

# 2016 SOUTH FLORIDA Environmental Report



*Pine Lake, Everglades National Park*

## HIGHLIGHTS

With Everglades water cleaner than it has been in generations, progress on key water quality improvement and restoration projects — plus managing above-average rainfall in the Lake Okeechobee region — marked the highlights of Water Year 2015 and Fiscal Year 2014-2015 for the Florida Department of Environmental Protection (FDEP) and the South Florida Water Management District (SFWMD). The agencies continue to implement, monitor and document a year of restoration, scientific and engineering accomplishments in the Kissimmee Basin, Lake Okeechobee, the Everglades and South Florida coastal areas in the *2016 South Florida Environmental Report*.

The *2016 South Florida Environmental Report* provides extensive peer-reviewed research summaries, data analyses, financial updates and a searchable database of environmental projects. The full report covers environmental information for Water Year 2015 (May 1, 2014 - April 30, 2015) and project/budgetary information for Fiscal Year 2014-2015 (October 1, 2014 - September 30, 2015). The full 2,239-page report is available online at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer).

## Everglades Water Quality

- **Everglades water quality continues to show signs of improvement.** Similar to previous years, the most recent five-year total phosphorus criterion assessment indicates that unimpacted portions of each Everglades Water Conservation Area passed all four parts of the state's compliance test. Over the past 10 years, significantly decreasing trends in annual geometric mean total phosphorus levels were measured at about 37 percent of total phosphorus rule monitoring locations. Also, no significant increases in annual geometric total phosphorus concentrations were observed at any monitoring stations during the reporting period. Mercury levels in Everglades bass and mosquitofish have declined across the Everglades. Interagency efforts are continuing to assess region-specific conditions that control mercury accumulation in fish and wildlife.

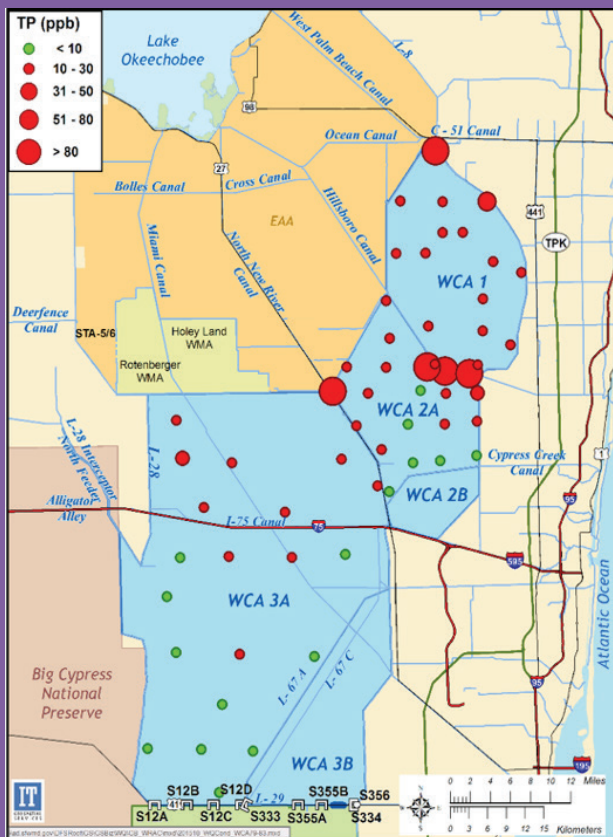
### Everglades Stormwater Treatment Areas

- **Over their 21-year operational period, the STAs have treated more than 16 million acre-feet of water and have retained approximately 2,000 metric tons of total phosphorus.** In Water

