South Florida Water Management District



August 2000

District Water Management Plan

EXECUTIVE SUMMARY

Each of the Florida's five water management districts has been charged with the preparation of an update to its respective *1995 District Water Management Plan* (DWMP) (SFWMD, 1995a). The DWMP is a compilation of information from many sources that is used to define the role of the South Florida Water Management District (SFWMD, District) in water resource management, and provides comprehensive, long-range direction and guidance for the actions of the District in implementing its responsibilities under state and federal laws. By establishing the District's long-term goals, issues, objectives, strategies, schedules, and performance measures, the DWMP is necessarily linked with the District's *Strategic Plan*, the *Five-Year Capital Improvement Plan*, and the annual budgeting process.

Within the DWMP, the District has identified and described six major efforts as being its main priorities into the forseeable future. These six efforts are (the order does not imply priority level): operation, maintenance, and modernization of the existing Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project); regional water resource planning and implementation; Kissimmee River restoration; Lake Okeechobee restoration; Everglades restoration; and the implementation of the Comprehensive Everglades Restoration Plan (CERP). The DWMP also identifies a series of water management infrastructural projects that are necessary in order to accomplish these six major priorities.

The status of activities planned in the previous DWMP (SFWMD, 1995a) are presented, along with the goals, resource assessments, issues, objectives, strategies and performance measures for each area of responsibility. The District's four major areas of responsibility are water supply, flood protection, water quality, and natural systems.

The DWMP also facilitates the tracking and reporting of the District's accomplishments by including performance measures. These measures will describe the District's performance, both in terms of the District's delivery of services, and in terms of the impacts of those activities on the water resources that the District is trying to improve. Core performance measures were agreed upon through extensive meetings between the Executive Office of the Governor, Florida Department of Environmental Protection (FDEP), the Florida Department of Agriculture and Consumer Services (FDACS), and the state's five water management districts. These will be used by all five of the state's water management districts as of October 1, 1999. The District also developed additional performance measures specifically for the SFWMD.

In addition to discussing the water resource issues by area of responsibility, the DWMP also provides a watershed management analysis. This analysis integrates the goals, issues, objectives, and strategies from the four major areas of responsibility for each of the District's four planning areas: Lower East Coast (LEC), Lower West Coast (LWC), Upper East Coast (UEC), and Kissimmee Basin.

The District's water management planning process includes the creation of integrated county water management plans that enhance the overall linkage of land and water management responsibilities. The development of integrated county plans has been

postponed for a year. This postponement is in keeping with the direction received from the FDEP, in order to facilitate county specific involvement, and allow the District to better identify individual county needs and appropriate strategies.

The DWMP is not intended to be a self-executing document. The general directives described in the DWMP provide the District's interpretation regarding the State Water Policy. These directives are not rules of the SFWMD, although they should be used to guide the District's future rulemaking efforts, and existing rules should be evaluated for consistency with the priorities described in the DWMP. SFWMD rules are one of several tools for implementing the DWMP. Other implementation tools include planning, research, operations and maintenance, and land acquisition.

INTRODUCTION

Water resource issues are major forces shaping the future of South Florida. The South Florida Water Management District (District, SFWMD) is charged with determining how to resolve the complex water resource questions facing the region, and the agency's success will depend on its ability to look ahead and plan for the future. The *District Water Management Plan* (DWMP) represents the District's examination of the complicated issues related to water supply, flood protection, water quality, and natural systems within the District, and describes the priorities and projects to which the District is committed. The breadth of programs and activities undertaken by the District reflects the multifunctional nature of water resource management in South Florida.

Each of the five water management districts has been charged with the preparation of a DWMP, consistent with the requirements of Section 373.036, Florida Statutes (F.S.), and Section 62-40.501, Florida Administrative Code (F.A.C.). The requirements for development of the DWMP were further interpreted by the Florida Department of Environmental Protection (FDEP), in conjunction with the Executive Office of the Governor and the five water management districts, through the development of the *Format and Guidelines, District Water Management Plan* document (FDEP, 1999).

The DWMP is also guided by the policies of the *State Comprehensive Plan* (Chapter 187, F.S.); the Florida Water Resources Act (Chapter 373, F.S.); the Air and Water Pollution Control Act (Chapter 403, F.S.); and State Water Policy (Chapter 62-40, F.A.C.). The DWMP, through its establishment of project schedules, will provide direction for the District's *Strategic Plan*, which will be used to direct resources for the agency's other planning efforts through the budget process. The results of these plans will then be implemented to improve the water resources of the region. **Figure 1** illustrates the relationship of the DWMP to the District's other planning activities.

In addition to serving as a direction-setting document for the District, the DWMP is also a communication tool. As such, it plays a role in Florida's growth management process. The DWMP should be considered as a source of technical information for local governments seeking guidance on water resource issues of concern within their jurisdictions.

The inclusion of performance measures is an integral part of the water management planning process. The 1995 DWMP (SFWMD, 1995a) included potential measures of performance for each of the District’s areas of responsibility (water supply, flood protection, water quality, and natural systems), twelve of which have been reported on in successive DWMP annual reports (SFWMD, 1996, 1997a, 1998a). This update of the DWMP goes a step further by linking objectives and strategies to performance measures. These performance measures were developed through extensive meetings between the Executive Office of the Governor, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), and the state’s five water management districts.

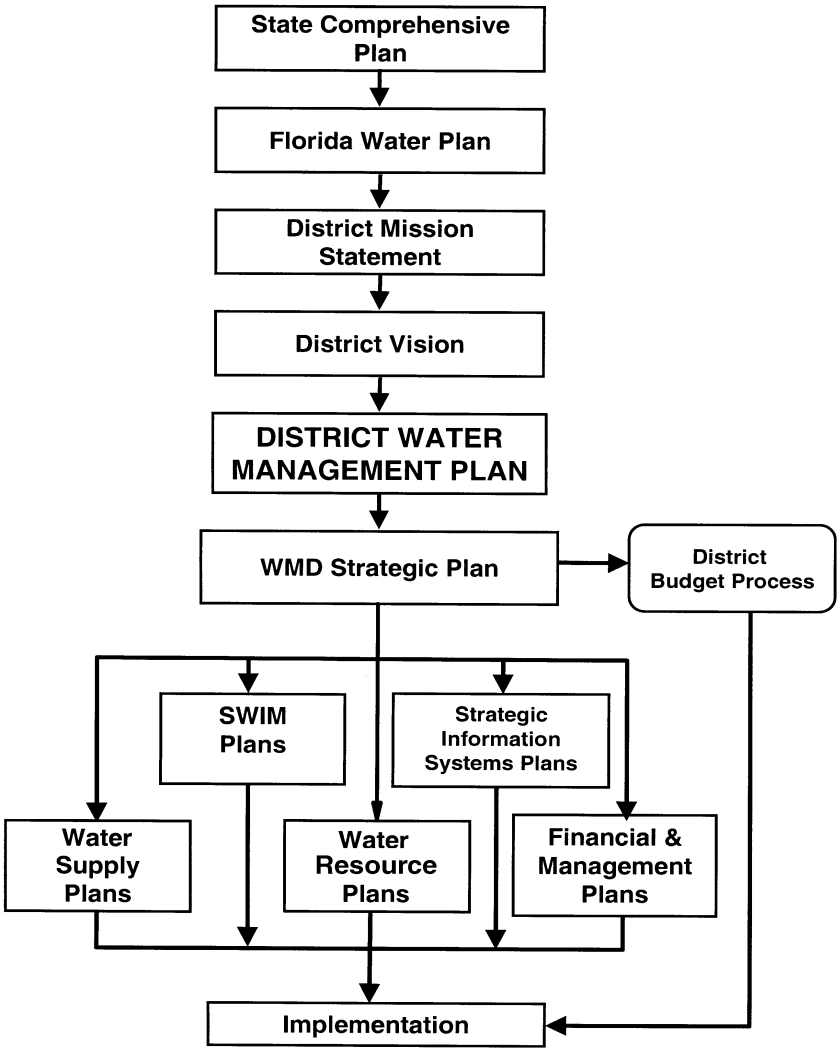


Figure 1. Water Management Planning Process.

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Chapter 1
DISTRICT OVERVIEW

DISTRICT HISTORY

Soon after Florida became a state in 1845, the federal government granted the state over 20 million acres of wetlands and swamps. During this early development period, the federal and state governments encouraged the drainage of wetlands for agriculture and residential uses.

The Everglades Drainage District (EDD), forerunner of the District, was created in 1907 to facilitate drainage of the Everglades. By 1927, six major drainage canals and numerous minor canals had been constructed, along with 47 miles of levees and 16 locks and dams. The EDD construction program ended in 1928 following the hurricane of that year. In 1931, the EDD defaulted on its bond payments, suffering the effects of the Great Depression and the collapse of the Florida land boom of the 1920s.

Although the hurricane of 1928 ended the construction activities of the EDD, it spurred creation of the Okeechobee Flood Control District in 1929, which improved flood control by constructing levees, control gates, and floodway channels along the shores of Lake Okeechobee. The southern shore of Lake Okeechobee was diked and the St. Lucie and Caloosahatchee rivers were used to divert water that had formerly flowed south to the Atlantic Ocean and the Gulf of Mexico.

In 1947, torrential rains flooded Central and South Florida. Two hurricanes struck the Everglades and Lake Okeechobee after earlier rains had already saturated the soils, resulting in extensive flood damage. The extent of area flooded is shown in **Figure 2**, and included the majority of the region presently within the District. In its report following the flooding, the U.S. Army Corps of Engineers (USACE) reported that “as these areas will inevitably grow and expand even without adequate flood protection, larger damages may be expected unless preventive measures are taken” (Huser, 1989).

Less than a year after the floods of 1947, the USACE recommended, and Congress authorized, $208 million for a flood control system, the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project)[1]. The C&SF Project was planned as a complete system of canals, storage areas, and water control structures spanning the area from Lake Okeechobee to both the east and west coasts, and from Orlando south to the Everglades. In addition, the C&SF Project was intended to improve recreational and navigational opportunities. The C&SF Project was designed and constructed by the USACE. The Florida Legislature created the Central and Southern Florida Flood Control District (FCD) in 1949 to serve as local sponsor for the C&SF

1. During the 1960s the title was shortened to Central and Southern Florida Project. The C&SF Project acronym is used for both versions of the name.

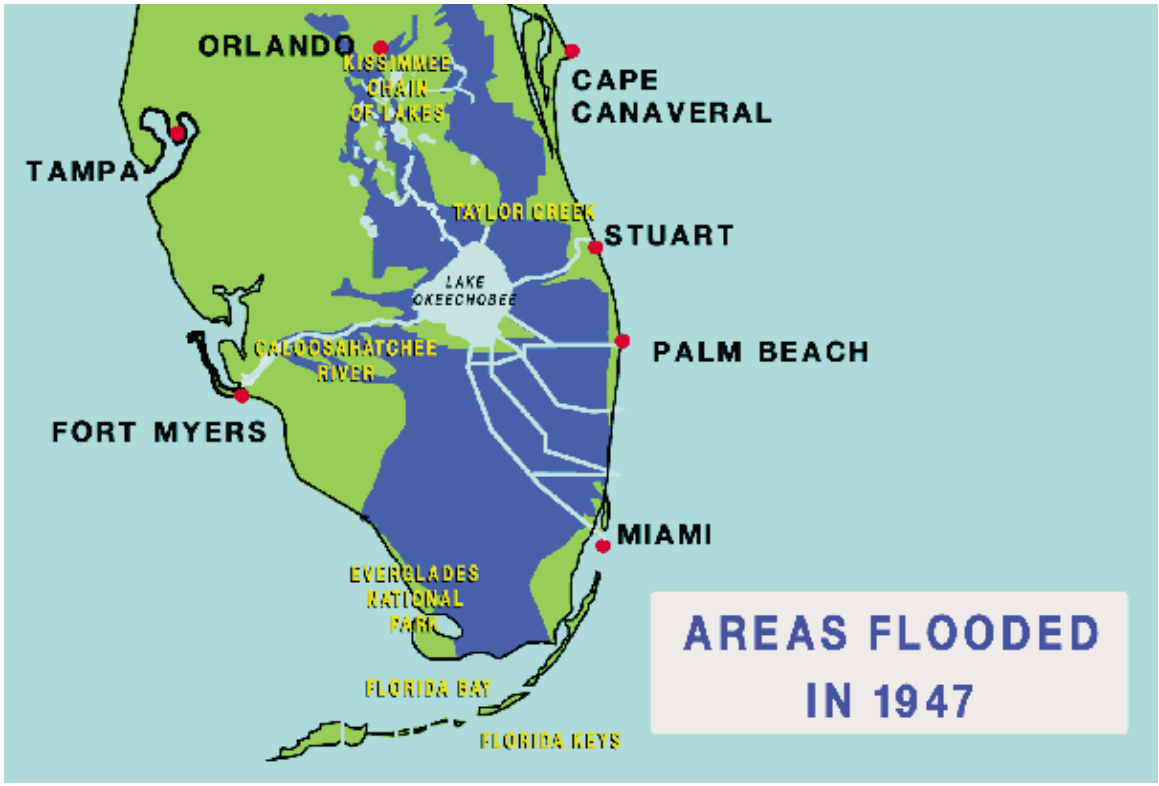


Figure 2. Map of Area Flooded in 1947.

Project. The FCD included the areas previously within the boundaries of the EDD and the Okeechobee Flood Control District. In the 1950s the FCD's efforts included acquisition of lands, easements, and rights-of-way for the construction program and for water storage. By 1954, the FCD had acquired titles or easements for 1,354 square miles of Everglades wetlands in Palm Beach, Broward, and Miami-Dade counties which became the Water Conservation Areas (WCAs). The three WCAs represent almost half of the original freshwater Everglades in Florida. By 1959, construction was completed on a network of levees and canals that circled and crossed the fertile mucklands of the Everglades Agricultural Area (EAA). Some additional east coast canals were also constructed at this time, including C-17 and C-18 in Palm Beach County (Huser, 1989).

The decade of the 1960s was a time of major construction for the C&SF Project. By the early 1960s, the WCAs were completed, and about 700,000 acres of land in the EAA had been drained and leveed. The dike around Lake Okeechobee was enlarged and extended. Pump stations were constructed. Dredges and draglines enlarged the Caloosahatchee River, excavated the Kissimmee River, and cut channels in the Kissimmee Chain of Lakes. Spillways, dams, and navigation locks were built on the canals. The USACE published the first in a series of maps, color coded in red and green, entitled Central and Southern Florida Flood Control Project. Red lines showed works that were completed or under construction. Green lines showed works that were planned but not completed. Periodically, the USACE updated this map and reprinted it, and over the years more and more green lines became red lines (Huser, 1989). However, not all the planned

canals and structures annotated by green lines were ever built, due to environmental concerns, costs, and further evaluation of these planned facilities.

The FCD initially operated the C&SF Project primarily for water control and flood protection. In the late 1960s and early 1970s, environmental awareness increased and the need for protection for water and related natural resources became more emphasized. Passage of the Florida Water Resources Act of 1972 by Florida's Legislature broadened the FCD's mission, and added responsibilities for water supply, water quality, and natural systems management to the existing flood protection mission. This act created five water management districts in the state, and expanded their responsibilities to include control and regulation of ground and surface waters and their use. **Figure 3** shows the boundaries of Florida's five water management districts. Chapter 373, F.S., also established a new system of water rights in Florida. One attains the right to use water through application to the appropriate water management district, and each water management district administers a consumptive use permitting program, pursuant to Section 373.223, F.S.

In 1976, the Florida Legislature changed the name of the FCD to the South Florida Water Management District for consistency with the other water management districts and to more accurately reflect the agency's broadened mission. The District covers 17,930 square miles, or about 31 percent of the State of Florida. The District includes all or part of 16 counties, and extends from southern Orlando to Key West and from Fort Myers to Fort Pierce.

The headquarters for the District are located in West Palm Beach. Service centers are located in Orlando, Okeechobee, Stuart, West Palm Beach, Fort Lauderdale, Miami, Islamorada, Naples, and Fort Myers (**Figure 4**). Service centers were established to offer District services and expertise at the local level and to provide more direct and responsive access to permitting and other District functions.

District field stations are located in Kissimmee, Okeechobee, West Palm Beach, Fort Lauderdale, Miami, Homestead, Naples, and Clewiston. District area offices are located in the Dupuis Reserve, Fort Pierce, Naples, and West Palm Beach. Field stations and area offices help the District to better operate and manage the vast regional water management network which includes 1,800 miles of canals and levees, close to 200 large water control structures, and over 2,000 smaller structures.

In addition to the Governing Board for the District, the Florida Legislature established a Basin Board for the Big Cypress Basin, which was officially created on January 1, 1977. As required by 1976 legislation, a District Governing Board member was named ex officio chairman of the new Big Cypress Basin Board. Soon after its organization in 1977, the Big Cypress Basin Board determined that the proper maintenance of certain key water control structures in the major drainage system would address the broad objectives of conservation, preservation, and enhancement of the water resources of the region. Accordingly, successive agreements between Collier County and the District have transferred operation and maintenance responsibilities of numerous water control structures to the Big Cypress Basin Board. As of 1999, the Big Cypress Basin Board had responsibility for operation and maintenance of, as well as providing

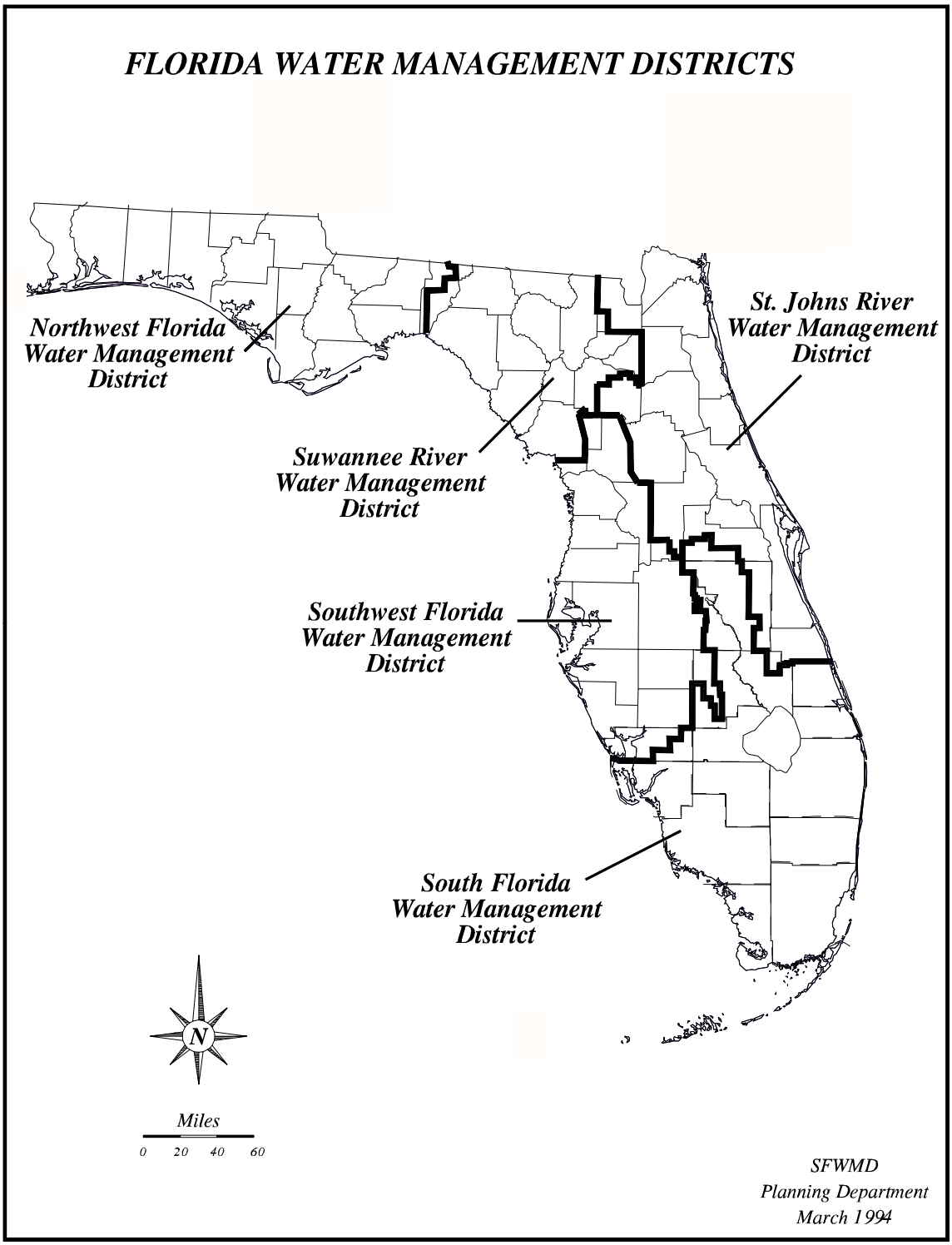


Figure 3. Boundaries of Florida's Five Water Management Districts.

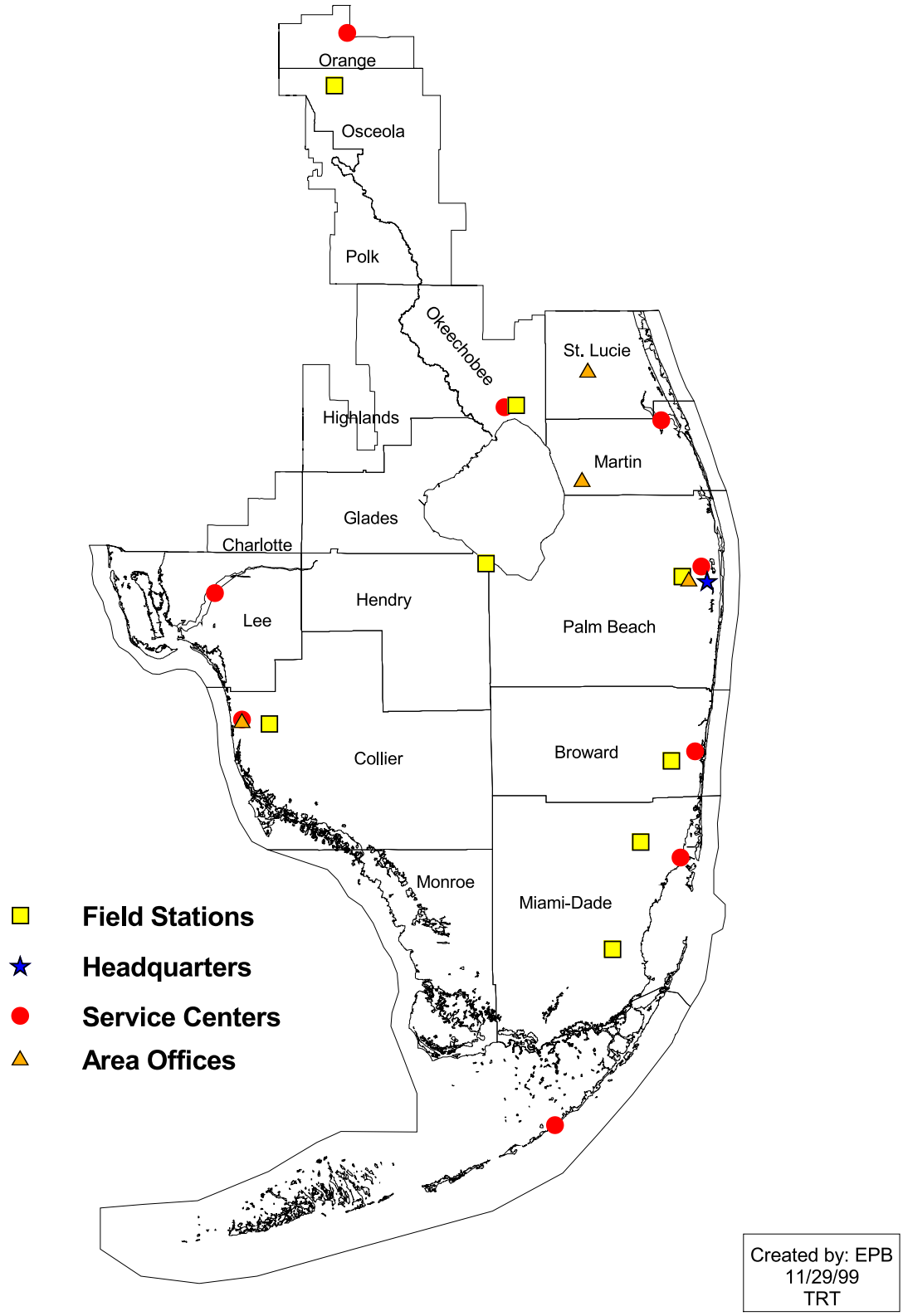


Figure 4. Location of SFWMD Facilities.

planning and capital improvements for, 163 miles of primary canals and 39 water control structures within the Big Cypress Basin.

PLANNING REGIONS

The District is divided into four regions within which planning and other activities are focused: the Lower East Coast (LEC), Lower West Coast (LWC), Upper East Coast (UEC), and Kissimmee Basin. **Figure 5** shows the four planning regions. Regional populations and irrigated agricultural acreages were analyzed as part of the *Districtwide Water Supply Assessment* (DWSA) (SFWMD, 1998b) and are presented below.

Lower East Coast Planning Region

The LEC planning region includes Palm Beach, Broward, and Miami-Dade counties and portions of Monroe, Hendry, and Collier counties. The LEC planning region encompasses a sprawling, fast-growing urban complex along the coast; extensive agricultural lands, including the EAA; critical environmental resources, such as the Everglades ecosystem; and important estuaries, including Biscayne Bay and Florida Bay. The region had a population of 4,518,401 in 1995 and is projected to increase to 6,086,700 by 2020. During the same period, irrigated agriculture is projected to decline from 569,000 acres to 504,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Miami-Dade, Broward, and Palm Beach counties, which are expected to remain the population centers for the region.

Lower West Coast Planning Region

This region includes all of Lee County and parts of Charlotte, Collier, Glades, Hendry, and Monroe counties. Rapid growth in population and irrigated agricultural acreage within the LWC planning region have caused demands for water to increase significantly. This region had 590,939 residents in 1995 and the region’s population is projected to increase to 992,805 by 2020. In 1995, the region had 244,000 acres of irrigated agriculture, and this is projected to increase to 293,000 acres by 2020 (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Lee and Collier counties. These areas are expected to remain the population centers for the region.

Upper East Coast Planning Region

The UEC planning region is comprised of St. Lucie and Martin counties and eastern Okeechobee County. The UEC planning region had a total population of 283,457 in 1995 and is projected to grow to 456,580 residents by 2020. From 1995 to 2020, irrigated agriculture is projected to increase from 186,000 acres to 211,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Martin and St. Lucie counties. These areas are expected to remain the population centers for the region.

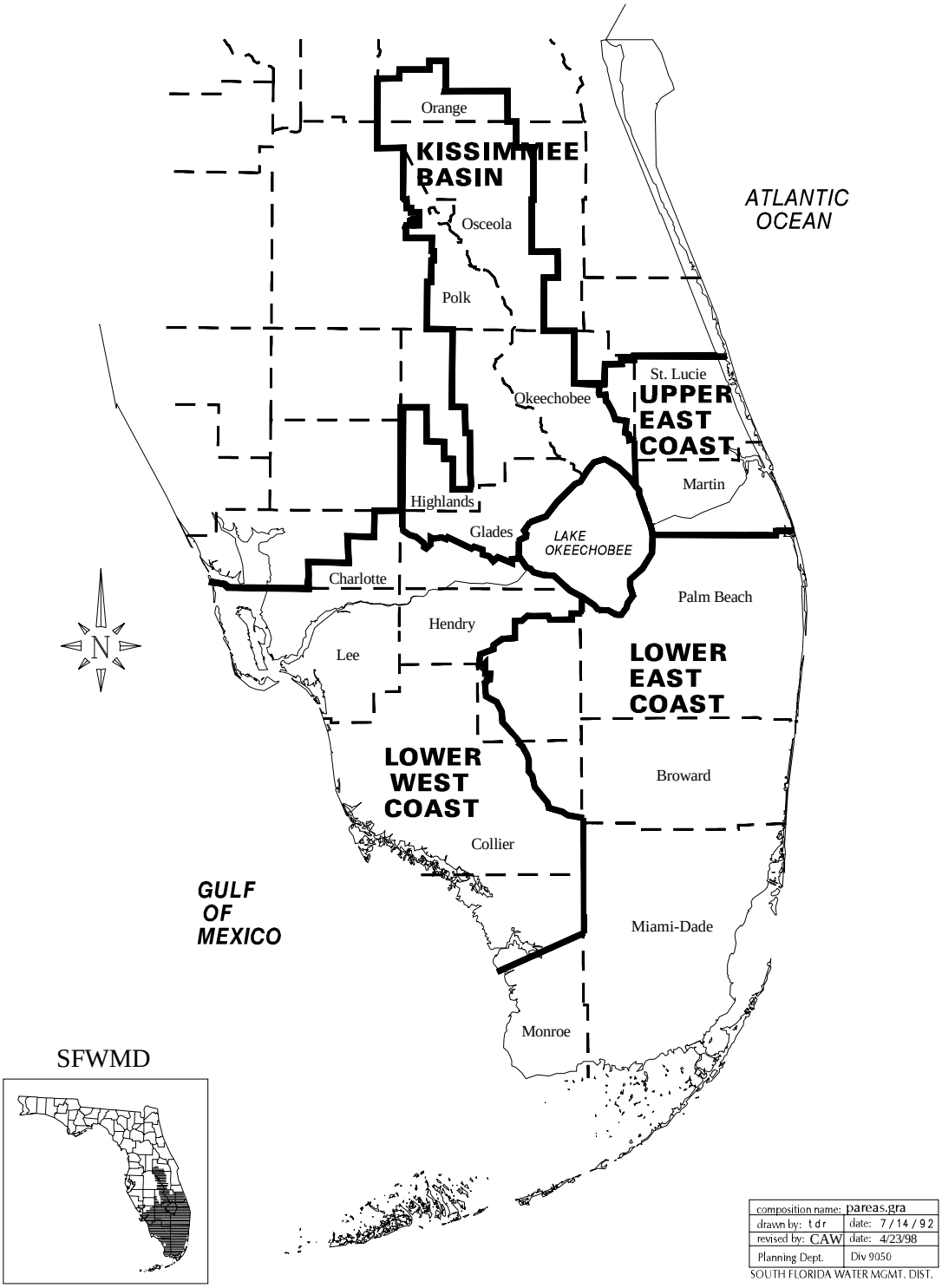


Figure 5. Planning Regions within the SFWMD

Kissimmee Basin Planning Region

The Kissimmee Basin planning region includes parts of Orange, Osceola, Polk, Highlands, Okeechobee, and Glades counties. The majority of the basin drains to the Kissimmee River, though some areas drain into Fisheating Creek, the canal system within the Indian Prairie Basin, or a few landlocked lakes within the basin. A few fringe areas drain to the Southwest Florida or St. Johns River water management districts. The population of this region is projected to increase from 362,837 in 1995 to 686,696 by 2020. In 1995, the region had 77,000 acres of irrigated agriculture, and this is projected to increase to 117,000 acres by 2020 (SFWMD, 1998b). Urban growth is anticipated to be concentrated in Orange and northern Osceola counties, while irrigated agricultural acreage is anticipated to increase to the south, in Highlands, Okeechobee, and Glades counties. Most of the region is rural/agricultural and this pattern is projected to continue through 2020.

PROGRAM OVERVIEW

To promote consistency among water management district budgeting and to aid the Florida Department of Environmental Protection (FDEP) in their review of water management district budgetary information, each water management district has agreed to categorize expenditures into six program areas. The District Fiscal Year 2000 (FY2000) budget totals $469 million. **Table 1** and **Figure 6** show the percentages of the total budgeted expenditures and personnel planned to be spent for each of the program areas in FY2000. The following sections briefly describe each of the program areas. A more detailed description and analyses of these program areas may be found in the *Standard Format Tentative Budget Submission* (SFWMD, 1999).

Table 1. Budgeted Expenditures and Personnel by Program for FY2000.

Program No.	Program Title	FY2000 Budgeted Expenditures	Percent of Total Expenditures	FY2000 Budgeted Personnel	Percent of Total Personnel
1	**Water Resources Planning and Monitoring**	$76,199,621	16.2%	478	25.3%
2	**Acquisition, Restoration, and Public Works**	$242,669,329	51.7%	199	10.5%
3	**Operation and Maintenance of Lands and Works**	$88,784,837	18.9%	666	35.3%
4	**Regulation**	$13,264,414	2.8%	203	10.7%
5	**Outreach**	$5,436,814	1.2%	35	1.9%
6	**Management and Administration**	$42,766,642	9.1%	308	16.3%
	Total	$469,121,657		1,889	

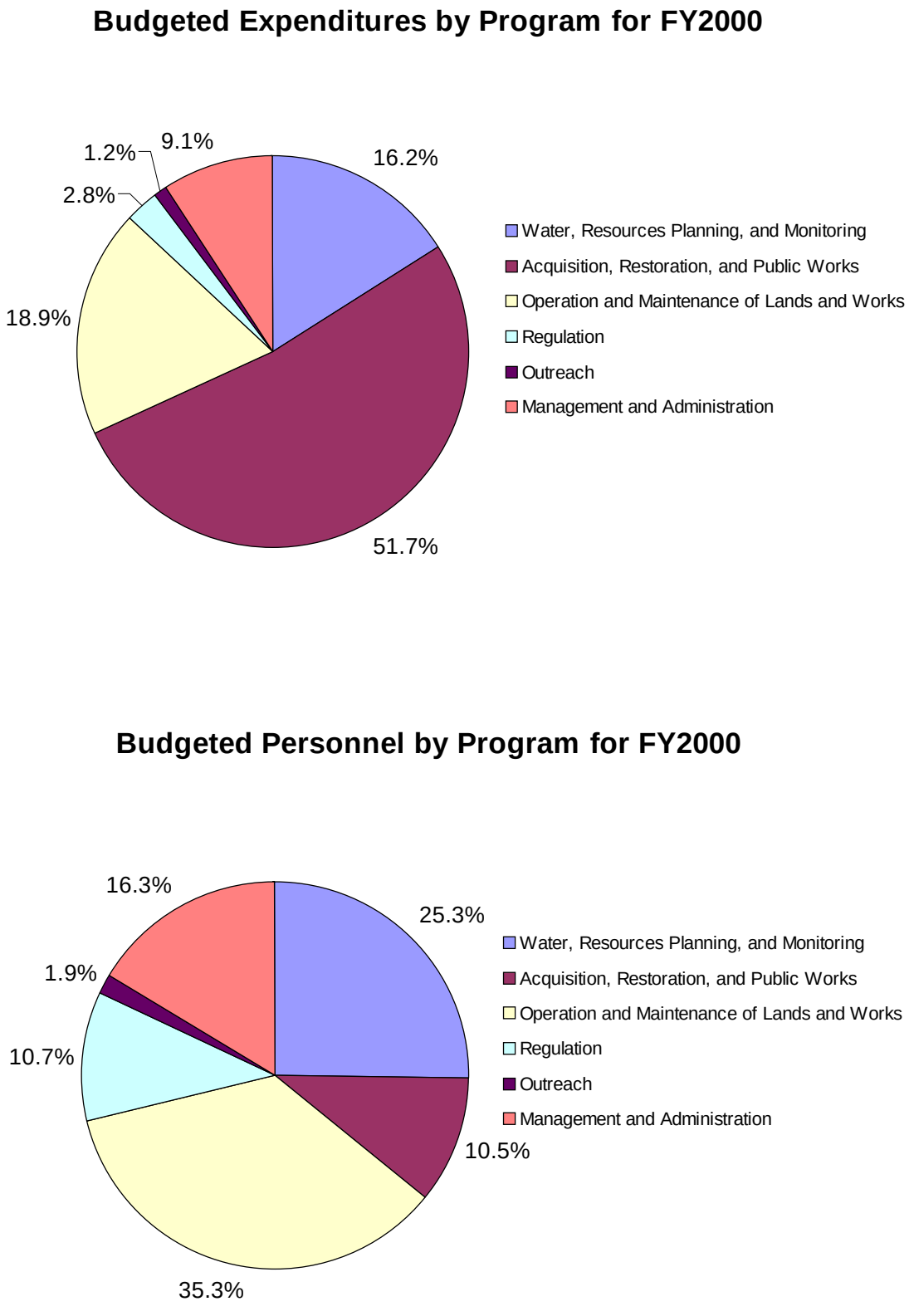


Figure 6. Budgeted Expenditures and Personnel for FY2000 by Program.

Program 1. Water Resources Planning and Monitoring

Definition

This program includes all water management planning, including water supply planning, development of Minimum Flows and Levels (MFLs), and other water resource planning; research, data collection, analysis, and monitoring; and technical assistance, including local and regional plan and program review.

General Description

The Water Resources Planning and Monitoring Program addresses the interactions of water supply, flood protection, water quality, and natural systems management. This program provides comprehensive long-range guidance to address demands for water and the ability of water resources to handle these demands.

Program 2. Acquisition, Restoration, and Public Works

Definition

This program includes the development and construction of all capital projects (except for those contained in Program 3, Operation and Maintenance of Lands and Works), including water resource development projects/water supply development assistance, water control projects, and support and administrative facilities construction; cooperative projects; land acquisition, including Save Our Rivers (SOR)/Preservation 2000); and the restoration of lands and water bodies.

General Description

The District is engaged in a variety of capital projects. These include land acquisitions identified in the District's Five-Year SOR Plan, the East Coast Buffer initiative, and land purchases associated with the Kissimmee River and Florida Bay restoration efforts. Other capital projects include various water resource development projects involving the design, permitting, and construction of projects which will serve to support the allocation and development of water supply. The District is also involved in constructing support and administrative facilities such as the Emergency Operations Center and Field Operations Center, as well as the construction of navigation locks, pump station modifications, and canal improvements necessary to operate and maintain the District's aging regional flood control system. In addition, the District provides financial and technical assistance to local governments in building and implementing storm water and alternative water supply projects. Finally, the District's largest capital project is the Everglades Construction Project (ECP), which includes the design and construction of various Stormwater Treatment Areas (STAs), pump stations, and other capital facilities necessary to restore the Everglades, consistent with the Everglades Forever Act.

Program 3. Operation and Maintenance of Lands and Works

Definition

This program includes all operation and maintenance of District operation and maintenance facilities, flood control and water supply structures, lands, and other works authorized by Chapter 373, F.S.

General Description

The operation and maintenance of lands and works is required to achieve effective operation of pumping facilities and water control structures for flood protection, water supply, and environmental flows/levels. Key products include the maintenance of pumping facilities, water control structures, canals and levees, and associated equipment. Emergency work and operations of the C&SF Project must be performed on demand, and is often driven by meteorological factors and other conditions outside the District's control. Maintenance of the C&SF Project must be performed on a preventative maintenance schedule basis. Management decisions and policy directions regarding the operation and maintenance of the C&SF Project are key elements of this program. Flood control and water supply operational decisions are executed by continuous 24-hour monitoring and control of the District's water management system. The ability to monitor the water management system on a real-time basis, using telemetry, significantly reduces the potential to incur serious damage to property and loss of life by minimizing the threat to public safety from heavy rainfall events. It also provides the capability to improve water supply, protect the coastal freshwater aquifers from the intrusion of salt water, and allow for water deliveries to meet environmental needs.

Program 4. Regulation

Definition

This program includes water use permitting, water well construction permitting, water well contractor licensing, environmental resource permitting, permit administration, compliance and enforcement, and sovereign submerged lands authorizations as delegated by the Board of Trustees of the Internal Improvement Fund. The Board of Trustees consists of the Governor and Cabinet. Most state land is titled in the name of the Board of Trustees, so when the state carries out real estate transactions they come before this version of the Governor and Cabinet. The FDEP Division of State Lands is the state agency that reports to the Board of Trustees.

General Description

The mission of the Regulation Program is to manage and protect the South Florida's water resources through 1) review and evaluation of applications and issuance of permits, 2) inspections to determine compliance with permit conditions, and 3) enforcement actions. The components include environmental resource permits, sovereign

submerged lands authorizations, water use permits (consumptive use permits), Everglades Works of the District permits, Lake Okeechobee Works of the District permits, and postpermit compliance monitoring for all permitting programs. The Regulation Program also includes additional efforts including: Development of Regional Impact/Siting/Coastal Zone Management; power plant and transmission line siting; ongoing rule development; and automation support.

Program 5. Outreach

Definition

This program includes all water resource education activities, such as water conservation campaigns and water resource education; public information activities; all lobbying activities relating to local, regional, state, and federal governmental affairs; and all public information activities, including related public service announcements, and advertising in any media.

General Description

This program captures activities and initiatives designed to implement and support water management goals and programs, including public information, community events, water conservation, adult and youth water resource education, intergovernmental coordination and cooperation, technical assistance, and cooperative agreements.

Program 6. District Management and Administration

Definition

This program consists of the District's functional support services including the following: administrative support, executive management, legal support, service center administration, budget, procurement, supplier diversity, inspector general/internal audit, information technology and infrastructure management/support, financial management, risk management, and human resource management.

General Description

Work in this program area supports the water resource line organizations and plays a key role in accomplishing District water resource goals and objectives through providing financial and human resources expertise; legal advice, counsel, and representation; procurement; information technology management; and accountability and risk management functions. These activities are vital for effective management, informed decision making and mandatory/statutory compliance. The program provides value-added strategies, resources, and systems to customers for timely planning, organization, direction, and evaluation. The functions in this program area cross a number of support departments and offices.

NATURAL SETTING

The topography of South Florida, like that of the state as a whole, is the result of sediment deposition and solution related processes that have sculptured the land over time. Average rainfall is about 53 inches per year, and intense storms, yielding large volumes of rainfall, are common. The District's present surface hydrology is largely governed by man-made systems superimposed on the natural hydrology of the region. The Biscayne and the Floridan aquifers underlie much of the region and are highly productive.

Topography and Physiographic Features

Nearly all the land in South Florida is less than 100 feet above mean sea level (msl). Land surface generally slopes from north to south. The coastal regions and most of the peninsula south of Lake Okeechobee are very flat and lie below 25 feet msl, except near Immokalee and parts of the Atlantic Coastal Ridge. North of Lake Okeechobee, the Lake Wales Ridge juts down the center of the peninsula and is mostly above the 100-foot contour. East of this ridge, the Okeechobee Plain rises from approximately 20 feet msl at the lake to 30 to 40 feet msl at the edge of the Osceola Plain, which rises in elevation from 60 to 90 feet.

The Kissimmee River valley crosses the Osceola and Okeechobee plains and is a major source of surface water to Lake Okeechobee and the Everglades. Rainfall in the northern portion of the Osceola Plain recharges the Floridan aquifer. The Immokalee Rise provides recharge to the water table and sandstone aquifers in Lee and Collier counties.

Lake Okeechobee, located in the heart of South Florida, is the third largest freshwater lake entirely in the United States. It was formed about 6,000 thousand years ago and is the central component of South Florida's interconnected Kissimmee River-Lake Okeechobee-Everglades ecosystem.

The Everglades is a resource of global significance. It is an extensive system of highly productive wetlands, habitat for numerous species of tropical and subtropical plants and animals, and a vast reservoir of fresh water. The term "Everglades" refers to the swamps, marshes, sloughs, prairies, tree islands, and forests that covered most of southeastern Florida west of the Atlantic coastal ridge.

Water from the Atlantic Coastal Ridge and the Everglades recharges the Biscayne aquifer in Miami-Dade and Broward counties and provides surface water flows to Florida Bay. The Big Cypress Swamp in eastern Collier and southern Hendry counties contributes primarily to surface water flow to coastal estuaries along the southwest coast of Collier County and Everglades National Park. The Florida Keys have no major source of fresh water except for rainfall and limited storage in the shallow aquifer of the larger islands. Coastal marshes and mangrove swamps, which are subject to tidal influx of salt water, border the southern end of the peninsula. The topographic and physiographic regions within the District are shown in **Figures 7** and **8**.

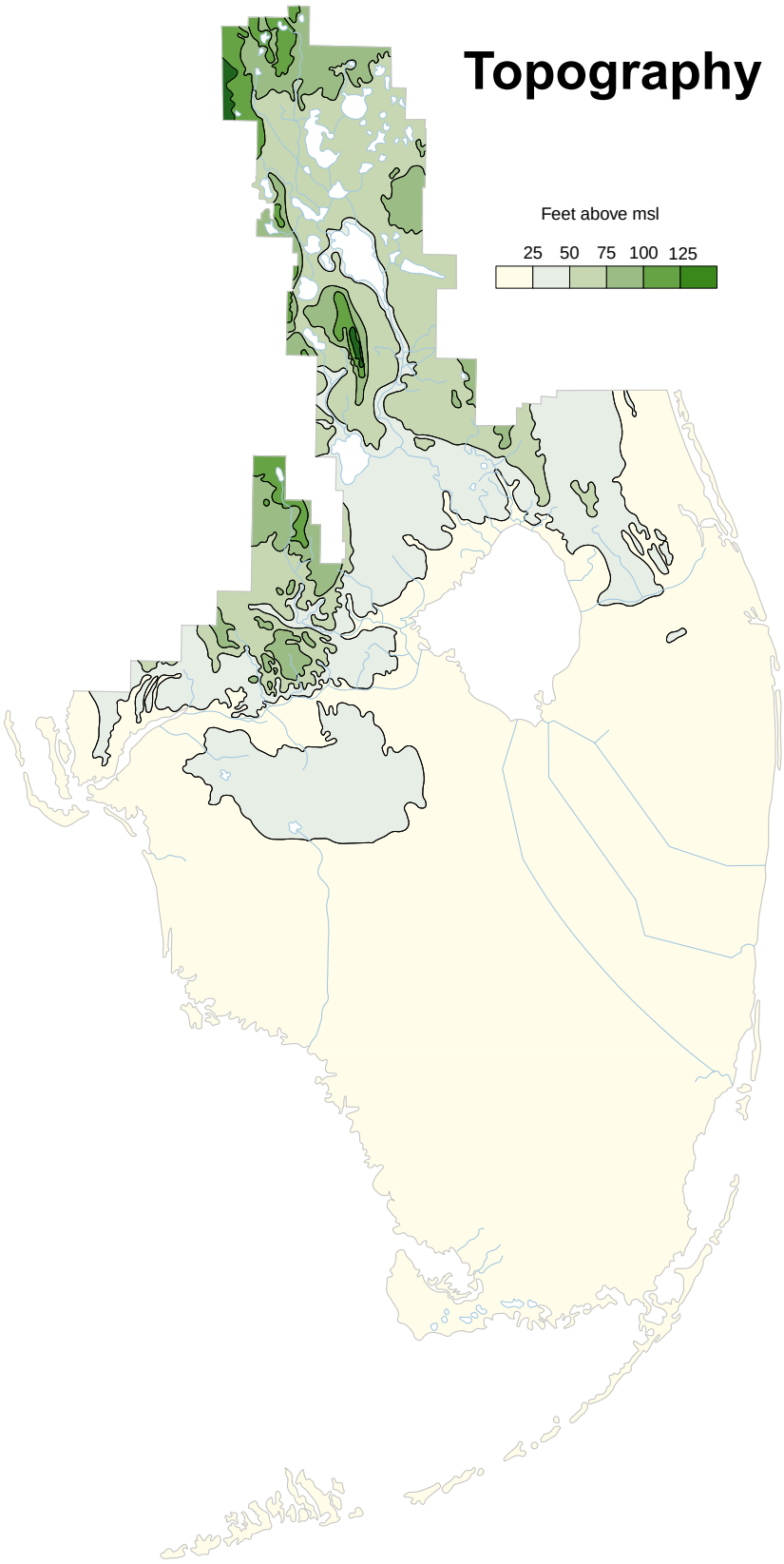


Figure 7. Topography within the SFWMD (Fernald and Purdam, 1998).

Physiographic Regions

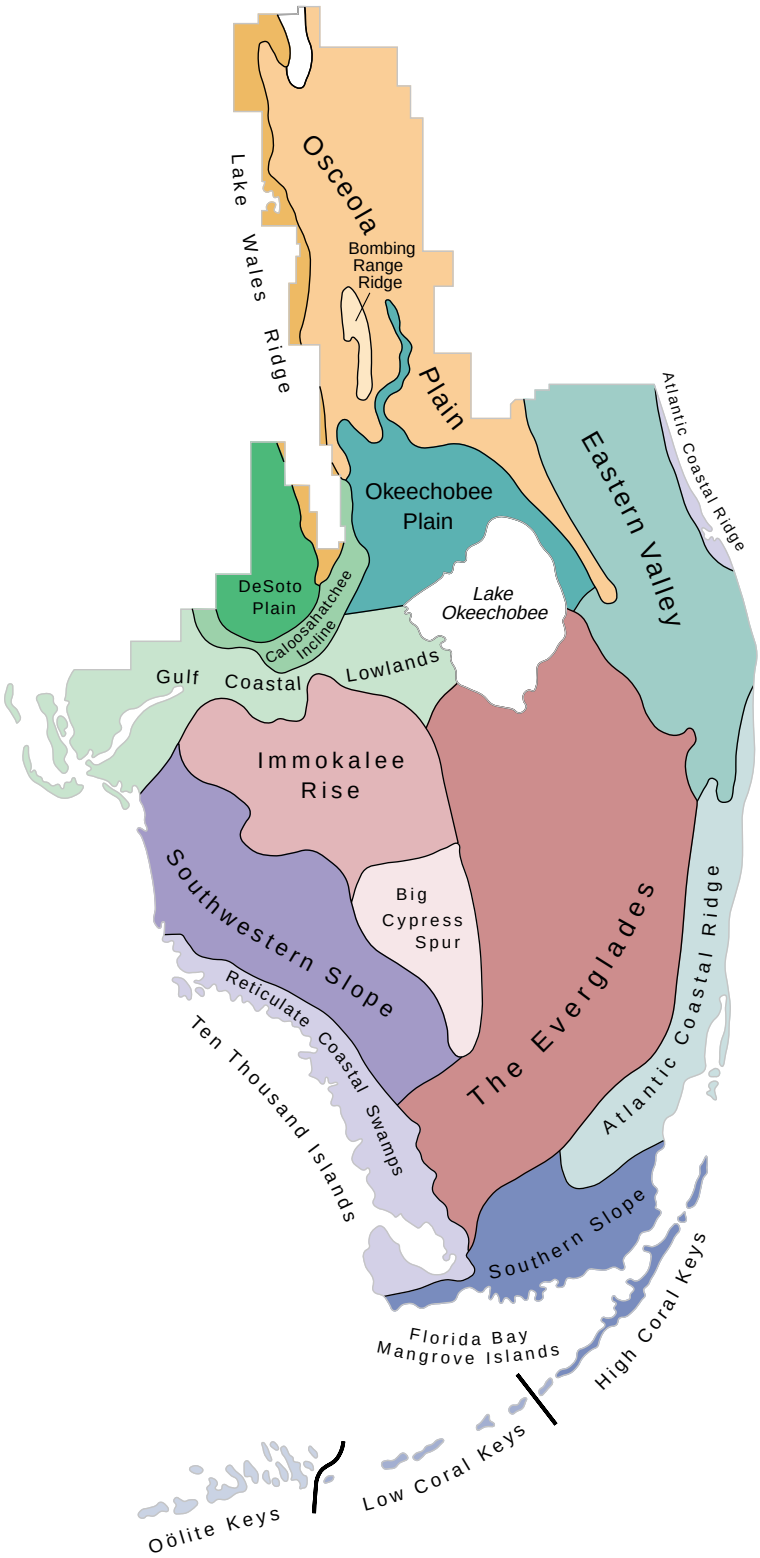


Figure 8. Physiographic Regions within the SFWMD (Fernald and Purdam, 1998).

Climate

The climate of South Florida is characterized by warm temperatures, an average annual rainfall of 52.8 inches, and usually light winds. Intense storms, yielding large volumes of rain are common. Seventy-three percent, or 38.5 inches, of the region's spatially averaged annual rainfall occurs in the six month period from May through October (Ali and Abtew, 1999). During the dry months, rainfall is more closely related to the passage of cold fronts and warm fronts. These frontal storms produce significant rainfall, but occur with less frequency than the wet season, summer storms. The monthly average rainfall distribution for the District is shown in **Figure 9**. Results from rainfall analysis conducted by the District show a significant variation around the historical mean for all basins and all months.

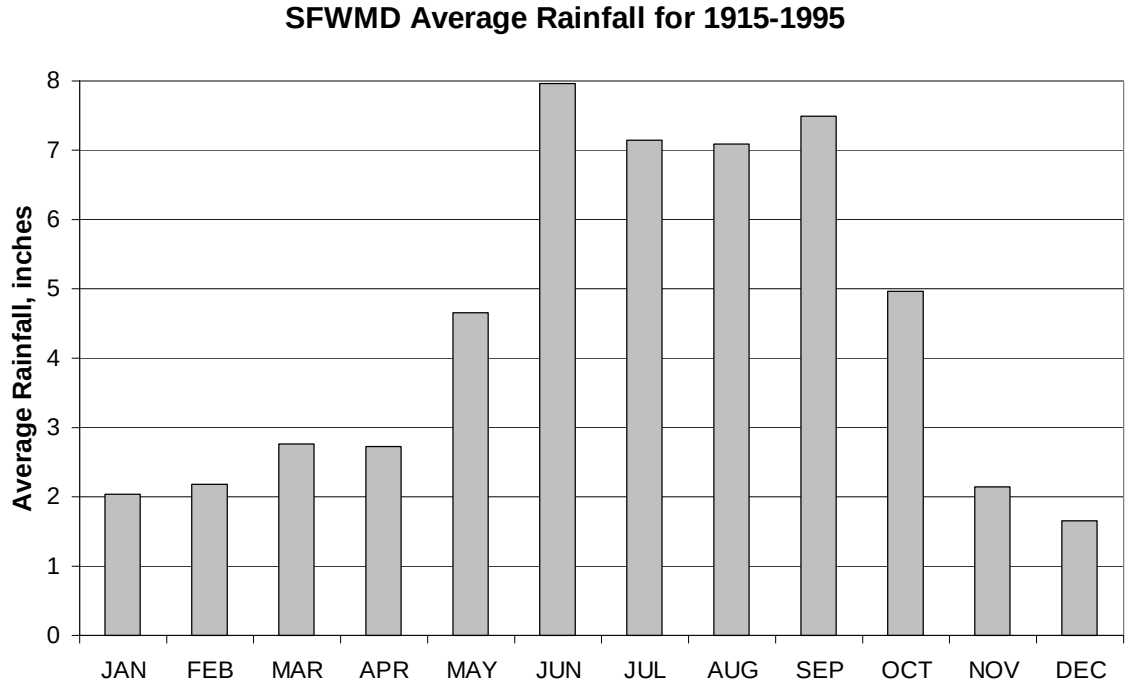


Figure 9. Monthly Distribution of Average Rainfall within the SFWMD.

In addition to the average seasonal variation of rainfall, year-to-year variability in total precipitation is an important feature of South Florida's climate. Annual District rainfall frequency analysis performed by Sculley (1986) depicted 1-in-10 year dry and wet annual District rainfall as 44.3 and 62.5 inches, respectively. Spatially averaged District rainfall quantities for the years 1915 through 1995 are shown in **Figure 10**. Annual rainfall fluctuates significantly from year-to-year, and the fact that South Florida can move so quickly from having excessive rainfall with associated flooding to a drought situation, or vice versa, exacerbates the difficulties associated with managing the water resources of the region.

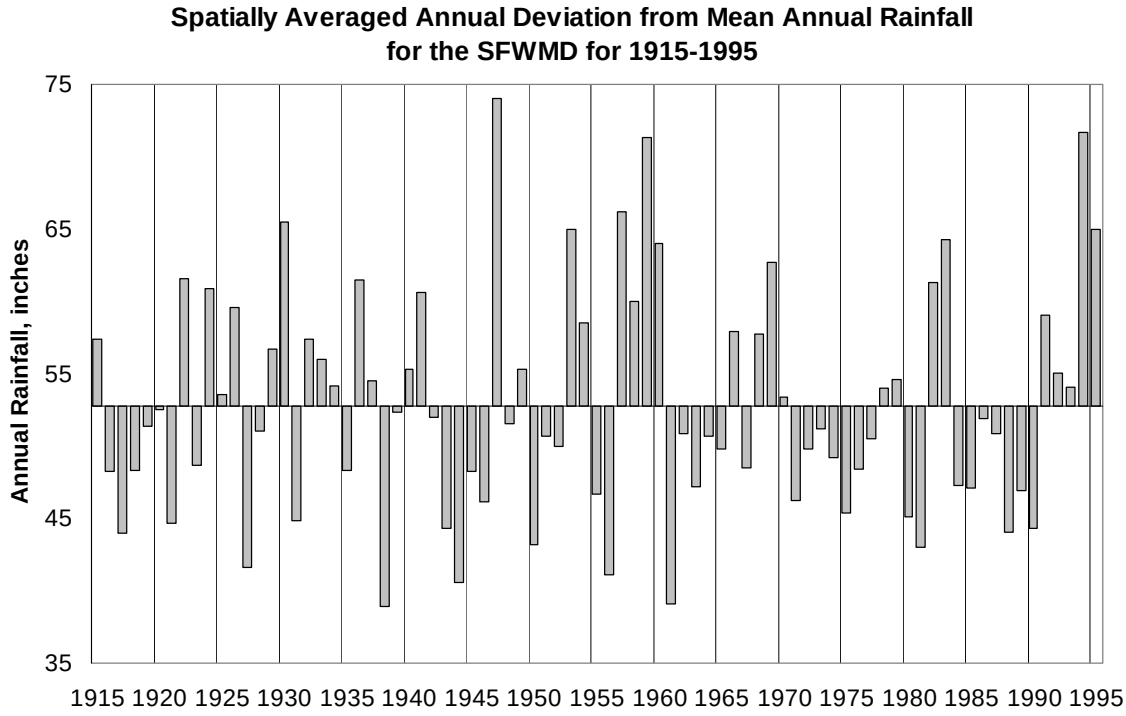


Figure 10. Spatially Averaged Annual Deviation of Rainfall from the Mean within the SFWMD.

SURFACE WATER RESOURCES

The natural surface hydrology of South Florida resulted from the interaction of the region's subtropical climate with its topography and geology. The natural hydrologic system was self-sustaining and dynamic with conditions ranging from dry periods to prolonged flooding during wet periods. During wet periods, water tended to accumulate on the predominantly flat, low-lying lands, flowing overland and via shallow streams into freshwater lakes and the ocean. Ponding persisted for several months, allowing infiltration of surface water into the underlying aquifers. During dry periods, surface water levels receded, but water stored in the soil and aquifer provided base flow for the rivers and wetlands. Occasionally, prolonged droughts caused more complete drying of the land. Wildfires were common during droughts.

Long periods of flooding and the extremes of droughts and hurricanes made most of South Florida inhospitable to development. Early development was generally confined to isolated uplands and the coastal ridge, which was often the only dry land available. There was, however, a strong desire to settle the lowlands, which were very fertile and had the potential to be of great agricultural value. In order to accommodate development, the natural hydrologic system was modified to enable agricultural and urban development. Extensive damage wrought by floods and droughts on urban and agricultural areas led to the construction of the C&SF Project and other surface water management systems managed by the District. A schematic of this surface water management system is shown in **Figure 24** in **Chapter 4**, and in detail on the *Structure and Canal Locations* map

inserted in this document's front cover. The region's surface hydrology is now largely governed by man-made systems superimposed on the District's natural hydrology. The boundaries of the District's major surface water basins, based on drainage divides, are shown in **Figure 11**.

Upper Kissimmee

The Upper Kissimmee Basin is dotted with hundreds of lakes, ranging in size from small sinkholes and ponds to large lakes. The surface water drainage pattern begins with a series of interconnected lakes in the northern portion, called the Kissimmee Chain of Lakes. Alligator Lake forms the drainage divide of the Chain of Lakes and water can be released either to the north or to the south. Northward flow goes though several canals and smaller lakes to Lake Mary Jane; the flow proceeds through Lakes Hart, East Tohopekaliga, and Tohopekaliga, then finally to Lake Cypress. Southward flow takes a shorter route through Lake Gentry and then to Lake Cypress. From Lake Cypress, water flows southward to Lake Hatchineha and then to Lake Kissimmee. Most of these lakes are shallow, with mean depths varying from six to 13 feet. The subbasins of the Upper Kissimmee Basin are generally delineated by the drainage divides of the major water bodies, and more detailed descriptions of these lakes may be found in the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a).

Okeechobee

The Okeechobee Basin includes the tributary watersheds of the Kissimmee River between the outlet of Lake Kissimmee (S-65) and Lake Okeechobee. There are a series of five subbasins (S-65A through E) along the C-38 Canal. These subbasins are named after the structures which divide the C-38 Canal into five pools. The water level in each of these pools is regulated according to an interim regulation schedule for the Kissimmee River Pools.

Lake Okeechobee is the largest lake in Florida and the third largest natural water body entirely within the United States. This lake and its associated wetlands provide habitat for a number of plants and animals, including several rare and endangered species such as the wood stork, snail kite, West Indian manatee, and Okeechobee gourd. Migratory birds and waterfowl use the littoral zone and adjacent wetlands as a resting area along the Atlantic flyway. The lake is also a major recreational resource. The lake supports a nationally renowned sport fishery, and is an important winter waterfowl hunting area. It is also part of the navigable Okeechobee Waterway connecting the east and west coasts of the state.

Lake Okeechobee also provides water storage for urban and agricultural water supply. During water shortages, canal discharges from Lake Okeechobee provides recharge water for the Biscayne aquifer, indirectly supplying water to 90 percent of the five million residents of the LEC planning region. The lake also supplies irrigation water for sugarcane, vegetables, sod, and rice crops grown in the EAA.

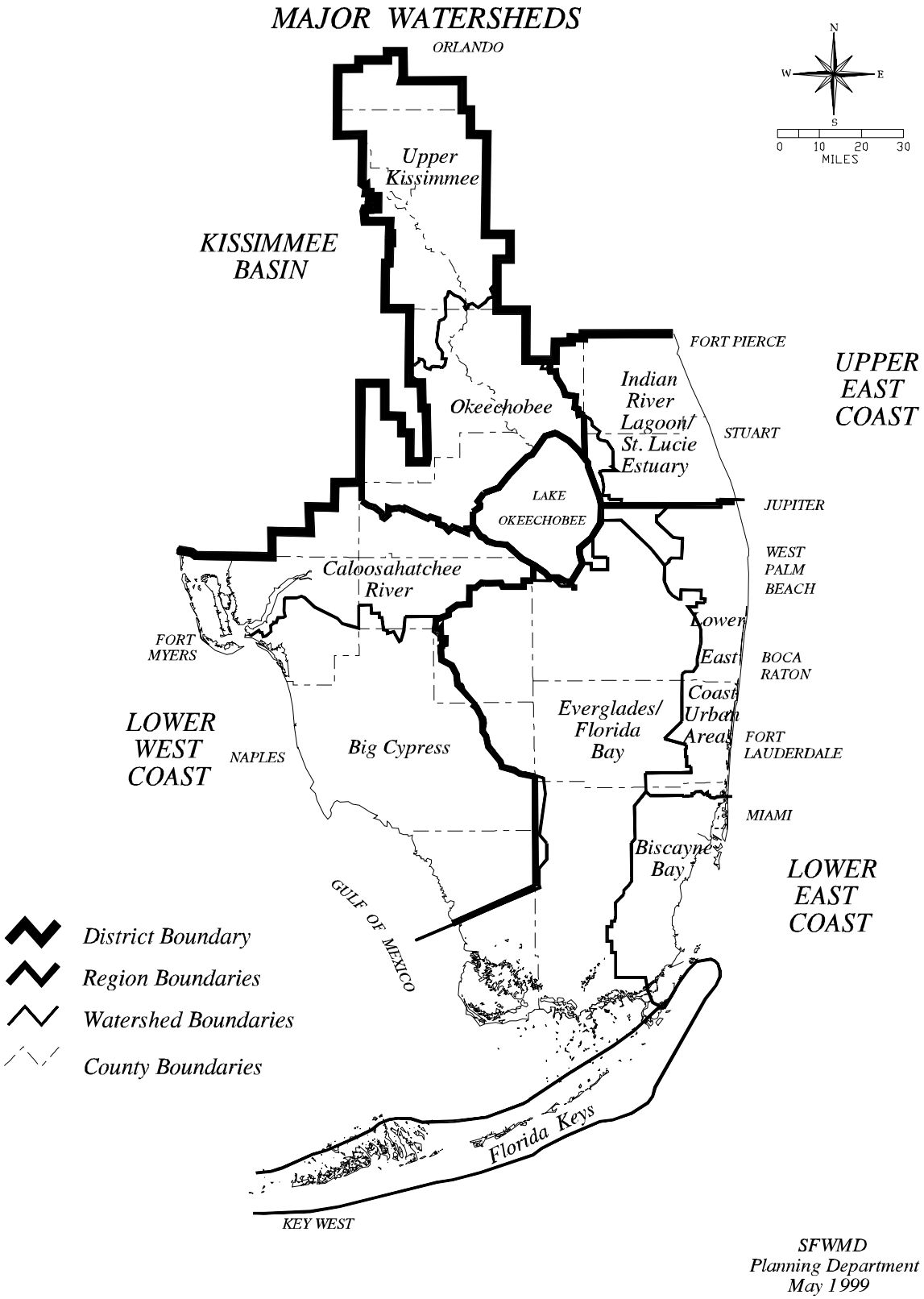


Figure 11. Major Surface Water Basins within the SFWMD.

Lake Istokpoga is the second largest lake within the District (fifth largest in the state) and is also within the Okeechobee Basin. This lake has a surface area of 43.3 square miles, and ranges in depth from 4.3 to 9.8 feet. Lake Istokpoga is known for the excellent fishing it offers, and represents 60 percent of the public access fresh water in Highlands County.

Caloosahatchee River

The Caloosahatchee River Basin extends from Lake Okeechobee to San Carlos Bay. It comprises the northern portion of the LWC planning region. Inflows from Lake Okeechobee and runoff from within its own basin supply the Caloosahatchee River. The freshwater portion of the river (C-43 Canal) extends eastward from the Franklin Lock and Dam (S-79) towards Lake Okeechobee and the cities of LaBelle and Moore Haven. The C-43 Canal is part of the Lake Okeechobee Waterway that provides navigation between the east and west coasts of Florida. West of the S-79 Structure, the river mixes freely with estuarine water as it empties into the Gulf of Mexico. The river is the only major surface water source used for water supply in the LWC planning region.

Big Cypress Basin

The Big Cypress Basin includes all of Collier County and part of Monroe County; including the Big Cypress National Preserve and the Ten Thousand Islands. The regional hydrologic system in the Big Cypress Basin is made up of natural sloughs, rivers, and wetlands. In some areas, local drainage canals provide limited regional flood protection during wet periods, but also lead to overdrainage during dry periods. Development in downstream coastal areas has degraded many natural flowways and their flood carrying capacities; leading to increased flooding in inland areas. The District, through its Big Cypress Basin Board, has adopted many of these canals as works of the Big Cypress Basin and has modified them to reduce overdrainage while maintaining flood protection.

Indian River Lagoon

The Indian River Lagoon Basin is composed of three interconnected estuarine lagoons: the Mosquito Lagoon, Indian River Lagoon, and the Banana River Lagoon. The lagoon system extends about 155 miles through six coastal counties from Ponce de Leon Inlet in Volusia County southward to Jupiter Inlet in Palm Beach County. For planning purposes, the watershed has been divided into four geographic segments. The North, North Central, and South Central segments are within the St. Johns River Water Management District. The South segment is within the SFWMD and is divided into drainage basins based on hydrologic characteristics. These drainage basins are the C-23, C-24, C-25, and C-44 canal basins and the basins which drain into the North and South Fork of the St. Lucie River.

The South Indian River Lagoon segment, under natural conditions, was poorly drained with many isolated wetlands. The natural drainage divides are poorly defined. The area has been developed for agriculture and urban/residential uses with a complex system of drainage canals. Many of these canals provide connections between basins.

Lower East Coast Urban Area

The LEC Urban Area consists of the coastal ridge portions of Palm Beach and Broward counties lying east of the WCAs, and is part of the most densely populated part of the state (together with Miami-Dade County). The largest population centers are near the coast and include the cities of West Palm Beach, Fort Lauderdale, and Hollywood. Water levels in coastal canals are controlled near the coastal shoreline to prevent overdrainage and to resist saltwater intrusion.

Low water levels in the canals east of the control structures enable salt water to migrate into the ground water, wellfields, and natural freshwater systems upon which the urban areas depend for a potable water supply. Except for pockets of publicly protected preservation lands, extensive development has resulted in nearly the complete urbanization of the coastal region, from West Palm Beach southward through Hollywood.

Everglades - Florida Bay

The Everglades is the largest subtropical wetland in the United States and a unique resource for South Florida. Everglades National Park was established in 1947, designated an International Biosphere Reserve in 1976, an Outstanding Florida Water in 1978, and a United Nations World Heritage Site in 1979. The park and the WCAs are the surviving remnants of the historical Everglades, which spread uninterrupted from Lake Okeechobee south to Florida Bay and east to the coastal ridge. This remaining area provides significant ecological benefits, including water storage and supply, habitat for wildlife of national significance, and internationally recognized recreational opportunities. The Everglades also encompasses the Western Basins area which contains two Native American Indian reservations. Big Cypress, the largest of the Seminole Tribe's reservations, occupies more than 52,000 acres in Hendry and Broward counties. The Miccosukee Tribe's reservation, just south of the Big Cypress reservation, comprises 75,000 acres in Broward County.

To the south, Florida Bay has begun to demonstrate signs of stress. Historically, the bay was a 772 square mile shallow, brackish estuary with fluctuating salinity. Salinity fluctuations were caused by seasonal changes in the outflow from the Everglades, and rainfall. The bay was popular with sport fishermen because of the schools of tarpon, bonefish, redfish, and sea trout feeding on the pink shrimp, crabs, and other bait. Large sections of the estuary have deteriorated in recent years. Hydrologic and geologic indicators of the deterioration of the estuary include murky water, loss of seagrass habitat, algal blooms, fish and invertebrate kills, and significant increases in salinity levels.

Biscayne Bay

The Biscayne Bay Watershed includes the highly urbanized, coastal area of Miami-Dade County. South of Miami the coastal area widens as the Everglades bends to the west. The watershed includes urban and agricultural areas that extend almost to the southern coast. Miami-Dade County’s agricultural industry covers more than 83,000 acres southwest of the coastal metropolitan area. Vegetables, tropical fruits, and nursery plants are grown in this area.

Biscayne Bay is a shallow subtropical estuary with a natural depth ranging from three to nine feet. Much of the upper bay has been modified and dredged, so that depths now average six to ten feet and include some dredged areas and channels up to forty feet deep. A basin of about 840 square miles drains to the bay. Seventeen canals in eastern Miami-Dade County operated by the District provide most of the surface flows of fresh water into Biscayne Bay.

The significance of ground water flows to Biscayne Bay is uncertain. Existing data suggest that historic dry season ground water flows have been greatly reduced. Canal construction has accelerated the rate at which ground water levels recede at the end of the wet season. Before canals and structures existed, some surface water flowed to the bay through the Miami River and a few natural creeks and streams. During wet periods, large amounts of water entered the bay as surface water flowed across adjacent freshwater marshes. Surface water now discharges from the mouths of canals at a much faster rate compared to the flow rate of natural conditions.

Biscayne Bay continues to support a wide variety of plants and animals, some of which are important for fisheries. Many rare, threatened, and endangered species occur in or near the bay, including manatees and crocodiles.

Florida Keys

The Florida Keys watershed consists of a limestone island archipelago of some 1,700 islands extending southwest for over 200 miles, from the southern tip of the Florida mainland to the Dry Tortugas. The area is bounded on the north and west by the relatively shallow mud shoals and seagrass beds of Biscayne Bay, Barnes and Blackwater sounds, Florida Bay, and the Gulf of Mexico. Fresh water is supplied to the Florida Keys by the Florida Keys Aqueduct Authority, which has a wellfield near Florida City on the mainland.

GROUND WATER RESOURCES

The predominant use of ground water in South Florida, especially for potable water supply, has developed due to the high productivity of the aquifers underlying the region. The Biscayne and the Floridan aquifers are among the most productive in the world. The Biscayne aquifer consists of cavernous limestone and is the primary source of drinking water for all municipal water systems in the LEC planning region south of the C-51 Canal in central Palm Beach County. The high permeability and proximity of the Biscayne aquifer to the land surface closely links it with the surface water hydrology. This link is enhanced by the network of canals of the C&SF Project, which can be used for aquifer recharge. The high permeability and land surface proximity also makes the Biscayne aquifer highly susceptible to saltwater intrusion and to contamination from surface sources (SFWMD, 1998b).

With the exception of the northern portion of the Kissimmee Basin (which predominantly uses water from the Floridan aquifer for potable purposes), the counties

within the District generally use shallow ground water supplies to meet their potable water demands. The Public Water Supply (PWS) wellfields are vulnerable to contamination from land based sources and need to be safeguarded.

In 1995, nearly 96 percent of South Florida's public utility supply and 100 percent of its domestic self-supply came from ground water. In addition, ground water accounted for 32 percent of the water used for agricultural irrigation. Overall, ground water supplied 53 percent of the total freshwater demands in the District in 1995 (USGS, 1999). Surface water plays an important role in maintaining the availability of ground water, which is recharged through rainfall and the regional canal system.

Principal Aquifer Systems

Virtually all areas within the District are underlain by aquifers capable of yielding some quantity of water. Three principal aquifer systems exist in South Florida: the Surficial, Intermediate, and Floridan aquifer systems, which are shown in the cross-section of South Florida delineated in **Figure 12**.

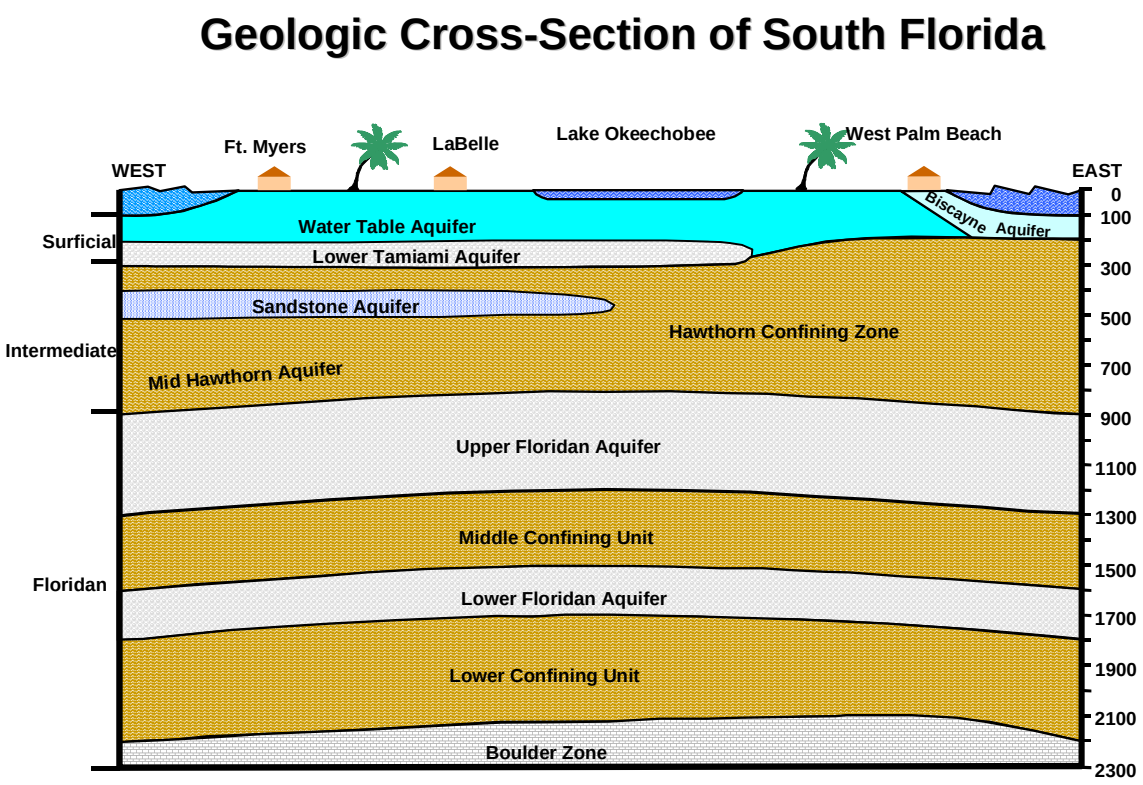


Figure 12. Geologic Cross-Section of South Florida.

The Surficial Aquifer System contains the unconfined Biscayne aquifer located in southeastern Florida (principally Miami-Dade, Broward, and southern Palm Beach counties); the undifferentiated water table aquifers located along the east coast from

St. Lucie County south into Palm Beach County, in parts of south Central Florida, and in the LWC planning region; and the confined lower Tamiami aquifer located in southwestern Florida. The Intermediate Aquifer System contains two major confined aquifers: the sandstone and mid-Hawthorn aquifers located along the southwestern Florida coast from Charlotte to Monroe counties. The Floridan Aquifer System underlies all of South Florida. Everywhere within the District, except in the Upper Kissimmee Basin, Floridan water must be treated extensively before it is potable.

Overall, the Surficial Aquifer System supplied approximately three-quarters of the total ground water withdrawals within the District in 1995. Of the remaining 1995 ground water demands, the Intermediate Aquifer System supplied 11 percent and the Floridan Aquifer System supplied 15 percent.

Surficial Aquifer System

The Surficial Aquifer System includes the Biscayne aquifer, various shallow water table aquifers, and the lower Tamiami aquifer. In general, the water producing zones of the Surficial Aquifer System are composed of interbedded unconsolidated sand and shell units with carbonate rock.

Biscayne Aquifer

The Biscayne aquifer is the major source of fresh water used for PWS within the LEC planning region. The aquifer underlies an area of approximately 3,200 square miles throughout Miami-Dade, Broward, and southern Palm Beach counties. It has been designated a sole source aquifer by the U.S. Environmental Protection Agency (USEPA) under the provisions of the Safe Drinking Water Act and, therefore, must be afforded stringent protection. The sole source aquifer designation is made by the USEPA if 50 percent or more of an area's drinking water is supplied by the aquifer and alternative sources of water are unavailable. By designating the Biscayne a sole source aquifer, the USEPA will preview any federally funded construction projects, such as airports and highways, to ensure that there will be no significant impact on the source of water to residents living in this area.

