is spreading rapidly throughout the ecosystem, but may occupy a somewhat different, though overlapping habitat with the native snail. Most of the native snail population was eliminated during the 2007–2008 drought. One small breeding and restocking study of the native apple snail was completed, but it had minimal impact on the snail population in the lake and the cost to scale it up to meaningful levels for snail kite recovery are prohibitive.

Observations suggest that kites recognize the exotic snails as a potential food source though full grown exotic snails are too large a prey item for effective use by juvenile snail kites. It is probable that during their growth cycle from juvenile to adult, the exotic snails pass through a range of sizes, some of which should make them suitable prey for juvenile kites, as well as for other animals that traditionally include apple snails as part of their diet.

Additional efforts to increase the numbers of native snails would greatly benefit the snail kite. Lake levels under the new regulation schedule (LORS 2008) also may favor the snail kite if lake levels do not fall to a stage where the littoral zone is desiccated.

6.4.3 Planting Native Vegetation

Taking advantage of drier conditions and building upon planting efforts conducted in past drought years, native trees will be planted in both Lake Okeechobee and Lake Istokpoga with the low lake stages expected in 2011. Planting trees when water levels are low greatly benefits the lakes' ecosystems and attracts wading birds, which are indicators of restoration success.

The respective sites are prioritized based on lake stages and permitting issues. The first priority will be to plant more than 2,000 native pond apple trees along Ritta Island in Lake Okeechobee to enhance a large wading bird nesting area. Planting is contingent on water levels being sufficient to get to the site by airboat. Over 600 cypress trees will be planted along the Rim Canal near the Alvin Ward Boat Ramp. The installation at this site is not as dependent on lake stage as the other sites and will be the last area to be planted.

More than 2,000 cypress and pond apple trees are planned to be planted along the shoreline of Lake Istokpoga and the lake's Big Island. These plantings are contingent upon approval by the USFWS and dependant on any potential effects to nesting snail kites.

6.5 Sub-Watershed Conceptual Plans and Modeling

The 2008 Lake Okeechobee P2TP recommended that feasibility studies be conducted at the sub-watershed level to further define the best mix of surface storage and water quality improvement features that are most suitable in a given sub-watershed. The District initiated the Fisheating Creek Sub-watershed feasibility study and Taylor Creek site feasibility study in 2008 and 2010, respectively, which are currently under way and described in Section 5. The following sub-sections describe the future feasibility studies and modeling activities that are planned to be undertaken by the coordinating agencies in the near term. See **Figure 1-1** for a map of the Lake Okeechobee Watershed and its sub-watersheds.

It should be also noted that the results of other feasibility studies, as captured in Section 5, will be used to help meet the objectives of the LOPP as cost effectively as possible. Studies and pilot projects that test and evaluate various water quality treatment technologies will also be used to refine and optimize phosphorus removal. The results from the dispersed water management, ASR pilots, and ASR regional study will be used to help determine the mix of surface and sub-surface storage needed to better manage Lake Okeechobee water levels.

6.5.1 Indian Prairie Sub-Watershed Phase I Assessment

The Indian Prairie Sub-watershed covers a portion of the Lake Okeechobee Watershed within Glades and Highlands counties. The Indian Prairie Sub-watershed is approximately 398,078 acres (622 square miles) and drains the area between Lake Istokpoga and Lake Okeechobee.

This project consists of the preparation of a feasibility report to develop and evaluate alternative management measures that will help meet the regional goals for water storage, water quality improvement, and ecological benefits in the sub-watershed. Further, the project includes the identification of local projects and/or partnerships to provide water quality and storage benefits. It also includes the necessary details for the incorporation of investigations and analyses obtained from previous topographic surveys, geotechnical and hydro-geological investigations, hydrologic and hydraulic modeling, and engineering services.

The intent of the feasibility report is to evaluate sites within the project area that will help achieve the storage goal and the average annual TP load reduction goal. Further, it will identify local-scale projects within existing publicly owned lands as well as potential partnerships with local landowners for specific water quality and storage goals and objectives of the P2TP.

6.5.2 Pre-Drainage Characterization Modeling

The Fisheating Creek feasibility study was the first feasibility study initiated under the P2TP, which is currently under way. Since the P2TP only provided conceptual-level guidance for water quality improvements (phosphorus-load reduction) and storage goals for individual sub-watersheds, the feasibility study had to conduct an independent analysis to estimate phosphorus-load reduction and storage planning targets that the study would address. These planning targets were based on a comparison of Watershed Assessment Model (WAM) simulated existing and pre-drainage flows and loads in the Fisheating Creek Sub-watershed.

Adopting planning targets for individual sub-watersheds, one sub-watershed at a time, may lead to a shortfall in the TP load reduction that is required to achieve the Lake Okeechobee phosphorus TMDL. To ensure that the required load reduction is met, the Phase II planning team has concurred that planning targets for all key sub-watersheds in the Lake Okeechobee Watershed should be established at this time using the same methodology that was used for the Fisheating Creek feasibility study. To establish these planning targets, existing and pre-drainage conditions (flows and phosphorus loads) associated with these key Lake Okeechobee Watershed sub-watersheds for the 1978–2008 period of record need to be characterized. For the purpose of this analysis, pre-drainage characteristics are defined as conditions that existed prior to construction of any water management features.

The analysis will address the following key sub-watersheds that historically drained to Lake Okeechobee by gravity: Upper Kissimmee, Lower Kissimmee, Lake Istokpoga, Indian Prairie, and Taylor Creek/Nubbin Slough. The WAM pre-drainage simulations for the Fisheating Creek Sub-watershed have already been completed. The remaining three sub-watersheds in the Lake Okeechobee Watershed (East Lake Okeechobee Basins, West Lake Okeechobee Basin, EAA Basins) will be analyzed under separate initiatives. Using the methodology developed for the Fisheating Creek feasibility study, estimates will be developed for storage and phosphorus load reduction targets for each of the other sub-watersheds. This modeling effort is expected to be initiated in 2011 if funding is available.

6.5.3 Upper Kissimmee Sub-watershed Feasibility Study

The Upper and Lower Kissimmee sub-watersheds comprise the Kissimmee River Basin, which includes most of the areas that drain into Lake Okeechobee from the north and northwest through the Kissimmee River (C-38 canal). The Kissimmee River Basin contributes the largest surface inflow to Lake Okeechobee. According to data from the baseline period of record (1991–2005), the Kissimmee River accounted for approximately 50 percent of the total inflow and 30 percent of TP loads to Lake Okeechobee (see Section 3). Much of these flows and loads are from the Upper Kissimmee Sub-watershed.

The Upper Kissimmee Sub-watershed covers approximately 1,633 mi^2 and includes Lake Kissimmee and the Chain of Lakes area in Orange and Osceola counties. The estimated average annual discharge is 853,368 ac-ft/yr with an estimated average annual TP loading of 97 mt (2001-2009). This is an area that has historically been under tremendous development pressure. Although this pressure has subsided due to the recent economic downturn, it is anticipated that the pressure will increase once the economy recovers. Furthermore, this is an area receiving much environmental restoration interest due to the recently announced proposed Greater Everglades Partnership Initiative (see Section 6.3.3 for more information). For these reasons, the Upper Kissimmee Sub-watershed Feasibility Study is included in the near-term project list.

The purpose of this feasibility study is to identify a preferred plan, comprising the most effective mix of nutrient reduction and storage features, aimed at restoring flows and phosphorus loads from the sub-watershed to Lake Okeechobee to the greatest extent practicable. The Pre-Drainage Characterization Modeling Study, discussed in Section 6.5.2, will be used in the development of the storage and phosphorus load reduction targets for this sub-watershed. The preferred plan is anticipated to contribute towards meeting the Lake Okeechobee TMDL and to support the holistic restoration of Lake Okeechobee. A main component of the planning process will be public outreach with multiple stakeholder and landowner meetings anticipated. Feedback and input from these entities is essential to successfully develop and implement the preferred plan.

6.6 River of Grass Land Acquisition

In October 2010, the SFWMD invested $194 million in cash to immediately acquire 26,800 acres (42 square miles) of U.S. Sugar Corporation land in the EAA and C-139 basin for water quality and environmental restoration projects. The SFWMD has options to purchase the remaining 153,200 acres of land from U.S. Sugar over the next 10 years.

This land acquisition holds the potential for additional storage and treatment in the EAA. Previous restoration efforts (e.g., CERP, Northern Everglades) were limited by land availability in the EAA. This acquisition is expected to reduce the potential for regulatory releases to the estuaries, improve the ability to manage Lake Okeechobee stages within a more desirable ecological range, and relieve some pressures on the Herbert Hoover Dike. Other possible benefits would be reducing the need for back pumping water into Lake Okeechobee and providing more and cleaner water to the Everglades.

The public planning process for the acquisition included determining viable configurations for constructing a managed system of water storage and treatment to support ecosystem restoration efforts and ensuring broad public and stakeholder participation in development of restoration project plans. The scope of the planning process was to determine the range and general location of lands needed for Everglades restoration in support of the Governing Board contract deliberations and negotiations.

Fifteen public planning workshops were held where stakeholders identified the vision, goals, and scope for the Phase I planning process and identified problems, objectives, and constraints. Nine stakeholder configurations were developed and evaluated for benefits (hydrology, ecology, water quality), potential impacts, and costs. Based on evaluation of the configurations, it was estimated that the total combined Northern Everglades and EAA storage needs are between 700,000 and 1.1 million ac-ft. At the conclusion of the first phase of planning, five primary combinations of features were identified for further consideration.

Storage needs north of the lake were also evaluated and refined through the River of Grass planning process. The results indicated 450,000–575,000 ac-ft of storage is necessary north of the lake. However, this is a conceptual level estimate that will be refined during the more detailed River of Grass Phase II planning effort. The LOPP storage target will be refined based on information resulting from the River of Grass Phase II Planning Process.

6.7 Lake Okeechobee Protection Plan Implementation

The updated LOPP will be implemented in three phases: (1) current projects (completed), (2) near-term projects that will be implemented or completed in the next three years, and (3) long-term projects that will be implemented or completed beyond the next three years. The schedule for the LOPP considers not only the time required to construct the various components, but also the lag between construction and actual load reductions. For this update, the near-term implementation measures listed in **Table 6-1** are most imminent and have the highest potential to be completed by the end of 2013. The long-term implementation measures are projects and activities that will be initiated or completed in 2014 or beyond. The schedule will be revisited and necessary adjustments will be made to the implementation measures and their status in the next LOPP Update in 2014. **Table 6-6** categorizes all implementation measures by their phase and provides project specific details.

This list of implementation measures takes into account the current economic realities and the likelihood of recovery in the near-term. The economic downturn has had a substantial impact on the State of Florida's funding capabilities. Advanced construction initiatives by the state plus its bold vision for land acquisition have been limited by significant revenue declines since 2008.

It should also be noted that due to the funding shortfall for BMP implementation that has occurred over the last several years, the completion of cost-shared BMP programs has fallen behind the implementation schedule outlined in previous versions of the LOPP. By September 30, 2011, the FDACS in cooperation with the coordinating agencies will prepare a budget analysis describing the total projected costs of completing the implementation of all cost-shared BMPs on agricultural lands within the watershed.

The District's funding has also drastically decreased within the last three years due to revenue loss. Three principal revenue sources (ad valorem, the Save Our Everglades Trust Fund, and Florida Forever) for District operations and capital projects have dropped from Fiscal Year (FY) 2008 to FY2011, causing reductions in funding of $332.6 million (43 percent). The proposed budget for FY2011 is 30 percent less than the FY2010 budget. This trend is expected to continue until the economy recovers from its current condition.

Furthermore, ongoing litigation related to water quality in the Everglades Protection Area may result in additional legally mandated projects for the Southern Everglades. Construction of thousands of acres of additional water quality remedies within mandated deadlines will require funding commitments from the District that will have direct effects on implementation of the LOPP.

The coordinating agencies continue to work to overcome these challenges and remain committed to restoring and protecting the Northern Everglades and implementing the LOPP. If additional funding sources are identified or economic conditions improve, expedited implementation of BMPs including edge-of-farm systems, the dispersed water management program, and chemical treatment/hybrid treatment systems would be priorities.

Table 6-1. Lake Okeechobee Protection Plan Projects that will be initiated and/or completed in the near-term (2011–2013).

		Initiated	Completed
Source Control	Agricultural and Urban BMPs*	✓	✓
	Revision of the SFWMD's existing regulatory source control program (Chapter 40E-61, F.A.C.) for the Lake Okeechobee Watershed		✓
	Revision of the FDEP's statewide stormwater proposed rule		✓
Construction Project	Dispersed Water Management Projects-Planned	✓	✓
	Northern Everglades Payment for Environmental Service Program Solicitation	✓	
	Fisheating Creek Wetland Reserve Special Project	✓	
	Alternative Nutrient Reduction Technologies (e.g.., HWTT, PRB technology, Chemical treatment)	✓	✓
	Lakeside Ranch STA Phase I		✓
	Aquifer Storage & Recovery (Kissimmee Pilot ASR and Taylor Creek ASR Reactivation)		✓
	C-44 Project	✓	
	Rolling Meadows Wetland Restoration Planning and Design		✓
	Fisheating Creek Sub-Watershed Feasibility Study		✓
	Indian Prairie Sub-Watershed Phase I Assessment		✓
	Taylor Creek Site Feasibility Study		✓
	Upper Kissimmee Sub-Watershed Feasibility Study	✓	
Research and Water Quality Monitoring	Pre-Drainage Characterization Modeling		✓
	New Alternative Technology Assessment	✓	
	Legacy Phosphorus Studies		✓
	BMP Research and Extension Coordinating Council Proposals	✓	
	Kissimmee River Phosphorus Study		✓
	Continue Watershed and In-Lake Monitoring	✓	✓
Exotic Species Control	Exotic Vegetation Management	✓	✓
Internal Phosphorus Management	In-lake Dredging	✓	
	In-Lake Phosphorus Management Study		✓

* Completed partial implementation through a phased approach

6.8 Watershed Water Quality Evaluation

The contribution of each project and activity toward meeting the Lake Okeechobee TP TMDL was determined using a combination of the WAM and a Microsoft Excel spreadsheet tool. The WAM has been applied to the Lake Okeechobee Watershed to evaluate the effectiveness of BMPs, which based on the modeling results were found to be the most cost effective approach for initial phosphorus load reductions. However, to see the full benefit of BMP implementation at the regional scale, implementation of BMPs throughout the watershed will need to be completed and adequate response time should be allowed. Load reductions from other projects were estimated based on best available data and P2TP evaluations. It should also be noted that the amount of phosphorus reduction is dependent upon the number of projects and at what rate they are being implemented. Thus, the faster these projects are implemented, the higher the reduction of phosphorus to reach the TMDL goal.

The watershed water quality evaluation is conducted for three phases as described in the following sub-sections.

6.8.1 Summary of Estimated Phosphorus Load Reductions from Current Activities

The following section provides a summary of existing phosphorus loads to the lake and an estimate of phosphorus reductions anticipated to result from current activities (projects that are constructed and/or completed).

During the baseline period of 2001–2009, the actual TP load to the lake was 539.2 mt/yr (not including the 35 mt from atmospheric deposition), which is 434 mt above the targeted load of 105 mt/yr. The estimated TP load reductions from current activities are shown in **Table 6-2**. A summary of each of these activities can be found in **Table 6-6** (highlighted in green) and a detailed description can be found in Appendix B. Examples of these activities include:

- **FDACS Agricultural BMP Program**
    - **Owner-implemented Agricultural BMPs.** These BMPs are affordable, cost-effective practices that do not require cost-share. Suites of owner-implemented BMPs are land-use specific. For example, cow/calf land uses may reduce phosphorus fertilization, improve grazing management, or incorporate better management of nitrogen and micronutrients. Additionally, the owner-implemented BMPs for urban areas include reductions in phosphorus fertilization and lawn maintenance activities.
    - **Cost-share Agricultural BMPs.** These BMPs are executed under existing cost-share programs (FDACS [state appropriations] and USDA-NRCS [federal appropriations]) and reflect BMP implementation efforts throughout the watershed.

  The WAM provided simulation results for the effectiveness of both owner-implemented and cost-share BMPs. Based on WAM simulations and the BMP implementation rate, it was estimated that roughly 51.8 mt/yr of phosphorus reduction could be achieved through the owner-implemented and cost-share BMPs that are currently being implemented in the watershed. The TP load reductions from the implementation of BMPs in the Lake Kissimmee and Lake Istokpoga sub-watersheds were not included because these reductions will have little or no short-term affect on what is leaving the sub-watersheds to Lake Okeechobee due to their internal buffering capacities. However, these lakes retain nutrients that could begin to adversely affect their chemistry over time. Furthermore, these increases in nutrient concentration could eventually affect discharges to the Lake Okeechobee.

- **Watershed Phosphorus Control Projects.** About 30 ongoing multiyear projects are aimed at reducing phosphorus loading from the northern Lake Okeechobee Watershed. Projects include isolated wetland restoration projects, Dairy Best Available Technology projects, former dairy remediation projects, and public-private partnership projects.
- **Regional Public Works Projects.** Some of these projects are constructed outside the purview of the Lake Okeechobee Protection Plan but will have water quality benefits for the lake. These include the diversion of 298 Districts flows (Everglades Construction Projects); and the Kissimmee River Restoration project. Also included under this category are Lake Okeechobee Water Retention Phosphorus Removal Critical Projects (Taylor Creek and Nubbin Slough STA Critical Projects).
- **Florida Ranchlands Environmental Services Project.** The goal of this pilot project is to develop a payment for environmental services program. FRESP partners include eight ranchers, World Wildlife Fund, Florida Cattlemen's Association, FDACS, FDEP, UF/IFAS, USDA-NRCS, MacArthur Agro-ecology Research Center, and the District.
- **Dispersed Water Management Projects.** These projects provide localized water quantity and water quality benefits in the Lake Okeechobee Watershed and contribute to overall improvements in lake water quality and stage management. They include Dispersed Water Management projects, Alternate Water Supply projects, Kissimmee River Restoration projects, and Wetland Reserve Program projects.
- **Hybrid Wetland Treatment Technology (HWTT).** The HWTT combines wetland and chemical treatment approaches within a wetland system to further reduce phosphorus loads. Six HWTT projects are included under the current activities.

Table 6-2. Current phosphorus reduction activities in the Lake Okeechobee Watershed with lead agencies and the estimated total phosphorus load reduction.

Current Activities	Estimated TP Load Reduction (mt/yr)	Lead Agency
Baseline Phosphorus Load (2001–2009)	539.2	
Current Activities		
FDACS Agricultural BMPs	51.8	FDACS
Watershed Phosphorus Control Projects	26.4	SFWMD
Regional Public Works Projects	35.1	SFWMD
Florida Ranchlands Environmental Services Project (FRESP)	5.9	SFWMD
Dispersed Water Management Projects	7.6	SFWMD
Hybrid Wetland Treatment Technology (HWTT)	1.1	FDACS and SFWMD
Total under Current Activities	**127.9**	

6.8.2 Summary of Estimated Phosphorus Load Reductions from Near-Term Activities

Near-term activities include projects and activities that are either initiated or completed in the next few years (2011–2013). TP load reductions from the near-term activities were estimated based on the best available information and data (**Table 6-3**). Collectively, these activities will provide an additional annual average TP load reduction of approximately 57 mt/yr within the next three years. A summary of each of these activities can be found in **Table 6-6** and a detailed description can be found in Appendix B. Some examples of these activities are as follows:

- **FDACS Agricultural BMPs.** An additional 259,200 acres will be enrolled in owner-implemented BMPs and 385,629 acres in cost-share BMPs.
- **Dispersed Water Management.** Includes multiple planned projects such as Alternative Water Storage and Disposal Interim Projects, Kissimmee River Restoration Projects, Wetland Reserve Program Projects, and other Dispersed Water Management Projects.
- **Northern Everglades – Payment for Environmental Service Program Solicitation.** The Northern Everglades – Payment for Environmental Service Dispersed Water Management Program (NE–PES) solicitation, released on January 7, 2011, offers eligible cattle ranchers the opportunity to compete for contracts for water and nutrient retention. Proposals will be evaluated and ranked based upon defined evaluation criteria. With the funding available, the top-ranked projects will be selected and move forward with final design, permitting,

construction, monitoring, and service documentation. Load reduction from these projects will be estimated once they are constructed and operational.

- **Fisheating Creek Wetland Reserve Special Project.** An approximately 26,000-acre site in the Fisheating Creek Sub-watershed purchased under the NRCS Wetland Reserve Program will be placed into a conservation easement.
- **Hybrid Wetland Treatment Technology – Grassy Island Site.** Another HWTT site will be located at the Grassy Island site in the Taylor Creek Sub-watershed.
- **Regional Projects.** Regional storage and treatment projects include the Kissimmee Pilot ASR and Taylor Creek ASR reactivation, C-44 project, and Lakeside Ranch STA.
- The additional following near-term activities are intended to contribute to overall achievement of the LOPP goals:
    - Complete or initiate new feasibility studies and assessments where additional load reduction strategies and projects could be identified. Those include the Indian Prairie Sub-watershed phase I assessment and Upper Kissimmee Sub-watershed feasibility study that will be initiated in the near-term. The Fisheating Creek Sub-watershed feasibility study and Taylor Creek site feasibility study will also be completed.
    - In-lake dredging. The District will be purchasing a dredge in 2011 for canal maintenance. The opportunity exists to use the dredge for in-lake dredging when lake levels are suitable and the dredge is not being used for other purposes. Disposal and dewatering options will need to be evaluated and permits will need to be obtained prior to initiating this work.

Table 6-3. Near-term TP reduction activities in the Lake Okeechobee Watershed, with lead agencies and the estimated TP load reduction.

Activities	Estimated TP Load Reduction (mt/yr)	Lead Agency
Baseline Phosphorus Load (2001–2009)	539.2	
Current Activities	**127.9 (from Table 6.1)**	
TMDL (not including the 35 mt of atmospheric deposition)	105	
Remaining Load	**306.3**	
Near-Term Activities		
FDACS Agricultural BMPs	16.8	FDACS
Dispersed Water Management Projects – Planned	16.5	SFWMD
Northern Everglades Payment for Environmental Service Program Solicitation	TBD	SFWMD
Fisheating Creek Wetland Reserve Special Project	3.5	USDA
Hybrid Wetland Treatment Technology (Grassy site)	2.9	SFWMD
Aquifer Storage Recovery (Kissimmee Pilot ASR and Taylor Creek ASR Reactivation)	1.3	SFWMD and USACE
C-44 Project	6.7	SFWMD and USACE
Lakeside Ranch STA Phase I	9.0	SFWMD
Subtotal	**56.7**	
Remaining Load	**249.6**	

6.8.3 Summary of Estimated Phosphorus Load Reductions from Long-Term Activities

Under the long-term activities, several management strategies are being considered to provide additional phosphorus reduction capability such as additional owner implemented and cost-share BMPs, additional potential sites under the Dispersed Water Management Program, chemical treatment at parcel and regional levels, regional projects such as the CERP – Lake Okeechobee Watershed Project, other regional storage/treatment facilities (Brady Ranch STA, Clewiston STA, Istokpoga/Kissimmee RASTA, etc), and ASR wells to be installed in the Lake Okeechobee Watershed. Feasibility studies relating to these strategies will be performed and the most cost-effective projects will be implemented.

These future reduction projects are estimated to further reduce the loads to the lake by approximately 188 mt/yr. That effectively brings the phosphorus loading to the lake down to approximately 62 mt above the target level of 105 mt (**Table 6-4**). Load reduction benefits from some of the regional and sub-regional projects (S-154 Basin Deep Injection Well, Lemkin Creek Urban Stormwater Facility, and Brady Ranch STA) could not be fully accounted for since conservative load adjustments were made using concentration limitation of 30 parts per billion (ppb) for each sub-watershed. For example, where reductions were projected to result in concentrations less than 30 ppb, the remaining loads were calculated by multiplying the sub-watershed flow by 30 ppb instead of a lower projected concentration. Without the load adjustments the remaining load above the target TMDL is estimated to be at 42 mt compared to the 62 mt calculated after adjustments.

A summary of each of these activities can be found in **Table 6-6** and a detailed description can be found in Appendix B. Long-term (2014 and beyond) TP reduction strategies and projects include the following (some of these measures can be implemented sooner if funding becomes available):

- **FDACS Agricultural BMPs.** An additional 172,800 acres are expected to enroll in owner-implemented BMPs and 514,171 acres in cost-share BMPs.
- **Dispersed Water Management.** Potential sites for additional dispersed water management include the Fisheating Creek Marsh Watershed Project, Okeechobee County East/West Stormwater Conveyance Project and Dupuis Reserve Project.
- **Regional and Parcel-level Chemical Treatment.** Implementing chemical treatment at the parcel level across the Lake Okeechobee Watershed and regional level at STAs and reservoirs.
- **Lemkin Creek Stormwater Improvement Project.** This project, located on District-owned land, will store and treat storm water before discharging to Lake Okeechobee through the District's S-133 pump station.
- **CERP – Lake Okeechobee Watershed Project.** This project will attenuate peak flows from the watershed, reduce phosphorus loads to Lake Okeechobee, bring more natural water level fluctuations to the lake, and restore wetland habitat. These goals will be accomplished by constructing three aboveground reservoirs that will provide approximately 272,823 ac-ft of storage, two STAs that along with the reservoirs will collectively reduce phosphorus loads by approximately

54.3 mt (excluding Lakeside Ranch STA), and a 3,730 acre isolated wetland restoration project.

- **Clewiston STA.** The site, located south of Lake Okeechobee in the EAA, is approximately 700 acres.
- **Brady Ranch STA.** The site is in the Taylor Creek/Nubbin Slough Sub-watershed and is approximately 1,800 acres.
- **Lakeside Ranch STA Phase II.** Construction of Phase II expanding the Lakeside Ranch STA by 1,050 acres, for a total treatment area of 2,000 acres with both phases.
- S**-68 STA.** This site is in the Lake Istokpoga and Indian-Prairie sub-watersheds and will help reduce TP loading from intense agricultural operations south of Lake Istokpoga.
- **Istokpoga/Kissimmee Reservoir Assisted Stormwater Treatment Area (RASTA).** This project in the Istokpoga or Kissimmee Sub-watershed has been conceptualized as providing 273,600 ac-ft of storage and 8,000 acres of treatment area.
- **Kissimmee Reservoir East.** This reservoir will receive flows from and discharge back to the Kissimmee River. The stored water can be potentially diverted to the Taylor Creek/Nubbin Slough Sub-watershed for additional treatment
- **Aquifer Storage and Recovery Projects.** Additional ASR sites may include the Paradise Run 10-well system, Seminole Brighton Reservoir ASR System, and Port Mayaca.
- **Deep-injection Well (S-154 Basin Deep Injection Well).** This feature will consist of a single deep injection well system located at the intersection of the S-154 connection to the C-38 canal.
- The additional following long-term activities are intended to contribute to overall achievement of the LOPP goals:
    - **In-lake sediment management.** Sediment dredging; muck removal, scraping or tilling; in-lake island or littoral zone habitat creation; and chemical treatment are all being considered as possible future activities.
    - **Wetland Restoration.** The restoration of wetlands at Paradise Run and Rolling Meadows could provide additional future phosphorus removal and water storage.
    - **Alternative Nutrient Reduction Technologies.** Some of these technologies are already included in near-term features (HWTT, PRB). Expansion of these technologies and inclusion of new approaches are under evaluation.
    - **Feasibility Studies.** Additional sub-watershed feasibility studies will explore additional activities that could be implemented.

As noted previously, the results of ASR pilots and regional studies along with results of the proposed innovative treatment technology projects (such as HWTT and chemical treatment) will help determine the best mix of facilities needed to meet the storage and treatment needs for specific basins. Also, those features identified under long-term activities are conceptual and integrated measures will be studied in detail before final project selection.

Table 6-4. Long-term TP reduction activities in the Lake Okeechobee Watershed, with lead agencies and the estimated TP load reduction.

	Activities	Adjusted TP Load Reduction* (mt/yr)	Lead Agency
	Baseline Phosphorus Load (2001–2009)	**539.2**	
	Current Activities	**127.9 (Table 6.1)**	
	Near-Term Activities	**56.7 (Table 6.2)**	
	TMDL (not including the 35 mt of atmospheric deposition)	**105**	
	Remaining Load	**249.6**	
Future Activities	**FDACS Agricultural BMPs**	18.0	FDACS
	Dispersed Water Management Project – Potential Sites	6.1	SFWMD
	Chemical Treatment at the Parcel Level	46.4	FDEP and SFWMD
	Chemical Treatment within Reservoirs	14.3	FDEP and SFWMD
	CERP Lake Okeechobee Watershed Project**	54	USACE and SFWMD
	Clewiston STA	2.5	SFWMD
	Brady Ranch STA	2.0	SFWMD
	Lakeside Ranch STA Phase II	10.0	SFWMD
	S-68 STA	8.0	SFWMD
	Istokpoga/Kissimmee RASTA	8.9	SFWMD
	Kissimmee Reservoir East	6.5	SFWMD
	Aquifer Storage and Recovery	11.2	SFWMD
	Subtotal	187.9	
	Remaining Load	**61.7**	

* To be conservative, where reductions were projected to result in concentrations less than 30 ppb, the remaining loads were calculated by multiplying the basin flow by 30 ppb instead of a lower projected concentration.

** CERP Lake Okeechobee Watershed Project load estimates do not include estimated load reductions from the Lakeside Ranch STA.

6.8.4 Watershed Water Quality Evaluation Conclusions

Starting with the nine-year (2001–2009) baseline load of 539 mt, the current activities reduce phosphorus loading to the lake by 127.9 mt/yr, leaving 306.3 mt/yr in excess. Near-term activities are expected to further reduce loads by 56.6 mt/yr to a remaining load of 249.6 mt/yr. Long-term projects are estimated to further reduce the loads to the lake by approximately 188 mt/yr. That effectively brings the phosphorus loading to the lake down to approximately 62 mt/yr above the target of 105 mt/yr. Based on this analysis, additional watershed phosphorus reduction projects or strategies are needed. This is especially true in the Fisheating Creek, Upper Kissimmee, and East Lake Okeechobee sub-watersheds where additional reduction strategies are needed the most due to the high levels of remaining concentrations and loads. For example, in the Upper Kissimmee Sub-watershed, the remaining load and concentration are estimated as 53 mt and 50 ppb, respectively, after the implementation of future reduction strategies (Appendix C).

Efforts undertaken by the coordinating agencies such as the Northern Everglades – Payment for Environmental Service Dispersed Water Management Solicitation Program, innovative nutrient reduction technologies, feasibility planning studies, and BMP research and optimization will be used to identify ways to fill this shortfall and accelerate achievement of plan objectives.

6.9 Lake Okeechobee Protection Plan Cost Estimates

The estimated costs for the current and near-term projects implemented under the LOPP were calculated in 2010 dollars and adjusted using a 3.5 percent inflation rate from 2011 to 2013. The total cost estimates are included in **Table 6-5**. All project costs were obtained from projected values or actual costs where available. The coordinating agencies will continue to pursue alternative funding sources including federal matching funds, other non-state funding, and public-private partnerships wherever possible to expedite implementation of this plan.

Table 6-5. LOPP Update expenditures for current and near-term projects.

Category of Cost	Cost Estimate
Agricultural BMPs	$16.1 M
O&M of Completed Projects	$9.6 M
Near-term Construction Project (included the PES program funding for Northern Everglades)	$62.9 M
Research and Water Quality Monitoring	$3.2 M
Exotic Species Control	$0.8 M
Internal Phosphorus Management	TBD
Total Cost	**$92.6 M**

Cost estimates are based on the following assumptions:

- An annual 3.5 percent inflation rate is applied.
- Costs do not include dollars that have already been expended.
- For typical BMPs that require funding, 12.5 percent to 87.5 percent state cost share for capital and 0 percent for operation and maintenance costs. The average value of 50 percent was used in the computation.
- The owner-implemented and cost-share agricultural BMPs have been implemented by 77 percent and 48 percent respectively as of December 2010. For 2011 to 2013, an additional 15 percent of owner-implemented and 22 percent of cost-share agricultural BMPs will be implemented. It is anticipated that the 100 percent implementation rate for owner-implemented BMPs will be achieved by 2015 and for cost-share BMPs by 2017.
- The completed project cost estimate includes monitoring, operations, and maintenance costs for watershed phosphorus control projects, Taylor Creek and Nubbin Slough STAs, FRESP projects and existing HWTT projects.
- The near-term construction project cost includes those projects under near-term activities. Both capital and operation/maintenance costs are included.
- The research and water quality monitoring estimate includes costs for research and ongoing monitoring for water quality and biology.
- Exotic species management includes only the District cost. Additional funds are normally provided by the FWC and are not included in the estimate.
- Internal phosphorus management includes opportunistic in-lake dredging activity in which the sediment disposal and dewatering costs still need to be determined.

Table 6-6. Lake Okeechobee Protection Plan Update activities and projects summary. (Note: bold checkmarks indicate the primary benefit from the project/activity.)

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
1	Agricultural BMPs – Owner-Implemented and Cost-Share	Total agricultural and rangeland acreage in the Lake Okeechobee Watershed is approximately 1,732,000 acres (Section 1, **Table 1-1**). Conservation plans, including Agricultural Nutrient Management Plans, have enrolled approximately 1,317,133 acres in the watershed to reduce TP load to lake. All of these enrolled acres are implementing typical owner-implemented BMPs where costs are incurred by the owner. Almost two-thirds of the agricultural acreage implementing typical owner implemented BMPs (838,780 acres) have also implemented typical cost-share BMPs. The costs are shared between the land owner and the state.	Current	✓	--
2	Urban Turf Fertilizer (UTF) Rule	The Urban Turf Fertilizer Rule is another statewide regulatory program targeting non-point source phosphorus in urban discharges. The UTF Rule, which is lead by the FDACS and was adopted in 2007, limits the phosphorus and nitrogen content of fertilizers used for urban turf and lawns.	Current	✓	--
3	Biosolids Rule	The FDEP adopted amendments to Chapter 62-640, F.A.C., which the Environmental Regulation Commission approved on May 20, 2010, to improve site accountability and management of biosolids. The new rule became effective on August 29, 2010.	Current	✓	--
4	Florida Yards and Neighborhoods	Educate citizens and builders about proper landscape design to minimize nutrient loading to Lake Okeechobee by reducing use of pesticides, fertilizers, and irrigation water.	Current	✓	--
5	ERP Regulatory Program	Permit program that regulaties activities in, on, or over wetlands or other surface waters and the management and storage of all surface waters.	Current	✓	--
6	NPDES Stormwater Program	Rules implemented by the U.S. Environmental Protection Agency (USEPA) to reduce stormwater pollutant loads discharged to surface waters.	Current	✓	--

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
7	Comprehensive Planning – Land Development Regulations	Basin-wide work with cities and counties to review current comprehensive plans, plan amendments and evaluation and appraisal reports (EAR), and ensure promotion of low impact design for stormwater treatment. The FDEP developed a “white paper” in January 2009 to provide guidance to FDEP and SFWMD staff when working with local governments to meet the NEEPP and to explain how existing growth management processes can further restoration and water quality objectives of the NEEPP.	Current	✔	✓
8	Farm and Ranchland Protection Program	Voluntary USDA Natural Resources Conservation Service program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to state, tribal, or local governments and non-governmental organizations to purchase conservation easements.	Current	✓	✔
9	Watershed Phosphorus Source Control Projects	About 30 constructed projects in the four priority basins to treat water and reduce TP loads at the source.	Current	✔	✓
10	Hybrid Wetland Treatment Technology	Hybrid Wetland Treatment Technology (HWTT) is an innovative approach that combines beneficial attributes of the two top ranked nutrient removal technologies, namely wetland treatment and chemical injection. Current project sites include Nubbin Slough, Mosquito Creek, Ideal Grove, Lemkin Creek, and Wolff Ditch.	Current	✔	✓
11	Taylor Creek STA Critical Project	142-acre STA located at the Grassy Island Ranch Site on District-owned lands. Receives flow from and discharges to Taylor Creek. Provides annual average TP load reduction of approximately 2 mt.	Current	✔	✓
12	Nubbin Slough STA Critical Project	809-acre STA located at the New Palm Dairy Site on District-owned lands. Receives flow from and discharges to Nubbin Slough. While it was designed for an average TP load reduction of approximately 5 mt/year, the most likely load reduction will be 3 mt/year.	Current	✔	✓
13	Dispersed Water Management – Avon Park Air Force Range	Onsite retention on 3,600 acres providing approximately 10,000 ac-ft of storage capacity. Includes restoration of existing levee and water control structures. Will reduce flows and nutrient loading to Arbuckle Marsh.	Current	✓	✔

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
14	Dispersed Water Management – Indiantown Citrus Growers Association	3,550 ac-ft of water storage on 492 acres. Includes rehabilitation and relocation of pump stations and widening ditches to reduce surface water volume discharged to St. Lucie Estuary.	Current	✓	✓
15	Dispersed Water Management – Barron Water Control District	5,000 ac-ft of water storage on 6,129 acres. Includes weir construction and ditch retention to enable water quality improvements and reuse by growers.	Current	✓	✓
16	Dispersed Water Management – Lykes Basinger Grove	7,500 ac-ft of water storage on 350 acres and TP load reduction of approximately 3.0 mt/year.	Current	✓	✓
17	Dispersed Water Management – Sumica	1,920 acres of over-drained property that has been over drained by adjacent Florida Department of Transportation box culverts. Management will provide 281 ac-ft of onsite storage and an annual average TP load reduction of approximately 0.03 mt/year.	Current	✓	✓
18	Alternative Water Supply (AWS) Project – Raulerson and Sons, Inc.	670-acre site in the Lower Kissimmee Sub-Watershed, the project has the potential to store approximately 300 ac-ft and provide annual average TP load reduction of approximately 0.033 mt/year.	Current	✓	✓
19	AWS – David Williams	17-acre site serving a drainage area of 502 acres in the Lower Kissimmee Sub-watershed, the project has the potential to store approximately 134 ac-ft and provides annual average TP load reduction of approximately 0.015 mt/year.	Current	✓	✓
20	AWS – Four Ranch, Rothert Farms Stormwater Recycling System	650-acre site serving a drainage area of 1,099 acres in the Lower Kissimmee Sub-watershed, the project has the potential to store approximately 25 ac-ft and provides annual average TP load reduction of approximately 0.003 mt/year.	Current	✓	✓
21	AWS – Haynes Williams – 101 Ranch	201-acre site in the Lower Kissimmee Sub-watershed, the project will have the potential to store approximately 25 ac-ft and will provide annual average TP-load reduction of approximately 0.003 mt/year.	Current	✓	✓
22	FRESP – Alderman-Deloney Ranch (C-25 basin) Pilot Project	49 ac-ft of onsite storage and TP load reduction of 0.018 mt/year in the C-25 basin.	Current	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
23	FRESP – Williamson Cattle Company (S-191) Pilot Project	150 ac-ft of onsite storage and TP load reduction of 0.063 mt/year in the S-191 basin.	Current	✓	✓
24	FRESP – Buck Island Ranch (C-41) Pilot Project	967 ac-ft of onsite storage and TP load reduction of 1.558 mt/year in the C-41 basin.	Current	✓	✓
25	FRESP – Lykes Bros (C-40) West Waterhole Pilot Project	5,000 ac-ft of regional water storage and TP-load reduction of 3.275 mt/year in the C-40 basin.	Current	✓	✓
26	FRESP – C.M. Payne and Son, Inc. (Fisheating Creek) Pilot Project	932 ac-ft of onsite storage and TP load reduction of 0.134 mt/year in the Fisheating Creek Sub-watershed	Current	✓	✓
27	FRESP – Lightsey Cattle Company (Fisheating Creek) Pilot Project	135 ac-ft of onsite water storage and TP load reduction of 0.134 mt/year in the Fisheating Creek Sub-watershed	Current	✓	✓
28	FRESP – Syfrett Ranch West (C-41A) Pilot Project	140 ac-ft of regional water storage and TP load reduction of 0.398 mt/year in the C-41A basin	Current	✓	✓
29	FRESP – Rafter T Ranch (Arbuckle Creek) Pilot Project	1,145 ac-ft of onsite storage and TP load reduction of 0.361 mt/year along Arbuckle Creek	Current	✓	✓
30	Kissimmee River Restoration (KRR) – Lykes Basinger Grove and Boatramp Nursery	350-acre site in the Lower Kissimmee Sub-watershed, the project will have the potential to store approximately 50 ac-ft and will provide an annual average TP load reduction of approximately 0.021 mt/year.	Current	✓	✓
31	KRR – KCOL Wetland Restoration – Otter Slough	550-acre site in the Upper Kissimmee Sub-watershed, the project will have the potential to store approximately 71 ac-ft and will provide an annual average TP load reduction of approximately 0.008 mt/year.	Current	✓	✓
32	KRR – KCOL Wetland Restoration – Rough Island	1,000-acre site in the Upper Kissimmee Sub-watershed, the project will have the potential to store approximately 215 ac-ft and will provide an annual average TP load reduction of 0.024 mt/year.	Current	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
33	KRR – Lake Wales Ridge Wildlife and Environmental Area Restoration (Royce Unit)	120-acre site in the Lake Istokpoga Sub-watershed, the project will have the potential to store approximately 20 ac-ft and will provide an annual average TP load reduction of approximately 0.003 mt/year.	Current	✓	✓
34	Wetland Reserve Program (WRP)	Three projects are complete with a total of 2,225 acres, the projects will have the potential to store approximately 582 ac-ft (total) and will provide an annual average TP load reduction of approximately 0.133 mt/year total.	Current	✓	✓
35	In-lake Strategies – Low-stage Muck Scraping and Tilling	Muck scraping and tilling were completed during the low stage levels in 2007 and 2008. Scraping removed 2,348,000 cubic yards of muck sediment from six locations between Fisheating Bay and Yankee Point. Tilling was conducted in 40 acres near Indian Prairie for phosphorus sequestering and exposure of the sand surface.	Current	✓	--
Included with Project #1	FDACS Agricultural BMPs – Owner-Implemented and Cost-Share	Additional owner-implemented (259,200 acres) and cost-share (385,629 acres) agricultural BMP projects to reduce the TP loads to Lake Okeechobee.	Near-term	✓	--
36	Lake Okeechobee Works of the District Rule Regulatory Phosphorus Source Control Program	Proposed amendments to the Lake Okeechobee Works of the District rule to meet current needs including phosphorus source control program, BMP optimization, and monitoring network to measure effectiveness of all BMP programs within the watershed.	Near-term	✓	✓
37	Environmental Resource Permit Program (Water Quality) – Proposed Statewide Stormwater Rule	Intended to increase the level of treatment required for TN and TP in storm water from new development, which is anticipated to address the discharge of nutrients in general. The proposed rule is also anticipated to have an incidental effect of reducing the volume of storm water.	Near-term	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
38	Environmental Resource Permit Program (Hydrology)- Northern Everglades Discharge Volume BMPs	The previous version of the LOPP included development of an ERP basin rule to address the potential for new activities to impact hydrology within the NEEPP. District staff developed a methodology to be included in a basin rule to demonstrate no impact to hydrology. During rule discussions, it was determined that this methodology can be applied utilizing existing ERP criteria. Therefore, an ERP basin rule is not necessary and the guidance memorandum described above will be utilized to provide a technical method for District staff to review and applicants to demonstrate reasonable assurance that their project will not cause adverse impacts to hydrology. The goal is to begin implementation of these guidelines within the Northern Everglades by early 2011.	Near-term	✓	✓
39 (included with project #10)	Hybrid Wetland Treatment Technology (Grassy Island)	HWTT is an innovative approach that combines beneficial attributes of the two top ranked nutrient removal technologies, namely wetland treatment and chemical injection. Project site is located in the Grassy Island. This project will provide an estimated annual average TP load reduction of 2.9 mt/year.	Near-term	✓	✓
40	Dispersed Water Management – Clewiston Site	728 acres of primarily state and some privately owned land bordering Lake Okeechobee just outside of Clewiston will provide approximately 1,500 ac-ft of storage and an annual average TP load reduction of approximately 0.27 mt/year.	Near-term	✓	✓
41	Dispersed Water Management – Lykes Nicodemus Slough	Design, engineer, and implement a water storage area on 16,129 acres The project will have the potential to store approximately. 33,860 ac-ft and will provide annual average TP load reduction of approximately 9.2 mt/year.	Near-term	✓	✓
42	Dispersed Water Management – Istokpoga Marsh Improvement District (IMDD)	Design and construct an agricultural water treatment facility within the Istokpoga Marsh Improvement District to reduce phosphorus runoff and provide additional stormwater storage for the 19,209-acre area. It will provide an annual average TP load reduction of approximately 4.5 mt/year and the potential to store approximately 7,800 ac-ft.	Near-term	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
43	Northern Everglades Payment for Environmental Service Program (NE-PES) Solicitation	The solicitation requests that landowners with low-intensity agriculture such as natural lands and cattle ranching submit proposals for providing water retention and water quality improvement services. Proposals are being evaluated and ranked based upon defined evaluation criteria. With the funding available, the top-ranked projects will be selected and move forward with final design, permitting, construction, monitoring, and service documentation.	Near-term	✓	✓
44	Alternative Water Storage and Disposal Interim Projects (AWSDI) – Pearce/Hartman	3,997-acre site in the Indian Prairie Sub-watershed, the project will have the potential to store approximately 1,786 ac-ft and will provide an annual average TP-load reduction of approximately 0.74 mt/year.	Near-term	✓	✓
45	AWSDI – Putnam Groves	2,577-acre site in the Lower Kissimmee Sub-watershed, the project will have the potential to store approximately 1,595 ac-ft and will provide an annual average TP load reduction of approximately 0.18 mt/year.	Near-term	✓	✓
46	AWSDI - Taylor Creek (Grassy Island) Interim Project	10,982 acre site in Taylor Creek/Nubbin Slough Sub-Watershed, the project will have the potential to store approximately 1,729 ac-ft and will provide an annual average TP load reduction of approx. 1 mt/year	Near-term	✓	✓
47	Kissimmee River Restoration (KRR) – Three Lakes Wildlife Management Area Hydrologic Restoration	Project is intended to reestablish more natural hydrology and partially restore wetlands on the property. This may provide more temporary water storage (600 ac-ft) and phosphorus removal (0.07 mt/year).	Near-term	✓	✓
48	KRR – Gardner-Cobb Marsh	Project would be sited on District-owned lands in the Upper Kissimmee Sub-watershed and reduce the rate of run-off from this region by holding the water higher, as well as provide incidental nutrient reductions due to plant uptake from overland flows in the marsh. The estimated average phosphorus load reduction is approximately 0.28 mt/year.	Near-term	✓	✓
49	Wetland Reserve Program –Planned	Four projects completed within a total of 6,011 acres, the projects will have the potential to store approximately 1,105 ac-ft (total) and will provide a total annual average TP load reduction of approximately 0.2 mt/year.	Near-term	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
50	Fisheating Creek Wetland Reserve Special Project	Approximately 26,000-acre site in the Fisheating Creek Sub-watershed purchased under the NRCS WRP. The project has the potential to store approximately 13,000 ac-ft and will provide an annual average TP load reduction of approximately 3.6 mt/year.	Near-term	✓	✓
51	Lakeside Ranch STA Phase I (North)	919-acre treatment wetland (STA) in western Martin County between Beeline Highway and Lake Okeechobee that will provide an annual average TP load reduction of approximately 9 mt/year.	Near term	✓	✓
52	Kissimmee River Pilot ASR Project	Facility is located along the Kissimmee River, 2 miles north of Lake Okeechobee. It is intended to test the feasibility of using ASR technology as part of CERP. It will provide an annual average TP load reduction of approximately 0.1 mt/year and the potential to store approx. 7,650 ac-ft.	Near-term	✓	✓
53	Taylor Creek ASR Reactivation	One 6-million gallon/day (mgd) well system located adjacent to the L-63N canal in Okeechobee, Florida will provide an annual average TP load reduction of approximately 1.2 mt/year and the potential to store approx. 5,400 ac-ft.	Near-term	✓	✓
54	C-44 Project	The project is located on District-owned land and includes a reservoir, west STA, and east STA identified in the CERP Indian River Lagoon-South Project Implementation Report.	Near-term	✓	✓
Included with project #1	FDACS Agricultural BMPs: Owner-Implemented and Cost-Share	Additional owner-implemented (172,800 acres) and cost-share (514,171 acres) agricultural BMP projects to reduce the TP load to Lake Okeechobee.	Future	✓	--
55 (included with project #51)	Lakeside Ranch STA Phase II (South)	788-acre treatment wetland (STA) in western Martin County between Beeline Highway and Lake Okeechobee that will provide an annual average TP load reduction of approximately 10 mt/year.	Future	✓	✓
56	Lemkin Creek Stormwater Improvement Project	Stormwater treatment project located on District-owned lands in Okeechobee to store and provide water quality treatment of stormwater in this area that ultimately discharges to Lake Okeechobee through the District's S-133 pump station. Estimated to provide 1.1 mt TP load reduction (not accounted for in the future load reduction due to load adjustment and concentration limitation)	Future	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
57	Dispersed Water Management – Potential Site: Fisheating Creek Marsh Watershed Project	Evaluate, engineer, and rehabilitate PL 566 water control structures in the Fisheating Creek Marsh Watershed project area to more effectively store and manage water and reduce phosphorus runoff from more than 50,000 acres in the headwaters of Fisheating Creek.	Future	✓	✓
58	Dispersed Water Management – Potential Site: Okeechobee County East/West Stormwater Conveyance Project	1,000-acre project in the Taylor Creek/Nubbin Slough Sub-watershed. The project aims to plan, acquire, and implement a stormwater conveyance system with retention and treatment components from east to west through the city of Okeechobee and Okeechobee County. Following water quality treatment and storage, the water will be conveyed into the District's Lemkin Creek urban water storage and treatment facility before making its way into the Rim Canal and ultimately Lake Okeechobee.	Future	✓	✓
59	Dispersed Water Management – Potential Site: Dupuis Reserve	2,830-acre project in east Okeechobee will provide approximately 4,500 ac-ft of storage and 1.0 mt/year of TP load reduction.	Future	✓	✓
60	AWSDI – Buckhead Ridge (Board of Trustees of the Internal Improvement Trust Fund [TIITF])	38-acre site in the Indian Prairie Sub-watershed, the project has the potential to store approximately 27 ac-ft and provide an annual average TP load reduction of approximately 0.012 mt/year	Future	✓	✓
61	AWSDI – Caloosahatchee East and West Property (TIITF)	61-acre site in the West Lake Okeechobee Sub-watershed, the project has the potential to store approximately 30 ac-ft and will provide an annual average TP load reduction of approximately 0.005 mt/year	Future	✓	✓
62	AWSDI – Fisheating Creek (TIITF)	702-acre site in the Fisheating Creek Sub-watershed, the project has the potential to store approximately 867 ac-ft and will provide an annual average TP load reduction of 0.24 mt/year.	Future	✓	✓
63	AWSDI – Harney Pond (TIITF)	33-acre site in the Indian Prairie Sub-watershed, the project has the potential to store approximately 30 ac-ft and will provide an annual average TP load reduction of approximately 0.01 mt/year	Future	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
64	AWSDI – Indian Prairie (TIITF)	2,708-acre site in the Indian Prairie Sub-watershed, the project has the potential to store approximately 52 ac-ft and will provide an annual average TP load reduction of approximately 0.02 mt/year.	Future	✓	✓
65	AWSDI – Okeechobee (TIITF)	23-acre site in the Taylor Creek/Nubbin Slough Sub-watershed, the project has the potential to store approximately 5 ac-ft and will provide an annual average TP-load reduction of approximately 0.003 mt/year.	Future	✓	✓
66	Brady Ranch STA	1,800-acre STA proposed to be located in Western Martin County between the Beeline Highway and Lake Okeechobee immediately east of Lakeside Ranch. It will receive flows from L-63 and discharges to Lake Okeechobee. Expected to provide 5-mt TP load reduction to the lake (adjusted to 2-mt load reduction due to the concentration limitation).	Future	✓	✓
67	Clewiston STA	700-acre STA south of Lake Okeechobee will receive flow from C-21 and provide annual average TP-load reduction of approximately 2.5 mt/year.	Future	✓	✓
68	S-68 STA	5,000-acre STA in the Istokpoga/Indian Prairie Sub-Watershed will provide approximately 8 mt/year of TP load reduction on an annual average basis.	Future	✓	✓
69	Taylor Creek Reservoir (CERP Lake Okeechobee Watershed Project)	1,600-acre, 16-foot deep reservoir on District-owned lands at the Grassy Island Ranch Site will provide approximately 24,000 ac-ft of storage.	Future	✓	✓
70	Paradise Run Wetland Restoration (CERP Lake Okeechobee Watershed Project)	3,730-acre wetland restoration site located at the confluence of Paradise Run, oxbows of the Kissimmee River, and Lake Okeechobee.	Future	✓	✓
71	Kissimmee Reservoir (CERP Lake Okeechobee Watershed Project)	Will provide approximately 161,263 ac-ft of storage in a 10,281-acre, 16-foot deep reservoir in the Istokpoga/Indian Prairie Sub-watershed and will capture flows from the Lower Kissimmee Sub-watershed.	Future	✓	✓
72	Istokpoga Reservoir (CERP Lake Okeechobee Watershed Project)	Will provide 79,560 ac-ft of storage in a 5,416-acre, 16-foot deep reservoir located in and will capture flows from the Istokpoga/Indian Prairie Sub-watershed.	Future	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
73	Istokpoga STA (CERP Lake Okeechobee Watershed Project)	Will provide approximately 29 mt/year of TP load reduction in a 8,044-acre treatment facility that will target flows from the Istokpoga Sub-watershed.	Future	✓	✓
74	Kissimmee Reservoir East	Will capture flows from the Kissimmee River and store approximately 200,000 ac-ft of water. 12,500 acre, 16-ft deep reservoir located to the east of the Kissimmee River in the Lower Kissimmee Sub-watershed. Also estimated to provide approx. 6.5 mt/yr of TP load reduction.	Future	✓	✓
75	Istokpoga/Kissimmee RASTA	Will provide a total annual average storage capacity of 273,600 ac-ft and target flows from the Istokpoga/Indian Prairie Basin and the Kissimmee River. 8,000-acre STA coupled with a 19,000-acre reservoir. Projected annual average load reduction of approximately 9 mt. Because of its proximity to Lake Okeechobee and its large size, this feature could also be used to store and treat Lake Okeechobee waters, as appropriate.	Future	✓	✓
76	NE Chemical Treatment Parcel Level	Provides TP load reduction by implementing chemical treatment at the parcel level across the Lake Okeechobee Watershed	Future	✓	--
77	NE Chemical Treatment Regional – Reservoirs	Addition of chemical treatment in CERP Lake Okeechobee Watershed reservoirs (Istokpoga Reservoir and Kissimmee Reservoir). These have the potential for 14.3 mt/year of phosphorus removal.	Future	✓	--
78	Rolling Meadows/Catfish Creek Wetland Restoration	720 acres of District-owned lands for interim onsite stormwater storage before eventually entering Lake Kissimmee. Bermed area already exists – project proposes installing a culvert to restore natural flows and gravity feed into the bermed area.	Future	✓	✓
79	Port Mayaca ASR Pilot Project	This ASR well "cluster" would be comprised of three ASR wells, each having a daily capacity of 5 mgd, equating to a total system capacity of 15 mgd. An exploratory well was constructed during 2004, which confirmed that conditions within the Floridan aquifer are favorable for the implementation of ASR at the site. This project has the potential to provide 9 mt/year TP load reduction.	Future	✓	✓

Project ID	Project/Activity	Description	Phase	Benefits	
				Water Quality	Water Quantity
80	Ten-Well ASR System (Paradise Run)	50-mgd ASR system along Lake Okeechobee in the area of Paradise Run in Highlands County, south of the S-65E structure. This project has the potential to provide 1.4 mt/year TP load reduction.	Future	✓	✓
81	Seminole Brighton Reservation ASR Pilot	One 5-mgd ASR well system located along the C-41 canal on the western edge of the reservation in Glades County. This project has the potential to provide 0.8 mt/year TP load reduction	Future	✓	✓
82	Deep-injection Well (S-154 Basin Deep-injection Well)	This proposed four-well cluster and 1,000-ac-ft storage pond is expected to provide approximately 19,000 ac-ft of storage and a TP load reduction of 8.3 to 10.6 mt/year. This feature will consist of a single deep-injection well system at the intersection of the S-154 connection to the C-38 canal.	Future	✓	✓
83	In-lake Strategies	To address internal phosphorus loading in Lake Okeechobee, several strategies are identified based on prior efforts: sediment dredging; muck removal, scraping and tilling; creation of in-lake islands or littoral zones; and chemical treatment.	Future	✓	--

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APPENDIX A. SUPPLEMENTAL INFORMATION ON PAST AND CURRENT ACTIVITIES

Section 5.1.2.6. National Pollutant Discharge Elimination System Permitting Program

Section 5.1.2.6 includes a discussion of the National Pollutant Discharge Elimination System (NPDES) and Clean Water Act efforts overseen by the Florida Department of Environmental Protection (FDEP) to regulate activities that may discharge a pollutant from a point source to surface waters. The regulatory activities aim to reduce or eliminate nutrient and other contamination loads to Lake Okeechobee and its tributaries. They include programs that address municipal separate storm sewer systems (MS4s), industrial activities, and construction activities that disturb lands greater than one acre. The following narratives are intended to provide greater detail on FDEP efforts to oversee NPDES- and Clean Water Act-related programs.

Stormwater Master Plan / Wastewater Infrastructure Updates

Originally, stormwater programs were intent on efficient drainage, taking runoff quickly to nearby streams. Resulting flooding then caused local communities to change their basic philosophy from efficient drainage to flood control through the imposition of detention requirements and stricter floodplain controls. Later still the concept of stormwater master planning began to replace ineffective detention programs. Then, in the late 1980s, stormwater program managers faced the need to also address stormwater quality though NPDES and other regulatory programs.

As described in Section 5.1.2.6, regulated MS4 operators must obtain an NPDES stormwater permit and implement a comprehensive stormwater management program to reduce the contamination of stormwater runoff and prohibit illicit discharges to MS4s. These programs, proposed by regulated municipalities, are required to address a number of stormwater control measures, including methods to detect and remove illicit discharge entering MS4s, as well as appropriate Best Management Practices (BMPs) to address discharges from industrial, commercial, and development activities. Permit conditions, however, cannot specify all the procedures necessary to put stormwater management programs into effect.

Stormwater management program strategies contain many linkages and dependencies among other program components and processes. Addressing some needs may require several years as preparatory steps are accomplished. For example, even if infrastructure improvements are the highest priority, they may have to be preceded by master planning studies, prioritization processes, engineering of specific projects, land acquisition, and contracting before a system improvement is actually realized. Formal approvals by elected officials may be needed at various points in this process, potentially creating additional delays. Stormwater master planning studies have been funded through the various water management districts (WMDs). Projects developed under these master plans are potential candidates for Florida Section 319 grant funds.

The Clean Water State Revolving Fund (CWSRF) Program provides low-interest loans for planning, designing, and constructing water pollution control facilities. The FDEP solicits information each year for wastewater and stormwater projects. This information is used to establish project priorities for the following annual cycle. Funds are made available for planning, design and construction loans. The loan terms include a 20-year amortization and low-interest rates. Planning and design loans are only available to financially disadvantaged small communities. Florida's Small Community Wastewater Facilities Grants Program is authorized by Sections 403.1835 and 403.1838, Florida Statutes (F.S.). These statutes authorize the FDEP to fund planning, design, and construction of wastewater management systems for qualifying small municipalities.

Wastewater infrastructure upgrades that involve new collection systems or an increase in capacity to the facility would require a permit from the FDEP. Inflow and infiltration improvement projects are considered operations and maintenance and do not require state permitting.

Table A-1 shows the stormwater projects funded by the FDEP from federal 319 grants in the Lake Okeechobee Watershed since 2000. **Table A-2** lists the stormwater and wastewater projects that have received CWSRF money (e.g., grants or loans) since 2000 in several counties within the lake's watershed, including Hendry, Highlands, Lee, Martin, Okeechobee, Osceola, Palm Beach, and Polk.

Table A-1. Stormwater projects funded in the Lake Okeechobee Watershed with federal 319 grants since 2000.

Year	Title	Recipient Agency	Watershed	County	Contract Amount	Project Description
2002	Little Lake Jackson Off-line Alum Injection Stormwater Treatment	University of Florida/ Institute of Food and Agricultural Sciences (UF/IFAS)	Kissimmee River, Lake Okeechobee	Highlands	$109,698.83	The project is a designed, permitted, and constructed stormwater treatment system to inject alum (aluminum sulfate) into the primary stormwater drainage to Little Lake Jackson in Highlands County and collect the alum floc in a settling pond immediately downstream of the treatment. The off-line alum injection stormwater treatment system is projected to reduce phosphorus loading to Little Lake Jackson by 54.7% or 47 kg/year year and reduce total suspended solids by 54.6% or 1,882 kg/year.
2006	Town of Windermere Stormwater Outfall Improvements	Town of Windermere	Kissimmee River, Lake Okeechobee	Orange	$362,942	BMPs will be constructed at stormwater outfalls where possible to reduce pollutant loadings to the receiving water body.
2008	Martin Leilani Heights Exfiltration & Inlets	Martin County	Lake Okeechobee	Martin	$558,625	The proposed improvements to provide stormwater quality treatment are to install five runs of exfiltration trenches: (1) 580 linear feet on NE 24th Street; (2) 600 linear feet along NE 13th Court; (3) 490 linear feet on NE 23rd Terrace; (4) 1,200 linear feet along NE 21st Terrace; and (5) 1,230 linear feet along NE 19th Avenue.
Total					**$1,031,265.83**	

Table A-2. Stormwater/wastewater projects funded by CWSRF since passage of the Lake Okeechobee Protection Act (LOPA) in 2000.

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
26040	Clewiston	$1,072,654	$1,726,259	The proposed project will construct an expansion of the city's existing wastewater collection system to serve the developments of Ridge View Estates and The Ridge. The aging septic tanks in these areas continue to experience high failure rates.	Hendry	9/28/2009
71703	Avon Park	$802,837		The funding will be used for sanitary sewer system improvements, expansion of treatment capacity to 1.5 million gallons per day (mgd), residuals treatment improvements to meet Class AA, decommissioning Sun'n'Lake's wastewater treatment plant (WWTP), and connecting to Avon Park and effluent reuse improvements such as filtration, storage, and pumping.	Highlands	11/6/2006
78702	Lake Placid	$1,066,290		The project is for construction of a new 0.25 mgd extended aeration domestic wastewater treatment plant with percolation ponds. The project will phase out several private package treatment plant and provides the town with sufficient capacity for future growth.	Highlands	6/20/2001
78703	Lake Placid	$1,026,200		The project is for the installation of collection sewers for the downtown area of the town of Lake Placid. The project includes numerous activities including installation of 8,600 linear feet of 8-inch and 10-inch gravity sewer lines with manholes, sewer services, and clean-outs.	Highlands	8/21/2003
90201	Sebring	$1,649,519		Removing gravity sewer and force main from sovereign land of Lake Jackson and replacing with gravity sewer lines and one pump station at an uplands location.	Highlands	6/22/2001
10901	East County Water Control District	$181,838		Stormwater management.	Lee	8/26/2002

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
10902	East County Water Control District	$347,354		Installing new weirs and replacing existing weirs.	Lee	8/26/2002
10903	East County Water Control District	$2,386,935		Replacing three earthen dam structures with fixed crest weirs with slide gates and replacing 28 corrugated metal culverts with reinforced concrete pipes with same hydraulic capacity. These infrastructure replacements will maintain conveyance.	Lee	9/29/2005
10904	East County Water Control District	$2,418,819		The proposed project includes the replacement of two water control structures at the Harns Marsh and replacement of two weirs called the Yellowtail weirs.	Lee	4/30/2009
63607	Martin County	$2,831,019		The project consists of approximately 25,700 linear feet (LF) of vacuum-assisted sewer main, 14,000 LF of gravity sewers, 125 LF of sewer force main, and a pump station to eliminate 460 septic tanks.	Martin	5/22/2002
63608	Martin County	$113,682		The project consists of 66,500 LF of vacuum-assisted sewer mains, 9,580 LF of gravity sewer mains, and 480 sewage collection tanks.	Martin	5/22/2002
63611	Martin County	$2,326,468		Construction and operation of a surface water management system to retrofit water quality treatment to serve a 412 acre project basin area.	Martin	2/25/2003
61510	Okeechobee Utility Authority	$23,056,266		Expansion of Cemetery Road WWTP to 3.0 mgd total capacity, eastern and western regional pump stations, and a collection system for six areas in town.	Okeechobee	8/21/2007
68615	St. Cloud	$391,835		The project recommends the collection system improvement by sewer rehabilitation in the city grid and wastewater delivery system improvements in several areas of the city.	Osceola	4/15/2002

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
68616	St. Cloud	$267,080		The project involves rehabilitation of existing stormwater conveyance system by replacing 20,500 LF of drainage pipe and constructing 188 new inlets in the oldest part of the town.	Osceola	11/22/2002
68617	St. Cloud	$2,605,030		The project recommends the collection system improvement by sewer rehabilitation in the city grid and wastewater delivery system improvements in several areas of the city.	Osceola	4/25/2005
68618	St. Cloud	$1,751,996		The project involves rehabilitation of existing stormwater conveyance system by replacing 20,500 LF of drainage pipe and constructing 188 new inlets in the oldest part of the town.	Osceola	4/25/2005
68619	St. Cloud	$2,312,042		The city is rehabilitating 8,000 LF of deteriorated stormwater steel pipe in an older section of the city.	Osceola	2/20/2006
68620	St. Cloud	$28,500,000		The project proposes to expand the existing 1.6 mgd Southside Wastewater Treatment Plant to 6.0 mgd. The existing Lakeshore WWTP will be decommissioned. The existing southside facility will be converted to aerobic digestion.	Osceola	2/6/2007
50100	Glades Utility Authority	$58,707	$626,321	The proposed project will rehabilitate the city’s sewer collection lines, manholes, and pump stations. South Bay has experienced a significant increase in sewage flows during rain events.	Palm Beach	7/22/2009
50110	Glades Utility Authority	$962,217	$4,409,058	The proposed project will rehabilitate the city’s sewer collection lines, manholes, and pump stations. Pahokee has experienced a significant increase in sewage flows during rain events. This increase is due to inflow into aging pipes that are damaged.	Palm Beach	7/17/2009

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
72707	South Bay	$347,610		Comply with the FDEP Final Order 030242-E by constructing a new 1.5 mgd wastewater package plant and correcting the infrastructure deficiencies that pose a health threat to South Bay.	Palm Beach	2/17/2005
51201	Polk City	$2,603,764		Elimination of the septic tanks. This project is the first of four phases. The project originally consisted of collection system improvements, force mains, pump stations, and a new 1.0 mgd treatment plant.	Polk	9/1/2006
60006	Frostproof	$266,794		Collection, transmission, and treatment.	Polk	9/7/2001
60007	Frostproof	$2,000,000		This project will expand the city's wastewater collection system and will rehabilitate the existing sewers.	Polk	8/9/2005
60009	Frostproof	$75,475		New collection sewers.	Polk	9/2/2005
60815	Lakeland	$1,588,787		West Lakeland Wasteload Reduction Facility, Glendale WWTP Class A Biosolids, Wetlands Algae Removal System, Northside WWTP Chlorine Contact Chamber, English Oaks Pump Stations, and Force Mains & Skyview Utility WWTP decommissioning.	Polk	11/13/2003
60816	Lakeland	$13,826,231		The proposed project consists of improvements to the city's transmission, treatment, and effluent disposal facilities. These facilities will enable the city to maintain FDEP permit compliance and will prevent the installation of approximately 480 septic tanks.	Polk	1/6/2006
60817	Lakeland	$ 478,753		The proposed project consists of the construction of approximately 19,400 LF of 30-inch and 36-inch force main from east of the booster pump station on Drane Field Road to the Glendale WWTP.	Polk	11/8/2006

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
60818	Lakeland	$19,920,064		This project will construct a 1.5 mgd Wasteload Reduction Facility to treat high strength (2,000 mg/L) biochemical oxygen demand (BOD) waste from the industrialized West Lakeland area.	Polk	7/6/2007
60819	Lakeland	$8,605,243		This project will construct two wastewater pumping stations and will install approximately 14,000 LF of 18-inch to 30-inch force main.	Polk	2/26/2009
71908	Lake Alfred	$146,878		The proposed project will upgrade and expand the city's wastewater treatment plant. The plant will be upgraded to meet Class I reliability standards to produce public-access quality reclaimed water.	Polk	7/29/2004
71909	Lake Alfred	$5,020,477		The project consists of the construction of a new 1.0 mgd USBF WWTF and retrofitting the existing 0.60 mgd trickling filter facility components into modified treatment units.	Polk	10/21/2005
75504	Bartow	$9,714,057		This project will construct the Northeast Force Main and associated improvements to the headworks of the Bartow WWTP. This new force main will allow the city to accept influent from Polk County's Central Regional WWTP.	Polk	12/6/2005
75911	Lake Wales	$1,120,193		Reclaimed water reuse facilities.	Polk	10/4/2001
75912	Lake Wales	$1,390,983		Treatment facilities.	Polk	9/20/2002
75913	Lake Wales	$990,960		Expansion of the city's WWTP to 5.2 mgd and refurbishment of the existing 20-year old facilities. The additional capacity is needed to serve planned developments.	Polk	6/10/2004
75914	Lake Wales	$350,000		Upgrade/modify the existing 1.90 mgd wastewater treatment plant to achieve a capacity rating of 2.19 mgd. These facilities are needed to meet the city's immediate capacity needs.	Polk	6/8/2009

Project Name	Sponsor	Loan Amount	Grant Amount	Description	County	Original Award Date
76508	Haines City	$1,860,153		Expand the WWTF from 2.97 mgd to 6.0 mgd. Effluent disposal will be accomplished using rapid infiltration basins and public access reuse.	Polk	12/27/2007
77005	Mulberry	$646,701		The proposed project will consist of sanitary sewer rehabilitation and wastewater treatment process improvements. The sewer work will rehabilitate approximately 20,000 LF of gravity mains and associated laterals and manholes.	Polk	6/13/2008
86503	Davenport	$537,267		Construction of approximately 1,150 LF of stormwater piping and associated inlets, CDS structures, ponds, and swales to upgrade the outfall conditions for each of the 10 stormwater basins.	Polk	8/20/2001
90401	Eagle Lake	$1,779,406		Expansion of the city's collection system by constructing additional force mains, gravity sewers, low pressure sewers, and lift stations.	Polk	7/19/2001

Wastewater Facilities

Table A-3. Active NPDES permits issued by the FDEP.

County	Facility Type					
	Car Wash	Concrete-Batch Plant	Domestic Wastewater	Industrial Wastewater	Mining	Petroleum Cleanup/ Dewatering Sites
Martin			35	5		1
Glades		6		1		
Okeechobee		2	18	2		1
Palm Beach	1	22	14	10	1	
St. Lucie		6	30	12		

Watershed Assessment

Program Overview

A TMDL is the maximum loading of a particular pollutant that can be discharged to a surface water and still meet its designated uses and applicable water quality standards. TMDLs provide quantitative water quality restoration goals that will guide restoration activities.

The TMDL requirements were originally promulgated as a part of the Federal Pollution Control Act of 1972 and were later expanded by the Clean Water Act of 1977 and the Water Quality Act of 1987. Pursuant to Section 303(d) of the Clean Water Act, states are required to define state-specific water quality standards for various designated uses and to identify water bodies for which the ambient water quality has been determined not to meet established standards. Water bodies that do not achieve such water quality standards as a result of human-induced conditions are considered impaired. An updated list of impaired water bodies must be presented by the state to the U.S. Environmental Protection Agency (USEPA) every two years and must designate which of the listed impaired water bodies require TMDLs. .

Once identified, the FDEP schedules the technical evaluation and development of the TMDL, which may involve a variety of technical approaches from simple data analysis to complex water quality modeling depending on the circumstances. This process is completed using public workshops and in consideration of public review and feedback. Each TMDL is adopted by rule in Chapter 62-304, F.A.C.

The identification of impaired water quality segments that necessitate development of a TMDL is accomplished through the application of the Impaired Waters Rule (IWR) (see Chapter 62-303, F.A.C.). The IWR provides a science-based methodology for evaluating the water quality data to identify impaired waters and establishes specific thresholds for impairment based on chemical parameters, interpretation of narrative nutrient criteria, biological impairment, shellfish and fish consumption advisories, primary contact and recreation activities, and ecological impairment. The IWR also establishes thresholds for data sufficiency and data quality, including the minimum sample size required and the number of exceedances of the applicable water quality standard for a given size that identify a water body as impaired. Assessments are performed on a rotating basin cycle, such that one-fifth of the state is assessed every year. Thus far, the Group 1 Basins, which include Lake Okeechobee and its tributaries, have been assessed twice. The following information contains impairment results from those assessments.

Lake Okeechobee and Tributary Impairments

Lake Okeechobee is currently identified as impaired and needing a TMDL for iron and mercury in fish tissue. The mercury in fish tissue impairment is scheduled to be addressed through the implementation of a statewide TMDL that is set to be developed in 2012. A TMDL to address the verified iron impairment is not scheduled at this time. The USEPA has developed a TMDL for iron for segments of the lake. The FDEP believes that a review of the scientific underpinning of the iron criteria is necessary to determine actual threats to aquatic life given the widespread existence of naturally occurring iron at the levels detected in Lake Okeechobee.

Some of the tributaries of Lake Okeechobee are also impaired. Popash Slough, Chandler Hammock Slough, Nubbin Slough, Taylor Creek, L-63 canal, Lettuce Creek, Henry Creek, Myrtle Slough, S-153, and S-135 do not attain the dissolved oxygen (DO) criterion (Chapter 62-302.530(30), F.A.C.) or the chlorophyll-*a* threshold (less than 20 micrograms/liter [µg/L] annual average, Chapter 62-303, F.A.C.). Turkey Slough, Otter Creek, and Mosquito Creek are only impaired for not attaining the DO criterion. Nubbin Slough, Mosquito Creek, Taylor Creek, and Otter Creek are verified as impaired for exceeding the fecal coliform criterion [less than 400 counts/100 milliliters, see Rule 62-302.530(6), F.A.C.].

Lake Okeechobee TMDL

A TMDL for total phosphorus (TP) for Lake Okeechobee was adopted by the FDEP in 2001, see Section 62-304.700(1), F.A.C. This TMDL is based on a five-year rolling average of 140 metric tons per year (mt/year), which includes atmospheric deposition of 35 mt/year. The TMDL is allocated to the sum of all nonpoint sources and includes all direct inflows into Lake Okeechobee.