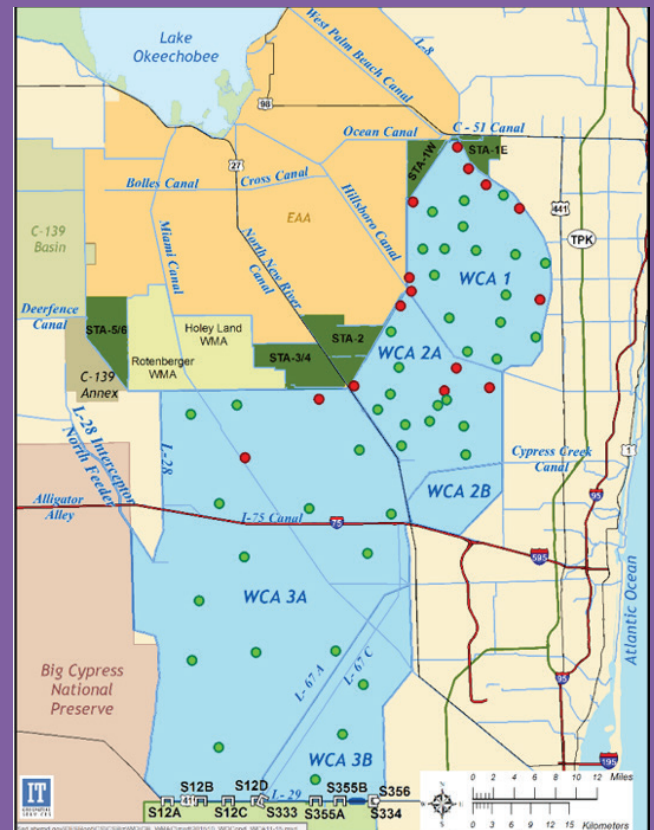
Year 2015, with 57,000 acres of treatment area, the STAs treated 1.4 million acre-feet of water. They reduced both inflow total phosphorus load and concentration by 83 percent and, in the process, kept 138 metric tons of total phosphorus from entering the Everglades Protection Area. Remarkably, the STAs also reduced total phosphorus concentrations heading south to 17 parts per billion — the lowest level observed since the start of their operations.

- **Water managers sought to move excess water southward.** An uneven distribution of rainfall across the region left the Everglades STAs with available treatment capacity, and a concerted effort was made to send regulatory lake releases south from Lake Okeechobee. In Water Year 2015, roughly 585,000 acre-feet of water from the lake was released to the Everglades STAs. Importantly, this unprecedented amount — 43 percent of total annual flow to the STAs — helped manage lake levels and reduce freshwater discharges to the Caloosahatchee and St. Lucie estuaries. Efforts are underway to evaluate the effects of this management action on STA conditions and long-term performance.

## Everglades Water Quality is Substantially Improved



1979 - 1983



2011 - 2015

**Left:** Prior to restoration efforts, cattail growth in the Water Conservation Areas, fueled by excessive levels of phosphorus, choked out native plant communities and disrupted food sources and habitat for endangered wildlife. The red dots show areas measured with excessively high levels of phosphorus.

**Right:** In 2015, with operation of 57,000 acres of stormwater treatment areas and implementation of best management practices, water quality throughout the Water Conservation Areas has been substantially improved. The green dots show areas that have been restored to ecologically healthy water quality. The handful of sampling stations that are not at 10 ppb (red dots) are continuing to make significant progress in achieving that standard. Notably, six stations in the Water Conservation Areas previously identified as "impacted" transitioned to an "unimpacted" status in WY2014 and have maintained that status in WY2015. Overall, 90 percent of the Everglades is at or below 10 parts per billion of phosphorus.