The Biscayne aquifer is one of the most productive shallow nonartesian aquifers in the United States and one of the most permeable aquifers in the world, displaying transmissivities in excess of 7 million gallons per day per foot (gpd/ft). Many wells yield 1,000 gallons per minute (gpm) or more with negligible drawdowns, because of the exceedingly high permeability of the solution riddled limestones that comprise the Biscayne aquifer. The aquifer is unconfined, close to the surface, and highly permeable, and, therefore, is vulnerable to contamination. Rapid urbanization and agricultural land use are potential contamination threats. The Biscayne aquifer is composed of unconsolidated sand and shell units interbedded with carbonate rocks. The carbonates are the most prolific water producing zones. The aquifer reaches its maximum thickness within the southern portion of the LEC planning region beneath the Atlantic Coastal Ridge and potable water exists to depths of about 200 feet.

Water Table Aquifers

Shallow water table aquifers are the principal water source for urban supply within the LWC and the UEC planning regions. Water table aquifers are also a source of water for agricultural irrigation in these areas.

The water table aquifer system in the LWC planning region has transmissivities ranging between 10,000 to 1,000,000 gpd/ft. In the UEC planning region, the aquifer has transmissivities as high as 200,000 gpd/ft, which decrease abruptly inland. PWS wells in both areas have well yields of about 300 gpm.

The proximity of the water table aquifers to the surface increases their susceptibility to contamination from a variety of sources. Lack of confinement, high recharge rate, relatively high permeability, and a high water table, all increase contamination potential. Because of increasing demands on these aquifers, there is also the threat of saltwater intrusion along the coasts.

Lower Tamiami Aquifer

The lower Tamiami aquifer is the most prolific aquifer in Collier and Hendry counties, serving as the primary source of municipal, industrial, and agricultural water supply. The proximity of the lower Tamiami aquifer to the surface increases its susceptibility to contamination. Because of large demands placed on this aquifer, it has been endangered by saltwater intrusion along the coast and is frequently included in water shortage restrictions.

Intermediate Aquifer System

The Intermediate Aquifer System consists of the sandstone aquifer and the mid-Hawthorn artesian aquifer. It is composed predominantly of interbedded clays and silts, sand, sandstones, dolostones, and limestones. The sandstone aquifer is relatively thin and discontinuous compared to the mid-Hawthorn aquifer, yet it produces more water, particularly for agriculture in Hendry, eastern Lee, and northern Collier counties.

Floridan Aquifer System

The Floridan aquifer serves as a major source for agricultural irrigation water within the UEC planning region, and is also utilized on a small scale as a complementary source for blending with water from the Surficial Aquifer System for PWS. The Floridan Aquifer System provides about 10 percent of total PWS pumpage in the region. Water from the Floridan Aquifer System typically must undergo desalination prior to potable use within the UEC planning region. Transmissivities are typically high, ranging from 100,000 to 500,000 gpd/ft.

Ground water withdrawals for urban and agricultural use within the Kissimmee Basin occur almost exclusively from the Floridan Aquifer System. This predominantly artesian system contains several distinct producing zones and fresh water. The Floridan

Aquifer System is also present in the LEC and LWC planning regions, but the water quality is not high in these regions. Because of the poor water quality, the Floridan aquifer is not a significant source in these planning regions, although there is some use of the Floridan by barrier island facilities in the LWC.

CULTURAL RESOURCES AND DEVELOPMENT

South Florida was in a relatively natural state in 1940, with Miami and Fort Lauderdale as the two primary urban areas. The Kissimmee River Basin and Okeechobee County were major cattle raising areas. Concentrations of agriculture in South Florida were located along the south rim of Lake Okeechobee, near Immokalee, west and south of Miami, and in Palm Beach County.

Extensive flooding in 1947 led to authorization of the C&SF Project by the federal government. The Florida Legislature created the FCD in 1949 to serve as local sponsor for the C&SF Project. Protection from flooding made additional residential areas in South Florida feasible, and the availability of air conditioning made Florida an increasingly attractive place to reside on a year-round basis.

Population

Between 1950 and 1995 the population of the area within the District's boundaries has grown from 0.8 million to 5.8 million. The region also has significant seasonal and tourist populations that are not included in those numbers. The permanent resident population of the District is projected to reach 8.2 million by 2020 (SFWMD, 1998b) (**Figure 13**).

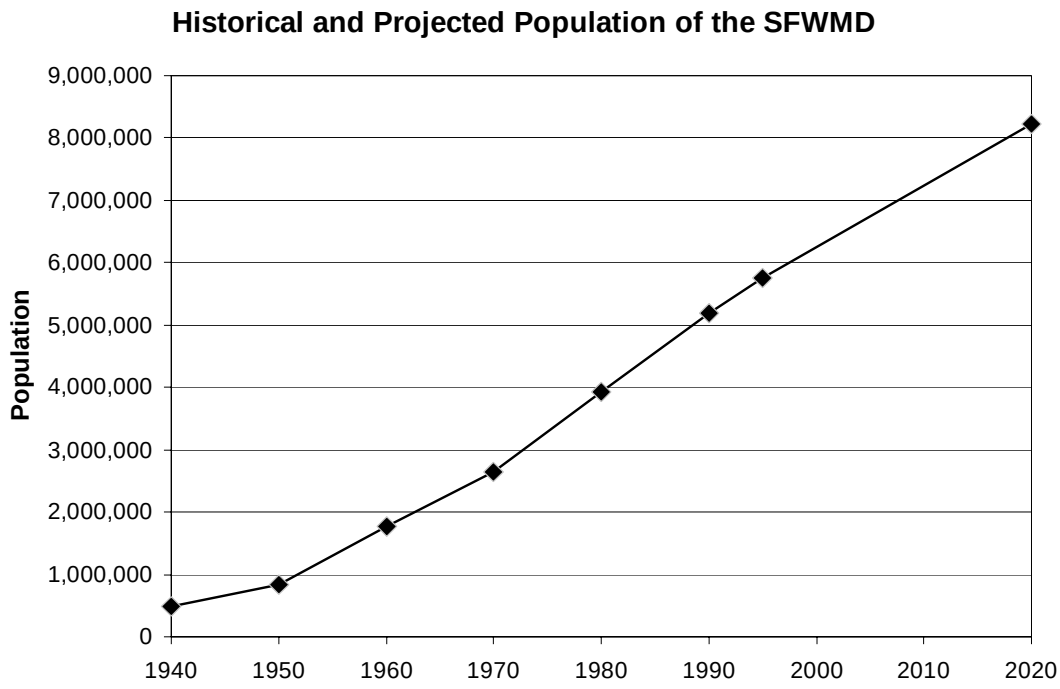


Figure 13. Projection of Future Population within the SFWMD.

Generally, urban development is concentrated along the unprotected areas of the coast and in the I-4 corridor/Orlando area. The 1990 census map, shown in **Figure 14**, clearly depicts the majority of the District's population as residing along the east coast of the District, with significant population centers also on the west coast and in and around Orlando. The assessed 1995 and projected 2020 distributions of population by planning region and county are shown in **Table 2** (SFWMD, 1998b).

Table 2. Assessed 1995 and Projected 2020 Populations for the SFWMD.

Counties	1995	2020	Percent growth
Lower West Coast			
Lee	375,238	594,300	58%
Collier	182,933	349,200	91%
Western Hendry	27,714	39,999	44%
Southern Glades	4,409	7,560	71%
Southeastern Charlotte	645	1,746	171%
LWC Total Population	590,939	992,805	68%
Lower East Coast			
Palm Beach	976,358	1,464,000	50%
Broward	1,412,942	1,926,600	36%
Miami-Dade	2,046,078	2,587,400	26%
Monroe	81,152	106,000	31%
Eastern Hendry	1,871	2,700	44%
LEC Total Population	4,518,401	6,086,700	35%
Upper East Coast			
St. Lucie	171,914	281,500	64%
Martin	110,495	173,500	57%
Eastern Okeechobee	1,048	1,580	51%
UEC Total Population	283,457	456,580	61%
Kissimmee Basin			
Southern Orange	186,131	349,453	88%
Western Osceola	130,605	260,937	100%
Southeastern Polk	6,375	13,832	117%
Eastern Highlands	7,700	11,590	51%
Western Okechobee	28,737	45,244	57%
Northern Glades	3,289	5,640	71%
Kissimmee Basin Total Population	362,837	686,696	89%
District Total Population	5,755,634	8,222,781	43%

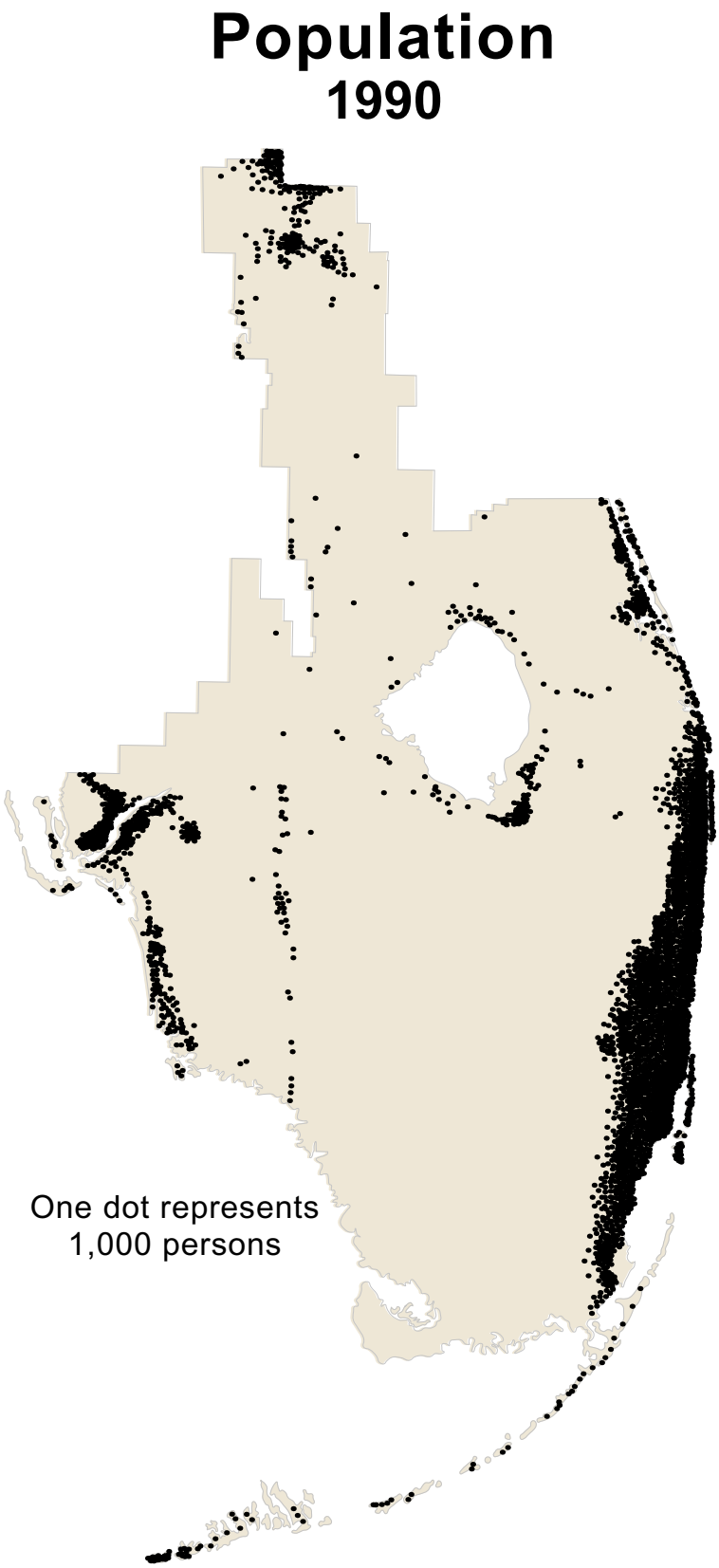


Figure 14. Distribution of Population Density within the SFWMD (Fernald and Purdam, 1998).

Tourism

Tourism plays a major role in the economy of South Florida. Attractions within the District include the beaches of both the Atlantic and Gulf coast; Everglades and Biscayne national park in Miami-Dade and Monroe counties; the Florida Keys; and the theme parks in southwestern Orange and northern Osceola counties.

Tourism results in significant seasonal variations in population. The major tourist season occurs during the dry winter months, and the degree to which the population varies seasonally varies by region within the District. For example, the proportion by which seasonal population shifts in the LWC planning region of the District is much higher than in the Miami area (SFWMD, 1995a).

In spite of large seasonal variations in population the monthly distribution of urban water demand remains fairly constant. During the winter months, the seasonal tourist population is at its peak, whereas outside irrigation demands peak in late spring, when tourist populations are declining. Landscape irrigation demands attributable to seasonal residents take place year-round for properties irrigated by property managers or automated irrigation systems.

Agriculture

Commercial agriculture is a major industry and the main water user within the District. The DWSA (SFWMD, 1998b) describes the irrigated agricultural acreage in each county within the District. Most of the interior area of the District not in public ownership is in agricultural use:

- Sugarcane and vegetable farms in the EAA (Palm Beach, Hendry, Glades, and Martin counties)
- The Agricultural Reserve Area of Palm Beach County
- The South Miami-Dade County Agricultural Area where vegetable crops dominate, especially tropical varieties
- Citrus groves throughout the District, but concentrated in St. Lucie, Martin, Hendry, Highlands, Collier, and Glades counties
- Cattle and dairy farms in Glades, Highlands, and Okeechobee counties

Commercial agricultural crops invariably require irrigation, and the estimation and projection of these irrigation requirements are fundamental to the water supply planning process. For consolidation and comparison purposes agricultural crops were categorized by the Water Demand Projection Subcommittee, which was made up of representatives of Florida's five water management districts. These crop categories are (1) citrus, (2) other fruits and nuts, (3) vegetables, melons, and berries, (4) field crops, (5) greenhouse/nursery, (6) sod, (7) pasture, and (8) miscellaneous. Agricultural acreages reported in this DWMP were taken from the DWSA (SFWMD, 1998b).

Citrus

Citrus is grown commercially within each county in the District except Monroe. While citrus production has historically been concentrated in the central portion of the state, a series of severe freezes during the 1980s resulted in the migration of citrus acreage southward. The three counties in the state with the most acreage planted in citrus, St. Lucie, Polk (a portion), and Hendry counties, are within the District. The region also accounts for virtually all of Florida's lime production (Miami-Dade County). Approximately 391,000 acres within the District were in citrus production in 1995. This acreage includes all categories of citrus (oranges, grapefruit, tangerines, limes, etc.).

Other Fruits and Nuts

Within the District, noncitrus fruit crops (avocados, mangos, papaya, etc.) are produced commercially in Miami-Dade and Lee counties. In 1995, about 10,000 acres were used within these two counties to produce noncitrus fruit crops.

Vegetables, Melons, and Berries

A wide variety of vegetables are grown commercially in South Florida. These include both traditional (e.g., bush and pole beans, carrots, celery, cucumbers, eggplant, endive, escarole, lettuce, peppers, potatoes, radishes, squash, sweet corn, tomatoes) as well as Latin vegetables (e.g., boniato, calabaza, malanga, yuca), and Chinese vegetables (e.g., bok choy, chihilli, napa, Chinese broccoli, dikon). Different types of vegetables are often grown interchangeably and multicropping is a normal practice. Counties with large acreages devoted to vegetable production include Miami-Dade, Palm Beach, Collier, Hendry, and Lee counties. Watermelon production takes place throughout the District, but does not take place on the same land each year due to a viral infestation that occurs in fields after one season of production. Blueberry production takes place in Highlands County. About 157,000 acres within the District were used to produce vegetables, melons, and berries in 1995.

Field Crops

Field crops grown within the District include sugarcane, rice, seed corn, soybean, and sorghum. By far the most significant of the field crops grown within the District in terms of crop acreage is sugarcane, which is grown commercially in Palm Beach, Hendry, Glades, and Martin counties. In 1995, there were about 463,000 acres of land within the District used to cultivate field crops. This does not include sugarcane lands that were fallow that year.

The majority of sugarcane grown in the United States is grown within the District. It is the dominant crop grown on the EAA’s muck soils, and there has been expansion of this crop onto sandland areas west of the EAA. Within the District, about 433,000 acres were planted with sugarcane in 1995. Because of production practices used for sugarcane (ratoon and fallow) there is an additional 25 percent of land used for sugarcane production

which is fallow in any given year. Within the EAA, rice and sweet corn are frequently grown during the fallow periods on the acreage typically devoted to sugarcane production.

Sod

There is some variation in the production practices of sod within the District. Some harvested sod is irrigated, and some is not, serving largely as pasture until the sod is sold. In 1995, there were about 18,000 acres of irrigated sod production within the District.

Greenhouse/Nursery

A variety of greenhouse and nursery crops are grown within the District. Production of ornamentals in South Florida is concentrated near urban areas in Miami-Dade, Palm Beach, and Broward counties, but also takes place throughout the rest of the District. Approximately 26,000 acres were devoted to ornamental nurseries within the District in 1995.

Pasture

Improved pasture has, by District definition, the facilities in place to carry out irrigation. However, these facilities were typically designed for drainage and, with the exception of a very few areas, are very rarely used for irrigation. This is because the returns associated with cattle production do not justify the expense associated with pasture irrigation. When irrigation is carried out, it is usually in a period of extreme drought and is done to prevent grass from dying.

Miscellaneous

The miscellaneous category includes cattle watering and aquaculture. Cattle ranching in South Florida is concentrated in the Kissimmee Basin, especially in Okeechobee, Highlands, and Osceola counties. Both dairy and beef cattle are raised. Aquaculture (fish farming) withdraws water for circulation purposes, and to replace evaporative losses. Commercial aquaculture presently takes place in Collier, Palm Beach, Miami-Dade, Martin, Highlands, and Okeechobee counties.

Land Development

Agricultural and urban land uses have expanded greatly since 1940. A large portion of South Florida is reserved for nature, though much of it has been disturbed. For example, substantial portions of original Everglades wetlands have been protected in the WCAs since the 1970s, but water levels and timing of deliveries have been artificially managed within these impoundments, resulting in adverse effects on native plant and animal communities. **Table 3** and **Figures 15** through **17** show the changing land uses within the District.

Table 3. Changes in Land Use within the District.

	1953		1973		1995	
	Square Miles	Percent	Square Miles	Percent	Square Miles	Percent
Urban	372	2.2%	1,234	7.2%	2,277	13.3%
Agricultural	1,632	9.5%	4,703	27.5%	4,757	27.8%
Natural	14,180	82.5%	10,234	59.9%	8,976	52.5%
Water	997	5.8%	909	5.3%	1,098	6.4%
Total	17,181[a]	100.0%	17,080[a]	100.0%	17,108[a]	100.0%

a. The slight variations in total land use between dates is caused by the difficulty in replicating the mean tide line along the coast.

In 1953, urban land uses made up 2.2 percent of the District's area, and this has increased continuously to 13.3 percent in 1995. In 1953, agricultural land made up 9.5 percent of the District, and this has increased to 27.8 percent in 1995. These changes in land use have had significant impacts to all four of the District's areas of responsibility (water supply, flood protection, water quality, and natural systems). Increased populations and agricultural development have meant increased demands for water supply; increased needs for flood protection; an overall decline in water quality; and a reduction in lands in their natural state.

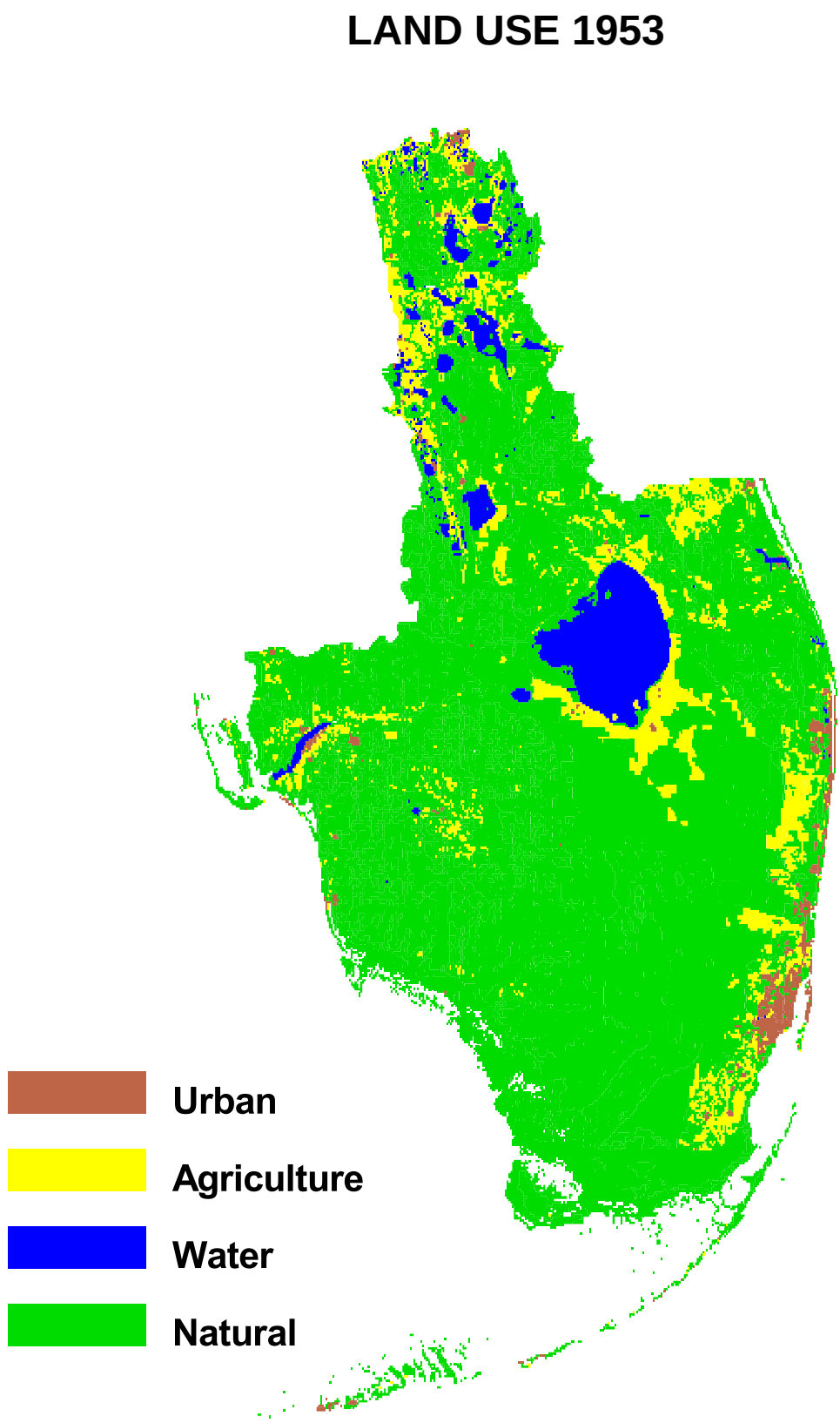


Figure 15. Land Use within the SFWMD in 1953.

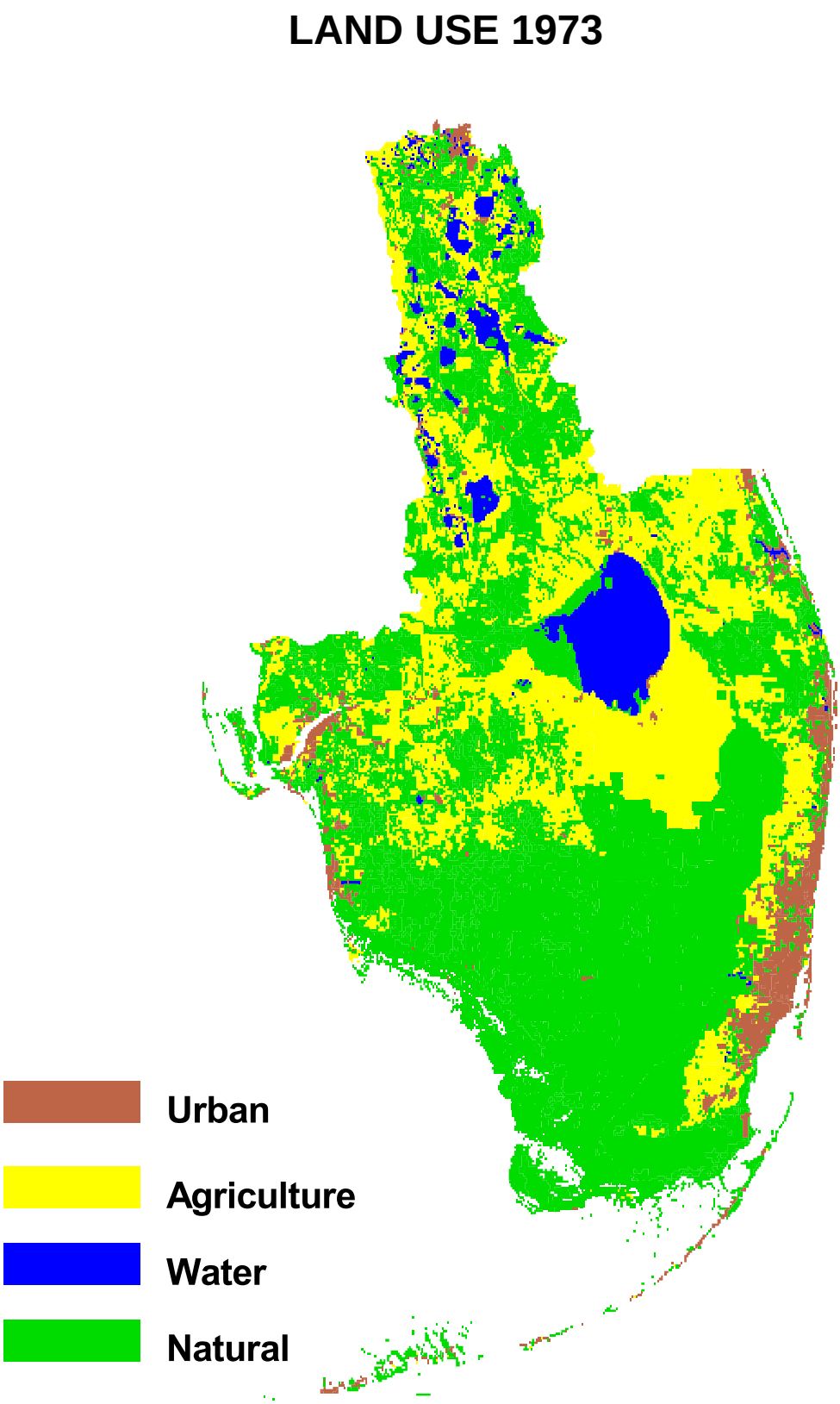


Figure 16. Land Use within the SFWMD in 1973.

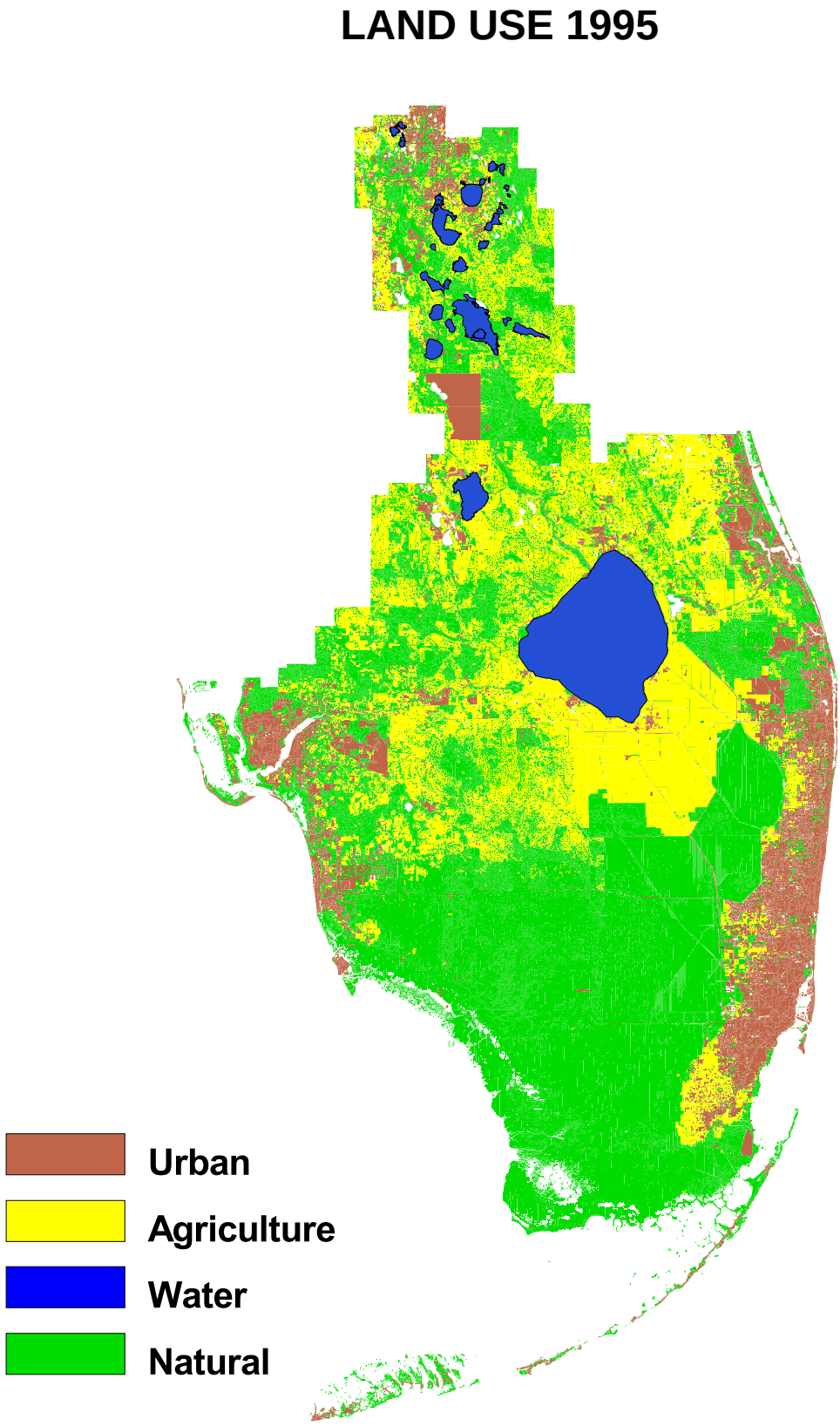


Figure 17. Land Use within the SFWMD in 1995.

Water Use

Demand assessments for 1995 and projections for 2020 are presented in the DWSA (SFWMD, 1998b) for the following water use categories:

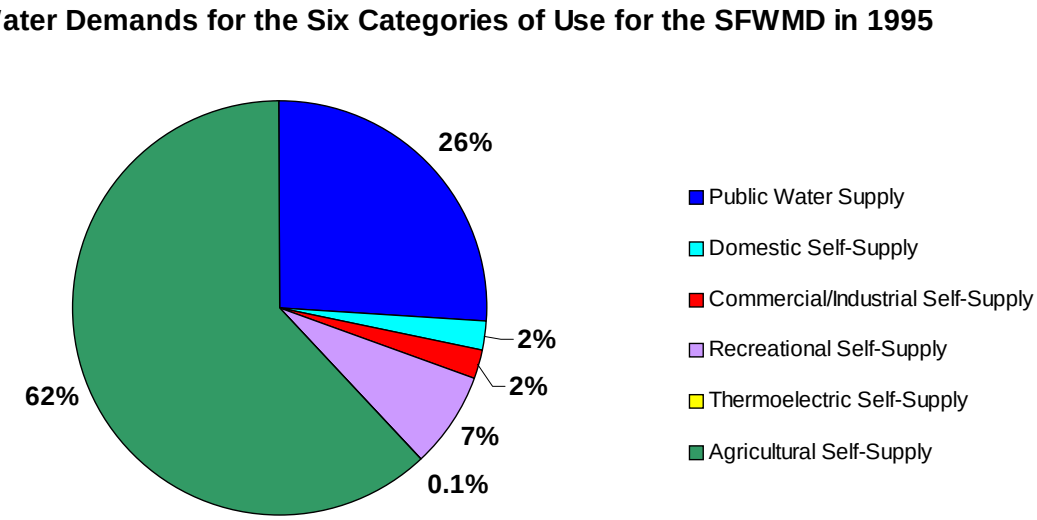
- Public Water Supply
- Domestic Self-Supply and Small Public Supply Systems
- Commercial/Industrial Self-Supply
- Recreational Self-Supply
- Thermoelectric Power Generation Self-Supply
- Agricultural Self-Supply

Districtwide, population residing in the District was assessed at 5,755,634 in 1995, with associated urban demands of 521,011 million gallons per year (mgy), or average daily demands of 1,427 million gallons per day (mgd). Irrigated agricultural acreage in the District was assessed at 1,075,993 acres in 1995 with associated demands of 847,699 mgy, or average daily demands of 2,322 mgd. Actual daily demand levels vary seasonally, especially agricultural irrigation demands.

Total freshwater withdrawals for the entire District were assessed at 1,368,710 mgy in 1995, or an average daily demand level of 3,750 mgd. **Table 4** and **Figure 18** show the average daily withdrawals and percentage of total demands for 1995. Demand projections for 2020, and a more detailed water use analysis may be found in **Chapter 3**, or the DWSA (SFWMD, 1998b).

Table 4. Water Demands for the Six Categories of Use for the District in 1995.

Category	1995 Average Water Demand (mgd)	Percent of Total Water Demand
Public Water Supply	975.3	26.0%
Domestic Self-Supply	91.1	2.4%
Commercial/Industrial Self-Supply	84.3	2.2%
Recreational Self-Supply	273.9	7.3%
Thermoelectric Self-Supply	2.8	0.1%
Agricultural Self-Supply	2,322.5	61.9%
District Total	3,749.9	



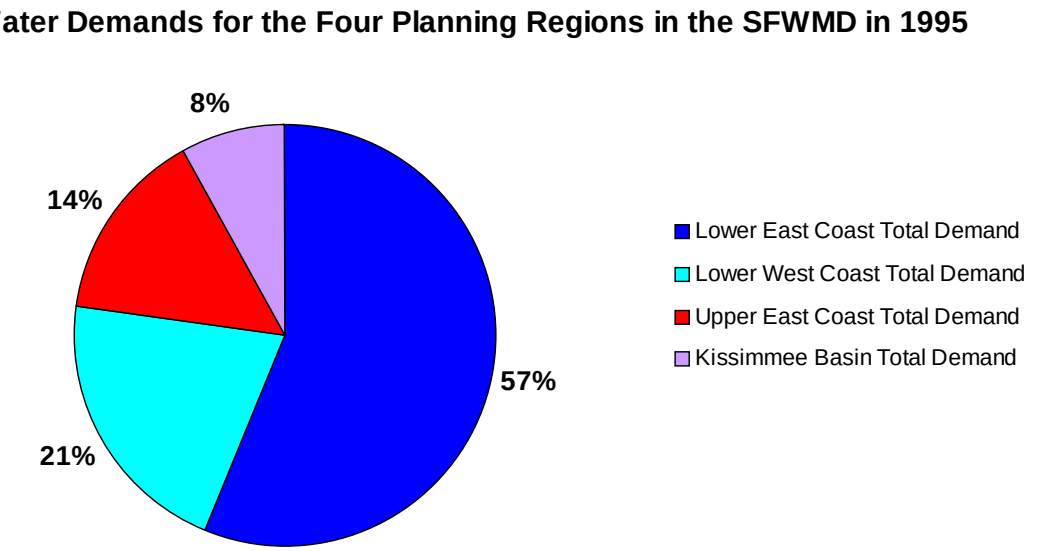


Figure 18. Proportional Distribution Among Six Categories of Water Use in the SFWMD and Among the Four SFWMD Planning Regions.

DISTRICT ACCOMPLISHMENTS SINCE THE 1995 DWMP

The District, in its 1995 DWMP (SFWMD, 1995a), established an ambitious schedule of activities. This schedule called for activities in each area of responsibility in the years following the plan's acceptance. The District has, for the most part, adhered to the schedule of activities described in the original DWMP (**Table 5**). DWMP Annual Reports (SFWMD, 1996, 1997a, 1998a) have included the status of the projects described in the 1995 DWMP. The status of activities for FY2000 is described below.

The 1995 DWMP described 54 District activities that would be under way or completed by the end of FY2000. Of these, 14 are ongoing activities with no fixed end date. Of the remaining 40 activities, two have been superseded or canceled and 23 have been completed. The District is continuing to work on the remaining 15 activities. Nine activities are behind the schedule that was described in the 1995 DWMP, while the remaining six activities are on schedule. If compliance is considered to be one minus the proportion of activities behind schedule, then this represents a compliance rate of 68 percent in 1996, 70 percent 1997, 73 percent in 1998, 70 percent in 1999, and 83 percent in 2000 with the schedule established in the 1995 DWMP.

Among the 54 activities, one group of projects has had schedule adjustments outside of the DWMP process. The District, with approval from the FDEP, developed MFLs Priority Lists and Schedules in December 1998 and 1999. These lists and schedules comply with legislation passed in 1997. Each year's list and schedule include revised schedules for the development of MFLs for water bodies within the District. This is an annual list that maybe changed each year.

If these revised schedules for establishing MFLs are considered (rather than the schedule established in the 1995 DWMP) then the present rate of successful compliance would rise to 93 percent. Brief activity summaries are included in each of the DWMP annual reports (SFWMD, 1996, 1997a, 1998a).

CHANGES IN DISTRICT EMPHASIS SINCE THE 1995 DISTRICT WATER MANAGEMENT PLAN

Coordination between water management districts has been emphasized since the 1995 DWMP. The District has formalized several agreements with the state's other water management districts. These include agreements regarding water resource investigation, planning, regulation, natural systems management, and water shortage declarations. The outlines for several planning efforts, including this DWMP, were coordinated with the other water management districts and the FDEP.

The policies and direction of the District are driven by natural resource needs as interpreted by legislation, and have reinforced the District's efforts and emphasis on its six priority projects. Major water resource legislation since 1994 is described in **Appendix A**.

Table 5. Summary of Activities Since the 1995 DWMP.

	Activity	Status
	Water Supply	
1	Water Use Permitting	Ongoing
2	Conservation Program	Ongoing
3	LEC Regional Water Supply Plan	Complete
4	LWC Water Supply Plan	Complete
5	UEC Water Supply Plan	Complete
6	Kissimmee Basin Water Supply Plan	Complete
7	Northwest Dade Lake Belt Plan	Complete
8	Glades/Highlands County Ground Water Reconnaissance	Behind Schedule
9	Okeechobee Regional Water/Sewer Infrastructure	Complete
10	Recharge Mapping	Complete
11	Prime Recharge Designation	Complete
12	Wellhead Protection Program	Ongoing
	Flood Protection	
13	Canal Conveyance Capacity Study	Complete
14	Key West Storm Water Retrofits	Ongoing
15	Western C-9 Detailed Design Workshop	Complete
16	Big Cypress Basin Assessment (Watershed Management Plan)	Complete
17	Watershed Interactive Network	Complete
18	Lake Istokpoga Study	Complete
19	Okeechobee County Surface Water Management	Complete
20	Boggy Creek Drainage Study	Complete
	Water Quality	
21	Water Quality Monitoring	Ongoing
22	Everglades Surface Water Improvement Management (SWIM)	N/A[a]
23	Everglades Program	On Schedule
24	Upper Kissimmee Chain of Lakes Plan	Behind Schedule
25	Biscayne Bay SWIM	Complete
26	Lake Okeechobee SWIM	Complete
27	Florida Keys Water Quality Plan	On Schedule
28	Florida Keys National Marine Sanctuary Water Quality Program	Ongoing
29	Florida Bay Water Quality Program	Complete
30	Indian River Lagoon SWIM	Complete
31	Miami River Water Quality Commission	Complete
32	Moore Haven Wastewater Feasibility Study	Complete
	Natural Systems Management	
33	Environmental Resource Permitting	Ongoing
34	Save Our Rivers Acquisitions	Ongoing
35	Aquatic Plant Maintenance	Ongoing
36	Melaleuca Task Force	Ongoing
37	Exotic Plant Control	Ongoing

Table 5. Summary of Activities Since the 1995 DWMP.

Activity		Status
38	C&SF Project Comprehensive Review Study (Restudy)/ Comprehensive Everglades Restoration Plan (CERP)	On Schedule[b]
39	Restudy/Indian River Lagoon	Behind Schedule
40	East Coast Buffer/Water Preserve Areas	On Schedule
41	Kissimmee River Restoration	On Schedule
42	Florida Keys Advanced Identification	Ongoing
43	Florida Panther Wildlife Refuge Protection	Ongoing
44	Taylor Slough Demonstration Project	Complete
45	Lake Okeechobee MFLs	Behind Schedule[c]
46	Big Cypress National Preserve	N/A[a]
47	Caloosahatchee Estuary	Behind Schedule[c]
48	Biscayne Aquifer	On Schedule
49	Loxahatchee Estuary MFLs[d] St. Lucie Estuary MFLs[d] UEC Florida Aquifer MFLs[d]	Behind Schedule[c] Behind Schedule[c] N/A[a]
50	Everglades MFLs	Behind Schedule[c]
51	Florida Bay MFLs	Behind Schedule[c]
52	LWC Surficial Aquifer System MFLs	Behind Schedule
General Activities		
53	Comprehensive Plan Review	Ongoing
54	Lake Okeechobee Detailed Design Workshops	Complete

a. N/A indicates that the activity has been superseded or canceled.

b. The Restudy was submitted to Congress on July 1, 1999; The CERP is on schedule.

c. Activity rescheduled with FDEP approval and is on the new schedule.

d. The Loxahatchee Estuary, St. Lucie Estuary, and UEC Floridan Aquifer MFL activities are jointly listed in all DWMP annual reports.

The SFWMD has identified six major efforts as being its main priorities at present and into the foreseeable future. The District has intensified its efforts on those projects since the 1995 DWMP. These efforts are described below (the order does not imply priority level):

- Operation, Maintenance, and Modernization of the C&SF Project
- Regional Water Resource Planning and Implementation
- Kissimmee River Basin Restoration
- Lake Okeechobee Restoration
- Everglades and Florida Bay Restoration
- Comprehensive Everglades Restoration Plan (CERP) (i.e., implementation of the C&SF Project Comprehensive Review Study)

Operation, Maintenance, and Modernization of the C&SF Project

The C&SF Project was designed following the 1947 flood, and the majority of its structures were built in the 1950s and early 1960s. The C&SF Project consists of 292 primary water control structures, 27 pump stations, 1,800 miles of canals, and 2,000 secondary structures. The components of the C&SF Project (which are further described in **Chapter 4**) typically range in age from 30 to 50 years. Due to the age of this infrastructure, the District annually allocates capital funds for the maintenance necessary to provide flood control and water supply readiness. These funds are allocated in the form of individual projects that target major components of the C&SF Project. The projects include improvements and upgrades through automation; pump station repair and restoration; gravity structure repair and restoration; levee repair; and canal conveyance dredging. These funds are not used for capital expansion. Typically, elements of large restoration projects such as the Everglades Construction Project and Kissimmee River Restoration are addressed as separately funded programs.

The C&SF Project system design was based on projected land uses that were primarily agricultural. When the C&SF Project was designed, its primary function was flood protection and water control. The C&SF Project provided additional benefits to water supply, fish and wildlife preservation, and other functions. Since the construction of the C&SF Project, the District's responsibilities have expanded to emphasize other aspects of water resource management. The operational goals have become broader and more complex than the system was originally designed to meet, resulting in the C&SF Project being pushed beyond its original design objectives.

In addition to the canal network and the corresponding structures (spillways, culverts, weirs, and pump stations) required to operate it, the C&SF Project includes Lake Okeechobee and the three WCAs. Lake Okeechobee has a surface area of 730 square miles and a maximum storage capacity of 1.05 trillion gallons (SFWMD, 1997b). The WCAs are set aside for water storage, natural system preservation, and fish and wildlife benefits.

The District presently operates and maintains the C&SF Project to accomplish the following objectives:

- Ensure the reliability and integrity of the system, through routine inspection, maintenance, and replacement of system components (i.e., water control structures, levees, canals)
- Optimize flood protection, water supply, and natural system benefits
- Improve the District's operational ability to anticipate and respond to the water resource management demands on the system, using the best available science and technology

The District has developed and implemented an effective maintenance and modernization program that is continuously evaluated and upgraded. This program has allowed the original components of the C&SF Project to remain in operation.

Realistically, many of the components have met, or are nearing the end, of their design life cycle. Examples include electrical systems and engines of the pump stations, secondary inflow culverts (project culverts) that were installed nearly 40 years ago, and the canals themselves that have accumulated sediment over the past 40 to 50 years.

Much progress is being made through selected projects using limited resources. The principle components of the pump station electrical systems, as of October 1999, have been almost completely replaced. The Canal Conveyance Capacity Program and other multiyear projects are currently in progress. The completion of these and other projects will provide operational reliability for the C&SF Project.

Regional Water Resource Planning and Implementation

This priority includes all water management planning and the implementation of those plans, including this DWMP. Within this category, water supply planning is presently the District's focus. However, the District also has planning efforts that address water quality, flood control, and natural systems. Previous water supply planning efforts by the District include the following: the *Water Supply Needs and Sources Document 1990-2010* (SFWMD, 1992a); the DWSA (SFWMD, 1998b), the *Lower West Coast Water Supply Plan* (SFWMD, 2000c); the *Interim Plan for Lower East Coast Regional Water Supply Plan* (SFWMD, 1998c); the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) the *Upper East Coast Water Supply Plan* (SFWMD, 1998d); the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a). With the exception of the *Upper East Coast Water Supply Plan*, these planning efforts have had a future planning horizon through 2010. In many cases, however, the demand levels analyzed far exceed the current 2010 projections due to the slowing of population and irrigated agricultural acreage growth rates.

During the 1997 legislative session, significant amendments were made to the Florida Water Resources Act of 1972 (Chapter 373, F.S.) regarding regional water supply planning. Section 373.036(2)(b)4, F.S., required each water management district to prepare a districtwide water supply assessment, and to then prepare water supply plans for regions that are anticipated to have the potential of demand outstripping available supply by 2020. These regional water supply plans identify specific geographical areas that have water resource problems that are critical or are anticipated to become critical by 2020. For these critical areas, the regional plans detail remedial or preventive measures including water resource development projects, water supply development projects, and operational and regulatory strategies. The regional plans also serve as a means of identifying areas where collection of resource data and technical studies are necessary.

The District has committed to preparing water supply plans for each of its four planning regions, which cumulatively cover the entire District. Water supply plans for the planning regions have been sequenced based on the history of water shortage problems in each region. The LWC was the first to be initiated, followed by plans for the LEC, UEC and the Kissimmee Basin. Each plan was developed in conjunction with an advisory committee composed of interested parties and chaired by a Governing Board member.

The District's water supply planning status for the four planning regions is as follows:

- The *Lower West Coast Water Supply Plan* (SFWMD, 2000c) was completed in 2000.
- The *Interim Plan for Lower East Coast Water Supply* (SFWMD, 1998c) was completed in 1998. The analyses within this document was expanded in the *Lower East Coast Regional Water Supply Plan* completed in 2000 (SFWMD, 2000b).
- The *Upper East Coast Water Supply Plan*, meeting the full water supply planning requirements of Chapter 373, F.S., was completed in 1998, and is currently being implemented.
- The *Kissimmee Basin Water Supply Plan* was completed in 2000.

In addition to the regional water supply plans, the District has also initiated the development of several subregional plans. Subregional planning efforts that are being initiated by the District include the *Caloosahatchee Water Management Plan*, the *North Palm Beach County Comprehensive Water Management Plan*, the *Southeast Palm Beach County Integrated Water Resource Strategy*, and the *Eastern Broward County Integrated Water Resource Plan*.

Water quality planning efforts by the District include Surface Water Improvement and Management (SWIM) plans as well as non-SWIM plans that address water quality. Since the SWIM program was initiated in 1987, the District has prepared a priority list of all water bodies within the District. SWIM plans have been developed for the Indian River Lagoon (SFWMD and SJRWMD, 1994), Lake Okeechobee (SFWMD, 1997b), Biscayne Bay (SFWMD, 1995b), and the Everglades (SFWMD, 1992b). The Everglades SWIM Plan was superseded by the Everglades Forever Act. In addition to improvement of water quality SWIM plans have also identified needs for restoration of natural ecosystem functions within the target water bodies. Since 1995, legislative appropriations for the SWIM Program have declined significantly, although the mandate to conduct the program still exists. In addition to SWIM plans, a water quality plan has been developed for the Florida Keys, and a water management plan that addresses water quality is presently being developed for the Kissimmee Chain of Lakes. Flood protection plans have been developed by the District in the past, but presently the only flood plans being prepared are for the Big Cypress Basin and for southern Lee County, although several other planning efforts consider flooding impacts.

District natural system planning efforts include the natural system restoration components of the C&SF Project Comprehensive Review Study (Restudy) and the CERP; the development of MFLs (which are a subset of the regional water supply planning efforts); the development of rainfall-driven schedules for the Everglades; establishing economic and hydrologic needs for the Everglades Protection Area; the South Miami-Dade County Integrated Water Resource Strategy; SWIM Plans; and land management plans for District holdings.

Kissimmee River Basin Restoration

Between 1962 and 1971, as part of the C&SF Project, the meandering Kissimmee River and flanking floodplain were channelized and transformed into a 30-foot deep central drainage canal (C-38), which was compartmentalized with levees and dam-like water control structures into a series of five pools. Channelization was done primarily to provide an outlet canal for draining floodwaters from the developing Upper Kissimmee Basin, but also to provide flood protection for lands adjacent to the river. The construction of the C-38 Canal took 10 years and satisfied the need for greater flood protection throughout the Kissimmee River Basin. But even before the work was complete, area residents and naturalists realized the channelization had destroyed valuable fish and wildlife habitat. Ninety percent of the wading bird population was lost, as was more than 70 percent of the nesting habitat for bald eagles. The once rich fishery was replaced by increasingly dominant populations of rough fish (i.e. fish species considered to be of poor fighting quality when taken on tackle or of poor eating quality).

The Kissimmee River restoration initiative began as a grassroots movement during the latter stages of channelization when concerned citizens and members of the environmental community voiced concerns regarding perceived environmental impacts of the flood control project. Subsequent studies documented the nature of these impacts to the Kissimmee River and its surrounding ecosystem, including the loss of 30,000 to 35,000 acres of wetlands, a major reduction in wading bird and waterfowl usage, and a continuing long-term decline in game fish populations.

These impacts provided the impetus for over 20 years of state and federally mandated restoration related studies, which culminated in the development of a restoration plan that was authorized for implementation as a state-federal partnership in the 1992 Water Resources Development Act. The restoration project will restore over 40 square miles of river and associated floodplain wetlands, and will benefit over 320 fish and wildlife species, including the endangered bald eagle, wood stork, and snail kite.

This will be accomplished by restoring 43 contiguous miles of the 56-mile long flood control canal, and removing two of the five water control structures within this reach of backfilled canal. Spoil banks composed of excavated sand and shell from the original channelization, which occur along the canal, will provide the source of this backfill material. Another important component of the restoration project is to modify the timing of water inflows to the river from the Kissimmee Chain of Lakes. This will be accomplished by raising the high water level in Lakes Kissimmee, Hatchineha and Cypress one foot higher than is currently allowed. This additional storage will provide the ability to reestablish continuous inflows and a more natural seasonal pattern of high and low flows to the restored river.

The total cost of the restoration project is estimated at $490 million, which will be equally cost-shared by the State of Florida and the federal government. Most of the state's fiscal responsibility will occur as land acquisition, through funds provided by the SOR and Preservation 2000 programs. The federal portion of the project cost will be provided

through annual budgetary appropriations. The first phase of canal backfilling began in the summer of 1999, and reconstruction is scheduled to be completed in 2011.

Reestablishment of floodplain wetlands and the associated nutrient filtration function is expected to result in decreased nutrient loads to Lake Okeechobee. It is also possible that restoration of the Kissimmee River floodplain could benefit populations of key avian species, such as wading birds and waterfowl, throughout South Florida by providing increased feeding and breeding habitat and refuge during adverse conditions.

Lake Okeechobee Restoration

Lake Okeechobee is the largest lake in Florida and the key surface water component of the South Florida ecosystem. The lake is extensively managed for flood control, water supply, and recreation, and past water management decisions have significantly impacted the lake and its associated downstream ecosystems (e.g. the Everglades, the Caloosahatchee River and Estuary and the St. Lucie River and Estuary). The initial lowering of its water level and the construction of an encompassing dike greatly modified Lake Okeechobee. These actions reduced its size and isolated it from its original extensive, dynamic system of littoral zone and floodplain. As a result of the managed water levels that existed between the early 1950s to the late 1970s, a new diverse 150-square mile littoral marsh was formed within the now well-defined 730-square mile lake.

Continuing ecosystem problems in Lake Okeechobee are primarily a result of nutrient runoff from ranching, dairy, and agricultural lands; a lake regulation schedule which places water supply and flood control concerns ahead of the ecological health of the lake; and invasion by exotic plants. High water levels and excessive phosphorus inputs have contributed to a significant degradation of the health of the native flora and fauna in Lake Okeechobee. Since 1978, when the regulation schedule for the lake was raised, frequent long periods of high water levels have resulted in significant changes in the native vegetation in the lake's large littoral zone. Excessive phosphorus inflows have increased the in-lake phosphorus concentrations, and contributed to more frequent damaging algal blooms. Major increases have occurred in the populations of blue-green algae and pollution-tolerant, bottom-dwelling animals. Also, sediment has accumulated in the lake that has exacerbated this problem. Exotic plants have displaced large areas of native vegetation in the lake. Major efforts to reduce phosphorus loads have been undertaken and significant progress has been made, particularly in reducing loading from dairies. However, since the average annual phosphorus load to the lake currently exceeds the target by about 100 tons per year, significant restoration work remains.

The Lake Okeechobee Program provides overall coordination of restoration efforts for the lake. It includes efforts on key management issues, including the following: reduction of external phosphorus loads to the lake; evaluation of the feasibility of removing in-lake sediments; effective eradication of exotic plants; and implementation of a modified lake regulation schedule. The District has been working with the USACE in evaluating alternative regulation schedules that might allow lower water levels without

significantly impacting water supply. The USACE is finalizing an Environmental Impact Statement recommending a new regulation schedule.

The District is working with the FDEP to update the current permit for District water control structures discharging into Lake Okeechobee. The intent is to guide implementation of measures necessary to reach phosphorus targets throughout the lake. The permit will be updated through a consent order with requirements that include continuation of regulatory programs in the basin; construction of pilot STAs and large-scale, reservoir-assisted STAs; a feasibility study to remove accumulated sediment in the lake; studies and data collection to reduce modeling uncertainty; and continued research and monitoring. To accomplish these activities, the District modified its Lake Okeechobee Program, beginning in FY2000, in order to expedite initiation of the required actions.

The USACE and the District are continuing programs to control melaleuca in Lake Okeechobee. The District is also researching methods to control torpedo grass. When this research is complete, the FDEP will assist in implementation of the recommended treatment methods.

Everglades and Florida Bay Restoration

Everglades and Florida Bay restoration involves the implementation of the ECP, the Everglades Stormwater Program, the C-111 Project, the Modified Water Deliveries Project, and other aspects of research and management for the Everglades and Florida Bay ecosystem separate from the CERP. Several of these projects derive from the Everglades Forever Act. That act, passed by the Florida Legislature in 1994, is a comprehensive approach to restoration, relying on a combination of construction, land acquisition, regulation, and extensive research and monitoring. Research provides the foundation for understanding and preserving the Everglades ecosystem and restoration efforts are intended to provide nutrient levels in the system that will not adversely impact native Everglades flora and fauna.

Everglades Construction Project

The ECP forms the foundation for the largest ecosystem restoration program in the history of Florida. The ECP is composed of 12 interrelated construction projects located between Lake Okeechobee and the Everglades. The cornerstone of the ECP is a group of six large constructed wetlands totaling over 47,000 acres. These STAs will use natural biological and geological processes to reduce the levels of phosphorus that enter the Everglades to an interim goal of 50 parts per billion (ppb). The Everglades Nutrient Removal (ENR) project, which is a prototype STA, has been operating for three years and is effectively reducing phosphorus levels below 25 ppb. In addition to the STAs, the ECP contains four hydropattern restoration projects that will improve the volume, timing, and distribution of water entering the Everglades. Construction began in 1997, and the last of the STAs is scheduled to be complete in October 2003, with ancillary facilities completed by 2006. The local share of design, construction, and land acquisition costs for the ECP is estimated to be approximately $506 million. When combined with the federal share of

$190 million, this brings the total estimate of capital costs to $696 million through 2006. The operation and maintenance of the ECP is anticipated to cost $133 million through 2014. This brings the total estimated cost of the project to $829 million. As of September 30, 1999, approximately $314 million had been expended for the ECP of which $280 million was nonfederal.

Everglades Stormwater Program

The Everglades Stormwater Program (formerly known as the Non-ECP initiative) was mandated by the 1994 Everglades Forever Act. The purpose of this program is to ensure that water quality standards are met by the end of 2006 at all structures that the District controls and pumps water into, within, or from the Everglades Protection Area, which are not within the ECP. The basins discharging through these structures include existing urban, agricultural, and Indian reservation lands. Compliance with water quality standards will be achieved through implementing the Non-ECP permit, water quality monitoring, water quality improvement strategies, and solutions such as Best Management Practices (BMPs) or construction projects. Other components of the program include a public education campaign and developing a method for reimbursement of expenditures through a special assessment authorized by the Everglades Forever Act.

C-111 Project

The C-111 Project consists of both structural and nonstructural modifications to the existing components of the C&SF Project within the C-111 Basin that promote more natural hydroperiods in Taylor Slough (a freshwater source for Florida Bay) and the eastern panhandle ecosystems of Everglades National Park. The C-111 Project modifications will be designed and operated to store and disperse the flows of water needed for Taylor Slough restoration. This will assist in Florida Bay restoration, as the bay's decline has been associated with a long-term increase in salinity that resulted from the diversion of fresh water away from Florida Bay via the C&SF Project canal system. Land acquisition, design, construction, and operation for the C-111 Project will be undertaken by the District and the USACE under the terms and conditions agreed to in the C-111 Project Cooperative Agreement entered into in January 1995. The USACE is authorized by the Water Resource Development Act (1996) to consider state water quality standards and add water quality features as needed. Total cost is estimated at $147 million. The District is currently obliged to pay 20 percent of construction and 100 percent of land acquisition costs.

Modified Water Deliveries Project

The Everglades National Park Protection and Expansion Act passed by Congress in 1989 authorized the USACE to modify the C&SF Project to improve freshwater deliveries to ENP via Shark River Slough (along with Taylor Slough, the only sources of fresh water for Florida Bay). The Modified Water Deliveries project that resulted from this legislation includes construction of gated culvert structures, concrete headwall structures, spillways, raising a portion of the Tamiami Trail, and flood mitigation of the 8 1/2 square mile area. Total cost of the Modified Water Deliveries Project is estimated at $110 million.

The Comprehensive Everglades Restoration Plan (Restudy Implementation)

The C&SF Project provides water supply and flood protection for the District South Florida's hydrology is now largely governed by a man-made system superimposed on the natural one. Although it has provided for urban and agricultural uses since its inception in 1948, the C&SF Project and the greater-than-expected growth and development that has ensued have unintentionally resulted in extensive damage to the South Florida environment. Over half of the original Everglades have been destroyed and the damage continues. Water is sent to tide through events such as the very wet spring of 1998, involving over 1.4 million acre-ft of emergency Lake Okeechobee flood control releases to the Caloosahatchee and St. Lucie estuaries. These releases caused major environmental, economic, and human impacts in those estuaries and later resulted in a subsequent need for the lost water as the region headed into drought conditions. Without a change to the current design and operation of the C&SF Project, forecasts project the continued loss of uplands; degradation of wetlands, estuaries, and aquatic life; increased water shortages for agricultural and urban uses; increased flooding; and the loss or forced movement of wellfields.

In 1992, Congress authorized the USACE to undertake a reexamination or restudy of the C&SF Project. The purpose of the C&SF Project Comprehensive Review Study (Restudy) was to determine the means by which the C&SF Project can be modified to restore the South Florida ecosystem, while providing for the other water-related needs of the region. The USACE and the District jointly developed a Project Study Plan for the Restudy, which was approved by the District's Governing Board in July 1995, to provide guidance for all subsequent phases of the Restudy. It was amended in May 1997, following the Water Resources Development Act of 1996. The USACE and the District established a series of interagency Restudy teams that began developing and commenting on Restudy alternatives. This effort started in September 1997 and culminated in June 1998 with the selection of an Initial Draft Plan. On October 15, 1998, the *Central and Southern Florida Flood Control Project Comprehensive Review Study Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1998), which contains the recommended comprehensive plan, was released and the USACE and the District immediately began a series of 12 public meetings throughout South Florida to actively solicit public comment on the plan. The *Central and Southern Florida Flood Control Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1999) was completed in April 1999 and submitted to Congress on July 1, 1999.

The keys to Everglades restoration have been determined in the Restudy to be increase the amount of water available, ensure adequate water quality, and reconnect the parts of the system. A key aim is to annually regain, for beneficial use, about two million acre-feet of excess water currently being discharged to tide for flood control.

The recommendations made within the Restudy (i.e. structural and operational modifications to the C&SF Project) are being further refined and will be implemented in

the Comprehensive Everglades Restoration Plan (CERP). The CERP is intended to be a retrofit and environmental remediation program to satisfy both the needs of the natural system and to provide water supply, flood protection, and quality water for South Florida users. The estimated cost of implementing the recommended CERP is $7.8 billion over approximately 25 years, with an annual operation, maintenance, and monitoring cost of $175 million. The CERP is being equally funded by the State of Florida and the federal government.

Comprehensive Everglades Restoration Plan Goals

The overall goal of the CERP is to enhance ecologic and economic values and social well being. Specific goals which will enhance ecologic value are as follows:

- Increase the total spatial extent of natural areas
- Improve habitat and functional quality
- Improve native plant and animal species abundance and diversity

Specific goals which will enhance economic values and social well being are as follows:

- Increase availability of fresh water (agricultural/municipal and industrial)
- Reduce flood damages (agricultural and urban)
- Provide recreational and navigational opportunities
- Protect cultural and archaeological resources and values

Comprehensive Everglades Restoration Plan Issues

The Restudy identified the following major issues involving the current C&SF Project:

- Too much water is sent to tide
- Estuaries often suffer
- Lake Okeechobee is treated like a reservoir
- The Everglades is not receiving the historic timing and flow of water
- Florida Bay lacks fresh water
- Water quality has deteriorated
- Urban and agricultural water supplies are dwindling
- Flood protection must be maintained

In response to these identified issues, the Restudy was developed to increase South Florida’s water supply, while improving water deliveries to its remaining natural areas.

The Restudy recommends the following modifications to the existing C&SF Project (USACE and SFWMD, 1999):

Developing Surface Water Storage Reservoirs. A number of water storage areas will be located north of Lake Okeechobee, in the Caloosahatchee and St. Lucie basins, in the EAA, and along western Palm Beach, Broward, and Miami-Dade counties. These areas will store 1.5 million acre-feet of water so that it is not sent to tide.

Creating Water Preserve Areas. Multipurpose water management areas are planned in Palm Beach, Broward, and Miami-Dade counties between urban areas and the eastern Everglades. The Water Preserve Areas will have the ability to treat urban runoff, store water, reduce seepage, and improve existing wetland areas.

Managing Lake Okeechobee as an Ecological Resource. Lake Okeechobee is presently managed for many, often conflicting, uses. The lake's regulation schedule will be changed to reduce the extreme high and low levels that harm the ecology of the lake and its shoreline.

Improving Water Deliveries to Estuaries. Excess rainwater that is discharged to the sea through the Caloosahatchee and St. Lucie rivers is very damaging to the estuary ecology. The recommended plan will greatly reduce these discharges by storing excess rain water in surface and underground water storage areas. In addition, during times of low rainfall, stored water can be retrieved to augment the estuaries.

Developing Underground Water Storage. More than 300 wells will be built to reach the Floridan aquifer. As much as 1.6 billion gpd may be pumped through the wells into underground storage zones. The injected fresh water forms a bubble within the existing underground salt water, and can remain in the same condition in which it was injected for years. During dry times it can be pumped out. This approach, known as Aquifer Storage and Recovery, or ASR, has been used for years on a smaller scale to augment municipal water supplies. A significant amount of water in surface reservoirs is lost through evaporation, and a major advantage of ASR is that water does not evaporate when it is underground. The recommended plan includes 200 wells around Lake Okeechobee, as well as others in the Water Preserve Areas and the Caloosahatchee Basin.

Developing Treatment Wetlands. About 30,000 acres of STAs, will be built to treat urban and agricultural runoff water before it is discharged to natural areas. These are in addition to the over 40,000 acres of man-made wetlands already being constructed to treat water discharged from the EAA.

Sending Water to the Everglades in a Way That Mimics Nature. Additional changes will be made to the rainfall-driven operational plan to improve the timing of water sent to the WCAs and Everglades National Park.

Removing Barriers to Sheetflow. More than 240 miles of C&SF Project canals and levees will be removed to reestablish the natural sheetflow of water through the Everglades. Most of the Miami Canal in WCA-3 will be removed. Twenty miles of the

Tamiami Trail (U.S. 41) will be rebuilt with bridges, allowing water to flow as a sheet into Everglades National Park, as it once did naturally. In the Big Cypress Preserve, a north-south levee will be removed to restore some natural overland water flow.

Storing Water in Quarries. Two limestone quarries in northern Miami-Dade County will be converted to water storage reservoirs to supply Florida Bay, the Everglades, and Miami-Dade County residents with water. The area will be ringed with an underground wall to ensure that stored water does not leak.

Reusing Wastewater. The recommended plan includes two advanced wastewater treatment plants in Miami-Dade County. The plants will be capable of making more than 220 mgd of the county's treated wastewater clean enough to discharge into wetlands along Biscayne Bay, and improve water supplies to southern Miami-Dade County and northeastern Shark River Slough (part of the Everglades).

Improving Water Deliveries to Biscayne Bay. The recommended plan will protect and restore Biscayne Bay coastal wetlands and treat storm water runoff before it enters the bay.

Improving Freshwater Flows to Florida Bay. Improved water deliveries to Shark River Slough, Taylor Slough, and the wetlands to the east of the Everglades National Park will send more fresh water to Florida Bay

INFRASTRUCTURE PROJECTS

The District, through the Restudy, has identified a series of water management infrastructure projects (**Figure 19**) that are necessary to accomplish these six major District priorities.

Legend for Figure 19 - Infrastructure Requirements

1. **Kissimmee River Restoration**
2. **North of Lake Okeechobee Storage Reservoir**
3. **Caloosahatchee Estuary Water Supply**
4. **Caloosahatchee Reservoir with ASR and Caloosahatchee Backpumping with STA**
5. **Taylor Creek/Nubbin Slough Storage Reservoir and Treatment Area**
6. **Indian River Lagoon Water Preserve Areas: Storage in the C-23, C-24,C- 25, C- 44, N. and S. Fork Basins**
7. **Revised Lake Okeechobee Regulation Schedule**
8. **St. Lucie Estuary Water Supply**
9. **Lake Okeechobee ASR**
10. **L-8 Project**
11. **WCA-1 Internal Canal Structures**
12. **STA Construction**
13. **EAA Storage Reservoirs**
14. **Modify G-404 and S-140 Pumps**
15. **Water Preserve Areas: Aboveground Storage, ASR, and Seepage Management**
16. **Big Cypress/L-28 Interceptor Modifications**
17. **Partial Decompartmentalization of WCA-3 and Everglades National Park**
18. **LEC Water Conservation and Broward County Secondary Canals Improvements**
19. **Miami-Dade Utility ASR**
20. **Water Preserve Areas: North and Central Lake Belt Storage Areas**
21. **Everglades Rain-Driven Operations**
22. **Modified Water Deliveries**
23. **West and South Miami-Dade County Reuse**
24. **L-31N Levee Improvements for Seepage Management**
25. **Biscayne Bay Coastal Wetlands**
26. **C-111 North Spreader Canal**
27. **Florida Bay Restoration and Other C-111 Projects**
28. **Southern Golden Gate Estates Hydrologic Restoration**
29. **Golden Gate Canal Improvements and ASR**
30. **Lake Trafford Restoration**
31. **Henderson Creek Spreader Canal and Improvements**
32. **Camp Keis Strand Restoration**
33. **WCA-2A Hydropattern Restoration**
34. **WCA-3A Hydropattern Restoration**
35. **Henderson Creek Improvements**
36. **Ten Mile Creek Project**

<u>Other Major Projects (not shown on the map)</u>

Water Resource Development

Critical Restoration Projects

Alternative Water Supply

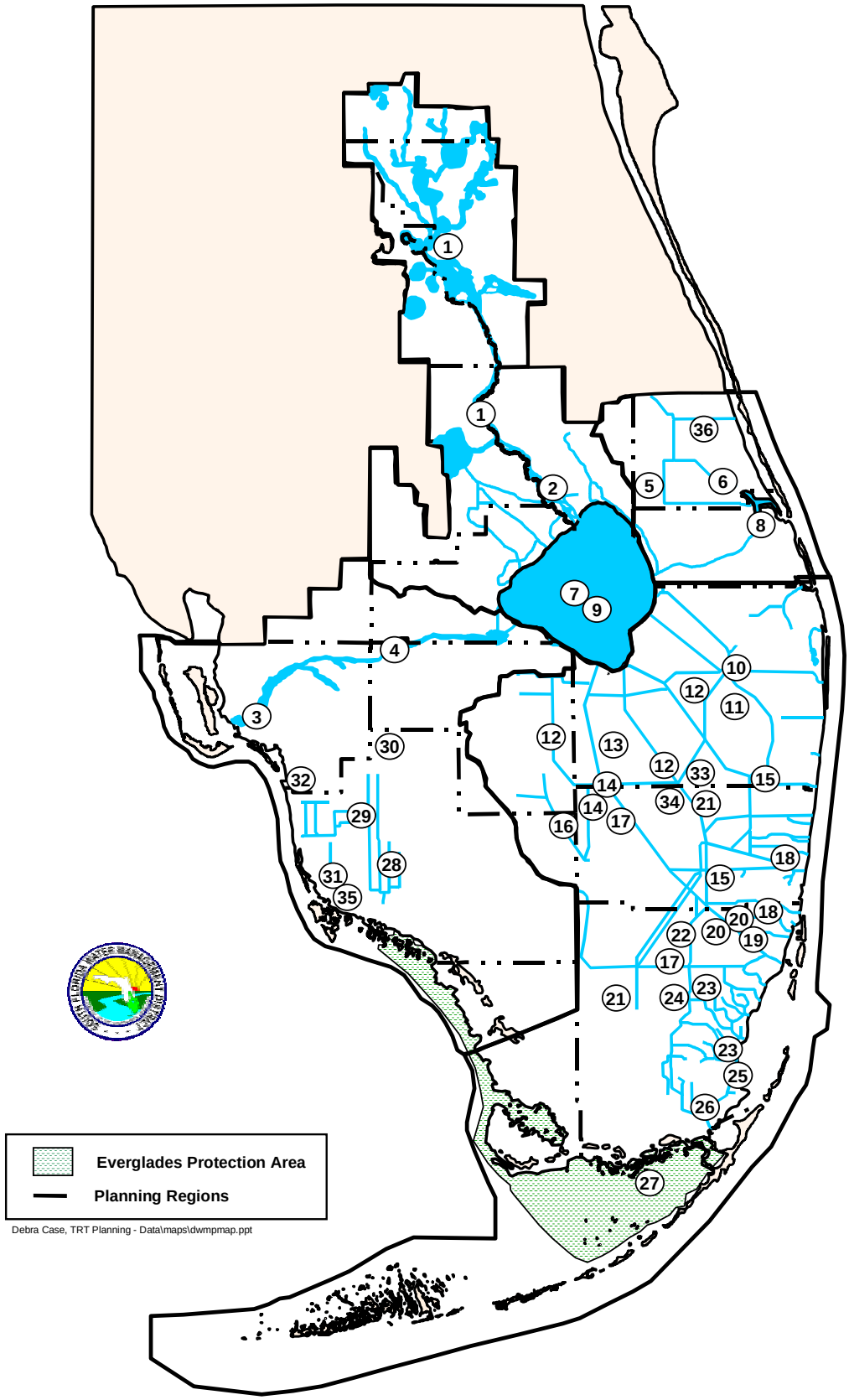


Figure 19. Water Management Infrastructure Needed to Accomplish SFWMD Priorities.

DISTRICT AND OTHER PUBLICLY OWNED LAND

The District is a major landholder in South Florida. It also participates in the protection and preservation of other major public holdings within its boundaries. These public holdings include Everglades National Park, Biscayne Bay National Park, Big Cypress National Preserve, the WCAs, J.W. Corbett Wildlife Management Area (WMA), DuPuis Reserve, Three Lakes WMA, Avon Park Bombing Range, and the Disney Preserve (Walker Ranch).

One of the most important natural resources for the District is the remaining Everglades. This nationally significant resource includes Everglades National Park and the WCAs. The expanse and geographic distribution of these public lands make them key tools for preserving important water resource corridors throughout the District (**Figure 20**). These corridors include major wetland systems and important rivers and sloughs. Many of these wetlands and environmentally sensitive upland areas are associated with rivers or natural flowways such as the Kissimmee and Loxahatchee rivers.

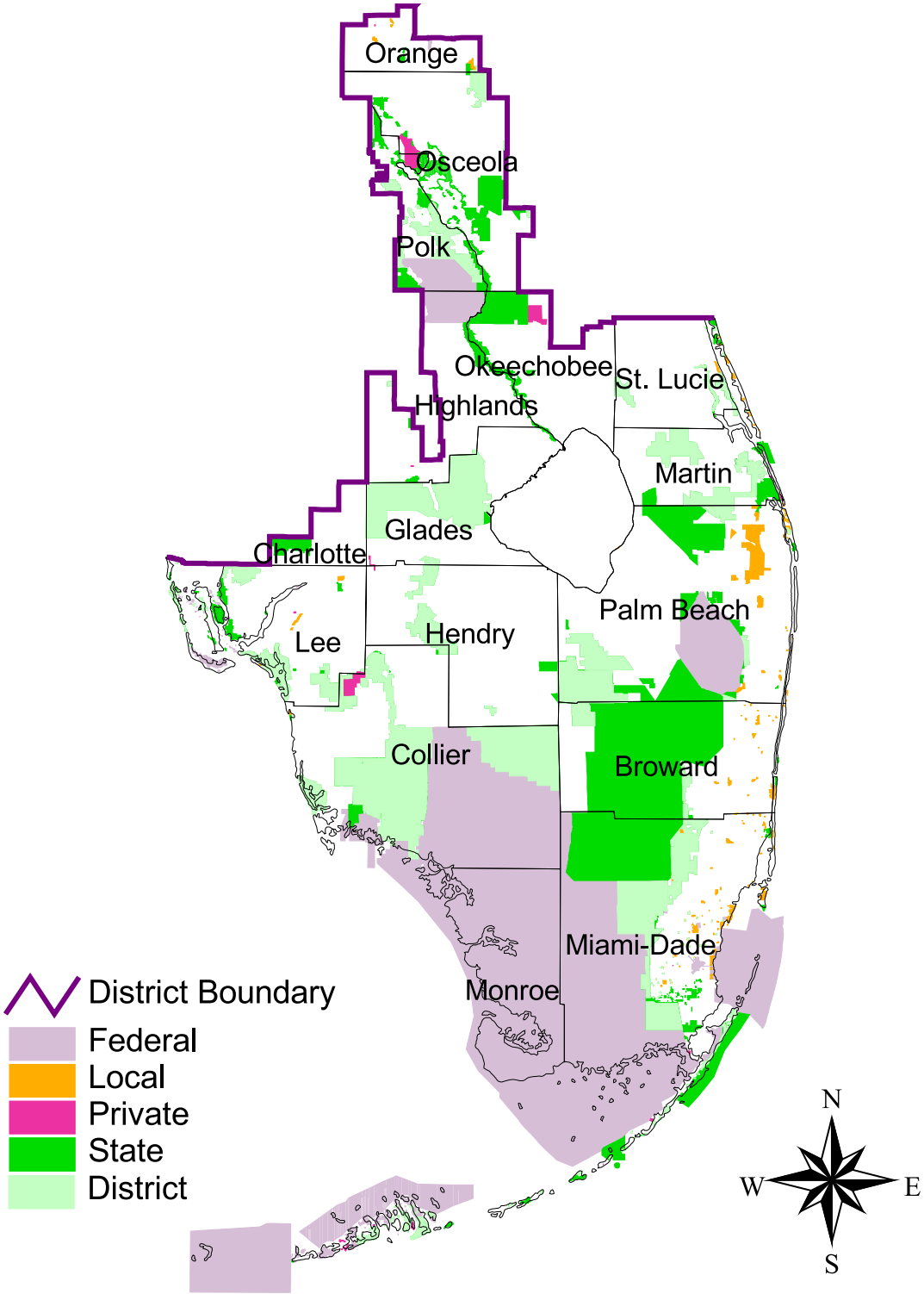


Figure 20. Public Land Ownership within the SFWMD.

Chapter 1
DISTRICT OVERVIEW

DISTRICT HISTORY

Soon after Florida became a state in 1845, the federal government granted the state over 20 million acres of wetlands and swamps. During this early development period, the federal and state governments encouraged the drainage of wetlands for agriculture and residential uses.

The Everglades Drainage District (EDD), forerunner of the District, was created in 1907 to facilitate drainage of the Everglades. By 1927, six major drainage canals and numerous minor canals had been constructed, along with 47 miles of levees and 16 locks and dams. The EDD construction program ended in 1928 following the hurricane of that year. In 1931, the EDD defaulted on its bond payments, suffering the effects of the Great Depression and the collapse of the Florida land boom of the 1920s.

Although the hurricane of 1928 ended the construction activities of the EDD, it spurred creation of the Okeechobee Flood Control District in 1929, which improved flood control by constructing levees, control gates, and floodway channels along the shores of Lake Okeechobee. The southern shore of Lake Okeechobee was diked and the St. Lucie and Caloosahatchee rivers were used to divert water that had formerly flowed south to the Atlantic Ocean and the Gulf of Mexico.

In 1947, torrential rains flooded Central and South Florida. Two hurricanes struck the Everglades and Lake Okeechobee after earlier rains had already saturated the soils, resulting in extensive flood damage. The extent of area flooded is shown in **Figure 2**, and included the majority of the region presently within the District. In its report following the flooding, the U.S. Army Corps of Engineers (USACE) reported that “as these areas will inevitably grow and expand even without adequate flood protection, larger damages may be expected unless preventive measures are taken” (Huser, 1989).

