SOUTH FLORIDA WATER MANAGEMENT DISTRICT

UPPER EAST COAST
WATER SUPPLY PLAN UPDATE

Planning Document

2016

Acknowledgements

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Furthermore, the SFWMD expresses appreciation to all District staff who contributed to the development and production of this Plan Update.

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Executive Summary

The South Florida Water Management District's (SFWMD's) strategic goal for its water supply plans is to identify sufficient water supply sources and future projects to meet existing and future reasonable-beneficial uses during a 1-in-10 year drought condition while sustaining water resources and related natural systems. This *2016 Upper East Coast Water Supply Plan Update* (2016 UEC Plan Update) is the third update to the *1998 Upper East Coast Water Supply Plan* (1998 UEC Plan), which was updated in 2004 and 2011. This update presents population and water demand projections through 2040, a review of water supply issues and evaluations, and a list of water source options. It also examines local and regional efforts completed since the 2011 update and describes future water resource and proposed water supply development projects for 2013 to 2040.

This 2016 UEC Plan Update was developed in an open public forum with water supply utilities, local governments, environmental organizations, agricultural interests, and other stakeholders through the SFWMD's Water Resources Advisory Commission. The process to develop the population and water demand projections began in 2013. Multiple meetings and workshops were held with water users, local governments, utilities, agriculture and other industry representatives, and environmental representatives to solicit input, provide information about planning results, and receive comments on draft sections of the plan.

The UEC Planning Area covers 1,230 square miles, including St. Lucie and Martin counties as well as the northeast (NE) portion of Okeechobee County. It generally reflects the watersheds of the C-23, C-24, C-25, and C-44 canals. While a portion of the Lake Okeechobee Service Area (LOSA) is within the UEC Planning Area, the entire LOSA is addressed in the Lower East Coast water supply planning process because that planning area has the greatest reliance on Lake Okeechobee.

The UEC Planning Area includes a portion of the Northwest Fork of the Loxahatchee River, the St. Lucie River and its tributaries, and the Southern Indian River Lagoon. Six state parks and one national wildlife refuge are located within the Planning Area.

Typically, the UEC Planning Area receives abundant fresh water seasonally, with volumes exceeding human and natural system needs during wet periods. Water availability varies annually and includes periodic drought years. Annual precipitation averages 54 inches with nearly 62 percent of the rainfall occurring between June and October. There is an extensive network of canals and related water works that are used for flood control and water supply. The Central and Southern Florida Flood Control Project (C&SF Project) canals (C-23, C-24, C-25, and C-44) are the backbone of the system in this area.

The UEC Planning Area relies on groundwater from the surficial aquifer system (SAS) and Floridan aquifer system (FAS) for urban uses. In 2013, the SAS accounted for approximately 40 percent of public water supply (PWS) use in the UEC Planning Area, and the FAS accounted for the remaining 60 percent. SAS use for PWS is projected to increase very little if at all as the use of alternative water sources such as brackish water from the FAS increases. Recreation and landscape irrigation, including golf courses is accomplished through a combination of water from surface water, the SAS, and reclaimed water. Additionally, the FAS

is used as a supplemental source for some landscape and golf course irrigation. Development of the SAS has been maximized in many portions of the UEC Planning Area.

Agriculture is a substantial part of the economy and the single largest water use category in the UEC Planning Area. Surface water from the C-23, C-24, C-25, and C-44 canals serve as the primary water source for agricultural uses. Additional use of water from these canals is restricted above existing allocations.

Total water demand is projected to increase by 38 percent, from 257.5 million gallons per day (MGD) in 2013 to 354.7 MGD by 2040. AGR is projected to use 52.6 percent of the planning area's total water demand with PWS using 20.6 percent in 2040. The remaining four categories: domestic (residential) self-supply, recreation and landscaping, industrial, and power generation, account for the remaining 26.8 percent.

NATURAL SYSTEMS

Natural systems in the UEC Planning Area include the St. Lucie River, the southern Indian River Lagoon, a portion of the Northwest Fork of the Loxahatchee River, and numerous wetlands. The planning area borders Lake Okeechobee. Indian River Lagoon has the greatest species diversity of any estuary in North America. The St. Lucie River Watershed encompasses an area of approximately 780 square miles. Wetlands within the UEC Planning Area are estimated to cover more than 145,000 acres and include Allapattah Flats, Cane Slough, DuPuis Reserve, Pal-Mar, and the Savannas. The Savannas ecosystem is one of the most endangered natural systems in south Florida.

The water supply needs for natural systems limit water available for allocation and are addressed through a variety of regulatory mechanisms and water resource development projects. Construction of ecosystem restoration projects is vital to the health of the region's water resources, including elements identified in minimum flow and level (MFL) recovery and prevention strategies.

The Comprehensive Everglades Restoration Plan (CERP), a partnership between the U.S. Army Corps of Engineers (USACE) and the SFWMD, is a critical component of water supply planning in the UEC Planning Area. CERP includes capital projects needed to protect and restore natural systems and may enhance water availability for urban and agricultural communities. Most CERP project components in the UEC Planning Area are contained within the Indian River Lagoon – South (IRL-S) Project. Located in Martin County, the C-44 Reservoir and Stormwater Treatment Area (STA) component of the IRL-S Project is currently under construction and expected to be complete by 2020. When complete, the C-44 Reservoir will have 50,600 acre-feet of water storage, and the STA will have 6,300 acres of emergent vegetation.

AGRICULTURAL WATER SUPPLY

Agriculture is expected to continue as a key industry in the UEC Planning Area despite economic challenges, damage from hurricanes, and prevalence of diseases such as citrus greening and canker. Water used for agriculture in the UEC Planning Area includes commercial crop irrigation, livestock watering, pasture irrigation, and aquaculture; the main crops are citrus, sugarcane, small vegetables, and berries. The projected increase in water use

is related to the anticipated conversion of some existing crops to higher water use demand crops and some increase in acreage.

Agricultural demands were developed based on the best available information, but it is recognized there is uncertainty in these projections. Citrus acreage has declined dramatically as a result of disease and fallow citrus land may be converted to other crops. Some of these crops have greater water needs and may require irrigation water with lower levels of total dissolved solids than citrus.

Agricultural areas are projected to need supplemental irrigation water for approximately 138,292 acres in 2040, with a gross average water demand of 186.7 MGD. The primary water source for most crops is surface water from the regional canal system. These users have relied on the FAS as a supplemental source to attain a 1-in-10 year drought level of certainty, for freeze protection and for blending with surface water in times of limited freshwater availability. However, if crops change, supplemental water from the FAS may not meet agricultural needs.

For surface water users located in LOSA, the level of certainty is currently reduced to a 1-in-6 year drought condition. Meeting the 1-in-10 year level of service for the LOSA is not likely within the next 5 years due to the interrelationship of the federal and state projects outlined in this plan update and current operations under the 2008 Lake Okeechobee Regulation Schedule. The SFWMD anticipates any additional water from Lake Okeechobee resulting from operational changes or a revised regulation schedule could return the lake to MFL prevention status, enhance the level of certainty to existing permitted users, and support other environmental objectives.

For users of the C-23, C-24, and C-25 canals, or any connected canal systems, restricted allocation criteria limit increased allocations of surface water above existing allocations due to limited surface water availability and canal bank instability at stages less than 14 feet NGVD. Because these canals have permitted withdrawals that are reduced or terminated based on water levels (14 feet NGVD), water shortages have been triggered more frequently than a 1-in-10 year drought; therefore, users of these canals may not have a 1-in-10 level of certainty. These users rely on the FAS as a supplemental source to attain a 1-in-10 level of certainty.

PUBLIC WATER SUPPLY

A growing population will lead to an increase in the water demand for the PWS category by 2040. Overall, the population is expected to increase by 204,304 residents (47 percent) from 434,015 in 2013 to 638,319 in 2040. St. Lucie County will experience the region's greatest increase in population with an increase of 171,438, approximately 60.6 percent, more residents. Martin County's population is projected to increase by 32,791 residents (21.8 percent) and the portion of NE Okeechobee County in the UEC Planning Area will increase by 75 residents (approximately 13.8 percent) over the planning period.

The projected gross water demand for 2040 for the UEC Planning Area's PWS is 73.2 MGD, an increase of 25.6 MGD from the 2013 demand of 47.6 MGD. The cumulative volume of water currently allocated for PWS slightly exceeds the total projected demand for 2040, and the majority of PWS water providers appear able to meet their 2040 projected demand without

additional permit allocation or infrastructure. The average per capita use rate for all PWS utilities within the UEC Planning Area has decreased substantially from 147 gallons per capita per day (GPCD) in 2005 to the current rate of 118 GPCD. Two utilities likely face a potential future deficit on an average daily or peak demand basis within the planning period. To meet these projected needs, one utility has proposed projects that will supply the deficit, and the other utility is in the process of modifying their water use permit to meet projected demands.

Utilities have diversified their water supply sources with development of alternative water supplies and implemented water conservation programs. These alternatives include brackish water from the FAS coupled with reverse osmosis treatment, and increased use of reclaimed water.

While only one utility will need to complete projects to meet 2040 projected demands, five utilities have proposed 10 new potable water supply projects, totaling 23.6 MGD. Projects include increased storage via proposed reservoirs, aquifer storage and recovery (ASR), and other traditional and alternative water supply projects. Some projects increase a utility's reliability, diversify sources, or meet peak or seasonal demands versus the average demands accounted for in the plan. Local governments, in coordination with utilities, will address the proposed projects as they revise their water supply facilities work plans, which must be submitted to the State of Florida Department of Economic Opportunity and reviewing agencies within 18 months of approval of this plan update.

In addition to the potable water supply projects, this 2016 UEC Plan Update incorporates seven non-potable water projects proposed by utilities. Four of these are reclaimed water projects. Conservation should remain an important component of utilities' plans for meeting future demands. A strong conservation program can continue to lower per capita use rates and reduce the need for additional water or capacity.

EAST COAST FLORIDAN MODEL

The East Coast Floridan Model (ECFM) is a density-dependent groundwater flow and transport model of the FAS, covering the east coast of the SFWMD. The ECFM was developed for use in regional water supply planning and uses the best available data regarding aquifer characteristics, rainfall, projected demands, water quality, water use, and evapotranspiration. The model was used to determine the long-term viability of the FAS.

The results of the model simulations were used to identify areas that require further evaluation. A few localized areas were identified where water quality degradation may occur and where water levels could be reduced to where the volume of water obtained from free-flowing wells in the Upper Permeable Zone would be diminished based on the 2013 estimated demands as well as the 2040 projected demands. However, the overall results indicated that no widespread impacts are projected to occur in the FAS from 24 years of pumping to meet current and future demands.

The FAS generally can meet 2040 demands; however, a few isolated areas of the Upper Permeable Zone will require additional planning and adaptive management strategies, and users of the Avon Park Permeable Zone may need to spread out withdrawal facilities or reduce average pumpage to slow water quality changes. It is recommended that these areas

continue to be monitored through a coordinated effort with utilities, agricultural and other stakeholders, and the St. Johns River Water Management District (SJRWMD).

FUTURE DIRECTION

Chapter 7 of this 2016 UEC Plan Update contains a number of recommendations that will help focus future efforts in the region to continue to meet future needs. Some of the key recommendations are as follows:

- The design of FAS wells, establishment of wellfield locations and configurations, and pumping regimes should maximize withdrawals while looking to minimize water level and quality changes. This likely will require a combination of additional wells with greater spacing between wells, lower capacity wells in the Avon Park Permeable Zone, and continued refinement of wellfield operational plans.
- The SFWMD should work with FAS stakeholders, including the SJRWMD, to further refine assumptions used in the ECFM simulation, to better define water quality tolerances for crops, and to fully understand FAS use as it relates to surface water availability.
- Users must consider using the lowest quality source of water to meet any particular demand. Where appropriate, blending multiple alternative water sources to achieve acceptable water quality is a prudent approach to water supply.
- Where appropriate, water users are encouraged to create storage areas within their boundaries or to find areas outside of their boundaries that store excess surface water for water supply purposes.
- Reservoirs and other storage systems could be developed, where appropriate, to increase surface water availability that could be used for environmental, agricultural, and urban water supply needs.
- The monitoring networks used for saltwater intrusion, aquifer assessment, and groundwater modeling currently are a hybrid of regional monitoring and monitoring required by or performed by water use permittees. Monitor wells have been lost due to changes in permit monitoring requirements, budget constraints, and construction activities. Efforts should be made to identify wells considered critical to long-term monitoring and modeling to ensure that these wells are maintained or replaced as necessary.
- SAS wellfields should have their operating plans reviewed and revised as necessary to maximize withdrawals while avoiding harm to natural systems and reducing uncertainties and potential impacts from saltwater intrusion.

CONCLUSION

This plan update provides an assessment of the water supply demand and available sources for the UEC Planning Area through 2040. With construction of the projects identified below, sufficient water appears to be available to meet the 2040 projected water demand during a 1-in-10 year drought condition for most users. Currently, this level of certainty is reduced to a 1-in-6 year drought condition for surface water users (primarily agriculture) located within the LOSA portion of the planning area. Additionally, surface water users served by the C-23, C-24, and C-25 canals currently may not have a 1-in-10 level of certainty; however, many users rely on the FAS as a supplemental source to attain a 1-in-10 level of certainty.

Demands were developed based on the best available information. For agricultural projections, there is unusual uncertainty because citrus acreage has declined dramatically as a result of disease, and fallow citrus land may be converted to other crops. Some of these crops may require irrigation water with lower levels of total dissolved solids than citrus, and may not be able to rely on the FAS as a supplemental source.

This plan update concludes that future water needs of the region can be met through the 2040 planning horizon with appropriate management, conservation, and implementation of projects identified herein. The SFWMD anticipates any additional water from Lake Okeechobee resulting from revision of the lake operating schedule could return the lake to minimum flow and level (MFL) prevention status, enhance the level of certainty to existing permitted users, and support other environmental objectives. Meeting future water needs depends on the following:

- Construction of one potable water supply development project by a PWS utility and completion of a water use permit modification by a PWS utility.
- Implementation of the Comprehensive Everglades Restoration Program (CERP) IRL-S Project and other projects identified in MFL prevention and recovery strategies.
- Utilization of the flexibility within the 2008 Lake Okeechobee Regulation Schedule as incremental dam safety improvements are completed; and in the longer term, completion of the seepage berm construction or equivalent repairs to the Herbert Hoover Dike for Reaches 1, 2, and 3 by the USACE and implementation of a new LORS.
- Additionally, if the UEC Planning Area experiences changes in crop types and irrigated acreage, construction of additional surface water storage systems to increase water availability may be required.

Successful implementation of this 2016 UEC Plan Update requires close coordination with agricultural interests, local governments, utility water supply planning entities, and other stakeholders. Collaboration with stakeholders is essential for directing the implementation of the preceding recommendations and guidance. This partnering should ensure that water resources in the UEC Planning Area continue to be prudently managed and available to meet future demand. The District anticipates that when the Plan is updated in 5 years, the trend in agricultural water use will be clearer, reducing uncertainty in agricultural demand projections.

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Acronyms and Abbreviations

AFSIRS	Agricultural Field-Scale Irrigation Requirements Simulation
AGR	Agricultural Self-Supply
APPZ	Avon Park Permeable Zone
ASR	aquifer storage and recovery
AWE	Alliance for Water Efficiency
AWS	alternative water supply
BEBR	Bureau of Economic and Business Research
BMP	best management practice
C&SF Project	Central and Southern Florida Flood Control Project
CERP	Comprehensive Everglades Restoration Plan
CFP	Cooperative Funding Program
cfs	cubic feet per second
CUPCon	Consumptive Use Permitting Consistency
District	South Florida Water Management District
DSS	Domestic Self-Supply
DWM	dispersed water management
ECFM	East Coast Floridan Model
EQIP	Environmental Quality Incentives Program
F.A.C.	Florida Administrative Code
FAS	Floridan aquifer system
FDACS	Florida Department of Agriculture and Consumer Services
FDEO	Florida Department of Economic Opportunity
FDEP	Florida Department of Environmental Protection
FPL	Florida Power & Light
FPUA	Fort Pierce Utilities Authority
FRESP	Florida Ranchlands Environmental Services Project
F.S.	Florida Statutes
FSAID	Florida Statewide Agricultural Irrigation Demand
FY	Fiscal Year

GIS	geographic information system
GPD	gallons per day
ICI	Industrial/Commercial/Institutional Self-Supply
IRL	Indian River Lagoon
IRL-S	Indian River Lagoon – South
LEC	Lower East Coast
LFA	Lower Floridan aquifer
LKB	Lower Kissimmee Basin
LORS	Lake Okeechobee Regulation Schedule
LOSA	Lake Okeechobee Service Area
LWC	Lower West Coast
MF	multi-family
MFL	minimum flow and level
MGD	million gallons per day
mg/L	milligrams per liter
MGY	million gallons per year
MIL	mobile irrigation laboratory
NE	northeastern
NEEPP	Northern Everglades and Estuaries Protection Program
NE-PES	Northern Everglades Payment for Environmental Services
NGVD	National Geodetic Vertical Datum
NRC	National Research Council
PCUR	per capita use rate
PWR	Power Generation Self-Supply
PWS	Public Water Supply
RAA	Restricted Allocation Area
REC	Recreational/Landscape Self-Supply
RECOVER	Restoration Coordination and Verification Program
RIB	rapid infiltration basin
RO	reverse osmosis
SAS	surficial aquifer system
SF	single family
SFWMD	South Florida Water Management District
SJRWMD	St. Johns River Water Management District

SMRU	South Martin Regional Utility
SLR	sea level rise
STA	Stormwater Treatment Area
TCEC	Treasure Coast Energy Center
TDS	total dissolved solids
UEC	Upper East Coast
UFA	Upper Floridan aquifer
UF/IFAS	University of Florida/Institute of Food and Agricultural Sciences
UPZ	Upper Permeable Zone
U.S.	United States
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USDA/NASS	USDA/National Agricultural Statistics Service
USDA/NRCS	USDA/Natural Resources Conservation Service
USGS	U.S. Geological Survey
VEC	valued ecosystem component
Water CHAMP	Water Conservation Hotel and Motel Program
WaterSIP	Water Savings Incentive Program
WPA	Water Preserve Area
WRAC	Water Resources Advisory Commission
WTP	water treatment plant
WWTF	wastewater treatment facility

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Introduction

The South Florida Water Management District (SFWMD or District) develops and updates regional water supply plans to provide for current and future water needs while protecting central and south Florida's water resources. This *2016 Upper East Coast Water Supply Plan Update* (2016 UEC Plan Update) assesses existing and projected water needs as well as water sources to meet those needs through 2040 for Martin and St. Lucie counties and the northeastern (NE) portion of Okeechobee County located within the UEC Planning Area. The 2016 UEC Plan Update presents current and projected population, water demands, water resource and water supply development projects, and related water supply planning information.

TOPICS

- Current Update
- Legal Authority and Requirements
- Goal and Objectives
- Planning Process
- Planning Area Background
- Progress Since the 2011 UEC Plan Update
- Outlook on Sea Level Rise and Climate Change
- Water Supply Planning Through 2040

CURRENT UPDATE

This update reflects the changes experienced in the UEC Planning Area since early 2011 and their effect on water use and projected water demands. This 2016 UEC Plan Update consists of three documents: the planning document, the associated appendices, and the 2016 Water Supply Plan Support Document. The planning document and appendices focus on the UEC Planning Area; the Support Document addresses information related to all five SFWMD regional planning areas and contains background material such as relevant legislation, resource protection and water conservation information, and information on water resource technologies. These documents are available online at http://www.sfwmd.gov/watersupply.

LEGAL AUTHORITY AND REQUIREMENTS

The legal authority and requirements for water supply planning are included in Chapters 373, 403, 187, and 163, Florida Statutes (F.S.). In accordance with Florida's Water Protection and Sustainability Program, regional water supply plans and local government comprehensive plans must ensure that adequate potable water facilities are constructed and concurrently available to meet the demands of new development. The water supply planning region identified in this plan shall be considered a Water Resource Caution Area under

Section 403.064, F.S., and affected parties may challenge the designation pursuant to Section 120.569, F.S.

GOAL AND OBJECTIVES

The goal for this water supply plan update is to identify sufficient water supply sources and future projects to meet existing and future reasonable-beneficial uses during a 1-in-10 year drought condition through 2040 while sustaining water resources and related natural systems. The objectives for the 2011 UEC Plan Update were reviewed and modified to develop the following seven objectives for this 2016 UEC Plan Update:

1. **Water Supply** – Identify sufficient sources of water to meet reasonable-beneficial consumptive uses projected through 2040 under a 1-in-10 year drought event without causing harm to natural resources.

2. **Natural Systems** – Enhance and protect wetland systems and water resources from harm due to water use, including water level drawdowns and the harmful movement of saline water towards freshwater aquifers.

3. **Estuarine and Riverine Systems** – Protect and enhance estuarine and riverine systems through management of water resources.

4. **Conservation and Alternative Source Development** – Encourage water conservation measures to improve the efficiency of water use, and support and promote the development of alternative sources of water.

5. **Linkage with Local Governments** – Provide information to support local government coordination with the 2016 UEC Plan Update through updates to the required Water Supply Facilities Work Plans.

6. **Compatibility and Linkage with Other Efforts** – Achieve compatibility with related planning activities within the region and with adjacent water management districts.

7. **Floridan Aquifer System** – Continue to encourage development of the Floridan aquifer system (FAS) as a water source option and continue the monitoring program to enhance the understanding of the relationship among water use, water levels, and water quality.

PLANNING PROCESS

This 2016 UEC Plan Update describes how anticipated water supply needs will be met in the UEC Planning Area through 2040. The planning process used to develop this 2016 UEC Plan Update is outlined in **Table 1-1**.

Table 1-1. Planning process for developing the 2016 UEC Plan Update.

PLANNING PROCESS →			
1	**2**	**3**	**4**
Planning and Assessment	**Data Collection, Analysis, and Issue Identification**	**Evaluation of Water Resources and Water Source Options**	**Identify Water Resource and Water Supply Development Projects**
The process incorporated extensive public participation and coordination with public water supply utilities, local governments, the Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Services, and other appropriate state and federal agencies. A review of previous planning efforts in the region and documentation of activities since the approval of the 2011 UEC Plan Update were key starting points.	Using the 2011 UEC Plan Update as a foundation, developing this plan involved collecting the latest information on current and projected population and water demand (**Chapter 2**), water resources, water conservation, and land use. Groundwater and surface water evaluations, Floridan aquifer modeling and a review of regulatory information and other related data (**Chapter 3**) confirmed the validity of previously identified issues and helped identify new issues.	The next phase of the planning process involved analyzing Floridan model results and reviewing existing and future conditions (**Chapter 4**). Water resource options were evaluated for availability in the UEC Planning Area. Water conservation was assessed also (**Chapter 5**).	Water resource development projects were identified (**Chapter 5**). Based on input from the utility water suppliers, water supply development projects intended to meet water needs over the planning period were identified, compiled, and evaluated by the SFWMD. The projects were screened for permitting feasibility (**Chapter 6**).

Public Participation

Public participation is a key component in the water supply planning process. One key form of public participation is through the SFWMD Water Resources Advisory Commission (WRAC). The WRAC serves as an advisory body to the District Governing Board and is the primary forum for conducting public workshops, presenting information, and receiving public input on water resource issues affecting central and south Florida. Commission members represent environmental, urban, and agricultural interests from each of the District's water supply planning areas.

The SFWMD held two WRAC Issues Workshops during the water supply planning process. Stakeholders representing a cross-section of interests in the region—agriculture, industry,

environmental protection, utilities, local government planning departments, and state and federal agencies—were invited to attend the workshops and provide input.

Individual meetings were held with local government planning departments, utilities, other planning agencies, St. Johns River Water Management District (SJRWMD), and agricultural industry representatives to discuss water demand projections and coordinate planning processes.

In addition to the water supply plan workshops, two public FAS modeling meetings were conducted (one in 2014 and one in 2015) and numerous meetings were held with stakeholder representatives that supplied information needed for the model.

PLANNING AREA BACKGROUND

The UEC Planning Area includes all of Martin and St. Lucie counties and the NE portion of Okeechobee County (**Figure 1-1**). This area covers approximately 1,230 square miles and generally reflects the watersheds of the C-23, C-24, C-25, and C-44 canals. To the north of the UEC Planning Area is the SJRWMD, to the west is the Lower Kissimmee Basin (LKB) Planning Area and Lake Okeechobee, to the south is the Lower East Coast (LEC) Planning Area, and to the east is the Atlantic Ocean. Surface water systems in the UEC Planning Area include Lake Okeechobee, the Indian River Lagoon, the St. Lucie River and Estuary, and portions of the Loxahatchee River. The St. Lucie River Watershed encompasses an area of approximately 780 square miles, and the UEC Planning Area's wetlands are estimated to cover more than 145,000 acres. Wetlands in the UEC Planning Area include Allapattah Flats, Cane Slough, DuPuis Reserve, Pal-Mar, and the Savannas.

Population and Water Demand Projections

Projections developed for this update estimate the UEC Planning Area's population will increase by 47 percent from 434,015 residents in 2013 to 638,319 by 2040. In contrast, the 2011 UEC Plan Update estimated a population increase of over 81 percent from 2010 to 2030, or 791,863 residents. Population and urban water demand estimates are discussed in detail in **Chapter 2** and **Appendix A**.

Public Water Supply (PWS) demand is projected to grow to 73.2 million gallons per day (MGD) by 2040 and represents about 21 percent of the UEC total water demand. This is an increase of 54 percent over the 47.6 MGD of water used in 2013. Most of the projected increased demand can be met with existing allocations and infrastructure.

Agricultural Self-Supply (AGR) continues as the largest water use category within the UEC Planning Area. This update projects demand for AGR to increase from 162.5 MGD in 2013 to 186.7 MGD by 2040, an increase of 15 percent. This projected demand represents 53 percent of the area's total gross water demand from all water use categories.

The remaining categories are Domestic Self-Supply (DSS), Recreation/Landscape Self-Supply (REC), Industrial/Commercial/Institutional Self-Supply (ICI), and Power Generation Self-Supply (PWR); their total demand represents 26 percent of the total demand in the UEC Planning Area. Total gross water demand in an average year is expected to increase from approximately 257.5MGD in 2013 to 354.7 MGD in 2040.

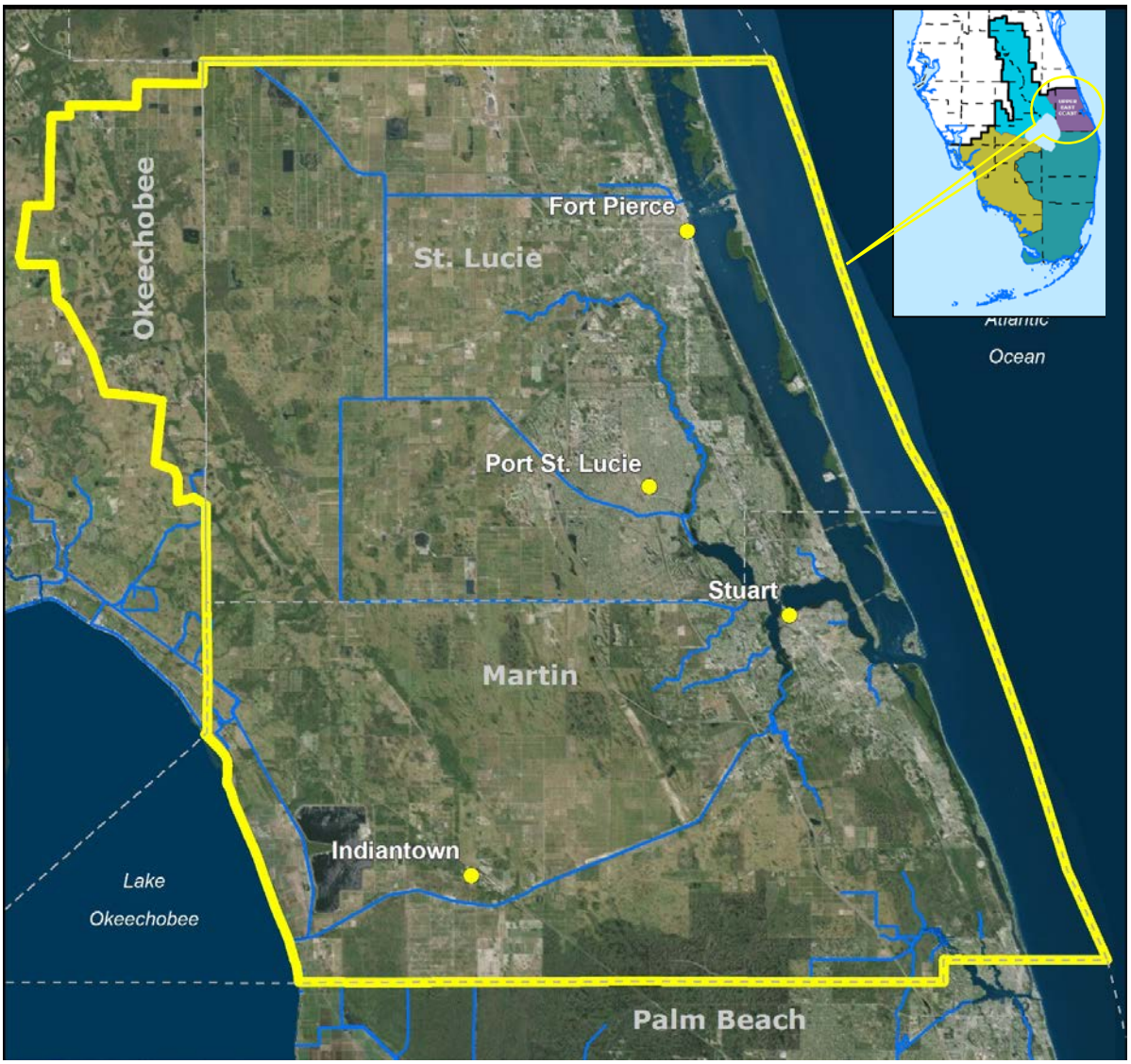

Figure 1-1. Upper East Coast water supply planning area.

Overview of Upper East Coast Water Resources

The primary sources of water throughout the UEC Planning Area originate from groundwater and surface water. Reclaimed water is used to supplement water supply. Determining the availability of water needed to meet projected demands requires consideration of the area's available water resources. The following is a brief description of these water sources and their historic use. **Chapters 3** and **5** discuss these topics in detail. In addition, information related to the UEC Planning Area and its water resources is included in the Support Document (SFWMD 2016).

Groundwater Sources

The UEC Planning Area uses groundwater from the surficial aquifer system (SAS) and the underlying FAS, which includes the Upper Floridan aquifer (UFA). **Figure 1-2** shows the relationship of these hydrogeologic units.

Surficial Aquifer System

The SAS is the traditional source of water for urban uses within the UEC Planning Area. This aquifer ranges in thickness from 50 to 250 feet in this region (Brown and Reece 1979). Water enters the SAS as precipitation; the water not removed by evapotranspiration or runoff to surface water bodies percolates into the SAS then moves laterally until it is discharged into surface water bodies or the ocean. Productivity and water quality in the SAS tends to improve from north to south and west to east. Additional withdrawals from the SAS are limited by saltwater intrusion and potential impacts to existing legal users and wetlands. The limits on availability of expanded withdrawals from the SAS have been a major factor in the development of the FAS's brackish waters in the region.

Floridan Aquifer System

The FAS is a thick multi-layered sequence of predominantly carbonate rocks that underlies all of Florida and parts of Alabama, Georgia, and South Carolina. The FAS is composed of the UFA and the Lower Floridan aquifer (LFA). In south Florida, the Upper Permeable Zone (UPZ) and the Avon Park Permeable Zone (APPZ) compose the UFA (**Figure 1-2**). Water in the UFA is brackish; water in the LFA is saline, with chloride concentrations approaching seawater levels. The productivity of the UFA is considerably greater than that of the SAS throughout most of the UEC Planning Area, and as the area continues to grow, use of the UFA to augment urban supply is expected to increase.

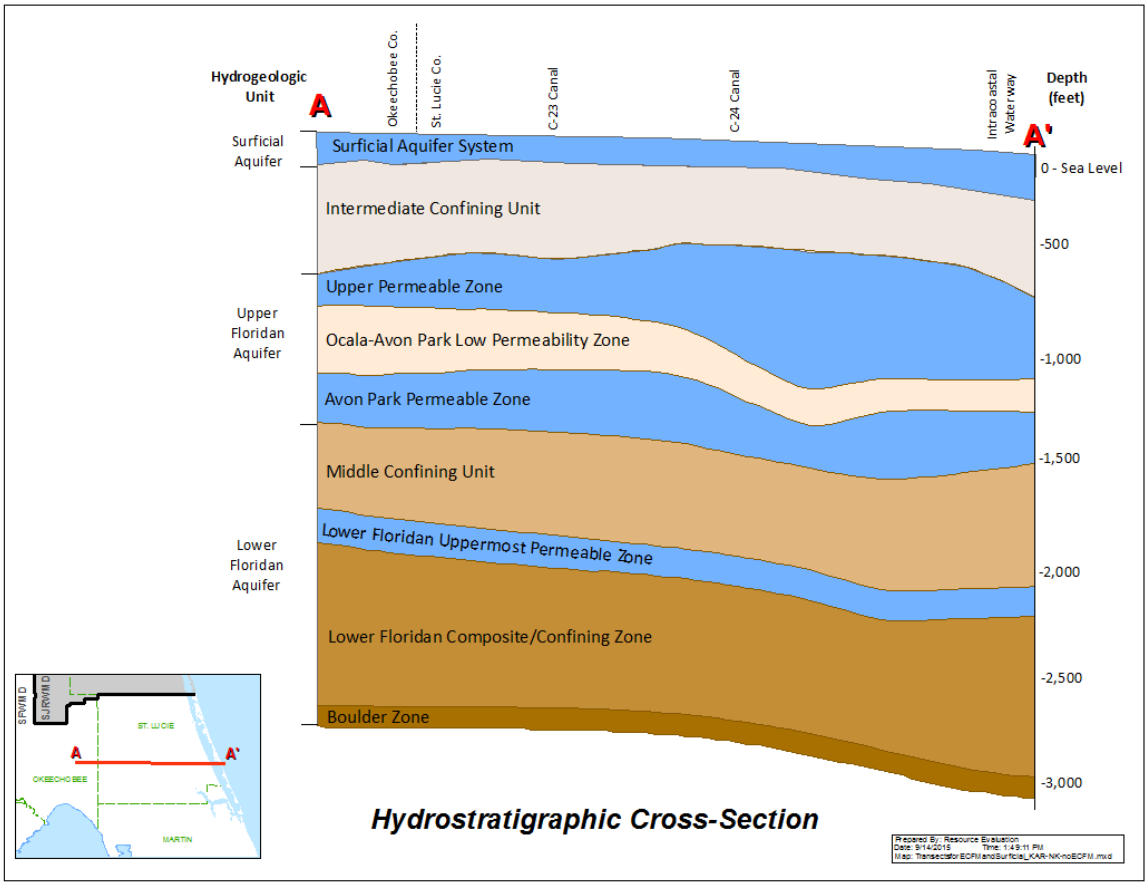

Figure 1-2. Generalized hydrogeologic cross-section of the UEC Planning Area.

Surface Water Sources

Surface water bodies in the UEC Planning Area include canals, reservoirs, natural water bodies, and wetlands. The St. Lucie Watershed is hydrologically divided into watersheds, each of which drains into a specific tributary or canal that connects to the St. Lucie Estuary. In the UEC Planning Area, the St. Lucie Estuary is a major tributary to the Southern Indian River Lagoon. Population growth and coastal development have altered the St. Lucie River watershed from natural sloughs and wetlands into a system of watersheds (SFWMD 2015b). **Figure 1-3** shows the major watersheds in the region.

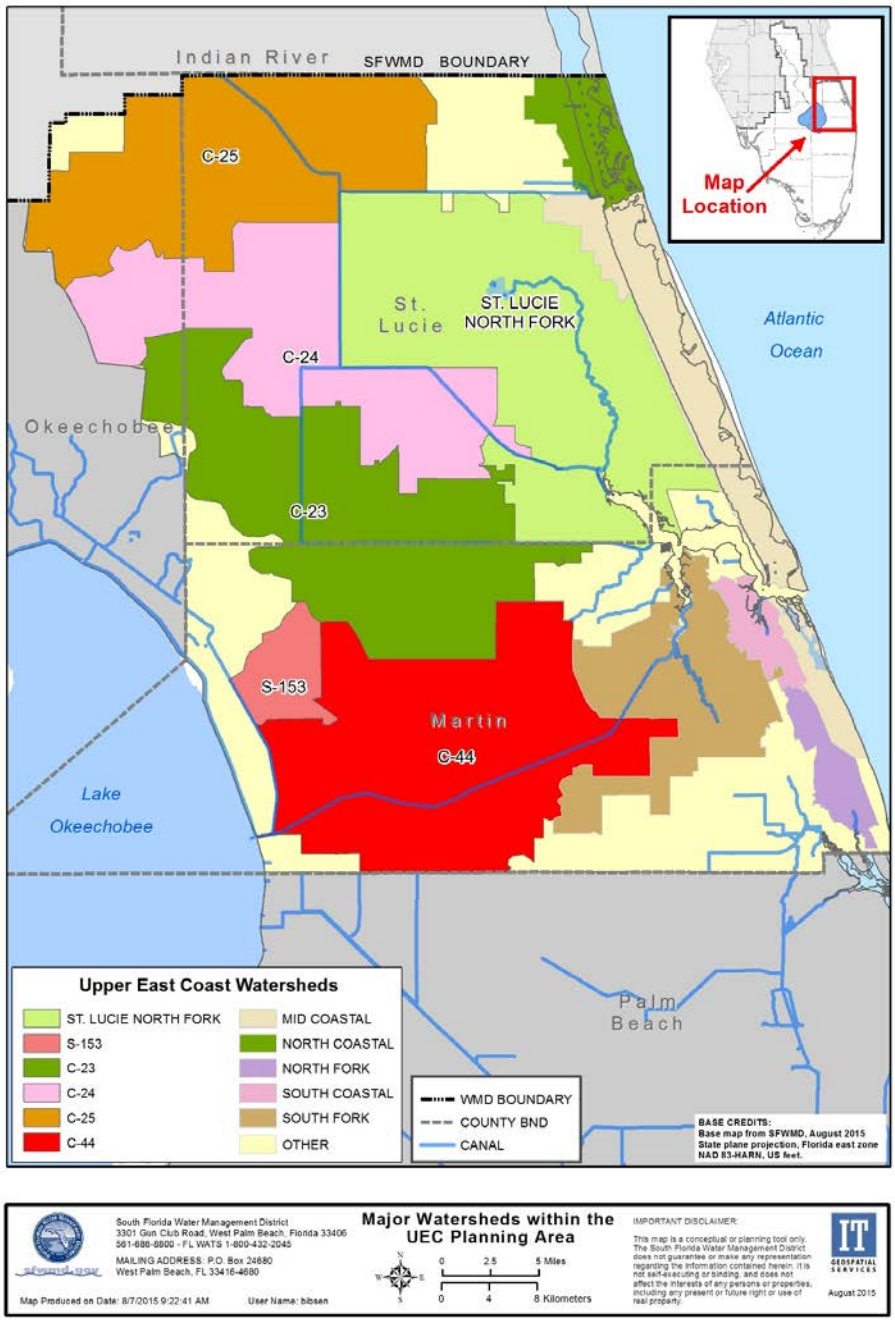

Figure 1-3. Major watersheds within the UEC Planning Area.

As part of the Central and Southern Florida Flood Control Project, the C-23, C-24, C-25, and C-44 (St. Lucie) canals primarily depend on rainfall for inflow and ultimately the canals discharge directly to coastal waters. The C-44 Canal, constructed as a navigable flood control outlet for Lake Okeechobee, is the only one of the planning area's four canals that receives inflow from outside its drainage basin. The canals in the UEC Planning Area are the traditional source of irrigation water for agricultural water users under average rainfall conditions.

C-23 Canal and Citrus Groves

Surface water systems in the UEC Planning Area include Lake Okeechobee, Indian River Lagoon, St. Lucie River and Estuary, and portions of the Loxahatchee River.

- **Lake Okeechobee** is a key component of the south Florida hydrologic system. The lake is critical for flood control during wet seasons and water supply, particularly during dry seasons. Its other functions include navigation and fisheries and wildlife habitat. The SFWMD's Lake Okeechobee Basin is described in Section 1.7.3.4 of the Applicant's Handbook for Water Use Permit Applications (SFWMD 2015a) and consists of several agricultural irrigation basins surrounding Lake Okeechobee. Surface water withdrawals from Lake Okeechobee and all surface water bodies hydraulically connected to the lake are currently limited due to restricted allocation area criteria. Outflows from the lake are received by the St. Lucie River, Caloosahatchee River, Everglades Agricultural Area, Lake Worth Lagoon, and Water Conservation Areas.
- **Indian River Lagoon** (IRL) is a water body composed of three distinct but interconnected estuarine systems. The IRL features the greatest species diversity of any estuary in North America. The IRL's habitats include mangrove forests and seagrass meadows and has evolved into a nursery for oysters, clams, shrimp, crabs, and hundreds of species of fish that thrive in the warm shallow waters. Stormwater discharges, nutrient input, and sedimentation have depleted historical species diversity, mangroves, and seagrass in the lagoon.
- The **St. Lucie River and Estuary** is a primary tributary of the southern IRL, which is part of the larger IRL system. The St. Lucie River Watershed covers approximately 780 square miles and includes the North Fork and South Fork of the St. Lucie River, several major drainage and irrigation canals, the surrounding watershed, and the St. Lucie Estuary.
- A portion of the **Loxahatchee River** is designated as an Aquatic Preserve by the State of Florida. The river has three major tributaries: the Northwest Fork, the North Fork, and the Southwest Fork. A portion of the Northwest Fork was designated by the Federal Government as a Wild and Scenic River, the first in Florida. The 2016 UEC Plan Update contains information about this system relative to water supply and projects within the UEC Planning Area. See also the 2013 Lower East Coast Water Supply Plan Update (SFWMD 2013) for information about the Loxahatchee River relative to water supply and projects within the Lower East Coast Planning Area.

Wetlands

There are more than 145,000 acres of wetlands in the UEC Planning Area (U.S. Fish and Wildlife Service 2010). Key wetlands in the UEC Planning Area include Allapattah Flats, the Atlantic Coastal Ridge, Cane Slough, DuPuis Reserve, Jonathan Dickinson State Park, the Savannas, and Pal-Mar.

Issues from Previous Plan Updates

Some issues were identified in previous water supply plans and updates. These affect the availability of water in the UEC Planning Area and these issues continue to influence water supply planning efforts in the UEC Planning Area are:

1. Increased withdrawals from the SAS are limited due to potential impacts on wetlands as well as increased potential for saltwater intrusion.

2. Additional surface water will not be allocated from the SFWMD C-23, C-24, and C-25 canals, or any connected canal systems that derive water supply from these District canals, over and above existing allocations.

3. Extreme freshwater discharges are affecting the health of the St. Lucie River and Estuary and southern Indian River Lagoon.

4. Surface water users within the Lake Okeechobee Service Area (LOSA) have only a water supply level of certainty in a 1-in-6 year drought.

PROGRESS SINCE THE 2011 UEC PLAN UPDATE

Since the 2011 UEC Plan Update, the following activities and programs implemented in the UEC Planning Area are enhancing the region's water resources, water supply, and natural systems.

Modeling and Hydrologic Studies

The SFWMD received peer review comments on the East Coast Floridan Model (ECFM) (Golder Associates 2008) from an independent panel in 2011, and updated the model to incorporate those comments before it was applied to the UEC Planning Area analysis. The updated ECFM (Giddings et al. 2014) was used to identify potential changes in water quality, flows, and water levels in the FAS for the 2013 and 2040 withdrawal scenarios. See **Chapter 3** for detailed information.

In addition to the ECFM modeling, saltwater interface mapping for the SAS was completed in 2011 (using 2009 data) and 2014. The ECFM and the SAS saltwater interface mapping provide important information and analyses supporting this 2016 UEC Plan Update.

Regulatory Protection and Water Quality Efforts

Herbert Hoover Dike/Lake Okeechobee – The U.S. Army Corps of Engineers (USACE) designated the Herbert Hoover Dike to be a Class I risk, the highest risk for dam failure. The construction of a 21.4-mile cutoff wall in Reach 1 was completed in 2012. The 32 water control structures (culverts) operated by the USACE are being replaced, removed, or abandoned and are scheduled to be completed in 2019. Rehabilitation of additional sections of the dike is planned for completion by 2022.

Herbert Hoover Dike

Water Storage

Indian River Lagoon – South (IRL-S) Project – The purpose of the IRL-S Project is to restore, preserve, and protect the IRL, the St. Lucie River, the St. Lucie Estuary, and the associated watershed while maintaining existing level of flood control and water supply. The project footprint includes the C-44 Reservoir and Stormwater Treatment Areas (STAs), C-23 and C-24 Reservoirs and STAs, C-25 Reservoir and STA as well as Natural Storage and Water Treatment Quality Areas for the Pal-Mar Complex, Allapattah Complex, and Cypress Creek/Trail Ridge Complex, North Fork Natural Floodplain Restoration, and Muck Remediation and Habitat Improvement.

- **C-44 Reservoir and STA** – The C-44 reservoir and STA are components of the IRL-S project that are currently under construction. The planned 3,400-acre reservoir is designed for a water depth of 15 feet and will provide up to 50,600 acre-feet of water storage and 6,300 acres of water quality treatment. The project will capture, store, and treat runoff from the C-44 basin. The STA will reduce average annual total nutrient loads and improve salinity in the St. Lucie Estuary as well as the southern portion of the IRL. Since the 2011 UEC Plan Update was approved, the USACE completed construction of the project intake canal and access road; the SFWMD completed construction of a communications tower and the system discharge structure and canal; and SFWMD currently has two active contracts under construction for this project. See **Chapter 3** for more details.

Ten Mile Creek – The Ten Mile Creek Water Preserve Area (WPA) consists of a 526-acre water storage area and 132-acre polishing cell. It was originally constructed by the USACE under the Water Resources Development Act of 1996. The District assumed responsibility for this project in 2015, including refurbishing pumps and removing vegetation, and initiated operating the Ten Mile Creek at lower water stages than originally designed to reduce seepage.

Lakeside Ranch STA – The project is a component of the Lake Okeechobee Watershed Construction Project. Phase I of the 2,700-acre STA, located in western Martin County, began operation in 2013. The performance evaluation shows phosphorous removal for the first year at a greater efficiency than projected. All three cells in Phase I are operational and the project is expected to achieve the targeted load reduction goal. Wetland vegetation has been established and is maintained under regular operations. Phase II construction is anticipated to begin in December 2015.

Cooperative Funding Program

For nearly two decades, the SFWMD has provided funding to local governments, special districts, utilities, homeowners associations, water users, and other public and private organizations for alternative water supply, water conservation, and stormwater projects that are consistent with the District's water supply mission. Beginning in Fiscal Year (FY) 2016, these cooperative funding efforts have been combined under the new Cooperative Funding Program (CFP), which provides financial incentives to promote local projects that complement ongoing regional restoration, flood control, water quality, and water supply efforts within the District's 16-county jurisdiction.

- The Water Savings Incentive Program (WaterSIP) provides up to 50-50 cost-sharing funds up to $50,000 for noncapital projects such as the purchase and installation of high-efficiency indoor plumbing fixtures, outdoor irrigation retrofits, and automatic distribution system line flushing devices. One irrigation upgrade project, PGA Village POA, Inc., received $27,745 in FY 2014. This project was estimated to save 24 million gallons per year (MGY). See **Chapter 5** for more information.
- Through the Alternative Water Supply (AWS) Funding Program, the District assisted water users in developing AWS projects, including reclaimed water and the use of the FAS with reverse osmosis treatment. Within the UEC Planning Area, two projects were funded and completed between FY 2010 and FY 2015, creating 1.0 MGD of additional reclaimed water distribution. More information on the AWS Funding Program is available in **Chapter 6**.

OUTLOOK ON SEA LEVEL RISE AND CLIMATE CHANGE

Climate change and rising sea level have the potential to create numerous challenges for south Florida's water managers and suppliers in the coming decades. Sea level rise may push saltwater farther inland within the SAS and threaten coastal PWS well fields and other users. Continuing trends of warmer air temperatures could cause increased rates of evapotranspiration, escalating irrigation demands by agricultural and urban users. The potential for long-term change in rainfall patterns is more difficult to project given south Florida's wide variability in annual and seasonal rainfall. Changes in effective rainfall may create a need for new or expanded water storage projects to meet seasonal demands.

Climate change and sea level rise could impact all elements of the SFWMD's mission. Future analyses of climate change implications for water supply generally will be performed in the context of the potential impacts on flood control, environmental protection and restoration, and water quality.

WATER SUPPLY PLANNING THROUGH 2040

The statutory link between local governments' comprehensive plans and the SFWMD's regional water supply plans, data sharing, and collaborative planning are credited with strengthening the water supply planning process. Updates to local governments' water supply facilities work plans, comprehensive plans, and the SFWMD's next 5-year water supply plan update will continue to refine the Public Water Supply demand estimates and

projections. Moreover, the SFWMD's Water Supply Planning staff closely coordinates with Water Use Permitting staff during the water supply planning process. Coordination also increased through implementation of the Florida Department of Environmental Protection 2012 guidance memorandum addressing coordination between water management districts' water supply planning and permitting staff regarding projects included in water supply plans. The water supply development projects included in this plan have undergone initial screening for permitting feasibility.

2

Demand Estimates and Projections

This chapter provides a summary of water demand estimates and projections for the South Florida Water Management District (SFWMD or District) Upper East Coast (UEC) Planning Area by water use category for the planning period of 2013 through 2040. The water demand projections were developed through coordination with stakeholders from agriculture, industry, local governments, utilities, and other interested groups. A detailed discussion of data collection and analysis conducted in support of this *2016 Upper East Coast Water Supply Plan* (2016 UEC Plan Update) can be found in **Appendix A**.

TOPICS

- Net versus Gross Demand
- Water Use Categories
- Population and Public Water Supply Trends
- Estimated Water Demand
- Summary of Demand Estimates
- Demand Projections in Perspective

Previous estimates and projections for the UEC Planning Area were published in the *2011 Upper East Coast Water Supply Plan Update* (SFWMD 2011). Since its publication, recovery from the Great Recession (December 2007 to June 2009) has been slow and projected growth rates have decelerated. Accordingly, there has been a slow pace of residential development with continuing favorable relative prices for land and opportunities for agricultural retention. Citrus continues to struggle due to greening and canker.

The baseline population and water use for this plan update was developed from various sources, including the 2010 United States Census (U.S. Census Bureau 2012), University of Florida's Bureau of Economic and Business Research (BEBR) 2013 estimates, aerial photography land use identification, industry reports on crop production, irrigation system efficiency data, historical water use, and the SFWMD Water Use Regulatory Database. Projections from the baseline were made using additional data, including the BEBR county-level population projections, site-specific variables, and regional climatic conditions. All population estimates and projections are for permanent populations.

Water demands in the UEC Planning Area are driven by population and agriculture. The population within the UEC Planning Area continues to increase while the per capita use rate continues to decline; these both have broad impacts on water demand. Total irrigated agriculture in the Planning Area is anticipated to increase slightly with the introduction of

new crops. In addition, it should be noted that acres dedicated to irrigated pasture were not included in the water demands table of the 2011 UEC Plan Update but are included in the water demands in this 2016 UEC Plan Update. Thus the 2013 irrigated agricultural acreage appears to have increased significantly from the previous plan. The citrus projections are based on the assumption that citrus will reach a minimum in 2020-2025 and then begin to increase. In general, acres no longer used for citrus are still used for agriculture. Acreage of vegetables, melons, and berries are expected to increase.

NET VERSUS GROSS WATER DEMAND

Water demand can be described as either gross or net values. Gross water demand is the total amount of water required from the source and accounts for treatment, distribution, and irrigation system losses. Gross water demand is also referred to as raw water or water withdrawal demand and is commonly associated with water use permits. Net demand is the volume of water needed by an end user/customer or agricultural activity and does not include treatment or delivery system inefficiencies. Net water demand, also known as finished water demand, represents the user/customer demand or plant growth requirements to sustain yield. Gross demands are most typically used because the value reflects the actual water required to be produced to meet the projected need and is the value most often referred to in this plan update. Water demands are calculated in million gallons per day (MGD) and are presented in **Appendix A** for each water use category.

DESCRIPTIONS OF WATER USE CATEGORIES

Water demands for this 2016 UEC Plan Update are estimated in 5-year increments for each of the following six water supply categories established by the Florida Department of Environmental Protection (FDEP):

- **Public Water Supply (PWS)** – Water supplied by water treatment facilities for potable use (drinking quality) with projected average pumpages greater than or equal to 100,000 gallons per day (GPD) or 0.1 MGD.
- **Domestic Self-Supply (DSS)** – Water used by households served by small utilities (less than 0.1 MGD) or private wells.
- **Agricultural Self-Supply (AGR)** – Water used for commercial crop irrigation, nurseries, livestock watering, pasture, and aquaculture.
- **Industrial/Commercial/Institutional Self-Supply (ICI)** – Self-supplied water of 0.1 MGD or more consumed by business operations.
- **Recreational/Landscape Self-Supply (REC)** – Water used for irrigation of golf courses, parks, cemeteries, large common areas (such as homeowners associations and commercial developments), and other self-supplied irrigation uses with demands of 0.1 MGD or greater.
- **Power Generation Self-Supply (PWR)** – Water consumed by power plants in the production of electricity, excluding use of seawater sources.

Projections for each water use category are based on demand under average annual rainfall conditions through 2040. Additionally, as water use is impacted by weather, particularly rainfall, demands for 1-in-10 year drought conditions are estimated and projected. Section 373.709, Florida Statutes (F.S.), states that the level of certainty planning goal associated with identifying demands shall be based on meeting demands during a 1-in-10 year drought event. **Appendix A** presents demands under average rainfall year and 1-in-10 year drought conditions through the 2040 planning horizon as well as details about the methods to estimate and project water demands for each water use category. For AGR, irrigated acreage and demand for each crop type are provided. Although not quantified in this chapter, environmental demand is addressed through resource protection criteria (**Chapter 3**). **Figure 2-1** compares estimated average gross water use by category in the UEC Planning Area in 2013 to projections for 2040.

INFO

1-in-10 year drought – A drought of such intensity that it is expected to have a return frequency of once in 10 years. A drought event that results in an increase in water demand to a magnitude that would have a 10 percent probability of being exceeded during any given year.

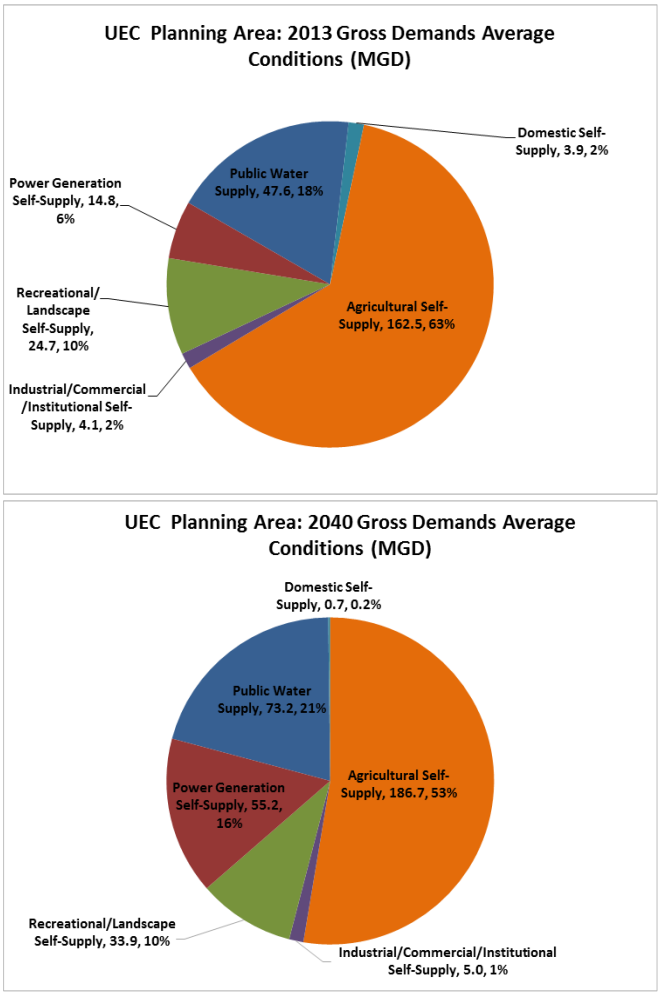

Figure 2-1. Top: Water use (in MGD) by category in 2013; Bottom: Projected water use (in MGD) by category in 2040.