**Nutrient Source Control Programs**

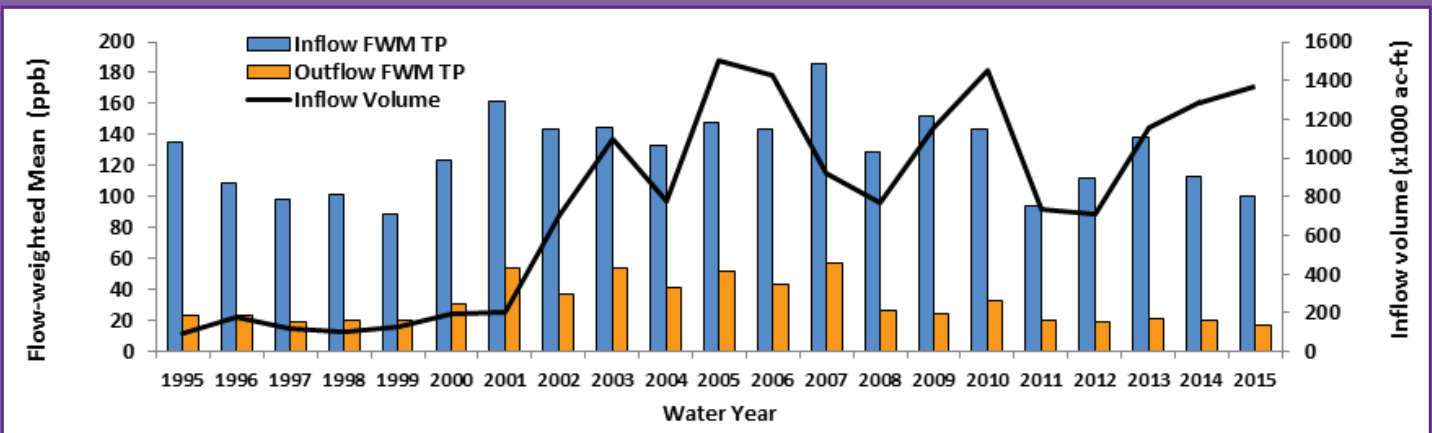
- Farming best management practices (BMPs) continue to reduce nutrients.** BMPs implemented under the South Florida Water Management District’s regulatory source control program reduced total phosphorus in agricultural runoff from 470,000 acres south of Lake Okeechobee by 79 percent in Water Year 2015, three times the amount required by state law. The District’s regulatory BMP program targets pollutants at their source, through practical cost-effective measures to reduce phosphorus levels entering the regional stormwater system. Source reductions through BMPs lessen the amount that must be captured in downstream STAs and improves the cost-effectiveness of those capital projects to further decrease total phosphorus levels. The South Florida Water Management District’s regulatory BMP program and Everglades STAs together have prevented more than 4,860 metric tons of total phosphorus from entering the Everglades Protection Area since 1996.

**Restoration Strategies: Clean Water for the Everglades**

- Implementation of Florida’s Restoration Strategies initiative advanced in Water Year 2015.** Work is proceeding on two of three massive flow equalization basins (FEBs), which will provide 105,000 acre-feet of additional water storage and are designed to attenuate peak stormwater flows prior to delivery to the Everglades STAs. Design of the first expansion to the existing STAs has been completed and construction has started on several conveyance improvement features as well as the first phase of expansion to STA 1 West.

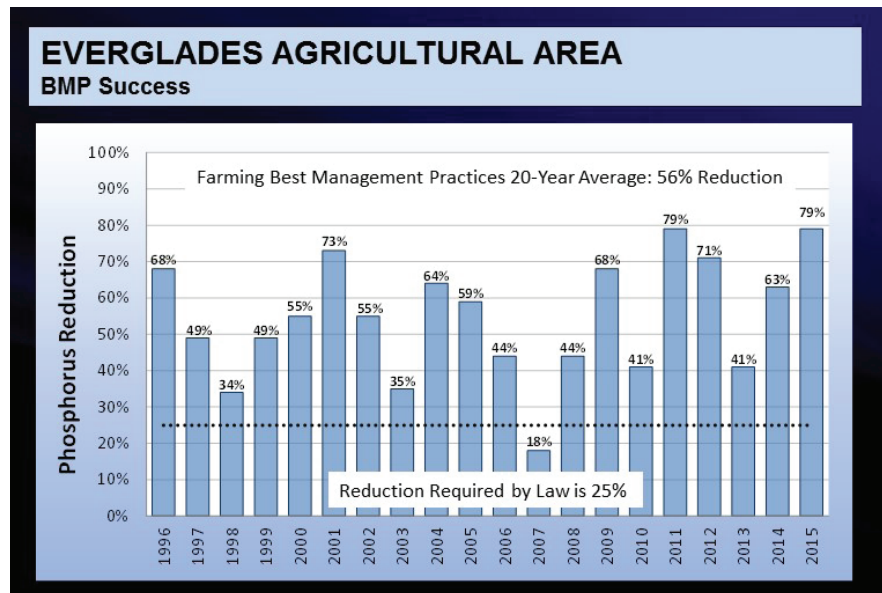
  - A-1 FEB (a 60,000 acre-foot shallow storage impoundment) construction was completed in November 2015 (more than six months ahead of its deadline) and operations have commenced.
  - L-8 FEB (a 45,000 acre-foot deep storage impoundment) is completing construction and now in operational testing.
  - STA-1 West Expansion (an additional 4,300 acres of treatment area) design was completed in June 2015 and construction