Less than a year after the floods of 1947, the USACE recommended, and Congress authorized, $208 million for a flood control system, the Central and Southern Florida Project for Flood Control and Other Purposes (C&SF Project)[1]. The C&SF Project was planned as a complete system of canals, storage areas, and water control structures spanning the area from Lake Okeechobee to both the east and west coasts, and from Orlando south to the Everglades. In addition, the C&SF Project was intended to improve recreational and navigational opportunities. The C&SF Project was designed and constructed by the USACE. The Florida Legislature created the Central and Southern Florida Flood Control District (FCD) in 1949 to serve as local sponsor for the C&SF

1. During the 1960s the title was shortened to Central and Southern Florida Project. The C&SF Project acronym is used for both versions of the name.

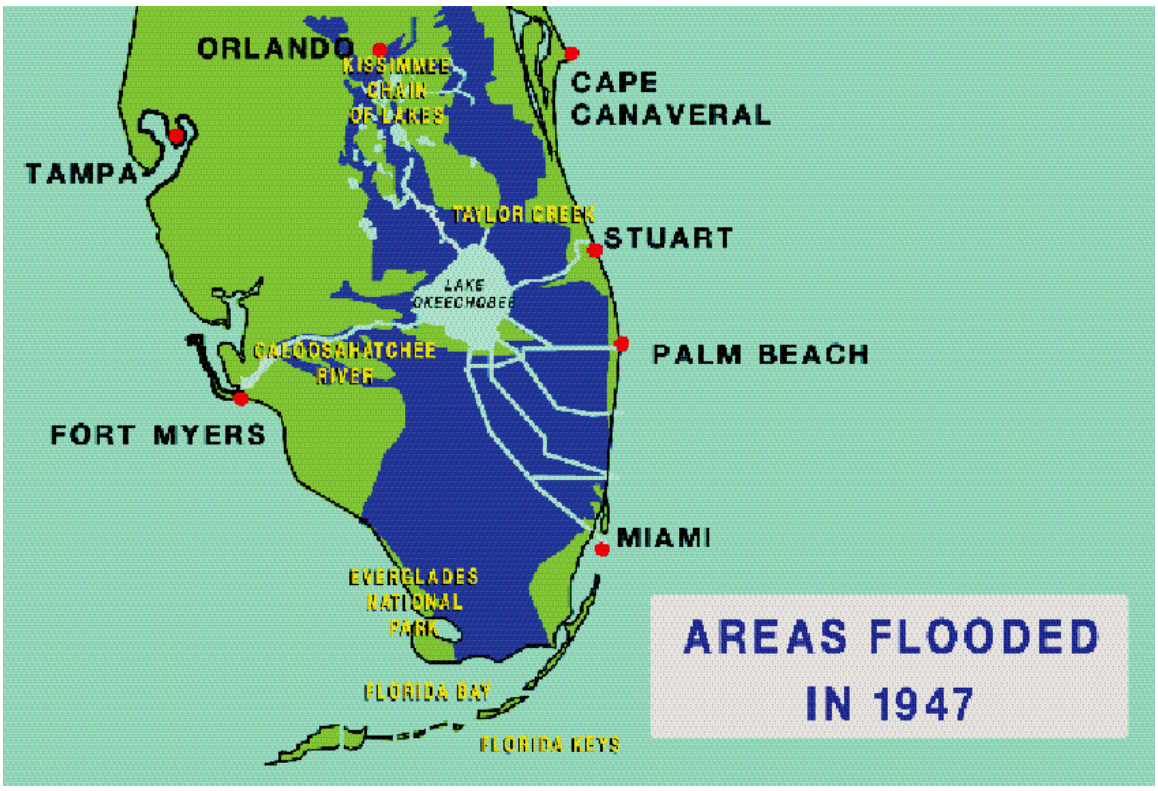


Figure 2. Map of Area Flooded in 1947.

Project. The FCD included the areas previously within the boundaries of the EDD and the Okeechobee Flood Control District. In the 1950s the FCD's efforts included acquisition of lands, easements, and rights-of-way for the construction program and for water storage. By 1954, the FCD had acquired titles or easements for 1,354 square miles of Everglades wetlands in Palm Beach, Broward, and Miami-Dade counties which became the Water Conservation Areas (WCAs). The three WCAs represent almost half of the original freshwater Everglades in Florida. By 1959, construction was completed on a network of levees and canals that circled and crossed the fertile mucklands of the Everglades Agricultural Area (EAA). Some additional east coast canals were also constructed at this time, including C-17 and C-18 in Palm Beach County (Huser, 1989).

The decade of the 1960s was a time of major construction for the C&SF Project. By the early 1960s, the WCAs were completed, and about 700,000 acres of land in the EAA had been drained and leveed. The dike around Lake Okeechobee was enlarged and extended. Pump stations were constructed. Dredges and draglines enlarged the Caloosahatchee River, excavated the Kissimmee River, and cut channels in the Kissimmee Chain of Lakes. Spillways, dams, and navigation locks were built on the canals. The USACE published the first in a series of maps, color coded in red and green, entitled Central and Southern Florida Flood Control Project. Red lines showed works that were completed or under construction. Green lines showed works that were planned but not completed. Periodically, the USACE updated this map and reprinted it, and over the years more and more green lines became red lines (Huser, 1989). However, not all the

planned canals and structures annotated by green lines were ever built, due to environmental concerns, costs, and further evaluation of these planned facilities.

The FCD initially operated the C&SF Project primarily for water control and flood protection. In the late 1960s and early 1970s, environmental awareness increased and the need for protection for water and related natural resources became more emphasized. Passage of the Florida Water Resources Act of 1972 by Florida's Legislature broadened the FCD's mission, and added responsibilities for water supply, water quality, and natural systems management to the existing flood protection mission. This act created five water management districts in the state, and expanded their responsibilities to include control and regulation of ground and surface waters and their use. **Figure 3** shows the boundaries of Florida's five water management districts. Chapter 373, F.S., also established a new system of water rights in Florida. One attains the right to use water through application to the appropriate water management district, and each water management district administers a consumptive use permitting program, pursuant to Section 373.223, F.S.

In 1976, the Florida Legislature changed the name of the FCD to the South Florida Water Management District for consistency with the other water management districts and to more accurately reflect the agency's broadened mission. The District covers 17,930 square miles, or about 31 percent of the State of Florida. The District includes all or part of 16 counties, and extends from southern Orlando to Key West and from Fort Myers to Fort Pierce.

The headquarters for the District are located in West Palm Beach. Service centers are located in Orlando, Okeechobee, Stuart, West Palm Beach, Fort Lauderdale, Miami, Islamorada, Naples, and Fort Myers (**Figure 4**). Service centers were established to offer District services and expertise at the local level and to provide more direct and responsive access to permitting and other District functions.

District field stations are located in Kissimmee, Okeechobee, West Palm Beach, Fort Lauderdale, Miami, Homestead, Naples, and Clewiston. District area offices are located in the Dupuis Reserve, Fort Pierce, Naples, and West Palm Beach. Field stations and area offices help the District to better operate and manage the vast regional water management network which includes 1,800 miles of canals and levees, close to 200 large water control structures, and over 2,000 smaller structures.

In addition to the Governing Board for the District, the Florida Legislature established a Basin Board for the Big Cypress Basin, which was officially created on January 1, 1977. As required by 1976 legislation, a District Governing Board member was named ex officio chairman of the new Big Cypress Basin Board. Soon after its organization in 1977, the Big Cypress Basin Board determined that the proper maintenance of certain key water control structures in the major drainage system would address the broad objectives of conservation, preservation, and enhancement of the water resources of the region. Accordingly, successive agreements between Collier County and the District have transferred operation and maintenance responsibilities of numerous water control structures to the Big Cypress Basin Board. As of 1999, the Big Cypress Basin Board had responsibility for operation and maintenance of, as well as providing

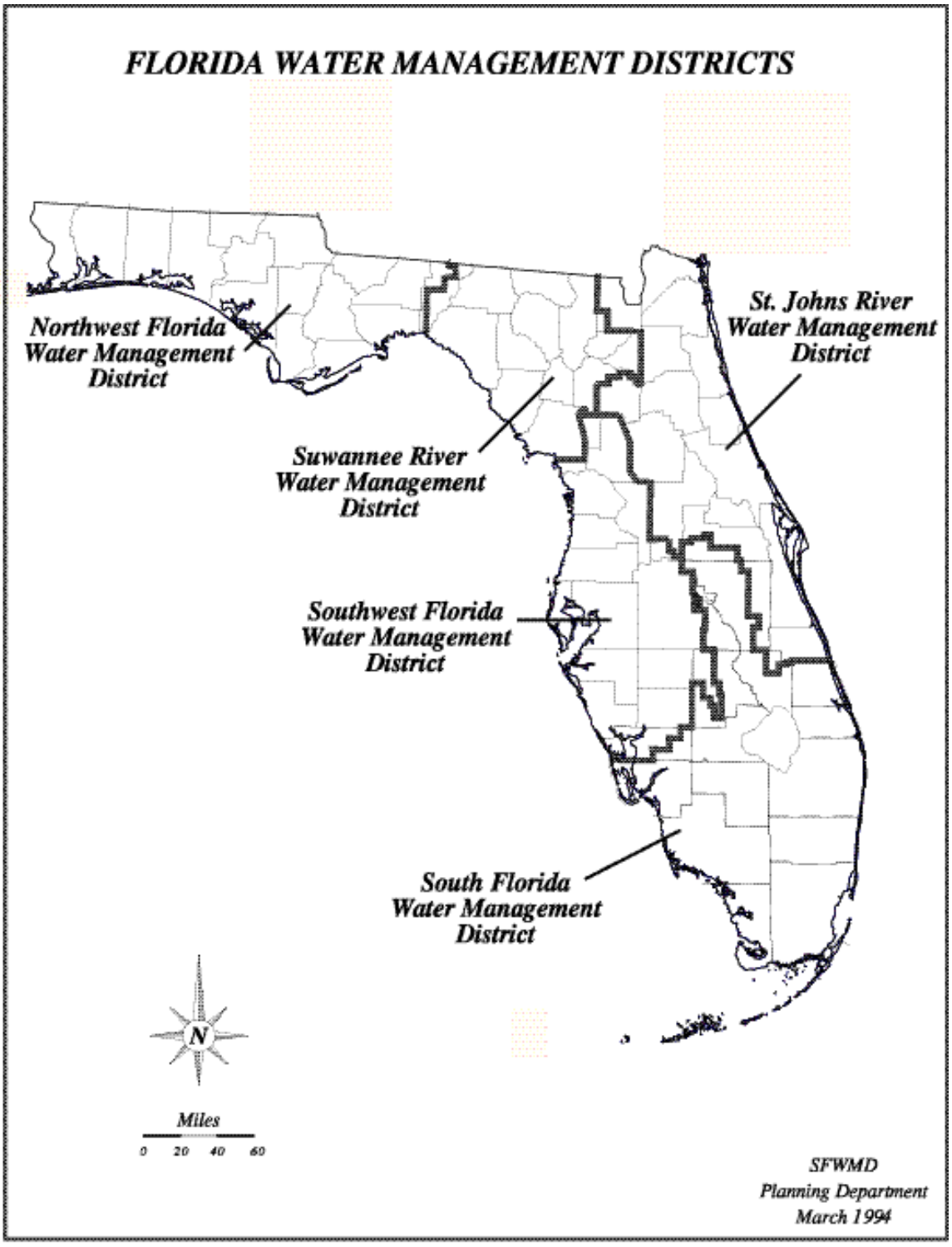


Figure 3. Boundaries of Florida's Five Water Management Districts.

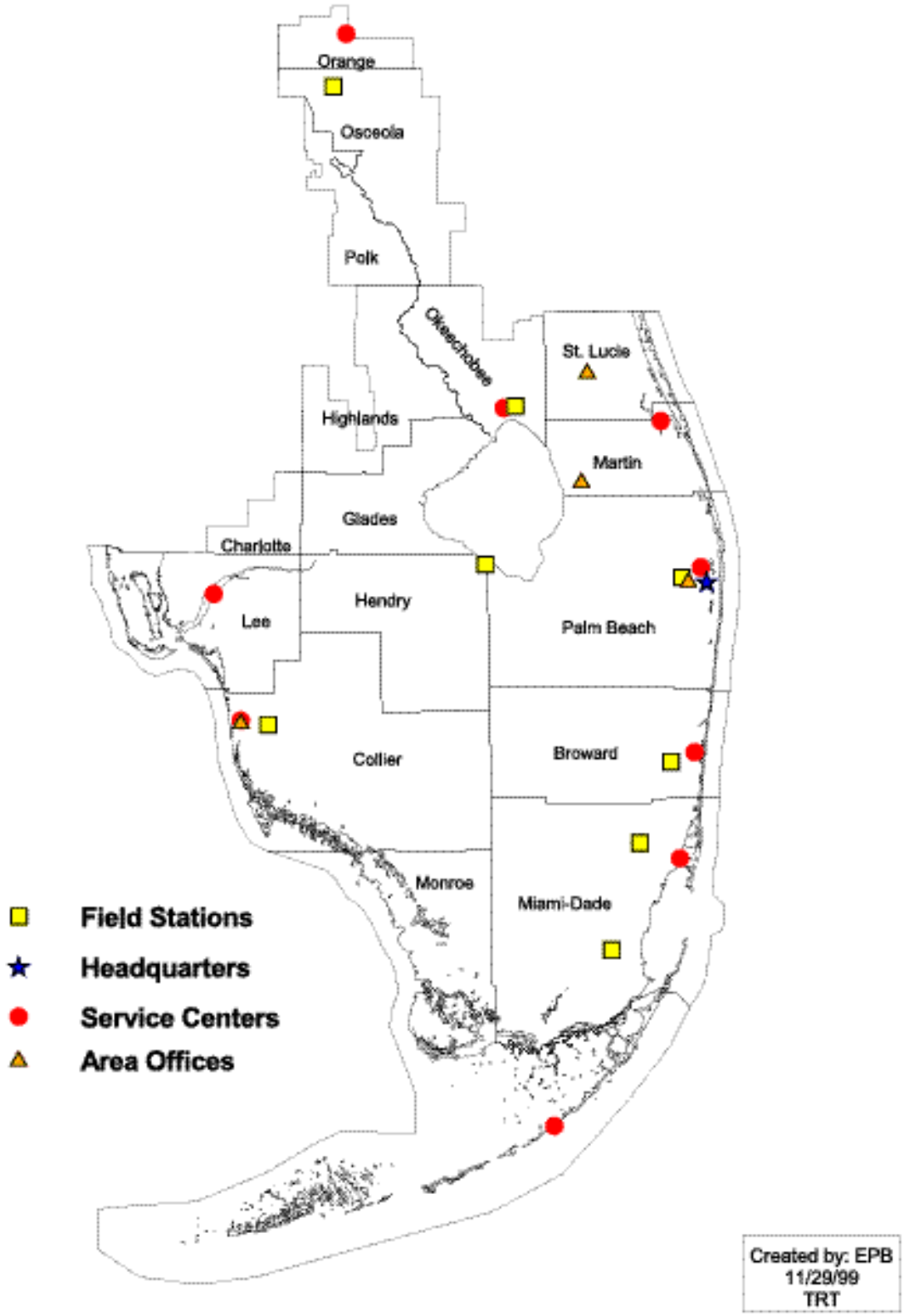


Figure 4. Location of SFWMD Facilities.

planning and capital improvements for, 163 miles of primary canals and 39 water control structures within the Big Cypress Basin.

PLANNING REGIONS

The District is divided into four regions within which planning and other activities are focused: the Lower East Coast (LEC), Lower West Coast (LWC), Upper East Coast (UEC), and Kissimmee Basin. **Figure 5** shows the four planning regions. Regional populations and irrigated agricultural acreages were analyzed as part of the *Districtwide Water Supply Assessment* (DWSA) (SFWMD, 1998b) and are presented below.

Lower East Coast Planning Region

The LEC planning region includes Palm Beach, Broward, and Miami-Dade counties and portions of Monroe, Hendry, and Collier counties. The LEC planning region encompasses a sprawling, fast-growing urban complex along the coast; extensive agricultural lands, including the EAA; critical environmental resources, such as the Everglades ecosystem; and important estuaries, including Biscayne Bay and Florida Bay. The region had a population of 4,518,401 in 1995 and is projected to increase to 6,086,700 by 2020. During the same period, irrigated agriculture is projected to decline from 569,000 acres to 504,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Miami-Dade, Broward, and Palm Beach counties, which are expected to remain the population centers for the region.

Lower West Coast Planning Region

This region includes all of Lee County and parts of Charlotte, Collier, Glades, Hendry, and Monroe counties. Rapid growth in population and irrigated agricultural acreage within the LWC planning region have caused demands for water to increase significantly. This region had 590,939 residents in 1995 and the region's population is projected to increase to 992,805 by 2020. In 1995, the region had 244,000 acres of irrigated agriculture, and this is projected to increase to 293,000 acres by 2020 (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Lee and Collier counties. These areas are expected to remain the population centers for the region.

Upper East Coast Planning Region

The UEC planning region is comprised of St. Lucie and Martin counties and eastern Okeechobee County. The UEC planning region had a total population of 283,457 in 1995 and is projected to grow to 456,580 residents by 2020. From 1995 to 2020, irrigated agriculture is projected to increase from 186,000 acres to 211,000 acres (SFWMD, 1998b). The existing population is concentrated in the coastal areas of Martin and St. Lucie counties. These areas are expected to remain the population centers for the region.

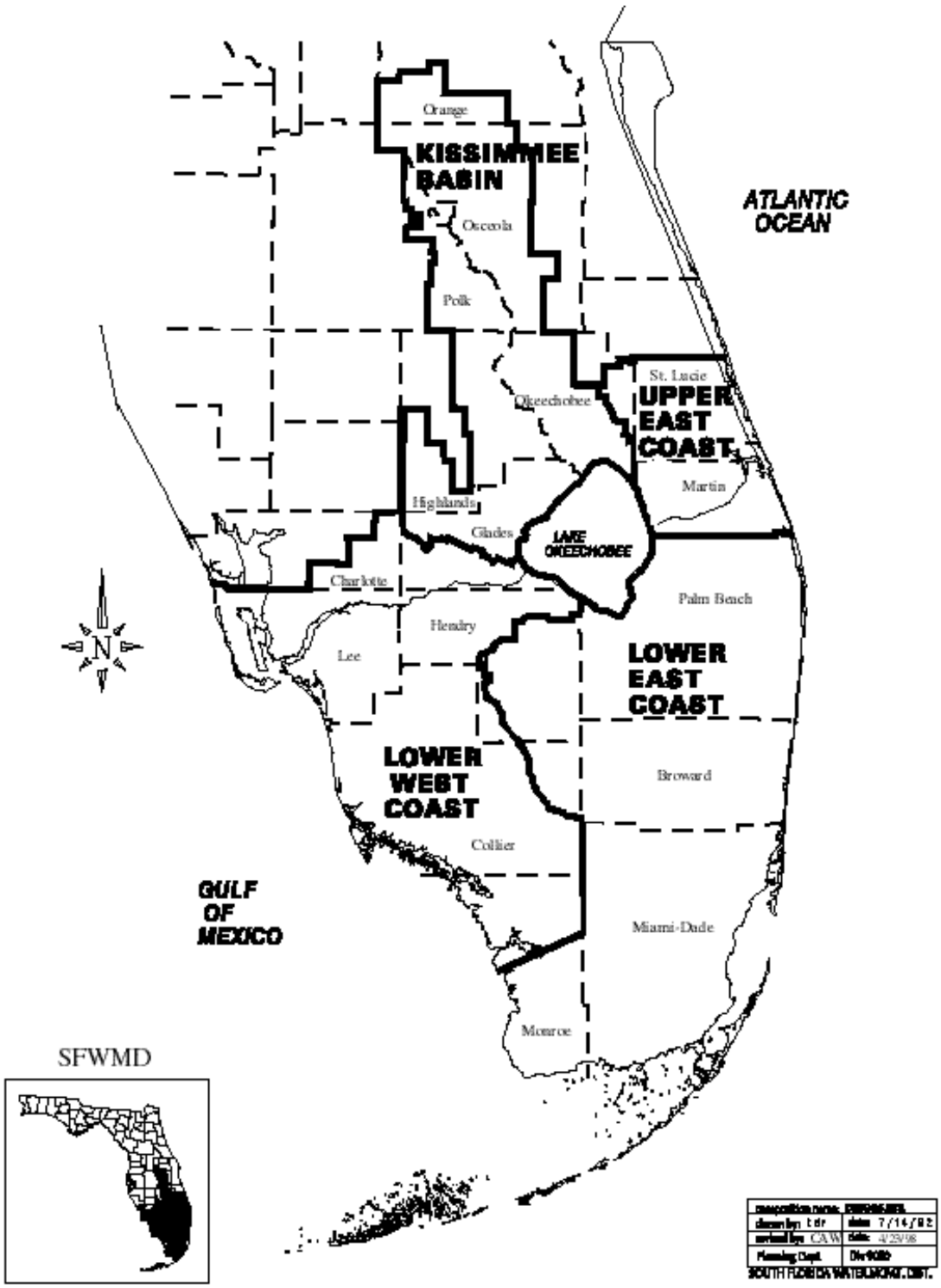


Figure 5. Planning Regions within the SFWMD

Kissimmee Basin Planning Region

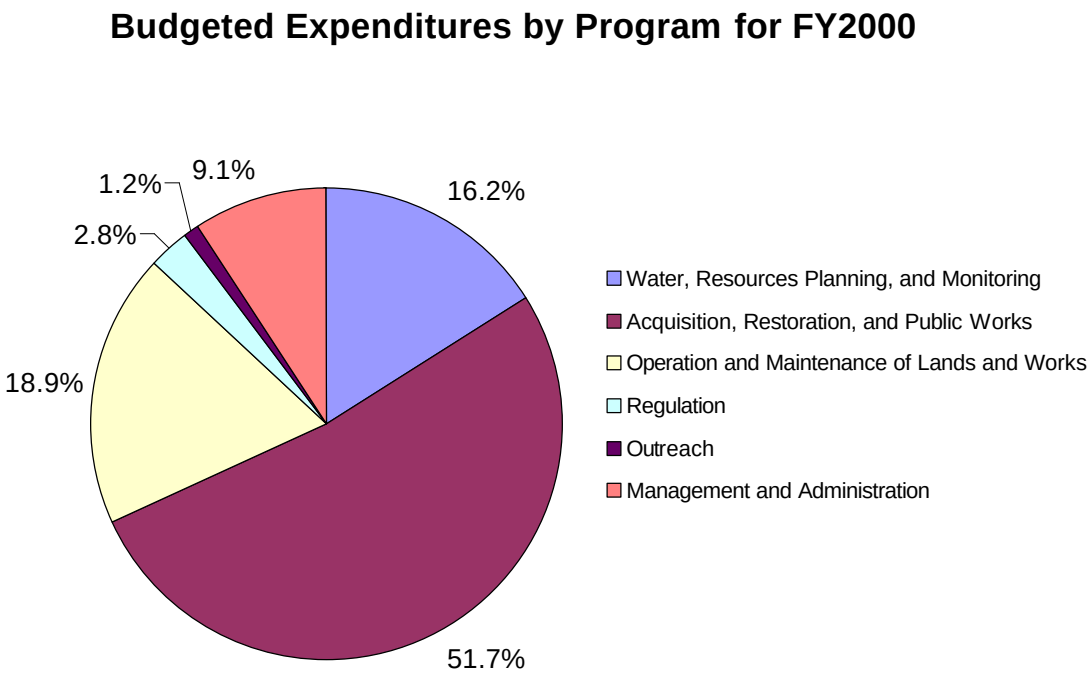
The Kissimmee Basin planning region includes parts of Orange, Osceola, Polk, Highlands, Okeechobee, and Glades counties. The majority of the basin drains to the Kissimmee River, though some areas drain into Fisheating Creek, the canal system within the Indian Prairie Basin, or a few landlocked lakes within the basin. A few fringe areas drain to the Southwest Florida or St. Johns River water management districts. The population of this region is projected to increase from 362,837 in 1995 to 686,696 by 2020. In 1995, the region had 77,000 acres of irrigated agriculture, and this is projected to increase to 117,000 acres by 2020 (SFWMD, 1998b). Urban growth is anticipated to be concentrated in Orange and northern Osceola counties, while irrigated agricultural acreage is anticipated to increase to the south, in Highlands, Okeechobee, and Glades counties. Most of the region is rural/agricultural and this pattern is projected to continue through 2020.

PROGRAM OVERVIEW

To promote consistency among water management district budgeting and to aid the Florida Department of Environmental Protection (FDEP) in their review of water management district budgetary information, each water management district has agreed to categorize expenditures into six program areas. The District Fiscal Year 2000 (FY2000) budget totals $469 million. **Table 1** and **Figure 6** show the percentages of the total budgeted expenditures and personnel planned to be spent for each of the program areas in FY2000. The following sections briefly describe each of the program areas. A more detailed description and analyses of these program areas may be found in the *Standard Format Tentative Budget Submission* (SFWMD, 1999).

Table 1. Budgeted Expenditures and Personnel by Program for FY2000.

Program No.	Program Title	FY2000 Budgeted Expenditures	Percent of Total Expenditures	FY2000 Budgeted Personnel	Percent of Total Personnel
1	**Water Resources Planning and Monitoring**	$76,199,621	16.2%	478	25.3%
2	**Acquisition, Restoration, and Public Works**	$242,669,329	51.7%	199	10.5%
3	**Operation and Maintenance of Lands and Works**	$88,784,837	18.9%	666	35.3%
4	**Regulation**	$13,264,414	2.8%	203	10.7%
5	**Outreach**	$5,436,814	1.2%	35	1.9%
6	**Management and Administration**	$42,766,642	9.1%	308	16.3%
	Total	$469,121,657		1,889	



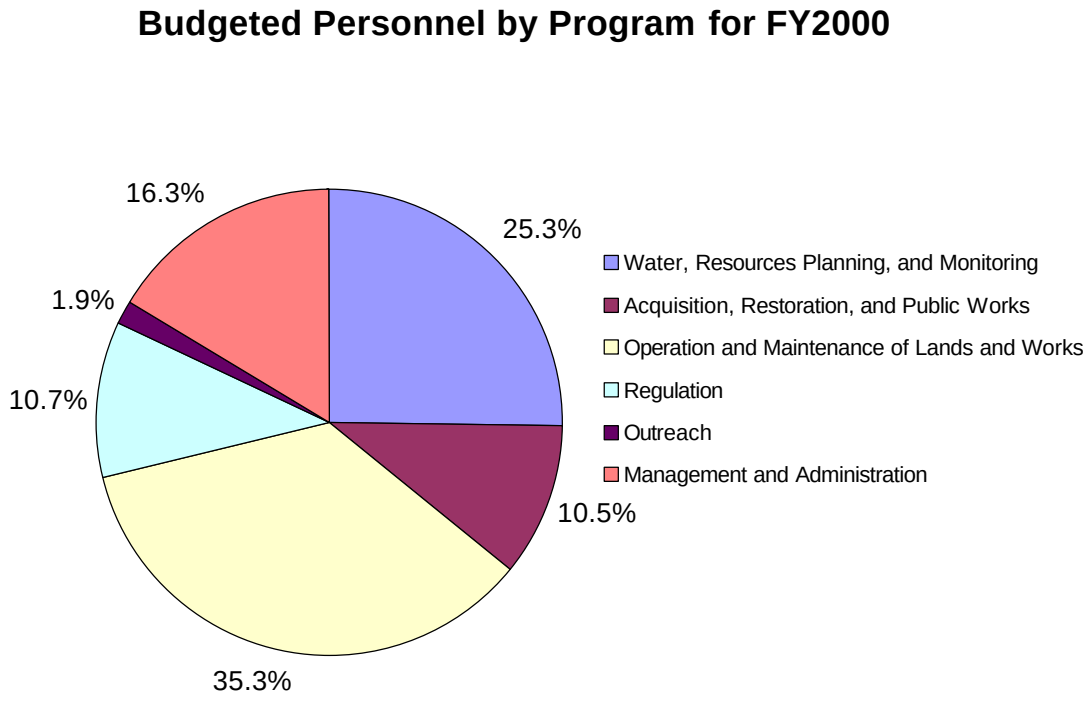


Figure 6. Budgeted Expenditures and Personnel for FY2000 by Program.

Program 1. Water Resources Planning and Monitoring

Definition

This program includes all water management planning, including water supply planning, development of Minimum Flows and Levels (MFLs), and other water resource planning; research, data collection, analysis, and monitoring; and technical assistance, including local and regional plan and program review.

General Description

The Water Resources Planning and Monitoring Program addresses the interactions of water supply, flood protection, water quality, and natural systems management. This program provides comprehensive long-range guidance to address demands for water and the ability of water resources to handle these demands.

Program 2. Acquisition, Restoration, and Public Works

Definition

This program includes the development and construction of all capital projects (except for those contained in Program 3, Operation and Maintenance of Lands and Works), including water resource development projects/water supply development assistance, water control projects, and support and administrative facilities construction; cooperative projects; land acquisition, including Save Our Rivers (SOR)/Preservation 2000); and the restoration of lands and water bodies.

General Description

The District is engaged in a variety of capital projects. These include land acquisitions identified in the District's Five-Year SOR Plan, the East Coast Buffer initiative, and land purchases associated with the Kissimmee River and Florida Bay restoration efforts. Other capital projects include various water resource development projects involving the design, permitting, and construction of projects which will serve to support the allocation and development of water supply. The District is also involved in constructing support and administrative facilities such as the Emergency Operations Center and Field Operations Center, as well as the construction of navigation locks, pump station modifications, and canal improvements necessary to operate and maintain the District's aging regional flood control system. In addition, the District provides financial and technical assistance to local governments in building and implementing storm water and alternative water supply projects. Finally, the District's largest capital project is the Everglades Construction Project (ECP), which includes the design and construction of various Stormwater Treatment Areas (STAs), pump stations, and other capital facilities necessary to restore the Everglades, consistent with the Everglades Forever Act.

Program 3. Operation and Maintenance of Lands and Works

Definition

This program includes all operation and maintenance of District operation and maintenance facilities, flood control and water supply structures, lands, and other works authorized by Chapter 373, F.S.

General Description

The operation and maintenance of lands and works is required to achieve effective operation of pumping facilities and water control structures for flood protection, water supply, and environmental flows/levels. Key products include the maintenance of pumping facilities, water control structures, canals and levees, and associated equipment. Emergency work and operations of the C&SF Project must be performed on demand, and is often driven by meteorological factors and other conditions outside the District's control. Maintenance of the C&SF Project must be performed on a preventative maintenance schedule basis. Management decisions and policy directions regarding the operation and maintenance of the C&SF Project are key elements of this program. Flood control and water supply operational decisions are executed by continuous 24-hour monitoring and control of the District's water management system. The ability to monitor the water management system on a real-time basis, using telemetry, significantly reduces the potential to incur serious damage to property and loss of life by minimizing the threat to public safety from heavy rainfall events. It also provides the capability to improve water supply, protect the coastal freshwater aquifers from the intrusion of salt water, and allow for water deliveries to meet environmental needs.

Program 4. Regulation

Definition

This program includes water use permitting, water well construction permitting, water well contractor licensing, environmental resource permitting, permit administration, compliance and enforcement, and sovereign submerged lands authorizations as delegated by the Board of Trustees of the Internal Improvement Fund. The Board of Trustees consists of the Governor and Cabinet. Most state land is titled in the name of the Board of Trustees, so when the state carries out real estate transactions they come before this version of the Governor and Cabinet. The FDEP Division of State Lands is the state agency that reports to the Board of Trustees.

General Description

The mission of the Regulation Program is to manage and protect the South Florida's water resources through 1) review and evaluation of applications and issuance of permits, 2) inspections to determine compliance with permit conditions, and 3) enforcement actions. The components include environmental resource permits, sovereign

submerged lands authorizations, water use permits (consumptive use permits), Everglades Works of the District permits, Lake Okeechobee Works of the District permits, and postpermit compliance monitoring for all permitting programs. The Regulation Program also includes additional efforts including: Development of Regional Impact/Siting/Coastal Zone Management; power plant and transmission line siting; ongoing rule development; and automation support.

Program 5. Outreach

Definition

This program includes all water resource education activities, such as water conservation campaigns and water resource education; public information activities; all lobbying activities relating to local, regional, state, and federal governmental affairs; and all public information activities, including related public service announcements, and advertising in any media.

General Description

This program captures activities and initiatives designed to implement and support water management goals and programs, including public information, community events, water conservation, adult and youth water resource education, intergovernmental coordination and cooperation, technical assistance, and cooperative agreements.

Program 6. District Management and Administration

Definition

This program consists of the District's functional support services including the following: administrative support, executive management, legal support, service center administration, budget, procurement, supplier diversity, inspector general/internal audit, information technology and infrastructure management/support, financial management, risk management, and human resource management.

General Description

Work in this program area supports the water resource line organizations and plays a key role in accomplishing District water resource goals and objectives through providing financial and human resources expertise; legal advice, counsel, and representation; procurement; information technology management; and accountability and risk management functions. These activities are vital for effective management, informed decision making and mandatory/statutory compliance. The program provides value-added strategies, resources, and systems to customers for timely planning, organization, direction, and evaluation. The functions in this program area cross a number of support departments and offices.

NATURAL SETTING

The topography of South Florida, like that of the state as a whole, is the result of sediment deposition and solution related processes that have sculptured the land over time. Average rainfall is about 53 inches per year, and intense storms, yielding large volumes of rainfall, are common. The District's present surface hydrology is largely governed by man-made systems superimposed on the natural hydrology of the region. The Biscayne and the Floridan aquifers underlie much of the region and are highly productive.

Topography and Physiographic Features

Nearly all the land in South Florida is less than 100 feet above mean sea level (msl). Land surface generally slopes from north to south. The coastal regions and most of the peninsula south of Lake Okeechobee are very flat and lie below 25 feet msl, except near Immokalee and parts of the Atlantic Coastal Ridge. North of Lake Okeechobee, the Lake Wales Ridge juts down the center of the peninsula and is mostly above the 100-foot contour. East of this ridge, the Okeechobee Plain rises from approximately 20 feet msl at the lake to 30 to 40 feet msl at the edge of the Osceola Plain, which rises in elevation from 60 to 90 feet.

The Kissimmee River valley crosses the Osceola and Okeechobee plains and is a major source of surface water to Lake Okeechobee and the Everglades. Rainfall in the northern portion of the Osceola Plain recharges the Floridan aquifer. The Immokalee Rise provides recharge to the water table and sandstone aquifers in Lee and Collier counties.

Lake Okeechobee, located in the heart of South Florida, is the third largest freshwater lake entirely in the United States. It was formed about 6,000 thousand years ago and is the central component of South Florida's interconnected Kissimmee River-Lake Okeechobee-Everglades ecosystem.

The Everglades is a resource of global significance. It is an extensive system of highly productive wetlands, habitat for numerous species of tropical and subtropical plants and animals, and a vast reservoir of fresh water. The term "Everglades" refers to the swamps, marshes, sloughs, prairies, tree islands, and forests that covered most of southeastern Florida west of the Atlantic coastal ridge.

Water from the Atlantic Coastal Ridge and the Everglades recharges the Biscayne aquifer in Miami-Dade and Broward counties and provides surface water flows to Florida Bay. The Big Cypress Swamp in eastern Collier and southern Hendry counties contributes primarily to surface water flow to coastal estuaries along the southwest coast of Collier County and Everglades National Park. The Florida Keys have no major source of fresh water except for rainfall and limited storage in the shallow aquifer of the larger islands. Coastal marshes and mangrove swamps, which are subject to tidal influx of salt water, border the southern end of the peninsula. The topographic and physiographic regions within the District are shown in **Figures 7** and **8**.

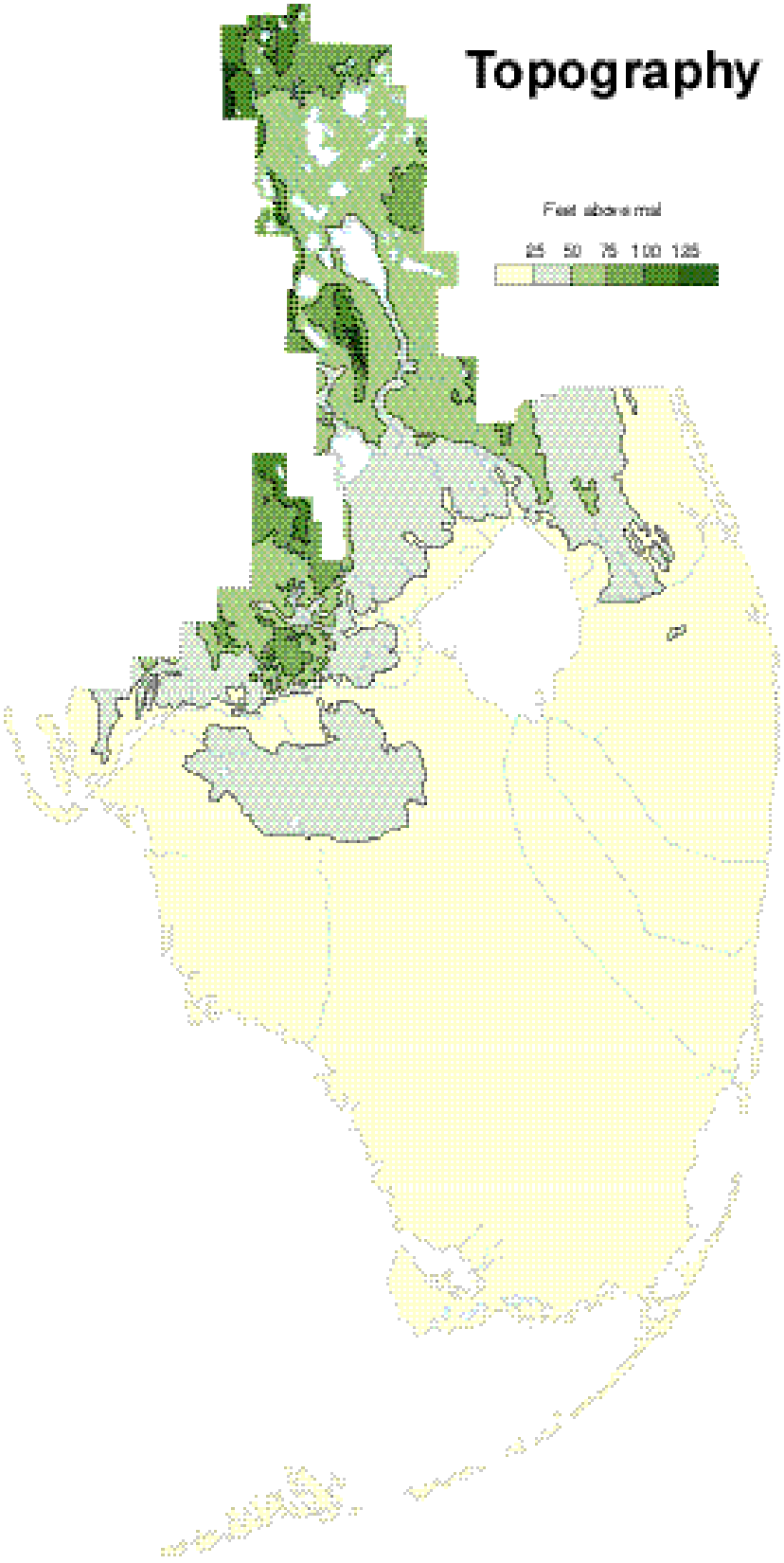


Figure 7. Topography within the SFWMD (Fernald and Purdam, 1998).

Physiographic Regions

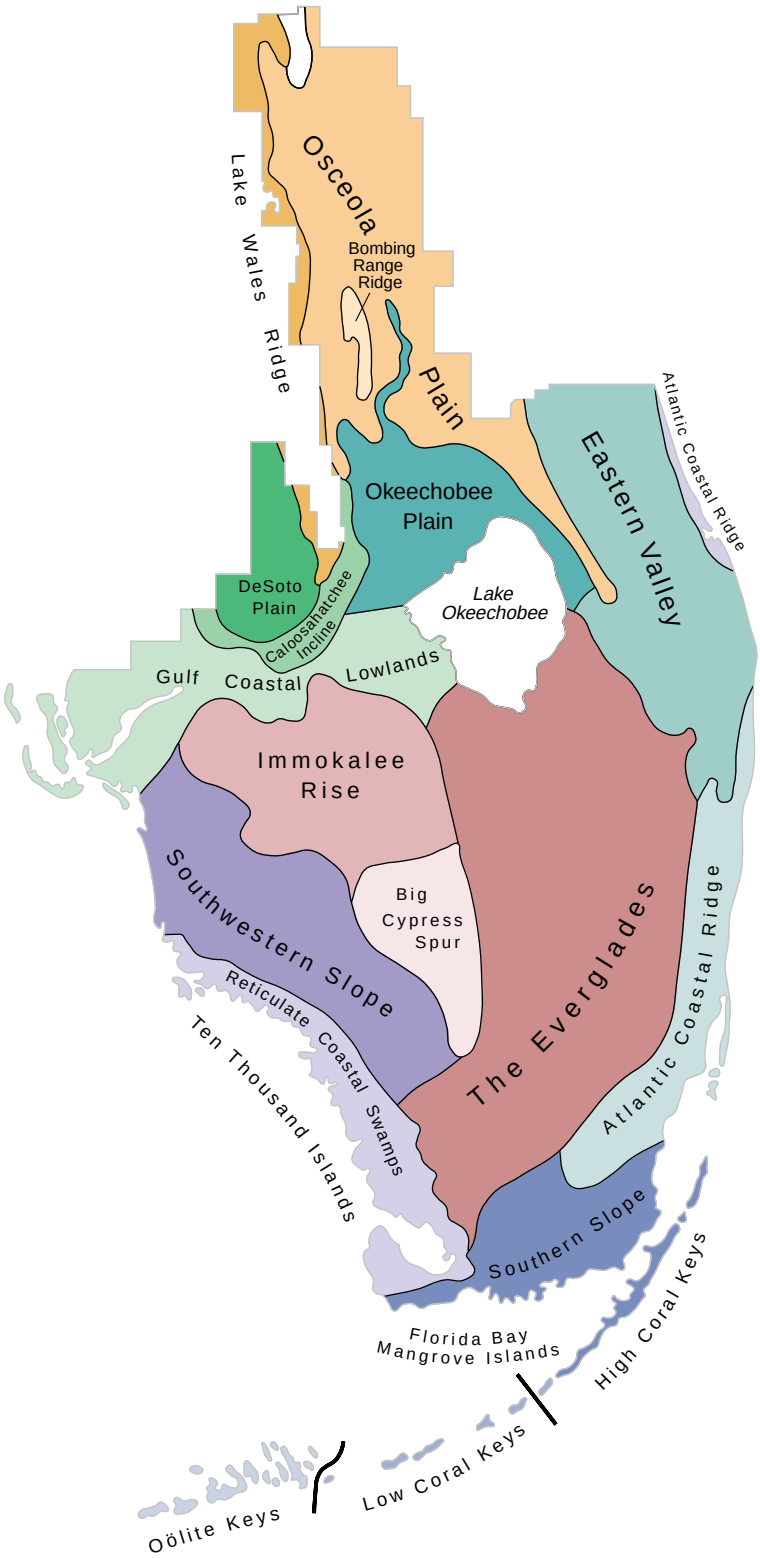


Figure 8. Physiographic Regions within the SFWMD (Fernald and Purdam, 1998).

Climate

The climate of South Florida is characterized by warm temperatures, an average annual rainfall of 52.8 inches, and usually light winds. Intense storms, yielding large volumes of rain are common. Seventy-three percent, or 38.5 inches, of the region's spatially averaged annual rainfall occurs in the six month period from May through October (Ali and Abtew, 1999). During the dry months, rainfall is more closely related to the passage of cold fronts and warm fronts. These frontal storms produce significant rainfall, but occur with less frequency than the wet season, summer storms. The monthly average rainfall distribution for the District is shown in **Figure 9**. Results from rainfall analysis conducted by the District show a significant variation around the historical mean for all basins and all months.

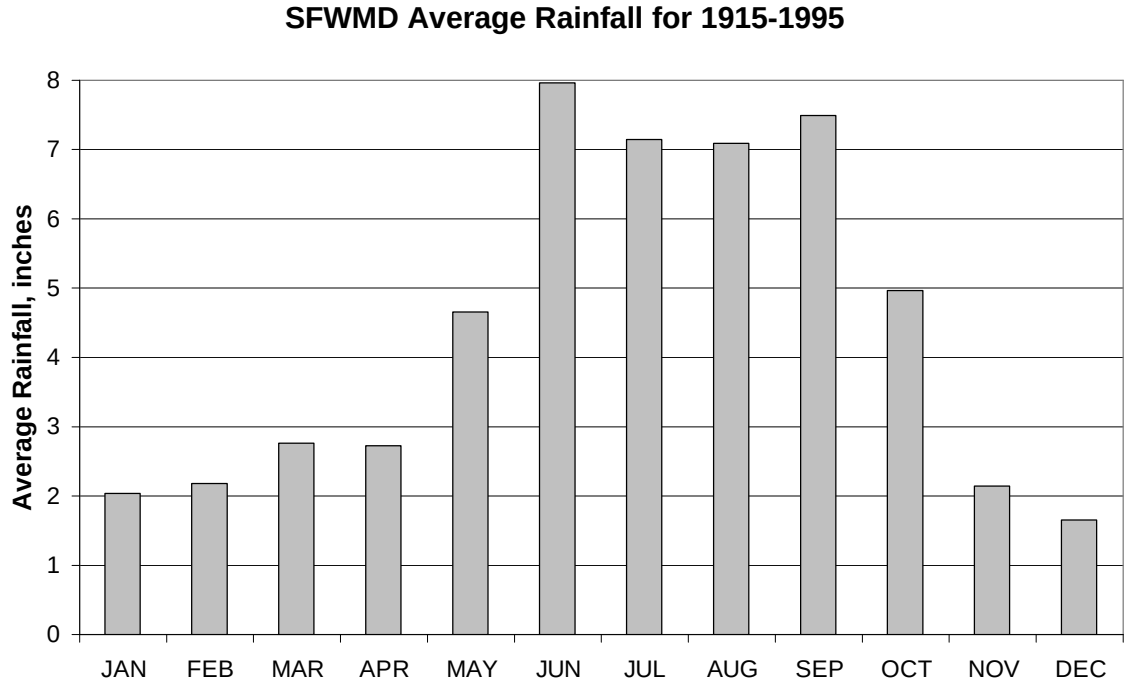


Figure 9. Monthly Distribution of Average Rainfall within the SFWMD.

In addition to the average seasonal variation of rainfall, year-to-year variability in total precipitation is an important feature of South Florida's climate. Annual District rainfall frequency analysis performed by Sculley (1986) depicted 1-in-10 year dry and wet annual District rainfall as 44.3 and 62.5 inches, respectively. Spatially averaged District rainfall quantities for the years 1915 through 1995 are shown in **Figure 10**. Annual rainfall fluctuates significantly from year-to-year, and the fact that South Florida can move so quickly from having excessive rainfall with associated flooding to a drought situation, or vice versa, exacerbates the difficulties associated with managing the water resources of the region.

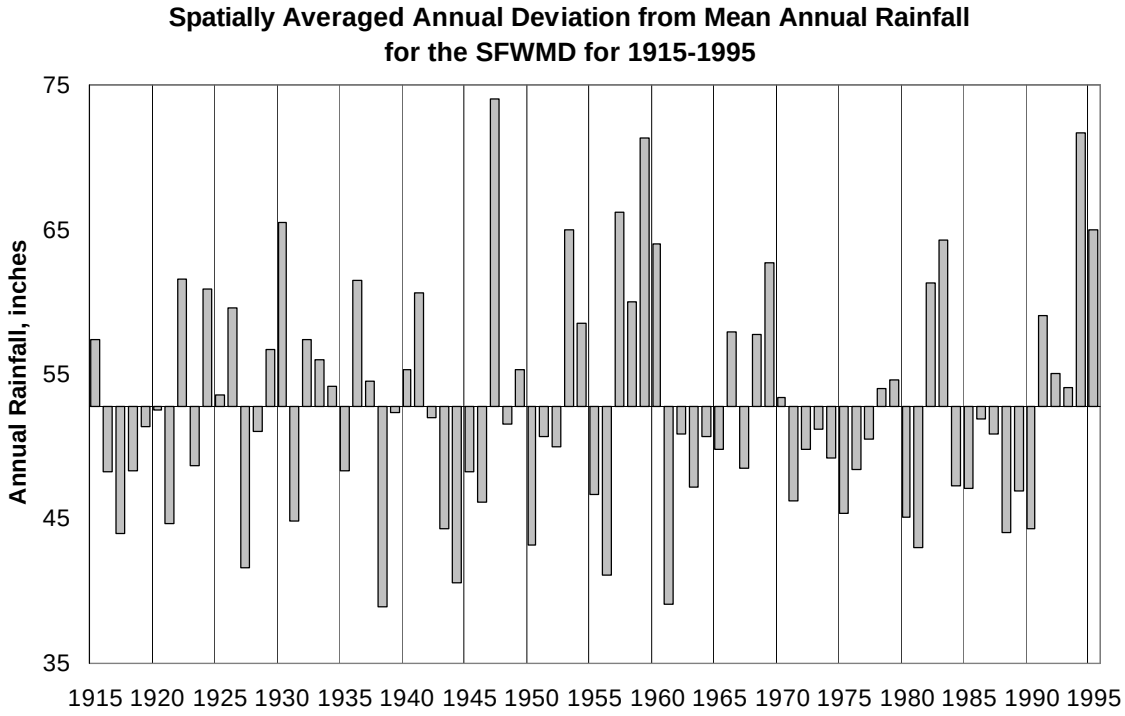


Figure 10. Spatially Averaged Annual Deviation of Rainfall from the Mean within the SFWMD.

SURFACE WATER RESOURCES

The natural surface hydrology of South Florida resulted from the interaction of the region's subtropical climate with its topography and geology. The natural hydrologic system was self-sustaining and dynamic with conditions ranging from dry periods to prolonged flooding during wet periods. During wet periods, water tended to accumulate on the predominantly flat, low-lying lands, flowing overland and via shallow streams into freshwater lakes and the ocean. Ponding persisted for several months, allowing infiltration of surface water into the underlying aquifers. During dry periods, surface water levels receded, but water stored in the soil and aquifer provided base flow for the rivers and wetlands. Occasionally, prolonged droughts caused more complete drying of the land. Wildfires were common during droughts.

Long periods of flooding and the extremes of droughts and hurricanes made most of South Florida inhospitable to development. Early development was generally confined to isolated uplands and the coastal ridge, which was often the only dry land available. There was, however, a strong desire to settle the lowlands, which were very fertile and had the potential to be of great agricultural value. In order to accommodate development, the natural hydrologic system was modified to enable agricultural and urban development. Extensive damage wrought by floods and droughts on urban and agricultural areas led to the construction of the C&SF Project and other surface water management systems managed by the District. A schematic of this surface water management system is shown in **Figure 24** in **Chapter 4**, and in detail on the *Structure and Canal Locations* map

inserted in this document's front cover. The region's surface hydrology is now largely governed by man-made systems superimposed on the District's natural hydrology. The boundaries of the District's major surface water basins, based on drainage divides, are shown in **Figure 11**.

Upper Kissimmee

The Upper Kissimmee Basin is dotted with hundreds of lakes, ranging in size from small sinkholes and ponds to large lakes. The surface water drainage pattern begins with a series of interconnected lakes in the northern portion, called the Kissimmee Chain of Lakes. Alligator Lake forms the drainage divide of the Chain of Lakes and water can be released either to the north or to the south. Northward flow goes though several canals and smaller lakes to Lake Mary Jane; the flow proceeds through Lakes Hart, East Tohopekaliga, and Tohopekaliga, then finally to Lake Cypress. Southward flow takes a shorter route through Lake Gentry and then to Lake Cypress. From Lake Cypress, water flows southward to Lake Hatchineha and then to Lake Kissimmee. Most of these lakes are shallow, with mean depths varying from six to 13 feet. The subbasins of the Upper Kissimmee Basin are generally delineated by the drainage divides of the major water bodies, and more detailed descriptions of these lakes may be found in the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a).

Okeechobee

The Okeechobee Basin includes the tributary watersheds of the Kissimmee River between the outlet of Lake Kissimmee (S-65) and Lake Okeechobee. There are a series of five subbasins (S-65A through E) along the C-38 Canal. These subbasins are named after the structures which divide the C-38 Canal into five pools. The water level in each of these pools is regulated according to an interim regulation schedule for the Kissimmee River Pools.

Lake Okeechobee is the largest lake in Florida and the third largest natural water body entirely within the United States. This lake and its associated wetlands provide habitat for a number of plants and animals, including several rare and endangered species such as the wood stork, snail kite, West Indian manatee, and Okeechobee gourd. Migratory birds and waterfowl use the littoral zone and adjacent wetlands as a resting area along the Atlantic flyway. The lake is also a major recreational resource. The lake supports a nationally renowned sport fishery, and is an important winter waterfowl hunting area. It is also part of the navigable Okeechobee Waterway connecting the east and west coasts of the state.

Lake Okeechobee also provides water storage for urban and agricultural water supply. During water shortages, canal discharges from Lake Okeechobee provides recharge water for the Biscayne aquifer, indirectly supplying water to 90 percent of the five million residents of the LEC planning region. The lake also supplies irrigation water for sugarcane, vegetables, sod, and rice crops grown in the EAA.

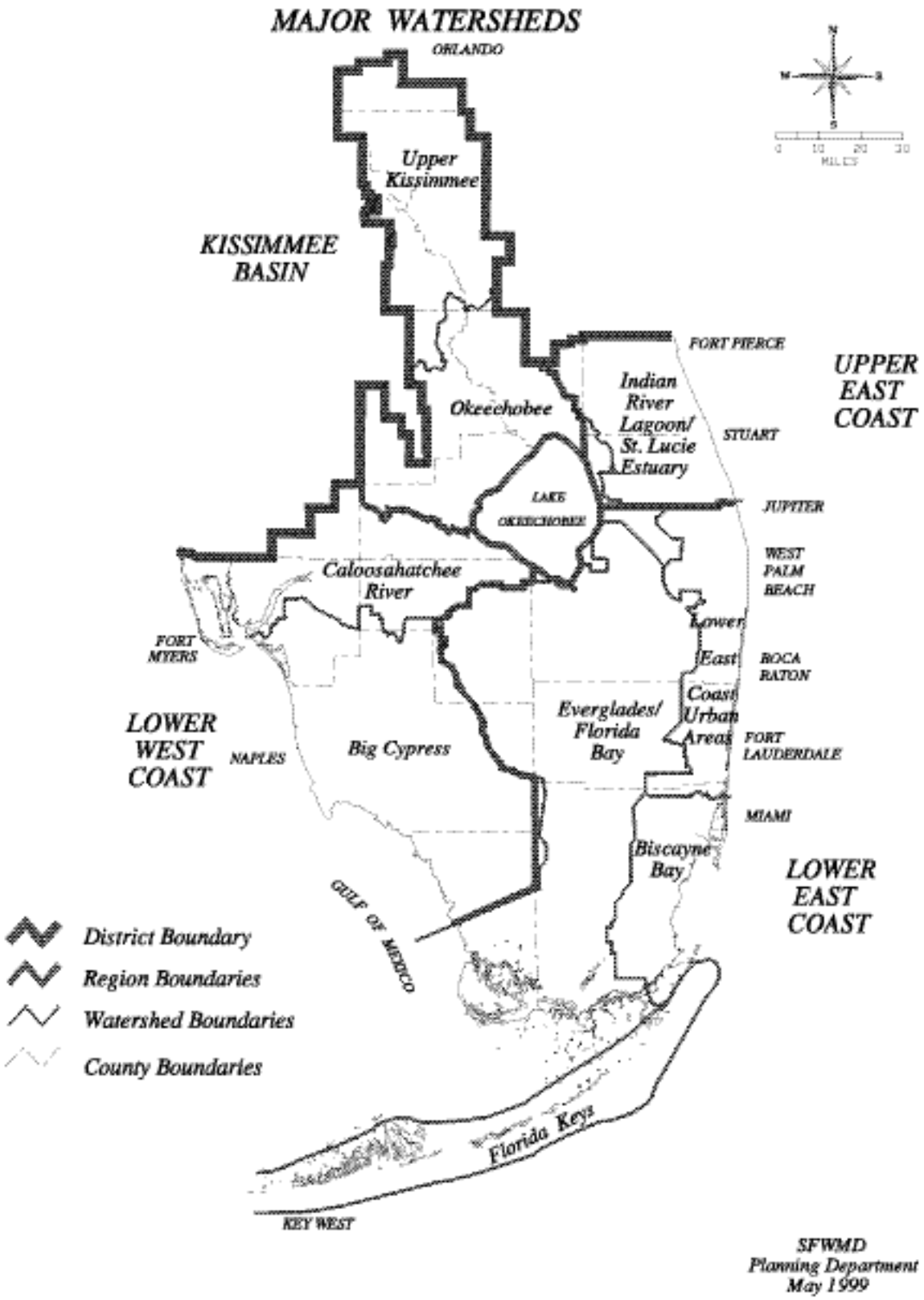


Figure 11. Major Surface Water Basins within the SFWMD.

Lake Istokpoga is the second largest lake within the District (fifth largest in the state) and is also within the Okeechobee Basin. This lake has a surface area of 43.3 square miles, and ranges in depth from 4.3 to 9.8 feet. Lake Istokpoga is known for the excellent fishing it offers, and represents 60 percent of the public access fresh water in Highlands County.

Caloosahatchee River

The Caloosahatchee River Basin extends from Lake Okeechobee to San Carlos Bay. It comprises the northern portion of the LWC planning region. Inflows from Lake Okeechobee and runoff from within its own basin supply the Caloosahatchee River. The freshwater portion of the river (C-43 Canal) extends eastward from the Franklin Lock and Dam (S-79) towards Lake Okeechobee and the cities of LaBelle and Moore Haven. The C-43 Canal is part of the Lake Okeechobee Waterway that provides navigation between the east and west coasts of Florida. West of the S-79 Structure, the river mixes freely with estuarine water as it empties into the Gulf of Mexico. The river is the only major surface water source used for water supply in the LWC planning region.

Big Cypress Basin

The Big Cypress Basin includes all of Collier County and part of Monroe County; including the Big Cypress National Preserve and the Ten Thousand Islands. The regional hydrologic system in the Big Cypress Basin is made up of natural sloughs, rivers, and wetlands. In some areas, local drainage canals provide limited regional flood protection during wet periods, but also lead to overdrainage during dry periods. Development in downstream coastal areas has degraded many natural flowways and their flood carrying capacities; leading to increased flooding in inland areas. The District, through its Big Cypress Basin Board, has adopted many of these canals as works of the Big Cypress Basin and has modified them to reduce overdrainage while maintaining flood protection.

Indian River Lagoon

The Indian River Lagoon Basin is composed of three interconnected estuarine lagoons: the Mosquito Lagoon, Indian River Lagoon, and the Banana River Lagoon. The lagoon system extends about 155 miles through six coastal counties from Ponce de Leon Inlet in Volusia County southward to Jupiter Inlet in Palm Beach County. For planning purposes, the watershed has been divided into four geographic segments. The North, North Central, and South Central segments are within the St. Johns River Water Management District. The South segment is within the SFWMD and is divided into drainage basins based on hydrologic characteristics. These drainage basins are the C-23, C-24, C-25, and C-44 canal basins and the basins which drain into the North and South Fork of the St. Lucie River.

The South Indian River Lagoon segment, under natural conditions, was poorly drained with many isolated wetlands. The natural drainage divides are poorly defined. The area has been developed for agriculture and urban/residential uses with a complex system of drainage canals. Many of these canals provide connections between basins.

Lower East Coast Urban Area

The LEC Urban Area consists of the coastal ridge portions of Palm Beach and Broward counties lying east of the WCAs, and is part of the most densely populated part of the state (together with Miami-Dade County). The largest population centers are near the coast and include the cities of West Palm Beach, Fort Lauderdale, and Hollywood. Water levels in coastal canals are controlled near the coastal shoreline to prevent overdrainage and to resist saltwater intrusion.

Low water levels in the canals east of the control structures enable salt water to migrate into the ground water, wellfields, and natural freshwater systems upon which the urban areas depend for a potable water supply. Except for pockets of publicly protected preservation lands, extensive development has resulted in nearly the complete urbanization of the coastal region, from West Palm Beach southward through Hollywood.

Everglades - Florida Bay

The Everglades is the largest subtropical wetland in the United States and a unique resource for South Florida. Everglades National Park was established in 1947, designated an International Biosphere Reserve in 1976, an Outstanding Florida Water in 1978, and a United Nations World Heritage Site in 1979. The park and the WCAs are the surviving remnants of the historical Everglades, which spread uninterrupted from Lake Okeechobee south to Florida Bay and east to the coastal ridge. This remaining area provides significant ecological benefits, including water storage and supply, habitat for wildlife of national significance, and internationally recognized recreational opportunities. The Everglades also encompasses the Western Basins area which contains two Native American Indian reservations. Big Cypress, the largest of the Seminole Tribe's reservations, occupies more than 52,000 acres in Hendry and Broward counties. The Miccosukee Tribe's reservation, just south of the Big Cypress reservation, comprises 75,000 acres in Broward County.

To the south, Florida Bay has begun to demonstrate signs of stress. Historically, the bay was a 772 square mile shallow, brackish estuary with fluctuating salinity. Salinity fluctuations were caused by seasonal changes in the outflow from the Everglades, and rainfall. The bay was popular with sport fishermen because of the schools of tarpon, bonefish, redfish, and sea trout feeding on the pink shrimp, crabs, and other bait. Large sections of the estuary have deteriorated in recent years. Hydrologic and geologic indicators of the deterioration of the estuary include murky water, loss of seagrass habitat, algal blooms, fish and invertebrate kills, and significant increases in salinity levels.

Biscayne Bay

The Biscayne Bay Watershed includes the highly urbanized, coastal area of Miami-Dade County. South of Miami the coastal area widens as the Everglades bends to the west. The watershed includes urban and agricultural areas that extend almost to the southern coast. Miami-Dade County’s agricultural industry covers more than 83,000 acres southwest of the coastal metropolitan area. Vegetables, tropical fruits, and nursery plants are grown in this area.

Biscayne Bay is a shallow subtropical estuary with a natural depth ranging from three to nine feet. Much of the upper bay has been modified and dredged, so that depths now average six to ten feet and include some dredged areas and channels up to forty feet deep. A basin of about 840 square miles drains to the bay. Seventeen canals in eastern Miami-Dade County operated by the District provide most of the surface flows of fresh water into Biscayne Bay.

The significance of ground water flows to Biscayne Bay is uncertain. Existing data suggest that historic dry season ground water flows have been greatly reduced. Canal construction has accelerated the rate at which ground water levels recede at the end of the wet season. Before canals and structures existed, some surface water flowed to the bay through the Miami River and a few natural creeks and streams. During wet periods, large amounts of water entered the bay as surface water flowed across adjacent freshwater marshes. Surface water now discharges from the mouths of canals at a much faster rate compared to the flow rate of natural conditions.

Biscayne Bay continues to support a wide variety of plants and animals, some of which are important for fisheries. Many rare, threatened, and endangered species occur in or near the bay, including manatees and crocodiles.

Florida Keys

The Florida Keys watershed consists of a limestone island archipelago of some 1,700 islands extending southwest for over 200 miles, from the southern tip of the Florida mainland to the Dry Tortugas. The area is bounded on the north and west by the relatively shallow mud shoals and seagrass beds of Biscayne Bay, Barnes and Blackwater sounds, Florida Bay, and the Gulf of Mexico. Fresh water is supplied to the Florida Keys by the Florida Keys Aqueduct Authority, which has a wellfield near Florida City on the mainland.

GROUND WATER RESOURCES

The predominant use of ground water in South Florida, especially for potable water supply, has developed due to the high productivity of the aquifers underlying the region. The Biscayne and the Floridan aquifers are among the most productive in the world. The Biscayne aquifer consists of cavernous limestone and is the primary source of drinking water for all municipal water systems in the LEC planning region south of the C-51 Canal in central Palm Beach County. The high permeability and proximity of the Biscayne aquifer to the land surface closely links it with the surface water hydrology. This link is enhanced by the network of canals of the C&SF Project, which can be used for aquifer recharge. The high permeability and land surface proximity also makes the Biscayne aquifer highly susceptible to saltwater intrusion and to contamination from surface sources (SFWMD, 1998b).

With the exception of the northern portion of the Kissimmee Basin (which predominantly uses water from the Floridan aquifer for potable purposes), the counties

within the District generally use shallow ground water supplies to meet their potable water demands. The Public Water Supply (PWS) wellfields are vulnerable to contamination from land based sources and need to be safeguarded.

In 1995, nearly 96 percent of South Florida's public utility supply and 100 percent of its domestic self-supply came from ground water. In addition, ground water accounted for 32 percent of the water used for agricultural irrigation. Overall, ground water supplied 53 percent of the total freshwater demands in the District in 1995 (USGS, 1999). Surface water plays an important role in maintaining the availability of ground water, which is recharged through rainfall and the regional canal system.

Principal Aquifer Systems

Virtually all areas within the District are underlain by aquifers capable of yielding some quantity of water. Three principal aquifer systems exist in South Florida: the Surficial, Intermediate, and Floridan aquifer systems, which are shown in the cross-section of South Florida delineated in **Figure 12**.

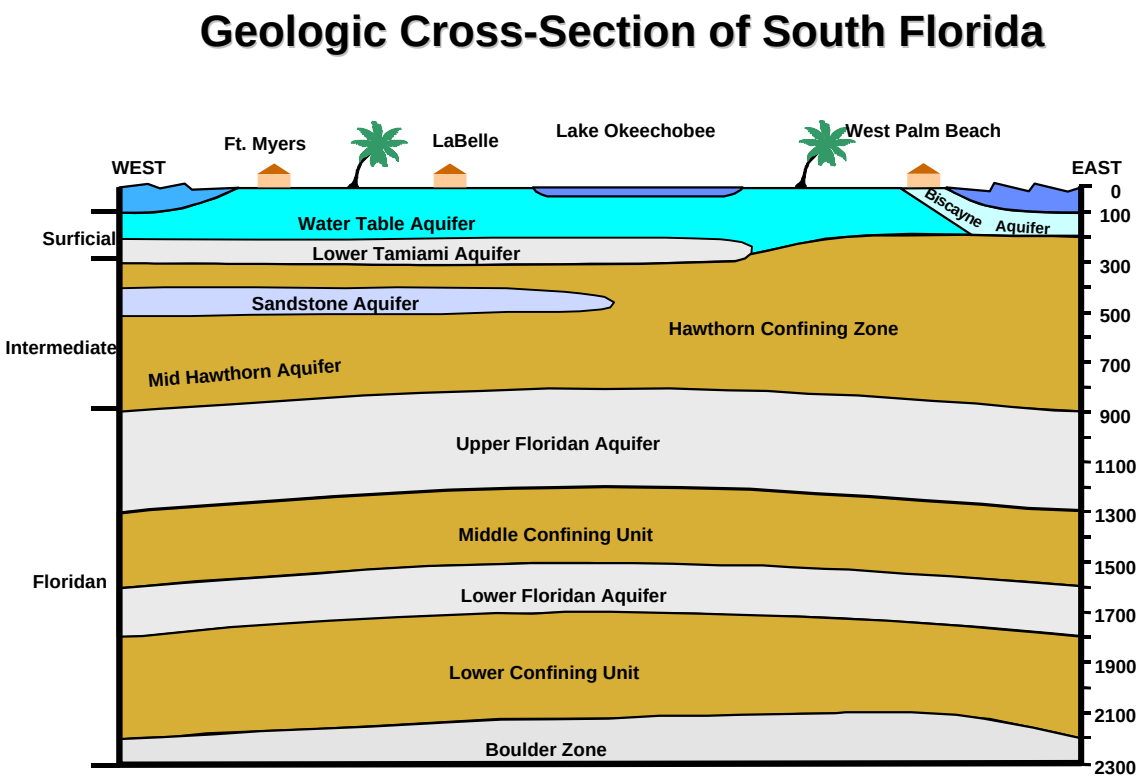


Figure 12. Geologic Cross-Section of South Florida.

The Surficial Aquifer System contains the unconfined Biscayne aquifer located in southeastern Florida (principally Miami-Dade, Broward, and southern Palm Beach counties); the undifferentiated water table aquifers located along the east coast from

St. Lucie County south into Palm Beach County, in parts of south Central Florida, and in the LWC planning region; and the confined lower Tamiami aquifer located in southwestern Florida. The Intermediate Aquifer System contains two major confined aquifers: the sandstone and mid-Hawthorn aquifers located along the southwestern Florida coast from Charlotte to Monroe counties. The Floridan Aquifer System underlies all of South Florida. Everywhere within the District, except in the Upper Kissimmee Basin, Floridan water must be treated extensively before it is potable.

Overall, the Surficial Aquifer System supplied approximately three-quarters of the total ground water withdrawals within the District in 1995. Of the remaining 1995 ground water demands, the Intermediate Aquifer System supplied 11 percent and the Floridan Aquifer System supplied 15 percent.

Surficial Aquifer System

The Surficial Aquifer System includes the Biscayne aquifer, various shallow water table aquifers, and the lower Tamiami aquifer. In general, the water producing zones of the Surficial Aquifer System are composed of interbedded unconsolidated sand and shell units with carbonate rock.

Biscayne Aquifer

The Biscayne aquifer is the major source of fresh water used for PWS within the LEC planning region. The aquifer underlies an area of approximately 3,200 square miles throughout Miami-Dade, Broward, and southern Palm Beach counties. It has been designated a sole source aquifer by the U.S. Environmental Protection Agency (USEPA) under the provisions of the Safe Drinking Water Act and, therefore, must be afforded stringent protection. The sole source aquifer designation is made by the USEPA if 50 percent or more of an area's drinking water is supplied by the aquifer and alternative sources of water are unavailable. By designating the Biscayne a sole source aquifer, the USEPA will preview any federally funded construction projects, such as airports and highways, to ensure that there will be no significant impact on the source of water to residents living in this area.

The Biscayne aquifer is one of the most productive shallow nonartesian aquifers in the United States and one of the most permeable aquifers in the world, displaying transmissivities in excess of 7 million gallons per day per foot (gpd/ft). Many wells yield 1,000 gallons per minute (gpm) or more with negligible drawdowns, because of the exceedingly high permeability of the solution riddled limestones that comprise the Biscayne aquifer. The aquifer is unconfined, close to the surface, and highly permeable, and, therefore, is vulnerable to contamination. Rapid urbanization and agricultural land use are potential contamination threats. The Biscayne aquifer is composed of unconsolidated sand and shell units interbedded with carbonate rocks. The carbonates are the most prolific water producing zones. The aquifer reaches its maximum thickness within the southern portion of the LEC planning region beneath the Atlantic Coastal Ridge and potable water exists to depths of about 200 feet.

Water Table Aquifers

Shallow water table aquifers are the principal water source for urban supply within the LWC and the UEC planning regions. Water table aquifers are also a source of water for agricultural irrigation in these areas.

The water table aquifer system in the LWC planning region has transmissivities ranging between 10,000 to 1,000,000 gpd/ft. In the UEC planning region, the aquifer has transmissivities as high as 200,000 gpd/ft, which decrease abruptly inland. PWS wells in both areas have well yields of about 300 gpm.

The proximity of the water table aquifers to the surface increases their susceptibility to contamination from a variety of sources. Lack of confinement, high recharge rate, relatively high permeability, and a high water table, all increase contamination potential. Because of increasing demands on these aquifers, there is also the threat of saltwater intrusion along the coasts.

Lower Tamiami Aquifer

The lower Tamiami aquifer is the most prolific aquifer in Collier and Hendry counties, serving as the primary source of municipal, industrial, and agricultural water supply. The proximity of the lower Tamiami aquifer to the surface increases its susceptibility to contamination. Because of large demands placed on this aquifer, it has been endangered by saltwater intrusion along the coast and is frequently included in water shortage restrictions.

Intermediate Aquifer System

The Intermediate Aquifer System consists of the sandstone aquifer and the mid-Hawthorn artesian aquifer. It is composed predominantly of interbedded clays and silts, sand, sandstones, dolostones, and limestones. The sandstone aquifer is relatively thin and discontinuous compared to the mid-Hawthorn aquifer, yet it produces more water, particularly for agriculture in Hendry, eastern Lee, and northern Collier counties.

Floridan Aquifer System

The Floridan aquifer serves as a major source for agricultural irrigation water within the UEC planning region, and is also utilized on a small scale as a complementary source for blending with water from the Surficial Aquifer System for PWS. The Floridan Aquifer System provides about 10 percent of total PWS pumpage in the region. Water from the Floridan Aquifer System typically must undergo desalination prior to potable use within the UEC planning region. Transmissivities are typically high, ranging from 100,000 to 500,000 gpd/ft.

Ground water withdrawals for urban and agricultural use within the Kissimmee Basin occur almost exclusively from the Floridan Aquifer System. This predominantly artesian system contains several distinct producing zones and fresh water. The Floridan

Aquifer System is also present in the LEC and LWC planning regions, but the water quality is not high in these regions. Because of the poor water quality, the Floridan aquifer is not a significant source in these planning regions, although there is some use of the Floridan by barrier island facilities in the LWC.

CULTURAL RESOURCES AND DEVELOPMENT

South Florida was in a relatively natural state in 1940, with Miami and Fort Lauderdale as the two primary urban areas. The Kissimmee River Basin and Okeechobee County were major cattle raising areas. Concentrations of agriculture in South Florida were located along the south rim of Lake Okeechobee, near Immokalee, west and south of Miami, and in Palm Beach County.

Extensive flooding in 1947 led to authorization of the C&SF Project by the federal government. The Florida Legislature created the FCD in 1949 to serve as local sponsor for the C&SF Project. Protection from flooding made additional residential areas in South Florida feasible, and the availability of air conditioning made Florida an increasingly attractive place to reside on a year-round basis.

Population

Between 1950 and 1995 the population of the area within the District's boundaries has grown from 0.8 million to 5.8 million. The region also has significant seasonal and tourist populations that are not included in those numbers. The permanent resident population of the District is projected to reach 8.2 million by 2020 (SFWMD, 1998b) (**Figure 13**).

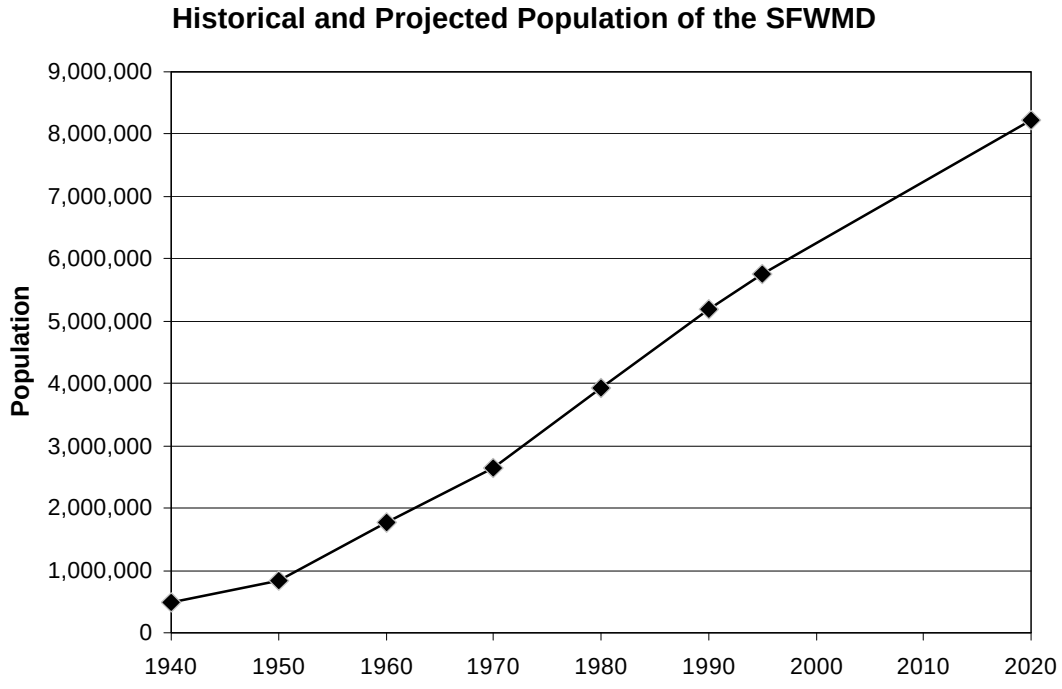


Figure 13. Projection of Future Population within the SFWMD.

Generally, urban development is concentrated along the unprotected areas of the coast and in the I-4 corridor/Orlando area. The 1990 census map, shown in **Figure 14**, clearly depicts the majority of the District's population as residing along the east coast of the District, with significant population centers also on the west coast and in and around Orlando. The assessed 1995 and projected 2020 distributions of population by planning region and county are shown in **Table 2** (SFWMD, 1998b).

Table 2. Assessed 1995 and Projected 2020 Populations for the SFWMD.