POPULATION AND PWS WATER USE TRENDS

Population estimates for this plan include permanent populations of Martin and St. Lucie counties and the northeastern (NE) portion of Okeechobee County. Overall, the population is expected to increase by 204,304 residents (47 percent) from 434,015 in 2013 to 638,319 in 2040. St. Lucie County will experience the region's greatest increase in population with an increase of 171,438, almost 60.6 percent, more residents. Martin County's population will increase by 32,791 residents (21.8 percent) and the portion of NE Okeechobee County in the UEC Planning Area will increase by 75 residents (approximately 13.8 percent) over the planning period.

ESTIMATED WATER DEMAND

Public Water Supply and Domestic Self-Supply

PWS is water supplied by water treatment facilities to homes, office and retail facilities, schools, institutions, and similar users for potable use (drinking quality). Utilities with projected average pumpage equal to or greater than 0.1 MGD through 2040 are included in the PWS category. Water used by households or facilities served by small utilities (less than 0.1 MGD) or individual wells are categorized as DSS.

Developing PWS water demand projections for the UEC Planning Area was a multistep process. The first step was to establish the 2010 population for each utility to use as the base for estimates and projections. This was done by overlaying census block population data from the most recent available (2010) United States Census (U.S. Census Bureau 2012) with utility service area maps to establish a draft 2010 PWS utility population. This was coordinated with the utilities to finalize the 2010 population. The next step was to update the maps to show the areas currently served by each utility (2013 PWS service areas) and the areas to be served in 2040. Again, this included extensive coordination with the utilities to ensure the maps were accurate. For some utilities, the 2013 and 2040 service areas are the same and for some, the 2040 service area is larger.

Using the 2013 service area map and applying the medium BEBR county-level 2013 population estimate, the 2013 population estimate was developed for each utility. To develop the 2040 population projections, information such as anticipated growth and build outs within each utility service area was collected. Using the 2040 medium BEBR population for each county, the 2013 population estimates for each utility, and the growth information, a preliminary 2040 population projection was developed for each PWS utility. Throughout the process, the draft projections were discussed with each utility to coordinate final 2040 projections. DSS populations represent the difference between the county population in the planning area and the PWS utility service area populations for the same county. Because some utilities are expanding their distribution lines and encouraging people with potable wells to connect to the utility, it is anticipated the number of people in the DSS category will decrease substantially by 2040. Projections were coordinated with St. Johns River Water Management District (SJRWMD) to ensure consistency in county population distributions.

The population information was used in conjunction with historic water use information (2010 to 2013) from each major utility to develop a per capita use rate (PCUR). The PCUR and population projections were used to develop a projected PWS gross water demand for each utility. The PCURs for DSS in Martin and St. Lucie counties were based on its countywide weighted average PCUR for PWS. The PCUR for NE Okeechobee County DSS was assumed to be the same as the state average PCUR reported by the FDEP. Water conservation measures were not factored into the demand projections used in this plan update; rather, water conservation is considered a water source option and is discussed in **Chapter 5**.

Table 2-1 provides a summary of the population estimates for St. Lucie and Martin counties as well as the portion of NE Okeechobee County located in the UEC Planning Area. **Table 2-2** lists the estimated and projected PWS and DSS water demand for 2013 and 2040, and **Table 2-3** is a summary of PWS and DSS average gross water demands by county and region in 5-year increments.

Table 2-1. Permanent resident population of PWS and DSS categories in the UEC Planning Area in 2013 and 2040.

County	2013 Population			2040 Projected Population		
	PWS	DSS	**Total**	PWS	DSS	**Total**
St. Lucie	256,196	26,566	**282,762**	453,201	1,000	**454,201**
Martin	143,122	7,588	**150,710**	179,500	4,000	**183,500**
NE Okeechobee	0	543	**543**	0	618	**618**
Total	**399,318**	**34,697**	**434,015**	**632,701**	**5,618**	**638,319**

Source: U.S. Census, 2010, BEBR medium 2013 estimated population and 2014 BEBR medium for projected population.

Table 2-2. Average gross PWS and DSS water demands in the UEC Planning Area for 2013 and 2040.

Water Use Category by County	2013 Estimated Use (MGD)	2040 Projected Demand (MGD)
St. Lucie County PWS	27.00	47.38
St. Lucie County DSS	2.71	0.10
St. Lucie County Total	**29.71**	**47.48**
Martin County PWS	20.61	25.77
Martin County DSS	1.10	0.58
Martin County Total	**21.71**	**26.35**
UEC NE Okeechobee County PWS	0.00	0.00
UEC NE Okeechobee County DSS	0.05	0.06
NE Okeechobee County Total	**0.05**	**0.06**
UEC Planning Area Total	**51.47**	**73.89**

Note: Perceived discrepancies in totals are due to rounding.

Table 2-3. Average gross water demand for PWS and DSS in the UEC Planning Area between 2013 and 2040.

County Area	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
St. Lucie	29.71	30.82	34.59	38.10	41.39	44.55	47.48
Martin	21.71	21.80	22.90	23.91	24.85	25.63	26.35
NE Okeechobee	0.05	0.05	0.05	0.05	0.05	0.05	0.06
Total	**51.47**	**52.67**	**57.54**	**62.05**	**66.29**	**70.24**	**73.89**

Agricultural Self-Supply

Agriculture is the largest water use category in the UEC Planning Area and includes water used for commercial crop irrigation, livestock watering, pasture irrigation, and aquaculture. In the UEC Planning Area, the main crops are citrus, sugarcane, small vegetables, and berries. Additionally, beef and dairy cattle have a significant presence in all three counties. Some key highlights are as follows:

- St. Lucie County ranks 7th in the state for total citrus production, producing 7.84 million boxes in the 2013-2014 season, spanning from June to September (U.S. Department of Agriculture/National Agricultural Statistics Service [USDA/NASS] 2015). Additionally, the county is number one in the U.S. for grapefruit production (USDA 2012a,b).
- The USDA places citrus production within the category of fruits, tree nuts, and berries. The total market value of fruits, tree nuts, and berries was $136.1 million for St. Lucie County (6th in state) and $66.6 million for Martin County (10th in state) in 2012 (USDA 2012a,b).
- Martin County is a leading producer of nursery/greenhouse, floriculture, and sod, producing $40.2 million in sales in 2012 (10th in state) (USDA 2012a).
- Martin County is a significant producer of sugarcane with approximately 17,000 acres in production.

Agriculture is expected to continue as a key industry in the area despite economic challenges and damage from hurricanes and diseases such as citrus greening and canker. The agricultural acreage of 122,048 acres in 2013 is projected to increase by 13.3 percent, to 138,292 acres by 2040. Water use was 162.46 MGD in 2013 and is projected to be 186.6 MGD in 2040. Irrigated pasture is included in the total irrigated agriculture acres and demands for the 2016 UEC Plan Update. Irrigated pasture was not included in total acres and demands in past UEC Plan Updates but

Citrus Grove

rather was included as a separate discussion. The UEC Planning Area has approximately 63,000 head of cattle under management. In the 2011 UEC Plan Update, agricultural acreage was projected to increase by 21 percent over the planning period.

Agricultural water use projections are based on the following commercially grown crop categories as generally developed by the FDEP for use in water supply plans: 1) citrus, 2) sugarcane, 3) vegetables, melons and berries, 4) sod, 5) greenhouse/nursery, 6) other field crops, 7) other fruits and nuts, 8) irrigated pasture, and 9) miscellaneous uses, such as cattle water and aquaculture.

In 2013, legislation was enacted to require the Florida Department of Agriculture and Consumer Services (FDACS) to develop agricultural water demand projections for all water management districts. Section 373.709 states:

> *Agricultural demand projections used for determining the needs of agricultural self-suppliers must be based upon the best available data. In determining the best available data for agricultural self-supplied water needs, the district shall consider the data indicative of future water supply demands provided by the Department of Agriculture and Consumer Services. Any adjustment of or deviation from the data provided by the Department of Agriculture and Consumer Services must be fully described, and the original data must be presented along with the adjusted data.*

The first set of data and projections were delivered to the water management districts in September 2014 and the second set in July 2015 with projections that go to 2035. Details of the project and data released in July 2015 can be found in **Appendix G** and on the FDACS website (http://www.freshfromflorida.com/Divisions-Offices/Agricultural-Water-Policy/Agricultural-Water-Supply-Planning).

The District developed agricultural acreage estimates and water demands for the UEC Planning Area in early 2014 because the information was needed for the Floridan aquifer system (FAS) modeling that was underway and FDACS data were not yet available. In this effort, the District coordinated their work with agricultural stakeholders, governmental agencies, and other industry professionals. The agricultural acreage was estimated using a number of sources, including land use maps prepared by the SFWMD in 2013 (2012 data), acreage from water use permit information, property tax parcel databases, and the recent USDA/NASS agricultural census reports. Acreage estimates for 2010 were derived from earlier NASS reports and land use maps with 2006 data. To ensure consistency with the modeling efforts, the agricultural projections developed by the SFWMD were used in this 2016 UEC Plan Update.

Agricultural acreage and associated water demand are challenging to project because of changes in land use patterns, economic development such as the pace of recovery in the housing market, global commodity forces, weather, and disease issues that can impact acreage, and production over the planning period. The projections are not parcel specific but are presented by county and incorporate general economic and agricultural production trend information using best professional judgement. Agricultural demand projections are uncertain due to citrus diseases, possible conversion of fallow citrus lands to other crops, and potentially changing water quality needs of these new crops.

Agricultural water demand was determined using estimated irrigated acreage, crop and soil types, growing seasons, and irrigation methods. AGR crop demand calculations for this 2016 UEC Plan Update were made using the Agricultural Field-Scale Irrigation Requirements

Simulation (AFSIRS) model. The model calculates water demands under average rainfall and 1-in-10 year drought conditions based on local historic daily rainfall and evaporation data (Smajstrla 1990).

Estimated acres were developed for the 2013 agricultural acreage and these estimates were then compared to the data and methods contained in the land use projection analysis completed by the SFWMD. Additional agricultural acreage estimates from the USDA and the SFWMD Water Use Regulatory Database were used to inform and reveal key patterns and guide in the development of acreage projections. Agricultural industry experts reviewed and provided input for the agricultural acreage estimates, and their comments were considered in the overall analysis. Industry information sources included the following:

- USDA/NASS
- FDACS
- SFWMD Water Use Regulatory Database
- Local agricultural extension offices
- University of Florida/Institute of Food and Agricultural Sciences (UF/IFAS)
- USDA/Natural Resources Conservation Service (USDA/NRCS)
- Florida Farm Bureau and other agricultural stakeholders
- SFWMD acreage estimates developed as part of geographic information system (GIS) agricultural land use/crop type analysis

In the UEC Planning Area, total active citrus acreage has the potential to increase by 26 percent, from approximately 45,379 acres in 2013 to just over 57,300 acres in 2040. Citrus greening and canker have affected groves throughout the area. Intensive research into occurrence and treatment of citrus greening, canker, and other diseases is being conducted by a variety of agencies and industry groups. The results of this research could affect the number of acres of citrus production in the future with the development of a disease-resistant root stock. A number of former citrus lands are being temporarily converted to other crops such as vegetables and potatoes as well as other uses such as pasture for cattle or water farming.

Subsequent to the development of the acreage and demand projections developed for this Plan Update as well as the associated FAS modeling and the FSAID 2 projections, data showing changes in land ownership indicate potential changes in the crops that will be grown in the UEC Planning Area. Based on recent input from industry representatives, it appears the primary modification will be that some acres formerly dedicated to citrus will now be used for a variety of small vegetables.

Exchanging citrus for small vegetable crops could affect future water demand in several ways. Small vegetables have a higher net irrigation requirement than citrus (**Appendix A**, Tables A-11 and A-13). Additionally, vegetables have different water quality needs. Many vegetables are less tolerant of chlorides in the water. This may limit the volume of brackish water from the FAS that a grower may use to supplement the primary source (surface water). In the short term, growers can manage the number of acres or crops grown per year to keep at or below their existing surface water allocation. Additionally, under some circumstances, on-site surface water storage could increase water availability during dry periods. In the long term, additional fresh water from regional or subregional water supply projects may be necessary if the acreage dedicated to small vegetables continues to increase.

Table 2-4 shows the acreage and gross irrigation requirements under average rainfall conditions by crop type for 2013 and 2040. The increase in demand is due to overall expansion of acres in agricultural production as well as conversion of citrus and other existing crops to crops with higher water use demand. More detailed information, including gross and net irrigation demands by crop type under average rainfall and 1-in-10 year drought conditions for 5-year increments from the 2013 baseline through the 2040 planning horizon is available in **Table 2-5** and in **Appendix A**.

Table 2-4. Estimated agricultural irrigated acreages and water demand by crop type for 2013 and 2040.

Category	2013		2040	
	Acres	Demand (MGD)	Acres	Demand (MGD)
Citrus	45,379	43.05	57,300	54.38
Sugarcane	17,952	21.18	17,952	21.18
Vegetables, Melons, and Berries	9,568	30.18	13,022	41.25
Sod	4,601	11.21	5,450	13.00
Greenhouse/Nursery	4,264	13.88	4,264	13.88
Other Field Crops	1,458	5.13	1,458	5.13
Other Fruits and Nuts	147	0.14	147	0.14
Irrigated Pasture	38,698	34.88	38,698	34.88
Cattle Watering and Aquaculture	0	2.81	0	2.81
Total	**122,068**	**162.46**	**138,292**	**186.65**

Note: Perceived discrepancies in totals are due to rounding.

Table 2-5. Average gross water demand for AGR in the UEC Planning Area between 2013 and 2040.

County Area	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
St. Lucie	82.04	81.21	79.55	80.83	82.10	85.24	90.24
Martin	68.49	77.55	77.29	78.01	79.04	80.94	83.79
NE Okeechobee	11.93	11.78	11.78	11.83	12.17	12.39	12.62
Total	**162.46**	**170.53**	**168.68**	**170.86**	**173.31**	**178.57**	**186.65**

Industrial/Commercial/Institutional Self-Supply

This self-supplied use category includes industrial and commercial facilities for production processing, manufacturing, and technical needs such as concrete, citrus and vegetable processing, and mining operations. Some industrial, commercial, and institutional facilities receive water from PWS utilities and are therefore included under the PWS category. As in the 2011 UEC Plan Update, population growth rates for each county were used to project ICI growth. Information from the SFWMD Water Use Regulatory Database was used to estimate

2013 water demand. It is presumed that growth in ICI water demands will remain proportional to the county population growth. ICI demands are projected to increase by approximately 1 MGD from 2013 to 2040. **Table 2-6** shows the estimates of existing and future water demand for ICI use through the 2040 planning horizon.

Table 2-6. Average gross water demand for ICI in the UEC Planning Area between 2013 and 2040.

County Area	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
St. Lucie	1.52	1.56	1.64	1.72	1.78	1.84	1.89
Martin	2.55	2.61	2.74	2.85	2.95	3.04	3.11
NE Okeechobee	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	**4.07**	**4.17**	**4.38**	**4.57**	**4.73**	**4.88**	**5.00**

Recreational/Landscape Self-Supply

Water demands in this category include landscape and golf course irrigation as well as water needs for parks, homeowners associations with common areas or consolidated irrigation systems, and areas with green space such as cemeteries, parks, and ball fields. Recreational and landscape demands supplied by PWS utilities are included in the PWS demand. Estimated landscape and golf course acreages for 2013 were determined through permits found in the SFWMD Water Use Regulatory Database. Gross demand for REC is projected to increase by 37.2 percent from the estimated 24.7 MGD in 2013 to 33.9 MGD in 2040.

Landscape and golf course growth were projected separately because their rates of expansion are calculated differently. Landscape areas are estimated to grow at a rate proportional to the population growth. Golf course acreage is projected to change at a lesser rate related to market fluctuations. The estimated growth rates were reviewed by local planning officials and industry professionals where available. **Table 2-7** presents the estimated increase in REC uses from 2013 to 2040. **Appendix A** provides additional detail on how each of these water demands estimates were calculated.

Table 2-7. Average gross water demand for REC in the UEC Planning Area between 2013 and 2040.

County Area	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
St. Lucie	14.67	15.22	16.84	18.34	19.75	21.07	22.28
Martin	9.89	10.05	10.43	10.76	11.07	11.33	11.56
NE Okeechobee	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Total	**24.65**	**25.37**	**27.36**	**29.20**	**30.92**	**32.49**	**33.94**

Note: Perceived discrepancies in totals are due to rounding.

Power Generation Self-Supply

Currently, two power generation plants in the UEC Planning Area are permitted to withdraw fresh or brackish water: Florida Power & Light (FPL) Martin Plant near Indiantown and Treasure Coast Energy Center (TCEC) in Fort Pierce. The FPL Martin Plant draws water from the C-44 Canal and an on-site cooling pond for cooling purposes, and the TCEC uses water from the FAS. The TCEC plans to use reclaimed water for part of their use needs in the future as it becomes available. Neither facility used reclaimed water in 2013.

In addition, the FPL St. Lucie Nuclear Plant uses seawater, which does not require a consumptive use permit and therefore is not addressed in this water supply plan update. The Indiantown Cogeneration Plant in Martin County, which sells power to FPL, is not included in this 2016 UEC Plan Update because it draws surface water from the L-63N Canal (Taylor Creek) within the portion of Okeechobee County located in the Lower Kissimmee Basin (LKB) and is addressed in the LKB Plan Update.

The need for additional power is expected to increase as the population in the UEC Planning Area and other portions of south Florida grows. The area's major power supplier, FPL, expects that much of the region's future power generating capacity will use fresh or alternative (brackish or reclaimed) water sources and cooling tower technology as a heat rejection method. The FPL Martin Plant uses cooling pond and cooling tower technology that varies by unit. Use of the cooling pond and cooling tower technology significantly decreases overall water supply demands at the FPL Martin Plant because the cooling pond is the intake and release point. FPL has future power generation plants planned for this area beginning as early as 2035. Power generation demands are expected to increase by 273 percent, from 14.8 MGD in 2013 to 55.2 MGD by 2040 (**Table 2-8**).

FPL has proposed a new plant for construction within the next 10 years in NE Okeechobee County. The site is within the SJRWMD approximately 6 miles outside the UEC Planning Area. The proposed plant is estimated to need 9 MGD of water supply on average (11 MGD peak) for operation; however, this demand is not included in this 2016 UEC Plan Update.

Table 2-8. Average gross water demand for PWR in the UEC Planning Area between 2013 and 2040.

County Area	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
FPL Martin (existing)	12.0	17.4	18.4	19.4	20.4	21.4	22.4
FPL Proposed	0.0	0.0	0.0	0.0	0.0	15.0	30.0
Treasure Coast Energy Center	2.8	2.8	2.8	2.8	2.8	2.8	2.8
UEC Planning Area Total	**14.8**	**20.2**	**21.2**	**22.2**	**23.2**	**39.2**	**55.2**

SUMMARY OF DEMAND ESTIMATES

In 2013, average annual gross water demand for all categories in the UEC Planning Area totaled 257.5 MGD. By 2040, the projected average annual gross water demands are expected to total 354.7 MGD, an increase of 38 percent. **Table 2-9** presents the estimated 2013 and 2040 average water demands for all water use categories, and **Table 2-10** is a 5-year incremental summary of all water use categories for the UEC Planning Area.

Average annual estimates are used to demonstrate general projected trends, including the following key highlights:

- PWS and DSS average gross demands are expected to increase by 43.5 percent, from 51.5 MGD in 2013 to 73.9 MGD in 2040. PWS remains the second largest water use category in the UEC Planning Area.
- AGR average gross demands are projected to increase from 162.5 MGD in 2013 to 186.7 MGD in 2040. The growth is related to the projected conversion of existing crops to crops with a higher water use demand and increased acres.
- ICI average gross demand is projected to increase 0.9 MGD over the planning period. The projected growth is related to population growth in the UEC Planning Area.
- REC average gross demands are projected to increase by 9.3 MGD by 2040.
- PWR average gross demands are projected to increase by 40.4 MGD by 2040.

Table 2-9. Estimated average gross water demands for all water use categories in the UEC Planning Area for 2013 and 2040.

Water Use Category	2013 Estimated Use (MGD)	2040 Projected Demand (MGD)	Percent Change	Percent of Projected 2040 Total
PWS	47.61	73.15	53.6%	20.6%
DSS	3.86	0.74	(80.8%)	0.2%
AGR	162.46	186.65	14.9%	52.6%
PWR	14.80	55.20	273.0%	15.6%
REC	24.65	33.94	37.7%	9.6%
ICI	4.07	5.00	22.9%	1.4%
Total	**257.45**	**354.68**	**37.7%**	**100%**

AGR = Agricultural Self-Supply; DSS = Domestic Self-Supply; ICI = Industrial/Commercial/Institutional Self-Supply; MGD = million gallons per day; PWR = Power Generation Self-Supply; PWS = Public Water Supply; REC = Recreational/Landscape Self-Supply.

Table 2-10. Summary of the average gross water demands for each water use category in the UEC Planning Area between 2013 and 2040.

Water Use Category	Average Gross Water Demand (MGD)						
	2013	2015	2020	2025	2030	2035	2040
PWS	47.61	49.89	55.22	60.70	65.55	69.50	73.15
DSS	3.86	2.78	2.32	1.36	0.75	0.74	0.74
AGR	162.46	170.54	168.67	170.86	173.31	178.57	186.65
ICI	4.07	4.17	4.38	4.57	4.73	4.88	5.00
REC	24.65	25.37	27.36	29.20	30.92	32.49	33.94
PWR	14.80	20.20	21.20	22.20	23.20	39.20	55.20
Total	**257.45**	**272.95**	**279.15**	**288.89**	**298.45**	**325.38**	**354.68**

AGR = Agricultural Self-Supply; DSS = Domestic Self-Supply; ICI = Industrial/Commercial/Institutional Self-Supply; MGD = million gallons per day; PWR = Power Generation Self-Supply; PWS = Public Water Supply; REC = Recreational/Landscape Self-Supply.

DEMAND PROJECTIONS IN PERSPECTIVE

The demand projections presented in this 2016 UEC Plan Update are based on the best information available. These projections reflect trends, circumstances, and industry intentions that change over time. Like any predictive tool based on past assumptions, there is uncertainty and a margin for error. **Table 2-11** shows the 2030 average gross demands projected for this area in the 2011 UEC Plan Update compared to the 2040 demands projected in this 2016 UEC Plan Update.

Table 2-11. Gross water demands under average rainfall conditions projected in the 2011 UEC Plan Update versus this 2016 UEC Plan Update.

Water Use Category	Projected 2030 Demand from 2011 UEC Plan Update (MGD)	Projected 2040 Demand (MGD)	Percent Difference
PWS	96.4	73.2	(24.1%)
DSS	0.7	0.7	0.0%
AGR*	137.0*	186.7	36.3%
PWR	51.3	55.2	7.6%
REC	45.0	33.9	(24.7%)
ICI	9.4	5.0	(46.8%)
Total	**339.8**	**354.7**	**4.4%**

AGR = Agricultural Self-Supply; DSS = Domestic Self-Supply; ICI = Industrial/Commercial/Institutional Self-Supply; MGD = million gallons per day; PWR = Power Generation Self-Supply; PWS = Public Water Supply; REC = Recreational/Landscape Self-Supply.
*Did not include irrigated pasture in the 2011 UEC Plan Update. Irrigated pasture represents an estimated 28 percent of total agricultural demand.

The 2040 AGR demands are projected to increase by approximately 36.3 percent as compared to the 2030 AGR demands in the 2011 UEC Plan Update. A key reason for this increase is that nearly 38,698 acres of irrigated pasture are now included in the water supply plan. This pasture represents approximately 28 percent of the 2040 AGR projected demand. In summary, the agricultural industry will continue to be the dominant water use category in this region, accounting for more than 52 percent of the demand in 2040. For AGR use, water quality is a key consideration because each crop has a different tolerance to chloride and other parameters.

The decrease in end of plan projected demands for the PWS category is related to slowed population growth, fewer developments under construction or planned, more efficient water use in new construction, improved conservation efficiencies, and implementation of the 2010 year-round landscape irrigation rule. The reduced demand for the REC and ICI categories is related to slowed population growth in the region.

3

Water Resource Analyses – Current and Future Conditions

TOPICS

- Overview of Major Water Resources
- Regulatory Protection
- Evaluation and Analysis
- Sea Level Rise and Climate Change
- Utilities of Concern and Utilities at Risk
- Summary

This chapter provides an overview of the water resources within the Upper East Coast (UEC) Planning Area and the protections afforded water resources through regulatory criteria. Water supply to meet the demands described in **Chapter 2** largely depends on the availability of water resources. Understanding the relationship and effect of meeting water demands via withdrawals from water resources is critical to water supply planning.

Prior to development, most of the UEC Planning Area was characterized by nearly level, poorly drained lands subject to frequent flooding. The current condition is a mosaic of the natural system and human alterations. Much of the surface water system was altered to make the land suitable for agriculture and other development and to provide flood protection. With an average annual precipitation of 54 inches and nearly 62 percent of the rainfall occurring in June through October, the region depends on the Central and Southern Florida Flood Control Project (C&SF Project) for flood control and other purposes.

Past analyses indicated that water from the surficial aquifer system (SAS) and surface water from Lake Okeechobee and canals was inadequate to meet the growing needs of the UEC Planning Area during 1-in-10 drought conditions. Potential impacts on wetlands, the possibility of saltwater intrusion, and other factors limit the use of these water bodies as water sources. The South Florida Water Management District (SFWMD or District) adopted Restricted Allocation Area (RAA) rules for the C-23, C-24, and C-25 canals as well as Lake Okeechobee and its service area. Following this, a variety of alternative water supply development projects were identified to avoid water resource impacts, avoid competition between water users, and provide a sustainable supply of water (SFWMD 2004, 2006). Implementation of these projects is ongoing and includes increased water conservation, use of reclaimed water, surface water storage and management, and development and use of brackish water as a treated water supply. Additionally, to protect water resources, minimum flows and levels (MFLs) were established for Lake Okeechobee, the St. Lucie River Estuary, and the Northwest Fork of the Loxahatchee River. In 2010, a water reservation was adopted

for the North Fork of the St. Lucie River in support of the Comprehensive Everglades Restoration Plan (CERP) Indian River Lagoon – South (IRL-S) Project.

The interaction between science, policy, statutory protection options, and regulatory programs aids in the protection of water supplies for natural systems. Water use permit applicants must provide reasonable assurances that the proposed water use 1) is reasonable-beneficial, 2) will not interfere with any existing legal use of water, and 3) is consistent with the public interest. An existing legal use of water is a water use authorized under a SFWMD water use permit or existing use exempt from permit requirements. This chapter describes water use permitting criteria, MFL criteria, water reservations, RAAs, and water shortage plans designed to protect and manage water resources. This chapter also describes the major water resources and their current condition, future trends, and the effect of changed operational protocols. Water resource development projects that provide additional water and restore or improve water quality of our water resources will be discussed in **Chapter 4**.

OVERVIEW OF MAJOR WATER RESOURCES

Major water resources of the UEC Planning Area include the St. Lucie River and Estuary; the southern Indian River Lagoon; Lake Okeechobee and its hydraulically connected surface water bodies; the C-44 (St. Lucie), C-23, C-24, C-25, and connected canals; the SAS and Floridan aquifer system (FAS); and the northwest fork of the Loxahatchee River.

Surface Water Resources

The surface water resources in the UEC Planning Area consist of natural systems and canals that were constructed for navigation, flood control, and drainage. The natural areas include Lake Okeechobee, portions of the Loxahatchee River, the St. Lucie River and Estuary, and the southern Indian River Lagoon. The C-44, C-23, C-24, and C-25 canals, the primary drainage canals in the planning area, are part of the C&SF Project, and discharge directly into coastal waters. The C-44 canal was constructed as a navigable flood control outlet for Lake Okeechobee and is the only one of the four canals to receive inflow from outside the basin. Rainfall and basin runoff are the water sources for the C-23, C-24, and C-25 canals.

Surface water is the primary source of irrigation water in the UEC Planning Area for Agricultural Self-Supply (AGR) and is also a source for the Recreational/Landscape Self-Supply (REC) water use category. In the 1998 UEC Plan, a surface water budget for the C-23, C-24, and C-25 basins was conducted to assess surface water availability for water supply in these basins. The analysis verified that during a 1-in-10 year drought event, surface water in these basins was not adequate to support the water supply demands. However, analyses concluded that the historical practice of supplementing surface water supplies with groundwater from the FAS during dry periods meets existing and future demands in the UEC Planning Area. However, if crops change, supplemental water from the FAS may not meet agricultural needs.

As stated in the *2011 Upper East Coast Water Supply Plan Update* (2011 UEC Plan Update), existing freshwater flows affect the health of the St. Lucie River and Estuary and southern Indian River Lagoon. Sizable water inflows often occur over short periods of time during rainfall events, dumping excessive amounts of fresh water with high nutrient levels, and

sediments into the estuary. Conversely, during seasonal dry periods and droughts, the UEC Planning Area's coastal resources receive little inflow.

The St. Lucie Estuary and its watershed have been greatly altered within the last 75 years to accommodate growth and development in the area. As a result, the timing and volume of freshwater flows to the St. Lucie River and Estuary have dramatically changed from historical conditions. The combination of drainage modifications and land use development in the watershed has noticeably increased wet season flows to the estuary and reduced dry season flows. In addition, high-volume stormwater discharges produce rapid salinity fluctuations and sedimentation. The increase in nutrient and sediment loading has contributed to the build-up of fine-grained muck and elevated nutrients in the estuary. These activities affect habitats and organisms that depend on brackish or freshwater areas during their life cycle.

The U.S. Army Corps of Engineers (USACE) is currently constructing the C-44 reservoir in Martin County as a component of the CERP IRL-S Project. The SFWMD currently has two active contracts under construction for the C-44 Project. The system discharge structure and canal was completed in November 2015. Additionally, contractors are constructing the Stormwater Treatment Area (STA) (to be completed in August 2017) and the reservoir pump station (to be completed in September 2018). Construction of the entire project is expected to be completed in 2020. The reservoir is intended to capture, store, and treat runoff from the C-44 basin prior to its discharge back to the C-44 canal and ultimately to the St. Lucie Estuary. The District will evaluate water availability upon completion of construction and operational testing phases associated with the reservoir. The District Governing Board may certify that additional water from the C-44 reservoir is available for allocation for consumptive use after the project is complete.

Groundwater Resources

Groundwater is the primary source for urban needs and is a supplemental source for many agricultural operations. There are three principal hydrogeologic units present in the UEC Planning Area: the SAS, the intermediate confining unit, and FAS. The SAS is unconfined and produces small to moderate quantities of good- to fair-quality water. In the UEC Planning Area, the intermediate confining unit generally acts as a regionally extensive confining unit over the underlying FAS. The FAS is a regionally extensive aquifer system that is confined and can produce large quantities of water of varying quality. The FAS consists of several producing and confining zones, each with its own characteristics of quantity and quality of water. A generalized hydrogeologic cross-section is shown in **Figure 3-1**, which also shows the corresponding model layers in the East Coast Floridan Model (ECFM). The cross-section is an updated version of similar cross-sections that were included in previous water supply planning documents. Differences are based on work done primarily by the U.S. Geological Survey (USGS) to refine the hydrostratigraphic nomenclature used throughout Florida. Changes include the upper permeable zone within the Upper Floridan aquifer (previously called the upper producing zone), the Ocala-Avon Park low permeability zone (previously called confining zone 1), and the middle confining unit (previously called confining unit 2). A more substantial change is that the Lower Floridan aquifer (LFA), previously defined as a single unit, has now been broken out into three distinct units: The Lower Floridan Uppermost Permeable Zone, the Lower Floridan Composite/Confining Zone, and the underlying highly permeable Boulder Zone, each represented by its own layer in the ECFM. The SAS and FAS, the two aquifer systems that provide groundwater in the UEC Planning Area, are discussed in more detail in the following subsections.

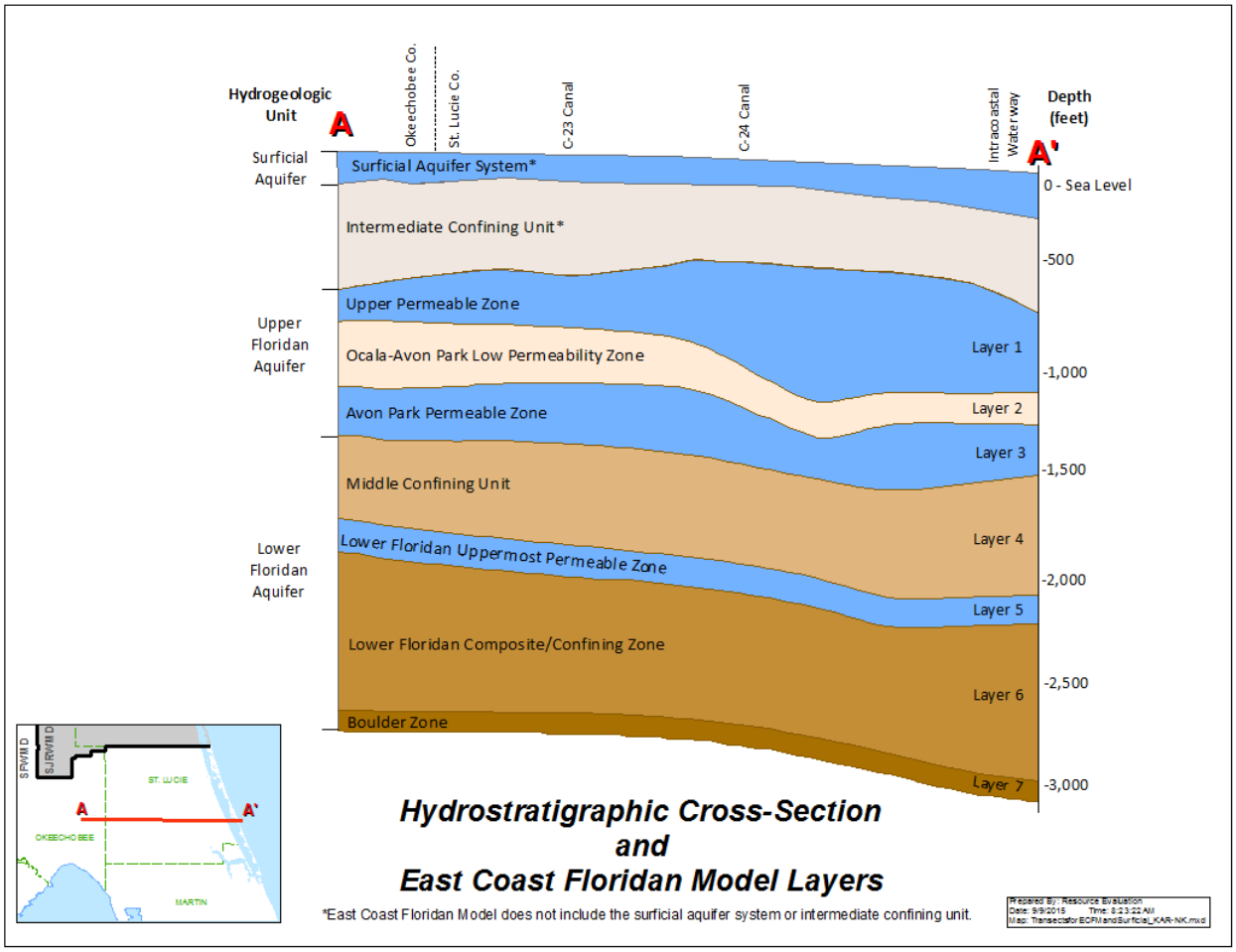

Figure 3-1. Generalized hydrogeologic cross-section and ECFM layers.

Surficial Aquifer System

Historically, the SAS has been the primary source of potable water for public consumption and urban irrigation throughout the UEC Planning Area. The use of the SAS generally has been maximized and potential increases in production are limited, especially in coastal areas. In parts of the planning area, additional supplies from the SAS may be permitted on an application-by-application basis.

The SAS consists of the water table aquifer and hydraulically connected units above the first occurrence of the intermediate confining unit. In the UEC Planning Area, the SAS is unconfined to semi-confined and is composed of three hydrogeologic zones: surficial sands, a primary water producing zone, and a deeper less permeable zone (Adams 1992). The surficial sands are shallow and may not be saturated throughout the year. The primary water producing zone consists of sand, shell, and thin beds and lenses of sandstone and limestone. The less permeable zone consists of sand, silt, shell, and unconsolidated silty limestone.

In general, the surficial sands range in thickness from 20 to 50 feet. The sands exhibit low to moderate permeability and can produce small quantities of water, although the sands are seldom used as a water source. The zone also includes localized shallow layers of organic

material ("hardpan" layers) and discontinuous layers of sandy clay and silt that act as localized semi-confining beds.

The primary producing zone in the SAS ranges in thickness from 20 to more than 250 feet, averaging between 130 and 150 feet. This zone is capable of producing small to moderate quantities of water, depending on the aquifer characteristics. The distribution of aquifer test data shows that the productivity of the primary producing zone generally increases to the east and south, corresponding to areas where limestone and sandstone deposits increase in permeability and thickness. An exception to this is the Stuart area, where a higher clay percentage results in lower aquifer productivity.

The SAS is recharged by infiltration from rain or local surface water bodies. Wellfield withdrawals from the SAS are limited by the rate of recharge, water movement in the aquifer, wetland impacts, land use, proximity to contamination sources, saltwater intrusion, and other existing legal users. The SFWMD maintains a groundwater monitoring network to track water levels and salinity within the SAS. **Figure 3-2** shows active water level monitoring wells in the SAS within the planning area. The monitoring wells are supplemented by wells within or near public water supply (PWS) wellfields monitored by the utilities as part of their water use permits.

Figure 3-3 shows the position of the regional saltwater interface in 2009 and 2014, locations of PWS wellfields, and selected chloride data during the end of the dry season from monitoring wells. **Figures 3-4** and **3-5** show chloride concentration trends at wells monitored by South Martin Regional Utilities and the City of Fort Pierce, respectively. Both graphs show the chloride levels in these wellfields remain well within acceptable ranges in the time period depicted.

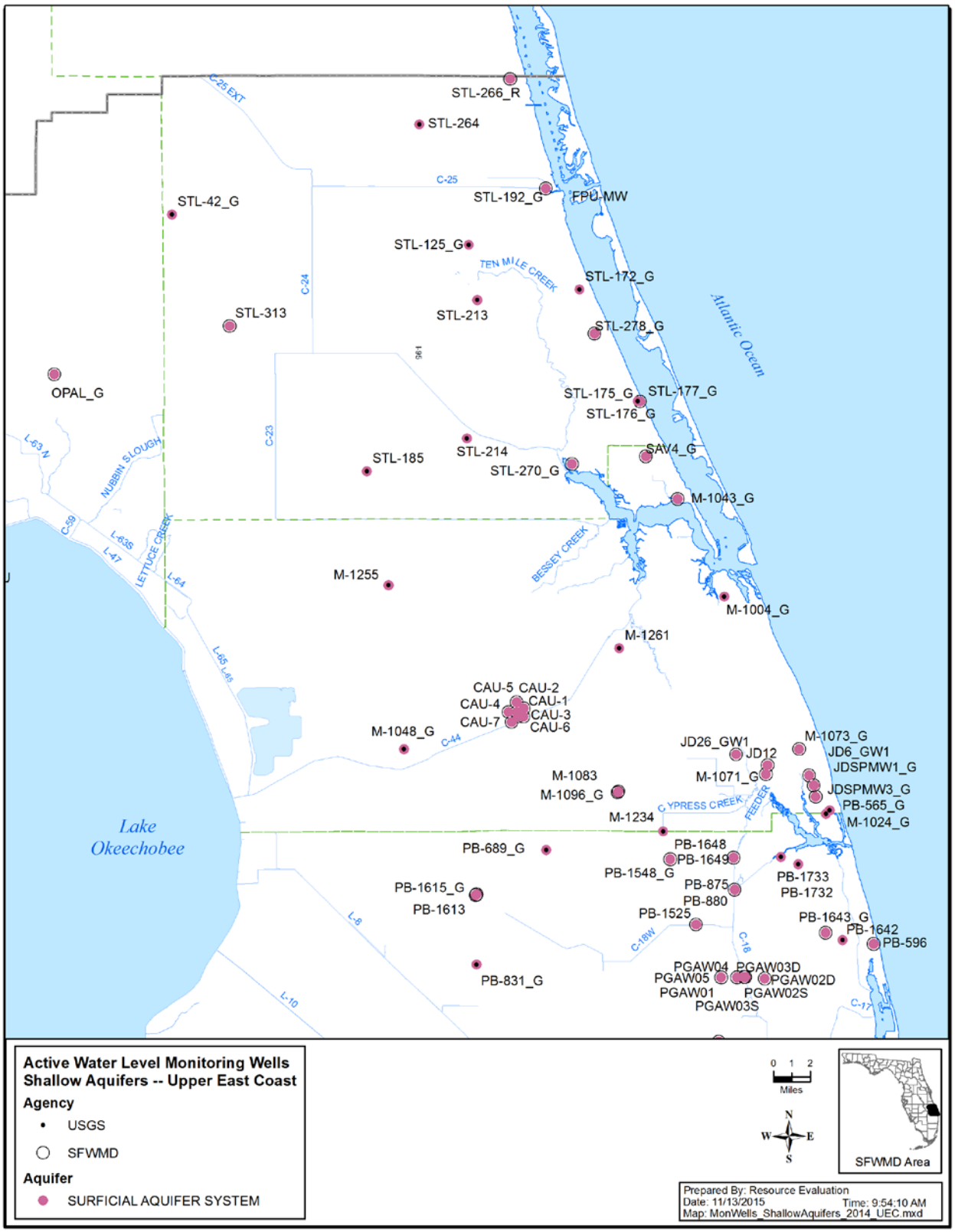

Figure 3-2. Active water level monitoring wells in the SAS in the UEC Planning Area.

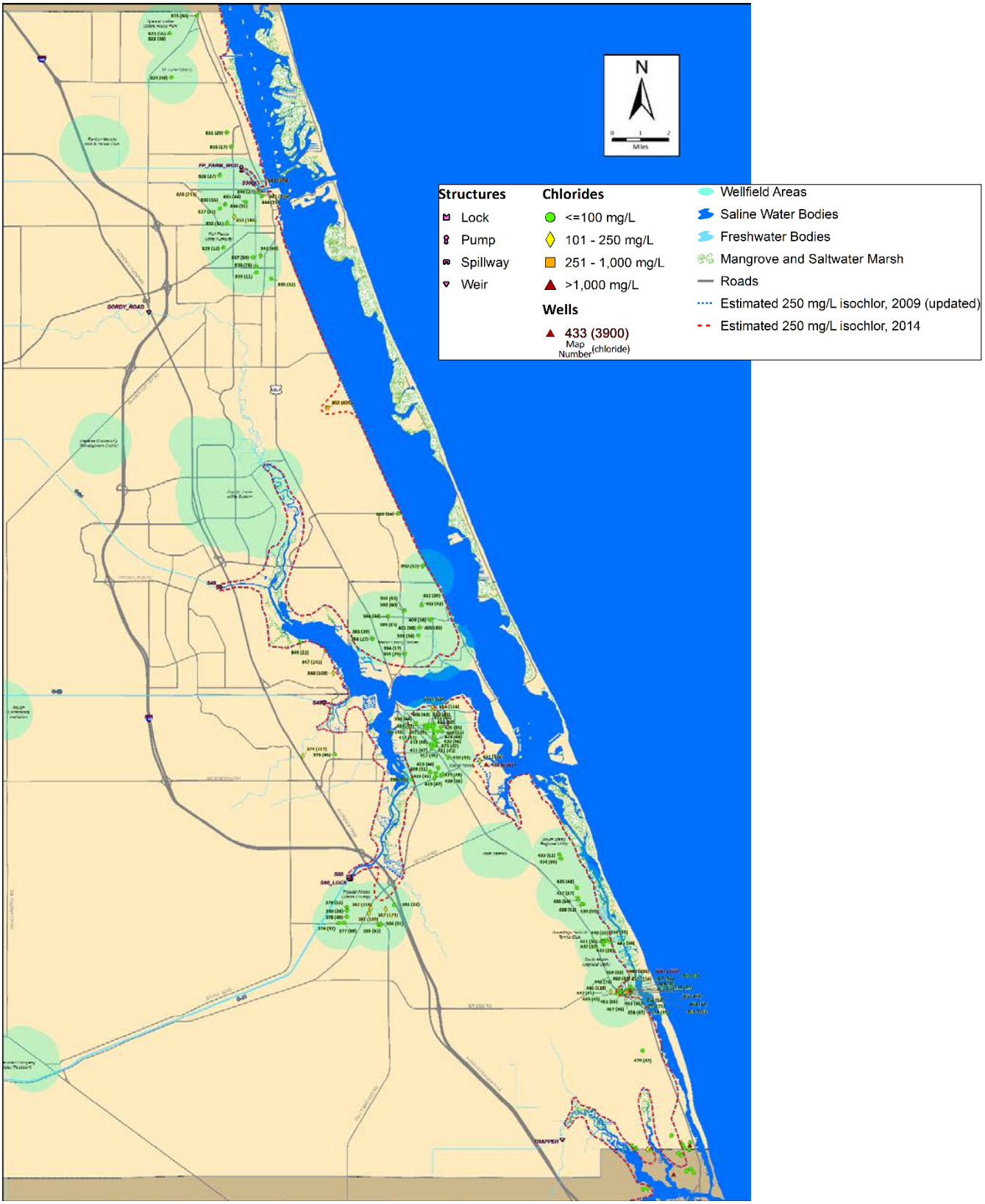

Figure 3-3. Estimated position of the SAS saltwater interface in the UEC Planning Area, 2009 and 2014.

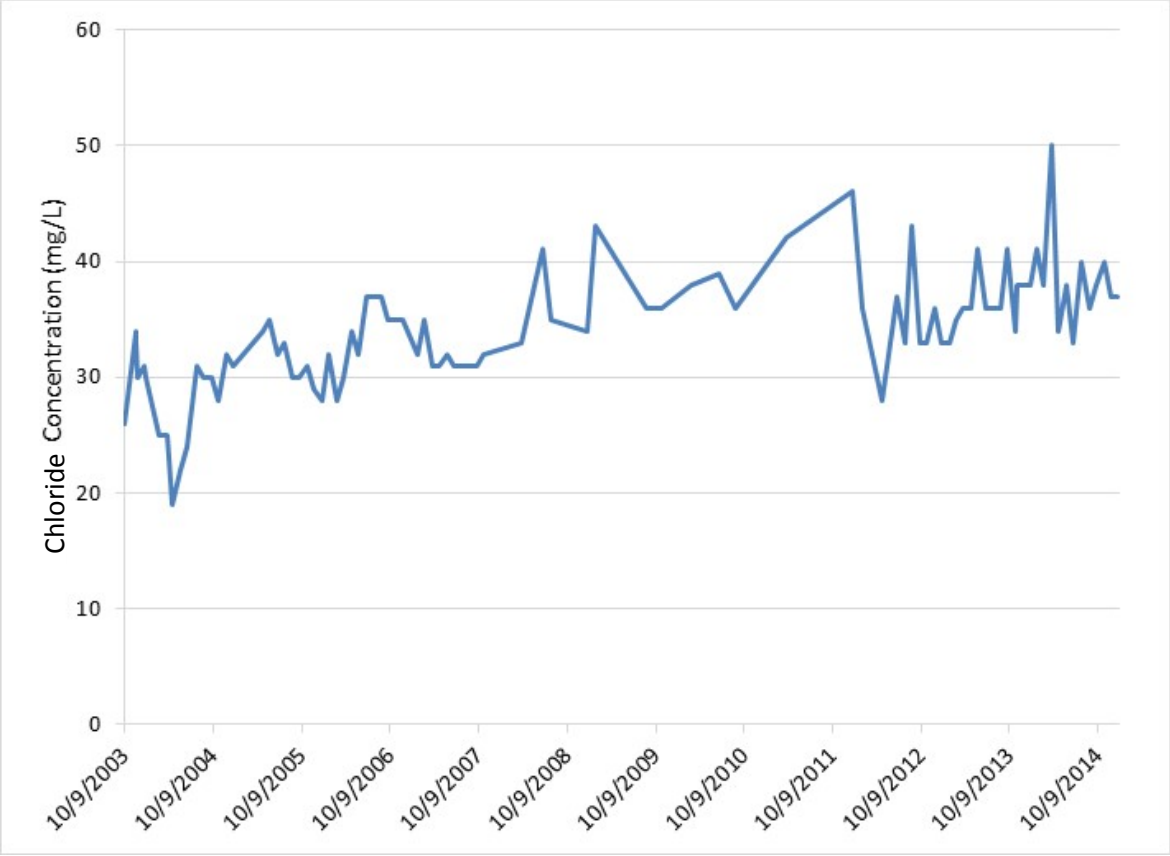

Figure 3-4. SAS chloride concentrations in South Martin Regional Utility Well 10S.

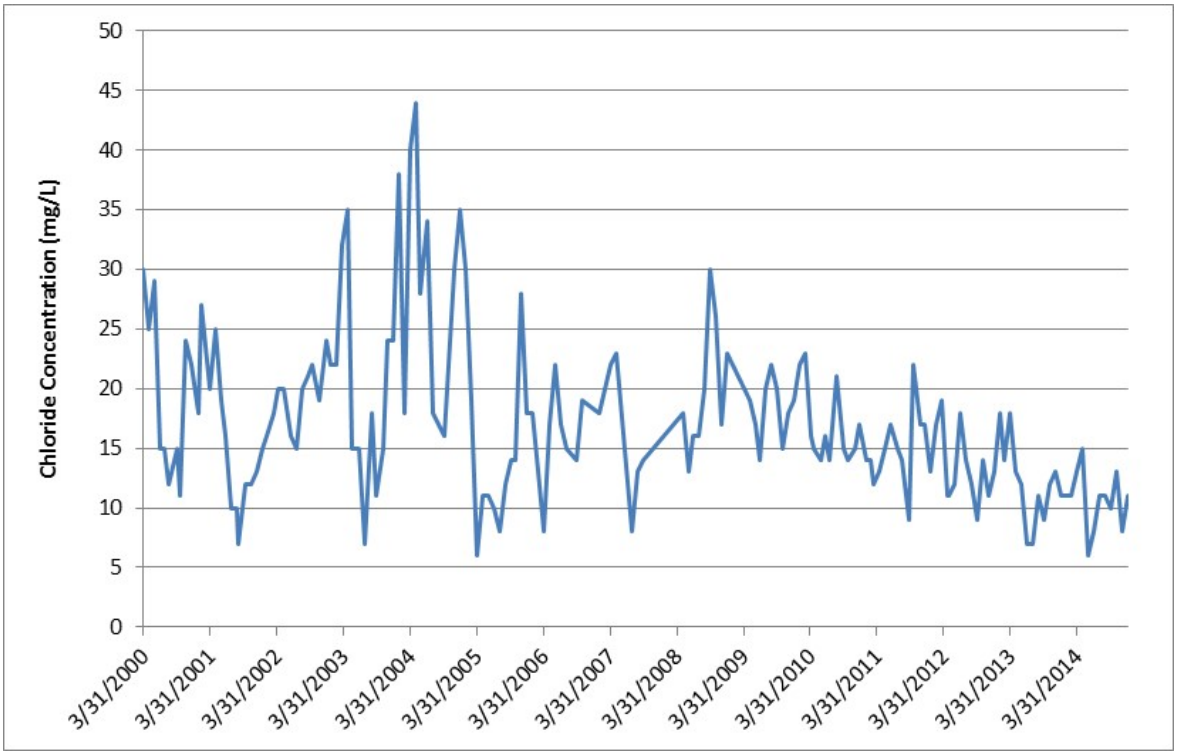

Figure 3-5. SAS chloride concentrations in Fort Pierce Well MW4.

Floridan Aquifer System

The FAS is a productive and important source of water for the PWS and AGR water use categories in the UEC Planning Area. Throughout much of the planning area, the FAS is brackish and flows naturally at the land surface without the need for pumps (artesian wells). As discussed earlier, there are two water producing zones in the FAS used in this planning area: the Upper Permeable Zone (UPZ) and the Avon Park Permeability Zone (APPZ). Water quality in the UPZ generally is better in the northern and western portions of the UEC Planning Area and declines to the south and east. This means that the UPZ can be used to irrigate a variety of crops in much of St. Lucie County. While the APPZ is used by several PWS utilities in the UEC Planning Area, it is rarely used by agriculture due to the higher total dissolved solids (TDS) concentrations. Currently, the LFA is not utilized as a water source in the planning area.

Many PWS utilities in the UEC Planning Area use the FAS for a portion of their supply. Because the water is brackish, it requires blending with fresh water or desalination treatment to meet potable standards. Utilities generally use reverse osmosis (RO) treatment to produce potable water from the FAS in the area. The approximate efficiency for these brackish RO plants is between 75 and 85 percent (Carollo Engineers, Inc. 2009).

The FAS consists of the Upper Floridan aquifer (UFA), the Ocala-Avon Park low permeability zone, the APPZ, the middle confining unit, and the LFA (Miller 1986). Reese and Richardson (2007) refined these units and provided a more consistent hydrogeologic framework. The results of their work (supplemented with data that became available after their report was published) were the basis for the development of the ECFM, and most of the following is summarized directly from their 2008 report.

The UFA occurs at the base of the Hawthorn Group and includes the UPZ, which consists of the upper portions of the Avon Park Formation and the Ocala Limestone. Reese and Richardson (2007) indicated that the UFA generally consists of several thin, highly permeable water-bearing zones interbedded with thicker zones of lower permeability. The transmissivity of the upper permeable zone ranges from 10,000 to more than 100,000 ft^2/day throughout the study area. The thickness of the UFA varies from less than 100 feet in central Florida to more than 700 feet in some areas of southern Florida. The UFA is fully confined throughout the UEC Planning Area.

The gradational boundary between the upper permeable zone and the Ocala-Avon Park Low Permeability zone is difficult to define precisely; therefore, the altitude of the top of the Ocala-Avon Park Low Permeability zone shows a high degree of variability. The thickness of the Ocala-Avon Park Low Permeability zone varies from less than 100 feet to more than 800 feet. The thickness and effectiveness of the Ocala-Avon Park Low Permeability zone as a confining unit could be important to the freshwater recovery performance of aquifer storage and recovery (ASR) wells in the brackish UFA. If vertical conductivity within the Ocala-Avon Park Low Permeability zone is high or the unit is thin, saline upconing from the APPZ might occur during withdrawal of injected water, reducing recovery efficiency. In south Florida, the APPZ generally is more saline than the UFA.

The APPZ is a major producer of water in the UEC Planning Area and underlies the UFA. The altitude of the top of the APPZ can vary greatly over relatively short distances. In the planning area, the altitude of the top of the APPZ generally decreases from north to south from 1,200 to

1,500 feet below National Geodetic Vertical Datum (NGVD) 1929, but locally it can change by approximately 200 to 300 feet between adjacent wells. In two wells located approximately 6 miles apart in Martin County, the top of the APPZ is 240 feet deeper in one well than the other. While the thickness of the APPZ in the UEC Planning Area varies from absent to almost 500 feet, it is more than 200 feet thick throughout most of the area. Transmissivity of the APPZ varies from less than 100,000 ft^2/day in the Lower East Coast (LEC) Planning Area to as high as 1,600,000 ft^2/day in west-central Florida. As previously stated, there generally is a high degree of variability in confinement between the APPZ and the upper permeable zone. In some areas of the UEC Planning Area, the APPZ might consist of two major producing zones (Lukasiewicz and Switanek 1995). Two distinct flow zones separated by a 250-foot thick semi-confining unit were found in a well in St. Lucie County. Throughout Florida, where it is transmissive and yields potable water, the APPZ is a major source of PWS. In the UEC Planning Area, the APPZ yields less potable water and is used as a primary production zone for RO treatment plants.