**Increased Volumes of Clean Water Are Now Flowing into the Everglades**



**Everglades stormwater treatment areas working to clean water:** Since 1995, approximately 16 million acre-feet of water have been treated by the South Florida Water Management District’s five stormwater treatment areas (STAs) – that’s enough to cover all 16 counties within the District with 1.25 feet of water. The STAs use nature’s own green technology, plants, to remove excessive phosphorus before it enters the Everglades. In 2015, water entering (inflow) the STAs averaged 99 parts per billion, and water leaving the STAs to the Everglades (outflow) averaged 17 parts per billion, the lowest level since the start of their operations. To date, 2,012 metric tons of phosphorus were removed through STAs.

- began in November 2015.
- Conveyance improvements (modifications to Structure S-5AS and construction of the new L-8 Divide Structure) are ongoing, with completion dates of September 2016 and September 2018, respectively.
- East Beach Water Control District Canal Cleaning Demonstration Project (a sub-regional source control project) is in year two of a three-year monitoring effort to determine project effectiveness at reducing phosphorus concentrations in canals.
- Mecca Shallow Impoundment design is underway.
- **Nine scientific studies are being implemented as part of the Restoration Strategies Science Plan.** The Science Plan is investigating ways for improving operation and management of the STAs to optimize their treatment performance and help achieve the Water Quality Based Effluent Limit for total phosphorus. Key investigations are focused on biogeochemical processes, soil amendments, periphyton-based STA, cattail sustainability and alternative vegetation to enhance treatment. The District is also developing operational FEB and STA guidelines and evaluating sampling methodologies for phosphorus in surface water.



**Farming Best Management Practices (BMPs) curb phosphorus runoff at the source:** The 20-year average decrease of 56 percent reduction (compared to pre-water quality efforts) in phosphorus runoff from the Everglades Agricultural Area farming is more than double the improvement required by state law. In 2015 alone, phosphorus runoff from the EAA was reduced by 79 percent versus the prior year. To date, 2,900 metric tons of phosphorus were prevented by BMPs from flowing to the Everglades.

## Everglades Ecology and Invasive Species

- **The South Florida Water Management District and collaborating agencies carry out monitoring, modeling and assessment** of Everglades hydrology, wildlife, plant ecology, ecosystem function, and landscape change. Applied science studies on tree islands, submerged vegetation, peat collapse and active cattail management are indicating either continued degradation or status quo. These studies focus on short-term regional hydrologic needs and decision-making for long-term restoration goals.

- A notable example is the Comprehensive Everglades Restoration Plan Decomp Physical Model (DPM) — a field-scale test being implemented to determine how to best design and formulate Everglades restoration plans in the vicinity of Water Conservation Areas 3A and 3B. DPM flow experiments indicate: (1) pulses create high sediment transport rates needed for restoration, (2) sheetflow can rebuild ridges, and (3) canals that are not completely backfilled could have ecological impacts on downstream water quality.

### What is phosphorus?

Although it is a vital nutrient in all natural systems, phosphorus is also a fertilizer component. It flows across the landscape in stormwater runoff (urban and agriculture), harming natural areas by promoting algae growth and an overabundance of non-native plants, crowding out natural vegetation and disrupting food sources and habitats used by native wildlife. The Everglades is naturally a low-nutrient system. Even small amounts of additional nutrients can upset the ecological balance needed by the native plants and animals in the historic “River of Grass.”

### What is an STA?

Stormwater treatment areas (STAs) are large, constructed wetlands with inflow and outflow structures for controlling water movement. Aquatic plants in the STAs remove and store excess nutrients (phosphorus) found in the stormwater runoff through growth and the accumulation of dead plant material in the layers of sediment. This natural process cleanses the water before it is moved out of the STA and into the Everglades or other water bodies.