Counties	1995	2020	Percent growth
Lower West Coast			
Lee	375,238	594,300	58%
Collier	182,933	349,200	91%
Western Hendry	27,714	39,999	44%
Southern Glades	4,409	7,560	71%
Southeastern Charlotte	645	1,746	171%
LWC Total Population	590,939	992,805	68%
Lower East Coast			
Palm Beach	976,358	1,464,000	50%
Broward	1,412,942	1,926,600	36%
Miami-Dade	2,046,078	2,587,400	26%
Monroe	81,152	106,000	31%
Eastern Hendry	1,871	2,700	44%
LEC Total Population	4,518,401	6,086,700	35%
Upper East Coast			
St. Lucie	171,914	281,500	64%
Martin	110,495	173,500	57%
Eastern Okeechobee	1,048	1,580	51%
UEC Total Population	283,457	456,580	61%
Kissimmee Basin			
Southern Orange	186,131	349,453	88%
Western Osceola	130,605	260,937	100%
Southeastern Polk	6,375	13,832	117%
Eastern Highlands	7,700	11,590	51%
Western Okechobee	28,737	45,244	57%
Northern Glades	3,289	5,640	71%
Kissimmee Basin Total Population	362,837	686,696	89%
District Total Population	5,755,634	8,222,781	43%

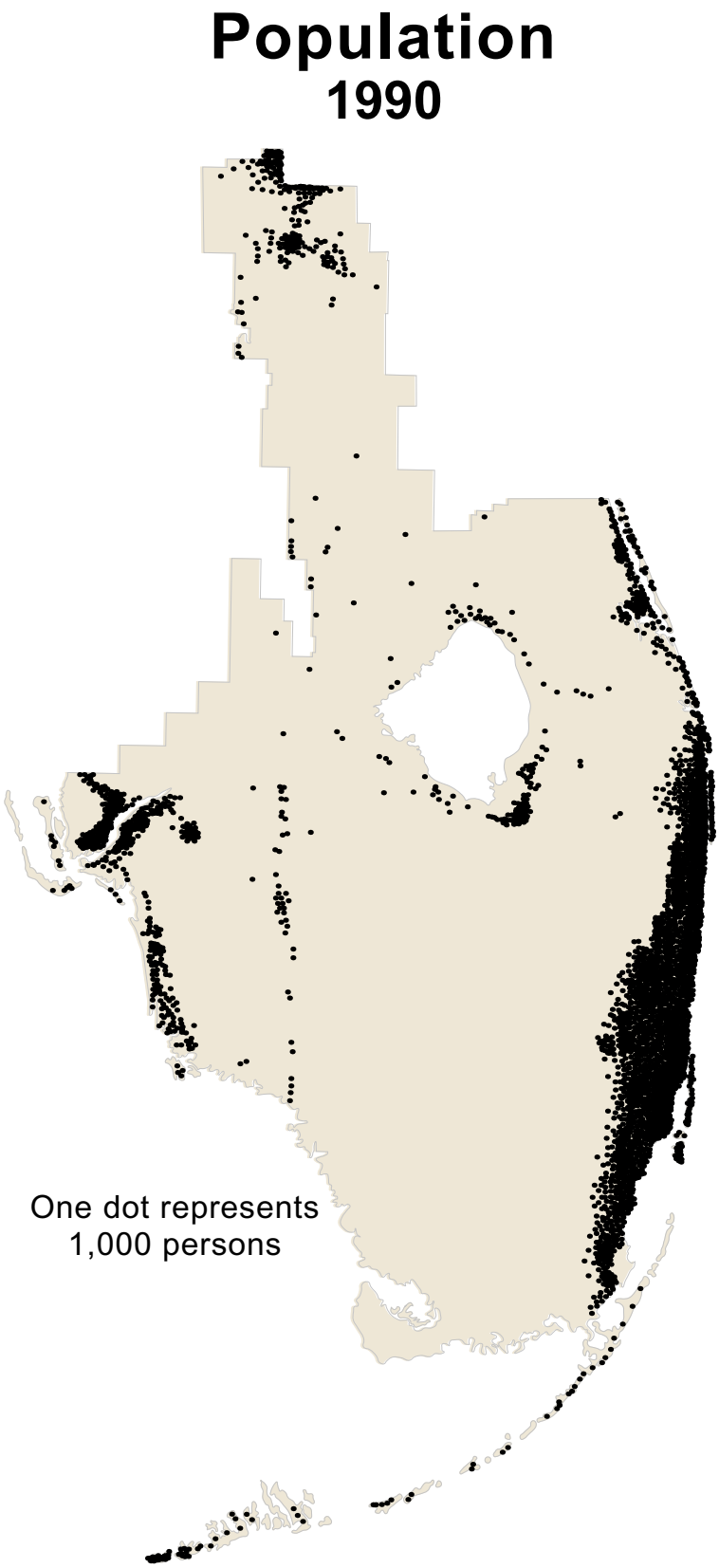


Figure 14. Distribution of Population Density within the SFWMD (Fernald and Purdam, 1998).

Tourism

Tourism plays a major role in the economy of South Florida. Attractions within the District include the beaches of both the Atlantic and Gulf coast; Everglades and Biscayne national park in Miami-Dade and Monroe counties; the Florida Keys; and the theme parks in southwestern Orange and northern Osceola counties.

Tourism results in significant seasonal variations in population. The major tourist season occurs during the dry winter months, and the degree to which the population varies seasonally varies by region within the District. For example, the proportion by which seasonal population shifts in the LWC planning region of the District is much higher than in the Miami area (SFWMD, 1995a).

In spite of large seasonal variations in population the monthly distribution of urban water demand remains fairly constant. During the winter months, the seasonal tourist population is at its peak, whereas outside irrigation demands peak in late spring, when tourist populations are declining. Landscape irrigation demands attributable to seasonal residents take place year-round for properties irrigated by property managers or automated irrigation systems.

Agriculture

Commercial agriculture is a major industry and the main water user within the District. The DWSA (SFWMD, 1998b) describes the irrigated agricultural acreage in each county within the District. Most of the interior area of the District not in public ownership is in agricultural use:

- Sugarcane and vegetable farms in the EAA (Palm Beach, Hendry, Glades, and Martin counties)
- The Agricultural Reserve Area of Palm Beach County
- The South Miami-Dade County Agricultural Area where vegetable crops dominate, especially tropical varieties
- Citrus groves throughout the District, but concentrated in St. Lucie, Martin, Hendry, Highlands, Collier, and Glades counties
- Cattle and dairy farms in Glades, Highlands, and Okeechobee counties

Commercial agricultural crops invariably require irrigation, and the estimation and projection of these irrigation requirements are fundamental to the water supply planning process. For consolidation and comparison purposes agricultural crops were categorized by the Water Demand Projection Subcommittee, which was made up of representatives of Florida's five water management districts. These crop categories are (1) citrus, (2) other fruits and nuts, (3) vegetables, melons, and berries, (4) field crops, (5) greenhouse/ nursery, (6) sod, (7) pasture, and (8) miscellaneous. Agricultural acreages reported in this DWMP were taken from the DWSA (SFWMD, 1998b).

Citrus

Citrus is grown commercially within each county in the District except Monroe. While citrus production has historically been concentrated in the central portion of the state, a series of severe freezes during the 1980s resulted in the migration of citrus acreage southward. The three counties in the state with the most acreage planted in citrus, St. Lucie, Polk (a portion), and Hendry counties, are within the District. The region also accounts for virtually all of Florida's lime production (Miami-Dade County). Approximately 391,000 acres within the District were in citrus production in 1995. This acreage includes all categories of citrus (oranges, grapefruit, tangerines, limes, etc.).

Other Fruits and Nuts

Within the District, noncitrus fruit crops (avocados, mangos, papaya, etc.) are produced commercially in Miami-Dade and Lee counties. In 1995, about 10,000 acres were used within these two counties to produce noncitrus fruit crops.

Vegetables, Melons, and Berries

A wide variety of vegetables are grown commercially in South Florida. These include both traditional (e.g., bush and pole beans, carrots, celery, cucumbers, eggplant, endive, escarole, lettuce, peppers, potatoes, radishes, squash, sweet corn, tomatoes) as well as Latin vegetables (e.g., boniato, calabaza, malanga, yuca), and Chinese vegetables (e.g., bok choy, chihilli, napa, Chinese broccoli, dikon). Different types of vegetables are often grown interchangeably and multicropping is a normal practice. Counties with large acreages devoted to vegetable production include Miami-Dade, Palm Beach, Collier, Hendry, and Lee counties. Watermelon production takes place throughout the District, but does not take place on the same land each year due to a viral infestation that occurs in fields after one season of production. Blueberry production takes place in Highlands County. About 157,000 acres within the District were used to produce vegetables, melons, and berries in 1995.

Field Crops

Field crops grown within the District include sugarcane, rice, seed corn, soybean, and sorghum. By far the most significant of the field crops grown within the District in terms of crop acreage is sugarcane, which is grown commercially in Palm Beach, Hendry, Glades, and Martin counties. In 1995, there were about 463,000 acres of land within the District used to cultivate field crops. This does not include sugarcane lands that were fallow that year.

The majority of sugarcane grown in the United States is grown within the District. It is the dominant crop grown on the EAA’s muck soils, and there has been expansion of this crop onto sandland areas west of the EAA. Within the District, about 433,000 acres were planted with sugarcane in 1995. Because of production practices used for sugarcane (ratoon and fallow) there is an additional 25 percent of land used for sugarcane production

which is fallow in any given year. Within the EAA, rice and sweet corn are frequently grown during the fallow periods on the acreage typically devoted to sugarcane production.

Sod

There is some variation in the production practices of sod within the District. Some harvested sod is irrigated, and some is not, serving largely as pasture until the sod is sold. In 1995, there were about 18,000 acres of irrigated sod production within the District.

Greenhouse/Nursery

A variety of greenhouse and nursery crops are grown within the District. Production of ornamentals in South Florida is concentrated near urban areas in Miami-Dade, Palm Beach, and Broward counties, but also takes place throughout the rest of the District. Approximately 26,000 acres were devoted to ornamental nurseries within the District in 1995.

Pasture

Improved pasture has, by District definition, the facilities in place to carry out irrigation. However, these facilities were typically designed for drainage and, with the exception of a very few areas, are very rarely used for irrigation. This is because the returns associated with cattle production do not justify the expense associated with pasture irrigation. When irrigation is carried out, it is usually in a period of extreme drought and is done to prevent grass from dying.

Miscellaneous

The miscellaneous category includes cattle watering and aquaculture. Cattle ranching in South Florida is concentrated in the Kissimmee Basin, especially in Okeechobee, Highlands, and Osceola counties. Both dairy and beef cattle are raised. Aquaculture (fish farming) withdraws water for circulation purposes, and to replace evaporative losses. Commercial aquaculture presently takes place in Collier, Palm Beach, Miami-Dade, Martin, Highlands, and Okeechobee counties.

Land Development

Agricultural and urban land uses have expanded greatly since 1940. A large portion of South Florida is reserved for nature, though much of it has been disturbed. For example, substantial portions of original Everglades wetlands have been protected in the WCAs since the 1970s, but water levels and timing of deliveries have been artificially managed within these impoundments, resulting in adverse effects on native plant and animal communities. **Table 3** and **Figures 15** through **17** show the changing land uses within the District.

Table 3. Changes in Land Use within the District.

	1953		1973		1995	
	Square Miles	**Percent**	**Square Miles**	**Percent**	**Square Miles**	**Percent**
Urban	372	2.2%	1,234	7.2%	2,277	13.3%
Agricultural	1,632	9.5%	4,703	27.5%	4,757	27.8%
Natural	14,180	82.5%	10,234	59.9%	8,976	52.5%
Water	997	5.8%	909	5.3%	1,098	6.4%
Total	17,181[a]	100.0%	17,080[a]	100.0%	17,108[a]	100.0%

a. The slight variations in total land use between dates is caused by the difficulty in replicating the mean tide line along the coast.

In 1953, urban land uses made up 2.2 percent of the District's area, and this has increased continuously to 13.3 percent in 1995. In 1953, agricultural land made up 9.5 percent of the District, and this has increased to 27.8 percent in 1995. These changes in land use have had significant impacts to all four of the District's areas of responsibility (water supply, flood protection, water quality, and natural systems). Increased populations and agricultural development have meant increased demands for water supply; increased needs for flood protection; an overall decline in water quality; and a reduction in lands in their natural state.

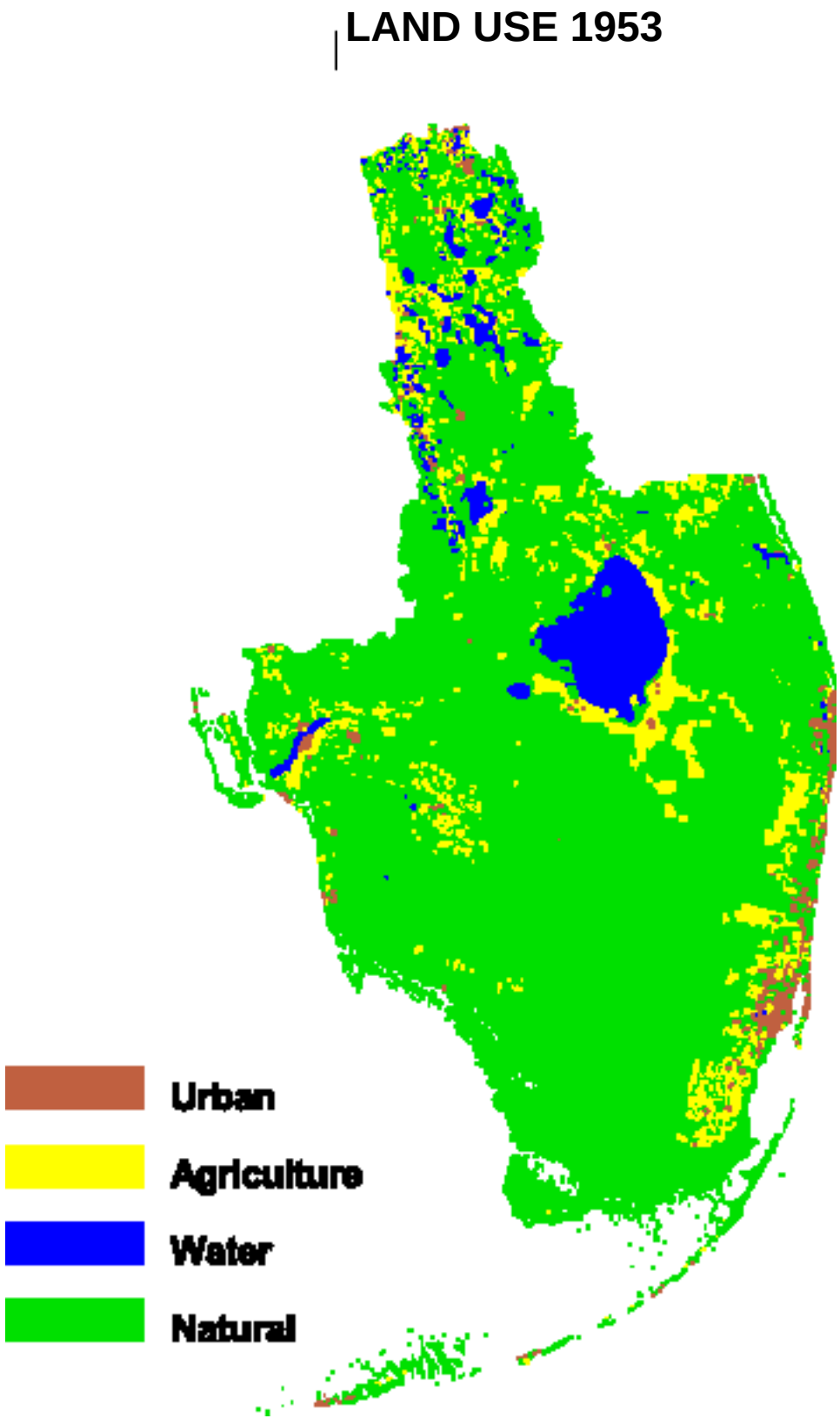


Figure 15. Land Use within the SFWMD in 1953.

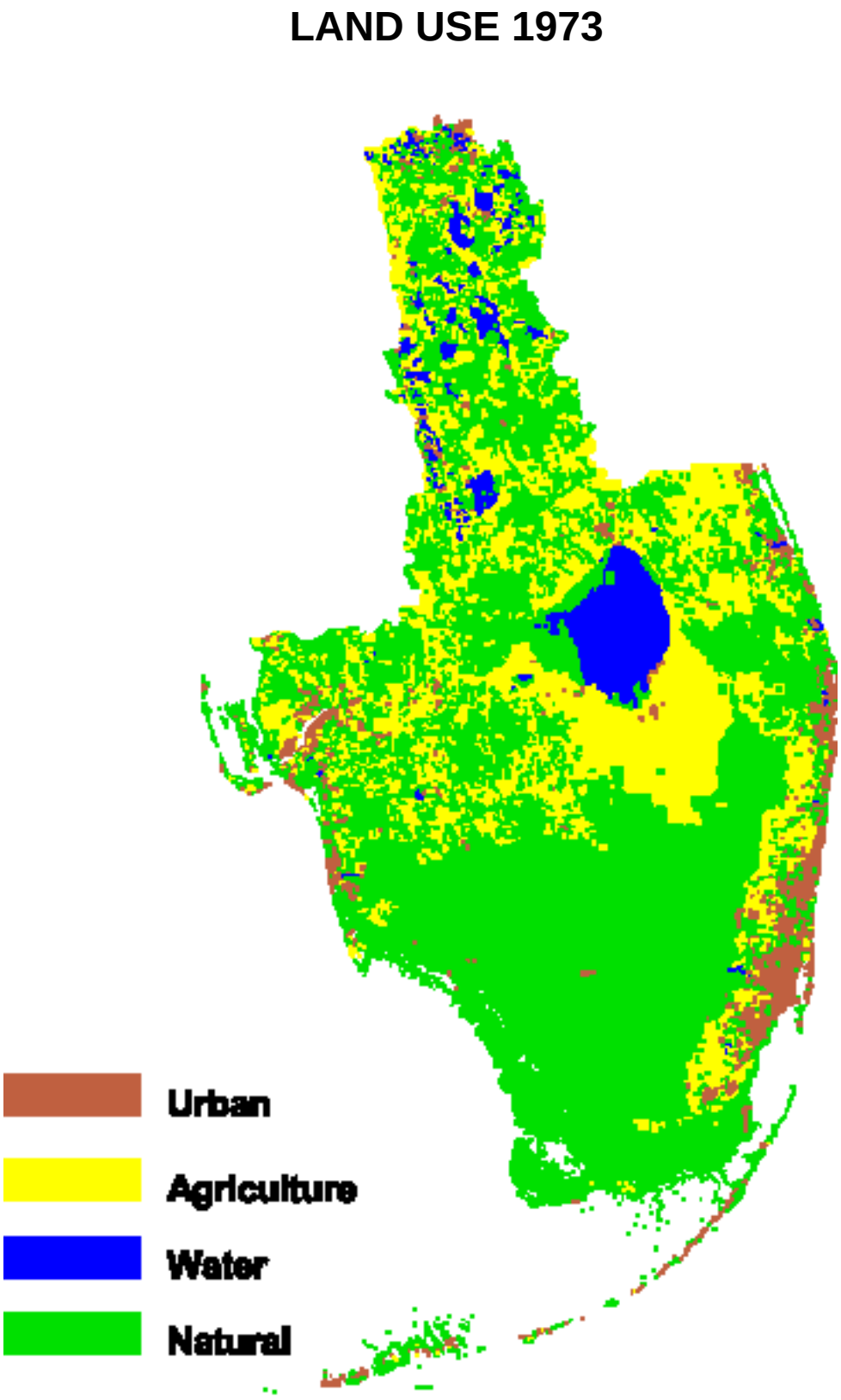


Figure 16. Land Use within the SFWMD in 1973.

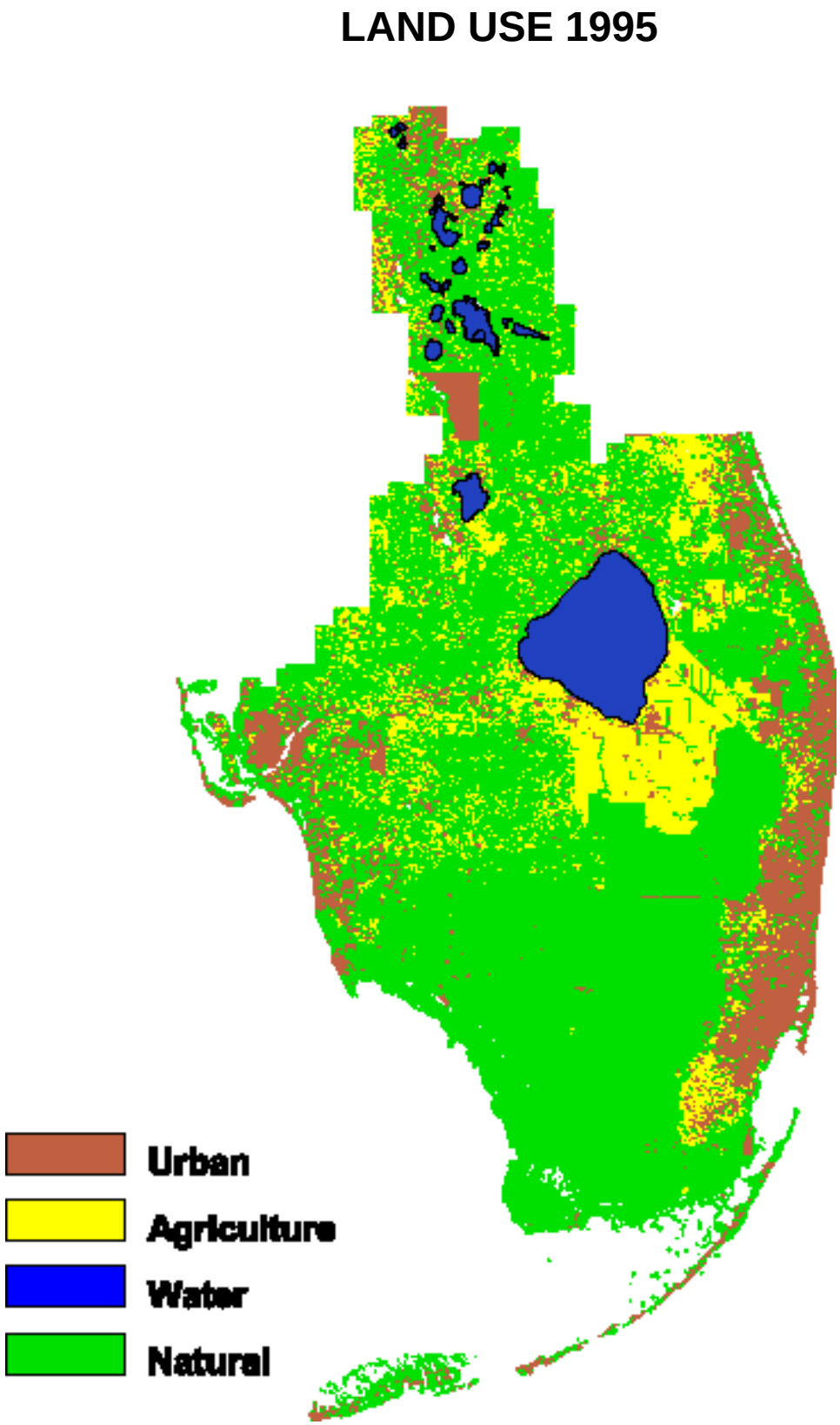


Figure 17. Land Use within the SFWMD in 1995.

Water Use

Demand assessments for 1995 and projections for 2020 are presented in the DWSA (SFWMD, 1998b) for the following water use categories:

- Public Water Supply
- Domestic Self-Supply and Small Public Supply Systems
- Commercial/Industrial Self-Supply
- Recreational Self-Supply
- Thermoelectric Power Generation Self-Supply
- Agricultural Self-Supply

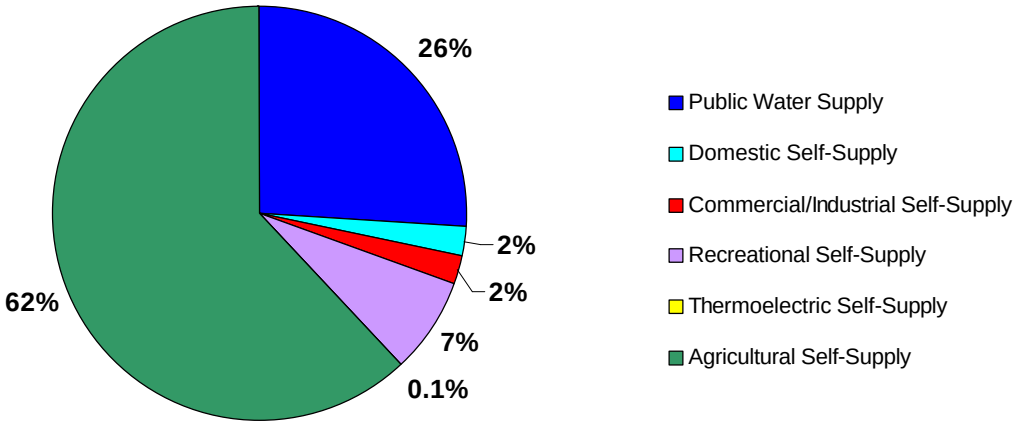
Districtwide, population residing in the District was assessed at 5,755,634 in 1995, with associated urban demands of 521,011 million gallons per year (mgy), or average daily demands of 1,427 million gallons per day (mgd). Irrigated agricultural acreage in the District was assessed at 1,075,993 acres in 1995 with associated demands of 847,699 mgy, or average daily demands of 2,322 mgd. Actual daily demand levels vary seasonally, especially agricultural irrigation demands.

Total freshwater withdrawals for the entire District were assessed at 1,368,710 mgy in 1995, or an average daily demand level of 3,750 mgd. **Table 4** and **Figure 18** show the average daily withdrawals and percentage of total demands for 1995. Demand projections for 2020, and a more detailed water use analysis may be found in **Chapter 3**, or the DWSA (SFWMD, 1998b).

Table 4. Water Demands for the Six Categories of Use for the District in 1995.

Category	1995 Average Water Demand (mgd)	Percent of Total Water Demand
Public Water Supply	975.3	26.0%
Domestic Self-Supply	91.1	2.4%
Commercial/Industrial Self-Supply	84.3	2.2%
Recreational Self-Supply	273.9	7.3%
Thermoelectric Self-Supply	2.8	0.1%
Agricultural Self-Supply	2,322.5	61.9%
District Total	3,749.9	

Water Demands for the Six Categories of Use for the SFWMD in 1995



Water Demands for the Four Planning Regions in the SFWMD in 1995

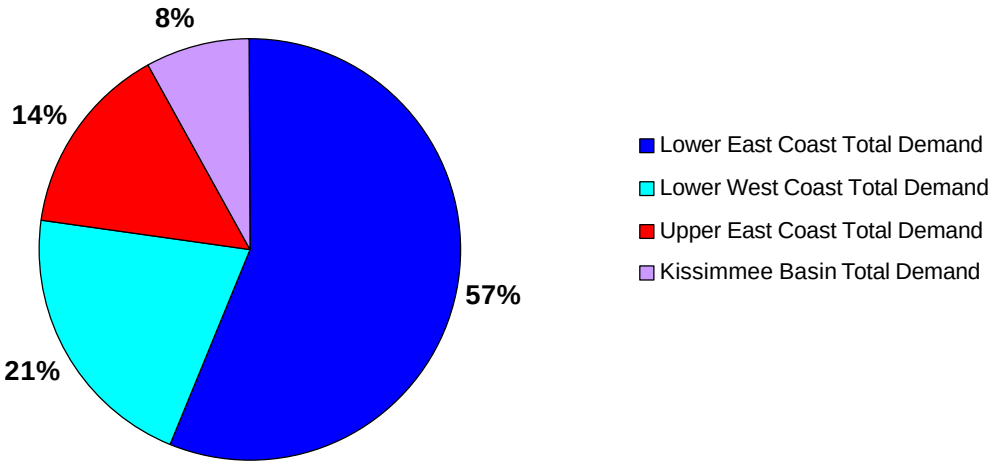


Figure 18. Proportional Distribution Among Six Categories of Water Use in the SFWMD and Among the Four SFWMD Planning Regions.

DISTRICT ACCOMPLISHMENTS SINCE THE 1995 DWMP

The District, in its 1995 DWMP (SFWMD, 1995a), established an ambitious schedule of activities. This schedule called for activities in each area of responsibility in the years following the plan's acceptance. The District has, for the most part, adhered to the schedule of activities described in the original DWMP (**Table 5**). DWMP Annual Reports (SFWMD, 1996, 1997a, 1998a) have included the status of the projects described in the 1995 DWMP. The status of activities for FY2000 is described below.

The 1995 DWMP described 54 District activities that would be under way or completed by the end of FY2000. Of these, 14 are ongoing activities with no fixed end date. Of the remaining 40 activities, two have been superseded or canceled and 23 have been completed. The District is continuing to work on the remaining 15 activities. Nine activities are behind the schedule that was described in the 1995 DWMP, while the remaining six activities are on schedule. If compliance is considered to be one minus the proportion of activities behind schedule, then this represents a compliance rate of 68 percent in 1996, 70 percent 1997, 73 percent in 1998, 70 percent in 1999, and 83 percent in 2000 with the schedule established in the 1995 DWMP.

Among the 54 activities, one group of projects has had schedule adjustments outside of the DWMP process. The District, with approval from the FDEP, developed MFLs Priority Lists and Schedules in December 1998 and 1999. These lists and schedules comply with legislation passed in 1997. Each year's list and schedule include revised schedules for the development of MFLs for water bodies within the District. This is an annual list that maybe changed each year.

If these revised schedules for establishing MFLs are considered (rather than the schedule established in the 1995 DWMP) then the present rate of successful compliance would rise to 93 percent. Brief activity summaries are included in each of the DWMP annual reports (SFWMD, 1996, 1997a, 1998a).

CHANGES IN DISTRICT EMPHASIS SINCE THE 1995 DISTRICT WATER MANAGEMENT PLAN

Coordination between water management districts has been emphasized since the 1995 DWMP. The District has formalized several agreements with the state's other water management districts. These include agreements regarding water resource investigation, planning, regulation, natural systems management, and water shortage declarations. The outlines for several planning efforts, including this DWMP, were coordinated with the other water management districts and the FDEP.

The policies and direction of the District are driven by natural resource needs as interpreted by legislation, and have reinforced the District's efforts and emphasis on its six priority projects. Major water resource legislation since 1994 is described in **Appendix A**.

Table 5. Summary of Activities Since the 1995 DWMP.

	Activity	Status
	Water Supply	
1	Water Use Permitting	Ongoing
2	Conservation Program	Ongoing
3	LEC Regional Water Supply Plan	Complete
4	LWC Water Supply Plan	Complete
5	UEC Water Supply Plan	Complete
6	Kissimmee Basin Water Supply Plan	Complete
7	Northwest Dade Lake Belt Plan	Complete
8	Glades/Highlands County Ground Water Reconnaissance	Behind Schedule
9	Okeechobee Regional Water/Sewer Infrastructure	Complete
10	Recharge Mapping	Complete
11	Prime Recharge Designation	Complete
12	Wellhead Protection Program	Ongoing
	Flood Protection	
13	Canal Conveyance Capacity Study	Complete
14	Key West Storm Water Retrofits	Ongoing
15	Western C-9 Detailed Design Workshop	Complete
16	Big Cypress Basin Assessment (Watershed Management Plan)	Complete
17	Watershed Interactive Network	Complete
18	Lake Istokpoga Study	Complete
19	Okeechobee County Surface Water Management	Complete
20	Boggy Creek Drainage Study	Complete
	Water Quality	
21	Water Quality Monitoring	Ongoing
22	Everglades Surface Water Improvement Management (SWIM)	N/A[a]
23	Everglades Program	On Schedule
24	Upper Kissimmee Chain of Lakes Plan	Behind Schedule
25	Biscayne Bay SWIM	Complete
26	Lake Okeechobee SWIM	Complete
27	Florida Keys Water Quality Plan	On Schedule
28	Florida Keys National Marine Sanctuary Water Quality Program	Ongoing
29	Florida Bay Water Quality Program	Complete
30	Indian River Lagoon SWIM	Complete
31	Miami River Water Quality Commission	Complete
32	Moore Haven Wastewater Feasibility Study	Complete
	Natural Systems Management	
33	Environmental Resource Permitting	Ongoing
34	Save Our Rivers Acquisitions	Ongoing
35	Aquatic Plant Maintenance	Ongoing
36	Melaleuca Task Force	Ongoing
37	Exotic Plant Control	Ongoing

Table 5. Summary of Activities Since the 1995 DWMP.

Activity		Status
38	C&SF Project Comprehensive Review Study (Restudy)/ Comprehensive Everglades Restoration Plan (CERP)	On Schedule[b]
39	Restudy/Indian River Lagoon	Behind Schedule
40	East Coast Buffer/Water Preserve Areas	On Schedule
41	Kissimmee River Restoration	On Schedule
42	Florida Keys Advanced Identification	Ongoing
43	Florida Panther Wildlife Refuge Protection	Ongoing
44	Taylor Slough Demonstration Project	Complete
45	Lake Okeechobee MFLs	Behind Schedule[c]
46	Big Cypress National Preserve	N/A[a]
47	Caloosahatchee Estuary	Behind Schedule[c]
48	Biscayne Aquifer	On Schedule
49	Loxahatchee Estuary MFLs[d] St. Lucie Estuary MFLs[d] UEC Florida Aquifer MFLs[d]	Behind Schedule[c] Behind Schedule[c] N/A[a]
50	Everglades MFLs	Behind Schedule[c]
51	Florida Bay MFLs	Behind Schedule[c]
52	LWC Surficial Aquifer System MFLs	Behind Schedule
General Activities		
53	Comprehensive Plan Review	Ongoing
54	Lake Okeechobee Detailed Design Workshops	Complete

a. N/A indicates that the activity has been superseded or canceled.

b. The Restudy was submitted to Congress on July 1, 1999; The CERP is on schedule.

c. Activity rescheduled with FDEP approval and is on the new schedule.

d. The Loxahatchee Estuary, St. Lucie Estuary, and UEC Floridan Aquifer MFL activities are jointly listed in all DWMP annual reports.

The SFWMD has identified six major efforts as being its main priorities at present and into the foreseeable future. The District has intensified its efforts on those projects since the 1995 DWMP. These efforts are described below (the order does not imply priority level):

- Operation, Maintenance, and Modernization of the C&SF Project
- Regional Water Resource Planning and Implementation
- Kissimmee River Basin Restoration
- Lake Okeechobee Restoration
- Everglades and Florida Bay Restoration
- Comprehensive Everglades Restoration Plan (CERP) (i.e., implementation of the C&SF Project Comprehensive Review Study)

Operation, Maintenance, and Modernization of the C&SF Project

The C&SF Project was designed following the 1947 flood, and the majority of its structures were built in the 1950s and early 1960s. The C&SF Project consists of 292 primary water control structures, 27 pump stations, 1,800 miles of canals, and 2,000 secondary structures. The components of the C&SF Project (which are further described in **Chapter 4**) typically range in age from 30 to 50 years. Due to the age of this infrastructure, the District annually allocates capital funds for the maintenance necessary to provide flood control and water supply readiness. These funds are allocated in the form of individual projects that target major components of the C&SF Project. The projects include improvements and upgrades through automation; pump station repair and restoration; gravity structure repair and restoration; levee repair; and canal conveyance dredging. These funds are not used for capital expansion. Typically, elements of large restoration projects such as the Everglades Construction Project and Kissimmee River Restoration are addressed as separately funded programs.

The C&SF Project system design was based on projected land uses that were primarily agricultural. When the C&SF Project was designed, its primary function was flood protection and water control. The C&SF Project provided additional benefits to water supply, fish and wildlife preservation, and other functions. Since the construction of the C&SF Project, the District's responsibilities have expanded to emphasize other aspects of water resource management. The operational goals have become broader and more complex than the system was originally designed to meet, resulting in the C&SF Project being pushed beyond its original design objectives.

In addition to the canal network and the corresponding structures (spillways, culverts, weirs, and pump stations) required to operate it, the C&SF Project includes Lake Okeechobee and the three WCAs. Lake Okeechobee has a surface area of 730 square miles and a maximum storage capacity of 1.05 trillion gallons (SFWMD, 1997b). The WCAs are set aside for water storage, natural system preservation, and fish and wildlife benefits.

The District presently operates and maintains the C&SF Project to accomplish the following objectives:

- Ensure the reliability and integrity of the system, through routine inspection, maintenance, and replacement of system components (i.e., water control structures, levees, canals)
- Optimize flood protection, water supply, and natural system benefits
- Improve the District's operational ability to anticipate and respond to the water resource management demands on the system, using the best available science and technology

The District has developed and implemented an effective maintenance and modernization program that is continuously evaluated and upgraded. This program has allowed the original components of the C&SF Project to remain in operation.

Realistically, many of the components have met, or are nearing the end, of their design life cycle. Examples include electrical systems and engines of the pump stations, secondary inflow culverts (project culverts) that were installed nearly 40 years ago, and the canals themselves that have accumulated sediment over the past 40 to 50 years.

Much progress is being made through selected projects using limited resources. The principle components of the pump station electrical systems, as of October 1999, have been almost completely replaced. The Canal Conveyance Capacity Program and other multiyear projects are currently in progress. The completion of these and other projects will provide operational reliability for the C&SF Project.

Regional Water Resource Planning and Implementation

This priority includes all water management planning and the implementation of those plans, including this DWMP. Within this category, water supply planning is presently the District's focus. However, the District also has planning efforts that address water quality, flood control, and natural systems. Previous water supply planning efforts by the District include the following: the *Water Supply Needs and Sources Document 1990-2010* (SFWMD, 1992a); the DWSA (SFWMD, 1998b), the *Lower West Coast Water Supply Plan* (SFWMD, 2000c); the *Interim Plan for Lower East Coast Regional Water Supply Plan* (SFWMD, 1998c); the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) the *Upper East Coast Water Supply Plan* (SFWMD, 1998d); the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a). With the exception of the *Upper East Coast Water Supply Plan*, these planning efforts have had a future planning horizon through 2010. In many cases, however, the demand levels analyzed far exceed the current 2010 projections due to the slowing of population and irrigated agricultural acreage growth rates.

During the 1997 legislative session, significant amendments were made to the Florida Water Resources Act of 1972 (Chapter 373, F.S.) regarding regional water supply planning. Section 373.036(2)(b)4, F.S., required each water management district to prepare a districtwide water supply assessment, and to then prepare water supply plans for regions that are anticipated to have the potential of demand outstripping available supply by 2020. These regional water supply plans identify specific geographical areas that have water resource problems that are critical or are anticipated to become critical by 2020. For these critical areas, the regional plans detail remedial or preventive measures including water resource development projects, water supply development projects, and operational and regulatory strategies. The regional plans also serve as a means of identifying areas where collection of resource data and technical studies are necessary.

The District has committed to preparing water supply plans for each of its four planning regions, which cumulatively cover the entire District. Water supply plans for the planning regions have been sequenced based on the history of water shortage problems in each region. The LWC was the first to be initiated, followed by plans for the LEC, UEC and the Kissimmee Basin. Each plan was developed in conjunction with an advisory committee composed of interested parties and chaired by a Governing Board member.

The District's water supply planning status for the four planning regions is as follows:

- The *Lower West Coast Water Supply Plan* (SFWMD, 2000c) was completed in 2000.
- The *Interim Plan for Lower East Coast Water Supply* (SFWMD, 1998c) was completed in 1998. The analyses within this document was expanded in the *Lower East Coast Regional Water Supply Plan* completed in 2000 (SFWMD, 2000b).
- The *Upper East Coast Water Supply Plan*, meeting the full water supply planning requirements of Chapter 373, F.S., was completed in 1998, and is currently being implemented.
- The *Kissimmee Basin Water Supply Plan* was completed in 2000.

In addition to the regional water supply plans, the District has also initiated the development of several subregional plans. Subregional planning efforts that are being initiated by the District include the *Caloosahatchee Water Management Plan*, the *North Palm Beach County Comprehensive Water Management Plan*, the *Southeast Palm Beach County Integrated Water Resource Strategy*, and the *Eastern Broward County Integrated Water Resource Plan*.

Water quality planning efforts by the District include Surface Water Improvement and Management (SWIM) plans as well as non-SWIM plans that address water quality. Since the SWIM program was initiated in 1987, the District has prepared a priority list of all water bodies within the District. SWIM plans have been developed for the Indian River Lagoon (SFWMD and SJRWMD, 1994), Lake Okeechobee (SFWMD, 1997b), Biscayne Bay (SFWMD, 1995b), and the Everglades (SFWMD, 1992b). The Everglades SWIM Plan was superseded by the Everglades Forever Act. In addition to improvement of water quality SWIM plans have also identified needs for restoration of natural ecosystem functions within the target water bodies. Since 1995, legislative appropriations for the SWIM Program have declined significantly, although the mandate to conduct the program still exists. In addition to SWIM plans, a water quality plan has been developed for the Florida Keys, and a water management plan that addresses water quality is presently being developed for the Kissimmee Chain of Lakes. Flood protection plans have been developed by the District in the past, but presently the only flood plans being prepared are for the Big Cypress Basin and for southern Lee County, although several other planning efforts consider flooding impacts.

District natural system planning efforts include the natural system restoration components of the C&SF Project Comprehensive Review Study (Restudy) and the CERP; the development of MFLs (which are a subset of the regional water supply planning efforts); the development of rainfall-driven schedules for the Everglades; establishing economic and hydrologic needs for the Everglades Protection Area; the South Miami-Dade County Integrated Water Resource Strategy; SWIM Plans; and land management plans for District holdings.

Kissimmee River Basin Restoration

Between 1962 and 1971, as part of the C&SF Project, the meandering Kissimmee River and flanking floodplain were channelized and transformed into a 30-foot deep central drainage canal (C-38), which was compartmentalized with levees and dam-like water control structures into a series of five pools. Channelization was done primarily to provide an outlet canal for draining floodwaters from the developing Upper Kissimmee Basin, but also to provide flood protection for lands adjacent to the river. The construction of the C-38 Canal took 10 years and satisfied the need for greater flood protection throughout the Kissimmee River Basin. But even before the work was complete, area residents and naturalists realized the channelization had destroyed valuable fish and wildlife habitat. Ninety percent of the wading bird population was lost, as was more than 70 percent of the nesting habitat for bald eagles. The once rich fishery was replaced by increasingly dominant populations of rough fish (i.e. fish species considered to be of poor fighting quality when taken on tackle or of poor eating quality).

The Kissimmee River restoration initiative began as a grassroots movement during the latter stages of channelization when concerned citizens and members of the environmental community voiced concerns regarding perceived environmental impacts of the flood control project. Subsequent studies documented the nature of these impacts to the Kissimmee River and its surrounding ecosystem, including the loss of 30,000 to 35,000 acres of wetlands, a major reduction in wading bird and waterfowl usage, and a continuing long-term decline in game fish populations.

These impacts provided the impetus for over 20 years of state and federally mandated restoration related studies, which culminated in the development of a restoration plan that was authorized for implementation as a state-federal partnership in the 1992 Water Resources Development Act. The restoration project will restore over 40 square miles of river and associated floodplain wetlands, and will benefit over 320 fish and wildlife species, including the endangered bald eagle, wood stork, and snail kite.

This will be accomplished by restoring 43 contiguous miles of the 56-mile long flood control canal, and removing two of the five water control structures within this reach of backfilled canal. Spoil banks composed of excavated sand and shell from the original channelization, which occur along the canal, will provide the source of this backfill material. Another important component of the restoration project is to modify the timing of water inflows to the river from the Kissimmee Chain of Lakes. This will be accomplished by raising the high water level in Lakes Kissimmee, Hatchineha and Cypress one foot higher than is currently allowed. This additional storage will provide the ability to reestablish continuous inflows and a more natural seasonal pattern of high and low flows to the restored river.

The total cost of the restoration project is estimated at $490 million, which will be equally cost-shared by the State of Florida and the federal government. Most of the state's fiscal responsibility will occur as land acquisition, through funds provided by the SOR and Preservation 2000 programs. The federal portion of the project cost will be provided

through annual budgetary appropriations. The first phase of canal backfilling began in the summer of 1999, and reconstruction is scheduled to be completed in 2011.

Reestablishment of floodplain wetlands and the associated nutrient filtration function is expected to result in decreased nutrient loads to Lake Okeechobee. It is also possible that restoration of the Kissimmee River floodplain could benefit populations of key avian species, such as wading birds and waterfowl, throughout South Florida by providing increased feeding and breeding habitat and refuge during adverse conditions.

Lake Okeechobee Restoration

Lake Okeechobee is the largest lake in Florida and the key surface water component of the South Florida ecosystem. The lake is extensively managed for flood control, water supply, and recreation, and past water management decisions have significantly impacted the lake and its associated downstream ecosystems (e.g. the Everglades, the Caloosahatchee River and Estuary and the St. Lucie River and Estuary). The initial lowering of its water level and the construction of an encompassing dike greatly modified Lake Okeechobee. These actions reduced its size and isolated it from its original extensive, dynamic system of littoral zone and floodplain. As a result of the managed water levels that existed between the early 1950s to the late 1970s, a new diverse 150-square mile littoral marsh was formed within the now well-defined 730-square mile lake.

Continuing ecosystem problems in Lake Okeechobee are primarily a result of nutrient runoff from ranching, dairy, and agricultural lands; a lake regulation schedule which places water supply and flood control concerns ahead of the ecological health of the lake; and invasion by exotic plants. High water levels and excessive phosphorus inputs have contributed to a significant degradation of the health of the native flora and fauna in Lake Okeechobee. Since 1978, when the regulation schedule for the lake was raised, frequent long periods of high water levels have resulted in significant changes in the native vegetation in the lake's large littoral zone. Excessive phosphorus inflows have increased the in-lake phosphorus concentrations, and contributed to more frequent damaging algal blooms. Major increases have occurred in the populations of blue-green algae and pollution-tolerant, bottom-dwelling animals. Also, sediment has accumulated in the lake that has exacerbated this problem. Exotic plants have displaced large areas of native vegetation in the lake. Major efforts to reduce phosphorus loads have been undertaken and significant progress has been made, particularly in reducing loading from dairies. However, since the average annual phosphorus load to the lake currently exceeds the target by about 100 tons per year, significant restoration work remains.

The Lake Okeechobee Program provides overall coordination of restoration efforts for the lake. It includes efforts on key management issues, including the following: reduction of external phosphorus loads to the lake; evaluation of the feasibility of removing in-lake sediments; effective eradication of exotic plants; and implementation of a modified lake regulation schedule. The District has been working with the USACE in evaluating alternative regulation schedules that might allow lower water levels without

significantly impacting water supply. The USACE is finalizing an Environmental Impact Statement recommending a new regulation schedule.

The District is working with the FDEP to update the current permit for District water control structures discharging into Lake Okeechobee. The intent is to guide implementation of measures necessary to reach phosphorus targets throughout the lake. The permit will be updated through a consent order with requirements that include continuation of regulatory programs in the basin; construction of pilot STAs and large-scale, reservoir-assisted STAs; a feasibility study to remove accumulated sediment in the lake; studies and data collection to reduce modeling uncertainty; and continued research and monitoring. To accomplish these activities, the District modified its Lake Okeechobee Program, beginning in FY2000, in order to expedite initiation of the required actions.

The USACE and the District are continuing programs to control melaleuca in Lake Okeechobee. The District is also researching methods to control torpedo grass. When this research is complete, the FDEP will assist in implementation of the recommended treatment methods.

Everglades and Florida Bay Restoration

Everglades and Florida Bay restoration involves the implementation of the ECP, the Everglades Stormwater Program, the C-111 Project, the Modified Water Deliveries Project, and other aspects of research and management for the Everglades and Florida Bay ecosystem separate from the CERP. Several of these projects derive from the Everglades Forever Act. That act, passed by the Florida Legislature in 1994, is a comprehensive approach to restoration, relying on a combination of construction, land acquisition, regulation, and extensive research and monitoring. Research provides the foundation for understanding and preserving the Everglades ecosystem and restoration efforts are intended to provide nutrient levels in the system that will not adversely impact native Everglades flora and fauna.

Everglades Construction Project

The ECP forms the foundation for the largest ecosystem restoration program in the history of Florida. The ECP is composed of 12 interrelated construction projects located between Lake Okeechobee and the Everglades. The cornerstone of the ECP is a group of six large constructed wetlands totaling over 47,000 acres. These STAs will use natural biological and geological processes to reduce the levels of phosphorus that enter the Everglades to an interim goal of 50 parts per billion (ppb). The Everglades Nutrient Removal (ENR) project, which is a prototype STA, has been operating for three years and is effectively reducing phosphorus levels below 25 ppb. In addition to the STAs, the ECP contains four hydropattern restoration projects that will improve the volume, timing, and distribution of water entering the Everglades. Construction began in 1997, and the last of the STAs is scheduled to be complete in October 2003, with ancillary facilities completed by 2006. The local share of design, construction, and land acquisition costs for the ECP is estimated to be approximately $506 million. When combined with the federal share of

$190 million, this brings the total estimate of capital costs to $696 million through 2006. The operation and maintenance of the ECP is anticipated to cost $133 million through 2014. This brings the total estimated cost of the project to $829 million. As of September 30, 1999, approximately $314 million had been expended for the ECP of which $280 million was nonfederal.

Everglades Stormwater Program

The Everglades Stormwater Program (formerly known as the Non-ECP initiative) was mandated by the 1994 Everglades Forever Act. The purpose of this program is to ensure that water quality standards are met by the end of 2006 at all structures that the District controls and pumps water into, within, or from the Everglades Protection Area, which are not within the ECP. The basins discharging through these structures include existing urban, agricultural, and Indian reservation lands. Compliance with water quality standards will be achieved through implementing the Non-ECP permit, water quality monitoring, water quality improvement strategies, and solutions such as Best Management Practices (BMPs) or construction projects. Other components of the program include a public education campaign and developing a method for reimbursement of expenditures through a special assessment authorized by the Everglades Forever Act.

C-111 Project

The C-111 Project consists of both structural and nonstructural modifications to the existing components of the C&SF Project within the C-111 Basin that promote more natural hydroperiods in Taylor Slough (a freshwater source for Florida Bay) and the eastern panhandle ecosystems of Everglades National Park. The C-111 Project modifications will be designed and operated to store and disperse the flows of water needed for Taylor Slough restoration. This will assist in Florida Bay restoration, as the bay's decline has been associated with a long-term increase in salinity that resulted from the diversion of fresh water away from Florida Bay via the C&SF Project canal system. Land acquisition, design, construction, and operation for the C-111 Project will be undertaken by the District and the USACE under the terms and conditions agreed to in the C-111 Project Cooperative Agreement entered into in January 1995. The USACE is authorized by the Water Resource Development Act (1996) to consider state water quality standards and add water quality features as needed. Total cost is estimated at $147 million. The District is currently obliged to pay 20 percent of construction and 100 percent of land acquisition costs.

Modified Water Deliveries Project

The Everglades National Park Protection and Expansion Act passed by Congress in 1989 authorized the USACE to modify the C&SF Project to improve freshwater deliveries to ENP via Shark River Slough (along with Taylor Slough, the only sources of fresh water for Florida Bay). The Modified Water Deliveries project that resulted from this legislation includes construction of gated culvert structures, concrete headwall structures, spillways, raising a portion of the Tamiami Trail, and flood mitigation of the

8 1/2 square mile area. Total cost of the Modified Water Deliveries Project is estimated at $110 million.

The Comprehensive Everglades Restoration Plan (Restudy Implementation)

The C&SF Project provides water supply and flood protection for the District South Florida's hydrology is now largely governed by a man-made system superimposed on the natural one. Although it has provided for urban and agricultural uses since its inception in 1948, the C&SF Project and the greater-than-expected growth and development that has ensued have unintentionally resulted in extensive damage to the South Florida environment. Over half of the original Everglades have been destroyed and the damage continues. Water is sent to tide through events such as the very wet spring of 1998, involving over 1.4 million acre-ft of emergency Lake Okeechobee flood control releases to the Caloosahatchee and St. Lucie estuaries. These releases caused major environmental, economic, and human impacts in those estuaries and later resulted in a subsequent need for the lost water as the region headed into drought conditions. Without a change to the current design and operation of the C&SF Project, forecasts project the continued loss of uplands; degradation of wetlands, estuaries, and aquatic life; increased water shortages for agricultural and urban uses; increased flooding; and the loss or forced movement of wellfields.

In 1992, Congress authorized the USACE to undertake a reexamination or restudy of the C&SF Project. The purpose of the C&SF Project Comprehensive Review Study (Restudy) was to determine the means by which the C&SF Project can be modified to restore the South Florida ecosystem, while providing for the other water-related needs of the region. The USACE and the District jointly developed a Project Study Plan for the Restudy, which was approved by the District's Governing Board in July 1995, to provide guidance for all subsequent phases of the Restudy. It was amended in May 1997, following the Water Resources Development Act of 1996. The USACE and the District established a series of interagency Restudy teams that began developing and commenting on Restudy alternatives. This effort started in September 1997 and culminated in June 1998 with the selection of an Initial Draft Plan. On October 15, 1998, the *Central and Southern Florida Flood Control Project Comprehensive Review Study Draft Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1998), which contains the recommended comprehensive plan, was released and the USACE and the District immediately began a series of 12 public meetings throughout South Florida to actively solicit public comment on the plan. The *Central and Southern Florida Flood Control Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1999) was completed in April 1999 and submitted to Congress on July 1, 1999.

The keys to Everglades restoration have been determined in the Restudy to be increase the amount of water available, ensure adequate water quality, and reconnect the parts of the system. A key aim is to annually regain, for beneficial use, about two million acre-feet of excess water currently being discharged to tide for flood control.

The recommendations made within the Restudy (i.e. structural and operational modifications to the C&SF Project) are being further refined and will be implemented in the Comprehensive Everglades Restoration Plan (CERP). The CERP is intended to be a retrofit and environmental remediation program to satisfy both the needs of the natural system and to provide water supply, flood protection, and quality water for South Florida users. The estimated cost of implementing the recommended CERP is $7.8 billion over approximately 25 years, with an annual operation, maintenance, and monitoring cost of $175 million. The CERP is being equally funded by the State of Florida and the federal government.

Comprehensive Everglades Restoration Plan Goals

The overall goal of the CERP is to enhance ecologic and economic values and social well being. Specific goals which will enhance ecologic value are as follows:

- Increase the total spatial extent of natural areas
- Improve habitat and functional quality
- Improve native plant and animal species abundance and diversity

Specific goals which will enhance economic values and social well being are as follows:

- Increase availability of fresh water (agricultural/municipal and industrial)
- Reduce flood damages (agricultural and urban)
- Provide recreational and navigational opportunities
- Protect cultural and archaeological resources and values

Comprehensive Everglades Restoration Plan Issues

The Restudy identified the following major issues involving the current C&SF Project:

- Too much water is sent to tide
- Estuaries often suffer
- Lake Okeechobee is treated like a reservoir
- The Everglades is not receiving the historic timing and flow of water
- Florida Bay lacks fresh water
- Water quality has deteriorated
- Urban and agricultural water supplies are dwindling
- Flood protection must be maintained

In response to these identified issues, the Restudy was developed to increase South Florida's water supply, while improving water deliveries to its remaining natural areas. The Restudy recommends the following modifications to the existing C&SF Project (USACE and SFWMD, 1999):

Developing Surface Water Storage Reservoirs. A number of water storage areas will be located north of Lake Okeechobee, in the Caloosahatchee and St. Lucie basins, in the EAA, and along western Palm Beach, Broward, and Miami-Dade counties. These areas will store 1.5 million acre-feet of water so that it is not sent to tide.

Creating Water Preserve Areas. Multipurpose water management areas are planned in Palm Beach, Broward, and Miami-Dade counties between urban areas and the eastern Everglades. The Water Preserve Areas will have the ability to treat urban runoff, store water, reduce seepage, and improve existing wetland areas.

Managing Lake Okeechobee as an Ecological Resource. Lake Okeechobee is presently managed for many, often conflicting, uses. The lake's regulation schedule will be changed to reduce the extreme high and low levels that harm the ecology of the lake and its shoreline.

Improving Water Deliveries to Estuaries. Excess rainwater that is discharged to the sea through the Caloosahatchee and St. Lucie rivers is very damaging to the estuary ecology. The recommended plan will greatly reduce these discharges by storing excess rain water in surface and underground water storage areas. In addition, during times of low rainfall, stored water can be retrieved to augment the estuaries.

Developing Underground Water Storage. More than 300 wells will be built to reach the Floridan aquifer. As much as 1.6 billion gpd may be pumped through the wells into underground storage zones. The injected fresh water forms a bubble within the existing underground salt water, and can remain in the same condition in which it was injected for years. During dry times it can be pumped out. This approach, known as Aquifer Storage and Recovery, or ASR, has been used for years on a smaller scale to augment municipal water supplies. A significant amount of water in surface reservoirs is lost through evaporation, and a major advantage of ASR is that water does not evaporate when it is underground. The recommended plan includes 200 wells around Lake Okeechobee, as well as others in the Water Preserve Areas and the Caloosahatchee Basin.

Developing Treatment Wetlands. About 30,000 acres of STAs, will be built to treat urban and agricultural runoff water before it is discharged to natural areas. These are in addition to the over 40,000 acres of man-made wetlands already being constructed to treat water discharged from the EAA.

Sending Water to the Everglades in a Way That Mimics Nature. Additional changes will be made to the rainfall-driven operational plan to improve the timing of water sent to the WCAs and Everglades National Park.

Removing Barriers to Sheetflow. More than 240 miles of C&SF Project canals and levees will be removed to reestablish the natural sheetflow of water through the Everglades. Most of the Miami Canal in WCA-3 will be removed. Twenty miles of the Tamiami Trail (U.S. 41) will be rebuilt with bridges, allowing water to flow as a sheet into Everglades National Park, as it once did naturally. In the Big Cypress Preserve, a north-south levee will be removed to restore some natural overland water flow.

Storing Water in Quarries. Two limestone quarries in northern Miami-Dade County will be converted to water storage reservoirs to supply Florida Bay, the Everglades, and Miami-Dade County residents with water. The area will be ringed with an underground wall to ensure that stored water does not leak.

Reusing Wastewater. The recommended plan includes two advanced wastewater treatment plants in Miami-Dade County. The plants will be capable of making more than 220 mgd of the county's treated wastewater clean enough to discharge into wetlands along Biscayne Bay, and improve water supplies to southern Miami-Dade County and northeastern Shark River Slough (part of the Everglades).

Improving Water Deliveries to Biscayne Bay. The recommended plan will protect and restore Biscayne Bay coastal wetlands and treat storm water runoff before it enters the bay.

Improving Freshwater Flows to Florida Bay. Improved water deliveries to Shark River Slough, Taylor Slough, and the wetlands to the east of the Everglades National Park will send more fresh water to Florida Bay

INFRASTRUCTURE PROJECTS

The District, through the Restudy, has identified a series of water management infrastructure projects (**Figure 19**) that are necessary to accomplish these six major District priorities.

Legend for Figure 19 - Infrastructure Requirements

1. **Kissimmee River Restoration**
2. **North of Lake Okeechobee Storage Reservoir**
3. **Caloosahatchee Estuary Water Supply**
4. **Caloosahatchee Reservoir with ASR and Caloosahatchee Backpumping with STA**
5. **Taylor Creek/Nubbin Slough Storage Reservoir and Treatment Area**
6. **Indian River Lagoon Water Preserve Areas: Storage in the C-23, C-24,C- 25, C- 44, N. and S. Fork Basins**
7. **Revised Lake Okeechobee Regulation Schedule**
8. **St. Lucie Estuary Water Supply**
9. **Lake Okeechobee ASR**
10. **L-8 Project**
11. **WCA-1 Internal Canal Structures**
12. **STA Construction**
13. **EAA Storage Reservoirs**
14. **Modify G-404 and S-140 Pumps**
15. **Water Preserve Areas: Aboveground Storage, ASR, and Seepage Management**
16. **Big Cypress/L-28 Interceptor Modifications**
17. **Partial Decompartmentalization of WCA-3 and Everglades National Park**
18. **LEC Water Conservation and Broward County Secondary Canals Improvements**
19. **Miami-Dade Utility ASR**
20. **Water Preserve Areas: North and Central Lake Belt Storage Areas**
21. **Everglades Rain-Driven Operations**
22. **Modified Water Deliveries**
23. **West and South Miami-Dade County Reuse**
24. **L-31N Levee Improvements for Seepage Management**
25. **Biscayne Bay Coastal Wetlands**
26. **C-111 North Spreader Canal**
27. **Florida Bay Restoration and Other C-111 Projects**
28. **Southern Golden Gate Estates Hydrologic Restoration**
29. **Golden Gate Canal Improvements and ASR**
30. **Lake Trafford Restoration**
31. **Henderson Creek Spreader Canal and Improvements**
32. **Camp Keis Strand Restoration**
33. **WCA-2A Hydropattern Restoration**
34. **WCA-3A Hydropattern Restoration**
35. **Henderson Creek Improvements**
36. **Ten Mile Creek Project**

<u>Other Major Projects (not shown on the map)</u>

Water Resource Development

Critical Restoration Projects

Alternative Water Supply

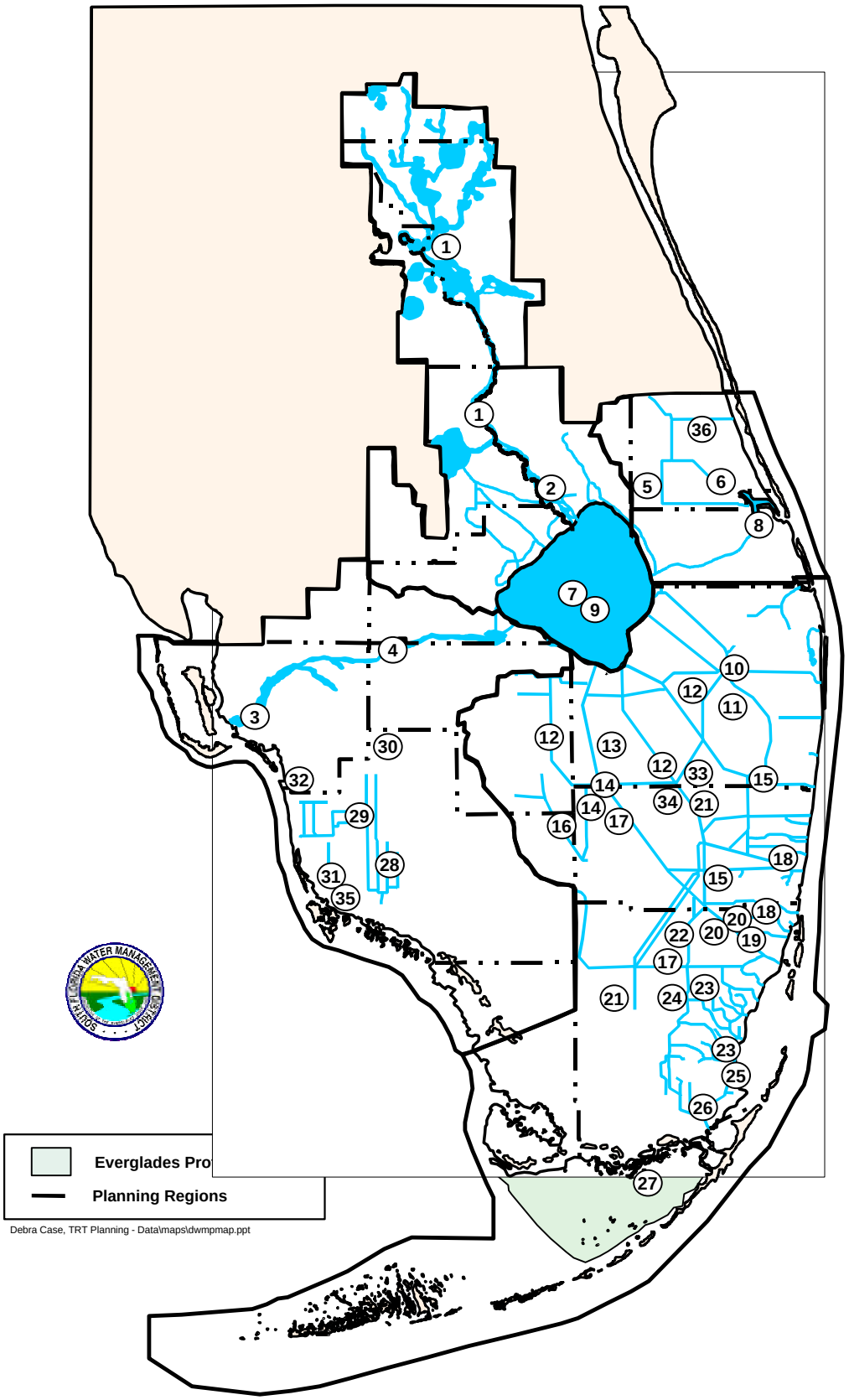


Figure 19. Water Management Infrastructure Needed to Accomplish SFWMD Priorities.

DISTRICT AND OTHER PUBLICLY OWNED LAND

The District is a major landholder in South Florida. It also participates in the protection and preservation of other major public holdings within its boundaries. These public holdings include Everglades National Park, Biscayne Bay National Park, Big Cypress National Preserve, the WCAs, J.W. Corbett Wildlife Management Area (WMA), DuPuis Reserve, Three Lakes WMA, Avon Park Bombing Range, and the Disney Preserve (Walker Ranch).

One of the most important natural resources for the District is the remaining Everglades. This nationally significant resource includes Everglades National Park and the WCAs. The expanse and geographic distribution of these public lands make them key tools for preserving important water resource corridors throughout the District (**Figure 20**). These corridors include major wetland systems and important rivers and sloughs. Many of these wetlands and environmentally sensitive upland areas are associated with rivers or natural flowways such as the Kissimmee and Loxahatchee rivers.

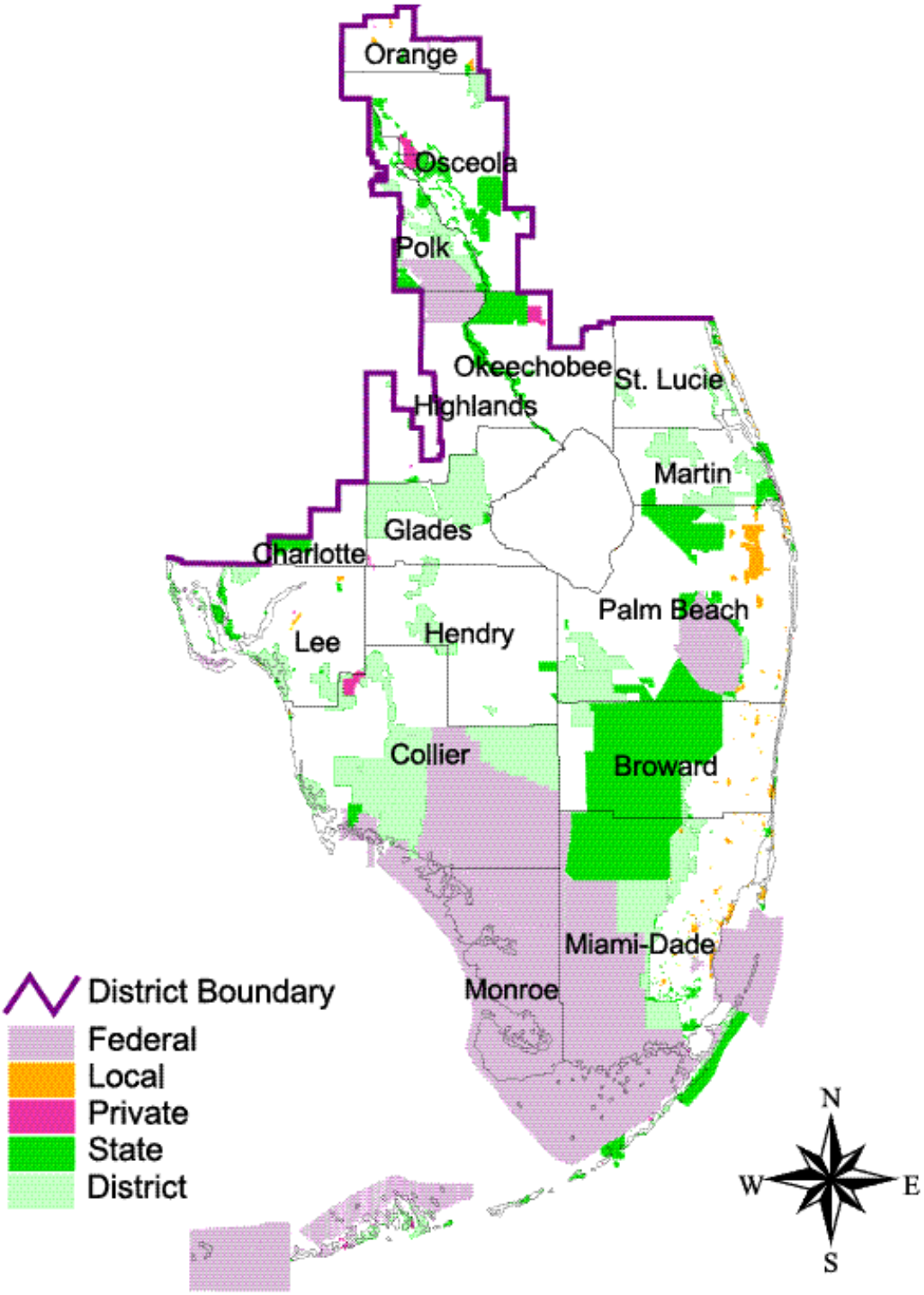


Figure 20. Public Land Ownership within the SFWMD.

Chapter 2
WATER MANAGEMENT GOALS

STATUTORY GUIDANCE

Water management programs and activities are determined by goals set in various state statutes. Long-term state and regional water management planning goals are defined in Chapter 186, F.S. Specific water resource goals are included in the *State Comprehensive Plan*, Chapter 187, F.S. The principal goal for water resource management in Florida is established by the Florida Legislature in Section 187.201(8)(a), F.S.:

> Florida shall assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial and shall maintain the functions of natural systems and the overall present level of surface and ground water quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards.

In addition to the general guidance provided through the *State Comprehensive Plan*, the Florida Water Resources Act of 1972 (Chapter 373, F.S.) and the State Water Resource Implementation Rule (Chapter 62-40, F.A.C.; Subsection 373.019(20), F.S.) provide guidance to water management districts for the development of water resource goals and plans. Goals for the District's areas of responsibility are described in this document in **Chapter 3** through **Chapter 6**. Regional goals are described in **Chapter 7**.

Chapter 373, Florida Statutes, Policy Guidance

Chapter 373, F.S., which established the water management districts, directs the Florida Department of Environmental Protection (FDEP) and water management districts to take into account the cumulative impacts on water resources and manage those resources in a manner to ensure their sustainability. The Florida Legislature further directed those agencies to apply the following policy guidance:

- Provide for the management of water and related land resources
- Promote the conservation, replenishment, recapture, enhancement, development, and proper use of surface and ground water
- Develop and regulate dams, impoundments, reservoirs and other works, and provide water storage for beneficial purposes
- Promote the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems
- Prevent damage from floods, soil erosion, and excessive drainage
- Minimize degradation of water resources caused by the discharge of storm water
- Preserve natural resources, fish, and wildlife

- Promote the public policy set forth in Section 403.021, F.S.
- Promote recreational development, protect public lands, and assist in maintaining the navigability of rivers and harbors
- Promote the health, safety, and general welfare of the people of Florida

Governor's Water Policy

In March 1999, Governor Jeb Bush released the following guiding principles for Florida's water management districts:

- Fiscal accountability - respect for Florida's taxpayers and their hard earned income
- Balance - respect for the multifaceted mission and roles of the water management districts
- Objectivity - independence from interest groups and not singularly reliant on water management staff
- Respect for the rights of property owners

DISTRICT MISSION AND VISION

After a consideration of the enabling and guiding legislation for Florida's water management districts, the SFWMD has adopted the following mission and vision statements.

Mission

The mission of the SFWMD is:

To manage and protect water resources of the region by balancing and improving water quality, flood control, natural systems, and water supply

Vision

The vision of the SFWMD is:

To be the world's premier water resource agency

WATER MANAGEMENT PLANNING

The DWMP provides long-range direction of District activities in two different ways. The first analysis is by area of responsibility, of which the District has four: (1) water supply; (2) flood protection and floodplain management; (3) water quality; and (4) natural systems. DWMP **Chapter 3** through **Chapter 6** examine the condition of water resources within the District, as well as issues related to each area of responsibility, and include the District's goals, objectives, strategies, and performance measures to improve water resource conditions within each area of responsibility, and quantify changes in those conditions.

The second analysis contained in the DWMP is organized by the District's four regional watersheds (**Chapter 7**): LEC, LWC, UEC, and Kissimmee Basin. These regional watersheds cumulatively cover the entire District. This analysis brings together the water resource related issues and concerns of **Chapter 3** through **Chapter 6** into a geographically integrated format by regional watershed, and includes regional goals, assessments, and issues for each of the planning regions.

Goals, Objectives, Strategies, and Performance Measures

The area of responsibility (**Chapter 3** through **Chapter 6**) and watershed analyses (**Chapter 7**) contain a hierarchy of District goals, objectives, strategies, and performance measures for each of the areas of responsibility and regional watersheds.

Goals

Goals are the high level outcomes that the District is trying to bring about. Goals are typically the District's interpretation of the statutory goals provided through legislation. The legislative background for these goals is provided by area of responsibility in **Chapter 3** through **Chapter 6**. Goals identified in the DWMP by area of responsibility are shown in **Table 6**.

Objectives

Objectives are outcomes that represent what the District is trying to achieve at a more focussed level than the described goals. Through meetings between the Executive Office of the Governor, FDEP, Florida Department of Agriculture and Consumer Services (FDACS), and the state's five water management districts, a set of core water management district objectives and performance measures were agreed upon. Core objectives identified in the DWMP by area of responsibility are shown in **Table 7**.

Table 6. Goals for the Areas of Responsibility.

Area of Responsibility	Goals
Water Supply	Assure an adequate supply of water for all existing and projected reasonable beneficial uses
	Increase available water supply
	Promote the use of alternative water supply sources and conservation
	Protect the water quality of source water from degradation and natural systems from significant harm, which would result from water use
Flood Protection and Floodplain Management	Protect from and mitigate for the impacts of flood events
	Protect and restore natural features of floodplains
Water Quality	Protect and improve surface water quality
	Protect and improve ground water quality
Natural Systems	Preserve native ecosystems, along with their water resource related functions
	Restore altered ecosystems, where appropriate, along with their water resource related functions

Table 7. Core Objectives for Each Area of Responsibility.

Area of Responsibility	Core Objectives
Water Supply	**WS 1:** Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs
	WS 2: Prevent contamination of water supply sources
Flood Protection and Floodplain Management	**FP 1:** Minimize damage from flooding
	FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain
Water Quality	**WQ 1:** Protect and improve surface water quality
	WQ 2: Protect and improve ground water quality
Natural Systems	**NS 1:** Maintain the integrity and functions of water resources and related natural systems
	NS 2: Restore degraded water resources and related natural systems to a naturally functioning condition

Strategies

A strategies is the means by which the District reaches an objective. Strategies related to the District's goals and objectives are described by area of responsibility in **Chapter 3** through **Chapter 6** and by regional watershed in **Chapter 7**. In these chapters the District has defined its strategies (programs, projects, and other activities) in order to meet its objectives. The activity tables in **Chapter 3** through **Chapter 6** list the major strategies that will be utilized by the District on an area of responsibility basis. The strategies discussed in **Chapter 7** reflect these major strategies, as well as additional, regionally specific tasks.

Performance Measures

Performance measures are used to track and report the District's accomplishments, both in terms of outputs and outcomes. Outputs are the services delivered by the District. Outcomes are the effects of District actions on water resources.

Core objectives and core performance measures for each of the four areas of responsibility were agreed upon through extensive meetings between the Executive Office of the Governor, FDEP, FDACS, and the state's five water management districts. Water management districts have the option of adding performance measures, and the SFWMD has done so as proposed by the agency's senior level management. Performance measures are to be used by all five of the state's water management districts as of October 1, 1999.

The objectives and their associated performance measures for each of the areas of responsibility are listed below.

Performance Measures Common to all Areas of Responsibility

- **Core CM(a):** Acres in managed conservation areas acquired by the District
- **Core CM(b):** For District-owned lands: 1) number of management plans required; 2) number of management plans completed; and 3) percentage of management plans completed on schedule
- **Core CM(c):** Number and percent of land management plan activities being implemented according to plan schedules
- **Core CM(d):** Acres of land acquired through less-than-fee simple ownership, on an annual and cumulative basis
- **Core CM(e):** Percentage of Environmental Resource Permitting (ERP) permits for which compliance inspections were conducted, and of those inspected, percentage found to be in compliance

Water Supply

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs

Performance Measures for Core Objective WS 1

- **Core WS 1(a):** Percentage of domestic wastewater reuse
- **Core WS 1(b):** Gross per capita water use (public supply) by District and water supply planning region
- **Core WS 1(c):** Within each water supply planning region: 1) the estimated amount of water supply to be made available through the water resource development component of the regional water supply plan; 2) percent of estimated amount under development; and 3) percent of estimated amount of water actually made available
- **Core WS 1(d):** Within each water supply planning region, the estimated additional quantities of water supply made available through District water supply development assistance

Core Objective WS 2: Prevent contamination of water supplies

Performance Measures for Core Objective WS 2

- **Core WS 2(a):** Percentage of surface water supply sources for which water quality fully attains the designated use
- **SFWMD WS 2(b):** Percentage of public water supply wellheads subject to wellhead protection ordinances

Flood Protection and Floodplain Management

Core Objective FP 1: Minimize damage from flooding

Performance Measures for Core Objective FP 1

- **Core FP 1(a):** Percentage of District works maintained on schedule
- **SFWMD FP 1(b):** Number and cost of storm water retrofit projects carried out by the District
- **SFWMD FP 1(c):** Average number of days to complete ERP review and issue a permit once the application is complete
- **SFWMD FP 1(d):** Number of permit applications received
- **SFWMD FP 1(e):** Number of preapplication inspections
- **SFWMD FP 1(f):** Number of permits issued

Core Objective FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain

Performance Measures for Core Objective FP 2

- **Core FP 2(a):** Number of acres identified for acquisition to minimize damage from flooding and the percentage of those acres acquired

Water Quality

Core Objective WQ 1: Protect and improve surface water quality

Performance Measures for Core Objective WQ 1

- **Core WQ 1(a):** Percentage of water segments that fully meet, partially meet, and do not meet their designated uses
- **Core WQ 1(b):** Number and percentage of Surface Water Improvement Management (SWIM) water bodies with approved SWIM plans for which Pollutant Load Reduction Goals (PRLGs) have been established
- **Core WQ 1(c):** Percentage of total stream miles and lake and estuary area in the District assessed for ambient water quality
- **SFWMD WQ 1(d):** Number of SWIM plans being implemented according to SWIM plan schedules
- **SFWMD WQ 1(e):** Number and percentage of permitted systems inspected through the ERP Program, and percentage of those inspected found in compliance with permit conditions

Core Objective WQ 2: Protect and improve ground water quality

Performance Measures for Core Objective WQ 2

- **Core WQ 2(a):** Improving, degrading, and stable trends in ground water quality
- **Core WQ 2(b):** Improving, degrading, and stable trends in nitrate concentrations in springs

Natural Systems

Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems

Performance Measures for Core Objective NS 1

- **Core NS 1(a):** Number and percentage of established Minimum Flows and Levels (MFLs) being maintained consistent with established recovery or prevention strategies
- **Core NS 1(b):** Number of MFLs, by water body type, established annually and cumulatively
- **Core NS 1(c):** Percentage of MFLs established in accordance with the previous year's schedule
- **Core NS 1 (d):** Total acres of wetlands or other surface water authorized by ERP to be impacted and acres required to be created, enhanced, restored, and preserved
- **SFWMD NS 1(e):** Acres of wetlands preserved as a percent of wetland acres reviewed through ERP applications; acres of wetlands reviewed; acres of wetlands impacted; acres of wetlands preserved; and acres of wetlands mitigated (may include wetlands preserved on-site)

Core Objective NS 2: Restore degraded water resources and related natural systems to a naturally functioning condition

Performance Measures for Core Objective NS 2

- **Core NS 2(a):** Acres of invasive nonnative aquatic plants in inventoried public waters
- **Core NS 2(b):** Acres of District managed lands infested with invasive nonnative upland plants by degree of land coverage
- **Core NS 2(c):** Acres of District-owned lands identified in land management plans as needing restoration; acres undergoing restoration; and acres with restoration activities completed
- **SFWMD NS 2(d):** Acres of land infested with invasive nonnative upland plants, by species inventoried
- **SFWMD NS 2(e):** Acres of cattail coverage relative to District 1995 aerial photo maps
- **SFWMD NS 2(f):** Percent increase in wading bird populations as measured by systematic reconnaissance flights

Chapter 3
WATER SUPPLY

GOALS

The State of Florida has statutory goals for water supply. Excerpts from these goals are as follows:

- Florida shall assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial and shall maintain the functions of natural systems and the overall present level of surface and ground water quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards (*State Comprehensive Plan*, Section 187.201(8)(a), F.S.).
- It is the intent of the Legislature that future growth and development planning reflect the limitations of the available ground water or other available water supplies (Section 373.0395, F.S.).
- The encouragement and promotion of water conservation and reuse of reclaimed water, as defined by the Florida Department of Environmental Protection (FDEP), are state objectives (Section 403.064, F.S., and Section 373.205, F.S.).
- The *State Comprehensive Pla*n (Chapter 187, F.S.) states as a goal that Florida "shall maintain the functions of natural systems and the overall present level of surface and ground water quality."
- The *State Comprehensive Plan* (Chapter 187, F.S.) lists as a policy: "Reserve from use that water necessary to support essential nonwithdrawal demands, including navigation, recreation and the protection of fish and wildlife."
- The Water Resources Act of 1972 (Chapter 373, F.S.) states: "The minimum water level shall be the level of ground water in an aquifer and the level of surface water at which further withdrawals would be significantly harmful to the water resources of the area."
- The District's *Water Supply Policy Document* (SFWMD, 1991) affirms that "the District recognizes the state policies which establish priority protection of the water supply required to maintain and enhance healthy natural systems."
- The SFWMD has statutory responsibility to review and comment on comprehensive plans, plan amendments (Chapter 163, F.S.), and the Developments of Regional Impact (DRI) to the Department of Community Affairs. The District provides assistance to local governments in the development and amendments of water resource elements of comprehensive plans and evaluation and appraisal reports.