The LFA consists of a sequence of permeable zones separated by semi-confining units. The Lower Floridan Uppermost Permeable Zone is somewhat contiguous throughout the UEC Planning Area. It is located near the base of the Avon Park Formation at elevations between 1,400 and 2,600 feet below sea level NGVD 1929. Its thickness ranges between near absent to more than 150 feet. Reported transmissivities range between 10,000 and 50,000 ft^2/day with some localized higher values. Below the Lower Floridan Uppermost Permeable Zone is a series of confining units with localized permeable zones at the upper portion of this deeper unit. These lower confining units and the thin permeable zones within them are all included in the Lower Floridan Composite/Confining Zone and are treated in the ECFM as a single semi-confining zone. Below the Lower Floridan Composite/Confining Zone is an extremely transmissive zone locally referred to as the Boulder Zone. The Boulder Zone occurs approximately 2,100 to 3,500 feet below sea level NGVD 1929 and can be several hundred feet thick in some areas with extremely high transmissivities values. The Boulder Zone represents the base of the FAS in south Florida as it is underlain by the massive impermeable anhydrite beds of the Cedar Keys Formation.

To monitor water levels and salinity within the FAS, the District maintains monitor wells that are completed into the various producing zones of the FAS. The wells are intended to collect background data that are not directly influenced by withdrawals for consumptive use. **Figure 3-6** shows the locations of active FAS monitor wells in the UEC Planning Area.

The water levels in monitor well SLF-76 are shown in **Figure 3-7**. This UFA well shows the typical seasonal fluctuations seen in most Floridan wells and some moderate long-term fluctuations. While there were distinct reductions in average water levels in the periods of 2005-2006 and 2008-2009, since approximately 2012, water levels appear to be recovering toward a long-term average of approximately 42 feet. The long- and short-term fluctuations are within the normal range expected to be seen in the UFA.

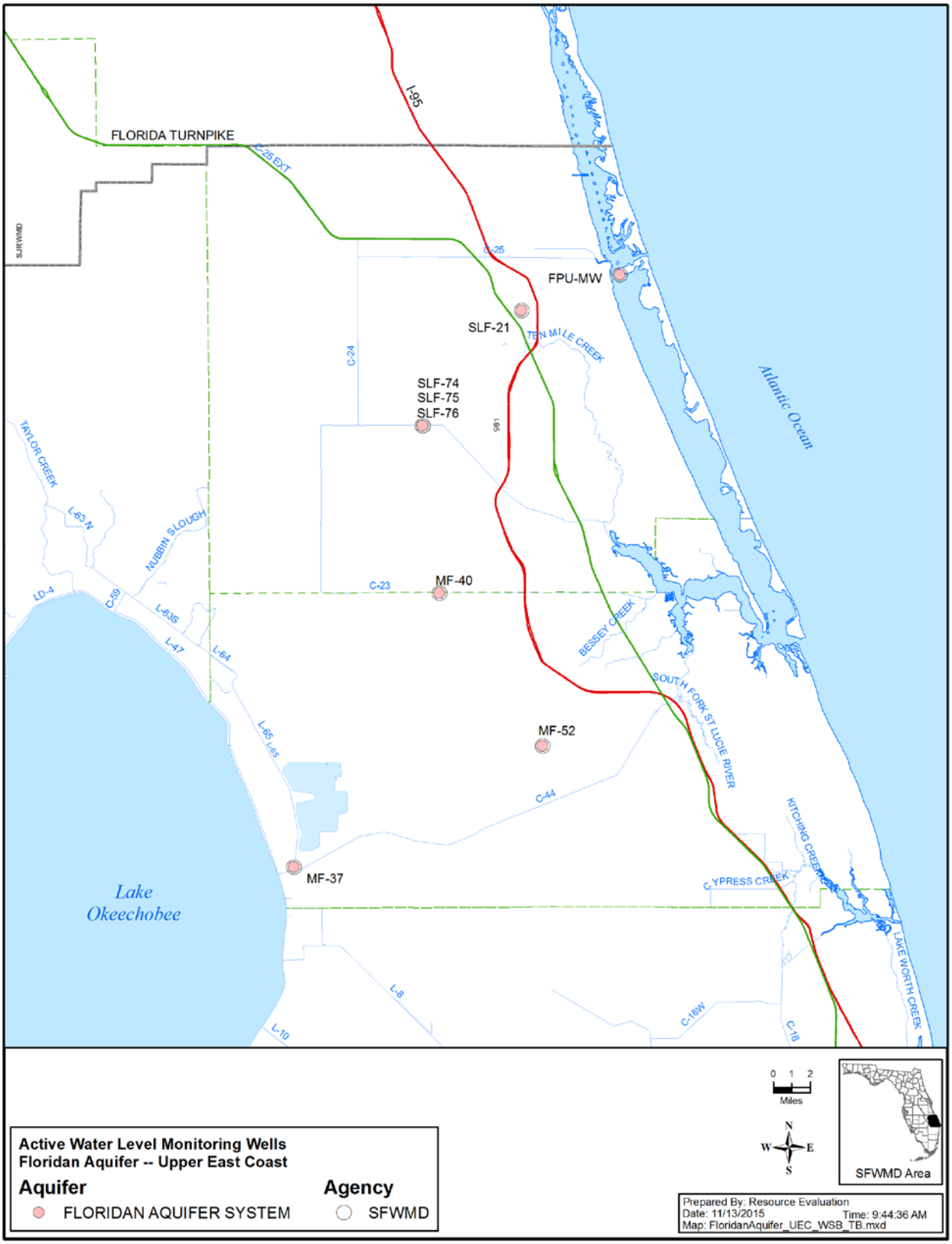

Figure 3-6. Active FAS water level monitoring wells in the UEC Planning Area.

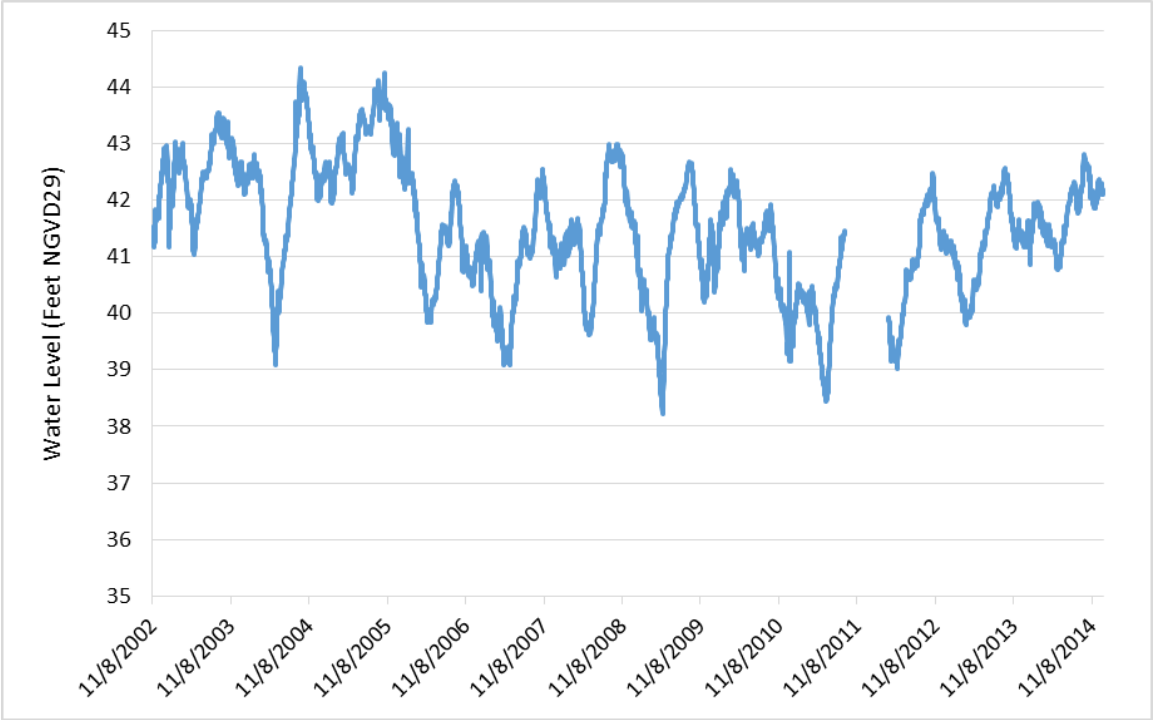

Figure 3-7. UPZ water levels in Monitor Well SLF-76 (Upper Floridan aquifer).

Floridan Aquifer System Chloride Levels

Figure 3-8 shows historical chloride concentrations for SLF-76, a UFA monitor well located along the C-24 canal in St. Lucie County. The chloride concentrations were fairly stable between 2001 and 2010, averaging between 1,200 and 1,400 milligrams per liter (mg/L).

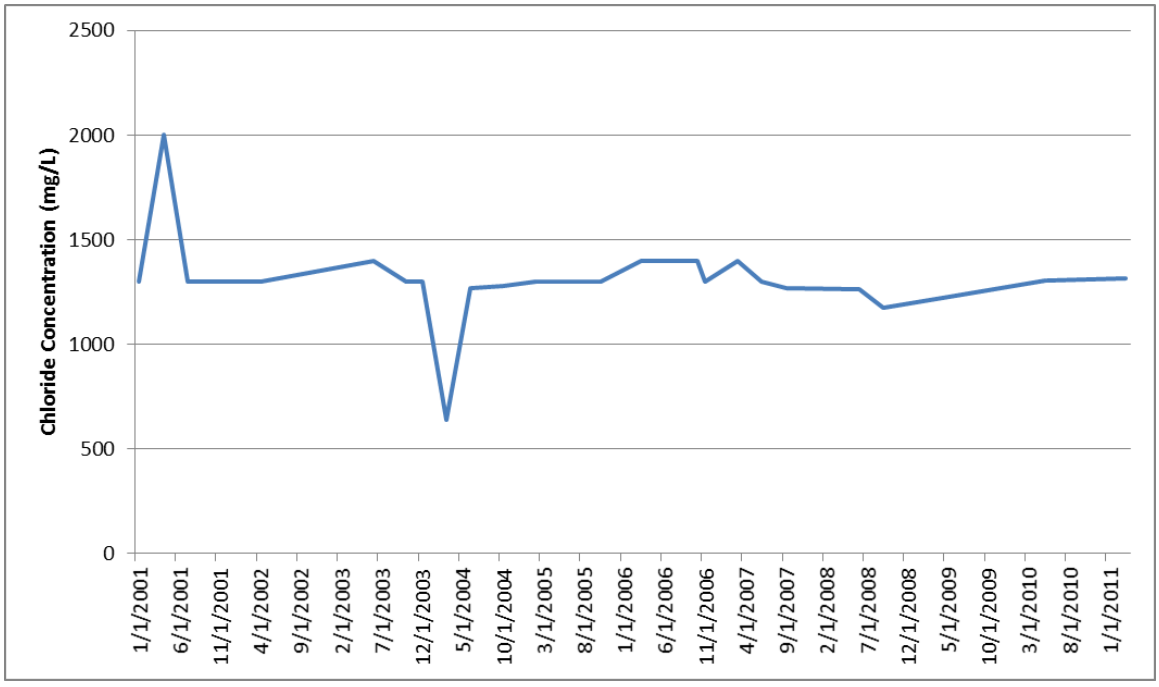

Figure 3-8. UPZ chloride levels in Well SLF-76 (Upper Floridan aquifer).

Figures 3-9 and **3-10** show chloride data for Wells F-2 and F-3, two UFA wells monitored by the Port St. Lucie Utility Systems Department. While Well F-2 shows generally stable chloride levels since 2007, Well F-3 shows a slight upward trend over the same period of time. This could be a result of upconing of higher chloride water from deeper layers in the FAS in response to withdrawals from the UFA.

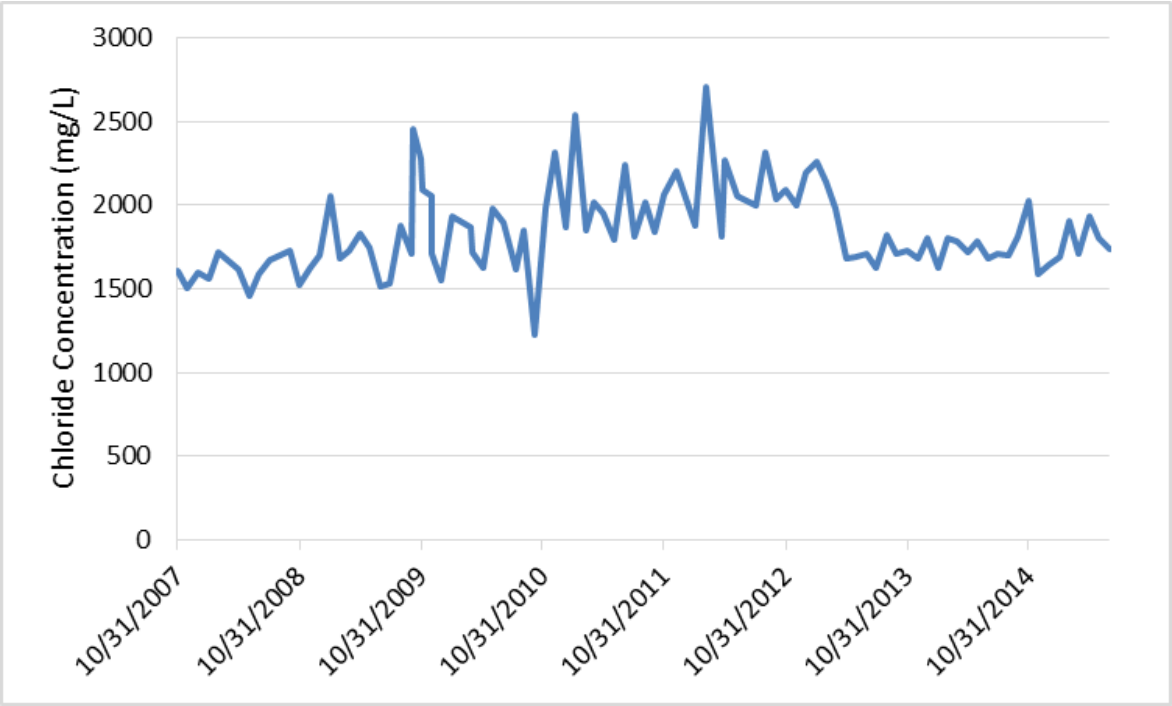

Figure 3-9. UPZ chloride levels in City of Port St. Lucie Utility Systems Well F-2.

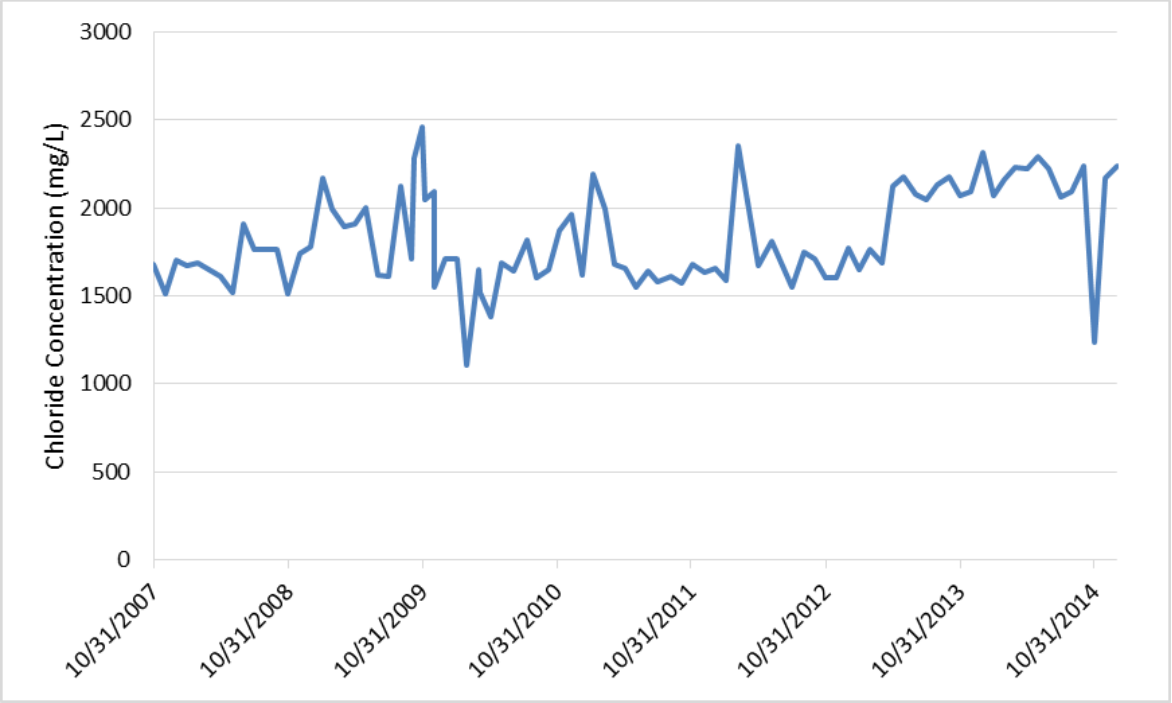

Figure 3-10. UPZ chloride levels in City of Port St. Lucie Utility Systems Well F-3.

REGULATORY PROTECTION OF WATER RESOURCES

The intent of Chapter 373, Florida Statutes (F.S.), is to promote the availability of sufficient water for all existing and future reasonable-beneficial uses and natural systems [Section 373.016(3)(d), F.S.]. The SFWMD developed water resource protection standards consistent with legislative direction that are implemented in phases to prevent various levels of harm (no harm, harm, significant harm, and serious harm) (**Figure 3-11**). Each standard plays a role in the ultimate goal of achieving a sustainable water resource. For instance, programs regulating surface water management and water use permitting must prevent harm to the water resource. **Figure 3-11** represents the conceptual relationship among the harm standards, associated conditions, and water shortage severity while **Table 3-1** summarizes statutory resource protection tools and definitions.

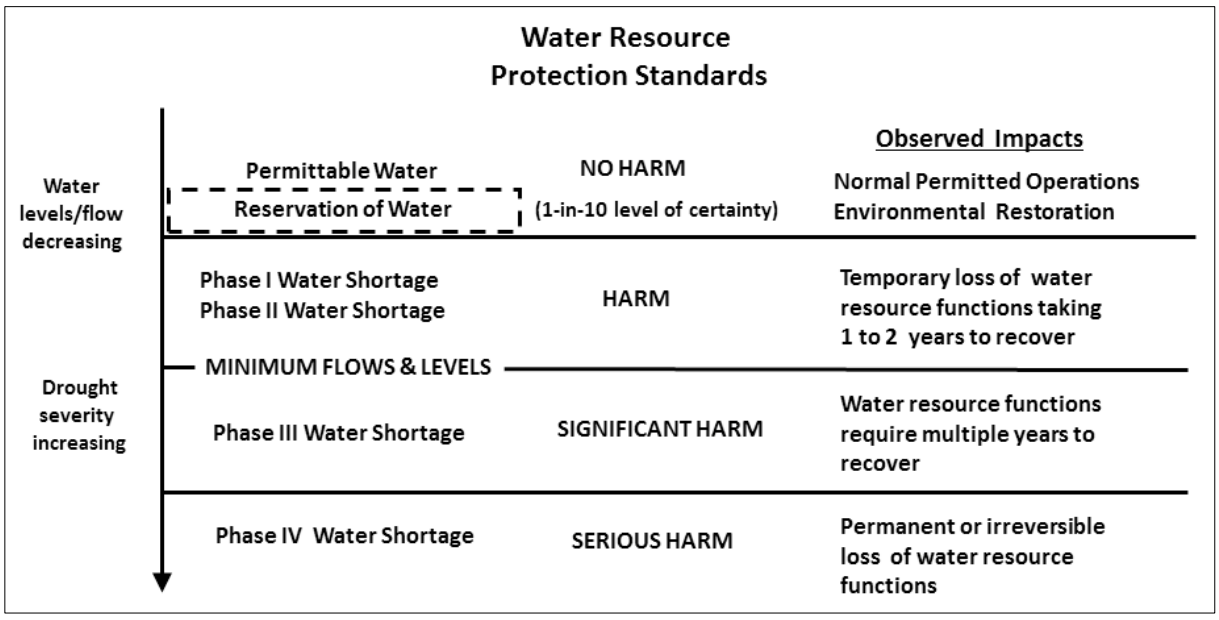

Figure 3-11. Conceptual relationship among water resource protection standards at various levels of water resource harm.

Table 3-1. Summary of resource protection tools.

Tool	Description
Water Use Permitting	The right to use water is authorized by permit, which allows for the use of water for reasonable-beneficial uses while protecting natural systems from harm. The conditions of permit issuance are more specifically enumerated in Chapter 40E-2, Florida Administrative Code (F.A.C.). To provide reasonable assurances that the conditions of permit issuance are met, applicants must meet the technical criteria in the *Applicant's Handbook for Water Use Permit Applications, within the South Florida Water Management District* (Applicant's Handbook; SFWMD 2015a). The technical criteria used to evaluate the quantity and the proposed water uses' impact on the source include the following: • Potential for saltwater intrusion • Wetland and other surface water body impacts • Pollution • Impacts to off-site land uses • Interference with existing legal users • MFLs and their regulatory components
Minimum Flows and Levels	MFL criteria are flows or levels at which the water resources or the ecology of the area would experience significant harm from further withdrawals. If the existing flow or level in a water body is below or is projected within 20 years to fall below the applicable MFL established pursuant to Section 373.042, F.S., the SFWMD must expeditiously implement a recovery or prevention strategy [Section 373.0421, F.S.].
Water Reservations	A water reservation sets aside water for the protection of fish and wildlife or public health and safety. When a volume of water is reserved, it is not available for allocation to consumptive uses [Section 373.223, F.S.]. Water reservations can be developed based on existing water availability or consideration of future water supplies made available by water resource projects. The Water Resources Development Act of 2000 requires the SFWMD to use its reservation or allocation authority to protect water made available by CERP projects as necessary for the natural system. Any volume of water not necessary for the protection of fish and wildlife or public health and safety may be certified as available and allocated to consumptive uses.
Water Shortage	Water shortages are declared by the District Governing Board when available groundwater or surface water is not sufficient to meet users' needs or when conditions require temporary reduction in total use within the area to protect water resources from serious harm. The SFWMD's Water Shortage Plans are contained in Chapters 40E-21 and 40E-22, F.A.C. The purposes of the plans are to protect the water resources of the SFWMD from serious harm; assure equitable distribution of available water resources among all water users during times of shortage consistent with the goals of minimizing adverse economic, social, and health related impacts; provide advance knowledge of the means by which water apportionments and reductions will be made during times of shortage; and promote greater security for water use permittees.
Restricted Allocation Areas	Restricted Allocation Area (RAA) criteria are established by rule to protect natural systems from consumptive use impacts. RAA criteria established for specific areas of the SFWMD are listed in Section 3.2.1 of the Applicant's Handbook, which is incorporated by reference into Chapter 40E-2, F.A.C.

Changes to Water Use Permitting

During the 2000 water supply planning process, key regional issues affecting water resource management, and strategies for resolving them, were identified. Water use permitting rules were subsequently revised regarding the 1-in-10 year drought event level of certainty,

resource protection criteria, water shortage triggers, saltwater intrusion, special designations and permit duration. A series of rulemaking efforts was completed in September 2003, resulting in amendments to Chapters 40E-1, 40E-2, 40E-5, 40E-8, 40E-20, and 40E-21, Florida Administrative Code (F.A.C.), and the *Applicant's Handbook for Water Use Permit Applications, within the South Florida Water Management District* (Applicant's Handbook; SFWMD 2015a). Among the most significant changes were amendments to permit duration, permit renewal, wetland protection, supplemental irrigation requirements, saltwater intrusion, ASR, and model evaluation criteria. Lake Okeechobee Service Area (LOSA) permit renewals began in 2009, with most permits issued by 2011. The renewal process for irrigation-class water use permits in the UEC Planning Area began in 2003 and was completed in 2005. Many renewed permits are for 20-year durations. The processing of permit applications, and the associated data and analysis to support and evaluate them, benefited the evaluation of current conditions for this plan update.

In 2013, changes were made to Section 373.236, F.S., to extend the duration of water use permits in some situations. Permits approved for the development of alternative water supplies shall be granted for at least 30 years if there is reasonable assurance that the conditions for the permit will continue to be met for the duration. Additionally, permits with a duration of up to 50 years may be authorized if a municipality, other government body, or public utility is required to provide for the retirement of bonds used for the construction of waterworks or waste disposal facilities.

In 2011, the Florida Department of Environmental Protection (FDEP) initiated a statewide effort called Consumptive Use Permitting Consistency (CUPCon) to improve consistency in the consumptive/water use permitting programs implemented by the water management districts. CUPCon resulted in changes to SFWMD water use permitting rules and criteria that became effective in 2014. The Applicant's Handbook (SFWMD 2015a) contains the revised SFWMD water use permitting criteria.

Additional Protection Afforded Water Resources

The water resource protection criteria contained in the conditions for permit issuance enumerated in Rule 40E-2.301, F.A.C., and the Applicant's Handbook (SFWMD 2015a) include three additional mechanisms to protect water supplies for natural systems from consumptive uses: 1) the regulatory components of an adopted MFL prevention or recovery strategy; 2) implementation criteria for water reservations, and 3) RAA criteria. In recent years, the SFWMD's priorities have focused on establishing water reservation and RAA rules to facilitate construction of the CERP project components. Federal law requires natural system water provided by CERP projects to be protected by water reservation or RAA criteria prior to executing cost-share agreements for project construction.

In addition, the SFWMD considers the CERP project schedule and the related federal and state requirements to protect water for the natural system using its reservation or allocation authority. The USACE has verified that federal requirements have been met for several CERP projects by virtue of the SFWMD's adoption of water reservations and RAA rules. Taken together, these rules afford protection for water resources across significant portions of the planning area.

Minimum Flows and Levels

MFL criteria are flows or levels at which specific water resources, or the ecology of the area, would experience significant harm from further withdrawals. Significant harm is defined in Subsection 40E-8.021(31), F.A.C., as the temporary loss of water resource functions, which results from a change in surface or ground water hydrology, that takes more than 2 years to recover, but is considered less severe than serious harm. MFL criteria are applied individually to affected water bodies and define the minimum flow or level for surface water bodies, or minimum water level in aquifers. When establishing MFLs, the District Governing Board considers changes and structural alterations to watersheds, surface waters, and aquifers as well as 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 [Section 373.0421, F.S.].

The SFWMD develops and adopts recovery or prevention strategies for all priority water bodies simultaneously with MFL rule adoption. The SFWMD develops a recovery strategy for water bodies where MFLs are currently violated. The goal of a recovery strategy is to achieve the established MFL as soon as practicable. A prevention strategy is developed when MFLs are not currently violated, but are projected to be violated within the next 20-year planning horizon. The goal of a prevention strategy is for the water body to continue to meet the established MFL in the future.

The SFWMD also continues to fulfill its statutory obligation to identify key water bodies for which MFLs should be developed or updated. Section 373.042, F.S., requires each of the five water management districts to provide an annual priority list and schedule for development of MFLs and water reservations to the FDEP. The priority list and schedule are available in the *2015 South Florida Environmental Report* (SFWMD 2015b).

The priority list is based on the importance of the waters to the state or region and the existence of, or potential for, significant harm to the water resources or ecology of the state or region, and includes waters that are experiencing or may reasonably be expected to experience adverse impacts.

The recovery or prevention strategies must include phasing or a timetable that will allow for the provision of sufficient water supplies for all existing and projected reasonable-beneficial uses, including development of additional water supplies and implementation of conservation and other efficiency measures consistent with the provisions of Sections 373.0421 and 373.709, F.S. MFL recovery and prevention strategies are implemented in phases with consideration of the SFWMD's missions in managing water resources, including water supply, flood protection, environmental enhancement, and water quality protection, as required by Section 373.016, F.S.

MFLs have been adopted in the UEC Planning Area for the St. Lucie Estuary; the Northwest Fork of the Loxahatchee River, which partially flows into Martin County; and Lake Okeechobee (**Figure 3-12**). Recovery strategies have been adopted for Lake Okeechobee and the Northwest Fork of the Loxahatchee River. A prevention strategy has been adopted for the St. Lucie Estuary. More information on MFLs and recovery and prevention strategies that have been adopted in the SFWMD can be found at www.sfwmd.gov/mfls and in Chapter 40E-8, F.A.C.

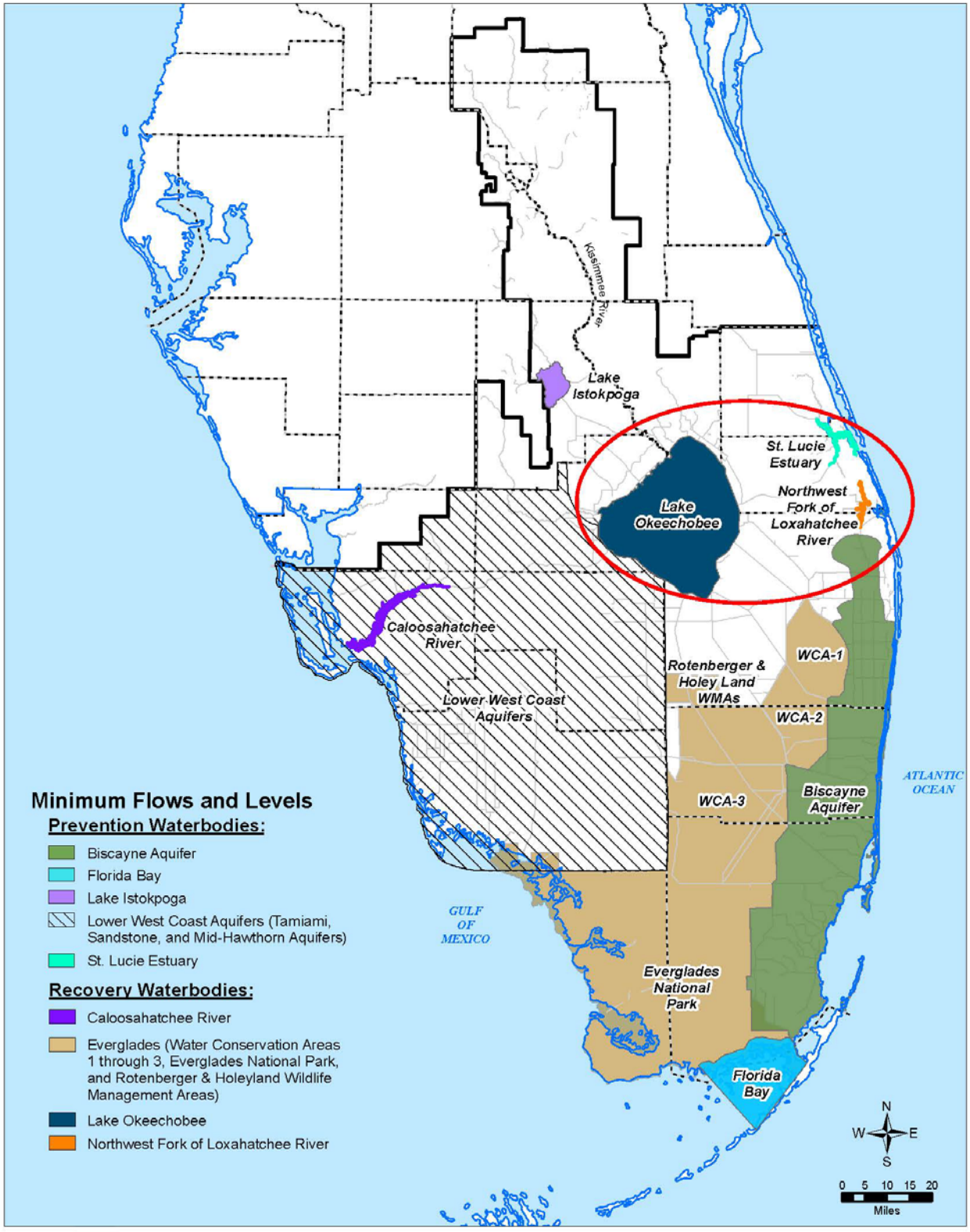

Figure 3-12. SFWMD water bodies with established MFLs.

St. Lucie Estuary MFL

The St. Lucie River flows through Martin and St. Lucie counties. The river is 35 miles long and has two major forks, the North Fork and the South Fork. Ten Mile Creek is the major freshwater tributary to the North Fork of the St. Lucie River, which is approximately 10 miles long. The North Fork is a freshwater system upstream and a brackish system near the St. Lucie Estuary. The St. Lucie Estuary, as defined in Rule 40E-8.021(29), F.A.C., is the surface water body south of the confluence of the St. Lucie River North Fork and the C-24 Canal, north of the confluence of the St. Lucie River South Fork and the C-44 Canal, and west of the western boundary of the intracoastal waterway, exclusive of canals (**Figure 3-13**).

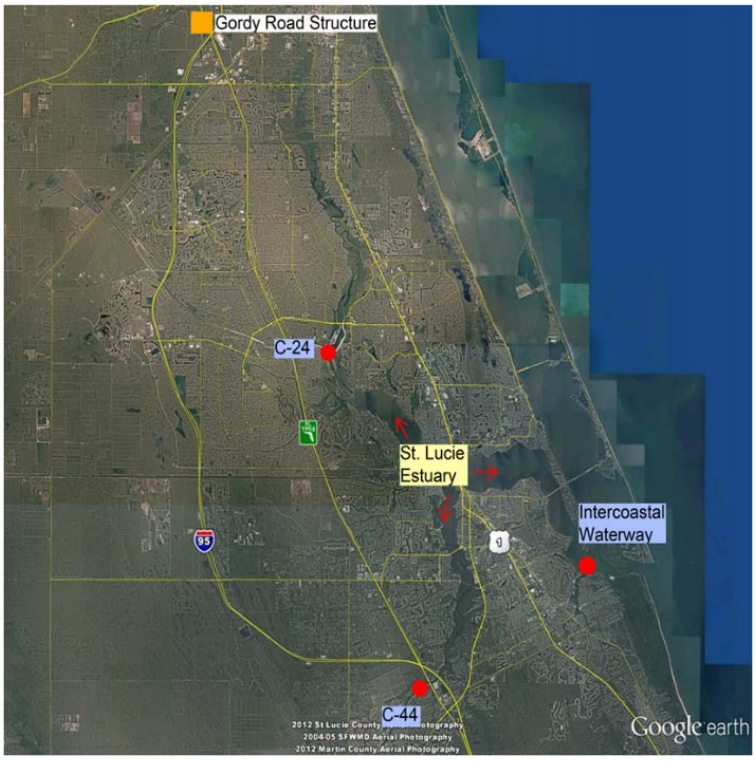

Figure 3-13. St. Lucie Estuary.

In 2002, the SFWMD adopted MFL criteria for the St. Lucie Estuary [Section 40E-8.341, F.A.C.]. The criteria are intended to protect its valued ecosystem components (VECs) from significant harm. A VEC can be a species, community, or set of environmental conditions and associated biological communities that are considered critical for maintaining the integrity of an ecosystem. The VECs identified for the St. Lucie Estuary include organisms inhabiting the oligohaline (low salinity) zone (i.e., submerged aquatic vegetation, phytoplankton, zooplankton, macroinvertebrates, and larval and juvenile fish and shellfish).

The MFL criteria for the St. Lucie Estuary were based on the determination that significant harm occurs to the oligohaline zone of the estuary when there are reduced net freshwater flows to the estuary. To ensure adequate freshwater deliveries to the North Fork, and to the downstream estuary, a minimum mean monthly flow criterion of 28 cubic feet per second (cfs) at the Gordy Road Structure was established. Further details about the MFL, and prevention strategy, for the St. Lucie Estuary can be found in **Appendix B** and at www.sfwmd.gov/mfls.

Northwest Fork of the Loxahatchee River MFL

The Loxahatchee River and Estuary (**Figure 3-14**) and its upstream watershed are located along the southeastern coast of Florida within the LEC and UEC planning areas. The watershed connects to the Atlantic Ocean via the Jupiter Inlet and partially flows into Martin County. The Loxahatchee River is referred to as the "last free flowing river in southeastern Florida" and represents one of the last vestiges of native cypress river swamp within southeast Florida. In 2003, SFWMD adopted MFL criteria for the Northwest Fork of the Loxahatchee River [Subsection 40E-8.221(4), F.A.C.]. The MFL criteria for the Northwest Fork include a minimum flow of 35 cfs over Lainhart Dam and an average daily salinity of less than or equal to 2 at river mile 9.2. Further details about the MFL and recovery strategy for the Northwest Fork of the Loxahatchee River can be found in **Appendix B**, at www.sfwmd.gov/mfls, and in the *2013 Lower East Coast Water Supply Plan Update* (2013 LEC Plan Update; SFWMD 2013a).

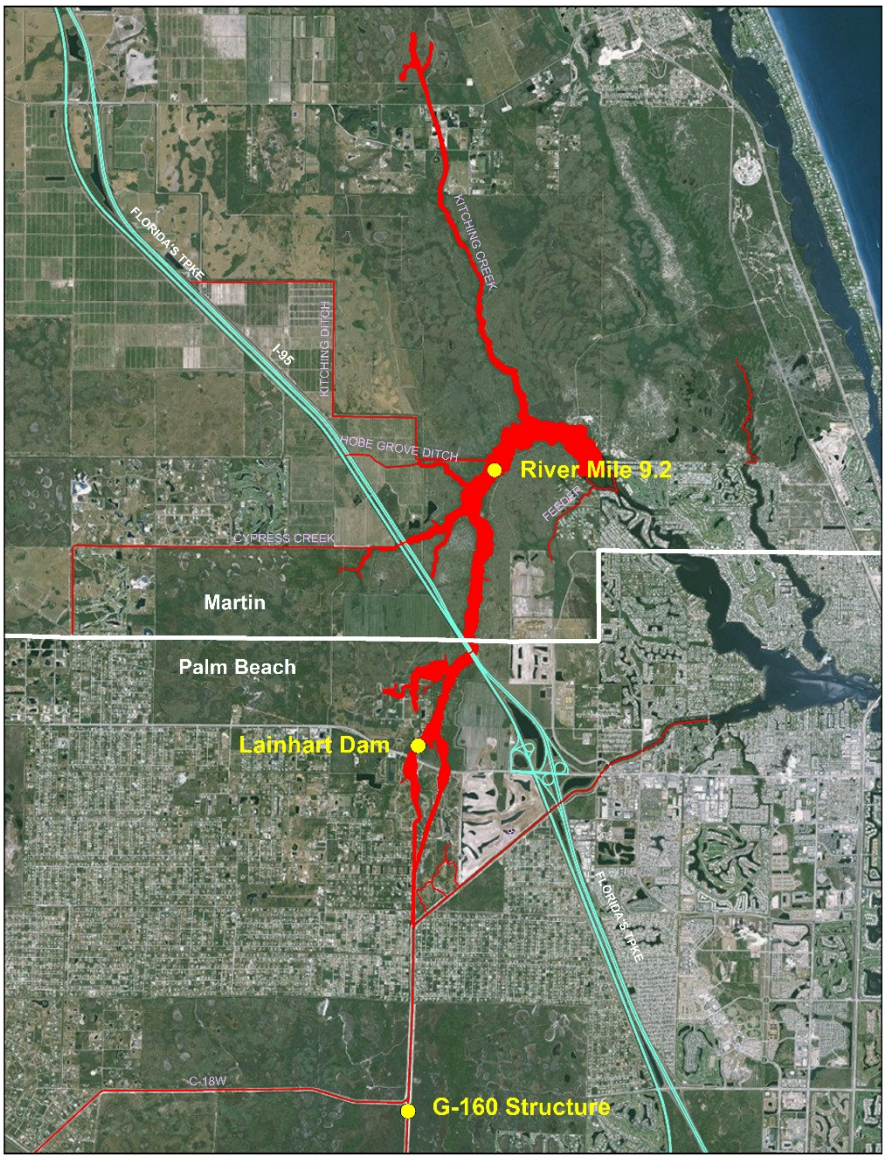

Figure 3-14. Northwest Fork of the Loxahatchee River.

Lake Okeechobee MFL

Figure 3-15. Lake Okeechobee.

Lake Okeechobee (**Figure 3-15**) is the largest lake in the southeastern United States and a central component of the hydrology and environment of south Florida. Lake Okeechobee is used for multiple purposes including urban, agricultural and environmental water supply, flood control, navigation, and commercial and recreational fisheries. It is also a key ecological component of the Greater Everglades ecosystem. The lake has multiple inflows, including the Kissimmee River, and receives water from a watershed in excess of 4,600 square miles. However, the lake has two major outlets for flood control and water delivery to downstream rivers and estuaries; the C-44 (St. Lucie) Canal to the east and the C-43 Canal to the west. Additional flood control discharges from Lake Okeechobee to the lower east coast are possible via the West Palm Beach Canal, Hillsboro Canal, North New River Canal, and Miami Canal. The 143-mile long Herbert Hoover Dike encircles the lake to protect the surrounding communities from flooding.

An MFL criterion of 11 feet NGVD 1929 was adopted for Lake Okeechobee in 2001 [Subsection 40E-8.221(1), F.A.C.]. An exceedance is a decline in lake level elevation below 11 feet related to the NGVD 1929 for more than 80, nonconsecutive or consecutive, days during an 18-month period. The 18-month period is initiated following the first day Lake Okeechobee falls below 11 feet NGVD 1929, and does not include more than one wet season, defined as May 31 through October 31 of any given calendar year [Rule 40E-8.221, F.A.C.]. Significant harm criteria of the MFL were based on the relationship between water levels in the lake and the abilities to 1) protect the coastal aquifer against saltwater intrusion, 2) supply water to Everglades National Park, 3) provide littoral zone habitat for fish and wildlife, and 4) ensure navigational and recreational access (SFWMD 2000). Further details about the MFL for Lake Okeechobee can be found in **Appendix B**, at www.sfwmd.gov/mfls, and in the 2013 LEC Plan Update (SFWMD 2013a).

2008 Lake Okeechobee Regulation Schedule and Adaptive Protocols

Due to concerns about the integrity of the Herbert Hoover Dike, the USACE adopted a new lake schedule, 2008 Lake Okeechobee Regulation Schedule (2008 LORS), in April 2008 to reduce the risk of the Herbert Hoover Dike failing before it is rehabilitated (USACE 2007). The schedule includes operating guidelines designed to maintain Lake Okeechobee water levels between 12.5 and 15.5 feet NGVD 1929, which is approximately 1 foot lower than the previous regulation schedule (i.e., Water Supply and Environment Schedule). Overall, the

changes under 2008 LORS resulted in an average loss of approximately 430,000 acre-feet of water storage. The new schedule also increased the frequency of low lake stages that violate the MFL criteria.

Due to the impacts of 2008 LORS, the SFWMD changed the lake's MFL status from prevention to recovery and developed a recovery strategy**.** The regulatory component of the strategy includes a RAA that limits future additional withdrawals from Lake Okeechobee and all surface waters hydraulically connected to the lake (referred to as the Lake Okeechobee Water Body) to prevent further degradation of the level of certainty of water supply for existing legal users.

To assist managing the lake under 2008 LORS, the Adaptive Protocols for Lake Okeechobee Operations were revised in 2010 (SFWMD 2010). The revised adaptive protocols were used to guide recommendations to the USACE for base flow regulatory releases from the lake and for environmental water deliveries to the Caloosahatchee Estuary. Adaptive protocols were further revised in 2012 to further improve salinity conditions in the Caloosahatchee Estuary. The adaptive protocols describe how the SFWMD staff and District Governing Board make recommendations to the USACE concerning 2008 LORS and the Water Control Plan (USACE 2008) provisions while considering the SFWMD's multiple statutory objectives and responsibilities outlined in Chapter 373, F.S. The protocols are not intended to establish, dictate, or regulate water levels or operations. Instead, they provide operational guidance to SFWMD staff, as local sponsor, when making operational recommendations to the USACE. These protocols are not self-executing and do not bind the SFWMD or any other person or entity to take, or not to take, any specific action. The key goals of the protocols are to improve water supply, flood protection, and ecosystem benefits within the constraints of 2008 LORS and the C&SF Project Water Control Plan (USACE 2008). Further details about the MFL and recovery strategy for Lake Okeechobee can be found in **Appendix B**, at www.sfwmd.gov/mfls, and in the 2013 LEC Plan Update (SFWMD 2013a).

Water Reservations

Section 373.709, F.S., requires regional water supply plans to include reservations of water adopted for the planning area. A water reservation rule sets aside water for the protection of fish and wildlife or public health and safety. When a volume of water is reserved, it is unavailable for allocation to consumptive uses. Water reservations are established based on existing water availability and consideration of future water supplies that water resource projects make available. The Water Resources Development Act of 2000 and Section 373.470, F.S., require increased water supplies identified in CERP project implementation reports to be reserved or allocated by the SFWMD.

A water reservation rule defines the volume of water being set aside for the associated natural system and any unreserved water remaining that is available for allocation to consumptive uses. In 2010, a prospective water reservation was adopted in the UEC Planning Area for the North Fork of the St. Lucie River [Rule 40E-10.051, F.A.C.] in support of the CERP IRL-S Project. **Figure 3-16** shows the location of the North Fork of the St. Lucie River water reservation. More information on water reservations that have been adopted in the SFWMD can be found at www.sfwmd.gov/reservations and in Chapter 40E-10, F.A.C.

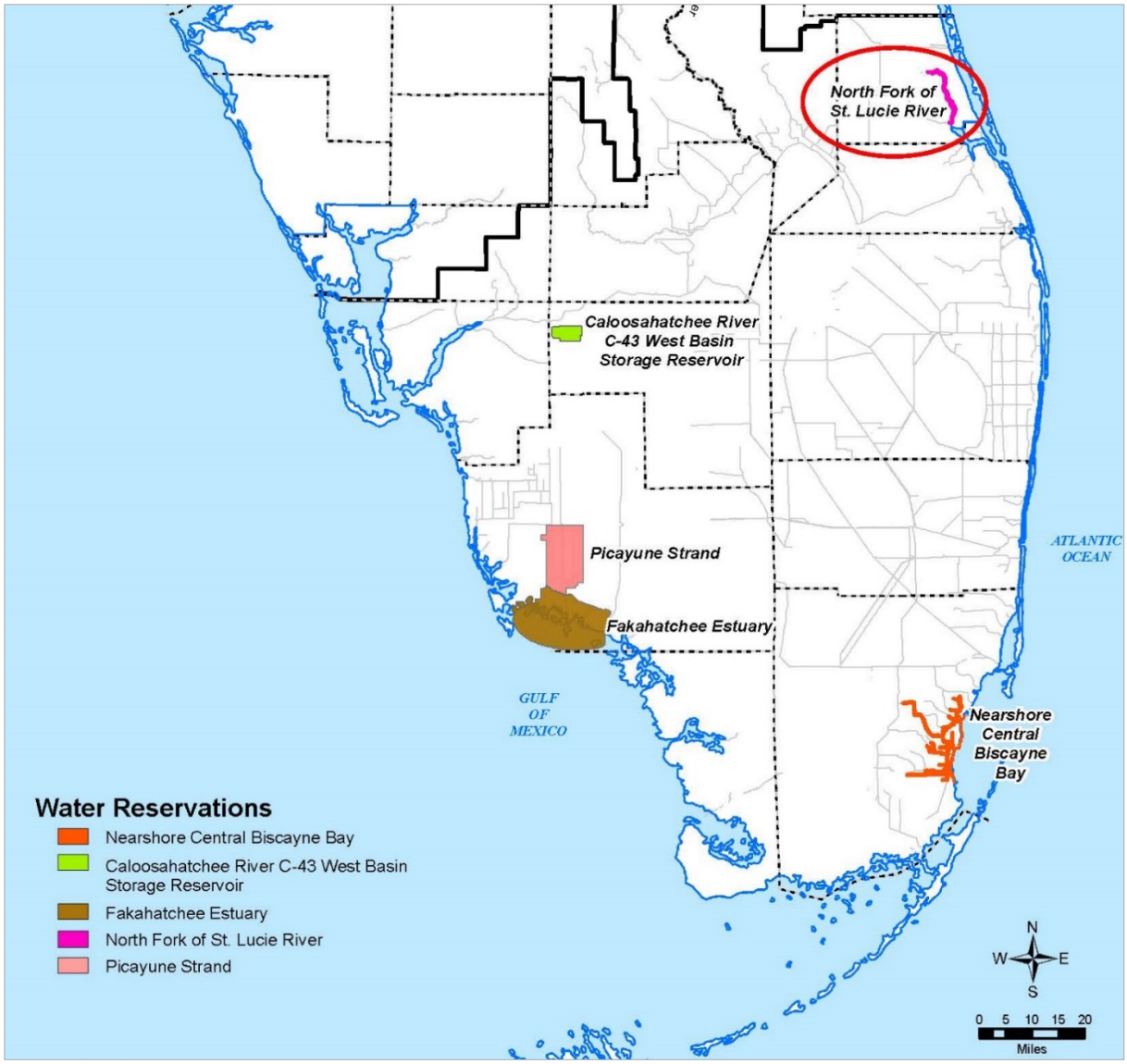

Figure 3-16. SFWMD water bodies with established water reservations.

Water Reservation for the North Fork of the St. Lucie River

The North Fork of the St. Lucie River (**Figure 3-17**) flows through St. Lucie County and is approximately 10 miles long. Ten Mile Creek is a major freshwater tributary to the North Fork. The CERP IRL-S Project was authorized by Congress in the Water Resources Development Act of 2007. To initiate construction of this federal project as part of CERP, the State of Florida was required to reserve or allocate water for the natural systems associated with the project prior to project implementation. A prospective water reservation rule for the North Fork [Rule 40E-10.051, F.A.C.] was adopted by the SFWMD to fulfill its commitments to the CERP IRL-S Project.

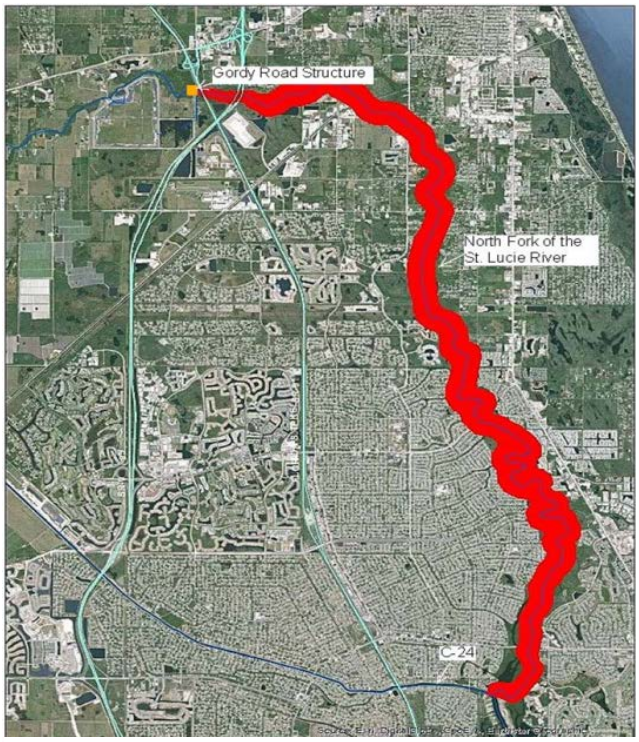

Figure 3-17. North Fork of St. Lucie River.

The purpose of the North Fork water reservation is to ensure that the CERP IRL-S Project provides the intended benefits for the natural system. Water reserved in a water reservation cannot be allocated for consumptive uses. Water use permit applicants must provide reasonable assurance that their proposed use of water will not withdraw water that is reserved for the protection of fish and wildlife or public health and safety. Therefore, the water reservation for the North Fork is considered by the District in evaluating permit applications within the St. Lucie River Watershed.

The District used a resource-based approach to develop the water reservation rule for the North Fork of the St. Lucie River. Technical evaluations to define hydrologic targets for the river, and quantify the volume of available water produced by the project included a summary of the available literature, review of empirical data, and development of watershed and hydrodynamic models. Relationships were identified among freshwater flows discharged from the watershed, salinity, and downstream estuarine ecological responses. These technical evaluations are documented in the District publication *Technical Document to Support a Water Reservation Rule for the North Fork of the St. Lucie River* (Technical Document) (SFWMD 2009). An independent, expert peer review panel reviewed the Technical Document and related documents and determined that the District's analysis of best available technical information supports the relationship between water supply projections resulting from the completed CERP project and water supply reserved to protect fish and wildlife. The Technical Document and other supporting information for the water reservation are available on the District's water reservation webpage at http://www.sfwmd.gov/reservations.

Restricted Allocation Area Criteria

RAA criteria limit allocations from water resources (e.g., lakes, wetlands, and canals) in defined geographic areas. RAA criteria for specific areas of the SFWMD are listed in Section 3.2.1 of the Applicant's Handbook (SFWMD 2015a), which is incorporated by reference into Chapter 40E-2, F.A.C. Some RAA criteria serve as the regulatory component of an approved MFL recovery or prevention strategy. **Figure 3-18** shows the locations of water bodies in the District, including the UEC Planning Area, for which RAA criteria have been adopted.

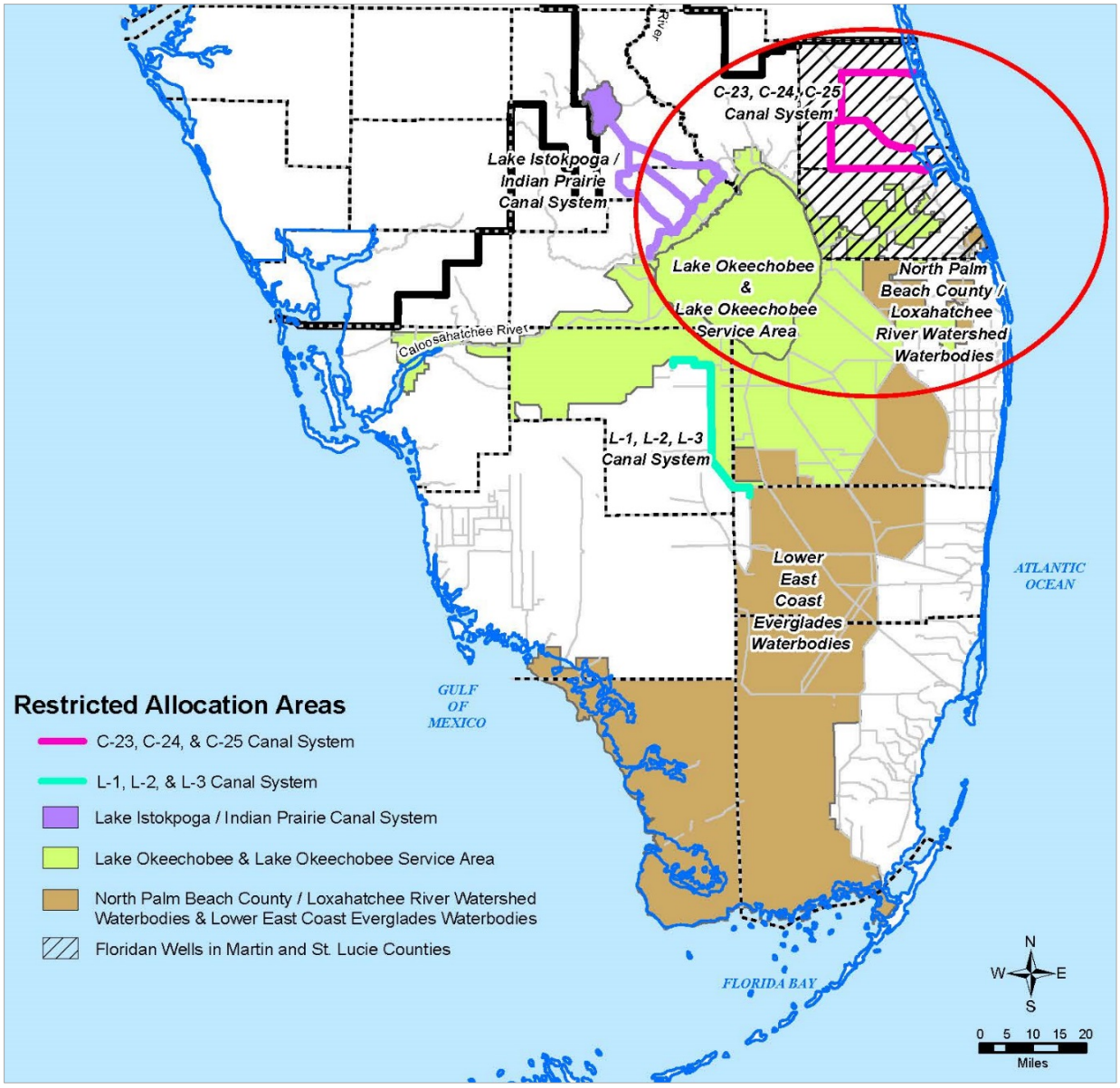

Figure 3-18. SFWMD water bodies with established RAAs.