Lake Okeechobee Tributary TMDLs

In June 2008, the USEPA established TMDLs for biochemical oxygen demand (BOD), DO, and nutrients in the Lake Okeechobee tributaries (Osceola, Polk, Okeechobee, Highlands, Glades, Martin counties). The FDEP issues Clean Water Act permits to implement the USEPA's TMDLs. Nonpoint-source and point-source reductions associated with these permitted activities will also implement the USEPA's TMDLs. The TMDL targets for the tributaries are for TP and total nitrogen (TN). The TMDL targets were developed to support Florida's narrative water quality standard for nutrients by not causing an imbalance in natural populations of aquatic flora or fauna and also to not cause or contribute to conditions that violate the state's standard for dissolved oxygen. In water body identifications (WBIDs) impaired for both DO and nutrients, it was assumed the TMDLs for TP and TN would address the DO impairment. When BOD data were available and a correlation was made linking DO and BOD (e.g., WBID 3186B), a TMDL for BOD was also included. On March 9, 2009, Friends of the Earth filed suit against the USEPA, challenging the phosphorus limits in these TMDLs as not being protective of the designated uses. This case has been stayed pending the development of numeric nutrient criteria for the freshwaters of the state by the USEPA.

Kissimmee TMDLs

The verified lists for the Kissimmee and Fisheating Creek Basins were adopted by Secretarial Order in 2006. These lists can be found on the TMDL program's web site[1]. Once the FDEP completed these lists, the staff began developing TMDLs for these impaired waters. As of this writing, TMDLs have been drafted for several sections of the watershed; however, these TMDLs have not been proposed. FDEP is currently reviewing the water quality in the basin through the Group 4 basin review process and will issue draft updated assessment decisions for the Kissimmee water bodies in June 2010.

EPA's Numeric Nutrient Criteria

On December 6, 2010, the USEPA promulgated numeric nutrient criteria for lakes, springs, and a majority of flowing freshwaters within Florida. The area for which the criteria were promulgated includes the northern portion of the Lake Okeechobee Watershed. Promulgation of these criteria may have significant effects on the Lake Okeechobee Watershed Protection Plan because these rules set new requirements for phosphorus, nitrogen, and chlorophyll in the regional watershed and Lake Okeechobee. However, the USEPA has recognized that site-specific plans such as the LOPP and the Lake Okeechobee TMDL on which it is based may be eligible for Site-Specific Alternative Criteria (SSAC) under their new rule. Specific implementation mechanisms will be determined over the next 13 months when the majority of the rule is set to be implemented (March 2012).

Basin Management Action Plans

Basin Management Action Plans (BMAPs) are identified in the Florida Watershed Restoration Act (FWRA) as the primary mechanism for implementing TMDLs, see Section 403.067, F.S. A BMAP is a comprehensive planning tool that identifies the set of actions and strategies that will be undertaken by stakeholders to reduce pollutant loadings to achieve a TMDL. It represents a comprehensive set of strategies, such as permit limits on wastewater facilities, urban and agricultural nonpoint BMPs, conservation programs, financial assistance and revenue generating activities. These strategies are designed to implement the pollutant reductions established by the TMDL. These broad-based, consensus-driven plans are developed with local stakeholders along with other regional, state, and federal entities and individuals, and they are adopted by Final Order.

The basic elements of a BMAP include details of the TMDLs, allocations, pollutant reduction strategies, an implementation schedule, funding sources, and an implementation or resource monitoring plan. The support and commitment of local officials is essential to the success of the plan. Section 403.067(7), F.S., provides specific guidance regarding BMAPs and TMDL implementation.

Full-scale BMAPs are recommended for nutrient, DO, or other impairments in large basins that may include a large number of affected stakeholders. They are also recommended for water bodies of statewide or regional significance and where the relationship to upstream or downstream waters is a major consideration. BMAPs are applicable when detailed allocations are necessary for implementation, especially in instances where significant reductions need to be

[1] http://www.dep.state.fl.us/water/watersheds/assessment/adopted_gp4.htm

achieved. BMAPs aim to reach consensus based on scientific foundations. The plan may include detailed allocations if there is sufficient scientific basis for the calculations. It includes recently completed, new, and planned projects and may be linked to MS4 and point-source permits, if applicable. A detailed monitoring plan and annual updates are integral to this approach. The BMAP process includes an adaptive management component, which allows for necessary reallocation of reductions and allocations as additional scientific information is collected or other changes in the basin occur.

The incentive for signing onto and implementing a BMAP is that it is a consensus-driven plan that lays out practicable, workable, and effective means for improving water quality, which is crucial to quality of life, the environment, and future growth. The plan also helps identify funding mechanisms for implementation. Various funding programs may provide assistance for BMAP implementation, including Section 19 grants, Florida Forever grants, the state Revolving Fund, WMD cost-share programs, U.S. Department of Agriculture cost-share programs, and Natural Resources Conservation Service (NRCS) programs.

Where BMAPs may not be developed, local stakeholders may develop local implementation plans. This may be an option in the case of impairments where there are one to several affected stakeholders and when additional projects need to be developed to address the impairment. Plan development is led by local stakeholders with guidance from the FDEP and includes identification of new and planned projects. Fecal coliform TMDL implementation will generally fall into this category and the FDEP is developing a guidance document to assist in the development of these plans. No formal action is required of the FDEP to adopt a local implementation plan, though it may be elevated to BMAP level at a later date.

In some impaired watersheds, significant effects are already completed, underway, or planned that are expected to be sufficient to meet the TMDL. In these instances, the FDEP may work with the local stakeholders to document these efforts and track the implementation of these efforts and resulting water quality improvements. Additional action may not be required.

Section 5.1.2.8
FDEP Dairy Rule / Concentrated Animal Feeding Operations

The FDEP's Feedlot and Dairy Wastewater Treatment and Management Requirements (Chapter 62-670, F.A.C.) define animal feeding operations (AFOs) and concentrated animal feeding operations (CAFOs). CAFOs are facilities where large numbers of poultry, swine, cattle, or other livestock are confined within a much smaller area than traditional pasture operations. The following narratives are intended to provide greater detail on FDEP programs to regulate dairies, AFOs, and CAFOs.

Concentrated Animal Feeding Operations

Current Facilities

The FDEP currently regulates 23 facilities in the Lake Okeechobee Watershed under Chapter 62-670, F.A.C. The Southeast District manages 21 large CAFOs (over 699 milk cows on average) and one medium AFO (PW Bishop Dairy, 600 milk cows on annual average). The South District manages one CAFO, Graham Farms (**Figure A-1** and **Table A-4**). As part of the permitting requirements, each CAFO submits an annual report to the FDEP, which includes the permitted herd size, average herd size, and nutrient-balance summary (e.g., lists all nutrient imports and exports from the facility over the calendar year). FDEP frequently inspects the permitted dairies and CAFOs and educates farm managers to prevent any negative environmental effects resulting from mismanagement of wastes. Properly managed manure and wastewater at CAFOs protects the environment and public health. Manure and wastewater have the potential to contribute pollutants, such as nitrogen, phosphorus, organic matter, sediments, pathogens, heavy metals, hormones, and ammonia to the environment. The dairies permitted in the Lake Okeechobee Watershed reuse their wastewater to fertilize crops and avoid offsite discharge.

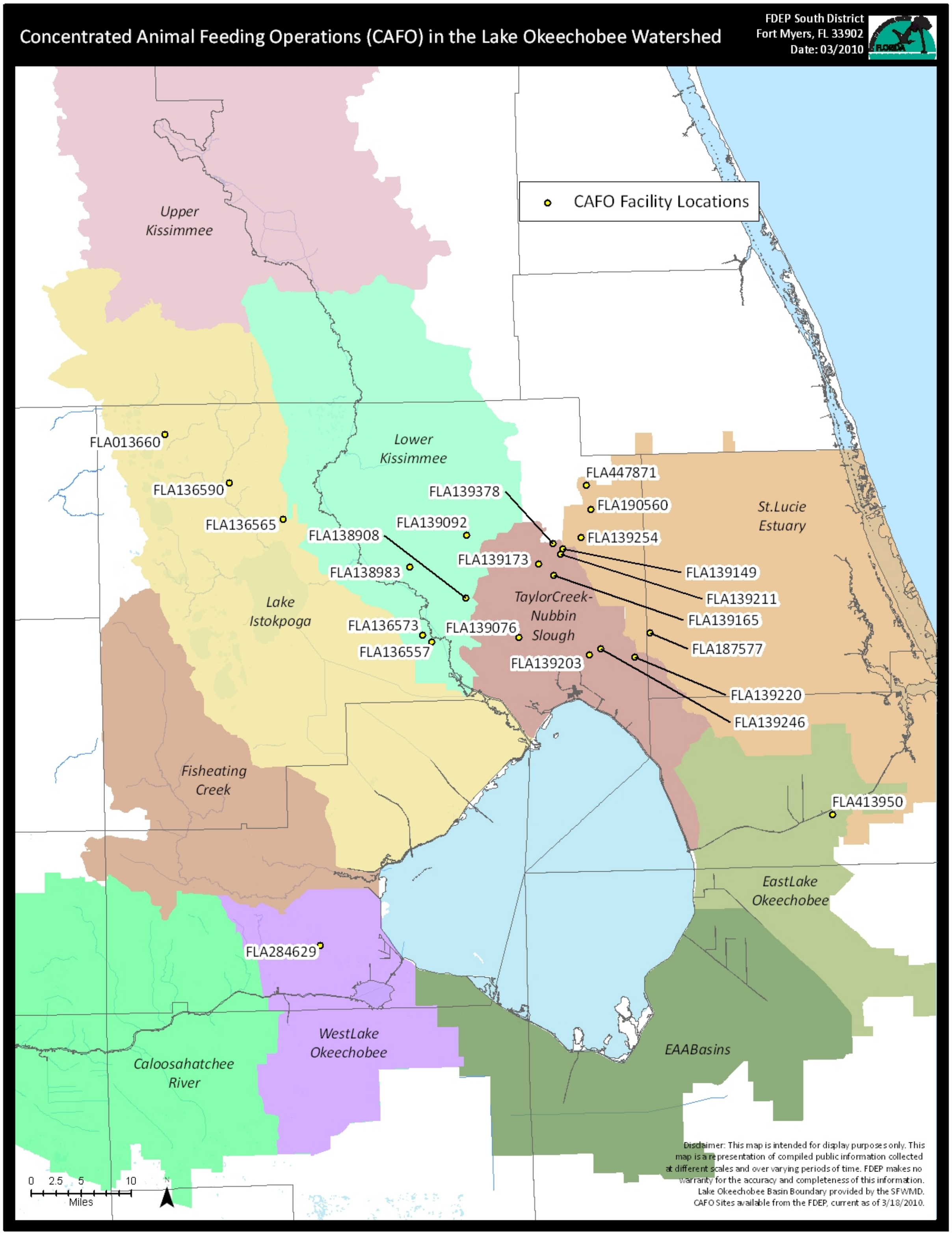


Figure A-1. Concentrated animal feeding operations in the Lake Okeechobe Watershed.

Table A-4. FDEP-permitted CAFOs in the Lake Okeechobee Watershed.

FDEP District*	Facility Permit ID	Facility Name	County	Watershed	Permit Issuance	Permit Expiration
SED	FLA136557	Butler Oaks Farm	Highlands	Lower Kissimmee	3/17/06	3/16/11
SED	FLA136565	Bishop Brothers Dairy	Highlands	Lake Istokpoga	7/22/05	7/21/10
SED	FLA136573	B-4 Dairy	Highlands	Lower Kissimmee	3/20/06	3/19/11
SED	FLA136590	Triple G Dairy	Highlands	Lake Istokpoga	2/20/06	2/19/11
SED	FLA013660	Wabasso Road Dairy	Highlands	Lake Istokpoga	11/12/08	11/11/13
SED	FLA138908**	P W Bishop Dairy	Okeechobee	Lower Kissimmee	6/21/06	6/20/11
SED	FLA138983	Basinger Farm	Okeechobee	Lower Kissimmee	3/17/06	3/16/11
SED	FLA139076	Milking R, Inc.	Okeechobee	Taylor Creek/Nubbin Slough	11/3/06	11/2/11
SED	FLA139092	C & M Rucks	Okeechobee	Lower Kissimmee	1/25/06	1/24/11
SED	FLA139149	McArthur Farms Dairy-Barn # 1 & 2	Okeechobee	St. Lucie Estuary Taylor Creek/Nubbin Slough	8/16/06	8/15/11
SED	FLA139165	H W Rucks Dairy-Barn #2	Okeechobee	Taylor Creek/Nubbin Slough	10/27/04	10/26/09
SED	FLA139173	H W Rucks-Barns #1 & 3	Okeechobee	Taylor Creek/Nubbin Slough	1/29/04	1/28/09
SED	FLA139203	Larson Dairy-Barn #5	Okeechobee	Taylor Creek/Nubbin Slough	2/7/07	2/6/12
SED	FLA139211	McArthur Farms Dairy-Barn #4	Okeechobee	Taylor Creek/Nubbin Slough	3/17/06	3/16/11
SED	FLA139220	Davie Dairy-Barns #1 & 2	Okeechobee	Taylor Creek/Nubbin Slough	4/21/04	4/20/09
SED	FLA013924	Larson Dairy-Barn #8	Okeechobee	Taylor Creek/Nubbin Slough	1/29/08	1/28/13
SED	FLA139254	Larson Dairy-Barn #3	Okeechobee	St. Lucie Estuary	7/1/08	6/30/13
SED	FLA013937	McArthur Farms Dairy-Barn # 3	Okeechobee	Taylor Creek/Nubbin Slough	12/12/07	12/11/12
SED	FLA187577	Gracewood Dairy	St. Lucie	St. Lucie Estuary	2/20/06	2/19/11
SED	FLA190560	J L Farms	Okeechobee	St. Lucie Estuary	5/16/08	5/15/13
SED	FLA413950	Payson Park Thoroughbred Training Center	Martin	East Lake Okeechobee Basin	8/2/07	8/1/12
SED	FLA4447871	Burnham Farms, Inc.	Okeechobee	St. Lucie Estuary	7/29/08	7/28/13
S	FLA284629	Graham Farms	Glades	West Lake Okeechobee Basin	8/5/05	8/4/10

*SED indicates Southeast District; S indicates South District.

**This facility is an AFO not a CAFO.

Section 5.1.2.9
Submerged Lands and Environmental Resources Program

The Submerged Lands and Environmental Resources Program regulates activities involving the alteration of surface-water flows, including new activities in uplands that generate stormwater runoff from construction and dredging and filling in wetlands and other surface waters. The following narratives are intended to provide greater detail on FDEP programs to regulate submerged lands and environmental resources.

Submerged Lands and Environmental Resources (SLER) Program

Environmental Resource Permit (ERP) applications within the Lake Okeechobee Watershed are processed by either the FDEP or the South Florida Water Management District (SFWMD or District) in accordance with the division of responsibilities identified in the "Operating Agreement Concerning Regulation under Part IV, Chapter 373, F.S., between South Florida Water Management District and Department of Environmental Protection," which was signed by the two agencies on May 10, 2007, and became effective on July 1, 2007.

Since the passage of the Lake Okeechobee Protection Act (LOPA) in 2000, the FDEP has issued 22 ERP permits, 4 modifications, and 19 exemptions to the United States Army Corps of Engineers (USACE), SFWMD, Kissimmee River Park, and Avon Park Air Force Range for projects in the Lake Okeechobee Watershed. **Table A-5** provides information on these permitted projects, including the associated permit numbers, project name and description, issuance date, and expiration date. These projects include activities designed to minimize phosphorus discharges from former dairy farms (e.g., Beaty Ranch, Candler Ranch, Mattson Ranch, Nubbin Slough Area A, and the Lamb Island Tributary Stormwater project), and isolated wetland restoration projects (Eckerd Youth Wetland Restoration and Lemkin Creek Wetland Restoration), to rehabilitate and repair Herbert Hoover Dike, and to restore the Kissimmee River.

Table A-5. ERP permits issued by the FDEP since the passage of LOPA in 2000.

Permit Number	Project	Action	Description	Applicant/ Permittee	Application Date	Issuance Date	Expiration Date
0282599-001	Avon Park/ Arbuckle Dike Restoration Project	Exemption	*Deminimus* exemption for dike restoration	Avon Park Air Force Range	9/14/07	3/28/08	N/A
0253280-001	Beaty Ranch	Exemption	Minimize phosphorus discharges from former dairy ranch through various methods of containment	SFWMD	7/1/05	10/5/05	10/5/06
0258816-001	Big Grassy	Exemption	Minimize phosphorus discharges from the former dairy site by installing two culverts with flash-board riser	SFWMD	11/18/05	12/15/05	12/15/06
0267164-001	Buttermilk Packingham Slough	New Permit	Restore pre-channelization hydroperiod to Buttermilk and Packingham Sloughs within Kissimmee River floodplain	SFWMD	6/8/06	1/11/07	1/11/12
0267164-002	Packingham Slough Temporary Berm Cuts	New Permit	Construct weirs within levee for temporary flood protection	SFWMD	6/29/09	8/21/09	8/21/14
0238833-002	C-38 Pool B Backfilling	New Permit	Kissimmee River Restoration	USACE	1/28/05	6/16/05	6/16/10
0253278-001	Candler Ranch	Exemption	Minimize phosphorus discharges from former dairy ranch through various methods of containment	SFWMD	7/1/05	7/28/05	7/28/06
0290850-001	Chandler Slough	New Permit	Noticed general permit (NGP) to install 3-mile long, five-strand barbed wire fence	SFWMD	8/15/08	9/2/08	9/2/13
0290850-002	Chandler Slough	Modification	Add more fencing line to existing NGP project	SFWMD	1/15/09	1/29/09	9/2/13
0290850-003	Chandler Slough	New Permit	Construct boardwalk and cross over bridge over isolated wetland	SFWMD	1/28/09	2/18/09	2/18/14
0238833-001	CSX Railroad-Kissimmee River	New Permit	Construct elevated railroad bridge	USACE	10/8/04	1/27/06	1/27/11
0262871-001	Eckerd Youth Wetland Restoration	Exemption	Minimize phosphorus discharges through wetland rehydration and phosphorus retention	SFWMD	3/7/06	4/3/06	4/3/07
0291982-001/002	G-36 Structure Maintenance	Exemption-Non Jurisdictional	Non-jurisdictional to install an upland wall and exemption to install riprap	SFWMD	9/29/08	11/4/08	12/4/09
0234604-001	Herbert Hoover Dike Rehabilitation and Repair	Exemption	Exemption to repair Reach 1A	USACE	7/2/04	8/2/04	8/2/05

Permit Number	Project	Action	Description	Applicant/ Permittee	Application Date	Issuance Date	Expiration Date
0234604-002	Herbert Hoover Dike Rehabilitation and Repair	Exemption	Exemption to repair Reach 1D	USACE	5/9/06	6/8/06	6/8/07
0234604-003		New Permit	Backfill ~20,000 feet of toe ditch in Reaches 1,2, and 3	USACE	10/27/06	3/8/07	3/7/12
0234604-004		New Permit	Construct 10,000 feet seepage berm on northern Reach 1A	USACE	3/20/07	5/11/07	5/10/12
0234604-005		Exemption	Construct seepage cutoff wall for Reach 1A	USACE	3/30/07	4/27/07	4/27/09
0234604-006		Exemption	Construct seepage cutoff wall for Reach 1B-1C-1D	USACE	7/17/07	8/16/07	8/16/09
0234604-007		New Permit	Backfill former borrow pits adjacent to levee in Reach 1D	USACE	1/18/08	5/19/09	5/19/14
0234604-008		New Permit	Remove Culvert 14 and reconstruct levee cross-section	USACE	7/21/08	2/19/09	2/18/14
0234604-009		New Permit	Backfill ~8,277 feet of toe ditch in Reach 2	USACE	7/21/08	3/27/09	3/26/14
0294517-001	Kissimmee Air Boat Crossing	Exemption	Repair and replace existing air boat ramps (width 10 feet)	SFWMD	3/3/09	3/27/09	3/27/10
0164286-001	Kissimmee River Restoration-C-41 Canal Spillway Additions	New Permit	Construct three water control structures	USACE	12/30/99	11/28/00	11/27/10
0272791-002	Kissimmee River Restoration-Headwaters Revitalization, C-37 Dredging	Major Modification	Modifying the dredging methodology, spoil disposal site, and use of flocculants in the spoil disposal area for the C-37 Dredging Project	USACE	6/22/09	10/2/09	1/19/12
0272794-001	Kissimmee River Restoration Reach 4 Backfill Contract 13B	New Permit	Kissimmee River Restoration	USACE	9/6/06	7/23/07	7/23/12
0238833-002	Kissimmee River Restoration-Reach 4 Backfill (Contract 13A)	New Permit	Backfill Reach 4 of the C-38	USACE	1/28/05	6/16/05	6/16/10
0238833-003	Kissimmee River Restoration-Istokpoga Canal Improvements	New Permit	Improvement of Istokpoga Canal	USACE	2/21/05	5/16/06	5/16/11
0238833-004		Modification	Modification to change the entrance to boat ramp	USACE	12/29/08	1/9/09	5/19/11

Permit Number	Project	Action	Description	Applicant/ Permittee	Application Date	Issuance Date	Expiration Date
0298610-001	Kissimmee River Restoration-Oxbow Restoration	New Permit	Fill an existing oxbow, create an oxbow and an earthen berm in preparation for revitalization	USACE	12/11/09	Processing as of March 2010	
0182163-001	Kissimmee River Wetland Jurisdictional	New Permit	Wetland jurisdictional	Kissimmee River Park	3/8/01	3/27/01	3/27/06
0182163-002	Kissimmee River Restoration-River Acres Subdivision	New Permit	New seepage and tieback levee	USACE	9/14/05	3/22/06	3/22/11
0182163-003		Modification	Modified the footprint of the northern and southern disposal areas	USACE	7/17/09	1/28/09	3/22/11
0285562-001	Lake Okeechobee Pilot Tilling – Phase 1: Indian Prairie Parcel	Exemption	50-acre soil/sediment/vegetation tilling on dry lakebed	SFWMD	1/16/08	2/11/08	2/11/09
0263143-001	Lamb Island Tributary Stormwater Project	Exemption	Minimize phosphorus discharges from former dairy ranch through various methods of containment	SFWMD	3/15/06	4/14/06	4/14/07
0254574-001	Lemkin Creek Wetland Restoration	Exemption	Minimize phosphorus discharges from former dairy ranch through various methods of containment	SFWMD	8/16/05	9/14/05	9/14/06
0291099001	Lykes Marsh Fence Line	New Permit	Install 1.2 mile five-strand barbed wire fence	SFWMD	8/15/08	9/16/08	9/16/13
0285408-001	Nubbin Slough Area A	Exemption	Minimize phosphorus loading from lands in the Lake Okeechobee watershed by installing six ditch plugs	SFWMD	12/19/07	1/17/08	1/17/09
0298591-001	Oasis Marsh Restoration Project	New Permit	Noticed General Permit to restore 2,429 acres in Kissimmee flood plain	SFWMD	12/10/09	1/8/10	1/8/15
0184264-001	Port Mayaca Dredging	Exemption	Maintenance dredging with clamshell dredge and material disposal	USACE	4/30/01	9/14/01	9/14/06
0224016-001	S-65D Structure and Bypass Channel	New Permit	Constructing additional structures at the S-65 Structure including the S-65DX1 and S-65DX2	USACE	12/3/03	7/9/04	7/9/09
0224016-002		Time Extension	Extend expiration date of permit	USACE	1/12/09	2/10/09	2/10/14
0224016-003		Exemption	Install dolphin pilings for the boat barrier in front of the S-65D structure	USACE	1/19/10	2/12/10	N/A
0194483-005	S-65E Spillway Structure Stability Project	New Permit	Emergency weir construction due to low Lake Okeechobee levels	SFWMD	2/20/08	3/13/08	3/13/12

Permit Number	Project	Action	Description	Applicant/ Permittee	Application Date	Issuance Date	Expiration Date
0286339-003	S-65E Weir Water Quality Monitoring Stations	Exemption	Construct water quality monitoring stations adjacent to weir	SFWMD	6/4/09	6/19/09	6/19/10
0285946-001	S-71 and S-72 Spillway Structure Stability Project	Exemption	Construct emergency weirs and water supply due to low Lake Okeechobee levels	SFWMD	1/29/08	2/14/28	2/14/12
0259591-001	Taylor Creek Algal Turf Scrubber Nutrient Recovery Facility	Exemption	Construct surface-water treatment system to remove nutrient pollutants from impaired waters	SFWMD	12/23/05	1/22/06	2/23/11

Section 5.1.2.10
Other FDEP Permitting Programs

The FDEP also administers the Comprehensive Everglades Restoration Plan Regulatory Act (CERPRA) (see Section 373.1502, F.S.), TMDLs under authority of Section 303(d) of the Clean Water Act via the Impaired Waters Rule (Chapter 62-303, F.A.C.), the Florida Watershed Restoration Act (Chapter 403.067, F.S.), and programs and initiatives covered in the NEEPP. The following narratives are intended to provide greater detail on the other permitting programs affecting source controls administered by the FDEP.

Comprehensive Everglades Restoration Plan Regulatory Act

In 2000, Congress authorized the Comprehensive Everglades Restoration Plan (CERP) to restore, preserve, and protect the South Florida ecosystem, while providing for other water-related needs of the region. Together these components are expected to deliver benefits to improve (1) the ecological function of over 2.4 million acres of the South Florida ecosystem, (2) urban and agricultural water supply, (3) deliveries to coastal estuaries, and (4) regional water quality conditions, while maintaining the existing levels of flood protection. CERP is a state/federal partnership between the USACE and the SFWMD. The FDEP has permitting authority for CERP projects pursuant to the CERPRA.

CERPRA regulates the construction, operation, and maintenance of project components as described in 373.1501, F.S. The 68 project components are identified in the Florida Project Comprehensive Review Study: Final Integrated Feasibility Report and Programmatic Environmental Impact Statement, April 1999, and also known as the "Restudy" or "Yellow Book." CERPRA regulates CERP project components unless they are otherwise subject to Section 373.4592, F.S. (Everglades Forever Act), Section 373.4595, F.S. (NEEPP), or the FDEP's rules on reuse of reclaimed water. Since the passage of the LOPA in 2000, FDEP has issued permits for two CERPRA projects in the Lake Okeechobee Watershed (**Table A-6**).

Table A-6. CERPRA permits issued by the FDEP since the passage of LOPA in 2000.

Permit Number	Project	Description	Applicant/ Permittee	Application Date	Issuance Date	Expiration Date
0236494-003	Lake Okeechobee ASR–Kissimmee	ASR CERPRA permit	SFWMD/ USACE	8/10/04	12/21/05	12/21/10
0236488-003	Lake Okeechobee ASR–Mayaca	Port Mayaca CERPRA permit	SFWMD/ USACE	8/10/04	4/21/06	4/20/11

NEEPP / Lake Okeechobee Protection Permits

Under NEEPP, the FDEP has the regulatory authority to issue Lake Okeechobee Protection Permits (LOPPs), formerly known as LOPA permits. LOPP permits are issued for Lake Okeechobee Watershed Construction Project (LOWCP) facilities and structures discharging into or from Lake Okeechobee. Since the passage of LOPA in 2000, FDEP has issued 11 permits, 2 major permit modifications, 1 exemption, and 1 non-jurisdictional exemption for projects in the Lake Okeechobee Watershed (**Table A-7**). These permits are for various projects, including the Lakeside Ranch Stormwater Treatment Area (STA), Lemkin Creek Hybrid Wetland Treatment Technology (HWTT), Lake Okeechobee Water Control Structures Operations Permit (LOOP), Nubbin Slough STA, and Taylor Creek STA.

Table A-7. LOPA (LOPP) permits issued by the FDEP since the passage of LOPA in 2000.

Permit Number	Project	Permit Type	Action	Description	Applicant/ Permittee	Application Date	Issue Date	Expiration Date
0288795 -001-GL	East Beach Water Control District/ C-10 Pump Station	LOPP	New Permit	Pump Station	East Beach Water Control District (EBCWD)	11/5/01	10/3/08	10/3/13
0288800 -001-GL	East Shore Water Control District/ C-12 Pump Station	LOPP	New Permit	Pump Station	East Shore Water Control District (ESWCD)	11/5/01	10/3/08	10/30/13
0291982 -001	G- 36 Structure Maintenance	LOPP	Non-Jurisdiction al	Install upland retaining wall and structure maintenance	SFWMD	9/28/08	11/4/08	11/4/13
0291982 -002		LOPP	Exemption	Repair existing riprap along structure	SFWMD	9/29/08	11/4/08	11/4/13
0174552 -001	Lake Okeechobee Water Control Structure Operations	LOPA	New Permit	Permit for operation of SFWMD structures	SFWMD	8/31/00	6/18/07	6/18/12
0287326 -001	Lakeside Ranch Stormwater Treatment Area (STA) – Phase I	LOPP	New Permit	Phase I construction of 2,700-acre STA	SFWMD	3/26/08	1/21/09	1/21/14
0287326 -003		LOPP	Major Modification	Phase II Construction of the STA	SFWMD	8/28/09	Process ing	
0254574 -002	Lemkin Creek Hybrid Wetland Treatment Technology	LOPP	New Permit	Installation of hybrid water treatment technology facility	SFWMD	2/20/09	5/5/09	5/5/14
0194483 -001	Nubbin Slough STA (New Palm/ Newcomb Dairy)	LOPA	New Permit	Construction and interim operations of STA facility	USACE	1/25/02	9/15/03	9/15/09
0194483 -002		LOPA	New Permit	Operations of STA facility	SFWMD	1/25/02	6/9/03	6/13/08
0194483 -005		LOPA	Major Modification	Enlargement of existing STA as part of LOPA	SFWMD	3/16/06	1/5/07	7/16/11
0288807 -001-GL	South Florida Conservancy District/ P-5-N Pump Station	LOPP	New Permit	Pump Station	South Florida Conservancy	2/21/07	10/3/08	10/3/13
0288806 -001-GL	South Shore Drainage District/Bean City Pump Station	LOPP	New Permit	Pump Station	South Shore Water Control District (SSWCD)	2/21/07	10/3/08	10/3/13
0194485 -001	Taylor Creek (Grassy Island Ranch) STA	LOPA	New Permit	Construction and interim operations of STA facility	USACE	1/25/02	9/15/03	9/15/09
0194485 -002		LOPA	New Permit	Operations of STA facility	SFWMD	1/25/02	6/9/06	6/9/11

5.1.4.1 Comprehensive Planning

The FDEP's Office of Intergovernmental Programs and the SFWMD's Department of Intergovernmental Programs coordinate each agency's involvement in statewide planning activities, although the nature and level of participation varies. While local government comprehensive plans have already been adopted, hundreds of plan amendments are reviewed by the FDEP's Office of Intergovernmental Programs and the SFWMD's Department of Intergovernmental Programs each year.

The focus for these reviews is to address the improvement of water quality in the NEEPP watersheds through environmentally sound land planning techniques and to help meet the NEEPP water quality requirements outside the regulatory process. In the past year, the documents listed in **Table A-8** have been reviewed.

Table A-8. Planning documents reviewed in the past year.

Evaluation and Appraisal Report (EAR)	EAR-Based Amendment	Development of Regional Impact (DRI)-Related	Regional Water Supply Plans (RWSP)	Miscellaneous Documents
South Bay	Hendry Co. 10-2ER	Martin Co. 09-D1	Hendry Co. 09RWSP-1	Hendry Co. 10-1
Moore Haven	Pahokee 09-1ER	Orange Co. 09-D1	South Bay 09RWSP-1	Palm Beach Co. 09-1
Kissimmee	Orange Co. 09-1ER	Lake Placid Groves DRI Application for Development Approval	Okeechobee Co. 09RWSP-1	Highlands Co. 08-2
	Reedy Creek 10-1ER		Moore Haven 09RWSP-1	Osceola Co. 09-1
			Glades Co. 09RWSP-1	Osceola Co. 09-2
			Kissimmee 09RWSP-1	Kissimmee 09-1
				St. Cloud 10-1
				St. Cloud 09-1
				Orange Co. 10-1
				Orange Co. 09-2

Florida-Friendly Landscaping Program

The Florida-Friendly Landscaping Program (FFL) is the overarching program that includes several sub-programs, including the Florida Yards and Neighborhoods Program (FYN), the Florida-Friendly BMPs for Protection of Water Resources by the Green Industries (GI-BMPs), and ordinance education. The FDEP, using USEPA Section 319(h) grant funding, pays for most of the FFL Program staff on the state-office level. The FDEP also collaborates closely, both on a technical and a policy level, on all publications and funding of most of the cost of publications and distribution of these manuals. Each year, the FDEP provides approximately $500,000 to the FFL Program through a federal 319 grant from the USEPA. These grants have totaled approximately $4 million since 2000 (**Table A-9**). **Table A-10** lists the BMP projects that have been funded by the FDEP since 2000 in the Lake Okeechobee Watershed.

Table A-9. Florida Yards and Neighborhoods (FYN) and Green Industries Best Management Practices (GI-BMP) projects funded through federal 319 grants since 2000 in Florida.

Year	Title	Recipient Agency	Watershed	County	319 Grant Award	Project Description
2000	FYN	UF/IFAS	Upper St. Johns, Oklawaha, Kissimmee, Withlacoochee, and Waccasassa	Marion and Osceola	$292,741.00	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2000	FYN – Marion and Osceola	UF/IFAS	Various	Statewide	$552,330.00	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2000	FYN – Statewide Oversight	UF/IFAS	Various	Statewide	$183,750.00	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2000	FYN – Demonstration and Training	UF/IFAS	Various	Statewide	$84,878.16	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2002	FYN – Statewide Oversight	UF/IFAS		Statewide	$224,140.65	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2003	FYN – Southwest and Central West Florida Expansion	UF/IFAS	Suwannee River	Middle Suwannee River Basin counties	$752,522.32	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.

Year	Title	Recipient Agency	Watershed	County	319 Grant Award	Project Description
2005	FYN – Lake Okeechobee Region Expansion	UF/IFAS	Lake Okeechobee	Okeechobee, Highlands	$158,944.00	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
2008	Continuation of Statewide Coordination of FYN Program	UF/IFAS	Statewide	Statewide	$1,551,395.00	This project seeks to reduce surface and groundwater contamination by changing the behavior of various stakeholder groups related to their landscape design and maintenance practices. Reductions in fertilizer and pesticide runoff from residential and other properties will be the primary strategy for reducing pollution.
Total					**$3,800,701.13**	
2005	Florida Green Industries	University of Florida	Statewide Educational	Statewide	$452,866.00	The objective of the education component of the GI-BMPs is to reduce nutrient pollution from landscapes by training all segments of the lawn care, pest control, and landscape industry in nutrient management.
2009	GI-BMP Training	FDEP	Statewide Educational	Statewide	$304,581.00	The GI-BMP for Protection of Water Resources in Florida Training Program was developed to provide Green Industry professionals with the knowledge, tools and skills to minimize the environmental impacts of non-point sources of pollution related to their business practices. This program is currently delivered statewide by the UF/IFAS, specifically under the direction of Dr. Laurie Trenholm. With additionally coordinators at Rookery Bay, Guana-Tolomato-Matanzas, and Apalachicola, the training program will be able to deliver/assist with delivering GI-BMP classes (in English and Spanish) throughout their respective regions. Second, they will conduct Train the Trainer classes to increase the number of approved trainers for this program throughout the state. Third, they will provide oversight of trainers to ensure consistency and quality of the training program
Total					**$757,447.00**	

Table A-10. BMP projects funded in the Lake Okeechobee Watershed with 319 funds since 2000.

Year	Title	Recipient Agency	Watershed	County	Contract Amount	Project Description
2000	Demonstration of Ebb and Flow Water Applications	University of Florida	St. Lucie, Okeechobee, Suwannee	St. Lucie, Gilchrist, Dixie, Levy, Columbia	$158,665.88	This project will focus on keeping nitrogen, phosphorus, and potassium in plant-available forms and minimize plant leachate with the use of BMPs. This project intends to demonstrate the BMPs for reducing nutrient and other plant leaching significantly.
2000	BMP for Beef Cattle Ranching in the Lake Okeechobee Basin	UF/IFAS	Lake Okeechobee	Glades, Martin, Okeechobee, Hendry, and Palm Beach	$245,572.68	This project seeks to optimize beef cattle BMPs, teach ranchers to use these BMPs, and begin infrastructure modifications for future phases of the project.
2001	Lake Okeechobee Watersheds	SWFWMD	Lake Okeechobee	Glades, Martin, Okeechobee, Hendry, and Palm Beach	$70,671.00	Project will evaluate the plant, soil, and water phosphorus implications of applying domestic wastewater residuals, animal manure, and water treatment residuals to south-central Florida cattle pastures
2002	Demonstration of Water Quality BMPs for Beef Cattle Ranching in the Lake Okeechobee Basin	UF/IFAS	Lake Okeechobee	Okeechobee, Highlands	$399,921.00	This project seeks to demonstrate and determine the efficacy of water quality BMPs, including the use of soil amendments to increase phosphorus retention, for reducing phosphorus loads to Lake Okeechobee from cow-calf operations in the Okeechobee basin, to communicate these BMPs to beef cattle ranchers through extension publications or other appropriate mechanisms, and to evaluate the ability of models to simulate the water quality effects of the demonstrated BMPs.
2005	Lake Okeechobee Water Retention	UF/IFAS	Lake Okeechobee	Highlands/ Glades	$211,811.00	The goal of this project is to demonstrate a reduction in phosphorus discharges by implementing a variety of water management alternatives (WMA) to increase water and phosphorus storage in the Lake Okeechobee TMDL implementation area. Demonstration of WMAs will contribute to the Florida Ranchlands Environmental Services Project (FRESP) concept of a market-based approach to secure environmental services on ranchlands.
Total					**$1,086,641.56**	

APPENDIX B
LAKE OKEECHOBEE PROTECTION PLAN UPDATE PROJECT/ACTIVITY SHEETS

01

2011 LOPP Update – Management Measure (Update)

Project: Florida Department of Agriculture and Consumer Services (FDACS) Best Management Practices (BMP) Projects

Description: The Northern Everglades and Estuaries Protection Program requires that FDACS, in consultation with the FDEP, SFWMD, and affected parties, develop BMPs and assist agricultural landowners with their implementation to achieve necessary phosphorus load reductions to Lake Okeechobee. In response to this directive, the FDACS adopted Chapter 5M-3, F.A.C. The purpose of this code is to affect pollutant reduction through the implementation of non-regulatory and incentive-based programs. Where water quality problems are detected for agricultural non-point sources despite the appropriate implementation of adopted BMPs, the FDACS, in consultation with the other coordinating agencies and affected parties, institutes a reevaluation of the BMPs and makes appropriate changes to the rule adopting those BMPs. In addition to the presumption of compliance with state water quality standards, participants in the FDACS BMP program are eligible to participate in cost-share programs that provide monetary assistance with the implementation of BMPs. These provisions are meant to provide an incentive for owners or operators of agricultural non-point sources to participate in the implementation of BMPs and improve water quality in the long term.

Agricultural lands enrolled in the FDACS owner implemented BMP programs within the Lake Okeechobee Watershed now total 1, 317,133 acres. This represents 77 percent of all agricultural lands within the Lake Okeechobee Watershed. On all of these enrolled acres, landowners are implementing nutrient management plans and other typical strategies such as rotational grazing and irrigation management. Approximately two thirds of the agricultural acreage implementing typical owner implemented BMPs (838,780 acres) have also implemented typical cost share BMPs. Near-term implementation (2011-2013) is expected to include additional owner-implemented (259,200 acres) and cost-share (385,629 acres) agricultural BMP projects to reduce the TP loads to Lake Okeechobee. The remaining BMP implementation are captured under the future implementation phase (2014 and beyond) including additional owner implemented (172,800) acres and cost share (514,171 acres). FDACS, subject to funding availability, continues to partner with the USDA/NRCS and with SFWMD to fund the implementation of cost-shared BMPS such as the installation of new and rehabilitation of old water control structures, construction of swales and other minor water storage features, and the restoration of isolated wetlands. The recent economic downturn has limited the availability of state funding for cost-share projects in recent years. At the current rate of funding, FDACS predicts that all agricultural lands will be implementing the typical owner-implemented BMPs by 2015 and cost-shared BMPS will be completed by 2017.

A critical component in the success of the agricultural BMP program is the collection and analysis of data to determine whether the BMPs are working as anticipated. The interagency team plans to continue funding on-farm BMP demonstration projects at representative sites that, over time, will provide both effectiveness data and insight into what new or modified practices may be necessary to reach the phosphorus reduction goals required to achieve lake and tributary restoration. These BMP demonstration and evaluation projects are ongoing at representative sites for all agricultural land uses in the watershed including dairies, beef cattle, citrus, and vegetable production. This effort incorporates regional and sub-regional water quality monitoring in collaboration with the SFWMD and the U.S. Geological Survey (USGS), which can help identify where to focus on plan development and implementation and BMP-effectiveness studies.

Purpose: Improve water quality by reducing transport of nutrients (primarily phosphorus) via runoff and leaching into regional system from agricultural and non-agricultural land uses. Specifically by storing and treating water through implementation of owner-implemented or typical cost-share BMPs.

Location/Size/Capacity (provide the shp files if available): Primarily within Lake Okeechobee Watershed; expanding into estuary watersheds. The following is a list of some projects located within the Lake Okeechobee Watershed.

Initiative Status

Agricultural – underway.

Cost: N/A

Drainage Area (acres that will be treated): acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum –** N/A
- **Maximum-** N/A
- **Most Likely-** based on each individual site as described above
- **Level of Certainty-** 2
- **Assumptions leading to benefit estimate-** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum –** N/A
- **Maximum-** N/A
- **Most Likely-** based on each individual site as described above
- **Level of Certainty-** 2
- **Assumptions leading to benefit estimate-**historical data; modeling

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957; Rich Budell; FDACS; 850-617-1704.

02

2011 LOPP Update – Management Measure (Update)

Project: Urban Turf Fertilizer (UTF) Rule

Description: The Urban Turf Fertilizer Rule is another statewide regulatory program targeting non-point source phosphorus in urban discharges. The UTF Rule, which is lead by FDACS and was adopted in 2007, limits the phosphorus and nitrogen content of fertilizers used for urban turf and lawns. The rule is enforced in two primary ways: First, all fertilizer products sold in Florida are required by law to be registered by FDACS. That registration process requires that each fertilizer product label be reviewed by staff in Tallahassee to confirm that the labeling is in compliance with the requirements of the Urban Turf Fertilizer Rule; second, FDACS field inspectors are present in the marketplace to assure that the products for sale to consumers are registered with the Department and in compliance with the requirements of the Urban Turf Rule. If products are found in the marketplaces that are either not registered with the Department or otherwise out of compliance with the requirements of the Rule, those products are put on “Stop-Sale” and embargoes from further sale and distribution. This rule in combination with the model local fertilizer ordinance provides effective control of fertilizer products at the point of sale and their end use in the urban landscape.

Purpose: Improve water quality by reducing phosphorus and nitrogen runoff and leaching resulting from application of fertilizers to urban turf.

Location/Size/Capacity: Statewide within urban settings.

Initiative Status: Rule was adopted in 2007

Cost: N/A

Drainage Area (acres that will be treated): acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum –** N/A
- **Maximum-** N/A
- **Most Likely-** TBD
- **Level of Certainty** - 2
- **Assumptions leading to benefit estimate-** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum –** N/A
- **Maximum-** N/A
- **Most Likely-** N/A
- **Level of Certainty-** 2
- **Assumptions leading to benefit estimate-**historical data; modeling

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Rich Budell; FDACS; 850-617-1704

03

2011 LOPP Update - Management Measure (Update)

Project: Biosolids Rule

Description: The FDEP adopted amendments to Chapter 62-640, F.A.C., which the Environmental Regulation Commission (ERC) approved on May 20, 2010 requiring an affirmative demonstration that domestic wastewater residuals will not add to phosphorus loadings in Lake Okeechobee or its tributaries prior to authorization of disposal. It further specifies that the demonstration will be based on achieving a net balance between phosphorus imports and exports on the permitted application site.

All domestic wastewater treatment facilities, which use biological treatment processes, generate biosolids as a by-product of the treatment process. The Department finds that unregulated use, disposal, or land application of biosolids poses a threat to the environment and public health. It is the intent of the Department in this chapter to regulate the management, use, and land application of biosolids so as to ensure protection of the environment and public health.

Purpose: The purpose of Chapter 62-640, F.A.C., is to provide minimum requirements for the treatment and management of biosolids and septage applied to land or distributed and marketed; establish land application criteria; and define requirements for agricultural operations which have received or will receive biosolids or septage.

Location/Size/Capacity: Basin wide

Initiative Status: Initiated

Cost: TBD

Documentation: CHAPTER 62-640 BIOSOLIDS

Estimate of Water Quality Benefits

- **Minimum:** Urban Rollup
- **Maximum:** Urban Rollup
- **Most Likely:** Urban Rollup
- **Level of Certainty:** Conceptual
- **Assumptions:** N/A

Estimate of Water Quantity Benefits

- **Minimum:** N/A
- **Maximum:** N/A
- **Most Likely:** N/A
- **Level of Certainty:** Final
- **Assumptions:** N/A

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Eric Livingston; Program Administration, NPDES Stormwater Section FDEP; 850-245-8430

04

2011 LOPP Update – Management Measure (Update)

Project: Florida Yards & Neighborhoods

Description: The Florida Yards and Neighborhoods (FYN), which is established in the University of Florida's Cooperative Extension Service, is a public outreach educational program that encourages homeowners, landscape maintenance personnel, and others to practice environmentally sensitive landscape techniques to conserve water and protect water quality. FYN is the source of the term "Florida-Friendly Landscaping." FYN incorporates the principles of "Florida-friendly landscapes" but goes one step further by focusing on all aspects of water quality and quantity that relate to urban landscape systems and the natural systems they impact. Florida Department of Environmental Protection (FDEP) has an ongoing monitoring program to determine the effectiveness of this program in reducing nutrient loads.

The FYN program is a partnership of the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS), Florida's water management districts, the FDEP, the National Estuary Program, the Florida Sea Grant College Program, concerned citizens, members of private industry and numerous other non-governmental agencies. FYN addresses the serious problems of pollution in stormwater runoff, water shortages and disappearing habitats by enlisting Floridians in the battle to save our natural resources. The program, which is implemented through the counties' UF/IFAS Cooperative Extension Service, provides education and outreach activities in the community to help residents reduce pollution conserve water and enhance their environment by improving home and landscape management.

This integrated approach to landscaping emphasizes nine interrelated principles:

1. Right plant, right place
2. Water efficiently
3. Fertilize appropriately
4. Mulch
5. Attract wildlife
6. Manage yard pests responsibly
7. Recycle yard waste
8. Reduce stormwater runoff
9. Protect the waterfront

FYN is an educational program and not a regulatory agency; however, the FDEP, the U.S. Environmental Protection Agency (EPA), the U.S. Department of Agriculture (USDA) and local governments strongly support the program.

Purpose: Reduce the use of nutrients and pesticides, and irrigation, thereby reducing nutrient loading and reducing water use.

Location/Size/Capacity: Statewide

Initiative Status: Ongoing

Cost: N/A

Documentation: For more information, please check http://www.myflorida.com/

Estimate of Water Quality Benefits

- **Minimum:** Urban Rollup
- **Maximum:** Urban Rollup
- **Most Likely:** Urban Rollup
- **Level of Certainty:** Conceptual
- **Assumptions:** Projected benefits will roll up under urban category

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Unknown
- **Assumptions:** N/A

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Michael Scheinkman, FDEP Environmental Specialist - Clean Lakes program, lake management. Florida Yards and Neighborhoods. Phone 850-267-2075

Eric Livingston, FDEP, on monitoring project for FYN

05

2011 LOPP Update - Management Measure

Feature: ERP Regulatory Program

Description: Under Part IV of Chapter 373, Florida Statutes, the FDEP and the water management districts were granted authority to implement the statewide Environmental Resource Permit (ERP) program. The ERP program regulates activities in, on, or over wetlands or other surface waters and the management and storage of all surface waters. Generally, the program's purpose is to ensure that activities do not degrade water quality, compromise flood protection, or adversely affect the function of wetland systems. The program applies only to new activities or to modifications of existing activities, and requires an applicant to provide reasonable assurances that an activity will not cause adverse impacts to existing surface water storage and conveyance capabilities, and will not adversely affect the quality of receiving waters such that any applicable water quality standards will be violated. Therefore, an applicant must address the long-term water quality impacts of a proposed activity and must prevent any discharge or release of pollutants from the system that will cause water quality standards to be violated.

Purpose: The purpose of this measure is to ensure that activities do not degrade water quality, impact flood protection or adversely impact the function of wetland systems.

Location/Size/Capacity: SFWMD jurisdiction

Initiative Status: Existing Program Activity

Cost: N/A

Estimate of Water Quality Benefits

- **Minimum:** Urban Rollup
- **Maximum:** Urban Rollup
- **Most Likely:** Urban Rollup
- **Level of Certainty:** Conceptual
- **Assumptions:** No increase in phosphorus loads resulting from new development; Applies to new development only; Additional unquantified benefits may occur from the conversion of intense agricultural uses (dairies, row crops, improved pasture, sod, citrus) with little or no water quality treatment to urban uses with modern surface water management systems with treatment; Projected benefits will roll up under the urban category

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Conceptual
- **Assumptions:** Applies to new development only; Additional unquantified benefits may occur from the conversion of intense agricultural uses (dairies, row crops, improved pasture, sod, citrus) with little or no stormwater storage to urban uses with modern surface water management systems with storage; Projected benefits will roll up under urban category

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Damon Meiers; SFWMD; 561-686-8800

06

2011 LOPP Update – Management Measure (Update)

Project: NPDES Stormwater Program

Description: In 1987, the Federal Clean Water Act was amended requiring the U.S. Environmental Protection Agency (EPA) to develop rules to implement the federal National Pollutant Discharge Elimination System (NPDES) stormwater permitting program. Phase I, promulgated in 1990, addresses the following sources:

"Large" and "medium" **municipal separate storm sewer** systems (MS4s) located in incorporated places and counties with populations of 100,000 or more, and eleven categories of **industrial activity**, one of which is large **construction activity** that disturbs 5 or more acres of land.

Phase II, promulgated in 1999, addresses additional sources, including MS4s not regulated under Phase I, and small construction activity disturbing between 1 and 5 acres.

In October 2000, EPA authorized the Florida Department of Environmental Protection (DEP) to implement the NPDES stormwater permitting program in the State of Florida (in all areas except Indian Country lands). FDEP's authority to administer the NPDES program is set forth in Section 403.0885, Florida Statutes (F.S.).

Important note**:** The NPDES stormwater permitting program is separate from the State's stormwater/environmental resource permitting programs (found under Part IV, Chapter 373, F.S. (593KB) and Chapter 62-25, F.A.C. and local stormwater/water quality programs, which have their own regulations and permitting requirements.

Purpose: To reduce stormwater pollutant loads discharged to surface waters, especially from existing land uses and drainage systems. This is especially true for the master drainage systems owned and operated by cities, counties, FDOT, and Chapter 298 water control districts. Also can help to reduce stormwater pollutant loads from existing industrial sites and from new construction sites.

Location/Size/Capacity: Basin wide

Initiative Status: Being implemented by FDEP

Cost: TBD

Documentation: See http://www.dep.state.fl.us/water/stormwater/npdes/index.htm

Estimate of Water Quality Benefits

- **Minimum:** Urban Rollup
- **Maximum:** Urban Rollup
- **Most Likely:** Urban Rollup
- **Level of Certainty:** Conceptual
- **Assumptions:** Projected benefits will roll up under urban category

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Conceptual
- **Assumptions:** Depends if infiltration BMPs or stormwater reuse is done; Projected benefits will roll up under urban category

Screening Criteria

- **Proof of Concept: N/A**
- **Other Impacts:** N/A

Contact: Steven Kelly, Program Administration, NPDES Stormwater Section, Tallahassee, 850-245-7518

07

2011 LOPP Update – Management Measure (Update)

Project: Comprehensive Planning/Land Development Regulations

Description: Adopted by the 1985 legislature, The Local Government Comprehensive Planning and Land Development Regulation Act (see Chapter 163, Part II, Florida Statutes) - also known as Florida's Growth Management Act - requires all of Florida's 67 counties and 410 municipalities to adopt Local Government Comprehensive Plans that guide future growth and development. Comprehensive plans contain chapters or "elements" that address future land use, housing, transportation, infrastructure, coastal management, conservation, recreation and open space, intergovernmental coordination, and capital improvements. A key component of the Act is its "concurrency" provision that requires facilities and services to be available concurrent with the impacts of development. For more information, you may view a presentation about the concurrency requirement.

The Florida legislature first visited the subject of growth management in 1972 with the adoption of two land use programs within Chapter 380, Florida Statutes (the Environmental Land and Water Management Act): Section 380.05, Florida Statutes, to protect Areas of Critical State Concern through state designation; and Section 380.06, Florida Statutes, to regulate developments of regional impact through regional and state oversight by means of an appeal process.

The laws adopted during the 1984-86 period established Florida's growth management system, including the adoption of a state comprehensive plan (see Chapter 187, Florida Statutes). It also required regional planning councils to prepare and adopt comprehensive regional policy plans consistent with the state comprehensive plan.

Purpose: The Growth Management Act authorizes the Department of Community Affairs, Division of Community Planning, to review comprehensive plans and plan amendments for compliance with the Act. Other review agencies, including the following, also review comprehensive plans and amendments and issue recommended objections to the Department.

- Regional Planning Councils
- Water Management Districts
- Department of State
- Department of Transportation
- Department of Environmental Protection
- Agriculture and Consumer Services
- Florida Fish and Wildlife Conservation Commission

The FDEP developed a “white paper” in January 2009 to provide guidance to FDEP and SFWMD staff when working with local governments to meet the NEEPP and to explain how existing growth management processes can further restoration and water quality objectives of the NEEPP legislation.

Local governments may amend their comprehensive plans twice per year.

Within an established time frame, the Department first issues an Objections, Recommendations and Comments report that identifies areas of the proposed plan or proposed amendment that are inconsistent with the provisions of Chapter 163, Part II, Florida Statutes. The local government may or may not address the recommendations to revise the proposed plan or amendment, or elect to adopt or not adopt the amendment. When the local government adopts the plan or amendment, it is submitted to the Department for a compliance review. Within 20 to 45 days of receipt of the adopted amendment, the Department issues a public Notice of Intent (see Objections, Recommendations and Comments, Reports, Notices of Intent and Public School Interlocal Agreements Online web page) to find the adopted plan and/or plan amendment either in or not in compliance with the Act. If the Department finds the plan or amendment not in compliance, the local government must take remedial actions to bring the plan or amendment into compliance to avoid an administrative hearing. View a flow chart that explains the plan and plan amendment process.

Location/Size/Capacity: State wide

Initiative Status: Current

Cost: N/A

Documentation: See http://www.dca.state.fl.us/fdcp/DCP/compplanning/index.cfm

Estimate of Water Quality Benefits

- **Minimum:** Urban Rollup
- **Maximum:** Urban Rollup
- **Most Likely:** Urban Rollup
- **Level of Certainty:** Conceptual
- **Assumptions:** Projected benefits will roll up under urban category

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Conceptual
- **Assumptions:** Depends if infiltration BMPs or stormwater reuse is done; Projected benefits will roll up under urban category

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Katie Hallas; FDEP; 850-245-7688

08

Northern Everglades – Potential Management Measure

Project Feature/Activity: Farm and Ranchland Protection Program Partnership

Level: 4

General Description/Background: The Farm and Ranchland Protection Program (FRPP) is a voluntary USDA Natural Resources Conservation Service (NRCS) program that helps farmers and ranchers keep their land in agriculture. The program provides matching funds to State, Tribal or local governments and non-governmental organizations to purchase conservation easements. The proposal is that the NRCS, The Nature Conservancy (TNC), local agricultural landowners, and the District enter into a agreement to each contribute $5 million dollars toward a long-term partnership.

Purpose: The partnership would acquire easements on private lands to remain in agriculture and provide water quality and storage benefits in support of the Northern Everglades initiative.

Location/Size/Capacity: Northern Everglades Watershed; Over fifteen large landowners are interested in participating in this partnership. Over 3000 acres of property in 42 states are currently under the FRPP.

Initiative Status: FRPP is an established program and landowners are waiting to participate.

Cost: The proposal is that the NRCS, The Nature Conservancy (TNC), local agricultural landowners, and the District enter into a agreement to each contribute $5 million dollars toward a long-term partnership. The partnership would bring federal, state, not-for-profit, and private funding together.

Estimate of Water Quality Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Unknown
- **Assumptions:** N/A

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Unknown
- **Assumptions:**

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Benita Whalen; SFWMD; 863-462-5260

09

2011 LOPP Update – Management Measure (Update)

Project: Watershed Phosphorus Source Control Projects

Description: Includes about 30 ongoing projects including the Phosphorus Source Control Grant Projects (13), Dairy Best Available Technologies (3 Dairy BATS), Isolated Wetland Restoration Projects (4), and the Former Dairy Remediation Projects (5).

Purpose: Treat water and reduce phosphorus loads at the source.

Location/Size/Capacity (provide the shp files if available): Mainly in the four priority basins (Kissimmee, TCNS, TP)

Initiative Status: All projects are completed and operational.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			N/A
Construction			N/A
S&A			N/A
O&M (Annual Cost)	2011	2012	$32,500

Documentation:

Drainage Area (acres that will be treated):

Location and Configuration (Layout including Spatial positioning and configuration):

GIS data:

Available ☒Yes ☐No

Stage-Storage Relationship (or Stage-Area Relationship): N/A

Control Protocol (Inlet and Outlet Structures):

- **Pump (water level relationship)**
  - **Start -Elevation:**
  - **Shut off -Elevation:**
- **Weir**
  - **Dimensions:**
  - **Crest Elevation:**
- **Gate (water level relationship)**
  - **Open -Elevation:**
  - **Close -Elevation:**

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** 27 mt/yr collectively
- **Maximum:** 27 mt/yr collectively
- **Most Likely:** 27 mt/yr collectively
- **Level of Certainty:** conceptual/final/unknown (see below)
- **Assumptions leading to benefit estimate (e.g. period of record; inflow concentration/load; did you assume BMPs were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.):** Calculated based on the existing (current) phosphorus concentrations

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** Incidental
- **Maximum:** Incidental
- **Most Likely:** Incidental
- **Level of Certainty- conceptual/final/unknown:** Level 1 (constructed)
- **Assumptions leading to benefit estimate (e.g., period of record; flow/volume; operational assumptions):** N/A

Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested?): 1

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts: 0

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Joyce Zhang, SFWMD, 561-682-6341

10 and 39

2011 LOPP Update – Management Measure (New or Update)

Project: Hybrid Wetland Treatment Technologies

Description: The Hybrid Wetland Treatment Technology (HWTT) represent a combination of wetland and chemical treatment approaches within a wetland system. Chemical coagulants are added, either continuously or intermittently, to the front end of the wetland treatment system, which contains one or more deep water zones to capture the resulting floc material. A fundamental concept of HWTT is that the floc resulting from coagulant addition generally remains active and has the capability of additional phosphorus sorption. Both passive and active reuse of floc material is utilized in HWTT. The HWTT system was developed to maximize nutrient removal per unit of chemical coagulant use, by incorporating novel design and multiple operational strategies. In addition to passive and active recycling/reuse of chemical flocs, other optimization approaches include the sequencing and configuring of wetland unit processes to provide desirable nitrogen and phosphorus species transformations.

In 2008, four HWTT systems were constructed and operational and optimization efforts were initiated. Three of the HWTT facilities – the 0.7-acre Ideal 2 Grove system, the 1.7-acres Nubbin Slough system, and the 1.4-acres Mosquito Creek system are continuous-flow systems (subject to water flow availability), while the fourth is situated adjacent to a dairy lagoon and is used for batch treatment of the high-strength waters. Two additional systems were constructed on Wolff Ditch and Lemkin Creek and began operations in late 2009. Initially these systems show promising results with total phosphorus concentration reductions ranging between 87 and 95 percent. This technology is being demonstrated under a joint effort between the District and the Florida Department of Agriculture and Consumer Services (FDACS) in the St. Lucie and Lake Okeechobee Watersheds.

Five systems (dairy lagoon system discontinued) are being operated for P load reduction and evaluated for cost effectiveness through March 2011. An additional system will be constructed and begin operations in 2010 at the District's Taylor Creek/Grassy Island property. Further implementation of these systems will be determined based on this additional information.

Purpose: Phosphorus load reduction to Lake Okeechobee

Location/Size/Capacity (provide the shp files if available): Northern Everglades

Initiative Status: Ongoing

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction	2008	2010	$4,017,655
S&A			
O&M (Annual Cost)	2008	2010	$1,660,000

Documentation:

Drainage Area (acres that will be treated):

Location and Configuration (Layout including spatial positioning and configuration):

GIS data:

Available ☐Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 4 mt (1.1 for existing sites and 2.9 for Grassy Island)
- **Level of Certainty- conceptual/final/unknown (see below):** Level 1
- **Assumptions leading to benefit estimate- (e.g. period of record; inflow concentration/load; did you assume BMPs were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.):**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:**
- **Maximum:**
- **Most Likely:**
- **Level of Certainty- conceptual/final/unknown (see below):**
- **Assumptions leading to benefit estimate (e.g., period of record; flow/volume; operational assumptions):**

Level of Certainty: (select one)

Level 1: already constructed/implemented or construction/implementation imminent
Level 2: construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3: implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4: implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5: implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested?):

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts: 0

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Jim Laing, SFWMD, X3732

11

2011 LOPP Update – Management Measure (Update)

Project: Taylor Creek Stormwater Treatment Area (STA) Critical Project

Description: This project involves the design, construction and operation of a stormwater treatment area located on District owned lands at the Grassy Island Ranch site along the banks of Taylor Creek. The purpose of the project is to capture and attenuate peak flows from portions of the Lake Okeechobee Watershed and to improve water quality. This project is part of the Lake Okeechobee Critical Restoration Project which was authorized through the federal Water Resources Development Act of 1996. The United States Army Corps of Engineers (the Corps) was responsible for the design and construction of the Stormwater Treatment Areas and the South Florida Water Management District (SFWMD) is responsible for operations and maintenance.

Purpose: The purpose of this project is to retain stormwater runoff and to reduce phosphorus from the Taylor Creek drainage basin.

Location/Size/Capacity (provide the shp files if available): The Taylor Creek STA is a long, narrow enclosure located about 2 miles north of the city of Okeechobee in central Okeechobee County. It is bordered on the east by US 441 and by Taylor Creek on the west (see figure). The STA is approximately 142 acres with an effective treatment area of 118 acres. It is divided into two cells in series and is expected to treat about 10% of the water flow in Taylor Creek. The expected annual average TP removal performance of the Taylor Creek Pilot STA was estimated at 2.08 metric tons/yr

Initiative Status: Repairs were completed on August 23, 2010. Following a demonstration of compliance with pre-discharge requirements as laid out in the Taylor Creek Permit, flow-through operations resumed on September 8, 2010. Once all flow-through discharge requirements are satisfied, the District will officially take control of the project, in accordance with an agreement between the SFWMD and the USACE, and begin the long-term operational phase of the project. The project is expected to be transferred to the District by the USACE in April 2011.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction			$3,045,097*
S&A			
O&M (Annual Cost)	2011	2015	$310,399

*Taylor Creek STA was fully constructed in April 2006.

Documentation: Lake Okeechobee Water Retention/Phosphorus Removal Project Design Documentation Report Final Submittal, June 2003; Taylor Creek STA Annual Reports, 2008-2009.

Drainage Area (acres that will be treated):

Location and Configuration (Layout including spatial positioning and configuration):

GIS data:

Available ☐Yes ☐No

Stage-Storage Relationship (or Stage-Area Relationship):

Control Protocol (Inlet and Outlet Structures):

- **Pump (water level relationship)**
  - **Start -Elevation:**
  - **Shut off -Elevation:**
- **Weir**
  - **Dimensions:**
  - **Crest Elevation:**
- **Gate (water level relationship)**
  - **Open -Elevation:**
  - **Close -Elevation:**

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** 0.7 mt/yr
- **Maximum:** 2.0 mt/yr
- **Most Likely:** 1.3 mt/yr
- **Level of Certainty:** Level 1
- **Assumptions leading to benefit estimate:** The anticipated long-term "maximum" phosphorus reduction for the Taylor Creek STA was estimated during the design phase. The "minimum" and "most likely" values were estimated based on 0.5 ft and 1.0 ft of water operating depths, respectively.

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 53.1 ac-ft
- **Maximum:** 159.3 ac-ft
- **Most Likely:** 106.2 ac-ft
- **Level of Certainty:** Level 1
- **Assumptions leading to benefit estimate:** Calculations were based on 90% effective treatment area at 0.5 ft, 1.5 ft and 1.0 ft of water operating depths, respectively.

Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: +1

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

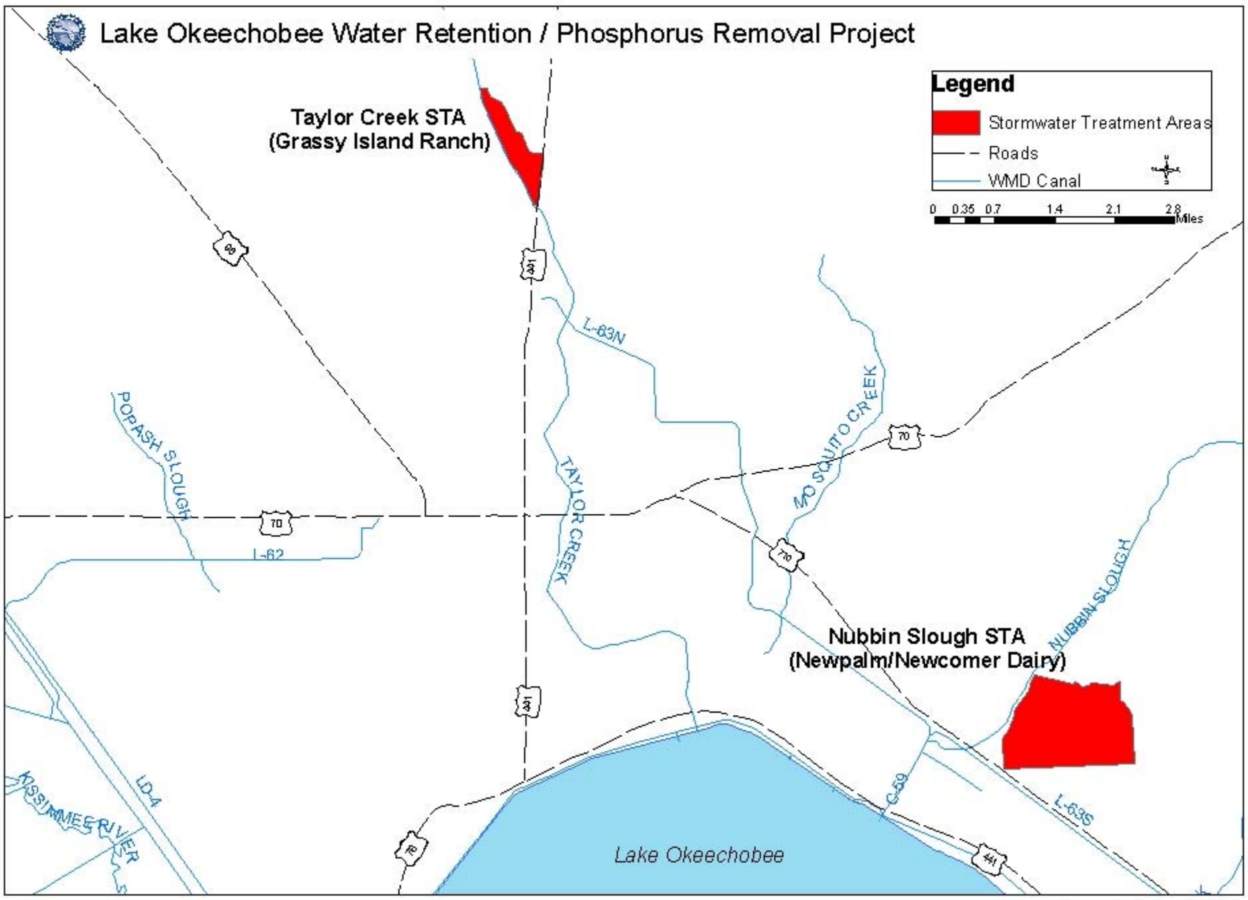
Other Unintended Impacts:

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other

+1 -treatment for P and also for N
-1 -berm and unintended flooding outside of project area
N/A -not applicable

Contact Information: Odi Villapando (rvillap@sfwmd.gov), SFWMD, (561) 682-2936

Location of the Taylor Creek STA.



12

2011 LOPP Update – Management Measure (Update)

Project: Nubbin Slough Stormwater Treatment Area (STA) Critical Project

Description: This project involves the design, construction and operation of a stormwater treatment area located on District owned lands at the New Palm Dairy site along the banks of Nubbin Slough. The purpose of the project is to capture and attenuate peak flows from portions of the Lake Okeechobee Watershed and to improve water quality. This project is part of the Lake Okeechobee Critical Restoration Project which was authorized through the federal Water Resources Development Act of 1996. The United States Army Corps of Engineers (the Corps) was responsible for the design and construction of the Stormwater Treatment Areas and the South Florida Water Management District (SFWMD) is responsible for operations and maintenance.

Purpose: The purpose of this project is to retain stormwater runoff and to reduce phosphorus from the Nubbin Slough drainage basin.

Location/Size/Capacity (provide the shp files if available): The Nubbin Slough STA is the larger of the two pilot STAs designed and constructed by the Corps. It is located approximately 6.5 miles southeast of the city of Okeechobee, adjacent to Nubbin Slough, immediately north of State Road 710 and just east of the bridge that spans Nubbin Slough (see figure). This two-celled STA is approximately 809 acres with an effective treatment area of 773 acres. The projected long-term average P reduction within the STA was estimated at over five metric tons per year or about 85% of the P load of Nubbin Slough at the project location.

Initiative Status:. Construction of the Nubbin Slough STA was completed in September 2006. However, operations have not been initiated due to a series of mechanical problems uncovered during pump tests. Construction of the repairs was completed in June 2010. A remaining major source of concern is that the Nubbin Slough Basin does not produce enough runoff in a normal rainfall year to supply the STA with sufficient water for full-time operation (Stanley Consultants, Inc. 2003). Shoaling and sediment maintenance are also identified as concerns. The USACE and the District explored ideas to provide additional water to the STA and how to address the sediment maintenance issues; however, provision of additional water to the STA from L-63S was too costly. Also conceptual design and cost estimates are being worked on for a fix to minimize sedimentation with the pump station intake bay and upstream pool.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction			$9,172,697*
S&A			
O&M (Annual Cost)	2011	2015	$418,647

*Nubbin Slough STA was fully constructed in September 2006.

Documentation: Lake Okeechobee Water Retention/Phosphorus Removal Project Design Documentation Report Final Submittal, June 2003.

Drainage Area (acres that will be treated):

Location and Configuration (Layout including spatial positioning and configuration):

GIS data:

Available ☐Yes ☐No

Stage-Storage Relationship (or Stage-Area Relationship):

Control Protocol (Inlet and Outlet Structures):

- **Pump (water level relationship)**
  - **Start -Elevation:**
  - **Shut off -Elevation:**
- **Weir**
  - **Dimensions:**
  - **Crest Elevation:**
- **Gate (water level relationship)**
  - **Open -Elevation:**
  - **Close -Elevation:**

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** 1.7 mt/yr
- **Maximum:** 5.0 mt/yr
- **Most Likely:** 3 mt/yr
- **Level of Certainty:** Level 1
- **Assumptions leading to benefit estimate:** The anticipated long-term “maximum” phosphorus reduction for the Nubbin Slough STA was estimated during the design phase. The “minimum” and “most likely” values were estimated based on 0.5 ft and 1.0 ft of water operating depths, respectively.

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 347.9 ac-ft
- **Maximum:-** 1043.6 ac-ft
- **Most Likely:** 695.7 ac-ft
- **Level of Certainty: conceptual/final/unknown** (see below)
- **Assumptions leading to benefit estimate:** Calculations were based on 90% effective treatment area at 0.5 ft, 1.5 ft and 1.0 ft of water operating depths, respectively.