In order to accomplish these statutory requirements, the SFWMD, during the development of the DWMP, has summarized its goals for water supply as follows:

- Assure an adequate supply of water for all existing and projected reasonable and beneficial uses
- Increase available water supply
- Promote the use of alternative water supply sources and conservation
- Protect the water quality of source water from degradation and natural systems from significant harm, which could result from water use

RESOURCE ASSESSMENT

Needs and Sources

In accordance with Section 373.036(2)(b)4, F.S., the SFWMD prepared a *Districtwide Water Supply Assessment* (DWSA) (SFWMD, 1998b). The DWSA includes water demand assessments and projections, and descriptions of the surface water and ground water resources within each of the SFWMD's four planning regions. Demand assessments for 1995 and projections for 2020 are presented in the DWSA (SFWMD, 1998b) for the following water use categories:

- Public Water Supply (PWS)
- Domestic Self-Supply and Small Public Supply Systems
- Commercial/Industrial Self-Supply
- Recreational Self-Supply
- Thermoelectric Power Generation Self-Supply
- Agricultural Self-Supply

The first five categories of use are associated with population and may be grouped together as urban use. The sixth category, agricultural self-supply, is related to acreage and type of irrigated agricultural crops. Environmental demands are not quantified in the DWSA, but are addressed during the water supply planning process through the incorporation of resource protection criteria.

Table 8 summarizes the water demands assessed for 1995 and projected for 2020 under average rainfall conditions (SFWMD, 1998b). Total District water demands are projected to increase by 24 percent, from 1,368,710 million gallons per year (mgy) in 1995 to 1,698,072 mgy in 2020. Districtwide, population is projected to increase by 43 percent, from 5,755,634 in 1995 to 8,222,781 in 2020. This increase in population will result in an increase in urban water demands, which are projected to rise by 49 percent from 521,011 mgy in 1995 to 777,394 mgy in 2020. Irrigated agricultural acreage is projected to rise by five percent from 1,075,993 acres in 1995 to 1,124,552 acres in 2020.

Annual average agricultural demands are projected to rise by nine percent from 847,699 mgy in 1995 to 920,678 mgy in 2020.

Table 8. Water Demands Assessed for 1995 and Projected for 2020 Under Average Rainfall Conditions.[a]

	Lower East Coast	Lower West Coast	Upper East Coast	Kissimmee Basin	Total District
1995					
Urban Demands (mgy)	385,179	68,412	29,101	38,319	521,011
Agricultural Demands (mgy)	385,118	219,778	168,714	74,089	847,699
Regional Total Demands (mgy)	770,297	288,190	197,815	112,408	1,368,710
Urban Percent of Regional Total	50%	24%	15%	34%	38%
Agricultural Percent of Regional Total	50%	76%	85%	66%	62%
2020 Average					
Urban Demands (mgy)	533,590	126,123	49,433	68,248	777,394
Agricultural Demands (mgy)	356,521	265,031	191,559	107,567	920,678
Regional Total Demands (mgy)	890,111	391,154	240,992	175,815	1,698,072
Urban Percent of Regional Total	60%	32%	21%	39%	46%
Agricultural Percent of Regional Total	40%	68%	79%	61%	54%
1995 to 2020 Average					
Urban Demand Growth	39%	84%	70%	78%	49%
Agricultural Demand Growth	-7%	21%	14%	45%	9%
Total Demand Growth	16%	36%	22%	56%	24%
Population					
Population (1995)	4,518,401	590,939	283,457	362,837	5,755,634
Population (2020)	6,086,700	992,805	456,580	686,696	8,222,781
Population Growth	35%	68%	61%	89%	43%
Irrigated Agricultural Acreage					
Irrigated Agricultural Acreage (1995)	568,995	244,070	185,980	76,948	1,075,993
Irrigated Agricultural Acreage (2020)	503,852	292,578	211,216	116,906	1,124,552
Irrigated Agricultural Acreage Growth	-11%	20%	14%	52%	5%

a. Rates of change in urban and agricultural demand do not exactly equal population and irrigated agricultural acreage rates of change due to the following: mix of categories of use, each with its own trend; crop types with differing evapotranspiration rates; irrigation systems with varying efficiencies; soil types with a range of usable soil water capacities; and dissimilar weather patterns as evidenced by historical records from rainfall stations. Demand projections presented in the DWSA should be considered preliminary and will be modified during the water supply planning process.

Drought conditions in 2020 would further increase demand levels. The DWSA includes projections for demands associated with both average rainfall conditions and those anticipated in a drought. The severity of the drought is defined as having the frequency of occurrence of once in every ten years (as required by Section 373.036, F.S.).

The DWSA also provides utility specific demands for 1995 and projections for 2020 for each PWS utility in the SFWMD with projected pumpage of 0.5 million gallons per day (mgd) or greater in 2020. Locations of the water sources used by PWS utilities are shown in **Figure 21**.

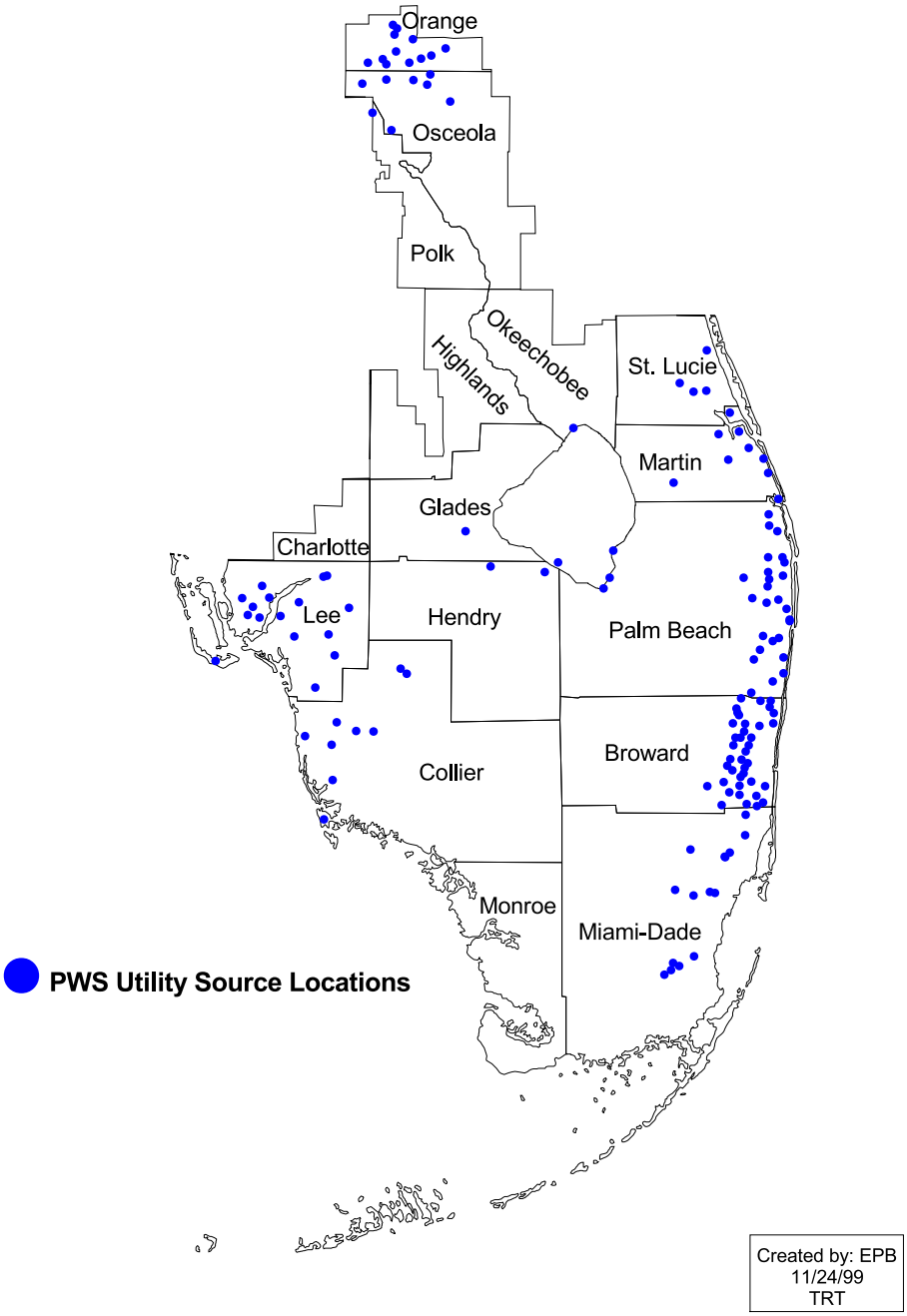


Figure 21. Public Water Supply Utility Source Locations in the SFWMD.

The DWSA also describes conservation strategies by the District to reduce projected demands. These conservation efforts are implemented by the District's Demand Management Program, which incorporates water supply planning, regulation, as well as supplemental measures in order to cultivate a conservation ethic in cooperation with water users.

Planning

The District has developed regional water supply plans for each of its four planning regions that cumulatively cover the entire District. Each regional water supply plan includes an account of needed conservation efforts, and the District aims to bring about necessary water conservation through the implementation of its regional water supply plans.

Regulation

The District's Consumptive Use Permitting (CUP) rules require submission of a water conservation plan by permittees for each water use type. Water conservation plans must address the following elements:

- Public water suppliers: irrigation hours ordinances, Xeriscape® landscape ordinances, ultra-low volume fixture ordinances, rain sensor device ordinances, water conservation-based rate structures, leak detection and repair programs, public education programs, and reclaimed water feasibility analyses
- Commercial/industrial users: water use audits, employee water conservation awareness programs, and implementation of cost-effective conservation measures
- Landscape and golf course users: Xeriscape® landscaping, rain sensor devices, and irrigation hour limitations
- Agricultural users: micro irrigation systems for new citrus and container nursery projects

In addition to CUP requirements, conservation requirements are also incorporated in District recommendations for DRIs. An integrated program between the CUP and local ordinances is created when local governments have adopted the ordinances and established a compliance program. PWS utilities are required to have a leak detection program if their unaccounted-for water is 10 percent or more.

Supplemental Measures

The District has a full-time Water Conservation Officer who works with major water user groups, water and wastewater utilities, and local governments. The Water Conservation Officer assists water users in establishing cost-effective projects and programs specifically tailored for each type of use. Supplemental water conservation measures which show significant savings for major water users are subject to District

funding priorities and cooperative funding partnerships with other state agencies. However, at this time, District budget priorities have been such that grant funding for this initiative will be minimal.

Source Protection

Surface Water

In order to make South Florida more accommodating for human habitation, the natural watercourses were channelized and interconnected to expedite movement of water away from urban or agricultural lands. South Florida presently has an extensive, heavily managed canal network; a series of high-capacity, low-head pumping installations; and several surface water impoundments totaling more than 1,000 square miles. These same canals and structures can be operated either for flood control or water supply purposes. The heart of this modern surface water management system consists of Lake Okeechobee and the interconnected major features of the Central and Southern Florida (C&SF) Project. These include the Kissimmee Chain of Lakes; the Kissimmee River; Lake Okeechobee and its outlets; the Water Conservation Areas (WCAs); Everglades National Park and Florida Bay; and the coastal canal networks of Miami-Dade, Broward, Palm Beach, Martin, and St. Lucie counties.

Lake Okeechobee functions as a primary storage reservoir for excess (flood) waters from lands adjacent to and north of the lake. In addition, the lake provides water supply to downstream basins. Most of the water enters the lake from rainfall, local runoff, and discharge from the Kissimmee River, Fisheating Creek, and Taylor Creek. Water is lost from the lake by evaporation and by discharge to the Everglades Agricultural Area (EAA) through the S-2 and S-3 structures, to the Caloosahatchee River through the S-77 structure, and to the St. Lucie River through the S-308 structure. A schematic of the District's surface water management system is shown in **Figure 24** in **Chapter 4**, and in detail in the Structure and Canal Locations map inserted into this document's front cover.

The EAA, located south and east of Lake Okeechobee, has very little natural drainage and, therefore, depends on the canals and large pump stations to provide protection from flooding. Four major canals traverse the area from north to south. Structures and pumps at the S-2 and S-3 stations release water from Lake Okeechobee into the northern end of the EAA for irrigation during the dry season. These facilities are also occasionally used to pump water into the lake for emergency flood relief. The S-5, S-6, S-7, and S-8 structures pump excess water from the southern portion of the EAA into the WCAs. Additional downstream structures provide for transfer of this water through the WCAs to east coast canals and to the sloughs and wetlands of the Everglades National Park.

Ground Water

Three major aquifer systems have been identified in South Florida. The Floridan Aquifer System is a deep, regionally extensive, artesian limestone system with generally

high transmissivity. The Floridan Aquifer System is the primary source of water supply in the northern counties of the District, and is used as a source of supplemental irrigation water as far south as Martin County. This system receives direct recharge along a structural high, which occurs in the central part of the state. From these recharge areas, the Floridan dips southward and becomes confined by the clays and silts of the Hawthorn Group. The potentiometric surface is highest at the point of primary recharge and decreases to the south. Near Lake Okeechobee the potentiometric surface of the aquifer exceeds land surface, causing Floridan wells to freely flow up to 1,000 gallons/minute (gpm).

The Intermediate Aquifer System is developed within the Hawthorn Group, mainly in southwestern Florida, and includes several aquifers. These leaky artesian aquifers consist of moderately transmissive sandstone or sandy and shelly limestone beds and produce fair-to-poor quality water. In most other parts of the state, the Hawthorn Group is a confining unit, separating the Surficial Aquifer System from the Floridan aquifer.

The Surficial Aquifer System consists of sands, sandy and shelly limestone, sandstone and silts, and contains water table and semiconfined aquifers. A major aquifer in this system is the Biscayne aquifer in Miami-Dade, Broward, and southern Palm Beach counties. This water table aquifer generally contains water of potable quality, and wells in it can yield in excess of 7,000 gpm. Other surficial aquifers have water quality that varies from potable to nonpotable, and yields to wells may vary from a few to over 2,000 gpm.

Three hydrogeologic regions have been identified within the SFWMD. In the northern region, generally north of Lake Okeechobee, water in usable quantity and quality is available from the surficial aquifers and the Floridan Aquifer System. The Floridan Aquifer System yields in excess of 2,000 gpm at the northern limits of the SFWMD and at various points in its recharge area along the central ridge. The District has conducted studies of this aquifer in the general vicinity of Lake Okeechobee and in Martin and St. Lucie counties. These studies have shown that water from the Floridan aquifer generally has high levels of dissolved solids that can be a source of contamination to the surficial aquifers. Use of water from the Floridan aquifer in these areas should be discouraged in favor of the better quality water available from shallow aquifers.

In the southeastern region, only the surficial aquifers are suitable as potable ground water supply sources. The Biscayne aquifer has extremely high transmissivities along the coast and is moderately thick in these areas. Wellfields in this aquifer can generally yield in excess of 2,000 gpm. The operation of wellfields near the coast may be constrained by saltwater intrusion. This aquifer tends to thin out toward the western portions of Miami-Dade and Broward counties, underneath the WCAs, and total ground water yields in these areas are limited. Wellfields in the Biscayne aquifer can be effectively recharged by the WCAs and the coastal canal system.

The southwestern part of the District is characterized by a complex sequence of hydrostratigraphic units representing all three aquifer systems. In this region, water availability is constrained both by high mineralization and low transmissivities in some

aquifers. The most productive aquifers in this area are located in the Surficial and Hawthorn Aquifer Systems in northeastern Collier and southwestern Hendry counties. These aquifers are recharged locally by rainfall in the Immokalee Rise. The District has conducted surveys of ground water resources of Collier and Lee counties that have identified a number of potential areas for future wellfield development.

Water Resource Caution Areas

In most areas within the District, water resources are deemed to be insufficient to meet all local demands, especially during dry periods. In these areas, thresholds for the issuance of consumptive use permits have been reduced to provide additional protection to the resource. Locations of these Water Resource Caution Areas (WRCAs) are shown in **Figure 22**. Based on analyses already completed in the water supply planning process no changes in the WRCA boundaries have been proposed in the Lower West Coast (LWC), Lower East Coast (LEC), and Kissimmee Basin planning regions. In the Upper East Coast (UEC) planning region, it is proposed that the WRCA be reduced from covering the entire region to include only the coastal areas (**Figure 22**).

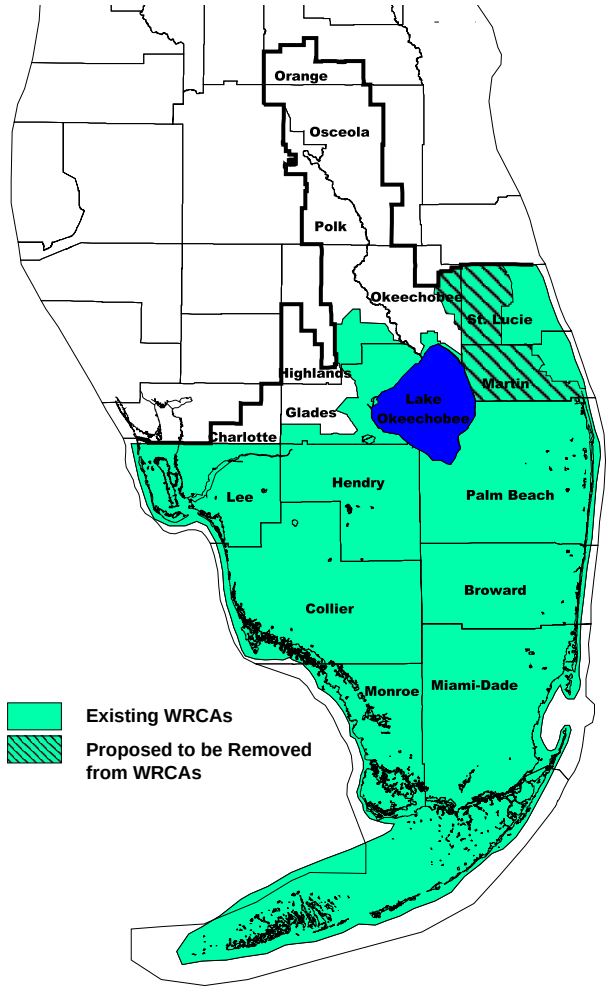


Figure 22. Locations of Designated Water Resource Caution Areas within the SFWMD.

ISSUES

All feasible sources will be considered during the SFWMD's water supply planning process, including conservation, reuse, supply development, and alternative technologies. Selected options must ensure sustainability for natural resources, water quality, and human demands. The water supply planning process to date has raised the following main issues:

Issue 1. Existing and future water demands in certain locations are threatening to exceed sustainable yields from particular sources.

Issue 2. Increased withdrawals in combination with land use changes create the potential for contamination of water supply sources.

Objectives, Strategies, and Performance Measures

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs.

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Operations and Maintenance, Regulation, Outreach, and Monitoring and Evaluation (**Table 9)**.

Performance Measures for Core Objective WS 1

- **Core WS 1(a):** Percentage of domestic wastewater reuse
- **Core WS 1(b):** Gross per capita water use (public supply) by District and water supply planning region
- **Core WS 1(c):** Within each water supply planning region: 1) the estimated amount of water supply to be made available through the water resource development component of the regional water supply plan; 2) percent of estimated amount under development; and 3) percent of estimated amount of water actually made available
- **Core WS 1(d):** Within each water supply planning region, the estimated additional quantities of water supply made available through District water supply development assistance

Table 9. Activities Table for Core Objective WS 1.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs				
		Planning		
Da01	LEC Water Supply Plan Development and Coordination	The LEC Regional Water Supply Plan is a long-range strategy for dealing with the future water supply needs of a growing population, as well as the local environment in the LEC Planning Area. The planning area consists of Palm Beach, Broward, and Miami-Dade counties, as well as portions of Hendry, Collier, and Monroe counties. The plan projects future water demands for urban areas and agriculture for 2020 and develops strategies to meet those demands while also meeting the needs of the environment.	2000	SFWMD
Db01	LWC Water Supply Plan	The LWC Water Supply Plan is a long-range strategy for dealing with the future water supply needs of a growing population, as well as the local environment in the LWC Planning Area. The planning area consists of Lee County, most of Collier and Hendry counties, and portions of Charlotte, Glades, and Monroe counties. The plan projects future water demands for urban areas and agriculture for 2020 and develops strategies to meet those demands while also meeting the needs of the environment.	2000	SFWMD
Jg01	Caloosahatchee Water Management Plan	This activity coordinates implementation projects from the *Caloosahatchee Water Management Plan* (SFWMD, 2000d) approved by the Governing Board in April 2000. The projects are related to the Caloosahatchee River and Estuary, and the river's tributary basins.	2000	SFWMD
Dd01	Kissimmee Basin Water Supply Plan Development	The Kissimmee Basin Water Supply Plan is a long-range strategy for dealing with the future water supply needs of a growing population, as well as the local environment in the Kissimmee Basin Planning Area. The planning area consists of portions of Orange, Osceola, Polk, Highlands, Glades, and Okeechobee counties. The plan projects future water demands for urban areas and agriculture for 2020 and develops strategies to meet these demands while also meeting the needs of the environment.	2000	SFWMD
Da06	Northern Palm Beach County Water Resource Development Program	This program is for the development of a subregional comprehensive plan for northern Palm Beach County. The plan focuses primarily on land areas located within the southern L-8 Basin, the city of West Palm Beach Water Catchment Area/water supply lake system, and the Loxahatchee Slough and associated tributary areas (known collectively as the C-18 Basin).	2001	SFWMD
Dc01	UEC Water Supply Plan Development and Coordination	This UEC Water Supply Plan incorporates development of a regional water supply plan for Martin and St. Lucie counties and eastern Okeechobee County. The plan projects future water demands (for at least a 20-year planning horizon) for urban areas and agriculture, and develops strategies to meet these demands while meeting the needs of the environment. The plan's strategies and recommendations incorporate both regional responsibilities (water resource development) and local responsibilities (water supply development), as well as identifies potential funding sources. The first water supply plan for the UEC was completed in 1998 (SFWMD, 1998d). It is scheduled to be updated in 2003.	2003	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Public Works Construction				
Pb01	Ten Mile Creek Critical Project	The Ten Mile Creek Critical Project is a critical restoration project which was authorized by Congress under Section 528 of the Water Resources Development Act of 1996. The project includes infrastructure improvements for the construction of an aboveground reservoir to receive water from Ten Mile Creek; a gated water-level control structure for the release of water back to the creek from the polishing cell; a gated gravity control structure for draining the facility for maintenance purposes; control structures between the deepwater storage area and the polishing cell for operational control; and an overflow weir. In addition, the project consists of the required planning and design activities, land acquisition, operational, and Best Management Practice (BMP) plans for the basin and reservoir.	2003	SFWMD
Pe04	Western Hillsboro (Site 1) ASR Pilot Project	This pilot project will determine the most suitable sites for the Aquifer Storage and Recovery (ASR) wells in the vicinity of the reservoir and determine the optimum configuration of those wells. The identification of the hydrogeological and geotechnical characteristics of the soils and aquifer will also be determined. The pilot project will also determine the specific water quality characteristics of water within the aquifer, as well as the quality of water proposed for injection and the water quality characteristics of water recovered from the aquifer.	2003	SFWMD
Pc03	L-31N Seepage Management Pilot Project	The purpose of this project is twofold: 1) determine the appropriate technology to control seepage from Everglades National Park and 2) determine the appropriate amount of ground water flow that should be returned to Everglades National Park during the wet season. The ground water flow that is intercepted must be balanced such that impacts to Miami-Dade County's west wellfield and freshwater flows to Biscayne Bay are minimized. Therefore, monitoring will be an important element of the pilot project.	2004	SFWMD
Pe05	Caloosahatchee ASR Pilot Project	This pilot project will identify the most suitable sites for ASR wells in the vicinity of the reservoir and will determine the optimum configuration of those wells. The pilot project will provide information regarding the characteristics of the aquifer system within the Caloosahatchee River Basin, as well as determine the hydrogeological and geotechnical characteristics of the upper Floridan aquifer. The pilot project will also determine the specific water quality characteristics of waters to be injected, the specific water quality characteristics and the amount of water recovered from the aquifer, and the water quality characteristics of water within the receiving aquifer.	2006	SFWMD
Pc09	WCA-3A and WCA-3B Seepage Management	This project includes canals, levees, water control structures, and a Stormwater Treatment Area (STA)/impoundment with a total storage capacity of 6,400 acre-feet located in western Broward County.	2008	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Pc14	Broward County Secondary Canal System	The Broward County Secondary Canal System feature includes a series of water control structures, pumps, and canal improvements located in the C-9, C-12, and C-13 canal basins and the eastern basin of the North New River Canal in central and southern Broward County. The purpose of this feature is to reduce water shortages by recharging local wellfields and stabilizing the saltwater interface. Excess water in the basins will be pumped into the coastal canal systems to maintain canal stages at optimum levels.	2009	SFWMD
Pc16	C-23 and C-24 Basins Water Preserve Area	The C-23 and C-24 Basins Water Preserve Area includes aboveground reservoirs with a total storage capacity of 349,400 acre-feet located in the C-23, C-24, C-25, Northfork, and Southfork basins in St. Lucie and Martin counties. The final location, size, depth, and configuration of these facilities will be determined through detailed analysis to be completed as a part of the Indian River Lagoon Feasibility Study.	2009	SFWMD
Pc04	Lake Belt Technology Pilot Project	This pilot project will determine construction technologies, storage efficiencies, impacts on local hydrology, and water quality effects of in-ground reservoirs. Water quality assessments will include a determination as to whether the in-ground reservoirs and seepage barriers will allow for storage of untreated waters without concerns about ground water contamination.	2012	SFWMD
Pc28	Southern L-8 In-ground Reservoir General Reevaluation Report (GRR)	This project includes a combination aboveground and in-ground reservoir with a total storage capacity of approximately 48,000 acre-feet located immediately west of the L-8 Borrow Canal and north of the C-51 Canal in Palm Beach County.	2014	SFWMD
Pc25	Flows From WCA-3 to the Central Lake Belt Area	Excess water in WCA-3A and WCA-3B will be captured to reduce stages above target stages in WCA-3 and to divert excess water through modified structures at S-9 and S-31 to the Central Lake Belt Storage Area via the L-33 Borrow Canal.	2016	SFWMD
Pc24	Flows From Central Lake Belt Storage Area to WCA-3B	This project includes pumps, water control structures, an STA, and a combination aboveground/in-ground storage reservoir with a total storage capacity of approximately 190,000 acre-feet located in Miami-Dade County.	2017	SFWMD
Da23	Hillsboro (East) ASR Pilot Project	This project includes the installation of one 5.0-mgd ASR well, one upper Floridan aquifer monitoring well, five surficial aquifer supply wells, and raw water piping to convey water from the surficial wells to the ASR well.	2002	SFWMD
Da02	LEC Water Supply Development Implementation	The *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) will be implemented by 1) using regional and local water supply planning efforts to predict when alternative sources will be needed and to provide guidance as to which source may be most appropriate for meeting the particular needs of each user; 2) conducting appropriate hydrologic and ecologic studies to identify the freshwater input needs of the Lake Worth Lagoon; and 3) encouraging the use of any permittable alternative water supply option which would achieve a reduction in saltwater intrusion.	2004	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Da22	Miami-Dade County ASR	The Miami-Dade County ASR uses excess wellfield capacity available from existing wellfields in the surficial aquifer during the wet season to provide water for storage in the upper Floridan Aquifer System. This water will later be recovered during the dry season to reduce the demands of the utility wellfields on the surficial aquifer.	2004	SFWMD
Ca	Capital Program	The Capital Program includes the capital improvements, modifications, or repairs to District water control and conveyance facilities.	Ongoing	SFWMD
Dd03	Kissimmee Basin Water Resource Development Implementation	This activity is for the implementation of the regional water resource development projects recommended in the *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a).	Ongoing	SFWMD
Db03	LWC Water Resource Development Implementation	This activity is for the implementation of regional water resource development projects recommended in the *Lower West Coast Water Supply Plan* (SFWMD, 2000c).	Ongoing	SFWMD
Dc03	UEC Water Resource Development Implementation	This activity is for the implementation of regional water resource development projects recommended in the *Upper East Coast Water Supply Plan* (SFWMD, 1998d).	Ongoing	SFWMD
Pz03	Comprehensive Everglades Restoration Plan (CERP) Reserves	This activity includes the cash reserves for the implementation of the CERP. It also includes the real estate support for the CERP. Real estate acquisition costs are budgeted to this activity and charged to the appropriate activity as acquisition activity occurs.	Ongoing	SFWMD
Operations and Maintenance				
Pc01	Lake Istokpoga Regulation Schedule	This feature includes development of a plan to address water resource problems in the Lake Istokpoga Basin. The major focus of this plan is to create a balance between environmental needs, water supply, and flood control in the Lake Istokpoga Basin.	2002	SFWMD
Ce	Structure Operations	Structure operations include the movement of water, pumping operations activities, and automation for the C&SF Project canal system.	Ongoing	SFWMD
Cf	Water Control Structure Maintenance	This activity is for water control structure maintenance, including District pump stations, structures, project culverts, and special construction projects as determined.	Ongoing	SFWMD
Cg	Canal/Levee Maintenance	This activity is for the maintenance of canals and levees, including replacement of project culverts, bank stabilization, revegetation, mowing, tree removal, and shoal removal.	Ongoing	SFWMD
Ci	Equipment Maintenance	Equipment maintenance consists of preventive and cyclic maintenance and restoration of a variety of equipment.	Ongoing	SFWMD
Cj	Electronics, Communications, and Control Device	District communication, electronics, and control devices must be developed, installed, supported, and maintained. These include Supervisory Control and Data Acquisition (SCADA) system devices, microwave system devices, and District radio communication components.	Ongoing	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Ck	Exotic Plant Control	Invasive exotic aquatic and terrestrial vegetation within District canals, canal banks, lakes, rights-of-way, and preserve lands must be controlled. This control is accomplished through in-house and contracted herbicidal, mechanical, and biological control methods. This program works primarily to ensure conveyance capacity within canals and water bodies.	Ongoing	SFWMD
Co	General Maintenance	This activity provides preventative maintenance and repairs to District fixed and mobile equipment to ensure operation of the District water control system and provides maintenance and repairs to District field facilities.	Ongoing	SFWMD
Dj06	C&SF Project Operational Planning	This activity includes, but is not limited to, (a) regional modeling support for the District and the U.S. Army Corp of Engineers (USACE) to develop and implement routine operational procedures (e.g., implementation of a Water Supply and Environment [WSE] schedule for Lake Okeechobee); (b) development of rain-driven operating rules for the greater Everglades and the CERP components; and (c) development of operational modifications recommended in the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) (e.g., supply-side management modifications, rain-driven operations).	Ongoing	SFWMD
Regulation				
Hb	Water Use Permitting	This program involves the review of water use permit applications. The objective is to ensure safe, efficient, equitable, and reliable development of the state's water resources. The major components are 1) review and prepare recommendations for permit applications for all consumptive uses of water within the District boundaries, 2) provide postpermit compliance checks on priority projects based on staffing resources, and 3) review and issue well construction permits for specific water wells within District boundaries. Water use permitting also includes permit planning, permit issuance, dispute resolution, mitigation support, technical support for enforcement, communication with the water supply planning activities of this agency, and criteria and rule development.	Ongoing	SFWMD
Hb01	Revise Consumptive Use Permitting (CUP) Rules	The last time District water use rules were substantially modified was in 1993, when the water conservation rules were updated. Since that time, numerous changes in legislation, District policy, and the development of the regional water supply planning process have caused District staff to reexamine the agency's water use rules. Some of the proposed changes will consist of administrative updates, while others involve technical criteria changes which relate to the implementation objectives of the District's regional water supply planning process.	2001	SFWMD
Outreach				
Da23	Hillsboro (East) ASR Pilot Project	A pilot regional ASR project will be located west of U.S. 441 along the Hillsboro Canal, through cooperation with Palm Beach County. This project is associated with the development of a new wellfield to serve Palm Beach County's Water Treatment Plant Number 9.	2002	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Da02	LEC Water Supply Development Implementation	The *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) will be implemented by 1) using regional and local water supply planning efforts to predict when alternative sources will be needed, and to provide guidance as to which source may be most appropriate for meeting the particular needs of each user; 2) conducting appropriate hydrologic and ecologic studies to identify the freshwater input needs of the Lake Worth Lagoon; and 3) encouraging the use of any permittable alternative water supply option which would achieve a reduction in saltwater intrusion.	2004	SFWMD
Da22	Miami-Dade County ASR	The Miami-Dade County ASR uses excess wellfield capacity available from existing wellfields in the surficial aquifer during the wet season to provide water for storage in the upper Floridan Aquifer System. This water will then be subsequently recovered to reduce the demands of the utility wellfields on the surficial aquifer during the dry season.	2004	SFWMD
Db02	LWC Water Supply Development Implementation	This activity will evaluate LWC alternative water supply sources, or combination of alternatives, with local water users to find the combination which best suits local requirements and conditions.	Ongoing	SFWMD
Dm	Alternate Water Supply (AWS) Cooperative Projects	AWS Cooperative Projects annually provide for the following: the receipt of AWS project applications; the review, ranking, and Governing Board approval of the proposed contract awards; execution of the contractual agreements; and the development of annual reports to the Florida Legislature. This program is being significantly cut back for FY2001 to provide funding for the CERP.	Ongoing	SFWMD
	Water Conservation	The District's water conservation efforts, also called demand management, refers to water use practices and technologies that provide the services desired by the users while using less water. The District's Demand Management Program incorporates water supply planning, regulation, and supplemental measures in order to cultivate a conservation ethic in cooperation with water users.	Ongoing	SFWMD
Monitoring and Evaluation				
Da03	Hydrologic Modeling and Analysis - Water Resource Development	Regional and subregional modeling to support the implementation of recommendations from the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) and their associated regulatory/rulemaking activities. These regulatory/rulemaking activities include reservations of water for natural systems and Minimum Flows and Levels (MFLs). Efforts will also include preregulatory modeling for water users.	Ongoing	SFWMD

Table 9. Activities Table for Core Objective WS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Dp02	Hydrologic Management - Hydrologic Studies	This activity provides fundamental hydrogeologic support across many programs including 1) the development and maintenance of a well inventory, lithologic application to store hydrogeologic information collected by the District and 2) the U.S. Geological Society (USGS) Cooperative Agreement Program. The USGS Cooperative Agreement Program is jointly funded and includes 12 hydrogeologic water resources investigations which support implementation of the recommendations made in the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b).	Ongoing	SFWMD
Dz03	Water Supply Program Controls	Programmatic oversight for the Water Supply Program including, but are not limited to, scheduling and tracking; estimating and forecasting; cost tracking and reporting; web site development and maintenance; progress reporting; and document control.	Ongoing	SFWMD

Core Objective WS 2: Prevent contamination of water supplies

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in three categories: Regulation, Outreach, and Monitoring and Evaluation (**Table 10**).

Performance Measures for Core Objective WS 2

- **Core WS 2(a):** Percentage of surface water supply sources for which water quality fully attains the designated use
- **SFWMD WS 2(b):** Percentage of PWS wellheads subject to wellhead protection ordinances

Table 10. Activities Table for Core Objective WS 2.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective WS 2: Prevent contamination of water supplies				
		Regulation		
Hb01	Water Use, Application, Compliance, and Criteria Development	Water use permitting (CUP) is a state mandated program assigned exclusively to the water management districts. The objective is to insure safe, efficient, equitable, and reliable development of the state's water resources. The major components are 1) review and prepare recommendations for permit applications for all consumptive uses of water within the District boundaries; 2) provide postpermit compliance checks on priority projects based on staffing resources (approximately 300 projects per year); 3) review and issue well construction permits for specific water wells within District boundaries; and 4) perform water conservation rulemaking analysis and make recommendations. This activity also includes prepermit planning, permit issuance, dispute resolution, litigation support, technical support, enforcement, communication with water supply planning activities of this agency, and criteria and rule development.	Ongoing	SFWMD
		Outreach		
Ga01	Local Government Comprehensive Plans	Comprehensive plans and amendments are reviewed by the District as required by Chapter 163, F.S. This activity is being significantly cut back for FY2001 to provide funding for the CERP.	Ongoing	SFWMD
Gc03	Local Liaison	Liaison with local county and city governments and agencies, including Chapter 298 Districts.	Ongoing	SFWMD
Event Specific Code	Water Shortage Management	The Governing Board may declare a water shortage and enforce the associated restrictions when not enough water is available for present or anticipated needs, or when a reduction in demand is needed to protect water resources. Ground water and surface water levels are continuously monitored. If they fall to levels considered critical for the time of year and anticipated demands, the water shortage process is initiated, pursuant to Section 373.246, F.S. Different levels of drought require corresponding levels of restrictions. Water shortage declarations range from a warning, which has voluntary moderate restrictions, through four phases of water shortage, to an emergency, which can disallow any further withdrawals.	As Needed	SFWMD
	Wellhead Protection Programs	The FDEP has a number of regulations under the Florida Administrative Code, which function to regulate hazardous and solid waste, storm water discharges, storage tank systems, etc. The primary goal of these legislative policies is to prevent problems before they occur, as contrasted to correcting or providing remedial action for preexisting problems. The intent of these ordinances is to protect and safeguard the health, safety, and welfare of the public by providing criteria for regulating and prohibiting the use, handling, production, and storage of certain deleterious substances which may impair present and future PWS wells and wellfields. The District has and will provide assistance to local governments in the preparation of their wellfield protection ordinances.	Ongoing	FDEP

Table 10. Activities Table for Core Objective WS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
	Recharge Mapping	As directed by Chapter 373, F.S., the SFWMD provides ground water recharge information to local governments to assist them with the development and implementation of appropriate water resource policies. In order to accomplish this, the SFWMD undertook a project to map recharge areas within its four planning regions. This effort was completed in 1995. The maps delineate precipitation recharge and leakage rates for all the primary PWS aquifers utilized throughout South Florida. The District has and will provide assistance to local governments in the delineation of prime recharge areas in order to implement voluntary tax assessment programs (under the Bluebelt Act) that protect the state's prime recharge areas.	As Needed	SFWMD
Monitoring and Evaluation				
Hf01	Criteria Development and Support	This activity supports the Regulation Program in developing a scientific basis for wetland protection criteria used in water use and environmental resource permitting. The activity was originated at the direction of the Governing Board and Executive Office to develop a research and monitoring program to investigate impacts. This information is needed to support rulemaking for the LWC and UEC regions, and is a critical element in the implementation of water supply plans for both regions.	2003	SFWMD

Chapter 4
FLOOD PROTECTION AND FLOODPLAIN MANAGEMENT

GOALS

The *State Comprehensive Plan*, Chapter 187, F.S., includes flood protection and floodplain management goals as follows:

- Require local governments, in cooperation with regional and state agencies, to adopt plans and policies to protect public and private property and human lives from the effects of natural disasters (Section 187.201(7)(b)25, F.S.)
- Encourage the development of a strict floodplain management program by state and local governments designed to preserve hydrologically significant wetlands and other natural floodplain features (Section 187.201(8)(b)8, F.S.)

In order to achieve these goals the District has identified the following goals for flood protection and floodplain management:

- Protect from and mitigate for the impacts of flood events
- Protect and restore natural features of floodplains

RESOURCE ASSESSMENT

Flood Protection

Without flood protection, most of South Florida would be unsuitable for existing urban and agricultural development. To the extent possible, the District provides regional flood protection through operation of the works of the Central and Southern Florida (C&SF) Project, as well as projects within the Big Cypress Basin. In accordance with state policies, these facilities are operated following the regulation schedules and operational guidelines established by the U.S. Army Corps of Engineers (USACE).

Flood protection in South Florida is achieved by a combination of regional and local drainage systems. The District's responsibilities for flood protection facilities relate to serving regional (primary) water conveyance and storage needs. The SFWMD plans, constructs, operates, and maintains regional water control facilities and regulates the discharges into that regional system. Subregional (secondary) and local (tertiary) drainage systems are operated by a variety of special districts, private property owners, and local governments, which operate under District permit. The local systems typically convey water from individual projects to the regional systems operated by the SFWMD.

Local governments have the primary responsibility for regulating land use. Local governments also enforce construction criteria for flood prone areas, establish local storm water management levels of service, construct and maintain local flood control facilities, and otherwise prevent flood damage to new and existing development. The SFWMD encourages local governments to recognize the limitations of the existing local and regional systems and to anticipate and plan for the impacts of proposed new development in their comprehensive plans.

Some areas of the District depend entirely on natural surface water systems, such as rivers, streams, sloughs, and wetlands, for flood protection. The water levels in many of these systems fluctuate in response to seasonal variations in rainfall. Land development and encroachment onto floodplains have increased the rate and volume of runoff and have reduced the area available for water storage. This has resulted in flooding and erosion in some areas. In order to minimize these impacts, the SFWMD works with local governments to preserve natural water management systems and to protect existing and future development from flooding.

National Flood Insurance Program Claims and Repetitive Losses

In spite of local, subregional, and regional efforts, the flat topography and intense land uses of South Florida, in combination with intense rainfall events, have resulted in periodic flooding. The pattern of the impacts on residents of these flooding events can be seen in **Figure 23,** which shows flood loss claims made within the National Flood Insurance Program (NFIP) and repetitive loss data from the Federal Emergency Management Agency (FEMA) between 1978 and 1998.

The C&SF Project

A central element of the C&SF Project is Lake Okeechobee, which has a surface area of 730 square miles and a maximum storage capacity of 1.05 trillion gallons (SFWMD, 1997b). Lake Okeechobee's regulation schedule is intended to provide flood protection benefits (in addition to benefits for the District's other areas of responsibility), so lower water levels are maintained in the summer wet season. In addition to the canal network and the corresponding structures (spillways, culverts, weirs, and pump stations) required to operate it, the C&SF Project includes the three Water Conservation Areas (WCAs). The WCAs divide the former Everglades into areas designated for development and areas set aside for water storage, natural system preservation, and fish and wildlife benefits.

The C&SF Project was designed following the 1947 flood, and the majority of its structures were built in the 1950s and early 1960s. The system design was based on the effects of a design storm on projected land use. A design storm for a basin is the most severe rainfall event for which the basin canals, structures, and/or lakes were designed to handle the runoff, without flooding occurring in the basin. The projected land uses the system was designed for were primarily agricultural. In many watersheds, actual land uses are presently more urban and more intensive than the projections used in the project's design, often resulting in the generation of more runoff than was originally projected.

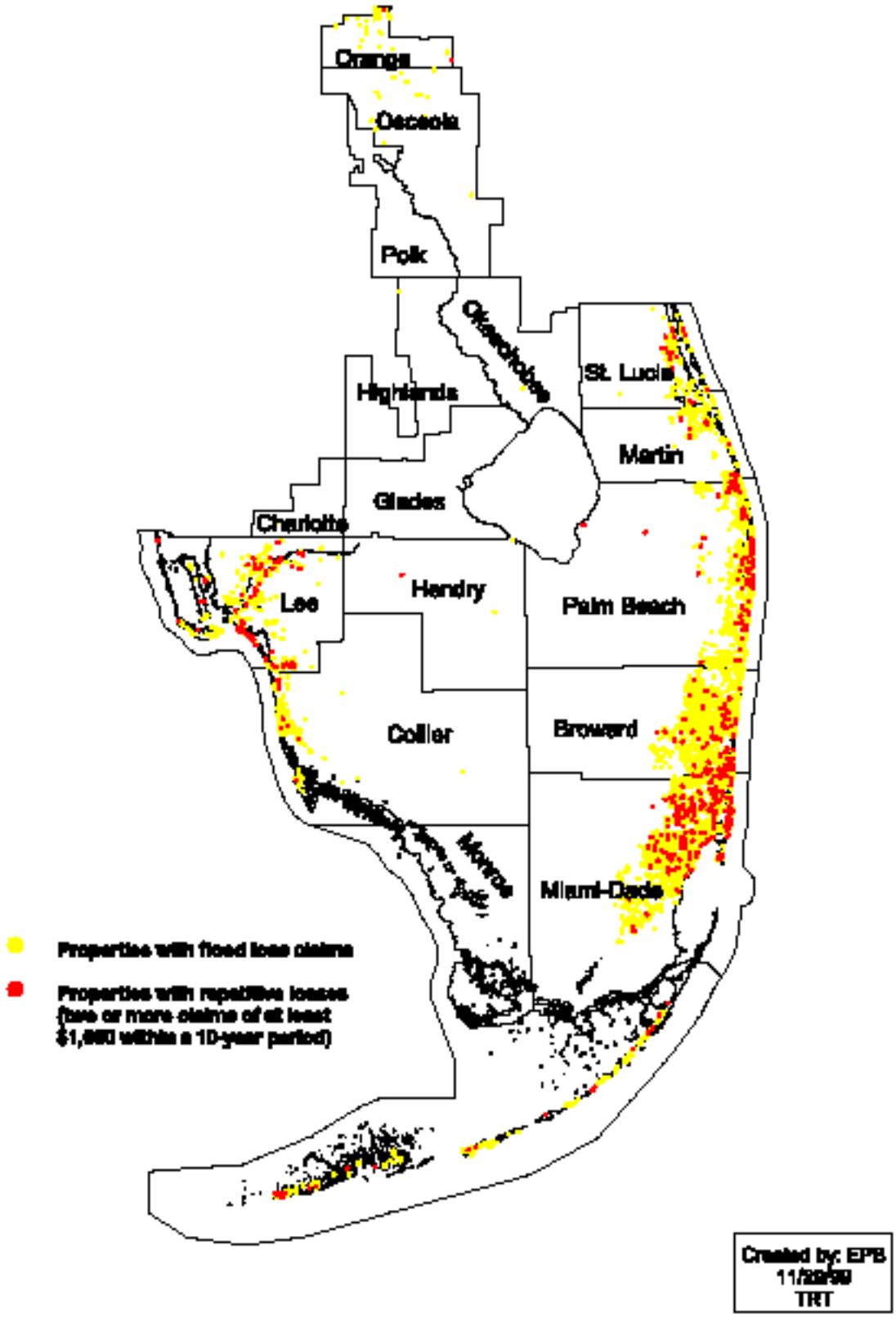


Figure 23. National Flood Insurance Claims and Repetitive Losses 1978 to 1998.

When the C&SF Project was designed, its primary function was flood protection, although there were additional benefits to water supply, fish and wildlife preservation, and other functions. Since the construction of the C&SF Project, the District's responsibilities have expanded to emphasize other aspects of water resource management. The operational goals of the system have become broader and more complex than the system was originally designed to meet, and this has pushed the C&SF Project beyond its original design objectives, and has revealed its limitations as a multifunctional system.

The SFWMD continues to operate and maintain the C&SF Project, which includes the primary drainage system of the Lower East Coast (LEC), the Upper East Coast (UEC), and the Kissimmee Basin. Major features of the project are shown in **Figure 24** and in detail on the Structure and Canal Locations map inserted in this document's front cover. The SFWMD operates and maintains the C&SF Project to accomplish the following objectives:

- Ensure the reliability and integrity of the system, through routine inspection, maintenance, and replacement of system components (i.e., water control structures, levees, canals)
- Optimize flood protection, water supply, and natural system benefits
- Improve the SFWMD's operational ability to anticipate and respond to the water resource management demands on the system, using the best available science and technology

In recent years, the District installed a microwave communications system that allows real time data collection and remote control of distant gate structures. This capability, together with expanded weather monitoring and forecasting activities, enhances operational effectiveness. The District's structural improvement and replacement projects are included in the Five-Year Capital Improvements Plans that are produced annually.

Canal Conveyance Capacity Program

The SFWMD has an ongoing Canal Conveyance Capacity (CCC) Program to evaluate the maintenance, dredging, and bank stabilization requirements of the C&SF Project. The primary objectives of this program are as follows:

- Continue a systematic approach to inspect SFWMD canals to determine the need for maintenance dredging
- Inspect all canals over a five-year period
- Establish standard canal survey criteria
- Develop detailed engineering plans and specifications to implement restoration of conveyance on each canal

The CCC Program is the single largest activity of the capital refurbishment effort. This program is intended to restore the original design capacity of the canals as constructed by the USACE. The CCC requires significant funding and resources and will

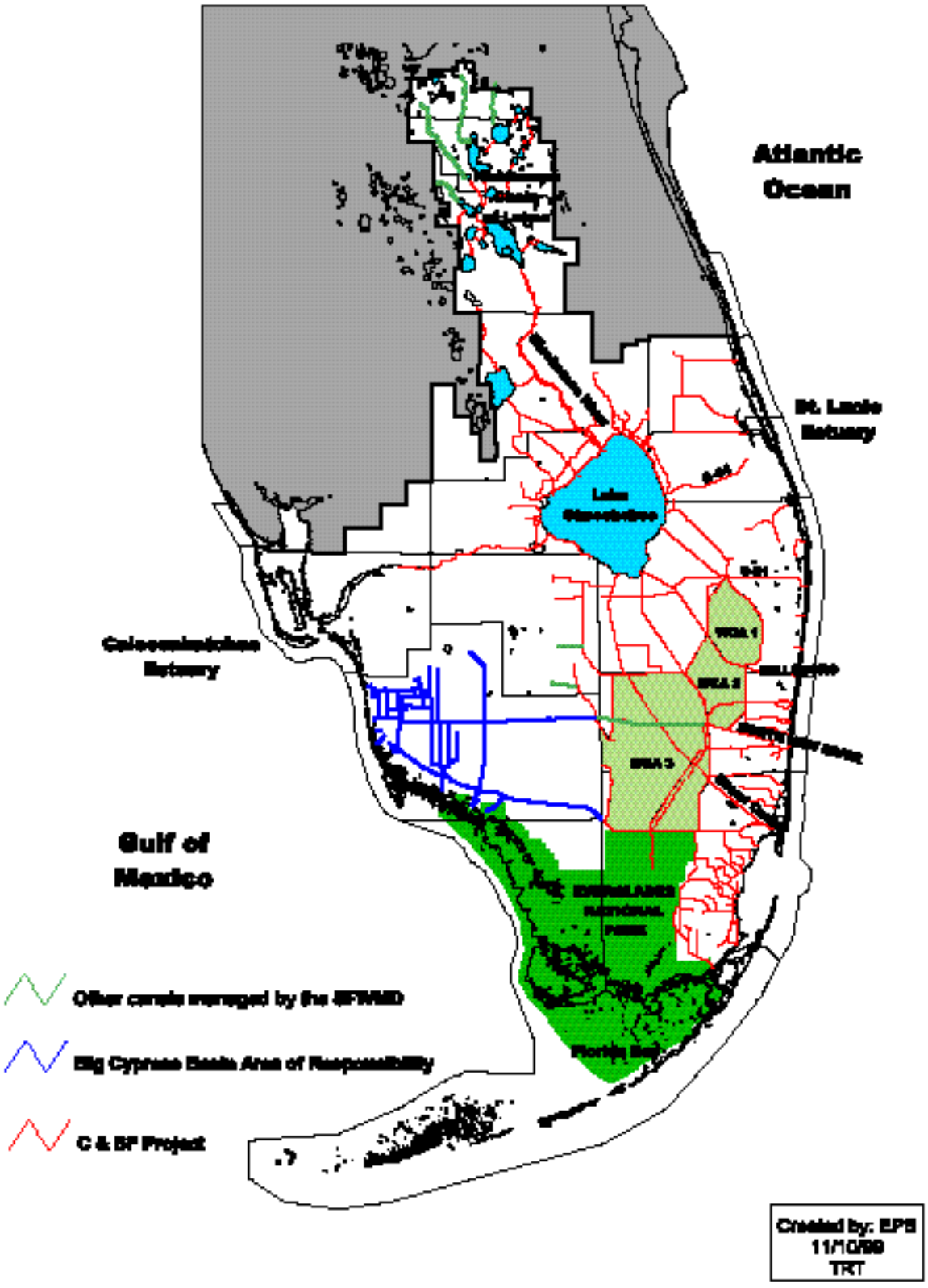


Figure 24. Surface Water Management System Managed by the SFWMD.

extend over a period of several years. The CCC program is a multidisciplinary initiative which allows the District to develop a system to establish the priority of canal maintenance projects considering a variety of factors, including service area, original design criteria, recorded flood problems, operational constraints, and shoal and stabilization problems.

C&SF Project Maintenance

The C&SF Project consists of 292 primary water control structures, 27 pump stations, 1,800 miles of canals, and 2,000 secondary structures. The C&SF Project is operated and maintained by the SFWMD. The components of the C&SF Project typically range in age from 30 to 50 years. Due to the age of this infrastructure, the SFWMD annually allocates significant funds for the maintenance necessary to provide flood control and water supply readiness. These funds are allocated in the form of individual projects that target major components of the C&SF Project. The principal components of the C&SF Project are improvements and upgrades through automation; pump station repair and restoration; gravity structure repair and restoration; levee repair; and canal conveyance dredging. These funds are not used for capital expansion. Typically, elements of large restoration projects such as the Everglades Construction Project (ECP) and Kissimmee River Restoration are addressed as separately funded programs.

The District has developed and implemented an effective maintenance program that is continuously evaluated and upgraded. This program has allowed the original components of the C&SF Project to remain in operation. However, many of the components have met, or are nearing the end of, their design life cycle. Examples include electrical systems and engines of the pump stations, secondary inflow culverts (project culverts) that were installed nearly 40 years ago, and the canals themselves that have accumulated sediment over the past 40 to 50 years.

The Restudy and the Comprehensive Everglades Restoration Plan

The C&SF Project Comprehensive Review Study (Restudy) was a five-year study effort that looked at modifying the current C&SF Project to restore the greater Everglades and South Florida ecosystem while providing for the other water related needs of the region. The study concluded with the *Central and Southern Florida Flood Control Project Comprehensive Review Study Final Integrated Feasibility Report and Programmatic Environmental Impact Statement* (USACE and SFWMD, 1999) being presented to Congress on July 1, 1999. The recommendations made within the Restudy (i.e., structural and operational modifications to the C&SF Project, are being further refined and will be implemented in the Comprehensive Everglades Restoration Plan (CERP). The Restudy and CERP are further described in **Chapter 1**.

The Big Cypress Basin System

The SFWMD, through its Big Cypress Basin Board, operates and maintains the Big Cypress Basin system in Collier County. This system includes 163 miles of canals and 40 water control structures. Land developers constructed most of these facilities to provide

drainage for urban or agricultural development. During the last two decades the Big Cypress Basin added several water control structures and modified many canal segments to enhance their flood conveyance and water conservation functions.

Big Cypress Basin's 1997-2001 five-year plan includes development of a basinwide water management plan. Much of the proposed effort focused on structure modification to remedy overdrainage problems and to address the needs and constraints of flood protection, water supply, natural systems, and water quality. The recently completed flood control element of the plan assessed that 47 miles of the basin's 163 miles of primary canals (29 percent) cannot provide the intended level of service for flood protection. The plan recommended a combination of five-segment capital improvements for the urban portion of Golden Gate Main, Henderson Creek, and CR 951 canals consisting of channel modification, flow diversion, structural retrofit, and ASR of wet season peak flows. These elements will be incorporated into the Big Cypress Basin Board's Five-Year Capital Improvement Program. The District will continue to pursue options to reduce overdrainage and saltwater intrusion caused by the system, while maintaining flood protection to existing development.

Floodplain Management

Flood protection overlaps with the overall floodplain management strategy. Floodplains are level land that may be submerged by flood waters. The water management districts have agreed that, for mapping purposes, floodplains should include "land area that may be submerged by floodwaters from a river, lake or coastal waters; but should not include isolated low lying areas which may be inundated due to a lack of drainage" (FDEP et al., 1994). The water management districts and the Florida Department of Environmental Protection (FDEP) have specifically stated that the definitions and practices established for designation of these areas are more applicable to areas with natural riverine flows than to areas with highly controlled water management systems. Much of South Florida has a highly controlled water management system, rather than the natural riverine flows that characterize other areas of the state.

At a minimum, each water management district is required to determine the 100-year flood levels for its priority floodplains. Because of the managed nature of the surface water system in South Florida, few areas of riverine flooding problems occur in the region. Therefore, floodplain mapping has not been a priority of the District.

Flooding in South Florida usually results from slow runoff and infiltration, which is due to the region's flat topography and soils that become saturated after extensive rains. The problems may affect extensive areas within a basin and are not necessarily confined to areas immediately adjacent to defined water courses. Existing development within a basin can result in increased runoff, which can lead to increased flood conditions within the basin or in other downstream basins. State Water Policy (Section 62-40.310, F.A.C.) encourages the utilization, preservation, restoration, and enhancement of natural water management systems and discourages the channelization or other alteration of natural rivers, streams, and lakes. The state seeks to protect the water storage and water quality

enhancement functions of wetlands and floodplains through acquisition, law enforcement, and the implementation of compatible land and water management practices. The state also must manage floodplains and other flood hazard areas to prevent or reduce flood damage.

The District's floodplain management efforts include planning and regulation. Conceptual plans are developed for each project area. Operational plans are created for only those management activities that require a technically detailed plan. Both operational and conceptual plan content is standardized in a logical sequence to ensure comprehensive coverage of pertinent issues and information. The purpose of conceptual management planning is to produce a guideline document that will direct the land manager toward realizing the land management goals on a specified management project area. Conceptual plans define goals and objectives, identify and prioritize major management needs and issues, serve as a management assessment, and are expandable to adjust for the discussion of future significant management requirements.

The SFWMD will also continue to protect floodplains through the Environmental Resource Permitting (ERP) Program. This will include active coordination with local governments, special districts, appropriate federal agencies, the Florida Department of Community Affairs, and the Florida Department of Health and Rehabilitative Services.

ISSUES

The SFWMD has, since its inception, mitigated the region's high vulnerability to flooding. This has been done through structural and nonstructural means. Structural methods include the construction and management of canals, levees, dikes, dams, pump stations, reservoirs, and other water control structures. Nonstructural approaches have included the acquisition of flood prone areas and appropriate floodplain management. The main issues that face the District, with regard to flood protection and floodplain management, are as follows:

Issue 1. The protection of public health, safety, and welfare from the impacts of flooding

Issue 2. The water supply, water quality, and environmental consequences of protecting land uses from flooding

Issue 3. Reconciling conflicting flood protection goals of different land uses (e.g., agriculture, residential, ecosystem restoration)

Objectives, Strategies, and Performance Measures

Core Objective FP 1: Minimize damage from flooding

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Operations and Maintenance, Regulation, Outreach, and Monitoring and Evaluation (**Table 11**).

Performance Measures for Objective FP 1

- **Core FP 1(a):** Percentage of District works maintained on schedule
- **SFWMD FP 1(b):** Number and cost of storm water retrofit projects carried out by the District
- **SFWMD FP 1(c):** Average number of days to complete ERP permit review and issue a permit once the application is complete
- **SFWMD FP 1(d):** Number of permit applications received
- **SFWMD FP 1(e):** Number of preapplication inspections
- **SFWMD FP 1(f):** Number of permits issued

Table 11. Activities Table for Core Objective FP 1.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective FP 1: Minimize damage from flooding				
		Planning		
Nf02	Big Cypress Basin Watershed Project	The Big Cypress Basin Watershed Project includes the generation of digital topographic information, the development of a calibrated hydrologic model for the Big Cypress Basin, and the incorporation and engineering, economic, and environmental analyses of alternative water management strategies into a recommended watershed management plan for the Big Cypress Basin.	2000	SFWMD
Jg02	South Lee County Watershed Plan	Severe flooding in 1995 raised the issue of water flows in southern Lee County. The South Lee County Watershed Plan addresses this issue. The work in this project will involve three phases. During Phase I, the necessary background data will be obtained and hydrologic and hydraulic models of the study area will be developed. During Phase II, the ecological value of the study area will be assessed and the target hydrologic parameters for restored conditions will be identified. During Phase III, models will be applied to evaluate the performance of existing water management facilities in the study area, existing problems will be identified, and alternative facilities and systems will be developed and assessed.	2003	SFWMD

Table 11. Activities Table for Core Objective FP 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Public Works Construction				
Ca	Capital Program	Capital Program activities include capital improvements, modifications, or repairs to District water control and conveyance facilities.	Ongoing	SFWMD
Ei	Modified Water Delivery Project	The Modified Water Deliveries Project is designed to restore the hydrologic balance between western Shark River Slough and northeastern Shark River Slough, to benefit Everglades National Park flora and fauna.	2003	SFWMD
Eh	C-111 Project Implementation	The C-111 Project consists of both structural and nonstructural modifications to the existing works within the C-111 Basin to promote more natural hydroperiods in Taylor Slough and the eastern panhandle ecosystems of Everglades National Park. Flood protection within the C-111 Basin east of the L-31N and C-111 canals will be maintained.	2004	SFWMD
Fb02	Kissimmee Basin Flood Control and Protection	This activity primarily provides for the construction of facilities for the flood mitigation efforts associated with the implementation of the Kissimmee River Restoration Project. Pool D residential flood proofing construction is scheduled for completion in 2002.	Ongoing	SFWMD
Operations and Maintenance				
Ce	Structure Operations	Structure operations include the movement of water, pumping operations activities, and automation for the C&SF Project canal system.	Ongoing	SFWMD
Cf	Water Control Structure Maintenance	Water control structure maintenance includes District pump stations, structures, project culverts, and special construction projects.	Ongoing	SFWMD
Cg	Canal/Levee Maintenance	Canals and levees must be maintained. Maintenance includes replacement of project culverts, bank stabilization, revegetation, mowing, tree removal, and shoal removal.	Ongoing	SFWMD
Ci	Equipment Maintenance	Equipment maintenance consists of preventive and cyclic maintenance and restoration of a variety of equipment for the regional flood control systems.	Ongoing	SFWMD
Cj	Electronics, Communications, and Control Devices	District communication, electronics, and control devices must be developed, installed, supported, and maintained. These include Supervisory Control and Data Acquisition (SCADA) system devices, microwave system devices, and District radio communication components.	Ongoing	SFWMD
Ck	Exotic Plant Control	Invasive exotic aquatic and terrestrial vegetation within District canals, canal banks, lakes, rights-of-way, and preserve lands must be controlled. This control is accomplished through in-house and contracted herbicidal, mechanical, and biological control methods. This program works primarily to ensure conveyance capacity within canals and water bodies.	Ongoing	SFWMD
Cl	Right-of-Way Management	Right-of-Way Management involves the management of uses of District rights-of-way by means of permitting and enforcement initiatives designed to minimize outside impacts on the District's ability to operate and maintain the canal and levee system.	Ongoing	SFWMD

Table 11. Activities Table for Core Objective FP 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
M	Emergency Management	The mission of the District's Emergency Management Program is to prevent or minimize, prepare for, respond to, and recover from emergencies or disasters that threaten life or property within the boundaries of the District. These activities ensure that the District can accomplish its mission during adverse conditions. The District also works closely with, and offers support to, local and state emergency managers to prepare for and assist with man-made hazards, dam failures, nuclear power plant failures, fires, storms, and a number of other types of emergencies within Florida.	As needed	SFWMD
Regulation				
Ha	Environmental Resource Permitting (ERP)	ERP involves the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information.	Ongoing	SFWMD
Outreach				
Ga01	Local Government Comprehensive Plans	Comprehensive plans and amendments are reviewed by the District as required by Chapters 163 and 298, F.S. This activity is being significantly cut back for FY2001 to provide funding for CERP.	Ongoing	SFWMD
Monitoring and Evaluation				
Fe03	Flood Control Level of Service	As an outcome of the Hurricane Irene action report, a full analysis of the current flood protection level of service for the entire geographic region of the Kissimmee Basin is being conducted. The flood protection level of service has been conducted as part of the Kissimmee River Restoration Project. This initiative will be conducted for the northern portion of basin.	Ongoing	SFWMD
Jm02	Basin Flood Studies	This consists of basin flood studies in the C-17 and C-51 basins. The C-17 Basin Study will investigate increasing flood mitigation and conveyance capacity of the C-17 Canal and the S-44 Structure without adversely affecting the receiving water body (Lake Worth Lagoon). The C-51 Basin Study will reevaluate the C-51 Basin Rule (surface water management permitting criteria).	Ongoing	SFWMD

Core Objective FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Land Acquisition and Regulation (**Table 12**).

Performance Measures for Objective FP 2:

- **Core FP 2(a):** Number of acres identified for acquisition to minimize damage from flooding and the percentage of those acres acquired

Table 12. Activities Table for Core Objective FP 2 .

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective FP 2: Promote nonstructural approaches to achieve flood protection, and to protect and restore the natural features and functions of the 100-year floodplain				
		Land Acquisition		
Ab	Stewardship Save Our River (SOR) Lands	SOR Stewardship activities include plan and implement a stewardship work plan, administer a land acquisition plan, administer a public use rule, and administer mitigation banks/ projects.	Ongoing	SFWMD
Za	General Land Acquisition	This activity involves land acquisition for the SOR Program. The SOR Act enables the water management districts to acquire lands necessary for water management, water supply, and the conservation and protection of water resources.	Ongoing	SFWMD
		Regulation		
Ha	Environmental Resource Permitting (ERP)	ERP involves the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites, requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information.	Ongoing	SFWMD

Chapter 5
WATER QUALITY

GOALS

The State of Florida has stated the following water quality goals:

- It is declared to be the public policy of this state to conserve the waters of the state and to protect, maintain, and improve the quality thereof for public water supplies, for the propagation of wildlife and fish and other aquatic life, and for domestic, agricultural, industrial, recreational, and other beneficial uses, and to provide that no wastes be discharged into any waters of the state without first being given the degree of treatment necessary to protect the beneficial uses of such water (Section 403.021(2), F.S.).
- Florida shall . . . maintain the functions of natural systems and the overall present level of surface and ground water quality. Florida shall improve and restore the quality of waters not presently meeting water quality standards (*State Comprehensive Plan*, Section 187.201(8)(a), F.S.).
- The *State Comprehensive Plan* (Chapter 187, F.S.) states as a goal that Florida "shall maintain the functions of natural systems and the overall present level of surface and ground water quality."

The SFWMD has the following related water quality goals:

- Protect and improve surface water quality
- Protect and improve ground water quality

RESOURCE ASSESSMENT

Surface Water Quality

A number of ongoing activities are under way throughout the District to assess and improve surface water quality. These include cooperative agreements with other agencies, landowners, and local governments.

Statewide Water Quality Assessment Program

Every two years, since 1978, the Florida Department of Environmental Protection (FDEP) produces a *Florida Water Quality Assessment 305 (b) Report*. Preparation of this report was first required by the Clean Water Act in 1975 to provide an assessment of the quality of Florida's waters every two years. It is divided into a Main Report and Technical

Appendices. The Main Report provides a summary of water quality by water body type and identifies sources and causes of pollution for each water body type. The report also summarizes pollution prevention programs, management programs, restoration and rehabilitation activities, monitoring activities, and provides an evaluation of ground water quality. Although emphasis of the report has been primarily placed on surface water resources, general ground water quality data are also included. The most recent version of the report summarizes data available through 1998 (Paulic and Hand, 1998). The assessments are made based on data available from the U.S. Environmental Protection Agency's (USEPA) computerized STORET water quality data base. Water quality conditions are characterized based on the following criteria:

- Water quality indices
- Biological and chemical data
- Occasions when Florida water quality standards were exceeded
- Fish consumption advisories
- Analysis of statistical trends
- Information from special studies
- Interviews with local experts

Although conclusions of the report need to be qualified for some locations due to limited data, the report provides a primary means for the water management districts to gauge progress made toward improving water quality conditions within their regions. Results of the most recent assessment have been reported each year in the *District Water Management Plan Annual Report* (SFWMD 1996, 1997a, 1998a).

Water Quality Monitoring Network

The SFWMD maintains a water quality monitoring network for surface waters within its boundaries. Surface water samples are analyzed for numerous parameters. These parameters are divided into six major groupings: physical, nutrients, major ions, trace metals, pesticides, and priority pollutants. The frequency of sampling for each parameter varies for each sampling station.

The monitoring network is comprised of almost 40 major water sampling programs that include 991 sampling locations and encompass a wide variety of South Florida's ecosystems, urban, and agricultural uses including lakes, rivers, estuaries, canals, wetlands, dairies, and cattle ranches. Locations of the primary water quality sampling efforts are shown in **Figure 25**.

Data collected from routine monitoring programs are often used to supplement more specific water quality studies. The District also has archived data from historical stations in the water quality database. The monitoring program is designed to directly support the following legislative acts, permits, agreements, and technical advisory committee recommendations:

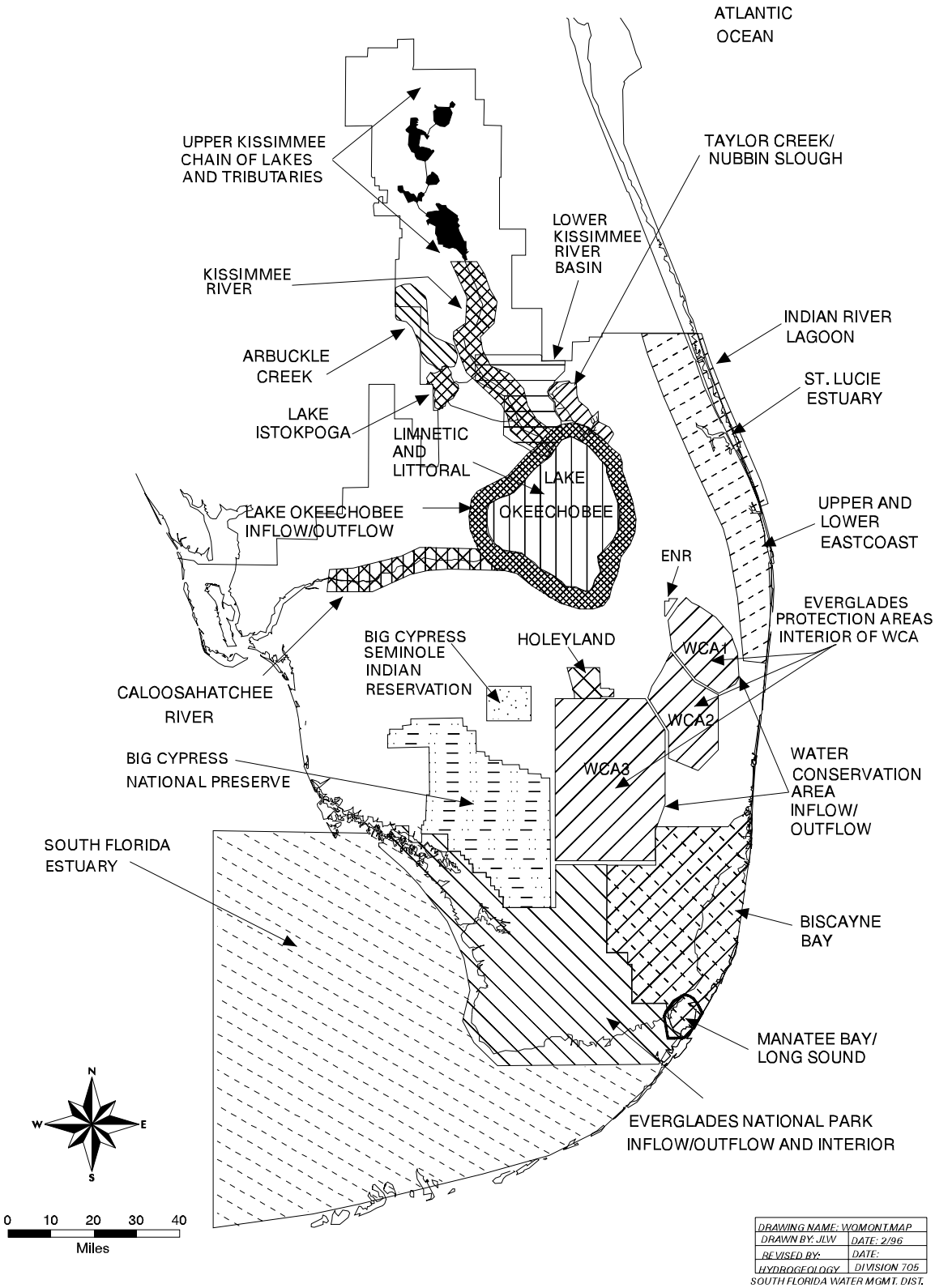


Figure 25. Locations of SFWMD Surface Water Quality Monitoring Programs.

- The Surface Water Improvement and Management (SWIM) Act
- Permits issued by the FDEP and the USEPA
- The Memorandum of Agreement (MOA) between the Everglades National Park, the SFWMD, and the U.S. Army Corps of Engineers (USACE)
- MOAs between the District and the Seminole Tribe of Florida
- The MOA between the SFWMD, the U.S. Department of Agriculture (USDA), and the USEPA

The District's major water quality monitoring programs are categorized under two broad networks: inorganics and pesticides/organics. Sampling methods and frequencies vary according to the project plan. Sample sites are accessed using trucks, boats, airboats, or helicopters. Sample collection frequencies range from weekly to annually. The District's chemistry laboratory performs physical parameters, nutrients, metals, major ions, and microbiological tests. All analytic and data processing procedures are conducted in conformance with a Quality Assurance Plan that has been approved by the FDEP. All data are reviewed thoroughly to ensure high quality prior to the final archiving into the historical water quality database.

In the future, the District will need to collect and process increasing amounts of information to meet monitoring requirements of the extensive water management facilities within District boundaries, as well as to meet the data needs for adaptive management of restored systems that are being instituted. Data collection and processing needs for these programs should be included in the overall program cost. District data collection procedures and equipment need to become much more efficient and effective. The District already gathers more data than it can effectively interpret and thus much of the data collected never gets analyzed. Conversely, the District's level of confidence in its models would be significantly improved by data which is not presently being gathered. To address these needs, a comprehensive data audit is needed to specify formats, processing tools, etc., and determine how the District's data gathering efforts need to be modified.

Regulatory Programs

Since 1974, pursuant to the Water Resources Act of 1972 (Chapter 373, F.S.), the SFWMD has regulated the management and storage of surface waters within its boundaries. Generally, permits are required for construction, alteration, operation, or maintenance of local surface water management systems. The SFWMD evaluates both the flood protection provided by the proposed system, as well as its effect on water quality. Additional information regarding the SFWMD's permitting program for the management and storage of surface waters may be found in the **Wetlands Regulation** section of **Chapter 6**.

In 1987, the state enacted the SWIM Act. The SWIM Act required Florida's water management districts to develop plans that contain strategies to either protect undisturbed natural water bodies or restore impacted areas. The SWIM Act, and subsequent enabling

legislation, provided the framework for establishment of two new District regulatory programs. These programs are the Lake Okeechobee Works of the District and the Everglades Works of the District.

The Lake Okeechobee Works of the District Permit Program is a performance-based phosphorus control program implemented by the District in 1989. Key features of the program involve regulation of land uses (excluding dairies) greater than 0.5 acre in size, in order to control phosphorus in surface discharges. Off-site discharge concentration limitations are set for each parcel based on land use, and permitted parcels are monitored for compliance. Corrective actions by the land owner are required for noncomplying parcels. Since implementation of this program, the initial permitting of the basins has been completed. The focus has now shifted to implementation of appropriate corrective measures for those parcels found not to be in compliance with the permitted off-site discharge limitations.

The Everglades Works of the District Permit Program was implemented in 1992 pursuant to the provisions of the Marjory Stoneman Douglas Everglades Protection Act of 1991 (Chapter 373.4592, F.S.). It requires all Everglades Agricultural Area (EAA) landowners holding property that discharge water to District works to obtain a Works of the District permit, implement Best Management Practices (BMPs), and monitor the quality and quantity of waters discharged from their lands into the District's works.