Due to limited surface water availability and canal bank instability at low stages, the C-23, C-24 and C-25 canal system is designated an RAA [Rule 40E-2.091, F.A.C.] (Subsection 3.2.1.B of the Applicant's Handbook [SFWMD 2015a]). The RAA criteria for the C-23, C-24 and C-25 canal system state that no additional surface water will be allocated from District canals C-23, C-24 and C-25, or any connected canal systems that derive water supply from these canals, over and above existing allocations. No increase in surface water pump capacity will be recommended. Because these canals have permitted withdrawals reduced or terminated based on water levels (14 feet NGVD), water shortages have been triggered more frequently than a 1-in-10 year drought; therefore, users of these canals may not have a 1-in-10 level of certainty.

Due to concerns regarding water availability and water quality, there are restrictions on pumps on Floridan aquifer wells in Martin and St. Lucie counties. RAA criteria in Subsection 3.2.1.D of the Applicant's Handbook (SFWMD 2015a) prohibit the use of pumps on flowing Floridan aquifer wells in Martin or St. Lucie counties unless: 1) the pump was in place before March 2, 1974; 2) the proposed pump is installed to increase pressure in attached piping, not to increase the flow above the natural flow from the well; 3) a study shows the withdrawals will not interfere with presently existing legal users; 4) the pump is installed temporarily for freeze protection; or 5) the pump is installed temporarily during a declared water shortage.

An RAA was adopted in 2007 for the North Palm Beach County/Loxahatchee River Watershed Waterbodies, as defined in Section 1.1 of the Applicant's Handbook (SFWMD 2015a), to ensure that water necessary for Everglades and Loxahatchee River watershed restoration activities is not allocated for consumptive use. The RAA is a component of the recovery strategies for MFLs for the Everglades and the Northwest Fork of the Loxahatchee River. The RAA prohibits net increases in the volume, or a change in timing on a monthly basis, of surface water and groundwater withdrawn from the North Palm Beach County/Loxahatchee River Watershed Waterbodies over that resulting from the base condition water use permitted as of April 1, 2006.

In October 2008, the District Governing Board adopted RAA criteria for the LOSA (Subsection 3.2.1.F of the Applicant's Handbook [SFWMD 2015a]). The criteria limit surface water withdrawals from Lake Okeechobee and all surface waters hydraulically connected to the lake to those water uses occurring from April 1, 2001 to January 1, 2008. The RAA criteria for the LOSA serve as part of the MFL recovery strategy for the lake.

Water Shortage Rules

In accordance with Sections 373.175 and 373.246, F.S., water shortages are declared to prevent serious harm from occurring to water resources. Serious harm is defined as the long-term loss of water resource functions resulting from a change in surface water or groundwater hydrology, which can result in long-term, irreversible, or permanent loss of water resource functions [Subsection 40E-8.021(30), F.A.C.].

The Water Shortage Plans laid out in Chapters 40E-21 and 40E-22, F.A.C., are applied to manage water use when insufficient groundwater or surface water is available to meet user needs or when conditions require temporary reduction in use. Chapter 40E-22, F.A.C., contains regional water shortage plans and restrictions related to specific water bodies, including the C-23, C-24, and C-25 canals and Lake Okeechobee. Further information on water shortage management is available in the *2016 Water Supply Plan Support Document* (SFWMD 2016).

EVALUATION AND ANALYSIS

Previous water supply plan updates incorporated regional groundwater modeling and surface water budget analysis as part of the evaluation process. This plan update incorporates new modeling of the FAS. For analysis of the SAS and surface water availability from major canals, District staff and stakeholders recognized the findings and conclusions of the previous plans as still representative of the issues in meeting the UEC Planning Area 2040 projected water demands.

The ECFM was utilized for the first time in support of this 2016 UEC Plan Update to analyze potential water quality and water level changes in the FAS, an important source of water for PWS and irrigation water. The application of the ECFM marked the first time that the District has been able to simulate changes in water quality using TDS as the parameter via groundwater modeling.

Water levels in the SAS, a limited but important source of fresh groundwater for PWS and irrigation in the UEC Planning Area, were evaluated also. The District also updated the saltwater interface map, showing the estimated position of the saltwater interface in the SAS in the planning area at the end of the dry season in 2009 and 2014. In general, the data indicate the saltwater interface is regionally stable, but some inland saltwater movement may be occurring near the Stuart, South Martin Regional Utility (SMRU), and Martin County (Tropical Farms) wellfield areas. District staff and stakeholders found the results of the new analyses generally consistent with the findings and conclusions of the 1998 UEC Plan as well as the 2004 and 2011 UEC Plan Updates.

Overview of Previous Analyses

The 1998 UEC Plan incorporated regional groundwater modeling as part of the analysis. The District also analyzed the ability of traditional water sources (surface water and the SAS) to supply future water demands. The 1998 UEC Plan and the 2004 UEC Plan Update recommended new sources of water be identified and used to reduce the potential for harm to the resources. Potential sources of water included the FAS and the use of reclaimed water. Increased water conservation was encouraged to lower demands.

Based on the analyses, regulatory strategies were implemented to prevent impacts from occurring in potential problem areas. Although additional surface water may be available in the future from CERP reservoir construction projects, it is premature to identify potential volumes of water anticipated to be available until construction is complete and projects are operational.

Overview of Analytical Tools and Results

Computer models represent the performance of a real system through a series of equations that describe the physical processes that occur in a system. Models also represent a simplified version of the real world that may be used to predict the behavior of a system under various conditions. In this 2016 UEC Plan Update, modeling was used to determine if the FAS production zones can meet current and anticipated water demands through 2040 while maintaining water quality within the limits of treatability. The SAS evaluation considered

water levels over time. Additionally, the SAS saltwater interface map prepared in 2014 was compared to the map with 2009 data to understand saltwater movement.

East Coast Floridan Model

The 2004 UEC Plan Update recommended the development of a groundwater model to conduct analysis of future increased withdrawals from the FAS in the UEC Planning Area. To address this recommendation, the LEC Floridan Model (HydroGeoLogic, Inc. 2006) was expanded to include the UEC Planning Area. The ECFM is a density-dependent groundwater flow and transport model of the FAS covering the east coast of the District. This combined LEC/UEC model, referred to as the ECFM, was completed in October 2008 (Golder Associates 2008) (see **Figure 3-19** for model boundary). The model was recalibrated with additional data that were not available when the original LEC Floridan Model was developed. An independent peer review of the model was conducted in 2011, a number of suggested changes were made, and the updated model was ready for use in 2014.

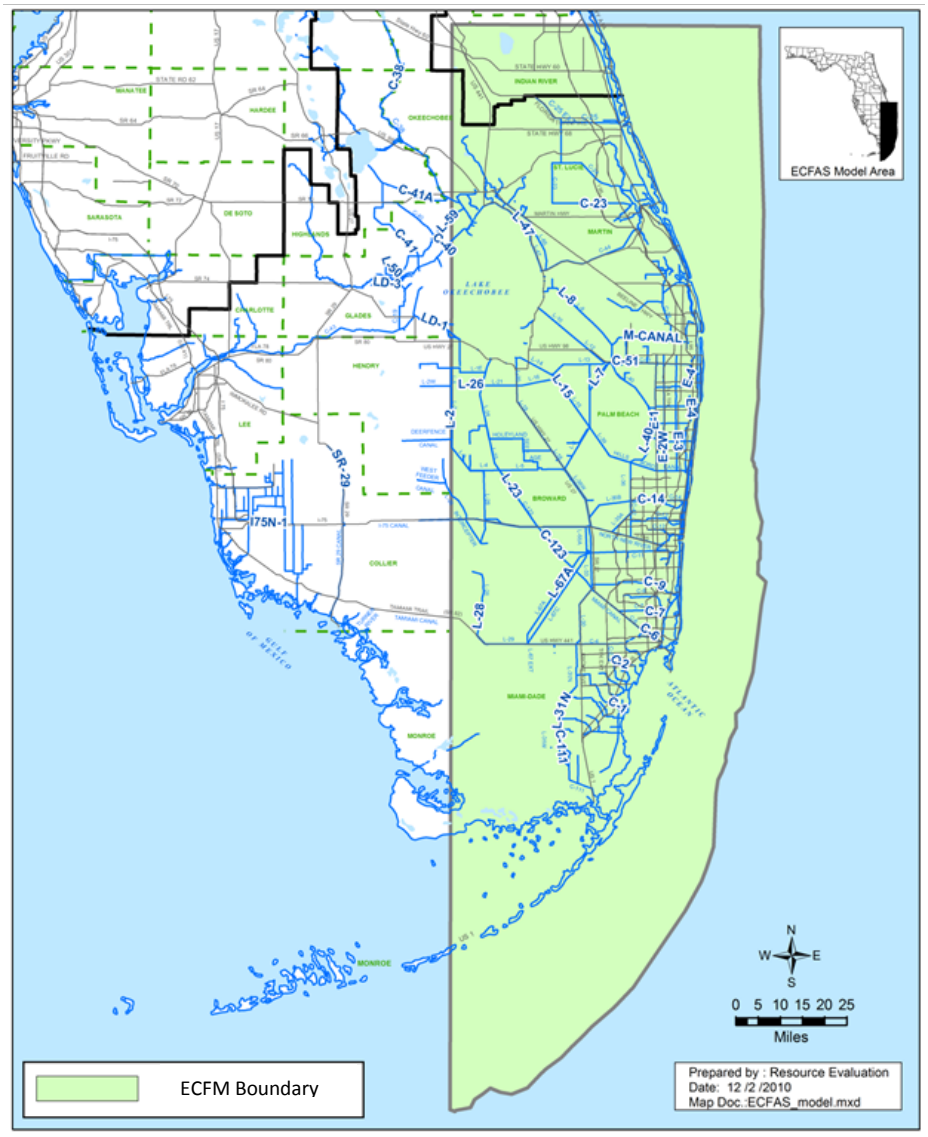

Figure 3-19. East Coast Floridan Model study area.

The ECFM is designed to provide simulations of regional groundwater levels, flows, and water quality changes (TDS) in the FAS in response to withdrawals. It was designed with seven layers (**Figure 3-1**); from the UPZ to the Boulder Zone with cells that are 2,400 feet by 2,400 feet. The two layers that are used as water supply sources in the UEC Planning Area are the UPZ and the APPZ. The ECFM does not simulate surface water or the SAS. The ECFM extends beyond the UEC Planning Area boundaries to account for water use activities outside that can affect the planning area as well as establish boundary conditions. A comprehensive description of the ECFM is available in Giddings et al. (2014).

ECFM Analysis

The ECFM was developed for use in regional water supply planning and uses the best available data regarding aquifer characteristics, water quality, rainfall, and evapotranspiration. Water use data included the locations of existing wells and reported, estimated, or projected use. For wells to be installed in the future, information from the permittee regarding locations was used. Where specific well information was not available for a proposed wellfield, withdrawals were sited in a single cell. The model utilizes TDS as the primary component for tracking changes in water quality; chlorides generally make up approximately 50 percent of TDS in FAS waters.

Assumptions

Because the modeling process was started prior to the 2016 UEC Plan Update process, it was necessary to develop 2040 irrigated acreage and water demand projections for agricultural production and landscape irrigation as well as population and demand for PWS and Industrial/Commercial/Institutional Self-Supply (ICI) use. While the demands used in the modeling are similar to the projected demands in this plan update, there are some differences. The differences are relatively small and unlikely to have a substantial impact on the model results. General descriptions of the assumptions used in the modeling are as follows:

- Existing irrigated acreage, crop type, irrigation method, withdrawal facilities, and water sources were obtained from SFWMD and St. Johns River Water Management District (SJRWMD) permitting databases.
- Acreages and permits were cross-checked against aerial and satellite imagery as well as land use cover, as needed.
- Water demands were calculated only for the acreage irrigated by the FAS using the Agricultural Field-Scale Irrigation Requirements Simulation (AFSIRS) program.
- Estimations of percentages of surface water to FAS withdrawals for users of both sources were calculated from actual farm operations, model calibration results, and water supply plan estimates.
- Estimations of ratios of SAS to FAS withdrawals for PWS utilities that use both sources were based primarily on actual withdrawal data from utilities, with consideration given to water use permits (available allocation, proposed wellfields) and discussions with utilities.

- In developing and distributing the demands for the simulations, only well locations identified in water use permits were used. As a result, several utilities had future wells sited in a single model cell, which concentrated the impact of withdrawals on water levels and water quality.
- Many utilities have implemented specific wellfield operational strategies to manage water quality changes in wells, including rotating wells, reducing withdrawals, and resting wells for longer periods of time. These strategies were reflected in the modeling to the extent practicable, but some were utility specific and could not be included. Increased demands came from existing wells if additional wells were not listed in the water use permit.

Simulations

Two simulations were conducted using the ECFM. The first simulation was of the current (2013) demands to review the potential impacts that might result if 2013 FAS demands continued for 24 years (288 months); this is referred to as the "2013 run." A second simulation, the future (2040) run, was made to see the potential impacts of a similar run applying 2040 FAS demands to the climate patterns for the same 24-year period. This is referred to as the "2040 run." Both runs started with the same water level, water quality, and flows. The starting data, known as the initial condition, were extracted from the final month (month 288) results of the ECFM calibration run. In addition to comparing the 2013 and 2040 runs to one another, both runs were compared to the initial conditions to identify changes in water quality, water levels, and flows. A summary of the demands used in the two runs is shown in **Table 3-2**.

Table 3-2. UEC Planning Area ECFM scenario demands.

Water Use Category	Simulated Average FAS Withdrawals (MGD)	
	2013	2040
Agricultural Irrigation	57.59	59.46
Recreation/Landscaping Irrigation	4.58	4.58
Industrial*	0.18	0.18
Public Water Supply	30.26	52.99
Total	**92.61**	**117.21**

MGD = million gallons per day.
*Industrial withdrawals are primarily in Martin County.

ECFM Results

The results of the FAS modeling are displayed graphically in this section. **Figure 3-20** shows water levels relative to land surface for the initial condition, and **Figure 3-21** shows water levels relative to land surface during a drought (month 220) of the 2040 model run in the UPZ. **Figure 3-22** shows the change in water levels in the UPZ between the initial condition and the end of the 2040 model run (month 288). These three figures focus on the potential for declining water levels that may result in reduced flows in nearby irrigation wells.

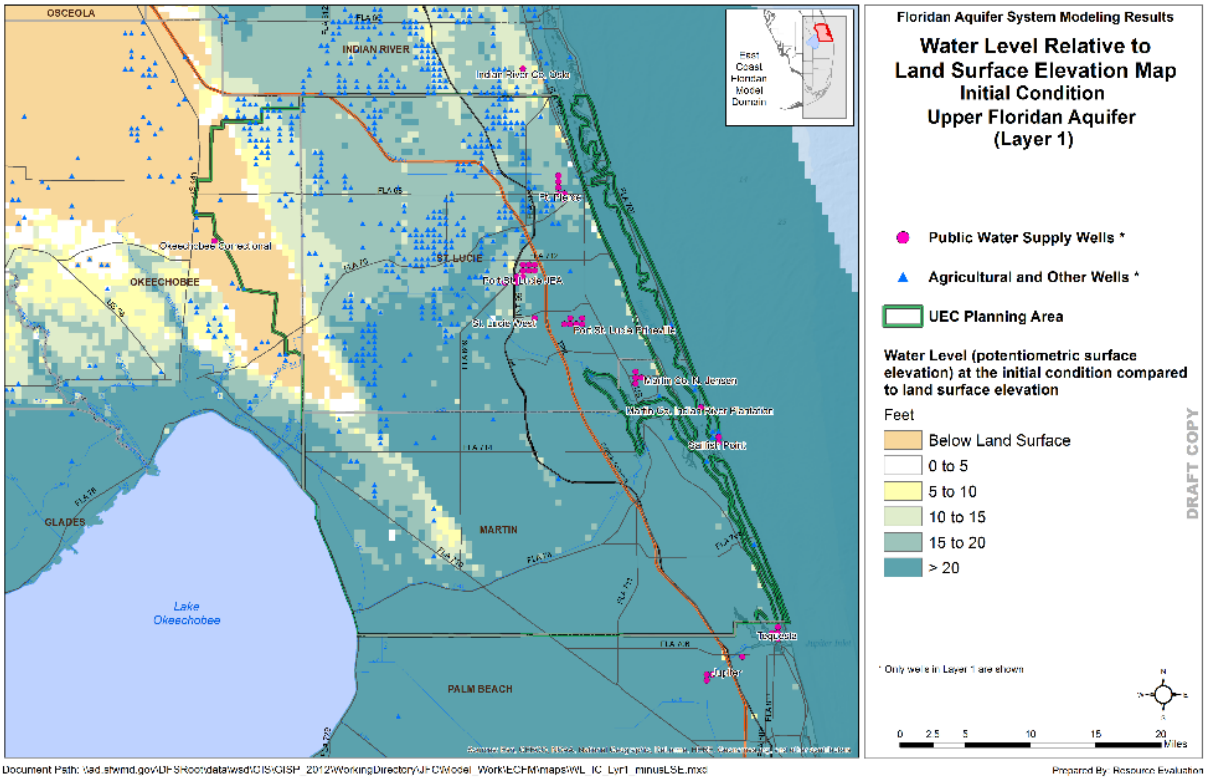

Figure 3-20. Initial water level relative to land surface in the UPZ (Layer 1).

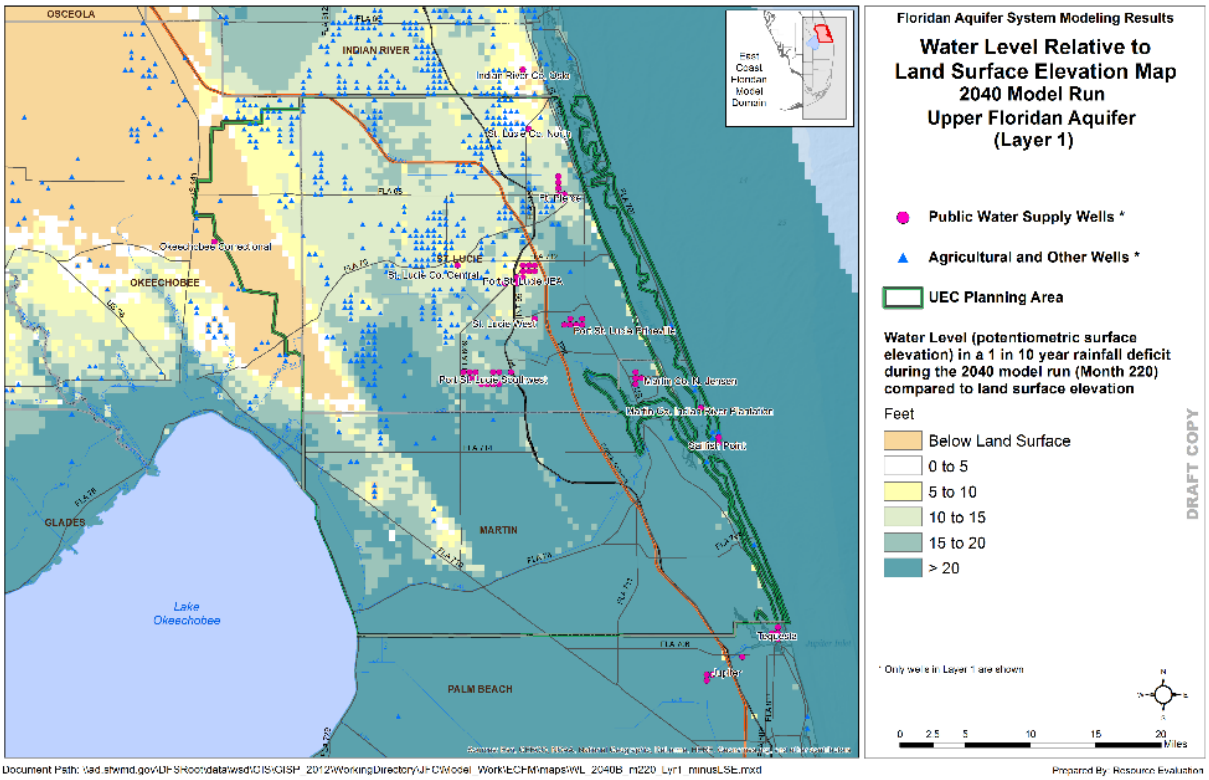

Figure 3-21. Water level relative to land surface in the UPZ (Layer 1) during an approximate 1-in-10 year drought condition (month 220) using 2040 demand projections.

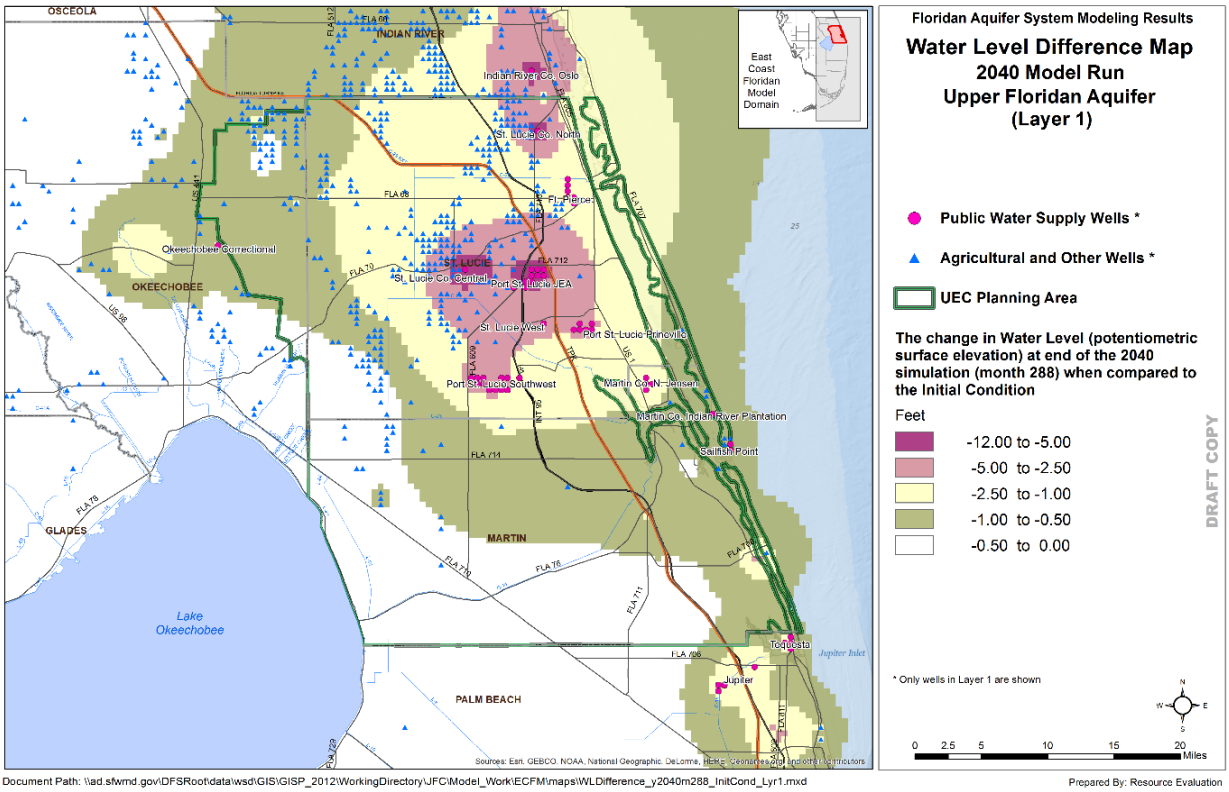

Figure 3-22. Water level changes between the initial condition and the end of the modeling period (month 288) using 2040 demand projections in the UPZ (Layer 1).

The SFWMD instituted regulatory protection of the FAS in the UEC Planning Area to ensure that users could equitably meet their water demands in a cost-effective manner while protecting the aquifer's flowing artesian head by restricting the use of pumps. Similar restrictions on pumps north of the planning area have not been adopted. This inconsistency has not been an issue to date, but could become one given the increased reliance on the FAS and the associated drawdown effects, and the need to protect existing legal users.

Water quality results are shown in **Figures 3-23** to **3-26** for the UPZ and the APPZ. Water quality results for the end of the 2040 simulation (month 288) is shown for the UPZ in **Figure 3-23**, while the change in water quality in the UPZ between the initial condition and the end of the 2040 simulation appear in **Figure 3-24**.

Water quality results in the APPZ for the end of the 2040 simulation (month 288) are shown in **Figure 3-25**, while the change in water quality in the APPZ between the Initial condition and the end of the 2040 simulation appear in **Figure 3-26**.

Modeling graphics and results, including individual well hydrographs and other regional results, are discussed further in Jurado and Giddings (2015). An evaluation of changes in horizontal and vertical flow direction and magnitude within a single aquifer layer or between aquifers through the confining units also are discussed.

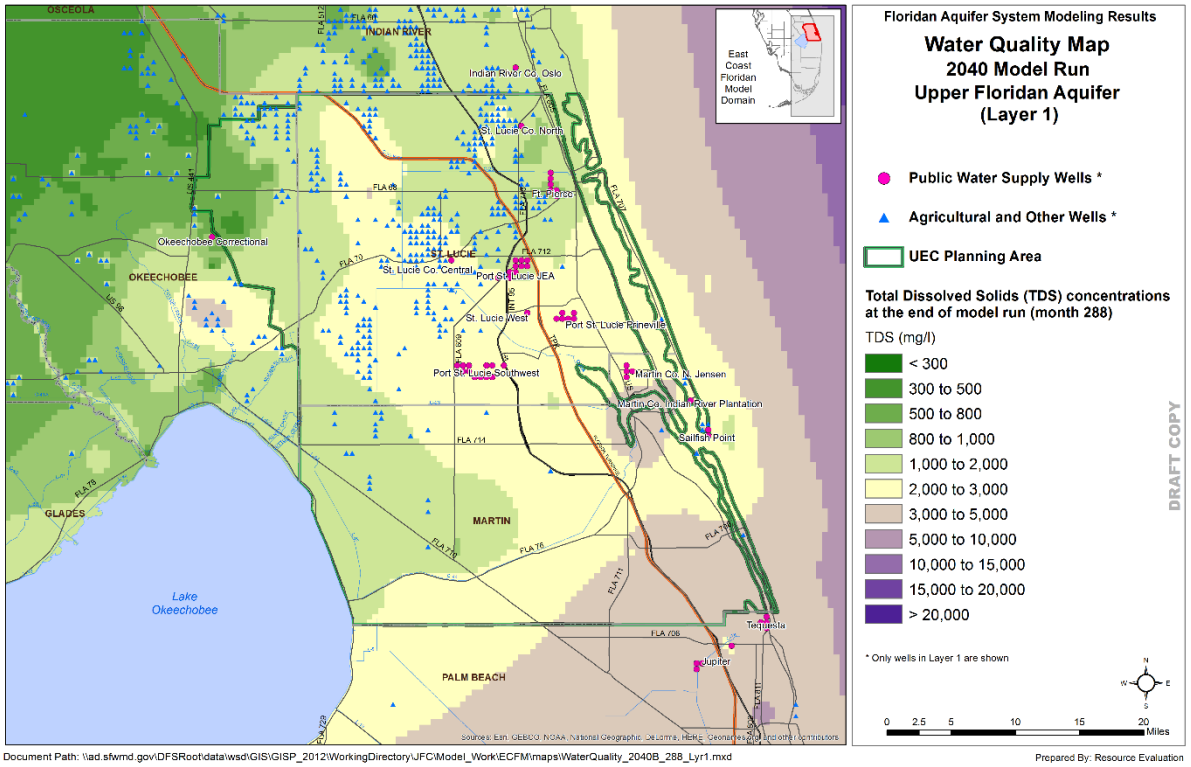

Figure 3-23. Water quality (TDS) at the end of the modeling period (month 288) using 2040 demand projections in the UPZ (Layer 1).

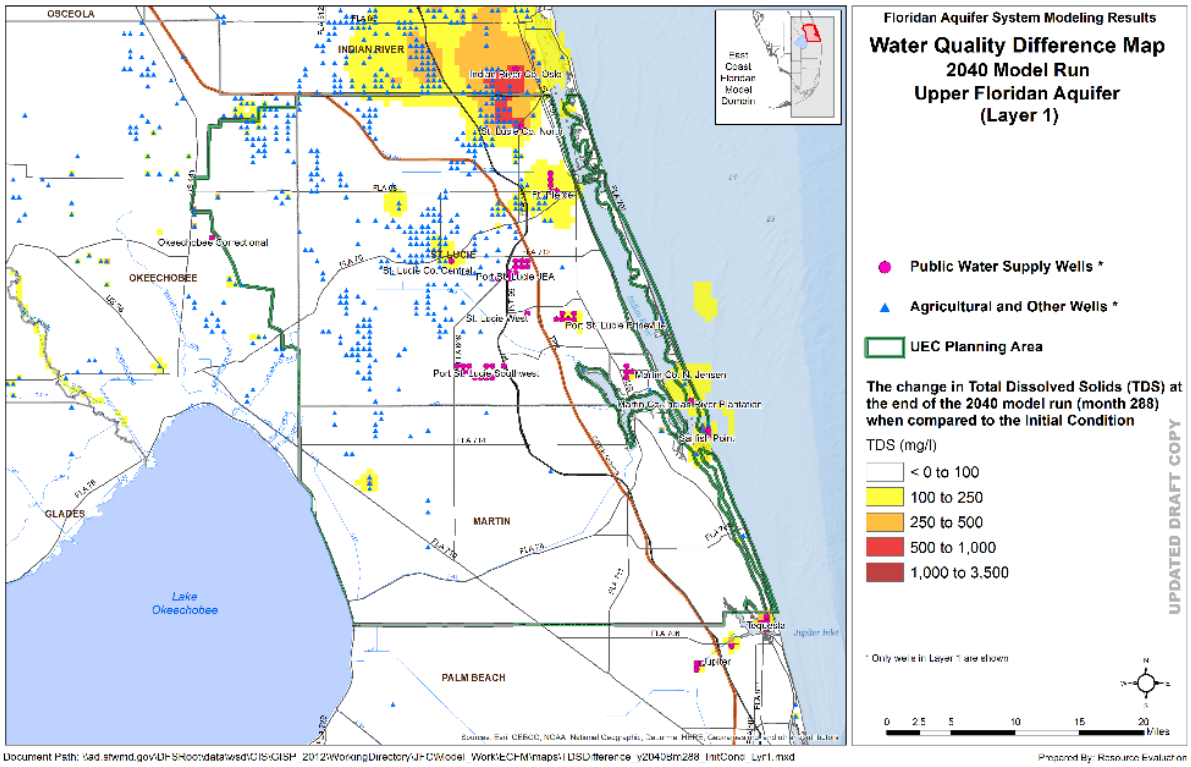

Figure 3-24. Water quality (TDS) changes between initial condition and the end of the modeling period (month 288) using 2040 demand projections in the UPZ (Layer 1).

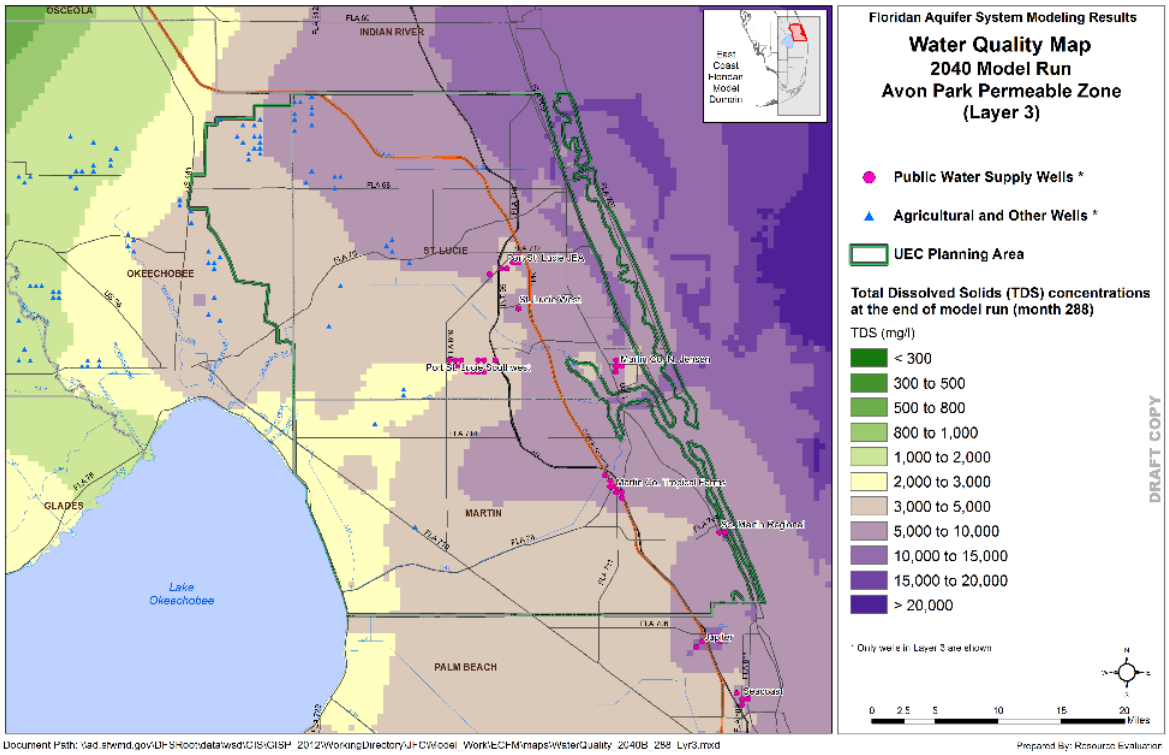

Figure 3-25. Water quality (TDS) at the end of the modeling period (month 288) using 2040 demand projections in the APPZ (Layer 3).

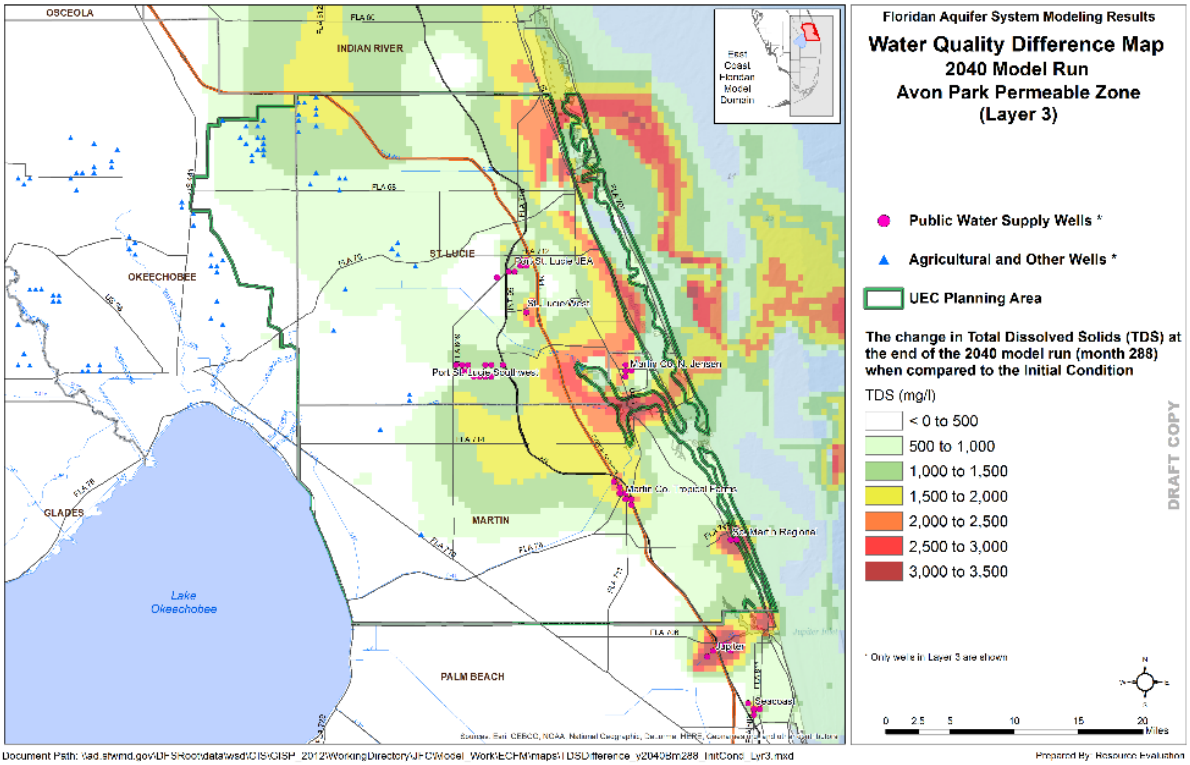

Figure 3-26. Water quality (TDS) difference between the initial condition and the 2040 run at the end of the modeling period using 2040 demand projections in the APPZ (Layer 3).

The results of the model simulations indicated that no widespread impacts are projected to occur in the FAS from 24 years of pumping levels to meet current and future demands. However, a few localized areas were identified where water quality degradation may occur and where water levels could be reduced to where the volume of water obtained from free-flowing wells would be diminished. It was concluded:

- The largest differences in water levels between the simulations in the UPZ are observed near the proposed Port St. Lucie Southwest wellfield and in the proposed St. Lucie County Utilities North and Central wellfields (**Figure 3-22**).
- The difference in water levels at the St. Lucie County Utilities Central wellfield in part is the result of the combined influence of this proposed wellfield with the existing Port St. Lucie JEA wellfield (**Figure 3-22**). The results may have been intensified because all withdrawals at the St. Lucie County Utilities proposed Central wellfield are assumed to come from a single model cell.
- A second noticeable difference in the UPZ occurs along the SJRWMD and SFWMD boundary in the water level change between the initial condition and the 2040 simulation (**Figure 3-22**). Water level differences of -5 to -16 feet in the 2040 run are caused by the proximity of Indian River County Utilities existing Oslo wellfield and the location of the proposed St. Lucie County Utilities North wellfield. The existing wells at the Oslo wellfield fall within a single model cell, and the proposed withdrawals of St. Lucie County's North wellfield also were assumed to come from a single model cell.
    - Continued withdrawals at current rates (2013) in southern Indian River County (in the SJRWMD) and northern St. Lucie County will have a combined effect on water levels and water quality in the UPZ.
    - Increased withdrawals at projected future rates (2040) will have a greater effect on water levels and water quality in the UPZ.
- Remaining areas show little or no change in water quality or water level in the UPZ through the model simulations. The water quality change in the UPZ between the initial condition and month 288 of the 2040 demands is shown in **Figure 3-24**.
- In the APPZ, water levels by and large declined less than 5 feet in the 2040 model simulation, except for three individual PWS wellfields where levels dropped between 5 and 12 feet.
- Some water quality degradation (increased TDS) will likely continue for (PWS) utilities drawing from the APPZ in St. Lucie, Martin, and northern Palm Beach counties. Water quality change in the APPZ between the initial condition and month 288 of the 2040 demands is shown in **Figure 3-26**.

Next Steps

The ECFM work that was conducted to support this plan update was recognized by SFWMD staff and stakeholders as comprehensive and provided insight to potential changes that may occur in the FAS over time. The results were used to identify areas that require further evaluation. It is recommended that these areas as well as some of the assumptions with the ECFM modeling continue to be looked at through a coordinated effort with utilities, agricultural and other stakeholders as well as the SJRWMD. Recommendations include the following:

- Coordination with utilities to facilitate successful long-term management of the FAS for PWS to implement the following, as appropriate:
  - Additional wells with greater spacing between wells
  - Lower capacity wells in the APPZ
  - Continued refinement of wellfield operational plans and communication of these refinements to the District for incorporation into the ECFM
- Coordination with agricultural stakeholders to better understand FAS use and define water quality tolerances for crops.
- Coordination with the SJRWMD on permitting, modeling, and planning issues that affect the UEC Planning Area. In particular, the SFWMD and SJRWMD should continue to evaluate resource conditions and, if warranted, pursue strategies to ensure regulator compatibility in this area.

SEA LEVEL RISE AND CLIMATE CHANGE

The potential water supply implications from climate change and sea level rise (SLR) continue to generate concerns across south Florida. Rising sea levels and increased air temperatures have been documented within the District and around the world. Other changes such as wider variability in rainfall and increases in evapotranspiration are more difficult to document and predict. Global models suggest substantial changes may occur in rainfall patterns, including longer dry periods between major rain events and more intense volumes of rain when wet conditions occur. Due to the very large scale of global models, the results are difficult to apply at the state, regional, and local levels.

Changes in rainfall in south Florida are difficult to predict because rainfall routinely varies widely seasonally and annually. Rainfall variability is partly due to global climate and atmospheric influences such as the El Niño Southern Oscillation and the Atlantic Multi-Decadal Oscillation. Another important factor in rainfall variability is the occurrence of tropical activity, which can create large rainfall volumes. Future changes in the frequency and intensity of tropical storms also may impact regional water availability.

If warming air temperatures cause an increase in evapotranspiration, as many experts expect, water demands would likely increase for the PWS, AGR, and REC water use categories. More frequent intense rainfall events with longer interim dry periods could increase total annual rainfall, but decrease effective rainfall as more water may be lost to runoff or tide.

SLR and climate change need to be considered in water use permitting rules, infrastructure design, the establishment of MFLs for water bodies and aquifers, water reservations, and potential declarations of water shortage. Satellite data from 1992 to present show that the rate of SLR has recently increased to more than 0.12 inches per year. Water managers and suppliers throughout south Florida need to better understand the potential changes to water supply sources due to SLR and climate change. Over time, the UEC Planning Area will need to prepare for and adapt to the evolving conditions. Information regarding the SFWMD analysis of current science, climate, sea level trends, and the potential impact to District operations and water supply are discussed in *Sea Level Rise and Climate Trends: Potential Impacts and Adaptation* (SFWMD in prep.).

Sea Level Rise and Saltwater Intrusion

SLR is occurring in the UEC Planning Area. For water supply, the primary concern of rising sea levels is the inland migration of salt water. In coastal south Florida, saltwater intrusion has been an issue since humans began draining lands for development and withdrawing groundwater for drinking or irrigation supplies. SLR will exacerbate the situation.

Most utilities in the UEC Planning Area use the SAS for all or part of their water needs and several utilities have limited ability to treat water to reduce chlorides. Thus, many utilities are required by their water use permit to maintain a network of monitoring wells in the SAS to identify possible inland movement of the saltwater interface. The three largest utilities using SAS wellfields near tidal surface waters are Stuart, SMRU, and both of Martin County Utilities' treatment plants (Tropical Farms and North Regional). SMRU and Martin County Utilities also use the FAS and RO treatment plants to meet a portion of their demand.

Density-dependent models can simulate the saltwater-freshwater interface. For the FAS, the ECFM has been developed using the SEAWAT model code to support water supply planning. The ECFM model runs conducted for this plan update did not include scenarios accounting for SLR, but the SFWMD anticipates making such modeling runs prior to a future update of this plan. A density-dependent model for the SAS would have to be developed.

Saltwater Intrusion Monitoring and Mapping

The SFWMD develops maps to document the position of the saltwater interface over time to protect its coastal aquifers. Salinity data from monitor wells was compiled from multiple sources (e.g., USGS, SFWMD, water use permittees) and contoured to estimate the position of the saltwater interface, defined herein as the line with 250 milligrams per liter (mg/L) chlorides. These maps were developed for coastal aquifers within the District except Miami-Dade County, which contracts this work out to the USGS. There are two series of maps that were developed, 2009 and 2014, with the plan to update the maps every 5 years. This approach will allow for tracking of the interface position over time, can be used to identify areas of concern that may require additional monitoring, and may suggest the need for changes in wellfield operations.

In general, the 2014 maps indicate that the interface is regionally dynamic, with inland movement in some areas and seaward movement in other areas. Local-scale investigation of the interface position could be warranted in areas of concern, depending on the network of monitor wells available, the proximity of saltwater sources to wellfield locations, and withdrawal rates.

UTILITIES OF CONCERN AND UTILITIES AT RISK

Introduction

In 2007, the SFWMD conducted an evaluation to identify PWS utilities that had supply sources vulnerable to the effects of drought, primarily saltwater intrusion. This effort produced a report titled *Utilities of Concern in the Upper East Coast Region* (SFWMD 2007), which classified vulnerable PWS utilities into two groups: Utilities at Risk and Utilities of

Concern. In 2015, these classifications were reevaluated to take advantage of new data and to reflect source diversification projects undertaken by PWS utilities since 2007. The updated classifications are displayed in **Table 3-3**.

Table 3-3. Updated classifications of Utilities at Risk and Utilities of Concern in the UEC Planning Area.

2007 Utilities at Risk	2007 Utilities of Concern
• City of Stuart • Miles Grant	• Fort Pierce Utilities Authority • Martin County Utilities North • South Martin Regional
2015 Utilities at Risk	**2015 Utilities of Concern**
• City of Stuart	• Fort Pierce Utilities Authority • Martin County Utilities North • South Martin Regional

Utilities with SAS wellfields vulnerable to the effects of drought (e.g., saltwater intrusion) can be classified as Utilities of Concern or Utilities at Risk depending on whether a utility has an alternate supply source that can be utilized in the event that the vulnerable wellfield becomes compromised. The definitions are as follows:

- **Utilities of Concern** include utilities that have SAS wellfields near the saltwater interface but have adequate supply provided by some combination of an inland wellfield, alternative sources, or interconnects with other utilities.
- **Utilities at Risk** include utilities with SAS wellfields near the saltwater interface that do not have an inland wellfield, have not developed alternative sources of water, or have limited ability to meet user needs through interconnects with other utilities.

Classifications Updated for 2015

Classifications were re-evaluated using 1) new maps of the estimated position of the saltwater interface in the SAS in Martin and St. Lucie counties, and 2) information on new capital improvement projects implemented by PWS utilities. The location of major PWS wellfields in the UEC Planning Area along with the estimated position of the saltwater interface for 2009 and 2014 are shown in **Figures 3-27** to **3-29**.

Miles Grant was purchased by Martin County in 2009, and its customers have since been connected to Martin County's regional system. Therefore, Miles Grant has been removed as a Utility at Risk. The City of Stuart remains a Utility at Risk because it still depends on the SAS and has limited access to alternative sources.

Identified as Utilities of Concern in 2007, Fort Pierce Utilities Authority (FPUA), Martin County North, and South Martin Regional remain classified as such. However, since 2007, the three utilities have diversified their supply sources by developing additional wellfield capacity in the FAS. The quantity of FAS supply available, at present, is not sufficient to warrant delisting these utilities from the Utilities of Concern classification, but as additional capacity is developed in the future, the classification can be re-evaluated. In many areas of **Figure 3-27**, the 2009 and 2014 saltwater intrusion isochlor lines overlap, indicating no changes in those areas.

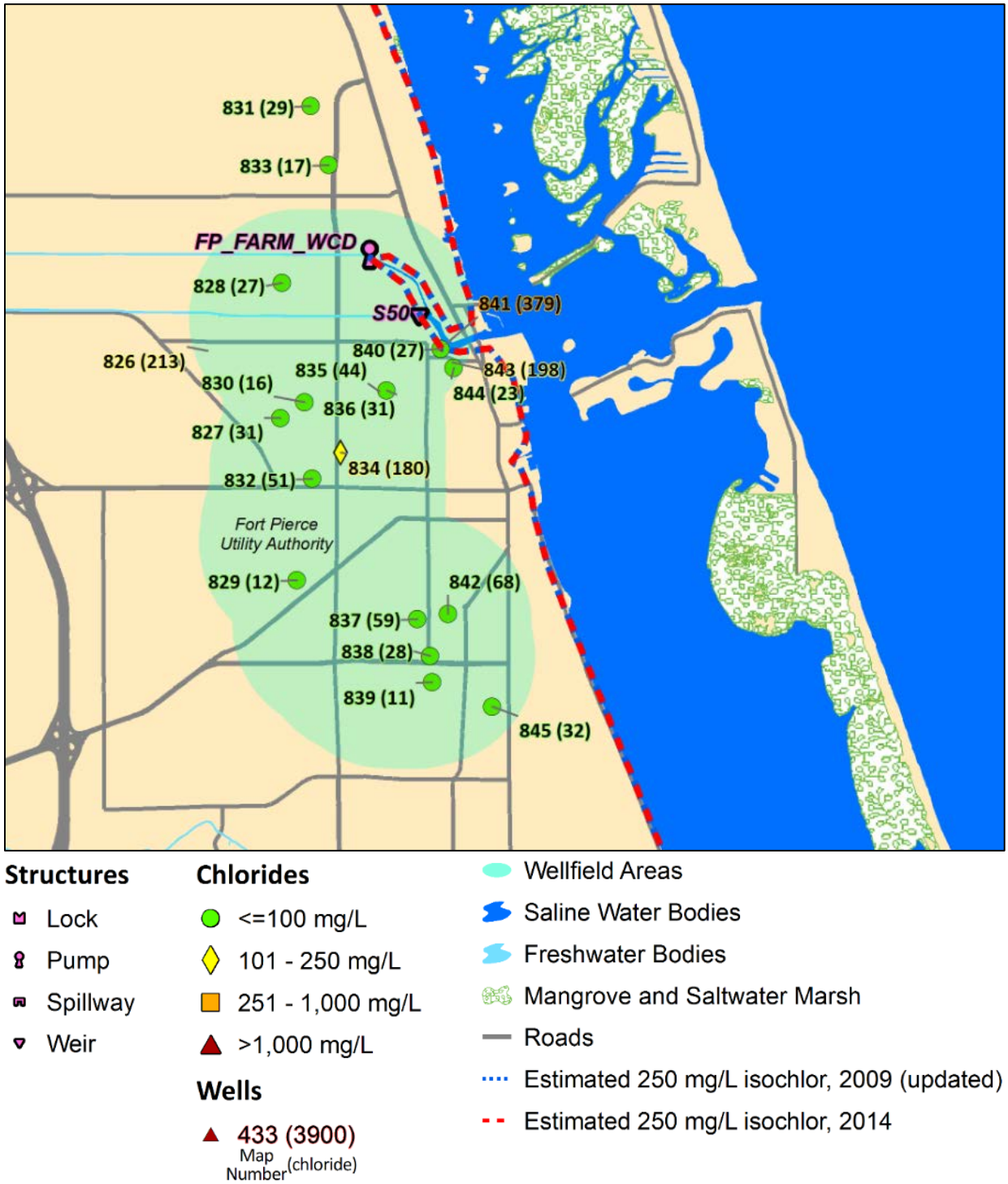

Figure 3-27. FPUA and saltwater intrusion isochlors in 2009 and 2014.

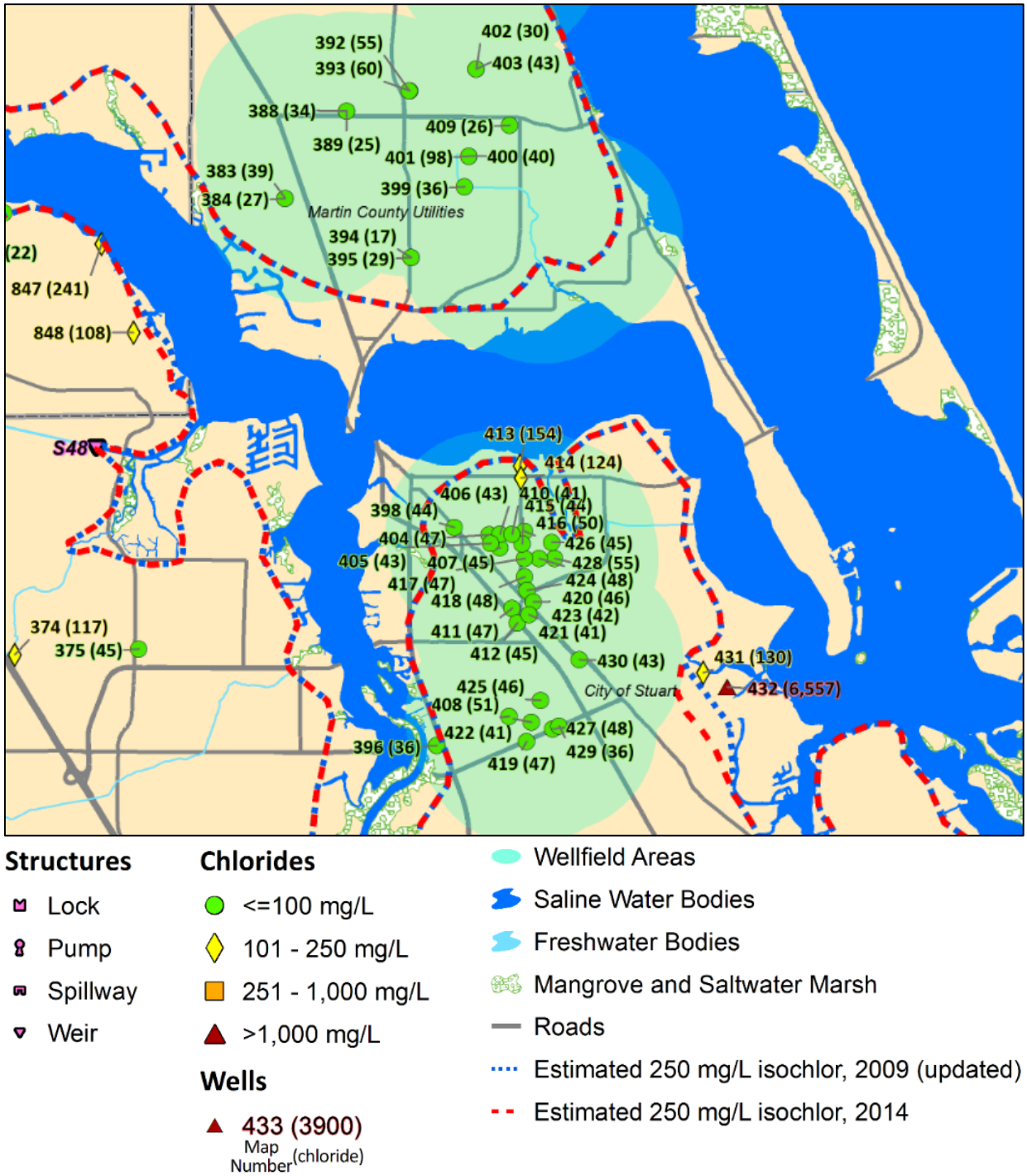

Figure 3-28. Saltwater intrusion isochlors in 2009 and 2014 near Martin County Utilities and the City of Stuart.