Level of Certainty: (select one)

Level 1: already constructed/implemented or construction/implementation imminent
Level 2: construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3: implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4: implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5: implementation certainty unknown; conceptual idea with limited information

Proof of Concept: +1

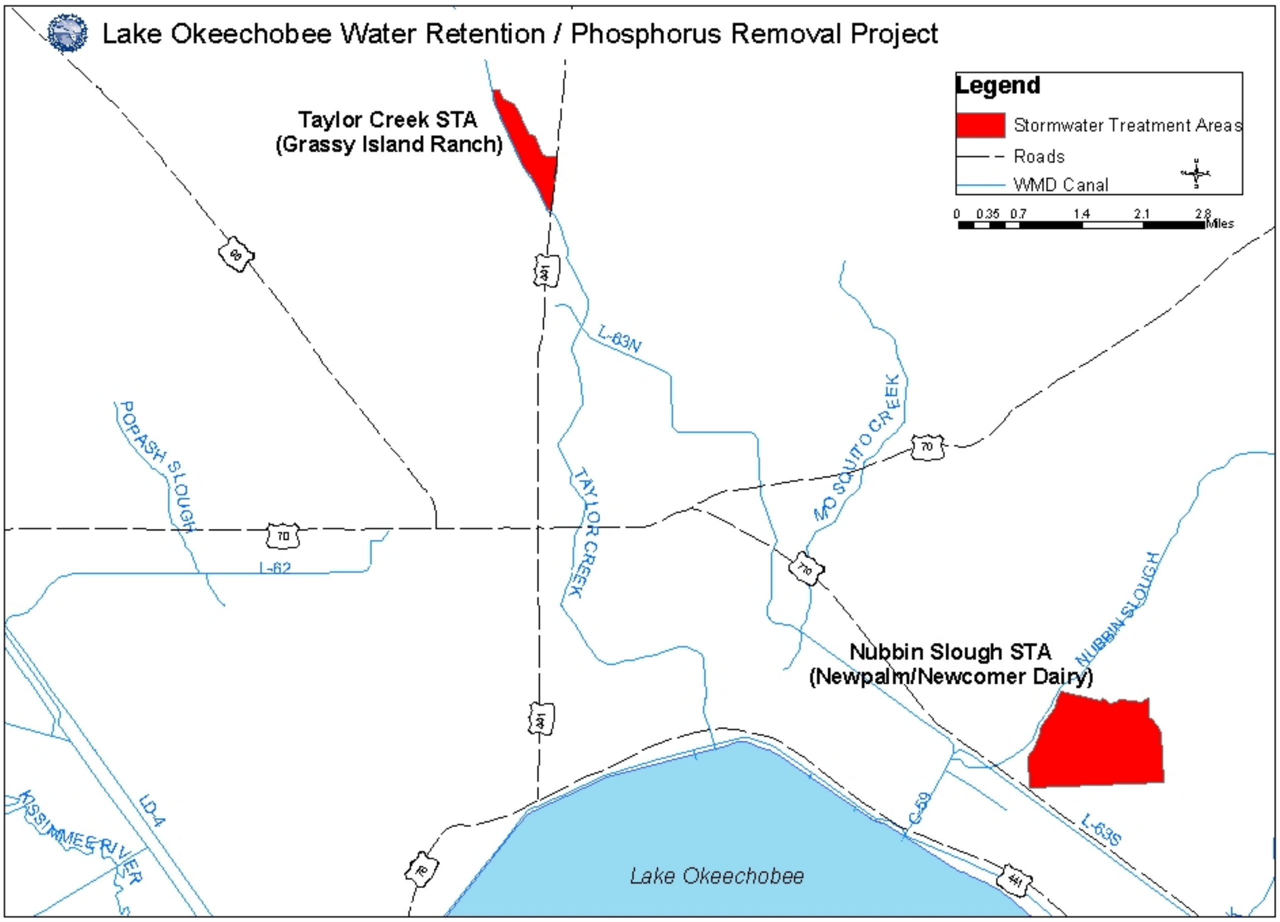
e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts:

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Odi Villapando (rvillap@sfwmd.gov), SFWMD, (561) 682-2936,

Location of the Nubbin Slough STA



13

2011 LOPP Update – Management Measure (Update)

Project: Avon Park Air Force Range (APAFR) Dispersed Water Management Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 3,600 acre project is in the Lake Istokpoga Sub-watershed located within the Lake Okeechobee Watershed. This project consists of the restoration of existing levee and water control structure replacements within Arbuckle Creek Marsh. This project will impact onsite flows within the Lake Okeechobee Watershed, specifically flows reaching Lake Okeechobee through Lake Istokpoga.

Initiative Status: The design and construction phases of the Avon Park Air Force Range (APAFR) Water Storage Project have been completed.

Cost: This project was funded with a 90/10 cost share and the District's share was $504,242 or $50/ac-ft of storage.

Activity	Start (Year)	Finish (Year)	Cost
PED	-----	-----	-----
Construction	-----	2009	$504,242
S&A	-----	-----	-----
O&M (Annual Cost)	2009	-----	-----

Drainage Area (acres that will be treated): 3,600 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 1.361 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 10,000 ac-ft
- **Most Likely:** 10,000 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1- already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

14

2011 LOPP Update – Management Measure (Update)

Project: Indiantown Citrus Growers Association (ICGA) Dispersed Water Management Project Phases 1 & 2

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 492 acre project is in the East Lake Okeechobee Sub-watershed located within the Lake Okeechobee Watershed. Phase 1 of this project consisted of the rehabilitation and relocation of pump stations. ICGA will utilize their irrigation pumps at the St. Lucie Canal to draw regulatory regional lake releases into their site for disposal, which will reduce freshwater volumes to the estuary. Phase 2 of the project will include widening ditches in the ICGA ditch system. The detention of stormwater within the existing ditch system will result in water quality improvements thereby promoting water conversation and reducing the volume of surface water discharge to the St. Lucie Canal and the estuary. The application number for this site is 070525-7.

Initiative Status: The design and construction of Phases 1 & 2 of the Indiantown Citrus Growers Association Water Storage Project have been completed.

Cost: This project was funded with a 75/25 cost share and the District's share was $267,853 or $75/ac-ft of storage.

Activity	Start (Year)	Finish (Year)	Cost
PED	2006	2006	-----
Construction	2006	2007	$267,853
S&A	-----	-----	-----
O&M (Annual Cost)	2007	-----	-----

Drainage Area (acres that will be treated): 492 acres

Location and Configuration (Layout including Spatial positioning and configuration): Martin County; Sections 27-29, 32-34/Township 39/Range 48, Sections 3-5/Township 40/Range 38

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.8 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 3,550 ac-ft
- **Most Likely:** 3,550 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1- already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

15

2011 LOPP Update – Management Measure (Update)

Project: Barron Water Control District (BWCD) C-2 Dispersed Water Management Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 6,129 acre project is in the West Lake Okeechobee Sub-watershed located within the Lake Okeechobee Watershed. The BWCD is constructing a dispersed water management project within its system which includes the construction of two weirs in an existing canal to retain more water within this system. Excess water in the Caloosahatchee River due to Lake Okeechobee regulatory regional releases will be pumped into BWCD for disposal when conditions support additional capacity. Retention within the existing ditch system and detention areas will result in water quality improvements and enable reuse by individual growers, thereby promoting water conservation and reducing the volume of discharge to the Caloosahatchee River. The application number for this site is 071002-11.

Initiative Status: The design and construction phases of the Barron Water Control District (BWCD) C-2 Water Storage Project have been completed.

Cost: This project was funded with a 50/50 cost share and the District's share was $200,000 or $40/ac-ft of storage.

Activity	Start (Year)	Finish (Year)	Cost
PED	-----	-----	-----
Construction	-----	2008	$200,000
S&A	-----	-----	-----
O&M (Annual Cost)	2008	-----	-----

Drainage Area (acres that will be treated): 6,129 acres

Location and Configuration (Layout including Spatial positioning and configuration): Glades County; Sections 11, 14/Township 43/Range 30

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.8
- **Level of Certainty:**
- **Assumptions leading to benefit estimate:** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 5,000 ac-ft
- **Most Likely:** 5,000 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1- already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

16

2011 LOPP Update – Management Measure (Update)

Project: Lykes Basinger Grove Dispersed Water Management Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 350 acre project is in the Indian Prairie Sub-watershed located within the Lake Okeechobee Watershed. This project consists of constructing a 50,000 gpm pump station onsite and revamping the existing system of internal ditches. The application number for this site is 071116-3.

Initiative Status: Construction of the Lykes Basinger Grove project has been completed.

Cost: The total District cost for this project was $200,000 or $27/ac-ft of storage.

Activity	Start (Year)	Finish (Year)	Cost
PED	------	------	------
Construction	-----	2008	$200,000
S&A	------	------	------
O&M (Annual Cost)	2008	------	------

Drainage Area (acres that will be treated): 15,000 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County; Section 36/Township 35/Range 31, Sections 29-33/Township 35/Range 32, Sections 1, 2, 11-14, 22-27, 34-36/Township 36/Range 31, Sections 3-36/Township 36/Range 32, Sections 17-20, 29-31/Township 36/Range 33, Sections 1, 3, 12, 13/Township 37/Range 31, Sections 1-18, 20-26/Township 37/Range 32, Sections 6, 18, 19, 30, 31/Township 37/Range 33

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 2.9 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 7,500 ac-ft
- **Most Likely:** 7,500 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1- already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

17

2011 LOPP Update – Management Measure (New)

Project: Dispersed Water Management - Sumica

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. Increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To construct a diked impoundment at the Sumica project site. A pump will be installed as the inlet for this project, while a gravity control structure will be constructed for discharging offsite.

Location/Size/Capacity (provide the shp files if available): This 1,920 acre project is in the Upper Kissimmee Sub-watershed located within the Lake Okeechobee Watershed.

Initiative Status: The Sumica water storage project is currently in the planning phase.

Cost: N/A

Activity	Start (Year)	Finish (Year)	Cost
PED	2008	-----	-----
Construction	-----	-----	-----
S&A	-----	-----	-----
O&M (Annual Cost)	-----	-----	-----

Drainage Area (acres that will be treated): 4,031 acres

Location and Configuration (Layout including Spatial positioning and configuration): Polk County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 32 kg/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0
- **Maximum:** 281 ac-ft
- **Most Likely:** 281 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

18 through 21

2011 LOPP Update – Management Measure (Update)

Project: Alternate Water Supply (AWS) Projects

Description: The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Assessments of available public and tribal lands for storage of excess surface water have been completed for the watershed, with assessments continuously ongoing for private lands. Four water storage/disposal projects have been completed including the Four K Ranch Rothert Farms Storm Water Recycling System, the Raulerson and Son Ranch project, the Haynes Williams – 101 Ranch project, and the David Williams project.

Purpose: To assess, plan, design, and construct water storage/disposal projects on public, private, and tribal lands.

Location/Size/Capacity (provide the shp files if available): These projects are in the Lower Kissimmee Sub-watershed located within the Lake Okeechobee Watershed. The total size of these projects is 2,023 acres.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	WQ Benefits	Water Quantity Benefits	County
Raulerson and Sons Inc.	Lower Kissimmee	670	670	0.033 mt/yr	300 ac-ft	Okeechobee
David Williams	Lower Kissimmee	17	502	0.015 mt/yr	134 ac-ft	Okeechobee
Four K Ranch, Rothert Farms Storm Water Recycling System	Lower Kissimmee	650	1,099	0.003 mt/yr	25 ac-ft	Okeechobee
Haynes Williams – 101 Ranch	Lower Kissimmee	201	201	0.003 mt/yr	25 ac-ft	Okeechobee
Total	**------**	**1,537**	**2,471**	**0.063 mt/yr**	**484 ac-ft**	**------**

Initiative Status: The construction phases of the David Williams AWS, Four K Ranch, Rothert Farms Storm Water Recycling System AWS, Haynes Williams – 101 Ranch AWS, and the Raulerson and Sons Ranch AWS projects have been completed.

Cost: Total District cost for the David Williams AWS project is $51,920 or $387/ac-ft of storage. Total District cost for the Four K Ranch, Rothert Farms Storm Water Recycling System AWS project is $109,000 or $4,360/ac-ft of storage. Total District cost for the Haynes Williams – 101 Ranch AWS project is $77,600 or $3,104/ac-ft of storage. Total District cost for the Raulerson and Sons Ranch AWS project is $497,000 or $1,657/ac-ft of storage.

Project Name	Activity	Start (Year)	Finish (Year)	Cost
David Williams	PED	2006	2006	------
	Construction	2006	2007	$51,920
	S&A	------	------	------
	O&M (Annual Cost)	2007	------	------
Four K Ranch, Rothert Farms Storm Water Recycling System	PED	2004	2007	------
	Construction	2007	2010	$109,000
	S&A	------	------	------
	O&M (Annual Cost)	2010	------	------
Haynes Williams – 101 Ranch	PED	2005	2006	------
	Construction	2006	2007	$77,600
	S&A	------	------	------
	O&M (Annual Cost)	2007	------	------
Raulerson and Sons Ranch	PED	------	------	------
	Construction	------	2008	$497,000
	S&A	------	------	------
	O&M (Annual Cost)	2008	------	------

Drainage Area (acres that will be treated): 2,471.2 acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.063 mt/yr
- **Level of Certainty:**
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 484 ac-ft
- **Most Likely:** 484 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1 - already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (Update)

Project: Florida Ranchlands Environmental Services Project

Description: The Florida Ranchlands Environmental Services Project (FRESP) is a pilot project to develop a payment for environmental services program. FRESP partners include eight ranchers, World Wildlife Fund, Florida Cattlemen's Association, FDACS, FDEP, UF-IFAS, USDA-NRCS, MacArthur Agro-ecology Research Center, and SFWMD. The concept consists of working ranches providing services of water management (retaining excess stormwater runoff) and/or water quality improvement for a contracted payment. The model program would include a negotiated fixed term contract with the ranch for a service provided above and beyond any regulatory requirements e.g. FDACS BMP Program. In exchange for the documented service provided by the ranch, the management of water could become a new revenue opportunity for ranchers. Retaining the water in shallow depths also results in native habitat protection and enhancement; paying the ranchers maintains the local tax rolls and rural employment sustains communities.

FRESP will be implemented over three phases. Phase I took place over three years (2006-2009), and implemented water management alternatives on eight volunteer ranchers. This phase field tested elements of a credible, transparent program to certify on-ranch provision of critical environmental services. Phase II will take place over two years (2010-2011) and a pay for performance program will be implemented with the volunteer ranches verifying and refining their program design. The last phase, Post 2011, will consist of a transition from the test group of participants to a state-wide program.

FRESP currently has eight constructed rancher pilot projects. Since October of 2005, an estimated 8,512 ac-ft of storage has been created over 22,099 acres on FRESP projects.

Two FRESP pilot participants are in the process of converting to a permanent WRP easement. The WRP design will utilize many of the facilities constructed under FRESP and it is anticipated that even a greater quantity of water management and treatment will be provided.

Purpose: To develop a payment program for working ranches that provide water management and/or water quality improvement services.

Location/Size/Capacity (provide the shp files if available): These projects are located within the Lake Okeechobee and St. Lucie River Watersheds. The total size of these projects is 8,732 acres with a capacity of 8,512 ac-ft of storage.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	WQ Benefits (lbs P/yr)	P Load Reductions (kg/yr)	Water Quantity Benefits	County
Alderman-Deloney Ranch Pilot Project	St. Lucie River Watershed	49	322	40	18	43 ac-ft	Okeechobee
Buck Island Ranch Pilot Project	Indian Prairie	3,748	3,748	3,434	1558	967 ac-ft	Highlands
C.M. Payne & Sons Pilot Project	Fisheating Creek	367	367	295	134	932 ac-ft	Highlands
Lightsey XL Ranch Pilot Project	Fisheating Creek	364	364	295	134	135 ac-ft	Highlands
Lykes West Waterhole Lease and Pilot Project	Indian Prairie	2,500	2,500	7,220	3275	5,000 ac-ft	Glades
Rafter T Ranch Pilot Project	Lake Istokpoga	942	1,624	795	361	1,145 ac-ft	Highlands
Syfrett Ranch West Pilot Project	Indian Prairie	521	2,197	878	398	140 ac-ft	Glades
Williamson Ranch Pilot Project	Taylor Creek/ Nubbin Slough	241	659	139	63	150 ac-ft	Okeechobee
Total in LOW	------	**8,732**	**11,122**	**13,056**	**5,922**	**8,512 ac-ft**	------

Initiative Status: The construction phases of the Alderman-Deloney Ranch, Buck Island Ranch, C.M. Payne & Sons, Lightsey XL Ranch, Lykes West Waterhole Lease, Rafter T Ranch, Syfrett Ranch West, and Williamson Ranch pilot projects have been completed. Currently, Phase II of the FRESP program is being implemented.

Cost: Total District cost for the Alderman-Deloney Ranch Pilot Project is $154,000 or $3,581/ac-ft of storage. Total District cost for the Buck Island Ranch Pilot Project is $570,400 or $590/ac-ft of storage. Total District cost for the Lykes West Waterhole Lease and Pilot Project is $928,564 or $186/ac-ft of storage. Total District cost for the Williamson Ranch Pilot Project is $275,000 or $1,833/ac-ft of storage.

Project Name	Activity	Start (Year)	Finish (Year)	Cost
Alderman-Deloney Ranch Pilot Project	PED	2006	------	------
	Construction	------	2009	$154,000
	S&A	------	------	------
	O&M (Annual Cost)	2010	------	------
Buck Island Ranch Pilot Project	PED	------	------	------
	Construction	------	2007	$570,400
	S&A	------	------	------
	O&M (Annual Cost)	2007	------	------
C.M. Payne & Sons Pilot Project	PED	------	------	PED - $60,000; Permitting - $15,000
	Construction	------	2009	$40,090
	S&A	------	------	------
	O&M (Annual Cost)	2009	------	$78,549/36 months
Lightsey Cattle Co. Pilot Project	PED	------	------	PED - $25,000; Permitting - $5,600
	Construction	------	2009	$30,930
	S&A	------	------	------
	O&M (Annual Cost)	2009	------	$15,000/36 months
Lykes West Waterhole Lease and Pilot Project	PED	------	------	------
	Construction	------	2006	$928,564
	S&A	------	------	------
	O&M (Annual Cost)	2006	------	------
Rafter T Ranch Pilot Project	PED	2007	2008	PED - $80,000; Permitting - $15,000
	Construction	2008	2010	$316,681
	S&A	------	------	------
	O&M (Annual Cost)	2010	------	$94,500/36 months
Syfrett Ranch West Pilot Project	PED	------	------	PED - $25,000; Permitting - $7,500
	Construction	------	2009	$28,000
	S&A	------	------	------
	O&M (Annual Cost)	2009	------	$60,000/36 months
Williamson Cattle Co. Pilot Project	PED	------	------	------
	Construction	------	2006	$275,000
	S&A	------	------	------
	O&M (Annual Cost)	2006	------	------

Drainage Area (acres that will be treated): 22,099 acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** 0 lbs P/yr
- **Maximum:** 5.922 mt/yr
- **Most Likely:** 5.922 mt/yr
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** monitoring data

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 8,512 ac-ft
- **Most Likely:** 8,512 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1- already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: KRR Lykes Basinger Grove and Boatramp Nursery Food Protection Project

Description: The Basinger Grove and Boatramp Nursery are previously permitted agricultural facilities located north and south of U.S. Highway 98, between the C-41A Canal to the south and the Istokpoga Canal to the north, in Highlands County. The total area of the grove is 43,700 acres, of which approximately 350 acres will require a permit modification due to alterations in river staging associated with the Kissimmee River Restoration Project.

The surface water management system that serves the nursery, on the north side of Highway 98, consists of swales, ditches and a pump station that conveys runoff to a dry detention area for water quality treatment and attenuation of the peak runoff rate. Discharge from the detention area is controlled by a gravity control structure and a downstream spreader berm that helps to enhance sheet flow of the runoff to the Kissimmee River.

The surface water management system that serves the grove, on the south side of Highway 98, consists of ditches and pump stations that convey runoff to several detention areas for water quality treatment and attenuation of the peak runoff rate. Runoff from the detention areas is ultimately delivered to the C-41A canal to the south and the Istokpoga canal to the north.

The proposed modifications to the existing surface water management system have been designed to provide flood protection without significantly altering the existing drainage patterns. The proposed work will serve to protect the existing nursery on the north side of U.S. 98 and the grove area on the south side of U.S. 98.

The proposed modifications to the existing nursery will consist of constructing several berms that tie into the existing berms on the property in order to create a continuous protective levee around the nursery. Also proposed are a flap gate on the existing nursery outfall and the replacement of the existing culvert at the existing, nursery pump station with a 36 inch diameter cmp with riser.

The proposed modifications to the existing grove will primarily consist of constructing a protection levee, the installation of a 36 inch diameter cmp with riser at two locations along the levee, the construction of the Basinger Grove North Detention Area (32.5 acres), the construction of a pump station (75 cfs) to deliver runoff into the detention area, the construction of 3 emergency outfall structures to limit high water surface elevations within the detention area and the construction of a primary outfall structure from the detention area. Additional modifications include the enlargement of the existing detention area to accommodate the proposed R-1 Pump Station (294 cfs), the construction of an additional western grove pump station (25 cfs) and modification of the existing outfall structures from the detention area.

The proposed system will outfall into the Istokpoga Canal and ultimately the Kissimmee River.

Purpose: To modify the existing surface water management system and to construct protective levees around the existing nursery and the existing grove to provide additional flood protection for the Lykes Basinger Grove and Boatramp Nursery Food Protection project property and the surrounding areas.

Location/Size/Capacity (provide the shp files if available): This 350 acre project is in the Lower Kissimmee Sub-watershed located within the Lake Okeechobee Watershed. The application number for this project is 060526-22.

Initiative Status: Construction of the Lykes Basinger Grove and Boatramp Nursery Food Protection project has been completed.

Cost: N/A

Activity	Start (Year)	Finish (Year)	Cost
PED	------	------	------
Construction	2006	2008	------
S&A	------	------	------
O&M (Annual Cost)	2008	------	------

Drainage Area (acres that will be treated): 350 acres

Location and Configuration (Layout including Spatial positioning and configuration): N/A

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.021
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:** N/A

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 50 ac-ft
- **Most Likely:** 50 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1 - Already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: KRR- KCOL Wetland Restoration – Otter Slough

Description: The 4,863.34 acre "Prairie Tract" was recently acquired by the Florida Division of Forestry under the Florida Forever Land Acquisition Program and is a component of the Lake Wales Ridge State Forest (LWRSF). This project consists of restoration of the 411 acre portion of the Prairie Tract known as "Lake Kissimmee Citrus Grove." The primary objective of the restoration project is to restore wetland hydrology and hydroperiod of the wet prairie system.

Prior to 1952, a 12 ft wide by 400 ft long ditch was dug to facilitate drainage of the pasture area. The proposed BMPs are located along the eastern side of that ditch. The existing service road will be regraded to a consistent height of 57.5 ft except at the stabilized low water crossings noted below. The first BMP consists of replacing an existing 48 inch culvert (inverts: 52.7 ft west, 52.9 ft east) with a water control structure (14 ft wide weir consisting of a Type D inlet box with dimensions of 3.5 ft x 3.5 ft, outfall 18 inch diameter pipe, crest elevation of 55.55 NGVD). The control structure will be located slightly north of the existing culvert location. A low water crossing will be installed approximately 120 feet north of the proposed water control structure at an invert elevation of 55.7 ft. The second BMP consists of replacing two existing 42 inch culverts (invert: 52.5 ft) and one 48 inch culvert (invert: 51.5 ft) with a low water crossing. The low water crossing will have an invert elevation of 55.7 ft. The third BMP consists of a third low water crossing near the north end of the existing ditch. Other proposed activities include the removal of exotic or nuisance vegetation (wax myrtle, water hyacinth, and climbing fern).

The Kissimmee Chain of Lakes (KCOL) Long Term Management Plan (LTMP) is a multi-agency/stakeholder project whose purpose is to improve, enhance, and/or sustain lake ecosystem while balancing impacts between upstream and downstream ecosystems. The KCOL LTMP was initiated in April 2003 (SFWMD Governing Board Resolution No. 2003-468). The SFWMD is the lead agency responsible for coordinating KCOL LTMP interagency activities and producing the plan.

After identifying existing water resource issues and conflicts within the KCOL, plan partner agencies decided the plan should focus on hydrologic management, habitat preservation, and enhancement, aquatic plant management, water quality, and public use and recreation. KCOL LTMP partner agencies will seek consensus among stakeholders on what resources need to be protected and preserved through interagency management practices and mandates. Stakeholders include the U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Florida Department of Environmental Protection (FDEP), Florida Fish & Wildlife Conservation Commission (FWC), Florida Department of Agriculture and Consumer Services (FDACS), local governments, environmental groups, and residents. Consensus will be built through collaboration on the development of performance measures, the assessment of existing conditions, and the identification of involved agencies mandates and resources that can be used to address Kissimmee Chain of Lakes management issues. The plan is not intended to be a specific management plan that will be routinely updated. Instead, it is intended to leverage mandates and resources to improve, enhance, and/or sustain lake ecosystem health and habitat quality. It will complement existing local government and watershed projects such as the Kissimmee River Restoration Project, Kissimmee Basin Water Supply Plan, Total Maximum Daily Loads, the Lake Okeechobee Watershed Project, the Lake Okeechobee Protection Plan, and SFWMD land management activities.

Purpose: The objective of the restoration plan is to restore the wetland hydrology of the Otter Slough WRP site as reasonably close as possible to its pre-drained condition with no adverse effects to offsite properties. The site hydrology shall be restored to support native wetland plant species such that wetland wildlife habitat values will be enhanced. Nuisance species will be removed as part of the ongoing State Management program. Any regrowth or recolonization by these or other undesirable species should be controlled and monitored as part of the site maintenance program.

Location/Size/Capacity (provide the shp files if available): This 550 acre project is in the Upper Kissimmee Sub-watershed located within the Lake Okeechobee Watershed. The application number for this project is 070425-29.

Initiative Status: Construction of the KCOL Wetland Restoration – Otter Slough project has been completed.

Cost: Total Restoration Costs $166,300; NRCS 75% cost-share - $124,725; Division of Forest 25% cost-share – $41,575

Activity	Start (Year)	Finish (Year)	Cost
PED	2007	2009	------
Construction	2009	2009	$166,300
S&A	------	------	------
O&M (Annual Cost)	------	------	------

Drainage Area (acres that will be treated): 550 acres

Location and Configuration (Layout including Spatial positioning and configuration): Polk County; Sections 27, 28/Township 30/Range 30

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.008
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 71 ac-ft
- **Most Likely:** 71 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1 - <u>Already constructed/implemented</u> or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: David Birdsall, SFWMD, 407-891-3574

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2011 LOPP Update – Management Measure (New)

Project: KRR KCOL Wetland Restoration – Rough Island

Description: The Kissimmee Chain of Lakes (KCOL) Long Term Management Plan (LTMP) is a multi-agency/stakeholder project whose purpose is to improve, enhance, and/or sustain lake ecosystem while balancing impacts between upstream and downstream ecosystems. The KCOL LTMP was initiated in April 2003 (SFWMD Governing Board Resolution No. 2003-468). The SFWMD is the lead agency responsible for coordinating KCOL LTMP interagency activities and producing the plan.

After identifying existing water resource issues and conflicts within the KCOL, plan partner agencies decided the plan should focus on hydrologic management, habitat preservation, and enhancement, aquatic plant management, water quality, and public use and recreation. KCOL LTMP partner agencies will seek consensus among stakeholders on what resources need to be protected and preserved through interagency management practices and mandates. Stakeholders include the U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Florida Department of Environmental Protection (FDEP), Florida Fish & Wildlife Conservation Commission (FWC), Florida Department of Agriculture and Consumer Services (FDACS), local governments, environmental groups, and residents. Consensus will be built through collaboration on the development of performance measures, the assessment of existing conditions, and the identification of involved agencies mandates and resources that can be used to address Kissimmee Chain of Lakes management issues. The plan is not intended to be a specific management plan that will be routinely updated. Instead, it is intended to leverage mandates and resources to improve, enhance, and/or sustain lake ecosystem health and habitat quality. It will complement existing local government and watershed projects such as the Kissimmee River Restoration Project, Kissimmee Basin Water Supply Plan, Total Maximum Daily Loads, the Lake Okeechobee Watershed Project, the Lake Okeechobee Protection Plan, and SFWMD land management activities.

Purpose: To restore hydrology to 1,000 acres of impacted wetlands by constructing earthen ditch plugs with onsite material at Rough Island in the Upper Kissimmee Chain of Lakes..

Location/Size/Capacity (provide the shp files if available): This 1,000 acre project is in the Upper Kissimmee Sub-watershed located within the Lake Okeechobee Watershed.

Initiative Status: The design of the KCOL Wetland Restoration project at Rough Island has been completed.

Cost: N/A

Activity	Start (Year)	Finish (Year)
PED	------	------
Construction	------	2009
S&A	------	------
O&M (Annual Cost)	2009	------

Drainage Area (acres that will be treated): 1,000 acres

Location and Configuration (Layout including Spatial positioning and configuration): Osceola County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.024 mt/yr Level of Certainty- N/A
- **Assumptions leading to benefit estimate:** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 215 ac-ft
- **Most Likely:** 215 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 1 - Already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: David Birdsall, SFWMD, 407-891-3574

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2011 LOPP Update – Management Measure (New)

Project: KRR Lake Wales Ridge Wildlife Environmental Area Restoration (Royce Unit)

Description: This project involves the hydrologic restoration of the Royce Unit Wildlife and Environmental Area (WEA), which is owned and managed by the Florida Fish and Wildlife Conservation Commission (FWC). Authorization is requested to re-establish natural sheet flow within an area along the west side of Lake Istokpoga by filling in several existing ditches which currently have open connections to Josephine Creek and Lake Istokpoga. The restoration is anticipated to restore shallow fresh water marsh habitat to the area.

The hydrologic restoration activity for this project consists of reestablishing sheet flow at the north end of the property by plugging four ditches draining to Lake Istokpoga. These four ditches are collectively identified as the North Ditches and are individually named as the “East Ditch”, “Central Ditch”, “West Ditch”, and “North Ditch”.

The permit obtained by FWC for this project only covers the portion of the project within the South Florida Water Management District (SFWMD). The remainder of the restoration project, primarily the Peace Pond restoration, falls within South West Florida Water Management District (SWFWMD) and will be permitted separately under Permit 32764 by SWFWMD.

Purpose: To restore natural sheet flow within an area along the west side of Lake Istokpoga by filling four existing ditches at the north end of the property that currently flow freely into Josephine Creek and Lake Istokpoga.

Location/Size/Capacity (provide the shp files if available): This 120 acre project is in the Lake Istokpoga Sub-watershed located within the Lake Okeechobee Watershed. The application number for this project is 070423-35.

Initiative Status: Construction of the Lake Wales Ridge WEA Restoration (Royce Unit) project has been completed.

Cost: N/A

Activity	Start (Year)	Finish (Year)	Cost
PED	2006	2007	------
Construction	2007	2009	------
S&A	------	------	------
O&M (Annual Cost)	2009	------	------

Drainage Area (acres that will be treated): 120 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County; Section 32/Township 35/Range 30

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.003 mt/yr
- **Level of Certainty:** unknown
- **Assumptions leading to benefit estimate:** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 20 ac-ft
- **Most Likely:** 20 ac-ft
- **Level of Certainty:** final
- **Assumptions leading to benefit estimate:** operational assumptions

Level of Certainty: Level 1 - Already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: Wetland Reserve Program

Description: The USDA NRCS Wetlands Reserve Program (WRP) offers technical and financial support to land owners who voluntarily agree to protect, restore, and enhance wetlands on their property by placing them in a long-term or permanent conservation easement. To be considered for a long-term or permanent WRP easement, the restoration area must be free of any other easements or encumbrances.

In watersheds where there is an agreement with the USDA NRCS, the area is eligible for participation in the Wetlands Reserve Enhancement Program (WREP). Under this program, Reserved Rights Pilot Program (RRPP) allows the land owner to reserve grazing rights if it is compatible with the land and consistent with the intended restoration. In the Fisheating Creek Sub-watershed, The Nature Conservancy and NRCS have been working collaboratively to identify land owners interested in participating in WREP. There is significant interest and a substantial opportunity in Fisheating Creek to restore hydrology in the basin through WRP/RRPP. Both of these types of easements are funded by the federal government.

Since October of 2005, eight WRP projects including Allapattah Parcels A & B East, Allapattah A & B West, Audubon Society Loop Road, Boney Ranch (Hog Island) – Green Lizard, Buck Island Ranch A, B, and C, Dinner Island Ranch W M A, Lake Wales Ridge State Forest Kissimmee-Otter Slough, and Spirit of the Wild WMA have created an estimated 4,751 acre-feet of storage over 26,463 acres on projects under the WRP.

Purpose: To protect, restore, and enhance wetlands on public, private, and tribal lands.

Location/Size/Capacity (provide the shp files if available): These projects are located within the Caloosahatchee River, Lake Okeechobee, and the St. Lucie River Watersheds while one project is located outside of the Northern Everglades and Estuaries Protection Program boundaries. The total size of these projects is 26,463 acres.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	Sub-watershed P Concentration after BMPs (ppb)	WQ Benefit/P Load Reduction (kg/yr)	Water Quantity Benefits (ac-ft)	County
Allapattah Parcels A & B East	St. Lucie River Watershed	6,000	6,000		TBD	2,000	Martin
Allapattah A & B West	St. Lucie River Watershed	6,300	6,300		TBD	1,500	Martin
Audubon Society Loop Road	St. Lucie River Watershed	139	139		TBD	24	Martin
Boney Ranch (Hog Island) – Green Lizard	Fisheating Creek	384	384	227	84	300	Highlands
Buck Island Ranch A, B, and C	Indian Prairie	1,141	6,000	353	27	62	Highlands
Dinner Island Ranch Wildlife Management Area	Outside the NEEPP	4,313	21,703		TBD	30	Hendry
Lake Wales Ridge State Forest Kissimmee-Otter Slough	Upper Kissimmee	700	700	92	25	220	Polk
Spirit of the Wild Wildlife Management Area	Caloosahatchee River Watershed	7,486	7,486		TBD	615	Hendry
Total in the LOW	------	**2,225**	**7,084**		**133**	**582**	------

Initiative Status: The design and planning phase of the Allapattah Parcels A & B East WRP project has been completed. The construction phases of the Allapattah A & B West WRP, the Audubon Society Loop Road WRP, the Boney Ranch (Hog Island) – Green Lizard WRP, the Buck Island Ranch A, B, and C WRP, the Dinner Island Ranch Wildlife Management Area WRP, the Lake Wales Ridge State Forest Kissimmee-Otter Slough WRP, and the Spirit of the Wild Wildlife Management Area WRP projects have been completed.

Cost: Cost share funds from USDA and NRCS

Project Name	Activity	Start (Year)	Finish (Year)	Cost
Allapattah Parcels A & B East	PED	-----	-----	-----
	Construction	-----	-----	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	-----	-----	-----
Allapattah A & B West	PED	-----	-----	-----
	Construction	-----	-----	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	-----	-----	-----
Audubon Society Loop Road	PED	2002	-----	-----
	Construction	-----	2004	USDA - $107,000
	S&A	-----	-----	-----
	O&M (Annual Cost)	2004	-----	-----
Boney Ranch (Hog Island) – Green Lizard	PED	-----	-----	-----
	Construction	-----	2007	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	2007	-----	-----
Buck Island Ranch A, B, and C	PED	-----	-----	-----
	Construction	-----	2007	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	2007	-----	-----
Dinner Island Ranch Wildlife Management Area	PED	-----	-----	-----
	Construction	2007	2008	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	2008	-----	-----
Lake Wales Ridge State Forest Kissimmee-Otter Slough	PED	-----	-----	-----
	Construction	-----	2009	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	2009	-----	-----
Spirit of the Wild Wildlife Management Area	PED	-----	-----	-----
	Construction	2007	2009	-----
	S&A	-----	-----	-----
	O&M (Annual Cost)	2009	-----	-----

Drainage Area (acres) that will be treated: 48,712 acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** To be determined
- **Maximum:** To be determined
- **Most Likely:** 0.136 mt/yr for the three completed projects: Boney Ranch (Hog Island), Buck Island Ranch A, B, and C and Lake Wales Ridge State Forest Kissimmee-Otter Slough.
- **Level of Certainty:** unknown
- **Assumptions leading to benefit estimate:** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 4,751 ac-ft
- **Most Likely:** 4,751 ac-ft (582 ac-ft for the three completed projects: Boney Ranch a/k/a Hog Island, Buck Island Ranch A, B, and C and Lake Wales Ridge State Forest Kissimmee-Otter Slough)
- **Level of Certainty:** conceptual/final
- **Assumptions leading to benefit estimate:** historical data/operational assumptions

Level of Certainty: Level 1 - already constructed/implemented or construction/implementation imminent

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New or Update)

Project: In-Lake Strategies – Low Lake Stage Muck Scraping and Tilling

Description: Low water levels in 2007 provided a management opportunity to effectively scrape muck sediments from several nearshore regions of the lake. The pre–post comparison at one site, Harney Pond East, illustrates a common pattern reported for other scraped sites. Prior to scraping, cattail (*Typha* spp.) was the most abundant emergent plant followed by American cupscale (*Sacciolepis striata*) and other grasses (8 acres). Two years after scraping, the dominant plants were native spikerush (*Eleocharis cellulosa*) and smartweed (*Polygonum hydropiperoides*). A second sediment management project was conducted in 2008 on a 40-acre site located adjacent to Indian Prairie canal in the lake's northwest littoral zone. The purpose of this project was to evaluate the effectiveness of tilling the surface organic layer into the underlying sand substrate as a mechanism for reducing the surficial total and extractable phosphorus levels and reducing internal phosphorus loading. As lake waters quickly rose to average conditions in August 2008, further muck removal plans were put on hold pending a return to lower water levels. Two years prior to tilling (pre-drought), cattail was the dominant plant species and covered most of the management area. As a result of the drought, the prominent vegetation in the site vicinity was herbaceous ground cover — primarily smartweed, with low-density patches of macrophytes such as cattail and bulrush (*Scirpus californicus*), and shrubs such as willow (*Salix* sp.) and primrose willow (*Ludgwigia* sp.). In 2010, two years after tilling, the area was much wetter with the prominent species being the desirable floatingheart (*Nymphoides*) or water lily (*Nymphaea*) species and emergent bulrush as well. Cattail coverage was low. Fish and wildlife habitat improved following both scraping and tilling. The quantified changes in landscape coverage were, in part, the result of management activity. Hydrologic conditions also influenced plant community composition and distribution. The evaluation of temporal landscape changes in these and other management areas will continue to determine the long-term effects of these sediment management practices on the lake's fauna and flora.

Purpose: There were multiple purposes for this project. One effort was to evaluate the effectiveness of tilling the surface organic layer into the underlying sand substrate as a mechanism for reducing the surficial total and extractable phosphorus levels and reducing internal phosphorus loading. The muck scraping was an effort to removal P-laden sediments from the marsh and expose the native lake bottom to improve the flora and fauna habitat.

Location/Size/Capacity (provide the shp files if available): Indian Prairie Marsh, Harney Pond

Initiative Status: Completed

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction	2007, 2008	2007, 2008	Tilling- $87,000 Scraping – $11,000,000
S&A			
O&M (Annual Cost)	N/A	N/A	N/A

Documentation:

Drainage Area (acres that will be treated): 40 acres tilled + 1900 scraped- 2,348,000 cubic yards of sediment removed.

Location and Configuration (Layout including spatial positioning and configuration): Indian Prairie Marsh and Harney Pond on the west shore of Lake Okeechobee.

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** Sequestration of < 400 lbs of P (tilling): 2,000,000 cubic yards of muck removed (scraping).
- **Maximum:** Sequestration of > 400 lbs of P, including topsoil (tilling); about 237 metric tonnes of P removed (scraping).
- **Most Likely:** Fish, wildlife and native plant habitat improvements.
- **Level of Certainty- conceptual/final/unknown:** Final
- **Assumptions leading to benefit estimate:** TP load reduction was based on the amount of P removed per acre of tilled marsh, and per cubic yards of muck removed. Fish and wildlife benefits were derived from the vegetation mapping conducted at the pre- and post muck removal sites.

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** N/A
- **Maximum:** N/A
- **Most Likely:** N/A
- **Level of Certainty- conceptual/final/unknown:** Final
- **Assumptions leading to benefit estimate:** N/A

Level of Certainty: 1

Proof of Concept: +1

Other Unintended Impacts: +1

Contact Information: David Unsell; SFWMD; 561-682-6888

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2011 LOPP Update – Management Measure (Update)

Project: Lake Okeechobee Works of the District Regulatory Phosphorus Source Control Program

Description: Chapter 40E-61, F.A.C., the Lake Okeechobee Works of the District (WOD) rule, which was adopted in 1989 as a result of the Lake Okeechobee Surface Water Improvement and Management plan, limits the amount of phosphorus that can be discharged from lands within the regulatory boundary defined by the rule regardless of whether the land use is agricultural or nonagricultural. This is accomplished by issuing permits that approve a phosphorus control plan. The rule criteria are based on initiatives in place at the time the rule was adopted. These criteria need updating.

Purpose: The current objective is to establish regulatory criteria and performance metrics that ensure that runoff to the tributaries and canals that discharge into Lake Okeechobee allow the District to meet the legislative policies established in Chapter 373, F.S. The SFWMD current initiatives are focused on revising the rule to meet this objective.

These initiatives include:

- implement a phosphorus source control program utilizing best management practices for lands within the Lake Okeechobee Watershed;
- recognize agricultural land uses that are participating in the FDACS BMP rule under Chapter 5M-3, F.A.C., by a certain deadline as meeting the intent of the District's WOD rule to prevent duplication of effort;
- establish a timeline for implementation of the regulatory source control program within the watershed;
- establish load or concentration-based performance measures for the collective source control programs implemented by the coordinating agencies in the watershed;
- define the monitoring network necessary to monitor compliance with the established performance measures, to identify priority areas of water quality concern and BMP improvement, and to provide data to evaluate and enhance performance of downstream treatment facilities;
- establish a plan for improving the collective source control programs implemented by the coordinating agencies should the expected water quality criteria not be met;
- ensure that the rule is consistent with the LOPP; and
- include incentives for permittees to participate in TP reduction demonstration projects that will provide valuable data for expanding, accelerating, and improving the implemented BMPs to meet water quality objectives and for further refinement of Lake Okeechobee Watershed Regulatory P Source Control Program as necessary.

Location/Size/Capacity (provide the shp files if available): The location is the Lake Okeechobee Watershed as defined by the Northern Everglades and Estuaries Protection Program.

Initiative Status: The District is currently considering public input for the development of draft rule text and anticipates adoption of rule amendments in 2011 to support the current initiatives. However, it should be noted that the Office of the Governor issued Executive Order No. 11-01 on January 4, 2011, which suspends all rulemaking and states that no agency may notice the development of proposed rules, amendment of existing rules, or adoption of new rules, except at the direction of the Office of Fiscal Accountablilty and Regulatory Reform, which was established in the Executive Order. Consequently, meetings and activities associated with any rulemaking efforts may be rescheduled. The coordinating agencies are committed to working with the Office of Fiscal Accountability and Regulatory Reform on the rulemaking process and will keep communities and stakeholders informed on the status of any rulemaking efforts described in this plan.

Workshops and stakeholder meetings were conducted from 2008 to 2010 to collect public input and to identify area specific issues. The district is developing performance metrics for the collective source control programs in the watershed. Performance measures are critical to ensure consistent implementation of source controls, to measure actual phosphorus reductions achieved, and to have a mechanism for requiring improvements should the water quality goals not be achieved. Additional public workshops will be held upon completion of draft rule text.

Success of the source control programs also depends on verification of BMP implementation through inspections and through a research/extension program that would continuously provide feedback to permittees. This feedback is essential so that permittees are able to use adaptive management methods to update their BMP plans and improve their BMP implementation techniques as new data and information become available. The District is evaluating resources to ensure staffing and funding to perform the verifications and outreach.

Additionally a technical evaluation of the LOW Assessment (LOWA) monitoring network was completed for the Taylor Creek/Nubbin Slough Sub-watershed to be used as a methodology for optimizing the monitoring network throughout the watershed. The existing multi-tiered monitoring network is a critical component of the District's ability to evaluate performance measures and to pinpoint areas of concern, especially in areas where the performance measures are not being met. The monitoring networks are continuously evaluated and maintained to ensure the best data and most representative data possible. The operation and maintenance of these sites as District-funded sites is necessary for the future success of the collective source control programs and the metrics for determining success.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction			N/A
S&A			
O&M (Annual Cost)			
Ongoing Regulatory Process	*	*	$1.1 Million**

*This is an ongoing regulatory process that occurs throughout the fiscal year every year.

**This is the cost for fiscal year 2011. It is anticipated that the costs will increase in future years.

Documentation:

Drainage Area (acres that will be treated): Approximately 3.4 million acres

Location and Configuration (Layout including Spatial positioning and configuration):

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty- conceptual/final/unknown (see below):** Final
- **Assumptions leading to benefit estimate- (e.g. period of record; inflow concentration/load; did you assume BMPs were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.):** N/A

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty- conceptual/final/unknown (see below):** Final
- **Assumptions leading to benefit estimate- (e.g., period of record; flow/volume; operational assumptions):** N/A

Level of Certainty: (select one) 2

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested? N/A

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts: N/A

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Steffany Gornak; SFWMD; 863-462-5260 ext. 3010

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2011 LOPP Update – Management Measure (New or Update)

Project: Environmental Resource Permit Program (Water Quality) Proposed Statewide Stormwater Rule

Description: The FDEP in coordination with the five water management districts are working to adopt the Unified Statewide Stormwater Rule to increase the level of treatment required for TN and TP in storm water from new development, which is anticipated to adequately address the discharge of nutrients in general. The proposed rule is also anticipated to have an indcidental effect of reducing the volume of storm water. Rulemaking efforts are currently under way (Chapter 62-347, F.A.C.). More information and the revised documents are available at the FDEP's web site.

The proposed rule will provide statewide regulatory criteria for new stormwater treatment systems, which are designed and constructed to control stormwater pollutant loads. Stormwater treatment systems usually are components of a surface water management system. Together these systems may incorporate methods to collect, convey, store, absorb, inhibit, treat, use, or reuse water to prevent or reduce flooding, over-drainage, environmental degradation and pollution, or otherwise affect the quality and quantity of discharges. The proposed rule will increase the level of nutrient removal required of stormwater treatment systems serving new development.

The proposed draft rule is technology-based and includes the following components:

- Performance standards or goals (for the minimum level of treatment for nutrients)
- Design criteria for BMPs used to treat storm water that will achieve the performance standard
- A rebuttable presumption that a stormwater treatment system designed in compliance with the BMP design criteria within this rule will not cause or contribute to violations of surface water standards
- Periodic review and updating of BMP design criteria as more information becomes available to increase their effectiveness in removing pollutants

Once adopted, the FDEP, the SFWMD, and the four other WMDs will implement the rule under their respective programs.

Purpose: To address the growing problem of nutrient enrichment of Florida's surface waters.

Location/Size/Capacity (provide the shp files if available): Individual Water Management Districts statewide

Initiative Status: In 2008, a Technical Advisory Committee (TAC) was established to assist the FDEP and the WMDs in developing the first versions of the draft rule and the Applicant's Handbook. Numerous public meetings have been conducted, and the TAC continues to refine the draft rule and the Applicant's Handbook in order to incorporate public comments. Rule adoption is tentatively scheduled for 2011.

It should be noted that the Office of the Governor issued Executive Order No. 11-01 on January 4, 2011, which suspends all rulemaking and states that no agency may notice the development of proposed rules, amendment of existing rules, or adoption of new rules, except at the direction of the Office of Fiscal Accountablilty and Regulatory Reform, which was established in the Executive Order. Consequently, meetings and activities associated with any rulemaking efforts may be rescheduled. The coordinating agencies are committed to working with the Office of Fiscal Accountability and Regulatory Reform on the rulemaking process and will keep communities and stakeholders informed on the status of any rulemaking efforts described in this plan.

Cost: N/A

Documentation: www.dep.state.fl.us/water/wetlands/erp/rules/stormwater/index.htm

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely- Level of Certainty- conceptual/final/unknown:**
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:**
- **Maximum:**
- **Most Likely:**
- **Level of Certainty- conceptual/final/unknown** (see below)
- **Assumptions leading to benefit estimate** (e.g., period of record; flow/volume; operational assumptions)

Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested?)

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts:

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Eric Livingston, FDEP, 850-245-8430

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2011 LOPP Update - Management Measure

Project Feature/Activity: Environmental Resource Permit Program – Northern Everglades Discharge Volume BMPs **Level**: 1

General Description/Background:

Under Part IV of Chapter 373, Florida Statutes, the FDEP and the water management districts were granted authority to implement the statewide Environmental Resource Permit (ERP) Program. The ERP program regulates activities in, on, or over wetlands or other surface waters and the management and storage of all surface waters. Generally, the program's purpose is to ensure that activities do not degrade water quality, compromise flood protection, or adversely affect the function of wetland systems. The pogram applies only to new activities or to modifications of existing activities, and requires an applicant to provide reasonable assurances that an activity will not cause adverse impacts to existing surface water storage and conveyance capabilities, and will not adversely affect the quality of receiving waters such that any applicable water quality standards will be violated. Therefore, an applicant must address the long-term water quality impacts of a proposed activity and must prevent any discharge or release of pollutants from the system that will cause water quality standards to be violated.

Water Quality

The District and DEP implement the ERP rules to prevent further degradation and net improvement of impaired waters, or other water bodies that do not meet state water quality standards, as a result of new activities that may alter stormwater discharges.

Current ERP rules require that activities be designed and operated so that offsite discharges will not violate state water quality standards. These rules specify a more detailed evaluation by the District and DEP staff for new activities which outfall to sensitive receiving waters. Lake Okeechobee is specifically listed as a sensitive receiving water body. The rules require that reasonable assurance be provided both for short term (during construction) and long term (during operation) that state water quality standards will not be violated.

The District's current technical criteria set forth in the Basis of Review for Environmental Resource Permits within the SFWMD, requires additional protective measures if ambient water quality for a particular site doesn't meet state water quality standards. In cases where a project is discharging to an impaired water body the applicant must demonstrate that the proposed activity will not contribute to the existing violation.

Additionally, the concept of cumulative impacts, set forth in Florida statutes and District rules, requires that impacts to water quality be evaluated to determine that the proposed activity, in conjunction with past activities, existing activities, and future activities, must not result in a violation of state water quality standards.

Importantly, where the applicant is unable to meet water quality standards because existing ambient water quality does not meet standards, Section 373.414(1)(a)3, Florida Statutes requires the District and DEP to: "consider mitigation measures proposed by the applicant that cause net improvement of the water quality in the receiving body of water for those parameters which do not meet standards."

Therefore, under this statutory direction, the District and DEP require a net improvement where a project will discharge to an impaired water body. This requirement for net improvement is currently applied to the water bodies included in NEEPP to assure a net improvement in discharges from new development for parameters which do not meet standards.

While the existing ERP rules require an applicant to provide reasonable assurance to demonstrate that a proposed activity will not contribute causative pollutants to an impaired water body the existing ERP rules do not provide design or operational criteria for the types of additional measures to be incorporated into the design to provide the requisite reasonable assurance. Therefore, DEP, in coordination with the five water management districts, and a Technical Advisory Committee, is working on the development of a proposed unified statewide stormwater rule to provide updated water quality criteria, concentrating on nutrient load reduction, and to provide consistent water quality protection throughout the state (Project ID 36).

In the interim, the SFWMD has developed guidance on additional measures which may be considered, on a activity-by-activity basis, as necessary to provide reasonable assurance that an activity will not contribute additional causative pollutants to an impaired water body or other water body that does not meet state water quality standards and net improvement for those parameters which do not meet standards."

Hydrology

Under current ERP criteria, in order to obtain an ERP, applicants must provide reasonable assurances that the construction, alteration, operation, maintenance, removal or abandonment of a surface water management system will not cause adverse water quantity impacts to receiving waters and adjacent lands. Therefore, in water bodies included in NEEPP, applicants must show that hydrology is not adversely affected by proposed new activities.

Section 373.4595, Fla. Stat., contains a statement of legislative intent that improvement to the hydrology within the Lake Okeechobee watershed, the Caloosahatchee River watershed and the St. Lucie River watershed is essential to the protection of the greater Everglades ecosystem. Section 373.414(1), Florida Statutes requires applicants to demonstrate that proposed new activities will not be inconsistent with the overall objectives of the District. Therefore, in order to demonstrate that an activity is not inconsistent with the overall objectives of the District, with regard to the improvement in hydrology in these watersheds, applicants must, at a minimum, demonstrate that the post development average annual discharge volume is no greater than the pre development average annual discharge volume, where the pre development condition is the existing site condition at the time the application is submitted.

District staff is currently finalizing a guidance memorandum which is intended to provide District staff and applicants with information, tools and examples of a reasonable method to demonstrate average annual discharge volumes are no greater than the pre development average annual discharge volume, meaning that there will be no negative impact to hydrology. The result of the application of the methodologies in this memo will be no increase in the volume of runoff from new development on an average annual basis discharging to downstream water bodies within NEEPP.

The previous version of the LOPP included development of an ERP basin rule to address the potential for new activities to impact hydrology within NEEPP. District staff developed a methodology to be included in a basin rule to demonstrate no impact to hydrology. During rule discussions, it was determined that this methodology can be applied utilizing existing ERP criteria. Therefore, an ERP basin rule is not necessary and the guidance memorandum described above will be utilized to provide a technical method for District staff to review and applicants to demonstrate reasonable assurance that their activity will not cause adverse impacts to hydrology. The goal is to begin implementation of these guidelines within the Northern Everglades watershed by mid 2011.

Purpose: The purpose of this measure is to ensure that activities do not increase average annual discharge volumes (no impact to hydrology) from new development.

Location/Size/Capacity: Northern Everglades Watersheds

Initiative Status: Under Development

Cost: N/A

Estimate of Water Quality Benefits

- **Minimum:**
- **Maximum:**
- **Most Likely:**
- **Level of Certainty:**
- **Assumptions:** No increase in average annual discharge volumes resulting from new development; Applies to new development only; Additional unquantified benefits may occur from the conversion of intense agricultural uses (dairies, row crops, improved pasture, sod, citrus) with little or no water quality treatment to urban uses with modern surface water management systems with treatment; Projected benefits will roll up under the urban category

Estimate of Water Quantity Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Conceptual
- **Assumptions:** No increase in average annual discharge volumes resulting from new development; Applies to new development only; Additional unquantified benefits may occur from the conversion of intense agricultural uses (dairies, row crops, improved pasture, sod, citrus) with little or no stormwater storage to urban uses with modern surface water management systems with storage; Projected benefits will roll up under urban category.

Screening Criteria

- **Proof of Concept:** N/A
- **Other Impacts:** N/A

Contact: Damon Meiers; SFWMD; 561-686-8800

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2011 LOPP Update – Management Measure (New)

Project: Dispersed Water Management- Clewiston Site

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. Increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To utilize the existing perimeter levee at the project site for water storage and treatment. Inflow pump stations will be constructed and the existing levee will be enhanced in order to facilitate this project’s purpose.

Location/Size/Capacity (provide the shp files if available): This 728 acre project is located in the Everglades Agricultural Area.

Initiative Status: The Clewiston Site water storage project is currently in the design phase.

Cost: N/A

Activity	Start (Year)	Finish (Year)	Cost
PED	-----	-----	-----
Construction	-----	-----	-----
S&A	-----	-----	-----
O&M (Annual Cost)	-----	-----	-----

Drainage Area (acres that will be treated): 728 acres

Location and Configuration (Layout including Spatial positioning and configuration): Glades County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.273
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0
- **Maximum:** 1,456 ac-ft
- **Most Likely:** 1,456 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (Update)

Project: Dispersed Water Management – Lykes Nicodemus Slough (Phase 1A Project)

Description: Lake Okeechobee is one of the most important water resources of Florida, providing many functions benefiting the public interest, including agricultural, public, and environmental water supply; flood control; fishing; navigation and recreation; and habitat to endangered and threatened species and other flora and fauna. Conditions in and around the lake affect lands, rivers, people and creatures to the east, west, north and south. Lake Okeechobee has received agricultural runoff for the past 50 years and has discharged these nutrients to the estuaries and the Everglades, causing ecosystem imbalance in these regions. South Florida Water Management District (SFWMD) and other agencies have an action plan being implemented to combine and accelerate all programs concerning the health of Lake Okeechobee and the surrounding ecosystems influenced by the Lake. Retaining water is an action beneficial not only as an efficient means of phosphorus load reduction but can also benefit owners of adjacent land to areas used for retention due to better water management and conservation capabilities and greater efficiency in agricultural irrigation through the reuse of runoff. The estimated stormwater runoff storage in the watershed needed to improve lake stage management and reduce the frequency of damaging freshwater releases to the estuaries is approximately 1.1 million ac-ft. This storage is anticipated to be provided by a combination of alternative water storage, surface storage and aquifer storage and recovery.

The goal of Phase 1A of the Nicodemus Slough on Lykes Bros. Inc. Lands project is to provide design alternatives to store and dispose of excess surface water to aid in reducing Lake Okeechobee levels and high discharge volumes to the estuaries, to create hydrologic sheet flow within the project area, and to rehydrate existing wetlands. This project is 16,129 acres, located on the west shore of Lake Okeechobee in Glades County, northwest of Moore Haven. Phase 1A of this project entails collecting the necessary information for site design and presenting design alternatives.

A total of fourteen alternatives were evaluated in a feasibility study to identify the best options for storing and disposing of excess surface water in the Fisheating Creek/Nicodemus Slough Sub-watershed. Two options, Alternatives 7A and 10A, were selected as the best options based on factors such as storage volume, technical suitability, and permitting. Both alternatives were modeled and Alternative 7A was found to be the most viable option. Estimated total storage, based on hydraulic modeling, for Alternative 7A is 33,860 ac-ft. This estimate factors in subsurface storage of as much as 11 inches, which greatly increases the storage capacity of the Nicodemus Slough on Lykes Bros. Inc. Lands Phase 1A project site.

Alternative 7A would consist of two pump stations, one at the northwestern portion of the site and one at the northeastern portion of the site, three internal levees with north-south orientations, an external levee at the southern boundary, and inter-cell flow devices. Both pump stations would be located on the Nicodemus Slough side of the levee, south of the Herbert Hoover Dike. Flow would be transferred to Nicodemus Slough through the Culvert 5 structure. This alternative would require a new conveyance channel or pipe, approximately 7.5 miles long with berms lower than 8 ft, but would not cross the Herbert Hoover Dike.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 16,129 acre project is in the Fisheating Creek/Nicodemus Slough Sub-watershed located within the Lake Okeechobee Watershed. This project will evaluate and identify alternatives for storing and disposing of excess surface water in the Fisheating Creek/Nicodemus Slough Sub-watershed, in order to reduce Lake Okeechobee levels and high discharge volumes to the estuaries. This project also aims to rehydrate existing, onsite wetlands and create hydrologic sheet flow over the entire project area.

Initiative Status: The Nicodemus Slough on Lykes Bros. Inc. Lands project is currently in the planning and design phase.

Cost: The estimated 2007 cost for Alternative 7A was $7,200,000 or $212/ac-ft of storage. The estimated 2010 cost is $4.5 million.

Activity	Start (Year)	Finish (Year)	Cost
PED	2008	------	$500,000
Construction	------	------	$3,000,000-$4,000,000
S&A	------	------	------
O&M (Annual Cost)	------	------	TBD
Service Payment	------	------	TBD

Drainage Area (acres that will be treated): 16,129 acres

Location and Configuration (Layout including Spatial positioning and configuration): Glades County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 9.2 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 33,860 ac-ft
- **Most Likely:** 33,860 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 3 - implementation certainty unknown; conceptual level of design/activity development complete; location defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: Dispersed Water Management - Istokpoga Marsh Drainage District

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. Increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 19,209 acre project is in the Indian Prairie Sub-watershed located within the Lake Okeechobee Watershed. The application number for this site is 901211-1-Q.

Initiative Status: The Istokpoga Marsh Drainage District project is in the planning phase and an agreement to build an agricultural water treatment facility has been executed.

Cost: Program costs FY2009 - $4,804,897; FY2010 - $1,474,493; Total cost - $6,279,390

Activity	Start (Year)	Finish (Year)	Cost
PED	------	------	------
Construction	------	------	------
S&A	------	------	------
O&M (Annual Cost)	------	------	------

Drainage Area (acres that will be treated): 19,209 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County; Sections 35, 36/Township 36/Range 30, Sections 31, 32, 33/Township 36/Range 31, Sections 1, 2, 3, 10, 11, 12, 13, 14, 23, 24, 25, 26, 35/Township 37/Range 30, Sections 3, 4, 5, 6, 7, 8, 9, 10, 15, 16, 17, 18, 21, 22/Township 37/Range 31

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum (dry year):** < 1.0 mt/yr
- **Maximum (wet year):** 9.0 mt/yr
- **Most Likely (annual average):** 4.5 mt/yr
- **Level of Certainty (+ or –):** 25%
- **Assumptions leading to benefit estimate:** (WAM predicted responses, see PPT file, WAM TP conc. were calibrated to observed data)

Estimate of Water Quantity Benefits (Increased Storage in Lake Istokpoga in ac-ft):

- **Minimum (dry year):** < 1,500 ac-ft
- **Maximum (wet year):** 14,000 ac-ft
- **Most Likely (annual average):** 7,800 ac-ft
- **Level of Certainty - (+ or –):** 25%
- **Assumptions leading to benefit estimate:** (WAM predicted responses, see PPT file, no historical flow data were available)

Level of Certainty: Level 2 - construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (Update)

Project: Dispersed Water Management - Northern Everglades Payment for Environmental Services Program (NE-PES) Solicitation

Description: Northern Everglades ranchers have the opportunity to participate in a new Payment for Environmental Services contracting program with the District to increase water retention and improve water quality on their lands. The program was developed and implemented under the Florida Ranchlands Environmental Services Pilot Project (FRESP) in collaboration with the Florida Department of Agriculture and Consumer Services (FDACS), the USDA Natural Resources Conservation Service (NRCS) and the Florida Department of Environmental Protection (FDEP).

Purpose: The purpose of this initiative is to request that landowners, with low-intensity agriculture such as natural lands and cattle ranching, submit proposals on providing water retention and water quality improvement services. These proposals are being evaluated and ranked based upon defined evaluation criteria. With the funding available, the top-ranked projects will be selected and move forward with final design, permitting, construction, monitoring and service documentation.

Location/Size/Capacity (provide the shp files if available): The Northern Everglades and Estuaries Watersheds geographic area (see figure).

Initiative Status: The NE-PES solicitation was released on January 7, 2011. The deadline for submissions is February 28, 2011.

Cost: TBD

Documentation:

Drainage Area (acres that will be treated): Entire watershed

Location and Configuration (Layout including spatial positioning and configuration): Entire watershed

GIS data:

Available ☒Yes ☐No

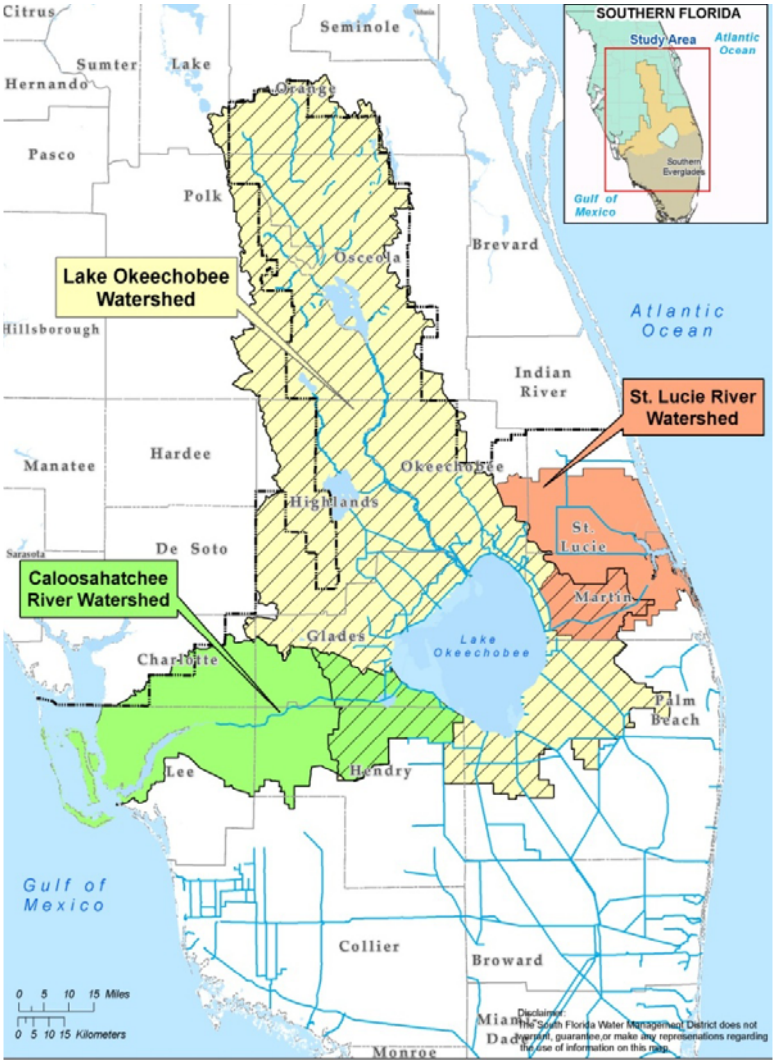
Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** TBD
- **Maximum:** TBD
- **Most Likely:** TBD
- **Level of Certainty:** Level 1
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** TBD
- **Maximum:** TBD
- **Most Likely:** TBD
- **Level of Certainty:** Level 1
- **Assumptions leading to benefit estimate:**

Location



Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: +1

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts:

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Benita Whalen (bwhalen@sfwmd.gov), SFWMD, (561) 682-2957

44 through 46, 60 through 65

2011 LOPP Update – Management Measure (New)

Project: Alternative Water Storage and Disposal Interim Projects

Description: In concert with the Lake Okeechobee Watershed Construction Project Phase II Technical Plan, the goals of the Lake Okeechobee Interim Water Storage Assessment effort are to reduce phosphorus loading as prescribed in the TMDL for Lake Okeechobee, to maintain Lake Okeechobee water levels within an ecologically desirable range, to meet desirable salinity ranges for the St. Lucie and Caloosahatchee estuaries, and to meet other water related needs of the region, including water supply and flood protection.

SFWMD has identified and assessed publicly owned parcels within the Lake Okeechobee Watershed for potential water storage. Since long term stormwater treatment areas (STAs) or other projects are planned on several project sites, possible enhancement measures are to be limited to interim facilities, temporary in nature. Site alternatives to the interim facilities include construction of onsite measures such as temporary ditch blocks, minor berming, minimal earthwork, wetland restoration, and potential water diversions to the project sites using temporary pump facilities.

Purpose: To utilize interim facilities for water storage by employing a range of site alternative measures at a number of project sites.

Location/Size/Capacity (provide the shp files if available): These projects are located within the Lake Okeechobee Watershed.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	WQ Benefits (kg/yr)	Water Quantity Benefits (ac-ft)	County
Buckhead Ridge Property (TIITF)	Indian Prairie	38	38	11	27	Glades
Caloosahatchee East & West Property (TIITF)	West Lake Okeechobee	61	61	5	30	Glades
Fisheating Creek (TIITF, FWC)	Fisheating Creek	702	702	242	867	Glades
Harney Pond Property (TIITF)	Indian Prairie	33	33	13	30	Glades
Indian Prairie Property (TIITF)	Indian Prairie	2,708	2,708	22	52	Glades
Okeechobee Property (TIITF)	Taylor Creek/Nubbin Slough	23	23	3	5	Okeechobee
Pearce/Hartman Property	Indian Prairie	3,997	3,997	740	1,786	Glades
Putnam Groves Property	Lower Kissimmee	2,577	2,577	180	1,595	Highlands
Taylor Creek (Grassy Island) Interim Project	Taylor Creek/Nubbin Slough	10,982	10,982	1000	1,729	Okeechobee
Total	**-----**	**21,121**	**21,121**	**2,383**	**6,121 ac-ft**	**-----**

Initiative Status: Site visits have been conducted to all of the project sites. Feasibility studies have been completed for the Buckhead Ridge Property (TIITF), the Caloosahatchee East & West Property (TIITF), the Fisheating Creek Property (TIITF, FWC), the Harney Pond Property (TIITF), the Indian Prairie Property (TIITF), and the Okeechobee Property (TIITF) and these projects are either under discussion or are being evaluated. The Pearce/Hartman Property and the Putnam Groves Property projects are currently in the design phase. The BOMA and Kissimmee Chain of Lakes projects are in the process of being designed and constructed by SFWMD consultants. The Grassy Island Interim project is in the process of being designed and constructed by the SFWMD Operations Division.

Cost: Total estimated District cost for the Putnam Groves Property project - $40,000. Total estimated District cost for the Taylor Creek (Grassy Island) Interim Project - $410,000.

Drainage Area (acres that will be treated):

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** total of approximately 2.4 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 6,121 ac-ft
- **Most Likely:** 6,121 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data; modeling

Level of Certainty: Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

47 and 48

2011 LOPP Update – Management Measure (New)

Project: Planned Kissimmee River Restoration (KRR) Projects

Description: The Kissimmee Chain of Lakes (KCOL) Long Term Management Plan (LTMP) is a multi-agency/stakeholder project whose purpose is to improve, enhance, and/or sustain lake ecosystem while balancing impacts between upstream and downstream ecosystems. The KCOL LTMP was initiated in April 2003 (SFWMD Governing Board Resolution No. 2003-468). The SFWMD is the lead agency responsible for coordinating KCOL LTMP interagency activities and producing the plan.

After identifying existing water resource issues and conflicts within the KCOL, plan partner agencies decided the plan should focus on hydrologic management, habitat preservation, and enhancement, aquatic plant management, water quality, and public use and recreation. KCOL LTMP partner agencies will seek consensus among stakeholders on what resources need to be protected and preserved through interagency management practices and mandates. Stakeholders include the U.S. Army Corps of Engineers (USACE), U.S. Fish & Wildlife Service (USFWS), U.S. Environmental Protection Agency (USEPA), Florida Department of Environmental Protection (FDEP), Florida Fish & Wildlife Conservation Commission (FWC), Florida Department of Agriculture and Consumer Services (FDACS), local governments, environmental groups, and residents. Consensus will be built through collaboration on the development of performance measures, the assessment of existing conditions, and the identification of involved agencies mandates and resources that can be used to address Kissimmee Chain of Lakes management issues. The plan is not intended to be a specific management plan that will be routinely updated. Instead, it is intended to leverage mandates and resources to improve, enhance, and/or sustain lake ecosystem health and habitat quality. It will complement existing local government and watershed projects such as the Kissimmee River Restoration Project, Kissimmee Basin Water Supply Plan, Total Maximum Daily Loads, the Lake Okeechobee Watershed Project, the Lake Okeechobee Protection Plan, and SFWMD land management activities.

Purpose: To restore hydrology to impacted wetlands in the Upper Kissimmee Chain of Lakes.

Location/Size/Capacity (provide the shp files if available): These projects are in the Upper Kissimmee Sub-watershed located within the Lake Okeechobee Watershed. The total size of these projects is 3,093 acres.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	WQ Benefits mt/yr	Water Quantity Benefits	County
East Lake Water Quality Improvements – Phase 2	Upper Kissimmee	58	58	TBD	2 ac-ft	Osceola
Three Lakes Wildlife Management Area Hydrologic Restoration (MM 52)	Upper Kissimmee	535	535	0.068	600 ac-ft	Osceola
SOR – Gardner Cobb Marsh Restoration (MM 53)	Upper Kissimmee	2,500	2,500	0.283	2,500 ac-ft	Osceola
Total	------	**3,093**	**3,093**	0.0.351	**3,102 ac-ft**	------

Initiative Status: These projects are designed and permitted and the East Lake Water Quality Improvements – Phase 2 project is under construction.

Cost: N/A

Drainage Area (acres that will be treated): 3,093 acres

Location and Configuration (Layout including Spatial positioning and configuration): Osceola County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.351 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 3,102 ac-ft
- **Most Likely:** 602 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: Wetland Reserve Program

Description: The USDA NRCS Wetlands Reserve Program (WRP) offers technical and financial support to land owners who voluntarily agree to protect, restore, and enhance wetlands on their property by placing them in a long-term or permanent conservation easement. To be considered for a long-term or permanent WRP easement, the restoration area must be free of any other easements or encumbrances.

In watersheds where there is an agreement with the USDA NRCS, the area is eligible for participation in the Wetlands Reserve Enhancement Program (WREP). Under this program, Reserved Rights Pilot Program (RRPP) allows the land owner to reserve grazing rights if it is compatible with the land and consistent with the intended restoration. In the Fisheating Creek Sub-watershed, The Nature Conservancy and NRCS have been working collaboratively to identify land owners interested in participating in WREP. There is significant interest and a substantial opportunity in Fisheating Creek to restore hydrology in the basin through WRP/RRPP. Both of these types of easements are funded by the federal government.

Since October 2005, an estimated 582 ac-ft of storage has been created over 5,241 acres on projects under the WRP and another 14,614 ac-ft of storage over 35,810 acres of land is either under construction or in the design phase. Florida received approximately $29.4 million for annual easement programs in 2010 with an additional $89 million for Fisheating Creek Wetland Reserve Special Project for purchase of almost 26,000 acres in easement.

Purpose: To protect, restore, and enhance wetlands on public, private, and tribal lands.

Location/Size/Capacity (provide the shp files if available): These projects are located within the Caloosahatchee River, Lake Okeechobee, and the St. Lucie River Watersheds while three projects are located outside of the Northern Everglades and Estuaries Protection Program boundaries. The total size of these projects is 8,476 acres.

Project Name	Sub-Watershed	Size (acres)	Drainage Area (acres)	Sub-watershed P Concentration after BMPs (ppb)	WQ Benefit/P Load Reduction (kg/yr)	Water Quantity Benefits (ac-ft)	County
Archbold Experiment Station	Fisheating Creek	1,194	1,194	227	71	255	Highlands
C.A. Thomas Wetland Restoration	Caloosahatchee Watershed	216	216		TBD	11	Collier
Conservation Fund	Outside the NEEPP	640	640		TBD	53	Hendry
Goldstein Ranch	St. Lucie River Watershed	40	40		TBD	15	Martin
Lazy O Ranch	Lower Kissimmee	2,594	2,594	107	33	250	Okeechobee
Loxahatchee Slough	Outside the NEEPP	66	1,699		TBD	TBD	Palm Beach
Myrtle Island Ranch	Indian Prairie	438	438	353	44	100	Glades
Santa Rosa Ranch	Lake Istokpoga	1,785	1,785	110	68	500	Highlands
Teague	St. Lucie River Watershed	320	320		TBD	15	St. Lucie
Turnpike Dairy	St. Lucie River Watershed	96	96		TBD	15	St. Lucie
Williamson Ranch	East Lake Okeechobee	532	532	152	11	60	Martin
Winding Waters Natural Area	Outside the NEEPP	555	555		TBD	46	Palm Beach
Total in the Northern LOW	------	**6,011**	**6,011**		**216**	**1105**	------

Initiative Status: Construction of the Archbold Experiment Station WRP project is currently ongoing. The C.A. Thomas WRP project is awaiting permit authorization from the U.S. Army Corp of Engineers. The Conservation Fund WRP, the Myrtle Slough Ranch WRP, the Santa Rosa WRP, the Teague WRP, and the Turnpike Dairy WRP projects are in the planning and design phase. Easements have been acquired for the Goldstein Ranch WRP and Williamson Ranch WRP projects. The Lazy O Ranch WRP project is awaiting permit authorization. The Loxahatchee Slough WRP and the Winding Waters Natural Area WRP projects are currently under construction.

Cost: Cost share funds from USDA and NRCS

Drainage Area (acres) that will be treated: 10,109 acres

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.23 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 1,320 ac-ft
- **Most Likely:** 680 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (New)

Project: Fisheating Creek Wetland Reserve Special Project

Description: The USDA's Natural Resources Conservation Service (NRCS) will provide $89 million through the Wetland Reserve Program (WRP) to acquire easements on almost 26,000 acres of land, from five large continuous ranches plus several smaller properties, in the Fisheating Creek Sub-watershed. The Nature Conservancy and the South Florida Water Management District partnered with NRCS on this project. The two partners will assist NRCS with easement acquisitions and wetland restoration planning and monitoring. The five largest ranches, representing only four ownerships and encompassing fifteen miles of Fisheating Creek frontage and more than 80,000 acres of habitat, include Blue Head Ranch, Westby Ranch, Carrion Ranch, Waldron Ranch and Darroh Ranch. Together, these lands comprise a contiguous block of prairie, pine flatwoods, rangelands and restorable wetlands important to such iconic and endangered animals as the Florida panther, Florida black bear, Swallow-tailed kite, Sherman's fox squirrel, Florida burrowing owl, Eastern indigo snake, Florida grasshopper sparrow, Crested caracara, Florida sandhill crane, Everglades snail kite, Wood stork, Florida scrub-jay and Bald eagle, all of which have been documented within this five-ranch complex. Four endemic and globally imperiled natural communities – dry prairie, mesic flatwoods, scrub and cutthroat seepage wetlands – also occur on these lands, as do two federal candidate plant species.