### What is an FEB?

Flow equalization basins (FEBs) are constructed impoundments designed to capture stormwater runoff and provide a more steady flow of water to the stormwater treatment areas (STAs), helping to maintain desired water levels needed to achieve optimal water quality improvement performance.

### How much is an acre-foot?

An acre-foot is the volume needed to cover 1 acre of land with 1 foot, or 325,851 gallons, of water.

- **2015 Wading Bird Report:** Approximately 33,140 wading bird nests were initiated in the Everglades (Water Conservation Areas and Everglades National Park) during the 2015 nesting season (December to July). This is 30 percent more nests than last year and almost identical to the average count of the past 10 years (33,092 nests). This year's improvement was the result of increased nesting by a single species — the white ibis (*Eudocimus albus*), a state species of special concern — having 34 percent more nests than its decadal average. Other key indicator species (wood stork, great egret, snowy egret and tricolored heron) had reduced nesting in 2015, ranging from 25 to 99 percent below the 10-year average.
- **Exotic species control remains vital for ecosystem restoration.** About 75 nonindigenous plant species are South Florida Water Management District priorities for control. With the ever-growing number of nonindigenous animals in South Florida — more than 130 species in the Greater Everglades alone — practical control measures are also necessary. Although results from interagency programs for some aggressive invaders have been positive, challenges remain as other invasive species are introduced and their ranges expand. The South Florida Water Management District continues to coordinate invasive species management efforts with other agencies and tribes throughout the region, with more than 158,000 acres swept for invasive plants in Fiscal Year 2015.

### Lake Okeechobee/Northern Everglades and Estuaries Protection Program

- **Projects and initiatives targeting storage in the Northern Everglades are progressing.** A host of restoration work in the Northern Everglades was completed or moved forward in the past year. Several water storage projects came online, such as

Nicodemus Slough, Boma Property, North Six Mile Cypress Slough and Mudge Ranch. Regional projects with both water storage and water quality benefits also progressed. For example, expedited construction began on the Comprehensive Everglades Restoration Plan Indian River Lagoon South – C-44 Reservoir/STA (St. Lucie Watershed) Project to help improve water quality in the St. Lucie River and Estuary.

#### Lake Okeechobee and its Watershed

- **As a major milestone, the Lake Okeechobee Basin Management Action Plan (BMAP) is launched.** In December 2014, the Florida Department of Environmental Protection adopted the Lake Okeechobee BMAP, Florida's blueprint for restoring impaired waters by reducing pollutant loads levels (Total Maximum Daily Loads, or TMDLs). Implementation of Phase I by the BMAP entities and the state's coordinating agencies — South Florida Water Management District, Florida Department of Environmental Protection and Florida Department of Agriculture and Consumer Services — is now underway in six sub-watersheds north of the lake to help meet target phosphorus levels.
- **In 2015, the South Florida Water Management District issued the 14th annual progress report** summarizing the hydrology, water quality and aquatic habitat conditions of the lake and its watershed, as well as the status of the Lake Okeechobee Watershed Construction Project. In Water Year 2015, total phosphorus loads to the lake from its tributaries and atmospheric deposition totaled 450 metric tons, or 26 percent less than the previous year. This reduction can be mostly attributed to cleaner water discharged to the lake (annual flow-weighted mean total phosphorus concentration of 117 micrograms per liter), primarily from the Upper and Lower Kissimmee sub-watersheds.



Construction is moving forward on the L-8 Flow Equalization Basin in Palm Beach County, one of several Restoration Strategies projects that are underway. The L-8 FEB is completing construction and now in operational testing. When complete, it will be capable of storing 45,000 acre-feet of water. An acre-foot is the volume needed to cover one acre of land with one foot of water, or 325,851 gallons of water.