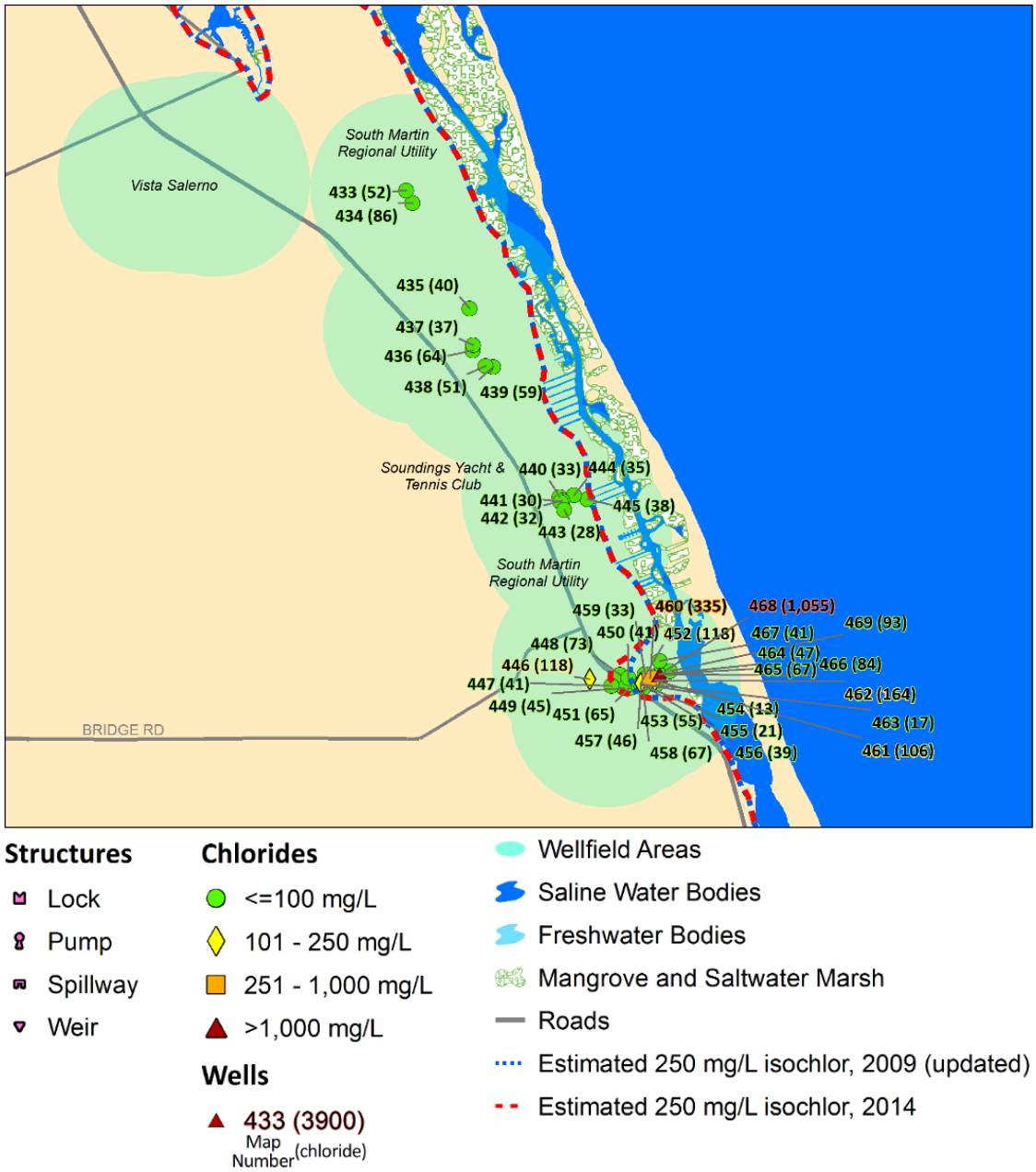

Figure 3-29. Saltwater intrusion isochlors in 2009 and 2014 near SMRU.

While the Utilities at Risk and Utilities of Concern classifications have not changed, each utility has taken steps to diversify their sources and manage their risk. Between 2005 and 2013, a total of 12 million gallons per day (MGD) of additional RO capacity to treat the brackish FAS water was added by FPUA and Martin County (additional 4 MGD and 8 MGD, respectively). In addition, the City of Stuart has entered into a long-term inter-local agreement with Martin County to purchase up to 0.8 MGD bulk potable water, has implemented a comprehensive water conservation program, and has constructed a water reclamation facility that provides reclaimed water for irrigation of green space within the City of Stuart. The City of Stuart also constructed a reclaimed water interconnect to provide excess reclaimed water to Martin County Utilities. This source diversification trend reduced vulnerability to the effects of seasonal drought for these utilities.

Source Diversification for PWS Utilities

In order to meet the challenge of increasing needs, saltwater intrusion, rising sea level, and increasing future climactic variability, utilities have diversified sources, expanded interconnections, and changed treatment technologies.

In 2014, finished water from the UEC Planning Area PWS utilities was 60.4 percent from the FAS and 39.6 percent from the SAS. Use of the FAS by utilities is expected to continue increasing to meet growth in PWS demands. **Figure 3-30** displays the shifting share of supply sources from 1998 to 2014 utilized by UEC Planning Area utilities. Additional discussion of the source diversification trend can be found in **Chapter 5**.

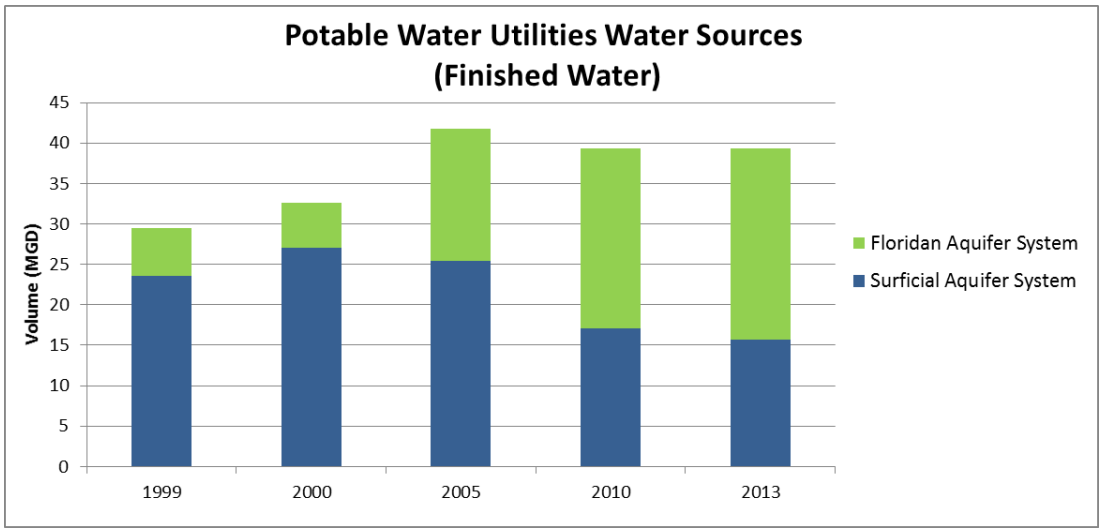

Figure 3-30. Shifting balance between FAS and SAS water sources relied upon by utilities in the UEC Planning Area (1999 to 2013).

SUMMARY

The findings and conclusions of the 1998 UEC Plan and the 2004 and 2011 UEC Plan Updates continue to represent the issues needing to be reviewed to meet the 2040 projected water demands within the UEC Planning Area. The following are findings regarding the availability of water resources within the UEC Planning Area to meet the projected 2040 water demands:

- New uses of surface water from the C-23, C-24, and C-25 canals are limited in accordance with RAAs.
- New uses of surface water from Lake Okeechobee and the C-44 Canal are limited in accordance with the LOSA RAA. The LOSA Water Availability Rule effectively limits future additional withdrawals from Lake Okeechobee and all surface waters that are hydraulically connected to the lake to prevent degradation of the level of certainty for existing legal users or change in the lake's MFL performance.
- The St. Lucie Estuary and the North Fork of the St. Lucie River are protected by MFL and Water Reservation rules.
- The SAS historically has served as the primary source of water for urban demands in the UEC Planning Area. Expansion of SAS withdrawals is limited due to potential

impacts to wetlands as well as the increased potential for saltwater intrusion. New or increased allocations of water from the SAS in coastal areas beyond those currently permitted require evaluation on an application-by-application basis.

- Most PWS utilities in the UEC Planning Area have the FAS as a source of potable water to meet some or all of their demands. The FAS will continue to provide a substantial and increasing portion of the water needed to meet 2040 projected demands.
- Surface water will remain the primary source for existing agricultural uses and the FAS will remain their supplemental source. Because agricultural crops have varying abilities to tolerate salinity, increasing TDS levels could cause problems for growers or limit the crop types grown. Additionally, potential decreases in FAS water levels increases the risk of artesian flow reductions for agricultural users in portions of St. Lucie County.
- Continued withdrawals at 2013 rates in northern St. Lucie County and southern Indian River County will have a combined effect on water levels and water quality in the UPZ. Increased withdrawals at projected future rates (2040) will have a greater effect on water levels and water quality in the UPZ. SFWMD staff should continue to coordinate with stakeholders and the SJRWMD regarding the use of the FAS in this area.
- There are areas in central and northern St. Lucie County where differences were observed in the UPZ water levels between the initial condition and the 2013 and 2040 simulations. Two of these areas are related to future new wellfields where the withdrawals from each wellfield occur from a single model cell.
- Most areas in the ECFM show little or no change in water quality or water level in the UPZ through the model simulations. In the APPZ, changes in water levels were seen at PWS wellfields through the model simulations.
- Some increases in TDS likely will continue for PWS utilities drawing from the APPZ in St. Lucie, Martin, and northern Palm Beach counties.
- To address changing conditions in the FAS, the SFWMD should coordinate with utilities to facilitate successful long-term management of the FAS for PWS to encourage greater spacing between new wells, lower capacity wells in the APPZ, and continue refinement of wellfield operational plans.
- The monitoring networks used for saltwater intrusion, aquifer assessment, and groundwater modeling is a hybrid of regional monitoring and monitoring required by or performed by water use permittees. Monitor wells have been lost due to changes in permit monitoring requirements and construction activities. Efforts should be made to identify wells considered critical to long-term monitoring and modeling to ensure that these wells are maintained or replaced as necessary. Periodic (annual) borehole geophysical logging of key monitor wells may be appropriate to track saltwater movement in particularly vulnerable areas.
- To meet the changing conditions from saltwater intrusions, rising sea level and increasing uncertainty in climatic conditions, utilities should continue to diversify their sources of water supply and treatment technologies. Utilities should consider expanding interconnections with other utilities and implementing groundwater recharge systems that utilize reclaimed water.
- To increase surface water availability, options to store excess water that is currently lost to tide should be considered.

4

Water Resource Development Projects

This chapter addresses the roles of the South Florida Water Management District (SFWMD or District) and other parties in water resource development projects and provides a summary of projects in the Upper East Coast (UEC) Planning Area. The water resource efforts presented in this chapter reflect the current budget categories the District uses for funding new and ongoing water resource development projects. The project summaries serve as an overview of water resource-related activities in the region. This document was created using the Fiscal Year (FY) 2015 Districtwide water resource budget and includes schedules and costs for FY 2015 to FY 2019. Additional detail on the status of these projects can be found in Volume II, Chapter 5A of the annual *South Florida Environmental Report* (available from www.sfwmd.gov/sfer).

TOPICS

- Regional Water Resource Development Projects
- Districtwide Water Resource Development Projects
- Comprehensive Everglades Restoration Plan
- Dispersed Water Management
- Summary

Florida water law identifies two types of projects to meet water needs: water resource development projects (subject of this chapter) and water supply development projects. Water resource development projects generally are the responsibility of water management districts. The projects support water supply development and are intended to ensure the availability of an adequate supply of water for all existing and future uses, including maintaining the functions of the natural systems. To fulfill the responsibility of providing water for the natural system, the SFWMD monitors the health of the natural system. Therefore, projects related to monitoring are included in this chapter.

Most water resource development projects do not yield specific quantities of water by themselves. Instead, these projects support water supply development and are intended to ensure the availability of an adequate supply of water for all existing and future uses, including maintaining the functions of natural systems. For example, hydrologic investigations as well as groundwater monitoring and modeling provide important information about aquifer characteristics such as hydraulic properties and water quality, which are useful for appropriate facility design, identifying safe yields, and evaluating the economic viability of water supply development projects.

Water supply development projects generally are the responsibility of water users such as utilities and involve the water source options described in **Chapter 5** to meet their needs. Specific water supply projects are identified in **Chapter 6** and **Appendix F**.

Water resource development is defined in Section 373.019(22), Florida Statutes (F.S.), as

> *the formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and underground water storage, and groundwater recharge augmentation; and related technical assistance to local governments, and to government-owned and privately owned water utilities.*

Water resource planning in the UEC Planning Area is influenced by the Comprehensive Everglades Restoration Plan (CERP). Authorized by the United States Congress in 2000, the CERP builds on and complements other state and federal initiatives to revitalize south Florida's ecosystem. There are multiple implementation phases within these efforts, which are supported by modeling, land acquisition, project controls, and technical services performed throughout the process. The CERP efforts are provided in this chapter and **Chapter 5** as well as in the SFER. Additionally, the Dispersed Water Management Program is addressed in this chapter, and the Aquifer Storage and Recovery Pretreatment Investigation is addressed in **Chapter 5**.

REGIONAL WATER RESOURCE DEVELOPMENT PROJECTS

The SFWMD funds development and application of numerical models for evaluation of groundwater and surface water resources in the District's five planning areas. These models support development of regional water supply plans, minimum flows and levels (MFLs), Water Reservations, and other projects benefitting a planning area's water resources. In the UEC Planning Area, water resource development projects generally focus on monitoring for MFLs and groundwater modeling. The District is currently performing the following modeling efforts with an emphasis on the UEC Planning Area.

East Coast Floridan Model

Regional groundwater flow models simulate the rate and direction of movement through the subsurface. The models include the major hydrologic components of the hydrologic cycle and are used in water supply planning to understand the effects of current and future water supply usage. The costs included in **Table 4-1** are for contracts (such as peer review) and staff time.

Table 4-1. Implementation schedule and costs for water resource development projects, FY 2015 to FY 2019 (Adapted from: SFWMD 2015b).

Water Resource Development Project		Estimated Finish Date	Plan Implementation Cost (in thousands)					
			FY 2015	FY 2016	FY 2017	FY 2018	FY 2019	**Total**
Regional Projects	Water Supply Planning (DA01)	Ongoing	$1,191	$1,200	$1,200	$1,300	$1,300	**$6,191**
	CFWI Project Facilitator (DA03)	2015	$25	*	*	*	*	**$25**
	CFWI Water Supply Planning Project (DA03)	2015	$457	$150	$150	$150	$150	**$1,057**
	CFWI/ECFT Model (DA03)	2019	$75	$30	$30	$30	$30	**$195**
	Water Supply Implementation (DB01)	Ongoing	$401	$401	$401	$401	$401	**$2,005**
	KCOL Long-Term Management Plan/KB Modeling & Operations Study[1] (FA09)	On hold	N/A	N/A	N/A	N/A	N/A	**N/A**
Regional Subtotal			**$2,149**	**$1,781**	**$1,781**	**$1,881**	**$1,881**	**$9,473**
Districtwide Projects	MFL, Water Reservation, and Restricted Allocation Areas Activities (DC01, DC09)	Ongoing	$751	$440	$440	$380	$380	**$2,391**
	Comprehensive Water Conservation Program (DD01, DD08)	Ongoing	$671	$675	$675	$675	$675	**$3,371**
	Alternative Water Supply (DE01, DE02)	Ongoing	$1,739	$1,740	$1,740	$1,740	$1,740	**$8,699**
	Drilling and Testing (DF05)	Ongoing	$198	$200	$200	$200	$200	**$998**
	Groundwater Monitoring (DF01, DF06)	Ongoing	$1,326	$1,330	$1,330	$1,330	$1,330	**$6,646**
	Groundwater Modeling (DF02, DF07, DA03)	Ongoing	$838	$840	$840	$840	$840	**$4,198**
Estimated Portion of C&SF Operation and Maintenance Budget Allocated to Water Supply[2]			$107,500	$107,500	$107,500	$107,500	$107,500	**$537,500**
Districtwide Subtotal			**$113,023**	**$112,725**	**$112,725**	**$112,665**	**$112,665**	**$563,803**
Total			**$115,172**	**$114,506**	**$114,506**	**$114,546**	**$114,546**	**$573,276**

C&SF = Central and Southern Florida Flood Control Project; CFWI = Central Florida Water Initiative; ECFT = East Central Florida Transient Model; FTE = full-time equivalent; KB = Kissimmee Basin; KCOL = Kissimmee Chain of Lakes; MFL = minimum flow and level; N/A = included in the CFWI water supply plan but not funded by the South Florida Water Management District.

* Project is complete; no future funding will be provided.

[1] Information on the Kissimmee Watershed Program is provided in Volume 1 of the South Florida Environmental Report.

[2] Approximated based on 50 percent of the FY 2015 Operation & Maintenance budget.

Use of the Floridan aquifer as a water source is anticipated to expand with the increased demand for water and limited availability of freshwater sources. The 2011 UEC Plan Update (SFWMD 2011) conveyed the District's intent to use the East Coast Floridan Model (ECFM) for water supply planning efforts and predictive analysis for the UEC Planning Area in this 2016 UEC Plan Update. The density-dependent groundwater flow and transport model of the Floridan aquifer system (FAS) covers the entire east coast of the District, extending from Indian River County in the St. Johns River Water Management District in the north to the Florida Keys in the south. The ECFM was calibrated and utilized to provide evaluation of regional conditions for the FAS in the UEC Planning Area. See **Chapter 3** of this document for further information on the model and results of the model runs.

The ECFM will continue to be used in the UEC Planning Area to evaluate potential changes to water use and projects. Additionally, the ECFM will be used in the future to evaluate water use of the FAS in the Lower East Coast Planning Area.

DISTRICTWIDE WATER RESOURCE DEVELOPMENT PROJECTS

Water resource development projects encompassing more than one planning area generally are considered Districtwide projects. **Table 4-1** summarizes the estimated costs and time frames for completion of the described Districtwide water resource development projects. Aspects specifically pertaining or relevant to the UEC Planning Area are identified within the context of the Districtwide projects. **Table 4-1** does not include other programs such as the CERP that have their own budgets and are primarily ecosystem restoration projects.

Development of AWS and source diversification is important to meeting Florida's future water needs and can reduce the effects of droughts in many areas. Through the Alternative Water Supply Funding Program, the SFWMD assists permittees in the development of reclaimed water projects, water reclamation facilities, brackish water well fields, reverse osmosis treatment facilities, and ASR well systems. From FY 2010 through FY 2015, the SFWMD provided more than $15.5 million in AWS funding for 52 projects; however, future funding is subject to severe budget constraints. In 2011, two projects within the UEC Planning Area generated 1.0 MGD of additional reclaimed water distribution. A full description of AWS-related projects and associated funding is contained in the SFWMD's Alternative Water Supply Annual Reports, prepared pursuant to Section 373.707(7), F.S., and published in Volume II of the SFER.

The following ongoing and future projects are discussed in this section:

- MFL, Water Reservation, and Restricted Allocation Area (RAA) Rule Activities
- Comprehensive Water Conservation Program
- Alternative Water Supply
- Drilling and Testing
- Groundwater Assessment
- Groundwater, Surface Water, and Wetland Monitoring
- Feasibility Studies

MFL, Water Reservation, and RAA Rule Activities

MFLs, water reservations, and RAA rules as well as water resource protection measures have been developed to help ensure the sustainability of water resources within the SFWMD. The costs included in **Table 4-1** are for contracts (such as groundwater monitoring) and staff time. For information on MFLs, water reservations, and RAAs, see **Chapter 3**, which summarizes the rules in effect as of 2015. Additional information can also be found in **Appendix B**.

Comprehensive Water Conservation Program

The long-standing conservation goal of the SFWMD is to prevent and reduce wasteful, uneconomical, impractical, or unreasonable uses of water resources. This is addressed through planning; regulation; and the use of alternative sources, including reclaimed water; public education; and demand reduction through conservation technology, best management practices and water-saving funding programs. The costs included in **Table 4-1** are for contracts and staff time.

The Comprehensive Water Conservation Program is a series of implementation strategies designed to create an enduring conservation ethic and permanent reduction in water use. It was approved in 2008 and developed in conjunction with stakeholders through the SFWMD's Water Resources Advisory Commission (WRAC). The program is organized into regulatory, voluntary and incentive-based, and educational and marketing initiatives. More detailed information about the Comprehensive Water Conservation Program can be found in **Chapter 5**. Additional supporting information can be found in **Appendix D** and in the draft *2016 Water Supply Plan Support Document* (SFWMD 2016).

Alternative Water Supply

The ability to meet the need for additional water supply hinges on efforts to develop region-specific sources that offer an alternative to traditional groundwater and surface water. Development of alternative water supply (AWS) projects and source diversification is important to meeting future water needs and can reduce the effects of droughts in many areas. Through the Alternative Water Supply Funding Program, the SFWMD assisted permittees in the development of reclaimed water projects, water reclamation facilities, brackish water wellfields, reverse osmosis treatment facilities, and aquifer storage and recovery (ASR) well systems. From FY 2010 to FY 2015, the SFWMD, in cooperation with the State of Florida, provided more than $15.5 million in AWS funding for 52 projects; however, future funding is subject to severe budget constraints. Two projects within the UEC Planning Area generated 1.0 million gallons per day (MGD) of additional reclaimed water distribution. A full description of AWS-related projects and associated funding is contained in the SFWMD's Alternative Water Supply Annual Reports, prepared pursuant to Section 373.707(7), F.S., and published in Volume II of the SFER. Additional information can be found in **Chapter 6** of this 2016 UEC Plan Update.

Drilling and Testing

Drilling and testing includes the installation of wells for short- to long-term monitoring of aquifer water levels. This work includes contract and staff time for items such as drilling and well construction, geophysical logging, pump tests, sediment analysis, and lithological descriptions. The costs included in **Table 4-1** are for contracts (such as drilling) and staff time.

Fort Pierce Floridan Well Drilling

The SFWMD's knowledge of south Florida hydrogeology is enhanced through the construction of exploratory/test wells. Such increased understanding has improved the accuracy of groundwater modeling and decision making regarding the approval of consumptive use permits. Full documentation of each well site (including location, well construction details, geophysical logging, and aquifer testing data) is provided in SFWMD technical publications as well as on the District's corporate environmental database, DBHYDRO, which is available from the SFWMD website at http://www.sfwmd.gov/dbhydro.

Groundwater Assessment

Groundwater assessment includes items such as reports on results of a drilling and testing program, the development of hydrostratigraphic maps and saltwater interface maps. The costs included in **Table 4-1** are for staff time.

Saltwater Interface Mapping

The SFWMD publishes maps displaying the estimated position of the freshwater-saltwater interface in the coastal surficial aquifer system (SAS) of St. Lucie, Martin, Palm Beach, Broward, Lee, and Collier counties to document the current inland extent of the saltwater front within the aquifer for future comparison. The most recent saltwater interface maps were developed and published in 2015, based on ongoing collection and analysis of groundwater monitoring data. Maps for Miami-Dade and Monroe counties are prepared by the U.S. Geological Survey (USGS).

Groundwater, Surface Water, and Wetland Monitoring

Information regarding the groundwater and surface water levels is essential to managing and protecting south Florida's water resources. Real-time data combined with historical information about water levels, weather, rainfall, and water quality changes help managers make water resource decisions. The costs included in **Table 4-1** are for contracts (such as USGS cooperative funding) and staff time.

Water level and water quality monitoring at existing wells provides critical information to aid the SFWMD in the development of groundwater models, assessing groundwater conditions, and management of these resources. The SFWMD maintains extensive groundwater monitoring networks and partners with the USGS to provide additional support for ongoing monitoring. Data are archived in DBHYDRO (the SFWMD's corporate environmental database), which stores hydrological, meteorological, hydrogeological, and water quality data. The USGS also monitors, archives, and publishes data annually.

Districtwide groundwater monitoring activities include the following:

- **USGS Contract for Water Level Monitoring –** An ongoing effort to collect data from groundwater level monitoring. The project includes well and recorder maintenance as well as archiving data in the USGS database for sites throughout the District.
- **Groundwater Monitoring –** An ongoing effort to monitor groundwater levels in all water supply planning areas of the SFWMD. As of 2015, Districtwide monitoring includes 755 active groundwater stations for the SAS, intermediate aquifer system, and FAS. Data are collected, analyzed, validated, and archived in DBHYDRO.
- **Regional FAS Exploration and Well Maintenance –** Water level and water quality monitoring is ongoing at 100 FAS well sites in the District as of 2015. Well maintenance is conducted as needed. Data are collected, analyzed, validated, and archived in DBHYDRO.
- **Hydrogeologic Database Improvements –** Backlogged data are being uploaded and miscellaneous database corrections are being made.
- **Monthly Groundwater Level Measurements** – Continued water level monitoring, including data collection, analysis, and validation, at select sites to supplement the existing groundwater level network.

Feasibility Studies

Feasibility studies evaluate potential options to meet specific needs. Below are two studies that were done in UEC Planning Area and SJRWMD.

St. Lucie and Indian River Counties Water Resources Study

The SFWMD and SJRWMD funded the St. Lucie and Indian River Counties Water Resources Study (HDR and HSW 2009) to determine storage options to increase surface water availability. Completed in November 2009, the St. Lucie and Indian River Counties Water Resources Study's objective was to 1) address excess surface water in St. Lucie and Indian River counties currently being discharged to the IRL by capturing, conveying, and storing the water to make it available for beneficial use; and 2) provide for increased flexibility of water management in these counties. In the study, median annual discharges to the IRL from the C-23, C-24, and C-25 basins were each identified as being approximately 130,000 acre-feet annually. In addition, approximately 100,000 acre-feet of water is discharged from the Indian River Farms Water Control District's Main, South, and North canals.

The study also evaluated the reconnection of the C-25 Basin in the SFWMD and the C-52 Basin in the SJRWMD. Reconnecting these basins could allow available water supplies to be conveyed across jurisdictional boundaries to more efficiently meet each district's water demands. Five

selected alternative plans were analyzed, resulting in the selection of a preferred alternative, and funding options are being explored by stakeholders.

Financial Feasibility Study of the Grove Land Reservoir and STA, Phase 2 Study

In August 2014, Hazen and Sawyer completed a study to assess the viability of the proposed Grove Land Reservoir and STA (Hazen and Sawyer 2014). The study conceptualized the completed project; estimated benefits, costs, and potential revenue; and projected the financial feasibility. Jointly financed by the land owner, SJRWMD, and SFWMD, the study concluded the project to be technically feasible as long as a sufficient water supply can be legally obtained from the C-23, C-24, and C-25 canals. Project partnerships and project governance will need to be developed.

COMPREHENSIVE EVERGLADES RESTORATION PLAN (CERP)

CERP is one of the largest environmental restoration programs in history. Congress authorized CERP in 2000, and the plan serves as a framework for modifications and operational changes to the Central and Southern Florida Flood Control Project (C&SF Project) to restore, preserve, and protect the land and water within the boundary of the SFWMD (**Figure 4-1**) while providing for other water-related needs of the region. The U.S. Army Corps of Engineers (USACE) is the lead federal agency and the SFWMD is the lead state agency for this multi-decadal effort. The USACE and SFWMD jointly implement CERP, a 50-50 cost share plan, which includes the planning and design of projects. One CERP project, the Indian River Lagoon – South (IRL-S) Project, is located within the UEC Planning Area.

Shallow-water retention projects provide local groundwater recharge, opportunities for water quality improvement, storage for excess flows, and rehydration of drained systems. While these projects are not constructed for water supply development, there are potential benefits towards offsetting seasonal impacts to water sources. The following summarizes the CERP and water retention projects in the UEC Planning Area.

CERP Indian River Lagoon – South Project

The CERP IRL-S Project, located within the UEC Planning Area, is designed to improve water quality within the St. Lucie Estuary and the IRL by reducing the damaging effects of watershed runoff; decreasing peak freshwater discharges to maintain salinity levels in the estuary; and reducing nutrient loads, pesticides, and other pollutants. The project may provide water supply for agriculture to offset reliance on the FAS. The CERP IRL-S Project is included in the integrated delivery schedule and located within the UEC Planning Area (**Figure 4-2**). Based on the current CERP integrated delivery schedule, the C-23 and C-24 components of the IRL-S Project are scheduled for design in 2018 and construction after 2020. Structural changes proposed for the watershed as part of the IRL-S Project Implementation Report (USACE and SFWMD 2004) are designed to provide additional retention basins (above-ground reservoirs), improved water conveyance facilities, and operational strategies within the watershed. The changes are expected to capture, store, and attenuate excess water previously discharged directly to tide and redistribute the water northward and southward via its historical flow pathways to be discharged down the St. Lucie River to the North Fork and South Fork. The objectives of the

retention basins are to help a) reduce the volume and frequency of damaging freshwater discharges to the St. Lucie Estuary; and b) restore a more natural volume, timing, and distribution of freshwater flow to the estuary, enhancing the opportunity for recovery of estuarine biota. Section 7.8.6 of the Final IRL-South Project Implementation Report and EIS (2004) stated the "SFWMD and USACE staff will need to develop processes that can allow non-traditional involvement of private interest while maintaining compliance with existing procurement regulations protecting fair and unbiased contracting procedures."

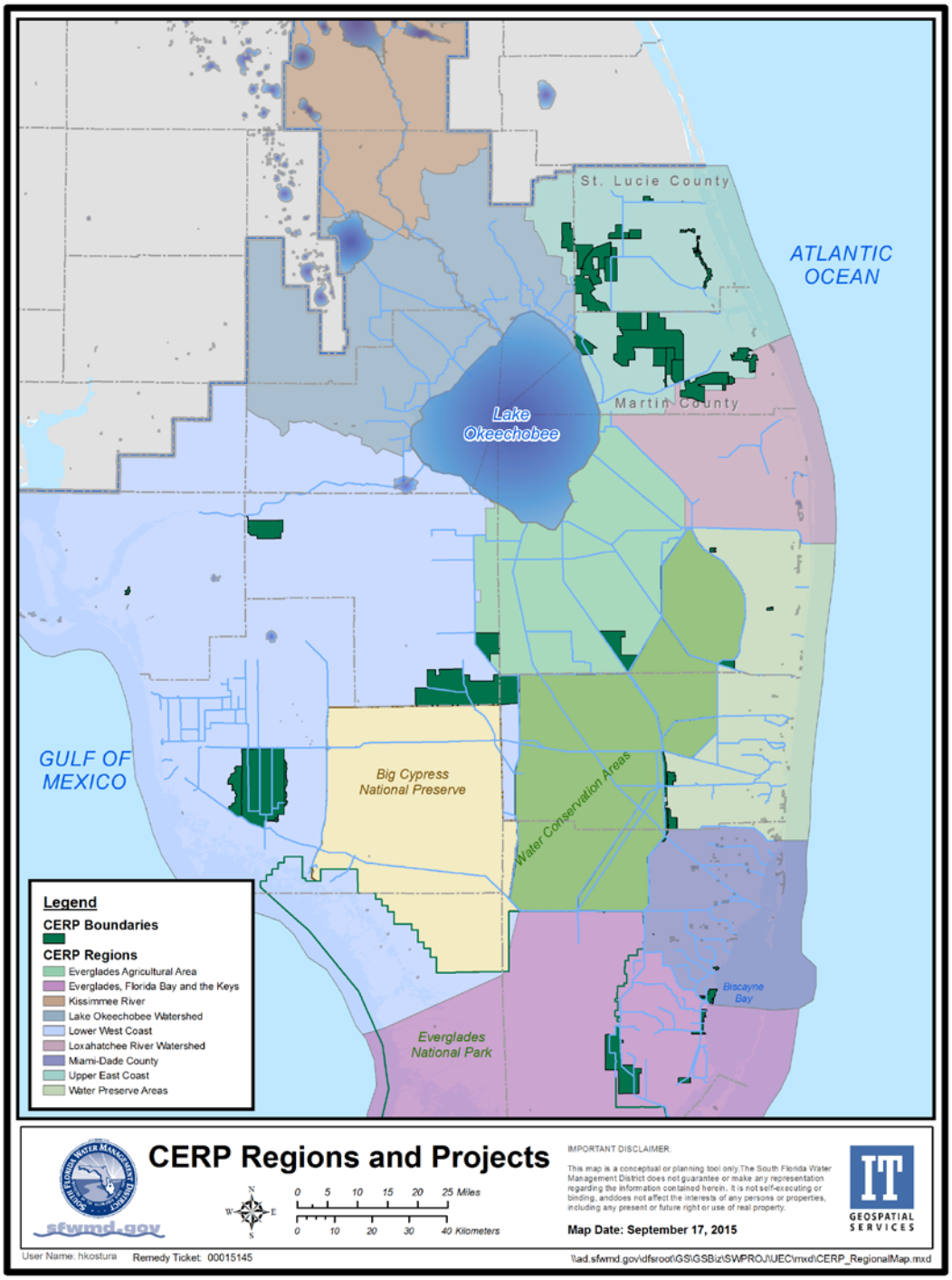

Figure 4-1. SFWMD CERP regions and projects.

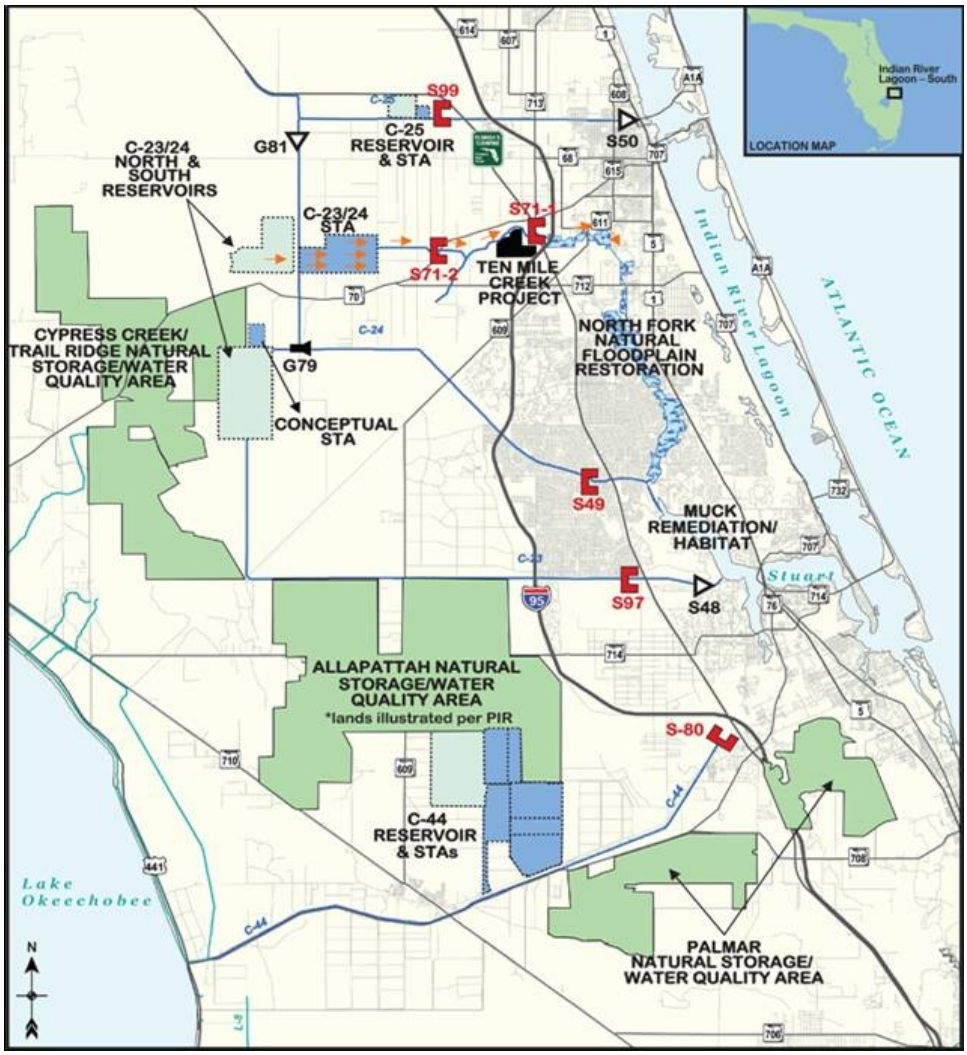

Figure 4-2. IRL-S Project components within the St. Lucie Watershed.

IRL-S Project Components

The CERP IRL-S Project Implementation Report details five features and operational modifications that together are expected to achieve its stated objectives (USACE and SFWMD 2004):

- Reservoirs
- Stormwater treatment areas
- Natural storage and treatment areas, including restoration within the North Fork floodplain
- Diversion
- Muck removal and the creation of artificial habitat within the estuary

Once constructed and in operation, six of the project features will convey water to the St. Lucie Estuary to restore more natural volume, timing, and distribution of water, which will help meet the estuary's MFL criteria. These six features as well as the remaining components of the IRL-S Project, are described as follows:

1. **C-23/C-24 North Reservoir and C-23/C-24 South Reservoir** – These features will capture water from the C-23 and C-24 canals, reducing the extreme peaks of freshwater discharge to the estuary and delivering water to meet fish and wildlife needs. Water stored in the reservoirs could be available to agriculture, which would reduce dependency on well water from the FAS (USACE and SFWMD 2004). Design of these reservoirs is projected to begin in 2018.

2. **Stormwater Treatment Areas (STAs)** – An STA will be built to treat water from the C-23/C-24 North Reservoir and C-23/C-24 South Reservoir. Operation of the C-23/C-24 STA is expected to reduce sediment, phosphorus, and nitrogen deliveries to the estuary and allow for restoration of estuarine water quality. Construction and operation of the STA in conjunction with the reservoirs is essential for delivering water of adequate quality for the restoration of this portion of the Greater Everglades ecosystem.

3. **C-25 Reservoir** – An above-ground reservoir capable of storing approximately 5,400 acre-feet on 741 acres as well as an STA of 163 acres, designed to capture the first 0.4 inches of runoff from the C-25 and Fort Pierce Farms basins. A reservoir location is identified on the north side of the C-25 Canal and adjacent to the S-99 structure. Water captured in the reservoir is to be delivered back to the IRL at Fort Pierce Inlet or could be made available to augment water supply.

4. **Diversions** – The diversion of existing flows via a canal connection and operating rules for new reservoirs and STAs will reduce the negative impacts of flows to the mid-estuary and provide for a more natural freshwater flow pattern to the North Fork of the St. Lucie River. Discharges from the C-24 outlet (S-49) will shift to the North Fork through the associated C-23/C-24 STA outlet. This northerly diversion will direct approximately 64,500 acre-feet of water from the C-23 and C-24 basins into the North Fork. This redirected water will provide increased dry season flows to the North Fork. Residual C-23 flows greater than natural system flows through Basin 4 will be directed to the C-44 Reservoir, STAs, and canal via the new proposed canal before discharge to the estuary through the S-80 Structure.

5. **Natural Storage and Treatment Areas, North Fork Floodplain Restoration** – Approximately 92,130 acres that have been disturbed by land use practices were identified within the C-23, C-24, and C-44 basins for acquisition and restoration. The planned natural storage and water quality treatment areas include the Pal-Mar Complex, Allapattah Complex, and Cypress Creek/Trail Ridge Complex. By restoring hydrologic conditions through the modification of on-site drainage features, these natural lands are expected to provide approximately 30,000 acre-feet of storage within the watershed through retention in natural wetland systems. The lands are also expected to improve water quality by reducing the amount of nutrient loading currently caused by large amounts of runoff. Additionally, the project includes restoring and preserving approximately 3,100 acres of floodplain wetlands and low-salinity habitat within the North Fork of the St. Lucie River. Restoring this portion of the river will provide additional water storage, maintain wading bird habitat, improve water quality, and protect areas that serve as a nursery area for larval and juvenile fishes.

6. **The C-44 (St. Lucie Canal) Reservoir and STA** – This component of the project will consist of a 3,400-acre above-ground reservoir, capable of storing 50,600 acre-feet of water, and 6,300 acres of STA, divided into six cells (**Figure 4-3**) that will operate independently from each other. The project is located in central Martin County on the north side of the C-44 Canal (**Figure 4-4**).

This project is intended to capture, store, and treat flood runoff from the C-44 Basin prior to its discharge back to the C-44 Canal and ultimately to the St. Lucie Estuary. Implementation of the project is expected to reduce damaging freshwater discharges, decrease nutrient loads, and maintain desirable salinity regimes within the St. Lucie Estuary and Indian River Lagoon. The SFWMD has acquired all of the required land and completed the design for the project. Various construction contracts to implement the project have been underway since 2010.

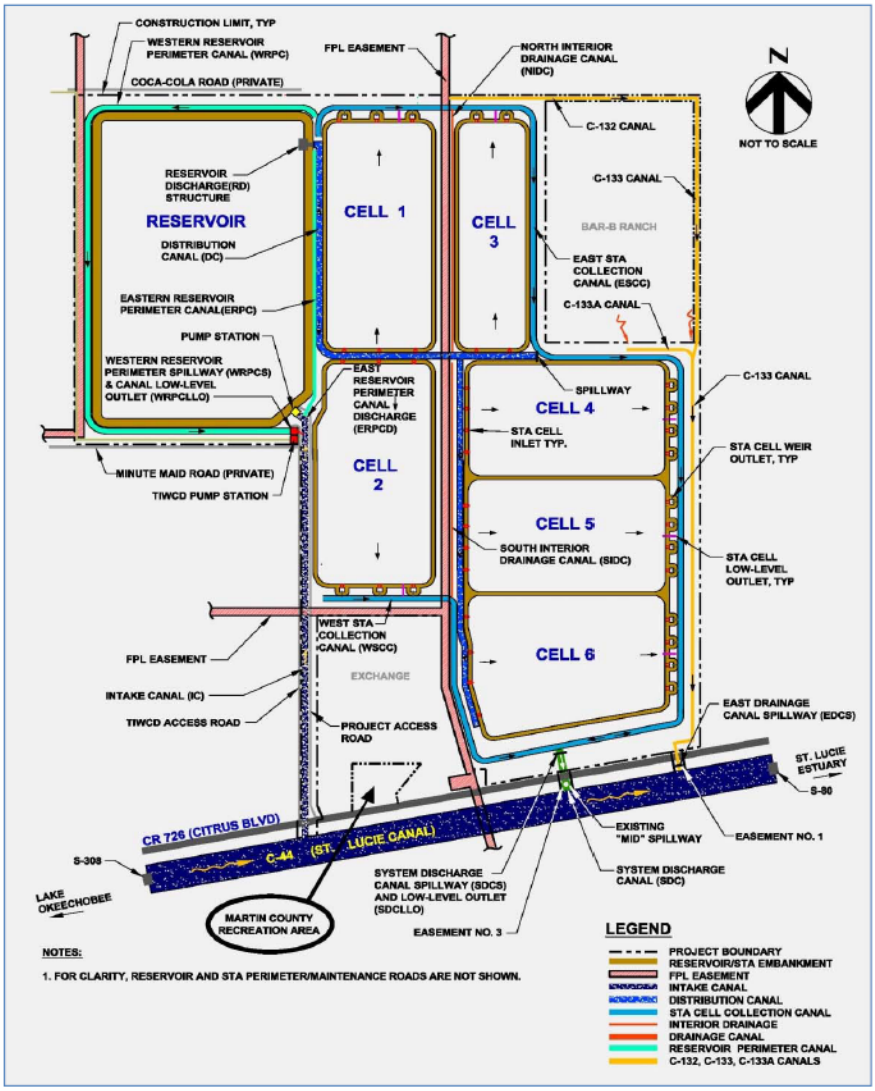

Figure 4-3. C-44 Reservoir and STA cells.

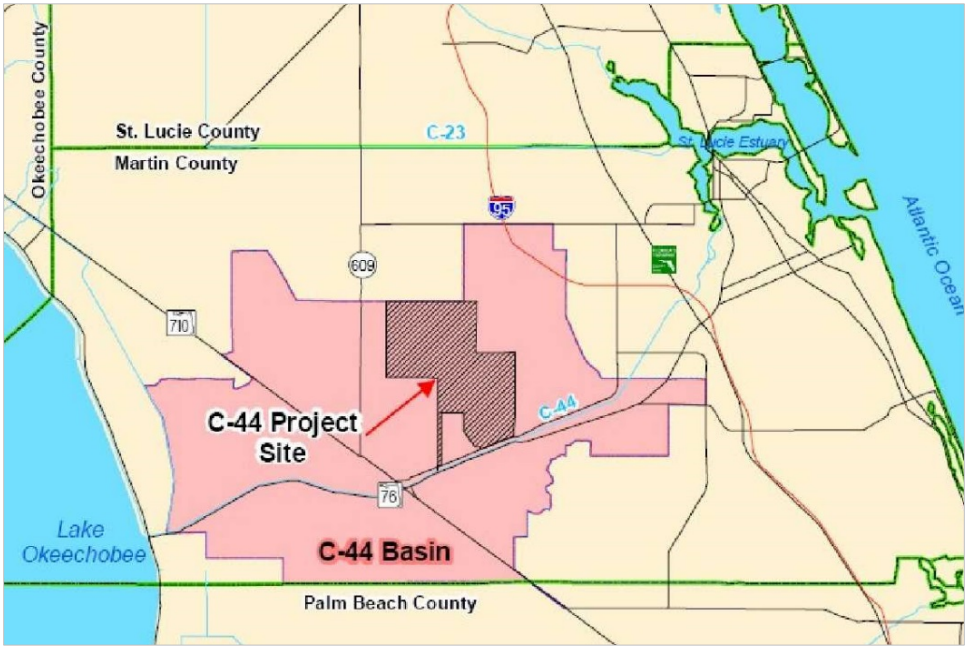

Figure 4-4. C-44 Reservoir and STA.

C-44 Construction S-404 Discharge Structure

In late 2010, the SFWMD completed realignment of Troup Indiantown Water Control District drainage and irrigation features to prepare the site for project construction. This allowed the drainage district to maintain autonomy by providing a separation from the project lands. A final contract to provide a permanent pumping station for the Troup Indiantown Water Control District will be initiated in FY 2016. In 2011, the USACE initiated the first major contract (Contract 1) for the C-44 project to construct the project's intake canal and access road, including the Citrus Boulevard Bridge, the C-133 Canal, and the eastern access roads. In 2012, the SFWMD initiated construction of the project communication tower and completed construction in December 2013. Contract 1 construction was completed by the USACE in July 2014. The SFWMD currently has two active contracts under construction for the C-44 Project. The system discharge structure and canal was completed in November 2015. Additionally, contractors are constructing the STA (to be completed in August 2017) and the reservoir pump station (to be completed in September 2018). The USACE started construction of the 3,400-acre reservoir in October 2015. Construction of the entire project is expected to be completed in 2020 (federal and state funds are used for this project).

Ten Mile Creek

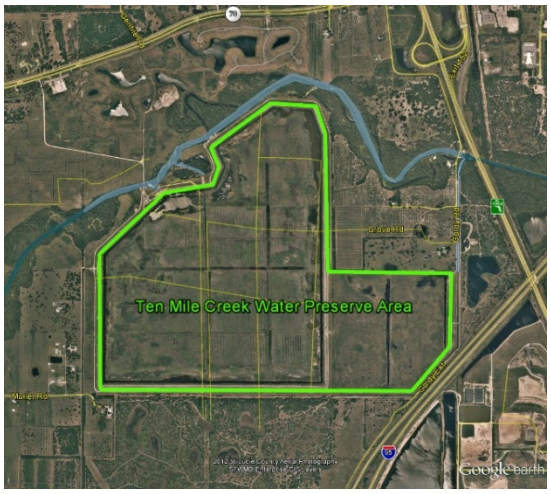

Figure 4-5. Ten Mile Creek WPA.

The Ten Mile Creek Water Preserve Area (WPA) (**Figure 4-5**) consists of a 526-acre water storage area and 132-acre polishing cell and was originally constructed by the USACE under the Water Resources Development Act of 1996. Currently, the U.S. Senate 2016 Appropriations Bill has a provision to de-authorize the project and return operation and maintenance responsibilities back to the SFWMD. The proposed project will eventually provide up to 4 feet of storage. The Ten Mile Creek WPA was designed to assist in the control of the quantity and timing of water deliveries to the St. Lucie River, help establish a more natural fresh water flow pattern to the St. Lucie River, provide up to 2,515 acre-feet of static storage, and improve water quality by moving water from the water storage area through the polishing cell prior to discharge back into Ten Mile Creek.

CERP ASR Regional Study

As part of CERP, the SFWMD and the USACE jointly developed the ASR Regional Study, which documents the results of more than a decade of scientific and engineering investigations and will serve as a technical guide when considering ASR as part of future Everglade's restoration efforts.

The ASR Regional Study incorporated the results from two pilot systems. One was constructed and tested along the Kissimmee River and the other along the Hillsboro Canal in western Boca Raton. The study included results from numerous regional investigations conducted by a multi-agency, multi-disciplinary team of scientists and engineers to address technical uncertainties. These investigations included a groundwater flow model, baseline ecological studies and geochemical analyses, which were integrated into a comprehensive regional environmental risk assessment. Essential findings from these projects are as follows:

- Economically efficient, large capacity (5 MGD) ASR systems can be built in south Florida. However, variability in aquifer characteristics makes it prudent to conduct an exploratory program before constructing surface facilities.
- To date, no "fatal flaws" have been uncovered that might hinder the implementation of CERP ASR. The results of the groundwater modeling evaluation indicate that the overall number of wells should be reduced from 333 wells to approximately 140 wells.
- The potential for rock fracturing and land subsidence resulting from ASR is very low, provided that the wells are spaced at safe distances from each other and that pumping pressures are kept low.

- Water recovered from the ASR pilot projects did not result in any quantifiable acute or chronic toxicologic effects on tested species, with the exception of a temporal inhibition of reproduction of a cladoceran (a type of water flea), which should be verified by additional testing.
- The potential from mercury methylation from storage and recovery of water from within the FAS has been determined to be very low. However, groundwater from the FAS has sulfate concentrations that are higher than those in surface water; therefore, recovery of ASR systems should be maintained so as not to result in deleterious concentrations of that constituent.
- Some reduction in nutrients were observed during ASR storage and subsequent recovery, which is postulated to be a result of microbial uptake, aquifer matrix filtration, or mineral precipitation.
- Implementation of CERP ASR should proceed in a phased approach, which includes expansion and continued testing of multi-well facilities and construction of new ASR systems at environmental restoration features that could be optimized by underground water storage, treatment, and recovery.

Prior to the release of the final report, the National Research Council (NRC) released a peer review of the ASR Regional Study in April 2015, concluding that it "significantly advances understanding of large-scale implementation of ASR in south Florida" (NRC 2015). An incremental adaptive restoration approach for ASR may involve one or more clusters of five ASR wells, perhaps including wells in both the UPZ and the APPZ, to address critical uncertainties such as recovery efficiencies, performance, long-term water quality and ecological effects.

The CERP ASR Regional Study Final Technical Data Report was released and can be found at http://www.saj.usace.army.mil/Portals/44/docs/Environmental/ASR%20Regional%20Study/Final_Report/ASR_RegionalStudy_Final_2015.pdf.pdf.

Additional UEC Water Supply-Related Efforts

Water supply development and restoration efforts are underway throughout the UEC Planning Area. In addition, some projects outside the boundaries of the UEC Planning Area impact the region's water supply. The following project descriptions are meant to serve as a brief overview of the additional water supply-related activities in and around the UEC Planning Area.

Northern Everglades and Estuaries Protection Program

Passed in 2000, the Lake Okeechobee Protection Act [Section 373.4595, F.S.] established a restoration and protection program for the lake. In 2007, the Florida legislature amended the Lake Okeechobee Protection Act to what is now known as the Northern Everglades and Estuaries Protection Program (NEEPP). NEEPP promotes a comprehensive interconnected watershed approach to protect Lake Okeechobee and the Caloosahatchee and St. Lucie rivers and their watersheds and includes the aforementioned watershed protection programs. The major components of the NEEPP Watershed Protection Plans are the phosphorus control program, construction projects, and research and water quality monitoring programs. The protection plans developed pursuant to NEEPP identify actions (e.g., programs and projects) to help achieve water quality and quantity objectives for the watersheds and restore habitat.

The coordinating agencies are jointly responsible for implementing NEEPP, each with specific areas of responsibility. The Florida Department of Environmental Protection's (FDEP's) Basin Management Action Plans in the Northern Everglades serve as the overarching water quality restoration plans. Other major responsibilities of the coordinating agencies include implementation of urban and agricultural source control programs, identification and implementation of water quality and quantity projects, and reporting and maintaining a monitoring network. For further information on NEEPP, please see Volume 1, Chapters 8 and 10 of the SFER at: www.sfwmd.gov/sfer.

Lakeside Ranch Stormwater Treatment Area

This project is a component of the Lake Okeechobee Watershed Construction Project. Phase I of the 2,700-acre STA is located in western Martin County and began operation in 2013. The performance evaluation shows phosphorous removal at a greater efficiency than projected for the first year. All three cells in Phase I are operational and the project is expected to achieve the targeted load reduction goal. Wetland vegetation has been established and is maintained under regular operations. Phase II construction is anticipated to begin in December 2015.

Indian River Lagoon Council

The Indian River Lagoon Council (IRL Council) was established in early 2015 as an independent special district of the State of Florida with the mission of building partnerships to restore and protect the IRL through implementation of a scientifically sound, community-based management plan. The IRL Council is the sponsoring agency of the IRL National Estuary Program, through which the council coordinates implementation of the Indian River Lagoon Comprehensive Conservation and Management Plan for lagoon restoration. The plan serves as the blueprint for restoration of the lagoon as mandated under the Section 320 of the federal Clean Water Act. The IRL Council includes Volusia, Brevard, St. Lucie, and Martin counties; FDEP; SFWMD; and the St. Johns River Water Management District (SJRWMD). In June 2015, the IRL Council voted to add the cities of Sebastian, Fellsmere, and Vero Beach to the council.

Dispersed Water Management

Since 2005, the SFWMD has been working with a coalition of governmental agencies, environmental organizations, farmers, ranchers, and researchers to enhance opportunities for storing excess surface water on private and public lands. These partnerships have made thousands of acre-feet of water retention and storage available throughout the Greater Everglades system. The effort known as Dispersed Water Management (DWM) programs includes the former pilot project Florida Ranchlands Environmental Services Project (FRESP), Northern Everglades Payment for Environmental Services (NE-PES), water farming, and interim public lands. The programs encourage property owners to retain water on their land rather than drain it and/or accept and detain regional runoff. Managing water on these lands reduces wet season water flow into Lake Okeechobee and the coastal estuaries.

DWM projects are constructed primarily to attenuate water releases, with ancillary benefits to water quality, increased opportunities for groundwater recharge, and habitat enhancement. Due to issues of seasonality and reliability associated with shallow storage, DWM projects are not constructed for the purpose of water supply development. Project locations are displayed in **Figure 4-6** and more information can be found at www.sfwmd.gov/storage.

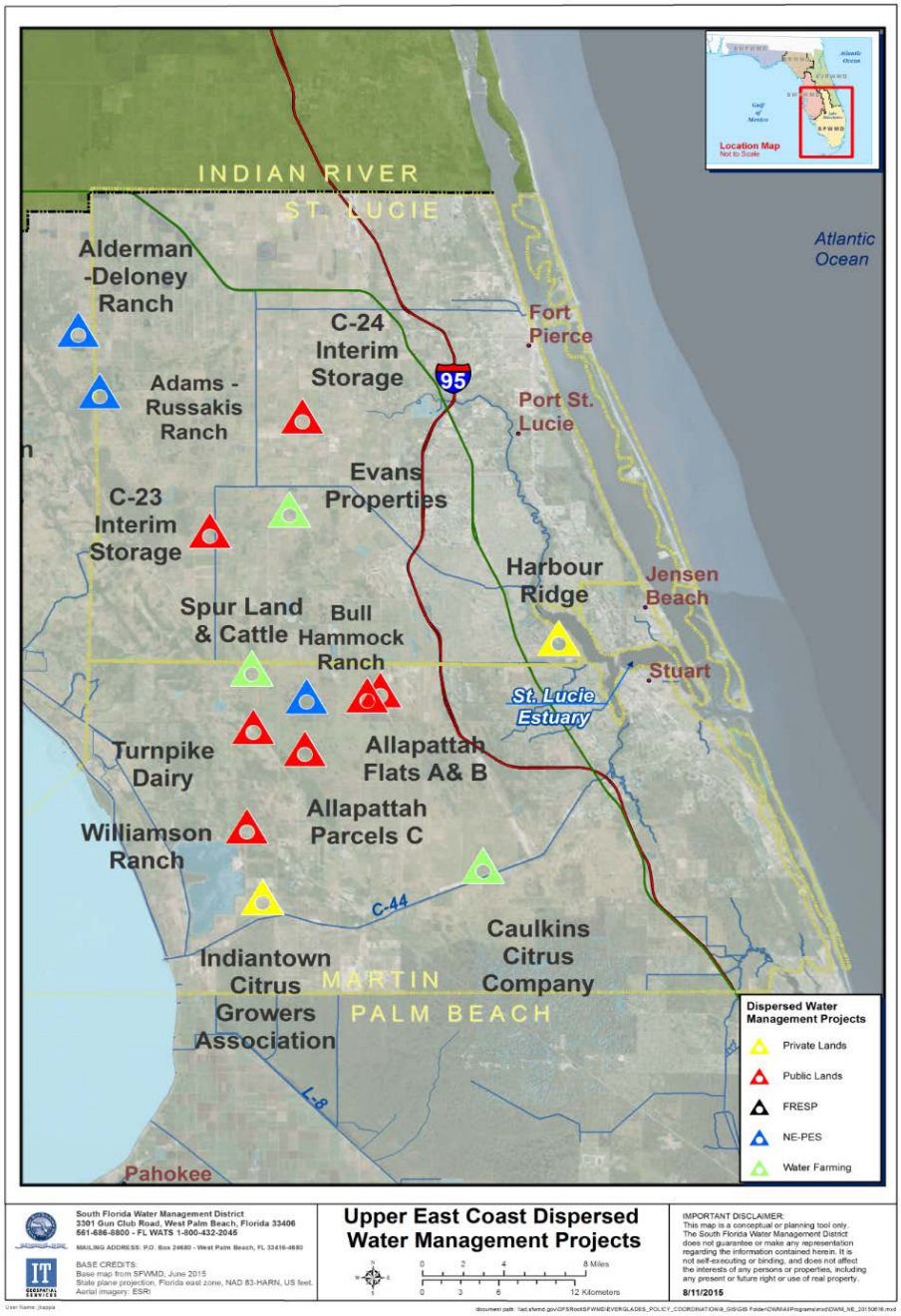

Figure 4-6. UEC Planning Area DWM projects.