Three major new regulatory activities are scheduled for initiation during the next few years:

- Implementation of rulemaking for the C-139 Basin
- Works of the District permitting for the five Chapter 298 drainage districts that are located south of Lake Okeechobee
- The St. Lucie Estuary BMP Program

However, staff limitations may necessitate postponement of these efforts.

Storm Water Management Levels of Service

The Growth Management Act requires local governments to develop and adopt comprehensive plans that specify levels of service for public facilities and services, including storm water management (Section 163.3177, F.S.). While the primary focus of local government storm water level of service has historically been flood protection, the SFWMD has encouraged local governments to adopt a level of service that also addresses water quality.

The District has worked with the Department of Community Affairs to ensure that local governments address both components of storm water management level of service through the comprehensive plan review process. The SFWMD permitting criteria also require that storm water management systems be designed to protect against both water quality degradation and flood damages.

The District intends to work more closely with local governments in the future to encourage the development and implementation of Storm Water Master Plans that will address specific local storm water management requirements. The District is prepared to provide technical assistance and review of draft plans in order to encourage these efforts.

Pollutant Load Reduction Goals

State water policy (Section 62-40.432, F.A.C.) requires that water management districts establish storm water management goals on a watershed basis, including watershed Pollution Loading Reduction Goals (PLRGs). The primary purpose of PLRGs is to reduce pollutant discharges from watersheds such that the water quality in receiving waters is restored or maintained consistent with applicable state water quality standards.

The concept of setting PLRGs is based on the idea that when the inflow rate, or loading, of a pollutant exceeds some critical value, the concentration in the receiving water will build up to a level that creates either a biological problem within the ecosystem or a threat to human health. Below the critical loading, the pollutant concentration is kept at acceptable levels by chemical or biological breakdown and flushing of the system. Thus, full implementation of the PLRG concept requires an understanding of the dynamics of pollutant loading and removal for the water body, as well as knowledge of the lowest concentration at which unacceptable biological effects will occur.

For Lake Okeechobee, PLRGs have been established with regard to phosphorus loadings and subsequently approved by the Florida Legislature (Section 373.4595, F.S.). As part of the Everglades Forever Act, a phosphorus criterion for the Everglades Protection Area will be established through research. Within the SFWMD portion of the Indian River Lagoon, the District has established an interim PLRG for salinity (total freshwater releases) to the St. Lucie Estuary. An interim PLRG has also been established for turbidity levels in Biscayne Bay.

Much work remains to be done before final PLRGs can be established for SWIM water bodies within the SFWMD. Information regarding how interim PLRGs were determined may be found in each of the respective SWIM plans. In some cases, the interim PLRGs represent feasible reductions based on present and historical concentrations rather than actual loadings, though they may still be too high to provide long-term protection. Taking such a conservative approach is, however, considered to be the most effective path toward establishing meaningful PLRGs. PLRGs will be established for additional high priority areas within the District as SWIM or other special water quality studies are developed.

Total Maximum Daily Loads

The federal requirement to establish Total Maximum Daily Loads (TMDLs) and the state requirement for PLRGs are similar in concept, but the processes and details for establishing these criteria are different. Section 303(d) of the Clean Water Act requires states to submit lists of impaired waters, i.e., surface waters that do not meet applicable water quality standards, and to establish TMDLs for pollutants for these waters. A TMDL

represents the maximum amount of a pollutant that a water body can assimilate without causing water quality standards to be exceeded. Both point source and nonpoint source components must be considered.

Implementation of TMDLs will include a combination of regulatory and/or incentive-based actions that reduce pollutant loading below the set maximum daily level. Incentive-based or nonregulatory actions may include development and implementation of BMPs, pollution prevention activities, and habitat preservation or restoration. Regulatory actions may include issuance or revisions of wastewater, storm water, or Environmental Resource Permitting (ERP) to include permit conditions consistent with the TMDL. These permit conditions may be numeric effluent limitations or, for technology-based programs, requirements to use a combination of structural and nonstructural BMPs needed to achieve the required pollutant load reduction.

The FDEP's Division of Water Resource Management is developing a framework document to detail the Watershed Management Program. This program will develop TMDLs for impaired waters. It will assess, monitor, and implement management activities in the state's river basins on a five-year rotating cycle. The Watershed Management Program is being designed to complement other watershed management initiatives produced by the state and the water management districts. The FDEP, with cooperation from the District, is in the process of developing a TMDL for phosphorus for Lake Okeechobee.

Surface Water Improvement and Management Programs

Since the SWIM Program was initiated in 1987, the SFWMD has prepared a priority list of all water bodies within the District (**Table 13**). Within **Table 13**, the A list represents immediate priorities. SWIM plans have been prepared for Lake Okeechobee, the Everglades, Biscayne Bay, and Indian River Lagoon. Efforts have been initiated for non-SWIM water quality plans for the Florida Keys and the Kissimmee Chain of Lakes. The Everglades SWIM Plan was superseded by the Everglades Forever Act. Since 1995, legislative appropriations for the SWIM Program have declined dramatically, although the mandate to conduct the program still exists. Some of the shortfall has been supplemented by the use of ad valorem funds and matching money from local interests. An alternative source of funding for SWIM is needed to continue the ongoing efforts and develop plans for additional SWIM priority water bodies.

In 1998, the Florida Legislature passed the Florida Forever Act (S.B. 908), creating Section 259.202, F.S. This program was intended to authorize the continued purchase of lands and interests in lands of the type acquired through the Preservation 2000 Program, but focuses on additional priority needs of the state. One of these needs is to acquire parcels needed to facilitate implementation of SWIM plans (Chapter 259.202(2)(d), F.S.). The Florida Forever Act also provides a dedicated source of funds for SWIM projects. This act amends Chapter 201.20(6), F.S., to state that four percent of taxes collected under this chapter shall be paid into the state treasury to the credit of the SWIM Trust Fund and shall be used by the water management districts for fixed capital

Table 13. SWIM Priority Water Body List.

Priority Number	Water Body
A List	
1	Lake Okeechobee/Kissimmee River
1	Biscayne Bay
1	Indian River Lagoon
1	Everglades Everglades National Park/Florida Bay Water Conservation Areas (WCAs) East Everglades Holey Land and Rotenberger wildlife management areas
5	Upper Kissimmee Chain of Lakes Lake Tohopekaliga East Lake Tohopekaliga Lake Kissimmee Alligator Lake Lake Jackson Lake Rosalie Cypress Lake Lake Hatchineha Lake Pierce Lake Marian Three Lakes Ranch Fish Lake
6	Florida Keys
B List	
7	Lake Weohyakapka
8	Caloosahatchee River Estuary
9	Big Cypress National Preserve
10	Lake Arbuckle
11	Corkscrew Swamp
12	Naples Bay/Gordon River
13	Estero Bay
14	Lake Butler
15	Pine Island Sound/Matlacha/Ding Darling
16	Lake Istokpoga
17	Lake Worth
18	Loxahatchee River
19	Rookery Bay/Marco
20	Lake Trafford
21	J.W. Corbett National Wildlife Management Area
22	Savannas State Reserve

outlay projects, including wastewater treatment and storm water management facilities, and for implementing SWIM plans in effect on July 1, 2000.

Section 373.59(4)(b), F.S., was added to the Florida Forever Act. It states that each water management district governing board shall annually adopt, and may amend as needed, a priority list of fixed capital outlay projects, including wastewater treatment and storm water management facilities, needed to implement SWIM plans in effect on July 1, 2000, and that funds for such projects shall be available from the SWIM Trust Fund.

The SWIM Act required water management districts to develop prioritized lists of water bodies within their jurisdictions from which SWIM plans and projects would be initiated. Chapter 62-43, F.A.C., specifies that the criteria to be used to establish priority lists must include water quality, biological and physical conditions, threats to use, protection of outstanding water bodies, coordination with local planning efforts, and feasibility.

The SFWMD coordinated its priority setting process with the FDEP, the Florida Fish and Wildlife Conservation Commission[1] (FWC), and local governments. Public input was also solicited. The first step of the process was to develop an inventory and map the locations of water bodies throughout the District. A water body was placed in the inventory only if it was publicly owned and was greater than 140 acres. The final inventory included 384 lakes, estuaries, canals, streams, and rivers. Priorities were established on the basis of four factors:

1. Water quality of lakes and estuaries or general conditions of wetlands
2. State Water Quality Classification I, II, III, or Outstanding Florida Water
3. Public use
4. Habitats that are essential to the survival of wildlife resources

Funding constraints and staff limitations dictated the following criteria for creating and implementing new SWIM plans: more than half of the material needed to create a SWIM Plan must be available in a readily usable form and another agency must be willing to be a full partner in development and implementation of the plan.

Ground Water Quality

The SFWMD's policies for ground water quality, as related to water supply, were accepted by the District's Governing Board in 1991 as part of the *Water Supply Policy Document* (SFWMD, 1991). The primary objective is to manage regional ground water to protect the resource and meet the full range of natural systems and human water needs. Water quality standards, including those for ground water, are developed by the FDEP and

1. The Florida Fish and Wildlife Conservation Commission (FWC) was formerly known as the Florida Game and Fresh Water Fish Commission (FGFWFC).

adopted by the Environmental Regulatory Commission. The FDEP has responsibility to ensure that these standards are enforced.

The primary strategies for ground water management by the District and FDEP, which address both water quality and quantity issues, include the following:

- Assessments of ground water conditions, including water levels, contamination, and saltwater intrusion, throughout the District
- Identification and characterization of recharge areas
- Permitting activities
- Cooperative efforts with other government entities, local interests, and utility companies to develop well protection ordinances

The SFWMD and FDEP compile ground water quality data from throughout South Florida to provide periodic assessment of regional conditions and problem areas. The District has also identified recharge areas within its boundaries and identified the relative rates of recharge that occur in different areas. Locations of ground water sampling sites are shown in **Figure 26**.

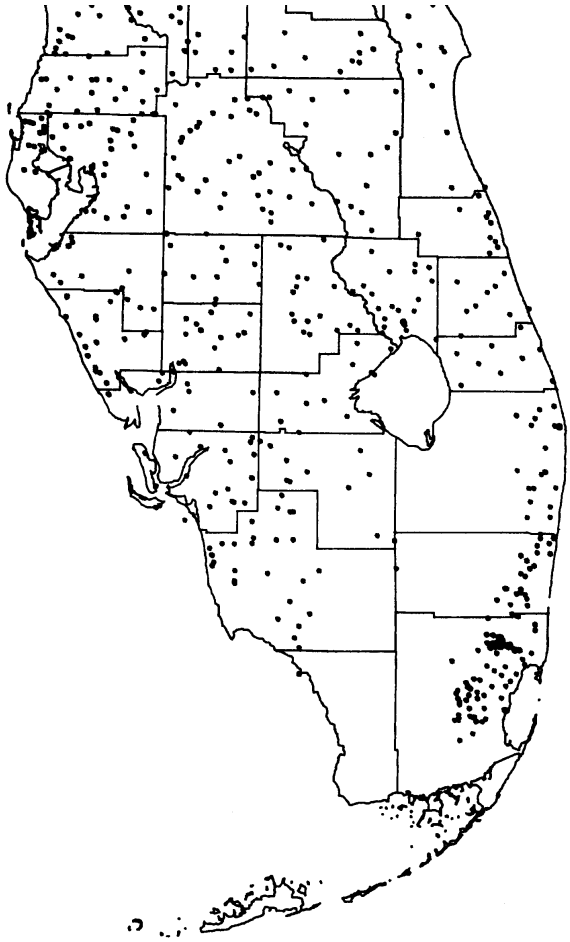


Figure 26. Background Monitoring Network Sampling Sites for Ground Water Quality in South Florida.

Through the Consumptive Use Permitting (CUP) Program, the SFWMD regulates ground water quality issues associated with water withdrawals. In general, the ground water quality aspect of permit review focuses on the potential for pollution of water resources and on saltwater intrusion. The issuance of a consumptive use permit shall be denied if the withdrawals would cause significant degradation of surface or ground water quality through the induced movement of pollutants into a water resource that is not polluted. Significant water quality degradation may result from altering the rate or direction of movement of pollutants. Similarly, a consumptive use permit is subject to denial if the application requests freshwater withdrawals that would cause significant saltwater intrusion. Significant saltwater intrusion includes the following:

- Movement of the saline water interface to a greater distance inland or vertically upward towards a freshwater source that has historically occurred as a result of seasonal fluctuations
- A sustained increase from background values of saline monitor wells with regard to dissolved chloride concentrations

During the District permit review process, the following potential impacts are routinely assessed to determine impacts due to pollution or saltwater intrusion:

- Saltwater intrusion
- Upconing of saline water
- Movement of nonsalt pollutant sources
- Spread of contamination from a point or nonpoint source through expansion of a cone of depression
- Changes in the hydroperiod and impacts in the natural treatment capacity
- Interaquifer exchange associated with well construction

Efforts are underway to streamline the CUP process and, thereby, reduce the amount of staff time required to process a permit. This will be accomplished by automating certain aspects of the permit application and review process, and by encouraging electronic filing of permit applications.

Land use decisions by local governments can impact ground water quality directly. In recognition of this, the District will continue to encourage local governments to consider water quality concerns in their comprehensive plans, especially as they relate to land use decisions. The District will, in its review of local government comprehensive plans, comment negatively on local government land use proposals which are not consistent with wellfield protection and aquifer recharge protection criteria. The District also will provide technical and other assistance to local governments to help identify recharge areas within local jurisdictions, wellfield protection zones, and appropriate wellfield protection ordinances.

ISSUES

The District funds and implements numerous activities to maintain and improve surface and ground water quality. The main issues are summarized as follows:

Issue 1. Water quality of surface waters has been degraded by human activity. Effective efforts must be implemented to protect and improve these resources by the following:

- Identifying and implementing the best procedures and management practices available to eliminate point and nonpoint sources of pollution

- Obtaining resources needed to restore and improve water quality in identified problem areas
- Establishing appropriate levels of discharge of pollutants to surface waters based on TMDLs and/or PLRGs
- Expediting Phase II of the Everglades Construction Project (ECP)

Issue 2. Ground water provides the major source of drinking water throughout the SFWMD and is the source of water for many natural rivers, streams, and wetlands. Ground water quality is threatened by human activities and must be protected and improved by the following:

- Eliminating point and nonpoint pollution and excessive withdrawals
- Establishing appropriate priorities and obtaining funds necessary to restore and improve ground water quality in identified problem areas
- Improving monitoring and source protection efforts

Objectives, Strategies, and Performance Measures

Core Objective WQ 1: Protect and improve surface water quality

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Regulation, and Monitoring and Evaluation (**Table 14**).

Performance Measures for Objective WQ 1

- **Core WQ 1(a):** Percentage of water segments that fully meet, partially meet, and do not meet their designated uses
- **Core WQ 1(b):** Number and percentage of SWIM water bodies with approved SWIM plans for which Pollutant Load Reduction Goals (PLRGs) have been established
- **Core WQ 1(c):** Percentage of total stream miles and lake and estuary area in the District assessed for ambient water quality
- **SFWMD WQ 1(d):** Number of SWIM plans being implemented according to SWIM plan schedules
- **SFWMD WQ 1(e):** Number and percentage of permitted systems inspected through the ERP Program, and percentage of those inspected found in compliance with permit conditions

Table 14. Activities Table for Core Objective WQ 1.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective WQ 1: Protect and improve surface water quality				
Planning				
Fe01	Kissimmee Basin Basic Plan Development	The SFWMD has consistently identified the Upper Kissimmee Chain of Lakes as a priority for water quality plan development. Development of such a plan identifies and prioritizes issues and efforts which provide efficiency for budget prioritization.	2001	SFWMD
Pa03	Florida Bay Feasibility Study	This is a feasibility study to comprehensively evaluate Florida Bay and to determine the types of modifications that are needed to successfully restore the water quality and ecological conditions of Florida Bay.	2004	SFWMD
Pa04	Comprehensive Integrated Water Quality Plan	The Comprehensive Integrated Water Quality Plan for South Florida involves identifying pollution-impaired water bodies, quantifying types and sources of pollution, establishing interim and final pollution load reduction targets necessary to achieve ecosystem restoration, recommending potential source reduction programs, developing baseline and future water quality monitoring programs to assess ecological responses to water quality changes, and constructing water quality treatment facilities.	2006	SFWMD
Ej	Florida Keys Water Quality Plan	The strategies identified in the Florida Keys Water Quallty Plan focus on eliminating water quality problems that are related to land-based activities in the Florida Keys. These problems may be caused by inadequate or nonexistent treatment of storm water runoff and wastewater. The plan builds upon several other plans, notably the Water Quality Protection Program and the Management Plan for the Florida Keys National Marine Sanctuary, and focuses on restoration strategies and projects that could be initiated or assisted by the District.	Ongoing	SFWMD
Ja20	Indian River Lagoon SWIM Plan Documentation	This activity involves an update of the *Indian River Lagoon Surface Water Improvement and Management Plan* (SFWMD and SJRWMD, 1994). The Indian River Lagoon SWIM project, a joint program administered with the St. Johns River Water Management District, is designed to develop and execute a combination of research and practical implementation projects to protect or restore the environmental resources of the St. Lucie Estuary and the Indian River Lagoon. The program has three goals: 1) attain and maintain water and sediment of sufficient quality to support a healthy, seagrass-based, estuarine ecosystem; 2) attain and maintain a functioning seagrass ecosystem which supports endangered and threatened species, fisheries, and wildlife; and 3) achieve heightened public awareness and coordinated interagency management. The focus of this effort has been on the improvement of water quality entering the estuary and lagoon, in terms of quantity, timing, and distribution of fresh water, and the associated suspended materials and nutrients that are transported into the system.	Ongoing	SFWMD
Ib01	Lake Okeechobee SWIM Plan Implementation	This activity includes work required to insure that the *Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b) is being implemented as intended.	Ongoing	SFWMD

Table 14. Activities Table for Core Objective WQ 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Public Works Construction				
Pb06	Lake Okeechobee Water Retention/ Phosphorus Removal	The South Florida Ecosystem Restoration Working Group ranked this project number ten on the list of critical restoration projects to be implemented under the USACE's authority provided in Section 528 of the 1996 Water Resources Development Act. This project was also recommended within the *Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b) to reduce phosphorus loading to the lake. This project includes two reservoir-assisted Stormwater Treatment Areas (STAs) and plugging of select local drainage ditches. The other portion of this feature includes the purchase of conservation easements within four key basins of Lake Okeechobee to restore the hydrology of isolated wetlands by plugging the connection to drainage ditches and the diversion of canal flows to adjacent wetlands.	2002	SFWMD
Pb07	Western C-11 (S-9) Water Quality Treatment Project	This project includes preconstruction engineering and design, real estate acquisition, and the construction of 1) a gated control structure on the C-11 Canal to divide western seepage waters from the eastern runoff waters in the canal and 2) an additional pump station adjacent to the S-9 Pump Station to pump clean seepage back into the Everglades Protection Area.	2002	SFWMD
Pf02	Lake Okeechobee Tributary Sediment Dredging	The purpose of the Lake Okeechobee Tributary Sediment Dredging Project is to remove phosphorus in canals located in areas of the most intense agriculture in the Lake Okeechobee Watershed. This project includes the dredging of sediments from ten miles of primary canals within an eight-basin area in the northern watershed of Lake Okeechobee. The initial design assumes that the dredged material will contain approximately 150 tons of phosphorus.	2005	SFWMD
Ba	Everglades Construction Project (ECP)	The District and the FDEP have set in motion a program that forms a comprehensive and consistent set of strategies to carry out the requirements of the Everglades Forever Act.	2006	SFWMD
Pf03	Pineland and Hardwood Hammock Restoration (C-111 Basin)	The purpose of the Pineland/Hardwood Hammock Restoration Project is to restore hammocks to a portion of the Frog Pond which has been purchased by the District as part of the C-111 Project to restore the Taylor Slough portion of the Everglades. This activity includes restoring South Florida slash pine and hardwood hammock species on a 200-foot wide strip on each side of two miles of State Road 9336 from the C-111 Canal to the L-31W Borrow Canal (approximately 50 acres) and the establishment of two one-acre hammocks in low-lying areas on each side of the road within Miami-Dade County.	2006	SFWMD
Pf08	Taylor Creek/ Nubbin Slough Reservoir and STA	This project includes an aboveground reservoir with a total storage capacity of 50,000 acre-feet and a STA with a capacity of 20,000 acre-feet in the Taylor Creek/Nubbin Slough Basin.	2009	SFWMD
Operations and Maintenance				
Bf	Operations and Maintenance of ECP	The operations and maintenance of the ECP is mandated by the Everglades Forever Act. This includes costs associated with the operations and maintenance of canals, levees, pipes, culverts, pump stations, and monitoring test cells within the ECP.	Ongoing	SFWMD

Table 14. Activities Table for Core Objective WQ 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Regulation				
Ed	Everglades Works of the District Permitting	The Federal Settlement Agreement and the Everglades Forever Act mandate the implementation of the Everglades BMP Program for the EAA to control phosphorus. In addition, the Everglades Forever Act mandates additional regulatory programs to include other water quality parameters and to include additional basins.	Ongoing	SFWMD
Eg	Everglades Storm Water Program	The Everglades Storm Water Program (formerly known as the Non-ECP initiative) was mandated by the Everglades Forever Act. The purpose of this program is to ensure that water quality standards are met at all structures that the District controls which pump water into, through, or from the Everglades Protection Area. This will be achieved through implementing the Non-ECP Permit, a combination of regulatory analysis, water quality monitoring, water quality improvement strategies, and solutions such as BMPs, or construction projects. Other components of the program include an education campaign, and developing a method for reimbursement of expenditures through a special assessment.	Ongoing	SFWMD
Ic	Lake Okeechobee Works of the District Permitting	The purpose of this activity is to inventory and permit all nondairy land uses in the priority basins of the northern Lake Okeechobee Watershed. High phosphorus areas will be identified through water quality surveys, monitoring will be performed to ensure compliance with SWIM phosphorus discharge concentration limits, and corrective actions will be required on parcels that are out of compliance.	Ongoing	SFWMD
Monitoring and Evaluation				
Ff	Kissimmee Basin Data Collection and Evaluation	The 2000 Lake Okeechobee Bill requires an assessment of the sources of phosphorus from the Upper Kissimmee Chain of Lakes and their relative contribution to the water quality of Lake Okeechobee. In addition, data evaluation and assessment efforts need to be conducted to meet the TMDL and Minimum Flows and Levels (MFL) requirements.	2003	SFWMD
Bb	ECP Research and Data Collection	This activity represents the ongoing research and data collection efforts on behalf of the ECP. The Everglades Forever Act and Federal Everglades Settlement Agreement, as well as permits and other legislation mandates require the District to conduct research, monitoring, and modeling activities.	Ongoing	SFWMD
Eb02	Everglades BMP Effectiveness Research	BMP research provides information on how to efficiently control pollutant releases from agricultural and other developed areas. The particular focus of this activity is on the prevention of phosphorus releases. Projects include research on understanding phosphorus releases from the EAA soils to optimize fertilizer application rates, development of a baseline of water quality data for the C-139 Basin, evaluation of pesticide releases and toxicity, and evaluation of mercury releases and bioaccumulation. This activity will also develop a chapter on BMPs for the 2001 Everglades Consolidated Report, as required by statute.	Ongoing	SFWMD

Table 14. Activities Table for Core Objective WQ 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Eb11	404 Permit Research, Monitoring, and Modeling - Receiving Waters	This activity will assess impacts of effluents from STAs on water quality (nutrients and toxins), soils, periphyton, and macrophytes.	Ongoing	SFWMD
Eb20	Water Quality Monitoring - Florida Bay	This activity supports monitoring of water quality throughout the Florida Bay region and monitoring of seagrass community in northeastern Florida Bay, Manatee Bay, and Barnes Sound. Impacts of changing freshwater flow and releases from C-111 Canal are being assessed.	Ongoing	SFWMD
Ja	St. Lucie Estuary/ Indian River Lagoon	This program includes monitoring, research, and implementation within the portions of the St. Lucie Estuary and Indian River Lagoon that are located within the District. This program has a very direct tie to the Indian River Lagoon portion of the Comprehensive Everglades Restoration Plan (CERP), as well as the basis of scientific information being used to carry out the Indian River Lagoon SWIM implementation and PLRG development.	Ongoing	SFWMD
Ia	Lake Okeechobee Research and Data Collection	This element includes the research and monitoring related activities being conducted in Lake Okeechobee and its watershed. This information is then fed to the planning and implementation projects to ensure that the District's restoration related activities are based on sound and defensible science. The key activities include in-lake research devoted toward determining the impacts of water level, nutrients, and invasive plants; watershed research dealing with the fate and transport of phosphorus; modeling activities associated with the impacts of phosphorus in the watershed and the lake; BMPs associated with beef cattle operations; and monitoring activities to assess the effectiveness of the District's restoration efforts.	Ongoing	SFWMD
Kb	Water Quality Monitoring	This activity encompasses the ongoing water quality monitoring work performed by the District that does not relate to any specific project. Various activities within the element include water analysis, water sampling, and quality control.	Ongoing	SFWMD
Nd	Lower West Coast Water Quality Monitoring	This activity encompasses the Lower West Coast Estuarine Water Quality Monitoring from Cape Romano to Caloosahatchee River (Florida International University) and Big Cypress Basin Inland (Collier County) water quality monitoring projects.	Ongoing	SFWMD

Core Objective WQ 2: Protect and improve ground water quality

The SFWMD has developed strategies to meet this core objective. The strategies will be implemented via budgeted activities in the categories of Planning, Regulation, Outreach, and Monitoring and Evaluation (**Table 15**).

Performance Measures for Objective WQ 2

- **Core WQ 2(a):** Improving, degrading, and stable trends in ground water quality
- **Core WQ 2(b):** Improving, degrading, and stable trends in nitrate concentrations in springs

Table 15. Activities Table for Core Objective WQ 2.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective WQ 2: Protect and improve ground water quality				
		Planning		
Pa06	Water Preserve Area Feasibility Study	This is a study to investigate the feasibility of an interconnected series of marshes, reservoirs, water quality treatment areas, ground water recharge areas, and storm water attenuation facilities between the natural Everglades system and the urbanized areas of the east coast of South Florida. This study includes modeling and studies of ground water flows, surface water flows, and water quality. The study will also determine specific uses of individual cells and develop plans for construction.	2001	SFWMD
		Regulation		
Hb01	Water Use, Application, Compliance, and Criteria Development	Water use permitting (Consumptive Use Permitting) is a state mandated program assigned exclusively to the water management districts. The objective is to insure safe, efficient, equitable, and reliable development of the state's water resources. The major components are 1) review and prepare recommendations for permit applications for all consumptive uses of water within the District boundaries; 2) provide postpermit compliance checks on priority projects based on staffing resources (approximately 300 projects per year); 3) review and issue well construction permits for specific water wells within District boundaries; and 4) perform water conservation rulemaking analysis and make recommendations. This activity also includes prepermit planning, permit issuance, dispute resolution, litigation support, technical support, enforcement, communication with water supply planning activities of this agency, and criteria and rule development.	Ongoing	SFWMD
		Outreach		
Ga01	Local Government Comprehensive Plans	Comprehensive plans and amendments are reviewed by the District as required by Chapters 163 and 298, F.S. This activity is being significantly cut back for FY2001 to provide funding for the CERP.	Ongoing	SFWMD

Table 15. Activities Table for Core Objective WQ 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Event Specific Code	Water Shortage Management	The Governing Board may declare a water shortage and enforce the associated restrictions when there is not enough water available for present or anticipated needs, or when a reduction in demand is needed to protect water resources. Ground water and surface water levels are continuously monitored. If they fall to levels considered critical for the time of year and anticipated demands, the water shortage process is initiated, pursuant to Section 373.246, F.S. Different levels of drought require corresponding levels of restrictions. Water shortage declarations range from a warning, which has voluntary moderate restrictions, through four phases of water shortage, to an emergency, which can disallow any further withdrawals.	As Needed	SFWMD
	Wellhead Protection Programs	The FDEP has a number of regulations under the Florida Administrative Code which function to regulate hazardous and solid waste, storm water discharges, storage tank systems, etc. The primary goal of these legislative policies is to prevent problems before they occur, as contrasted to correcting or providing remedial action for preexisting problems. The intent of these ordinances is to protect and safeguard the health, safety, and welfare of the public by providing criteria for regulating and prohibiting the use, handling, production, and storage of certain deleterious substances which may impair present and future Public Water Supply (PWS) wells and wellfields. The District has and will continue to provide assistance to local governments in the preparation of their wellfield protection ordinances.	Ongoing	FDEP
	Recharge Mapping	As directed by Chapter 373, F.S., the SFWMD provides ground water recharge information to local governments to assist them with the development and implementation of appropriate water resource policies. In order to accomplish this, the SFWMD undertook a project to map recharge areas within its four planning regions. This effort was completed in 1995. The maps delineate precipitation recharge and leakage rates for all the primary PWS aquifers utilized throughout South Florida. The District has and will provide assistance to local governments in the delineation of prime recharge areas in order to implement voluntary tax assessment programs (under the Bluebelt Act) that protect the state's prime recharge areas.	As Needed	SFWMD
Monitoring and Evaluation				
Hf01	Wetland Criteria Development Support	This activity supports the Regulation Program in developing a scientific basis for wetland protection criteria used in water use and environmental resource permitting. The activity was originated at the direction of the Governing Board and Executive Office to develop a research and monitoring program to investigate impacts. This information is needed to support rulemaking for the Lower West Coast and Upper East Coast regions and is a critical element in the implementation of water supply plans for both regions.	2003	SFWMD

Table 15. Activities Table for Core Objective WQ 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Pe02	Lake Okeechobee Aquifer Storage and Recovery (ASR) Pilot Project	This pilot project will identify the most suitable sites for the ASR wells in the vicinity of Lake Okeechobee and identify the optimum configuration of those wells. Additionally, the pilot project will determine the specific water quality characteristics of waters to be injected, the specific water quality characteristics and amount of water to be recovered from the aquifer, and the water quality characteristics of the receiving aquifer. Further information from the pilot project will provide the hydrogeologic and geotechnical characteristics of the upper Floridan Aquifer System within the region, and the ability of the upper Floridan Aquifer System to maintain injected water for future recovery.	2004	SFWMD

Chapter 6
NATURAL SYSTEMS

GOALS

The following state natural system goals have been outlined by the Florida Legislature:

- Conserve forests, wetlands, fish, marine life, and wildlife to maintain their environmental, economic, aesthetic, and recreational values (Section 187.201(10)(b)1, F.S.)
- Reserve from use that water necessary to support essential nonwithdrawal demands, including navigation, recreation, and protection of fish and wildlife (Section 187.201(8)(b)14, F.S.)
- Protect the functions of entire ecological systems through enhanced coordination of public land acquisition, regulatory, and planning programs (Section 94-356, 2(c), Laws of Florida)
- The Florida Legislature hereby declares the policy of the state to be management and preservation of its renewable marine fishery resources, based upon the best available information, emphasizing protection and enhancement of the marine and estuarine environment in a manner as to provide for optimum sustained benefits and use to all the people of the state for present and future generations (Section 370.025(1), F.S.)

In order to preserve, enhance, and restore the water resource related natural systems within its boundaries, the SFWMD is committed to the following goals:

- Preserve native ecosystems, along with their water resource related functions
- Restore altered ecosystems, where appropriate, along with their water resource related functions

RESOURCE ASSESSMENT

Two main elements of the District's natural system management efforts are ecosystem protection and ecosystem restoration.

Ecosystem Protection

The primary components of ecosystem protection include activities such as establishment and implementation of Minimum Flows and Levels (MFLs), the Save Our Rivers (SOR) program, and wetlands regulation.

Minimum Flows and Levels

Definition

The establishment of minimum flows for surface watercourses and levels for both surface waters and aquifers is critical to maintaining environmental quality. In recognition of this fact, the Florida Legislature has mandated that all water management districts establish MFLs for water bodies within their jurisdictions (Section 373.042, F.S.). Minimum flows for watercourses (generally rivers, streams, or the flow of fresh water into an estuary) represent the limit at which further withdrawals would be significantly harmful to the water resources or ecology of the area. Minimum levels are the level of ground water in an aquifer and/or the level of surface water (generally in a lake or wetland) below which further withdrawals would be significantly harmful to the water resources.

In 1997 the Florida Legislature provided additional guidance (Section 373.0421, F.S.) concerning establishment of MFLs:

> (1)(a) Considerations.—When establishing minimum flows and levels pursuant to s. 373.042, the department or the governing board shall consider changes and structural alterations to watersheds, surface waters, and aquifers, and the effects such changes or alterations have had, and the constraints such changes or alterations have placed, on the hydrology of an affected watershed, surface water, or aquifer, provided that nothing in this paragraph shall allow significant harm as provided by s. 373.042(1) caused by withdrawals.
>
> (b) Exclusions.—
>
> 1. The Legislature recognizes that certain water bodies no longer serve their historical hydrologic functions. The Legislature also recognizes that recovery of these water bodies to historical hydrologic conditions may not be economically or technically feasible, and that such recovery effort could cause adverse environmental or hydrologic impacts. Accordingly, the department or governing board may determine that setting a minimum flow or level for such a water body based on its historical condition is not appropriate.
>
> 2. The department or the governing board is not required to establish minimum flows or levels pursuant to s. 373.042 for surface water bodies less than 25 acres in area, unless the water body or bodies, individually or cumulatively, have significant economic, environmental, or hydrologic value.
>
> 3. The department or the governing board shall not set minimum flows or levels pursuant to s. 373.042 for surface water bodies constructed prior to requirement for a permit, or pursuant to an exemption, a permit, or a reclamation plan which regulates the size, depth, or function of the surface water body under the provisions of this chapter (373), chapter

> 378, or chapter 403, unless the constructed surface water body is of significant hydrologic value or is an essential element of the water resources of the area.
>
> The exclusions of this paragraph shall not apply to the Everglades Protection Area, as defined in s. 373.4592(2)(h).

MFL Schedules

The *1998 District Water Management Plan Annual Report* (SFWMD, 1998a) included a schedule for establishing MFLs for priority water bodies within the District. Chapter 373.04(2), F.S., requires the District to annually review the priority list and schedule and, with Florida Department of Environmental Protection (FDEP) approval, make necessary updates and revisions. In November 1999, the SFWMD submitted a revised priority list and schedule to the FDEP. Future DWMP annual reports will include updated priority lists and schedules.

Proposed Criteria

In July 1998, the District published the revised draft document entitled *Proposed Minimum Water Level Criteria for Lake Okeechobee, the Everglades, and the Biscayne Aquifer within the South Florida Water Management District* (SFWMD, 1998e), and authorized staff to conduct a voluntary peer review of the draft document. The revised document presents the technical basis for establishing MFL criteria for Lake Okeechobee, the Water Conservation Areas (WCAs), the Holey Land and Rotenberger Wildlife Management Areas (WMAs), Everglades National Park, and the coastal Biscayne aquifer. The report also provides a definition of significant harm which states "…Significant harm is defined as a loss of specific water resource functions that take multiple years to recover, which result from a change in surface water or ground water hydrology…". The report also provides a conceptual relationship of the term significant harm to the consumptive use permitting standard of harm, and water shortage serious harm standard as presented in **Figure 27**.

Public Workshop and Peer Review

In August 1998, District staff held a two-day public workshop to conduct an independent, scientific, peer review of the draft MFL technical document. At this meeting District staff presented the proposed MFL criteria to an expert panel of scientists. The panel also listened to comments provided by members of the public and staff representing the various agencies that have management responsibilities for these areas (e.g., the Florida Fish and Wildlife Conservation Commission (FWC)[1], FDEP, Everglades National Park, Biscayne Bay National Park, and the U.S. Geological Survey (USGS).

1. The Florida Fish and Wildlife Conservation Commission (FWC) was formerly known as the Florida Game and Fresh Water Fish Commission (FGFWFC).

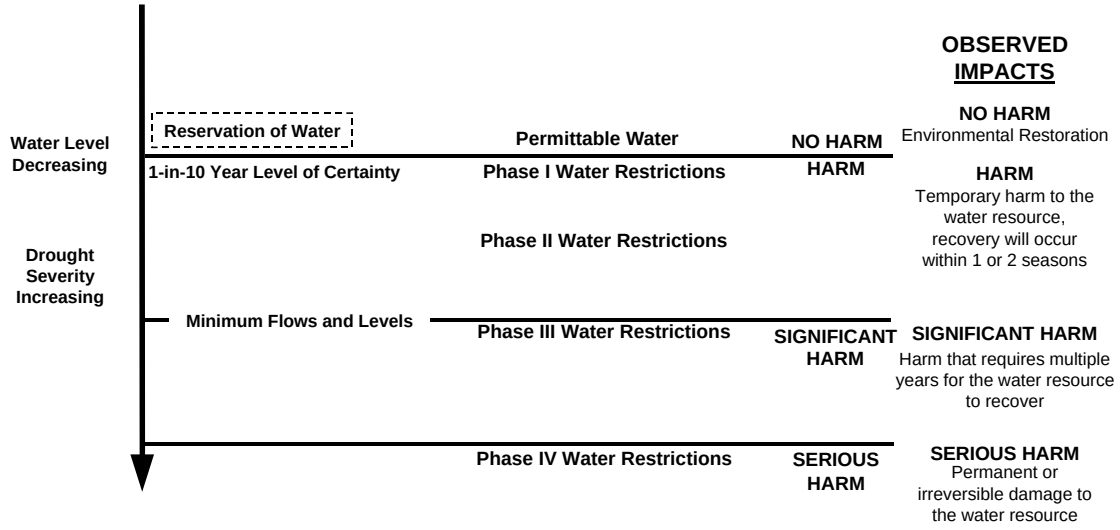


Figure 27. Conceptual Relationship Between Harm, Significant Harm, and Serious Harm.

In September 1998, the final report of the scientific peer review panel was posted on the internet for public review and comment. In October 1998, the peer review panel presented the results of their findings to the Governing Board. Major conclusions of the review included the following:

- The draft document presents a logical, well-supported case for the proposed MFL criteria
- The recommendations are backed by reference to appropriate scientific findings in published literature and SFWMD experience and research
- The report made a clear connection between policy foundations and the reviewable technical issues
- The issue of significant harm was clear for each priority water body

With regards to concerns expressed by members of the public concerning Florida Bay and Biscayne Bay the panel did the following:

- The panel concluded that it is possible to set initial MFLs for the three hydrologic systems under consideration prior to setting MFLs for the other systems
- The panel recommended that MFLs for Florida Bay and Biscayne Bay be moved up in the District's MFL priority list

Sufficiency Review

The panel has recommended that a sufficiency review should be conducted to determine if any new data or information has surfaced that illustrates the relationships between ecosystem water levels, flows, and bay and estuary water and salinity levels. A sufficiency review of the required information necessary to develop MFLs for Florida Bay

and Biscayne Bay was completed. In November 1999, the District submitted a revised priority list to FDEP and it was accepted in December 1999.

In addition, as part of the Lower East Coast (LEC) regional water supply planning process, the District has initiated the process of developing a MFL Prevention and Recovery Plan. This plan will accomplish the following tasks:

- Identify water resource development projects and strategies necessary to achieve recovery and to prevent levels from falling below the minimum
- Develop a timetable and phased schedule for implementation of additional water supplies to ensure sufficient water for existing and projected uses

Save Our Rivers

Placing land in public ownership is a major option available to protect environmentally sensitive lands. In 1981, the Florida Legislature enacted the Save Our Rivers (SOR) Program. The legislation created the Water Management Land Trust Fund (Section 373.59, F.S.), which receives revenues from documentary stamp taxes and is administered by the FDEP. Funds are also added to this program from the Florida Preservation Trust Fund, created through the Preservation 2000 Act in 1990 and the Florida Forever Act in 1999. Implementation tools of the SOR Program include land acquisition, land management, cooperative management agreements for public use, and environmental education.

Land Acquisition

Water management districts may use SOR funds for the acquisition of fee simple, or other interest, in lands necessary for water management, water supply, and the conservation and protection of water resources. From 1981 to June 1999, approximately 359,000 acres were acquired at a cost of more than $550 million.

Applications to consider a particular land parcel for purchase under the SOR Program can be made by a landowner, private citizen, local government, or the SFWMD. Applications are accepted throughout the year and each spring the District reviews the new applications and proposes boundary adjustments. Site inspections are conducted and projects are scored using a land evaluation matrix. The matrix contains the following parameters that address a site's water resource and environmental values:

- Water Management
- Connectiveness
- Water Supply
- Species Diversity
- Conservation and Protection of Water Resources

- Vulnerability
- Rarity
- Manageability
- Nature Oriented Human Use
- Habitat Diversity

The resulting scores are the basis for the recommendations of the Land Selection Committee, comprised of senior level SFWMD managers. The Land Selection Committee meets in an advertised public meeting to discuss staff recommendations and, in turn, recommends a work plan to the Governing Board. Taxpayers from several South Florida counties have passed local bond issues for the acquisition of environmentally sensitive land. Wherever possible, the SFWMD has worked with local governments to acquire lands that are on both regional and county lists. **Table 16** indicates projects that were on the 1999 priority list for acquisition and management, and identifies the entities that are working in partnership with the District to implement these projects.

Table 16. 1999 Land Acquisition and Management Plan for Save Our River Projects.

Project	Acquisition Partner
Allapattah Ranch	Conservation and Recreational Lands (CARL)
Atlantic Ridge Ecosystem	CARL
Corkscrew Regional Ecosystem Watershed	CARL
East Coast Buffer	CARL
Florida Bay (Southern Glades, Model Lands, L-31N)	CARL/Miami-Dade County
Kissimmee River	None
Lake Walk-in-Water	Polk County
Loxahatchee Slough	None
McDaniel Ranch	None
North Fork St. Lucie River	CARL/St. Lucie County
West Jupiter Wetlands (Pal-Mar)	CARL/Martin and St. Lucie counties
Shingle Creek	Mitigation
Stormwater Treatment Areas (STAs)	Federal Government
Ten Mile Creek	Federal Government
Twelve Mile Slough	CARL

Land Management

Land management under the SOR Program focuses on the following areas:

- Hydrologic restoration - wetland restoration and the establishment of sheetflow conditions, where possible
- Prescribed burning - wildfire prevention, fuel load reduction, and ecological burning for habitat enhancement
- Exotic plant control - treatment of invasive exotic vegetation by the use of approved chemical herbicides with trained applicators
- Habitat protection and enhancement - posting, fencing, and providing physical security; maintenance of disturbed habitats through mowing, chopping, and disking; and general maintenance activities

The District has also acquired numerous parcels of land for future restoration, water quality treatment, and/or water resource development projects, for which planning and design are under way. On an interim basis, until such time as construction is initiated, existing agricultural land uses are being continued as a means of managing these lands. A competitive bid process is used to solicit proposals and award contracts, which include the appropriate cancellation clauses so the land is available when needed. The benefits of this interim use include the following:

- On-site property manager provided at no cost to the District
- On-site exotic control, use of Best Management Practices (BMPs), fencing, etc., mandated as contract conditions
- Income generated helps offset District acquisition and future project costs
- Property remains on the local county tax rolls until it is actually needed by the District
- Continued use of the property supports the local agricultural economy

Land management activities by the District continue to be uncertain, since the District has not been given clear direction concerning its future role in long-term management of lands that have been acquired to protect or preserve natural systems.

Cooperative Management Agreements

In addition to agreements with the FWC, the District has entered into cooperative agreements with other state agencies, local governments, and the private sector for assistance in the management of certain SOR lands. In most cases, the SFWMD has a Memorandum of Agreement (MOA) and an annual work plan that detail services and compensation. The cooperators provide many services for which the SFWMD does not pay, including managerial, planning, and administrative support from the organization’s headquarters staff, and specialized services, such as law enforcement and management of public hunting.

Public Use

Public recreational opportunities are being developed on SOR lands where such uses are appropriate. Hiking and equestrian trails and primitive back country camp sites have been planned and developed by the SFWMD, in cooperation with volunteers from the Florida Trail Association and local horsemen's clubs. The trail systems enable visitors to see and enjoy these sensitive lands with minimal impact to the resource.

Public hunting is also allowed on certain SOR properties and is managed by the FWC through cooperative agreements with the SFWMD. Special regulations established by the FWC restrict the number of hunters, establish bag limits, and restrict use of dogs and off-road vehicles.

Wetlands Regulation

Since 1974, pursuant to the Water Resources Act of 1972 (Chapter 373, F.S.), the SFWMD has regulated wetlands through its Surface Water Management Permitting Program. For the first few years, the regulatory program focused primarily on drainage and flood protection and little attention was given to wetland protection or environmental considerations. Revisions to the SFWMD's rules during the 1980s included the addition of criteria to protect wetlands. The rules remained relatively flexible regarding wetland protection, requiring more protective measures for wetlands that comprised larger systems and were deemed to be directly related to the water resources of the District. The emphasis of early wetland regulatory criteria was to achieve protection of larger environmental systems. The regulatory program evolved over the years, and in 1987 the District's Isolated Wetlands Rule was adopted (Chapter 40E-4, F.A.C.) to provide additional protection to wetland systems.

FDEP Dredge and Fill Delegation

Changes in the regulatory program were implemented under the terms of an operating agreement, approved in 1992, between the SFWMD and FDEP. In November 1992, the SFWMD began reviewing certain dredge and fill activities proposed in FDEP jurisdictional wetlands. The operating agreement specified the type of projects in which the SFWMD could authorize dredging or filling activities in FDEP jurisdictional wetlands. The delegation agreement was the first step towards achieving a one-stop permitting program in Florida.

Environmental Resource Permitting

The Florida Environmental Reorganization Act of 1993 consolidated dredge and fill permitting activities and surface water management permitting activities into one program implemented through Chapter 373, F.S. The rules governing the implementation of the Environmental Resource Permit (ERP) Program went into effect in October, 1995. The merging of the criteria for wetland and surface water management permitting resulted in only one permit being issued.

In October of 1995, the District began to process applications for the use of sovereign submerged lands when a proprietary authorization is required in conjunction with an ERP permit. The proprietary authorization for the use of sovereign submerged lands is governed by Chapters 253 and 258, F.S.

The ERP Program deals with the construction of surface water management systems and dredge and fill activities. Surface water management systems are required for all forms of development: agricultural, commercial, and residential. Developed sites, containing more impervious surfaces or altered topography, must provide a way to direct storm water to water management areas for water quality treatment and flood attenuation.

During the ERP application review process, wetlands are evaluated both on and adjacent to the project site. If wetland impacts are proposed in an ERP application, an analysis is conducted to determine if the impacts can be eliminated or reduced. If the proposed wetland impacts are determined to be permittable, an applicant will need to provide compensation for the loss of the wetland functions. Generally this is accomplished through mitigation. Mitigation consists of the restoration or enhancement of existing wetlands, the creation of new wetland habitat, or a combination of these methods.

If the applicant proposes to preserve the wetlands on the project site, an analysis is conducted to determine what effects the development will have on the wetlands. An applicant must ensure that an upland buffer exists, that adequate amounts of water will be available, that wetlands will not be inundated for prolonged periods, and that a conservation easement is provided to ensure long-term protection.

Wetland Impact Due to Consumptive Use

Wetlands impacts are also reviewed through the Consumptive Use Permitting (CUP) program. Wetlands are identified during the review process and an analysis of potential impacts on wetland systems is performed. The potential drawdown effect on wetlands by wellfields or dewatering operations is often modeled by the applicant, as well as District staff, to determine the extent of potential impact. Adverse impacts to wetlands through dewatering or wellfield drawdowns cannot be permitted. If an adverse impact is identified, the application must be modified to eliminate the adverse impact or staff will recommend a reduced allocation. Development has begun on a rule that would allow limited drawdown under wetlands.

Environmental Compliance

In 1989, the District completed an internal study assessing the ability of its regulatory program to manage and protect wetland resources. An independent company analyzed the program. As a result of those studies, a major initiative to develop a postpermit compliance program was undertaken in 1990, and the District has staffed a wetland mitigation compliance work unit since 1992. These staff review submitted monitoring reports and verify success criteria on-site. Mitigation sites are monitored for five years and thereafter site inspections are completed annually.

The District's compliance staff have inspected projects permitted with mitigation requirements and identified a number of noncompliance cases. Most of the cases have been resolved without the need for formal enforcement action.

Ecosystem Restoration

The primary components of ecosystem restoration include planning activities such as natural resource restoration components of the Comprehensive Everglades Restoration Plan (CERP), Surface Water Improvement and Management (SWIM) plans and related projects, Kissimmee River restoration, Everglades restoration, Lake Okeechobee restoration, and control of exotic and nuisance plant species.

Natural System Restoration Components of the CERP

Although some level of ecological improvement will occur in the South Florida ecosystem as a result of implementation of projects currently planned outside of the CERP (e.g., Kissimmee River restoration), the cumulative, regional benefits from these projects would not result in a sustainable South Florida ecosystem. Based on an evaluation of conditions projected for 2050, the overall health of the ecosystem will substantially deteriorate if the CERP is not implemented. The analyses show that making modifications to only some portions of the Central and Southern Florida Flood Control (C&SF) Project will not achieve sustainable natural systems.

An important component of the CERP is to restore natural communities within the study area that have been impacted by construction and operation of the C&SF Project. The primary types of impacts that have occurred include loss of wetlands due to land development, alteration of hydroperiods to provide too much or too little water at inappropriate times, and changes to species composition of wetland ecosystems due to degradation of water quality. These systems will be restored through a combination of land acquisition, creation of new lakes and short-hydroperiod wetlands, removal of existing canals and levees that impede the natural flow patterns, construction of new facilities to capture and distribute water, and efforts to provide improved depth, timing, and distribution of water throughout the Everglades. Details of the CERP are further described in **Chapter 2**.

SWIM Plans and Projects

In addition to improvement of water quality, SWIM plans have also identified needs for restoration of natural ecosystem functions within the target water bodies. The basis for SWIM efforts is described in **Chapter 5**.

The SWIM legislation that was enacted in 1987 identified three priority water bodies within the SFWMD. The most recent revisions of SWIM plans were prepared in 1994 for Indian River Lagoon (SFWMD and SJRWMD, 1994), in 1995 for Biscayne Bay (SFWMD, 1995b), and in 1997 for Lake Okeechobee (SFWMD, 1997b). An additional water body, the Everglades, was identified through the SWIM priority setting process. A plan was completed in 1992 that identified the problems facing the Everglades, the resources that were threatened, probable causes, and proposed actions (SFWMD, 1992b). The Everglades SWIM Plan was subsequently superseded by the Everglades Protection Act and the Everglades Forever Act, which incorporated many of the actions proposed in the SWIM plan and directed how restoration efforts were to proceed. The Florida Legislature also indicated that no further SWIM planning efforts were to be conducted in the Everglades until the mandated recovery programs were completed. Locations of District SWIM planning areas are shown in **Figure 28.**

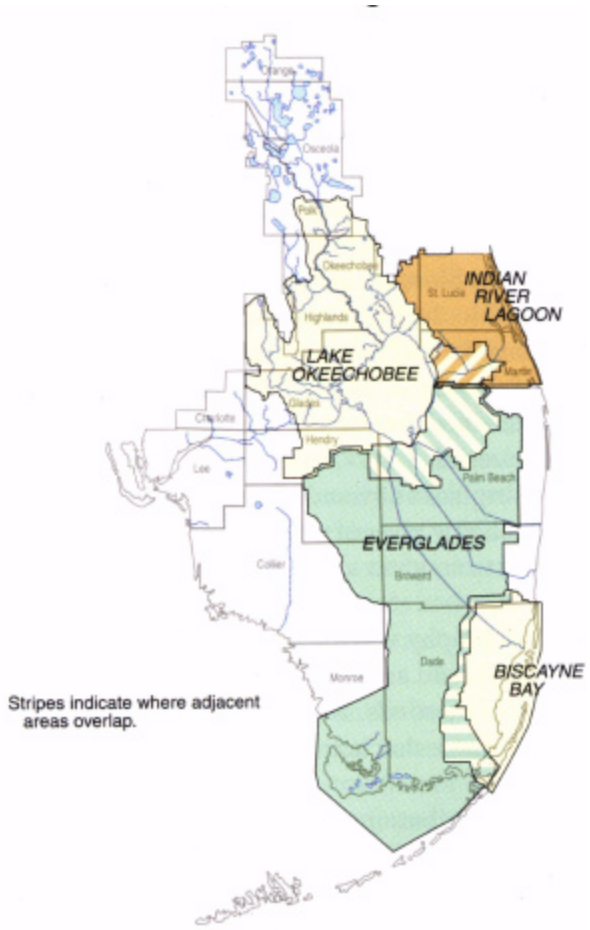


Figure 28. Locations of District SWIM Planning Areas (Fernald and Purdam, 1998).

The discussion below is focused on ecological conditions that have improved within the three water bodies that have active SWIM programs. Other reporting requirements are in place to continually inform the Florida Legislature on the progress of efforts to improve water quality and restore natural systems in the Everglades, including the *2000 Everglades Consolidated Report* (SFWMD, 2000e) and the *2000 Everglades Annual Report* (SFWMD, 2000f), which are available from the SFWMD.

The discussion in this section addresses ecological features such as fisheries, birds, endangered species, bottom communities including submerged algae and seagrasses, and emergent shoreline wetland communities such as marshes and swamps. Emphasis of ecological monitoring efforts has been placed on habitats rather than populations of

individual species. The assumption is made that if appropriate habitats exist, then the various species will increase in numbers to occupy those habitats. The primary ecosystem improvements include protection and restoration of mangroves and seagrasses in Biscayne Bay and the Indian River Lagoon, and control of the spread of exotic and nuisance vegetation in Lake Okeechobee.

Lake Okeechobee SWIM

Littoral Zone. Much of the productivity within Lake Okeechobee occurs along the shoreline, especially in the 100,000 acres of emergent vegetation that occupy much of the western edge of the lake. The major change in littoral zone vegetation has been the increase of undesirable and exotic species such as hydrilla, melaleuca, and torpedo grass. This has led to the initiation of efforts to control their spread.

Melaleuca Control. Other management methods include the use of herbicides and mechanical harvesting to control the spread of melaleuca. In 1993, before initiation of the treatment program, about 25,000 acres of Lake Okeechobee's littoral zone were impacted by melaleuca. Today, all of these areas have been treated and the spread of melaleuca is largely controlled. It is anticipated that within a few years, only limited maintenance efforts will be needed to prevent reinfestation.

Plankton. The District has begun to collect phytoplankton and zooplankton data to quantify long-term trends in the ecosystem health in Lake Okeechobee. Periodically, excessive growth of algae occurs in the lake and creates algal blooms. These conditions are undesirable because some species produce algal toxins and because the high concentrations of algae often result in low levels of oxygen in the water at night and on cloudy days. Lack of oxygen, in turn, may result in the death of fishes and invertebrates over large areas. The occurrence of several invertebrate kills, covering large areas of Lake Okeechobee during 1986 and 1987 was one factor that contributed to the designation of Lake Okeechobee as a SWIM priority water body by the Florida Legislature. The primary measure of phytoplankton is the concentration of chlorophyll in the water. Overall growth of phytoplankton and the relative distribution of desirable and undesirable species of algae are also closely linked to the concentration of phosphorus.

Indian River Lagoon SWIM

Mosquito Impoundment Restoration. There are approximately 4,700 acres of mosquito impoundments within the SFWMD portion of the Indian River Lagoon. This represents more than half of the 8,140 acres of mangroves in coastal Martin and St. Lucie counties. Through the Indian River Lagoon SWIM program, approximately 4,300 of these 4,700 acres have been reconnected to the lagoon.

Seagrass Evaluation. The growth and distribution of seagrasses have been monitored in the lagoon since 1986 and historical data from aerial maps are available from 1970 to the present. Preliminary analysis of available data was conducted by Woodward-Clyde, Inc. in 1994 (Woodward-Clyde Consultants et al., 1994). At that time it was estimated that submerged vegetation, including seagrasses, covered about 9,250 acres of

the 27,200 acres of potentially suitable substrate in the south segment of the lagoon. This represented a 31 percent decline from the coverage that existed in 1986, but an increase of 43 percent relative to the 6,479 acres of submerged plants that were present in 1970.

Other Habitat Restoration Projects. Through the Indian River Lagoon SWIM Program several habitat restoration projects are underway within the SFWMD that will result in creation/restoration of over 50 acres of wetlands. Wetlands have been created/ restored along Sim's Creek in Palm Beach County. A wetland creation project at the Jupiter Inlet Natural Area in Palm Beach County was completed in January, 2000. A shoreline restoration plan has also been completed for Blowing Rocks Preserve in Martin County. Project construction will result in creation/restoration of one mile of shoreline in phases over a 10-year period.

Additionally, the Indian River Lagoon SWIM Program is supporting a project to remove exotic vegetation from 1,000 acres of publicly owned lands along the North Fork of the St. Lucie River. The SFWMD is working closely with St. Lucie County and FDEP to coordinate wetland restoration activities that will be needed after the exotic vegetation has been removed.

Oysters. An additional indicator of the lagoon's health is the distribution and abundance of oysters, a target organism in the St. Lucie Estuary. The District has initiated a contract to document changes in these populations over time.

Biscayne Bay SWIM

Seagrasses and Mangroves. An extensive effort was undertaken by Miami-Dade County to map the distribution of various ecological resources within Biscayne Bay during the 1980s. This map provided a sound basis to document changes in bottom communities over time. Monitoring and remapping of these areas were conducted under the SWIM Program and has shown a 25 percent increase (1,600 acres of new beds) in the coverage of seagrasses between 1984 and 1995. As part of the SWIM program, 700 acres of emergent wetland marshes and mangrove swamps have been created, primarily in northern and central Biscayne Bay.

SWIM funds also supported a project to restore freshwater flow to mangroves along the shoreline of Biscayne National Park. The intent was to divert excess flow from District coastal canals through a spreader canal to provide sheetflow across the mangroves. Facilities have been constructed, but sufficient water is not available to operate the system properly.

Diseased Fish. SWIM supports efforts to document the extent and nature of the occurrence of diseased and injured fish in Biscayne Bay. This problem has been impacting commercial and sports fisheries for a number of years and appears to be linked to poor water quality in certain areas of Biscayne Bay.

Kissimmee River Restoration

Historically, the Kissimmee River meandered 103 miles from Lake Kissimmee to Lake Okeechobee through a one to two mile wide floodplain. The river and its flanking floodplain consisted of a mosaic of wetland plant communities and supported a diverse group of waterfowl, wading birds, fish, and other wildlife. Thc river was channelized between 1962 and 1971. Two-thirds of the historical floodplain was drained. One-third of the river channel was destroyed by excavation of the canal and placement of the spoil material. Implementation of the Kissimmee Flood Control Project led to drastic declines in wintering waterfowl, wading bird, and game fish populations, as well as loss of ecosystem functions.

The Kissimmee River Restoration Project will restore the ecological integrity of the damaged ecosystem by recreating the historic mosaic of wetland plant communities and restoring the historic biological diversity and functionality. The major components of the project include reestablishing historic hydrologic conditions and recreating the historical river-floodplain connectivity

The major hydrologic restoration components of the project include reestablishment of inflows from Lake Kissimmee that will be similar to historical discharge characteristics, continuous backfilling of 22 miles of canal, and removal of two water control structures. Historical river-floodplain connectivity will be recreated through acquisition of approximately 85,000 acres of land in the Kissimmee Chain of Lakes and river valley, and recarving of nine miles of former river channel (**Figure 29**).

Once these physical and hydrologic changes have been completed it is assumed that ecosystems will recover over time, restoring an estimated 40 square miles of river-floodplain ecosystem. This ecosystem will include 26,500 acres of wetlands and 43 continuous miles of meandering river. It will provide habitat for over 300 species, including three endangered species of birds: the bald eagle, the snail kite, and the wood stork.

Major components of the restoration project are the ecological evaluation programs which have been designed to evaluate the success of the project in restoring ecosystem integrity and to provide for scientifically informed fine tuning and adaptive management of the recovering and restored system. Multiple targets of success have been established and will be continuously tracked during and after the project construction.

This Kissimmee River Restoration Project was authorized by the U.S. Congress in the Water Resources Development Act of 1992. Construction will be phased over 15 years. The total project cost is estimated at $415 million. This cost will be equally shared by the State of Florida and the federal government.

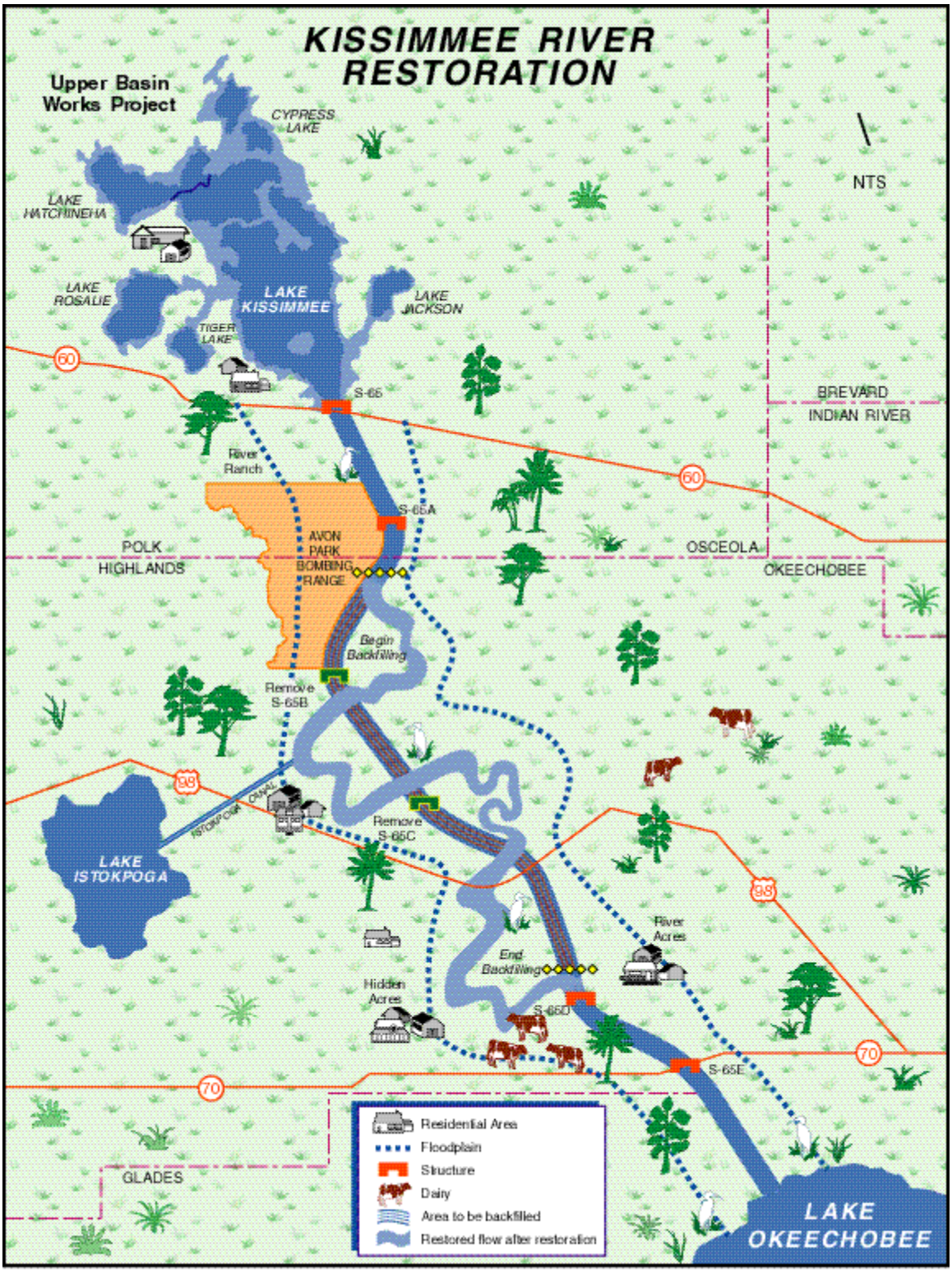


Figure 29. Major Features of the Kissimmee River Restoration Project.

Everglades Restoration

Much of the Everglades restoration effort is focused on water quality and is discussed in **Chapter 5**. Efforts to restore Everglades natural systems are largely directed towards research and monitoring activities to ensure that relevant and current information is available to decision makers. Research and monitoring are presently under way to evaluate the effectiveness of restoration efforts in improving water quality and ecosystem health. Two focal areas that deal with ecosystem health include understanding ecological needs and documenting ecological changes that occur due to restoration activities.

Understanding Ecological and Hydrological Needs

A primary consideration for restoration of the Everglades is that major components of the ecosystem have been irrevocably lost due to land development activities and drainage. The magnitude of this loss is illustrated in **Figure 30.**

At issue is how best to manage the resources that remain within the Everglades Protection Area. The FDEP and the District are scheduled to complete an evaluation of the ecological and hydrological needs of the Everglades Protection Area in 2003. This requirement is being met through modeling, experimental research, and coordination with the LEC regional water supply planning and CERP efforts. The District is developing and using six computer models that simulate the response of the natural system to water and nutrient management decisions. The District is also conducting field research to determine effects of management actions on wading birds, vegetation, tree islands, and other ecosystem components. Cooperative research studies between the District and Florida Atlantic University, which began in 1997, have shown that cattail outcompetes sawgrass under conditions of elevated nutrients and altered hydropattern.

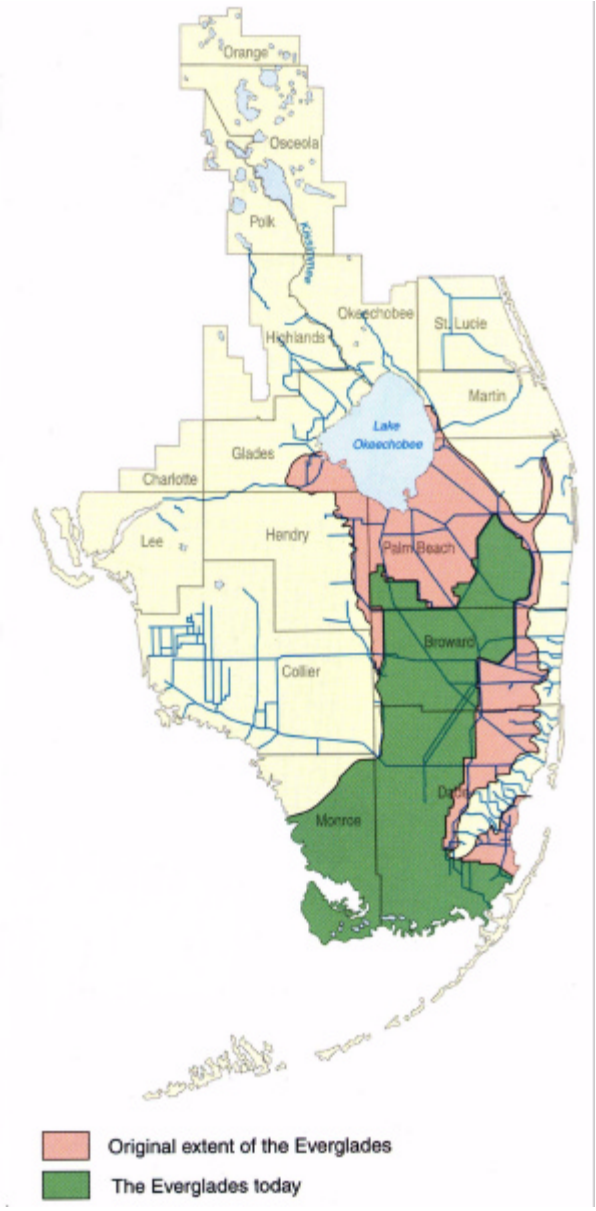


Figure 30. Boundaries of Historic (pre-1800) and Modern Everglades

Documenting Ecological Changes from Restoration Activities

Three programs are documenting ecological changes that occur as a result of restoration activities:

- A mapping program to detect changes in vegetation, based on analysis and comparison of color infrared aerial photography of the WCAs
- Field monitoring to show trends in water quality, biota, and sediment erosion
- Ongoing surveys of wading birds and their food web

Florida Bay and Southern Everglades Restoration

Located between the Florida mainland and Florida Keys, Florida Bay is the Everglades watershed's largest estuarine system. Historically, this subtropical estuary was noted for clear water, lush seagrass beds, and outstanding fishing, but has shown marked deterioration. Widespread mortality of seagrass, turbid water associated with this die-off, large and sustained phytoplankton blooms, and a decline in the commercial and recreational fisheries yield are among the problems. Hypotheses to explain the deterioration suggest that altered hydropattern, excess nutrient loading, changed circulation patterns, and lack of hurricane-induced mixing all may play a role. The District's program for Florida Bay involves the following:

- Research, modeling, and biological and water quality monitoring activities in Florida Bay to document existing resources and define restoration goals
- Research efforts in the transition zones, upstream from the bay, that are likely to be affected by water management actions
- Major upstream restoration projects in the C-111 Canal Basin and adjacent areas
- The Modified Water Deliveries Project to restore hydropatterns associated with northeastern Shark River Slough

The District is working cooperatively with the University of Florida, Florida International University, Louisiana State University, the USGS, District, FDEP, Everglades National Park, other agencies, and private organizations to implement these projects.

Lake Okeechobee Restoration

Ecosystem restoration efforts in Lake Okeechobee are focused primarily on research concerning the lake's natural systems and control of the spread of exotic and nuisance vegetation in the littoral zone. Research efforts include ecological monitoring, determining the effects of nutrient addition, and wildlife habitat and food web studies. Efforts to control vegetation are focused on two species: chara and melaleuca. Brief descriptions of these studies are provided below.

Zooplankton Monitoring. Scientists are concerned that an exotic species of water flea, *Daphnia lumholtzi* may outcompete the smaller native species and become dominant during periods when larval and juvenile fishes are feeding on zooplankton. Such change in species composition could negatively impact the fisheries in Lake Okeechobee.

Ecological Monitoring and Trends. The District is developing a suite of standard field and laboratory analyses, including plankton biomass, taxonomic composition, primary productivity, and nutrient limitation status, that may become part of the lake's regular monitoring program to provide a holistic picture of how the ecosystem is changing.

Lake Okeechobee Nutrient Addition Mesocosm Experiments. Despite accelerated eutrophication of open water regions of Lake Okeechobee, the littoral marsh remains pristine and nutrient-poor. An experimental approach is being used to quantify the responses of a whole plant and animal community (mesocosm studies) to a gradient of phosphorus and nitrogen additions.

Wildlife Survey and Habitat Evaluation Study. Wildlife (amphibians, reptiles, birds, mammals, fish, and invertebrates) use within Lake Okeechobee's littoral zone will be evaluated over a two-year period to study the potential effects that changing hydroperiod (lake level) may have on the lake's plant and animal community.

Lake Okeechobee Food Web Studies. The food web in Lake Okeechobee is complex and interactions among the many species are still poorly known. Fish, invertebrates, algae, and protozoa were collected from open water and marsh locations in the lake, and a combination of stomach content analysis and chemical stable isotope analyses was used to describe the food web linkages at each site.

Distribution and Abundance of *Chara*. The benthic macroalga *Chara* in Lake Okeechobee may help reduce phosphorous levels and phytoplankton abundance. Measurements of *Chara* distribution, biomass, and ecophysiology suggest that reduced light levels, largely because of higher lake stages, have resulted in less *Chara* in the lake.

Torpedo Grass Management. Torpedo grass *(Panicum repens*), a perennial exotic grass that was introduced to Lake Okeechobee in the 1940s, has invaded more than 16,000 acres of Lake Okeechobee's littoral zone and continues to expand into new areas. The District and the University of Florida have been conducting experiments to test

different herbicides, treatment rates, treatment frequencies, and surfactants for their ability to help control torpedo grass.

Melaleuca Mapping. The exotic tree melaleuca (*Melaleuca quinquenervia*) was introduced to Lake Okeechobee in the 1940s and has invaded nearly 20,000 acres of the lake's upper littoral zone. A baseline map was developed in 1994. When the revised map is complete, District staff will be able to quantify changes in the melaleuca community compared to baseline conditions.

Exotic Plant Control

Exotic plant control is an integral component of ecosystem management. Undesirable aquatic weeds (i.e., hydrilla, water hyacinths, water lettuce) affect numerous water bodies in the SFWMD. The uncontrolled expansion of these plants impedes navigation, hinders recreation, disrupts flood control structures, decreases water quality, and replaces native plant communities. Other exotic plants that replace native vegetation and disrupt wildlife habitat include melaleuca, Brazilian pepper, kudzu, Old World climbing fern, and tropical soda apple.

Exotic Water Plant Species

Aquatic weeds are found in water bodies throughout the District. Hydrilla, water hyacinths, and water lettuce are not native to Florida and, as such, are not subject to existing biological controls. This fact, in concert with suitable growing conditions, allows these plants to reproduce and spread rapidly throughout the state.

To deal with these invasive plants, the Bureau of Aquatic Plant Management was created within the FDEP to administer the aquatic plant control programs of Chapter 369, F.S. The FDEP oversees a complex network of state, federal, and local government groups, as well as organizations of private citizens that are responsible for various aquatic plant management functions. All aspects of aquatic plant management are coordinated and managed through the FDEP to enhance efficiency, statewide consistency, and cost-effectiveness.

The FDEP enters into grant agreements with water management districts and local governments to implement programs for management of invasive aquatic plants (Chapter 16C-54, F.A.C.). These programs seek to maintain the target plant population at the lowest feasible level of funding. The District participates with the FWC, the FDEP, the U.S. Army Corps of Engineers (USACE), the University of Florida, and citizens' groups in maintenance programs for aquatic weed management. The maintenance programs include mechanical harvesting, biological controls, and herbicides. While all of these techniques are used, herbicides are the most efficient and most commonly used method. The herbicides used by the District for aquatic weed control are labeled for direct application to water.

The SFWMD will continue to coordinate aquatic weed control through the FDEP. This approach ensures statewide management and resource protection and manages the

distribution of funds appropriately. The SFWMD will work with management groups to identify alternative funding sources for aquatic weed control.

Exotic Upland Plant Species

The District is actively continuing control efforts for melaleuca, Brazilian pepper, Old World climbing fern, Australian pine, cogon grass, tropical soda apple, and downy rose myrtle through a combination of manual removal and herbicide application.

The District has made control of melaleuca (*Melaleuca quinquenervia*) a major initiative. In 1989, the SFWMD created the Melaleuca Task Force, which included representatives from the FDEP. The Melaleuca Task Force has developed a control program involving mechanical, biological, and chemical controls. The emphasis is on testing and evaluation of biological controls. Until recently, melaleuca was spreading at a rate faster than it was being controlled. Although melaleuca may never be eradicated, it appears that SFWMD efforts are successfully containing the tree's spread within the WCAs and the Lake Okeechobee marsh. Other agencies report similar progress for work in Everglades National Park, Big Cypress National Preserve, and natural areas maintained by municipal governments. SFWMD efforts include financial support of biological control studies at the U.S. Department of Agriculture (USDA) and support of physical control work at Everglades National Park and Arthur R. Marshall Loxahatchee National Wildlife Refuge. Florida's 1994 Everglades Forever Act specifically requires the FDEP to spend $1 million annually on melaleuca control and the SFWMD to assess progress of melaleuca management every two years.

The District also supports the USDA's melaleuca biocontrol project. The USDA first released the melaleuca snout beetle (*Oxyops vitiosa*) in Florida in the spring of 1997. Preliminary results show that the insect is causing damage to new growth at several release sites. The snout beetle is the first of a suite of insects that are being studied for release. The project is funded by the District, USACE, FDEP, and Miami-Dade County.

The SFWMD will continue to cooperate with other agencies, including the FDEP, the USDA, the National Park Service, the University of Florida's Institute of Food and Agricultural Sciences (IFAS), and the U.S. Fish and Wildlife Service (USFWS) to control the spread of exotic plants throughout South Florida. These efforts will include continued use of mechanical and chemical controls and identification of biological controls for exotic pest plants. At present, manual removal of seedlings in conjunction with application of herbicides to trees is being used to address melaleuca infestations.

ISSUES

Drainage and land filling activities have lowered water tables, modified natural hydroperiods, eliminated wetlands, degraded water quality, and diminished critical habitat for fish and wildlife. The native ecosystems of South Florida have been heavily impacted by alterations designed to increase the amount of land suitable for agricultural use and residential, commercial, and industrial development. The main issues pertaining to the

preservation and restoration of the water resource related ecosystems in South Florida are as follows:

- The need to protect the integrity and function of natural systems, including the definition and maintenance of MFLs for watercourses, lakes, and aquifers; regulatory activities; and management practices
- The need to restore the integrity and function of water resources and related natural ecosystems that have been altered by the adverse impacts of land use changes and other human activities

Objectives, Strategies, and Performance Measures

Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems

The strategies will be implemented via budgeted activities in the categories of Planning, Land Acquisition, Regulation, and Monitoring and Evaluation (**Table 17**).