- Focusing on one of the nutrient-high basins in the lake's watershed**, the northern Lakeside Ranch STA (Phase I) in the Taylor Creek/Nubbin Slough sub-watershed has removed a total of 23 metric tons of total phosphorus over the past two years since its start-up in 2013, well exceeding its planned design rate of 9 metric tons per year. In July 2015, a Corps permit was also issued for the project's second phase. Advancing on the southern portion, Phase II implementation began in fall 2015.
- While overall rainfall in Water Year 2015 was slightly below average, its distribution across the region was uneven, creating many water management challenges.** In particular, the Lake Okeechobee watershed was very wet, resulting in far above average inflows and outflows of the lake — both 134 percent of their historical average. In response, Lake Okeechobee rose more than 3 1/2 feet during the wet season (reaching 16 feet NGVD in October triggering freshwater regulatory releases to the Caloosahatchee and St. Lucie estuaries). The South Florida Water Management District, Florida Department of Environmental Protection and other agencies met weekly to discuss the state of the regional system and develop operational recommendations to the Corps. With conditions drier than normal south of the lake, the Everglades STAs had treatment capacity available, and unprecedented operations sent lake releases into the STAs for treatment prior to discharge to the southern Everglades. Lake outflow was 1.9 million acre-feet, with roughly a third (0.7 million acre-feet) discharged to the estuaries and the remainder directed southward.

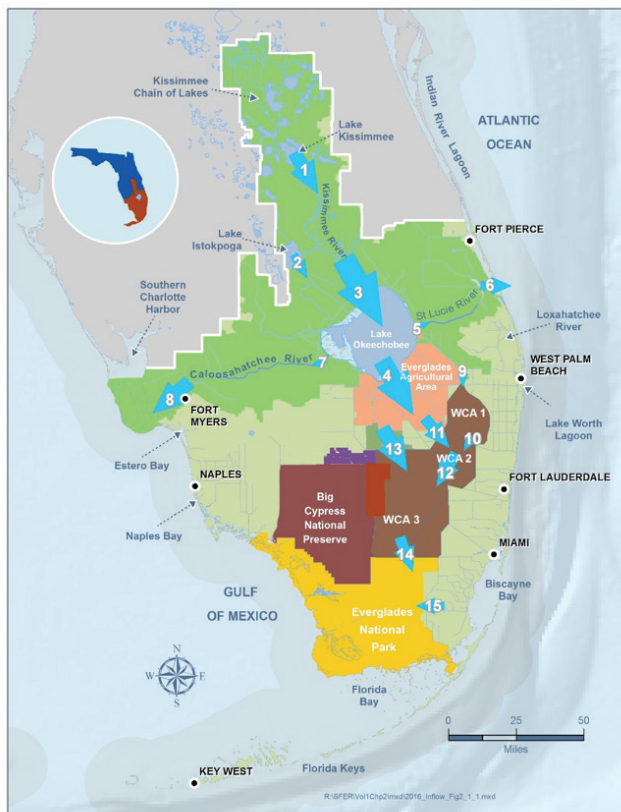
### St. Lucie and Caloosahatchee River Watersheds

- In 2015, the South Florida Water Management District published the second three-year update to both the St. Lucie and Caloosahatchee River Watershed Protection Plans**, including project construction progress, research and monitoring results



**Florida expedites construction:** The C-44 Reservoir and Stormwater Treatment Area project in Martin County will provide 50,600 acre-feet of storage to capture and treat local basin runoff to protect the St. Lucie Estuary.

and integrated strategies for moving forward to benefit both watersheds. Notable was the progress made on the C-43 Water Quality Treatment and Testing Facility Project, which has the goal of demonstrating and implementing cost-effective, wetland-based strategies for reducing nitrogen loadings to the Caloosahatchee that may also be applicable in other South Florida systems. Phase I of the demonstrations, bioassays and mesocosms was launched in December 2014. This phase will determine the fraction of biologically available dissolved organic nitrogen in the river