The Nature Conservancy estimates that there is a significant acreage of restorable wetlands on these five ranches alone, with the majority of this acreage concentrated on the three northernmost properties -- Blue Head, Westby and Carrion ranches. Significantly, Fisheating Creek runs through a large ~5,000-acre marsh, Fisheating Marsh, entirely encompassed by these three ranches, that was ditched and drained in the 1950s and 1960s to provide better grazing. By restoring this marsh, a large amount of natural water storage can be achieved to benefit Lake Okeechobee and the greater Everglades restoration efforts. Given the extent of restorable wetlands on all five ranches, tens of thousands of acre-feet of water may potentially be stored naturally on this landscape. Because all of these ranches are being enrolled in permanent conservation and restoration funding is being provided, we have an unprecedented opportunity to restore a significant amount of wetland habitat and freshwater storage in the future.

Purpose: The goal of this project is to enhance and improve wetlands, wildlife habitat, and the water quality ultimately discharging to Lake Okeechobee and the Everglades.

Location/Size/Capacity (provide the shp files if available): This 26,000 acre project is in the Fisheating Creek Sub-watershed located within the Lake Okeechobee Watershed.

Initiative Status: The Fisheating Creek Wetland Reserve Special project is currently under development/evaluation pending final completion of the contract.

Cost: TBD

Drainage Area (acres) that will be treated: 26,000 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 3.5 mt/year
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** 0.5 ft of water storage over entire acreage

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 13,000 ac-ft
- **Maximum:** 13,000 ac-ft
- **Most Likely:** 13,000 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** 0.5 ft of water storage over entire acreage

Level of Certainty: Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined

Proof of Concept: N/A

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

51 and 55

2011 LOPP Update – Management Measure (Update)

Project: Lakeside Ranch Stormwater Treatment Area (Phase I & II)

Description: Lakeside Ranch STA is in the Taylor Creek/Nubbin Slough Sub-watershed, one of the nutrient "hot spots" in the Lake Okeechobee watershed. The project involves a 2,700-acre site on which 1,707 acres of treatment wetlands that will use emergent vegetation to remove phosphorus from stormwater runoff will be constructed. Phase I involves constructing 919 acres of treatment wetlands and Phase II involves constructing 788 acres of treatment wetlands.

The Project is designed in two phases: The northern STA and inflow pump station; and the southern STA, including a second pump station to manage rim canal levels in Lake Okeechobee during high water flow periods and recirculate the water in Lake Okeechobee back to the STA for additional phosphorus removal.

Purpose: STA will treat stormwater runoff in the Taylor Creek/Nubbin Slough basin to remove phosphorus before it enters Lake Okeechobee.

Location/Size/Capacity (provide the shp files if available): The Lakeside Ranch STA is a proposed 2,000- acre wetland STA in western Martin County between the Beeline Highway and Lake Okeechobee.

Initiative Status: The construction of the northern STA has achieved several milestones with an investment of $7.8 million in construction to date, including: (1) constructed 6.9 miles of canals and seepage ditches, (2) built 5 miles of levees, (3) planted 35 acres of sod on the levees, (4) cleared 700 acres of land, (5) constructed six control structures, and (6) hauled 700,000 cubic yards (35,000 dump trucks) of material.

Construction of the northern STA and the S-650 pump station is expected to be complete in January 2012 and February 2012, respectively. Pre-final design of the southern STA was completed in August 2010. The final design will be completed in March 2011. The pre-final design for the S-191A pump station (Phase 2) was completed in September 2010. Final design for this component will be submitted in April 2011.

Cost:

Phase I: The total cost is estimated $31 million including engineering design, construction, engineering during construction, construction management services.

The annual operation and maintenance cost is estimated $311,800.

Phase II: The total construction cost is estimated $49.8 million including construction, engineering during construction, construction management services.

Documentation:

Drainage Area (acres that will be treated): The stormwater runoff in the Taylor Creek/Nubbin Slough basin will be treated.

Location and Configuration (Layout including Spatial positioning and configuration): Taylor Creek Sub-watershed

GIS data:

Available ☒Yes ☐No

Stage-Storage Relationship (or Stage-Area Relationship):

Control Protocol (Inlet and Outlet Structures) for Phase I:

- **Pump Station S-650 (water level relationship)**
  - Start -Elevation: 17.0’ NAVD (Wet Season), 17.0’ NAVD (Dry Season)
  - Shut off -Elevation: 16.8’ NAVD (Wet Season), 16.9 NAVD’ (Dry Season)
- **Weir**
  - Dimensions: 60’-4” x 8’-6”
  - Crest Elevation: 25.00’ NAVD Inlet, 23.50’ NAVD Outlet
- **Gate – Inlet (water level relationship)**
  - Open -Elevation: 25.00 ‘ NAVD
  - Close -Elevation: 28.00 ‘ NAVD
- **Gate – Outlet (water level relationship)**
  - Open -Elevation: 23.50 ‘ NAVD
  - Close -Elevation: 26.50 ‘ NAVD

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:** 16 mt/yr
- **Maximum:** 22 mt/yr
- **Most Likely:** 19 mt/yr
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** BMPs in place for minimum estimate, not in place for maximum estimate. Most likely estimate assumes BMPs in place. Period of record: 1965-2005. Inflow concentration: 345 ppb without BMPs, 122 ppb with BMPs. Considering various discharge concentrations for different flow rates and hydraulic residence times, the project can provide an average annual load reduction of approximately 19 MT/yr.

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 2,700 ac-ft
- **Maximum:** 2,700 ac-ft
- **Most Likely:** 2,700 ac-ft
- **Level of Certainty- conceptual/final/unknown:** (see below)
- **Assumptions leading to benefit estimate:** Period of record: 1965-2005. STA storage volume based on 90 percent of footprint area of 2,000 acres X 1.5 standard operating depth.

Level of Certainty: (select one) Level 1

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested? 1

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts: 1

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Jian Cai, SFWMD;(561)242-5520 x4031

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2011 LOPP Update – Management Measure

Project Feature/Activity: Kissimmee River ASR Pilot Project

Description: One of the proposed CERP Lake Okeechobee Aquifer Storage and Recovery (ASR) Pilot Projects.

Purpose: The purpose of the Kissimmee River (KRASR) Pilot Project is to test the feasibility of using ASR technology as part of the CERP. ASR would be used to store excess water during times of excess, and provide water during times of need. The pilot project will be operated a minimum of two years.

Location/Size/Capacity: Along the C-38 Canal (Kissimmee River) about 2 miles upstream (north) of the confluence with Lake Okeechobee. The constructed one-well ASR system has a daily capacity of 5 mgd.

Initiative Status: Construction of the system was completed in 2008. Since 2009, the system has been undergoing cycle testing, which will continue through 2011.

Cost: Approximately $7 million for construction.

Documentation: Pilot Project Design Report (September 2004)

Estimate of Water Quality Benefits

- **Minimum:** < 1 mt/yr
- **Maximum:** < 1 mt/yr
- **Most Likely:** 0.1 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Estimate based on previous ASR project recovery efficiencies

Estimate of Water Quantity Benefits

- **Minimum:** 7,650 ac-ft
- **Maximum:** 7,650 ac-ft
- **Most Likely:** 7,650 ac-ft
- **Level of Certainty:** Final
- **Assumptions:** Assuming one well only

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Bob Verrastro, SFWMD, 561-681-2563

53

2011 LOPP Update – Management Measure

Project Feature/Activity: Taylor Creek (L-63N Canal) ASR Reactivation

General description/Background: The project involves the assessment and eventual re-activation of the Taylor Creek/Nubbin Slough Aquifer Storage and Recovery (ASR) system, which was originally constructed and operated by the SFWMD during the mid-1980s. Since that time, the system has been inactive. Project tasks will include mechanical evaluations of the existing system, permitting, design studies, construction of new appurtenances and eventual operation and maintenance of the system.

Purpose: The primary objective of this project is to reactivate the existing Taylor Creek/ Nubbin Slough ASR system using as many of the original facility components as possible. The new water treatment system should use a combination of filtration and ultraviolet disinfection to meet primary drinking water standards, prior to recharge into the existing Floridian Aquifer well.

Location/size/capacity: One 6 mgd well system adjacent to the L-63N Canal in Okeechobee, Florida.

Initiative status: Design has been completed and an Underground Injection Control construction permit and petition for an Aquifer Exemption are pending. Anticipate construction by 2012.

Cost: System construction should be approximately $2,500,000. Operational costs have yet to be determined.

Estimate of Water Quality Benefits

- **Minimum:** 0.62 mt/yr
- **Maximum:** 4.12 mt/yr
- **Most Likely:** 1.23 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Water quality benefits associated with the 30 percent of the pumped volume that is not returned back to the surface.

Estimate of Water Quantity Benefits

- **Minimum:** 2,700/1,890 ac-ft
- **Maximum:** 5,400/0 ac-ft
- **Most Likely:** 5,400/3,780 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** In each of the estimates above, the first number reflects quantity of water stored and the second number reflects quantity of water recovered

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 0

Contact: Bob Verrastro; SFWMD; 561-681-2563

54

2011 LOPP Update – Management Measure (Update)

Project: C-44 Reservoir (CERP – IRL South)

Description: The C44 Reservoir/ STA Project is located on approximately 12,000 acres of land owned by SFWMD. This project comprises three components (Reservoir, West STA, and East STA) identified in the Indian River Lagoon south (IRL-S) Project Implementation (PIR).

Purpose: The project objectives, as defined in the PIR, are to capture local runoff from the C44 Basin, treat some or all of it via sedimentation and natural transformation of nutrients, and return it to the C-44 Canal when there is a need. The components are designed for flow attenuation to the St. Lucie Estuary, water quality benefits from reduced loading of nutrients, pesticides, herbicides, and other pollutants contained in runoff presently discharged to the estuary, and water supply benefits

Location/Size/Capacity: The project is located in Martin County, directly north of the C-44 Canal (St. Lucie Canal), halfway between Lake Okeechobee and the Atlantic Ocean. The project components include a reservoir, a pump station, stormwater treatment areas, canals, embankments, structures, roads, and the temporary reconfiguration of TIWCD canals:

- Reservoir -Acreage 3,400 acres -Water Depth ~ 15 ft -Storage volume 50,600 to 55,000 ac-ft -Embankment length 48,600 linear ft
- Pump Station -Capacity 1,100 cfs
- TIWCD Irrigation Pump Station -85,000 gallons per minute (gpm)
- STA -Acreage 6,300 acres -Intake/Discharge Canals 20,000 linear ft -Perimeter Canals 92,500 linear ft -Conveyance/Control Structures 19 -Storage Volume: 8,505 ac-ft (based on 90 percent footprint area available for storage and 1.5 ft standard operating depth)

Initiative Status: Final plans and specs submitted June 29, 2007

Cost: Pre-final Design Opinion of Probable Construction Cost is $339.8 million

Documentation: For more information, please see Formal BODR and Final Design Report and calculations.

Estimate of Water Quality Benefits

- **Minimum:** 6.7 mt/yr
- **Maximum:** 6.7 mt/yr
- **Most Likely:** 6.7 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** This is the load reaching Lake Okeechobee. Period of Record for Modeling is 1968-2000. 4 mt/yr load reduction from STA and 2.7 mt/yr load reduction from land use conversion.

Estimate of Water Quantity Benefits

- **Minimum:** Reservoir (55,000 ac-ft); STA (8,505 ac-ft)
- **Maximum:** Reservoir (55,000 ac-ft); STA (8,505 ac-ft)
- **Most Likely:** Reservoir (55,000 ac-ft); STA (8,505 ac-ft)
- **Level of Certainty:** Conceptual
- **Assumptions:** STA storage volume based on 90 percent footprint area X 1.5 ft standard operating depth

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Sue Ray; SFWMD; 561-242-5520 *4019

56

2011 LOPP Update - Management Measure

Project Feature/Activity: Lemkin Creek Urban Stormwater Facility

Description: The Lemkin Creek Urban Stormwater Facility consists of two parcels. The first (west parcel) is approximately 40 acres and is being used as a hybrid wetland treatment pilot project (which is considered under project #10). The second (east parcel), the focus of this project, is approximately 93 acres and is being reviewed in cooperation with Okeechobee County and the City of Okeechobee for use as a shallow impoundment/wetland treatment area. The parcels are located in Okeechobee County southwest of the City of Okeechobee. The impoundment/wetland treatment area will increase storage and treat water to remove phosphorus before it enters Lake Okeechobee. This feature will be implemented as one of the LOFT components of the LOER.

Purpose: This impoundment/wetland treatment area will increase storage and treat water to remove phosphorus before it enters Lake Okeechobee.

Location/Size/Capacity: The Lemkin Creek Urban Stormwater Facility is a proposed 93 acre impoundment/wetland treatment area in Okeechobee County southwest of the City of Okeechobee. This impoundment/wetland treatment area will increase storage and treat water to remove phosphorus before it enters Lake Okeechobee.

Initiative Status: An alternatives analysis has been completed resulting in three potential alternatives. Discussions with Okeechobee County and the City of Okeechobee will be conducted to determine the final project and potential partnering opportunities.

Cost: $3.7 to 4.4 million

Estimate of Water Quality Benefits

- **Minimum:**
- **Maximum:**
- **Most Likely:** 1.1 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Detailed phosphorus removal estimates will be available after alternative selection and design is completed. Load reduction not accounted for in the future load reduction due to load adjustment and concentration limitation.

Estimate of Water Quantity Benefits

- **Minimum:** 300 ac-ft
- **Maximum:** 344 ac-ft
- **Most Likely:** 320 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** 93 acre site with 3.2 to 3.7 ft deep storage.

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Damon Meiers; SFWMD; 561-686-8800

57

2011 LOPP Update – Management Measure (Update)

Project: Fisheating Creek Marsh Watershed PL-566 Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 50,000 acre project is in the Fisheating Creek/Nicodemus Slough Sub-watershed located within the Lake Okeechobee Watershed. The aim of this project is to evaluate, engineer, and rehabilitate the PL-566 water control structures in the Fisheating Creek Marsh Watershed project area to more effectively store and manage water and reduce phosphorus runoff from more than 50,000 acres in the headwaters of Fisheating Creek.

Initiative Status: An agreement is being developed for the Fisheating Creek Marsh Watershed PL-566 project and a feasibility study has been completed for this project.

Cost: Estimated total costs for the Fisheating Creek Marsh Watershed PL-566 project are $1,175,000

Activity	Start (Year)	Finish (Year)	Cost
PED	2009	------	------
Construction	------	------	$1,175,000
S&A	------	------	------
O&M (Annual Cost)	------	------	------

Drainage Area (acres that will be treated): 50,000 acres

Location and Configuration (Layout including Spatial positioning and configuration): Highlands County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 4.6 mt/yr
- **Level of Certainty:** unknown
- **Assumptions leading to benefit estimate:** not determined

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 11,000 ac-ft
- **Maximum:** 22,000 ac-ft
- **Most Likely:** 16,500 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** amount of water available to previously drained wetlands on an annual basis

Level of Certainty: Level 3- implementation certainty unknown; <u>conceptual level of design/activity development complete</u>; location defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

58

2011 LOPP Update – Management Measure (Update)

Project: Dispersed Water Management - Okeechobee County East/West Stormwater Conveyance Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 1,000 acre project is in the Taylor Creek/Nubbin Slough Sub-watershed located within the Lake Okeechobee Watershed. This project aims to plan, acquire, and implement a stormwater conveyance system with retention and treatment components from east to west through the City of Okeechobee and Okeechobee County. Following water quality treatment and storage, the water will be conveyed into the District's Lemkin Creek urban water storage and treatment facility before making its way into the Rim Canal and ultimately Lake Okeechobee.

Initiative Status: The Okeechobee County East/West Stormwater Conveyance project is currently under discussion and is in the preliminary design phase.

Cost: Total Estimated District cost is $1,620,000

Activity	Start (Year)	Finish (Year)	Cost
PED		------	------
Construction	------	------	$1,620,000
S&A	------	------	------
O&M (Annual Cost)	------	------	------

Drainage Area (acres that will be treated): 1,000 acres

Location and Configuration (Layout including Spatial positioning and configuration): Okeechobee County

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 0.32 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 500 ac-ft
- **Most Likely:** 500 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

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2011 LOPP Update – Management Measure (Update)

Project: Dispersed Water Management - Dupuis Reserve Project

Description: Dispersed Water Management provides both localized water quantity and water quality benefits in the Northern Everglades Estuaries Watershed and contributes to overall improvements in Lake Okeechobee water quality and stage management. This program seeks to increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

The 2005 Lake Okeechobee Estuary and Recovery (LOER) action plan was developed to help restore the ecological health of Lake Okeechobee and adjoining estuaries, through a series of fast-track water quality improvement projects and several other far-reaching and innovative components. Among these additional components is an initiative to identify options for storage and/or disposal of excess surface water to aid in reducing lake levels and high discharge volumes to the estuaries. Preliminary assessments of available public lands for storage of excess surface water have been completed for both the northern and southern portions of the watershed, identifying potential water storage sites along with available acreage and storage volume estimates per site. A number of resulting water storage projects are either in the planning phases or have been implemented, with investigations beginning into additional water storage projects based on the potential water storage site lists produced under the storage assessments. All of these LOER and Lake Okeechobee Protection Plan (LOPP) efforts have been incorporated into the more recent Northern Everglades and Estuary Protection Planning initiatives. The Lake Okeechobee Phase II Technical Plan has identified that between 900,000 and 1.2 million acre-feet of water storage is necessary in the Northern basins.

Purpose: To increase public, private and tribal water storage from all agency and entity efforts to 450,000 acre-feet by 2015.

Location/Size/Capacity (provide the shp files if available): This 2,830 acre project is in the East Lake Okeechobee Sub-watershed located within the Lake Okeechobee Watershed. The aim of this project is to design, engineer, and implement an additional 1 ft of storage in the Dupuis Marsh before onsite stormwater enters the L-8 canal.

Initiative Status: An agreement has been executed for the Dupuis Reserve project, which is in the preliminary design phase.

Cost: Total costs for the Dupuis Reserve project range from $1,609,800 ($575/ac-ft of storage) to $2,006,400 ($358/ac-ft of storage) if the existing levee is raised by 1 ft or 2 ft, respectively.

Activity	Start (Year)	Finish (Year)	Cost
PED	2006	------	$340,551 - $386,312
Construction	------	------	$1,269,221 - $1,620,055
S&A	------	------	------
O&M (Annual Cost)	------	------	------

Drainage Area (acres that will be treated): 2,830 acres

Location and Configuration (Layout including Spatial positioning and configuration): Palm Beach

GIS data:

Available ☐Yes ☒No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 1.0 mt/yr
- **Level of Certainty:** N/A
- **Assumptions leading to benefit estimate:**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:** 0 ac-ft
- **Maximum:** 4,500 ac-ft
- **Most Likely:** 4,500 ac-ft
- **Level of Certainty:** conceptual
- **Assumptions leading to benefit estimate:** historical data

Level of Certainty: Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined

Proof of Concept: +1

Other Unintended Impacts: N/A

Contact Information: Benita Whalen, SFWMD, 561-682-2957

66

2011 LOPP Update – Management Measure (Update)

Project: Brady Ranch STA

Description: The Brady Ranch STA is a proposed 1,800 acre STA in western Martin County between the Beeline Highway and Lake Okeechobee immediately east of Lakeside Ranch.

Purpose: This STA will treat water to remove phosphorus before it enters Lake Okeechobee.

Location/Size/Capacity: The Brady Ranch STA is a proposed 1,800 acre STA in western Martin County between the Beeline Highway and Lake Okeechobee immediately east of Lakeside Ranch.

Initiative Status: Conceptual project, land acquisition in progress

Cost: $101 million

Estimate of Water Quality Benefits

- **Minimum:** 5 mt/yr
- **Maximum:** 9 mt/yr
- **Most Likely:** 5 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** BMPs in place for minimum estimate, not in place for maximum estimate; Most likely estimate assumes BMPs in place; Period of record: 1965-2005; Inflow concentration: 332 ppb without BMPs, 118 ppb with BMPs; Cultural resource mitigation is assumed to not impact treatment area; BMP estimate based on 2007 LOPP update. Load reduction adjusted down from 5 mt/yr to 2 mt/yr due to the concentration limitation.

Estimate of Water Quantity Benefits

- **Minimum:** 2,430 ac-ft
- **Maximum:** 2,430 ac-ft
- **Most Likely:** 2,430 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record: 1965-2005. STA storage volume based on 90 percent footprint area of 1,800 X 1.5 ft standard operating depth.

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

67

2011 LOPP Update – Management Measure (Update)

Project: Clewiston STA

Description: The State of Florida (TIITF) currently owns a parcel of land along the southwestern boundary of Lake Okeechobee in Clewiston (see attached site map Parcel HH200-004). This land in both Hendry and Glades Counties is approximately 766 acres in size and is bordered by Lake Okeechobee on the north side and Canals C-21 and C-20 on the south side. The land is currently in a natural state although it is reportedly impacted by invasive plant species. The potential exists for this land to be used as a natural treatment area for water that is currently discharged to Lake Okeechobee.

Purpose: The purpose of this potential Management Measure is to convert existing State owned land into a Stormwater Treatment Area to treat storm water from the S4 Basin and surrounding area that is currently sent to either Lake Okeechobee (via Culvert 2, S-310 lock Structure and/or S4 Pump Station) or the Caloosahatchee River (via S-235).

Location/Size/Capacity: The land area is approximately 766 acres of which approximately 700 – 750 acres could be used as "treatment area" with the remaining area used for levees and other infrastructure. The current estimated average load is 6.87 mt/yr from the S-4 Basin. It is assumed that a percentage of this water could be routed through the proposed STA.

Initiative Status: Conceptual

Cost: To Be Determined – Note: Other efforts (public and private) in the immediate area could potentially provide funding for all or portions of this proposal. The two main efforts include the S-169 Relocation Study – General Reevaluation Report by the U.S. Army Corps of Engineers and a development proposal by a private developer in Clewiston.

Documentation: Lake Okeechobee Protection Plan Evaluation Report – February 23, 2007

Estimate of Water Quality Benefits

- **Minimum: 0 mt/yr**
- **Maximum: 6.87 mt/yr**
- **Most Likely: 2.5 mt/yr**
- **Level of Certainty: Conceptual**
- **Assumptions: Flow rate = 40 cfs; Inflow P Concentration = 200 ppb; STA size = 750 acres; Outflow P Concentration = 130 ppb**

Estimate of Water Quantity Benefits

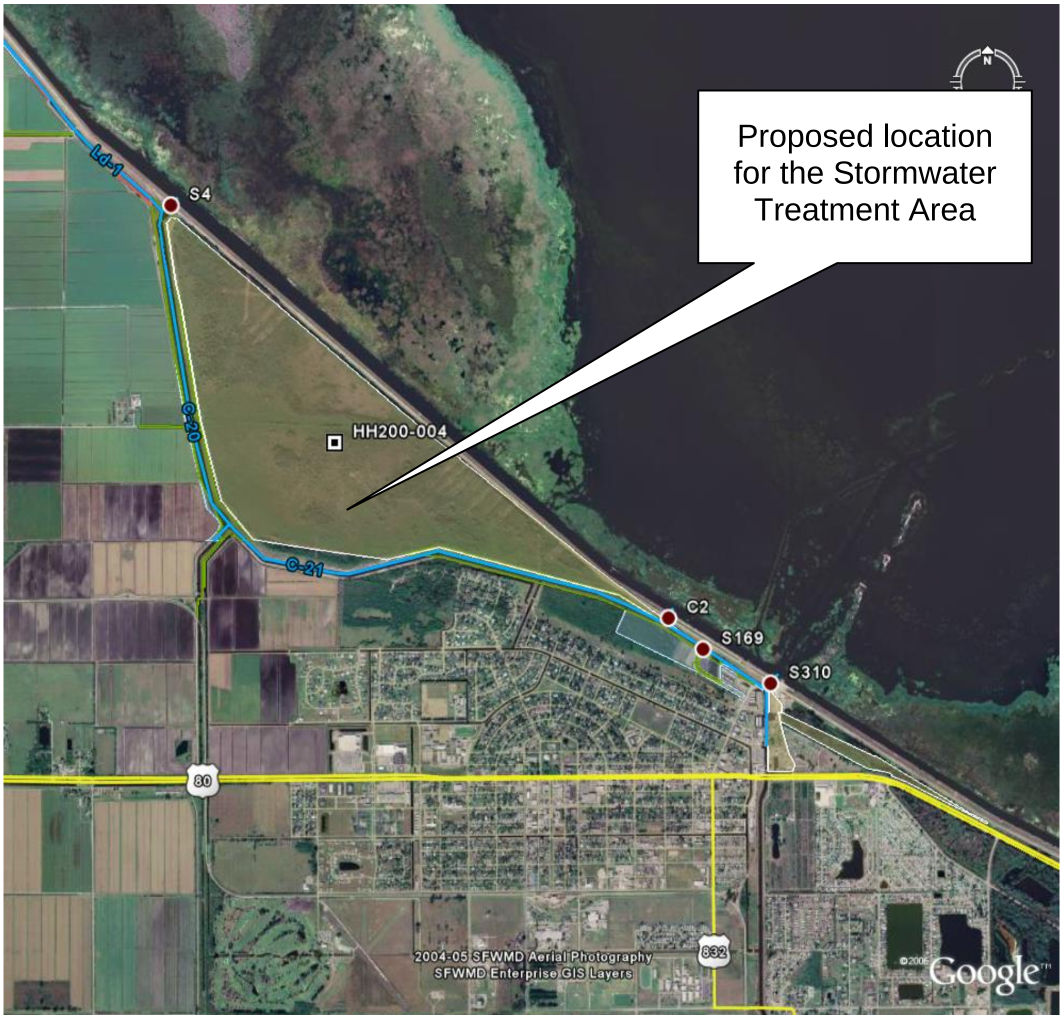
- **Minimum:** 1,013 ac-ft
- **Maximum:** 1,013 ac-ft
- **Most Likely:** 1,013 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** STA storage volume based on 90 percent of footprint acreage X 1.5 ft standard operating depth

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez, SFWMD, Ext. 3739

Clewsiton STA Location



68

2011 LOPP Update – Management Measure (Update)

Project: S-68 STA

Description: One of the major sources of TP loading in the Istokpoga/Indian Prairie Sub-watershed is flows from the intense agricultural operations located to the south of Lake Istokpoga. The proposed feature would target flows from the agricultural operations before they reached the regional drainage system.

Purpose: Provide additional water quality improvements in the Indian Prairie Sub-Watershed

Location/size/capacity: A 5,000 ac STA is proposed to be located in the Indian Prairie Sub-Watershed.

Initiative status: This is a proposed initiative that would be funded and executed as part of Phase II Implementation

Cost: TBD

Estimate of Water Quality Benefits

- **Minimum:** 5 mt/yr
- **Maximum:** 9 mt/yr
- **Most Likely:** 8 mt/yr

Level of Certainty: Conceptual

Estimate of Water Quantity Benefits

- **Minimum:** 6,750 ac-ft
- **Maximum:** 6,750 ac-ft
- **Most Likely:** 6,750 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** STA storage volume is based on 90 percent area X 1.5 ft depth

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: David Unsell; SFWMD; 561- 682-6888

69

2011 LOPP Update – Management Measure (Update)

Project: Taylor Creek Reservoir (CERP Lake Okeechobee Watershed Project)

Description: The Taylor Creek Reservoir is a proposed reservoir on District owned land (Grassy Island Ranch) in Okeechobee County.

Purpose: The reservoir will be designed to capture water from Taylor Creek and release it back into the creek during drier periods. This water will then be available for treatment in the existing Taylor Creek STA and the proposed Lakeside Ranch STA.

Location/Size/Capacity: The Taylor Creek Reservoir is a proposed 24,000 acre-foot reservoir located just north of the City of Okeechobee.

Initiative Status: Basis of Design Report completed. This project is currently on hold pending resolution of the water quality cost share issue discussed in Section 4.5 of the LOPP Update.

Cost: $240 million

Estimate of Water Quality Benefits

- **Minimum:** 2 mt/yr
- **Maximum:** 7 mt/yr
- **Most Likely:** 2 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** BMPs in place for minimum estimate, not in place for maximum estimate; Most likely estimate assumes BMPs in place; Period of record: 1965-2005; Inflow concentration: 728 ppb without BMPs, 255 ppb with BMPs; BMP estimate based on 2007 LOPP update

Estimate of Water Quantity Benefits

- **Minimum:** 24,000 ac-ft
- **Maximum:** 40,000 ac-ft
- **Most Likely:** 24,000 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record: 1965-2005

Screening Criteria

- **Proof of Concept:** 0
- **Other Impacts:** 1

Contact: Matt Alexander; SFWMD; Ext.3701

70

2011 LOPP Update – Management Measure (Update)

Project: Paradise Run Wetland Restoration

Description: Water from the watershed and the lake will be detained in large storage areas during wet periods for later use during dry periods. The increased storage capacity will reduce the duration and frequency of both high and low water levels in the lake that stressful to its littoral zone ecosystems and will reduce discharges from the lake that are damaging to the downstream estuarine ecosystems. Water from upstream tributaries will be diverted to storm water treatment areas to reduce nutrient loading into the lake. In addition, the project will also address restoration of the hydrology of isolated wetlands by plugging connections to drainage ditches and diverting canal flows to adjacent wetlands and water resources problems in the Lake Istokpoga Drainage Basin through changes in the currently implemented Lake Istokpoga Regulation Schedule. Real estate acquisition is near completion. Awaiting WRDA legislation authorization.

Purpose: The primary objective of the Lake Okeechobee Watershed (LOW) project is to increase aquatic and wildlife habitat in Lake Okeechobee by providing the capability to better manage water levels in Lake Okeechobee and to reduce nutrient loading into Lake Okeechobee. Lake Okeechobee is one of the primary sources of water for natural system areas of South Florida.

Location/Size/Capacity: This 3,730 acre wetland restoration site is located at the ecologically significant confluence (under pre-development conditions) of Paradise Run, oxbows of the Kissimmee River, and Lake Okeechobee. Under restored conditions it would have a rain-driven hydrology unless future efforts to further enhance watershed conditions could link the site to the surface flows from the C-38 (Kissimmee River) or C-41A (Istokpoga) Canals.

Initiative Status: Alternative Formulation. This project is currently on hold pending resolution of the water quality cost share issue discussed in Section 4.5 of the LOPP Update.

Cost: $62 million (RE & Construction)

Documentation: Alternatives Formulation Briefing meeting read-ahead, Lake Okeechobee Watershed Project

Estimate of Water Quality Benefits

- **Minimum:** < 1 mt/yr
- **Maximum:** 2 mt/yr
- **Most Likely:** < 1 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** N/A

Estimate of Water Quantity Benefits

- **Minimum:** Incidental
- **Maximum:** Incidental
- **Most Likely:** Incidental
- **Level of Certainty:** Conceptual
- **Assumptions:** N/A

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

71

2011 LOPP Update – Management Measure (Update)

Project: Kissimmee Reservoir

Description: Water from the watershed and the lake will be detained in large storage areas during wet periods for later use during dry periods. The increased storage capacity will reduce the duration and frequency of both high and low water levels in the lake that stressful to its littoral zone ecosystems and will reduce discharges from the lake that are damaging to the downstream estuarine ecosystems. Water from upstream tributaries will be diverted to storm water treatment areas to reduce nutrient loading into the lake. In addition, the project will also address restoration of the hydrology of isolated wetlands by plugging connections to drainage ditches and diverting canal flows to adjacent wetlands and water resources problems in the Lake Istokpoga Drainage Basin through changes in the currently implemented Lake Istokpoga Regulation Schedule. Awaiting WRDA legislation authorization.

Purpose: The primary objective of the Lake Okeechobee Watershed (LOW) project is to increase aquatic and wildlife habitat in Lake Okeechobee by providing the capability to better manage water levels in Lake Okeechobee and to reduce nutrient loading into Lake Okeechobee. Lake Okeechobee is one of the primary sources of water for natural system areas of South Florida.

Location/Size/Capacity: This 10,281 acre above ground reservoir will provide a maximum storage capacity of 161,263 ac-ft at 16 ft average depth. The feature will be located in the C-41A sub basin within the Kissimmee River drainage basin. It will receive flow from and discharge back to the C-38 canal (Kissimmee River).

Initiative Status: Alternative Formulation. This project is currently on hold pending resolution of the water quality cost share issue discussed in Section 4.5 of the LOPP Update.

Cost: $500 million (RE & Construction)

Documentation: Alternatives Formulation Briefing meeting read-ahead, Lake Okeechobee Watershed Project

Estimate of Water Quality Benefits

- **Minimum:** 4.5 mt/yr
- **Maximum:** 13.5 mt/yr
- **Most Likely:** 9 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Modeling period of record is 1965-2000; modeling assumed full implementation of LOPP recommended BMPs; as described in the 2004 LOPP.

Estimate of Water Quantity Benefits

- **Minimum:** 161,000 ac-ft
- **Maximum:** 161,000 ac-ft
- **Most Likely:** 161,000 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record is 1965-2000

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

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2011 LOPP Update – Management Measure (Update)

Project: Istokpoga Reservoir

Description: This project feature would consist of a reservoir located at Site I-17 as shown in the figure.

Purpose: The reservoir will provide a maximum storage capacity of 79,560 ac-ft at an average depth of 16 ft. It will receive inflow from and discharge back to the C-41A canal. A 500 cfs inflow pump will be needed to operate this reservoir. The reservoir would also provide approximately 7 mt/yr of P-load reduction.

Location/Size/Capacity: This 5,416 acre storage facility will be located in the C-40A and C-41A sub-basins of the Istokpoga Sub-watershed, approximately 1200 ft south of the C-41A canal. The reservoir will provide a maximum storage capacity of 79,560 ac-ft at an average depth of 16 ft.

Initiative Status: This feature is a component of the LOW Project and therefore would be funded once the LOW Project Implementation Report is approved by Congress.

Cost: LOW Project planning level cost estimates for this feature include approximately $50M for real estate and $250 M for construction.

Documentation: Alternatives Formulation Briefing meeting read-ahead, Lake Okeechobee Watershed Project. This project is currently on hold pending resolution of the water quality cost share issue discussed in Section 4.5 of the Update

Estimate of Water Quality Benefits

- **Minimum:** 3.5 mt/yr
- **Maximum:** 10.5 mt/yr
- **Most Likely:** 7 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record is 1965-2000

Estimate of Water Quantity Benefits

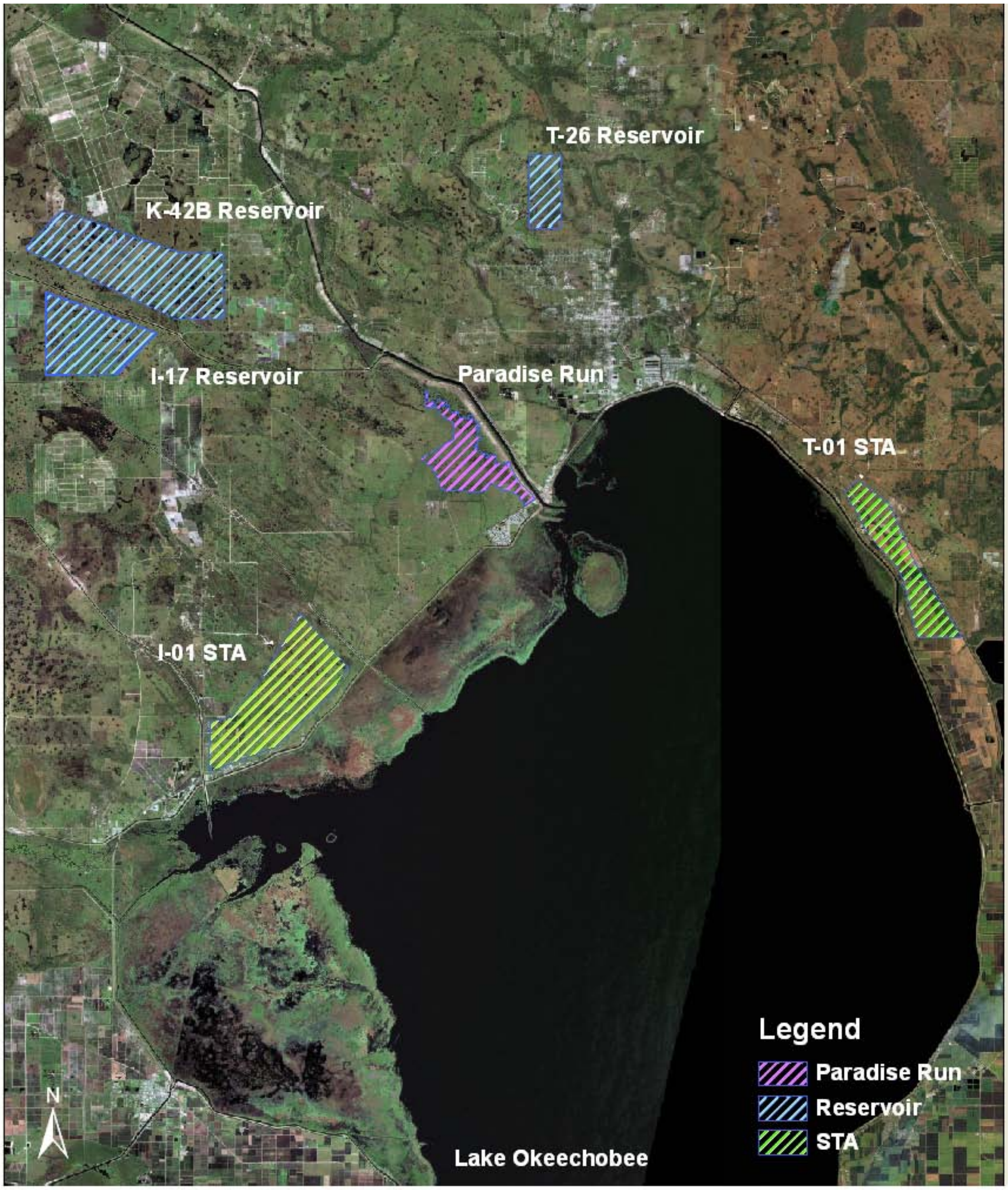
- **Minimum:** 79,560 ac-ft
- **Maximum:** 79,560 ac-ft
- **Most Likely:** 79,560 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record is 1965-2000

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

Location of Proposed Istokpoga Reservoir



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2011 LOPP Update – Management Measure (Update)

Project: Istokpoga STA

Description: This project feature would consist of a STA located at Site I-01 as shown in the figure.

Purpose: This 8,044 acre treatment facility will be located in the L-49 sub-basin of the Istokpoga Sub-watershed, approximately 2,100 ft east of C-41 canal. The STA will receive flow from the C-41 canal and discharge treated water to Lake Okeechobee. It is expected to provide approximately 29.1 mt of annual average P-load reduction.

Initiative Status: This feature is a component of the LOW Project and therefore would be funded once the LOW Project Implementation Report is approved by Congress. This project is currently on hold pending resolution of the water quality cost share issue discussed in Section 4.5 of the LOPP Update.

Cost: LOW Project planning level cost estimate for this feature include approximately $65 M for real estate and $150 M for construction.

Documentation: Alternatives Formulation Briefing meeting read-ahead, Lake Okeechobee Watershed Project

Estimate of Water Quality Benefits

- **Minimum:** 14.5 mt/yr
- **Maximum:** 43.5 mt/yr
- **Most Likely:** 29 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record is 1965-2000

Estimate of Water Quantity Benefits

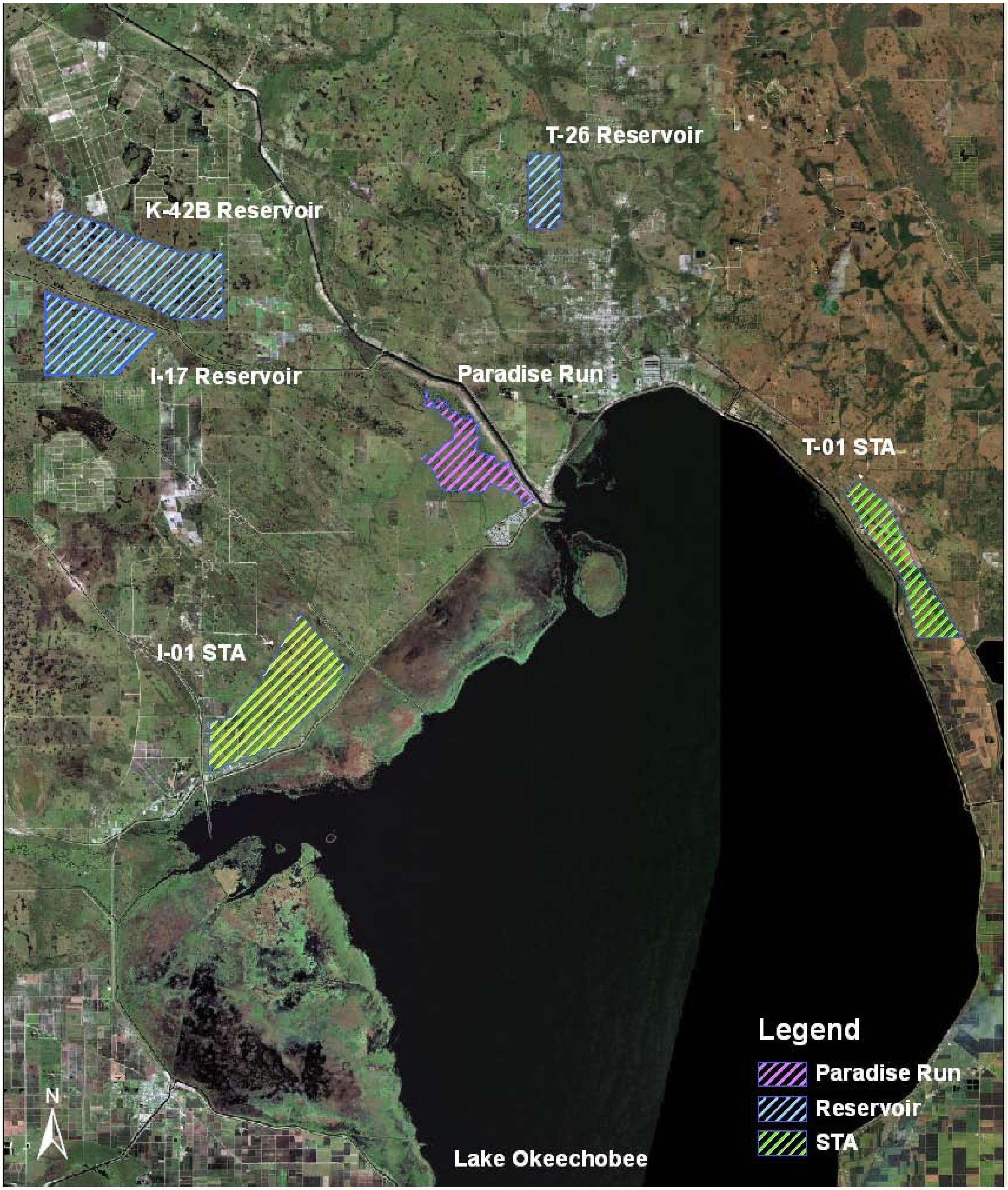
- **Minimum:** 10,860 ac-ft
- **Maximum:** 10,860 ac-ft
- **Most Likely:** 10,860 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Period of record is 1965-2000. STA storage volume based on 90 percent of footprint acreage x 1.5 ft standard operating depth.

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

Location of Proposed Istokpoga STA



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2011 LOPP Update – Management Measure (Update)

Project: Kissimmee Reservoir East

Description: The primary intent of the NEEPP legislation is to protect and restore surface water resources and achieve and maintain compliance with water quality standards in the Lake Okeechobee Watershed, the Caloosahatchee River Watershed, and the St. Lucie River Watershed, and downstream receiving water through the phased comprehensive, and innovative protection program which includes long-term solutions based upon the total maximum daily loads. The proposed project feature would help meet the intent of the legislation by providing additional storage in the Lake Okeechobee Watershed (LOW).

Purpose: Enhance existing storage capacity in the LOW.

Location/size/capacity: This proposed feature would provide up to 200,000 ac-ft of storage capacity and would be located to the east of Kissimmee River in the Lower Kissimmee Sub-watershed. It consists of a 16 ft deep, 12,500 acre reservoir that would primarily receive flows from and discharge back to the Kissimmee River. Water stored in this reservoir can potentially also be diverted to the Taylor Creek/Nubbin Slough Sub-watershed for additional treatment.

Initiative status: This is a proposed initiative that would be funded and executed as part of Phase II Implementation.

Cost: TBD

Estimate of Water Quality Benefits

- **Minimum:** 6.48 mt/yr
- **Maximum:** 14.1 mt/yr
- **Most Likely:** 9.43 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** POR 1965-2000

Estimate of Water Quantity Benefits

- **Minimum:** 201,600 ac-ft
- **Maximum:** 201,600 ac-ft
- **Most Likely:** 201,600 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Reservoir storage volume based on 90 percent area X 16 ft depth

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

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2011 LOPP Update – Management Measure (Update)

Project: Istokpoga/Kissimmee RASTA

Description: The primary intent of the NEEPP legislation is to protect and restore surface water resources and achieve and maintain compliance with water quality standards in the Lake Okeechobee Watershed, the Caloosahatchee River Watershed, and the St. Lucie River Watershed, and downstream receiving water through the phased comprehensive, and innovative protection program which includes long-term solutions based upon the total maximum daily loads. The proposed project feature would help meet the intent of the legislation by providing additional storage in the Lake Okeechobee Watershed (LOW).

Purpose: Enhance existing storage and capacity and provide additional water quality improvement in the Lake Okeechobee Watershed.

Location/size/capacity: This proposed feature would collect runoff from the Lake Istokpoga and Indian Prairie Basin Sub-watersheds and the Kissimmee River Sub-watershed. It includes an 8,000 ac STA coupled with a 19,000 ac reservoir and it would be located in the Indian Prairie Basin Sub-watershed. Because of its proximity to Lake Okeechobee and its large size, this feature could also be used to store and treat Lake Okeechobee waters, as appropriate.

Initiative status: This is a proposed initiative that would be funded and executed as part of Phase II Implementation

Cost: TBD

Estimate of Water Quality Benefits

- **Minimum:** 9 mt/yr
- **Maximum:** 9 mt/yr
- **Most Likely:** 9 mt/yr

Level of Certainty: Conceptual

Estimate of Water Quantity Benefits

- **Minimum:** 273,600 ac-ft
- **Maximum:** 273,600 ac-ft
- **Most Likely:** 273,600 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Reservoir storage volume based on 90 percent area X 16 ft depth; STA storage volume is based on 90 percent area X 1.5 ft depth

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Armando Ramirez; SFWMD; Ext. 3739

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2011 LOPP Update – Management Measure (New or Update) NEW

Project: Northern Everglades Chemical Treatment Pilot Project Parcel Level (68 parcel scale sites)

Description: As part of Phase II of the Northern Everglades Chemical Treatment Pilot Project, an implementation costs and site selection analysis was conducted. The results of this analysis provided information on 68 sites for possible implementation of chemical treatment for water quality improvements.

Purpose: This management measure provides phosphorus load reduction and cost estimates for 68 site. Additional information for the Northern STAs (Lakeside Ranch, Nubbin Slough, and Taylor Creek) was not included in the plan update because other MMs have been identified to meet the TMDL for the Taylor Creek/Nubbin Slough Subwatershed.

Location/Size/Capacity (provide the shp files if available): Maps, shape files and WAM information can be obtained from SWET, Inc. and the District

Initiative Status: Ongoing, cost estimates to be completed during September 2010.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction			Under development
S&A			
O&M (Annual Cost)			Under development

Documentation: WAM modeling information can be obtained from SWET, Inc.

Drainage Area (acres that will be treated): LOW

Location and Configuration (Layout including Spatial positioning and configuration): LOW

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits (TP Load Reductions in lbs or metric tons):

- **Minimum:**
- **Maximum:**
- **Most Likely:** 44.9 metric tons
- **Level of Certainty- conceptual/final/unknown (see below):** Level 4
- **Assumptions leading to benefit estimate- (e.g. period of record; inflow concentration/load; did you assume BMPs were implemented or not) (e.g. for activities- location/sub-watershed where activity will apply; what does % reduction apply to-which land uses, only new development, etc.):**

Estimate of Water Quantity Benefits (Increased Storage in ac-ft):

- **Minimum:**
- **Maximum:**
- **Most Likely:** Not applicable
- **Level of Certainty- conceptual/final/unknown (see below):** Level 4
- **Assumptions leading to benefit estimate- (e.g., period of record; flow/volume; operational assumptions):**

Level of Certainty: (select one)

Level 1- already constructed/implemented or construction/implementation imminent
Level 2- construction/implementation likely; detailed design/activity development ongoing; location well defined
Level 3- implementation certainty unknown; conceptual level of design/activity development complete; location defined
Level 4- implementation certainty unknown; conceptual idea; may have rough order of magnitude cost and/or general basin location
Level 5- implementation certainty unknown; conceptual idea with limited information

Proof of Concept: (Based on how well the technology has performed in the past/has it been field tested?) +1

e.g.	+1	-for STA or chemical treatment
	-1	-pilot study –not performing
	0	-new technology with potential but has not been tested locally
	N/A	-not applicable

Other Unintended Impacts: +1

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Jim Laing, SFWMD, X3732

77

Northern Everglades – Potential Management Measure

Project Feature/Activity: NE Chemical Treatment Regional – Reservoirs

Level: 4

General Description/Background: Reservoirs proposed under the CERP Lake Okeechobee Watershed and the Lake Okeechobee Phase 2 Technical Plan are expected to reduce certain amount of P-loads in the stored water. This reduction can be primarily attributed to sedimentation; a secondary factor is biological uptake within the system. The proposed project will add a chemical treatment unit at the front end of the reservoir to increase the phosphorus load reduction capacity. Chemical treatment with alum, for example, has been previously shown to be quite effective in reducing phosphorus loads.

Purpose: To enhance reservoir P-load reduction capacity

Location/Size/Capacity: The size and capacity of the proposed chemical treatment unit for the reservoirs will have to be determined through further engineering evaluations.

Initiative Status: These projects will be implemented as part of the CERP and Lake Okeechobee Phase II Technical Plan implementation. This management measure includes chemical treatment in the Kissimmee and Istokpoga reservoirs.

Cost: TBD

Estimate of Water Quality Benefits

- **Minimum:** To be determined
- **Maximum:** To be determined
- **Most Likely:** 14.3 mt/yr
- **Level of Certainty:** 4
- **Assumptions:** N/A

Estimate of Water Quantity Benefits

- **Minimum:** N/A
- **Maximum:** N/A
- **Most Likely:** N/A
- **Level of Certainty:**
- **Assumptions:** N/A

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 0

Contact: Joyce Zhang; SFWMD; 561-682-6341

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2011 LOPP Update - Management Measure

Project: Rolling Meadows (Catfish Creek) Wetland Restoration

General Description/Background: This restoration project located in Polk County adjacent to Lake Hatchineha in the Upper Chain of Lakes involves restoration of nearly 2,000 acres of former lake floodplain wetlands along Lake Hatchineha, and restoration of Catfish Creek which has been channelized through the property.

Purpose: Restore sod farm back to historic lake littoral wetlands connected to Lake Hatchineha.

Location/Size/Capacity: Utilize 720 acres of District-owned lands for interim onsite stormwater storage before eventually entering Lake Kissimmee. Bermed area already exists – project proposes installing a culvert to restore natural flows and gravity feed into bermed area. Small agricultural pumps could also be used to fill detention area with more agricultural land runoff.

Initiative Status: FY10 Phased Planning; FY11 Phase I design. FY12 Phase I Construction

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED (incl. Phase 1 contamination remediation: $250K)	FY09	FY11	$1.3 million
Construction	FY12	FY12	$4.4 million
S&A			
O&M / land mgmt in perpetuity			$ 1.5 million

GIS data:

Available ☒Yes ☐No

Estimate of Water Quality Benefits

- **Minimum:** Unknown
- **Maximum:** Unknown
- **Most Likely:** Unknown
- **Level of Certainty:** Unknown
- **Assumptions:** Not determined

Estimate of Water Quantity Benefits

- **Minimum:** 1,456 ac-ft
- **Maximum:** 2,912 ac-ft
- **Most Likely:** 1,456 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** Preliminary engineering design complete

Screening Criteria:

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Maura Merkal, SFWMD, Ext. 3719

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2011 LOPP Update – Management Measure (Update)

Project: Port Mayaca ASR Pilot Project

Description: One of the proposed CERP Lake Okeechobee Aquifer Storage and Recovery (ASR) Pilot Projects.

Purpose: The purpose of the Port Mayaca ASR Pilot Project is to test the feasibility of using multi-well ASR technology as part of the CERP. ASR would be used to store excess water during times of excess, and provide water during times of need. The pilot project will be operated a minimum of two years.

Location/Size/Capacity: Along the C-44 Canal, about 1 mile downstream upstream (east) of the confluence with Lake Okeechobee. This ASR well "cluster" would be comprise of 3 ASR wells, each having a daily capacity of 5 mgd, equating to a total system capacity of 15 mgd.

Initiative Status: A preliminary design for the 3-well pilot ASR system was developed as part of the combined Pilot Project Design Report (PPDR) in 2004. An exploratory well was constructed during 2004, which confirmed that conditions within the Floridan Aquifer are favorable for the implementation of ASR at the site. Currently, the project is on "hold", pending funding for the development of a final design, permitting, construction and testing.

Cost: Approximately $21 million for construction.

Documentation: Pilot Project Design Report (September 2004)

Estimate of Water Quality Benefits

- **Minimum:** < 1 mt/yr
- **Maximum:** 9 mt/yr
- **Most Likely:** 8 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Estimate based on previous ASR project recovery efficiencies

Estimate of Water Quantity Benefits

- **Minimum:** 7,650 ac-ft
- **Maximum:** 7,650 ac-ft
- **Most Likely:** 7,650 ac-ft
- **Level of Certainty:** Final
- **Assumptions:** Assuming three (3) operational ASR wells, with a total installed capacity of 15 mgd.

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 1

Contact: Bob Verrastro, SFWMD, 561-681-2563

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2011 LOPP Update – Management Measure (Update)

Project: 10-Well ASR System (Paradise Run)

Description: The project involves the planning, siting, design, construction and operating a new 10-well Aquifer Storage and Recovery (ASR) system as a means of managing water levels and water quality in Lake Okeechobee while minimizing harmful discharges to the estuaries. The study will look at the technical, environmental and regulatory issues associated with undertaking such a project.

Purpose: The project purpose is to develop a 50 million gallons per day (mgd) ASR system along Lake Okeechobee designed to store treated surface water (filtration and disinfection) during periods of elevated water levels in Lake Okeechobee for recovery during drier weather conditions. It is desired that this system be operational within the next 5 years.

Location/size/capacity: The siting evaluation has determined that the area of Paradise Run in Highlands County, south of the S-65E structure would be a good spot for the system.

Initiative status: Preliminary design evaluations (geotech, surveying and hydraulic modeling) were completed in 2009. An exploratory well was constructed in 2008, which confirmed that favorable conditions exist within the Floridan Aquifer for ASR implementation at the site. Currently, the project is on “hold”, waiting on funding for final design, permitting and construction activities.

Cost: Yet to be determined, based on extent of associated floodplain re-hydration and environmental enhancements. Expect an engineer’s estimate when the conceptual design is complete. (Planning Level Cost approximately $12,000,000)

Estimate of Water Quality Benefits

- **Minimum:** < 1 mt/yr
- **Maximum:** 1.4 mt/yr
- **Most Likely:** < 1 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** nutrient load reduction associated with the 30 percent of the water that does not return back to the surface.

Estimate of Water Quantity Benefits

- **Minimum:** 11,475 ac-ft
- **Maximum:** 22,950 ac-ft
- **Most Likely:** 17,213 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** 5 mgd per well X 10 wells = 50 mgd (or 150 ac/ft/day). Maximum volume will be associated with daily pumping for the entire 5 month (Jun – Oct) wet period = 153 days X 150 ac-ft/day = 22,950 ac-ft. Most likely value is estimated at 75 percent of the maximum and min volume estimated at 50 percent of the max.

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 0

Contact: Bob Verrastro; SFWMD; 561-681-2563

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2011 LOPP Update – Management Measure (Update)

Project: Seminole – Brighton Reservation ASR Pilot Project

Description: Assist the Seminole Tribe to design, permit, construct and test a pilot ASR system at the Brighton Reservation.

Purpose: The purpose of the project is to expand water resources in the Indian Prairie Basin and answer technical questions regarding aquifer storage and recovery (ASR) technology in the vicinity north of Lake Okeechobee, Florida. The initial contract is to have the Seminole Tribe of Florida (Tribe) perform services related to construction of an exploratory well at the Brighton Reservation, in conjunction with the South Florida Water Management District (SFWMD). If the results of the exploratory well indicate that favorable hydrogeologic conditions exist, then the Tribe may proceed with further development of an ASR facility at the location under another future contract with the District.

Location/size/capacity: One 5 mgd ASR well system along the C-41 Canal on the western edge of the Reservation in Glades County.

Initiative status: The exploratory well was constructed in 2009. Engineering and geotechnical studies were conducted in 2010. Currently, the project is on "hold", awaiting funding so that the surface facilities and treatment system can be designed and constructed.

Cost: Total system construction should be approximately $5,000,000. Operational costs have yet to be determined.

Estimate of Water Quality Benefits

- **Minimum:** 3 mt/yr
- **Maximum:** 1.73 mt/yr
- **Most Likely:** 0.86 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Water quality benefits associated with the 30 percent of the pumped volume that is not returned back to the surface.

Estimate of Water Quantity Benefits

- **Minimum:** 1,350/945 ac-ft
- **Maximum:** 5,400/3,780 ac-ft
- **Most Likely:** 2,700/1,890 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** In each of the estimates above, the first number reflects quantity of water stored and the second number reflects quantity of water recovered

Screening Criteria

- **Proof of Concept:** 1
- **Other Impacts:** 0

Contact: Bob Verrastro; SFWMD; 561-681-2563

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Northern Everglades – Potential Management Measure

Project Feature/Activity: S-154 Basin Deep Injection Well

Level: 4

General Description/Background: Construction of a deep injection well system upstream of the intersection of the S-154 connection to the C-38 Canal.

Purpose: Water and Phosphorus load disposal.

Location/Size/Capacity: Specific location and size as of yet undetermined. A 4-well cluster with a 1,000 acre foot storage pond to optimize the removal of flow and well operation.

Initiative Status: To be determined

Cost: $60,000,000

Estimate of Water Quality Benefits

- **Minimum:** 11 mt/yr
- **Maximum:** 11 mt/yr
- **Most Likely:** 9.5 mt/yr
- **Level of Certainty:** Conceptual
- **Assumptions:** Used results from the Disposal Well Simulation Model (DWSM). A simple model developed in STELLA™. (See appendix). Monthly flow values for S-154 from 1972 to 2007. P concentration 451 ppb. Flow to storage pond limited only by spare capacity to pond. No evaporation or rainfall. Four wells at 10 mgd (123 ac-ft) as minimum. Four wells at 17 mgd (209 ac-ft/day) as maximum. Most likely value is the average of these two results.

Estimate of Water Quantity Benefits

- **Minimum:** 15,000 ac-ft
- **Maximum:** 25,000 ac-ft
- **Most Likely:** 19,000 ac-ft
- **Level of Certainty:** Conceptual
- **Assumptions:** See above.

Screening Criteria

- **Proof of Concept:**
- **Other Impacts:**

Contact: Bob Verrastro; SFWMD; 561-682-6139 and Tom James; SFWMD; 561-682-6356

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2011 LOPP Update - Management Measure

Project: In-Lake Strategies

Description: Several conceptual in-lake strategies to address internal phosphorus loading in Lake Okeechobee have been identified. These strategies include sediment dredging, creation of in-lake islands or littoral zones, and chemical treatment.

- **Sediment dredging.** Removal of surface sediments by dredging can reduce potential phosphorus flux into the water column. However, there are water quality concerns if water from dredging operations is to be returned to the lake. Treating the water is very expensive, and significant costs savings are possible if treatment can be avoided. For example, deep-wells could be used for disposal of the water removed during dredging of sediments. If ideal rock strata can be found, even the dredged sediments could be disposed of in a deep well. This approach would eliminate almost all processing and land costs. Such a rock stratum is believed to exist on the north side of the lake.
- **Creation of in-lake islands or littoral zones near outlets.** Very large sumps could be excavated in the pelagic zone of the lake. The excavated sand and rock could be used to build islands or could be removed from the lake. Sediments, propelled by the natural currents of the lake, would settle into the sump and would be confined below any likely disturbance created by wind events, in essence creating a sediment trap. This could greatly reduce the surface area of the sediments contributing to phosphorus flux. A modified version of this option includes construction of a sediment impoundment (sand and rock) in the lake that would receive the dredged muck material. This area would have a top elevation similar to the existing littoral zone. Once the area is filled with the dredged muck material, it could be capped with sand and muck to create littoral habitat.
- **Chemical treatment.** In-lake excess phosphorus can be controlled by the addition of alum, and will suppress the turbidity potential of the sediments but the alum application must be repeated periodically. Alum treatment was one of the alternatives that was retained for full-scale evaluation under the feasibility study conducted by the District in 2003 (BBL Sediment Management Study 2003), hence could be reconsidered as an in-lake sediment management strategy.

Purpose: To reduce TP loading from the sediment bed in Lake Okeechobee

Location/Size/Capacity:

Initiative Status: The ability to investigate these ideas is limited at this time due to funding constraints. Staff will pursue these approaches within current data and skill limitations. As funding becomes available, feasibility studies should proceed rapidly. However, the coordinating agencies included an in-lake phosphorus management study as a near-term project. This study will review the recommendations from the 2003 feasibility study. New concepts and technologies would be evaluated and then compared against those from the previous report. Permitting requirements and potential limitations associated with these options will also be evaluated. Finally, new recommendations would be made for implementation.

Cost: TBD

Estimate of Water Quality Benefits

- **Minimum:** TBD
- **Maximum:** TBD
- **Most Likely:** TBD
- **Level of Certainty:** Conceptual
- **Assumptions:** TBD

Estimate of Water Quantity Benefits

- **Minimum:** TBD
- **Maximum:** TBD
- **Most Likely:** TBD
- **Level of Certainty:** Conceptual
- **Assumptions:** TBD

Screening Criteria

- **Proof of Concept:** 0
- **Other Impacts:** 0

Contact: David Unsell; SFWMD; 561-682-6888

APPENDIX C. CALCULATION OF ESTIMATED PHOSPHORUS LOAD REDUCTIONS

This appendix explains the methods used to calculate the estimated phosphorus load reductions shown in Tables 6-1 through 6-3 of Section 6 of the Lake Okeechobee Protection Plan Update. **Table C-1** is a summation of estimated phosphorus load reductions to Lake Okeechobee under the Lake Okeechobee Protection Plan (LOPP) at the sub-watershed level. Nine sub-watersheds are defined in the Lake Okeechobee Watershed (**Figure C-1**). The land uses within each basin were divided into 13 categories: barren land, citrus, dairies, improved pasture, other areas, row crops, sod farms, sugarcane, unimproved pasture/rangeland, upland forests, urban (commercial, residential, recreational), water, and wetlands (**Table C-2**).

Table C-1: Summary of Estimated P Load Reductions to Lake Okeechobee under the Lake Okeechobee Protection Plan

Sub-watershed	Watershed Baseline Data				Current Activities								Near-Term P Reduction Activities (2011 to 2013) (5)		P Reduction Strategies (6)			
					Owner and Cost-share Implemented BMPs (1)		Watershed P Control Projects (2)		Regional Public Works Projects (3)		Other Regional and Sub-Regional Projects (4)							
	Area (acres)	Average Annual Discharge (Measured) (2001-2009) (Acre-ft)	Average Annual P Load (Measured)(2001-2009) (Mtons)	Average Annual P Conc. (Calculated) (2001-2009) (ppb)	Load Red. (Mtons)	Remain. Load (Mtons)	Load Red. (Mtons)	Remain. Load (Mtons)	Load Red. (Mtons)	Remain. Load (Mtons)	Load Red. (Mtons)	Remain. Load (Mtons)	Load Red. (Mtons)	Remain. Load (Mtons)	Load Red. (Mtons)	Remain. Load (Mtons)	Remain. Conc. (ppb)	Adjusted Remain. Load* (Mtons)
Upper Kissimmee (S-65)	1,021,674	853,368	97	92	0	97	0	97	13	84	0	84	0	83	30	53	50	53
Lower Kissimmee (S-65A,B,C,D,E)	429,283	359,254	57	129	18	39	7	33	8	25	0	25	6	19	6	13	30	13
Taylor Creek/Nubbin Slough (S-191,154,133,135)	198,299	146,900	105	578	18	87	19	68	5	63	2	60	20	40	35	5	30	5
Lake Istokpoga (S-68)	392,147	290,826	40	110	0	39	0	39	0	39	2	38	0	37	27	11	30	11
Indian Prairie Basins (12 basins)	294,147	219,581	101	373	10	91	0	91	0	91	8	82	9	74	66	8	30	8
Fisheating Creek & Nicodemus Slough	315,007	295,324	86	236	6	80	0	80	0	80	0	80	15	65	18	47	128	47
West Lake Okeechobee Basin (S-77)	200,993	29,270	5	138	0	5	0	5	0	5	1	4	0	4	2	2	53	2
EAA Basins	361,707	107,419	20	152	0	20	0	20	9	11	0	11	0	10	3	8	60	8
East Lake Okeechobee Basins (C-44, L-8)	237,831	131,522	29	180	0	29	0	29	0	29	1	28	7	22	2	19	120	19
Total Reductions to the Lake	**3,451,087**	**2,433,464**	**539**	**180**	**52**	**487**	**26**	**461**	**35**	**426**	**15**	**411**	**57**	**355**	**188**	**167**	**56**	**167**
TMDL (not including 35 t of atmospheric deposition)																		**105**
Remaining Load																		**62**

(1) Reduction resulting from owner implemented and cost-share BMPs simulated by Watershed Assessment Model (applied to all basins except EAA basins).

(2) Reduction due to ongoing watershed P source control projects.

(3) Reduction resulting from implementation of LO Critical Projects (5.0 t), Kissimmee River Restoration (KRR) (20.6 t), and the ECP/Diversions (9.4 t).

(4) Reduction resulting from other regional and sub-regional projects: FRESP (5.9 t), HWTT (1.1 t), and Dispersed Water Management Projects (7.6 t).

(5) Reduction resulting from the planned regional and sub-regional projects: Dispersed Water Management Projects (16.5 t), FDACS owner-implemented and cost-share BMPs (16.8 t), HWTT at Grassy site (2.9 t), Lakeside Ranch STA Phase I (9 t), Aquifer Storage Recovery (Kissimmee Pilot ASR and Taylor Creek ASR Reactivation) (1.3 t), Fisheating Creek Wetland Reserve Special Project (3.5 t), and C-44 project (6.7 t).

(6) Reduction resulting from owner-implemented and cost-share BMPs (18.0 t), the Dispersed WMP - potential sites (6.1 t), Brady Ranch (2 t), Aquifer Storage and Recovery (11.2 t), Chemical treatment to LOWP reservoirs (14.3 t), S-68 STA (8 t), Istokpoga/Kissimmee RASTA (8.9 t), Kissimmee reservoir east (6.5 t), additional P reductions resulting from chemical treatment at the parcel level (46.4 t), Lakeside Ranch STA Phase II (10.0 t), Clewiston STA (2.5 t), and CERP LOWP (54 t).

* To be conservative, where reductions were projected to result in concentrations less than 30 ppb, the remaining load was estimated by multiplying the basin flow by 30 ppb instead of a lower projected concentration.

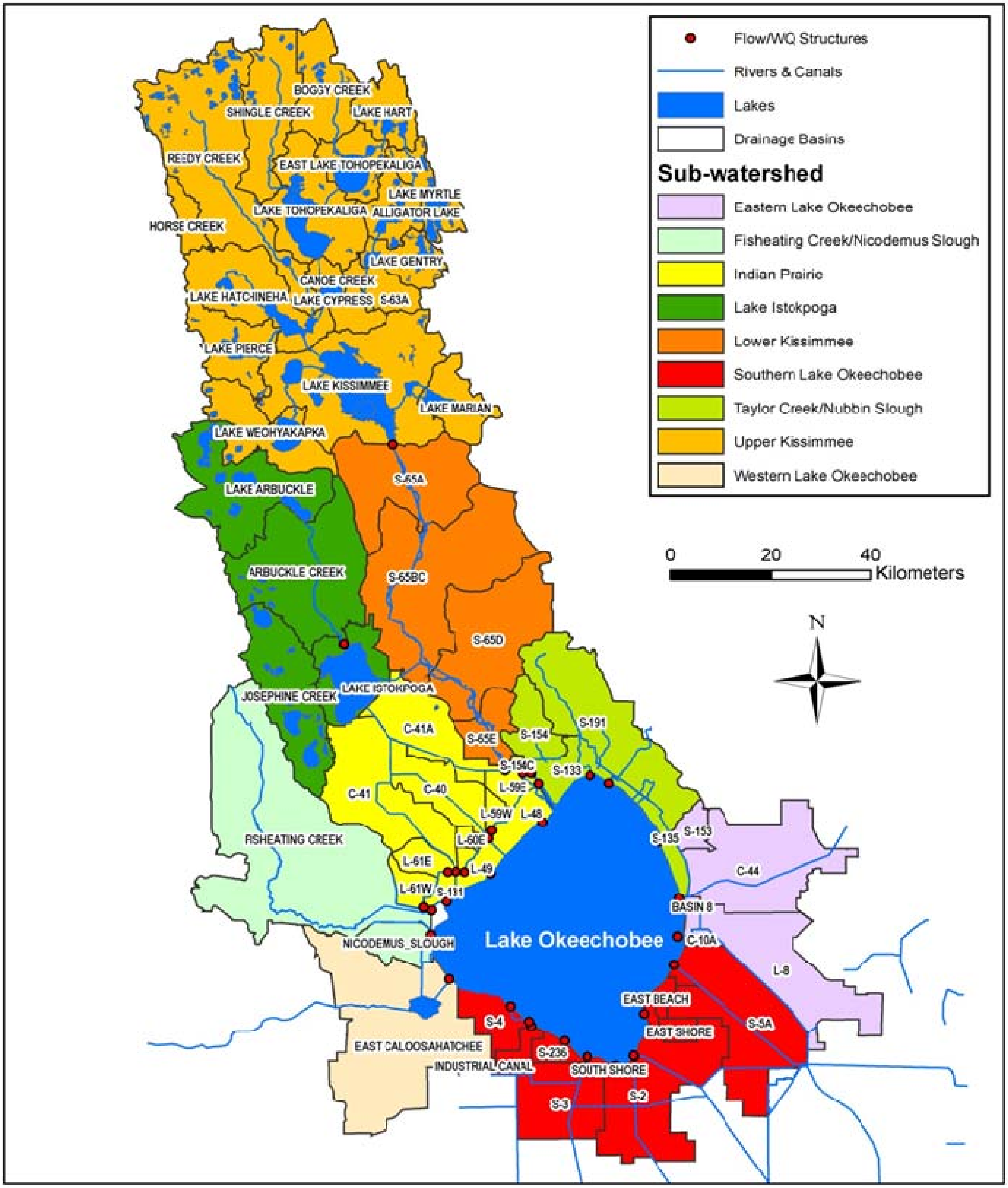

Figure C-1. Lake Okeechobee sub-watershed and drainage basins.

Table C-2. Land use data for the Lake Okeechobee Protection Plan area.

Land Use	Area (acres) 2006	Percent
Barren Land	41,318	1.2%
Citrus	245,790	7.1%
Dairies	23,361	0.7%
Improved Pastures	676,991	19.7%
Other Areas	30,935	0.9%
Row Crops	23,238	0.7%
Sod	38,425	1.1%
Sugarcane	399,213	11.6%
Unimproved Pastures/ Rangeland	325,064	9.4%
Upland Forests	392,200	11.4%
Urban	410,397	11.9%
Water Bodies	220,127	6.4%
Wetlands	615,081	17.9%
LOPP Total Acreage	3,442,141	100.0%

The calculations described in the following sections were performed for each sub-watershed.

Watershed Baseline Data (2001–2009)

- **Sub-watershed**: A sub-watershed contains one or more drainages basins in the Lake Okeechobee Watershed. For example, the Lake Istokpoga summary basin contains four drainage basins (see **Figure C-1**).
- **Sub-watershed Area (acres)**: Area in acres for which the LOPP will implement management strategies for phosphorus reduction. The total acreage for each sub-watershed was obtained from GIS land use coverage data updated in 2006.
- **Average Annual Discharge (2001–2009) (acre-feet)**: Measured flow discharge from each sub-watershed from calendar year 2001 through 2009.
- **Average Annual Phosphorus Load (2001–2009) (metric tons)**: Total average phosphorus load for each sub-watershed in metric tons (mt) calculated using measured flow and water quality data for the nine-year period of record from 2001 through 2009.
- **Average Annual Phosphorus Concentration (2001-2009) (parts per billion)**: Total average phosphorus concentration in parts per billion (ppb) for each basin calculated using measured flow and phosphorus load for the nine-year period of record from 2001 through 2009.

Current Activities

Owner-implemented and Cost-share Best Management Practices (BMPs) (1)

The phosphorus load reductions associated with the implementation of BMPs (both owner-implemented and cost-share) were simulated using the Watershed Assessment Model (WAM). Results from the WAM simulation showed that an overall phosphorus reduction of 84.3 mt could be achieved through the owner-implemented and cost-share BMP programs. Based on the estimated implementation rate, the total load reduction of 86.7 mt under BMPs was redistributed into three categories: current activities, near-term activities (2011 to 2013), and long-term activities (beyond 2014). The total phosphorus (TP) load reductions from the implementation of BMPs in the Lake Kissimmee and Lake Istokpoga sub-watersheds were not included because they have little or no short-term effect on what is leaving the sub-watersheds to Lake Okeechobee due to the lakes' internal buffering capacities.