Florida Ranchlands Environmental Services Project

FRESP was a pilot project in which ranchers in the Northern Everglades are compensated for providing water retention, total phosphorus load reduction, wetland habitat expansion, or other environmental services. The program is a collaboration among the World Wildlife Fund, participating ranchers, the U.S. Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS), Florida Department of Agriculture and Consumer Services (FDACS), the SFWMD, and FDEP. A number of original FRESP pilot projects have been converted to NE-PES projects.

Northern Everglades – Payment for Environmental Services

Based on the success of the FRESP pilot projects, the NE-PES program was developed as a partnership between water managers and private landowners to achieve environmental services such as water storage, water quality, and habitat improvement benefits in the Northern Everglades. The first eight NE-PES projects were approved by the District Governing Board in 2011 and six additional projects were approved in 2014. Three projects are within the UEC Planning Area.

Bull Hammock NE-PES – Martin County

Water Farming Projects

Water Farm Located on the C-23 Canal in Martin County

An innovative approach to delivering environmental services has emerged from the DWM Program. Using market-like concepts, the water farming concept seeks to field-test the potential for retaining water on fallow citrus lands to contribute to the delivery of environmental services. Under the DWM Program, the water farming pilot project offered eligible landowners the opportunity to compete for contracts to help determine the cost effectiveness and benefits associated with retaining water on fallow citrus lands. Currently, there are three water farming pilot projects operational within the UEC Planning Area. The District will review and analyze the results of these pilot projects to understand the costs and benefits for potential future funding.

- The Evans Ideal 1000 project consists of a 970-acre water farm adjacent to the C-24 Canal and has a designed water storage of 3,635 acre-feet per year, or approximately 14.4 MGD. This facility became operational in 2015 and the interim contract is due to expire in 2017.
- The Caulkins Citrus Company project is a 415-acre water farm adjacent to the C-44 Canal with a designed water storage capacity of 6,780 acre-feet per year, or approximately 40.7 MGD. This facility became operational in 2014 and the interim contract is due to expire in 2016.
- The Spur Land and Cattle project is a 60-acre water farm adjacent to the C-23 Canal with a designed water storage capacity of 870 acre-feet per year, or approximately 20.3 MGD. This facility became operational in 2015 and the interim contract is due to expire in 2017.

SUMMARY

Water resource development projects serve various purposes in support of water supply development. Benefits of the water resource development projects reviewed in this chapter include the following:

- Improved understanding of the hydrogeology and water availability of the region
- Increased future supply availability
- Preservation of existing supplies through better understanding, management, and continued monitoring of resources
- Prevention of the loss of the natural system
- Water conservation to protect water sources and provide an efficient way to expand current water supplies
- Development of the ECFM for evaluation of regional conditions for the FAS in the UEC Planning Area
- Coordination with other agencies and stakeholders to exchange hydrogeologic knowledge and data

5

Water Source Options

This chapter presents an evaluation of water supply options and water conservation measures available through 2040 within the Upper East Coast (UEC) Planning Area of the South Florida Water Management District (SFWMD or District). To accommodate future urban and agricultural growth while still meeting the needs of the ecosystem, region-specific evaluations were conducted within the context of the issues identified in **Chapter 3**.

TOPICS

- Water Sources and Options
- Water Source Options Summary
- Water Conservation
- Water Conservation Summary

WATER SOURCES AND OPTIONS

In the UEC Planning Area, freshwater source options are considered traditional water sources and include groundwater from the surficial aquifer system (SAS) and surface water from a regional network of canals — primarily from the C-23, C-24, C-25, C-44, and connected canals. Non-traditional or alternative water source options include brackish groundwater from the Floridan aquifer system (FAS), reclaimed water, seawater, and water stored in aquifer storage and recovery (ASR) and reservoirs. In addition, water conservation demand management is a key element in meeting future water needs.

This chapter includes descriptions of water source options, current and projected uses, and factors that affect availability for water supply purposes in addition to water conservation. More detailed information about water conservation and related costs is provided in the *2016 Water Supply Plan Support Document* (Support Document) (SFWMD 2016). Water treatment technologies and associated costs also are presented in the Support Document.

Groundwater

Two major aquifer systems: the SAS and the FAS lie beneath the UEC Planning Area. The SAS provides fresh groundwater and the upper portion of the FAS provides brackish groundwater to the UEC Planning Area. The FAS is composed of the Upper Floridan aquifer (UFA) and the Lower Floridan aquifer (LFA). The UFA is further divided into three zones with the Upper Permeable Zone (UPZ) and the Avon Park Permeable Zone (APPZ) being the major water-bearing units. **Figure 5-1** illustrates the relationship of the hydrologic units underlying the UEC Planning Area.

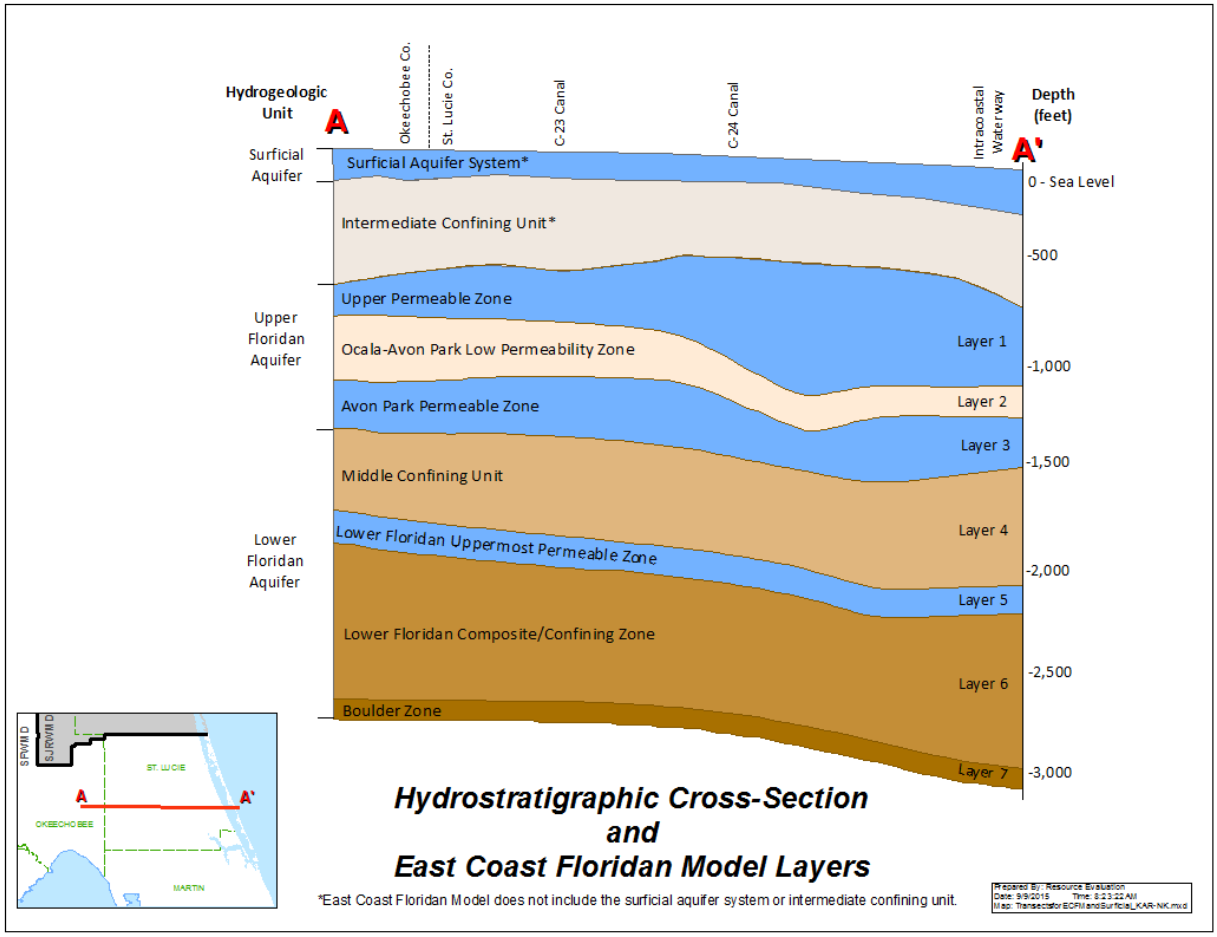

Figure 5-1. Generalized hydrogeologic cross-section of the UEC Planning Area.

Fresh Groundwater

Historically, the SAS has been the primary source of potable water for public consumption and urban irrigation throughout the UEC Planning Area. From a regional perspective, the development of the SAS generally has been maximized over time, and potential increases in allocation are limited, especially in coastal areas. The SAS is recharged by infiltration from rain and local surface water bodies. Water availability from the SAS is limited by the rate of recharge and water movement in the aquifer, wetland impacts and off-site land use, proximity to contamination sources, saltwater intrusion, and other existing legal users in the area. In many areas, additional water supplies from the SAS may only be permitted and developed on an application-by-application basis, depending on the quantities required, local resource conditions, and the viability of other supply options.

WATER OPTIONS

Freshwater sources include those sources historically used as the region's primary sources of water. Water quality and availability determine the viability of freshwater sources, and differ from region to region. Where freshwater sources are determined to have limited availability, alternative water sources must be identified and developed. Fresh groundwater contains less than 1,000 milligrams per liter (mg/L) of dissolved solids.

In 2005, the SAS provided approximately 60 percent of the Public Water Supply (PWS) while brackish sources delivered approximately 40 percent. However, by 2013 this changed and approximately 40 percent of the PWS. The percentage of SAS use for PWS is projected to continue decreasing over time as the use of other alternative water sources such as brackish water increases.

Brackish Groundwater

In the UEC Planning Area, the UFA is used extensively by PWS utilities and agricultural permit holders as a supplemental irrigation source when surface water availability is limited. In the UEC Planning Area, the productivity of the UFA is considerably greater than that of the SAS, and throughout most of the planning area, the FAS is under artesian conditions (the wells flow naturally at land surface without the need for a pump). As discussed in **Chapter 3**, pumps are prohibited on flowing FAS wells in Martin and St. Lucie counties that increase the flow above the natural flow from the well.

In the UEC Planning Area, water in the FAS is brackish and the quality decreases substantially from central Florida to south Florida, increasing in hardness, chlorides, and salinity. Salinity also increases with depth, making the deeper producing zones less desirable for development than shallower parts of the system. For agricultural purposes, the water from the UFA generally is blended with fresh water from the SAS or surface water to reduce potential problems associated with salinity.

WATER OPTIONS

Brackish (saline) groundwater is defined as water with a total dissolved solids concentration greater than 3,000 mg/L and less than 10,000 mg/L. The terms fresh, brackish, saline, and brine are used to describe the quality of water. Although brackish supplies in the low range of these salinities may be used for some agricultural purposes, this raw water does not meet public drinking water standards. Advanced treatment technologies, such as reverse osmosis, electrodialysis, or electrodialysis reversal, must be employed before this type of supply is suitable for human consumption.

Utilities in the UEC Planning Area that draw on the FAS as a drinking water source use reverse osmosis (RO) to remove excess salinity as part of the treatment process. To some extent, FAS water can be blended with freshwater and treated with lime softening or nanofiltration technology to meet drinking water standards for chlorides. The ability to use blending depends on the water quality of the FAS water and other treated water produced by the utility. Blending can increase production efficiency.

Currently, approximately 60 percent (25 million gallons per day [MGD]) of the water supply used by PWS in the UEC Planning Area is derived from the FAS. The ratio of FAS to SAS use to meet demands has increased since 1999 as indicated in **Figure 5-2**. The use of the FAS as a supply source for PWS is expected to increase further to accommodate the area's growth through 2040. In this 2016 UEC Plan Update, local utilities have proposed an additional 36 MGD of brackish water development by 2040.

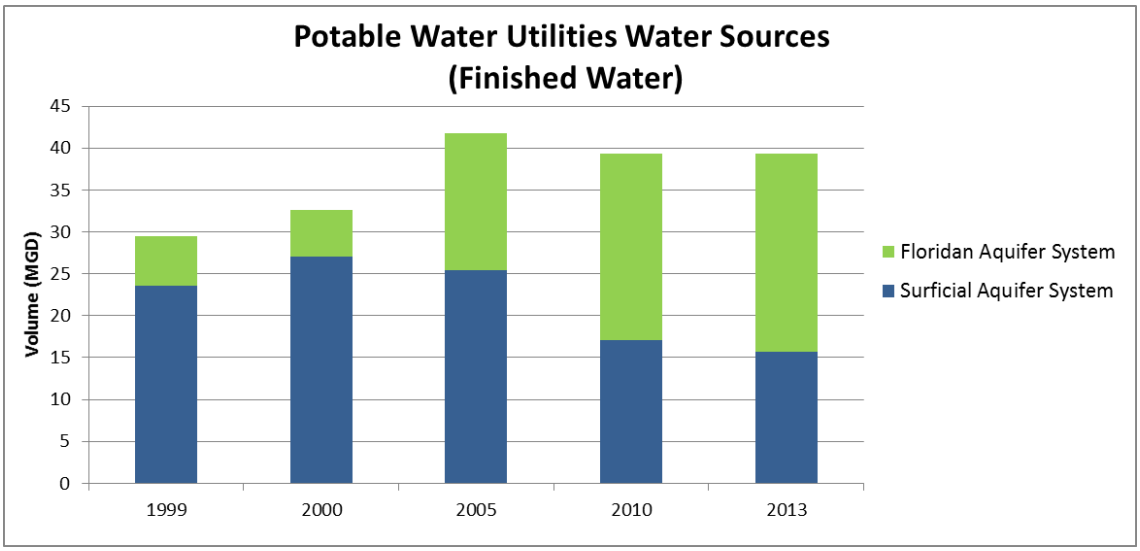

Figure 5-2. Potable water utilities water sources (1999 to 2013).

As discussed in **Chapter 3**, an FAS monitor well network was established in the UEC Planning Area to monitor water levels and quality. Analyses of projected FAS demands in previous water supply plans did not indicate major long-term reductions in water levels or quality. More recent water level and quality data from the FAS confirm no discernible trends to the contrary.

Current water supply planning modeling analyses, in combination with consumptive use permitting activities, indicate the FAS could supply sufficient water to meet all PWS demands through 2040. In addition, the FAS meets the supplemental water needs of agricultural users during a 1-in-10 year drought event without exceeding the resource protection criteria. The most recent regional modeling of the FAS in the UEC Planning Area has focused on potential changes to water levels and quality in the FAS. A density-dependent numerical model, the East Coast Floridan Model (ECFM), was developed, calibrated, and used as an analysis tool to evaluate the effects of proposed withdrawals on the FAS in the UEC Planning Area. For further information on the ECFM, see **Chapter 3**.

Surface Water

Surface water is water that has not penetrated much below the surface of the ground. Surface water bodies are used for regional water supply in the UEC Planning Area, primarily by Agricultural Self-Supply (AGR). In this Plan Update, storm water is included with the discussion of surface water. Because there is a lack of surface water and stormwater storage in this region, the availability of surface water may be limited and unable to meet demands during times of reduced rainfall.

In the UEC Planning Area, the District operates and maintains the C-23, C-24, C-25, and C-44 canals, and the U.S. Army Corps of Engineers (USACE) operates and maintains Lake Okeechobee, all of which are primary surface water sources in the region. As discussed in **Chapter 3**, Restricted Allocation Area (RAA) rules were established due to limited surface water availability and canal bank instability at low stages in the canals. The RAA prohibited increased allocations of surface water from the C-23, C-24, and C-25 canals as well as their directly connected canals; the Loxahatchee River Watershed water bodies; and the Lake

Okeechobee Service Area (LOSA) – including the lake – above existing or historic allocations. In addition, minimum flows and levels (MFLs) were established for the St. Lucie Estuary and the Northwest Fork of the Loxahatchee River. A Water Reservation was adopted for the North Fork of the St. Lucie River in March 2010. RAAs, MFLs, and Water Reservations must be considered when determining surface water availability (see **Chapter 3**).

Lake Okeechobee provides water to some agricultural users throughout the year and is critical for flood control during wet periods. Increased allocations from the lake are limited due to the implementation of the 2008 Lake Okeechobee Regulation Schedule (2008 LORS) by the USACE. Surface water users within the LOSA have only a 1-in-6 year drought level of certainty.

C-24 Canal and S-49 Structure in St. Lucie County

A surface water budget analysis included in the 1998 UEC Water Supply Plan assessed availability for water supply in three major surface water basins around the C-23, C-24, and C-25 canals within the UEC Planning Area. Results of the analysis verified that during a 1-in-10 year drought condition, surface water availability with the existing canal and storage network is not adequate to support the water supply demands placed on this water source. Water from the FAS has been used as a supplemental source for citrus irrigation when surface water was not available. However, because the FAS is brackish, its use as a supplemental source is limited for some crop types.

Another source option for the UEC Planning Area is to capture, treat, and store seasonally available surface water and storm water in reservoirs or ASR. In the St. Lucie and Indian River Counties Water Resources Study (HDR 2009), median annual discharges to the IRL from the C-23, C-24, and C-25 basins were each identified as being approximately 130,000 acre-feet annually. Regional storage projects, which are components of the Comprehensive Everglades Restoration Plan (CERP) Indian River Lagoon – South (IRL-S) Project, may enhance surface water availability. In addition, there are two proposed water supply project options (City of Port St. Lucie McCarty Ranch Reservoir, and Grove Land Reservoir and STA) that are addressed in **Chapter 6**. Opportunities to capture freshwater resources are addressed in the *New Storage Capacity for Surface Water or Groundwater* section of this chapter.

Reclaimed Water

Reclaimed water is water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility [Rule 62-610.200, Florida Administrative Code (F.A.C.)]. Reuse is the deliberate application of reclaimed water for a beneficial purpose. Criteria used to classify projects as "reuse" or "effluent disposal" are contained in Rule 62-610.810, F.A.C. The term "reuse" is synonymous with "water reuse."

Reclaimed water is a key component of water resource management in south Florida. Potential uses of reclaimed water include landscape irrigation (e.g., medians, residential lots,

and golf courses), agricultural irrigation, groundwater recharge, industrial uses, environmental enhancement, and fire protection.

The State of Florida encourages and promotes the use of reclaimed water. The Water Resource Implementation Rule [Chapter 62-40, F.A.C.] requires the Florida Department of Environmental Protection (FDEP) and water management districts to advocate and direct the reuse of reclaimed water as an integral part of water management programs, rules, and plans. The SFWMD requires all water use permit applicants to use reclaimed water unless the applicant demonstrates it is not feasible to do so. Reclaimed water provides additional water supply for uses such as irrigation that do not require potable water.

Existing Reuse in UEC Planning Area

The primary use of reclaimed water in the UEC Planning Area is for irrigation of public access areas, including golf courses, residential lots, parks, schools, and other green spaces. Reclaimed water is also used to recharge groundwater. Use of reclaimed water for industrial cooling is expected to grow as Power Generation Self-Supply (PWR) demands increase through 2040 (refer to **Chapter 2**).

In the UEC Planning Area, wastewater management has evolved over the last 20 years from package plants and subregional facilities to an integrated system of larger regional facilities and a network of reclaimed water pipelines that carry reclaimed water. The volume of reclaimed water used for a beneficial purpose increased almost 69 percent between 1994 and 2014 (**Figure 5-3**). Over this period, the volume of reclaimed water use varied from year to year, depending on the addition of new users and area rainfall.

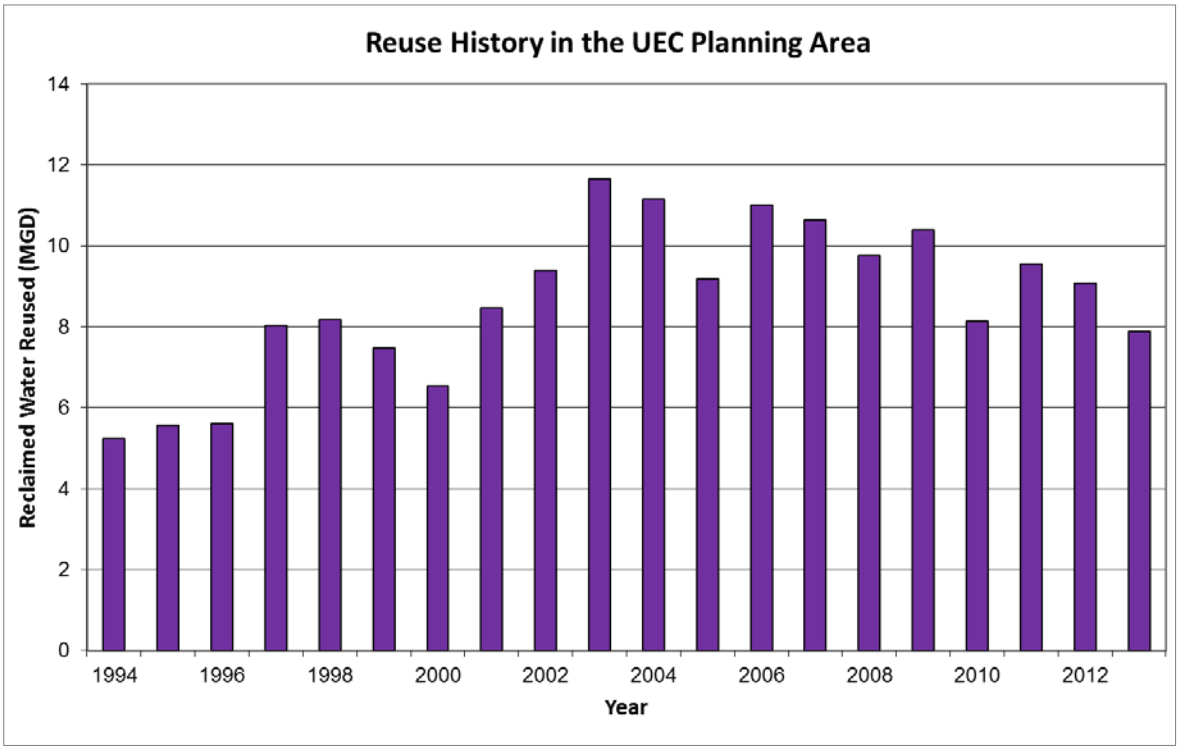

Figure 5-3. Water reuse history in the UEC Planning Area.

In 2013, 21 wastewater treatment facilities (WWTFs) in the UEC Planning Area had a capacity of 0.1 MGD or greater; 20 of these reuse at least part of their wastewater. Although the regional capacity of the WWTFs in the UEC Planning Area totals 48.2 MGD, an average of only 22.4 MGD of wastewater was treated in 2013. Regionally, 7.9 MGD (35 percent) of the treated wastewater in 2013 was reused, primarily for public access irrigation such as irrigation of golf courses, parks, schools, and residences. Public access irrigation accounted for 6.7 MGD of the 7.9 MGD, 0.6 was reused for groundwater recharge through percolation ponds, and 0.6 MGD was reused for other uses such as agriculture and industrial. Effluent not reused was disposed of through deep well injection (13.9 MGD). Currently, there are no reclaimed water producers in the portion of northeastern (NE) Okeechobee County located in the UEC Planning Area.

The *2013 FDEP Reuse Inventory Report* (FDEP 2014) indicated that 27 percent of the wastewater generated in St. Lucie County and 52 percent of the wastewater generated in Martin County is being reused. A listing of reclaimed water facilities and capacities is provided in **Appendix C**.

Reclaimed Water System Interconnects

Reclaimed water system interconnects may be owned or operated by different utilities, or may be shared between two or more domestic WWTFs that provide reclaimed water for reuse activities. When two or more reclaimed water systems are interconnected, additional system flexibility is attained, which increases efficiency and reliability. The City of Stuart has extended a reclaimed transmission main to supply excess reclaimed water to Martin County Utilities for distribution and reuse.

Future Reuse in UEC Planning Area

Utilities are projecting wastewater flows will increase from 22.4 MGD in 2013 to approximately 37.8 MGD by 2040. Utilities currently distributing reclaimed water intend to continue and expand their reuse systems as additional reclaimed water and users become available. In many cases, future reuse will occur in new residential developments. The major utilities providing reclaimed water are the City of Port St. Lucie, Fort Pierce Utilities Authority (FPUA), St. Lucie West Services District, St. Lucie County Utilities, Martin County Utilities, the City of Stuart, and South Martin Regional Utility (SMRU).

Utilities are well positioned to expand their reclaimed water distribution network as development occurs. Many have constructed the required treatment facilities to produce reclaimed water for public access irrigation up to their plant capacity in anticipation of increased reclaimed water demand in the future. In many areas, local government development approval includes the use of reclaimed water and the extension of reclaimed water pipelines. Applying the current reuse rate of 35 percent to projected wastewater flows will result in 5 MGD of additional reuse by 2040.

Planned activities by utilities that could facilitate increased reuse in the UEC Planning Area include the following:

- Construction of a mainland water reclamation facility by the FPUA to replace their Island Water Reclamation Facility located on South Hutchinson Island that has limited reuse potential because of the lack of demand near the facility and its location.
- The proposed use of reclaimed water at the Treasure Coast Energy Center (TCEC) for cooling water.
- Construction of a regional WWTF in northeastern St. Lucie County that will make reclaimed water available for new development in addition to expansion of other reuse distribution systems.
- Development of a reclaimed water interconnect between the City of Stuart and Martin County Utilities that allows for potential expanded reuse of the city's reclaimed water and begins to establish a regional reclaimed water distribution network in Martin County.

Many of the utilities are proposing to use reclaimed water for irrigation in new residential developments. This could replace the use of potable water for irrigation in the developments and reduce the projected PWS demands on the FAS than currently projected.

Supplemental Sources

The use of supplemental water supplies to meet peak demands for reclaimed water may enable a water utility to maximize its use of reclaimed water. However, during times of drought, water sources such as surface water, groundwater, and storm water may not be available to supplement reclaimed water supplies in some areas. Use of supplemental water supplies is subject to consumptive use permitting by the SFWMD.

St. Lucie West Services District currently supplements its reclaimed water supply with water from its stormwater management lakes. SMRU uses the SAS to supplement its reclaimed water.

New Storage Capacity for Surface Water or Groundwater

Storage is an essential component of any supply system experiencing fluctuation in supply and demand. Capturing and storing excess surface water and groundwater during wet conditions for use during dry conditions increases the use of available water. Two-thirds of south Florida's annual rainfall occurs in the wet season. Without sufficient storage capacity, much of this water discharges to tide through the surface water management system. In the UEC Planning Area, potential types of water storage include ASR and reservoirs.

Aquifer Storage and Recovery

ASR is the underground storage of storm water, surface water, fresh groundwater, drinking water, or reclaimed water into an acceptable aquifer. The water is stored with the intent to recover it for use in the future. In this process, the aquifer acts as an underground reservoir for the injected water. The water is treated to appropriate standards, which may vary depending on the water quality of the receiving aquifer, and then pumped into the aquifer through a well. The water is pumped back out (recovered) at a later date for use. The percent of water that is recovered depends on subsurface conditions while the level of treatment required after storage and recovery depends on whether the water is for public consumption, irrigation, surface water augmentation, or wetlands enhancement.

The volume of water made available through ASR wells depends on several factors such as well yield, water availability, variability in water supply and demand, and use type. Uncertainty of storage and yield capabilities as well as water quality characteristics present risks for success, but ASR provides storage of water that would otherwise be lost to tide, deep well injection, or evaporation.

Most of the ASR systems in the District have been built by public water utilities as a method of storing water during periods of low seasonal demand for subsequent recovery during dry periods of high demand. Currently, there are no existing ASR wells in the UEC Planning Area; however, the City of Port St. Lucie Utility Systems Department has applied for construction of an ASR well for reclaimed water at its Westport WWTF. Additionally, the City of Port St. Lucie has proposed ASR wells at the planned McCarty Ranch Reservoir and Water Treatment Plant site (**Appendix F**, Table F-1).

The SFWMD, as part of the CERP ASR pilot projects, proposed construction of a three-well ASR well "cluster" in the Port Mayaca area near Lake Okeechobee (**Figure 5-4**). One ASR well and one monitoring well were constructed, but never placed in operation. As discussed in **Chapter 3**, the SFWMD, in cooperation with the USACE, is pursuing regional ASR systems as part of the CERP, and has recently completed the CERP ASR Regional Study.

Local and Regional Reservoirs

Reservoirs can improve water quality and provide supplemental water supply for municipalities, agricultural and industrial uses, and environmental management. Water typically is pumped from rivers or canals and stored in reservoirs, which provide storage of water, primarily during wet conditions for use in the dry season. For example, small-scale (local) reservoirs are used by individual farms for storage of recycled irrigation water or the collection of local stormwater runoff. These reservoirs may provide water quality treatment before off-site discharge. Large-scale reservoirs (regional) are used for stormwater attenuation, water quality treatment in conjunction with Stormwater Treatment Areas (STAs), and storage of seasonally available supplies for use during dry periods.

Existing and Proposed Projects to Capture, Treat, and Store Water

The CERP IRL-S Project, including the C-44 Reservoir and STA is addressed in **Chapter 4**, and two local proposed reservoir projects (the City of Port St. Lucie McCarty Ranch Reservoir, and the Grove Land Reservoir) are addressed in **Chapter 6**.

Figure 5-4. Proposed ASR projects in the UEC Planning Area.

Seawater

Another water source option for the UEC Planning Area is the use of desalinated seawater from the Atlantic Ocean. Although the ocean is an abundant source of water from a quantitative perspective, seawater has a chloride concentration at or above 19,000 mg/L and the removal of salt (desalination) is required before potable and irrigation uses are feasible. To accomplish salt removal, a desalination treatment technology such as distillation, RO, or electrodialysis reversal is needed. Significant advances in treatment and efficiencies in seawater desalination occurred over the past decade. As a result, seawater treatment costs are declining. The cost of stand-alone seawater desalination facilities remain moderately higher than brackish water desalination. Continued advances may result in further use of seawater for water supply in the future.

Report on Expansion of Beneficial Use of Reclaimed Water, Stormwater, and Excess Surface Water (Senate Bill 536)

The Florida Legislature, recognizing the importance of sustainable water supplies to the state's economy, environment and quality of life, passed Senate Bill 536 in the 2014 Legislative Session. Senate Bill 536 directs the Florida Department of Environmental Protection (FDEP) to conduct a comprehensive study by December 2015 to determine how the use of reclaimed water, stormwater, and excess surface water could be expanded to assist in meeting future demands.

The final report includes a review and analysis of the historic development, regulatory framework, current status, and potential for future expansion of reclaimed water, stormwater, excess surface water, and storage. The report also discusses impediments and constraints to increasing the use of reclaimed water, stormwater, and excess surface water for water supply as well as makes recommendations to mitigate or eliminate impediments and provide incentives for increased beneficial use of these water sources.

In addition to statewide recommendations, the report concludes that the SFWMD should continue regional water resource development projects that address a range of water-related needs, including urban and agricultural water supply, and also should continue implementation of storage reservoir projects as part of CERP. The Senate Bill 536 report can be obtained at http://www.dep.state.fl.us/water/reuse/docs/sb536/SB536-Report.pdf.

WATER SOURCE OPTIONS SUMMARY

Overall, with continued diversification of water supply source options such as the use of the UFA, reclaimed water, water storage and appropriate water conservation measures (demand management), the future water demands of the UEC Planning Area can be met during a 1-in-10 year drought condition through 2040. Certain surface water sources such as the C-23, C-24, and C-25 canals and Lake Okeechobee do not have additional water available in a 1-in-10 year drought beyond their current permitted withdrawal amounts. Surface water users within the LOSA have only a 1-in-6 year drought level of certainty.

The FAS in the UEC Planning Area is a brackish water source that typically requires blending or desalination treatment before use. This update to the UEC Water Supply Plan shows development of these brackish sources have exceeded development of freshwater sources for potable water demands. Development of the FAS is expected to continue through 2040.

Two-thirds of south Florida's annual rainfall occurs in the wet season; however, without sufficient storage capacity, much of this water discharges to tide. In the UEC Planning Area, potential types of needed water storage are under development, including ASR wells and reservoirs.

Reclaimed water is a key component of water resource management in south Florida. Currently, approximately 35 percent of the wastewater treated in the planning area is reused, primarily for public access irrigation. Effluent not reused was primarily disposed of through deep well injection. Further development of reclaimed water as source is expected through 2040.

Water source options depend on location, use type, demand, regulatory requirements, and cost. As competition for limited water resources increases, development of alternatives will increase as well. Water conservation measures are also considered an option to meet the water needs of the region by reducing water use demands. The following section presents an evaluation of water conservation measures.

WATER CONSERVATION

Water conservation includes any activity or action that reduces the demand for water and is an integral part of water supply planning and water resource management. Conservation includes the prevention or reduction of wasteful or unnecessary uses as well as steps to improve the efficiency of necessary uses. Conservation, also referred to as demand management, can reduce, defer, or eliminate the need for expansion of water supply sources to meet current or future demands. The implementation of conservation programs is often among the lowest cost solutions to meet future water needs and has been shown to reduce costs over the long term if properly planned and implemented.

This section describes conservation opportunities, programs, and strategies available to users in the UEC Planning Area. To estimate potential water savings achievable in the UEC Planning Area by 2040, data were analyzed using a select set of conservation best management practices (BMPs) and other methods. General approaches toward securing conservation for each use category, along with a brief overview of conservation programs, are discussed also. Supporting information, including conservation BMPs and measures by user types, as well as tools and programs available to help local governments and utilities encourage users to achieve significant water use efficiency can be found in the Support Document (SFWMD 2016).

Water use efficiency and conservation should be maximized regardless of the water source. All sources are finite and their use incurs embedded costs that often users are not aware of. While most water supply development options require significant upfront investments, ongoing maintenance, and operations expenses, costs associated with conservation typically are less. Conservation reduces demand, which has the same effect as expanding the existing water supply capacity.

In the UEC Planning Area, conservation efforts are reflected in the PWS use rate measured in gallons per capita per day (GPCD), which has been steadily declining since 2000 (**Table 5-1**). This decline is likely the result of new construction designed for more efficient water use, the year-round irrigation rule, and other conservation factors.

Table 5-1. Finished water in Martin and St. Lucie counties.

County	Gallons Per Capita Per Day		
	2000	2005	2010-2013
Martin	212	178	145
St. Lucie	136	129	102

Comprehensive Water Conservation Program

In 2008, the District Governing Board approved the Comprehensive Water Conservation Program. This program is organized into three initiatives:

- Regulatory
- Voluntary and incentive based
- Education and marketing

Each initiative has corresponding goals and specific yet adaptable implementation strategies. The purpose of the program is to achieve a measurable reduction in water use by inspiring governments, citizens, and businesses to value and embrace a conservation ethic and serve as a model for water conservation. This voluntary program is independent from the consumptive use permitting process and is non-binding. The scope and implementation schedule of the action steps outlined in the program are subject to funding levels and voluntary participation by public water suppliers and other participating water users. The SFWMD's conservation program is more fully described in the Support Document.

Estimated Potential for Water Conservation Savings

Estimates of water conservation potential were created using select sets of conservation BMPs and measures for water users in the UEC Planning Area. The Alliance for Water Efficiency's (AWE's) Water Conservation Tracking Tool was used to generate the estimates for non-agriculture categories. A mathematical calculation was utilized to generate an estimate for the agricultural category and the methods are described in the following subsections.

Agriculture

To develop the agricultural estimates, agricultural irrigation permits within the UEC Planning Area were reviewed to identify the irrigated acreage, crop type, irrigation type, and 1-in-10 allocation. A 1-in-10 allocation is the volume of water required to meet crop demands as a result of rainfall deficit during a drought with a recurrence probability of one year in ten. The permits were reviewed to identify only those not using the most efficient irrigation type possible for their crop and not irrigating pasture. This evaluation produced a list of 195 permittees who could conserve water by converting to a more efficient irrigation system. Permits from the Secondary Diversion and Impoundment use class serving agriculture were not included to prevent double counting of those volumes.

The Modified Blaney-Criddle formula, utilized in water use permitting, was used to calculate the 1-in-10 demand as permitted and a new 1-in-10 demand with the irrigation efficiency value for the most efficient irrigation method practical for that crop type (e.g., converting container nursery from sprinkler to micro-drip). The difference between the existing and revised demand calculation is the potential savings volume.

This evaluation resulted in an estimated total savings potential of 38.4 MGD, which represents a 38 percent savings on the identified permits. However, several assumptions were made in the estimation process that should be considered, including the following:

- Water use at 1-in-10 drought event level rather than average use
- Permitted acreage is fully planted with the crop type permitted
- The irrigation method present at permit issuance has not changed
- The efficiency improvements will be made to the maximum extent possible and not to a method with an efficiency between the current method and the optimal method
- All permittees will make the efficiency improvements
- Assumes crops and acreage stayed the same

Because all of the assumptions are unlikely to occur, it is conservatively assumed that the savings for crop irrigation will be approximately 10 percent of the estimate. This results in a calculated water savings potential of 3.87 MGD as shown in **Table 5-2**. Higher participation rates and savings may be expected if incentive-based programs for agriculture are developed and funded. Additional savings could occur if other types of efficiency improvements are made such as the introduction of computerized weather-based irrigation controllers.

Table 5-2. Water savings potential (in MGD) assuming a participation rate of 10 percent for crops and 5 percent for irrigated pasture.

Use Sector	Martin County	St. Lucie County	NE Okeechobee County	**Total**
Crops (non-pasture)	2.06	1.74	0.07	**3.87**
Pasture	0.6	0.8	N/A	**1.4**
Total	**2.66**	**2.54**	**0.07**	**5.27**

There are 38 agricultural permits for irrigated pasture in the UEC Planning Area. These permitted areas currently use gravity flow (flood) irrigation systems, which are the least expensive method to operate. Water use for irrigated pasture is more difficult to predict because use is not consistent. Previous work conducted in the Lower Kissimmee Basin (LKB) Planning Area showed the reported water use for irrigated pasture ranged from none to the full allocation.

A change to travelling gun (sprinkler) irrigation from flood irrigation could result in estimated potential savings of 28 MGD. However, this change comes with operational and equipment costs, which means the change, while possible, may not be practical. Additionally, because of the issues identified above, a 5 percent adoption/implementation rate was utilized to calculate a savings potential of 1.4 MGD for planning purposes (see **Table 5-2**).

Urban

Estimates of water conservation potential were made for PWS and ICI. Domestic Self-Supply (DSS) users were analyzed with PWS users. The AWE Conservation Tracking Tool (Ver. 2.0), was used to estimate PWS single family (SF) and multi-family (MF) residential users.

In general, the AWE Conservation Tracking Tool's default savings assumptions for each conservation measure were used. A household savings of 2,329; 2,642; and 2,986 gallons per year was assigned to Martin, St. Lucie, and NE Okeechobee counties, respectively. County-wide populations were assumed to be the same as the populations used in this plan

update for demand projections. Water use was based on FDEP finished water monthly operating reports.

Residential conservation (demand reduction) estimates (**Table 5-3**) assume approximately 20 percent of the pre-1994 homes would be affected by the measures listed below by 2040. A second estimate of 100 percent of all remaining pre-1994 homes is also shown.

Table 5-3. Potential water saved (in MGD) based on urban demand reduction estimates achievable by 2040.

Use Sector	Martin County		St. Lucie County		NE Okeechobee County	
	Participation Rate					
	20%	100%	20%	100%	20%	100%
PWS and DSS[a]	3.13	7.50	4.93	13.23	0.01	0.02
ICI[b]	0.47	1.09	0.28	0.66	--[c]	--[c]
Total	**3.60**	**8.59**	**5.21**	**13.89**	**0.01**	**0.02**

[a] Includes all residential users and PWS-supplied non-residential users. Includes indoor and outdoor water use conservation for residential users and indoor water use conservation for non-residential users.
[b] Includes indoor water use savings potential only.
[c] Not done for this water use category in NE Okeechobee County.

Conservation measures included in the estimates were as follows:

- Water Use Surveys for residential users (SF, MF)
- High-Efficiency Toilets (SF, MF)
- High-Efficiency Showerheads (SF, MF)
- Lavatory Faucets (SF, MF)
- High-Efficiency Washers (SF, MF)
- Irrigation Controllers, (SF)
- Turf Replacement (SF)
- Efficient Irrigation Nozzles (SF)

The water savings of Industrial/Commercial/Institutional Self-Supply (ICI) facilities receiving their water from PWS utilities is included in the PWS category. ICI facilities that are self-supplied are shown separately. All ICI use has been correlated to square footage of building space under climate-control (Morales et al. 2009). Efficiency improvements in the ICI water use category have been shown to produce water savings ranging from 15 to 50 percent, with 15 to 35 percent being typical (Dziegielewski et al. 2000). Industrial operations may see similar savings. Using Florida Department of Revenue parcel data, estimates of water use and potential savings (in million gallons per year [MGY]) for PWS-supplied ICI users was calculated and added to the PWS residential savings estimate. Conservation savings estimates using the same method were generated for self-supplied ICI users as well.

Conservation Opportunities

Conservation and water use efficiency programs generally are designed for a specific use or a certain type of user. Fortunately, many conservation BMPs and measures can be

implemented by multiple user groups. For example, a computerized irrigation controller can be used to improve irrigation efficiency for residential lawns, agricultural areas and large recreation areas such as public parks and golf courses. It is left to conservation coordinators to decide which users they wish to target and what BMPs or measures are most appropriate, and then craft a program to reach the targeted group.

The following sections contain brief descriptions of conservation opportunities applicable to different use categories. A comprehensive list of conservation BMPs, measures, and programs can be found on the SFWMD website.

Agricultural Irrigation Users (AGR)

The Florida Department of Agriculture and Consumer Services (FDACS) develops and adopts by rule agricultural BMPs to address water quality. Some of these BMPs also contain an implicit water conservation component. Irrigated and non-irrigated lands are enrolled in the FDACS BMP Program with citrus encompassing approximately one-quarter of the acreage in the UEC Planning Area. As of June 30, 2015, the UEC Planning Area had a total of 288,749 irrigated and non-irrigated acres enrolled in the program.

Because of the costs associated with moving water (which affects the profitability of the overall crop), it is assumed that most farmers are as efficient as practical using their existing irrigation systems and growing methods. Financial incentives may be necessary to help farmers transition to more efficient irrigation systems or growing methods.

Public Water Supply (PWS)

Conservation professionals have many options available for designing effective PWS demand management plans. Many programs feature incentives to replace older, less efficient indoor plumbing fixtures and reduce outdoor water use through irrigation system performance audits and the dissemination of rain and soil moisture sensors and computerized irrigation controllers.

For effective design, the PWS conservation professionals should start with the following:

- Clear demand management goals (e.g., lowering peak demand only, versus over all per capita)
- A detailed understanding of the users in their service area
- A service area profile

This information will drive the structure of the overall plan and the individual plan components. PWS utilities are strongly encouraged to use a conservation planning tool when creating a water conservation program. Planning tools can help a utility evaluate and compare the costs and benefits of various conservation measures, show projected water savings, and create a goal-based conservation program.

Domestic Self-Supply (DSS)

Indoor and outdoor conservation options prescribed for residential PWS users are also applicable to DSS users.

Industrial/Commercial/Institutional Self-Supply (ICI)

In water supply planning, this category is for ICI users that are self-supplied. However, in terms of water conservation, the BMPs apply to all ICI users, regardless of the source. Due to the diverse use of water by industrial entities, the development of efficiency programs can be challenging. A broad approach could seek to increase efficiency in water use areas common to most ICI users such as domestic indoor water uses, heating, ventilation, and air conditioning applications.

Power Generation Self-Supply (PWR)

This section does not address cooling water efficiencies or efficiency increases for power generation. However, indoor water use at power plants should be optimized through the use of high-efficiency water-using fixtures and equipment. Additional gains may be available using high-efficiency heating, ventilation, and air conditioning equipment.

Recreational/Landscape Self-Supply (REC)

Demand reduction is possible through the implementation of Florida-Friendly Landscaping™ Program principles, rain or soil moisture sensors, advanced irrigation technology, proper irrigation system design and scheduling, and maintenance of automatic irrigation systems. Other on-site options include capture of gray water or storm water in cisterns.

Golf courses are visible users of water in this category, with 53 courses in the UEC Planning Area. The annual gross irrigation demand for golf course irrigation of 9.6 MGD comes from SAS and FAS sources as well as reclaimed water (4.4 MGD) sources. Golf courses typically are very efficient in their water use. Golf courses in the UEC Planning Area should consider upgrading to the latest irrigation control technology, if they have not already done so, and use Florida-Friendly Landscaping™ Program principles where feasible.

Programmatic Conservation Opportunities

Per capita demand reduction in the UEC Planning Area and by individual PWS service areas will occur over time as a result of users implementing conservation BMPs in the absence of incentives. These “passive savings” typically are the result of building codes or ordinances mandating the installation of high-efficiency items in new construction and major renovations; the replacement of older, less efficient water-using fixtures, appliances, and equipment with newer, more efficient ones; and public education. However, relying on passive conservation savings alone would delay or completely miss significant conservation savings potential. Therefore, many local governments, utilities, and regional and state agencies sponsor water conservation programs. The SFWMD supports many of these programs through financial sponsorships, collaborative partnerships with other governmental and non-governmental entities, or direct administration. An overview of some of the programs available can be found in the following subsections.

Education, Outreach, and Marketing

Education, outreach, and marketing are essential to accomplish a measurable reduction in water use and instill a lasting conservation ethic in businesses and communities. Cities and utilities are uniquely positioned as the first point of contact between the resource and the end users, and therefore should have robust and comprehensive conservation educational campaigns. In addition to local efforts to reach end-users and professionals, the SFWMD has provided support to water providers in their efforts to promote, develop, and implement conservation programs. These programs, when combined with conservation BMPs, have yielded substantial water savings, which can be documented and reproduced by others. Some of the programs and activities are as follows:

- School educational programs
- Media campaigns
- Informative billing
- Training staff and associates at facilities and operations that provide irrigation materials, services, and supplies and/or Florida-Friendly Landscaping™ supplies
- Florida-Friendly Landscaping™ demonstration gardens
- Workshops and exhibits
- Landscape design and irrigation education for residents and landscape and irrigation industry professionals
- Irrigation water audits for residential, commercial, and agricultural users
- Indoor water use audits for residential and commercial users
- Retrofit and rebate programs for replacing inefficient water using devices with efficient ones

The SFWMD will continue working with utilities utilizing voluntary conservation initiatives and providing assistance with goal-based planning design, the use of analysis tools, and cost-share funding for conservation projects.

Cost-Share Funding Programs

The SFWMD administers a cost-sharing program, formerly known as the Water Savings Incentive Program (WaterSIP) that supported technology and hardware-based conservation projects. In Fiscal Year (FY) 2016, this program has been combined with the District's alternative water supply development and stormwater cost-share projects under the title Cooperative Funding Program (CFP). Since its inception in 2003, the WaterSIP program has funded 10 programs in the UEC Planning Area, with a total allocation of $190,257 and an estimated savings of 201 MGY. The CFP is accessible to local governments and utilities, homeowner's associations, commercial entities, and agricultural operations for technology and hardware-based conservation programs. Additional information regarding WaterSIP and the CFP can be found on the District's webpage.

Certification and Recognition Programs

Many cities and utilities support programs that recognize end user conservation efforts such as the Florida Green Building Coalition, the Florida Green Lodging Program, Leadership in Energy and Environmental Design (LEED), and Green Globes. Some of these programs are driven by a single focus while others are holistic. Holistic programs typically include criteria

affecting water use, energy efficiency, more climate-adaptive landscaping, sustainable building material, site selection, indoor environmental quality, and greenhouse gas emissions. While holistic programs are more comprehensive in overall environmental impact than single-focus programs, meeting criteria in all areas can be difficult and cost prohibitive. Therefore, in addition to advocating holistic programs, the SFWMD oversees two single-focused water efficiency programs: the Water Conservation Hotel and Motel Program (Water CHAMP) and the Florida Water Star program.

Water CHAMP recognizes water efficiency efforts made by properties in the lodging industry. The SFWMD has partnered with five municipalities and utilities in the UEC Planning Area to sponsor Water CHAMP. To date, 30 lodging properties, accounting for more than 2,100 rooms, have enrolled in the program for an estimated savings of 13.4 MGY. The District estimates there are 38 properties left in the UEC Planning Area not enrolled in Water CHAMP or the Florida Green Lodging Program. If these properties were enrolled in Water CHAMP, another 8.7 MGY in savings could be realized.

The Florida Water Star program certifies buildings that have been built or retrofit to high water efficiency standards. The program offers accredited professional and continuing education training for landscape and irrigation professionals. The Florida Water Star program can be implemented at nearly any residential or nonresidential property with water savings of approximately 40 percent. This program is functionally linked to the Florida Green Lodging program, making it easier for participants to qualify for one program after having received certification in the other. To date, seven properties in the UEC Planning Area have been certified under the Florida Water Star program. Further descriptions of these programs can be found on the District's website and in the Support Document.

The Florida-Friendly Landscaping™ Program is implemented by the University of Florida Institute of Food and Agricultural Sciences (UF/IFAS) and the FDEP. This program promotes low maintenance plants, environmentally sustainable landscaping, and irrigation practices through its nine principles. The Florida-Friendly Landscaping™ Program recognizes landscapes that have been designed and managed using environmentally friendly techniques. This program is functionally linked to the Florida Water Star program, making it easier for participants to qualify for one program after having received certification in the other. Descriptions of these District-sponsored and District-supported programs are available on the SFWMD website.

Environmental Quality Incentives Program

The Environmental Quality Incentives Program (EQIP), implemented through the U.S. Department of Agriculture/Natural Resources Conservation Service (USDA/NRCS), provides a voluntary conservation program for farmers and ranchers. EQIP promotes agricultural production and environmental quality as compatible national goals. Financial and technical assistance is offered to eligible participants to install or implement structural and management practices that address impaired water quality and conservation of water resources on eligible agricultural land. During FY 2012 and FY 2015, 28 irrigation efficiency projects, encompassing 1,272 acres, were funded by the EQIP in Martin and St. Lucie counties for installation of micro-irrigation and subsurface irrigation systems, water control structures, pumping plants, and improved water management practices. During FY 2012 and FY 2015, 28 irrigation efficiency projects, encompassing 12,940 acres, were funded by the EQIP in Okeechobee County. While not all of the Okeechobee County projects were located in

the UEC Planning Area, the projects included land leveling, installation of sprinkler irrigation systems, installation of tailwater recovery systems and improvement to water conveyances and pipelines.

Agricultural Mobile Irrigation Labs

Agricultural mobile irrigation labs (MILs) evaluate the performance of irrigation systems and encourage the adoption of efficient irrigation hardware and management practices that conserve water. The St. Lucie Soil Water Conservation District MIL services agricultural properties located in St. Lucie, Martin, Okeechobee, and Indian River counties. From January 2014 to the third quarter of 2015, the St. Lucie MIL conducted 107 initial and 40 follow-up evaluations on selected agricultural properties. For the reporting period, FDACS estimated an actual total water savings of 1.08 MGD and a potential water savings of 3.55 MGD.

Urban Mobile Irrigation Labs

Up to half of residential water use occurs irrigating landscaped areas. Urban MILs measure the performance of landscape irrigation systems at residences and businesses. In addition, urban MILs provide recommendations for operation and management efficiency similar to agricultural MILs, but for residential applications. Although the SFWMD discontinued funding the MIL program in the UEC Planning Area in 2009, local municipalities are encouraged to investigate opportunities to expand the deployment of urban MILs.

Conservation Programs Resources

The following conservation programs provide a service to conservation professionals and others by providing standards, information, and other resource materials on conservation.

- **Alliance for Water Efficiency:** Provides information on water efficient products and programs, maintains a web-based water conservation resource library, provides assistance on water conservation efforts to conservation professionals, and offers use of its conservation planning tool free to members (www.allianceforwaterefficiency.org)
- **WaterSense:** Certifies water efficiency products and provides information on programs and practices that meet stringent water use performance criteria (www.epa.gov/WaterSense)
- **Consortium for Energy Efficiency**: Energy-efficient products and services, with water efficiency crossover benefits (www.cee1.org)
- **ENERGY STAR:** Information on energy-efficient products and practices, including lists of qualified products. Program standards now consider water use efficiency for water-using appliances and equipment (www.energystar.gov)
- **Food Service Technology Center:** Industry leader in commercial kitchen energy and water efficiency and appliance performance (www.fishnick.com)

Regional Approach to Water Conservation

Smaller utilities or other user groups may find it advantageous to create partnerships among themselves to implement water conservation projects or programs. This type of consortium may capitalize on bulk buying and other economy of scale benefits by pooling and sharing resources. A regional partnership such as this does not currently exist in the UEC Planning Area, but the SFWMD encourages this type of collaboration and would provide support if requested.

Regulatory Initiatives

Regulatory measures are key tools in an effective conservation program. Regulations or mandates can be used to shift improved practices or devices into mainstream use and, when applied at the regional or state level, simplify working conditions for commercial users operating those areas, versus working in areas with a patchwork of differing standards. As regulations necessitate users make costly investments in efficiency improvements, some regulations could be matched with financial assistance programs to ease the burden on those affected.

Conservation-related ordinances that local governments can adopt include those requiring greater water efficiency in construction such as the International Green Construction Code and standards derived from the Florida Water Star program and the Florida Green Building Coalition. Ordinance and code adoptions can be adopted wholly or partially, depending on pre-existing conditions in the locality. Regulations, mandates, or ordinances can be adopted: statewide, by statute; by local governments, per ordinance; or by water management districts, by rule. In addition, some utilities may be able to require their implementation as a condition of service.

Water Conservation Summary

Water conservation generally is less costly than alternative water supply development projects. Therefore, regardless of source, conservation should be maximized before more costly development options are implemented. Analysis suggests that with 20 percent participation, Martin, St. Lucie, and NE Okeechobee counties can save approximately 3.60, 5.21, and 0.01 MGD, respectively, by 2040 if the urban conservation options discussed in this chapter are employed. Greater savings may be possible if additional measures are implemented or if the participation rate of the region exceeds 20 percent.

Local governments and utilities are encouraged to review the programs and other opportunities discussed as well as the SFWMD's Comprehensive Water Conservation Program to help them meet their conservation goals.

Regional and local agencies should conduct thorough analyses of their service areas, allocate adequate funding to assist individual users make the necessary investments in conservation, and reduce the need for more costly projects in the future. Cities and utilities should consider the use of conservation planning tools. Finally, District staff are available to assist conservation program developers with technical support, collaborative program implementation, ordinance review, and long-term demand management planning.

6

Water Supply Development Projects

This chapter summarizes the water supply development projects anticipated to meet the water needs of the Upper East Coast (UEC) Planning Area for the 2013 to 2040 planning period. Information is provided for each water use category presented in **Chapter 2**. Additional details about water demand projections, utility information, and local government planning information can be found in **Appendices A**, **C**, and **E**, respectively.

TOPICS

- Regional and Local Planning Linkage
- Projects Identified for this Plan Update
- Funding
- Summary
- Public Water Supply Utility Summaries

Water users such as utilities; local governments; and self-suppliers, including Agricultural Self-Supply (AGR) and Industrial/Commercial/Institutional Self-Supply (ICI) users, are primarily responsible for water supply development projects. For each Public Water Supply (PWS) utility supplying 0.1 million gallons per day (MGD) or more to its service area, a utility summary is included at the end of this chapter. Each summary includes population and demand projections, permitted water allocations, potable water and wastewater permitted capacities, and the water supply projects proposed by utilities. For other water use categories, specific projects are identified as provided to the South Florida Water Management District (SFWMD or District) for this *2016 Upper East Coast Water Supply Plan* (2016 UEC Plan Update).