Performance Measures for Objective NS 1

- **Core NS 1(a):** Number and percentage of established MFLs being maintained consistent with established recovery or prevention strategies
- **Core NS 1(b):** Number of MFLs, by water body type, established annually and cumulatively
- **Core NS 1(c):** Percentage of MFLs established in accordance with the previous year's schedule
- **Core NS 1 (d):** Total acres of wetlands or other surface water authorized by ERP to be impacted and acres required to be created, enhanced, restored, and preserved
- **SFWMD NS 1(e):** Acres of wetlands preserved as a percent of wetland acres reviewed through ERP applications; acres of wetlands reviewed; acres of wetlands impacted; acres of wetlands preserved; and acres of wetlands mitigated (may include wetlands preserved on-site)

Table 17. Activities Table for Core Objective NS 1.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems				
Planning				
Da09	LEC MFLs	This project aims to establish MFLs for Everglades National Park, the WCAs, Lake Okeechobee, and the Biscayne aquifer (except that portion of the aquifer located in south Miami-Dade County). This effort is required by Chapter 373, F.S.	2000	SFWMD
Da12	Rain-Driven Schedules for Everglades	The objective of this project is to develop rainfall-based delivery plans for WCAs and the Rotenberger WMA as part of the LEC regional water supply planning process. This activity has both water supply and natural systems components. Work plan assessment tools and a rainfall formula are being developed and water supply alternatives are being modeled. In FY2002, the National Environmental Policy Act Environmental Impact Statement will be initiated and a peer review is scheduled. Implementation of the plan is targeted for FY2003.	2003	SFWMD
Pa05	Indian River Lagoon Restoration Feasibility Study	This feasibility study will examine alternatives that address the water resource problems and needs within the C&SF Project canal watersheds in Martin and St. Lucie counties. This study focuses on making improvements that will restore the environmental health of the receiving water bodies, as well as their watersheds.	2001	SFWMD
Eb18	Florida Bay MFLs	This activity will determine MFLs for Florida Bay and predict the effects of restoration. This will be accomplished by determining the effects of high salinity on seagrass processes, survival, and production. This will include both the collection of new data and the synthesis of existing information from Florida Bay and other estuaries.	2003	SFWMD
Pa02	Southwest Florida Feasibility Study	This feasibility study will determine in southwestern Florida water resource conditions and develop potential solutions to any problems that may be identified. The study includes Collier, Lee, Charlotte, Glades, and Hendry counties. It will provide a framework to address the following issues: health of aquatic ecosystems, water flows, water quality (including appropriate pollution reduction targets), water supply, flood protection, wildlife, biological diversity, and natural habitat.	2004	SFWMD
Ff04	Kissimmee Basin MFL Development	This activity is for the development of MFLs for the Kissimmee Basin. MFLs for the Kissimmee River, Lake Kissimmee, and Floridan Aquifer will be developed by 2004. MFLs will be developed by 2006 for the following lakes: Tohopekaliga, Alligator, Jackson, Rosalie, Cypress, Hatchineha, Pierce, Marian, and Fish.	2006	SFWMD
Ia02	In-Lake Research on Water Level Impacts	Research is being conducted to determine operations that will minimize harm to the natural ecosystem of Lake Okeechobee. This research involves controlled experiments to identify how lake stage affects growth and survival of submerged aquatic vegetation.	Ongoing	SFWMD
Jc01	Minimum/ Maximum Flow Targets	This project is a proposed joint venture between the SFWMD and Palm Beach County Environmental Resources Management. The proposed project would utilize seagrass communities within Lake Worth Lagoon as key indicators of the health and sustainability of ecosystems within the lagoon.	Ongoing	SFWMD

Table 17. Activities Table for Core Objective NS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Nf	Big Cypress Basin Watershed Management Plan	The Big Cypress Basin Watershed Management Plan will provide a road map for development of capital projects for the construction and improvement of the facilities presently operated and maintained by the Big Cypress Board for fulfilling its mission on flood control, water supply, water quality, and natural systems.	Ongoing	SFWMD
Land Acquisition				
Aj	Wetlands Mitigation - K-Mart	The K-Mart wetlands are to be acquired and restored through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank.	No Date	SFWMD
Za	General Land Acquisition	This activity will monitor District nonspecific land acquisition and disposal projects for other programs throughout the District and for external entities.	Ongoing	SFWMD
Ab	Stewardship Save Our Rivers (SOR) Lands	SOR Stewardship will ensure that SOR lands are managed in a manner that is conducive to the maintenance of the integrity and functions of water resources and related natural systems. The activity includes operations and maintenance, development of public use facilities, and some mitigation.	Ongoing	SFWMD
Ag	Wetland Mitigation - Corkscrew Regional Ecosystem Watershed (CREW)	The CREW project is a SOR partnership project. The CREW Land and Water Trust is a private, not-for-profit organization dedicated to the preservation and stewardship of water resources and natural communities in and around the CREW. The trust coordinates the land acquisition, land management, and public use of the CREW lands. Since the CREW Land and Water Trust was formed in 1989, over 24,000 acres of the 60,000-acre project have been acquired through the District's SOR program, Lee County, the Big Cypress Basin, the state's Conservation And Recreational Lands (CARL) Program, and mitigation funds. The 60,000-acre project spans Lee and Collier counties and is the largest undisturbed watershed in southwestern Florida.	Ongoing	SFWMD
Ah	Wetlands Mitigation - DuPuis Reserve	The Dupuis Reserve is a 21,875-acre SOR partnership project located between the J.W. Corbett WMA and Lake Okeechobee. The reserve is actively managed by the District and the FWC.	Ongoing	SFWMD
An	Wetlands Mitigation - Pennsuco	The Pennsuco Wetlands are being acquired and restored through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank.	Ongoing	SFWMD
Ao	Wetlands Mitigation - Shingle Creek	The Shingle Creek wetlands in southern Orange and northern Osceola counties are being acquired and restored as mitigation for the Orlando Beltway Southern Connection. To date, 1,132 acres of the 7,655-acre project have been acquired.	Ongoing	SFWMD
Ap	Wetlands Mitigation - Upper Lakes Basin	The Upper Lakes Basin wetlands are being managed through payments from permit applicants who contribute funds to the District in lieu of performing mitigation themselves or purchasing credits from a mitigation bank.	Ongoing	SFWMD

Table 17. Activities Table for Core Objective NS 1. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Regulation				
Ha	Environmental Resource Permitting (ERP)	This ongoing activity involves the review of permit applications. It includes the technical review and evaluation of construction plans for proposed development activities, recommendations for project design changes to ensure proposed activities meet District criteria, negotiation with permit applicants, field inspections of project sites requesting permits or wetland determinations, compliance review of project sites to ensure compliance with permit requirements, compliance review of submitted documents required by permit special conditions, preparation of technical staff reports, and preparation of requests for additional information. Also included in this element are the administrative and automation support critical to the ERP Program.	Ongoing	SFWMD
Hf01	Regulation Criteria Development and Support	This activity supports the Regulation Program in developing a scientific basis for wetland protection criteria used in water use and environmental resource permitting. The activity was originated at the direction of the Governing Board and Executive Office to develop a research and monitoring program to investigate impacts to wetlands caused by water table drawdown and to develop specific recommendations for drawdown criteria that prevent significant adverse impacts. This information is needed to support rulemaking for the LWC and UEC planning regions and is a critical element in the implementation of the water supply plans for both regions.	Ongoing	SFWMD
Hf02	Regulation Model Technology Development/ Application	This activity supports the Regulation Program in developing computer applications and technology for use in the water use permitting process.	Ongoing	SFWMD
Jm50	Environmental Operations Protocol	Rules for low-level releases of water from Lake Okeechobee to the St. Lucie and Caloosahatchee estuaries are being developed through this activity.	Ongoing	SFWMD
Monitoring and Evaluation				
Ia	Lake Okeechobee Research and Data Collection	This element includes the research and monitoring-related activities being conducted in Lake Okeechobee and its watershed. This information is then used when projects are planned and implemented to ensure the District's restoration-related activities are based on sound and defensible science. The key activities include in-lake research on the impacts of water level, nutrients, and invasive plants; watershed research on the fate and transport of phosphorus; modeling activities associated with the impacts of phosphorus in the watershed and the lake; BMPs associated with beef cattle operations; and monitoring activities to assess the effectiveness of restoration efforts.	Ongoing	SFWMD
Ja21	Indian River Lagoon Seagrass Monitoring	Seagrasses have been identified as a valued ecosystem component for the Indian River Lagoon. This effort will obtain a current inventory of seagrass resources, identify healthy areas that may deserve special protection efforts, and identify potential problem areas that require further investigation.	Ongoing	SFWMD

Core Objective NS 2: Restore degraded water resources and related natural systems to a naturally functioning condition

The strategies will be implemented via budgeted activities in the categories of Planning, Public Works Construction, Operations and Maintenance, and Monitoring and Evaluation (**Table 18**)

Performance Measures for Objective NS 2

- **Core NS 2(a):** Acres of invasive nonnative aquatic plants in inventoried public waters
- **Core NS 2(b):** Acres of District managed lands infested with invasive nonnative upland plants by degree of land coverage
- **Core NS 2(c):** Acres of District-owned lands identified in land management plans as needing restoration; acres undergoing restoration; and acres with restoration activities completed
- **SFWMD NS 2(d):** Acres of land infested with invasive nonnative upland plants, by species inventoried
- **SFWMD NS 2(e):** Acres of cattail coverage relative to District 1995 aerial photo maps
- **SFWMD NS 2(f):** Percent increase in wading bird populations as measured by Systematic Reconnaissance Flights

Table 18. Activities Table for Core Objective NS 2.

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Core Objective NS 2: Restore degraded water resources and related natural systems to a naturally functioning condition				
Planning				
Ib01	Lake Okeechobee SWIM Plan Implementation	This activity includes work required to update the *1997 Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b).	Ongoing	SFWMD
Da12	Rain-Driven Schedules for the Everglades	The objective of this project is to develop rainfall-based delivery plans for WCAs and the Rotenberger WMA as part of the LEC regional water supply planning process. This activity has both water supply and natural systems components. Work plan assessment tools and a rainfall formula are being developed and water supply alternatives are being modeled. In FY2002, the National Environmental Policy Act Environmental Impact Statement will be initiated and a peer review is scheduled. Implementation of the plan is targeted for FY2003.	2003	SFWMD

Table 18. Activities Table for Core Objective NS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Eb04	Establish Ecological and Hydrologic Needs for the Everglades Protection Area	The effects of water level, flow, and water quality on key performance measures of sloughs and wet prairies will be determined through this activity. Plant community structure and productivity will be measured and recommendations for the restoration of these communities will be made. RECOVER (REstoration, COordination and VERification) conceptual models will be assessed through measurements of baseline status, history, and development of ridge and slough landscape.	2003	SFWMD
Da11	South Miami-Dade County Integrated Water Resource Strategy	The long-term objective of this project is to identify management strategies necessary to ensure water quality protection, flood protection, water supply, and environmental protection and enhancement, in response to anticipated changes in demographics, land use, and regional ecosystem restoration activities in south Miami-Dade County. The short-term objective is to focus on countywide water resource and water supply efforts. FY2001 monies are being used to support the CERP.	Ongoing	SFWMD
Jd20	Biscayne Bay SWIM Plan Update	The SWIM Act requires an update of the Biscayne Bay SWIM Plan. The last update was in 1995 (SFWMD, 1995b) The District is working with the USACE, Miami-Dade County, and the Florida Power and Light (FP&L) Company to implement this project. This project includes continued analysis to determine the freshwater needs of Biscayne Bay and to establish MFLs for the bay by 2004.	Ongoing	SFWMD
Land Acquisition				
Fd	Kissimmee River Restoration Land Acquisition	This activity will enable the District to acquire 12 to 15 ownerships for the Kissimmee River Restoration Project by the specified deadline. Land acquisition costs include relocation costs.	2011	SFWMD
Public Works Construction				
Pb03	Western C-4 Structure Critical Project	This activity is for the East Coast Canal Structure C-4 Critical Restoration Project. The District will be responsible for the installation of remote operation instrumentation once the structure is complete. Removal of Structure G-119 will occur when the acquisition of the Pennsuco Wetlands is completed. Interim operation of the structure will be compatible with existing land use ordinances until full land acquisition is completed. The District will be reimbursed $20,000 for the design and installation of electronic equipment that will allow remote operation of the structure. The design of the water control structure will occur during FY2000 and construction is scheduled for FY2001.	2001	SFWMD
Pb02	Tamiami Trail Culverts (West) Critical Project	The project is located on the Tamiami Trail (U.S. 41) in Collier County between State Road 92 and 50-Mile Bend (a distance of approximately 43 miles). The purpose of this project is to increase the number of north-south flowways by adding water conveyance structures under Tamiami Trail in locations that will restore a more natural hydropattern. In addition, plugs will be installed in the existing borrow canal at appropriate places to reduce east-west flow. This project will help restore a more natural hydropattern to southern Big Cypress Basin and coastal areas to the south including the Big Cypress National Preserve.	2002	SFWMD

Table 18. Activities Table for Core Objective NS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Pb05	Lake Trafford Restoration	This activity is for Critical Ecosystem Restoration Project development. The District is the local sponsor in partnership with USACE and the FWC.	2003	SFWMD
Eh	C-111 Project Implementation	The C-111 Project consists of both structural and nonstructural modifications to the existing works within the C-111 Basin to promote more natural hydroperiods in Taylor Slough and the eastern panhandle ecosystems of Everglades National Park. Flood protection within the C-111 Basin east of the L-31N and C-111 canals will be maintained.	2004	SFWMD
Ei	Modified Water Deliveries	This activity will implement the Modified Water Deliveries Project, which is designed to restore hydrologic balance between western Shark Slough and northeastern Shark River Slough. This will benefit Everglades National Park flora.	2004	SFWMD
Pd13	Florida Keys Tidal Restoration	The purpose of this feature is to restore the tidal connection that was eliminated in the early 1900s during the construction of Flagler's railroad. Restoring the circulation to areas of surface water that have been impeded and stagnant for decades will significantly improve water quality, benthic floral and faunal communities, larval distribution of both recreational and commercial species (i.e. spiney lobster), and the overall hydrology of Florida Bay. This feature includes the use of bridges or culverts to restore the tidal connection between Florida Bay and the Atlantic Ocean in Monroe County. The four locations are as follows: 1) Tarpon Creek, just south of Mile Marker 54 on Fat Deer Key (width 150 feet); 2) unnamed creek between Fat Deer Key and Long Point Key, south of Mile Marker 56 (width 450 feet); 3) tidal connection adjacent to Little Crawl Key (width 300 feet), and 4) tidal connection between Florida Bay and Atlantic Ocean at Mile Marker 57 (width 2,400 feet).	2005	SFWMD
Pb05	Lake Trafford Restoration	The water quality of the headwaters (Lake Trafford) of the Corkscrew Swamp and Camp Keis Strand have been targeted for protection. Lake Trafford has poor water quality, extensive muck accumulations, loss of native submergent plant communities, periodic aquatic weed infestations, and numerous moderate fish kills. Poor water quality is attributed to internal nutrient cycling from extensive organic muck deposits throughout the lake's basin. Water quality within Lake Trafford will be improved by lakewide organic sediment removal.	2005	SFWMD
Pd15	S-356 Structures (Miami-Dade County)	This feature includes relocation of the Modified Water Deliveries structure (S-357) to provide more effective water deliveries to Everglades National Park. New discharges to Everglades National Park will be designed to meet applicable water quality criteria.	2008	SFWMD
Pd23	Additional S-345 Structures	This project includes the construction of new water control structures and the modification or removal of levees, canals, and water control structures in WCAs-3, located in western Broward County.	2009	SFWMD
Pd09	G-404 Pump Station Modifications	This feature includes relocation and modifications to pump stations and development of a spreader canal system located in the northwestern corner and west-central portions of WCA-3A in western Broward County. The purpose of this feature is to increase environmental water supply availability, increase depths, and extend wetland hydropatterns in the northwestern corner and west-central portions of WCA-3A.	2009	SFWMD

Table 18. Activities Table for Core Objective NS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Pd18	Southern Golden Gate Estates Hydrologic Restoration	The Southern Golden Gate Estates Hydrologic Restoration Project is a CERP project developed in partnership with the USACE. The project will reestablish historic flowways, sheetflow, and hydroperiods of wetlands to near historic levels within the Southern Golden Gate Estates. It will also improve water quality and increase water supply for aquifer recharge.	2010	SFWMD
Pd22	Lake Worth Lagoon Restoration	In Palm Beach County, the Lake Worth Lagoon Estuary is the receiving water body for most of the urban watershed. Sediment laden flows from the C-51 Canal have resulted in accelerated sedimentation of Lake Worth Lagoon (the receiving waters). The restoration project involves three phases. Phase I will examine both the quantity and quality of bottom sediment accumulations within the C-51 Canal and the downstream discharge area within the lagoon. Phase II will develop a project plan to provide for sediment removal or capping that could include creating a series of sediment traps along the C-51 Canal where sediment accumulations increase. Phase III will involve the removal of bottom sediments within the C-51 Canal, as well as implementing a prototype project to either remove or cap the organic bottom layer within the lagoon.	2011	SFWMD
Fb03	Kissimmee River Restoration Design	This activity supports the District's participation with the USACE in the design and construction of project components that will ensure the Kissimmee River Restoration Project meets its restoration goals. These components include the Avon Park fence, the Lake Istokpoga boat ramp, and the Oak Creek 100-year flood line modeling.	2011	SFWMD
Fb	Kissimmee River Restoration Engineering	This element supports the District's participation with the USACE in the analysis and design of project construction elements for meeting flood protection constraints and ecosystem restoration goals for the Kissimmee River Restoration Project.	Ongoing	SFWMD
Operations and Maintenance				
Ee	Everglades Exotic Species Control	This activity provides for the elimination and monitoring of exotic plants within the Everglades.	Ongoing	SFWMD
Pd05	Holey Land WMA Regulation Schedule	Modification to the current operating plan for the Holey Land WMA will be made to implement rain-driven operations for this area. Water deliveries are made to the Holey Land WMA from the Rotenberger WMA or, if Rotenberger WMA flows are insufficient, from STA-3 and STA-4. The deliveries are assumed to be of acceptable water quality. These new operational rules are intended to improve the timing and location of water depths within the Holey Land WMA.	2001	SFWMD
Pd06	Rotenberger Regulation Schedule	Modification to the current operating plan for the Rotenberger WMA will be made to implement rain-driven operations for this area. Water deliveries are made to the Rotenberger WMA from STA-5. Discharges from the Rotenberger WMA are made to the Holey Land WMA. The deliveries are assumed to be of acceptable water quality. These new operational rules are intended to improve the timing and location of water depths within the Rotenberger WMA.	2001	SFWMD

Table 18. Activities Table for Core Objective NS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Id	Lake Okeechobee Exotic Control	This activity allows for exotic control for Lake Okeechobee. Control of melaleuca and other exotic plants is critical for Lake Okeechobee preservation and restoration. If not managed, plants like melaleuca form dense monocultures, displacing all other plant communities.	Ongoing	SFWMD
Monitoring and Evaluation				
Bb08	STA/Everglades Nutrient Removal (ENR) Project Optimization, Research, and Modeling	This activity includes 1) field collection and laboratory analysis of water quality, vegetation, and sediment samples associated with research and monitoring efforts of the ENR Project; 2) development and implementation of the Wetland Water Quality Model; 3) analysis of nutrient removal performance data from other South Florida wetlands; and 4) optimization experiments that will be conducted in the ENR test cells. This work is all part of the District's STA Optimization Research Program. The District is mandated by the Everglades Forever Act to conduct research on optimizing performance of the STAs.	2004	SFWMD
Eb17	Florida Bay Research - Seagrass Mortality and Algal Blooms	This research activity will measure the effects changes in timing and the amount of freshwater flow to Florida Bay has on seagrass habitat viability and restoration. This activity will also measure algal bloom response, including spatial extent, persistence, occurrence of harmful blooms, and impacts on other living resources (benthos, seagrasses, and fisheries). This activity will also provide recommendations on water management operations which will achieve the restoration of habitat and water quality within Florida Bay.	2004	SFWMD
Eb15	Florida Bay - Ecological Response to Restoration Activities	This activity supports research studies to determine the ecological response of Florida Bay to restoration activities. The ecological conditions of the southeastern Everglades will be monitored to determine the effects of changes in water flow and hydroperiod associated with structural and operational changes. Research will also include the measurement of nutrient inputs from the C&SF Project; determination of the nutrient cycle (nutrient transport, transformation, retention, and release) for the wetlands, including the salinity transition zone of Florida Bay; and the determination of the amount of nutrient loading to Florida Bay. In the C-111 Basin and Taylor Slough, plant community composition and productivity and soil accretion or loss will be measured. Spatial and temporal changes in periphyton and water quality conditions in response to hydrologic restoration in the southern Everglades will be monitored.	2004	SFWMD
Fa	Kissimmee Basin Restoration Evaluation and Assessment	Research and evaluation data will be used to evaluate the success of the Kissimmee River Restoration Project, fine tune reconstruction phases, and provide for adaptive management of the restored ecosystem. Outputs include publications, technical reports, and an integrated database.	2011	SFWMD

Table 18. Activities Table for Core Objective NS 2. (Continued)

FY2001 Budget Activity Code	Strategies	Description	Year Complete	Responsible Entity
Eb05	Everglades Food Web/Wading Birds Hydrologic Effect	This effort will generate a series of scientific publications: 1) analysis of systematic reconnaissance flight wading bird surveys from former contracts and other agencies to determine wading bird distributions and identify depth thresholds that preclude wading birds from feeding successfully; 2) scientific publication examining the amount of movement various species of wading birds exhibit as an indication of how likely they are to be affected by local restoration projects; 3) reports and scientific publications that define fish and aquatic macroinvertebrate populations in the WCAs; 4) scientific publications containing recommendations for water depths and durations that promote the existence of healthy tree islands and associated wildlife; 5) annual report on the numbers of nesting wading birds in South Florida; 6) scientific publications of test cell experiments to identify the optimum and minimum water depths necessary for successful foraging.	Ongoing	SFWMD
Ka	Hydrologic Monitoring	This activity includes long-term hydrologic data collection, database management, routine data reporting, and data evaluation. These data document the operation of the C&SF Project and provide data for the CERP, restoration of the Kissimmee River, the Everglades, Florida Bay, and Lake Okeechobee, and water resource planning and implementation	Ongoing	SFWMD
Pg	Monitoring and Evaluation (RECOVER)	This element is a grouping of activities to organize and apply scientific and technical information in ways that are most effective in supporting the objectives of the CERP. Activities include the coordination and application of the components of the Applied Science Strategy during the implementation of the CERP.	Ongoing	SFWMD
Ia	Lake Okeechobee Research and Data Collection	This element includes the research and monitoring related activities being conducted in Lake Okeechobee and its watershed. This information is then used when projects are planned and implemented to ensure the District's restoration related activities are based on sound and defensible science. The key activities include in-lake research on the impacts of water level, nutrients, and invasive plants; watershed research on the fate and transport of phosphorus; modeling activities associated with the impacts of phosphorus in the watershed and the lake; BMPs associated with beef cattle operations; and monitoring activities to assess the effectiveness of restoration efforts.	Ongoing	SFWMD
Ib01	Lake Okeechobee SWIM Plan Implementation	This activity includes work required to insure that the *Lake Okeechobee Surface Water Improvement and Management Plan* (SFWMD, 1997b) is implemented.	Ongoing	SFWMD

Chapter 7
REGIONAL WATERSHED MANAGEMENT

This chapter brings together the same goals, issues, and strategies discussed by area of responsibility in **Chapter 3** through **Chapter 6** into a geographically integrated format. The goals, issues, and strategies to resolve the issues are discussed for each watershed region. The District is divided into four watershed regions: the Lower East Coast, the Lower West Coast, the Upper East Coast, and the Kissimmee Basin. The District's planning regions are generally defined by the drainage divides of major surface water systems in South Florida. **Figure 31** shows the four watershed regions and the nine major watersheds that comprise the more than 100 drainage basins and subbasins of the District.

There is a significant connectivity and overlap among the major watersheds, reflecting both the historic flows of the Kissimmee-Lake Okeechobee-Everglades system and the impact of the Central and Southern Florida (C&SF) Project on the hydrology of South Florida. The movement of water throughout South Florida watersheds was significantly altered by the construction of the C&SF Project. Initially designed about fifty years ago, it has been reexamined in the C&SF Project Comprehensive Review Study (Restudy). The recommendations made in the Restudy will be implemented within the Comprehensive Everglades Restoration Plan (CERP) during the next 20 to 30 years and will affect virtually every watershed within the District. **Chapter 1** contains a more extensive description of the CERP. Several public works construction projects are identified for each of the regions, and **Figure 19** in **Chapter 1** shows their locations.

LOWER EAST COAST REGIONAL WATERSHED

The Lower East Coast (LEC) regional watershed encompasses a rapidly expanding, developed area of about five million residents with most of the population living along the coast. It contains extensive agricultural lands, including the Everglades Agricultural Area (EAA); extensive wetlands comprising the Everglades system; and important estuaries, such as the Florida and Biscayne bays. Four major watersheds are completely within the LEC region: the LEC urban area, Biscayne Bay, Everglades-Florida Bay, and the Florida Keys. Part of the Okeechobee Basin is also within the LEC region, but with the exception of Lake Okeechobee issues, the Okeechobee Basin is discussed in the **Kissimmee Basin Regional Watershed** section. Lake Okeechobee is discussed in the **Lower East Coast Regional Watershed** section because it is a major source of water for the LEC region and its health affects the health of the Everglades-Florida Bay watershed. Due to the complexity of the water management issues for the LEC, the areas of responsibility are summarized for the region as a whole and discussed in detail by major watershed. The Biscayne aquifer is also discussed separately within this section.

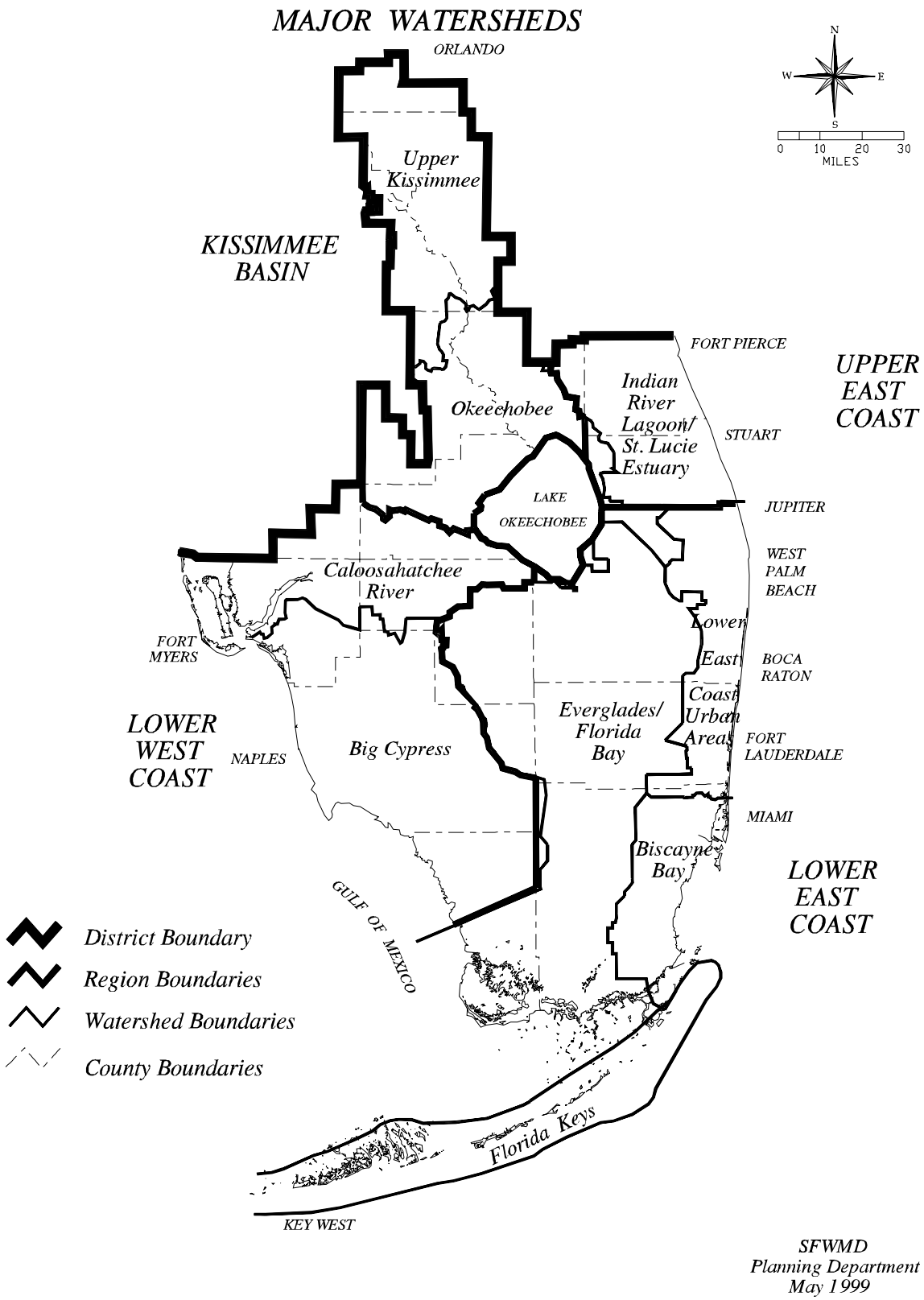


Figure 31. The Four Watershed Regions and the Nine Major Watersheds of the SFWMD.

Overall Lower East Coast Regional Watershed

Regional Watershed Goals

The regional watershed goals for the LEC region are as follows:

- Assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial
- Maintain the functions of natural systems
- Maintain the overall present level of surface and ground water quality
- Improve and restore the quality of waters not presently meeting water quality standards
- Maintain current flood protection

Status of Areas of Responsibility

The four areas of responsibility are water supply, flood protection and floodplain management, water quality, and natural systems. A summary of the status of the areas of responsibility within the LEC region is provided here and a more detailed description is provided within the major watershed basin discussions.

Water Supply

The primary sources for water supply in the LEC region are the Biscayne aquifer, Lake Okeechobee, and the Water Conservation Areas (WCAs). Most water used in the urbanized coastal basins is withdrawn from the Biscayne or other surficial aquifers, which are recharged primarily from local rainfall. Other important sources of recharge are seepage from the WCAs and deliveries of surface water from the WCAs and Lake Okeechobee.

Competition for water among urban development, agriculture, and natural systems is extensive. The LEC region has access to alternative water supply sources, although there has been no significant use of these alternatives to date. These water supply alternatives include reverse osmosis treatment of water from the Floridan aquifer, Aquifer Storage and Recovery (ASR), surface water storage, reuse, and backpumping of storm water. Alteration of demand patterns, through increased conservation measures, can also aid in reducing water supply needs within the LEC region.

Flood Protection and Floodplain Management

Most of the C&SF Project lies within the LEC region. The C&SF Project was designed in 1947 to provide flood protection based on future land uses projected at that time. Areas projected to be developed with urban land uses were afforded higher levels of flood protection than those anticipated to be used for agriculture or to remain undeveloped. As South Florida developed, urban land uses have spread further west than

was anticipated in the original system design. In general, the western subbasins are more prone to flooding because of low ground surface elevations relative to the eastern subbasins. Development in these areas must depend on on-site storage and local storm water management systems for their flood protection.

Water Quality

Water quality issues within the LEC region include the deterioration of water quality in Lake Okeechobee, adverse impacts of large water releases into the St. Lucie and Caloosahatchee estuaries, aquatic weed invasion in the canals of the LEC urban area, pollution of the Miami River and its subsequent effect on Biscayne Bay, degradation of natural systems within the Everglades and Florida Bay, impacts to the coral reefs and other natural resources of the Florida Keys, and saltwater intrusion into wellfields along the coast.

Natural Systems

Natural systems within the LEC region have been impacted by the construction of the C&SF Project, invasion of exotic plants, urban and agricultural development, and water quality deterioration. Significant environmental resources within the LEC region are described under the resources section of each major watershed basin.

Lake Okeechobee

Background

Lake Okeechobee is the largest lake in Florida and the third largest lake entirely within the United States. Its watershed encompasses the Lower Kissimmee Basin. Historically, the lake was an integral part of a naturally integrated hydrologic system stretching from the headwaters of the Kissimmee River to Florida Bay. During the wet season, water along Lake Okeechobee's southern shore would intermittently spill over into the upper Everglades with sheetflow continuing south to Florida Bay.

Construction of the Herbert Hoover Dike stopped the sheetflow and altered Lake Okeechobee's natural morphometry and hydrology. The dike is an earthen dam which enclosed all of the lake's historic limnetic zone, but only a small portion of its historic littoral zone. The largest portion of the original littoral zone is now located outside of the dam and isolated from the lake. Vegetative changes continue to occur in both littoral zone fragments.

Resources

Lake Okeechobee is of regional significance because of its enormous water holding capacity and water supply capability. During water shortages, canal discharges from Lake Okeechobee provide recharge water for the Biscayne aquifer, indirectly

supplying water to 90 percent of the LEC region's five million residents. The lake also supplies irrigation water for sugarcane, vegetables, sod, and rice crops grown in the EAA.

Lake Okeechobee and its associated wetlands provide habitat for a number of plants and animals, including several rare and endangered species such as the wood stork, snail kite, West Indian manatee, and Okeechobee gourd. Migratory birds and waterfowl use the littoral zone and adjacent wetlands as a resting area along the Atlantic flyway.

Lake Okeechobee is a major recreational resource. The lake supports a nationally renowned sport fishery for largemouth bass and black crappie and is an important winter waterfowl hunting area. It is also part of the navigable Okeechobee Waterway connecting the east and west coasts of the state.

Specific Lake Okeechobee Goals

The Lake Okeechobee goals are as follows:

- Protect and enhance ecosystem health
- Ensure adequate local and regional flood protection
- Ensure an adequate local and regional water supply
- Support and improve recreational opportunities on and around Lake Okeechobee
- Maintain navigation on and around Lake Okeechobee
- Protect and enhance Lake Okeechobee's aesthetic characteristics

Status of Areas of Responsibility

Water Supply

Within its service area, Lake Okeechobee is the primary source of water used to supplement local rainfall. Lake Okeechobee depends on rainfall runoff from its numerous tributary basins, the largest of which is the Kissimmee Basin. However, use of the lake for water supply has impacted its natural systems, especially its littoral zone.

Water Quality

Lake Okeechobee's water quality has deteriorated since the 1960s, primarily because of phosphorus and other nutrients entering the lake from tributaries to the north. Large algal blooms in the 1970s and 1980s suggested that Lake Okeechobee was receiving excessive nutrients and becoming increasingly eutrophic. Both phosphorus and nitrogen contribute to algal growth, but bacteria and blue-green algae can fix nitrogen from the atmosphere and add it to the water column, making it harder to control than phosphorus. Accordingly, the primary water quality issue associated with the lake is the control of phosphorus. Another source of nutrients entering the lake has been backpumping of runoff from sugarcane and other crops in the EAA. The SFWMD has sought to reduce this source

of nutrient loading to the lake through implementation of its Works of the District Rule (Chapter 40E-61, F.A.C.), which requires permits for the discharge of runoff into SFWMD owned, operated, maintained, or regulated waterways. To address these issues a Surface Water Improvement and Management (SWIM) Plan has been completed (SFWMD, 1997b) and is currently being implemented for Lake Okeechobee.

Lake Okeechobee Issues

The major issues affecting Lake Okeechobee are water quality and littoral zone protection and exotic plant infestation.

Lake Okeechobee Water Quality and Littoral Zone Protection

Issues regarding Lake Okeechobee water quality and littoral zone protection include phosphorus loading from the watershed, coupled with in-lake sediments acting as a nutrient sink, and high water levels impacting littoral communities

Phosphorus Loading. Increased phosphorus loading to Lake Okeechobee was the key water quality issue identified in the *Interim Lake Okeechobee SWIM Plan* (SFWMD, 1989). Between 1974 and 1989 lakewide concentrations of phosphorus increased by two and one-half times. Algal blooms suggested that the lake was receiving excessive nutrients. Subsequent modeling indicated that lake loading needed to be reduced to an annual average of 397 tons, some 200 tons below the loading at that time. During 1998, phosphorus loadings to Lake Okeechobee were the highest since 1984, despite a rigorous and expensive cleanup program involving the cooperation of dairy and other farmers north of the lake. Much of these loadings appeared to be attributable to the S-65D, S-65E, S-154, and the Taylor Creek/Nubbin Slough watersheds.

In 1997, the *Lake Okeechobee SWIM Plan* (SFWMD, 1997b) was updated to include management objectives and strategies for water supply, environmental resources, flood protection, recreation and navigation, as well as to update information in the water quality and public information elements. To reduce phosphorus loading to the lake the District has developed several strategies, including continued implementation of the *Lake Okeechobee SWIM Plan* (SFWMD, 1997b) and updating the plan by 2000; completion of the Lake Okeechobee Water Retention/Phosphorus Removal Critical Project by 2002; carrying out the Lake Okeechobee tributary sediment dredging by 2005; continuation of the Lake Okeechobee Works of the District Permitting Program; and continuation of research and data collection efforts. The Florida Department of Environmental Protection (FDEP), in conjunction with the District, is in the process of developing a Total Maximum Daily Load (TMDL) for phosphorus for Lake Okeechobee.

High Water Levels. Water levels in Lake Okeechobee have been much higher than average during the past five years (1994-1999), affecting the health of the lake. Mud sediments have moved from the middle of the lake to areas near the shore, making the water turbid. This has caused less light to reach the lake bottom, resulting in the loss of some aquatic plants. Wave action has uprooted vast areas of submerged plants, causing them to lose their ability to stabilize the sediments and provide an important habitat for

fisheries. This vegetation has been naturally deposited along the shore of the lake, forming a muck berm in areas and impacting bulrush, Kissimmee grass, and eelgrass communities which provide fish habitat. To help address this issue, the District is currently establishing Minimum Flows and Levels (MFLs) for Lake Okeechobee.

Other Water Quality Issues. Other water quality issues include the need to more thoroughly evaluate other water quality parameters relative to existing Class I, Class III, and Class IV standards for the basin and to obtain a better understanding of the impacts of nitrogen upon the lake ecosystem. The *Interim Lake Okeechobee SWIM Plan* (SFWMD, 1989) also recognized the need to ascertain the impacts of septic tank systems upon lake water quality.

Exotics Infestation

Lake Okeechobee has been infested by exotic species that are threatening the natural ecosystem of the lake. In the marsh zone of Lake Okeechobee, at least 14 exotic plant species have been documented. Of those, five species have become a major threat to the ecosystem due to their rapid expansion into areas once occupied by native plants. Melaleuca and torpedo grass are threatening the higher elevation regions and water hyacinth, water lettuce, and hydrilla are threatening the lower elevation areas where there is year-round standing water. The elimination of melaleuca from around the lake is continuing, and the SFWMD is currently continuing research on the possibility of eradicating the exotic plants in the littoral zone.

Lower East Coast Urban Area

Background

The LEC urban area watershed consists of the coastal ridge portions of Palm Beach and Broward counties lying east of the WCAs and is part of the most densely populated part of the state. Except for pockets of publicly protected preservation lands, the coastal region from West Palm Beach southward through Hollywood is almost completely urbanized. The largest population centers are near the coast and include the cities of West Palm Beach, Fort Lauderdale, and Hollywood.

Significant natural system resources within the LEC urban area watershed include the West Palm Beach Water Catchment Area, the Lake Worth Lagoon, the Loxahatchee River and Slough, and the Strazzulla Tract.

Specific Watershed Goals

The LEC urban area watershed goals are as follows:

- Assure the availability of an adequate supply of water for all competing uses deemed reasonable and beneficial
- Maintain the functions of natural systems

- Maintain the overall present level of service for flood protection
- Maintain ground water quality
- Improve and restore the quality of waters not presently meeting water quality standards

Status of Areas of Responsibility

Water Quality

Water quality in the LEC urban area is fair. The major source of contamination is urban storm water. The canals in the Fort Lauderdale area, especially the New River, generally exhibit the poorest quality. Aquatic weeds frequently choke these canals and must be removed by mechanical harvesting or herbicide treatment.

Low water levels in the canals east of the control structures enable salt water to migrate into the ground water, wellfields, and natural freshwater systems upon which the urban areas depend for a potable water supply. Therefore, water levels in coastal canals are controlled near the coastal shoreline to help prevent this overdrainage and to resist saltwater intrusion.

Natural Systems

The Lake Worth Lagoon, a coastal waterway in central Palm Beach County, is subjected to extreme salinity changes due to changes in the volume, distribution, and timing of freshwater inflows. The loss of wetlands, lowered water tables, increased watershed imperviousness, and the redirection of historical runoff have significantly reduced discharges to the lagoon during drought conditions, and increased discharges during wet conditions.

Issues

The major issues affecting the LEC Urban Area are future water supply and source protection, and Lake Worth Lagoon protection.

LEC Urban Area Future Water Supply and Source Protection

It is anticipated that between 1995 and 2020, population in the LEC region will increase by 35 percent, irrigated acreage will decrease by 11 percent, and the overall water demand will increase by about 16 percent (SFWMD, 1998b). Palm Beach County is projected to increase its Public Water Supply (PWS) demands by almost 58 percent (SFWMD, 1998b). With current water supply capabilities, urban area water shortages will increase in frequency and severity.

Because the Biscayne aquifer lies close to the surface and is highly permeable, ground water in the LEC region is vulnerable to contamination. Rapid urbanization continues to threaten contamination of the shallow ground water supplies. For example,

costly contamination has already occurred at the Peele Dixie wellfield in Fort Lauderdale. Fortunately, because of the natural benefits of seasonal heavy rainfall combined with dilution, levels of contamination within the Biscayne aquifer are generally reduced in magnitude.

Several programs have already been implemented to ensure future urban and agricultural water supply and source protection:

- Wellfield protection programs have been designed to protect existing supply sources and are being implemented in Broward and Palm Beach counties.
- A Floridan aquifer model is being developed based on Floridan aquifer well drilling and will be implemented by 2000.
- The *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) was completed in 2000 and is currently being implemented.
- To facilitate conservation, the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b) recommends the establishment of a water conservation coordinator. This plan also recommends that future rulemaking establish enhanced water conservation requirements for water users. Potential alternative water supply sources within the LEC include the construction of reservoirs, desalination of water from the Floridan aquifer, and the utilization of ASR. The plan recommends regional ASR projects in Palm Beach, Broward, Glades, and Okeechobee counties, as well as utility ASR projects in Miami-Dade and Palm Beach counties. It also calls for the construction of regional reservoirs in concert with ASR projects. It directs that the feasibility of desalination of water from the Floridan Aquifer System should be further evaluated using refinements of the existing Floridan Aquifer System ground water flow model.
- Subregional plans are also being developed: the Northern Palm Beach County Comprehensive Water Management Plan, the Southeast Palm Beach County Integrated Water Resource Strategy, and the Eastern Broward County Integrated Water Resource Strategy.
- The Hillsboro ASR and the In-Ground Reservoir Technology pilot projects will help determine if ASR will enhance storm water storage for future use. Construction of the Western Hillsboro (Site 1) ASR Pilot Project is scheduled for completion by 2003. The In-Ground Reservoir Technology Pilot Program is scheduled to be carried out by 2012 and the completion of the Southern L-8 In-Ground Reservoir General Evaluation Report is scheduled for completion by 2014.
- The Broward County Secondary Canal System will provide recharge to the ground water and wellfields and stabilize the saltwater interface in southeastern and southern coastal Broward County by pumping any excess water within the basin into the coastal canal systems to maintain canal stages. The system is scheduled for completion by 2009.

- Large portions of the Loxahatchee Slough, located in northern Palm Beach County, have been acquired through the District's Save Our Rivers (SOR) Program.

Lake Worth Lagoon Protection

The Lake Worth Lagoon is connected to the Atlantic Ocean by two permanent inlets: a northern inlet 800 feet wide by 35 feet deep and a southern inlet 130 feet wide by up to 12 feet deep. The lagoon contains 28 marinas and hundreds of private docks along its shoreline. Since settlers first arrived on the banks of Lake Worth in the 1800s, the lagoon has experienced a continuous onslaught of channel dredging, shoreline hardening, dredging and filling, causeway and bridge construction, dock and marina construction, canal development, industrial and sewage waste disposal, storm water runoff, port development, mosquito control, and power plant construction and operation.

Today, the lagoon is subjected to extreme salinity changes due to changes in the volume, distribution, and timing of freshwater inflows. The loss of wetlands, lowered water tables, increased watershed imperviousness, and the redirection of historical runoff have significantly reduced discharges to the lagoon during drought conditions and increased discharges during wet conditions.

Efforts have been under way since 1994 to reverse these conditions. By August 1998, an interagency team had developed a management plan to guide the restoration and enhancement of the Lake Worth Lagoon. The District has been cooperating with Palm Beach County on this effort and has developed a hydrodynamic salinity model for the lagoon. The lagoon restoration is scheduled to be completed by 2011.

Biscayne Bay

Background

The Biscayne Bay watershed includes both the highly urbanized coastal area of Miami-Dade County and 83,000 acres of agricultural lands to the southwest. Vegetables, tropical fruit, and nursery plants are grown within this agricultural area.

Biscayne Bay is a shallow, subtropical estuary with a natural depth ranging from three to nine feet. Much of the upper bay has been modified and dredged, so that depths now average six to ten feet and include some dredged areas and channels up to forty feet deep. A basin of about 840 square miles drains to the bay. Seventeen canals in eastern Miami-Dade County operated by the District provide most of the surface flows of fresh water into the bay.

The significance of ground water flows to Biscayne Bay is uncertain. Existing data suggest that historic dry season ground water flows have been greatly reduced. Before canals and structures existed, some surface water flowed to the bay through the Miami River and a few natural creeks and streams. During wet periods, large amounts of water

entered the bay as surface water flowed across adjacent freshwater marshes. Canal construction has accelerated the rate at which ground water levels recede at the end of the wet season, because surface water now discharges from the canals at a much faster rate rate than under natural conditions.

Resources

Biscayne Bay continues to support a wide variety of plants and animals, some of which are important for fisheries. Many rare, threatened, and endangered species occur in or near the bay, including manatees and crocodiles. Significant natural system resources within the Biscayne Bay watershed include Biscayne National Park, Southern Glades, the Frog Pond and the Model Lands Basin.

Specific Watershed Goal

The goal for Biscayne Bay is to maintain and improve water quality to protect and restore natural ecosystems and human uses of the bay while protecting its environmental resources.

Status of Areas of Responsibility

Water Quality

Water quality within Biscayne Bay is generally good, with a few exceptions. Monitoring data has indicated that some areas have low oxygen levels or have been contaminated by sewage and other pollutants. Oxygen levels are moderate in the bay, and the tributary canals have even lower levels. The Miami River, a tributary to the bay, has serious problems with high coliform counts and contaminated sediments. Overloading of the sewer system during periods of high inflow of storm water or ground water results in discharges of sewage to the river. Sediments are contaminated with heavy metals, pesticides, and organic pollutants. Sources of these pollutants include storm water runoff, domestic and industrial waste discharges, and bioacid used on vessels. To address these issues a SWIM Plan has been completed and is currently being implemented for Biscayne Bay.

Natural Systems

The Biscayne Bay watershed includes coastal upland, coastal wetland, and submerged aquatic communities. These communities provide shoreline stabilization, nutrient cycling, removal of suspended materials, habitat for aquatic and terrestrial organisms, and a basis for the aquatic food chain. These communities require good water quality, adequate light penetration, and inputs from healthy upland systems to maintain their integrity. They are impacted by water quality and physical disturbance, including land development and dredge and fill activities. In the southern portion of the bay, some mangrove productivity has been lost because sheetflow of fresh water has been redirected as a result of the drainage projects serving South Florida. Prior to the construction of the coastal canal system, marshes along the shore of Biscayne Bay were dominated by

freshwater plants. Many of these areas have been invaded by saltwater marsh species and mangroves. Seagrass beds are found throughout the bay, but are more prevalent in South Bay than North Bay. In South Bay, the seagrass beds benefit from flushing action and the lack of urbanization of adjacent land areas.

Card Sound and Barnes Sound are sensitive marine lagoons in the southernmost portion of the bay. They serve as important habitats for a number of threatened and endangered species. Card Sound and Barnes Sound are areas of restricted circulation and freshwater flow. During the dry season, these areas may become hypersaline. Primary threats to these areas are dumping, unnatural freshwater pulses, and future development.

Biscayne Bay Issues

Issues affecting the Biscayne Bay watershed are future urban and agricultural water supply and source protection.

Biscayne Bay Future Urban and Agricultural Water Supply and Source Protection

The following programs and projects are being implemented to ensure the protection of the water supply for the Biscayne Bay watershed:

- Wellfield protection programs designed to protect existing supply sources are being implemented in Miami-Dade, County. One of these projects is the completion of the Miami-Dade County ASR near existing wellfields by 2004.
- In addition to the *Lower East Coast Regional Water Supply Plan* (SFWMD, 2000b), the District has also initiated the development of several subregional plans. One of these plans is the South Miami-Dade County Integrated Water Resource Strategy.
- The construction of additional water control structures on the C-4 Canal in Miami-Dade County will also increase the level of water supply for the LEC Urban Area, with a major benefit of this project being to help restore the Everglades.
- The District will continue to update and implement the *Biscayne Bay SWIM Plan* (SFWMD, 1995b).
- MFLs will be established for Biscayne Bay by 2004.
- The District is currently engaged in providing for the acquisition, restoration, and management of the Pennsuco and Model Lands mitigation banking projects. Mitigation banking is a process by which wetland losses are mitigated in advance of a loss of wetlands to ensure that no net loss of wetland function occurs in a region.

Biscayne Bay Protection

Biscayne Bay protection issues include impacts to submerged aquatic and mangrove communities and the occurrence of several toxic metals at elevated levels, indicating persistent contamination sources.

Seagrasses. Impacts to seagrasses and other submerged aquatic communities are primarily caused by degraded water quality and physical disturbance. Land development activities destroy submerged aquatic communities by the direct impacts of dredge and fill, as well as by the indirect effects of polluted water and increased turbidity. Turbidity is also caused by boat propellers stirring up the bottom and boat wakes eroding shorelines. In general, seagrasses will tend to colonize any areas that are suitable for their survival and will not survive, even if they are transplanted, in areas that are unsuitable. For this reason, great care should be taken before seagrasses are removed under the pretext that they will be reestablished in another location. The best policy is to require that any proposed mitigation activities be successfully conducted prior to the removal of the original community.

Mangroves. The most direct threat to the mangrove communities of Biscayne Bay is land development along the shoreline and adjacent uplands. It is much more cost-effective to preserve the mangrove forests of Miami-Dade and Monroe counties than to institute costly treatment systems to replace the functions of the natural mangrove communities, such as retrofitting, water delivery, wetland restoration, flood control, and hurricane protection.

Everglades - Florida Bay

Background

The Everglades is the largest subtropical wetland in the United States and is a unique resource for South Florida. Everglades National Park was established in 1947, designated an International Biosphere Reserve in 1976, an Outstanding Florida Water in 1978, and a United Nations World Heritage Site in 1979. The park and the WCAs are the surviving remnants of the historical Everglades, which formerly spread uninterrupted from Lake Okeechobee south to Florida Bay and east to the coastal ridge. This remaining area provides significant ecological benefits including water storage and supply, habitat for wildlife of national significance, and internationally recognized recreational opportunities. The Everglades also encompasses the Western Basins area which contains two Native American Indian reservations. Big Cypress, the largest of the Seminole Tribe's reservations, occupies more than 52,000 acres in Hendry and Broward counties. The Miccosukee Tribe's reservation, just south of the Big Cypress Reservation, comprises 75,000 acres in Broward County.

To the south, Florida Bay has begun to demonstrate signs of stress. Historically, the bay was a 772-square mile, shallow, brackish estuary with fluctuating salinity. Salinity fluctuations were caused by changes in the season, outflow from the Everglades, and

rainfall. The bay was popular with sport fishermen because of the schools of tarpon, bonefish, redfish, and sea trout feeding on the pink shrimp, crabs, and other bait present. Large sections of the estuary have deteriorated in recent years. Hydrologic and geologic indicators of the deterioration of the estuary include murky water, loss of seagrass habitat, algal blooms, fish and invertebrate kills, and significant increases in salinity levels.

Resources

Significant natural systems resources within the Everglades-Florida Bay watershed include Everglades National Park, the WCAs, the Arthur R. Marshall Loxahatchee National Wildlife Refuge (WCA-1), the Crocodile National Wildlife Refuge, the Holey Land and Rotenberger WMAs, and the North Everglades Buffer Strip.

Specific Watershed Goals

The goals for the Everglades-Florida Bay watershed include the following:

- Preserve and protect existing Everglades water resources by restoring areas defined as degraded
- Eliminate or mitigate conditions that may lead to further decline
- Develop options for environmental enhancement

Status of Areas of Responsibility

Water Supply

With current water supply capabilities, irrigation demands for the EAA will become increasingly hard to meet.

Water Quality

High concentrations of phosphorus in water that flows into the Everglades have caused degradation of natural systems in some areas. Canals within the WCAs have high concentrations of nutrients, especially during the wet season, as a result of inflows from the EAA and other tributary basins. The major canals of the C&SF Project located in the EAA (L-8, West Palm Beach, Hillsboro, North New River, and Miami canals) have waters with high nutrients and low dissolved oxygen values. Pesticides, bacteria, and suspended solids have also been identified as problems. Agricultural runoff and seepage from sugar mill retention ponds are sources of pollutant loading to these canals. Backpumping water into the WCAs from the urban areas along the coast for flood protection and water storage has resulted in high nutrient concentrations and low concentrations of dissolved oxygen at perimeter sites. The continuation of rapid urbanization in the region could potentially result in increased loading of nutrients, pesticides, and heavy metals in waters discharged into the Everglades system. The 1994 Everglades Forever Act addresses the Everglades system and superseded the Everglades SWIM Plan.

The Western Basins represents a 711-square mile area of Broward, Collier, and Hendry counties that have been identified as also contributing nutrients to the Everglades. Some conversion of pasture and native range to citrus is anticipated in the future, which may further increase phosphorus levels.

Natural Systems

Construction and operation of the C&SF Project altered water levels, changed the volume, timing, and distribution of water flows, and changed water quality. This alteration of hydroperiod within the LEC region has impacted the WCAs and Everglades National Park. Also, exotic plant infestation is a particular problem in the Everglades. Brazilian pepper, melaleuca, and Australian pine are becoming increasingly abundant in many areas.

Everglades-Florida Bay Issues

Flood Control Versus Everglades Protection in the Western LEC Urban Areas, the South Dade Agricultural Area, and Water Protection Areas

Many of the ecological problems facing the Everglades National Park and Florida Bay are related to alterations in surface water flows, water depths, and hydropatterns associated with the flood control provided by the construction and operation of the C&SF Project. The existing schedule of water deliveries from the C&SF Project to Everglades National Park is being modified to lessen the adverse ecological impacts to the park. The East Everglades, located to the south of Tamiami Trail and west of the L-31N Canal in south central Miami-Dade County, encompasses the heart of Shark River Slough, the principal watershed of Everglades National Park. Therefore, restoring its surface water flows, water depths, and hydropatterns is critical to this initiative. Portions of the East Everglades have been settled and both agricultural and residential areas currently exist within the area. This land must either be acquired or existing flood protection must be maintained.

The Modified Water Deliveries to Everglades National Park Project will provide for the structural modifications to the C&SF Project. This is necessary to restore more natural water flows to Shark River Slough while maintaining the existing level of flood protection in the 8.5-Square Mile residential area.

8.5-Square Mile Area. Efforts to restore flows to the eastern Everglades have been complicated by the fact that agricultural and residential development has occurred in the area immediately adjacent to Everglades National Park. One area in particular, known as the 8.5 Square Mile Area (**Figure 32**), has been a topic of public debate for more than 20 years. It is a low-lying area west of the flood protection levee which was once part of the historic Everglades. At times, portions of the 8.5 Square Mile Area are subject to extensive flooding.

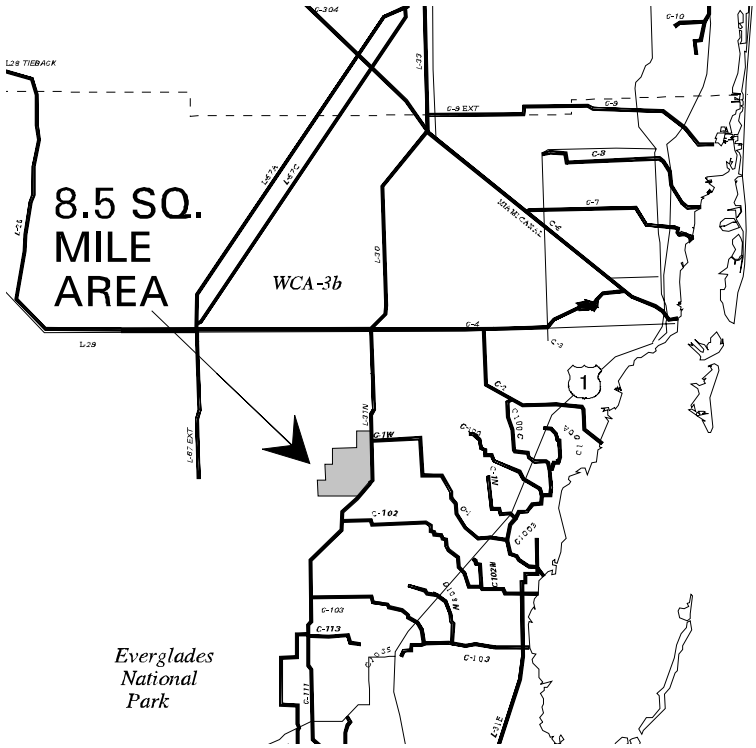


Figure 32. Location of the 8.5-Square Mile Area.

In 1989, Congress enacted the Everglades National Park Protection and Expansion Act. This law expanded the Everglades National Park to include 107,600 acres in the East Everglades, placing the boundary of the Everglades National Park immediately to the west of the 8.5 Square Mile Area. The legislation provided for historic flows to be restored, but recognized that given the hydrogeology of the region, restored overland flows would create higher water levels in the privately owned 8.5 Square Mile Area. In order to prevent adverse flood impacts to this area, the Modified Water Delivery Project includes the construction of a seepage levee and canal around the western and northern edges of the area and the relocation of Pump Station S-357 to remove excess seepage water. This relocation is scheduled to be completed by 2008.

Agricultural Activity in the Eastern Everglades. Levee 31 North runs north-to-south through Miami-Dade County and forms part of the eastern protective levee. It is one of the more prominent features of the C&SF Project and the original protective boundary between developed urban and agricultural areas and the Everglades. Construction of the eastern protective levee was intended to separate development from natural areas. However, agricultural activities were documented in the East Everglades beginning in 1956. This development and other structural changes resulted in a significant altering in the hydropattern, quantity, distribution, and timing of water flows within the Shark River Slough Basin. This impacted natural flow into northeastern Shark River Slough and left this area dependent on local rainfall and seepage for annual water flows. As a result, in Shark River Slough, wet season water depths dropped by more than a foot and the marsh experienced seasonal drawdowns during all but the wettest years. The CERP is addressing this issue with the L-31 North Levee Improvements for Seepage Management component. This component will eliminate water losses due to levee seepage to the east coast of

Florida. A pilot project will be conducted by 2004 to determine the appropriate technology to control the seepage and the appropriate amount of water flow that should be returned to Everglades National Park during the wet season.

Water Preserve Areas. As part of the overall Restudy effort, the Water Preserve Areas Feasibility Study, scheduled for completion in 2001, is investigating methods to capture and store excess surface waters that are normally released to tide via the C&SF Project canal system. This would be accomplished by backpumping these surface waters to a series of Water Preserve Areas for storage. Water Preserve Areas consist of a series of marshes, reservoirs, and ground water recharge areas. The Water Preserve Areas will provide the following system benefits:

- Prevent overdrainage of the Everglades and reestablishing natural hydropatterns within existing natural areas
- Provide for the re-creation of natural storage systems lost due to the impacts of development
- Provide for the increased spatial extent of short hydroperiod wetlands
- Provide a buffer between the Everglades and the increasingly urbanized LEC area
- Provide for an improved water supply to the LEC region

Water Preserve Areas will be constructed within the East Coast Buffer, which is located east of the WCAs in Palm Beach, Broward, and Miami-Dade counties. A series of marshes, reservoirs, and ground water recharge areas will be constructed to biologically treat storm water runoff from urban areas to the east and release it into the WCAs. This will reduce the impacts of development on the Everglades, reduce levee seepage from the Everglades, increase ground water recharge, capture storm water discharged to tide, and enhance wetland areas east of the WCAs. The acquisition of the East Coast Buffer is scheduled to be completed by 2018.

Mitigation banking is a process by which wetland losses are mitigated in advance of a loss of wetlands to ensure that there is no net loss of wetland function in a region. One such mitigation bank is the Buffer Strip Mitigation Bank. The District is currently acquiring, restoring, and managing Cells 17 and 18 within the mitigation bank.

Additional Water Control Structures. As part of the *Interim Plan for Lower East Coast Water Supply* (SFWMD, 1998c), the District recommended implementation of two water control structures on the C-4 Canal in Miami-Dade County. The eastern structure will maintain water levels in the vicinity of the western and northwestern wellfields. The western structure will restore hydroperiods in the Pennsuco Wetlands and allow for routing of water supply to the C-2 Canal for wellfield recharge. This recommendation is intended to reduce excess surface water runoff to tide, and to reduce the under-levee seepage that causes a loss of water from the Everglades system. In addition to ecosystem restoration benefits, the C-4 structures can be operated to provide an increased level of water supply and flood protection. The design of the Western C-4

Structure Critical Project will be completed during 2000 and construction will be initiated by 2001.

EAA Water Quality Management Providing High Quality Water to the Everglades

The SFWMD and other agencies have determined that high concentrations of phosphorus in water that flows into the Everglades are causing significant degradation in certain areas, often allowing cattails to displace native sawgrass habitats. These changes threaten fish and wildlife populations that are adapted to, or dependent upon, the vegetative makeup of the WCAs.

Everglades Works of the District Permit Program. The Everglades Works of the District Permit Program was implemented in 1992 pursuant to the provisions of the Marjory Stoneman Douglas Everglades Protection Act of 1991 (Chapter 373.4592, F.S.). It requires all EAA landowners holding property that discharge water to District works to obtain a Works of the District permit, implement Best Management Practices (BMPs), and monitor the quality and quantity of waters discharged from their lands into the District's works. Research is being conducted to determine the effectiveness of BMPs.

Stormwater Treatment Areas. The District will continue management of the Everglades Nutrient Removal (ENR) Project and other Stormwater Treatment Areas (STAs). The District will also conduct ENR research to optimize STA performance by 2004.

Everglades Construction Project. The Everglades Construction Project (ECP) includes the design and construction of various STAs, pump stations, and other capital facilities necessary to restore the Everglades, consistent with the Everglades Forever Act. It is scheduled for completion in 2006.

Everglades and Florida Bay Restoration

Major problems confronting the Everglades-Florida Bay system include the following:

- Reduction of the original Everglades ecosystem by half has placed a limitation on its capacity to support populations of wildlife that once used the area in much greater numbers.
- Fragmentation of the Everglades system has resulted in the loss of connections between the central Everglades and adjacent transitional wetlands.
- Changes in timing, distribution, and quantity of water discharges into and within the freshwater wetlands and estuarine systems has resulted in loss or degradation of native plant communities, loss or destruction of the habitats of threatened and endangered plants and animals, and a decline in commercial and recreational fisheries.

- Water quality associated with discharges from the EAA and other basins has impacted the natural Everglades ecosystem.
- Hypersalinity and algal blooms in Florida Bay

Decompartmentalization of the Water Conservation Areas. To reestablish the ecological and hydrologic connection between these areas, flow obstructions will be removed to allow unconstrained, passive flow between WCA-3A and WCA-3B and Northeast Shark River Slough. Two of the components of this project, rerouting the Miami Canal and adding the S-345 structures, will be implemented by 2009.

Reducing Seepage from WCA-3A and WCA-3B. Reducing seepage from WCA-3A and WCA-3B will improve hydropatterns within the WCAs by utilizing the marsh areas that are located east of the WCAs and west of U.S. 27. Seepage from the marshes will be collected and returned to the WCAs to maintain flood protection. Construction of seepage management features will be completed by 2008.

C-111 Project. The C-111 Project will restore the Taylor Slough portion of the Everglades. Completion of structural and nonstructural modifications to the C-111 are scheduled for completion by 2004. One component of the C-111 project is the Pineland and Hardwood Hammock Restoration Project. In this project a 200-foot wide strip of land within the Frog Pond will be used to test and demonstrate the techniques required to reestablish native conifer and tropical hardwood forest on land that has been rock plowed. The Frog Pond is located in south Miami-Dade County, just east of Everglades National Park. The Pineland and Hardwood Hammock Restoration Project is scheduled to be completed by 2006. Flood protection within the C-111 Basin east of the L-31N and C-111 canals will be maintained while the project is being implemented.

Other Projects to Restore Flows and Hydropatterns. The current Holey Land and Rotenberger WMAs regulation schedule will be revised by 2001 and Pump Station G-404 will be modified by 2009. Several planning activities will help improve the hydropatterns within the Everglades: establishment of MFLs for the WCAs and Everglades National Park by 2000; implement rain-driven delivery schedules for WCA-1, WCA-2A, WCA-3A and the Rotenberger WMA by 2003; establishment of economic and hydrologic needs of the Everglades Protection Area by 2004. The District will continue to publish Everglades research results on food webs, wading birds, and hydrologic impacts.

Everglades Stormwater Program. The primary goal of the Everglades Stormwater Program is to ensure that state water quality standards are achieved, to the maximum extent practicable, by December 31, 2006, at all water control structures included in the Non-Everglades Construction Project permit issued by the FDEP (SFWMD, 2000e).

Treating C-11 Runoff. Untreated runoff from the western C-11 Basin, which is presently backpumped through the S-9 Pump Station into WCA-3A, will be diverted from the North New River and C-9 canals to the Central and North Lake Belt storage areas. Once the water is treated it will be backpumped into WCA-3A. This will 1) restore a

portion of water deliveries to WCA-3A that are eliminated by segregating the C-11 runoff from levee seepage, 2) reduce stages within WCA-2B, and 3) divert water through WCA-3A and WCA-3B to northeastern Shark River Slough. The completion of the Western C-11 (S-9) Water Quality Treatment Project is scheduled to be completed by 2002. Capturing excess flows from WCA-3A and diverting them to the Central Lake Belt Storage Area and capturing excess flows from the Central Lake Belt Storage Area and diverting them to WCA-3B are scheduled to be completed by 2016 and 2017, respectively.

Hypersalinity and Algal Blooms in Florida Bay. In recent years, Florida Bay has demonstrated signs of stress. Large sections of the once pristine water body have deteriorated, with murky water, seagrass and sponge die-offs, algal blooms, fish kills, and an increase in salinity levels. Samples taken from central Florida Bay in 1989 and 1990 showed that salinity levels within the bay were higher than in the Atlantic Ocean. As the water in the bay has increased in salinity, biodiversity has declined. The absence of hurricanes in recent years reduced the beneficial flushing action, and the drought of the late 1980s exacerbated the problems of the bay. Die-offs of seagrasses compound the problems, allowing the barren bottom to release more sediment and nutrients, which causes the water to become turbid. Algal blooms erupted and spread, killing more seagrass and sponges. By 1992, more than 450 square miles of Florida Bay was suffering from algal blooms, creating an area which scientists and fishermen named the Dead Zone. Though the size of the Dead Zone has since decreased, it is still extremely large. To address this issue, the District will conduct Florida Bay research on seagrass mortality and algal blooms and research on the effects of freshwater inflow on the mangrove transitional zone. A Florida Bay Feasibility Study will comprehensively evaluate the Florida Bay and determine the types of modifications that are needed to successfully restore the water quality and ecological conditions of Florida Bay. Both the research and the feasibility study are scheduled for completion in 2004.

Exotics Infestation

Melaleuca was first introduced into South Florida from Australia in the early 1900s. Since that time, it has rapidly invaded many natural areas in the region, creating dense monocultures which may displace native plant communities and alter wildlife value. It currently infests thousands of acres in the Everglades, and is very persistent and hard to eradicate. The largest infestations occur in portions of the WCAs. The District will continue its aquatic and upland exotic plant control efforts.

Florida Keys

Background

The Florida Keys watershed consists of a limestone island archipelago of some 1,700 islands extending southwest over 200 miles, from the southern tip of the Florida mainland to the Dry Tortugas. The area is bounded on the north and west by the relatively shallow mud shoals and the seagrass beds of Biscayne Bay, Barnes and Blackwater Sounds, Florida Bay, and the Gulf of Mexico. Fresh water is supplied to the Florida Keys

by the Florida Keys Aqueduct Authority which has a wellfield near Florida City on the mainland.

Resources

The Florida Keys watershed has extensive shoreline and marine resources, including mangroves, coral reef formations, seagrass beds, wetlands, and fish and wildlife and their habitat.

Specific Watershed Goals

Goals for the Florida Keys watershed are as follows:

- Protect shoreline and marine resources, including mangroves, coral reef formations, seagrass beds, wetlands, and fish and wildlife and their habitat
- Protect freshwater wetlands, including wildlife and their habitat
- Limit the adverse impacts of development on the quality of water throughout the Florida Keys
- Protect the value, efficiency, cost-effectiveness, and amortized life of public investments, including the Florida Keys Aqueduct Authority

Status of Areas of Responsibility

An area of responsibility which has issues relating to the Florida Keys watershed is natural systems.

Natural Systems

Public Law 101-605 designated 2,600 square nautical miles of coastal waters as the Florida Keys National Marine Sanctuary. This law requires the U.S. Secretary of Commerce to develop a comprehensive management plan and the necessary regulations to protect the sanctuary's resources. It further charges the Administrator of the U.S. Environmental Protection Agency (USEPA) and the Governor of Florida to develop a comprehensive water quality protection program for the sanctuary. The SFWMD has been, and will continue to be, actively involved in all phases of the water quality protection program, which is being developed under the direction of the National Ocean and Atmospheric Administration (NOAA).

Florida Keys Issues

An issue affecting the Florida Keys is nearshore water quality.

Florida Keys Nearshore Water Quality

Historically, nearshore water quality in the Florida Keys has been good because of rapid flushing and dilution. Despite its high quality, water in the Florida Keys is subject to pollution from wastewater treatment plants, septic tanks, cesspools, and storm water runoff. These sources of pollution produce changes in nutrient levels and turbidity, as well as introduce toxics into the nearshore waters, which can have disastrous impacts on the coral reefs and other natural resources. The District will continue to address these issues by developing and implementing a Florida Keys Water Quality Plan.

The Florida Keys Tidal Restoration Project will restore the tidal connection between Florida Bay and the Atlantic Ocean in Monroe County that was eliminated in the early 1900s during the construction of Flagler's railroad. Restoring the circulation to areas of surface water that have been impeded and stagnant for decades will significantly improve water quality, benthic floral and faunal communities, larval distribution of both recreational and commercial species (i.e. spiney lobster), and the overall hydrology of Florida Bay. The connections will be restored by the construction of bridges or culverts at four locations (see **Chapter 6** for more details). The Florida Keys Tidal Restoration Project is scheduled to be completed by 2005.

Lower East Coast Regional Watershed Strategies

The SFWMD has proposed strategies to address the issues within the LEC regional watershed. These strategies are identified by area of responsibility and core objective, and implemented through budget activities (or projects). More generalized tasks that cover more than one regional watershed are not discussed within this chapter. Therefore, not all core objectives are discussed within this chapter, even if the projects will benefit the watershed. These Districtwide tasks, along with a more complete description of the tasks mentioned below, are presented in **Chapter 3** through **Chapter 6**.

Water Supply

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs

Planning

- Begin implementation of the Northern Palm Beach County Water Resources Development Program by 2001
- Initiate reclaimed water system for irrigation in Palm Beach/Martin County in 2000.
- Complete a East Broward County Integrated Water Resource Strategy by 2001
- Complete a Southeast Palm Beach County Integrated Water Resource Strategy by 2004

Land Acquisition

- Complete acquisition of the East Coast Buffer by 2018

Public Works Construction

- Construct the Western Hillsboro (Site 1) ASR Pilot Project by 2003; complete well construction by 2014
- Carry out and begin monitoring of the L-31 North Seepage Management Pilot Project by 2004
- Construct the WCA-3A and WCA-3B seepage management features by 2008
- Complete the Broward County Secondary Canal System by 2009
- Carry out the Lake Belt Technology Pilot Project by 2012
- Complete the Southern L-8 In-Ground Reservoir General Reevaluation Report (GRR) by 2014
- Divert excess flows from WCA-3 to the Central Lake Belt Storage Area by 2016
- Divert excess flows from the Central Lake Belt Storage Area to WCA-3B by 2017
- Complete the Hillsboro (East) ASR Pilot Project in southern Palm Beach County in 2002
- Implement the *Lower East Coast Regional Water Supply Plan*
- Complete the Miami-Dade County ASR Project in 2004

Operations and Maintenance

- Develop and implement a Water Supply and Environmental (WSE) schedule for Lake Okeechobee as recommended in the *Lower Coast Regional Water Supply Plan*
- Develop rain-driven operating rules for the greater Everglades and the CERP components
- Implement the operational modifications recommended in the *Lower East Coast Regional Water Supply Plan*

Regulation

- Establish enhanced water conservation requirements for water users with rulemaking by 2001

Outreach

- Complete the Hillsboro (East) ASR Pilot Project by 2002
- Implement the *Lower East Coast Regional Water Supply Plan* by 2004
- Complete Miami-Dade County ASR from existing wellfields by 2004
- Establish a water conservation coordinator in 2000

Monitoring and Evaluation

- Continue to implement the LEC Water Resource Development Program
- Implement hydrologic studies

Flood Protection and Floodplain Management

Core Objective FP 1: Minimize damage from flooding

Public Works Construction

- Maintain flood protection while implementing the Modified Water Delivery Project by 2003
- Maintain flood protection within the C-111 Basin east of the L-31N and C-111 canals while implementing the C-111 Project by 2004

Monitoring and Evaluation

- Continue conducting flood studies in the C-17 and C-51 basins

Water Quality

Core Objective WQ 1: Protect and improve surface water quality

Planning

- Conduct the Florida Bay Feasibility Study by 2004
- Continue developing a Florida Keys Water Quality Plan
- Continue to implement the *Lake Okeechobee SWIM Plan*
- Update the Lake Okeechobee SWIM Plan by 2000

Public Works Construction

- Complete the Lake Okeechobee Water Retention/Phosphorus Removal Critical Project by 2002
- Complete the Western C-11 (S-9) Water Quality Treatment Project by 2002
- Carry out Lake Okeechobee Tributary Sediment Dredging by 2005

- Complete the ECP by 2006
- Finish Pineland and Hardwood Hammock Restoration project (C-111 Basin) by 2006

Operations and Maintenance

- Continue to operate and maintain the canals, levees, pipes, culverts, pump stations, and test cells within the ECP

Regulation

- Continue Everglades Works of the District permitting
- Continue developing the Everglades Storm Water Program
- Continue Lake Okeechobee Works of the District permitting

Monitoring and Evaluation

- Continue ECP research and data collection efforts
- Continue Everglades BMP effectiveness research and develop a chapter on BMPs for the Everglades Consolidated Report by 2001
- Continue water quality monitoring in Florida Bay
- Continue Lake Okeechobee research and data collection efforts
- Continue monitoring the test cells within the ECP

Core Objective WQ 2: Protect and improve ground water quality

Planning

- Complete the Water Preserve Area Feasibility Study by 2001

Monitoring and Evaluation

- Complete the Lake Okeechobee ASR Pilot Project by 2004

Natural Systems

Core Objective NS 1: Maintain the integrity and functions of water resource-related natural systems

Planning

- Establish MFLs for Everglades National Park, the WCAs, Lake Okeechobee, and most of the Biscayne aquifer by 2000
- Implement rain-driven delivery schedules for the Arthur R. Marshall Loxahatchee National Wildlife Refuge (WCA-1), WCA-2A, and WCA-3A, and the Rotenberger WMA by 2003

- Establish MFLs for Florida Bay by 2003
- Continue In-Lake Research on water level impacts on Lake Okeechobee
- Continue to establish minimum and maximum flows to the Lake Worth Lagoon

Land Acquisition

- Continue to provide for the acquisition, restoration, and management of the Cells 17 and 18 Mitigation Project
- Continue to provide for the acquisition, restoration, and management of the Pennsuco Wetlands Mitigation Project
- Continue to provide for the acquisition, restoration, and management of the K-Mart Mitigation Project

Monitoring and Evaluation

- Continue Lake Okeechobee research and data collection

Core Objective NS 2: Restore degraded water resources and related natural systems to a naturally functioning condition

Planning

- Update the Lake Okeechobee SWIM Plan by 2000
- Implement rain-driven delivery schedules for the Arthur R. Marshall Loxahatchee Wildlife Refuge (WCA-1), WCA-2A, WCA-3A, and the Rotenberger WMA by 2003
- Establish the ecological and hydrologic needs of the Everglades Protection Area by 2003
- Continue to develop the South Miami-Dade County Integrated Water Resource Strategy
- Continue the Biscayne Bay SWIM planning process and establish a MFL for Biscayne Bay by 2004

Public Works Construction

- Construct the Western C-4 Structure by 2001
- Complete structural and nonstructural modifications to the C-111 Project by 2004
- Implement the Modified Water Deliveries Project by 2004
- Complete the Florida Keys Tidal Restoration Project by 2005
- Relocate the S-357 structure by 2008 to provide more effective water deliveries to Everglades National Park

- Complete G-404 Pump Station modifications by 2009
- Reroute the Miami Canal by 2009
- Add the S-345 structures by 2009 to establish more natural hydropatterns and hydroperiods in northeastern Shark River Slough and WCA-3B
- Complete the Lake Worth Lagoon Restoration by 2011

Operations and Maintenance

- Continue exotic species control in the Everglades
- Revise the current Holey Land WMA Regulation Schedule by 2001
- Revise the current Rotenberger WMA Regulation Schedule by 2001
- Continue ongoing elimination of exotic species from around Lake Okeechobee

Outreach

- Continue to implement the Biscayne Bay SWIM Plan

Monitoring and Evaluation

- Conduct ENR research to optimize STA performance by 2004
- Conduct Florida Bay research on seagrass mortality and algal blooms by 2004
- Conduct Florida Bay research on freshwater inflow effects on mangrove transitional zone by 2004
- Continue to publish Everglades research results on food webs, wading birds, and hydrologic impacts
- Continue hydrologic monitoring in Lake Okeechobee, the Everglades, and Florida Bay
- Continue Lake Okeechobee research and data collection efforts
- Continue implementing the *Lake Okeechobee SWIM Plan*

LOWER WEST COAST REGIONAL WATERSHED

Overall Lower West Coast Regional Watershed

The Lower West Coast (LWC) region presently has one of the highest population growth rates in the state and this trend is projected to continue. In addition to significant urban population growth, the LWC has experienced notable growth in agricultural activity. Citrus acreage grew significantly in this region following a series of freezes in Central Florida in the 1980s. Population growth and an increase in irrigated agricultural acreage have resulted in demands for more water for urban and agricultural use.

The LWC regional watershed contains two major watersheds formed by ten drainage basins. These two major watersheds are the Caloosahatchee River and the Big Cypress Basin watersheds.

Regional Watershed Goals

The regional watershed goals are to identify sufficient sources of water and funding to meet the needs of all reasonable-beneficial uses within the LWC region through 2020 during a drought event that has the probability of occurring no more frequently than once every ten years, while sustaining the water resources and related natural systems (SFWMD, 2000c).

Status of Areas of Responsibility

The four areas of responsibility are water supply, flood protection and floodplain management, water quality, and natural systems. A summary of the status of each area of responsibility within the LWC region is provided below.

Water Supply

The Surficial Aquifer System is the primary source of municipal, industrial, and agricultural water supply in the LWC region. Areas close to the Caloosahatchee River have access to some surface water for supply, but the remainder of the region utilizes ground water or limited surface water that can be found locally. Urban water demands are projected to increase by 84 percent between 1995 and 2020. Irrigated agricultural demand is projected to increase by 21 percent over the same time period (SFWMD, 1998b).