- **Load Red. (mt)**: Based on the estimated implementation rate, the total load reduction of 86.6 mt under BMPs was redistributed in three categories: current activities (51.8 mt), near-term activities (16.8 mt), and long-term activities (18.0 mt). The phosphorus reduction of 27.8 mt was included in this column and the other two reductions were included in items 5 and 6 respectively.
- **Remain. Load (mt):** The remaining load is the difference between **Average Annual P Load (2001-2009) and Load Red.** For the Lake Istokpoga and Lake Kissimmee sub-watersheds, the **Remain. Load** is **the Average Load** because the lakes act as buffers and assimilate phosphorus.

Watershed Phosphorus Control Projects (2)

The category includes ongoing watershed programs and projects, including the Phosphorus Source Control Grant Program, Dairy Best Available Technologies, Isolated Wetlands Restoration, and the Public-Private Partnership program. **Table 6-1** provides a list of all the current projects.

- **Load Red. (mt)**: The load reduction was calculated as follows: **Remain. Load (mt)** from **Owner and Cost-Share BMPs (2)** less the phosphorus reduction for each sub-watershed.
- **Remain. Load (mt)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.** The total remaining basin load is provided at the top of each sub-watershed.

Regional Public Works Projects (3)

This category includes phosphorus reductions expected from the completed or existing regional projects such as Lake Okeechobee Critical projects, ECP 298 Diversion Projects, and the Kissimmee River Restoration (KRR) (Section 6, **Table 6-1**).

- **Load Red. (mt)**: The load reduction was calculated as follows: **Remain. Load** from **Watershed P Control Projects (2)** times the phosphorus reduction for each basin according to information in the above tables**.**

- **Remain. Load (mt)**: The remaining load is the difference between the **Remain. Load** from the previous category **(Watershed P Control Projects [2])** and the calculated **Load Red.** for this category.

Other Regional and Sub-Regional Projects (4)

This category includes phosphorus reductions expected from the completed Florida Ranchland Environmental Services Projects (FRESP), Dispersed Water Management projects, and Hybrid Wetland Treatment technology projects (**Table 6-1**).

- **Load Red. (mt)**: The load reduction was calculated as follows: **Remain. Load** from **Regional Public Works Projects (3)** times the phosphorus reduction for each basin according to information in the above tables**.**
- **Remain. Load (mt)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.** for this category.

Near-term P Reduction Activities (5)

This column represents reductions from planned regional and sub-regional projects. This category includes the Florida Department of Agriculture and Consumer Services (FDACS) BMP projects, the planned Dispersed Water Management projects, Lakeside Ranch Stormwater Treatment Area (STA) Phase I, Hybrid Wetland Treatment Technology at the Grassy Island Site, Aquifer Storage and Recovery (ASR (Kissimmee Pilot ASR and Taylor Creek ASR Reactivation), Fisheating Creek Wetland Reserve Special Project, and the C-44 project. The estimated TP load reduction under each project is listed in **Table 6-3**.

- **Load Red. (mt)**: The load reduction was calculated as follows: **Remain. Load (mt)** from column **(4)** minus the phosphorus reduction for the project in **Table 6-2**.
- **Adjusted Remain. Load (mt)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.**, where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the sub-watershed flow by 30 ppb.

Long-term P Reduction Strategies (6)

A phosphorus concentration associated with the remaining load for activities under the long-term reduction strategies (2014 and beyond) was calculated for each sub-watershed using individual basin flows. If the concentration was less than 30 ppb, the load was adjusted to the equivalent 30 ppb load to produce the adjusted remaining load. Once a sub-watershed reached the equivalent 30 ppb phosphorus load, no additional reductions were considered feasible.

This category includes reductions resulting from owner-implemented and cost-share BMPs, the dispersed water management projects to be implemented at the several potential sites, Brady Ranch STA, Lakeside Ranch STA Phase II, Aquifer Storage and Recovery, chemical treatment to CERP LOWP reservoirs, S-68 STA, Istokpoga/Kissimmee RASTA, Kissimmee Reservoir East, additional phosphorus reductions resulting from chemical treatment at the parcel level, Clewiston STA, and CERP LOWP (Section 6, **Table 6-4**).

- **Load Red. (mt)**: The load reduction was calculated as follows: **Remain. Load (mt)** from column **(5)** minus the phosphorus reduction for the project in **Table 6-3**.
- **Adjusted Remain. Load (mt)**: The remaining load is the difference between the **Remain. Load** from the previous category and the calculated **Load Red.**, where load reductions were projected to exceed the load contribution, the remaining load was estimated by multiplying the sub-watershed flow by 30 ppb.

APPENDIX D. PUBLIC COMMENTS AND RESPONSES FROM THE COORDINATING AGENCIES

This section includes comments submitted during the public review of the LOPP Update followed by the responses of the coordinating agencies (**Table D-1**).

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December 8, 2010

Lesley Bertolotti
South Florida Water Management SFWMD
MS 7431
3301 Gun Club Road
West Palm Beach, FL
Via Email: lbertolo@sfwmd.gov

RE: Lake Okeechobee Protection Plan 2011 Update Recommendations

Dear Ms. Bertolotti:

This letter constitutes Audubon's comments on the Lake Okeechobee Protection Plan draft update (draft LOPP), released November 9th, 2010.[1] While the draft LOPP reflects an impressive amount of agency effort and knowledge, it does not describe a blueprint for the recovery of Lake Okeechobee, its watershed, and the Northern Everglades. The draft LOPP neither articulates the necessary directives, nor supplements such directives with explicit budget proposals and timelines to meet the legislatively mandated phosphorus total maximum daily load (TMDL) by 2015. Therefore, Audubon of Florida offers suggestions regarding source control, water quality treatment, and dispersed water management (DWM) for the draft LOPP update for your consideration.

The accumulation of legacy phosphorus and phosphorus stored within in-lake sediments continues to increase at rates worthy of grave concern. The draft LOPP reports that the net phosphorus imports for improved pastures increased by 15 percent from previous data collected in 2004.[2] Despite reported phosphorus loading decreases attributable to two land use types, which the draft LOPP acknowledges are possibly temporary due to economic conditions, Tables 4-1 and 4-2 demonstrate an alarming rate of total phosphorus import to the sub-watershed, at 6088 metric tons (mt).[3] Urban land uses, while only 12 percent of the watershed, account for 29 percent of the total net phosphorus import.

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[1] See "Draft Lake Okeechobee Protection Plan Update." November 2010 (draft LOPP)
[2] Draft LOPP at 55.
[3] Draft LOPP at 54.

The 2011 update of the Lake Okeechobee Protection Plan should be a course correction that lists policy and spending recommendations to guide the South Florida Water Management District (SFWMD), Florida Department of Agriculture and Consumer Services (FDACS), and Florida Department of Environmental Protection (FDEP), and make recommendations to the Legislature and agencies to craft necessary changes in laws, rules and budgets necessary to implement the plan's goals. The 2007 Lake Okeechobee Protection Plan states, "If actual [Best Management Practices (BMP)] performance does not meet initial expectations, the Lake Okeechobee Protection Act (LOPA) requires that BMPs be appropriately modified to improve their effectiveness. Should there be a significant deviation from the assumptions and performance expectations of this Plan, the plan will be modified accordingly."[4] In light of alarmingly high phosphorus levels, the draft LOPP must, but has not, been modified accordingly. AF-1

The comments in this letter were collaboratively developed by Dr. Paul Gray, Science Coordinator of Audubon's Lake Okeechobee Watershed Program, Jane Graham, Esq., Everglades Policy Associate, and Charles Lee, Audubon's Director of Advocacy. Specific recommendations for text insertions are keyed to the line numbering system in the draft LOPP.

1. Source Control

Meeting Lake Okeechobee's phosphorus TMDL by 2015 is mandated by the LOPA and is an essential priority for Everglades restoration. Source control offers the least expensive solution to improve water quality in the Northern Everglades. Audubon makes the following suggestions for the draft LOPP update.

Nutrient Source Control from Agricultural Sources

- *Adequate funding for BMP Implementation is essential but missing in the draft LOPP. The current draft LOPP states at line 3628:* AF-2a

  > *"Recent funding shortfalls have slowed the pace of implementing the more capital-intensive components of the BMP program, such as rehydration of wetlands, installation of water control structures, and construction of edge-of-farm retention/detention facilities. As funding is made available, these projects will be prioritized and installed, as envisioned."*

  Audubon believes that it is not good public policy to simply write a statement that progress is failing due to lack of funding. Audubon recommends that the draft LOPP be revised as follows:

  Insert at Line 3628: A budget will be established that illustrates the necessary funding to fully carry out the BMP program to implement all of the elements of the program necessary to achieve Lake Okeechobee water quality improvement. AF-2b

[4] Lake Okeechobee Protection Program, Lake Okeechobee Protection Plan Evaluation Report, February 23, 2007 at 32, *available at* https://my.sfwmd.gov/portal/page/portal/pg_grp_sfwmd_koe/portlet_northerneverglades/tab2302089/lopp_report2007.pdf.

- *The premise of BMPs should be changed to base phosphorus application rates on water quality goals for receiving waters. SFWMD should propose specific collaborative work with the FDACS to revise BMPs to reduce phosphorus loading in the basin to meet the TMDL number when implemented. We suggest the following specific changes in the draft LOPP:* AF-3a

  <u>Insert at Line 3614</u>: "The SFWMD, FDACS, and FDEP will work together to revise BMPs to reduce phosphorus loading in the basin to meet the applicable TMDL number when implemented. Phosphorus application rates will be based on water quality goals for receiving waters. AF-3b

  <u>Insert at Line 3837:</u> "However, due to increasingly stringent water quality and quantity pressures, the driving force behind BMPs must be rethought, and retooled in order to meet the 2015 TMDL goal. Coordinating agencies should base phosphorus application rates on water quality goals for receiving waters, and revise the BMPs to reduce phosphorus loading in the basin to meet the TMDL number." AF-3c

- *Restrict the addition of phosphorus in feedstock and fertilizer by working with FDACS to develop nutrient balance methodologies. The pounds in = pounds out formula would allow for the application of phosphorus in fertilizer or feedstock only where the same amount of phosphorus is removed from the basin.* AF-4

  <u>Insert at Line 3628:</u> "New revisions to BMPs will restrict the addition of phosphorus in feedstock and fertilizer by developing nutrient balance methodologies. The pounds in = pounds out formula would allow for the application of phosphorus in fertilizer or feedstock only where the same amount of phosphorus is removed from the basin."

- *Report the level of BMP implementation in several categories to better reveal progress and results.* AF-5a

  <u>Insert at Line 3620</u>: "However, a systematic method of accurately reporting the actual meaningful accomplishments in BMP implementation is needed. The coordinating agencies will develop an amended memorandum of understanding on source control containing a new BMP implementation reporting program that requires reporting the progress of BMP implementation in several categories. The suggested reporting levels are 1) fully implemented and functioning cost-shared BMPs, 2) fully implemented land owner BMPs without functioning cost share for further work and 3) signed letters of intent with incomplete implementation." AF-5b

  <u>Insert at Line 3877</u>: "There will be a new program instituted for reporting of BMP implementation to provide for greater accountability and transparency throughout the BMP program." AF-5c

<u>Insert at Line 3878</u>: **"BMP Implementation Reporting Program:** The coordinating agencies will develop an amended memorandum of understanding on source control containing a new BMP implementation reporting program that requires reporting the progress of BMP implementation in several categories. The suggested levels are 1) fully implemented and functioning cost-shared BMPs, 2) fully implemented land owner BMPs without functioning cost share for further work and 3) signed letters of intent with incomplete implementation. This breakdown will make clear the functional level of BMP implementation that is actually taking place, and the potential for actual phosphorus reduction." AF-5d

- *Develop Edge of Farm treatment requirements for landowners implementing BMPs that still fail to achieve appropriate reductions.* AF-6a

<u>Insert at Line 3634:</u> "In the short term, edge-of-farm treatment requirements will be developed for farms operating under BMPs that fail to achieve appropriate phosphorus reductions." AF-6b

<u>Insert at Line 3835:</u> "**Water re-use:** Develop models and formulas for requirements for reuse that increase agricultural flexibility while reducing runoff volumes and loads." AF-6c

<u>Insert at Line 3837:</u> "Require manure spreading from animal operations to follow the same nutrient balance and tissue testing requirements as for human wastes." AF-6d

<u>Insert at Line 3837</u>: "Nutrient balance methodologies will be developed to restrict the addition of phosphorus in feedstock and fertilizer. A pounds in = pounds out formula will be developed to allow for the application of phosphorus in fertilizer or feedstock only where the same amount of phosphorus is removed from the basin. Manure spreading from animal operations will be required to follow the same nutrient balance and tissue testing requirements as for human wastes." AF-6e

- *Pursue implementation of the Dairy Best Available Technologies Program (DBAT) at all dairies.* AF-7a

<u>Insert at Line 3689:</u> "Dairy phosphorus outflows remain disproportionately high to be compatible with Lake Okeechobee's phosphorus TMDL. The DBAT Pilot Program was successful and should be pursued on all dairies. The three functional processes to reduce phosphorus loading from dairies were (a) water recycling, (b) water retention on site, and (c) effluent treatment with chemicals. The excellent results, some in the range of 100% reduction of phosphorus loading from individual sites, warrant implementation at all dairies and funding for such is needed. The potential average annual phosphorus load reduction from these AF-7b projects that have been constructed is estimated at 26 mt but could be increased if all dairies had DBATs installed." With proper funding, this could be completed by 2015." AF-7b cont.

<u>Insert at Line 4484:</u> Category of Cost. At this point insert a proposed budget for the Dairy BAT program. AF-7c

- *Develop and specify Edge of Farm treatment methods that are appropriate for the commonly occurring agricultural operations in the Northern Everglades not meeting tributary water quality goals.* AF-8a

<u>Insert at Line 3634</u>: "These Edge of Farm treatment methods, threshold criteria, and monitoring methods, will be developed and specified for the commonly occurring agricultural operations in the Northern Everglades that are not meeting tributary water quality goals. The budget and timeline for Edge of Farm Treatment is as follows: (Insert Budget and Timeline)." AF-8b

- *Utilize the basin nutrient load model. This model was developed by the SFWMD to determine the amount of phosphorus additions allowable in each sub-basin. This will be based on attaining the TMDL that conforms to Lake Okeechobee Operating Permit allowances. Translate the number into an appropriate loading/concentration target number for all tributaries.* AF-9a

<u>Insert at Line 3614</u>: After our insertion ending with "receiving waters," (see pg 3 of this document), "Furthermore, the basin nutrient load model developed by the SFWMD to determine the amount of phosphorus additions allowable in each basin will be based on attaining the TMDL loading number and accounting for planned regional water quality projects. The number will then be translated into an appropriate loading/concentration target number for all tributaries." AF-9b

<u>Insert at Line 4287</u>: "The amount of phosphorus reduction is dependent upon how many projects are implemented and at what rate. Thus, the faster these projects are implemented, the higher the reduction of phosphorus within the Lake Okeechobee basin." AF-9c

- *Allocate funds in the FY 2011-12 budget to support the development, rulemaking, and implementation of the above suggestions.* AF-10

<u>Insert at Line 3599</u>: "Funding needs in the FY 2011-12 budget will be specified to support the development, rulemaking, and implementation of the suggestions."

Biosolid Controls

- *Work with the FDEP to amend the Biosolids Rule 62-640 FAC to revise BMP criteria for AA biosolids to require fertilization rates to assure TMDL compliance. Establish a balance between basin nutrient inputs and exports.* AF-11

- *Require wastewater plant operators shipping AA material to sites within the Okeechobee, Caloosahatchee and St. Lucie Basins to document the proper agronomic soil and plant tissue tests for phosphorus and nitrogen indicating a need for the application of that fertilizer.* AF-12

- *Draft an interagency agreement between the SFWMD and the DEP, and work with the DEP to amend 62-640, FAC to train and deploy SFWMD field personnel to help enforce the Class B land spreading prohibition in the Okeechobee, Caloosahatchee and St. Lucie River Basins. Coordinate on tracking the remaining Class B permits.* AF-13

- *Document and annually report the amount of Class B biosolids imported to the basin under old permits and the amount of Class AA biosolids imported to the basin.* AF-14

- *Improve the tracking mechanism for the limited uses of Class AA allowable in the basin. Report AA use for SFWMD boundaries, and Okeechobee watershed boundaries, rather than county totals.* AF-15

- *Revise the Phase II Technical Plan of the Lake Okeechobee Watershed Construction Project (LOWCP) to phase out the use of AA material entirely within the Okeechobee, St. Lucie and Caloosahatchee basins.* AF-16a

<u>Insert at Line 3650</u>: "The amendments regarding monitoring, reporting, and recordkeeping of biosolids will be helpful in tracking compliance. 62-640.650. The coordinating agencies are further discussing these amendments, especially in regards to AA solids. The coordinating agencies will now engage in the interpretation of the new biosolids rule, and craft additional guidance. The goal for the biosolids amendments is to establish a balance between basin nutrient inputs and exports. The new biosolids amendments and guidance will create a framework that mandates the following actions: AF-16b

1. BMP criteria for AA biosolids will require fertilization rates to assure TMDL compliance. AF-16c
2. Wastewater plant operators shipping AA material to sites within the Okeechobee, Caloosahatchee and St. Lucie Basins will be required to document the proper agronomic soil and plant tissue tests for phosphorus and nitrogen indicating a need for the application of that fertilizer.
3. Additional staff from the coordinating agencies, including SFWMD field personnel, will be trained and deployed to help enforce the Class B land spreading prohibition in the Okeechobee, Caloosahatchee and St. Lucie River Basins. There will be further coordination on the tracking the remaining Class B permits.
4. Class B biosolids imported to the basin under old permits and the amount of Class AA biosolids imported to the basin will be documented and annually reported.

5. The tracking mechanism for the limited uses of Class AA allowable in the basin will be improved to account for all materials applied. Coordinating agencies will provide further guidance for the amendments appearing in the Biosolids Rule at 62-640.650.
6. Reports will reflect AA use for SFWMD boundaries, and Okeechobee watershed boundaries, rather than county totals.
7. The Phase II Technical Plan of the Lake Okeechobee Watershed Construction Project (LOWCP) will phase out the use of AA material entirely within the Okeechobee, St. Lucie and Caloosahatchee basins." AF-16c cont.

Controlling Other Urban Nutrient Sources

- *Amend the Environmental Resource Permit (ERP) Rule 40E-4, FAC to require the monitoring of phosphorus and nitrogen above certain threshold sizes as an ERP permit condition in the Okeechobee basin. It should also mandate low impact development techniques and use Florida Friendly native landscaping to avoid the need for supplemental irrigation.* AF-17

- *Undertake independent rulemaking to establish specific TMDL related stormwater criteria for the Okeechobee basin, requiring nutrient monitoring for both phosphorus and nitrogen in all ERP permits above certain threshold sizes. Provide safe harbor provisions, such as no discharge= no monitoring, or 100% native vegetation & no irrigation = no monitoring. Provide incentives to property owners who construct stormwater systems with a PRE/POST reduction outcome (where PRE is pre-modern impact), to include nutrient reduction credits that can be traded in a stormwater mitigation scenario.* AF-18

- *Require that development projects do not add nutrient loading to the system.* AF-19

- *Revise Rule 40E-24, FAC, and work with the DEP to amend 62-520, FAC to make special provisions for the use and distribution of reclaimed water in the Okeechobee basin. Discourage the use of reclaimed water for residential and commercial landscape irrigation unless there is an affirmative demonstration that the wastewater will not add nutrients to downstream waters.* AF-20

- *Continue providing strategic support and input to the DEP for the development of the Unified Statewide Stormwater Rule, 62-347, FAC, urging them to adopt the above suggestions.* AF-21a

<u>**Insert at Line 3678**</u>***:*** "Some improvements the guidance memorandum will include are as follows: AF-21b

1. Specific TMDL related stormwater criteria for the Okeechobee basin will be established through amendments to the ERP Rule.

2. The monitoring of phosphorus and nitrogen above certain threshold sizes will be a requirements for an ERP permit condition in the Okeechobee basin
3. Safe harbor provisions, such as no discharge = no monitoring, or 100% native vegetation & no irrigation = no monitoring.
4. Development projects are required to not add nutrient loading to the system.
5. Special provisions for the use and distribution of reclaimed water in the Okeechobee basin will be developed, discouraging the use of reclaimed water for residential and commercial landscape irrigation unless there is an affirmative demonstration that the wastewater will not add nutrients to downstream waters.

AF-21b cont.

Stormwater Mitigation Program
The new program will provide incentives to property owners who construct stormwater systems with a PRE/POST reduction outcome. Nutrient reduction credits can be traded in a stormwater mitigation scenario.

AF-22

Comprehensive Planning/Land Development Regulations
In 2009, the FDEP, in collaboration with the SFWMD, finalized the Nutrient Loading Considerations for Planning Decisions in Northern Everglades and Estuaries Protection Program (NEEPP) Watersheds report (a.k.a., "white paper"). The white paper provides guidance to the FDEP and SFWMD when working with local governments to meet the NEEPP requirements. It also explains how existing growth management processes can further the restoration and water quality objectives of the NEEPP. However, as guidance, this current document does not hold much binding authority, and SFWMD staff must persuade, rather than mandate, local governments that the directives of the "white paper" are followed. As a solution, the coordinating agencies will enter into a memorandum of understanding to create binding authority to the ideas expressed. The memorandum will include:

AF-23a

1. Low impact development techniques and use "Florida Friendly" native landscaping will be required throughout the Okeechobee Basin and estuaries to avoid the need for supplemental irrigation.

2. A high-visibility program with representatives from the coordinating agencies will be created to provide advice and recommendations to the Department of Community Affairs (DCA) and local governments on proper methods to minimize nutrient generation by urban developments. The program should produce specific recommendations for local

AF-23b

ordinances and use by DCA in the Comprehensive Plan Amendment and Evaluation Appraisal and Review (EAR) processes. It should be more mandatory than persuasive in authority." AF-23b cont.

2. Treatment

Water quality treatment is an expensive alternative to prevention, consumes land that could be put to other uses, and requires major investments of public and private funds. For example, this year the SFWMD allocated $111.5 million for the continued construction of stormwater treatment area (STAs), over $15 million for the Lakeside Ranch Phase III projects, and almost $27 million for long term operations and maintenance. AF-24

Stormwater Treatment Areas/ Hybrid Wetland Technologies

- *Include critical decision points and basin prioritization schedule for the design, construction and implementation of additional treatment areas. Pinpoint optimal treatment construction locations through the nutrient loading model.* AF-25

- *Pursuant to Fl. Stat. 373.453(6) and Fl. Stat. 373.459(2), contract with private investors/landowners to construct water quality treatment features and pay them for phosphorus removal on a payment for environmental services (PES) basis. The SFWMD should design specifications for water quality feature construction, establish a "price per pound" for phosphorus removal to serve as a basis for private investment, and evaluate results and compare performance/cost basis with known results of SFWMD constructed STAs.* AF-26a

Insert at Line 3737: "Regional projects including STAs and reservoir-assisted stormwater treatment areas (RASTAs) will also be part of the strategies to address the water quality problems. With funding constraints in mind, future plans will include critical decision points and basin prioritization schedule for the design, construction and implementation of additional treatment areas. Optimal treatment construction locations will be re-assessed in light of new and innovative private partnership mechanisms. The SFWMD and FDEP will pursue creation of a PES program for the construction and operation of treatment facilities. AF-26b

The SFWMD will contract with private investors/landowners to construct water quality treatment features and pay them for phosphorus removal on a PES basis. Design specifications for water quality feature construction will be provided. A market based competitive "price per pound" for phosphorus removal will serve as a basis for private investment. The results will then be evaluated, comparing results against other treatment technologies."

Insert at Line 3740: "The 2,700 acre Lakeside Ranch STA, of which Phase I is nearing completion with projected costs of $76 million, will remove approximately 19 mt of phosphorus per year. Pre-treatment of these waters with a chemical precipitation process, or other treatment designed to reduce the AF-26c phosphorus loading of the STA, working as a treatment train with the STA itself could substantially increase the tons of phosphorus removed. Thus, for the maximization of cost effectiveness and efficiency, efforts to pre-treat the water in this project through chemical precipitation will be expedited. Funds saved will be relocated to a budget increase for the implementation DWM projects, and help expedite efforts to and nutrient removal projects constructed on a pay for performance basis." AF-26c cont.

<u>Insert at Line 3757</u>: Insert a proposed budget for these projects at this location. AF-26d

Alternative Treatment

- *Emphasize technologies to remove phosphorus and nitrogen through chemical precipitation, algal turf scrubbers, physical removal and other mechanisms on a pay for performance basis.* AF-27

- *Expedite funding for the evaluation and demonstration of technologies that could harvest algae biomass and suspended sediments from Lake Okeechobee's water column.* AF-28

- *Organize proposals for alternative treatment technologies into separate tracks for 1). existing STAs, 2). in-lake phosphorus laden sediments, and 3). concentrated inflow points of phosphorus discharge to Lake Okeechobee.* AF-29a

<u>Insert at Line 3697</u>: "In addition to promoting further research and development of these technologies, this plan emphasizes technologies to remove phosphorus and nitrogen through chemical precipitation, algal turf scrubbers, physical removal and other mechanisms on a pay for performance basis. In response to the large variety of alternative technology proposals, the coordinating agencies will organize proposals for alternative treatment technologies into separate tracks for 1). Existing STAs 2). In-lake phosphorus laden sediments and 3). Concentrated inflow points of phosphorus discharge to Lake Okeechobee." AF-29b

<u>Insert at Line 3735</u>: "Funding should be expedited for the evaluation and demonstration of technologies that could harvest algae biomass and suspended sediments from Lake Okeechobee's water column." AF-29c

<u>3. Dispersed Water Management (DWM)</u>

LOPP revisions should substantially increase the use of DWM using PES, easements, or other incentives. AF-30

<u>Insert at Line 3916:</u> "The coordinating agencies will emphasize DWM as the primary program to achieve water storage in the Northern Everglades."

- *For future DWM project planning, the SFWMD should assess the water storage capacity needed to meet the TMDL in order to determine an appropriate storage target. The plan to create 450, 000 acre feet of DWM projects is impressive and ambitious, and should be implemented in the next 5 years.* AF-31a

Insert at Line 3913: "The LOPP goal is to have 450,000 ac-ft of dispersed water management projects implemented within five years. However, the 450-575k ac-ft storage target also omitted consideration of water storage capacity needed to meet the TMDL, and could change significantly once strategies for this important factor are added." AF-31b

- *A payment platform for the PES approach should be determined, considering acre feet of water impounded within projects, pounds of phosphorus sequestered in projects, or both.* AF-32

Insert at Line 3972: "The SFWMD will implement a PES approach that considers acre feet of water impounded within projects, pounds of phosphorus sequestered in projects, or both as a payment platform."

- *Prioritize the Kissimmee watershed for project. This watershed provides approximately half of inflows to Lake Okeechobee and is under the greatest threat from new development pressure.* AF-33a

Insert at Line 3998: "The SFWMD will prioritize the Kissimmee watershed for projects. It provides approximately half of inflows to Lake Okeechobee and is under the greatest threat from new development pressure." A table should be included in this section to show the timeline for implementation of projects and a budget showing anticipated funding needed. AF-33b

"The Fisheating Creek basin will be targeted for intense implementation and monitoring, including lands recently subject to projects under the United States Department of Agriculture (USDA) program, as well as other suitable lands in the basin with willing landowner participants."

.

Insert at Line 4123: "Because this sub-basin is relatively small and not under immediate development pressure, planning will be postponed until after the Kissimmee River Valley is addressed." AF-33c

- *For the budget planning process for FY 2011-12, shift emphasis previously placed on funding regional reservoirs or STAs (notably, Phase II of Lakeside Ranch) to funding the implementation of DWM projects. Provide for yearly incremental increases in funding. We deeply appreciate your staff's efforts increasing the FY 2010-11 budget for DWM projects from $4.2 million to $8,752,297, as seen on FY 2011 Annual Work Plan, pg. 39, and encourage the SFWMD to increase funding to at least $20 million annually starting in FY 2011-12.* AF-34a

Insert at Line 4021: "In response to the positive support, during the budget planning process for FY 2011-12, the SFWMD will shift emphasis previously placed on funding regional constructed projects to funding the implementation of DWM projects, and provide for yearly incremental increases in funding." A budget should be inserted at this point in the LOPP which proposes a schedule AF-34b for achieving the proposed 450,000 acre feet of dispersed storage. The budget should redirect funds from Phase II Lakeside Ranch project construction as one of its immediate sources. Fund research on the phosphorus release phenomenon observed at some locations when DWM projects newly flood previously phosphorus enriched soils. Analyze soil types and situation parameters to isolate the circumstances where this effect occurs and provide guidance for design and management of projects to avoid or minimize the effect." AF-34b cont.

Insert at Line 4311: "New research will be also funded on the phosphorus release phenomenon observed at some locations when DWM projects newly flood previously phosphorus enriched soils. For greater effectiveness, soil types and situation parameters to isolate the circumstances where this effect occurs will be analyzed and used to provide guidance for design and management of projects to avoid or minimize the effect." AF-34c

- *Fund monitoring of projects to document performance and compliance. Performance measures must be developed to ensure accountability and transparency.* AF-35

Insert at Line 3942: "There will be additional funds allocated toward the monitoring of projects to document performance and compliance."

4. Legacy Phosphorus

- *The continued accumulation of legacy phosphorus may be one of the most important indicators of the health of the Okeechobee watershed. The release of these legacy phosphorus deposits will eventually surpass annual reductions of phosphorus imports unless more decisive action is taken, beginning with more aggressive source controls. The graph below*[5]*, prepared by Dr. Paul Gray, Science Coordinator of Audubon of Florida's Lake Okeechobee Watershed Program, shows the history and continued accumulation of legacy phosphorus. This is happening regardless of the efforts that the SFWMD and other agencies have undertaken.* AF-36a

Insert at Line 3807: "At this rate, the legacy loads have roughly doubled since initiation of the Surface Water Improvement and Management Act (SWIM) in 1989, and risen from about 150,000 mt tons when the LOPA passed in 2000, to about 200,000 mt in 2010, a 33% increase (Fig.1)." AF-36b

Insert at Line 3810: "Research also is needed to find ways to slow the rapid increase in legacy loads (i.e., reduce new imports to the maximum extent possible)." AF-36c

[5] This graph uses Soil and Water Engineering Technology's (SWET) 2007 estimate of 190,000 mt of legacy phosphorus and backdated likely legacy loads using Mock Roos import numbers, as well as SWET's revised numbers for the past three years. The fact that the legacy load drops below zero in the 1970s shows some inaccuracies in the estimates, but does not change the general trend.

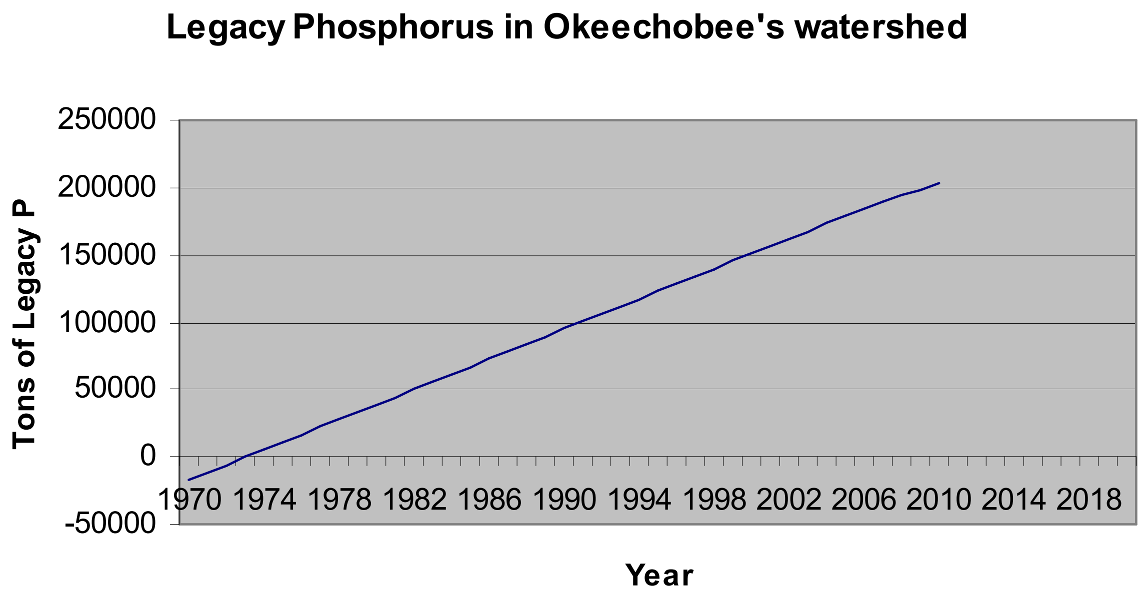

Figure from AF-36a

Figure 1. Legacy loads are increasing rapidly. [The draft LOPP should include a graph like this backdating SWET's 190,000 mt in 2007 using SWET, Mock Roos, and Hiscock estimates of previous annual imports]

Insert at line 3756: "A charter mission for the Water Quality Center of Excellence will be finding ways to reduce the on-going addition of new nutrients to Florida's legacy loads." AF-36d

Insert at Line 4229: "Phosphorus levels in these lakes have roughly doubled in the past 10 years, indicating saturation effects and portending nutrient problems in the lakes themselves, and greater nutrient levels from these watersheds than in the past. Present nutrient control plans that are based upon past periods of record are inadequate to address an increasing load scenario, and reinforce the need to work upstream of these lakes before the problems become too advanced (expensive)." AF-36e

5. Crops

- *Certain crops may require so much water or nutrients as to be fatally incompatible with south Florida conditions. Alternative crops will be developed. Once designated, incompatible crops should be phased out.* AF-37

Insert at Line 3868: "Crop compatibility. Certain crops may require so much water or nutrient as to be fatally incompatible with south Florida conditions. Alternative crops will be developed and once designated, incompatible crops phased out."

6. Regional Water Storage Projects

- *Large regional water storage projects are dependent on large sums of money from uncertain sources. Therefore, the draft LOPP should reflect this economic reality in its assessment and evaluation of these projects.* AF-38a

  Insert at Line 4028: "However, it must be made clear that completion of this project is dependent on the receipt of three billion dollars. As such, the emphasis will be moved away from large regional storage projects such as the CERP LOWP, and moved towards the DWM projects, as described in 6.3.1." AF-38b

  Insert at Line 4239: "It is important to note that the expediency of their implementation is dependent on the uncertain receipt large amounts of funds from outside sources." AF-38c

  Insert at Line 4347: ", which is dependent on the receipt of funding from an uncertain source." AF-38d

  Insert at Line 4080: "Because in-lake sediment removal will not be fully effective until inflow loads decrease, and such decrease appears far in the future, available funds would be best spent primarily on upstream watershed activities that achieve nutrient reductions and full-scale implementation of in-lake removal projects be postponed. Pilot projects that demonstrate and perfect in-lake sediment removal should be pursued." AF-38e

  Insert at Line 4097: ", and the cost to scale it up to meaningful levels for Snail Kite recovery are prohibitive. Attention should focus on recovering habitat to benefit snail recovery." AF-38f

7. Relationship to River of Grass initiative

- *Discussion of this issue should also consider water storage available to aid in meeting the TMDL.* AF-39

  Insert at Line 4192: "This estimate also omits consideration of water storage needed to meet the TMDL, which could significantly change estimated final storage needs."

8. Accuracy of 6.7.1 Watershed Water Quality Evaluation

- *The 2007 LOPP update stated that the phosphorus reductions predicted in the 2004 LOPP had not materialized. The 2007 update then made its own predictions about future phosphorus reductions, specifically Table 3 estimated load reductions from "current activities" of 146 tons. This prediction also has not materialized, as demonstrated by the lack of significant reductions reported in Section 3.2 of the 2010 draft LOPP update.* AF-40

Insert at Line 4194: The agencies should explain in detail why the estimated load reductions again failed to occur. More importantly, the agencies must state what adjustments have been made to improve the reader's faith that the estimates in Section 6.7 of the 2010 report are reasonable. AF-40 cont.

9. Funding

- *Pursuant to Fl. Stat. 373.4595(1)(k), "a continuing source of funding is needed to effectively implement the programs (LOPP)." It is the SFWMD's duty to clearly articulate to the legislature budgets, actions, and policy changes that must be undertaken if the Lake Okeechobee watershed is to be rescued from eutrophic collapse.* AF-41

  Insert at Line 4474: "The following is a proposed budget that would adequately provide for the implementations of these projects." Insert detailed budget proposal here, with timeline of implementation.

In conclusion, we believe that the draft LOPP remains seriously deficient. It lacks key policy recommendations, functional program elements, timelines, and budget proposals to build, initiate, or complete the necessary steps to reduce phosphorus loading and store water in the Northern Everglades. We fully understand that economic conditions may impose budgetary constraints on future implementation. Nonetheless, the LOPA required the agencies to "…conduct an evaluation of any further phosphorus load reductions necessary to achieve compliance with the LOPA total maximum daily load established pursuant to Fl. Stat. 403.067." This draft update does not fulfill this mandate.

In most cases, we believe that the recommendations made by Audubon for revisions to the draft LOPP can be accomplished within existing legislative authority. In the event that SFWMD takes the position that any of these recommendations exceed current legislative authority, Audubon asks that recommendations for legislative amendments to accomplish the policy changes proposed in these comments be included in the final LOPP update. We strongly urge the staff of SFWMD to correct these deficiencies prior to presenting this plan to the Governing Board for final approval.

Sincerely,

Charles Lee,
Director of Advocacy
Audubon of Florida

Paul N Gray

Dr. Paul Gray
Science Coordinator, Lake Okeechobee Watershed Protection Program
Audubon of Florida

Jane Graham

Jane Graham, Esq.
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December 8, 2010

Carol Wehle
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, FL
Via Email: cwehle@sfwmd.gov

Subject: Lake Okeechobee Protection Plan 2011 Update Recommendations

Dear Ms. Wehle:

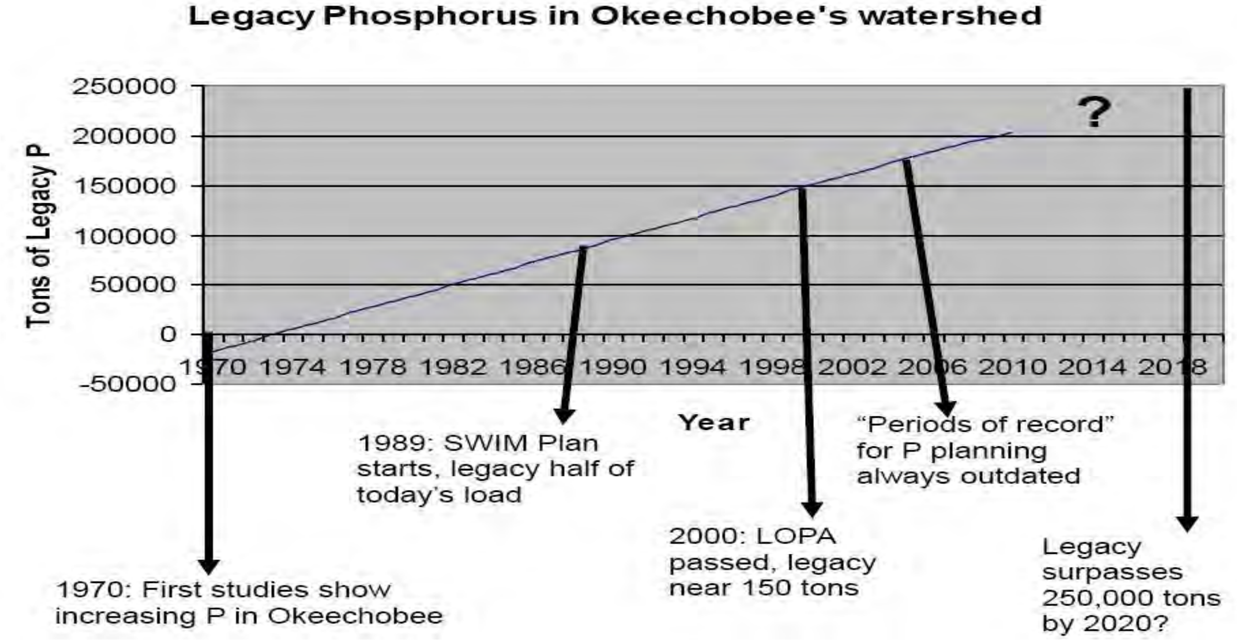
Attached please find Audubon of Florida's comments on the Lake Okeechobee Protection Plan 2011 update draft (draft LOPP). After reviewing the draft LOPP, we believe it will neither resolve the water quality problems of Lake Okeechobee and its downstream estuaries, nor those of the greater Everglades.

The draft LOPP's Table 4-2 "Comparison of phosphorus (P) budget analyses" reveals the gravity of the situation.[1] Phosphorus imports to the Okeechobee watershed remain at a staggering 6,088 metric tons (mt). On the surface, there is an apparent reduction from previous years of phosphorus loading for row crops and sugarcane. However, the draft LOPP suggests that the reasons for this change may be temporary, relating to reduced production in row crops attributable to the economy, and a different measurement system accounting for phosphorus in sugarcane.[2]

Most notably, the largest land use category in Table 4-2, improved pasture at 714,245 acres, showed a 15 percent increase in phosphorus loading. The draft LOPP attributes this to inputs from sewage residual land spreading. We have repeatedly communicated our concerns to both the South Florida Water Management District (SFWMD) and the Florida Department of Environmental Protection (DEP) regarding the significance of sewage residuals (biosolids) in the Okeechobee basin. We urge the SFWMD and DEP to move more aggressively to enforce the 2007 legislation intended to eliminate biosolids as a source of phosphorus loading in the Okeechobee Basin. AF-42

[1] See "Draft Lake Okeechobee Protection Plan Update." November 2010 (draft LOPP) at 54. The table is attached in this letter's appendix for your convenience.
[2] Draft LOPP at 55.

Moreover, the continuing accumulation of legacy phosphorus in the Okeechobee watershed is disturbing. The graph below[3], prepared by Dr. Paul Gray, Science Coordinator of Audubon of Florida's Lake Okeechobee Watershed Program, approximates the history and continued accumulation of legacy phosphorus.



The continued accumulation of legacy phosphorus may be one of the most important indicators of the health of the Okeechobee watershed. The release of legacy phosphorus will eventually surpass the annual reductions of phosphorus imports unless more decisive action is taken, beginning with more aggressive source controls.

Audubon recognizes the challenging economic times for government budgets. However, reducing phosphorus loading and the rapid movement of surface water toward Lake Okeechobee is not only an issue of crisis proportion for south Florida, but a statutory duty. Pursuant to Fl. Stat. 373.4595(1)(k), "a continuing source of funding is needed to effectively implement the programs (LOPP)." It is the SFWMD's duty to clearly articulate to the legislature the necessary budgets, actions, and policy changes required if the Lake Okeechobee watershed and the downstream waters are to be rescued from eutrophic collapse. AF-43

We commend the SFWMD for ramping up the dispersed water management (DWM) effort this year. These projects will help slow flows toward the lake and facilitate increased water quality treatment. We recommend that the coordinating agencies develop a clear and ambitious timeline to fulfill the stated goal of 450,000 acre feet of DWM projects. AF-44

[3] This graph used the Soil and Water Engineering Technology (SWET) 2007 estimate of 190,000 mt of legacy phosphorus. The graph backdated likely legacy loads using Mock Roos import numbers, as well as SWET's revised numbers for the past three years. The fact that the legacy load drops below zero in the 1970s shows some inaccuracies in the estimates, but does not change the general trend.

Our attached detailed comments recommend the necessary changes for the draft LOPP. We hope that you and the Governing Board will give them serious consideration.

Sincerely,

Eric Draper
Executive Director
Audubon of Florida

Appendix

Table 4-2. Comparison of phosphorus (P) budget analyses.

Land Use	Previous 2002–2003 P Budget Analysis				Current P Budget Analysis			
	Area (acre)	Percent	Net P Import (mt)	Percent	Area (acre)	Percent	Net P Import (mt)	Percent
Barren Land	64,092	1.9%	—	0.0%	41,318	1.2%	—	0.0%
Citrus	250,755	7.3%	285	3.5%	245,790	7.1%	1,274	20.9%
Dairies	28,256	0.8%	504	6.2%	23,361	0.7%	470	7.7%
Improved Pastures	714,245	20.8%	1,672	20.7%	676,991	19.7%	1,916	31.5%
Other Areas	52,853	1.5%	434	5.4%	30,935	0.9%	170	2.8%
Row Crops	22,699	0.7%	1,845	22.8%	23,238	0.7%	309	5.1%
Sod	32,823	1.0%	(493)	(6.1%)	38,425	1.1%	(256)	(4.2%)
Sugarcane	399,836	11.6%	1,562	19.3%	399,213	11.6%	543	8.9%
Unimproved Pastures/ Rangeland	337,385	9.8%	2	0.0%	325,064	9.4%	(84)	(1.4%)
Upland Forests	416,214	12.1%	(14)	(0.2%)	392,200	11.4%	(36)	(0.6%)
Urban	281,633	8.2%	2,288	28.3%	410,397	11.9%	1,783	29.3%
Water Bodies	226,650	6.6%	—	0.0%	219,847	6.4%	—	0.0%
Wetlands	614,701	17.9%	—	0.0%	615,081	17.9%	—	0.0%
Total Acreage	**3,442,141**	**100.0%**	**8,085**	**100.0%**	**3,441,861**	**100.0%**	**6,088**	**100.0%**

Audubon furnished letters with policy recommendations for the **LOPP** and I submit these comments separately, due to their more technical nature.

Differentiate P loading into the Lake by the northern sub-watersheds vs southern sub-watersheds

line 334. Here, and in other places throughout this Update, imports to the watershed for all six subbasins (6,088 mt total) are reported as a lump sum. However, the 3 southern watersheds (south, east and west) only have a small fraction of their water flow into the lake. Thus, nutrient loading in them has different implications for Lake O than the "upstream" watersheds, whose entire outflow is to the lake. It would be very informative to report the downstream watersheds separately, or at least differently, than the upstream ones. The upstream net import is 4,029 and downstream import 2,059. If you could differentiate the percent of the source discharge (and 2,059 mt net import) to the lake and the fraction that flows away, it would be very useful. AF-45

Wetlands in pastures should be classified as pastures (agriculture) b/c subject to grazing, drainage, mowing, fertilizing, etc.

line 498 I agree that pasture wetlands under 2 acres should have land use classified as pasture. However, I think wetlands larger than 2 acres also should be included in the land use of improved pasture. First, "wetland" is not really a land "use." More importantly, all wetlands in pastures are subject to grazing, drainage, mowing, plowing, planting, and fertilizing. I think classifying them as wetland when they are used these ways gives an inaccurate picture of the acreage of pasture in the watershed. I think the 615,000 acres of wetlands in Table 1-1 should mostly be classed as pasture. AF-46

See Comment above. We don't list wetlands as nutrient sources in this line.

line 776 With 12 percent of flows from urban and 51 from ag, I assume the remainder (37%) is wetlands and natural areas? This seems to support the idea that imbedded wetlands should be reported as agriculture. Wetlands tend to be nutrient sinks, not sources, and listing them as sources is confusing. AF-47

Same as AF-36a-c comment

Section 4.1 this section would benefit from a graph showing the change in legacy loads by year (such as in the Audubon letter to Carol Wehle), similar to the in-lake legacy Figure 3-22. A discussion of the rapidity of the change should be included to allow readers to understand the situation is not static, and indeed, getting noticably worse over time. AF-48

Legacy Phosphorus

A discussion of how the ever-increasing legacy load affects future P flows to Okeechobee would be useful as well. For example, we use a past "period of record" of P flows to plan future control strategies. However, future loads could be greater due to greater legacy loads. Thus, our plans are always behind. In comparison, water supply planning looks to the future and plans ahead to meet future challenges. Perhaps reliance on the period of record could be supplemented with future forecasts. AF-49

Report N loading into the Lake by the northern sub-watersheds vs southern sub-watersheds (do we already do this in Table 4-3?)

line 1531 The different N characteristics of the south, east and west basins also make the case to report them differently, as recommended above AF-50

Report that the chemistry of the lakes in the Upper Kissimmee region is already being affected by upstream loading

line 1551 "…though, could begin adversely affecting the chemistry of the lakes..." this section should mention that upstream loading already appears to be affecting the chemistry of these lakes as AF-51 evidenced by the ~doubling of P levels over the last decade. The discussion should include the implications of increasing P levels when P control plans are based on a period of record reflecting times when P conditions were not as bad. (i.e., the plans are outdated if P keeps rising) AF-51 con't

Pie chart colors- 2 adjacent pie charts have different colors for the same land uses

Fig. 4-2 It would help if the same colors were used for the same land uses in the adject pie charts. It's confusing to me having them different--makes it harder to compare. AF-52

FDACS- Clarify the return inspections on BMPs

Line 2040. "This is equivalent to about 21 percent of the total enrolled acres in the watershed." I don't quite understand this, please elaborate. It seems to imply that in the past 5 years or so, only 1 in 5 properties were inspected? Whatever the return inspection is, it needs to be reported clearly so increased funding can be sought for this important effort. AF-53

Section titled “phosphorus reduction and river restoration- Concerned that the project will be used as a water quality treatment project. Requesting discussion that Lake Kissimmee’s P condition needs to be stabilized or reversed.

Line 3467 **Phosphorus Reduction and River Restoration**: Audubon wants to protect the Restoration from nutrient pollution and is adverse to using the River as a treatment facility, as this paragraph notes. We also have great concerns that the Restoration has no water quality component and that Lake Kissimmee's P outflows have increased greatly over the past 10-15 years. This section (or another appropriate section of this update) should discuss the fact that Lake Kissimmee's P condition needs to be stablized, or even reversed, to protect the Restoration project, and that the KCOL sub-basin plan will be the veihcicle to address this concern. AF-54

line 4198 Perhaps the word "predicts" would be better here than "found." The model predicts BMPs will be effective, if the world works like the model does. Indeed, line 1689 reports that 1.153 of 1.7 million acres of ag land total are in BMPs (more than half), yet the P trend analysis in Section 3 "found" no obvious trends. AF-55

Overall comment: it is very commendable to develop nitrogen budgets and we thank you for this improvement AF-56

thanks for all your hard work and giving us the opportunity to comment!

Florida Farm Bureau Comments

Lake Okeechobee Protection Plan Update Document Comments

FFB - 1
- Line 296 – Does this acreage figure account for the recent lands in the Fisheating Creek watershed (Lykes and three other landowners)?

FFB - 2
- Line 305 – Change 'in' to 'by' so that it reads 'By 2013 no Class B biosolids application will be permitted in the Lake Okeechobee watershed.' Using 'in' denotes that biosolids applications will only cease for one year. Using 'by' indicates that it will be from that time forward.

FFB - 3
- Line 366 – Remove comma after 'e.g.'

FFB - 4
- Line 564 – Should 'minimum' be 'maximum'?

FFB -5
- Lines 608 through 610 – Lines are blank

FFB - 6
- Lines 700 through 702 – is that volume of storage for all of LOSA or just north of the lake? It is my understanding that it is for all of LOSA.

FFB - 7
- Lines 769 through 773 - Where are you trying to say by this statement? (For the Lake Okeechobee Watershed, where Class B is expected to cease in the next couple of years, the new Class AA provisions probably have more importance and are expected to help minimize the potential for indiscriminant dumping of Class AA biosolids, even if distributed and marketed as a fertilizer.)

FFB - 8
- Lines 901 through 902 - Isn't it a minimum of 50 years instead of 'almost 50 years'?

FFB - 9
- Line 1476 – further define the 140 mt with (105 mt inflow + 35 mt atmospheric)

FFB-10
- Line 1480 – period of record for 'historic discharge'

FFB-11
- Lines 1482 through 1493 - How is the lag time to determine BMP effectiveness being determined and how will that be addressed in this document?

FFB-12
- Lines 1612 through 1613 – Since we are discussing the removal of P, what is the estimated P removal contained in the 2 million cubic yards of muck?

FFB-13
- Lines 1630 through 1634 – The culvert problem was detected on February 24, 2009 and the repair was not complete until August 23, 2010. Due to the dry weather during this period, not much attention is given to the time to repair a culvert. This must be addressed so that it does not happen again!

FFB-14
- Line 1655 – What research is taking place with the hypothesis of increasing flow to the south even when the water has levels of P above what is currently allowed. Will the increase in flow offset the determents as a result of increased nutrient loading? This was discussed greatly at the South Florida Ecosystem Restoration Task Force meeting in Coral Gables on October 28, 2010. Might this discussion be included in this report?

FFB-15
- Line 1721 – Add "and landowners" between the words "agencies" and "whereby". The cooperative effort of landowners and representative groups such as Florida Farm Bureau Federation, Florida Cattleman's Association and others should be recognized as a participants in the BMP effort.

FFB-16
- Line 3341 (General question on the topic) – Has increased water consumption by the restored reaches of the Kissimmee River been calculated? This consumption may take place via incorporation into the surfical aquifer (to be later recovered) or more likely by evapotranspiration.

FFB-17

- Line 3617 – Why is the word ‘typical’ used with agricultural BMPs? The BMP process allows the most effective (using various means to determine effectiveness) to be used on a specific piece of property. These may vary widely even with the same owner over different parcels due to the unique specifics of the land. The use of this word may lead one to believe that the BMP process is a cookie cutter ‘one size fits all’ sort of procedure. This is certainly not the case at all. I would recommend removing the word ‘typical’.
- Line 3622 – See comment for 3617
- Line 3625 - See comment for 3617
- Line 3626 - See comment for 3617

FFB-18

- Line 3835 – The goal of ‘less fertilizer’ should not be as important as increasing the efficient use of fertilizers. Less fertilizer is a misguided goal. One would hope that the goal would be for every pound of element applied, close to 100% of that element is utilized by the plant/animal and removed from the system when harvested.

December 13, 2010

Leslie Bertolotti
South Florida Water Management District, MS 7431
3301 Gun Club Road
West Palm Beach, Florida 33406

Dear Ms. Bertolotti:

On behalf of the Everglades Foundation, I am submitting comments on the *Lake Okeechobee Protection Plan Draft Update* (LOPP). We very much appreciate the significant efforts undertaken by the three coordinating agencies (South Florida Water Management District, [SFWMD]; Florida Department of Environmental Protection, [FDEP]; and Florida Department of Agriculture and Consumer Services, [FDACS]) to restore Lake Okeechobee and its watershed. The draft plan provides details on how the State plans to decrease the total phosphorus (TP) loads and increase water storage. The Everglades Foundation would like to offer some specific improvements that would make the plan clearer on how it will achieve its stated objectives.

TMDL timeline

The LOPP was developed to document how the State will reach the legislatively mandated Total Maximum Daily Load (TMDL) target of 105 mtons/year of TP in water flowing into Lake Okeechobee by 2015. In this update, rather than identify all the specific actions that will be undertaken to meet the TMDL, the LOPP Draft Update states in the introduction that "it is not anticipated that the entire Action Plan can be implemented by 2015 nor realistically will its implementation guarantee achievement of state water quality standards by 2015". As a result, the update lacks a realistic roadmap showing how and when the ultimate TMDL goal will be met, and therefore does not meet the expressed intent of the project and the Legislature's direction. Although the Draft Update provides a list of programs and the corresponding P load reduction, it does not specify when (timeline) and how (specific plan) the TMDL should be reached. Furthermore, the proposed long-term strategy detailed in the LOPP would only achieve a load reduction of 166.7 mtons/year (61.7 mtons/year in excess of the TMDL). This is a major shortcoming requiring correction in the final draft.

EF-1A

EF-1B

EF-1C

A specific plan to reach the TMDL

The technical plan developed in the LOPP Draft Update heavily relies on watershed source control based mostly on Best Management Practice (BMP) projects. The estimated TP load reduction from BMPs in the near and long term is around 86.3 mtons/year, representing 23 % of the total reduction target. This is a concern for the Everglades Foundation for two reasons. First, past implementation of BMPs focused on the projects with the lowest cost, lowest efficiency and speed of TP removal. The LOPP should contain clear guidance on how to improve the efficiency of current BMPs. Second, the

EF-2A

EF-2B

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agencies should assess a wider range of BMPs with higher TP removal. For example, implementation of the "edge-of-farm" chemical treatment in some Lake Okeechobee sub-watersheds with the highest TP loads may represent one quick technology to decrease the total load and meet the TMDL. EF-2B cont.

Recognizing that BMPs are only part of the solution, the LOPP Draft Update proposes other activities based primarily on watershed P control projects, such as regional public works, dispersed water management facilities, and hybrid wetland treatment technologies (HWWT) in order to reach the objective. These activities could achieve an estimated TP load reduction in the near and long term around 282.1 mtons/year, representing 76 % of the total reduction target. The near-term TP reduction projects also rely on dispersed water management facilities currently considered as pilot projects and primarily designed for water storage and not for TP load reduction. In the near term, 58.4 % of the TP load reduction would originate from BMPs and dispersed water project management projects. However, the TP reduction from dispersed water storage has not yet been demonstrated on a regional scale. The results presented in the LOPP draft are only preliminary and we would need to wait for the final results before assessing the TP removal achieved with this technology. EF-3

In order to meet the Lake Okeechobee TMDL, we think that the development of regional facilities is essential, even in the near-term. However, in the LOPP, there is no clear indication that even the planning is being undertaken. The majority of the regional efforts are very small scale, such as studies or pilot projects, with low TP reduction impacts. The plan should considering implementation of advanced large-scale treatment technology projects (such as Reservoir Assisted STAs [RASTAs], HWWT and chemical treatment). In short, draft update should be a self-contained and clear explanation of what projects are required to meet the TMDL goal, and what the State is doing to implement those required projects. EF-4 EF-5

Cost and budget

The LOPP draft update presented only the current and near term budgets for reaching the TMDL; these costs were estimated at $ 120.4 million. The long term costs were not included. The short-term costs, primarily BMPs and some dispersed storage, represent only a relatively small portion of the total estimated expenditure, especially considering the magnitude of the phosphorus problem in the watershed and the relatively high long term costs. The LOPP has to present more realistic budgetary figures that reflect the true cost to implement a plan to meet the TMDL. Overall costs and a detailed budget breakdown (current, near and long terms) are missing in the LOPP. Given the current financial pressures the state agencies are facing, it is mandatory to examine creative, innovative, and more aggressive funding alternatives, but first, the costs need to be estimated and understood. We think that initiatives such as market-driven programs (e.g. nutrient exchange program developed by the Everglades Foundation) and breakthrough technologies for P reduction represent non-conventional options to be explored. EF-6 EF-7

A few final recommendations are as follows:

- We recommend reforming BMPs to modify the base fertilizer application rates to be set based on water quality goals for receiving waters rather than on the current agronomic rates. FDACs should review BMPs so as to reduce phosphorus loading in the basin to meet the tributary TMDLs when implemented. EF-8

- Legacy phosphorus is one of the most critical problems in the watershed and is to be adequately addressed. The currently suggested soil amendments to reduce legacy P should not be the only technical solution. Because of their disadvantages (long term stability and high cost) their effectiveness of controlling P is limited. More options are needed here. EF-9

- The proposed historic pre-drainage modeling is a valuable tool for estimating historic phosphorus loadings from each of the sub-watershed. However, if Lake Okeechobee TMDL of 105 mtons/year is to be attained, specific loadings from each of the sub-watersheds should be determined and EF-10 then checked to make sure the sum of the sub-watersheds does not exceed the TMDL. As an example, the TP load from Fisheating Creek should not exceed 11.1 mtons/year to be compared to Fisheating Creek modeling results indicating pre-drainage loads of 27 mtons/year. When using the higher loading rates from each sub-watershed, the overall lake TMDL could not be reached. EF-10 cont.

- The general need for long and short term drought storage in Lake Okeechobee watershed is to be accommodated using a mix of regional large-scale storage and dispersed water management projects, as properly proposed in the LOPP draft. The LOPP suggests a total storage target of 450,000-575,000 ac-ft north of Lake Okeechobee, based on River of Grass Phase I Public Planning Process. The short-term seasonal storage is to use 268,029 ac-ft from different programs (dispersed water management and storage). Subtracting these two values indicates that a total of 181,971-306,971 ac-ft of reservoirs or other combination of regional storage are required north of Lake Okeechobee. We think that the LOPP draft is heavily relying on dispersed storage. We do agree that some long term storage is required north of Lake Okeechobee. However, given the limitations of land availability and land cost in this region, some of this regional storage could be shifted to south of Lake Okeechobee. A specific plan for the location and the price of future properties to be acquired north of Lake Okeechobee is not included in the LOPP draft. EF-11 EF-12

We at the Everglades Foundation appreciate the opportunity to review the LOPP draft and provide our input. I am available at 305-251-001 for any further elaboration on our recommendations.

Sincerely,

Rosanna Rivero, Ph.D.
GIS Scientist
Everglades Foundation
18001 Old Cutler Road, Suite 625,
Palmetto Bay, Florida 33157

Save Our Creeks

Please submit as part of the comments for the Draft Lake Okeechobee Plan Update Public Review

RESOLUTION OF OBJECTION AND REQUEST TO ABANDON

To: South Florida Water Management District
From: Save Our Creeks, Inc.
Re: Resolution of Objection and Request to Abandon Plans for Nicodemus Slough
Date: Nov. 21, 2010

This "Resolution of Objection and Request to Abandon" refers to the plans as set forth in "Payment for Environmental Services," presented July 14, 2010, by South Florida Water Management District Board, and "Nicodemus Slough Phase 1A Storage and Hydraulic Flow of Water on Lykes Bros. Inc. Lands" dated April, 2008, that will construct and transform Nicodemus Slough from an unpolluted and natural ecological slough into a storage reservoir for highly polluted water from Lake Okeechobee.

Save Our Creeks, Inc., an environmental preservation and restoration non-profit corporation, objects to the South Florida Water Management District plan to flood the existing natural wetlands of Nicodemus Slough with polluted water from Lake Okeechobee and other sources. This plan does nothing to restore or protect the environment, and will in fact further destroy the environment by flooding a natural wetlands with highly toxic and polluted wastewater. SOC-1

Nicodemus Slough is now a fairly dry slough because of the HH Dike severance and other water diversions. It provides habitat for native Threatened and Endangered (T&E) species and is relatively unpolluted ranchlands, similar to the contiguous Fisheating Creek WMA. The plan by SFWMD in conjunction with the benefitting landowner, Lykes Brothers, will use this area as a polluted back pumped Lake Okeechobee storage area. This will erase and destroy this natural area, while gaining nothing of value for the environment. There will be, however, a windfall to the private landowner, and significant costs to taxpayers. The public will pay 3 times: once with SOC-2A SOC-2B irretrievable losses to the environment and wildlife, again with the initial and ongoing costs of the project, and a third loss will occur when the public will give up the infrastructure at the end of the lease. SOC-2B cont.

At approximately 16,000 acres, the area holding toxic water would be larger than any of the lakes in Highlands County, except for Istakpoga (28,000). The area to be developed is inhabited by Swallowtail kites. Their presence has been documented in a 1,000 foot radius from the HH Dike, and specifically in close proximity where the 2 pumping stations are planned. Disturbance from the construction and lights and noise from the pumping stations and towers will impact this important raptor species. This site is the largest and most significant pre-migratory roost of this species in North America. This is not a project that any environmental group or agency should support. SOC-3

If storage of toxic polluted water is the goal (regardless of its lack of merit), the water could easily be stored in existing canals or flow ways to the south, rather than pumped uphill to Glades or Highlands County. SOC-4 The plan, as presented, creates a new downstream point source of pollution, and this has not been considered or addressed. In fact, according to the April, 2008, plan, no environmental (archeological or other) considerations have been examined as yet, but this project is marching forward. SOC-5

To what purpose, we ask? With no proven benefit, is it worth destroying a natural Everglades wetland to store polluted water from the Orlando area south, including urban stormwater and Kissimmee Basin cattle feces, not to mention polluted EAA agricultural backpumped runoff? SOC-6

If state efforts and resources were put towards cleaning up water pollution at is source rather than sacrificing downstream environments, real solutions to these problems could be found. Lake Okeechobee will not be benefitted from this and other projects like it. The health of the Everglades systems will not be benefitted by this.

Abandon this temporary $50 million plus give-away to private landowners that has no long or short-term benefit for Florida. Since part of this project was originally a Save Our Rivers purchase and the rest of the parcel is a Top Priority for Florida Forever funds, this entire area is crucial to the State of Florida's Ecological Greenways System. Alternately, what could be accomplished is the true restoration of Nicodemus Slough, as the historic delta confluence of Fisheating Creek and Lake Okeechobee.

Save Our Creeks
P.O. Box 135
Palmdale, FL 33944

From: DMandCH@aol.com
Sent: Wednesday, December 08, 2010 11:17 PM
To: Wehle, Carol
Cc: Bertolotti, Lesley
Subject: Lake Okeechobee Protection Plan

Carol Wehle
Executive Director
South Florida Water Management District
3301 Gun Club Road
West Palm Beach, Fl

Dear Carol:

I appreciate the opportunity to comment on this plan. I have many of the same concerns as Audubon. I agree that the amount of phosphorus being brought into the system is too great. SC - 1

I am concerned about the spreading of bio-solids on ag-lands and the increased use of these materials. SC - 2

I am concerned about the amount of development that is eliminating wetlands that help to reduce pollutants. SC - 3

I am concerned that we do not have a long term plan to eliminate the phosphorus and nitrogen being placed on crops and to replace these nutrients with legacy nutrients that are already present in the environment. If we could get farmers to keep water on the premises and reuse the nutrients we could reduce the phosphorus load entering the lake's ecosystem. SC - 4

I believe BMPs need to become tighter as too much phosphorous is entering the ecosystem. SC - 5

I believe the farmers need to reduce their phosphorus loading. SC - 6

We need to eliminate back pumping. Back pumping transfers nutrients back into the lake. Back pumping is a serious degradation of the lake. SC - 7

I am supportive of rewarding farmers for improved behavior. We also need to pay farmers for crop loss resulting from reduced pumping of water off their land and to store water on their land during wet periods. SC - 8

The more we protect the lake the better for all of us.

Drew Martin
Everglades Committee Chair
Sierra Club of Florida
500 Lake Ave. #102
Lake Worth, Fl 33460

EW - 1a-e

6 DEC 2010

SUBJECT - PUBLIC COMMENTS.
OKEECHOBEE PROTECTION PLAN.
TO LESLEY BERTOLOTTI BEFORE 9 DEC 2010

I HAVE MADE COMMENTS ON AREAS OF MY IDEAS, WHERE MORE ACTIVE ENFORCEMENT. IS TO BE PLACED. I ALSO KNOW YOU PEOPLE WILL, NEVER MAKE (TMDL) MAN DATED 2015, TO LAKE OKEECHOBEE. BECAUSE SFWMD - FDEP - FDACS - DO NOT HAVE ANY PEOPLE IN THE SERVICE AREA. WHO HAVE MADE ANY EFFORT TO ENFORCE YOUR OWN RULES 40E-61 OR SWIM. OR THE CLEAN-WATER ACT, OR LOPP OR BMPS, BMAP, DBAT, WATER QUALITY OR RUN-OFF WATER RULES.

AT PRESENT TIME I SEE EVERY DAY HERE IN OKEECHOBEE COUNTY. CATTLE IN CONTACT WITH FLOWING WATER TO LAKE OKEECHOBEE. THIS CONTACT OF CATTLE WITH WATER BY-PASSES (STA) AREAS. NOW FOR EXAMPLE, IF (FDACS) WAS DOING THEIR JOB, I WOULD NOT SEE CATTLE IN CONTACT WITH FLOWING WATER TO LAKE OKEECHOBEE; ALL ALONG 441 S.E. OR 78 WEST AREAS.

Robert M Norton
ECOSYSTEM WATCH.

Our view

Water rule delay justified

■ Take advantage of 15-month repriev to analyze the science, politics involved

Opponents of new federal rules on water pollution in Florida are expected to continue their fight despite a federal decision to postpone implementation of the rules for 15 months.

Rather than setting up an opportunity to scuttle the rules, the delay should be used to fine-tune the rules and to give opponents and supporters the chance to voice their opinions about the sweeping new guidelines designed to improve water quality based on scientific measurements.

The delay should be used to fine-tune the rules and to give opponents and supporters the chance to voice their opinions about the sweeping new guidelines

The delay also will give the U.S. Environmental Protection Agency the chance to counteract claims by opponents about the potential cost of meeting the new guidelines.

The Florida rules — the first in the nation to set pollution limits for nutrients such as nitrogen and phosphorous, the leading causes of environmental damage in the state's waters — stem from a 1998 order by the federal agency for states to establish limits for nutrient pollution to meet requirements of the Clean Water Act.

When the 2004 deadline for compliance passed and no action was taken by Florida or the federal agency, environmental groups in Florida filed suit against the federal government for failing to enforce its order.

Last year, a federal judge approved an agreement that called on the federal agency to establish science-based standards since the state EPA had failed to do so.

The new federal guidelines recently were unveiled and brought howls of opposition from agriculture and other business interests, utility operators and politicians who claimed the rules were too stringent and compliance so costly it could cripple the state's struggling economy.

Opponents assert the rules would cost $21 billion to implement. The federal agency strongly disagrees, saying the cost would be more like $130 million to $200 million. And, it says, failure to reduce pollution, which now impacts about half the state's rivers and more than half of its lakes, could be a much greater economic drain on the state than the cost of complying.

Nutrient pollution is not uncommon on the Treasure Coast and has been evident in recent years with choking algae blooms, damaged sea grass and fish kills.

Will the new rules be costly for some Florida businesses? Yes, if those businesses are now polluting waters that do not belong to them, but that belong to the public. Shouldn't the public's right to clean water supersede the profit-driven concerns of businesses? Some politicians, including some in the Florida Legislature, don't think so and plan to use taxpayer money to fight the clean water standards.

The new rules adopted by the federal agency following last year's court agreement were produced in an exceptionally quick manner compared with normal government actions. And the agency did not provide sufficient time or opportunity for input from those who would be impacted by the rules.

The delay gives time for more analysis of the science involved and for the public to gain a better understanding of the issues involved and the motivations of those for and against the regulations.

If the rules are shown to be reasonable, Florida needs to comply and set an example of environmental protection of our vital waters for other states to follow.

NOTE - PEOPLE WHY MAKE RULES WHEN NO ONE WANTS TO ENFORCE THEM

ECOSYSTEM WATCH: OKEECHOBEE FLA

OVERVIEW

BOB NORTON STARTED 1989 TO 2010 NOW

For the past decade, the coordinating agencies—the South Florida Water Management District (SFWMD or District), the Florida Department of Agriculture and Consumer Services (FDACS), and the Florida Department of Environmental Protection (FDEP)—have diligently been working on reducing phosphorus loads into Lake Okeechobee. This effort was initiated as a result of actions taken by the Florida legislature in 2000 through the Lake Okeechobee Protection Act, which requires state water quality standards including the total maximum daily load to be achieved by January 1, 2015. MANDATED STATE REQUIREMENT

POOR-POOR ENFORCEMENT

Water quality remains a serious challenge in Lake Okeechobee and its watershed. Concentrations of phosphorus within Lake Okeechobee remain on average, above 100 ppb. Nevertheless, ecological conditions within the lake are greatly improved since the previous update in 2008. This improved status may have been achieved largely through two improved conditions in the lake. First, water clarity has increased as suspended solids brought into the water column during the hurricanes of 2004 and 2005 have settled into the sediments. Second, and maybe more importantly, stage conditions have been exceptionally beneficial over the past two years and have resulted in expanding spatial extent of submerged and emergent vegetation communities. The lake stages have been almost entirely within the highly desirable 12.5 to 15.5 foot NGVD range since mid 2008. Wading birds had great nesting success in 2009 and their foraging has been very good in 2010. Fishing, for largemouth bass in particular, has seen a tremendous improvement over the past three years. Benthic invertebrates, the base of the lake's food chain, have been steadily increasing in numbers and species diversity. These data suggest that if favorable stages can be maintained, good aquatic vegetation growth may allow the lake to sustain itself while watershed nutrients are brought under appropriate control. SFWMD/FDACS/FDEP ONLY GUESSING AGAIN!

COE ARMY

To date, numerous local, sub-regional, and regional projects have been completed (or are under way) to implement water storage and water quality improvements across the Lake Okeechobee Watershed. These include: TALK ONLY NO ENFORCEMENT OF THE CLEAN-WATER ACT.

- ✓ Best Management Practices (BMPs)
- ✓ Regulatory rule revisions
- ✓ Regional Stormwater Treatment Areas (STAs)
- ✓ Phosphorus control and management projects
- ✓ Dispersed water management
- ✓ Stormwater projects
- ✓ Wetland restoration VOLUNTARY ONLY
- ✓ Sub-regional treatment projects
- ✓ In-lake phosphorus management projects SLOW TO HAVE ANY MANAGEMENT
- ✓ Alternative nutrient reduction technologies
- ✓ Feasibility studies NO MANAGEMENT BY ANY STATE AGENCY SFWMD-FDACS AND FDEP HERE NOW.