REGIONAL AND LOCAL PLANNING LINKAGE

The District's water supply planning process is closely coordinated and linked to the water supply planning of local governments and utilities. Significant coordination and collaboration throughout the water supply plan development and approval process is needed among all water supply planning entities.

Since the *2011 Upper East Coast Water Supply Plan Update* (2011 UEC Plan Update), the District has worked with staff from PWS utilities in the UEC Planning Area to evaluate the need for water supply development projects for this 2016 UEC Plan Update. Although comprehensive plans, facilities work plans, and consumptive use permits are prepared at different times, each uses the latest and best available data. Local governments' future

projects should generally be consistent among plans and permits, and meet projected water demands.

Appendix E provides information and statutory requirements relevant to local government comprehensive plans. The regional and local water supply planning process is described below and illustrated in **Figure 6-1**.

PROCESS

Regional and Local Water Supply Planning Process

The District is required to notify each PWS utility of the projects identified in this plan for that utility to consider and incorporate into its corresponding government's required Water Supply Facilities Work Plan in meeting future water demands. This notification must occur within 6 months following approval of the water supply plan update. PWS utilities then must respond to the SFWMD about their intentions to develop and implement the projects identified by the plan or provide a list of other projects or methods to meet these needs [Section 373.709(8)(a), Florida Statutes (F.S.)].

Within 18 months following approval of the regional water supply plan, local governments are required to update their water supply facilities work plans and related amendments in their comprehensive plans. The work plans contain the capital improvements projects, which outline specifics about the need for and the location of public facilities, principles for construction, cost estimates, a schedule of capital improvements, and other related information.

The local government's water supply facilities work plan is required by Section 163.3177(6)(c), F.S., to carry out the following tasks:

- Incorporate the water supply projects or projects selected by the local government from those projects identified in the updated regional water supply plan or proposed by the local government.
- Identify water supply projects to meet the water needs identified in the updated regional water supply plan within the local government's jurisdiction.
- Include a work plan covering at least a 10-year planning period for building public, private, and regional water supply facilities, including the development of alternative water supplies that are identified in the potable water element to meet the needs of existing and new development.

By November 15 of every year, all utilities are required to submit a progress report to the District about the status of their water supply projects (completed, under way, or planned for implementation). The capital improvements element must be reviewed by the local government on an annual basis to reflect the timing, location and funding of capital projects needed to achieve and maintain adopted level of service standards for public facilities that are necessary to implement the comprehensive plan. **Figure 6-1** shows the linkage and sequence of the water supply planning process with water supply facilities work plans and local government comprehensive plans, beginning with the adoption of a water supply plan update.

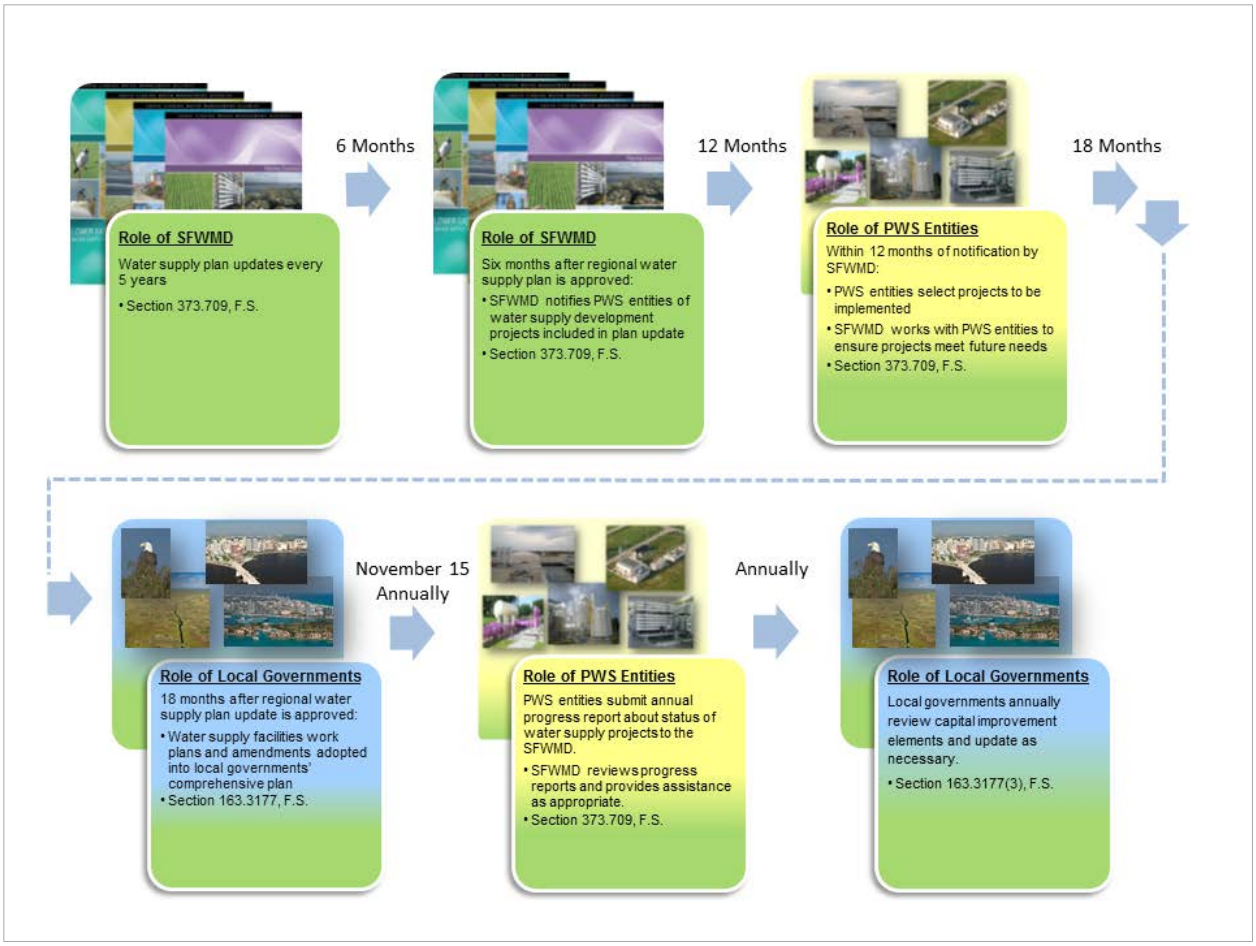

Figure 6-1. Linking regional water supply planning with local government comprehensive planning.

Link to Water Use Permitting

PWS utilities and local governments are required to use best data available when preparing comprehensive plans, water supply facility work plans, and water use permit applications. Population projections from these plans and applications should also consider data from the most recent water supply plan update. Local governments' future water supply development projects generally should be consistent among the plans and permits and must meet projected water demands. However, local economic conditions and population growth may affect when water is needed, projects are required, and water use permits are modified to accommodate demand. This means some documents may not be completely consistent with earlier documents.

A Florida Department of Environmental Protection (FDEP) 2012 guidance memorandum addresses coordination between the SFWMD's water use permitting and water supply planning staff on projects included in water supply plans. By increasing coordination during the water supply planning process, water use permit applicants planning an identified water supply project will be assured that SFWMD staff is familiar with the projects, have supporting data, and will be able to facilitate the permitting process. The proposed projects considered

for this plan update were initially reviewed by SFWMD staff working in water use permitting and water supply planning using the following set of questions:

- Does the proposed project use a source of limited availability?
- Is the project located in a Restricted Allocation Area (RAA)?
- Is the proposed source from a minimum flow and level (MFL) water body or is it connected, directly or indirectly, to an MFL water body? If yes, is the proposed use consistent with MFL recovery or prevention strategies?
- What other environmental water needs (e.g., Comprehensive Everglades Restoration Plan [CERP] targets, water reservations) may be impacted?
- What resource issues have been identified in recent permit applications in the general area for the same source (e.g., wetlands, saltwater intrusion, MFL)?
- Have existing legal users of the same source had resource-related compliance issues?
- Have any new technical studies been completed related to source availability?

However, each proposed use of water must meet the conditions for permit issuance found in Section 373.223, Florida Statutes (F.S.), and the implementing criteria found in Chapter 40E-2, Florida Administrative Code (F.A.C.). Section 373.223, F.S., requires applicants to establish that the proposed use of water 1) is a reasonable-beneficial use as defined in Section 373.019, F.S.; 2) will not interfere with any presently existing legal use of water; and 3) is consistent with the public interest. Water use permits are required for all water supply development projects, except for those using 100 percent seawater or reclaimed water under direct pressure or from a lined pond.

The availability of new supplies from the surficial aquifer system (SAS) in the UEC Planning Area is limited due to existing water demands, source limitations, and resource issues such as saltwater intrusion, environmental needs, and aquifer protection criteria (see **Chapter 3**). New or increased allocations from the SAS will be evaluated on an application-by-application basis to determine if the project meets consumptive use permitting criteria. Some SAS development may be feasible given local conditions such as reductions in historical water use and availability of new resources.

A discussion of the demand and supply conditions for each of the six major water use categories can be found in the following sections.

PROJECTS IDENTIFIED FOR THIS PLAN UPDATE

A discussion of the demand and supply conditions for each of the six major water use categories is presented here. All of the proposed potable and non-potable water and conservation projects were proposed by and will be implemented by PWS utilities.

To manage the water resources in the UEC Planning Area, this update promotes the continued diversification of sources for the water supply projects needed to meet future demands. Projects proposed for inclusion in this update were evaluated based on factors discussed in the previous section, level of detail provided (i.e., project scope, cost, and schedule), and

whether the project is expected to contribute to new water supply, resulting in a potentially permittable increase in their allocations or a treatment system's rated capacity.

Furthermore, a project identified for inclusion in this 2016 UEC Plan Update may not necessarily be selected for development by the user. In accordance with Section 373.709(6), F.S., nothing contained in the water supply component of a regional water supply plan should be construed to require local governments, public or privately owned utilities, special districts, self-suppliers, multijurisdictional entities, or other water suppliers to select the identified projects for utilities.


Water Treatment Facility

If the projects identified in this plan update are not selected by a utility, the utility must identify another method to meet its needs and advise the SFWMD of the alternative project(s). The local government then needs to include the project information in its water supply facilities work plan. One reason a project may not be selected for implementation is need, or lack thereof. Several utilities proposed projects that exceed the projected demands for 2030. As experienced with the 2011 UEC Plan Update, utilities may replace or delete projects that are not needed or defer projects beyond the 20-year planning horizon of this update.

Public Water Supply

Public Water Supply (PWS) demand includes all potable uses served by public and private utilities with a pumping capacity greater than or equal to 0.1 MGD. As of 2013, PWS in the UEC Planning Area was met by fresh groundwater from the SAS (40 percent) and brackish groundwater from the upper Floridan aquifer system (FAS) (60 percent). The PWS average net demand (finished water) is projected to grow from 38.6 MGD in 2013 to 59.5 MGD by 2040, a 54 percent increase. Although reclaimed water and conservation of potable water do not produce potable water per se, it is a means to meet non-potable demand or extend the existing potable supplies to meet future demand.

The demand for PWS in the UEC Planning Area is projected to increase through 2040. A combination of existing and additional capacity developed by new water supply development projects will be used to meet the demand. The utility summaries indicate all UEC Planning Area utilities can meet their projected 2040 demand with existing treatment capacity or by supplementing that capacity by developing one or more identified projects. In addition to meeting demands, utilities may propose water supply development projects due to their own unique situations. These can include accommodating a change in treatment processes or sources, or optimizing distribution systems to match future demand locations. Each utility's proposed projects are displayed in their summary found at the end of this chapter and in **Appendix F**, Table F-1.

All PWS water use permits contain provisions limiting the volume of water withdrawn from each source. If a utility cannot meet the projected 2040 demand, water supply development projects, a permit modification, or other options may be necessary.

In aggregate, UEC Planning Area utilities have adequate permitted water allocations and potable water treatment capacity to meet 2040 demands. This is due to proactive water supply planning by utilities in coordination with regional planning by the SFWMD, slower than anticipated growth rates over the past 5 years, and issuance (including renewals and modifications) of water use permits with 20-year durations. In this plan update, 6 utilities have proposed 10 new PWS projects to implement system expansions, source diversification, changes in treatment technology, construction of new reverse osmosis (RO) water treatment plants, expansion of existing plants, a surface water reservoir, and construction of new production wells.

Two PWS utilities need to address the following to have sufficient water capacity to meet their anticippg118ated 2040 potable water demands:

- Construction of 2.5 MGD of the proposed potable water supply development projects.
- Complete the process of a water use permit modification for the higher water allocation that was bifurcated.

The following key utility projects have been proposed by the utilities and are included in the utility summaries as well as **Appendix F**, Table F-1:

City of Port St. Lucie McCarty Ranch Reservoir and Water Treatment Plant

The City of Port St. Lucie purchased 5,134 acres in two parcels: McCarty Ranch Preserve and McCarty Ranch Extension located in southern St. Lucie County. The McCarty Ranch Extension site is located one mile south of the McCarty Ranch Preserve. Both properties have access to the C-23 Canal. Acquisition of these properties was driven by the city's need to ensure the availability of an alternative potable water supply source for the buildout of the city's population (projected at 407,472 residents in 2060). Future plans for the site include a surface water reservoir, a 30 MGD water treatment plant for the treatment of surface water for potable water use by 2033, and a storage and recovery system relying on excess stormwater pumped from the C-23 Canal as well as rainwater. Two reservoirs (300 acres and 150 acres) (**Figure 6-2**) planned for these properties are designed to hold approximately 18,000 acre-feet of water.

The system will pump water from the C-23 Canal during the wet season then treat and store the water in the on-site reservoirs and ASR system (**Chapter 5**). In the dry season, stored water will be recovered, treated, and distributed to meet future potable water demands for the City of Port St. Lucie's utility customers.

Intended environmental benefits include reducing discharges to the C-23 Canal, storage of local stormwater runoff, decreasing nutrient loading in storm water (nitrogen and phosphorous), and reducing freshwater discharges from the C-23 Canal to the Indian River Lagoon during the wet season.

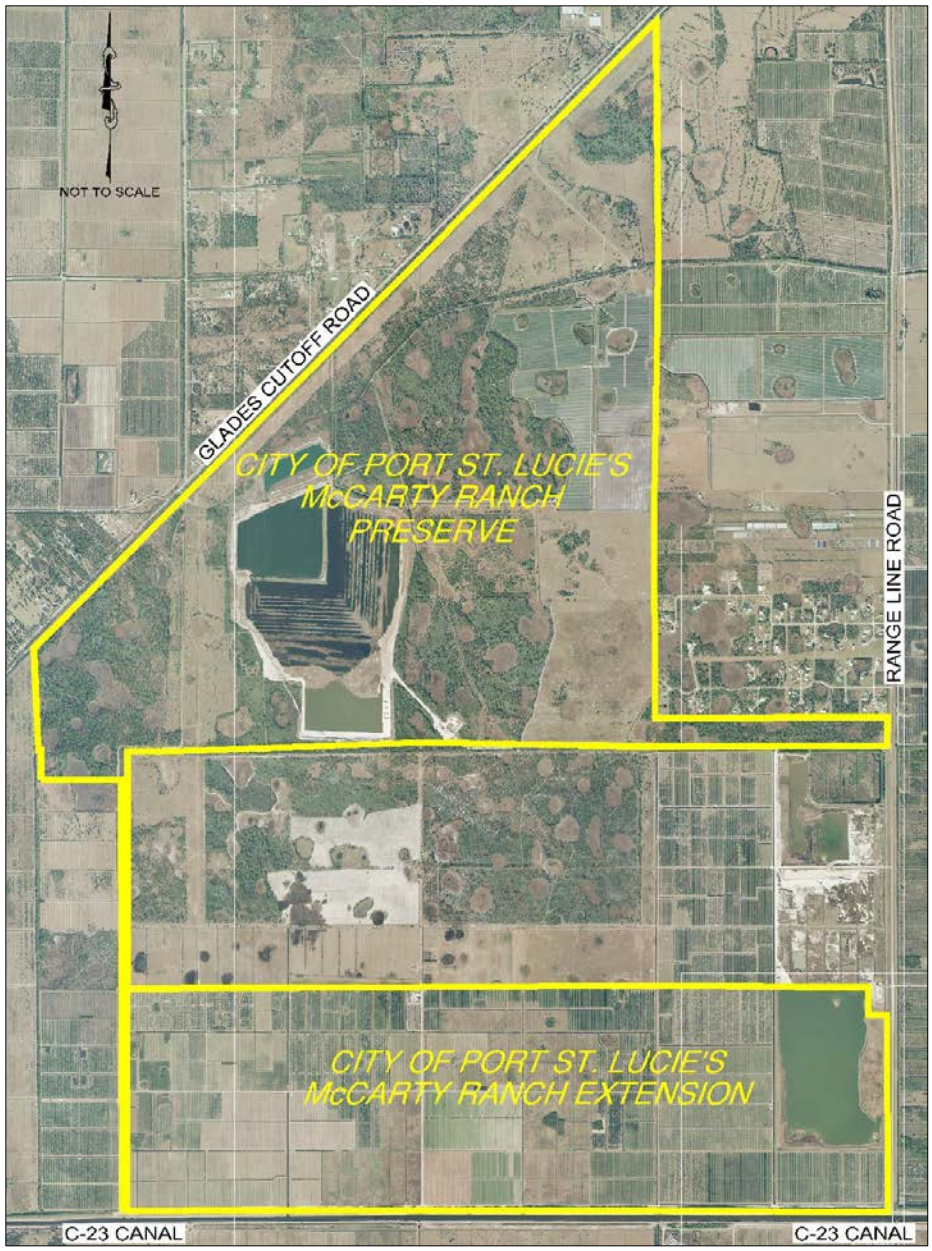

Figure 6-2. Port St. Lucie McCarty Ranch Reservoir and WTP.

Prior to construction of the water treatment plant, the city intends to utilize the McCarty Ranch Extension property as an interim water farming project. This should help restore the water quality of the C-23 Canal by storing water for periods of time in shallow on-site impoundments. When the plant is put into operation, the impoundments will be used to store and pre-treat source water, which will improve the water quality in the C-23 Canal and the IRL.

- Martin County Consolidated System is planning a 4 MGD brackish water treatment plant (WTP) expansion at Tropical Farms RO water treatment plant (WTP).

- St. Lucie County Utilities District initiated a three-phased 17 MGD brackish WTP to be known as North County Utility Regional WTP. A pilot FAS well is underway. The county acquired land for this site (Taylor Dairy Road site) adjacent to the county airport (Treasure Coast Regional International Airport).
- Fort Pierce Utilities Authority is planning a 4.33 MGD brackish WTP expansion at the Henry Gahn RO WTP.

In total, the proposed PWS development projects could create new treatment capacity, yielding 68.6 MGD of finished water, as described in **Table 6-1**. Together with existing capacity, this will exceed the projected 2040 PWS total finished demand of 64 MGD.

Table 6-1. Proposed PWS development projects and capacity for 2013 to 2040.

Project Types	Water Source	Number of Projects[a,b,c]	Capacity (MGD)
PWS	Surface Water	1	30.0
PWS	SAS	2	1.1
PWS	FAS	7	37.5
Total		**10**	**68.6**

[a] Projects designed to expand distribution of treated water are not included because they do not generate new water.
[b] Three inter-local agreements for bulk potable water are not included: two agreements that total 1.10 MGD in 2040 and one inter-local agreement for 1 MGD that ends in 2028.
[c] Many of the projects are multi-phased (e.g., more than one project at the same water treatment plant).

The utilities have proposed reclaimed water supply projects that could create 22.3 MGD of additional water supply for landscape irrigation and groundwater recharge (**Table 6-2**). The proposed reclaimed water projects include the construction and expansion of reclaimed water production facilities, a reclaimed water distribution line and storage facility, and aquifer storage and recharge projects. Although projects involving new reclaimed water distribution lines and other infrastructure may qualify for the Cooperative Funding Program (CFP), they are not included as reclaim projects because they do not generate new water supply. These projects will meet multiple types of demand such as landscape irrigation, including golf courses and parks, and groundwater recharge. The *2013 FDEP Reuse Inventory Report* (FDEP 2014) indicated that 27 percent of the wastewater generated in St. Lucie County and 52 percent of the wastewater generated in Martin County is reused for irrigation and to recharge aquifers. This is expected to increase in the future.

Table 6-2. Proposed reclaimed water supply development projects and capacity for 2013 to 2040.

Project Type	Water Source	Number of Projects[a,b]	Capacity (MGD)
Reclaimed	Reclaimed	5	18.3
Reclaimed	Reclaimed Storage/ASR[c]	1	4.0
Project Total		6	22.3

ASR = aquifer storage and recovery.
[a] Projects designed to expand distribution of treated water are not included because they do not generate new water.
[b] Many of the projects are multi-phased (more than one project at the same water treatment plant).
[c] Supplemental non-potable water supply for irrigation.

Conservation is an important component of utilities' plans for meeting future demands. A strong conservation program can lower per capita use rates (PCURs) and reduce the need for additional water or capacity.

Utility Summaries

Individual utility summaries for each PWS utility within the UEC Planning Area are presented at the end of this chapter. The summaries are organized by county and alphabetically within each county. No PWS utilities are located in the northeastern portion of Okeechobee County within the UEC Planning Area.

The summaries provide information about base year and projected populations, finished water demands, existing permitted sources and allocations, completed and proposed projects that create water capacity, and other related information. The population and water demands for each utility are based on the methodology and results provided in **Appendix A**. The water demand projections represent finished water per capita use rates and net water demands.

Maps in **Appendix D** display utility service areas. Utilities that produce less than 0.1 MGD annually were not evaluated and do not appear on the service area maps in the appendix. The populations served by these smaller utilities are included in the Domestic Self-Supply (DSS) category.

Domestic Self-Supply

DSS includes potable water from a private domestic well serving a private residence and utilities that produce less than 0.1 MGD on an annual basis. DSS average net (finished) demands in the UEC Planning Area are projected to decrease from 3.83 MGD in 2013 to 0.74 MGD in 2040. This decrease is expected to occur because utilities are expanding their distribution lines and encouraging homeowners to connect. DSS needs are currently met with fresh groundwater utilizing the SAS. All future needs in this use category are expected to be met using fresh groundwater supplies. As such, no water supply development projects are proposed for this use class.

Agricultural Self-Supply

Agricultural irrigation is the largest water use in the UEC Planning Area and is projected to remain so over the planning horizon. The SFWMD estimates irrigated acreage to increase by 2040. Agricultural water use includes supplies for aquaculture, water for cattle, and irrigated commercially grown crops such as pasture grasses. Gross agricultural water demand is projected to rise 24.2 MGD (14.9 percent) from 162.5 MGD in 2013 to 186.7 MGD in 2040. Actual demand will depend on how much citrus transitional land (currently fallow) goes into production within the planning horizon and what crops are grown. **Chapter 2** and **Appendix A** provide more information about agricultural water use and projected demands.

The primary water source for agricultural irrigation in the UEC Planning Area is fresh surface water from the C-23, C-24, and C-25 canals with brackish groundwater from the FAS serving as a backup source during periods of low rainfall and limited surface water availability. Although total agricultural water use in the planning area is projected to rise over the planning period, the RAA Rule is in effect for the C-23, C-24 and C-25 canals and Lake

Okeechobee Service Area (LOSA). This rule limits surface water increases in allocation from these sources (*Applicant's Handbook for Water Use Permit Applications* [SFWMD 2015a]).

The renewal process for irrigation class consumptive use permits in the UEC Planning Area was generally completed by the end of 2005. Because water use permits usually are valid for 20 years, permits renewed during that time remain in effect.

Farming in the UEC Planning Area

Development of groundwater and surface water may be practicable in some areas; however, permitting new freshwater supplies will depend on local resource conditions. Increased withdrawals from the C-23, C-24, and C-25 canals are restricted by District rules. Although additional surface water may be available in the future from CERP reservoir construction projects, it is premature to identify potential volumes of water anticipated to be available until construction is complete and projects are operational. Potential new water may be provided through subregional storage and the capture and recycling of storm water (stormwater retention and tailwater recovery). Reclaimed water could be used to irrigate some crops though not all. If fallow citrus lands are converted to other crops that are less tolerant of chlorides, an additional source of fresh water may be needed for agriculture.

The Grove Land Reservoir and STA was identified as a water supply development project for agriculture (**Table 6-3**; **Appendix F**, Table F-1).

Table 6-3. Proposed agricultural water supply project and capacity for 2013 to 2040.

Project Type	Water Source	Number of Projects	Capacity (MGD)
Water Supply and River Augmentation	Surface Water/Stormwater	1	122.4 (raw water)
Total		**1**	**122.4 (raw water)**

Grove Land Reservoir and STA

The Grove Land Reservoir and STA is a proposed project consisting of a 5,000-acre reservoir, 2,000-acre STA, intake/discharge structures, conveyance improvements, and other associated facilities in northern Okeechobee and southern Indian River counties on land owned by Evans Properties, Inc. (**Figure 6-3**). The reservoir water would be supplied from excess stormwater runoff captured from the C-23, C-24, and C-25 basins via the C-23, C-24, and C-25 canals. Water from the reservoir would flow to the STA, which reduces total phosphorus and total nitrogen concentrations. Treated water could be discharged to the St. Johns River Water Management District (SJRWMD) C-52 flow-way and subsequently north to the St. Johns River when water levels in the St. John Upper Basin Project are not too high

or south to the SFWMD's C-25 Canal for water supply and environmental deliveries. One proposal for the Grove Land Reservoir and STA project is for it to be a river augmentation project with the potential to discharge 122 MGD of water into the headwaters of the St. Johns River. Potential benefits include surface water augmentation, groundwater recharge, and nutrient reduction.

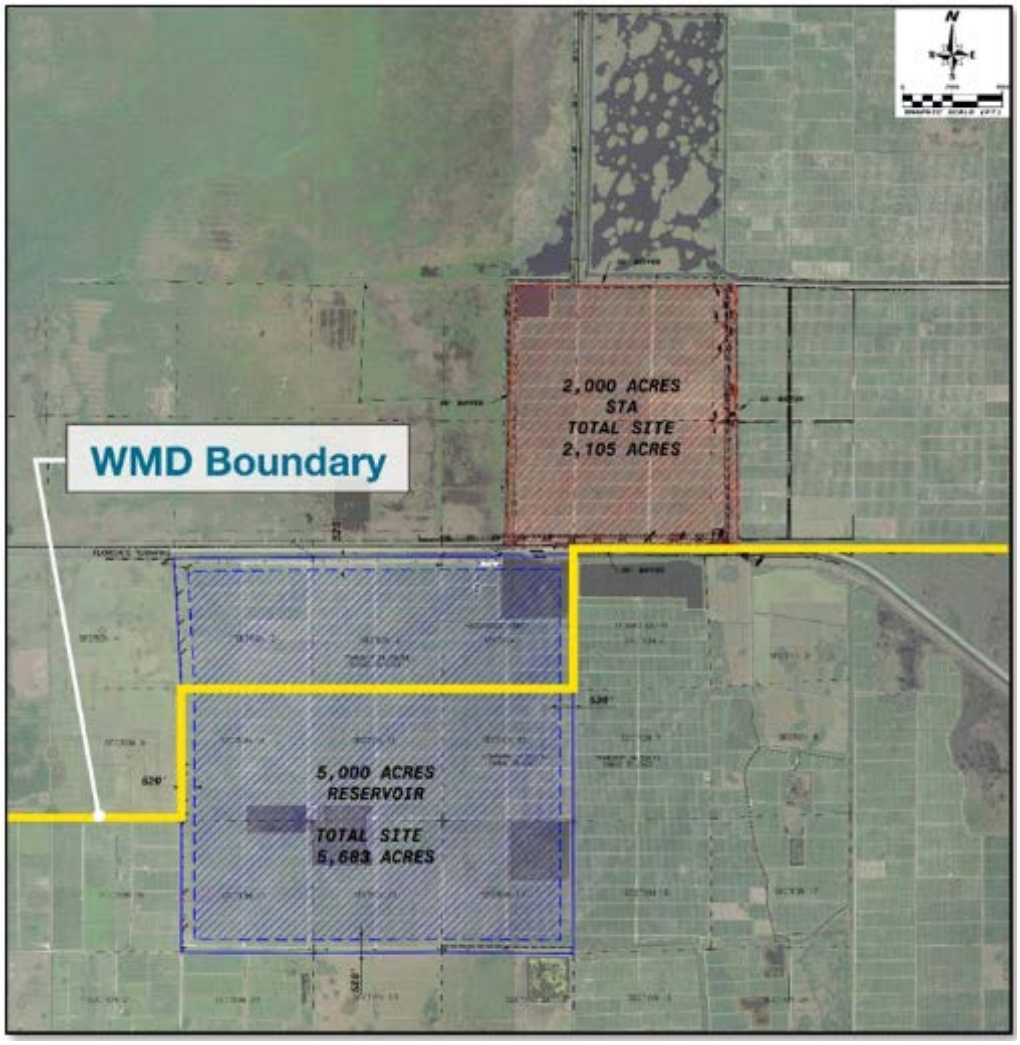

Figure 6-3. Grove Land Reservoir and STA.

The project has been conceptually designed to deliver 136 MGD. The analysis showed the reservoir was capable of delivering water at this rate 90 percent of the time using historic daily rainfall and canal flow data over a 41-year simulation period. This is estimated to be roughly equivalent to a 1-in-10 year drought event. It was concluded there could be 122.4 MGD of raw water made available for use (accounting for natural system losses).

Grove Land is listed as a water supply project option under the surface water category in Table D-1 of the 2015 Final Central Florida Water Initiative (CFWI) Regional Water Supply Plan (RWSP), Solutions Strategies, Volume IIA. The Grove Land Reservoir and STA is also included as a proposed project in the SJRWMD Reservoir Storage section of the Senate Bill 536 report on expansion of beneficial use of reclaimed water, stormwater, and excess surface water. More information on Senate Bill 536 is provided in **Chapter 5**.

A feasibility study was prepared in 2014 to assess the viability of the proposed Grove Land Reservoir and STA (Hazen and Sawyer 2014). The study, financed by the land owner, the SJRWMD, and the SFWMD concluded the project to be technically feasible as long as a sufficient water supply can be legally obtained from the C-23, C-24, and C-25 canals. Project partnerships and project governance will need to be developed for this project. The Florida legislature allocated $3 million in 2015 to initiate the Project Development and Environment study for this project. Coordination and approvals between the SFWMD and SJRWMD will be necessary for the transfer or use of surface water. The report may be accessed at: http://www.evansprop.com/images/uploads/financial-feasibility-of-glrsta-project-45529-000r005final-reduced.pdf.

The continued and increased voluntary use of Florida Department of Agriculture and Consumer Services' (FDACS') best management practices (BMPs), including water conservation, could reduce the amount of water needed to meet crop demands in an average year, but would not provide the water needed in a 1-in-10 year drought.

Industrial/Commercial/Institutional Self-Supply

The ICI water use category includes citrus and sugar processing plants as well as rock mines. Users historically have relied on fresh groundwater and, to a limited extent, fresh surface water for their supply. The projected average gross demand for this category is estimated to be 4.9 MGD by 2040, which is a slight increase from current demands.

The ICI use category has sufficient supply to meet future needs. Although fresh groundwater supplies generally are considered adequate to meet the relatively small new demands projected for this use category, alternative water supply options should be considered based on location and local conditions. If reclaimed water is available to meet existing and new ICI water demands, the feasibility of such opportunities will be evaluated through consumptive use permitting. No specific water supply development projects for this category were provided or have been identified for this plan update.

Recreational/Landscape Self-Supply

The Recreational/Landscape Self-Supply (REC) category includes irrigation for large landscaped areas such as parks, golf courses, community common areas, and cemeteries. Historically, irrigation supplies for this category include local fresh groundwater and surface water captured from canals or ponds in stormwater management systems. Some golf courses use brackish groundwater treated by RO while irrigation for new golf courses often includes reclaimed water and on-site blending of brackish groundwater with surface water. In the UEC Planning Area, REC average gross demand is projected to increase from 24.7 MGD in 2013 to 33.9 MGD in 2040. Harbour Ridge Utility installed three surficial wells for irrigation in 2013 (**Table 6-4**; **Appendix F**, Table F-1).

Golf Course – Martin County

Table 6-4. Recreation and landscape water supply project and capacity

Project Type	Water Source	Number of Projects	Capacity (MGD)
Recreation/Landscape (Supplemental Groundwater for Irrigation)	SAS	1	0.9
Total		**1**	**0.9**

The projected increase in growth for this category is expected to be met, for the most part, by currently proposed reclaimed water projects. In the UEC Planning Area, reclaimed water is used to irrigate large landscaped areas such as golf courses, parks, and cemeteries as well as residential and commercial parcels. Projects submitted by utilities and wastewater treatment facilities specify that significant additional reclaimed water will be made available in the future. Expanded utility wastewater treatment capacity is expected to add 19.35 MGD of reclaimed water by 2040. The additional supply may provide an opportunity to allow current irrigation to change from fresh water to reclaimed water. Where reclaimed water is not available, users may qualify for limited freshwater withdrawals on an application-by-application basis.

Power Generation Self-Supply

The Power Generation Self-Supply (PWR) water use category is projected to increase from 14.8 MGD in 2013 to 55.2 MGD in 2040. Florida Power & Light (FPL) may expand its Martin County facilities. FPL utilizes an assessment method incorporating generation and cooling technologies most appropriate for site-specific conditions, including water supply and wastewater disposal. The different technologies may require and utilize traditional and alternative water sources. Because the availability of fresh water is limited in the UEC Planning Area, alternative water sources may be the most feasible options for meeting future PWR use.

Currently, two power generation plants in the UEC Planning Area are permitted to withdraw water: FPL Martin Power Plant and Treasure Cost Energy Center (TCEC), located in western Martin County and the City of Fort Pierce, respectively. The Martin site uses fresh water for cooling purposes, and the TCEC uses water from the FAS. The TCEC anticipates using reclaimed water for part of its needs in the future. The existing St. Lucie Nuclear Plant is located in this region and uses ocean water, which is not addressed in the water supply plans because ocean water is not regulated by consumptive use permitting. The existing Indiantown Cogeneration Plan withdraws water from Taylor Creek/Nubbin Slough in the adjacent Lower Kissimmee Basin (LKB) Planning Area and is addressed in the *2014 Lower Kissimmee Basin Water Supply Plan*. No specific water supply development projects for this category were provided; however, FPL is proposing facilities that would use an additional 30 MGD in the region.

FUNDING

Funding for water supply development and water conservation at the local level is the shared responsibility of water suppliers and users. The State of Florida and the water management districts have provided funding assistance to local water users to develop alternative water supplies and measurable water conservation programs. One criterion for funding

consideration is that the project has to be included in, or consistent with, a regional water supply plan update. Some projects not in this 2016 UEC Plan but consistent with the plan's goals, may also be funded.

When the SFWMD deems appropriate, a plan may specifically identify the need for multijurisdictional approaches to project options based on analysis, the ability to permit and finance, and technical feasibility. The SFWMD historically has provided funding for alternative water supply and measurable water conservation through its Alternative Water Supply (AWS) Program and Water Savings Incentive Program (WaterSIP). Any AWS or water conservation project identified in a SFWMD water supply plan or plan update would make that project eligible for future funding, although funding is not guaranteed. An application must be submitted and processed for the determination of an award.

Cooperative Funding Program

For nearly two decades, the SFWMD has provided funding to local governments, special districts, utilities, homeowners associations, water users, and other public and private organizations for alternative water supply, water conservation, and stormwater projects that are consistent with the District's core mission. Beginning in Fiscal Year (FY) 2016, these cooperative funding efforts will be brought together under the CFP, which provides financial incentives to promote local projects that complement ongoing regional restoration, flood control, water quality, and water supply efforts within the District's 16-county jurisdiction.

Each fiscal year, the District Governing Board will determine the amount of funding to allocate to the CFP, the project priorities for that year, and the cost share to be allocated. SFWMD staff will coordinate evaluation of the projects for funding based on criteria and priorities established by the District Governing Board. Each year, program funding is subject to approval by the District Governing Board.

Alternative Water Supply

This component of the CFP, formerly known as the AWS Program, provides cost-share funding for projects that increase water supply. When available, the SFWMD provides matching funds for qualified projects. From FY 2010 through FY 2015, the SFWMD provided more than $15.5 million in AWS funding for 52 projects located throughout the District. Two projects within the UEC Planning Area were funded and completed, generating 1.0 MGD of additional reclaimed water distribution (**Table 6-5**). See **Chapter 4** for more information.

Table 6-5. Reclaimed irrigation projects supported by the AWS Program.

Project Name	County	Fiscal Year	Capacity (MGD)
Martin County Miles Grant Reclaimed Water Main	Martin	2011	0.10
City of Stuart Reclaimed Water Main and Interconnects	Martin	2011	0.90
Total			**1.00**

Water Conservation

This component of the CFP, formerly known as the WaterSIP, provides cost-share funding for projects that reduce urban water use. The SFWMD has provided matching funds up to $50,000 or up to 50 percent, whichever is less, to water providers and users (i.e., cities, utilities, industrial groups, schools, hospitals, homeowners associations) for water-saving technologies. These technologies include low flow plumbing fixtures, rain sensors, fire hydrant flushing devices, and other hardware. From FY 2010 to FY 2015, the SFWMD partially funded more than $5.1 million towards 181 projects through this program, with an estimated water savings of 2.8 billion gallons per year, or 7.79 MGD. In the UEC Planning Area, one irrigation upgrade project (PGA Village POA, Inc.) received $27,745 in FY 2014. This project was estimated to save 24 million gallons per year (MGY). See **Chapter 4** for more information.

SUMMARY

Total water demands within the UEC Planning Area, from all sources, are projected to rise by approximately 97.23 MGD by 2040. During the planning horizon, the PWS category projects a 53.1 percent increase in average finished demand. While six utilities proposed a total of 10 potable water multi-phased projects, only one utility appears to need the projects before 2040 based on UEC Planning Area projections or their respective treatment system requirements. Some utilities will meet future demand by purchasing water from other suppliers. Based on the evaluation for this plan, groundwater and surface water supplies are believed to be adequate to meet all projected demands through the planning horizon of 2040.

Meeting the water demands in the UEC Planning Area requires continued use of diverse water sources, including brackish groundwater, reclaimed water, seasonally available surface water, and water conservation. Aquifer storage and recovery (ASR) can enhance access to seasonal supplies for future needs.

Among the DSS, ICI, and PWR water use categories, no specific new projects have been proposed. Future needs for DSS and ICI can be met under existing permit allocations, by using existing and alternative sources and through conservation. Although development of fresh groundwater and surface water may be practicable in some areas, permitting new freshwater supplies will depend on local resource conditions, and any increases in withdrawals from the C-23, C-24, and C-25 canal systems must comply with the RAA criteria.

Seventeen PWS utilities with a capacity of more than 0.1 MGD are located within the UEC Planning Area. The City of Port St. Lucie Utility Systems Department is the largest utility in the region and is projected to serve approximately 304,000 residents by 2040. One PWS utility needs to construct 2.5 MGD of water supply development projects to meet 2040 projected demands, and one PWS utility is in the process of modifying their water use permit so their water allocation for 2040 will be adequate. All other growth within the UEC Planning Area will be served with existing facilities although eight utilities have proposed projects for their utilities. The proposed PWS development projects could generate 68.6 MGD of new water treatment capacity to meet the PWS net demand of 61.4 MGD, exceeding the 21.2 MGD of net potable water needed from 2013 to 2040 to meet PWS demand. The new capacity consists of 37.5 MGD produced by FAS water source projects, 30 MGD produced by a surface

water reservoir and WTP, and an additional 1.10 MGD produced by SAS water source projects.

PUBLIC WATER SUPPLY UTILITY SUMMARIES

This section includes utility summaries for all the PWS utilities that provide more than 0.1 MGD of potable water for the UEC Planning Area. In 2015, SFWMD staff updated the utility summaries by querying the FDEP website for drinking water capacity and reclaimed water capacity (FDEP 2014). In addition, the proposed projects were updated with information supplied to the SFWMD in the statute-required November 2014 utility reports and from direct contact with the utilities in 2014-2015.

Potential future water conservation savings are not included in the following utility summaries unless a specific project was identified by the utility. **Chapter 5** of this plan update addresses conservation and potential water savings.

INDIANTOWN COMPANY

County: Martin

Service Area: Unincorporated Martin County serving Indiantown, Cogeneration Power Plant and Indiantown Golf and Country Club

Description: Potable water supplies are 100 percent from the SAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.57 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	6,507	6,944	7,545	8,181
Average 2010-2013 Per Capita (gallons per day [GPD] finished water)	79			
Potable Water Demands (daily average annual finished water in MGD)	**0.51**	**0.55**	**0.60**	**0.65**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 43-00041-W (expires 2029)			
Surficial Aquifer System	1.18			
Floridan Aquifer System	0.00			
Total Allocation	**1.18**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4430667)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	1.30	1.30	1.30	1.90
Floridan Aquifer System	0.00	0.00	0.00	0.00
Total Potable Capacity	**1.30**	**1.30**	**1.30**	**1.90**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.75	0.75	0.75	0.75

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Expand SAS Water Treatment Plant (WTP) from 1.3 to 1.9 MGD contingent upon growth	SAS	2040	$3.2	0.00	0.00	0.60
Total Potable Water			**$3.2**	**0.00**	**0.00**	**0.60**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$3.2**	**0.00**	**0.00**	**0.60**

MARTIN COUNTY CONSOLIDATED SYSTEM

County: Martin

Service Area: Unincorporated Martin County including portions of City of Stuart, Jensen Beach, Martin Downs, Palm City, Port Salerno, Tropical Farms, Miles Grant Golf and Country Club, Indian River Plantation, Floridian National Golf Club, and all of Town of Ocean Breeze Park, Piper's Landing Yacht and Country Club, Town of Sewell's Point, and the southern portion of Hutchinson Island in St. Lucie County

Description: Potable water supplies are 29 percent from the SAS and 71 percent from the FAS; they are projected to be 22 percent SAS and 78 percent FAS in the future. This utility is reusing 49 percent (2.02 MGD) of its wastewater.

Bulk: Martin County provides up to 1.0 MGD of potable water to the City of Stuart through 2028

Population and Finished Water Demand (MGD)						
		Existing	Projected			
		2013	2020	2030	2040	
Population		88,887	97,339	106,925	112,572	
Average 2010-2013 Per Capita (GPD finished water)		103				
Potable Water Demands (daily average annual finished water in MGD)		**9.16**	**10.03**	**11.01**	**11.59**	
SFWMD Consumptive Use Permitted Allocation (MGD)						
Potable Water Source		Permit Number 43-00102-W (expires 2035)				
Surficial Aquifer System		4.42				
Floridan Aquifer System		15.09				
Total Allocation		**21.00**				
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4431891)						
Permitted Capacity by Source		Cumulative Facility & Project Capacity (MGD)				
		Existing	Projected			
		2013	2020	2030	2040	
Surficial Aquifer System		5.55	5.55	5.55	5.55	
Floridan Aquifer System		13.50	13.50	17.50	19.50	
Total Potable Capacity		**19.05**	**19.05**	**23.05**	**25.05**	
FDEP Non-Potable Water Treatment Capacity (MGD)						
Reclaimed Water		8.06	8.06	8.06	8.06	
Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Drill North Jensen Floridan Well RO-5	FAS	2021	$2.25	0.00	2.00	2.00
Expand Tropical Farms RO WTP from 10 to 12 MGD (2 MGD) (2025) and expand from 12 to 14 MGD (2MGD) (2035)	FAS	2025/2035	$9.5	0.00	2.00	4.00
Total Potable Water			**$11.75**	**0.00**	**4.00**	**6.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$11.75**	**0.00**	**4.00**	**6.00**

SAILFISH POINT

County: Martin

Service Area: Unincorporated Martin County serving Sailfish Point development on South Hutchinson Island.

Description: Potable water supplies are 100 percent from the FAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.08 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing		Projected	
	2013	2020	2030	2040
Population	1,002	1,002	1,002	1,002
Average 2010-2013 Per Capita (GPD finished water)	150			
Potable Water Demands (daily average annual finished water in MGD)	**0.15**	**0.15**	**0.15**	**0.15**

SFWMD Consumptive Use Permitted Allocation (MGD)	
Potable Water Source	Permit Number 43-00146-W (expires 2022)
Surficial Aquifer System	0
Floridan Aquifer System	0.22
Total Allocation	**0.22**

FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4434000)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0	0	0	0
Floridan Aquifer System	0.35	0.35	0.35	0.35
Total Potable Capacity	**0.35**	**0.35**	**0.35**	**0.35**

FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.25	0.25	0.25	0.25

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No Projects						
Total Potable Water			**$0.00**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$0.00**	**0.00**	**0.00**	**0.00**

SOUTH MARTIN REGIONAL UTILITY

County: Martin

Service Area: Town of Jupiter Island, Hobe Sound vicinity, and portions of southeastern unincorporated Martin County

Description: Potable water supplies are 75 percent from the SAS and 25 percent from the FAS; they are projected to be 59 percent SAS and 41 percent FAS in the future. This utility is reusing 100 percent (0.80 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	23,629	25,151	27,326	29,500
Average 2010-2013 Per Capita (GPD finished water)	150			
Potable Water Demands (daily average annual finished water in MGD)	**3.54**	**3.77**	**4.10**	**4.43**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 43-00066-W (expires 2032)			
Surficial Aquifer System	4.83			
Floridan Aquifer System	4.76			
Total Allocation	**8.64**[a]			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4430624)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	6.14	6.14	6.14	6.14
Floridan Aquifer System	2.00	2.00	4.20	4.20
Total Potable Capacity	**8.14**	**8.14**	**10.34**	**10.34**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	1.40	1.40	2.40	2.40

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Expand RO WTP from 2.0 to 4.2 MGD (2.2 MGD)	FAS	2025	$3.5	0.00	2.20	2.20
Total Potable Water			**$3.5**	**0.00**	**2.20**	**2.20**
Non-Potable Water						
Expand WW Supplemental IQ sources	SAS/Reclaimed	2025	$1.0	0.00	1.00[b]	1.00
Total Non-Potable Water			**$1.0**	**0.00**	**1.00**	**1.00**
Total New Water			**$4.5**	**0.00**	**3.20**	**3.20**

[a] The SAS and FAS permit allocation does not always total exactly. See permit for further information.

[b] The expansion of wastewater supplemental IQ water sources does not increase the non-potable water treatment capacity.

CITY OF STUART

County: Martin

Service Area: City of Stuart and portion of unincorporated Martin County

Bulk: Stuart has a 20-year inter-local agreement with Martin County to receive potable water of up to 1.0 MGD (2008 to 2028)

Description: Potable water supplies are 92 percent from the SAS and 8 percent from the FAS; they are projected to be 88 percent SAS and 12 percent FAS in the future. This utility is reusing 13 percent (0.21 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	16,841	17,919	19,460	21,000
Average 2010-2013 Per Capita (GPD finished water)	196			
Potable Water Demands (daily average annual finished water in MGD)	**3.30**	**3.51**	**3.81**	**4.12**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 43-00053-W (expires 2029)			
Surficial Aquifer System	3.67			
Floridan Aquifer System	0.00			
Total Allocation	**3.67**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4430259)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	6.00	6.00	6.00	6.00
Floridan Aquifer System	0.50	0.50	0.80	0.80
Total Potable Capacity	**6.50**	**6.50**	**6.80**	**6.80**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	4.00	4.00	4.00	4.00

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
20 year inter-local agreement with Martin County for purchase of up to 1.0 MGD bulk potable water (2008-2028)	FAS	2028	Not specified	0.50	0.80	0.80
Total Potable Water			**$0.0**	**0.50**	**0.80**	**0.80**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$0.30**	**0.00**	**0.00**	**0.00**
Total New Water			**$0.30**	**0.50**	**0.80**	**0.80**

FORT PIERCE UTILITIES AUTHORITY (FPUA)

County: St. Lucie

Service Area: City of Ft. Pierce and provides bulk water to St. Lucie County Utilities

Bulk: FPUA provides up to 1.01 MGD potable water to St. Lucie County through inter-local agreement 2013 to 2027

Description: Potable water supplies are 68 percent from the SAS and 32 percent from the FAS; they are projected to be 56 percent SAS and 44 percent FAS in the future. This utility is reusing 3 percent (0.15 MGD) of its wastewater.

Population And Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	43,074	51,351	63,176	75,000
Average 2010-2013 Per Capita (GPD finished water)	115			
Potable Water Demands (daily average annual finished water in MGD)	**4.95**	**5.91**	**7.27**	**8.63**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00085-W (expires 2027)			
Surficial Aquifer System	8.00			
Floridan Aquifer System	13.13			
Total Allocation	**21.13**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4560490)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	13.00	13.00	13.00	13.00
Floridan Aquifer System	6.00	6.00	10.33	10.33
Total Potable Capacity	**19.00**	**19.00**	**23.33**	**23.33**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	10.00	10.00	15.00	20.00

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Expand Henry Gahn RO WTP from 6.00 to 10.33 MGD (4.33 MGD) includes 2.0 MGD FAS well and raw water pipeline and spare feed pump for emergencies (2021) and 2nd DIW (3 MGD) for concentrate disposal (2027 -$3.6M)	FAS	2021/2027	$12.1	0.00	4.33	4.33
Total Potable Water			**$12.1**	**0.00**	**4.33**	**4.33**
Non-Potable Water						
Construct Mainland Water Reclamation Wastewater Treatment Facility (WWTF) Phase 1- 5 MGD (2021) and Phase 2 expansion by 5 MGD (2031)	Reclaimed	2021/2031	$56.5	0.00	5.00	10.00
Total Non-Potable Water			**$56.5**	**0.00**	**5.00**	**10.00**
Total New Water			**$68.6**	**0.00**	**9.33**	**14.33**

HARBOUR RIDGE

County: St. Lucie

Service Area: Unincorporated St. Lucie County serving Harbour Ridge Country Club

Description: Potable water supplies are 100 percent from the SAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.07 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	1,071	1,196	1,200	1,200
Average Per Capita 2010-2013 (GPD finished water)	103			
Potable Water Demands (daily average annual finished water in MGD)	**0.11**	**0.12**	**0.12**	**0.12**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00449-W (expires 2029)			
Surficial Aquifer System	0.13			
Floridan Aquifer System	0.00			
Total Allocation	**0.13**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4565002)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.36	0.36	0.36	0.36
Floridan Aquifer System	0.00	0.00	0.00	0.00
Total Potable Capacity	**0.36**	**0.36**	**0.36**	**0.36**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.12	0.12	0.12	0.12

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No projects						
Total Potable Water			**$0.0**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
Installation of 3 irrigation surficial wells (0.94 MGD)[a]	SAS	2013	$0.3	0.94	0.94	0.94
Total Non-Potable Water			**$0.3**	**0.94**	**0.94**	**0.94**
Total New Water			**$0.3**	**0.94**	**0.94**	**0.94**

[a] This capacity does not increase the non-potable water treatment capacity.

MEADOWOOD COMMUNITY ASSOCIATION

County: St. Lucie

Service Area: Unincorporated St. Lucie County serving Meadowood Community Association.

Description: Potable water supplies are 100 percent from SAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.06 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	668	791	800	800
Average 2010-2013 Per Capita (GPD finished water)	129			
Potable Water Demands (daily average annual finished water in MGD)	**0.09**	**0.10**	**0.10**	**0.10**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00462-W (expires 2032)			
Surficial Aquifer System	0.14			
Floridan Aquifer System	0.00			
Total Allocation	**0.14**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4564397)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.43	0.43	0.43	0.43
Floridan Aquifer System	0.00	0.00	0.00	0.00
Total Potable Capacity	**0.43**	**0.43**	**0.43**	**0.43**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.11	0.11	0.11	0.11

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No Projects						
Total Potable Water			**$0.0**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$0.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$0.0**	**0.00**	**0.00**	**0.00**

CITY OF PORT ST. LUCIE UTILITY SYSTEMS DEPARTMENT

County: St. Lucie

Service Area: City of Port St. Lucie (including a portion of the Reserve development) and portions of unincorporated St. Lucie County

Bulk: Port St. Lucie provides up to 0.35 MGD potable water to the Martin County Correction Institution through an inter-local agreement with Martin County.

Description: Potable water supplies are 24 percent from the SAS and 76 percent from the FAS; they are projected to be 42 percent surface water/reservoir, 11 percent SAS, and 47 percent FAS in the future. This utility is reusing 14 percent (1.03 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	171,016	209,272	263,782	304,296
Average 2010-2013 Per Capita (GPD finished water)	79			
Potable Water Demands (daily average annual finished water in MGD)	**13.51**	**16.53**	**20.84**	**24.04**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00142-W (expires 2028)			
Surficial Aquifer System	5.00			
Floridan Aquifer System	46.38			
Total Allocation	**51.38**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4560954)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surface water	0.00	0.00	0.00	30.00
Surficial Aquifer System	8.00	8.00	8.00	8.00
Floridan Aquifer System	33.65	33.65	33.65	33.65
Total Potable Capacity	**41.65**	**41.65**	**41.65**	**71.65**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	18.00	18.00	18.00	18.00
Aquifer Storage and Recovery (ASR)	0.00	4.00	10.25	20.25

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Construct McCarty Ranch Reservoir in preparation for future surface water WTP, includes dredging, culverts, pond dredging & berm construction & stormwater pumping station and WCS No. 9 Replacement for future SW WTP with storage of water from the C-23 Canal (2017-2030)	Stormwater	2030	$60.0	0.00	0.00	0.00
Construct 20 MGD McCarty Ranch Surface Water WTP (2031) for treatment of surface water and for potable water use and a 10 MGD expansion (2033)	Surface water	2031/2033	$147.0	00.0	00.0	30.00
Total Potable Water			**$207.0**	**0.00**	**0.00**	**30.00**

Projects Summary (Continued)						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Non-Potable Water						
Drill and construct ASR well at Westport WWTF FDEP permitted (2017 or as funds become available $1.6M) & development of annual ASR cycle 2018, $0.6M)	ASR/ Reclaimed	2017/2018	$2.2	4.00	4.00	4.00
Drill and construct ASR wells at McCarty Ranch WTP – 6.25 MGD in 2025 and an additional 10 MGD in 2031	ASR/ Surface water/ stormwater	2025/2031	$14.0	0.00	6.25	16.25
Total Non-Potable Water			**$16.2**	**0.00**	**0.00**	**0.00**
Total New Water			**$255.6**	**0.00**	**0.00**	**0.00**

RESERVE COMMUNITY DEVELOPMENT DISTRICT

County: St. Lucie

Service Area: The Reserve development (portion) is located within the City of Port St. Lucie and receives bulk water from St. Lucie West Services District

Description: Potable water supplies are 62 percent from the SAS and 38 percent Floridan bulk water from SLWSD; they are projected to be 58 percent SAS and 42 percent FAS in the future. This utility is not reusing wastewater.

Bulk: RCDD receives up to 0.30 MGD bulk potable water from St. Lucie West Services District through 2024 with automatic 5-year renewals.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	4,465	5,466	5,500	5,500
Average 2010-2013 Per Capita (GPD finished water)	72			
Potable Water Demands (daily average annual finished water in MGD)	**0.32**	**0.39**	**0.40**	**0.40**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00552-W (expires 2029)			
Surficial Aquifer System	0.17			
Floridan Aquifer System	0.00			
Total Allocation	**0.17**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4565030)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.41	0.41	0.41	0.41
Floridan Aquifer System	0.25	0.25	0.30	0.30
Total Potable Capacity	**0.66**	**0.66**	**0.71**	**0.71**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.00	0.00	0.00	0.00

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
Potable bulk water agreement with SLWSD through 2024 up to 0.30 MGD with automatic 5-year renewals	FAS	TBD	Not Specified	0.25	0.30	0.30
Total Potable Water			**Not Specified**	**0.25**	**0.30**	**0.30**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$0.0**	**0.00**	**0.00**	**0.00**
Total New Water			**Not Specified**	**0.25**	**0.30**	**0.30**

SPANISH LAKES COUNTRY CLUB

County: St. Lucie

Service Area: Unincorporated St. Lucie County serving Spanish Lakes Country Club

Description: Potable water supplies are 100 percent from the SAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.10 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	1,532	1,762	2,114	2,422
Average 2010-2013 Per Capita (GPD finished water)	127			
Potable Water Demands (daily average annual finished water in MGD)	**0.19**	**0.22**	**0.27**	**0.31**

SFWMD Consumptive Use Permitted Allocation (MGD)	
Potable Water Source	Permit Number 56-00401-W (expires 2026)
Surficial Aquifer System	0.31/0.22[a]
Floridan Aquifer System	0.00
Total Allocation	**0.31/0.22[a]**

FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4564006)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.48	0.48	0.48	0.48
Floridan Aquifer System	0.00	0.00	0.00	0.00
Total Potable Capacity	**0.48**	**0.48**	**0.48**	**0.48**

FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.16	0.16	0.16	0.16

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No Projects						
Total Potable Water			**$0.00**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$0.00**	**0.00**	**0.00**	**0.00**

[a] The surficial aquifer allocation was bifurcated on July 15, 2011 with a decrease in allocation from 0.31 to 0.22 MGD. To continue with the higher allocation the utility is in the process of preparing for a permit modification for the higher allocation.