All of Lee County and the coastal portions of Collier County are currently designated as Reduced Threshold Areas (RTAs) and 87 percent of the LWC region is included in a Water Resource Caution Area (WRCA) (**Chapter 3**). RTAs are established as a precautionary measure when water demand approaches or exceeds supply capacity. However, the District is involved in rulemaking to drop the RTA designated for these areas.

The *Lower West Coast Water Supply Plan* (SFWMD, 2000c) accomplished the following:

- Assessed existing and projected future (2020) agricultural and urban water demands
- Developed strategies to meet these needs, while providing adequate water to support the needs of the environment
- Identified specific geographical areas that have water resource problems that are critical or are anticipated to become critical by 2020
- Established a framework around which future water use decisions in the planning region can take place
- Identified data collection and technical studies needs

Flood Protection and Floodplain Management

Southwest Florida is one of the most hurricane vulnerable areas in the country. Flooding from tropical storms and hurricanes occurs in low lying areas, along barrier islands, and around river and bay systems. Hurricane storm surge inundation modeling indicates that extensive areas of Lee and Collier counties could be flooded in a major hurricane. These correspond to areas already developed for urban use and areas anticipated for future urban growth.

The primary waterway serving the LWC is the Caloosahatchee River, which traverses Glades, Hendry, and Lee counties. Except for localized canal systems, the only other major waterway is the system of canals in western Collier County. Most of the canals in Hendry and Glades counties are privately-owned within large tracts of land.

The major constraints on flood control upgrades in this area are environmental and financial. The basic issue becomes one of the value to the public of improved flood control versus the potential for environmental deterioration. The high cost of implementation delays or prohibits many designs which provide structural flood control without adverse environmental effects.

Water Quality

The SFWMD has identified several water bodies within the LWC regional watershed as candidates for SWIM Plans. These include the Big Cypress National Preserve, Caloosahatchee River, Corkscrew Swamp, Naples Bay, Estero Bay, Pine Island Sound, Rookery Bay, and Lake Trafford.

The operation and maintenance of canal systems, particularly through discharges to tidal waters, have impacted the water quality and natural resource features of the LWC region. Serious problems have occurred at the mouth of the Sanibel River on Sanibel Island, located in San Carlos Bay, within the Charlotte Harbor watershed. Domestic wastewater and runoff from Sanibel Island development were the major sources of this

problem. Improvements to wastewater treatment plants have controlled the leachate problem, though runoff continues to be a problem. Water quality in the other areas of the Charlotte Harbor watershed within the SFWMD is generally good. Large regulatory releases of fresh water from Lake Okeechobee to the Caloosahatchee River during times of heavy rainfall adversely impact the health of the estuaries associated with the river.

Natural Systems

The natural resource features in portions of the LWC region have been substantially altered from the natural conditions by agricultural and urban development. The development of citrus groves significantly influences the natural systems of the region. Planning and research are currently under way to evaluate reasonable options for mitigating changes resulting from the migration of citrus to the LWC region. Although water quality is a concern, changes to the habitat and the reduction of ground water levels in wetlands are of even greater concern. Infestation by exotic plants, particularly melaleuca, is a significant problem in portions of this area.

Caloosahatchee River

Background

The Caloosahatchee River and Estuary extend about 70 miles from Lake Okeechobee to San Carlos Bay on Florida's southwest coast. This watershed includes the East, West, and Tidal Caloosahatchee drainage basins; and the North Coastal, Telegraph Swamp, C-21, and S-236 drainage basins. The freshwater portion of the river has been reconfigured as a canal (C-43), extending 45 miles from the Moore Haven Lock and Dam (S-77) to Franklin Lock and Dam (S-79), to better convey flood water to the Gulf of Mexico.

Resources

Significant natural system resources within the Caloosahatchee River watershed include Pine Island Sound, Matlacha Pass, Charlotte Harbor aquatic preserves, and Telegraph Swamp.

Specific Watershed Goals

The goal of the *Caloosahatchee River Watershed Management Plan* (SFWMD, 2000d) is to protect and enhance the estuaries that receive freshwater regulatory releases from Lake Okeechobee through the Caloosahatchee River.

Caloosahatchee River Watershed Issues

The major issues affecting the Caloosahatchee River watershed are water supply availability, Caloosahatchee River salinity variations, and Caloosahatchee River nutrient levels.

Caloosahatchee River Watershed Water Supply Availability

The water availability issues affecting the Caloosahatchee Basin are limited surface water sources; protection of water resources and associated natural systems; and pressure on these resources from increasing urban and agricultural demands. Increasing urban and agricultural water demands have the potential to adversely impact the region's water resources and associated natural systems. Ground water is the most important source of supply for most of the LWC region, but the Caloosahatchee River is an important surface water source in the northern portion of the region. Rapid growth in population and irrigated agricultural acreage has caused demands for water to increase significantly. Increased withdrawals in the future may cause ground water levels to decline and potentially impact wetlands. Additionally, increased demands may cause saltwater intrusion if unrestricted in the surficial and lower Tamiami aquifers along the coastlines of Lee and Collier counties. The SFWMD reviewed the problems of wetland protection, intrusion of seawater into aquifers, and general protection of aquifers from excessive drawdowns in the *Lower West Coast Water Supply Plan* (SFWMD, 2000c).

Supply augmentation options include ASR, increased surface water storage, and increased implementation of reuse programs. Alteration of demand patterns, through increased conservation measures, can also aid in meeting the water supply needs of this region. One such project, the Caloosahatchee ASR Pilot Project, will be constructed by 2006.

Caloosahatchee River Salinity Variations

Alteration of freshwater flow is a key environmental issue in the Caloosahatchee River Estuary. Lake Okeechobee regulatory releases and uncontrolled runoff from the Caloosahatchee River subbasins have resulted in too much fresh water entering the estuary too frequently, causing wide salinity variations that are destructive to estuarine communities. At the other extreme, during low flow conditions, too little water has been available. Low flow conditions allow saline water to migrate upstream threatening public drinking water supplies.

The first phase of a three dimensional model of the Caloosahatchee River is under development. This model will enable a quantitative evaluation of the effects of differing river water discharges.

The District is currently establishing MFLs for Lake Okeechobee, which will include limiting large regulatory releases and uncontrolled runoff from Lake Okeechobee into the Caloosahatchee River. The strategies for this project are discussed within the **Lower East Coast Regional Watershed** section.

Caloosahatchee River Nutrient Levels

Low dissolved oxygen levels and algal blooms have been observed near the Olga Treatment Plant intake. As a result the water quality is rated fair in this segment of the Caloosahatchee River (Paulic and Hand, 1998). The most likely causes of these problems

are agricultural runoff and the influence of nutrient enriched waters from Lake Okeechobee. Within the estuarine portion of the Caloosahatchee River elevated nutrient concentrations, especially phosphorus, and low water column transparencies have been identified. This portion of the drainage basin is highly developed and nonpoint sources impact water quality.

As mentioned in the **Lower East Coast Regional Watershed** section, the establishment of MFLs for Lake Okeechobee will limit the amount of water released from Lake Okeechobee into the Caloosahatchee River.

Big Cypress Basin

Background

The western Big Cypress Basin includes the Estero and Imperial river basins of Lee County, and a 1,200-square mile area drained by many natural sloughs and about 170 miles of primary canals. These primary canals are operated and maintained by the Big Cypress Basin Board. The eastern Big Cypress Basin watershed (east of State Road 29) includes vast natural areas presently occupied by the Big Cypress National Preserve, and the western part of the Everglades National Park.

Resources

Significant natural system resources within the Big Cypress Basin include Big Cypress National Preserve, Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, Southern Golden Gate Estates, Belle-Meade Royal Palm Hammock, Camp Keis Strand, Okaloacoochee Slough, Cape Romano-Ten Thousand Islands, Rookery Bay and Estero Bay aquatic preserves, Collier-Seminole State Park, Corkscrew Regional Ecosystem Watershed (CREW), Twelve Mile Slough, and Six Mile Cypress Slough.

Some large natural systems, such as Big Cypress National Preserve, Fakahatchee Strand, and CREW, are relatively intact. The CREW covers nearly 55,000 acres in Collier and Lee counties. It provides numerous water resource benefits including critical wildlife habitat for a number of rare, threatened, or endangered species. These large systems are especially dominant in the southern half of the region. State land acquisition efforts are bringing more of the area under protection. Large coastal areas have been protected by the establishment of six state aquatic preserves in the region: Cape Romano-Ten Thousand Islands, Rookery Bay, Pine Island Sound, Matlacha Pass, Charlotte Harbor, and Estero Bay.

Specific Watershed Goals

The goal for the Big Cypress watershed management plan is to conserve and protect the natural resources and scenic beauty of the area, while maintaining the level of service of flood protection, water supply, and water quality for a robustly urbanizing region.

Big Cypress Basin Issues

The major issues affecting the Big Cypress Basin are water supply availability, hydrologic restoration projects like the Southern Golden Gate Estates, prevention of flooding in southern Lee County, particularly in Bonita Springs, and enhancement of the level of service of the Big Cypress Basin canals for flood protection and aquifer recharge.

Big Cypress Basin Water Availability

This issue is discussed in the **Overall Lower West Coast Regional Watershed** section

Southern Golden Gate Hydrologic Restoration

Southern Golden Gate Estates encompasses an area of 94 square miles and is part of a bankrupt real estate development project undertaken in the 1960s. Prior to development, the area was characterized by seasonal flooding several months of the year. Broad, slow moving sheetflow sustained wetland vegetation and rejuvenated freshwater aquifers. A network of roads intercepts historic flowways. Forty-eight miles of canals over drain the landscape and quickly divert surface and ground water flow to a point discharge into the Faka Union Bay, thus damaging the ecology of the Ten Thousand Islands Estuary.

Southern Golden Gate Estates was identified in 1985 as a component of the Governor's Save Our Everglades Program and is included in the state's Conservation and Recreation Lands (CARL) Program. Land acquisition, which is a key component of the restoration, is being administered by the FDEP. The primary restoration goals are as follows:

- Reestablish historic flowways, sheetflow, and hydroperiods of wetlands to near historic levels
- Reduce point discharges to improve the health and productivity of downstream estuaries
- Maintain flood protection for developed areas north of the Southern Golden Gate Estates project
- Improve aquifer recharge for water supply and a saltwater intrusion barrier
- Restore and enhance habitat for fish and wildlife resources including listed species such as the Florida panther, Florida black bear, and wood stork, as well as rare habitat such as tropical hammocks and plant species, including orchids and bromeliads
- Preserve upland habitat
- Control invasive exotic plants
- Improve water quality of storm water runoff
- Reduce or eliminate overdrainage of adjacent, sensitive ecosystems

- Provide resource-based recreational opportunities
- Provide contiguous habitat conservation for the greater Everglades ecosystem including the Florida Panther National Wildlife Refuge, Fakahatchee Strand State Preserve, Ten Thousand Islands National Wildlife Refuge, Collier Seminole State Park, and the Belle Meade CARL area

At the request of the Governor of Florida, the SFWMD has developed a Hydrologic Restoration Plan for Southern Golden Gate Estates. The primary components of the restoration plan are as follows:

- Acquisition of approximately 55,000 acres of land
- Construction of 2.4 miles of spreader channels, 83 canal plugs, 130 miles of road removal and regrading, and three pump stations with a combined discharge capacity of 860 cfs
- Ecological and hydrological monitoring program to determine effectiveness
- Adaptive management to ensure desirable ecological responses

This project is planned to be implemented in partnership with the U.S. Army Corps of Engineers (USACE) after completion of acquisition of all of the project land under public ownership.

Bonita Springs Flooding

During 1995, extensive flooding occurred in Lee and Collier counties, particularly in the Bonita Springs area. The area has not maintained the natural regional drainage system and the flooding was caused by a combination of numerous high intensity rainfall events, coupled with wet antecedent moisture conditions. The existing conveyance capacity of the Estero River, Halfway Creek, Spring Creek, Camp Keis Strand, Cocohatchee River, and Imperial River in southern Lee County and northern Collier County were inadequate to handle the vast amounts of flood water from the combined watersheds. Flooding of the residential areas in both the Imperial and the Cocohatchee watersheds in southern Lee and northern Collier counties occurred twice during 1995.

The *South Lee County Watershed Study* (Johnson Engineering, Inc., 1997), a result of the flooding in 1995, was completed in May 1997. The main recommendations from this study are to continue to protect and enhance major flowways and pursue an active land acquisition program in the CREW area and the Imperial River flowway.

Since the flooding of 1995, the Imperial River has been cleaned from Oak Creek to Bonita Grande Road. Exotics and trash were removed and low vegetation blocking the flow was trimmed. The Kehl Canal weir has been replaced with a permanent, operable structure. The Imperial Bonita Estates Bridge, a major constriction in 1995, has been replaced with a larger bridge. The Estero River has been cleaned from U.S. 41 to the

north/south fork, and efforts are presently under way to finish the cleaning to I-75. Halfway Creek is presently being cleaned from U.S. 41 to a mile west of U.S. 41. The Florida Power and Light (FP&L) Bridge is being replaced to increase flow. The natural flowway for Halfway Creek from U.S. 41 to I-75 is being recreated by the Brooks Development. Also, a connection from U.S. 41 to the channel to the west is being discussed with a proposed development. The last major project is the land acquisition east of Bonita Grande Road and the Imperial River flowway for flood reduction, water recharge, and enhancing the environment. Approximately 1,000 acres of the 4,670-acre project have been purchased using CARL funds, and a $7 million grant from the Department of the Interior has been accepted for some of the land acquisition related to this project. District staff will continue to work with new developments to protect and enhance the major flowways. A South Lee County Watershed Plan, scheduled for completion by 2003, will address the issue of minimizing flood-related damage.

Lower West Coast Regional Watershed Strategies

The SFWMD has proposed strategies to address the issues within the LWC regional watershed. These strategies are identified by area of responsibility and core objective, and implemented through budget activities (or projects). More generalized tasks that cover more than one regional watershed are not discussed within this chapter. Therefore, not all core objectives are discussed within this chapter, even if the projects will benefit the watershed. These Districtwide tasks, along with a more complete description of the tasks mentioned below, are presented in **Chapter 3** through **Chapter 6**.

Water Supply

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs

Planning

- Complete the *Lower West Coast Water Supply Plan* during 2000
- Finalize the *Caloosahatchee Water Management Plan* during 2000
- Finalize the *Big Cypress Basin Watershed Management Plan* by 2001

Public Works Construction

- Construct the Caloosahatchee ASR Pilot Project by 2006
- Implement the water resource development projects recommended in the *Lower West Coast Water Supply Plan*

Outreach

- Implement the *Lower West Coast Water Supply Plan*

Core Objective WS 2: Prevent contamination of water supplies

Monitoring and Evaluation

- Develop criteria to support rulemaking for the LWC region by 2003

Flood Protection and Floodplain Management

Core Objective FP 1: Minimize flood-related damage

Planning

- Implement flood control elements through the Basin Board's Capital Projects Construction Program.
- Develop a South Lee County Watershed Plan by 2003

Water Quality

Core Objective WQ 1: Protect and improve surface water quality

Monitoring and Evaluation

- Complete Phase II of the Estero Bay/watershed assessment by 2003
- Continue LWC water quality monitoring from Cape Romano to the Caloosahatchee River
- Continue water quality monitoring of inland canals, lakes, and streams within the Big Cypress Basin in cooperation with Collier County

Core Objective WQ 2: Protect and improve ground water quality

Monitoring and Evaluation

- Develop a scientific basis for wetland protection criteria used in water use and environmental resource permitting by 2003

Natural Systems

Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems

Planning

- Complete the Southwest Florida Feasibility Study by 2004
- Continue updating the *Big Cypress Basin Watershed Management Plan*

Land Acquisition

- Continue to provide for the acquisition, restoration, and management of the CREW mitigation project

Regulation

- Continue to develop regulation criteria for the LWC region
- Continue to develop rules for low-level releases of water from Lake Okeechobee to the Caloosahatchee Estuary

Core Objective 2: Restore degraded water resources and related natural systems to a naturally functioning condition

Public Works Construction

- Complete the Tamiami Trail Culverts (West) Critical Project by 2002
- Complete the Tamiami Trail Flow Enhancement project by 2002
- Carry out the Lake Trafford Critical Ecosystem Restoration Project development by 2003, in cooperation with USACE and Florida Fish and Wildlife Conservation Commission (FWC)
- Complete Lake Trafford Sediment Removal project by 2005
- Complete the Southern Golden Gate Estates Hydrologic Restoration Project by 2010, in partnership with the USACE
- Divert a portion of peak wet season flow of the Golden Gate Main Canal to Henderson Creek to improve Naples Bay Estuary by 2006

UPPER EAST COAST REGIONAL WATERSHED

The Upper East Coast (UEC) is composed of St. Lucie and Martin counties and eastern Okeechobee County. The region covers over 1,200 square miles and has an average elevation of 20 feet. Annual average rainfall in the watershed region is about 51 inches, with almost three-fourths of this rainfall occurring during the May to October wet season. The UEC is predominantly agricultural, mainly citrus, especially in St. Lucie County and in the western portions of the region. The existing population is concentrated in the coastal areas of Martin and St. Lucie counties. These areas are expected to remain the population centers for the region. The UEC consists almost entirely of the Indian River Lagoon watershed.

Regional Watershed Goals

The watershed goals for the UEC are as follows:

- Promote the use of conservation and water supply alternatives within the UEC
- Develop the relationship between water use, water levels, and water quality for the Floridan Aquifer System within the UEC
- Protect wetland systems from harm due to water use drawdowns in the UEC
- Protect the Surficial Aquifer System from saltwater intrusion
- Establish a uniform level of certainty for all UEC permitted water uses and for the environment
- Promote compatibility between the SFWMD Plans and local land use decisions and policies
- Protect and enhance the St. Lucie Estuary and the Indian River Lagoon
- Promote coordination, compatibility, and integration of regional water resource planning efforts

Indian River Lagoon

Background

The Indian River Lagoon is a series of three distinct, but interconnected, estuarine systems, which extend 155 miles from Ponce Inlet to Jupiter Inlet on Florida's east coast. The northern portion of the lagoon is within the St. Johns River Water Management District. The estuary is characterized by the greatest species diversity of any estuary in North America, and supports multimillion dollar fishing, clamming, tourism, agricultural, and recreational industries. The drainage basins for the lagoon have been substantially modified by human activity. The combined effects of storm water runoff, drainage, navigation, and agricultural and urban development have severely impacted the lagoon’s water, sediment, and habitat quality.

Resources

Environmental resources of regional significance within the UEC include Indian River Lagoon, Savannas State Preserve, Jonathan Dickinson State Park, the St. Lucie River, Pal-Mar, DuPuis Reserve, and the northern Savannas.

Specific Watershed Goals

The management goals for the Indian River Lagoon and St. Lucie Estuary are to attain and maintain water and sediment quality to achieve a healthy, macrophyte-based, lagoon system which supports endangered and threatened species, fisheries, and recreation (SFWMD and SJRWMD, 1994).

Status of Areas of Responsibility

The four areas of responsibility are water supply, flood protection and floodplain management, water quality, and natural systems.

Water Supply

The *Upper East Coast Water Supply Plan* (SFWMD, 1998d), approved by the District's Governing Board in 1998, concluded that historically used sources of water, especially the Surficial Aquifer System in the coastal portions of the region, are not sufficient to meet projected water demands during a 1-in-10 year drought condition. However, with appropriate management and diversification of water supply sources, sufficient water is available to meet the needs of the region. Analyses indicated that the traditional source for urban water needs, the surficial aquifer, has limited potential for expansion due to potential impacts on wetland systems, and increased vulnerability to saltwater intrusion in the vicinity of PWS wellfields. In western portions of the region, where surface water from the regional canal system is heavily relied upon for agricultural needs, analysis showed that existing surface water supplies are inadequate to meet existing, as well as future, demands. However, it was concluded that when supplemented with water from the Floridan aquifer, the combination of sources is sufficient to meet the needs of agriculture. In fact, preliminary evaluations indicate that the Floridan aquifer has sufficient supplies to meet both existing and future PWS and agricultural demands.

Flood Protection and Floodplain Management

A regional canal system is located in the western, agricultural areas of St. Lucie County (the C-23, C-24, and C-25 canals), as well as extensively developed secondary canal systems. These systems were constructed for flood control and have limited surface water storage capabilities.

The SFWMD has received numerous complaints of flooding from eastern St. Lucie County. The St. Lucie (C-44) Canal is the only regional canal in Martin County, although half of the C-23 Canal's drainage basin is within Martin County. The St. Lucie Canal was constructed for navigation and as a flood control outlet for Lake Okeechobee. It

receives runoff from numerous secondary systems and it has limited surface water storage capabilities.

Water Quality

The surface water quality in the UEC region is generally rated as good. However, there are major problem areas in Five and Ten Mile creeks near Port St. Lucie. These creeks receive runoff from agricultural lands and exhibit high levels of pesticides and herbicides. Also, the St. Lucie River is impacted by runoff from urban development, especially near Manatee Pocket, which has poor water quality. The Savannas, a long freshwater marsh located between Fort Pierce and Stuart, has excellent water quality. The Loxahatchee River has good-to-fair water quality. Problem areas include a small portion of the North Fork of the Loxahatchee River, which has had low dissolved oxygen levels, and waters within Jonathan Dickinson State Park, which have exhibited high coliform counts. Large regulatory releases of fresh water from Lake Okeechobee to the St. Lucie River during times of heavy rainfall adversely impact the health of the estuaries associated with the river.

Water quality within the Surficial Aquifer System meets state drinking water standards, although localized areas of poor water quality do exist. The proximity of the Surficial Aquifer System to the surface in this region increases its susceptibility to contamination. In addition, because of increasing demands being placed on the system, it is in constant threat of saltwater intrusion along the coast. Zones of increasing mineralization tend to occur locally along the coast, due to saltwater intrusion, and inland where residual seawater or Floridan Aquifer System irrigation water have left high total dissolved solids concentrations. This limits withdrawals from PWS wellfields that utilize conventional lime softening as the means of treatment in these areas.

Water in the Floridan Aquifer System is of high mineral content and not suited for potable use without undergoing pretreatment. At this time, the primary utilization of the Floridan system within this region is for irrigation purposes.

Natural Systems

The Indian River Lagoon system has the highest species diversity of any estuary in North America. Approximately 2,200 species have been identified in the lagoon system, with 35 of these species listed as threatened or endangered. Species diversity is generally high in the south end of the lagoon system and near inlets. It is lower near cities, where nutrient input, sedimentation, and turbidity are high, and where large areas of mangroves and seagrasses have been lost.

Since the 1950s, the Indian River Lagoon system has lost over 75 percent of its emergent wetlands through destruction and impoundment. While many impoundments of the high salt marsh and mangrove communities have furnished needed mosquito control, they have also isolated the vast majority of the marsh and mangrove community from the lagoon.

Seagrass beds play an important role in biological productivity and diversity, and are a critical component of the Indian River Lagoon. Some seagrass beds may be threatened by adverse water quality conditions, especially increases in turbidity and nutrients.

Upper East Coast Issues

The major issues affecting the UEC regional watershed are surface water supply availability, undesirable salinity fluctuations and increased nutrient loading, and loss of seagrass beds and other wetlands.

Surface Water Supply Availability

The *Upper East Coast Water Supply Plan* (SFWMD, 1998d) is being implemented locally and the five-year update of the plan will be completed by 2003. The UEC Water Resource Caution Areas will be updated by 2001. The Indian River Lagoon Restoration Feasibility Study will also address this issue.

Undesirable Salinity Fluctuations and Increased Nutrient Loading

A major water quality issue within the Indian River Lagoon stems from extreme, salinity fluctuations, which occur as a consequence of modified freshwater inflows. Large regulatory releases of water from Lake Okeechobee to the St. Lucie River adversely impact the salinity and health of the estuary. After prolonged periods of heavy rainfall, the level in Lake Okeechobee can rise above the maximum regulation schedule, forcing damaging discharges to the St. Lucie River and, ultimately, to the Indian River Lagoon. For example, prolonged high volume releases from Lake Okeechobee are believed responsible for the defoliation of seagrasses, oyster kills, and the lesioned fishes that occurred within the St. Lucie Estuary during 1998. This issue is being addressed by the Indian River Lagoon SWIM Plan update which is discussed below.

Significant reductions of freshwater discharges to the Indian River Lagoon may occur during extended dry periods because of artificially lowered water tables. Reduced water levels can cause the loss of wetlands, which would otherwise serve as natural storage areas. The reduction of flows through coastal structures may also reflect an attempt to conserve water for agricultural and urban uses. In general, changes in the historic volume, distribution, and timing of inflows can adversely affect salinity gradients, nutrient and suspended matter loadings, sedimentation rates, and biotic communities distribution.

Ten Mile Creek Project. The Ten Mile Creek Project encompasses 1,266 acres in St. Lucie County, just south of Ten Mile Creek and west of Florida's Turnpike. The District is developing this water resource project into a regional storm water attenuation reservoir to restore more natural hydroperiods and improve water quality for the St. Lucie Estuary and the Indian River Lagoon. Construction is scheduled to be completed by 2003.

Other Projects. Indian River Lagoon and St. Lucie Estuary monitoring, modeling, and research will continue. This issue is also being addressed by the Indian River Lagoon SWIM Update and the Indian River Lagoon Restoration Feasibility Study which are discussed below. An established MFL for the St. Lucie Estuary is anticipated to be completed by 2001.

Loss of Seagrass Beds and Other Wetlands

The Indian River Lagoon Technical Advisory Committee identified seagrass protection and management, and the loss of emergent wetlands and their isolation from the lagoon, as its dominant concerns. Through the SWIM Habitat Program, the technical advisory committee is trying to define and achieve seagrass management requirements that focus on the preservation of existing seagrass beds and continue to protect and rehabilitate the lagoon's salt marshes.

Rehabilitation of the impounded wetlands could have the greatest, most expedient impact on improving the lagoon ecosystem. Most of the emergent saltwater wetlands have been impounded for mosquito control. Reconnecting the impoundments to the lagoon (through the use of gated culverts or pumping systems) is the primary method of marsh rehabilitation proposed. Indian River Lagoon/St. Lucie Estuary monitoring, modeling, and research continue to address this issue. This issue is also being addressed by the Indian River Lagoon SWIM Plan Update and the Indian River Lagoon Restoration Feasibility Study which are discussed below.

Indian River Lagoon SWIM Plan

The *Indian River Lagoon SWIM Plan* (SFWMD and SJRWMD, 1994) is currently being updated to include an assessment of activities that have been completed or begun since 1994. The update is scheduled for completion in 2001. The purpose of the update is to evaluate the effectiveness of initial strategies; assess the progress made in both research and implementation activities; identify new issues and opportunities facing the Indian River Lagoon and associated water bodies; and develop goals, objectives, strategies, and projects to address these issues. Storm water retrofits, habitat restoration, Pollution Load Reduction Goal (PLRG) development, construction of surface water storage facilities, and appropriate monitoring and research efforts will continue in an ongoing attempt to improve water quality within the Indian River Lagoon watershed.

Indian River Lagoon Restoration Feasibility Study

As a component of the Restudy, the Indian River Lagoon Restoration Feasibility Study was initiated in July 1996. The study is examining water resource issues of the UEC region, focusing on alternative surface water management options in the project canal basins of Martin and St. Lucie counties. The purpose of the study is to investigate making structural and operational modifications to the C&SF Project to improve the quality of the environment, improve protection of the aquifer, improve the integrity, capability, and conservation of urban and agricultural water supplies, and other water-related purposes.

This study is being equally cost-shared with the USACE. It is scheduled for completion in 2002. The stated objectives include the following:

- Improve quality, quantity, timing, and distribution of freshwater flow to estuaries
- Improve habitat quality in estuarine ecosystems
- Improve functional quality of wetland ecosystems
- Eliminate excessive sediment loading to estuaries
- Eliminate flocculent ooze
- Improve regional water supply for urban and agricultural use
- Maintain a healthy estuarine ecosystem which supports recreation and an abundance of commercially and recreationally important fisheries
- Enhance opportunities for ecotourism

Upper East Coast Regional Watershed Strategies

The SFWMD has proposed strategies to address the issues within the UEC regional watershed. These strategies are identified by area of responsibility and core objective, and implemented through budget activities (or projects). Districtwide tasks that cover more than one regional watershed are not discussed within this chapter. Therefore, not all core objectives are discussed within this chapter, even if the projects will benefit the watershed. Districtwide tasks, along with a more complete description of the tasks mentioned below, are presented in **Chapter 3** through **Chapter 6**.

Water Supply

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs

Planning

- Review the UEC Water Resource Caution Areas by 2001
- Revise and complete the five-year update of the Upper East Coast Water Supply Plan by 2003

Public Works Construction

- Complete the construction of the Ten Mile Creek Critical Project by 2003
- Complete construction of the C-23 and C-24 basins water preserve area by 2009
- Continue implementing the recommendations in the *Upper East Coast Water Supply Plan*)

Outreach

- Continue assisting with local implementation of the *Upper East Coast Water Supply Plan*

Core Objective WS 2: Prevent contamination of water supplies

Monitoring and Evaluation

- Develop a scientific basis for wetland protection criteria used in water use and environmental resource permitting by 2003

Water Quality

Core Objective WQ 1: Protect and improve surface water quality

Planning

- Update the *Indian River Lagoon SWIM Plan* by 2001

Monitoring and Evaluation

- Continue Indian River Lagoon and St. Lucie Estuary monitoring, modeling, and research

Flood Protection and Floodplain Management

The District has not developed specific strategies for this area of responsibility for the UEC region, but strategies under Districtwide efforts (**Chapter 4**) include activities that will enhance flood protection and floodplain management in the UEC region.

Natural Systems

Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems

Planning

- Implement the Indian River Lagoon Restoration Feasibility Study by 2001

Land Acquisition

- Acquire land for the DuPuis Reserve

Regulation

- Develop rules for low-level releases of water from Lake Okeechobee to the St. Lucie Estuary

Monitoring and Evaluation

- Continue monitoring Indian River Lagoon seagrasses

KISSIMMEE BASIN REGIONAL WATERSHED

Overall Kissimmee Basin Regional Watershed

The Kissimmee Basin includes parts of Orange, Osceola, Polk, Highlands, Okeechobee, and Glades counties. The basin is comprised of two watersheds: the Upper Kissimmee and the Okeechobee watersheds. Portions of the Okeechobee Basin are also considered, for planning purposes, to be within the LEC and LWC regions.

The Kissimmee Basin encompasses 3,568 square miles and has an average elevation of 63 feet. Annual average rainfall is 50 inches, falling mainly during the May to October wet season. The region contains numerous lakes and is dominated by the Kissimmee River. Most of the region's expanding population resides in the northern portion of the region (Orange and Osceola counties), south of which agriculture remains the principal land use.

The majority of the region drains to the Kissimmee River, although some areas drain into Fisheating Creek, the canal system within Indian Prairie Basin, or a few landlocked lakes within the region. In its natural state, the Kissimmee River rose out of the Kissimmee Chain of Lakes and slowly made its way through a one to two miles wide floodplain supporting a variety of wildlife habitats. The Kissimmee's broad, yet shallow, overland flow of fresh water once snaked its way southward through a 103-mile course before emptying into Lake Okeechobee.

When channelized to become the C-38 Canal, the river's natural length of 103 miles between Lake Kissimmee and Lake Okeechobee was reduced to 56 miles. Because the total difference in elevation between lakes at the north and south ends of the system is approximately 36 feet, the canal was constructed as a series of five, equally spaced, terraced pools whose water levels are held constant by six water control structures and adjoining locks.

Regional Watershed Goals

The Kissimmee Basin regional watershed goals are as follows:

- Manage the headwaters of the Kissimmee Basin to provide more natural flow conditions to the river while maintaining flood protection within the region
- Restore the ecological integrity of the Kissimmee River and floodplain ecosystem
- Reestablish discharges to the Okeechobee Basin that are necessary to restore the ecological integrity of the Kissimmee River while optimizing environmental improvements to the Upper Kissimmee Basin

- Manage the Chain of Lakes to minimize tussock development and conduct periodic lake drawdowns to remove existing tussocks
- Reduce local flooding

Status of Areas of Responsibility

The four areas of responsibility are water supply, flood protection and floodplain management, water quality, and natural systems. A summary of the status of each area of responsibility within the Kissimmee Basin region is provided below.

Water Supply

The Kissimmee Basin region as a whole is, historically, the least problematic of the four SFWMD regions for water supply purposes. However, population is projected to grow by 89 percent between 1995 and 2020, and increases in irrigated agricultural acreage are anticipated in Highlands, Okeechobee, and Glades counties. Total water supply demand, under average rainfall conditions, is projected to increase by 56 percent between 1995 and 2020 (SFWMD, 1998b).

The primary water source for urban and agricultural use is the Floridan aquifer, due to the limited capacity in the surficial aquifers. Floridan Aquifer System wells produce greater quantities of water and are a reliable source of water during periods of drought. Well yields from the Floridan aquifer in the Kissimmee Basin average about 1,500 gallons per minute (gpm). There is also limited use of lakes for agricultural irrigation and urban use.

Throughout most of the Kissimmee Basin, the surficial aquifer produces good quality water of low mineral content, although it does not yield sufficient quantities of water for many applications. The proximity of the Surficial Aquifer System to the surface in the Kissimmee Basin increases its susceptibility to contamination. Lack of confining layers, high recharge, relatively high permeability, and a high water table in most areas where this unit exists, all increase contamination potential.

Flood Protection and Floodplain Management

The C&SF Project in the region consists of the Kissimmee River (C-38 Canal) and six structures in the lower basin; 14 canals and eight structures between the lakes in the Upper Kissimmee Basin; and the Lake Istokpoga-Indian Prairie water control system, consisting of four canals and eight structures and located northwest of Lake Okeechobee. Additional project works, such as the levees and water control structures, exist along the northern shore of Lake Okeechobee. Minimal secondary flood control facilities exist, other than those that were constructed by developers and subsequently deeded over to local governments for long-term maintenance.

Water Quality

Several water bodies within the region have been designated as priorities for SWIM plans, based on water quality, condition of the wetlands, public use, and wildlife habitat areas. The water bodies within the Upper Kissimmee Basin which have been designated as priorities for SWIM plans include the Kissimmee Chain of Lakes and the Alligator Chain of Lakes. Several water bodies within the Okeechobee Basin have also been designated as priorities for SWIM plans: Lakes Okeechobee, Weohyakapka, Arbuckle, Butler, and Istokpoga. Of these, Lake Okeechobee has an adopted SWIM Plan and a water management plan is presently being developed for the Kissimmee Chain of Lakes.

Natural Systems

The channelization of the Kissimmee River in the 1960s altered the hydrology and physical form of the Okeechobee Basin, and caused the loss of many of the environmental values of its original ecosystem. Over 40,000 acres of floodplain wetlands disappeared and the alterations degraded fish, wading bird, waterfowl, and other wildlife habitat. Degradation of the natural cleansing capabilities of the river's historic oxbow and floodplain marshes, coupled with major changes in land use during the 1960s and 1970s, also increased phosphorus loading into Lake Okeechobee.

Upper Kissimmee Basin

Resources

The significant natural system resources within the Upper Kissimmee Basin are the Kissimmee River, the Kissimmee Chain of Lakes, the Alligator Chain of Lakes, the Three Lakes WMA, Walker Ranch (Disney Preserve), the Lake Forest Preserve, Reedy Creek, and Marian Creek.

Upper Kissimmee Basin Issues

The major issues affecting the Upper Kissimmee Basin are water supply availability, Chain of Lakes maintenance and water quality problems, and overall basin water quality.

Upper Kissimmee Basin Water Supply Availability

The *Kissimmee Basin Water Supply Plan* (SFWMD, 2000a) has been completed. An ongoing analysis of water supply issues in the Orlando Metropolitan Area by the St. Johns River Water Management District indicates that over the long-term, the existing ground water resources will have to be supplemented by additional wells from outside the metropolitan area or by surface water withdrawals, primarily from Lake Monroe. Additionally, the Southwest Florida Water Management District has identified several lakes on top of the Lake Wales Ridge whose water levels have decreased in the recent

past, probably due to ground water withdrawals to the west. The SFWMD continues to work with both districts to ensure a comprehensive approach to the management of both ground and surface water resources in Central Florida. Ground water contamination from drain wells is a potential issue of concern in Orange and Osceola counties.

Chain of Lakes Maintenance and Water Quality Problems

Water level is a key environmental issue affecting the lakes in the Upper Kissimmee Basin. These lakes, called the Kissimmee Chain of Lakes, suffer long standing problems of stage stabilization and overall reduction in stage from historical levels. Although the lakes continue to support a generally excellent fishery, the range of water fluctuation, which is critical to the long-term health of the littoral zone, affects fish population and wading birds. The problems associated with level stabilization have been offset, to some degree, for several of the major lakes by new management procedures and drawdowns carried out over the past decades.

Changes in the management of the water levels in the lakes in the Upper Kissimmee Basin will be made possible by the completion of the downstream Kissimmee River restoration activity. These management changes will enable the lakes to attain better ecological health. However, drawdowns and removal of sediments from the lakes will continue to be necessary, hopefully at longer time intervals. This is an ongoing project for the drawdown and maintenance of the Alligator Chain of Lakes for 1999 through 2002.

Upper Kissimmee Basin Water Quality Problems

The most notable water quality problem area in the Upper Kissimmee Basin occurs in Lake Tohopekaliga. Lake Tohopekaliga has demonstrated signs of eutrophication as a result of high nutrient loading from wastewater plant discharges and nonpoint source runoff. Stopping the practice of discharging wastewater into the lake has reduced phosphorus loading and resulted in improved water quality. Aquatic weeds continue to be a problem in Lake Tohopekaliga, as well as other lakes in the Kissimmee Basin, including Lakes Cypress, Hatchineha, and Kissimmee. Water clarity is the major problem associated with Lake Istokpoga, but turbid water may be a naturally occurring condition.

Lakes in the Upper Kissimmee are frequently the receiving water bodies of storm water runoff from the rapidly developing Orlando Metropolitan Area. As development continues past the Orange County border and into northern Osceola County, the potential for water quality degradation of the lakes increases. Continued protection of the remaining wetlands, along with continued monitoring and improved storm water quality practices will become necessary.

Okeechobee Basin

Resources

The significant natural system resources within the Okeechobee watershed include the Kissimmee River; Lakes Okeechobee, Weohyakapka, Arbuckle, Butler, and Istokpoga; the Avon Park Bombing Range; the Audubon Sanctuary; Fisheating Creek; and Nicodemus Slough.

Okeechobee Basin Issues

The major issues affecting the Okeechobee Basin are water supply availability, continuation of the Kissimmee River Restoration Project, and impacts to Lake Okeechobee water quality.

Okeechobee Basin Water Supply Availability

Historically, the Lake Istokpoga-Indian Prairie Basin, located in the southwestern portion of the region, has had water shortages. Water use in the basin is primarily agricultural. The Floridan aquifer is intensively used, but water quality is variable. Because of its limited contributing area, surface supplies in this basin are limited. The District is developing a Lake Istokpoga Regulation Schedule by 2002.

Continuation of the Kissimmee River Restoration

Degradation of the Kissimmee River's water quality, wetlands, and ecosystem has been the subject of numerous local, state, and federal studies. The SFWMD is currently engaged in an effort to reintroduce flows to remnant river oxbows and restore 26,000 acres of wetlands in the river floodplain. Backfilling of 1,000 feet of the canal was started in 1994 to test construction methods and provide information to aid in the remaining work. This preparatory work has been completed and work on the actual restoration has begun. The remaining land acquisitions, engineering, and construction activities necessary to complete the restoration is scheduled to be implemented by 2011, but completion is contingent upon continued federal funding. Kissimmee River restoration research and evaluation data will be published by 2011 and coordination of flood restoration efforts involved with the project will continue.

Impacts to Lake Okeechobee Water Quality

Agricultural runoff flowing too quickly into the Kissimmee River system results in nutrient enriched waters within Lake Okeechobee. Large algal blooms in the 1970s and 1980s suggested that Lake Okeechobee was receiving excessive nutrients and becoming increasingly eutrophic. Both phosphorus and nitrogen contribute to algal growth, but bacteria and blue-green algae can fix nitrogen from the atmosphere and add it to the water column making nitrogen harder to control than phosphorus. Accordingly, the primary water quality issue associated with the lake is the control of phosphorus.

Historically, one source of phosphorus and other nutrients entering Lake Okeechobee has been the tributaries within the Lower Kissimmee Basin, including Taylor Creek. Taylor Creek has had some of the poorest water quality in the state, with frequent violations of dissolved oxygen standards, as well as elevated bacteria and nutrient levels. These problems were associated with runoff from dairy farms in the area. The Florida Department of Agriculture and Consumer Services Dairy Buy-Out Program, in conjunction with the FDEP's Dairy Rule (Chapter 62-670, F.A.C.), has worked to address these problems.

Lake Istokpoga-Indian Prairie Area

In the Lake Istokpoga-Indian Prairie area, periodic water shortages and design deficiencies of the major water control structures are the major issues of concern and are now being addressed. An investigation of the Lake Istokpoga regulation schedule is targeted for 2002. A mobile irrigation lab, utility audit project, and conservation plans are scheduled for 2003. A wetlands impact study and Lake Istokpoga pump installation are scheduled for 2004.

Kissimmee Basin Regional Watershed Strategies

The SFWMD has proposed strategies to address the issues within the Kissimmee Basin regional watershed. These strategies are identified by area of responsibility and core objective, and implemented through budget activities (or projects). Districtwide tasks that cover more than one regional watershed are not discussed within this chapter. Therefore, not all core objectives are discussed within this chapter, even if the projects will benefit the watershed. Districtwide tasks, along with a more complete description of the tasks mentioned below, are presented in **Chapter 3** through **Chapter 6**.

Water Supply

Core Objective WS 1: Increase available water supplies and maximize overall water use efficiency to meet identified existing and future needs

Planning

- Complete the development of the *Kissimmee Basin Water Supply Plan* during 2000

Public Works Construction

- Implement the water resource development projects recommended in the *Kissimmee Basin Water Supply Plan*

Operations and Maintenance

- Develop Lake Istokpoga Regulation Schedule by 2002

Flood Protection and Floodplain Management

Core Objective FP 1: Minimize damage from flooding

Public Works Construction

- Construct facilities for the flood mitigation efforts associated with the implementation of the Kissimmee River Restoration Project

Monitoring and Evaluation

- Continue the analyses of the flood control level of service for the Kissimmee Basin

Water Quality

Core Objective WQ 1: Protect and improve surface water quality

Planning

- Develop a SWIM plan for the Kissimmee Chain of Lakes by 2001

Public Works Construction

- Construct the Taylor Creek/Nubbin Slough Reservoir and STA by 2009

Monitoring and Evaluation

- Collect and evaluate data to assess sources of phosphorus from the Upper Kissimmee Chain of Lakes and to assess if the TMDL and MFL requirements can be met

Natural Systems

Core Objective NS 1: Maintain the integrity and functions of water resources and related natural systems

Planning

- Develop MFLs for the Kissimmee Basin by 2006

Land Acquisition

- Continue to provide for the acquisition, restoration, and management of the Kissimmee Mitigation Project
- Continue to provide for the acquisition, restoration, and management of the Shingle Creek Mitigation Project
- Continue to provide for the acquisition, restoration, and management of the Upper Lakes Basin Mitigation Project

Core Objective NS 2: Restore degraded water resource and related natural systems to a naturally functioning condition

Land Acquisition

- Acquire 12 to 15 ownerships for the Kissimmee River Restoration Project by 2011

Public Works Construction

- With the USACE, design and construct Kissimmee River restoration components by 2011 to meet restoration goals
- Continue ongoing engineering for meeting flood protection constraints and ecosystem goals for Kissimmee River Restoration Project

Monitoring and Evaluation

- Publish Kissimmee River restoration research and evaluation data by 2011
- Continue hydrologic monitoring to support the Kissimmee River Restoration Project

Chapter 8
IMPLEMENTATION COORDINATION

The SFWMD stresses the importance of a coordinated and cooperative approach to water resource management. To accomplish its mission, the District has integrated its efforts with the federal and state governments, 145 local governments and 68 water control districts within its jurisdiction, and a variety of agencies, organizations, utilities, and private citizens that play a role in water resource management. The District will continue to take the lead role in establishing the framework for regional water resource management within South Florida, while recognizing the authority and responsibilities of other governmental entities and the needs and concerns of other interested and affected parties. The main groups of agencies and organizations with which the SFWMD systematically coordinates its water resource management efforts are discussed below.

FEDERAL GOVERNMENT

The District coordinates all of its federal initiatives with both the State of Florida's Washington D.C. Office and with the Florida congressional delegation. The SFWMD has cooperative efforts with the U.S. Army Corps of Engineers, the U.S. Geological Survey, the U.S. Department of Agriculture, the U.S. Department of Interior, the U.S. Department of Commerce, the U.S. Environmental Protection Agency, the National Oceanic and Atmospheric Administration, and the Federal Emergency Management Agency.

U. S. Army Corps of Engineers

As local sponsor for the Central and Southern Florida (C&SF) Project, the District has had a long and productive relationship with the U.S. Army Corps of Engineers (USACE). The federal government has established an Interagency Task Force on South Florida that is coordinating all federal agencies' interests in the South Florida ecosystem. One of the major work efforts of the task force was the C&SF Project Comprehensive Review Study (Restudy). The task force is currently developing the Comprehensive Everglades Restoration Plan (CERP), which will refine and implement the Restudy. District staff will continue to participate on the project team of the CERP and will be involved in formulating its recommendations.

While the CERP may result in new directions in the future, the District and other state and federal agencies will continue to coordinate in reshaping the present water management system in South Florida. The Kissimmee River Restoration, the Everglades Construction Project (ECP), and Modified Deliveries to the Everglades National Park are joint projects that will integrally link the District, state, and federal interests in the restoration of South Florida's natural environment.

U. S. Geological Survey

The U.S. Geologic Survey (USGS) conducts and publishes results of geological research and maps related to topography, landforms, and hydrology. The USGS also conducts ground and surface water monitoring within the SFWMD. The District will continue to pursue joint hydrologic studies and outreach efforts with the USGS, as well as to utilize USGS data and expertise in its water resource management efforts.

U.S. Department of Agriculture

The National Resources Conservation Service (NRCS) is an agency of the U.S. Department of Agriculture (USDA). The SFWMD had coordinated efforts with the NRCS in a variety of soil and water conservation activities.

U.S. Department of the Interior

The SFWMD works cooperatively with the National Park Service and the U.S. Fish and Wildlife Service of the Department of the Interior. These agencies have substantial interest in the management of waters affecting federal properties including Everglades National Park, Biscayne Bay National Park, Big Cypress National Preserve, Arthur R. Marshall Loxahatchee National Wildlife Refuge, and the J.N. “Ding” Darling National Wildlife Refuge.

U.S. Department of Commerce

The National Oceanic and Atmospheric Administration (NOAA) is an agency of the Department of Commerce, and issues weather forecasts, as well as technical data regarding coastal and other environmental resources. The District will continue to coordinate with NOAA in order to improve flood forecasting throughout South Florida. The District is also engaged with NOAA as part of the Florida Keys National Marine Sanctuary Program.

U.S. Environmental Protection Agency

The U.S. Environmental Protection Agency (USEPA) is another federal partner of the SFWMD. The District is working with the USEPA's National Estuary Program in the Indian River Lagoon, and strongly supports national estuary designation for the Caloosahatchee River/Charlotte Harbor system. In light of Clean Water Act reauthorization and the implementation of the National Pollution Discharge Elimination System Program, the SFWMD will be increasingly active in coordinating with the USEPA with regard to water quality, water supply, and natural systems.

Federal Emergency Management Agency

The SFWMD will continue to coordinate its emergency management efforts with the Federal Emergency Management Agency (FEMA), which administers the National Flood Insurance Program (NFIP). The NFIP is a federal program enabling property

owners in participating communities to purchase insurance protection against losses from flooding. Participating communities adopt and enforce a floodplain management ordinance to reduce future flood risks to new construction in flood prone areas. The federal government, in return, makes flood insurance available within the community.

STATE GOVERNMENT

The SFWMD will continue to coordinate with many state agencies in order to carry out its mission. The District has developed strong working relationships with the Executive Office of the Governor, the Cabinet, the Florida Legislature, the Florida Department of Environmental Protection (FDEP), the Department of Community Affairs, the Public Service Commission, the Florida Fish and Wildlife Conservation Commission, the Florida Department of Agriculture and Consumer Services, the Department of Health, the Department of Transportation, and the Department of Education.

The Water Planning Coordination Group is composed of representatives from the FDEP and all five water management districts. This group has met since the early 1990s to help guide all parties toward effective implementation of the Florida Water Plan, the District Water Management Plans (DWMPs), and regional water supply plans. Attendees have included representatives from the Florida Department of Agriculture and Consumer Services, the Department of Community Affairs, and the Office of Program Policy Analysis and Government Accountability.

Governor's Office, Florida Cabinet, and Legislature

The SFWMD will continue its close coordination with the Executive Office of the Governor, the Cabinet, and the Florida Legislature in order to communicate regional needs, maximize funding effectiveness, and coordinate state and regional efforts.

Many land acquisition matters involving the District (e.g., Kissimmee River restoration and restoration of flows to Taylor Slough and Florida Bay) are considered by the Cabinet. Similarly, during every legislative session, key legislation affecting water resources and the water management districts is considered. The state plays a lead role in defining coordination between land use planning and water resource protection, and ensures coordination among the State Comprehensive Plan (Chapter 187, F.S.), the Florida Water Plan, the Florida Transportation Plan, all five DWMPs, and the regional planning councils' strategic regional policy plans. These are the principal plans that guide local land use and land development decision making, transportation system development, water management, and regional policy making.

In 1994, the Governor's Commission for a Sustainable South Florida was established to examine the relationship between a healthy Everglades ecosystem and economic growth and development in the region. The Governor's Commission was congressionally recognized as a formal advisory body to the South Florida Ecosystem Restoration Task Force overseeing the Restudy. A Governing Board member represented the SFWMD on the Governor's Commission until it completed its work in March 1999.

The commission produced 14 reports during its five-year tenure, many of them directly relating to the Restudy.

In June 1999, Governor Jeb Bush signed Executive Order 99-144 creating the Governor's Commission for the Everglades to continue the work started by the Governor's Commission for a Sustainable South Florida. The Commission for the Everglades is intended to have a two-year tenure and is intended to serve as an advisory body to the task force.

Florida Department of Environmental Protection

Statutorily, the District operates under the general supervisory authority and budgetary oversight of the FDEP. Many vital programs including the administration of the CERP, Surface Water Improvement and Management (SWIM) plans, the Save Our Rivers (SOR) Program, the Environmental Resource Permitting (ERP) Program, and the DWMP rely on close coordination between the agencies. The state's five water management districts work with the FDEP to update the Florida Water Plan, which addresses four areas of responsibility: water supply, flood protection, water quality, and natural systems. The Executive Office of the Governor and FDEP have also worked with the state's five water management districts to identify core objectives and performance measures within each district's areas of responsibility.

Department of Community Affairs

The SFWMD will continue to work closely with the Department of Community Affairs (DCA) to ensure that water resources are considered in local planning efforts. The District reviews and comments on local government comprehensive plans for the DCA, and works with the DCA to provide technical assistance to local government planning efforts. The District will also continue to coordinate its emergency management efforts with DCA's Emergency Operations Center and Division of Emergency Management.

Public Service Commission

The Public Service Commission is responsible for regulating the rates, services, and safety of several types of investor-owned utilities, including water and wastewater utilities. The SFWMD will continue to coordinate with the Public Service Commission to promote and facilitate reuse of reclaimed water, as well as to promote conservation oriented rate structures for public water supplies.

Florida Department of Agriculture and Consumer Services

The Florida Department of Agriculture and Consumer Services (FDACS), through its Office of Water Policy, carries out it's commitment to participate in the development of water policy. FDACS communicates the needs of the agricultural industry to the Florida Legislature, the FDEP, and the water management districts, and ensures participation of agriculture in the development and implementation of water policy decisions. FDACS

also oversees Florida's soil and water conservation districts, which coordinate closely with the federal NRCS.

Florida Fish and Wildlife Conservation Commission

The Florida Fish and Wildlife Conservation Commission (FWC) was previously called the Florida Game and Fresh Water Fish Commission (FGFWFC). This agency administers hunting and freshwater fishing regulations, in addition to conducting research and educating the public on the value of nongame species. The FWC coordinates with the SFWMD in regards to hunting and fishing regulations on District lands. The SFWMD will continue to develop joint management agreements for SFWMD land with the FWC where appropriate, as well as coordinate related outreach efforts.

Department of Health

The Department of Health has regulatory authority for septic tanks, as well as water quality testing of private wells. This department addresses water resource protection through programs administered by each county health unit. The SFWMD will share water quality monitoring data with the Department of Health, as well as coordinate enforcement efforts of septic tank regulations.

Department of Transportation

The Department of Transportation is responsible for design, construction, and maintenance of the state highway system. The SFWMD will continue to work with the Department of Transportation in the planning of future state road projects, consistent with the District's mission.

Department of Education

The SFWMD will continue coordinated efforts with the Department of Education's Regional Centers for Environmental Education to provide innovative programs to educate Floridians about the unique and complex nature of our environment.

REGIONAL AGENCIES

The SFWMD communicates and confers with the four other water management districts in the State of Florida, as well as with the regional planning councils and the regional water supply authority within SFWMD boundaries.

Water Management Districts

The SFWMD has an expansive working relationship with the other water management districts in the state. Planning initiatives, emergency operations procedures, regulatory issues, communications and educational programs, and financial and administrative activities are all coordinated among the five districts. Development of the

districtwide water supply assessments and the district water management plans are noteworthy examples of this coordination. The annual Florida Water Management Conference is another vehicle for coordination and cooperation among the districts.

In order to ensure coordination between the SFWMD and the adjoining neighboring districts (St. Johns River and Southwest Florida water management districts) all three districts have developed a Memorandum of Understanding (MOU). The MOU includes provisions on coordination in water shortage declarations and water resource investigation, planning, and regulation. Through the implementation of this MOU, and additional appropriate contacts, the SFWMD will continue to coordinate its efforts with neighboring water management districts.

Regional Planning Councils

The District works closely with the five regional planning councils within its jurisdiction. As a result of legislation recommended by ELMS III (the third statewide Environmental Land Management Study), the water management districts now serve in an ex officio (nonvoting) capacity on the regional planning councils. District involvement with the regional planning councils includes information sharing, assistance with GIS mapping, and participation in jointly funded studies and planning efforts. Through these efforts, the District has and will continue to contribute to the integration of land use and water management.

Regional Water Supply Authorities

The regional water supply authorities are established pursuant to interlocal agreements to provide wholesale water supply. They may acquire water and water rights; develop, store, and transport water; and provide, sell, and deliver water for county or municipal uses. The composition of the authority's governing body is specified in the interlocal agreement. Lee County Regional Water Supply Authority is the only agency of this type presently operating within SFWMD boundaries. Others agencies within the District are termed authorities, but they are really special districts.

Sanitary and Water Supply Districts

Sanitary and water supply districts were established by special act to provide water supply, sewerage, or solid waste disposal facilities. Within the SFWMD, these are the Florida Keys Aqueduct Authority, Immokalee Water and Sewer District, Loxahatchee River Environmental Control District, and the Solid Waste Authority of Palm Beach County. The SFWMD will continue to coordinate water resource related efforts with these special districts, as appropriate.

Water Control Districts

The SFWMD contains water control districts which provide local drainage. The water control district canals are considered part of the secondary drainage system, and typically drain into the District controlled, primary canal system. Most of these districts

were created pursuant to Chapter 298, F.S. These are known as the 298 Districts. The 298 Districts frequently take in water from developments' tertiary drainage systems, or from areas used for agriculture. Effective communication between the managers of the three levels of drainage facilities (primary, secondary, and tertiary) is essential in order to maximize the capability of South Florida's water resource management efforts. The SFWMD will continue to facilitate communication between these three levels in order to maximize the flood protection capability of the combined systems.

The SFWMD will also explore options for stormwater retrofit projects with the 298 Districts, as well as develop agreements to assist in implementing flowway projects, preserving wetlands, and restoring natural water fluctuations, where possible.

LOCAL GOVERNMENTS

Since 1986, the SFWMD has had an active program of outreach and assistance to local governments. Because local land use decisions and utility operations impact water resources, improving lines of communication and keeping local interests apprised of District policies and programs are critical to the success of regional water management. Similarly, operation of the C&SF Project and other District programs and activities can directly affect local communities. The responsibility rests with the SFWMD to constantly improve its relationship with, and responsiveness to, its local partners.

SFWMD local government assistance representatives are assigned to work with individual counties or groups of counties, and to coordinate District resources with municipal and local interests. These representatives facilitate interaction on a variety of matters including regulatory issues, local water resource planning efforts, technical and financial assistance for storm water management and planning, water supply development, resource protection, and recreational projects.

A key responsibility of the District with respect to local governments is the review of water resource related elements of local comprehensive plans and plan amendments. Designated a review agency in the Local Government Comprehensive Planning and Land Development Regulation Act of 1985 (Section 163.3184, F.S.), the SFWMD focuses on ensuring that local planning actions consider potential impacts on water resources. Data and information from local comprehensive plans are utilized in District planning efforts. The SFWMD also assists in the preparation of local government plans by providing technical assistance and information regarding the status of water resources throughout the region.

The SFWMD also works with local governments on the development and adoption of local ordinances designed to protect local resources and wetlands. Wellfield protection ordinances, water conservation ordinances, model landscape codes, and model rate structures are examples of products which the District has developed to aid in local decision making and resource management.

SOVEREIGN NATIONS

Native American communities within the jurisdiction of the SFWMD include the Seminole Tribe of Florida and the Miccosukee Tribe of Indians of Florida. The District and the Seminole Tribe of Florida have a cooperative relationship in the Seminole Compact, which is a complex accord that affirms both the tribe's and the state's water rights. Negotiations on a water rights compact between the District and the Miccosukee Tribe were suspended several years ago pending settlement of litigation. Annual meetings between the two resumed in June 1999, and it is hoped that an agreement similar to the compact with the Seminole Tribe can be achieved in the future.

Beyond formal agreements, the District interacts with the sovereign Native American nations on a variety of issues including access to rights-of-way and land management concerns; water quality issues including the *Lake Okeechobee SWIM Plan Update* (SFWMD, 1997b) and Everglades restoration; drainage and flooding matters; and oil exploration in the Everglades. The District will continue to coordinate efforts, and pursue appropriate cooperative relationships with the Seminole and Miccosukee tribes in order to serve their needs in the most effective manner possible.

PUBLIC INVOLVEMENT

The SFWMD will continue to seek the involvement of the public in its activities on a regular basis. In doing so, the District endeavors to go beyond the minimum requirements of law to keep the public informed and involved in its decisionmaking processes. Public involvement will continue to occur on a monthly basis at the workshops and regular meetings of the SFWMD's Governing Board. Members of the public frequently participate in discussions during presentations and during the public comment periods. Comments range from concerns about site specific water resource issues to broad policy issues.

In addition to the Governing Board’s monthly meetings, the District will continue to provide numerous venues to solicit public input. The methods used are often issue driven, diverse, and tailored to the needs of the interested public, including the following:

- Annual series of budget workshops
- Informational workshops
- Public meetings
- Speaker's bureau
- Informational brochures
- Notices of meetings/hearings sent to general and special purpose mailing lists
- Special public relations campaigns in both print and electronic media
- Web site

MEDIA

Largely through the media, the residents of South Florida are able to keep abreast of SFWMD projects and initiatives. As a result, the District must work closely with the various categories of the media to ensure accurate coverage and to make sure that the District's message is clear. The District will continue to provide the media with appropriate information in a timely manner, schedule tours to familiarize reporters with District activities, and highlight important activities carried out by the District.

ADVISORY GROUPS

The SFWMD encourages intense levels of participation with regard to some activities. For the past eight years, the District has been active in seeking the input of regional interests in the development of regional water supply plans. Water supply plan advisory committees are made up of local, state, and federal officials; agricultural, environmental, and urban interests; and water resource professionals. Advisory committees have been established for the water supply planning efforts for all four planning regions (the Lower East Coast, the Lower West Coast, the Upper East Coast, and the Kissimmee Basin).

Until April 2000, the SFWMD had District established advisory committees for agriculture, utilities, and the environment. District staff utilized input from these interested and affected party advisory committees to provide broad-based interest group recommendations on its water resource management programs. However, as District constituted advisory bodies, these committees and their members were subject to the strict requirements of the Florida Sunshine, Public Records, and Ethics laws, which was increasingly creating conflict issues for committee members during their normal course of non-District business. Therefore, in April 2000, these committees were decommissioned as advisory committees of the District, but the interests formerly represented on these committees were encouraged in that Governing Board action to create their own independent committee frameworks if they still desired to communicate future concerns to the District.

The District Governing Board initially created an outside independent Budget and Finance Advisory Commission in May 1995. The commission is composed of nine individuals from both the private and public sectors, each appointed by a current board member. The commission reports directly to the Governing Board on budget development and long-term financial planning issues.

These advisory groups will continue to be a valuable channel of communication between the District and the community it serves. The input provided by these groups will facilitate the development, refinement, and implementation of District initiatives.

WATER SUPPLY AND WASTEWATER UTILITIES

The SFWMD works closely with both public and private utilities through regulatory and planning activities. The SFWMD also cooperates with utilities in the development of comprehensive water conservation and demand management programs to reduce water withdrawals. The District also promotes and encourages increased wastewater reclamation and reuse throughout South Florida.

PRIVATE LAND TRUSTS

Private land trusts within the SFWMD perform a variety of tasks. The general goal shared by all is to preserve environmentally-sensitive lands either through acquisition, conservation easements, or in lieu fee programs. Private land trusts that operate within the SFWMD include the Trust For Public Land, Corkscrew Regional Ecosystem Watershed (CREW) Trust, The Nature Conservancy, Land Trust Alliance, Green Horizon Land Trust, and Florida Land Trust Group. These entities assist the District in land acquisition by providing assistance in the negotiations, land management, development of public use programs, and environmental education. Private land trusts may prefer to form partnerships to achieve their goals. Private land trusts typically specialize in one or two of these components to achieve the common vision of preserving environmentally sensitive lands. The SFWMD will continue to coordinate with private land trusts in order to preserve environmentally sensitive lands.

Chapter 9
PROCEDURES FOR PLAN DEVELOPMENT

DEFINITIONS

The glossary of terms at the end of the document has been developed in conjunction with other planning efforts within the SFWMD, and with other water management districts and the Florida Department of Environmental Protection (FDEP).

CONVENTIONS

In 1994, the state's five water management districts and the FDEP jointly developed 16 water resource management conventions. These describe common approaches to key water management issues, and provide a basis for improved consistency and coordination between the water management districts. A full report was developed for each convention, and the reports were summarized in the *1995 District Water Management Plan* (SFWMD, 1995a). These conventions have been used in order bring closer alignment between the policies and practices of the state's five water management districts. Conventions were developed for the following items:

- Agricultural water use
- Economic assessments
- Surface water basins and floodplain mapping
- Ground water availability
- Ground water basins
- Hydrogeologic nomenclature
- Management of surface water quality
- Mapping and Geographic Information Systems (GIS)
- Population and per capita water use
- Recharge mapping
- Recharge protection
- Reuse
- Storm water management system level of service
- Surface water availability
- Water use categories
- Wellhead protection

PUBLIC PARTICIPATION

Members of the public have been encouraged to participate in the preparation and review of this District Water Management Plan (DWMP). Public meetings regarding this DWMP were scheduled in concert with the District's Fiscal Year (FY) 2001 budget review workshops. District staff made presentations on the purpose, content, and schedule for the this DWMP during these public meetings, and input was gathered regarding regional water management issues to be prioritized within this DWMP.

PARTICIPATION BY GOVERNMENT ORGANIZATIONS

The outline for the *2000 DWMP* has been prepared in coordination with the FDEP, the Executive Office of the Governor, and the state's other water management districts. Local and regional governments were sent notices of all workshops and meetings scheduled. Local government involvement will increase during the preparation of integrated county plans, which will be carried out in 2001.

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ACRONYMS

ASR	Aquifer Storage and Recovery
AWS	Alternate Water Supply
BMP	Best Management Practice
C&SF	Central and Southern Florida
CARL	Conservation And Recreational Lands
CCC	Canal Conveyance Capacity
CERP	Comprehensive Everglades Restoration Plan
CREW	Corkscrew Regional Ecosystem Watershed
CUP	Consumptive Use Permitting
DCA	Department of Community Affairs
District	South Florida Water Management District
DRI	Developments of Regional Impact
DWMP	District Water Management Plan
DWSA	Districtwide Water Supply Assessment
EAA	Everglades Agriculture Area
ECP	Everglades Construction Project
EDD	Everglades Drainage District
ERP	Environmental Resource Permitting
F.A.C.	Florida Administrative Code
FCD	Central and Southern Florida Flood Control District
FDACS	Florida Department of Agriculture and Consumer Services
FDEP	Florida Department of Environmental Protection
FEMA	Federal Emergency Management Agency
FGFWFC	Florida Game and Fresh Water Fish Commission
FP&L	Florida Power and Light Company
F.S.	Florida Statutes
FWC	Florida Fish and Wildlife Conservation Commission
FY	Fiscal Year
GIS	Geographic Information System

gpd	gallons per day
gpm	gallons per minute
GRR	General Reevaluation Report
IFAS	Institute of Food and Agricultural Sciences
LEC	Lower East Coast
LWC	Lower West Coast
MFLs	Minimum Flows and Levels
mgd	million gallons per day
mgy	million gallons per year
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
msl	mean sea level
NFIP	National Flood Insurance Program
NOAA	National Ocean and Atmospheric Administration
NRCS	Natural Resources Conservation Service
PLRG	Pollution Loading Reduction Goals
PWS	Public Water Supply
RECOVER	REstoration, COordination, and VERification
Restudy	Central and Southern Florida Project Comprehensive Review Study
RTA	Reduced Threshold Area
SCADA	Supervisory Control and Data Acquisition
SFWMD	South Florida Water Management District
SOR	Save Our Rivers
STA	Stormwater Treatment Area
SWIM	Surface Water Improvement and Management
TMDL	Total Maximum Daily Loads
UEC	Upper East Coast
USACE	United States Army Corps of Engineers
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey

WCA	Water Conservation Area
WMA	Wildlife Management Area
WRCA	Water Resource Caution Area
WSE	Water Supply and Environmental

Appendix A
MAJOR WATER RESOURCE LEGISLATION SINCE 1994

Each year, after the legislative session, the District's Office of Counsel prepares a *Legislative Review.* This booklet is a compilation of summaries and analyses of bills that passed during the year's state legislative session that impact or may be of interest to District staff. Each *Legislative Review* has three sections: Summary of the Bill, District Impact and Analysis, and District Action/Rulemaking. Below are brief descriptions of the legislation that most significantly have impacted the District's activities. A more detailed compilation of legislation is available in the *Legislative Review* (SFWMD, 1994, 1995, 1996, 1997, 1998, 1999) or within the legislation. Throughout the section below the term "districts" refers to any of Florida's five water management districts.

1994

Water Management District Review Commission (CS/SB 1068)

CS/SB 1068 created the Water Management District Review Commission whose responsibilities are to perform a comprehensive review of Florida's water management system including the following:

- The legal responsibilities of the districts
- The need for water management districts and regional offices of the Florida Department of Environmental Protection (FDEP)
- Ways to improve land management activities of the districts
- The costs of operating the districts
- Funding mechanisms available to the districts
- Ways to improve financial and programmatic accountability of districts
- Potential land management agreements between the districts and other agencies
- Potential revision of the districts' budget development and adoption procedures
- Whether to continue the current system of district governing board appointments
- The feasibility of creating new committees to oversee the districts

The 1994 Wetlands Act (CS/SB 1346)

The 1994 Wetlands Act (CS/SB 1346) impacts the District's regulatory and planning programs. This act is comprised of three main components: establishment and ratification of a unified statewide wetland delineation methodology; creation of conditional exemptions from specified permit review criteria for certain storm water and wastewater treatment ponds and for wetlands created by mosquito control activities; and grandfathering for certain projects.

The Everglades Forever Act (SB 1350)

In 1994, the Florida Legislature adopted a major piece of legislation, the Everglades Forever Act, which affected the water resources of South Florida. This legislation was originally known as SB 1350 and is codified at Section 373.4592, F.S. The Everglades Forever Act is based on legislative findings that the unique Everglades ecosystem is endangered due to adverse changes in water quality, quantity, distribution, and timing of flows. The Everglades Forever Act creates the Everglades Program. The Everglades Program is comprised of seven distinct elements, each element has multiple, implementing projects. The comprehensive nature of the Everglades Forever Act legislation is understood by describing the range of elements. These elements are as follows:

- The Everglades Construction Project - 18 projects
- Hydropattern Restoration - 7 projects
- Research and Monitoring - 12 projects
- Regulation - 10 projects
- Exotic Species Control - 2 projects
- Funding - 5 projects,
- Annual Progress Report - 1 project.

Given the broad scope of the Everglades Forever Act, the impact of this legislation is, and will continue to be, felt for many years. Finalization of state water quality standards and integration of these programs with water supply planning efforts and the Comprehensive Everglades Restoration Plan (CERP) will be critical in the years to come.

1995

The Florida Preservation 2000 Act (CS/HB 735)

The Florida Preservation 2000 Act (CS/HB 735) was essentially superseded by the Florida Forever Act that passed in 1999.

The Private Property Rights Protection Act and the Florida Land Use and Environmental Dispute Resolution Act (CS/HB 863)

The Private Property Rights Protection Act and the Florida Land Use and Environmental Dispute Resolution Act (CS/HB 863) provide that when an action of a governmental entity has inordinately burdened an existing use of real property or a vested right to a specific use of real property, the property owner is entitled to various forms of relief, which may include compensation for the actual loss to fair market value of the property caused by the government action. This creates a separate cause of action other than those that may arise under *takings* law, and applies to actions that do not rise to the level of being a *taking* under the Florida or United States constitutions.

Alternative Water Supplies (HB 2609)

Alternative Water Supplies (HB 2609) legislation requires districts to include money in their annual budgets for the development of alternative water systems within Water Resource Caution Areas (WRCAs). Beginning in 1996, these budgeted amounts are to be disbursed annually to providers and users based on stated criteria for eligibility and grant committee input.

1996

The Henry Swanson-Bruce McEwan Bluebelt Act of 1996 (SB 10)

The Henry Swanson-Bruce McEwan Bluebelt Act of 1996 (SB 10) charges districts to inventory ground water resources and designate prime ground water recharge areas for use by local governments as a planning tool for water supply and ground water protection. To encourage landowners to preserve high-water recharge lands, municipalities and counties are authorized to adopt, by ordinance, a tax incentive program for land owners.

1997

The 1997 Legislative Session was marked by a great deal of interest in water supply planning and water use regulation issues. Most of these issues were debated during the 1996 Legislative Session but did not result in legislation in 1996. There was also significant debate over the implementation of the projects within the Everglades Forever Act. A Joint Legislative Committee on Everglades Oversight and Accountability was created to monitor the SFWMD's implementation of the Everglades Forever Act.

An Act Relating to Water Supply and Minimum Flows and Levels (HB 715)

An Act Relating to Water Supply and Minimum Flows and Levels (MFLs) (HB 715) includes provisions, requirements, and/or authority for the following items:

- Requires a Florida water plan
- Requires District Water Management Plans (DWMPs)
- Requires Districtwide water resource assessments and details contents required
- Requires regional water supply plans
- Requires a level of certainty planning goal
- Requires establishment and implementation of MFLs
- Authorizes interagency agreements for projects that cross district boundaries
- Details the schedule for appointing district governing board members
- Requires district governing board members to have significant expertise in water resource management or business management
- Describes district staffing responsibilities for an ombudsman, executive director, and legal staff
- Delineates water resource development as the proper role of districts
- Delineates water supply development as the proper role of local governments and water users
- Requires districts to fund water resource development
- Provides that lands owned and controlled by districts may be used for multiple purposes
- Provides that consumptive use permits may be issued for a duration of up to 20 years
- Provides for a reevaluation of areas previously delineated as contaminated water supplies
- Provides procedures for distributing district budgets and audits
- Provides notice requirements for district budget workshops
- Authorizes the Executive Office of the Governor to approve or disapprove district budgets
- Delineates conditions under which districts may utilize their lands for water supply development and water resource development
- Authorizes regional water supply authorities to implement alternative sources of potable water independently or jointly with districts

- Makes funds from the Water Quality Assurance Trust Fund available to subsidize constructing potable water wells in areas requiring contamination remediation
- Outlines conditions for severance pay for district employees
- Requires a study to examine district employee compensation
- Changes the submission date for the annual reuse report from January 30 to June 1
- Allows for extensions of submerged land leases within areas designated as historic
- Authorizes FDEP to issue licenses for importation and possession of anadromous sturgeon
- Provides penalties for violating certain fishing limits
- Provides that it is illegal to use nets outside of legal limits for harvesting marine life
- Provides inspection and reporting procedures regarding crawfish
- Provides for the establishment of a three-year pilot program for certain saltwater products license holders
- Provides that the FDEP shall classify discharge of demineralization concentrate as a potable water by-product

An Act Relating to Land Management and Acquisition (HB 1119 and HB 1577)

An Act Relating to Land Management and Acquisition (HB 1119 and HB 1577) precludes districts from excluding cattle dipping vats from acquisition programs using state funds, and removes district liability associated with leaking vats. The act also adds archeological or historical value to the districts' criteria to be considered when acquiring lands. The Florida Forever Advisory Council (a seven member council appointed by the Governor) and each district was required to commission a study, to be completed by October 1, 1997, to determine remaining needs and priorities of the Preservation 2000 Program. Leases, easements, or licenses granted on Preservation 2000 lands were required to be compatible with the purposes for which the property was acquired. The redistribution of unencumbered Preservation 2000 funds in accounts for more than two years was postponed from Fiscal Year (FY) 1998 to FY1999. Properties valued under $500,000 require one appraisal, while properties over $500,000 require two appraisals. If the two appraisals differ significantly the district may obtain a third.

Regarding land management, beginning in FY1999, if more than one-third of a district’s management plans are overdue, it will receive only 75 percent of the acquisition funds which it would be otherwise be entitled from the Preservation 2000 Trust Fund. Districts are to report to FDEP annually on the progress of the funding, staffing, and resource management for each project it manages. Multiple land uses are allowed unless

prohibited by covenants. The act also provided substantially more management funding by increasing the percentage of each district's Water Management Lands Trust Fund allocated for management, maintenance, and capital improvements from up to 15 percent to the entire allocation. Districts are encouraged to use soil and water conservation districts and volunteers to manage lands. Districts are also required to establish management review teams to review land management practices.

An Act Relating to Everglades Restoration Oversight and Accountability of the South Florida Water Management District (HB 1775)

A Joint Legislative Committee on Everglades Oversight was established within the Florida Legislature to monitor the SFWMD's implementation of the Everglades Forever Act. The SFWMD is required to deposit funds for projects undertaken pursuant to the Everglades Forever Act into the Everglades Trust Fund that was created by ballot through Amendment 6 in the November 1996 elections. The SFWMD is also required to submit information relating to the impacts of federal Clean Water Act permits on the funding and time lines for the Everglades Program. The SFWMD is also required to file a truth in borrowing statement and a financial report whenever it incurs a debt or obligation because of the Everglades Forever Act. Requirements are also established for the use of funds towards Everglades restoration, including quarterly reporting to Florida's Governor and Legislature.

1998

In 1998, the only water resource legislation that passed of a potentially high level of significance to the SFWMD is the Local Source First Bill.

Local Source First (CS/SB 312 and 2298)

The Local Sources First Bill imposes a mandate upon districts to encourage the use of water from sources nearest the area of use or application. The bill specifies the factors to be considered when evaluating whether a potential end use of ground or surface water across county boundaries is in the public interest.

1999

The 1999 Legislative Session resulted in significant legislation affecting water resource management in Florida. These included the Florida Forever, the Restudy, and Total Maximum Daily Loads (TMDL) Acts.

The Restudy Bill (CS/SB 1672)

The Restudy Bill sets in motion a mechanism for state participation for the Everglades restoration pursuant to the Restudy. The primary emphasis is to provide a process to facilitate and support implementation of the project in cooperation with federal

agencies and the U.S. Congress, while addressing interests of the State of Florida. The law emphasizes coordination between the SFWMD, state and federal agencies, and stakeholders to streamline implementation of the Restudy.

The procedural requirements of the law include significant intergovernmental coordination and evaluation. Under the Restudy Bill, the SFWMD is authorized to act as local sponsor for Restudy projects, subject to review and oversight by the FDEP. As local sponsor, the District is required to participate in the development of Restudy project components. Project components are subject to review by the FDEP before they are submitted to Congress for authorization or before receiving additional state funds, and the Executive Office of the Governor is required to review all proposed expenditures for project components in the SFWMD's budget.

The Florida Watershed Restoration Act (TMDL Bill) (SB 2282)

The Florida Watershed Restoration Act (TMDL Bill) (SB 2282) requires a massive undertaking for the FDEP. The bill requires that the FDEP coordinate and consult with districts on the assessment list, assessment methodology, calculation methodology, Pollution Load Reduction Goals (PLRGs), implementation, implementation/evaluation of interim measures, and a 2005 report. Districts will also participate with FDEP in the technical advisory committee created in the bill to develop recommendations for a 2001 report. Rulemaking for Lake Okeechobee TMDLs will commence immediately.

The Florida Forever Program (SB 908)

Florida Forever significantly affects districts' land acquisition, land disposal, and land management programs. The act streamlines funding for land acquisition for conservation purposes into one primary source, replacing prior funding from Preservation 2000, the Conservation and Recreation Lands (CARL) Trust Fund, and the Water Management Land Trust Fund. The act also creates a Florida Forever Advisory Council that is directed to develop goals and performance measures by November 1, 2000, to guide agencies' use of the Florida Forever funds. Funding is to be used to implement goals and objectives recommended by the Florida Forever Advisory Council. Districts are encouraged to enter into cooperative land management agreements with state agencies or local governments to provide for the coordinated and cost-effective management of lands.

The SFWMD is required to develop a Florida Forever five-year work plan that must identify projects that meet the criteria set forth in the statute. The five-year work plan must be integrated with existing Surface Water Improvement and Management (SWIM) plans, Save Our Rivers (SOR) land acquisition lists, storm water management projects, proposed water body restoration projects and other properties or activities that would assist in meeting the goals of the Florida Forever Act. The project list submitted by the District shall include fourteen items of information for each project, including numeric performance measures, baselines, and standards for each project.

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