NOTE- TERM ONLY EXPECTED OR MAYBE, OR COULD BE ONLY GUESSING AGAIN PEOPLE

Highlights of achievements that have been completed or are near completion include:

- ✓ Land owners enrolled approximately 1,153,000 acres (67%) of agricultural land in the FDACS-adopted BMP program and were implementing typical owner-implemented BMPs focused on reducing phosphorus loads to Lake Okeechobee. Almost one third of the agricultural acreage implementing typical owner implemented BMPs (380,487 acres) have also implemented typical cost-share BMPs. VOLUNTARY ONLY NOT ENFORCED BY SFWMD-FDACS
- ✓ Construction of more than 30 phosphorus reduction projects including isolated wetland restorations, Dairy Best Available Technology projects, former dairy remediation projects, and public-private partnership projects. The potential average annual phosphorus load reduction from the projects that have been constructed is estimated at 26 metric tons. VOLUNTARY ONLY NOT ENFORCED BY ANY AGENCY
- ✓ Six Hybrid Wetland Treatment Technology (HWTT) projects have been implemented under a joint effort between the District and FDACS in the St. Lucie and Lake Okeechobee watersheds. Another HWTT site in the Lake Okeechobee Watershed is being designed and is expected to be built by the end of 2010. Collectively, these projects will provide approximately 4 metric tons of phosphorus load reduction per year. NOT ENFORCED BY SFWMD- FDACS- FDEP AT ALL.
- ✓ Construction of two regional STAs is complete, and a third is under way. Together these STAs are expected to reduce the average phosphorus load by approximately 24 metric tons per year once they are all fully operational. NOT PROVEN TO DO SO. ONLY SPECULATION ONLY WASTED STATE MONEYS HERE
- ✓ Removed or "sequestered" approximately 1.9 million cubic yards of muck from Lake Okeechobee, exposing thousands of acres of natural lake bottom sand and promoting the return of native plant species. In addition, the project removed 142 metric tons of phosphorus from the lake. SPECULATION ONLY NO PROOF SPECULATION ONLY BY SFWM- FDACS- FDEP
- ✓ A total of 128,722 acre-feet of storage has been achieved in the Northern Everglades and connected watersheds through partnership programs that have implemented water management alternatives since 2005. A total of 89,307 acre-feet of this storage is within the Lake Okeechobee Watershed. Additional water storage sites are being developed as part of the dispersed water management program. SHOW ME PROOF WHERE AND HAVE THESE PROJECTS (WORKED)
- ✓ The FDEP adopted amendments to Chapter 62-640, Florida Administrative Code (F.A.C.), which the Environmental Regulation Commission approved on May 20, 2010, to improve statewide application site accountability and management of domestic wastewater residuals, also known as Class B biosolids. The new rule became effective on August 29, 2010. In 2013 no Class B biosolids application will be permitted in the Lake Okeechobee watershed. 2010 NOW STATE MAN DATE 2015
- ✓ Revision of the SFWMD's regulatory source control program rule (Chapter 40E-61, F.A.C.) for the Lake Okeechobee Watershed, including incorporating the expanded watershed boundary, is anticipated to be complete by the end of 2011. REVISION COME ON PEOPLE STATE OF FLORIDA HAS NEVER ENFORCED CHAPTER 40E-61 THAT I KNOW OF SINCE 1989 R.M. NORTON

NOTE- WORD ANTICIPATED, MAYBE, COULD BE, OR WILL NOT ONLY EXPANDING IDEAS HERE PEOPLE

NOTE- ANY TIME I SEE THE WORD ASSUME, IT MEANS TO ME POOR-POOR MANAGEMENT

✓ Adoption of the FDEP's statewide stormwater rule is anticipated to be completed by the end of 2011. The rule will require additional water detention and water quality treatment of urban runoff. STOP (ANTICIPATED) AND ENFORCE WATER QUALITY

STATE AGENCYS ARE TO MUCH AGRICULTUR CONTROLED

Since the enactment of the Lake Okeechobee Protection Act in 2000, approximately $273 million has been invested through state appropriations and District contributions for Lake Okeechobee Watershed restoration. Additional projects not described here are currently being planned and are expected to provide additional nutrient load reductions. NO LOAD REDUCTION

NO ENFORCEMENT OF (TMDL) BY STATE AGENCYS NO 40E-61 USED,

Despite these extensive and ongoing efforts, many daunting challenges remain. Among them are the legacy phosphorus throughout the Lake Okeechobee Watershed; nutrient imports; in-lake phosphorus-loading; north of the lake STA challenges; delays in the implementation of the Comprehensive Everglades Restoration Plan (CERP)–Lake Okeechobee Watershed Project; and funding constraints. Approximately 176,000 metric tons of phosphorus are currently stored in uplands and isolated wetlands and tributary sediments (SWET 2008). Initial assumptions for planning purposes were that up to 50 percent of the legacy phosphorus could be mobile or easily released into surface water. Based on recent work by Reddy et al. (in press), it is now estimated that approximately 35 percent of total phosphorus in soils is non-reactive and is not biologically available based on chemical fractionation of soil phosphorus. The remaining 65 percent is reactive and may be available for release at different time scales. To put this into perspective, assuming 10 to 25 percent of the reactive phosphorus is available for release at the current total phosphorus loading rate of 500 metric tons per year load, it would take approximately 23 to 57 years to flush the existing legacy phosphorus from the system, assuming phosphorus imports and exports were immediately balanced. These studies indicate that sufficient legacy phosphorus is in the watershed to maintain elevated levels in inflows to Lake Okeechobee for many decades.

POOR MANAGEMENT BY STATE AGENCYS

ASS/U/ME

POOR-POOR STATE WATER MANAGERS WHERE EVER THEY ARE

Nutrient imports pose another challenge for the Lake Okeechobee Watershed. Approximately 6,088 net metric tons of phosphorus were imported into the watershed annually from anthropogenic land use activities, and 5,047 metric tons of the phosphorus import were stored on-site in upland soils, based on 2009 data. Although the annual phosphorus imports remains a major problem in the Lake Okeechobee Watershed, there has been an improvement. Compared to the 2002 study, net phosphorus imports have decreased by 25 percent and on-site phosphorus storage is down 29 percent. These decreases are primarily due to changes in phosphorus import from land uses (truck crop and sugarcane) and implementation of Best Management Practices.

VOLUNTARY ANY THING IS POOR-POOR WATER MANAGEMENT

Sediments and internal phosphorus loading are also major concerns within the lake. Suspended sediments within the lake reduce light conditions and algal and aquatic plant growth. In addition, over the years, excessive phosphorus loads to Lake Okeechobee have led to a large pool of the nutrient accumulating in the lake's sediments. The upper 10 centimeters of all sediments within the lake (mud, sand, and peat) contain an estimated 28,700 metric tons of phosphorus (Reddy et al. 1995). This surface sediment is a primary source of dissolved inorganic phosphorus to the water column, which is roughly equivalent to external loads of total phosphorus. Both internal and external loads of inorganic phosphorus are stimulants of algal growth. On the other hand, the deposition and burial of sediments has maintained some ability of the sediments to remove phosphorus from the water column. Over time, however, this net phosphorus sink has declined (Havens and James 2005) resulting in increased phosphorus concentrations in the water column. EXPLAIN TO ME WHY SFWMD- FDACS- FDEP

CAN NOT MEET (TMDL TO LAKE OKEECHOBEE) 140MT- 40PPB

THEY HAVE NEVER BEEN ABLE TO MEET WATER QUALITY ANY WHERE IN LAKE OKEECHOBEE. WATER BASINS OR ANY OTHER BASINS IN OUR STATE

NOTE VERY GOOD ITEM OF POOR-POOR WATER MANAGEMENT IN THE OKEECHOBEE WATER SHED HERE.

Among the other challenges in the watershed are operational issues with the Northern Stormwater Treatment Areas and availability of cost-share funds for water quality features of the CERP–Lake Okeechobee Watershed Project. Operations of the Taylor Creek and Nubbin Slough Critical Project STAs have been halted due to culvert problems and insufficient rainfall runoff to supply the STA for full-time operation. Repairs are completed but there are remaining problems that have yet to be resolved regarding the operations of the Nubbin Slough STA. In addition, the CERP–Lake Okeechobee Watershed Project is critical to providing additional load reductions and storage. The total phosphorus load reduction estimated for this project is approximately 74 metric tons; however, the project has been on hold due to the cost-share issues for construction of water quality features with the U.S. Army Corps of Engineers.

ONLY GUESSING HERE PEOPLE - NO PROVEN FACT

Lastly, funding is the critical determinant in the timely implementation of Lake Okeechobee Watershed projects to achieve the water quality and storage goals. The costs of source control, construction projects other than CERP features, research, water quality monitoring projects, and other elements of the Lake Okeechobee Protection Plan (e.g., exotic species management, internal phosphorus management) will be primarily borne by the coordinating agencies and the state. Allocation of state funds for Lake Okeechobee projects is in competition with other large-scale restoration activities and pending litigation may continue to divert funds away from Lake Okeechobee Watershed projects. While authorized CERP-related costs are eligible for up to a 50 percent cost share with the federal government, federal funding is contingent on many factors including Army Corps of Engineers nationwide policies and must compete against other large-scale restoration and public works projects nationwide. Recently, significant federal funding for wetland restoration projects in the Lake Okeechobee Watershed has come from the Natural Resource Conservation Service and will help achieve some plan benefits. Like CERP funding, support from the Natural Resource Conservation Service is subject to annual appropriations from Congress. WHERE IS STATE HELP ON WATER PROBLEM.

WHERE IS SFWMD - FDACS - FDEP PEOPLE

Given the magnitude of these challenges and expansive size of the watershed, the coordinating agencies have developed the Action Plan (described herein); however, it is not anticipated that the entire Action Plan can be implemented by 2015 nor realistically will its implementation guarantee achievement of state water quality standards by 2015. POOR-POOR WATER MANAGEMENT STATE OF FLORIDA IS THE PROBLEM HERE

The coordinating agencies continue to work to overcome these challenges and remain committed to restoration and protection of the Northern Everglades and implementation of the Lake Okeechobee Protection Plan. Furthermore, this update provides a "road map" of strategic projects, promising technologies, and other proposals that can be implemented in Lake Okeechobee and its watershed to continue to move toward achieving this goal.

THE LOPP PLAN HAS NEVER BEEN ANY GOOD. BECAUSE IT IS STATE RUN. ON A VOLUNTARY SYSTEM. NO ENFORCEMENT BY ANY STATE WATER PEOPLE. EXAMPLE SFWMD - FDACS - FDEP. ONLY ENFORCEMENT OF CLEAN-WATER ACT ALSO STATES OWN RULE 40E-61 WILL DO THIS JOB TO MEET TMDL TO LAKE OKEECHOBEE.

SECTION 1: INTRODUCTION

1.1 Document Purpose

LAKE OKEECHOBEE IS THE DRINKING SUPPLY FOR ALL OF SOUTH FLORIDA

Lake Okeechobee, the largest lake in the southeastern United States, is a shallow, eutrophic lake that represents the central component of the hydrology and environment of South Florida. The lake provides flood control and water supply for nearby towns and surrounding areas, including agricultural lands and downstream estuarine ecosystems. It serves as an important back-up water supply for urban areas along the lower east coast of Florida and also is used for navigational purposes. Lake Okeechobee supports a multimillion-dollar recreational and commercial fishery and provides important habitat for migratory water fowl, wading birds, and several threatened and endangered plant and animal species. (DRINKING WATER SUPPLY PEOPLE)

For the past four decades, Lake Okeechobee has been subjected to various forms of environmental degradation, including (1) excessive phosphorus loads, (2) extreme high and low water-level fluctuations, and (3) rapid spread of exotic and nuisance plants within the lake's littoral zone. Three coordinating agencies, the South Florida Water Management District (District or SFWMD), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS), are working cooperatively to address these interconnected issues to rehabilitate the lake and enhance the ecosystem services that it provides while maintaining its contributions to the regional water supply and flood control. LAKE OKEECHOBEE WATER SUPPLY IS CONTROLLED BY MAN - LITTLE WORRY OF FLOOD TO PEOPLE NOW 2010

This document fulfills the requirement for a three-year update of the Lake Okeechobee Protection Plan (LOPP). It focuses on the progress of the three coordinating agencies in reducing phosphorus loads consistent with the Total Maximum Daily Load (TMDL)[1] established for the lake as well as increasing storage to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. The document provides (1) an introduction detailing the purpose of the LOPP Update, legislative requirements, and a description of the Lake Okeechobee Watershed; (2) an overview of the Lake Okeechobee Protection Program, including a description of its components; (3) information on the current status of Lake Okeechobee; (4) a review of past and current activities with summaries of completed and ongoing projects and activities; (5) challenges in the watershed; and (6) strategies for moving forward to reduce phosphorus inputs to the lake and increase storage over the next three years, including a schedule, funding requirements, and other project planning elements. THE SFWMD-FDACS-FDEP-HAVE DONE VERY LITTLE TO ENFORCE ANY TMDL ON THE BOOKS NOW. THESE PEOPLE CAN NOT EVEN MAKE TMDL 140 MT-40 PPB TO LAKE OKEECHOBEE EVER SINCE (TMDL SET 2001) UNTIL NOW 2010 THEY HAVE NEVER MADE TMDL TO LAKE OKEECHOBEE 9 YEARS LATER "COME ON MAN"

[1] A TMDL is the maximum amount of a given pollutant that a water body can absorb and still maintain its designated uses (e.g., drinking, fishing, swimming, shellfish harvesting). The Lake Okeechobee TMDL is based on a five-year rolling average to account for variations in rainfall, water flow, and loads.

I STARTED TO COMPLAIN ABOUT WATER QUALITY

1.1.1 Legislative Mandate

BACK IN 1989 ALSO (TMDL)

HERE WE ARE 2010 NO SWIM ENFORCEMENT DONE 40E-61

In 1987 the Florida legislature enacted the Surface Water Improvement and Management (SWIM) Act, which required the state's water management districts to develop restoration plans for priority water bodies. In 1989, The SFWMD developed a SWIM Plan to control phosphorus loading to Lake Okeechobee. Despite the plan, no substantial phosphorus reductions were achieved during the 1990s. As a result, the Florida legislature passed the Lake Okeechobee Protection Act (LOPA)(Section 373.4595, Florida Statutes [F.S.]) in 2000 to establish the Lake Okeechobee Protection Program to restore and protect the lake. In 2007, the legislature amended the LOPA and passed the Northern Everglades and Estuaries Protection Program (NEEPP) (Chapter 373.4595, F.S.). The 2007 NEEPP expanded Lake Okeechobee restoration efforts to downstream estuaries (Caloosahatchee and St. Lucie River Watersheds) and changed the program's name to the Lake Okeechobee Watershed Protection Program. NEVER WAS THERE ANY FOLLOW-UP ON (SWIM PLANS) NO ENFORCEMENT DONE

The Lake Okeechobee Watershed Protection Program (LOWPP) includes the following elements: (1) Lake Okeechobee Watershed Protection Plan (LOPP), (2) Lake Okeechobee Watershed Construction Project, (3) Lake Okeechobee Watershed Phosphorus Control Program, (4) Lake Okeechobee Watershed Research and Water Quality Monitoring Program, (5) Lake Okeechobee Exotic Species Control Program, (6) Lake Okeechobee Internal Phosphorus Management Program, and (7) annual progress reports. Section 2 of this report provides an overview of the Lake Okeechobee Watershed Protection Program and its seven elements.

TMDL SET 2001 NOW 2010 9 YEARS LATER NO IMPROVEMENT

The LOPA (now NEEPP) mandates a TMDL of 140 metric tons (mt) of total phosphorus (TP) per year to the lake be met by January 1, 2015. This TMDL was adopted by the FDEP in 2001 and established in accordance with Section 403.067, F.S. and consists of 105 mt per year of TP from the watershed and 35 mt per year from atmospheric deposition (e.g., rainfall and wind). LOPA also requires an aggressive program to control exotic plants and a long-term program of water quality and ecological assessment, research, and predictive model development to address the problem of phosphorus loading. ALL THESE PLANS AND STILL NO PHOSPHORUS REDUCTIONS STILL NO (TMDL) IN PLACE BY SFWMD-FDACS-FDEP

NEEPP also requires the LOWPP to be reevaluated every three years to identify if further phosphorus load reductions are necessary to achieve compliance with the Lake Okeechobee TMDL pursuant to Section 403.067, F.S. The coordinating agencies have previously produced evaluation reports in 2004 and 2007 (SFWMD et al. 2004, SFWMD et al. 2007). NEEPP promotes a comprehensive and interconnected watershed approach to protection of the Lake Okeechobee, Caloosahatchee River, and St. Lucie River watersheds. The Lake Okeechobee Watershed Construction Plan – Phase II Technical Plan (P2TP) was submitted to the Florida legislature in February 2008 as required by NEEPP (SFWMD et al. 2008). The P2TP identifies construction projects and on-site measures that prevent or reduce pollution at the source, such as agricultural and urban Best Management Practices (BMPs), needed to achieve the TMDL for TP established for Lake Okeechobee. In addition, the P2TP includes other projects for increasing water storage north of Lake Okeechobee to achieve healthier lake levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. 2010 NO IMPROVEMENT

This report, the *Lake Okeechobee Protection Plan Update*, provides a three-year re-evaluation of the P2TP with the most recent information available and addresses the three coordinating agencies' efforts in meeting defined phosphorus reduction and storage goals. This report also defines current and future proposed phosphorus reduction and storage projects that

POOR-POOR MANAGEMENT BY STATE AGENCYS SUCH AS (SFWMD) (FDACS) (FDEP) IS THE WATER PROBLEMS.

will require future funding for implementation and identifies the lead agencies for implementing each activity or project. IMPLEMENTATION of TMDL AND CLEAN-WATER ACT Will SOLVE PROBLEMS, ALSO NEW LEADERSHIP NEEDED

1.2 Physical Description of Lake Okeechobee

Lake Okeechobee covers more than 427,500 acres, with an average depth of about 8.9 feet (ft) and a maximum depth of 18 ft (James et al. 1995). The lake's watershed extends from just south of Orlando to agricultural areas around the lake's perimeter. The watershed spans 10 counties and 5,400 square miles (mi^2) (**Figure 1-1**). The Lake Okeechobee Watershed includes the Upper Kissimmee Chain of Lakes, the Kissimmee River, Taylor Creek/Nubbin Slough, Lake Istokpoga/Indian Prairie, Fisheating Creek, portions of the Everglades Agricultural Area (EAA), and other smaller basins on the lake's eastern and western sides. PROBLEM AREA HERE PEOPLE

The lake discharges water to the south to the Everglades Protection Area, to the east via the C-44 canal to the St. Lucie Estuary and Atlantic Ocean, and to the west via the C-43 canal to the Caloosahatchee River and Estuary and Gulf of Mexico. Lake Okeechobee functions as the central part of a large interconnected aquatic ecosystem located in South Florida and represents a major surface water body of the U.S. Army Corps of Engineers' (USACE) Central and Southern Florida Flood Control Project. LAKE OKEECHOBEE, IS THE DRINKING WATER SUPPLY FOR All of SOUTH FLORIDA PEOPLE

1.3 Land Use

PLEASE SOMEONE IN GOVERMENT WAKE-UP

Nutrient levels in surface water runoff are directly related to land use and land management practices within the watershed (Hiscock et al. 2003, Zhang et al. 2002). The Lake Okeechobee Watershed is dominated by agricultural land uses that account for 51.2 percent of the total area (1.7 million acres); followed by natural areas including wetlands, upland forests, and water bodies (35.7 percent or 1.2 million acres); and urban areas (11.9 percent or ~410,000 acres), the majority of which lie within the Upper Kissimmee and Lake Istokpoga sub-watersheds (**Figure 1-2** and **Table 1-1**). Agricultural land uses can be further classified as improved pasture (19.7 percent) for beef cattle grazing and unimproved pasture/rangeland (9.4 percent) north of the lake; sugarcane production (11.6 percent) south of the lake within the EAA; citrus groves (7.1 percent) located primarily within the eastern portion of the watershed and Lake Istokpoga basin; and sod farms, row crops, dairies, and "other areas" make up the remaining (3.4 percent) of land uses within the watershed. NO BMPS ENFORCED Although dairy farms in the northern basins cover less than one percent of the land use area, they represent a considerable source of phosphorus to some tributaries and up to 5 percent of the total external loading to the lake (Bottcher 2006). AGRICULTURE IS 80% OF LAND USE AROUND NORTH OF LAKE OKEECHOBEE

The SFWMD uses the Florida Land Use, Cover, and Forms Classification System (FLUCCS) to define land use types. The SFWMD's minimum mapping unit standards for land cover and land use are 5 acres for upland and 2 acres for wetlands. For example, a wetland area less than 2 acres located within pastures will not be counted as wetland and will be included in the pasture total. The 2006 land use data were updated in 2008 as part of the Watershed Assessment Model enhancement project and minor revisions were made, such as the addition of "abandoned dairies" and fixing problems with low density residential in the S-133 basin. These updates are reflected in **Table 1-1**. DAIRIES STILL OPERATE IN THE OKEECHOBEE WATER BASINS DAIRIES ARE A PROBLEM EVEN NOW 2010 CATTLE ORANGE GROVE, SOD, TREE NURSERYS ARE STILL A WATER PROBLEM OKEECHOBEE WATER BASIN 2010 STATE AGENCYS SFWMD-(FDACS)-(FDEP) ARE STILL A WATER PROBLEM HERE OKEECHOBEE WATER BASIN.

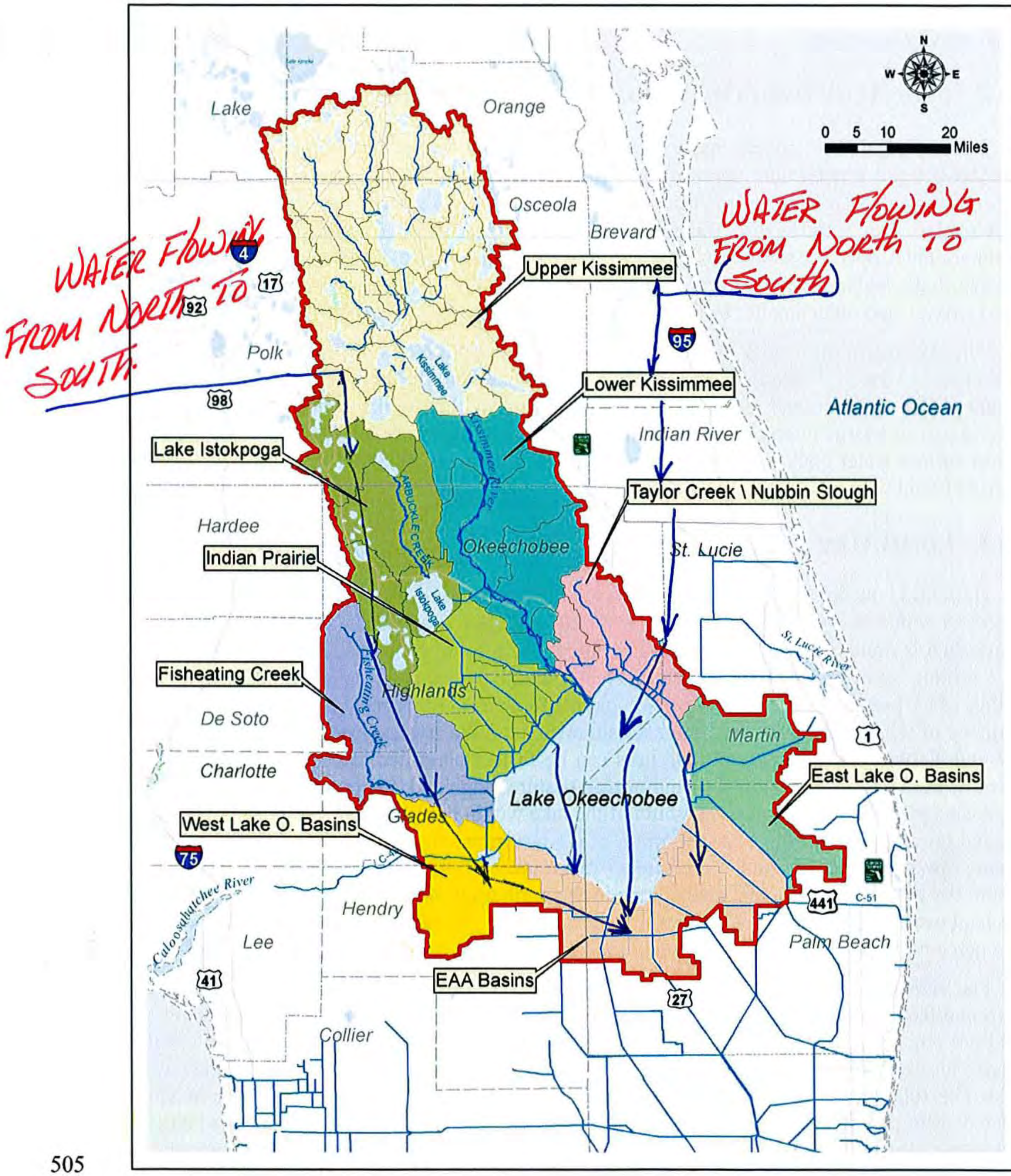
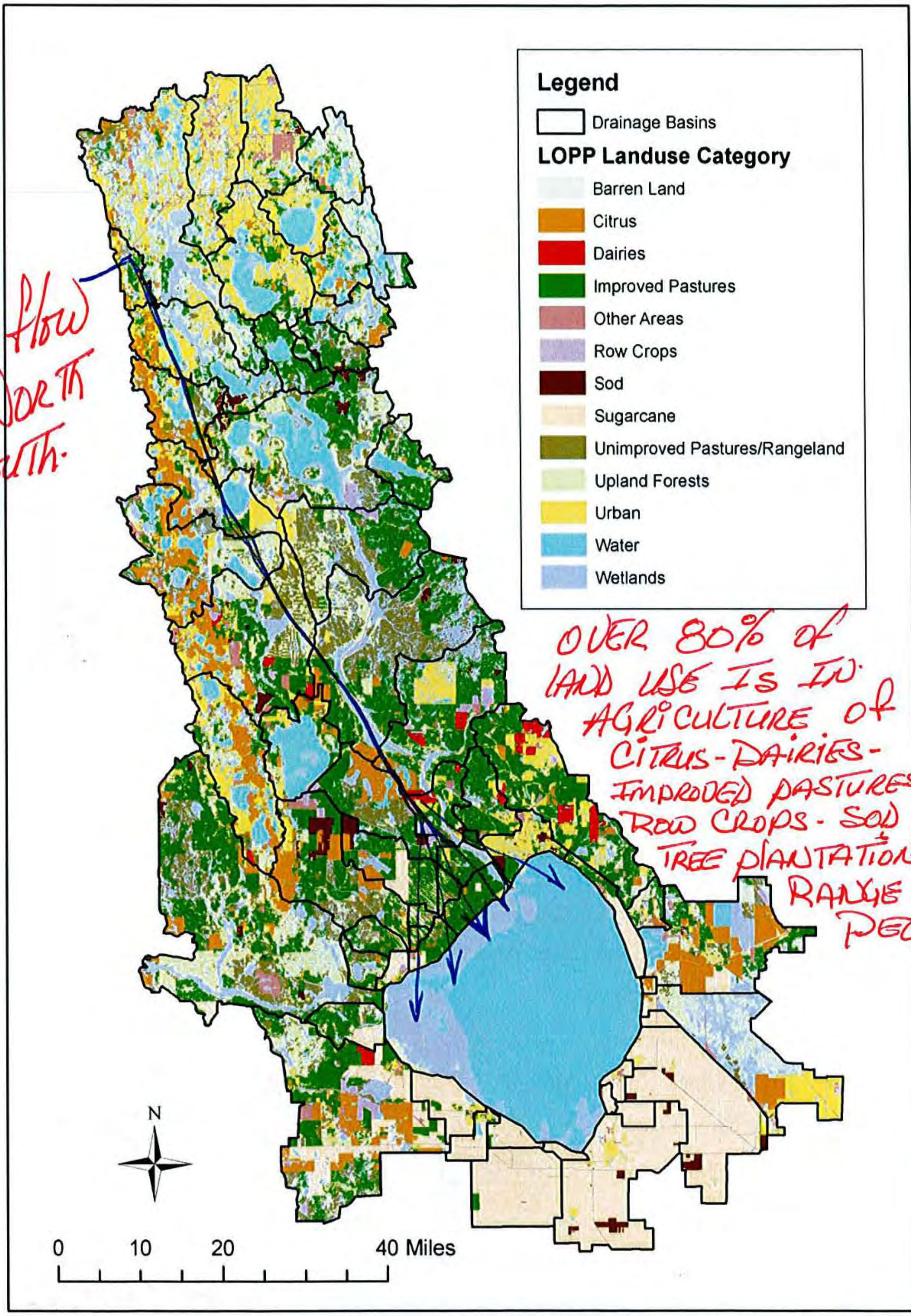


Figure 1-1. Lake Okeechobee Protection Plan boundaries and sub-watersheds.



507 **Figure 1-2.** Land use distribution in the Lake Okeechobee Watershed (2006).

Table 1-1. Land use data for the Lake Okeechobee Protection Plan area.

Land Use	Area (acres) 2008	Percent
Barren Land	41,318	1.2%
Citrus	245,790	7.1%
Dairies	23,361	0.7%
Improved Pastures	676,991	19.7%
Other Areas	30,935	0.9%
Row Crops	23,238	0.7%
Sod	38,425	1.1%
Sugarcane	399,213	11.6%
Unimproved Pastures/ Rangeland	325,064	9.4%
Upland Forests	392,200	11.4%
Urban	410,397	11.9%
Water Bodies	220,127	6.4%
Wetlands	615,081	17.9%
LOPP Total Acreage	**3,442,141**	**100.0%**

PROBLEMS FOR WATER FLOWING TO THE LAKE OKEECHOBEE

1.4 Lake Okeechobee Sub-Watersheds

The Lake Okeechobee Watershed consists of four distinct tributary systems: the Kissimmee River Valley, Lake Istokpoga–Indian Prairie/Harney Pond, Fisheating Creek, and Taylor Creek/Nubbin Slough. With the exception of Fisheating Creek, all major inflows to Lake Okeechobee are controlled by gravity-fed or pump-driven water control structures. These four major tributary systems are generally bounded by the drainage divides of the major water bodies and are further divisible into smaller sub-watersheds based on the hydrology and geography shown in **Figure 1-3**. MAN MADE WATER PROBLEMS HERE

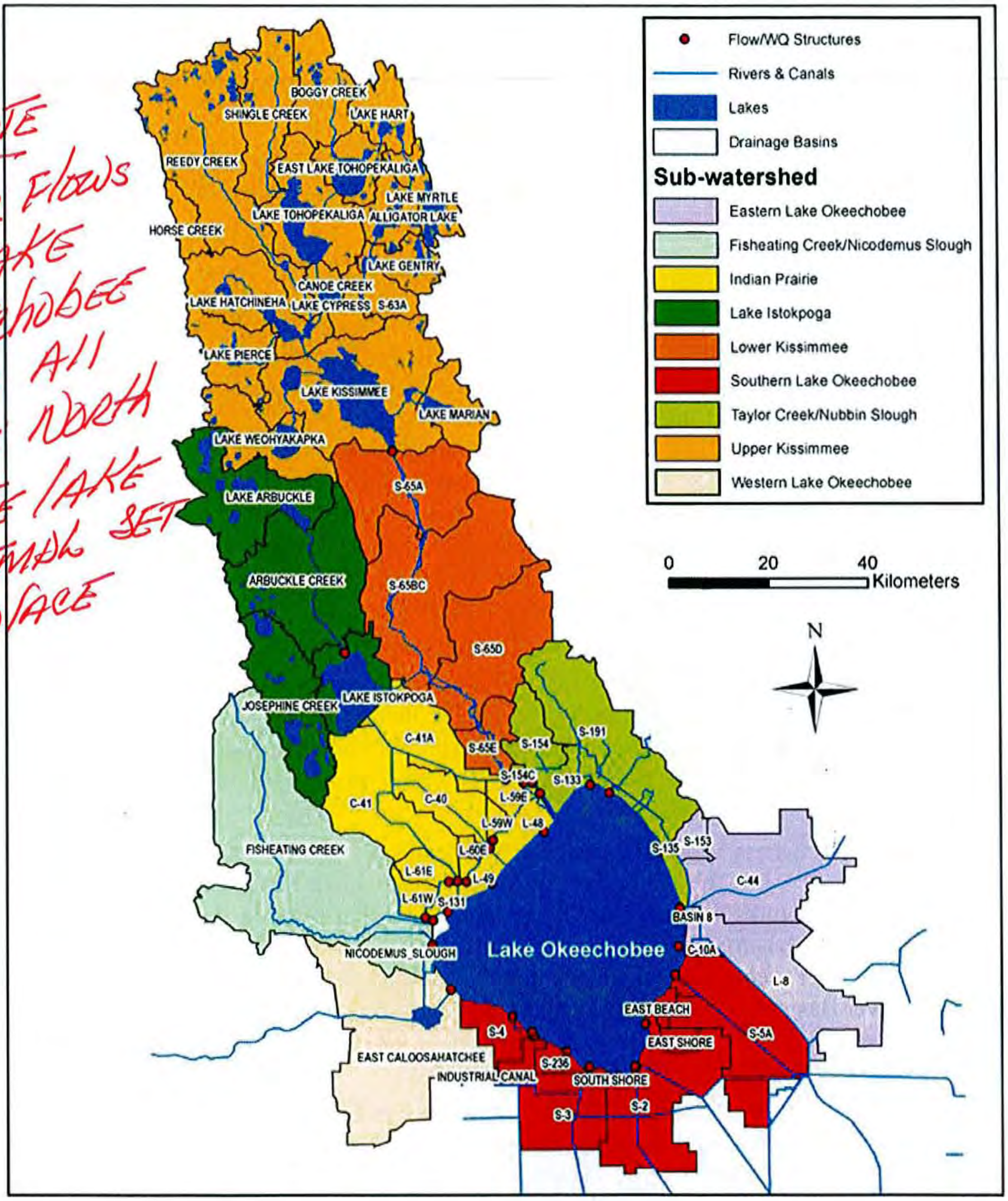
The nine sub-watersheds of the Lake Okeechobee Watershed are:

- Upper Kissimmee
- Lower Kissimmee
- Taylor Creek/Nubbin Slough
- Lake Istokpoga
- Indian Prairie
- Fisheating Creek
- Eastern Lake Okeechobee (C-44/L-8 Basin)
- Western Lake Okeechobee (C-43 Basin)
- Southern Lake Okeechobee (includes EAA and Chapter 298 Districts)

NONE OF THESE NINE AREAS HAVE (TMDLS SET) OR HAVE (40E-61) OR (CLEAN-WATER ACT) USED NO SWIM- NO LOPP CONTROLS SET TO CLEAN-WATER QUALITY FLOWS TO LAKE OKEECHOBEE EVEN NOW 2010 YEAR. ONLY TALK NO ACTION TAKEN

BY ANY STATE AGENCYS (SFWMD)(FDEP) OR (FDACS) ONLY FEDERAL ACTION DONE 2010

Each of these sub-watersheds is further divisible into basins based on hydrologic and/or geographic divides. The entire Lake Okeechobee Watershed can be divided into 61 such drainage basins, each draining downhill into a body of water, such as a river or lake.



NOTE
WATER FLOWS
TO LAKE
OKEECHOBEE
FROM ALL
AREAS NORTH
OF THE LAKE
NO TMDL SET
IN PLACE

Figure 1-3. The Lake Okeechobee Watershed detailing sub-watershed and structure locations.

NOTE WATER PROBLEMS ARE MAN-MADE AND MAN MUST ADJUST

HOLDING PONDS SHOULD COME INTO PLAY ALSO STAS

The Upper Kissimmee, Lower Kissimmee, Taylor Creek/Nubbin Slough, Lake Istokpoga, Indian Prairie, and Fisheating Creek sub-watersheds primarily drain into Lake Okeechobee by gravity. The S-133 basin (part of the Taylor Creek/Nubbin Slough Sub-watershed) and other urban areas can also pump into the lake from the north when the lake stage is high. The East and West Lake Okeechobee sub-watersheds contribute flow by gravity, but only when Lake Okeechobee water levels are below 14.5 ft and 11.5 ft in relation to the National Geodetic Vertical Datum of 1929 (NGVD), respectively. When high lake stages make gravity flows impossible, urban areas north of the lake are drained via pumps. THIS IS A NO-NO

The South Lake Okeechobee Sub-watershed, which includes a portion of the EAA, contributes flow through pumping into the lake for flood control purposes under certain specific circumstances. THIS ALSO IS A NO-NO BACK PUMPING INTO LAKE OKEECHOBEE

Upper and Lower Kissimmee Sub-Watersheds

The Upper and Lower Kissimmee sub-watersheds comprise the Kissimmee River Basin, which includes most of the areas that drain into Lake Okeechobee from the north and northwest through the Kissimmee River (C-38 canal). The Upper Kissimmee Sub-watershed covers approximately 1,633 mi^2 and includes Lake Kissimmee and the Chain of Lakes area in Orange and Osceola counties. The 758 mi^2 Lower Kissimmee Sub-watershed includes the tributary watersheds of the Kissimmee River that lie between the Lake Kissimmee outlet and the Kissimmee River inlet to Lake Okeechobee. The Kissimmee River Basin contributes the largest surface inflow to Lake Okeechobee. According to data from the baseline period of record (1991–2005), the Kissimmee River accounted for approximately 50 percent of the total inflow and 30 percent of TP loads to Lake Okeechobee (see Section 3).

The S-65 sub-basins (S-65A, S-65BC, S-65D, and S-65E) are located along the length of the C-38 canal and form four pools (**Figure 1-3**). Structure S-65B was removed as a part of the first phase of Kissimmee River Restoration Project and reduced the number of pools from five to four. The final phase of the restoration project (scheduled to be completed in 2012) will include removal of S-65C to form pool S-65BCD. Water levels in each of the pools are regulated according to interim regulation schedules. THIS IS A GOOD THING

Monitoring stations are located at each S-65 structure (at the downstream boundary of each sub-basin) and at station S-65, which is at the outlet from Lake Kissimmee to the Kissimmee River. The S-65 structures are gated spillways and locks that provide flood protection within their respective sub-basins and upstream basins. Each structure provides a minimum of 3,000 cubic feet per second (cfs) flow-through capacity for flood control in the Upper Kissimmee River Basin, irrespective of local runoff conditions. RUN-OFF MUST MEET TMDL'S BEFORE RUN-OFF CAN GO TO STRUCTURE

Taylor Creek/Nubbin Slough Sub-Watershed

The Taylor Creek Sub-watershed (104 mi^2) and Nubbin Slough Sub-watershed (84 mi^2) are interconnected and drain into Lake Okeechobee from the north and northeast. The Nubbin Slough Sub-watershed includes three tributaries: Lettuce Creek, Henry Creek, and Mosquito Creek, which along with Nubbin Slough are intercepted by canals (L-63, L-64, and C-59) and enter Lake Okeechobee through flow-control structure S-191. The unmonitored boat locks at S-193 are used for gravity flows into and out of the lake. The lower reaches of Taylor Creek, downstream of S-192, flow into the lake through structure S-193. Additional flow into the lake is provided by the S-133 pump station, which is primarily operated for flood protection.

THIS WHOLE AREA IS A PHOSPHORUS PROBLEM AREA'S ALL RELEASES SHOULD MEET TMDL BEFORE ANY RELEASE FROM STRUCTURES HERE

Lake Istokpoga Sub-Watershed

The 613 mi^2 Lake Istokpoga Sub-watershed is located to the west and north (upstream) of Lake Istokpoga and is largely characterized by natural lands. It is the source of all inflows to Lake Istokpoga. The primary outlet from Lake Istokpoga is through the S-68 structure, which releases water through a series of canals southeastward to both Lake Okeechobee and the Kissimmee River. RELEASED WATER FROM THIS STRUCTURE MUST MEET CLEAN-WATER ACT ALSO MUST MEET TMDL FOR RELEASE

Indian Prairie Sub-Watershed

The 622 mi^2 Indian Prairie Sub-watershed drains the area between Lake Istokpoga and Lake Okeechobee. It includes the C-41, C-40, S-84, L-49, L-59, and S-131 sub-basins. THIS WHOLE AREA IS A REAL PROBLEM FOR THE HEALTH OF LAKE OKEE.

Fisheating Creek Sub-Watershed

The Fisheating Creek Sub-watershed drains into Lake Okeechobee from the west and is the only sub-watershed with an uncontrolled "natural" discharge. It covers approximately 440 mi^2 and originates in western Highlands County and flows south through a large cypress swamp into Glades County with an average gradient of 0.5 feet per mile. From central Glades County, water leaves the creek channel and flows east through Cowbone Marsh into Lake Okeechobee. Levees have been constructed roughly parallel to the creek near its outlet to the lake. THIS IS AN AREA THAT ALSO IS A BIG PROBLEM AREA. "UNCONTROLLED"

Southern Lake Okeechobee Sub-Watershed

As shown in **Figure 1-1**, the northern portion of the Everglades Agricultural Area is included in the Lake Okeechobee Watershed because this area can potentially contribute flows to the lake through pumping. This sub-watershed includes portions of the EAA and several Chapter 298 districts (named for Chapter 298, F.S., which established them), including the S-2, S-3, S-6, S-5A, S-236, South Shore, 715 Farms, East Beach, East Shore, and Culvert 10A sub-basins. A 2007 Lake Okeechobee Operating Permit allows the District to pump waters into the lake at S-2 and S-3 for flood control purposes when EAA Canal stages reach 12.5 ft NGVD. Historically, these urban areas adjacent to lake have relied on S-2 and S-3 to provide flood protection by pumping into the lake. Under normal circumstances, the majority of runoff from the EAA is discharged into the Water Conservation Areas. In addition, the S-4 structure discharges for flood control purposes to Lake Okeechobee because no alternative discharge is available.

NO BACK PUMPING INTO LAKE OKEE

East and West Lake Okeechobee Sub-Watersheds

The East Lake Okeechobee Sub-watershed (S-153, C-44, and L-8 basins and Basin 8) is primarily farmed for sugarcane. The West Lake Okeechobee Sub-watershed includes the East Caloosahatchee basin. NO CONTROL OF (TMDL) HERE AT ALL POOR WATER MANAGEMENT IN THIS WHOLE AREA PEOPLE

NOTE- THE STATE OF FLORIDA HAS NEVER
SINCE 1989 THAT I KNOW OF.
ENFORCED ANY RULES OR REGULATION
TO REDUCTION OF POLLUTANT LOADING TO
ANY AREA OF STATE WATER QUALITY
Robert M Norton
ECOSYSTEM WATCH
LAKE OKEECHOBEE.

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SECTION 2: OVERVIEW OF LAKE OKEECHOBEE WATERSHED PROTECTION PROGRAMS

The Lake Okeechobee Protection Act (LOPA)(Section 373.4595, Florida Statutes [F.S.]) was passed in 2000 by the Florida legislature to establish a restoration and protection program for the lake. This program addresses the reduction of total phosphorus (TP) loading to the lake from both internal and external sources. In 2007, the legislature amended the LOPA to also include protection of the Caloosahatchee River and St. Lucie River watersheds. Section 373.4595, F.S., which is now known as the Northern Everglades and Estuaries Protection Program (NEEPP), promotes a comprehensive, interconnected watershed approach to protecting these water bodies (SFWMD et al. 2008). The NEEPP includes the Lake Okeechobee Protection Plan (LOPP), now incorporated into the Lake Okeechobee Watershed Protection Program (LOWPP), and the Caloosahatchee and St. Lucie River Watershed Protection Plans completed in January 2009. The relationship among the NEEPP, the LOWPP, the Caloosahatchee and St. Lucie River Watershed Protection Programs, and their associated elements and projects is illustrated in **Figure 2-1**.

These programs address the reduction of pollutant loadings, restoration of natural hydrology, and compliance with applicable state water quality standards. Three coordinating agencies, the South Florida Water Management District (SFWMD or District), the Florida Department of Environmental Protection (FDEP), and the Florida Department of Agriculture and Consumer Services (FDACS), are charged with carrying out the protection program.

The LOWPP includes the following seven key elements:

- Lake Okeechobee Protection Plan
- Lake Okeechobee Watershed Construction Project (Phase I and Phase II)
- Lake Okeechobee Watershed Phosphorus Control Program
- Lake Okeechobee Watershed Research and Water Quality Monitoring Program
- Lake Okeechobee Exotic Species Control Program
- Lake Okeechobee Internal Phosphorus Management Program
- Progress reports published annually in the *South Florida Environmental Report*

NOTE - THESE THREE AGENCYS (SFWMD - FDEP - FDACS) HAVE NEVER DONE A THING SINCE 1989 TO 2010 SO FAR. ON ANY PROTECTIONS PROGRAMS THAT I KNOW OF THESE THREE AGENCYS DO NOT ENFORCE ANY THING AGRICULTURE, THE RANCHERS OWN THESE PEOPLE HERE I OKEECHOBEE COUNTY. Conflict of INTREST HERE

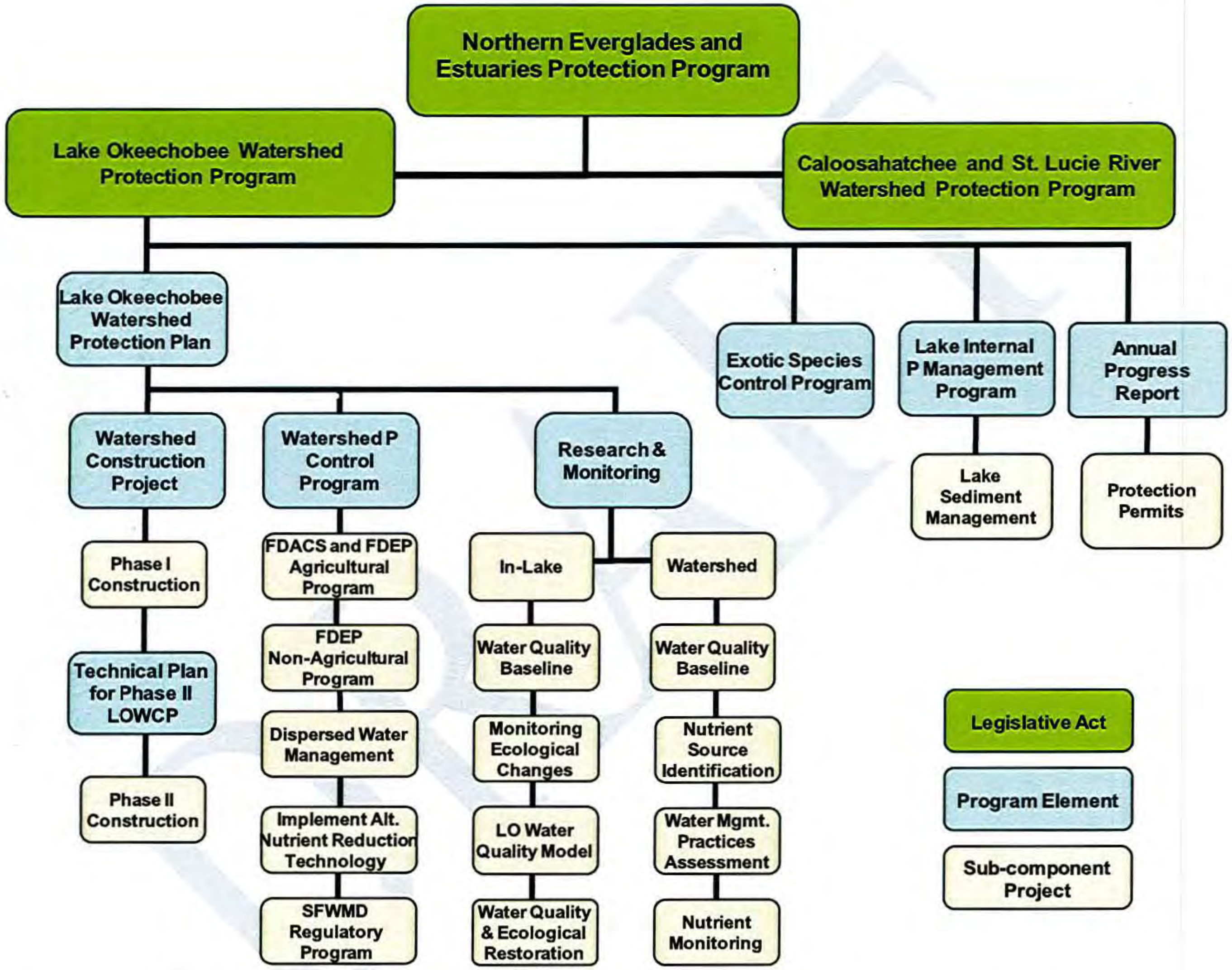

Figure 2-1. The Northern Everglades and Estuaries Protection Program structure, detailing the Lake Okeechobee Watershed Protection Program, its elements, and projects (P: phosphorus; LOWCP: Lake Okeechobee Watershed Construction Project; LO: Lake Okeechobee).

include a formal Lake Okeechobee Protection Plan (LOPP). The LOPP identifies alternative plans, schedules and costs to meet the established TP TMDL for Lake Okeechobee (LOPP, 2004). The TMDLs contained in this report are consistent with the LOPP and, therefore, the established Lake Okeechobee TP TMDL.

The original LOPP Project Area was composed of thirty-four basins that define the Lake Okeechobee watershed. The basins are essentially the same as the basins used in the Surface Water Improvement and Management Plan (SWIM) developed by the [SFWMD]. In 2005, the project boundaries were extended to the north to include the Upper Kissimmee River basin. The approximate project boundaries are shown in Figure 1. Often more than one WBID will be contained within an LOPP basin. The location of the original basins relative to the impaired WBIDs is shown in Figure 2. A listing of impaired WBIDs within each LOPP basin and the percent of area these WBIDs encompass is provided in Table 2.

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TP loads allocated in the LOPP to the basins are summarized in Table 3. The column, "Target Based on Load," depicts the loads necessary to achieve the Lake Okeechobee TMDL. The column, "Target Concentration Based on Load," represents the annual average TP concentration corresponding to the load required at the pour point of each basin to comply with the LOPP.

A comparison of LOPP loads and WBID loads is provided in Table 4. WBID loads are based on a TP concentration of 113 ug/L. This table also identifies some of the control strategies planned for the various LOPP basins (FDEP et. al., 2008). A complete listing of the control strategies planned for the various basins can be found in FDEP's Lake Okeechobee Watershed Construction Plan (FDEP et. al., 2008). In cases where the loads required by the TMDL for the WBIDs are less than the LOPP load, additional BMPs should be implemented. WBID loads in Table 4 are based on estimated flows as derived in Section 7 of this report. This table indicates that to achieve the LOPP loads, flows may need to be reduced below existing conditions or TP concentrations may need to be reduced below the target, or a combination of both.

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Table 2. Comparison of LOPP Basins and Impaired WBIDs

LOPP Basin	LOPP Basin Area (acres)	Impaired WBIDs	Impaired WBID Area (percentage)	
C-40 Basin #1	43,964	3206	100%	INDIAN PRAIRIE CANAL
C-41 Basin #2	94,928	3204	100%	HARNEY POND CANAL
L-59E #3	14,409	3209	100%	KISSIMMEE RIVER
Taylor Creek/Nubbin Slough #4	120,754	3205, 3205D, 3203A, 3203B, 3213A,	99%	TAYLOR CREEK - OTTER CREEK - NUBBIN SLOUGH - MOSQUITO CREEK - LETTUCE CREEK

#1 PLANNING UNIT NORTH WEST LAKE OKEECHOBEE
#2 " " " " " "
#3 " " LOWER KISSIMMEE
#4 " " TOL-63 COMPLEX 3205
" " TOL-63 COMPLEX 3205D
" " NHLMS COMPLEX 3203A
" " NHLMS COMPLEX 3203B
" " NHLMS COMPLEX 3213A

PLEASE SOME ONE with 1/2 OF A BRAIN ANSWER MY REQUEST

LOPP Basin	LOPP Basin Area (acres)	Impaired WBIDs	Impaired WBID Area (percentage)
		3213B, 3213D	
S-135 Basin	25,408	3213C	75%
S-154 Basin	24,630	3199B	38%
S-65 A, B, C, D, E	427,913	3188, 3188A, 3186B, 3186C, 3186D, 3192C	53%
S-65	1,021,674	1436	0.3%
S-2	31,399	3248, 3248A	100%
S-3	9794	3251	100%
S-4	29,164	3246	100%

Note: Impaired WBIDs listed for S-65 basin are Group 4 WBIDs in the Consent Decree schedule.

Comprehensive Everglades Restoration Plan (CERP):

The Comprehensive Everglades Restoration Plan (CERP) provides a framework and guide to restore the south Florida ecosystem including the Everglades. The conceptual plan for the Lake Okeechobee watershed consists of construction of stormwater treatment areas (STAs) and reservoirs; restoration of wetlands; and removal of phosphorus-laden sediment from tributaries. The Taylor Creek/Nubbin Slough (WBIDs 3505 and 3203A) Reservoir-assisted Stormwater Treatment Area (RASTA) is one of ten initially authorized projects. The SFWMD purchased pastureland located adjacent to Taylor Creek and converted the land to a reservoir suitable for storage and water quality treatment. The Taylor Creek RASTA is estimated to remove about 3 to 5 Mtons of phosphorus each year. The Nubbin Slough STA is constructed wetlands for treating stormwater runoff before it enters Lake Okeechobee. The STA is estimated to remove about 22 to 24 Mtons of phosphorus per year. Other phosphorus reduction projects are planned for the watershed and should result in improved water quality in both the impaired waterbodies and Lake Okeechobee.

ERROR WBID 3205 "NOT 3505"

ONLY GUESSING HERE WILL IT REMOVE

Florida Geological Study:

Howard T. Odum investigated phosphorus levels in Florida streams in the 1950's as part of a Florida Geological Survey study (Odum, 1953). This was one of the first studies in Florida on the behavior of phosphorus in water and the impact it has on aquatic growth. Water samples were collected

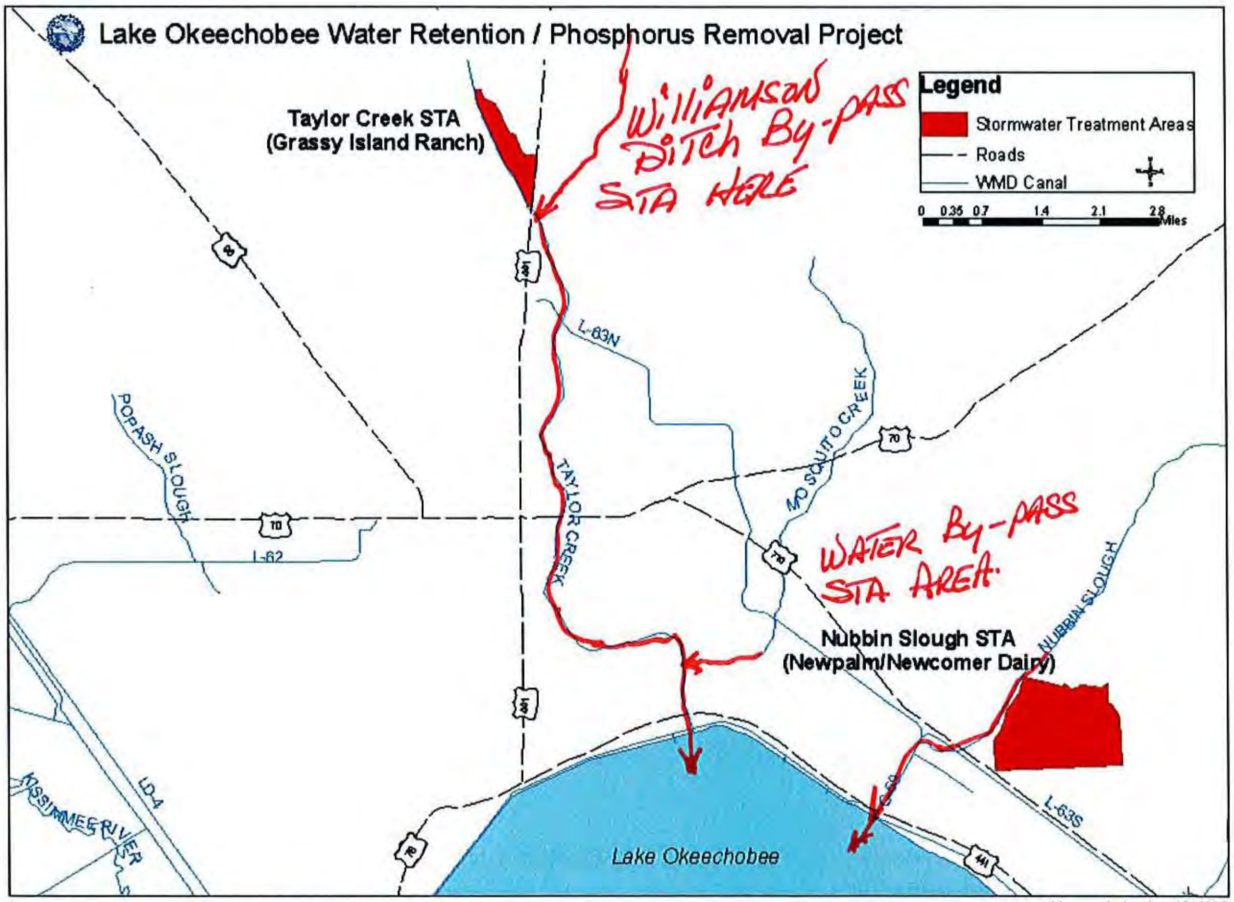
NOTE - HERE WE HAVE A WORD (ESTIMATED) ONLY GUESSING NO PROVEN FACT. (SFWMD) (FDEP) (FDACS) HOPEING FOR SOMETHING TO WORK TO SAVE THEM BY 2015 MAN-DATE TMDL 140 MT - HOPPB TO LAKE OKEECHOBEE

Other Unintended Impacts:

e.g.	+1	-removal of P
	-1	-removal of P but introduction of N or other
	+1	-treatment for P and also for N
	-1	-berm and unintended flooding outside of project area
	N/A	-not applicable

Contact Information: Odi Villapando (rvillap@yahoo.com), SFWMD, (561) 682-2936

Location of the Taylor Creek STA.



NOTE- PAGE # 13 - ITEM 673-674 AREA IT SEEMS THAT STA HAS A FAILURE OF COLVERT AT THE OUTFLOW. STRUCTURE. ALSO ABOVE YOU SEE WHERE RANCH AND URBAN POLLUTED WATER BY PASSES. STA AREAS. MANAGEMENT FOR (SFWMD) (FDEP)-(FDACS) DO NOT SEE THIS. (COME ON MAN)

12

2011 LOPP Update – Management Measure (Update)

Project: Nubbin Slough Stormwater Treatment Area (STA) Critical Project

Description: This project involves the design, construction and operation of a stormwater treatment area located on District owned lands at the New Palm Dairy site along the banks of Nubbin Slough. The purpose of the project is to capture and attenuate peak flows from portions of the Lake Okeechobee watershed and to improve water quality. This project is part of the Lake Okeechobee Critical Restoration Project which was authorized through the federal Water Resources Development Act of 1996. The United States Army Corps of Engineers (the Corps) was responsible for the design and construction of the Stormwater Treatment Areas and the South Florida Water Management District (SFWMD) is responsible for operations and maintenance.

Purpose: The purpose of this project is to retain stormwater runoff and to reduce phosphorus from the Nubbin Slough drainage basin.

Location/Size/Capacity (provide the shp files if available): The Nubbin Slough STA is the larger of the two pilot STAs designed and constructed by the Corps. It is located approximately 6.5 miles southeast of the city of Okeechobee, adjacent to Nubbin Slough, immediately north of State Road 710 and just east of the bridge that spans Nubbin Slough (see figure). This two-celled STA is approximately 809 acres with an effective treatment area of 773 acres. The projected long-term average P reduction within the STA was estimated at over five metric tons per year or about 85% of the P load of Nubbin Slough at the project location.

Initiative Status: Scheduled to go into full operation in August 2010.

Cost:

Activity	Start (Year)	Finish (Year)	Cost
PED			
Construction			$9,172,697*
S&A			
O&M (Annual Cost)	2011	2015	$418,647

*Nubbin Slough STA was fully constructed in September 2006.

Documentation: Lake Okeechobee Water Retention/Phosphorus Removal Project Design Documentation Report Final Submittal, June 2003.

Drainage Area (acres that will be treated):

Location and Configuration (Layout including spatial positioning and configuration):

GIS data:

Available ☐Yes ☐No

Stage-Storage Relationship (or Stage-Area Relationship):

2.1 Lake Okeechobee Protection Plan

(DBAT) BMPS) ARE VOLUNTARY NOT ENFORCED

The LOPP was delivered to the legislature in 2004 and an update was submitted in February 2007. The LOPP contains an integrated management strategy that is based on implementation of phosphorus source control programs including Best Management Practices (BMPs) at parcel, sub-basin and regional levels, flow attenuation projects, and in-lake remediation activities. The LOPP also contains elements of exotic species control and research and water quality monitoring. Since the LOPA was enacted, the coordinating agencies have collectively implemented a large number of TP load reduction projects in the Lake Okeechobee Watershed. These include phosphorus source control grants for agricultural landowners, Dairy Best Available Technology (DBAT) pilot projects, soil amendment projects, isolated wetland restoration projects, remediation of former dairies, and regional public/private partnerships. A comprehensive Lake Okeechobee monitoring program has also been initiated that regularly monitors water quality and ecological indicators in the lake. Research and model applications have been instituted that continue to provide predictive understanding necessary to evaluate the effectiveness of water management alternatives. ENFORCEMENT ACTION MUST BE DONE TO BE EFFECTIVE IN OKEECHOBEE WATER BASINS.

2.2 Lake Okeechobee Watershed Construction Project

2.2.1 Phase I

The Lake Okeechobee Watershed Construction Project (LOWCP) is being implemented in two phases. Phase I was intended to bring immediate TP load reductions to the lake. The project features are designed to improve hydrology and water quality of Lake Okeechobee and downstream receiving waters, consistent with recommendations included in the South Florida Ecosystem Restoration Working Group's Lake Okeechobee Action Plan (Harvey and Havens 1999). Phase I included projects identified as the Lake Okeechobee Water Retention Phosphorus Removal Critical Project that was authorized in the Water Resources Development Act of 1996.

Phase I projects within the Taylor Creek and Nubbin Slough basins included two pilot stormwater treatment areas (STAs) and a sediment removal pilot project. The sediment removal pilot project was completed in 2004; however, no significant removal of particulate phosphorus was observed. The STAs at Taylor Creek and Nubbin Slough, areas of water quality concern for nutrients in the Lake Okeechobee Watershed, are fully constructed. The Taylor Creek STA was fully operational from June 26, 2008, to February 24, 2009, when pumping and discharge activities were suspended after a failure of the culvert at the outflow structure was detected. Culvert repairs were completed and flow through operations began in September 2010. The Nubbin Slough STA is fully constructed; however, initiation of operations has been delayed pending repairs to the pump station, which were completed and tested in June 2010. Details on the status of the Taylor Creek and Nubbin Slough STAs can be found in Section 5.2, whereas ongoing challenges with operations and other issues are described in Section 4.

NOTE - STA PROBLEMS ARE DUE TO POOR-POOR WATER MANAGEMENT PEOPLE HERE. THE TAYLOR CREEK STA HAS TO MANY BY-PASS CANALS AND DITCHES TO BE EFFECTIVE. ALSO ONGOING PROBLEMS TO WORK WELL.

2.2.2 Phase II Technical Plan

NOTE BMPS AND DBATS ARE VOLUNTARY AND DO NOT WORK

The NEEPP required the development of the LOWCP – Phase II Technical Plan (P2TP). The P2TP was developed by the SFWMD in coordination with the FDEP and the FDACS with extensive input from stakeholders and was submitted to the Florida legislature on February 1, 2008 (SFWMD et al. 2008). To achieve the restoration goals outlined in the NEEPP, the coordinating agencies evaluated various alternatives using the best available technology and scientific information including significant public involvement and review. The resulting plan identifies construction projects and on-site measures that prevent or reduce pollution at the source, such as agricultural or urban BMPs, needed to achieve the total maximum daily load (TMDL) target established for Lake Okeechobee. The P2TP also includes projects for increasing water storage north of the lake to achieve healthier water levels and reduce harmful discharges to the Caloosahatchee and St. Lucie estuaries. Components of the P2TP include:

MUST SEE TO BELIVE

- Implementing BMPs on more than 1.7 million acres of farm and urban lands
- Adopting new regulations that will reduce the impacts of development on water quality and flow

MUST SEE TO BELIVE

- Building treatment wetlands to clean water flowing into the lake
- Using other nutrient control technologies to reduce phosphorus loads from the watershed
- Creating between 900,000 and 1.3 million acre-feet of water storage north of the lake through a combination of aboveground reservoirs, underground storage, and alternative water storage projects on public, private, and tribal lands

Since the delivery of the P2TP to the Florida legislature in February 2008, numerous projects and engineering components have begun. Section 5 provides more details on the results and status of these projects.

2.3 Lake Okeechobee Watershed Phosphorus Control Program

The Lake Okeechobee Watershed Phosphorus Control Program consists of a multifaceted approach that includes (1) continued implementation of existing regulations and voluntary agricultural and non-agricultural BMPs, (2) development and implementation of improved BMPs, (3) improvement and restoration of the hydrologic functions of natural and managed systems, and (4) utilization of alternative technologies for nutrient reduction. The SFWMD, FDEP, and FDACS entered into a memorandum of agreement in 2001, which was subsequently amended in 2002, that addresses how this program is implemented and coordinated with existing regulatory programs, including the SFWMD Works of the District Permitting Programs (Chapters 40E-61 and 40E-63 Florida Administrative Code [F.A.C.]), the SFWMD Environmental Resource Permitting Program, the FDEP's Dairy Rule (Rule 62-670.500, F.A.C.), and the Everglades Forever Act (Section 373.4592[4], F.S.).

Under the NEEPP, each coordinating agency is responsible for certain program aspects. The FDACS is charged with implementing an incentive-based BMP program on all agricultural lands within the Lake Okeechobee Watershed. The FDEP is responsible for developing non-

FDACS - IS A PROBLEM AGENCY TO MUCH AGRICULTURE CONFLICT OF INTREST HERE PEOPLE ALSO VERY - VERY POOR MANAGEMENT PEOPLE LOCAL HERE

FDEP → BMPS ARE A VOLUNTARY SYSTEM DO NOT WORK

agricultural, nonpoint-source BMPs. The SFWMD is responsible for the implementation of phosphorus reduction projects including sub-regional and large-scale regional projects, and for enforcement of existing regulatory source control programs. An overview of the various watershed phosphorus control programs that have been established within the Lake Okeechobee Watershed is provided in Section 5.1. SFWMD PHOSPHORUS REDUCTION IS ALSO NOT WORKING PEOPLE IN CONFLICK HERE LOCAL

2.3.1 FDACS Agricultural Programs

Pursuant to the NEEPP, the FDACS has adopted into Florida's Administrative Code a comprehensive BMP program that requires agricultural producers in the Lake Okeechobee Watershed to implement nutrient management and other applicable BMPs to address identified environmental resource challenges on their lands. The FDACS-adopted BMP programs cover citrus, beef cattle operations, containerized nurseries, sod, and vegetable and agronomic crop production. More details concerning the status of the FDACS Agriculture BMP Program are presented in Section 5.1.2. CONFLICK OF INTREST BY PEOPLE WHO RUN THIS AGENCY ALL ARE AGRICULTURE PEOPLE

2.3.2 FDEP Agricultural Programs

The FDEP permits and inspects active dairies and other concentrated animal feeding operations (CAFOs) within the Lake Okeechobee Watershed pursuant to the National Pollutant Discharge Elimination System (NPDES) permit program under the Clean Water Act. CAFOs are facilities where large numbers of poultry, swine, cattle, or other livestock are confined within a much smaller area than traditional pasture operations. The FDEP currently permits 23 facilities in the Lake Okeechobee Watershed pursuant to Chapter 62-670, F.A.C. These permitted facilities are frequently inspected and farm managers are educated to prevent environmental impacts that could result from improper management of wastes. Manure and wastewater from these facilities have the potential to contribute pollutants, including nitrogen, phosphorus, organic matter, sediments, pathogens, heavy metals, and hormones, to the environment. The dairies permitted in the Lake Okeechobee Watershed reuse their wastewater to fertilize crops and avoid off-site discharges. CONFLICK OF INTREST BY CONTROLING PEOPLE

Domestic wastewater residuals, also known as sewage sludge or biosolids, are the solids from municipal wastewater treatment facilities. If properly treated, biosolids may be beneficially used as a soil amendment or fertilizer. About 60 percent of Florida's biosolids are land-applied as Class B biosolids, primarily through surface application to pastures. MUST STOP Class B biosolids are treated to reduce pathogens, but a number of site restrictions must be met to minimize potential human exposure while any remaining pathogens die off after application. In contrast, Class AA biosolids have been treated to eliminate pathogens and may be sold to farmers and the public. About 25 percent of Florida's biosolids are distributed and marketed as Class AA.

The spreading of Class B biosolids in the Lake Okeechobee, St. Lucie River, and Caloosahatchee River watersheds is anticipated to cease by the end of 2012 because of the difficulty with showing compliance with the nutrient balance demonstration required by Section 373.4595, F.S. Class AA biosolids distributed and marketed as a fertilizer product are currently exempted from the nutrient balance demonstration of the statute. Class AA biosolids are fertilizer products subject to FDACS fertilizer regulations. Regulations require residuals to be applied at an agronomic rate to minimize or prevent nitrogen leaching. Application rates are based on the

ALL OF CLASS B BIOSOLIDS MUST BE STOPPED IN THE LAKE OKEECHOBEE BASINS nutrient content of the residuals and the needs of the crops. Florida also requires phosphorus to be considered in certain geographic areas, including the Lake Okeechobee Watershed.

The FDEP adopted amendments to Chapter 62-640, F.A.C., which the Environmental Regulation Commission approved on May 20, 2010, to improve site accountability and management and to address public concerns. The new rule became effective on August 29, 2010. The revisions primarily added site permitting, nutrient management plans, and additional requirements for Class AA biosolids, in addition to revising other site requirements. For the Lake Okeechobee Watershed, where Class B is expected to cease in the next couple of years, the new Class AA provisions probably have more importance and are expected to help minimize the potential for indiscriminant dumping of Class AA biosolids, even if distributed and marketed as a fertilizer. WHAT DO YOU MEAN WHEN YOU SAY EXPECTED HOW ABOUT THE WORD ENFORCED TO CORRECT PROBLEMS.

2.3.3 FDEP Non-Agricultural Programs

The size of urban land that drains to Lake Okeechobee is minimal compared to agricultural lands. As a result, the percent of the total nutrient load flowing into Lake Okeechobee from urban areas is relatively small (12 percent) in comparison to agricultural lands (51 percent). However, the higher per-acre nutrient contribution from urban areas prompted the FDEP and stakeholders to continue their comprehensive approach to reducing nutrient loads flowing into Lake Okeechobee. The largest contributors of TP from non-agricultural areas to the lake are nonpoint sources, such as runoff from residential lawns that carries fertilizers, pet wastes, and effluent from septic tanks. A SMALL PROBLEM HERE 20% AGRICULTURE RUN OF 80% OF LAND USED

The FDEP uses regulatory and incentive methods to enhance and protect the Lake Okeechobee Watershed and provides grants for municipalities and others to construct projects that treat storm water before it enters surface waters. The two primary regulatory programs that address urban point-source stormwater and nonpoint-source inflows to Lake Okeechobee tributaries are the NPDES Stormwater Permitting Program and the Submerged Lands and Environmental Resources Program respectively. The FDEP also issues other permits for restoration activities in the Lake Okeechobee Watershed and NPDES permits for wastewater. In addition to permitting activities, the FDEP is responsible for numerous other programs and activities designed to improve water quality in the Lake Okeechobee Watershed and the rest of the state (e.g., rulemaking efforts pertaining to the statewide stormwater rule and numeric nutrient criteria). FDEP DOES NOT ENFORCE PERMITTED SITES

Another key responsibility of the FDEP is to administer the TMDL program for the U.S. Environmental Protection Agency (USEPA). The TMDL program is a surface water assessment and restoration program intended to bring all states' surface water bodies into compliance with respective water quality standards. Lake Okeechobee and its tributaries have TMDLs established for total phosphorus. Once a TMDL is established, a Basin Management Action Plan (BMAP) may be created to direct restoration efforts to meet the TMDL. BMAPs identify and describe various projects, programs, and activities (such as those mentioned in the previous paragraphs) planned to reduce pollutant loading, restore beneficial uses, and meet water quality standards. Currently, the Lake Okeechobee Protection Plan fulfills the role of a BMAP for Lake Okeechobee and its tributaries. FDEP HAS NEVER DO ANY TYPE OF ENFORCEMENT OF TMDL 140 MT - 40 APS TO LAKE OKEECHOBEE THAT I KNOW OF SINCE 1989 "COME ON MAN"

NOTE- WHY IS IT THAT THE USEPA DOES NOT HOLD OTHER AGENCYS RESPONSEABLE THAT DO NOT DO THEIR JOBS

Mr. Robert M. Norton
4200 US Highway 441 SE
Okeechobee, FL 34974

NOTE- ECOSYSTEM WATCH. BECAME EFFECTIVE 1989

2.3.4 SFWMD Source Control Programs

NOW HERE IN 2010 STILL NO CLEAN-UP DONE

The SFWMD Lake Okeechobee Watershed Regulatory Source Control Program began with the enactment of the Surface Water Improvement Management Act in 1987 (Section 373.4595, F.S.), which became the LOPA in 2000, and subsequently the NEEPP in 2007. The original act authorized the creation of the Lake Okeechobee Works of the District Program, which became effective in 1989. The LOPA established and the NEEPP (Section 373.4595, F.S.) now contains source control program requirements for the Lake Okeechobee Watershed, with specific and varying levels of responsibility accorded to the SFWMD, FDACS, and FDEP. The NEEPP specifies that the coordinating agencies operate in concert through an interagency agreement so that resources, responsibilities, and efforts can be properly coordinated and aligned. Source control planning for the Lake Okeechobee Watershed is incorporated into the P2TP (See Section 2.2.2). The update on the status of the Lake Okeechobee Watershed phosphorus source control programs identified in the P2TP is provided in Section 5.1. ALL THESE SECTIONS STILL SAME OLD PROBLEMS

The measures included in the source control programs are intended to: (1) minimize the amount of nutrients used on-site to the greatest extent possible, (2) ensure that when nutrients are applied that it is in an effective manner that minimizes nutrient discharge into local runoff, and (3) ensure that local runoff is detained on-site to minimize discharge of nutrients into the regional drainage system. The measures may take the form of structural or non-structural actions intended to minimize or eliminate nutrient impacts to receiving water bodies. Structural source control measures include creating physical changes in the landscape to reroute local discharges, erecting fences and barriers to prevent introduction of nutrients in runoff, and installing water control structures to detain runoff on-site as long as possible. Non-structural source control measures include education and operational changes. The measures are implemented and enforced through permit requirements under existing regulatory programs, such as the SFWMD Works of the District and Environmental Resource Permitting Programs. PERMITS ARE NOT ENFORCED HERE

The current objective of the Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program is to establish criteria that ensure that runoff to the tributaries and canals that discharge into Lake Okeechobee allow the District to meet the legislative policies established in Chapter 373, F.S. The District is updating the rule criteria to be compatible with current initiatives and amendments to the statute. Section 5.1.2.3 provides a more detailed summary of the District's Lake Okeechobee Watershed Regulatory Phosphorus Source Control Program.