Map ID	Water Body	WY2015 flows (ac-ft)	WY2014 flows (ac-ft)
1	Lake Kissimmee Outflows	1,170,556	765,563
2	Lake Istokpoga Outflows	446,215	319,317
3	Lake Okeechobee Inflows	2,831,832	2,695,257
4	Lake Okeechobee Outflows	1,933,353	2,527,633
5	Flows into the St. Lucie Canal from Lake Okeechobee	129,227	444,651
6	Flows into the St. Lucie Estuary through the St. Lucie Canal	188,236	675,800
7	Flows into the Caloosahatchee Canal from Lake Okeechobee	575,971	1,225,613
8	Flows into the Caloosahatchee Estuary through the Caloosahatchee Canal	1,234,173	2,521,600
9	Water Conservation Area 1 Inflows	245,360	380,269
10	Water Conservation Area 1 Outflows	198,051	471,206
11	Water Conservation Area 2 Inflows	823,996	1,078,408
12	Water Conservation Area 2 Outflows	810,056	965,358
13	Water Conservation Area 3 Inflows	1,312,417	1,248,362
14	Water Conservation Area 3 Outflows	779,167	1,452,583
14,15	Everglades National Park Inflows	1,015,301	1,590,971

#### LEGEND

- CANALS
- NORTHERN EVERGLADES
- WATER CONSERVATION AREAS
- STORMWATER TREATMENT AREAS
- MICCOSUKEE INDIAN RESERVATION
- BIG CYPRESS SEMINOLE INDIAN RESERVATION
- ROTENBERGER AND HOLLEY LAND
- WILDLIFE MANAGEMENT AREAS

**Managing rainfall (hydrology) in 2015:** While overall rainfall in Water Year 2015 was slightly below average, its distribution across the region was uneven, creating many water management challenges. In particular, the Lake Okeechobee watershed was very wet, resulting in far above average inflows and outflows of the lake — both 134 percent of their historical average.

ecosystem and assess potential surface water nitrogen removal rates using various plant communities and hydrologic loading rates. The initial mesocosm design was completed in Fiscal Year 2015.

- **St. Lucie Estuary:** In Water Year 2015, annual rainfall in the St. Lucie watershed (55.4 inches) was 12.6 percent above the long-term average. Freshwater inflow to the St. Lucie was 0.75 million acre-feet, with about 90 percent coming from the St. Lucie watershed and 10 percent from Lake Okeechobee. Salinity at the US1 Roosevelt Bridge was generally (79 percent of the time) within the desired salinity range and favorable than those observed in the previous two years.
- **Caloosahatchee River and Estuary:** In Water Year 2015, annual rainfall in the Caloosahatchee watershed (42.4 inches) was below the long-term average. Total freshwater inflow to the Caloosahatchee was 1.43 million acre-feet, with most flow from the Caloosahatchee watershed and tidal basin (66 percent) and 34 percent from Lake Okeechobee. At the Ft. Myers station, the daily average salinity goal was fully met, while the 30-day moving average goal was nearly achieved, except for 23 days at the year's start. Similar to the St. Lucie, these salinity values were favorable to a healthier estuary.

## Kissimmee River Restoration

- **Construction for the Kissimmee River Restoration Project is moving forward.** The first three major phases of Kissimmee River restoration have reestablished nearly continuous flow to 24 miles of river channel and intermittent inundation of more than 7,700 acres of floodplain. In Water Year 2015, restoration construction continued with the backfilling of MacArthur Ditch, a feature that is disrupting flow and overdraining a portion of the western Phase I restoration area. This work paves the way for the final major phases of construction, which will backfill the remaining 9 miles of the C-38 canal and are projected for completion in 2019.
- **To provide water essential for the protection of fish and wildlife** in the Kissimmee River, its vast floodplain and the Upper Chain of Lakes, in 2014 the District authorized the next step in a public process to reserve water for the ecosystem. Rule development continued this past year with two public workshops to update stakeholders, completion of draft rule language and release of the draft rule and its supporting technical document for public comment. Looking ahead, the final step of this process is to adopt the water reservation by rule.