THAT IS OUR PROBLEM PROGRAMS ARE NOT ENFORCED HERE

2.4 Lake Okeechobee Research and Water Quality Monitoring Program

A research and water quality monitoring program requires the District, in cooperation with other coordinating agencies, to: (1) collect data to establish long-term water-quality trends in the Lake Okeechobee Watershed, (2) develop a water quality model for the lake, (3) continue to identify and quantify phosphorus sources in the watershed, (4) assess water management practices within the watershed, (5) evaluate the feasibility of alternative nutrient removal technologies, and (6) assess the relationship between water volumes and timing from the Lake Okeechobee Watershed, water level changes in Lake Okeechobee, and the timing and volume of water delivered to the estuaries. CHANGES DUE TO C.O.E. SCHEDULES (ACE)

THE U.S. ARMY CONTROLS LAKE OKEECHOBEE NOT THE STATE OF FLORIDA

The District, in cooperation with FDACS, FDEP, University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS), and other agencies and interested parties, has been implementing a comprehensive research and assessment program for the Lake Okeechobee Watershed. Research and assessment projects are assessed and prioritized each year by the Northern Everglades Interagency Team, which expanded and includes participants from local governments in the Northern Everglades Planning Area, including the Upper Kissimmee Region and the Caloosahatchee and St. Lucie River watersheds. This team works to ensure that key issues and information needs are being addressed and it is an integral component of the overall restoration program. Research, demonstration, and assessment projects that are under way or have been completed since the previous update in 2007 are summarized in Section 5.3.

CONFLICK OF INTREST DONE BY AGRICULTURE PEOPLE HERE

2.5 Exotic Species Control Program

The Exotic Species Control Program is required to: (1) identify the exotic species that threaten native flora and fauna within the Lake Okeechobee Watershed, and (2) develop and implement measures to protect native species. The exotic plants and animals identified as threats to native species will require management of the existing invasion, or in the case of some animal species, monitoring of possible future invasions.

The species lists were compiled based on discussions of interagency staff and current management efforts within the watershed. Plants and animals will be added as new threats are discovered or as minor exotic species become more dominant. In addition, while other exotic species within the watershed threaten agriculture and warrant additional focus, the costs associated with the protection plan only attempt to address exotic species that pressure native flora and fauna.

The approach to implementation of the exotic species plan within the Lake Okeechobee Watershed has been and will continue to be through the cooperative efforts of state and federal agencies. In March 1989, a letter of operation procedures for aquatic management in Lake Okeechobee was signed by the U.S. Army Corps of Engineers (USACE), FDEP, Florida Fish and Wildlife Conservation Commission (FWC), and SFWMD to formalize the operational avenue through which the agencies advise and provide exotics treatment. This agreement stipulates bimonthly interagency meetings, chaired by the USACE, to visually inspect affected areas prior to potential treatment. Impacts on upcoming fishing tournaments and similar events are discussed and evaluated.

The program goal of each primary exotic plant species is maintenance control which is defined as "a method of managing exotic plants in which control techniques are utilized in a coordinated manner on a continuous basis in order to maintain a plant population at the lowest feasible level." Maintenance control results in the use of less herbicides, less organic deposition in aquatic environments, less overall environmental impacts from the weeds and their management, and reduced management costs (SFWMD 2002).

AGRICULTURE INTREST COME ON PEOPLE WE HAVE EVERYONE'S INTREST NOT JUST ONE GROUP
NOTE - Why NOT LET SOME PEOPLE NOT ON THE AGRICULTURE PAY-ROLL DO SOME OF THESE TEST AND BE NUTRAL RESULTS AND TRUE NUMBERS.

2.6 Internal Phosphorus Management Program

Phosphorus-rich sediments have been accumulating in Lake Okeechobee for many years. Currently, it is estimated that more than 300 square miles of lake bottom are covered by roughly 260 million cubic yards of mud sediments. This sediment will exchange phosphorus with the water column of the lake under certain circumstances. Therefore, there is a general scientific consensus that if internal phosphorus loading from these mud sediments is not addressed, the lake may not fully respond to reductions in external phosphorus loading that are expected to result from the numerous projects in the Lake Okeechobee Watershed under the NEEPP and other local efforts. THE WHAT IF POLICY IS NOT PROVEN FACT

The LOPA required a study to examine the engineering, ecological, and economic feasibility of removing or treating internal phosphorus loading. If treating this loading was determined to be feasible, the SFWMD would be positioned to pursue design, funding, and permitting of such a project. The feasibility study was completed in 2003 and determined that sediment removal would not be effective in reducing internal phosphorus loading. Also, there was no acceptance of the use of alum or any similar chemical treatment of lake sediments when the cost was estimated to be about $500 million every 15 years or so. Under the assumption that watershed inflows to the lake would improve to meet the TMDL by the January 2015 deadline, it would still be almost 50 years before the lake water would meet the phosphorus target concentration of 40 parts per billion (ppb) due to internal loading. POOR-POOR LAKE MANAGEMENT BY ALL THREE HERE SFWMD - FDEP - FDACS.

During the intervening years, new possibilities have emerged that may impact the conclusions and recommendations of the 2003 study. First, there may be an unwillingness to wait decades after the completion of watershed improvements to experience restored water quality conditions in the lake. There is greater recognition that even if the phosphorus is eventually leached from the sediments, the sediments themselves will still be present, leading to continuing turbidity and light penetration issues for submerged plants and potential impacts to downstream water bodies. Finally, there is also recognition that additional improvements to the quality of water entering the Everglades downstream of the Everglades Agricultural Area will also be difficult to achieve without improving the quality of water from the lake. Several in-lake sediment management options are proposed under Section 6 to address this problem.

PROBLEM IS AND ALWAYS HAVE BEEN, IS THE STATE OF FLORIDA AGENCYS. SFWMD-FDEP-FDACS. THESE AGENCY'S HAVE ALWAYS HAD VERY-VERY-POOR MANAGEMENT BY THEIR PEOPLE IN CHARGE.

NOTE WHEN YOU PUT PEOPLE WHO ARE RANCHERS- DAIRY, SOD FARMERS, IN CHARGE OF A AGRICULTURE (FDACS) YOU HAVE A PROBLEM OF RULE ENFORCEMENT BEING DONE "COME ON MAN"

NOTE- ALSO YOU HAVE A CONFLICK OF INTREST. WITH AGRICULTURE PEOPLE CHECKING SYSTEMS. IT IS LIKE LETTING COL SANDERS WATCH YOUR CHICKENS, AND WONDERING WHY SOME ARE MISSING. (COME ON MAN)

NOTES. WHEN I READ THESE DRAFT I STILL SEE WORDS.
(SUCH AS)

ASSUMPTION, ONLY GUESSING HERE
BMAP- ONLY VOLUNTARY NOT ENFORCED

COWBOY RANCHERS DO NOT VOLUNTARY FOR ANY THING. ONLY ENFORCEMENT WORKS HERE IN THE OKEECHOBEE WATER BASIN.

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SECTION 3: CURRENT STATUS OF LAKE OKEECHOBEE

3.1 Ecological Status

3.1.1 Water Levels

Water levels in Lake Okeechobee during 2007–2009 fluctuated from extreme drought conditions to highs related to tropical storms. In July 2007, the lake level fell to a record low of 8.82 feet (ft) relative to the National Geodetic Vertical Datum of 1929 (NGVD). A high water level of 15.16 ft NGVD was reached in September 2008 after the passing of Tropical Storm Fay (**Figure 3-1**). Water levels returned to near-average levels (14.2 ft NGVD) during the last half of 2009. Average, in this case, is defined by a simulation of the Lake Okeechobee Regulation Schedule (LORS) 2008 for the years 1965–2000.

During the 2007–2008 drought, lake levels fell into the water shortage management band. This lasted until Tropical Storm Fay passed over the region in August 2008. After the storm, lake stage increased 3.9 ft in one month and water levels rose out of the water-shortage management band (**Figure 3-1**). The storm was followed by the driest six-month period on record and water levels slowly declined but remained above the water shortage management band through the end of 2009.

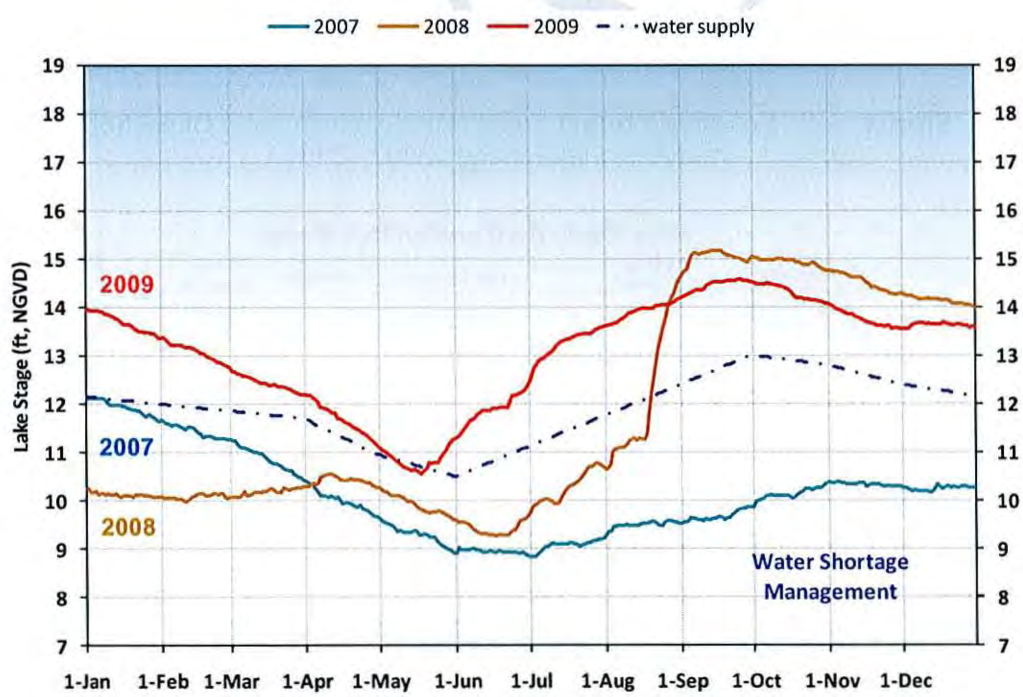


Figure 3-1. Lake Okeechobee stage and water supply management trigger lines, 2007–2009.

NOTE- THE ARMY C.O.E. CONTROLS WATER TO LAKE OKEECHOBEE.

3.1.2 Nearshore Phosphorus and Turbidity Levels

PHOSPHORUS LOAD TO LAKE TO HIGH

Phosphorus levels and light conditions in nearshore areas of the lake have improved since the hurricanes of 2004–2005 resuspended phosphorus-laden sediments and raised lakewide turbidity. As lake levels slowly declined and drought conditions intensified, less of the phosphorus-laden, highly turbid pelagic water was transported into nearshore areas of the lake. Both total phosphorus (TP) concentrations and total suspended solids (TSS) in the nearshore areas have declined to pre-hurricane levels (**Figures 3-2** and **3-3**).

NOTE TMDL SET FOR LAKE OKEECHOBEE YEAR 2001 AT 140 MT - HOPPB HAS NEVER BEEN MADE YEAR 2010

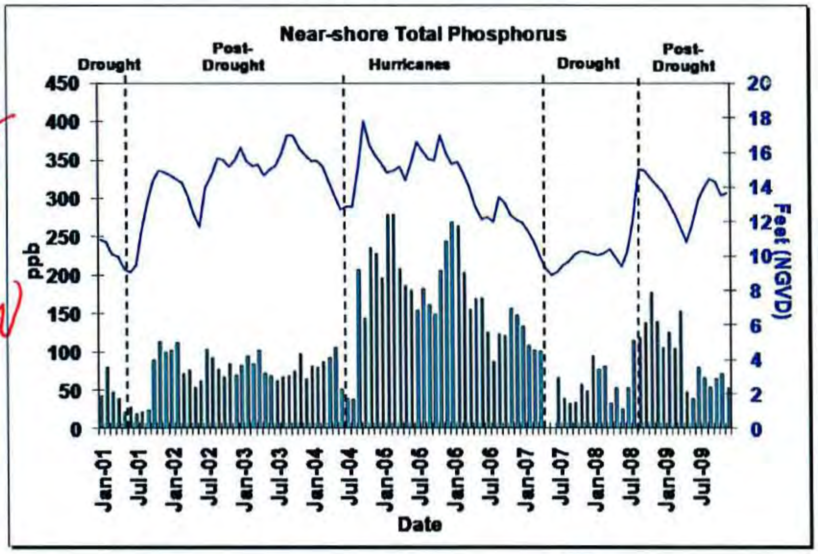


Figure 3-2. Nearshore total phosphorus levels in Lake Okeechobee related to lake stage, 2001–2009.

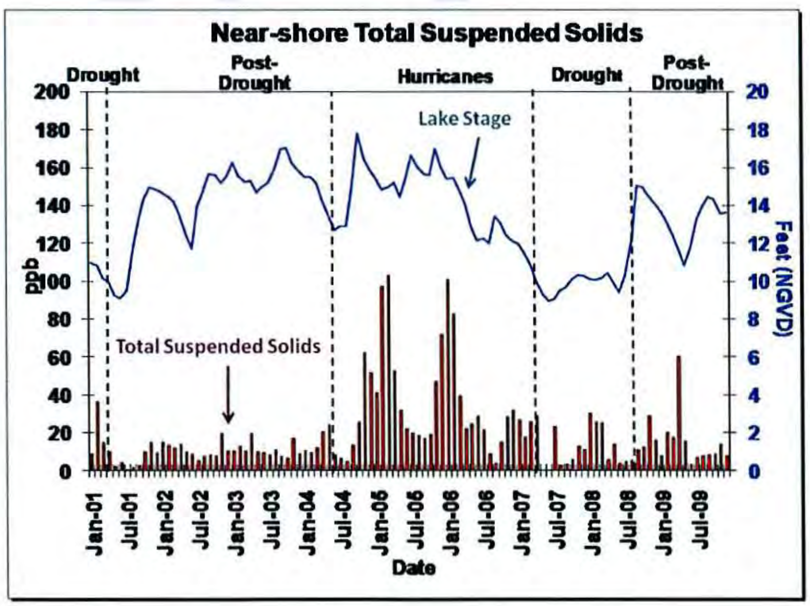


Figure 3-3. Nearshore total suspended solids concentrations and lake stage, 2001–2009.

3.1.3 Algal Blooms

ALGAL BLOOM IS MAN-MADE EVENTS CONTROLLED BY POOR-POOR MANAGEMENT.

Although the above described conditions have the potential to favor algal blooms, no major algal bloom events (i.e., chlorophyll *a* concentrations greater than 40 parts per billion [ppb]) were observed during this reporting period (**Figure 3-4**). In the summer of 2005, many water bodies within the South Florida Water Management District (SFWMD or District) boundaries, including Lake Okeechobee, experienced substantial blue-green algal blooms. After Hurricane Wilma in October 2005, only minor isolated surface blooms have occurred. Additionally, the levels of microcystin, a toxin associated with blue-green algal blooms, have been below the analytical limit of detection (0.2 ppb) since October 2005 (**Figure 3-4**).

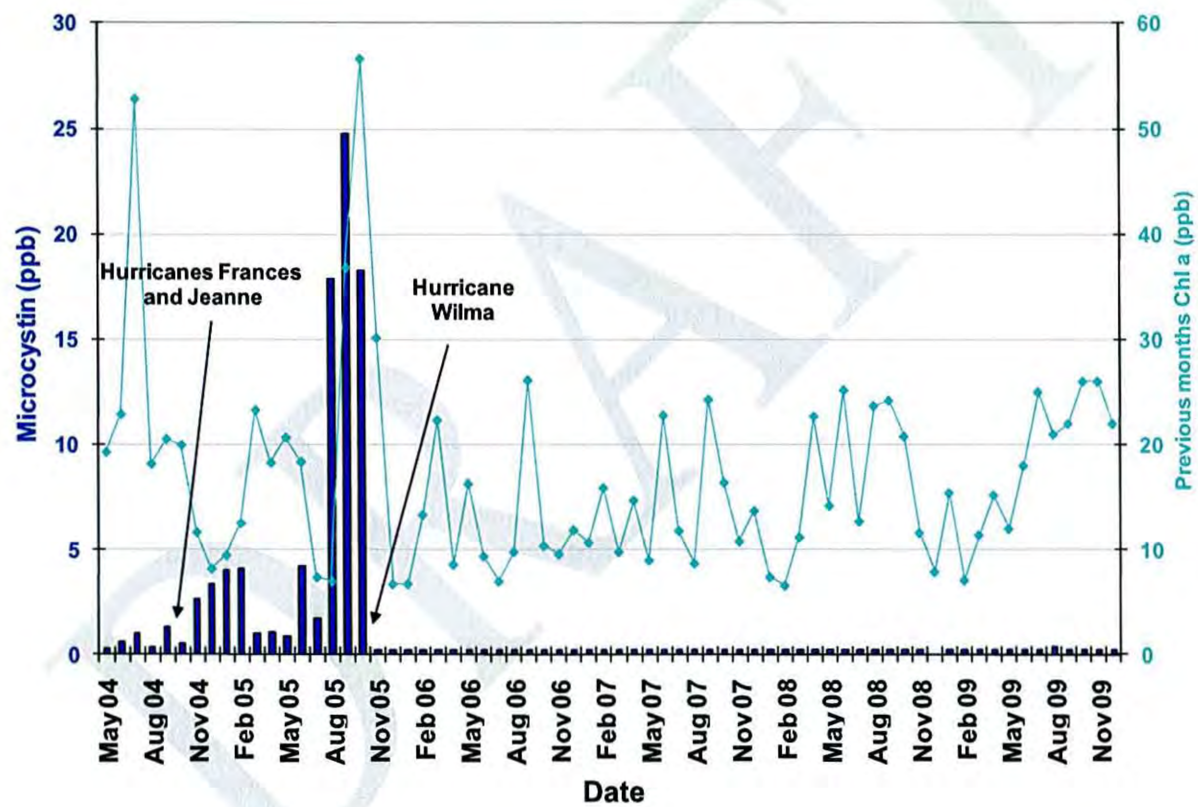


Figure 3-4. Average chlorophyll *a* and microcystin concentrations in Lake Okeechobee from May 2004–December 2009. Chlorophyll *a* values greater than 40 ppb indicate bloom conditions.

ABOVE 40PPB IS A MAN MADE EVENT CAUSED BY POOR WATER MANAGEMENT DONE BY THREE AGENCY'S SFWMD-FDEP-FDACS PEOPLE

3.1.4 Littoral Vegetation

Plant communities in Lake Okeechobee's littoral zone continue to recover from recent hurricanes and drought. After the 2004–2005 hurricanes, lakewide coverage of submerged aquatic vegetation (SAV) decreased to about 3,000 acres (**Figure 3-5A**). As water levels slowly declined during the drought, light levels improved within nearshore areas and SAV coverage increased from 28,180 acres in 2007 to 35,834 acres in 2008. While much of the initial increase was due to the growth of musk grass (*Chara* sp.), a non-vascular macroalga, vascular species including eelgrass (*Vallisneria americana*), coontail (*Ceratophyllum* sp.), the exotic *Hydrilla verticillata*, and southern naiad (*Najas guadalupensis*) expanded across the western and northern shoreline. By August 2009, SAV coverage increased to 46,418 acres, which is comparable to pre-hurricane levels documented in 2004 (**Figure 3-5A**).

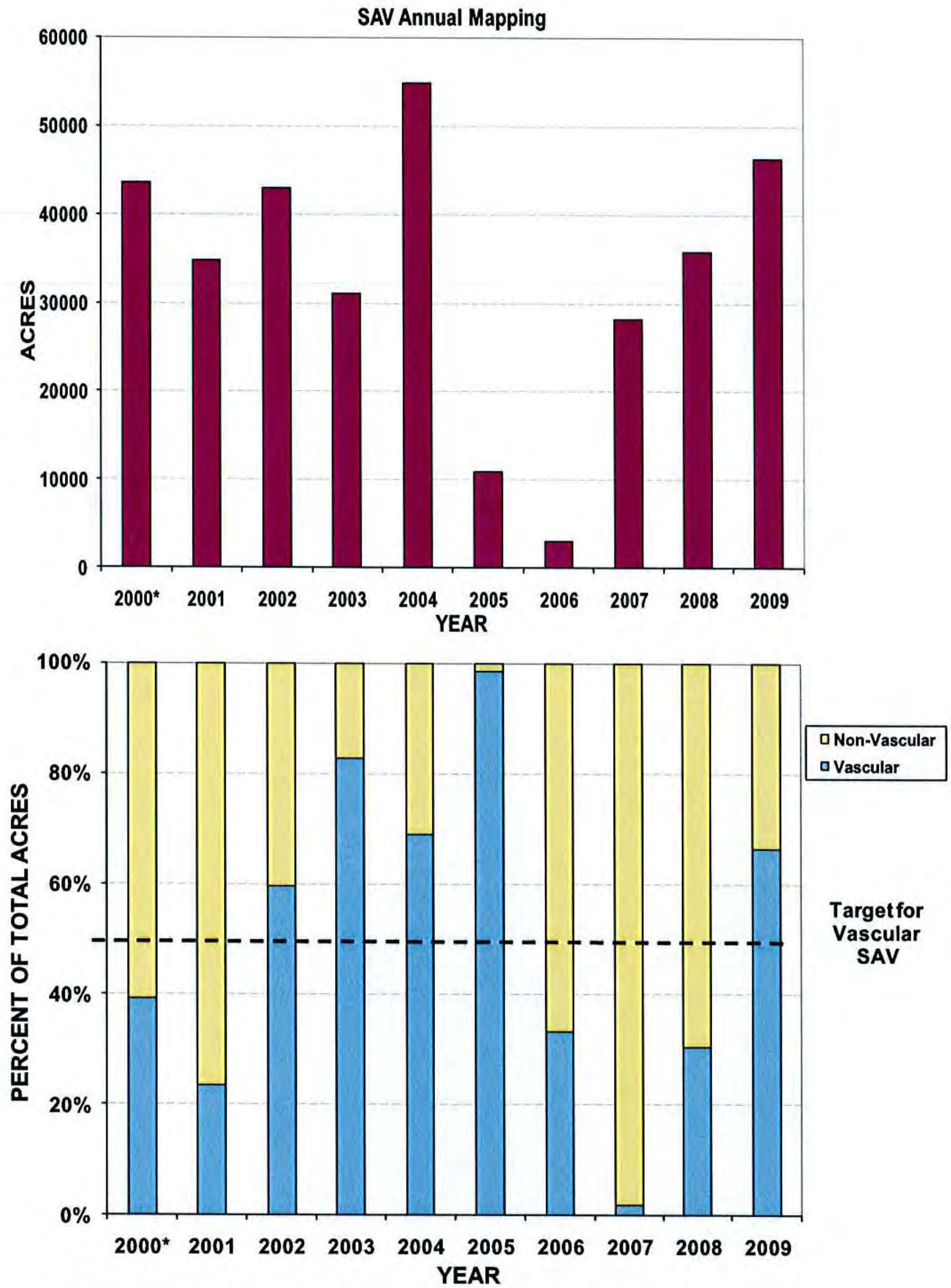
Additionally, vascular species, which provide young fish with better foraging areas and protection than non-vascular species, accounted for almost 65 percent of the total SAV (**Figure 3-5B**). The current SAV coverage meets the Lake Okeechobee restoration goal (CERP 2007) of greater than 40,000 acres of total SAV, with at least half being comprised of vascular species.

Based on comparisons of emergent vegetation maps from 2003 and 2007, significant changes occurred across the marsh landscape. Some of the reported changes were caused by extreme differences in hydrologic conditions that occurred prior to the evaluation dates. In 2003 the marsh was inundated as lake stage remained above 14.5 ft NGVD. In contrast, a regional drought that started in 2006 exposed the lake's 100,000-acre western marsh when water levels fell below 10.5 ft NGVD for more than one year (**Figure 3-6**).

Between 2003 and 2007, the abundance and spatial distribution of a number of plant species changed. Cattail (*Typha* spp.) coverage decreased from nearly 24,000 acres to less than 3,500 acres and fragrant water lily (*Nymphaea odorata*) decreased from greater than 10,000 acres to less than 5 acres. Most of the nearly 7,000-acre increase in spikerush (*Eleocharis cellulose*) coverage occurred along or near the outside edge of the marsh. Smartweed (*Polygonum hydropiperoides*) and knotgrass (*Polygonum aviculare*) each increased by more than 12,000 acres.

In addition to the hydrologic influences previously discussed, multiple fires burned nearly all of the littoral zone marsh in 2007 and 2008. This widespread burning created additional changes in the plant community across much of the landscape. Following these fires and persistent dry conditions, dog fennel (*Eupatorium capillifolium*), a species not observed in 2003, expanded to cover nearly 8,000 acres of exposed marsh in 2007 (**Figure 3-7**). Other more terrestrial species, including American cupscale (*Sacciolepic striata*) and barnyard grass (*Echinochloa* spp.), also became common in dry regions of the marsh. Managed fire has been a valuable tool for controlling exotic and invasive vegetation and returning affected areas to more natural and productive plant communities; however, the lake, as currently constrained by the Herbert Hoover Dike, does not encompass any true fire sub-climax vegetative communities.

NOTE - BURNING INSIDE LAKE OKEECHOBEE IS A MAN MADE ISSUE



* 2000 is based on a 0.5 km² grid and 2001 to 2009 is based on a 1 km² grid

Figure 3-5. (A) Acres of total SAV (vascular and non-vascular species). **(B)** Percent of total acres of vascular and non-vascular species from the annual Lake Okeechobee SAV mapping results, 2000–2009.

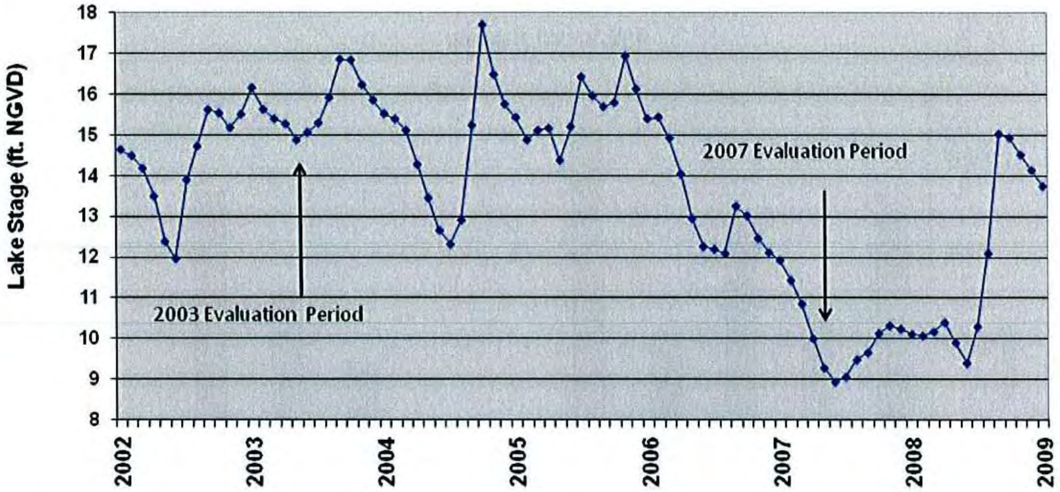


Figure 3-6. Lake Okeechobee stages from 2002–2009 showing water levels consistent with marsh inundation versus marsh dry out.

Figure 3-7. Dry marsh conditions south of Indian Prairie Canal (July 2008). Dog fennel and other terrestrial species became dominant across much of the marsh landscape.

NOTE - MARSH DRY OUT IS MAN MADE ISSUE WATER CONTROLLED BY C.O.E LEVELS OF LAKE CONTROLLED WATER SUPPLY HERE PEOPLE (ACE) (SFWMD) CONTROLS OUTSIDE OF LAKE MAN MADE ISSUES OF CANALS AND LOCKS OF FLOWING WATER TO STA AREA'S

Historically, bulrush (*Scirpus californicus*) was common along the lakeward edge of the western marsh (Pesnell and Brown 1977). Bulrush is an important feature of the marsh landscape: it provides beneficial habitat for fish and wildlife and attenuates wave energy and stabilizes bottom sediments, creating favorable conditions for the growth of desirable SAV and emergent plants. The areal coverage of bulrush had declined to less than 600 acres in 2003 and no bulrush was observed during 2007. In 2009, bulrush responded to relatively shallow (less than 3.3 ft [1 meter]) and clear water conditions by rapidly colonizing much of the western shoreline from Mayaca Cut to north of Indian Prairie Canal (**Figure 3-8**).

Although the extent of bulrush has not been quantified, it has become a dominant feature of the marsh landscape. Bulrush should continue expanding provided hydrologic conditions remain favorable. Maintaining an abundant, healthy emergent bulrush community is important for sustaining the lake's sports fishery, which has been in decline during this reporting period (McCormick et al. 2010). NOTE - HERE AGAIN WE SEE MANAGEMENT FOR MAN BY MAN ISSUE HERE. BOATING OUT ON THE LAKE AT HIGH SPEED. DAMAGE TO GROWTH.

Figure 3-8. New bulrush growth along the lakeward edge of the marsh near Indian Prairie Canal (August 2009). DUCK HEAVEN. HERE PLENTY OF HUMAN ACTION OUT ON LAKE DAMAGE TO BULRUSH FROM AIR BOATS, ON THE HUNT FOR DUCKS IN LARGE NUMBERS.

3.1.5 Control of Exotic Vegetation

The dry marsh conditions over the past three years have allowed for aggressive treatment of exotic vegetation in Lake Okeechobee. For example, more than 10,000 acres of torpedograss were treated during 2004–2006 as compared to 20,000 acres treated during 2007–2009. Wildfires that burned the marsh in 2007 and 2008 removed thousands of acres of dead torpedograss and other dead plant material. Although torpedograss is still present in many areas, its coverage has decreased dramatically. Native plant communities have colonized some of the treated sites and monthly wading bird surveys conducted in 2010 have documented thousands of birds foraging in shallow open water areas previously overgrown by torpedograss.

Luziola subintegra, a South American watergrass, has recently become a serious problem in Lake Okeechobee. The plant was first observed near the mouth of Fisheating Creek in 2007, which represented the first documented occurrence of this plant in the United States (Kunzer and Bodle 2008). The pathway for introduction of *Luziola* to South Florida is unknown. It grows rapidly in shallow water to form dense mats several acres in size that appear to exclude other plant species. Herbicide applications near the mouth of Fisheating Creek were mixed in their effectiveness to control *Luziola*. An initial application of glyphosate effectively controlled mature plants but had little effect on immature plants. Mixtures of different herbicides were tested and improved control was achieved with a combination of glyphosate and imazapyr. Nearly 600 acres of watergrass were treated in the Fisheating Bay region of the lake in 2009 (**Figure 3-9**). It is anticipated that repeated treatments will be required to successfully eradicate this species.

The floating exotic plants water hyacinth (*Eichhornia crassipes*) and water lettuce (*Pistia stratiotes*) continue to pose significant ecological harm to the marsh. The coverage of these plants rapidly expanded during the summer and fall of 2009 in response to increased water levels. During that time, more than 11,000 acres of water hyacinth and 4,000 acres of water lettuce were treated. Because dense mats of water hyacinth often were entangled in bulrush, the treatments caused significant non-target damage to bulrush. Much of the damage to bulrush appears to be short-term as the plants have shown signs of recovery. Monitoring of the treated bulrush continued throughout summer 2010. MAN MADE PROBLEMS TO MANAGEMENT (SFWMD) PEOPLE HERE

Figure 3-9. South American watergrass (*Luziola subintegra*) treatment in Fisheating Bay.

3.1.6 Benthic Invertebrate Communities

The benthic invertebrate community is important to Lake Okeechobee's food web, and has slowly recovered from recent hurricanes and drought. Benthic invertebrates were monitored at long-term sampling locations between August 2005 and February 2009 (Warren et al. 2008). Species richness and diversity indices were low compared to the 1987–1997 period and were dominated by pollution-tolerant taxa. The poor community quality that characterized the 2005–2006 study year (**Table 3-1**) appears related to the impact of the 2004 and 2005 hurricanes. Wave action during these major storm events scoured and displaced bottom sediments, severely affecting the benthic communities. During drought conditions, as external organic loading and transport of mud sediments from the center of the pelagic zone declined, the density of benthic invertebrate species increased. The recovery was fastest within sand and peat substrate zones and slowest in the mud zone located within the center of the lake. ORGANIC LOADING IS A MAN MADE ISSUE PEOPLE

Table 3-1. Pelagic benthic macroinvertebrate community health indices for 2005–2008 (Warren et al. 2008).

Descriptor	Study Year 2005–2006	Study Year 2006–2007	Study Year 2007–2008
Total Taxa	48	68	94
Mean Species Richness	5.7[a]	8.9[b]	11.8[c]
Mean Diversity	1.54[a]	1.88[b]	2.18[c]
Mean Evenness	0.69[a]	0.66[a]	0.66[a]
Mean Total Organisms per Square Meter	3,338[a]	7,591[b]	12,678[c]

Note: Means with same letter superscript are not significantly different.

The Florida apple snail (*Pomacea paludosa*), a common component of Lake Okeechobee's benthic invertebrate community, represents the primary food source for the endangered Everglade snail kite (*Rostrhamus sociabilis*). This snail species is capable of tolerating brief periods of drying (e.g., less than 12 weeks), but appears to be unable to survive significant drawdown events such as a prolonged drought. WATER LEVELS TO LAKE OKEECHOBEE IS CONTROLLED BY ARMY C.O.E PEOPLE

In the spring of 2008, a survey was conducted to determine the extent that extreme drought conditions had on Lake Okeechobee's apple snail population. The survey identified one remaining local population of Florida apple snails, confirming expectations that the native snail population had been depleted due to extreme low water levels within most of the littoral zone.

As a result, a feasibility study was initiated to determine if Florida apple snails grown in captivity could be used to increase apple snail populations within the lake (**Figure 3-10**). Initial growth and reproduction experiments showed some promise; however, reproductive success of snails reared in captivity was lower than observed in the wild.

An experiment that varied the diet fed to laboratory-reared snails showed that commercial catfish chow significantly increased snail growth rate and survival compared to a diet of romaine lettuce. This short experiment did not determine the effect of diet on reproduction, but diet clearly is an important variable to be considered in future snail-rearing efforts.

Two controlled release experiments were conducted in Eagle Bay marsh, a wetland area adjacent to Lake Okeechobee, to determine the success of captive-reared snail releases as a means of augmenting natural population recovery processes (**Figure 3-11**). Analysis of data from these experiments is currently under way. MAN-MADE WATER CONTROLLED EXPERIMENT MAN MADE PROBLEM HERE

Figure 3-10. The Florida apple snail (*Pomacea paludosa*) laying eggs at the aquaculture facility at Harbor Branch Oceanographic Institute, provided under SFWMD contract.

A

B

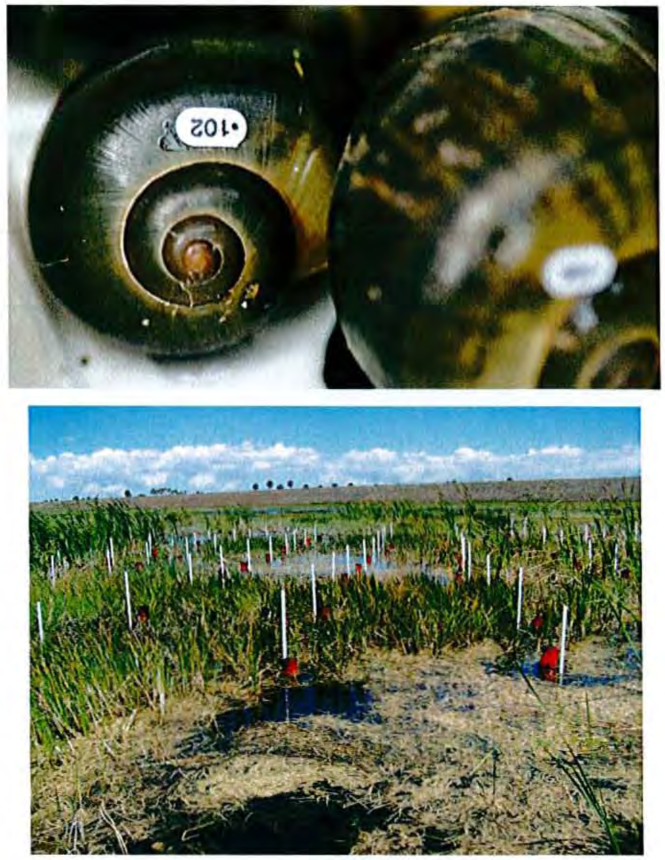


Figure 3-11. (A) Captive-reared apple snails with numeric markers. **(B)** Release site in the Eagle Bay marsh located on the northern end of Lake Okeechobee showing transect design and pyramid trap placement.

3.1.7 Amphibian and Reptile Communities

Amphibians and reptiles are an important component of Lake Okeechobee's wetland food web. With the exception of the American alligator (*Alligator mississippiensis*), these species have not been well inventoried or monitored within the lake. Consequently, little information exists on their response to changes in lake stage, extreme water level events (droughts and hurricanes), and marsh habitat management practices. SFWMD staff completed a study in July 2010 to determine suitable sampling protocols for these species that can be used to better understand their distribution and abundance in the lake. Following the study, SFWMD staff initiated a monitoring effort to track changes in habitat and amphibian and reptile populations in response to seasonal and lake stage changes. NOTE - SFWMD STAFF DO THEY CHECK THE ALLIGATORS FOR HIGH MERCURY IN THE MEAT OF ALLIGATORS IN LAKE OKEECHOBEE. MERCURY IS HARMFUL OF AND TO MAN'S HEALTH.

3.1.8 Fish Communities

During the late 1990s, the largemouth bass and black crappie populations within Lake Okeechobee were depressed due to high lake levels and subsequent loss of primary and secondary production. Following the 2001 drought, a substantial increase the areal coverage of SAV provided additional fish habitat and produced strong year classes in 2002 for both populations. However, high lake levels in 2003 negated some of the ecological gains observed in 2001–2002 and fish population size, as depicted by catch per unit effort, declined due to the lack of recruitment of young fish and mortality (natural and fishing pressure) of adults. Hurricanes in 2004 and 2005 further hastened the decline of the largemouth bass and black crappie populations (**Figure 3-12**).

After the hurricanes, the catch rates for largemouth bass were the second lowest observed since the monitoring program began in 1992, and very little recruitment of young-of-the-year largemouth bass occurred in 2005 (**Figure 3-12**). The black crappie population also experienced a significant decline. Only five adult fish (longer than 200 millimeters [mm]) were collected from 27 predetermined sampling sites following 540 minutes of trawling. The decline in the black crappie population in 2005 exceeded 99 percent when compared to the average annual catch reported in 1988–1991 (2,037 fish). A similar decline (97 percent) also was reported for the threadfin shad, a primary forage fish for adult black crappie in Lake Okeechobee.

The largemouth bass population has recovered more quickly than the black crappie population following damaging effects from hurricanes and prolonged periods of high water levels. In 2009, a strong largemouth bass year class was produced, but there was little evidence of recruitment of young-of-the-year black crappie (**Figure 3-12**). This finding is partly attributed to largemouth bass's robust feeding and reproduction habits. Largemouth bass tend to eat a greater variety of forage from the time they hatch through adulthood. In contrast, black crappie forage primarily on zooplankton (rotifers) after hatching. They eventually move offshore where they eat invertebrates before switching to young-of-year shad when they reach a length of about 200 mm. The hurricanes in 2004 and 2005 resuspended flocculent bottom sediments, creating turbid conditions within open water areas of the lake that persisted for several years. These events depressed phytoplankton and zooplankton production, which have negatively affected black crappie and threadfin shad populations.

The bluegill and redear sunfish populations have also undergone major changes over the past four years. In 2005 (following Hurricane Wilma) there was almost no recruitment of these species; the populations consisted mostly of adult fish. Following improvements in habitat and water quality in 2008, both species have showed strong signs of production and recovery.

NOTE - MAYBE BETTER MANAGEMENT BY SOME AGENCYS ARE WORKING NOW.

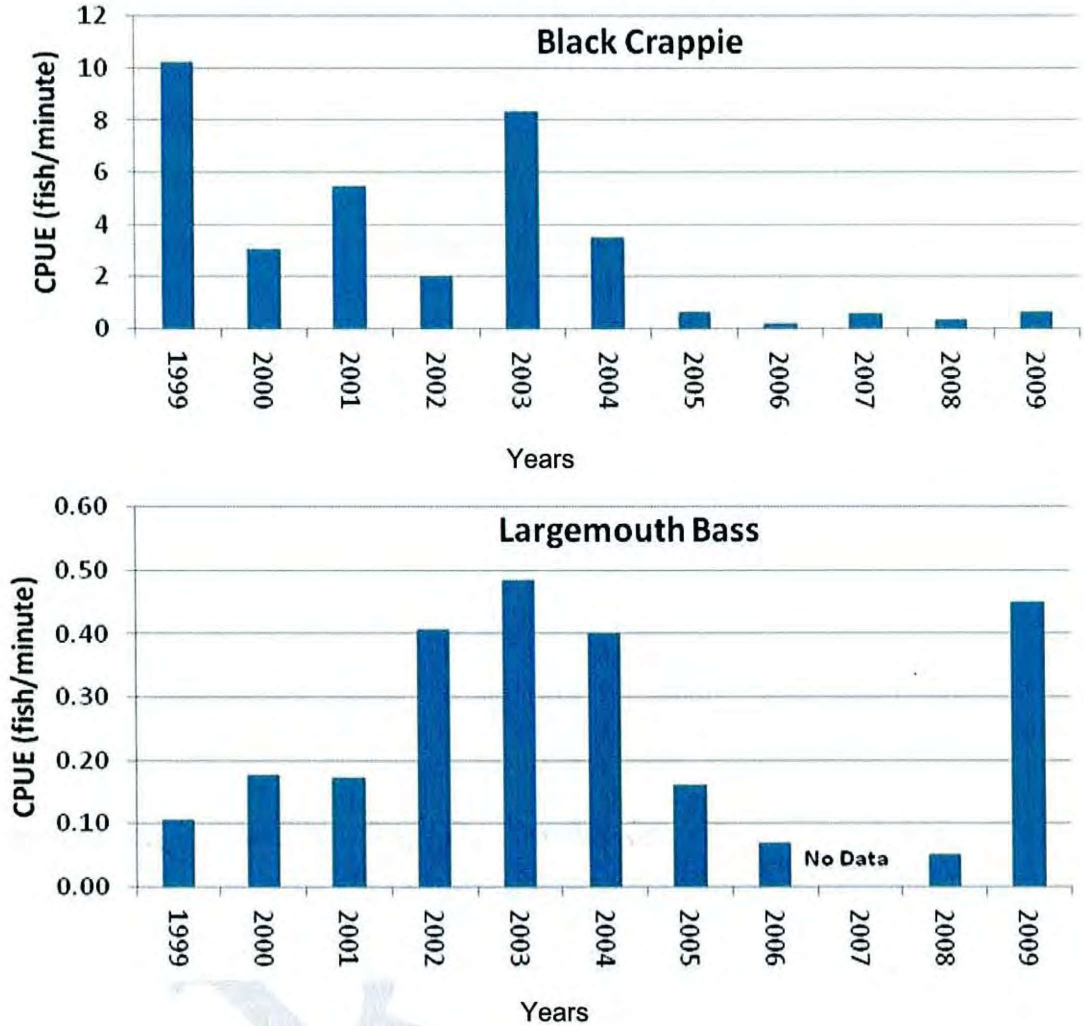


Figure 3-12. Abundance of black crappie and largemouth bass based on catch per unit effort (CPUE) data.

IN LAKE MANAGEMENT NEEDS TO BE MORE ACTIVE, TO PROTECT FISH SUPPLY. BUT WITH MERCURY IN FISH AND ALLIGATOR IS HARMFUL TO HUMAN HEALTH.

3.2 Current Water Quality Trends (2001–2009)

NEVER HAS THE TMDL

3.2.1 Lake Phosphorus Reduction Goal

BEEN MADE BY ANYONE

The Total Maximum Daily Load (TMDL) for TP for Lake Okeechobee was adopted by the Florida Department of Environmental Protection (FDEP) and approved by the U.S. Environmental Protection Agency in 2001 (FDEP 2001). The TMDL is defined as the maximum amount of a given pollutant (in this case TP) that a water body can absorb and still maintain its designated use (e.g., drinking water, fishing, swimming, shellfish harvesting). The TMDL establishes an annual load of 140 metric tons (mt) of phosphorus to Lake Okeechobee to achieve a target phosphorus concentration of 40 ppb in the pelagic (open water) zone of the lake. The target was developed using chlorophyll *a* as an indicator of algal biomass, which acts as a surrogate for indicating excessive nutrient concentrations. The FDEP (2001) report states that the TMDL will be evaluated using a five-year rolling average of monthly loads calculated from measured flow and concentration values. The 40 ppb target for the entire pelagic zone is considered a conservative goal that introduces an implicit margin of safety into the TMDL. This is because TP concentrations are relatively homogeneous across the open-water region under high lake conditions. When water stages are low, TP in the nearshore area is considerably lower than in the open-water zone. Hence, if 40 ppb is met at the pelagic stations, the TP concentrations should be below 40 ppb in the nearshore area during most years. This restoration target will support a healthy lake system, restore the designated uses of Lake Okeechobee, and allow the lake to meet applicable water quality standards (FDEP 2001). POOR-WATER MANAGEMENT BY All SFWMD. FDEP- FDACS PEOPLE HERE

3.2.2 Tributary Nutrient Loading Trends

Trends of five parameters—mean monthly flow (acre-feet [ac-ft]), TP load (mt), TP concentration (µg/L), total nitrogen (TN) load (mt), and TN concentration (milligrams per liter [mg/L])—from 2001 to 2009 (calendar year) for the nine Lake Okeechobee sub-watersheds were analyzed with a Seasonal Kendall Tau test (**Table 3-2**, **Figure 3-13**). This non-parametric test is frequently used to detect trends for water quality time series data. It is a rank-order statistic that can be applied to time series data exhibiting seasonal cycles, missing and censored data, and indications of non-normality (Yu and Zou 1993). When data are collected over time, significant autocorrelation may exist between data values. The Seasonal Kendall Tau test provides an adjusted p-value for data that exhibit a significant level of dependence (Reckhow et al. 1992). An alpha (α) level of 0.05 or less was considered statistically significant in these tests. The test also produces a Sen slope value, which is an estimate of the amount of change in the measured value (e.g., metric tons, mg/L) per year. ONLY GUESSING HERE PEOPLE (NO FACT)

Each sub-watershed consists of one or more drainage basins that ultimately flow into the lake through designated water control structures (**Figure 3-13**). Two sub-watersheds (Lower Kissimmee and Indian Prairie) included in this analysis do not have well-defined groundwater drainage boundaries and can be influenced over shorter data intervals (e.g.., monthly) by seepage through the structure and groundwater interactions. The program normally used to calculate annual loads for these two sub-watersheds involves subtracting out upstream sub-basins to obtain more reliable annual flow values. Since this method could not be employed for this analysis when computing the monthly basin-level flow, TP, and TN using structure measurements in these two sub-watersheds, monthly data represented by structure S-65E for the Lower Kissimmee and S-70, S-71, and S-84 for Indian Prairie, respectively, were used.

The Western Lake Okeechobee Sub-watershed is represented by inflows through the S-77 structure located at the interface of the Caloosahatchee River with Lake Okeechobee. Lake water is primarily discharged through this structure. However, flow to the lake can occur through S-77 during periods of extreme drought or extreme, isolated rainfall events within the Caloosahatchee Basin when the lake is at a low stage. This infrequent level of flow to the lake was not sufficient to produce mean monthly values to calculate a trend using this statistic over the past nine years, so the Western Lake Okeechobee Sub-watershed was excluded from this analysis. Annual loadings are available for this sub-watershed in the annual South Florida Environmental Report[2].

While the presence of significant trends provides the most valuable management tool for determining how a sub-watershed is reacting to regulatory or restoration measures or other influencing factors, other statistics presented in **Table 3-2** can be used to assess apparent trends and help focus resources on the most efficient ways to achieve water quality improvements for the Lake Okeechobee Watershed. For instance, the Sen slope indicates the change in annual concentration for a constituent, which taken into consideration with the p-value, can indicate if the sub-watershed is more likely to continue to follow its current direction within the upcoming years and if these changes will be significant. Sub-watersheds with highly negative or positive slopes with p-values close to 0.05, though not showing a statistically significant trend, could still be targeted for in-depth investigations to help evaluate success stories, or identify areas where more intense nutrient control measures are required. POOR MANAGEMENT BY SFWMD - FDEP - FDACS

Four of the eight sub-watersheds analyzed revealed significant trends for one or more of the five parameters (**Table 3-2**, **Figures 3-14, 3-15**, **3-16**, **3-17**, and **3-18**). The only sub-watershed with a statistically significant trend not related to flow was the Southern Lake Okeechobee Sub-watershed (Everglades Agricultural Area [EAA]). The EAA showed a decreasing trend in both the TN load ($p = 0.04$) and the TN flow-weighted mean concentration ($p < 0.001$). Given that the flow from this sub-watershed was not significantly trending and due to the presence of a highly significant decreasing trend in TN for concentration, it is likely that nitrogen is either being managed better, regulated more rigorously, or generally being used less in this area. Significant decreasing trends of flow, TN load, and TP load were found for the Taylor Creek/Nubbin Slough Sub-watershed (**Table 3-2**, **Figures 3-14**, **3-15**, and **3-17**). The Sen slope for TP (-6.00) and TN (-0.01) concentrations show negatively trending values even though they are not statistically significant. This may be a reflection of the sub-watershed having the largest Best Management Practice (BMP) implementation rate and the completion of many TP source control projects.

The Lake Istokpoga Sub-watershed exhibited significant decreasing trends for flow and TP load (**Figures 3-14** and **3-17**). However, concentrations of TP and TN had a positive Sen slope (**Table 3-2**).

The Indian Prairie Sub-watershed displayed a significant decreasing trend for flow and TN load (**Figures 3-14** and **3-15**). Again, a positive Sen slope for TP concentrations was found (**Table 3-2**).

[2] www.sfwmd.gov/sfer

For the Fisheating Creek and Eastern Lake Okeechobee sub-watersheds, no significant trends were found among the five parameters. Concentrations for TP at these two sub-watersheds showed a negative Sen slope.

VOLUNTARY SYSTEMS DO NOT WORK IN AGRICULTURE

Although BMPs have been initiated to a certain degree, a large percentage of the watershed still needs dedicated resources to realize the full level of BMP implementation for nutrient reduction. The high levels of legacy phosphorus in the soils play a role in the delayed response of the watershed to reduced TP concentrations. Increased levels of water management, including stormwater recycling would assist with reducing the legacy phosphorus contributions to downstream water bodies. Nevertheless, more aggressive nutrient control measures must be implemented in all the surrounding basins that discharge to the lake to reach the TMDL goal of 140 mt of phosphorus per year (FDEP 2001). To assess the success or deficiencies of restoration efforts in the Lake Okeechobee Watershed, many years of continued evaluation of these sub-watersheds for statistically significant trends is critical. The highly variable nature of the data from these sub-watersheds and the influence of storm events on the data make continuous evaluations necessary. Evaluations that show no significant trends over several years can also be useful to determine if the system has stabilized and what measures need to be taken if the lake does not meet water quality goals. NOTE I KNOW THAT THE LAKE OKEECHOBEE; WILL NOT MEET 2015 GOALS MANDATED, DUE TO POOR MANAGEMENT BY ALL THREE AGENCY'S IN OUR STATE GOVERNMENT. THE (SFWMD) THE (FDEP) THE (FDACS) ALL OF THESE AGENCY'S HAVE DONE VERY-VERY LITTLE EVER SINCE 1989 THAT I KNOW OF.

TO ENFORCE ANY TYPE OF WATER QUALITY ANY TYPE OF TMDL, ANY TYPE OF ENFORCEMENT. OF THEIR OWN RULES SUCH AS 40E.61 OR SWIM EVERY YEAR EVER SINCE 1989 UNTIL NOW 2010 THEY BLAME OTHER PEOPLE FOR THEIR POOR-POOR MANAGEMENT OF THE ECOSYSTEM OF FLORIDA

Mr. Robert M. Norton
4200 US Highway 441 SE
Okeechobee, FL 34974

Robert M Norton
ECOSYSTEM WATCH
LAKE OKEECHOBEE

Table 3-2. Seasonal Kendall Tau trend analyses of flow, TP, and TN for 2001–2009. Bolded, italicized parameters indicate significant changes.

Sub-Watershed	Parameter (unit)	Number of Samples (Total / NA / Zero Values)[2]	Kendall's Tau	Sen Slope	Intercept	P-Value	Significant Trend
Upper Kissimmee (S65)	Flow (acre-feet)	108 / 0 / 12	-0.081	-1,526	43,108	0.67	No
	Total Nitrogen Load (metric tons)	108 / 0 / 12	-0.104	-2.86	69.5	0.57	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 12 / 0	0.044	0.005	1.27	0.78	No
	Total Phosphorus Load (metric tons)	108 / 0 / 12	-0.060	-0.10	4.29	0.45	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 12 / 0	0.106	1.00	71.5	0.22	No
Lower Kissimmee (S65E)	Flow (acre-feet)	108 / 0 / 10	-0.120	-5,554	81,473	0.52	No
	Total Nitrogen Load (metric tons)	108 / 0 / 10	-0.130	-8.13	121	0.46	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 10 / 0	0.121	0.015	1.11	0.42	No
	Total Phosphorus Load (metric tons)	108 / 0 / 10	-0.130	-0.48	7.58	0.46	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 10 / 0	0.039	0.42	67.9	0.73	No
Lake Istokpoga (S68)	***Flow (acre-feet)***	***108 / 0 / 8***	***-0.266***	***-1,972***	***23,658***	***<0.001***	***Yes***
	Total Nitrogen Load (metric tons)	108 / 0 / 8	-0.169	-2.47	38.4	0.35	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 8 / 0	0.198	0.060	1.26	0.32	No
	Total Phosphorus Load (metric tons)	***108 / 0 / 8***	***-0.188***	***-0.11***	***1.77***	***0.02***	***Yes***
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 8 / 0	0.046	0.75	70.3	0.59	No
Indian Prairie[1]	***Flow (acre-feet)***	***108 / 0 / 1***	***-0.194***	***-1,357***	***25,717***	***0.01***	***Yes***
	Total Nitrogen Load (metric tons)	***108 / 0 / 1***	***-0.185***	***-3.49***	***59.4***	***0.02***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 1 / 0	-0.026	-0.006	1.92	0.87	No
	Total Phosphorus Load (metric tons)	108 / 0 / 1	-0.148	-0.14	3.71	0.06	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 1 / 0	0.127	4.25	150	0.11	No
Fisheating Creek	Flow (acre-feet)	108 / 0 / 0	-0.139	-531	11,901	0.08	No
	Total Nitrogen Load (metric tons)	108 / 0 / 0	-0.106	-0.54	19.3	0.18	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 0 / 0	0.097	0.019	1.52	0.62	No
	Total Phosphorus Load (metric tons)	108 / 0 / 0	-0.100	-0.065	1.72	0.21	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 0 / 0	-0.118	-3.63	149	0.13	No
Taylor Creek/ Nubbin Slough	***Flow (acre-feet)***	***108 / 0 / 17***	***-0.197***	***-282***	***4,184***	***0.01***	***Yes***
	Total Nitrogen Load (metric tons)	***108 / 0 / 17***	***-0.192***	***-0.55***	***8.15***	***0.01***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 17 / 0	-0.089	-0.01	1.85	0.49	No
	Total Phosphorus Load (metric tons)	***108 / 0 / 17***	***-0.222***	***-0.11***	***1.47***	***0.004***	***Yes***
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 17 / 0	-0.117	-6.00	379	0.23	No
Southern Lake Okeechobee (EAA)	Flow (acre-feet)	108 / 0 / 3	-0.241	-271	3,955	0.07	No
	Total Nitrogen Load (metric tons)	***108 / 0 / 3***	***-0.287***	***-1.38***	***15.7***	***0.04***	***Yes***
	Total Nitrogen Flow-Weighted Mean (mg/L)	***108 / 3 / 0***	***-0.319***	***-0.13***	***3.65***	***<0.001***	***Yes***
	Total Phosphorus Load (metric tons)	108 / 0 / 3	-0.162	-0.04	0.62	0.18	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 3 / 0	0.208	7.49	120	0.17	No
Eastern Lake Okeechobee (S308C)	Flow (acre-feet)	108 / 0 / 20	0.132	93.9	1,304	0.47	No
	Total Nitrogen Load (metric tons)	108 / 0 / 20	0.113	0.10	3.70	0.51	No
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 20 / 0	-0.076	-0.018	1.98	0.45	No
	Total Phosphorus Load (metric tons)	108 / 0 / 20	0.086	0.01	0.26	0.63	No
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 20 / 0	-0.131	-8.00	213	0.37	No
Western Lake Okeechobee	Flow (acre-feet)	108 / 0 / 80	Insufficient data to perform trend analysis				
	Total Nitrogen Load (metric tons)	108 / 0 / 80					
	Total Nitrogen Flow-Weighted Mean (mg/L)	108 / 80 / 0					
	Total Phosphorus Load (metric tons)	108 / 0 / 80					
	Total Phosphorus Flow-Weighted Mean (µg/L)	108 / 80 / 0					

[1] Structures used to calculated Indian Prairie sub-watershed flows, loads and flow-weighted means: L59W, L60E, L60W, S127, S129, S131, L59E, S71, S72 ar

[2] NA - not available due to zero values of flow and load.

WATER Flows South TO LAKE OKEECHOBEE FROM HERE

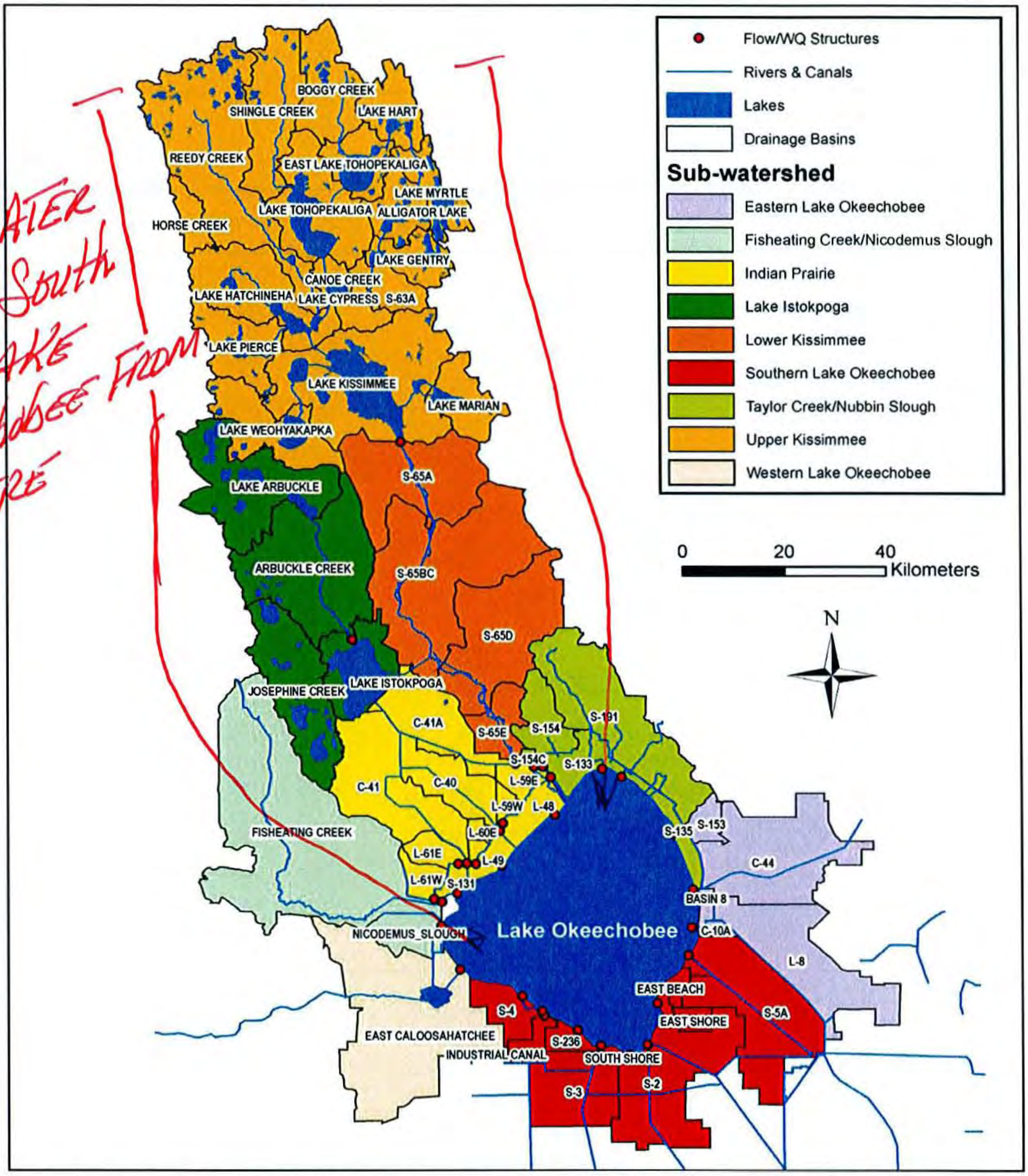


Figure 3-13. The Lake Okeechobee Watershed, detailing sub-watershed and water management structure locations.

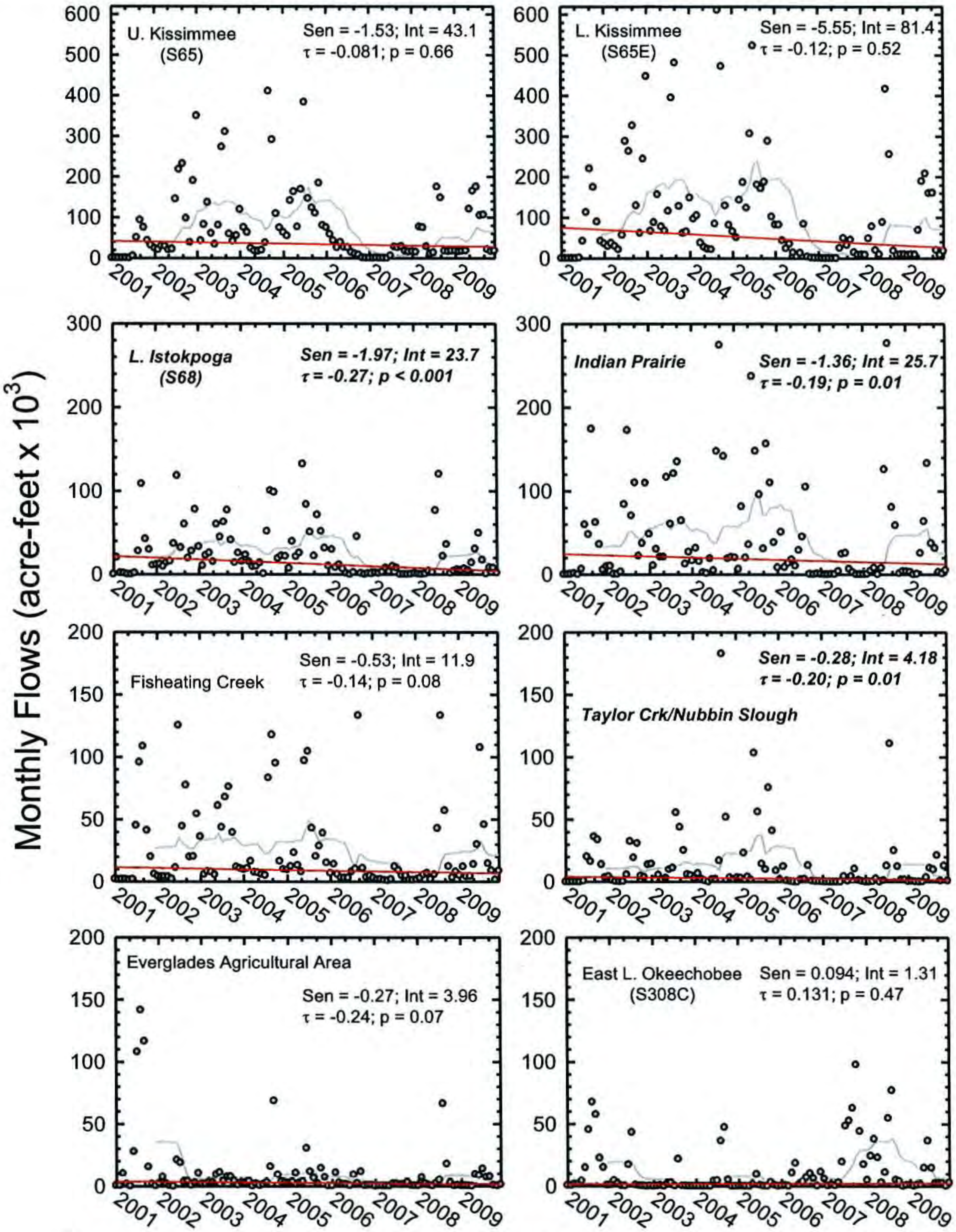
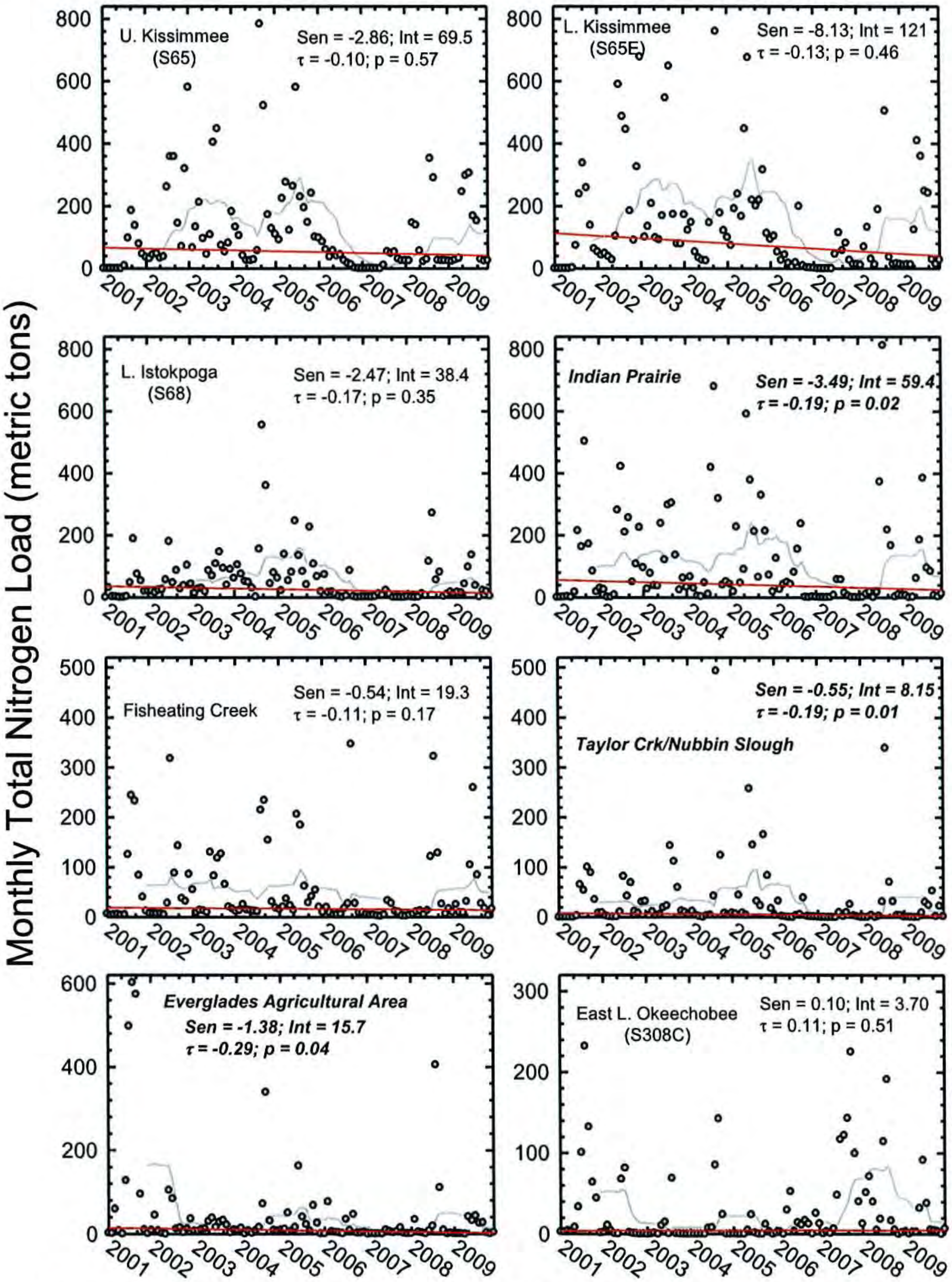


Figure 3-14. Monthly sub-watershed flows for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.



1290 **Figure 3-15.** Monthly sub-watershed TN loads for 2001–2009. Gray dots represent
1291 monthly values, gray lines represent 12-month moving averages, and red lines
1292 represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a
1293 significant relationship.

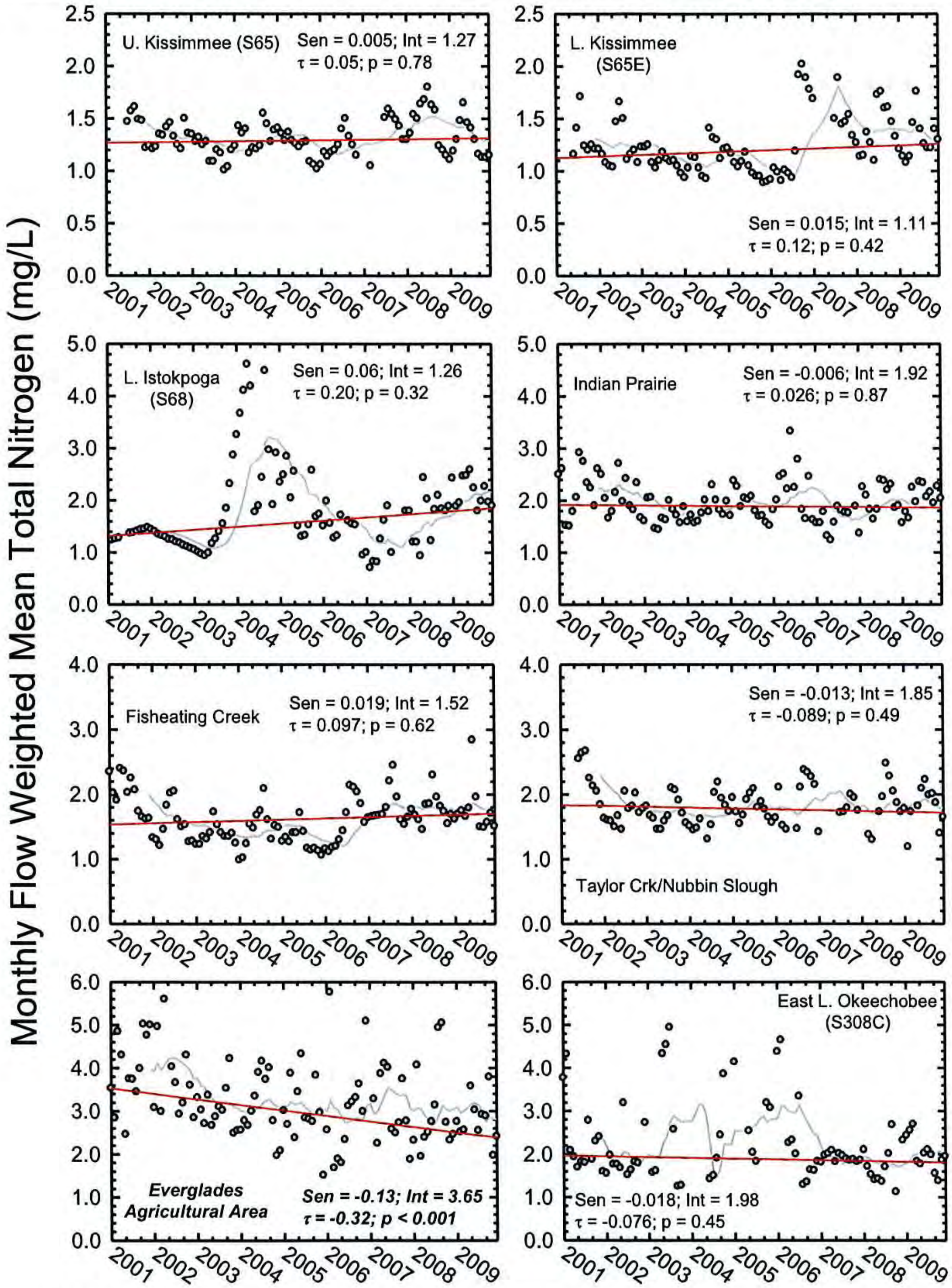


Figure 3-16. Monthly sub-watershed TN flow-weighted mean concentrations for 2001–2009. Gray dots represent monthly values, gray lines represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.