## Central Florida Water Initiative Regional Water Supply Plan

- **The South Florida Water Management District worked with the Southwest Florida and St. Johns River water management districts to finalize a joint water supply plan for the Central Florida Water Initiative (CFWI) area.** Based on a 20-year planning horizon, the final plan identifies projects expected to meet reasonable-beneficial water needs and to protect natural resources. In November 2015, the respective governing boards of the three water management districts approved the 2015 Central Florida Water Initiative Regional Water Supply Plan Volumes I and II with their



**Exotic species control remains vital for ecosystem restoration:** *Non-native invasive plants growing throughout South Florida impede ecosystem restoration and can clog canals and structures used for flood control and water supply. Old World climbing fern (Lygodium), for example, is an invasive vine that grows quickly in remote areas where it is difficult for land managers to control. A moth species (Neomusolima conspurcatalis) is monitored to determine if its caterpillars are an effective biological control for the exotic vine.*

associated appendices of the *South Florida Environmental Report*. These documents are available at [www.cfwewater.com](http://www.cfwewater.com).

## Annual Plans and Reports

### Five-Year Capital Improvements Plan

- **Over the next five years, the South Florida Water Management District estimates spending \$1.6 billion on projects contained in its Five-Year Capital Improvements Plan.** The plan reflects ongoing commitments to District Governing Board priorities for Fiscal Year 2015-2016 through Fiscal Year 2019-2020, including an estimated \$1.3 billion for restoration projects. The balance is allocated for other agency priorities related to water supply and operations and maintenance. The Fiscal Year 2015-2016 adopted budget included a planned capital improvements project budget of \$375.0 million. Based on the revised estimated project schedules, the District's Five-Year Capital Improvement Plan was adjusted to a total of \$321.9 million for Fiscal Year 2015-2016. The difference of \$53.1 million has been re-budgeted in the Fiscal Year 2016-2017 preliminary budget or is available for future Governing Board allocation.

### Fiscal and Performance Accountability Reports

- **The South Florida Water Management District tracks and manages agency performance by linking long-term strategic priorities to annual budgets and performance metrics in agency reporting.** Fiscal and Performance Accountability Reports are prepared quarterly, with the fourth quarter report presenting agency accomplishments at the end of the fiscal year. Earned Value is a project management tool in which planned and actual completed work is compared to confirm if agency projects are on track. The report presents the FY2015 Annual Work Plan project milestone achievement based on Earned Value indices

(schedule and cost) and performance level achieved: A (on plan), B or C status. Performance indices were calculated for each project and measured against the defined ranges (see chart). A project with a Schedule Performance Index of 1.00 is exactly on schedule, and a project with a Cost Performance Index (CPI) of 1.00 is exactly on budget, which represents the ideal situation where project execution matches project planning. Overall schedule-wise in Fiscal Year 2014-2015, 125 (65 percent) of the total (191) portfolio projects were categorized in A status, 46 (24 percent) in B status, and 20 (10 percent) in C status.

**Regulatory Reports**

- **Reports are prepared annually to comply with permits** issued to the South Florida Water Management District by the U.S. Army Corps of Engineers or by the Florida Department of Environmental Protection to construct and operate regional restoration projects. If a specific project is operational, a detailed annual report with monitoring information and compliance with specific permit conditions are provided as a separate appendix in the *South Florida Environmental*

*Report*. Otherwise, a project status update is presented in the associated chapter.

**Consolidated Project Report Database**

- **The online South Florida Environmental Report Consolidated Project Report Database** at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer) provides a comprehensive update on many South Florida Water Management District projects (activities with start and end dates) and processes (ongoing activities) referenced in the 2016 South Florida Environmental Report. The database enables rapid data sorting, searches and retrieval for efficient information and project management.

The complete *2016 South Florida Environmental Report* is available online at [www.sfwmd.gov/sfer](http://www.sfwmd.gov/sfer).

Find updates on key restoration projects by checking out this interactive map at [www.sfwmd.gov/restorationprogress](http://www.sfwmd.gov/restorationprogress).



**Optimizing system performance:** Completed ahead of schedule in November 2015, the A-1 Flow Equalization Basin in Palm Beach County, which is part of Florida’s Restoration Strategies Plan for clean water for the Everglades, assists in optimizing the performance of two nearby stormwater treatment areas in removing phosphorus. It can hold up to 60,000 acre-feet of water up to 4 feet deep, and then delivers water in a controlled manner to the treatment areas. It is surrounded by 21 miles of levees and has 15 associated water control structures.



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