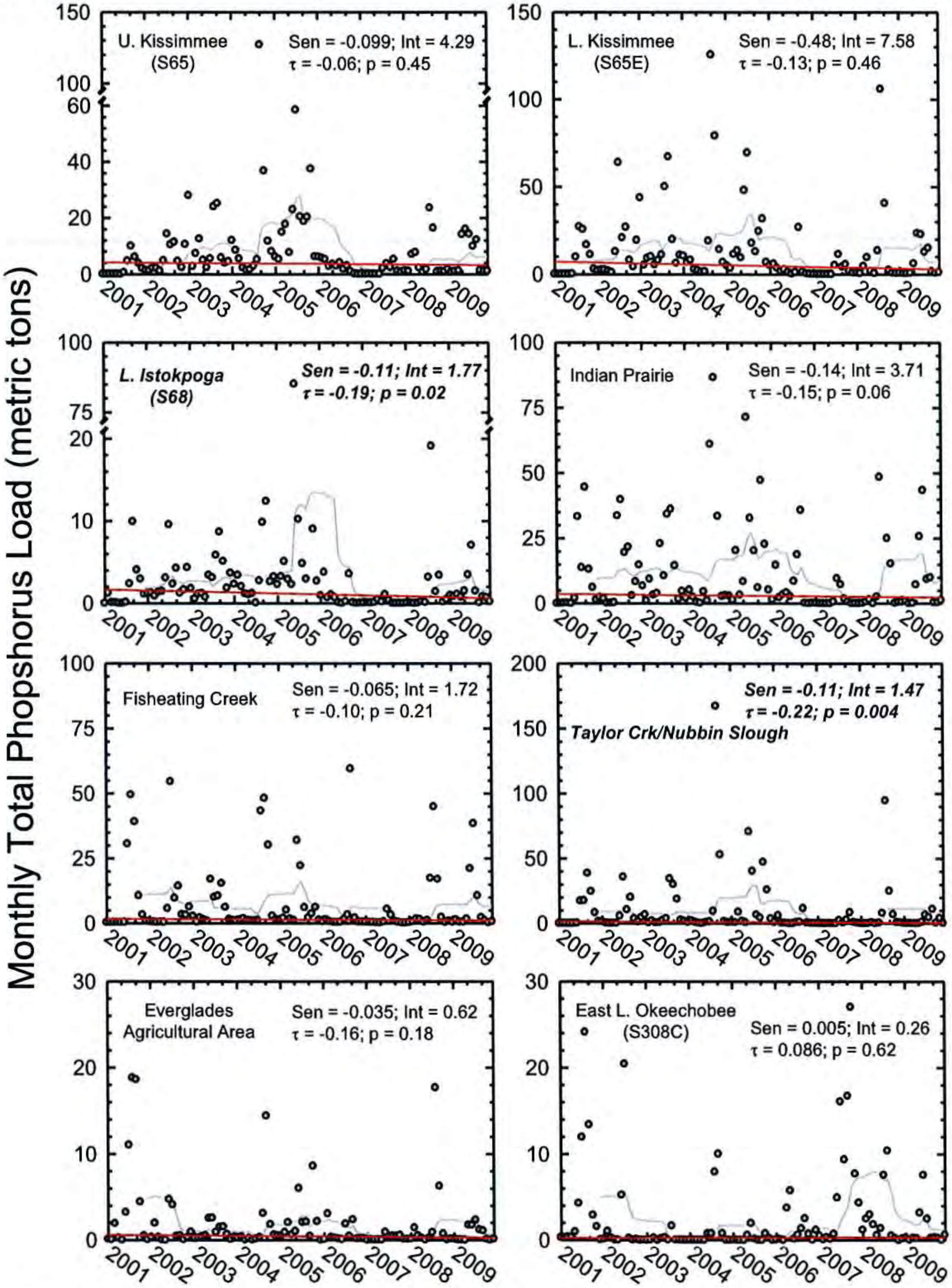
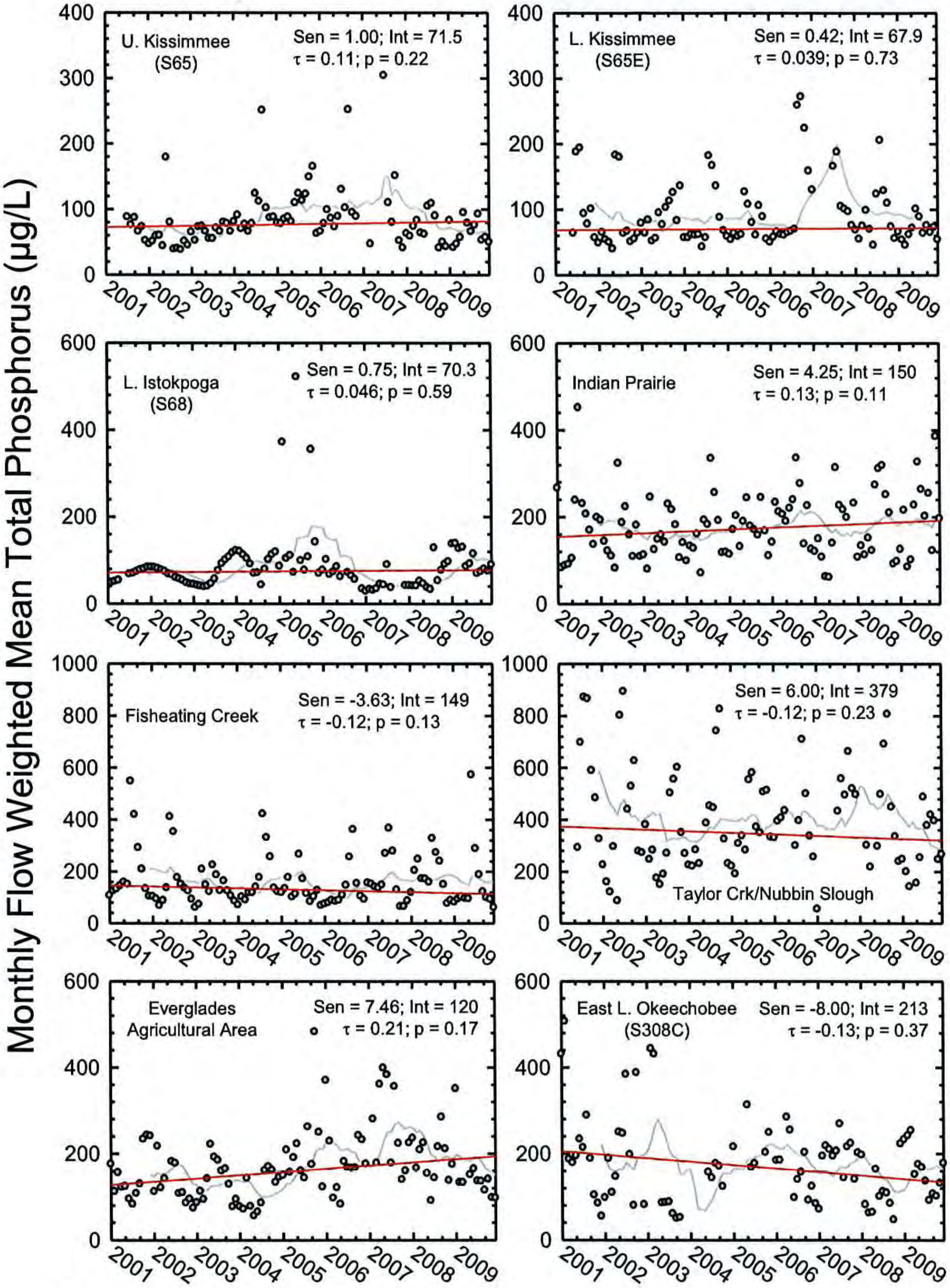


Figure 3-17. Monthly sub-watershed TP loads for 2001–2009. Gray dots represent monthly values, gray line represent 12-month moving averages, and red lines represent Seasonal Kendall trend lines. Bold, italicized sub-watershed labels signify a significant relationship.



1302 **Figure 3-18.** Monthly sub-watershed TP flow-weighted mean concentrations for
1303 2001–2009. Gray dots represent monthly values, gray lines represent 12-month
1304 moving averages, and red lines represent Seasonal Kendall trend lines.

EVERY YEAR SINCE 1989-2010 SOME 20YEARS NOW NT-LOADS TO LAKE OKEECHOBEE HAVE BEEN HIGH VERY HIGH LOADS

NO ACTION TO REDUCE BY SFWMD-FDEP-FDACS PEOPLE

3.2.3 Inflow Phosphorus Loading Trends and In-Lake Phosphorus Concentrations

3.2.3.1 Lake Okeechobee Inflows (2001–2009)

Inflow TP loads are calculated by multiplying the TP concentration times the measured flow. As a result, TP loads are strongly related to surface water inflows. Inflows to Lake Okeechobee have varied greatly over the past nine years (2001–2009) with three years of drought (2001, 2006, 2007) and three years with major storms (2004—Hurricanes Frances and Jeanne, 2005—Hurricane Wilma, and 2008—Tropical Storm Fay)(**Figure 3-19A**). The maximum annual inflow to the lake was 4.0 million ac-ft in 2005 and the minimum was 0.7 million ac-ft during 2007, one of the driest periods on record. The average inflow over the past decade—2.35 million ac-ft—is slightly less than the baseline period (1990–2005) average of 2.52 million ac-ft. Lake discharges ranged from 0.30 million ac-ft in 2001 to 3.75 million ac-ft in 2005 (**Figure 3-19B**).

Average lake volume was greatest in 2003 at 4.30 million ac-ft and least in 2007 at 2.06 million ac-ft (**Figure 3-19C**). Review of monthly average volumes clearly document the seasonal variability of water within the lake, with lowest values typically occurring in winter and spring months and highest values occurring in summer and fall (**Figure 3-19D**). The minimum average monthly lake level was 8.94 ft at the height of the drought in June 2007, while the maximum average monthly lake level was 17.7 ft in October 2004, one month after Hurricanes Frances and Jeanne passed over Lake Okeechobee.

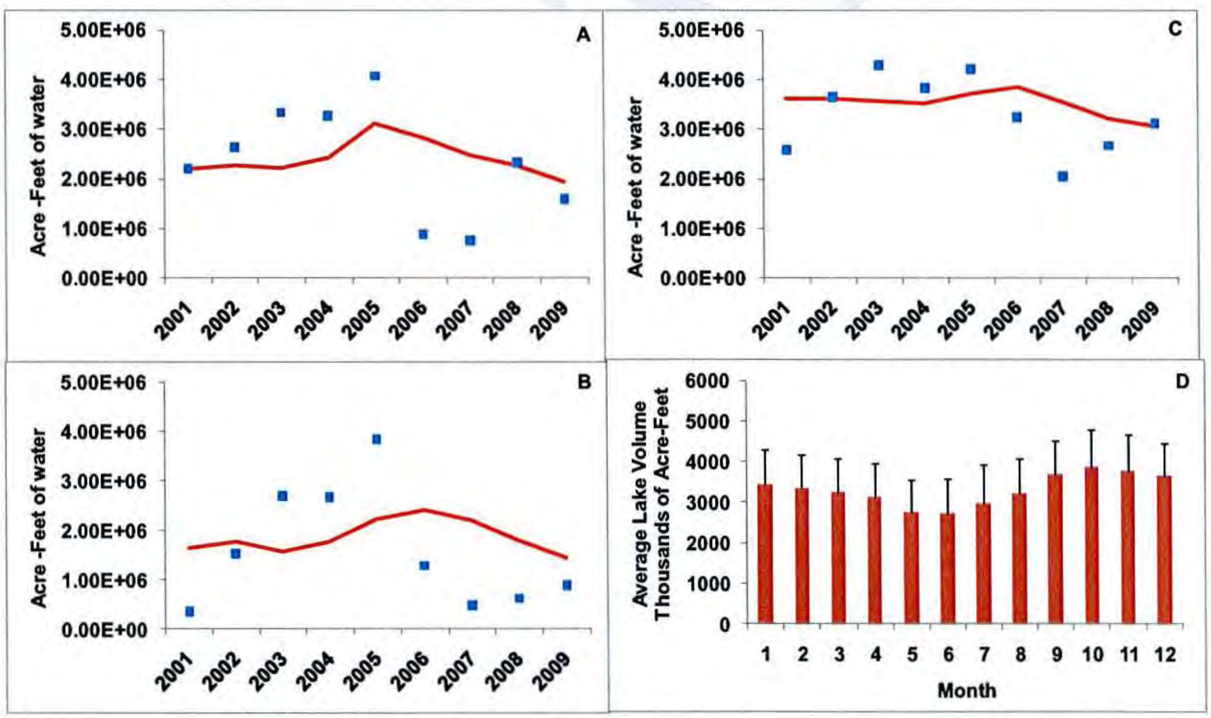


Figure 3-19. (A) Annual surface inflow to Lake Okeechobee (blue squares) and five-year moving average (redline). **(B)** Annual discharge (blue squares) and five-year moving average (redline). **(C)** Annual average lake volume (blue squares) and five-year moving average (redline). **(D)** Monthly average lake volume and one-standard error for 2001–2009.

3.2.3.2 Inflow TP Loads and In-Lake TP Concentrations (1973–2009)

Over the 37-year period of record (1973–2009), both the maximum and minimum TP loads to Lake Okeechobee by calendar year (including 35 mt per year derived from atmospheric deposition [FDEP 2001]) occurred in the last decade: the minimum was 156 mt in 2000 and maximum was 1,102 mt in 2004 (**Figure 3-20A**). The five-year rolling average in the past nine years ranged from 465 mt to 719 mt per year. This average is well above the TMDL of 140 mt to WILL NOT MAKE be met by 2015. No significant trend for inflow phosphorus loads was found in either the 2001–2009 period or 1973–2009 period (**Table 3-3**). Inflow-weighted TP concentrations ranged from a high of 313 ppb in 1988 and a low of 105 ppb in 1996 (**Figure 3-20B**). Over the 37-year period of record, there has been a significant decline in inflow concentration (**Table 3-3**). However, after 1996, this trend did not continue. For 2001–2009, there were no significant trends for inflow TP concentration despite the variation from a minimum of 133 ppb in 2003 to a maximum of 299 ppb in 2004 (**Table 3-3**).

Annual average in-lake TP concentrations increased significantly from below 50 ppb in 1974 to over 100 ppb after 1988 (**Figure 3-20B**). From 1989 to 1999 values continued to increase but remained below 120 ppb. The highest annual average in-lake concentrations of 223 ppb and 208 ppb occurred in 2005 and 2006, respectively. These years were also the first time that in-lake concentrations exceeded inflow concentrations. The most probable cause of these high concentrations is sediment resuspension and nutrient flux driven by hurricane impacts in the preceding years (James et al. 2008). After 2006, the annual average concentrations have declined, falling below 120 ppb in 2009.

YEAR 2001 TMDL SHOULD BE 40PPB AT NO TIME DO WE SEE 40PPB

HERE FOR EXAMPLE ARE POSTED ANNUAL TP-IN LOADS TO MT LOADS TO LAKE OKEECHOBEE

YEAR	MT LOADS
2001	302
02	393
03	339
04	357
05	442
06	575
07	490
08	411
09	432
10	??

REMEMBER SINCE YEAR 2001 TMDL OF 140MT 40PPB TO LAKE OKEECHOBEE. EVER SINCE YEAR 2001. THESE THREE AGENCYS FOR THE STATE OF FLORIDA (SFWMD. FDEP. FDACS) HAVE NEVER MADE A 140MT-40PPB TO LAKE OKEECHOBEE. I DO NOT KNOW ABOUT YOU PEOPLE, BUT I CALL THIS VERY-VERY POOR MANAGEMENT.

R.M. Norton ECOSYSTEM WATCH.

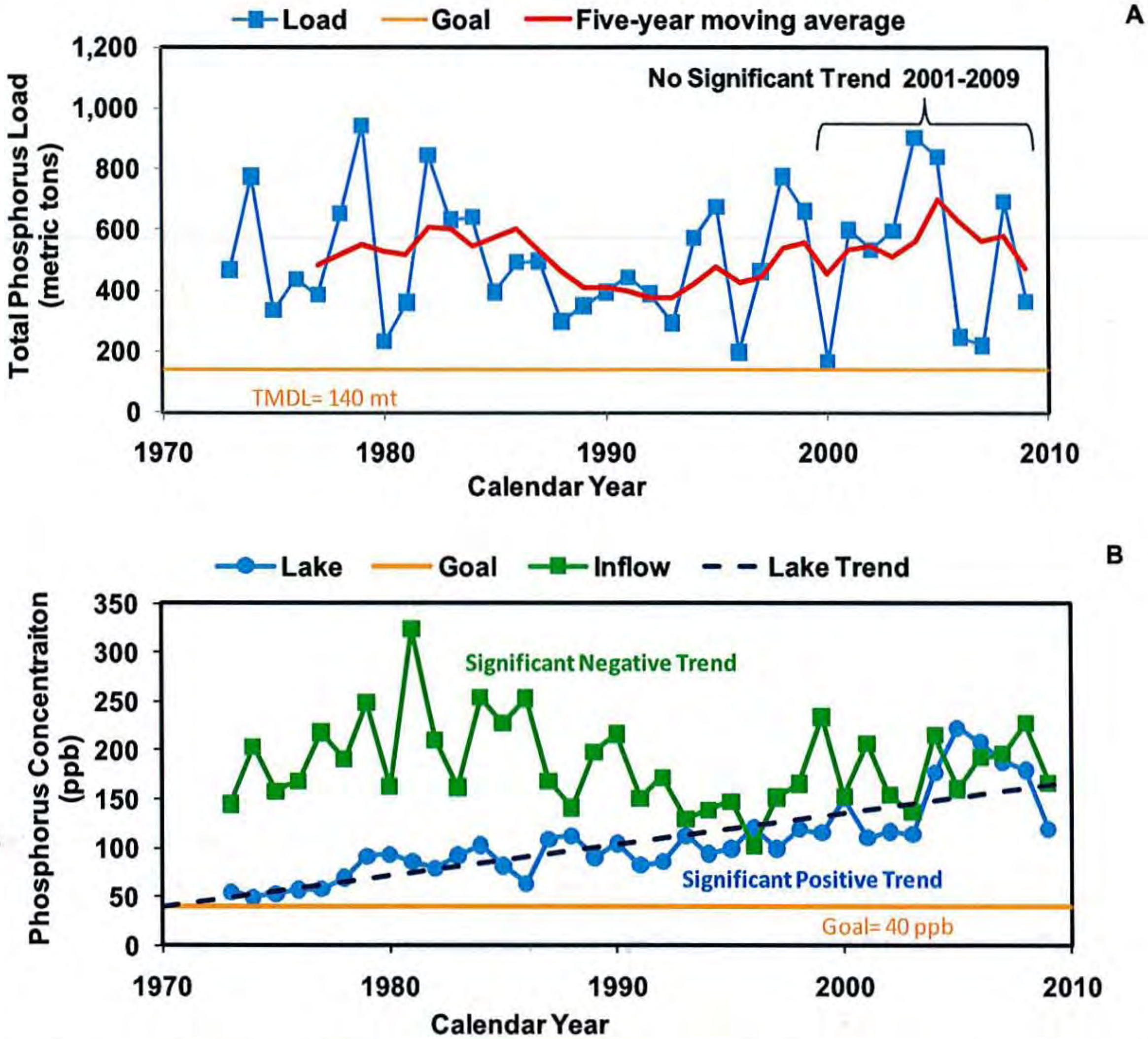


Figure 3-20. (A) Annual phosphorus load (mt) to Lake Okeechobee (blue squares), five-year moving average (red line), and the phosphorus TMDL (gold line). **(B)** Annual inflow phosphorus flow-weighted concentration (µg/L) to Lake Okeechobee (green squares), annual average in-lake concentrations (blue circles), in-lake concentration goal (gold line), and linear trend of in-lake concentration (dashed blue line: R2=0.67).

Table 3-3. Kendall's Tau trend analysis of Lake Okeechobee phosphorus and water flow.

Parameters	2001-2009			Period of Record (1973–2009)		
	Tau Statistic	Slope	P value	Tau Statistic	Slope	P value
Inflow (ac-ft/yr)	-0.153	-7870.80	0.338	-0.030	-342.47	0.574
Outflow (ac-ft/yr)	-0.116	-3062.60	0.578	0.114	872.17	0.109
Loads to the lake (mt)	-0.181	-1.18	0.195	-0.086	-0.146	0.092
Discharge loads from the lake (mt)	-0.093	-0.39	0.641	0.230	0.269	0.002
Inflow TP concentration (µg/L)	0.079	1.26	0.517	-0.169	-1.298	0.008
In lake TP concentration (µg/L)	0.269	5.95	0.169	0.553	2.496	<0.001
Outflow TP concentration (µg/L)	0.069	1.40	0.628	0.330	1.683	<0.001

3.2.4 Lake Discharge Phosphorus Trends

Average discharge TP loads from the lake were less than loads into the lake for the 2001–2009 period. The discharge loads ranged from 58 mt in 2001 to 827 mt in 2005 (**Figure 3-21A**). No significant trends were found for the 2001–2009 period; however, significant increasing trends of discharge loads and outflow TP concentration occurred over the 1973–2009 period (**Table 3-3**). Net loads (loads minus discharge) were overall positive (the lake is a net sink for TP), with the exception of 2005 and 2006 when there was a net export of TP (**Figure 3-21B**). Sediment loads were mostly negative, indicating that TP was absorbed into the sediments; however, in 2005 and 2007 sediments released more TP than they absorbed (**Figure 3-21C**). Total flow-weighted outflow TP concentrations ranged from 100 µg/L in 2003 to 196 µg/L in 2006 (**Figure 3-21D**). Over the period of record (1973–2009) the estimated accumulation of TP into the sediments has been over 11,000 mt (**Figure 3-22**). This is an increase in the sediment TP load of approximately 300 mt per year, which is the difference between the inflow and discharge loads.

The majority of the discharge from Lake Okeechobee occurred through structures S-77 and S-308 into the Caloosahatchee and St. Lucie rivers, respectively (**Table 3-4**). These are the largest discharge structures on the lake and are used when water levels exceed the stage regulation schedule (USACE 2008). The next four largest discharges during 2001–2009 were through S-351, S-352, S-354, and L-8 (C10A). These primarily provide water supply to the EAA and provide backup water supply for the southeastern coast. Of the remaining structures, all but S-135 provide some local water supply to the northwestern basins of Lake Okeechobee during dry periods. Discharge is small and outflow TP concentrations are lower than at other discharge structures because the waters pass through marshes where TP is removed by vegetation.

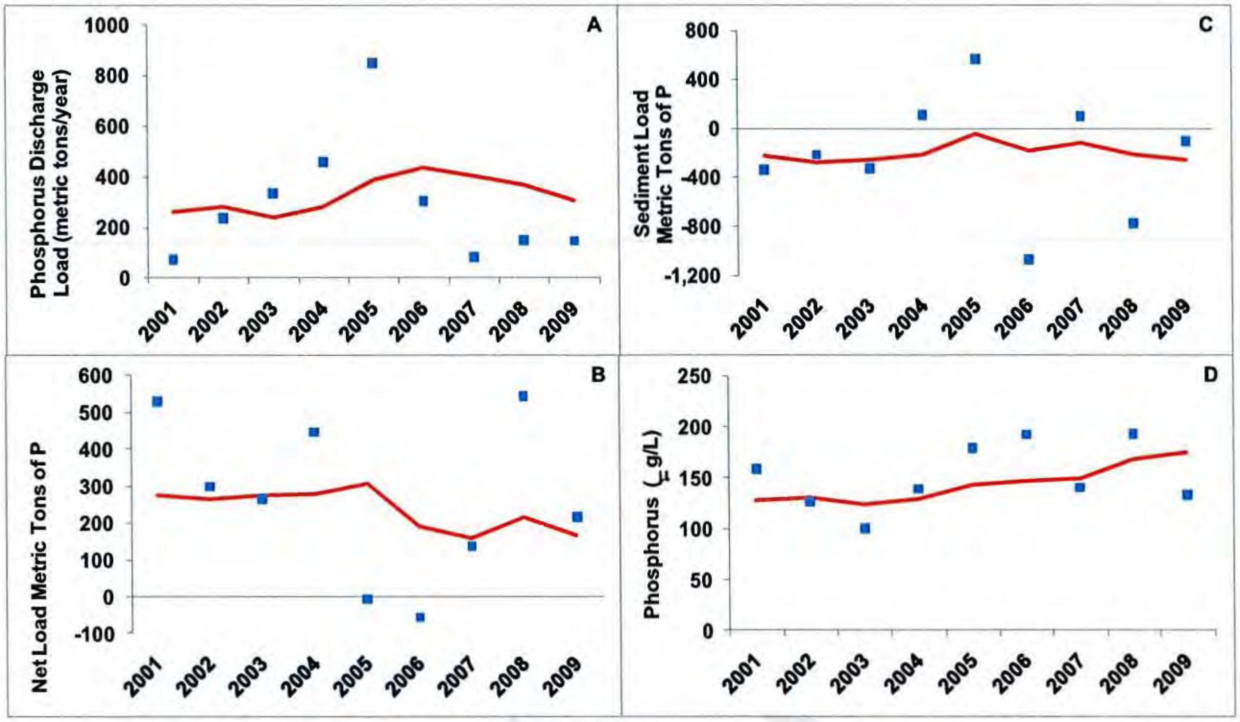


Figure 3-21. (A) Annual phosphorus load (mt) discharged from Lake Okeechobee (blue squares) and five-year moving average (redline). **(B)** Net (inflow-discharge) phosphorus load (mt) to Lake Okeechobee (blue squares) and five-year moving average (redline). **(C)** Net calculated sediment load (change in water column mass – net load) to Lake Okeechobee (blue squares) and five-year moving average (redline). **(D)** Annual discharge phosphorus flow-weighted mean concentration (blue squares) and five-year moving average (redline).

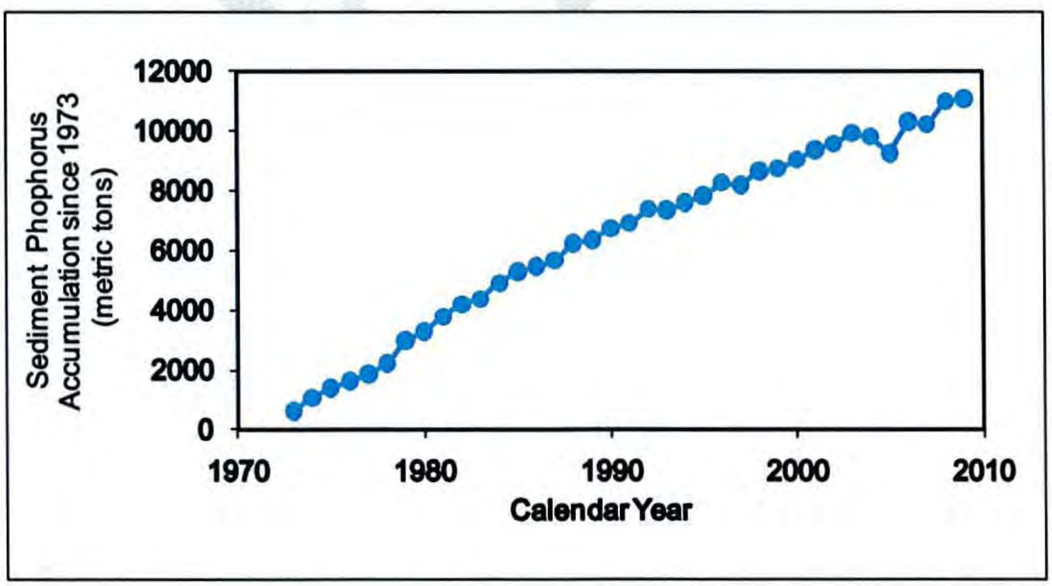


Figure 3-22. Estimated accumulation of phosphorus into Lake Okeechobee sediments since 1973 based on annual loads to and from the lake.

Table 3-4. Discharge by structure from Lake Okeechobee from 2001 to 2009.

Structure	Discharge (ac-ft/yr)	Annual TP Discharge (metric tons)	Flow Weighted Mean Concentration (mg/L)
C5*	24	0.005	169
S135	256	0.03	90
S129	542	0.03	45
S131	1,339	0.1	59
S127	2,066	0.3	98
G207	2,913	0.4	110
G208	4,338	0.7	135
INDS(S310)	30,353	3.9	105
C5A	56,255	8.2	118
L8(C10A)	92,802	26.1	228
S354	109,199	16.8	125
S352	120,928	31.6	212
S351	176,829	30.8	141
S308	303,925	79.2	211
S77	691,810	93.8	110
Total	**1,593,582**	**291.8**	**148**

NOTE AGAIN I SAY THESE THREE AGENCYS FOR OUR STATE OF FLORIDA. THE (SFWMD) THE (FDEP) THE (FDACS) HAVE NOT DONE THEIR JOBS. FROM YEAR 1989 WHEN I FIRST STARTED. TO GET THESE STATE PEOPLE. WE PAY OUR TAX DOLLARS TO DO THEIR JOBS. NOW WHEN MAN DATED YEAR 2015 FOR (TMDL) TO LAKE OKEECHOBEE, CAN NOT BE MADE BY THESE AGENCYS OF STATE. DO YOU THINK WE MAY NEED TO GET NEW LEADERSHIP TO MOVE FORWARD.

NOTE - WHEN I READ DRAFT I STILL SEE WORDS:

(SUCH AS)

ABOUT- MEANS TO ME SOME ONE DOES NOT HAVE AN IDEA WHAT IS GOING ON IN THE WATER SHED OF OKEECHOBEE.

APPROXIMATE - ONLY GUESSING HERE PEOPLE NO INFO TO SUPPORT GOOD OR BAD.

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ASSUMING - ONLY GUESSING HERE PEOPLE ANY TIME WE ASS/U/ME WE MAKE A ASS OUT OF U AND ME. "COME ON PEOPLE"

Table D-1. Responses to public comments by the coordinating agencies.

Comment No.	Response
AF-1	At this point, there is no reason to believe that the initial Best Management Practice (BMP) performance is not meeting expectations. Research by the University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS) for specific sites (see August 2010 Northern Everglades Interagency Meeting presentations) clearly indicates that implementation of BMPs results in significant reductions of phosphorus. Although these are site-specific projects, there is no reason to believe that similar results will not be obtained throughout the watershed once BMPs are fully implemented. Furthermore, numerous studies have been conducted to demonstrate the effectiveness of specific BMPs as described in the draft Lake Okeechobee Protection Plan (LOPP) Update (e.g., wetland water retention, holding water table higher, ditch fencing and culvert crossing, cow/calf BMP optimization). Based on these research efforts, we feel that BMPs are effective and achieve the balance envisioned by the statute. However, to see the full benefits of BMPs at the regional scale, we need to complete their implementation throughout the watershed and allow for adequate response time. Legacy phosphorus can also mask the effectiveness of BMPs. It should also be noted that, there has been a 41% reduction in phosphate use in the LOPP basin between 2001 and 2010. We attribute a significant portion of that reduction to nutrient management BMPs. There is also an effort under way through the South Florida Water Management District's (SFWMD or District) regulatory source control program (40E-61) to develop performance metrics to measure effectiveness of collective source control programs at the basin level. This will allow us to make more detailed assessments of BMP effectiveness at the basin scale. With that information, we will be able to determine whether additional BMP implementation will be required. The coordinating agencies have scheduled a meeting to discuss opportunities to expedite BMP implementation throughout the watershed.
AF-2a	The LOPP Update already includes costs for specific projects over the next few years (2011-2013). The update must be submitted to the legislature in early March 2011. Due to this time constraint and the complexity of the required analyses, we are unable to develop overall plan costs and schedule for incorporation into this document. However, the coordinating agencies appreciate the comments received regarding the need for more detail on priorities, costs, and schedule; and are committed to working with the stakeholders to develop this additional detail. Furthermore, by September 30, 2011, FDACS in cooperation with the coordinating agencies will prepare a budget analysis describing the total projected costs of completing the implementation of all cost-shared BMPs on agricultural lands within the watershed.
AF-2b	The coordinating agencies are willing to work cooperatively to identify appropriate mechanisms to fully fund BMP implementation and monitoring, but this information will not be available for incorporation into this 2011 LOPP update. However, it will be incorporated into annual reports and future LOPP updates as appropriate.
AF-3a	Under Section 373.4595, Florida Statutes (F.S.), BMP "means a practice or combination of practices determined by the coordinating agencies, based on research, field-testing, and expert review, to be the most effective and practicable on-location means, including economic and technological considerations, for improving water quality in agricultural

Comment No.	Response
	and urban discharges. Best management practices for agricultural discharges shall reflect a balance between water quality improvements and agricultural productivity." In accordance with this definition, BMPs are designed to strike a balance between agricultural productivity and environmental impact. This includes application of phosphorus fertilizers when soil and tissue testing justify the application. Reducing the phosphorus application rates to meet water quality goals or to achieve a nutrient balance as opposed to agronomic rates is inconsistent with this statutory definition, because this concept does not reflect that balance.
AF-3b	Please see response to comment AF-3a
AF-3c	Please see response to comment AF-3a
AF-4	Implementation of this recommendation is not feasible, nor does it comply with the definition of Best Management Practice. It is not practical to develop a nutrient balance, especially since crops are not 100% efficient in using nutrients applied for their production. The goal of nutrient management planning is to optimize application or addition while minimizing offsite movement. We believe that improving onsite water management through the implementation of BMPs such as swales and water control structures are instrumental in reducing phosphorus load discharges from agricultural lands. This emphasis on water management has been the focus of the BMP implementation program throughout the watershed. As noted above, the Northern Everglades-Payment for Environmental Services dispersed water management solicitation initiated by the SFWMD will augment the water management BMP effort by providing additional nutrient load reductions within the Lake Okeechobee Watershed. Additionally, there has been a 41% reduction in phosphate use in the LOPP basin between 2001 and 2010. We attribute a significant portion of that reduction to nutrient management BMPs.
Af-5a	For the agricultural operations enrolled in the Florida Department of Agriculture and Consumer Services (FDACS) BMP programs, the data available are total acreage, operations that are fully implemented, and operations that are partially implemented. Agricultural operations enrolled in the FDACS BMP program are required to immediately implement the nutrient management BMPs and usually all of the management BMPs are already being implemented, such as grazing management, feed and mineral trough placement, etc. The main reason a producer would not be fully implemented is that they are waiting cost-share funding for a structural BMP. The FDACS provided a chart indicating the categories of BMP implementation for which data are available, which is included in Section 5.1.2.4. The LOPP Update captures three levels of BMP data reporting: total acreage enrolled, acreage that has completed implementation of all planned BMPs (including those requiring cost-share), and acreage of owner-implemented BMPs. In the final update, we will include a Lake Okeechobee Watershed map depicting total enrolled acreage by sub-watershed and two tables: one describing sub-watershed total acreage enrollment and the other containing acreages by BMP implementation categories for the entire watershed. Data are not available on a sub-basin level since many of the parcels enrolled in the BMP program do not fall into just one sub-basin.
AF-5b	Please see response to comment AF-5a

Comment No.	Response
AF-5c	Please see response to comment AF-5a
AF-5d	Please see response to comment AF-5a
AF-6a	The coordinating agencies agree that edge-of-farm systems are effective and should be implemented where appropriate. Historically, the coordinating agencies have defined edge-of-farm systems as including detention, retention, or chemical treatment systems that are intended for use on intensive land uses such as dairies or row crops. According to our understanding, Audubon considers water management structures on pastures as edge-of-farm systems as well. With that understanding, the coordinating agencies agree that edge-of-farm systems and water management structures are critical elements of the source control program and agree to evaluate options for expanding and expediting implementation of these systems where possible. The SFWMD provided the FDACS with an additional $3 million in FY2010 for the purposes of implementing these types of projects and the FDACS has proceeded with implementation using these funds. The coordinating agencies will continue to work together in the future to identify funding opportunities to implement these systems.
AF-6b	Please see response to comment AF- 6a.
AF-6c	Upon clarification through discussions with Audubon staff, the main premise of this comment is requesting a means to ensure nutrients in reclaimed water do not enter downstream surface waters and a method to correspondingly reduce the amount of phosphorus added as fertilizer to account for the phosphorus increase from reclaimed water. Water re-use is not compatible with all agricultural landuses given food safety and plant disease issues. Some water reuse BMPs are being voluntarily implemented on agricultural lands that have existing tailwater recovery systems and this would have required an environmental resource permit (ERP). Because a variety of site-specific factors decrease nutrient levels as the applied water migrates through the soil and groundwater to surface waters, it will likely be recommended that reliance on the existing regulatory framework be the mechanism to ensure land application and reuse projects are permitted with appropriate treatment levels to protect downstream waters. Furthermore, the nutrient management plans, under BMP authority, require composted biosolids, reclaimed water, and organic supplements are accounted for and considered in the nutrient budgets. Determining the amount of phosphorus from reclaimed water available to plants is challenging and complex. The Florida Department of Environmental Protection (FDEP) is currently working with the St. John's River Water Management District to conduct a reuse study on this subject.
AF-6d	Manure management is an integral component to the implementation of a nutrient management plan. Soil and tissue testing is required by FDACS rule to justify the application of phosphorous in the Lake Okeechobee Watershed. All manure applications must be made in compliance with the applicable BMP program. We believe that improving onsite water management through the implementation of BMPs such as swales and water control structures are instrumental in reducing phosphorus load discharges from agricultural lands. This emphasis on water management has been the focus of the BMP implementation program throughout the watershed. Also, the Northern Everglades-Payment for Environmental Services (NE-PES) dispersed water management solicitation initiated by the SFWMD will augment the water management

Comment No.	Response
	BMPs by providing additional nutrient load reductions within the Lake Okeechobee Watershed.
AF-6e	Please see the response to commnet AF-4.
AF-7a	Implementation of this suggestion is not economically or technically feasible. The Dairy Best Available Technology (DBAT) project can only be implemented at sites with sufficient land for a large retention system; therefore it is not possible at all dairies. Furthermore, all dairy concentrated animal feeding operations (CAFOs) and one medium dairy animal feeding operation (AFO) in the Lake Okeechobee Watershed are permitted under the National Pollutant Discharge Elimination System (NPDES) program. It is important to note, however, that medium and small AFOs are not required to obtain NPDES permits under the CAFO rules.
AF-7b	Please see the response to comment AF-7a.
AF-7c	DBAT costs were determined and presented in the Final DBAT Report (See SWET 2008 reference in Section 5).
AF-8a	Please see the response to comment AF-6a.
AF-8b	Please see the response to comment AF-6a.
AF-9a	A more refined method for evaluating phosphorus loading will be utilized for the future Plan Update. The basin nutrient load model will be included in the suite of tools the agencies will consider.
AF-9b	Please see the response to comment AF-9a.
AF-9c	Agree. A sentence is added in Section 6.8 in response to this comment.
AF-10	Funding needs for the current and near-term proposed projects are included in Table 6-5, ranging from source controls to construction projects, research and WQ monitoring and exotics control. Please also see the response to comment AF-2a.
AF-11	The FDEP understands and recognizes Audubon's concerns about Class AA biosolids spreading in the Lake Okeechobee Watershed. Various measures were adopted during the rulemaking efforts to help address some of Audubon's concerns about dumping of Class AA biosolids, such as the prohibition on having more than one-dry ton of unapplied Class AA biosolids on one's property without proper storage. The FDEP will continue to work with Audubon to address their comments and concerns. Section 373.4595, F.S., states that Class AA biosolids marketed and distributed as a fertilizer are exempt from demonstrating a net balance between imports and exports. As a fertilizer product, Class AA biosolids fertilizers would be subject to the same BMPs as other fertilizers. The FDEP can review fertilizer BMPs to determine if there should be any changes unique to biosolids but the BMPs, when implemented, already address the nutrients of concern. For other classes of biosolids, the statute requires a demonstration of a net balance between phosphorus imports relative to exports on the permitted application site rather than at the basin level as suggested by this comment. To require a balance at the basin level, the statute language would need to be revised to provide the coordinating agencies with this authority.
AF-12	Because the FDEP does not regulate the end use of Class AA biosolids (the end use is regulated as fertilizer), the FDEP's authority to require such tests and to require domestic wastewater facilities to document that the persons to whom the facility is distributing and marketing biosolids have conducted such tests would likely be questioned. Also, requiring such tests and documentation for Class AA biosolids treats them differently

Comment No.	Response
	from other fertilizers and nutrient sources. If such tests and documentation are required for Class AA biosolids, it seems fertilizer sellers should be required to provide such tests and documentation before their buyers use their fertilizers within the watershed. The issue of fertilizers that are blended with Class AA biosolids should also be addressed.
AF-13	The FDEP adopted a biosolid rule in August 2010 that results in a decrease in the number of land application sites and the amount of Class B biosolids being applied in the three NEEPP basins with the end of Class B land application expected by January 2013. FDEP staff will be responsible for enforcing the rule implementation and will coordinate with District staff as necessary.
AF-14	The amount of Class B biosolids applied within the basin can generally be determined from existing permit and reporting requirements that were developed for establishing compliance on a field-by-field basis and not for general, overall statistics. Therefore, these quantities would not always be exact. Recent rule revisions associated with permitting and reporting will be more conducive to providing overall statistics in addition to providing the FDEP with field-by-field compliance data. However, it is important to note that the time frame for implementing the permitting and reporting changes coincides with the expected loss of sites within the basin; land application of Class B biosolids is expected to end by January 1, 2013. Rule revisions would be needed to require tracking and reporting of Class AA fertilizer to determine the quantity imported into the basin. However, such rule revisions cannot be accomplished through the LOPP Update. The FDEP will continue to hold discussions with Audubon on this issue.
AF-15	In addition to requiring alteration to the biosolids rule, potential legislation may be needed depending on the extent of information the coordinating agencies determine necessary to track AA biosolid use at this level. The coordinating agencies will continue to discuss potential tracking mechanisms.
AF-16a	Currently, Section 373.4595, F.S., does not prohibit Class AA biosolids fertilizers. Therefore, phasing out Class AA material would likely require legislation. Also, this would eliminate the sale of Class AA biosolids as fertilizer. With out-of-state entities selling Class AA biosolids as registered fertilizer, legal issues involving the interstate commerce clause may be raised. It is not clear whether phasing out the use of Class AA material would include those biosolids sold to fertilizer blenders as an ingredient for their custom fertilizer blends or for imported blended fertilizers.
AF-16b	Please see the responses to comments AF-11 through AF-15.
AF-16c	Please see the responses to comments AF-11 through AF-15.
AF-17	Revisions to the Environmental Resource Permit rules for water quality are currently under development. This Unified Statewide Stormwater Rule initiative is discussed further in this document in Sections 5 and 6. The initiative is being facilitated by the FDEP with substantial input from all five water management districts. The comments provided will also be considered as part of the process.
AF-18	The Unified Statewide Stormwater Rule may reduce the need to provide specific Total Maximum Daily Load (TMDL) criteria for specific basins depending upon the criteria included in the final rule. Please also see the response to comment AF-17.
AF-19	The District, under its current rules, is requiring applicants to provide an analysis to demonstrate that the proposed project will not increase the nutrient load discharging

Comment No.	Response
	offsite on an average annual basis. The comments provided are being considered as part of the Unified Statewide Stormwater Rule development initiative. Please also see the response to comment AF-17.
AF-20	Chapter 62-520, Florida Administrative Code (F.A.C.), contains rules related to “groundwater classes, standards, and exemptions.” While reclaimed water is mentioned several times in this rule, it is unclear what type of amendments could be made to “discourage the use of reclaimed water for residential and commercial landscape irrigation” in the Lake Okeechobee Watershed. Florida laws (373.250 and 403.064, F.S.) encourage and promote reuse as an alternative water supply; while regulations found in Chapter 62-610, F.A.C., ensure protection of public health, safety, and the environment. Rule 62-610.850(1)(a), F.A.C., states “reuse and land application projects shall not cause or contribute to violations of water quality standards in surface waters.” Because a variety of site-specific factors decrease nutrient levels as the applied water migrates through the soil and ground waters to surface waters, the FDEP recommends relying on its existing regulatory framework to ensure land application and reuse projects are permitted with appropriate treatment levels to protect downstream waters. The coordinating agencies understand the potential for unintended consequences in association with the use of reclaimed water. The FDEP has been a partner with the Water Reuse Foundation in a project to address this issue. A final report on the project is due in September 2011. Also, determining the amount of phosphorus from reclaimed water available to plants as a fertilizer offset is challenging and complex; however, the FDEP is currently working cooperatively with the St. Johns River Water Management District to implement a contract with UF/IFAS to conduct a reuse study on this subject.
AF-21a	Noted. The SFWMD, as well as the other water management districts, will continue to work together in the development of the Unified Statewide Stormwater Rule, 62-347, FAC.
AF-21b	The guidance memorandum will only address the volume of water discharged offsite from a proposed project in accordance with existing rules. The proposed changes in the comment are directed at water quality and would require new rulemaking. Please also see the response to comment AF-17.
AF-22	This suggestion has been provided to Eric Livingston and others associated with development of the Unified Statewide Stormwater Rule. Please also see the response to comment AF-17.
AF-23a	FDEP staff, in coordination with SFWMD staff, drafted the white paper for exactly the purpose stated by Audubon—to provide guidance to our staffs when working with local governments to meet Northern Everglades and Estuaries Protection Program (NEEPP) requirements and to address NEEPP issues through the comprehensive planning process. In that regard, our staffs have been actively utilizing the document for that purpose. As noted, the white paper does not and cannot constitute binding authority without legislative authority. Such authority cannot be obtained through a memorandum of understanding, which is simply a mechanism for entities to memorialize how they will implement their existing authority, nor can such authority be obtained through an update of the LOPP.
AF-23b	Please see the response to comment 23a.

Comment No.	Response
AF-24	We strongly believe that the solution to the Lake Okeechobee nutrient and storage problems is a mixture of regional, sub-regional and local projects. No single approach will address the complicated issues and challenges that Lake Okeechobee is facing. Therefore, the LOPP Update includes a projects and activities that need to be implemented at different spatial scales. The LOPP Update emphasizes Dispersed Water Management (DWM) efforts and agrees that DWM is the most promising near-term option to address the storage goal for the Northern Everglades. Hence, the District initiated the Payment for Environmental Services program, which was recently released. Proposals are due in April 2011, with contract selection/approval expected in June. Our hope is to select a set of quality projects and to work closely with those projects to ensure success of the project both from the State's and the rancher's perspectives. This will maximize our ability to expand the program successfully to whatever optimal storage proves feasible.
AF-25	The LOPP Update provides a general framework and road map that will result in progressive improvements/reductions in phosphorus loading to meet the TMDL and additional storage that will improve Lake Okeechobee's operating levels to more ecologically desirable ranges as well as reduce undesirable discharges to the estuaries. However, due to the general nature of many of the projects identified in this update, a significant amount of detailed planning, design and engineering is necessary prior to project implementation. Therefore, sub-watershed feasibility studies will be conducted where alternative plans will be developed and compared using the nutrient loading model (i.e., WAM). Specific water quality and storage features and locations will be identified in these sub-watershed feasibility studies.
AF-26a	The Northern Everglades-Payment for Environmental Services solicitation, released on January 7, 2011, is a mechanism to contract with landowners to construct water retention and nutrient reduction features and pay them for those services. Please see section 6.3.1 for more information.
AF-26b	Please see the responses to comments AF-24 and AF-26a.
AF-26c	There have been numerous discussions of adding chemical treatment in one form or another to the front side of STAs in the northern watershed. As a result, the District has conducted a chemical treatment study to evaluate this and has presented the results of that study in Section 5.1.3.2. The Lakeside Ranch Stormwater Treatment Area (STA) is one the regional facilities included in this study for potential implementation of chemical treatment technology. Additional text has been added to Section 6.2.2.2 of the LOPP update indicating that the District will conduct more detailed evaluations of chemical treatment technology in conjunction with the Lakeside Ranch Phase I project prior to proceeding with construction of Lakeside Ranch Phase II.
AF-26d	This comment refers to Line 3757 which is under the New Alternative Technology Assessment section. This is a new initiative which provides a forum to explore additional alternative nutrient reduction technologies to help nutrient load reductions in the Lake Okeechobee Watershed and connected watersheds. The proposed budget will depend on the proposed technology.
AF-27	We agree and believe the current plan emphasizes removal of nutrients through innovative technologies. As discussed previously, there are several ongoing alternative

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	treatment technology studies (e.g., hybrid wetland treatment technology [HWTT], PRB) and efforts to find new technologies continue. Also the District's new Water Quality Center of Excellence initiative will provide a forum for interested parties to explore new ideas on alternative nutrient reduction technologies through collaborative partnerships. Please see Sections 5 and 6 of the plan for more details.
AF-28	At this time, the algae biomass and suspended solids in the Lake Okeechobee water column are relatively low. We know of no cost-effective, proven technology that could be employed for this purpose.
AF-29a	We are open and receptive to qualified vendor proposals for alternative technologies. Identifying the most productive situations for the deployment of the new technologies does not appear to be a particularly challenging issue. The most important part of the effort is determine if the technologies perform as claimed, are cost effective, and if there are any undesirable side effects.
AF-29b	As stated above in response to comment AF-27, the agencies are eager to identify viable technologies and determine suitable deployment opportunities.
AF-29c	The St. Johns River Water Management District is currently evaluating such a technology. It may receive consideration for Lake Okeechobee when that pilot test is complete or conclusions on its performance are available.
AF-30	The District has demonstrated a commitment to the Dispersed Water Management program as can be seen by the increased funding that was provided to this program in FY2010. Also, the draft LOPP Update already places emphasis on DWM as a near-term, cost-effective means to achieve water storage in the Northern Everglades. Additional information has been added on DWM in the final update document. Please also see the response to comment AF-24.
AF-31a	The water storage goal for the Lake Okeechobee Watershed is identified in the Lake Okeechobee Phase II Technical Plan (P2TP). This will be further refined under the sub-watershed level feasibility studies. In addition, the coordinating agencies are proposing to conduct a Lake Okeechobee Pre-drainage Characterization study, as captured under the near-term project list (Table 6-4). The Lake Okeechobee Pre-drainage Characterization will model existing and pre-drainage hydrologic characteristics of the sub-watersheds and provide nutrient reduction and storage goals. Although water storage may provide ancillary water quality benefits, traditionally we have not looked at water storage as a primary tool to meet our water quality objectives. The majority of the storage projects included in the LOPP Update are not intended to meet the water quality goals. Additionally, identification of future DWM funding needs and schedule largely depends on the success of the Northern Everglades-Payment for Environmental Services dispersed water management solicitation.
AF-31b	Please see the response to Comment AF-31a.
AF-32	Dispersed Water Management through the Northern Everglades-Payment for Environmental Services will compensate landowners for documented services of water retention or nutrient removal.
AF-33a	The Kissimmee Watershed is included in the Northern Everglades and Estuaries Protection Program. Numerous projects have been completed and are planned in this watershed including hydrologic restoration projects under the Kissimmee River Restoration Program. Proposed development projects are required to obtain

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	Environmental Resource Permits, which require applicants to demonstrate that the proposed activity will not contribute to an existing impairment of the receiving water body. In the draft LOPP Update, the Upper Kissimmee Sub-watershed Feasibility Study was considered a long-term project. In the final update document, it is included as a near-term project. The timing of implementation will be contingent upon funding and resources.
AF-33b	The requested DWM table is under development for projects planned for implementation. The District and U.S. Department of Agriculture-Natural Resource Conservation Service (USDA-NRCS) have executed a memorandum of understanding to partner in the implementation of WRP projects including Fisheating Creek. This partnership includes the development and implementation of a performance monitoring network for the sub-watershed. Additionally, please see the response to comments AF-33a and AF-31a .
AF-33c	The Kissimmee Sub-watershed Feasibility Study has been moved from a long-term project to a near-term project in the Final update.
AF-34a	Dispersed Water Management is an approach that complements regional projects. The DWM program contains several approaches to dispersed water management including easements, cost-share projects, and payment for environmental services. The varied nature of these approaches and their funding mechanisms coupled with the District's first solicitation for the PES program being currently underway, make it will be difficult to identify a clear budget and timeline for this program, despite the coordinating agencies clear commitment to the program, which is described in the LOPP Update text. Please also see the response to comment AF-24.
AF-34b	Please see the responses to comments AF-24 and AF-34a. Possible release of nutrients from soils was considered in the development of the Northern Everglades-Payment for Environmental Services (NE-PES) program. NE-PES soil sample data will be used to establish the operational regime of water management alternatives.
AF-34c	The Northern Everglades-Payment for Environmental Services dispersed water management solicitation includes water quality monitoring to address this issue. Furthermore, the coordinating agencies are conducting research studies in collaboration with UF/IFAS (i.e., the Wetland Water Retention Project described in the LOPP Update) and the results will provide additional guidance.
AF-35	The Northern Everglades-Payment for Environmental Services dispersed water management solicitation includes monitoring and reporting requirements for future projects.
AF-36a & b	A tremendous amount of uncertainty is associated with legacy phosphorus estimates. Further, since only two points comprise the straight line in Figure 1, which may not necessarily prove a relationship, we think it would not be prudent to include this figure in the document. Nevertheless, it is almost certain that legacy phosphorus will continue to increase as long as there is a net import of phosphorus into the watershed. This further emphasizes the need to develop and implement projects and technologies to sequester and/or treat excess phosphorus in the watershed.
AF-36c	The following preferred language was inserted: “Research also is needed to develop new approaches and technologies to sequester or remove the excess phosphorus entering the watershed.”

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AF-36d	Charter missions for the Water Quality Center of Excellence are currently under development and this recommendation will be considered.
AF-36e	The following language was added: "however as these lakes retain nutrients it could begin adversely affecting the chemistry of the lakes and could eventually result in increased nutrient discharges to the Kissimmee River and Lake Okeechobee". Please also see the responses to comments AF-49 and AF-51
AF-37	The agencies will work with farmers to find ways to minimize water and nutrient use associated with crops, store water on site, and limit nutrients from leaving the site and entering downstream waters with current crops. The LOPP Update also includes proposals from the BMP Research and Extension Coordinating Council for creating farming systems that use less water and fertilizers.
AF-38a	This is discussed in the Watershed Challenges Section of the LOPP Update (Section 4). Please also see the response to comment AF-38c.
AF-38b	We addressed cost-share issues associated with the Comprehensive Everglades Restoration Plan (CERP) Lake Okeechobee Watershed (LOW) project and funding constraints in Section 4.0. Please also see the response to comment AF-24.
AF-38c	Please see the response to comment AF-38b
AF-38d	Please see the response to comment AF-38b
AF-38e	Internal phosphorus loading in Lake Okeechobee is one of the major issues and remains a challenge as described in Section 4 of the LOPP Update. If internal phosphorus loading is not addressed, the lake may not fully respond to external load reductions. Also, Everglades and estuary restoration will be more difficult without improving the quality of water discharged from the lake. The LOPP Update includes different approaches to address these concerns, which will be demonstrated through pilot projects to test their feasibility.
AF-38f	We agree that habitat protection and restoration are critical. The following language was included in the final LOPP Update at line 4097: "and the cost to scale it up to meaningful levels for snail kite recovery are prohibitive. The protection and restoration of snail kite habitat is critical."
AF-39	Although it is recognized that storage provides ancillary water quality benefits, traditionally we have not looked at water storage as a primary tool for meeting water quality objectives.
AF-40	The estimated phosphorus reductions were not achieved because of the challenges highlighted in Section 4 of the LOPP Update. These challenges include legacy phosphorus, annual nutrient imports, in-lake phosphorus loading, issues with STAs, CERP challenges, and funding constraints. However, the coordinating agencies remain committed to achieving the intent of the legislation and continue to work to overcome the many resource challenges and funding uncertainties. This plan identifies strategic projects, promising technologies, and other proposals that can be implemented in Lake Okeechobee and its watershed to continue to move toward achieving the ultimate TMDL goal.
AF-41	BMP funding is allocated from a dedicated funding source for the Everglades Forever Trust Fund. The FDACS and SFWMD are committed to funding BMP cost-share programs to the extent funds are made available annually by the legislature. Please also see the response to comment AF-2.

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AF-42	Please see the responses to comments AF-11 through AF-15.
AF-43	Please see the response to comment AF-2.
AF-44	Please see the response to comment AF-34a.
AF-45	This paragraph was changed as follows: "Nutrient imports pose another challenge for the Lake Okeechobee Watershed. Approximately 6,088 net metric tons of phosphorus were imported into the watershed annually from anthropogenic land use activities. Among the six regions included in this study, the three upstream regions (Lake Istokpoga, Northern Lake Okeechobee, and Upper Chain of Lakes), all draining to the lake with 76 percent of the drainage area, contributed a net phosphorus import of 4,256 mt per year (70%). The net phosphorus import from the three southern regions (south, east and west) contributed about 1,832 mt per year (30%), however only have a small fraction of their water flow into the lake. Approximately 5,047 mt of the phosphorus import were stored onsite in upland soils based on 2009 data. Although the annual phosphorus imports remains a major problem in the Lake Okeechobee Watershed, there has been an improvement. Compared to the 2002 study, net phosphorus imports have decreased by 25 percent and onsite phosphorus storage is down 29 percent. These decreases are primarily due to changes in phosphorus import from land uses (truck crop and sugarcane) and implementation of Best Management Practices."
AF-46	Based on the Florida Land Use, Cover and Forms Classification System, improved pasture is composed of land that has been cleared, tiled, reseeded with specific grass types, and periodically improved with brush control and fertilizer application. Wetlands are areas where the water table is at, near, or above the land surface for a significant portion of most years. Based on these definitions, it may not be proper to classify wetland as improved pasture since they have totally different hydrologic regimes and management practices.
AF-47	The net import from wetland was assumed to be zero (not a source or sink).
AF-48	Please see the responses to comments AF-36a and AF-36b
AF-49	For planning purposes, the period of record is through 2009. Although this is not predictive, the data are current and will be updated as appropriate with each three-year LOPP update.
AF-50	This paragraph was changed to reflect the net import of nitrogen from the East, West, and South Lake Okeechobee sub-watersheds, which is 6,219 mt (15%).
AF-51	The sentence was changed to: "The continued accumulation of nutrients had resulted in increased nutrients in the lakes' water columns which could lead to higher nutrients in discharges to the Kissimmee River and Lake Okeechobee." The period of record used for planning purposes is through 2009. Although this is not predictive, the data are current and will be updated as appropriate with each three-year LOPP update.
AF-52	The colors in the pie chart are automatically generated by the program used and cannot be manipulated by the user.
AF-53	This line and associated percentage have been revised based on updated information included in the final update. This percentage was calculated by dividing 156,276 by 996,5741 (the total adjusted enrolled acres less the Everglades Agricultural Area [EAA]-enrolled acres).
AF-54	The paragraph referenced in the comment was not intended to imply that the Kissimmee River Restoration Project will be used as a treatment facility. With the work

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	being performed, it is expected that the restoration will change phosphorus uptake throughout the system and the District is interested in studying how the restoration will affect the phosphorus uptake of the system. With regard to Lake Kissimmee's increasing phosphorus outflows, it is true that average loads and concentrations at the outlet structure (S-65) have been higher in the last decade. This can be attributed partially to natural conditions (e.g., rain events leading to larger discharges and hurricanes resulting in high discharges and sediment resuspension in the lake), and hydrilla treatments and vegetation removal leading to a more open lake with more opportunity for phytoplankton growth and more exposure of lake sediment to wind resuspension. Although total phosphorus (TP) concentrations in Lake Kissimmee have fluctuated somewhat since monitoring began in 1982, current concentrations are close to what they were nearly 30 years ago. However, TP concentrations have become higher at S-65 than in the middle of the lake, which points to some influence on lake water quality near the structure. SFWMD scientists are currently focusing on this.
AF-55	This section was changed to: The WAM has been applied to the Lake Okeechobee Watershed to evaluate the effectiveness of BMPs, which based on the modeling results were found to be the most cost effective approach for initial phosphorus load reductions. However, in order to see the full benefit of BMP implementation at the regional scale, implementation of BMPs throughout the watershed will need to be completed and adequate response time should be allowed. It should be also noted that there are multiple factors that can mask the BMP effectiveness such as legacy phosphorus, variability due to site and discharge point characteristics, the fact that water quality is being monitored regionally and tributary contribution to phosphorus load.
AF-56	Noted. Thank you.
FFB-1	This acreage does not include the USDA-NRCS Fisheating Creek WRP. The 128.722 acre-feet of storage is for completed, operational projects. Once the USDA-NRCS Fisheating Creek WRP is constructed and operational, the storage volume will be included.
FFB-2	The sentence was changed to: "By 2013 no Class B biosolids application will be permitted in the Lake Okeechobee Watershed."
FFB-3	The comma was removed.
FFB-4	Discharge from S-65 will vary between 3,000 and 11,000 cubic feet per second according to the downstream condition (Master Water Control Manual for Kissimmee River-Lake Istokpoga Basin, USACE Jacksonville District, August 1994). Hence no change is made.
FFB-5	This is simply a formatting issue with line numbering. There was no information associated with lines 608-610.
FFB-6	It is for the Lake Okeechobee Watershed only, which includes nine sub-watersheds (see Figure 1-1 of the LOPP Update). The Lake Okeechobee Protection Act permitting basin boundary is larger than the Lake Okeechobee Watershed boundary.
FFB-7	This sentence was changed to: "In the Lake Okeechobee Watershed, most, if not all sites, are expected to end land application of Class B biosolids by 2013. Therefore, the rule changes most applicable to the watershed are those related to Class AA biosolids."
FFB-8	No change made.

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FFB-9	This sentence was changed to the following: "The Lake Okeechobee TMDL for the total phosphorus (TP) load has been set at 140 mt/year based on a 5 year rolling average (105 mt from the Lake Okeechobee Watershed and 35 mt from atmospheric deposition) (FDEP 2001), and the tributary TMDL for the TP concentration has been set at 113 parts per billion (ppb) for the northern Lake Okeechobee Watershed by the U.S. Environmental Protection Agency (USEPA)."
FFB-10	The 55 ppm was based on data from several points in the upper Kissimmee River Basin, including Lake Kissimmee and Reedy Creek. The period of record for the various datasets ranged from 1974-2008 to 1984-2008.
FFB-11	We cannot determine the lag time with the tools available this time. We plan to refine the tools we have and will strive to address this comment in a future update.
FFB-12	The estimated phosphorus removal was 237 metric tons (Reference: Table 10-16, 2008 South Florida Environmental Report [SFER]). This information was added to the referenced lines in Section 4.3 as follows: "The result was the removal of over 2 million cubic yards (yd3) of detrital sediment from 2,000 acres of the lake’s nearshore bottom (James and Zhang 2008), which resulted in the removal of approximately 237 metric tons of phosphorus."
FFB-13	Currently the U.S. Army Corps of Engineers (USACE) is the federal sponsor/owner of the Taylor Creek STA project and therefore is the agency responsible for repairs.
FFB-14	Recently, there have been discussions in multiple forums regarding this issue including the South Florida Ecosystem Restoration Task Force and the NAS Committee on Independent Scientific Review of Everglades Restoration Progress. These discussions are expected to lead to some suggestions as to what research or analysis may need to be done to further evaluate this issue. We will be participating in and following the progress of this issue and will incorporate any relevant findings into Lake Okeechobee Protection Plan updates and annual reports.
FFB-15	This sentence was revised as follows: "Source control programs have evolved and expanded through cooperative efforts by the coordinating agencies and stakeholders whereby the agencies implement their respective programs through specific rules promulgated by each agency based on statutory authorizations".
FFB-16	The Integrated Feasibility Report and Environmental Impact Statement for the Kissimmee River Restoration Project states that “Restoration of the Kissimmee River will reduce the average annual inflows to Lake Okeechobee by about 15,000 acre-feet, reducing the current Kissimmee River flows to Lake Okeechobee (948,400 acre-feet per year; U.S. Geological Survey Water-Data Report FL-89-1A) by about 1.6%. This reduction would result from additional evapo-transpiration associated with increased floodplain flooding.” This section of the report also concludes that the changes would be small and that the accuracy of the data is not adequate to detect such minor changes (USACE 1991, page 200, Section 9.8.7 “Water Supply”). The cited analysis would have used a project footprint that included Pool E, so it likely overestimated the losses due to restoration, since as implemented the project will extend south only into a portion of Pool D. The increased water consumption in the Kissimmee River due to evapotranspiration (ET) from the restoration project is estimated to be so small, relative to Kissimmee Basin Runoff, that it would be difficult if not impossible to measure. This small increase is very unlikely to impact the Kissimmee River Restoration Project (KRRP) Performance

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	Measures. Also, the performance measures for hydrology were based on data measured prior to channelization, when comparable losses to ET during floodplain inundation would have occurred. We did a quick estimate of the increased consumption to respond to the reviewer's question. Evaporation estimates come from a Caloosahatchee Basin model calibrated to 20 years of measured flow data, and the 'acres impacted' are limited to the restored area of the Kissimmee River floodplain. The estimates of increased consumption are shown in the following table. This estimate is independent of the Feasibility Report estimate cited above, but the conclusion is very similar.

	Pre-restoration	**Post-Restoration**
Dominant land type in floodplain	Pasture	Marsh or Open Water
Typical evapotranspiration	37 inches per year	40 – 42 inches per year
Difference in evapotranspiration	42 – 37 = 5 inches per year	
Acres impacted	14,000 acres	
Increase in evapotranspiration	5,800 acre-feet per year	
Typical flow at S-65 E	1,200,000 acre/feet per year	
Decrease in flow at S-65E caused by increase in Kissimmee River evapotranspiration	<0.5%	

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	Because of its low yield, the surficial aquifer system is not a significant source of water supply in the area. Thus, any increased groundwater storage under the floodplain of the river would not have implications for increased losses from the system. Literature Cited: U. S. Army Corps of Engineers. 1991. Final integrated feasibility report and environmental impact statement, environmental restoration Kissimmee River, Florida. U.S. Army Corps of Engineers, Jacksonville, Florida, USA.
FFB-17	Del Bottcher developed an appendix for the 2004 LOPP that detailed, by land use, the various types of BMPs that a landowner might use. It was divided into "Owner Implemented," "Cost share," and "Advanced" BMPs. The Owner Implemented and Cost Share BMPs were considered to be "typical" and are the same set of BMPs that are represented in the BMP manuals. Typical was a term used to identify a suite of BMPs that were most commonly being implemented for a certain agricultural use. Each agricultural operation that has filed a notice of intent to implement BMPs following FDACS-adopted programs identifies site-specific BMPs applicable to that site.
FFB-18	This section was renamed "Creating Farming Systems that Use Water and Fertilizers More Efficiently" to better describe its content.
EF-1A	The LOPP Update identifies specific projects with estimated phosphorus load reductions (listed in Table 6-2 and Table 6-3) for near-term and long-term implementation to move closer to the TMDL goal. It also identifies specific activities being performed (e.g., feasibility studies, additional modeling, research projects). As noted in the LOPP Update, the timeline for meeting the TMDL depends on funding availability (federal, state, SFWMD, and local funding), as well as technical issues (e.g., response time, legacy phosphorus). Many competing mandates require funding and the

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	plan will be implemented as expeditiously as funding allows. It is anticipated that there will be some lag time between implementation of the plan and the desired ecological results, due to a number of technical factors that are difficult to predict, including ecological response time, legacy phosphorus in the watershed, and internal lake loading. Also see the response to comment AF-2a regarding the overall plan schedule and budget.
EF-1B	Please see the response to comment EF-1A.
EF-1C	The coordinating agencies brainstormed and worked with stakeholders to identify potential projects that will reduce phosphorus loadings to achieve the Lake Okeechobee TMDL. However, even with all the projects included in this LOPP Update there is still a shortfall of 62 mt/yr of total phosphorus. The agencies continue to identify further phosphorus-reduction projects and are investigating new nutrient removal technologies and programs. For example, the District's new Water Quality Center of Excellence initiative will provide a forum for interested parties to explore new ideas on alternative nutrient reduction technologies through collaborative partnerships. We welcome any proposals for potentially viable nutrient removal projects that could be included in the LOPP Update to address this shortfall. Please also see the response to comment AF-40.
EF-2A	It is not accurate to say past implementation focused on lowest cost or lowest efficiency. Initial efforts to address the TMDL set by the legislature and were focused on the priority basins and specific landuses in those basins. Please also see the response to comment AF-1 regarding BMP effectiveness.
EF-2B	Please see the response to comment AF-1
EF-3	Comment noted. Please reference Table 5-8 for the pilot Florida Ranchlands Environmental Services Project (FRESP) performance data. These data were utilized in the regional Watershed Assessment Model (WAM) for this LOPP Update. Please also see the response to comment AF-1 regarding BMP effectiveness.
EF-4	The Lakeside Ranch STA is a regional facility included in the near-term implementation phase. The construction of Phase I and the design of Phase II are under way. The near-term phase also includes continuation of the HWTT projects and implementation of a new HWTT site at Grassy Island/Brady Ranch. Additionally, the near-term phase includes three planning studies (Fisheating Creek sub-watershed feasibility study, Taylor Creek site feasibility study, and Indian-Prairie sub-watershed Phase I assessment), which will evaluate and identify specific projects (regional and sub-regional) that should proceed to implementation. Regional and farm-scale chemical treatment are included as long-term projects in the 2011 LOPP Update and will proceed based on information that is currently being evaluated in the ongoing Chemical Treatment Study. Additional regional STAs, Reservoir-Assisted STAs, and reservoirs are included in the long-term phase and are at various stages of planning.
EF-5	Please see the response to comment EF-1A.
EF-6	The LOPP Update includes the cost estimates for the near-term implementation phase (2011-2014), which includes the operating and maintenance costs of the current projects and capital and operation and maintenance costs of proposed near-term projects. Please also see the response to AF-2a.
EF-7	We agree that the assessment of new technologies is essential to success in achieving nutrient reductions goals in the Lake Okeechobee Watershed. Hence, the LOPP Update includes innovative nutrient reduction technologies including Hybrid Wetland Treatment

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	Technology, the Northern Everglades Chemical Treatment project, and Permeable Reactive Barrier Technology. Also, the New Alternative Technology Assessment initiative, which is designed to provide opportunities for interested parties to demonstrate potential alternative technologies for reducing nitrogen and phosphorus loading in water and sediments is included in the LOPP Update. We are open to learning more about the Everglades Foundation's nutrient exchange program.
EF-8	Please see the response to comment AF-3a.
EF-9	Legacy phosphorus is a challenging issue that the coordinating agencies are committed to understanding better and finding ways to handle within the watershed. For example, there is a recently completed legacy phosphorus study that outlines an abatement plan and other technologies, such as the permeable reactive barrier, are being investigated for their effectiveness. If results are favorable, this technology may be considered for implementation in the sub-watershed. Please also see the responses to comments AF26a, AF26b, and AF27.
EF-10	Adopting planning targets for individual sub-watersheds, one sub-watershed at a time, may potentially lead to a shortfall in the total phosphorus load reduction required to achieve the Lake Okeechobee Phosphorus Total Maximum Daily Load (TMDL). To ensure that the necessary total phosphorus load reduction is achieved, the coordinating agencies determined that preliminary planning targets for all key sub-watersheds in the Lake Okeechobee Watershed should be established at this time using the same methodology used in the Fisheating Creek feasibility study. Accordingly, the coordinating agencies are developing a scope of work for the "Lake Okeechobee Watershed Pre-drainage Characterization," which, among other things, will determine the historic and existing loading from each of the five remaining key sub-watersheds (Upper and Lower Kissimmee, Taylor Creek/Nubbin Slough, Indian prairie, and Lake Istokpoga).
EF-11	We concur. Please see the response to comment AF-24.
EF-12	The LOPP Update identifies storage and water quality features that work towards achieving the Lake Okeechobee TMDL at a high level. However, as recommended in the Lake Okeechobee Watershed Phase 2 Technical Plan, more detailed feasibility studies are needed and planned for each of the nine sub-watersheds that will provide more details on features (e.g., locations, preliminary costs). Other considerations are landowner sensitivities and the effects that siting features and estimating related land costs may have on the property owner's future use or sale of their property, and doing so could expose the agencies to potential lawsuits.
SOC-1	The District has collaborated closely with the U.S. Fish and Wildlife Services, U.S. Army Corp of Engineers, and Florida Department of Environmental Protection in the development of the Dispersed Water Management Program (DWM) projects. The program's goal is to keep more water on the landscape as it more naturally occurred prior to the construction of extensive drainage and levee systems. This approach of working collaboratively with willing landowners to implement cost-effective solutions is in addition to the planned regional treatment and storage facilities that are necessary to meet comprehensive restoration program goals. A meeting was held with Save Our Creeks and the District in which these specific comments on the Nicodemus Slough DWM Project were discussed in detail.
SOC-2A	Please see the response to comment SOC-1.

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SOC-2B	Please see the response to comment SOC-1.
SOC-3	Comment noted. Please see the response to comment SOC-1.
SOC-4	Please see the response to comment SOC-1.
SOC-5	Please see the response to comment SOC-1.
SOC-6	Please see the response to comment SOC-1.
SC-1	Comment noted. Please also see our specific comments to Audubon Florida above on this comment.
SC-2	Please see responses to comments AF10, AF11, and AF12.
SC-3	The environmental resources permitting program (under the authority of 373 and 403, F.S.), implemented by both the District and the FDEP address wetland impacts. Under the ERP program, applicants must incorporate practicable design modifications to avoid and minimize wetland impacts. If impacts are deemed unavoidable, mitigation must fully offset these impacts. Wetlands are evaluated for functional value under the Unified Mitigation Assessment Method (62-345, F.A.C.) and mitigation with an equal or greater functional value is required. Additionally, the proposed Unified Statewide Stormwater Rule focuses on requiring greater nutrient reduction for new developments to help reduce nutrient loading from stormwater discharges. Furthermore, the Dispersed Water Management program will help reduce the conversion of wetlands to other land uses through private/public partnerships, easements, and payment for environmental services.
SC-4	Legacy nutrients, even though they are present in the soil, are not always available for plant uptake. Reuse water can be utilized in certain agricultural operations, but not all given food safety concerns and plant disease issues. The SFWMD has released a solicitation initiating a pay for environmental services concept for dispersed water storage that will give the landowners opportunity for water retention and nutrient reduction.
SC-5	State statute allows for the implementation of additional BMPs if it is demonstrated that the current BMPs are not providing the benefit required to meet the TMDL. Also, new BMPs can be used once they are identified by research.
SC-6	Reduction of phosphorus use below the agronomic rate is not economically feasible and therefore would not meet the current statutory definition of a BMP. Farmers have reduced their phosphorus use as demonstrated by the reduction in fertilizer sales within the LOPP and having implemented BMPs applicable to their operations. Please also see the responses to comments AF-1 and AF-3a.
SC-7	Two types of backpumping have occurred in association with Lake Okeechobee: flood protection and water supply. Flood protection backpumping is only utilized in limited instances when all preventative measures have been taken to avoid or minimize backpumping (e.g., pre-storm drawdown), but rainfall conditions and canal elevations still warrant backpumping to avoid flooding. Water supply backpumping is a seldom-used practice that sends excess water from rainfall events to the lake for storage during dry periods/drought conditions. Water supply backpumping to Lake Okeechobee has not occurred since 2001.
SC-8	The SFWMD has released a solicitation initiating a pay for environmental services concept for dispersed water storage. This concept would compensate agricultural producers for storing water. For more information on the NE-PES dispersed water

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	management solicitation please see Section 6.
EW-1a	The coordinating agencies thank you for you input on the draft LOPP Update during the public comment period. The final plan includes several revisions that address many of your concerns. Additionally, the main essence of your comments was categorized into four general categories: enforcement and management, estimating versus providing data, backpumping, and Lake Okeechobee as a drinking water source. These general categories are addresses in responses EW1b-1e.
EW-1b	Water management in South Florida is challenging and complex, with many competing needs. These state agencies have taken steps to substantially reduce phosphorus inputs to the system; however, legacy phosphorus continues to be a significant challenge. The coordinating agencies are committed to enforcing rules and ensuring implementation of programs to improve the health of Lake Okeechobee and connected watersheds.
EW-1c	Many of the projects and programs included in the LOPP Update are new treatment technologies for which specific load reduction data are not available. Other projects are in the design phase and estimates were taken from the design estimates. When actual data are available, they will be included in future updates.
EW-1d	Please see the response to comment SC-7.
EW-1e	Several drinking water supply sources are used in South Florida. The reliance on Lake Okeechobee as a drinking water source has been greatly reduced recently. The Okeechobee Utility Authority is the only active public water supply system that still pulls source water from the lake.