SPANISH LAKES FAIRWAYS

County: St. Lucie

Service Area: Unincorporated St. Lucie County serving Spanish Lakes Fairways

Description: Potable water supplies are 100 percent from the SAS and are projected to remain the same in the future. This utility is reusing 100 percent (0.12 MGD) of its wastewater.

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	2,082	2,394	2,873	3,290
Average 2010-2013 Per Capita (GPD finished water)	97			
Potable Water Demands (daily average annual finished water in MGD)	**0.20**	**0.23**	**0.28**	**0.32**

SFWMD Consumptive Use Permitted Allocation (MGD)	
Potable Water Source	Permit Number 56-00627-W (expires 2018)
Surficial Aquifer System	0.38
Floridan Aquifer System	0.00
Total Allocation	**0.38**

FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4565043)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.57	0.57	0.57	0.57
Floridan Aquifer System	0.00	0.00	0.00	0.00
Total Potable Capacity	**0.57**	**0.57**	**0.57**	**0.57**

FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	0.25	0.25	0.25	0.25

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No Projects						
Total Potable Water			**$0.00**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$0.00**	**0.00**	**0.00**	**0.00**

ST. LUCIE COUNTY UTILITIES DISTRICT

County: St. Lucie

Service Area: Unincorporated St. Lucie County including serving north and central county areas and South Hutchinson Island

Description: Potable water supplies are 100 percent fresh groundwater from SAS and 1.0 MGD potable bulk water received from FPUA; they are projected to be 3 percent SAS and 97 percent FAS in the future. This utility is reusing 99 percent (0.69 MGD) of its wastewater.

Bulk: St. Lucie County receives up to 1.01 MGD potable bulk water from FPUA through inter-local agreement 2013-2027. St. Lucie County distributes this bulk potable water through its distribution lines to unincorporated St. Lucie County (serving North Hutchinson Island, Indian River Estates, Portofino Shores and the Midway Road-Okeechobee Road Corridor).

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	17,093	25,792	37,280	39,853
Average 2010-2013 Per Capita (GPD finished water)	74.5			
Potable Water Demands (daily average annual finished water in MGD)	**1.27**	**1.92**	**2.78**	**2.97**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00406-W (expires 2028)			
Surficial Aquifer System	0.17			
Floridan Aquifer System	6.65			
Total Allocation	**6.82**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4561689)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.29	0.79	0.79	0.79
Floridan Aquifer System	0.00	5.50	4.00	25.0
Total Potable Capacity	**0.29**	**6.29**	**5.79**	**25.79**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	2.40	2.75	10.75	14.75

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
A 15 year inter-local agreement to receive brackish bulk potable water from FPUA up to 1.01 MGD (2013-2027)	FAS	2028	Not Specified	1.00	0.00	0.00
Expand Holiday Pines SAS WTP[1]	SAS	2018	$1.0	0.50	0.50	0.50
Construct North County Utility (NCU) FAS RO WTP phased 5.0 MGD (2020) and expand by 5.0 MGD (2028) and expand by 7 MGD (2040) for a total of 17.0 MGD	FAS	2020-2040	$136.0	5 .00	10.00	17.00
Construct Central County FAS RO WTP phased 2 MGD (2030) and expand by 2.0 MGD (2040) to a total of 4 MGD	FAS	2030-2035	$16.0	0.00	2.00	4.00
Construct South County FAS RO WTP phased 2.0 MGD (2034) and expand by 2.0 MGD (2039) to a total of 4 MGD	FAS	2034-2039	$16.0	0.00	2.00	4.00
Total Potable Water			**$169.0**	**6.50**	**14.50**	**25.50**

Projects Summary (Continued)						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Non-Potable Water						
Expand No. Hutchinson Island WWTF from 0.5 to 0.85 (0.35 MGD expansion and upgrades)	Reclaimed	2015	$4.06	0.35	0.35	0.35
Construct No. County 2.0 MGD WWTF (2016-2020) and expand by 2.0 MGD (2028) and expand by 2 MGD (2040) to total of 6 MGD	Reclaimed	2016-2040	$72.0	2.00	4.00	6.00
Construct Central County 2.0 MGD WWTF (2020), expand by 2.0 MGD (2028), and expand again by 2.0 MGD (2040) to total of 6.0 MGD	Reclaimed	2020-2040	$72.0	2.00	4.00	6.00
Total Non-Potable Water			**$148.06**	**4.35**	**8.35**	**12.35**
Total New Water			**$317.10**	**10.85**	**22.85**	**37.85**

[1] This proposed SAS project would require a modification the Water Use Permit with impact modeling and analysis to determine if the SAS allocation could be increased due to concerns for existing legal users, wetlands and saline water conditions.

ST. LUCIE WEST SERVICES DISTRICT

County: St. Lucie

Service Area: St. Lucie West development located within the City of Port St. Lucie.

Description: Potable water supplies are 100 percent from the FAS and are projected to be same in the future. This utility is reusing 100 percent (1.71 MGD) of its wastewater.

Bulk: SLWSD provides up to 0.30 MGD potable bulk water to the Reserve through 2024 with automatic 5-year renewals

Population and Finished Water Demand (MGD)				
	Existing	Projected		
	2013	2020	2030	2040
Population	13,398	14,591	16,296	18,000
Average 2010-2013 Per Capita (GPD finished water)	115			
Potable Water Demands (daily average annual finished water in MGD)	**1.54**	**1.68**	**1.87**	**2.07**
SFWMD Consumptive Use Permitted Allocation (MGD)				
Potable Water Source	Permit Number 56-00614-W (expires 2025)			
Surficial Aquifer System	0.00			
Floridan Aquifer System	2.33			
Total Allocation	**2.33**			
FDEP Potable Water Treatment Capacity (MGD) (PWS ID # 4565031)				
Permitted Capacity by Source	Cumulative Facility & Project Capacity (MGD)			
	Existing	Projected		
	2013	2020	2030	2040
Surficial Aquifer System	0.00	0.00	0.00	0.00
Floridan Aquifer System	3.40	3.40	3.40	3.40
Total Potable Capacity	**3.40**	**3.40**	**3.40**	**3.40**
FDEP Non-Potable Water Treatment Capacity (MGD)				
Reclaimed Water	2.00	2.00	2.00	2.00

Projects Summary						
Water Supply Projects	Source	Completion Date	Total Capital Cost ($ Million)	Projected Cumulative Design Capacity (MGD)		
				2020	2030	2040
Potable Water						
No Projects						
Total Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Non-Potable Water						
No Projects						
Total Non-Potable Water			**$00.0**	**0.00**	**0.00**	**0.00**
Total New Water			**$00.0**	**0.00**	**0.00**	**0.00**

7

Future Direction

This chapter of the *2016 Upper East Coast Water Supply Plan Update* (2016 UEC Plan Update) summarizes the future direction for water supply in the UEC Planning Area of the South Florida Water Management District (SFWMD or District). This plan update provides an assessment of the water supply demand and available sources for the UEC Planning Area through 2040. Water demand is expected to increase by approximately 97.2 million gallons per day (MGD) in the UEC Planning Area by 2040, primarily due to increases in AGR, PWS, and Power Generation Self-Supply (PWR) water use categories, as discussed in **Chapter 2**.

TOPICS

- Water Sources
- Water Conservation
- Coordination
- Sea Level Rise and Climate Change
- Conclusions

Snowy Egrets

Meeting the 1-in-10 year drought event level of certainty for surface water users located within the Lake Okeechobee Service Area (LOSA) portion of the planning area is not possible within the next 5 years due to the relationship of the federal and state projects outlined in this plan update and operations of Lake Okeechobee under the 2008 Lake Okeechobee Regulation Schedule (2008 LORS). Rehabilitation of the Herbert Hoover Dike by the U.S. Army Corps of Engineers (USACE) is important for the protection of citizens living near the lake, and completing the project in part or wholly may enable revision of the lake operating schedule. The SFWMD anticipates any additional water from Lake Okeechobee resulting from revision of the lake operating schedule could return the lake to minimum flow and level (MFL) prevention status, enhance the level of certainty to existing permitted users, and support other environmental objectives.

Guidance offered in this plan update should be considered when developing water supply options to meet future needs. Statutory requirements, existing conditions, resource constraints (including protection tools and criteria), and the needs of all water users are addressed. All water users are encouraged to continue being prudent with water use decisions and use water efficiently. The SFWMD's future direction for water supply planning in the UEC Planning Area recommends continued coordination with agricultural stakeholders, utilities, and other water users; natural resource protection; and continued monitoring to develop responses to changes in water levels and water quality in surface water and groundwater.

WATER SOURCES

The UEC Planning Area has relied on surface water from the C-23, C-24 and C-25 canals as well as Lake Okeechobee and its connected canals for agricultural irrigation with supplementation from the Floridan aquifer system (FAS) during dry periods. Fresh groundwater from the surficial aquifer system (SAS) and water from the FAS are the primary water sources for PWS and other urban and industrial uses.

Restricted Allocation Area (RAA) criteria limit increased allocations of surface water from the C-23, C-24, and C-25 canal systems, and directly connected canals, any use above existing allocations. Pumps on Floridan wells in Martin and St. Lucie counties are restricted also, except under certain conditions, as outlined in the *Applicant's Handbook for Water Use Permit Applications* (SFWMD 2015a). In addition, RAA criteria for the LOSA limit surface water withdrawals from Lake Okeechobee and hydraulically connected canals, such as the C-44 (St. Lucie) Canal. In the LOSA, the current level of certainty is for 1-in-6 year drought conditions.

Withdrawals from the SAS have been maximized in many areas, especially along the coast, due to potential impacts on wetlands as well as the increased potential for saltwater intrusion into freshwater sources; therefore, the FAS will be used as a source to a greater degree in order to meet future water demands in the UEC Planning Area. Since the 2011 UEC Plan Update, the use of brackish water from the FAS for water supply has increased slightly. Blending brackish water with fresh water from the SAS or surface water is a practical solution for meeting some of the region's AGR needs when surface water availability is limited or during freezes. However, if crops change, supplemented water from the FAS may not meet agricultural needs.

Water storage features such as reservoirs, aquifer storage and recovery (ASR) wells, and impoundments can be used to capture storm water, groundwater, and surface water during wet weather periods and to provide supplemental water supply for AGR, PWS, natural systems, and other needs.

Conservation is an important component of integrated water resource management and may reduce, defer, or eliminate the need to expand water supply infrastructure. Water conservation by all users is a key element in meeting future water needs. Reclaimed water can be used to meet new uses or replace freshwater sources and potable water currently used for irrigation or industrial purposes.

The SFWMD offers recommendations and guidance in the following sections for consideration by local governments, utilities, agricultural entities, other water users, and SFWMD water supply managers and staff as a basis for the future direction of water supply planning in the UEC Planning Area.

Groundwater

Groundwater is the primary source of water for urban needs with approximately 40 percent of the PWS demand in 2013 being met using fresh groundwater from the SAS and 60 percent using brackish groundwater from the FAS. Brackish groundwater from the FAS also serves as a supplemental source for many agricultural stakeholders.

Surficial Aquifer System

The use of the SAS for new or increased allocations will be evaluated on an application-by-application basis to determine if the project meets the District's water use permitting criteria. The following actions are recommended:

- Design of well/wellfield locations, configurations, and pumping regimes should maximize withdrawals while avoiding harm to natural systems and reducing uncertainties and potential impacts from saltwater intrusion.
- Utilities should continue to expand interconnections with other utilities and develop alternative water supply (AWS) projects as needed.
- Utilities should consider implementing groundwater recharge systems utilizing reclaimed water.
- The monitoring networks used for saltwater intrusion and assessment of the SAS is a hybrid of regional monitoring and monitoring required by or performed by water use permittees. The SFWMD, in coordination with PWS utilities, should identify wells considered critical to long-term monitoring and modeling to ensure that these wells are maintained or replaced as necessary. Geophysical assessment of the monitor wells should be included, as appropriate.
- Utilities at risk and utilities of concern should continue implementing options such as interconnections, AWS development, and appropriate wellfield operations.

Floridan Aquifer System

The FAS in the UEC Planning Area is expected to be the primary water source to meet increased demands. Brackish groundwater from the FAS is not considered a limited resource in the UEC Planning Area. The following future actions are recommended:

- Brackish water from the FAS may be blended with fresh groundwater or surface water to produce acceptable irrigation-quality water. Utilization of blended water supplies depend on crop requirements, water sources, type of treatment, volume of stored water, and natural system requirements. They also require monitoring to ensure acceptable water quality.
- All local water users installing FAS wells are encouraged to collaborate with the SFWMD to gather and share hydrogeologic data. The data increase knowledge of the FAS and could be used to support future groundwater modeling efforts.
- The monitoring networks used for assessment and modeling of the FAS is a hybrid of regional monitoring and monitoring required by or performed by water use permittees. Monitor wells have been lost due to changes in permit monitoring requirements and construction activities. Efforts should be made to identify wells considered critical to long-term monitoring and modeling to ensure that they are maintained or replaced as necessary.
- Local water users, other agencies, local governments, and utilities are encouraged to coordinate with the SFWMD to improve ongoing water level and water quality monitoring of the FAS. Efforts should be made to identify wells considered critical

to long-term monitoring and modeling to ensure that these wells are maintained or replaced as necessary. Geophysical assessment of the monitor wells should be conducted, as appropriate.

- Design of wells, establishment of wellfield locations and configurations, and pumping regimes should maximize withdrawals while minimizing water level and water quality changes. This will require a combination of additional wells with greater spacing between wells, lower capacity wells in the Avon Park Permeable Zone (APPZ), and continued refinement of wellfield operational plans.
- The SFWMD should continue to work with FAS stakeholders, including the St. Johns River Water Management District (SJRWMD), to further refine assumptions used in the East Coast Floridan Model (ECFM) simulations to better define water quality tolerances for crops and understand FAS use as it relates to surface water availability.
- Landowners are encouraged to plug and abandon inactive or dysfunctional FAS wells in accordance with existing rules and regulations. This will prevent loss of water via free-flowing wells and contamination of the SAS and intermediate confining unit with more saline water from the FAS.
- Utilities that have the FAS as a source should look to use reclaimed water to reduce potable demand and thereby minimize the potential water quality changes identified in the ECFM simulations.

Surface Water

Surface water is the primary source for the AGR water use category in the UEC Planning Area. Due to limited surface water availability and canal bank instability at low stages, the C-23, C-24, and C-25 canal system is designated a RAA [Rule 40E-2.091, F.A.C.] (Subsection 3.2.1.B of the Applicant's Handbook [SFWMD 2015a]). The RAA criteria for the C-23, C-24, and C-25 canal system state that no additional surface water will be allocated from these canals, or any connected canal systems that derive water supply from these canals, over and above existing allocations. Because these canals have permitted withdrawals reduced or terminated based on water levels (14 feet NGVD), water shortages have been triggered more frequently than a 1-in-10 year drought; therefore, users of these canals may not have a 1-in-10 level of certainty.


C-23 in St. Lucie Agricultural Area

The following actions are suggested for the UEC Planning Area:

- The SFWMD will continue to implement CERP, including construction of the C-44 Reservoir and Stormwater Treatment Area (STA) and other projects identified in MFL prevention and recovery strategies.

- Where appropriate, water users are encouraged to create storage areas within their boundaries or to identify other areas for storage of excess surface water for water supply purposes.
- The SFWMD will continue to implement MFL recovery and prevention strategies for the St. Lucie River and Estuary, the Northwest Fork of the Loxahatchee River, and Lake Okeechobee, and update these in conjunction with future plan updates.
- The USACE should complete seepage berm construction or equivalent repairs to the Herbert Hoover Dike for Reaches 1, 2, and 3 no later than 2022 and revise the LORS, as recognized in the *Final Environmental Impact Statement Including Appendices A through G – Lake Okeechobee Regulation Schedule* (USACE 2007) and the *Draft Integrated Project Implementation Report and Environmental Impact Statement – Central Everglades Planning Project* (USACE and SFWMD 2013).
- Where appropriate, agricultural users should augment use of surface water with projects such as stormwater and tailwater recovery, the blending of brackish groundwater with fresh water, and more efficient water conservation practices.

Reclaimed Water

In the UEC Planning Area, reclaimed water is used primarily for landscape irrigation, with some usage for groundwater recharge, cooling water, and environmental enhancement. Approximately 22.4 MGD (on average) of wastewater was treated in this region in 2013; this is projected to increase to 37.8 MGD by 2040. In 2013, 7.9 MGD (35 percent) of the treated wastewater was reused for a beneficial purpose. Opportunities to expand reclaimed water use include the following:

- Local governments should consider requiring construction of reclaimed water infrastructure in new developments and establishing mandatory reuse zones. The SFWMD will provide technical assistance to local governments to establish mandatory reuse zones.
- Local governments and utilities should support the development of additional reclaimed water lines for green space irrigation such as residential lots, medians, common areas, and golf courses.
- To promote efficient use, utilities should consider strategies to support the expansion of reclaimed water supply such as metering, tiered rate structures, limiting days of the week for landscape irrigation, and facilitating interconnects between reclaimed water utilities.

Reclaimed Water Pipes

- Providers may consider the use of storage and supplemental water supplies to meet peak reclaimed system demands to maximize use of reclaimed water. Storage and supplemental water may enable a utility to extend its supply of

reclaimed water over a larger area. However, during times of drought, availability of supplemental water sources such as surface water, groundwater, and storm water to supplement reclaimed water supplies may be limited in some areas.

- Users must consider using the lowest quality source of water to meet any particular demand. Reclaimed water may be the most appropriate source for uses such as irrigation or some industrial uses. Blending multiple alternative water sources to achieve acceptable water quality can be a prudent approach to water supply.
- Amendments to Section 373.250, Florida Statutes (F.S.), made in 2013, recognize the use of "substitution credits" and "impact offsets" to promote increased availability and distribution of reclaimed water.

New Storage Capacity for Surface Water or Groundwater

Additional storage can increase water availability during dry periods. Potential types of water storage include ASR wells, off-stream reservoirs, and surface water impoundments and ponds. Opportunities for new storage capacity include the following:

- Development of reservoirs provides surface water storage that can be used for environmental, agricultural, and urban water supply needs.
- Construction of new or retrofitted surface water storage systems for agricultural operations could provide additional supply for irrigation.
- Development of ASR systems to store water during periods of low demand and high wet season water levels for subsequent recovery during dry periods, to reduce withdrawal from the SAS wells.

Seawater

The ocean is an important source of water, but desalination is required before seawater can be used for water supply purposes. Where appropriate, utilities should consider the feasibility of desalinated seawater from the Atlantic Ocean as an additional water source option for the UEC Planning Area.

WATER CONSERVATION

The continuing implementation of robust water conservation programs throughout the UEC Planning Area offers the potential to reduce future water demand by all water use categories. The continuing decline in per capita use rates shows, in part, the importance of conservation programs by PWS utilities since the last plan update. All water suppliers and users are urged to implement water conservation measures to reduce water supply demands and defer the construction of capital-intensive projects. The following conservation-related actions are recommended:

- The District will continue to implement the District's Comprehensive Water Conservation Program (SFWMD 2008).
- Local governments should develop or enhance existing ordinances to be consistent with Florida-friendly landscaping provisions [Section 373.185, F.S.] and the District's Year-round Landscape Irrigation Conservation Measures Rule [Chapter 40E-24, Florida Administrative Code (F.A.C.)].

Smart Irrigation Sensor

- PWS utilities are encouraged to develop goal-based conservation plans to implement water conservation measures with numerical goals for achievable water savings.
- Landscape water users should implement advanced irrigation technology (e.g., smart irrigation sensors), improve landscape design and management practices, and participate in recognition programs to further increase landscape water use efficiency.
- Local governments and builders should consider adoption of Florida Water Star standards for new residential construction, which could reduce water use by up to 40 percent.
- Water conservation public education programs help instill a year-round conservation ethic. Local governments and utilities are encouraged to continue providing water conservation-related educational programs in cooperation with the SFWMD.
- Industrial, commercial, and institutional entities are encouraged to utilize the *Water Efficiency and Self-Conducted Water Audits at Commercial and Institutional Facilities, A Guide for Facility Managers* (SFWMD 2013b) to improve water use efficiency and reduce operating costs.
- Agricultural and other outdoor water users are encouraged to use Florida Automated Weather Network irrigation tools.
- Installation of higher efficiency irrigation systems by AGR water users is encouraged where applicable and appropriate for specific crop types.

COORDINATION

Coordination and collaboration among regional, local government, and utility planning entities throughout the water supply planning process is essential. Examples of coordination activities include the following:

- Water Supply Facilities Work Plans are due within 18 months of approval of this 2016 UEC Plan Update. Local governments and utilities need to provide linkages

and coordination between the 2016 UEC Plan Update and the local government water supply-related elements of their comprehensive plans.

- The SFWMD should continue to work with the Florida Department of Agriculture and Consumer Services (FDACS) and agricultural stakeholders on methodologies and data sources for future crop projections.

SEA LEVEL RISE AND CLIMATE CHANGE

Sea level rise and climate change could affect hydrologic conditions, and thus water supply sources, as well as patterns of water demand. Recommendations related to climate change include the following:

- Because of changing weather patterns, the SFWMD should investigate the ability to extend the climate data used in modeling more often than the typical frequency of once every 5 years.
- The SFWMD should continue to partner with utilities, other water management districts, local government representatives, and academic organizations in the Florida Water and Climate Alliance, a stakeholder-scientist partnership committed to support decision-making in water resource management, planning, and supply operations in Florida.
- The District should continue to update the saltwater interface maps at least every 5 years. Following the map update, the SFWMD should review the PWS utilities to identify Utilities at Risk and Utilities of Concern.
- The SFWMD, in coordination with stakeholders and local governments should identify methods to evaluate the potential impacts of sea level rise and climate change in the planning area.

CONCLUSIONS

This plan update provides an assessment of the water supply demand and available sources for the UEC Planning Area through 2040. With construction of the projects identified below, sufficient water appears to be available to meet the 2040 projected water demand during a 1-in-10 year drought condition for most users. Currently, this level of certainty is reduced to a 1-in-6 year drought condition for surface water users (primarily agriculture) located within the LOSA portion of the planning area. Additionally, surface water users served by the C-23, C-24, and C-25 canals currently may not have a 1-in-10 level of certainty; however, many users rely on the FAS as a supplemental source to attain a 1-in-10 level of certainty.

Demands were developed based on the best available information. For agricultural projections, there is unusual uncertainty because citrus acreage has declined dramatically as a result of disease, and fallow citrus land may be converted to other crops. Some of these crops may require irrigation water with lower levels of total dissolved solids than citrus and may not be able to rely on the FAS as a supplemental source.

This plan update concludes that future water needs of the region can be met through the 2040 planning horizon with appropriate management, conservation, and implementation of projects identified herein. The SFWMD anticipates any additional water from Lake

Okeechobee resulting from revision of the lake operating schedule could return the lake to minimum flow and level (MFL) prevention status, enhance the level of certainty to existing permitted users, and support other environmental objectives. Meeting future water needs depends on the following:

- Construction of one potable water supply development project by a PWS utility and completion of a water use permit modification by a PWS utility.
- Implementation of the Comprehensive Everglades Restoration Program (CERP) IRL-S Project and other projects identified in MFL prevention and recovery strategies.
- Utilization of the flexibility within the 2008 Lake Okeechobee Regulation Schedule as incremental dam safety improvements are completed; and in the longer term, completion of the seepage berm construction or equivalent repairs to the Herbert Hoover Dike for Reaches 1, 2, and 3 by the USACE and implementation of a new LORS.
- Additionally, if the UEC Planning Area experiences changes in crop types and irrigated acreage, construction of additional surface water storage systems to increase water availability may be required.

Successful implementation of this 2016 UEC Plan Update requires close coordination with agricultural interests, local governments, utility water supply planning entities, and other stakeholders. Collaboration with stakeholders is essential for directing the implementation of the preceding recommendations and guidance. This partnering should ensure that water resources in the UEC Planning Area continue to be prudently managed and available to meet future demand. The District anticipates that when the Plan is updated in 5 years, the trend in agricultural water use will be clearer, reducing uncertainty in agricultural demand projections.

Glossary

1-in-10 year drought A drought of such intensity that it is expected to have a return frequency of once in 10 years. A drought, in which below normal rainfall occurs, has a 90 percent probability of being exceeded over a 12-month period. A drought event that results in an increase in water demand to a magnitude that would have a 10 percent probability of being exceeded during any given year**.**

1-in-10 year level of certainty (see *Level of Certainty*)

Acre-foot, acre-feet The volume of water that covers 1 acre to a depth of 1 foot; 43,560 cubic feet; 1,233.5 cubic meters; 325,872 gallons, which is approximately the amount of water it takes to serve two typical families for one year.

Agricultural best management practice (Agricultural BMP) A practice or combination of agricultural practices, based on research, field testing, and expert review, determined to be the most effective and practicable means of improving water quality or quantity while maintaining or even enhancing agricultural production.

Agricultural Field Scale Irrigation Requirements Simulation (AFSIRS) A simple water budget model for estimating irrigation demands that estimates demand based on basin-specific data. The AFSIRS Model calculates both net and gross irrigation requirements for average and 1-in-10 year drought irrigation requirements. A crop's net irrigation requirement is the amount of water delivered to the root zone of the crop, while the gross irrigation requirement includes both the net irrigation requirement and the losses incurred in the process of delivering irrigation to the crop's root zone.

Agricultural Self-Supply The water used to irrigate crops, to water livestock and for aquaculture (e.g., fish production) that is not supplied by a Public Water Supply utility.

Alternative Water Supply Salt water; brackish surface water and groundwater; surface water captured predominately during wet-weather flows; sources made available through the addition of new storage capacity for surface water or groundwater; water that has been reclaimed after one or more public supply, municipal, industrial, commercial, or agricultural uses; the downstream augmentation of water bodies with reclaimed water; storm water; and, any other water supply source that is designated as nontraditional for a water supply planning region in the applicable regional water supply plan. (Section 373.019, F.S.).

Annual average daily flow The total volume of wastewater flowing into a wastewater facility during any consecutive 365 days, divided by 365, and expressed in units of MGD.

Annual withdrawal The quantity of water permitted to be withdrawn during any 12-month time period.

Anthropogenic Resulting from human influence.

Applicant's Handbook *Applicant's Handbook for Water Use Permit Applications*. Read in conjunction with Chapters 40E-2, Florida Administrative Code (F.A.C.), the Applicant's Handbook further specifies the general procedures and information used by SFWMD staff for review of water use permit applications with the primary goal of meeting SFWMD water resource objectives.

Aquatic preserve Water body set aside by the state to be maintained in essentially natural or existing condition for protection of fish and wildlife and public recreation so its aesthetic, biological, and scientific values may endure for the enjoyment of future generations.

Aquifer A geologic formation, group of formations, or part of a formation that contains sufficient saturated, permeable material to yield significant quantities of water to wells and springs.

Aquifer storage and recovery (ASR) The underground storage of storm water, surface water, fresh groundwater or reclaimed water, which is appropriately treated to potable standards and injected into an aquifer through wells during wet periods. The aquifer (typically the Floridan aquifer system in south Florida) acts as an underground reservoir for the injected water, reducing water loss to evaporation. The water is stored with the intent to recover it for use during future dry periods.

Aquifer system A heterogeneous body of (interbedded or intercalated) permeable and less permeable material that functions regionally as a water-yielding hydraulic unit and may be composed of more than one aquifer separated at least locally by confining units that impede groundwater movement, but do not greatly affect the hydraulic continuity of the system. (Laney and Davidson 1986).

Area of influence For groundwater systems, the area of influence is defined by the cone of depression. For surface water systems, the area of influence is defined as the extent to which the withdrawal results in a measurable change in surface water levels or flows.

Artesian A commonly used expression, generally synonymous with "confined" and referring to subsurface (ground) bodies of water, which, due to underground drainage from higher elevations and confining layers of soil material above and below the water body (referred to as an Artesian aquifer), result in groundwater at pressures greater than atmospheric pressures.

Available supply The maximum amount of reliable water supply, including surface water, groundwater and purchases under secure contracts.

Average daily demand A water system's average daily use based on total annual water production (total annual gallons or cubic feet divided by 365).

Average rainfall year A year having rainfall with a 50 percent probability of being exceeded over a 12-month period.

Base flow Sustained flow of a stream in the absence of direct runoff. It includes natural and human-induced stream flows. Natural base flow is sustained largely by groundwater discharges.

Basin (groundwater) A hydrologic unit containing one large aquifer, or several connecting and interconnecting aquifers.

Basin (surface water) A tract of land drained by a surface water body or its tributaries.

Below land surface Depth below land surface regardless of land surface elevation.

Blaney-Criddle A formula to calculate evapotranspiration (ET) based on mean temperature and number of daylight hours. The "Modified Blaney-Criddle" is a variation of Blaney-Criddle, which multiplies the ET from Blaney-Criddle by a coefficient that relates mean air temperature to the growth stage of a crop. Additionally, effective rainfall is calculated using the mean temperature and hours of daylight, the Blaney-Criddle ET, average monthly rainfall, and a soil factor. Further calculations consider average rainfall to drought rainfall (1-in-10 year drought).

Boulder Zone A highly transmissive, cavernous zone of limestone within the Lower Floridan aquifer used to dispose of secondary-treated effluent from wastewater treatment facilities and concentrate from membrane water treatment facilities via deep injection wells.

Brackish water Water with a chloride level greater than 250 milligrams per liter (mg/L) and less than 19,000 mg/L.

Canal A human-made waterway that is used for draining or irrigating land or for navigation by boat.

Canal recharge (see *Recharge*)

Capacity Capacity represents the ability to treat, move, or reuse water. Typically, capacity is expressed in million gallons of per day (MGD).

Captured storm water/surface water Water captured predominantly during wet-weather flow and stored aboveground or underground for future beneficial use.

Central and Southern Florida Flood Control Project (C&SF Project) 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. It was designed and constructed during the 1950s by the U.S. Army Corps of Engineers (USACE) to provide flood control and improve navigation and recreation.

Comprehensive Everglades Restoration Plan (CERP) The framework and guide for the restoration, protection, and preservation of the south Florida ecosystem. CERP also provides for water-related needs of the region, such as water supply and flood protection.

Cone of depression The conical shape taken by the potentiometric surface showing the variation of drawdown with distance due to pumping from a well or wellfield.

Cone of influence The area around a producing well that will be affected by its operation.

Confined aquifer An aquifer containing groundwater that is confined under pressure and bounded between substantially less permeable materials such that water will rise in a fully penetrating well above the top of the aquifer. In cases where the hydraulic head is greater than the elevation of the overlying land surface, a fully penetrating well will naturally flow at the land surface without means of pumping or lifting.

Confining unit A body of significantly less permeable material than the aquifer, or aquifers, that it stratigraphically separates. The hydraulic conductivity may range from nearly zero to some value significantly lower than that of the adjoining aquifers, and impedes the vertical movement of water.

Conservation (see *Water conservation*)

Conservation Rate Structure A water rate structure that is designed to conserve water. Examples of conservation rate structures include, but are not limited to, increasing block rates, seasonal rates, and quantity-based surcharges.

Consumptive Use Any use of water that reduces the supply from which it is withdrawn or diverted.

Control structure An artificial structure designed to regulate the level/flow of water in a canal or other water body (e.g., weirs, dams).

Critical habitat A specific geographic area(s) that contains features essential for the conservation of a threatened or endangered species and that may require special management and protection.

Cubic feet per second (cfs) A rate of the flow (e.g., in streams and rivers). It is equal to a volume of water one foot high and one foot wide flowing a distance of one foot in one second. One "cfs" is equal to 7.48 gallons of water flowing each second. For example, if a car's gas tank was 2 feet by 1 foot by 1 foot (2 cubic feet), then gas flowing at a rate of 1 cubic foot/second would fill the tank in 2 seconds.

Culvert Conveyance structure that provides a means for water to pass under a road or railroad.

DBHYDRO The SFWMD's corporate environmental database, storing hydrologic, meteorologic, hydrogeologic, and water quality data.

Demand The quantity of water to fulfill a requirement.

Demand management Water conservation. Reducing the demand for water through activities that alter water use practices; improve efficiency in water use; reduce losses of water; reduce waste of water; alter land management practices; and/or alter land uses.

Desalination The process of removing or reducing salts and other chemicals from seawater or other highly mineralized water sources.

Dike An embankment to confine or control water, especially one built along the banks of a river to prevent overflow of lowlands; a levee.

Discharge The rate of water movement past a reference point, measured as volume per unit time (usually expressed as cubic feet or meters per second).

Disinfection The process of inactivating microorganisms that causes disease. All potable water requires disinfection as part of the treatment process prior to distribution. Disinfection methods include chlorination, ultraviolet (UV) radiation, and ozonation.

Disposal Effluent disposal involves the wasteful practice of releasing treated effluent back to the environment using ocean outfalls, surface water discharges, and deep injection wells.

Dissolved oxygen The concentration of oxygen dissolved in water, sometimes expressed as percent saturation, where saturation is the maximum amount of oxygen that theoretically can be dissolved in water at a given altitude and temperature.

Domestic Self-Supply (DSS) The water used by households whose primary source of water is water treatment facilities and/or private wells with pumpages of less than 100,000 gallons per day.

Domestic Use Use of water for household purposes, such as drinking, bathing, cooking, or sanitation.

Domestic wastewater Wastewater derived principally from residential dwellings, business or commercial buildings, institutions, and the like; sanitary wastewater; sewage.

Downstream augmentation Use of reclaimed water downstream of the point of treatment and discharge for indirect potable and nonpotable projects, such as wellfield recharge, wetland rehydration, applicable irrigation, and for maintaining minimum flows and levels.

Drainage basin Describes the land area where precipitation ultimately drains to a particular watercourse (river, stream) or body of water (lake, reservoir). Drainage basins in south Florida are defined by Rule and are periodically redefined to reflect changes in the regional drainage network.

Drawdown (1) The vertical distance between the static water level and the surface of the cone of depression. (2) A lowering of the groundwater surface caused by pumping.

Drought A long period of abnormally low rainfall, especially one that adversely affects growing or living conditions.

Ecological risk assessment (1) An organized procedure to evaluate the likelihood that ecological effects will occur as a result of exposure to stressors related to human activities, such as the draining of wetlands or release of chemicals. (2) The process that evaluates the likelihood of adverse ecological effects that may occur or are occurring as a result of exposure to one or more stressors.

Ecology The study of the inter-relationships of plants and animals to one another and to their physical and biological environment.

Ecosystem Biological communities together with their environment, functioning as a unit.

Ecosystem restoration The process of reestablishing to as near its natural condition as possible, the structure, function, and composition of an ecosystem.

Effective rainfall The portion of rainfall that infiltrates the soil and is stored for plant use in the crop root zone.

Effluent Treated water that is not reused after flowing out of any facility or other works used for treating, stabilizing, or holding wastes. Effluent is "disposed" of.

Elevation The height in feet above mean sea level according to National Geodetic Vertical Datum (NGVD) or North American Vertical Datum 88 (NAVD). May also be expressed in feet above mean sea level as reference datum.

Environmental impact statement (EIS) Required under United States environmental law by the National Environmental Policy Act for federal government agency actions "significantly affecting the quality of the human environment." The EIS evaluates the positive and negative environmental effects of a proposed agency action.

Estuary The part of the wide lower course of a river where its current is met by ocean tides or an arm of the sea at the lower end of a river where fresh and salt water meet.

Evapotranspiration (ET) The total loss of water to the atmosphere by evaporation from land and water surfaces and by transpiration from plants.

Exceedance The violation of the pollutant levels permitted by environmental protection standards.

Existing legal use of water A water use authorized under a District water use permit or existing and exempt from permit requirements.

Fallow Land left unseeded during a growing season. The act of plowing land and leaving it unseeded. The condition or period of being unseeded.

Feasibility study The phase of a project where the purpose is to describe and evaluate alternative plans and fully describe a recommended project.

Finished water Water that has completed a purification or treatment process; water that has passed through all the processes in a water treatment facility and is ready to be delivered to consumers. Contrast with *Raw Water*.

Fiscal Year (FY) The South Florida Water Management District's fiscal year begins on October 1 and ends on September 30 the following year.

Florida Administrative Code (F.A.C.) The Florida Administrative Code is the official compilation of the administrative rules and regulations of state agencies.

Florida Department of Agriculture and Consumer Services (FDACS) 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. The FDACS also oversees Florida's Soil and Water Conservation districts, which coordinate closely with the U.S. Department of Agriculture–Natural Resources Conservation Service.

Florida Department of Economic Opportunity (FDEO) Through the Division of Community Development, the FDEO manages the state's land planning and community development responsibilities, ensuring that new growth fosters economic development while protecting resources of state significance.

Florida Department of Environmental Protection (FDEP) The SFWMD operates under the general supervisory authority of the FDEP, which includes budgetary oversight.

Florida Fish and Wildlife Conservation Commission (FWC) State agency charged with managing fish and wildlife resources for their long-term well-being and benefit of the people.

Florida-friendly landscaping Quality landscapes that conserve water, protect the environment, are adaptable to local conditions, and are drought tolerant. The principles of such landscaping include planting the right plant in the right place, efficient watering, appropriate fertilization, mulching, attraction of wildlife, responsible management of yard pests, recycling yard waste, reduction of stormwater runoff, and waterfront protection. Additional components include practices such as landscape planning and design, soil analysis, the appropriate use of solid waste compost, minimizing the use of irrigation, and proper maintenance.

Florida Statutes (F.S.) The Florida Statutes are a permanent collection of state laws organized by subject area into a code made up of titles, chapters, parts, and sections. The Florida Statutes are updated annually by laws that create, amend, or repeal statutory material.

Floridan aquifer system (FAS) A highly used aquifer system composed of the Upper Floridan and Lower Floridan aquifers. It is the principal source of water supply north of Lake Okeechobee, and the Upper Floridan aquifer is used for drinking water supply in parts of Martin and St. Lucie counties. From Jupiter to south Miami, water from the Floridan aquifer system is mineralized (total dissolved solids are greater than 1,000 mg/L) along coastal areas and in south Florida.

Flow The actual amount of water flowing by a particular point over some specified time. In the context of water supply, flow represents the amount of water being treated, moved, or reused. Flow is frequently expressed in millions of gallons per day (MGD).

Flow meter An instrument, when properly installed and calibrated, that is used for the accurate measurement of water flow through a closed pipe.

Flow rate The rate at which water moves by a given point; in rivers it is usually measured in cubic meters per second (m^3/sec) or cubic feet per second (cfs).

Flow regime Seasonal variation in river runoff response usually expressed as monthly mean flow.

Fresh water An aqueous solution with a chloride concentration less than or equal to 250 milligrams per liter (mg/L).

Geologic unit A geologic unit is a volume of rock or ice of identifiable origin and age range that is defined by the distinctive and dominant, easily mapped and recognizable petrographic, lithologic, or paleontologic features that characterize it.

Geographic information systems (GIS) The abstract representation of natural (or cultural) features of a landscape into a digital database, geographic information system.

Governing Board Governing Board of the South Florida Water Management District.

Gross water demand or raw water demand is the amount of water withdrawn from the water resource to meet a particular need of a water user or customer. Gross demand is the amount of water allocated in a consumptive use permit. Gross or raw water demands are nearly always higher than net or user/customer water demands.

Groundwater Water beneath the surface of the ground, whether or not flowing through known and definite channels. Specifically, that part of the subsurface water in the saturated zone, where the water is under pressure greater than the atmosphere.

Groundwater heads Elevation of water table.

Groundwater recharge (see *Recharge*)

Harm As defined in Chapter 40E-8, F.A.C., the temporary loss of water resource functions that results from a change in surface or groundwater hydrology and takes a period of one to two years of average rainfall conditions to recover.

Headwater(s) 1) Water that is typically of higher elevation (with respect to tailwater) or on the controlled side of a structure. 2) The waters at the highest upstream point of a natural system that are considered the major source waters of the system.

Hydrogeologic unit Any rock unit or zone that because of its hydraulic properties has a distinct influence on the storage or movement of groundwater.

Hydrogeology The geology of groundwater, with particular emphasis on the chemistry and movement of water.

Hydrologic condition The state of an area pertaining to the amount and form of water present.

Hydrologic model A conceptual or physically based procedure for numerically simulating a process or processes that occur in a watershed.

Hydrology The scientific study of the properties, distribution, and effects of water on the earth's surface, in the soil and underlying rocks, and in the atmosphere.

Hydrostratigraphic unit Bodies of rock with considerable lateral extent that act as a reasonably distinct hydrologic system.

Hydrostratigraphy A geologic framework consisting of a body or rock having considerable lateral extent and composing a reasonably distinct hydrologic system.

Impermeable Solid material, such as rock or clay that does not allow water to pass through.

Impoundment Any lake, reservoir, or other containment of surface water occupying a depression or bed in the earth's surface and having a discernible shoreline.

Indian River Lagoon (IRL) Extending for 156 miles from north of Cape Canaveral to Stuart along the east coast of Florida, this lagoon is one of America's most diverse estuaries, home to thousands of plant and animal species.

Industrial/Commercial/Institutional Self-Supply Water used by industrial, commercial, or institutional operations withdrawing a minimum water quantity of 100,000 gallons per day from individual, on-site wells.

Infiltration The movement of water through the soil surface into the soil under the forces of gravity and capillarity.

Inflow 1) The act or process of flowing in or into. 2) The measured quantity of water that has moved into a specific location.

Initial condition The water level, water quality, and flow vectors used as the starting point for all simulations in the East Coast Floridan Model. For this 2016 Upper East Coast Water Supply Plan, the data for each model cell were extracted from the final month of the calibration run, which simulated a 24-year period from 1989 to 2012. The individual cell results from the 288th month of calibration represent the model's calculation of conditions for December 2012.

Injection well Refers to a well constructed to inject treated wastewater directly into the ground. Wastewater is generally forced (pumped) into the well for dispersal or storage in a designated aquifer. Injection wells are generally drilled below freshwater levels, or into unused aquifers or aquifers that do not deliver drinking water.

Institute of Food and Agricultural Sciences (IFAS) Agricultural branch of the University of Florida that performs research, education, and extension.

Intermediate aquifer system (IAS) This aquifer system consists of five zones of alternating confining and producing units. The producing zones include the Sandstone and Mid-Hawthorn aquifers.

Intrusion (see *Saline water or saltwater intrusion*)

Irrigation The application of water to crops and other plants by artificial means.

Irrigation audit A procedure in which an irrigation systems application rate and uniformity are measured.

Irrigation efficiency The average percent of total water pumped or delivered for use that is delivered to the root zone of a plant.

Irrigation system efficiency A measure of the effectiveness of an irrigation system in delivering water to a crop for irrigation and freeze protection purposes. It is expressed as the ratio of the volume of water used for supplemental crop evapotranspiration to the volume pumped or delivered for use.

Irrigation water use A water use classification, which incorporates all uses of water for supplemental irrigation purposes, including golf, nursery, agriculture, recreation, and landscape.

Lagoon A body of water separated from the ocean by barrier islands, with limited exchange with the ocean through inlets, and having no connections to a major river or estuary.

Lake Okeechobee Located in central Florida, the lake, at 730 square miles, is the second-largest freshwater lake wholly within the United States and the largest freshwater lake in Florida.

Landscape irrigation The outside watering of shrubbery, trees, lawns, grass, ground covers, vines, gardens, and other such flora, not intended for resale, which are planted and are situated in such diverse locations as residential and recreational areas, cemeteries, public, commercial and industrial establishments, and public medians and rights of way.

Leakance The vertical movement of water from one aquifer to another across a confining zone or zones due to differences in hydraulic head. Movement may be upward or downward depending on hydraulic head potential in source aquifer and receiving aquifer. This variable is typically expressed in units of gallons per day per cubic foot.

Leak detection Systematic method to survey the distribution system and pinpoint the exact locations of hidden underground leaks.

Levee An embankment to prevent flooding or a continuous dike or ridge for confining the irrigation areas of land to be flooded.

Level of Certainty A water supply planning goal to assure at least a 90 percent probability during any given year that all the needs of reasonable-beneficial water uses will be met, while sustaining water resources and related natural systems during a 1-in-10 year drought event.

Marsh A frequently or continually inundated unforested wetland characterized by emergent herbaceous vegetation adapted to saturated soil conditions.

Maximum daily allocation The maximum quantity permitted to be withdrawn in any single 24-hour period.

Maximum monthly allocation The maximum quantity of water assigned to the permit to be withdrawn during the month in the growing season when the largest supplemental crop requirement is needed by the specific crop for which the allocation is permitted.

Mean Sea Level 1) The level of the surface of the sea between mean high and mean low tide; used as a reference point for measuring elevations. 2) The average height of the sea for all stages of the tide over a 19-year period, usually determined from hourly height observations on an open coast or in adjacent waters having free access to the sea. 3) (FEMA) For purposes of the National Flood Insurance Program (NFIP), the National Geodetic Vertical Datum (NGVD) of 1929 or other datum, to which base flood elevations shown on a community's Flood Insurance Rate Map (FIRM) are referenced.

Metric A specific variable used to quantify and serve as an indicator of the condition or state of an attribute. For example, for an attribute called largemouth bass, the relative abundance of largemouth bass may be one of several metrics chosen for measurement.

Microfiltration A membrane separation process in which particles greater than approximately 20 nanometers in diameter are screened out of a liquid in which they are suspended.

Micro-irrigation The application of small quantities of water on or below the soil surface as drops or tiny streams of spray through emitters or applicators placed along a water delivery line. Micro-irrigation includes a number of methods or concepts, such as bubbler, drip, trickle, mist or microspray, and subsurface irrigation.

Million gallons per day (MGD) A rate of flow of water equal to 133,680.56 cubic feet per day, or 1.5472 cubic feet per second, or 3.0689 acre-feet per day. A flow of one million gallons per day for one year equals 1,120 acre-feet (365 million gallons). To hold one million gallons of water, a swimming pool approximately 267 feet long (almost as long as a football field), 50 feet wide, and 10 feet deep would be needed.

Minimum Flow and Level (MFL) A flow established by the District pursuant to Sections 373.042 and 373.0421, F.S., for a given water body, at which further withdrawals would be significantly harmful to the water resources or ecology of the area.

Mobile Irrigation Laboratory (MIL) A vehicle furnished with irrigation evaluation equipment, which is used to carry out on-site evaluations of irrigation systems and to provide recommendations on improving irrigation efficiency.

Model A computer model is a representation of a system and its operations, and provides a cost-effective way to evaluate future system changes, summarize data, and help understand interactions in complex systems. Hydrologic models are used for evaluating, planning, and simulating the implementation of operations within the SFWMD's water management system under different climatic and hydrologic conditions. Water quality and ecological models are also used to evaluate other processes vital to the health of ecosystems.

MODFLOW A modular, three-dimensional, finite-difference groundwater modeling code created by the U.S. Geological Survey, which is used to simulate the flow of groundwater through aquifers. The SFWMD uses it for subregional groundwater modeling.

Monitor well Any human-made excavation by any method to monitor fluctuations in groundwater levels, quality of underground waters, or the concentration of contaminants in underground waters.

Monthly average daily flow The total volume of wastewater flowing into a wastewater facility during a calendar month, divided by the number of days in that month and expressed in units of MGD.

Monthly average flow The total volume of wastewater flowing into a wastewater facility during a calendar month, and expressed in units of MGD.

National Geodetic Vertical Datum (NGVD) 1929 A geodetic datum derived from a network of information collected in the United States and Canada. It was formerly called the "Sea Level Datum of 1929" or "mean sea level." Although the datum was derived from the average sea level over a period of many years at 26 tide stations along the Atlantic, Gulf of Mexico, and Pacific coasts, it does not necessarily represent local mean sea level at any particular place.

Natural system A self-sustaining living system that supports an interdependent network of aquatic, wetland-dependent, and upland living resources.

Net rainfall The portion of rainfall that reaches a stream channel or the concentration point as direct surface flow.

Net water demands The water demands of the end user, after accounting for treatment and process losses and inefficiencies (e.g., irrigation inefficiency). When discussing public water supply, the term "finished water demand" is commonly used.

North American Vertical Datum (NAVD) of 1988 The official civilian vertical control datum (reference for elevation data) for surveying and mapping activities in the United States.

Nutrient loading Discharging of nutrients from the watershed (basin) into a receiving water body (lake, stream, wetland); expressed usually as mass per unit area per unit time (kg/ha/yr or lb/ac/yr).

Nutrients Organic or inorganic compounds essential for the survival of an organism. In aquatic environments, nitrogen and phosphorus are important nutrients that affect the growth rate of plants.

Outflow 1) The act or process of flowing out of. 2) The measured quantity of water that has left an area or water body during a certain period of time.

Outlet An opening through which water can be freely discharged from a reservoir.

Overhead sprinkler irrigation A pressurized system, where water is applied through a variety of outlet sprinkler heads or nozzles. Pressure is used to spread water droplets above the crop canopy to simulate rainfall.

Peak flow The maximum instantaneous discharge of a stream or river at a given location. Peak flow usually occurs at or near the time of maximum stage.

Per capita use (1) The average amount of water used per person during a standard time period, generally per day. (2) Total use divided by the total population served.

Performance measure Scientifically measurable indicator or condition that can be used as a target for meeting water resource management goals. Performance measures quantify how well or how poorly an alternative meets a specific objective. Good performance measures are quantifiable, have a specific target, indicate when a target has been reached, and measure the degree to which the goal has been met.

Permeability The capacity of a porous rock, sediment, or soil for transmitting a fluid.

Planning Area The SFWMD is divided into four areas within which planning activities are focused: Kissimmee Basin (KB), Upper East Coast (UEC), Lower West Coast (LWC), and Lower East Coast (LEC).

Potable water Water that is suitable for drinking, culinary, or domestic purposes.

Potentiometric head The level to which water will rise when a well is pierced in a confined aquifer.

Potentiometric surface A surface that represents the hydraulic head in an aquifer and is defined by the level to which water will rise above a datum plane in wells that penetrate the aquifer.

Power Generation Self-Supply The difference in the amount of water withdrawn by electric power generating facilities for cooling purposes and the water returned to the hydrologic system near the point of withdrawal.

Primary wastewater treatment The first stage of the wastewater-treatment process where mechanical methods, such as filters and scrapers, are used to remove pollutants. Solid material in sewage also settles out in this process.

Priority Water Bodies List and Schedule Section 373.042(2), Florida Statutes, requires each of the five water management districts to provide the Florida Department of Environmental Protection with an annual list and schedule of specific lakes and rivers with minimum flows and levels and water reservation rules that will be adopted to protect them from the effects of consumptive use allocations.

Process water Water used for nonpotable industrial usage, e.g., mixing cement.

Public Water Supply (PWS) Water supplied by water treatment facilities for potable use (drinking quality) with projected average pumpages greater than 0.1 million gallons per day.

Public Water Supply (PWS) Demand All potable (drinking quality) water supplied by water treatment facilities with projected average pumpages greater than 100,000 gallons per day to all types of customers, not just residential.

Rapid infiltration basin (RIB) A wastewater treatment method by which wastewater is applied in deep and permeable deposits of highly porous soils for percolation through deep and highly porous soil.

Raw water (1) Water that is direct from the source—groundwater or surface water—without any treatment. (2) Untreated water, usually that entering the first unit of a water treatment facility. Contrast with *Finished Water*.

Raw water demand The amount of water that must be withdrawn from the groundwater or surface water system to meet a particular need. Withdrawal demands are nearly always higher than User/Customer Demands because of inherent treatment and process losses, and inefficiencies associated with delivering water from the source to the end user.

Reasonable-beneficial use Use of water in such quantity as is needed for economic and efficient use for a purpose, which is both reasonable and consistent with the public interest.

Recharge (canal) The discharge of highly treated wastewater or reclaimed water into canals or surface water bodies for beneficial recharge of groundwater or downstream augmentation.

Recharge (groundwater) The natural or intentional infiltration of surface water into the ground to raise groundwater levels.

Recharge (hydrologic) The downward movement of water through soil to groundwater; the process by which water is added to the zone of saturation; or the introduction of surface water or groundwater to groundwater storage, such as an aquifer. Recharge or replenishment of groundwater supplies consists of three types:

1) Natural Recharge, which consists of precipitation or other natural surface flows making their way into groundwater supplies.

2) Artificial or Induced Recharge, which includes actions by man specifically designed to increase supplies in groundwater reservoirs through various methods, such as water spreading (flooding), ditches and pumping techniques.

3) Incidental Recharge, which consists of actions, such as irrigation and water diversion, which add to groundwater supplies, but are intended for other purposes. Recharge may also refer to the amount of water so added.

Recharge area (groundwater) The land area over which precipitation infiltrates into soil and percolates downward to replenish an aquifer; the area in which water reaches the zone of saturation by surface infiltration. Infiltration moves downward into the deeper parts of an aquifer in a recharge area. Also referred to as a recharge zone.

Reclaimed water Water that has received at least secondary treatment and basic disinfection and is reused after flowing out of a domestic wastewater treatment facility (Rule 62-610.200, F.A.C.)

RECOVER Stands for Restoration, Coordination and Verification. RECOVER is an interagency, interdisciplinary team designed to comprehensively monitor, assess and coordinate CERP activities relative to CERP goals.

Recovery The rate and extent of return of a population or community to some aspect(s) of its previous condition. Because of the dynamic nature of ecological systems, the attributes of a "recovered" system should be carefully defined.

Recreational/Landscape Self-Supply Water used for landscape and golf course irrigation. The landscape subcategory includes water used for parks, cemeteries, and other irrigation applications greater than 0.1 million gallons per day (MGD). The golf course subcategory includes those operations not supplied by a Public Water Supply or regional reuse facility.

Regional Simulation Model A regional hydrologic model developed principally for application in South Florida. It is developed on a sound conceptual and mathematical framework that allows it to be applied generically to a wide range of hydrologic situations. It simulates the coupled movement and distribution of groundwater and surface water throughout the model domain using a hydrologic simulation engine to simulate the natural hydrology and a management simulation engine to provide a wide range of operational capability.

Regional Water Supply Plan Detailed water supply plan developed by the District under Section 373.709, F.S., providing an evaluation of available water supply and projected demands, at the regional scale. The planning process projects future demand for 20 years and recommends projects to meet identified needs.

Reservoir An artificial or natural water body used for water storage. Reservoirs can be above- or below-ground.

Resource efficiency The efficient use of water as measured in terms of the net impact on the relevant water storage system. A relevant water storage system will include the surface water and groundwater bodies that are determined by the District to provide storage, using the factors stated in Section 2.3.3.2 of the Basis of Review.

Restoration The recovery of a natural system's vitality and biological and hydrological integrity to the extent that the health and ecological functions are self-sustaining over time.

Restricted Allocation Area Area designated within the District for which allocation restrictions are applied regarding the use of specific sources of water. The water resources in these areas are managed in response to specific sources of water in the area for which there is a lack of water availability to meet the projected needs of the region from that specific source of water.

Retention The prevention of stormwater runoff from direct discharge into receiving waters; included as examples are systems that discharge through percolation, exfiltration, filtered bleed-down, and evaporation processes.

Retrofit (1) Indoor: The replacement of existing water fixtures, appliances, and devices with more efficient fixtures, appliances, and devices for the purpose of water conservation. (2) Outdoor: The replacement or changing out of an existing irrigation system with a different irrigation system, such as a conversion from an overhead sprinkler system to a micro-irrigation system (Basis of Review, SFWMD 2010a).

Return flow (1) The part of a diverted flow that is not consumptively used and returned to its original source or another body of water. (2) Irrigation water that is applied to an area that which is not consumed in evaporation or transpiration and returns to a surface stream or aquifer.

Reuse The deliberate application of reclaimed water for a beneficial purpose. Criteria used to classify projects as "reuse" or "effluent disposal" are contained in Rule 62-610.810, F.A.C. The term "reuse" is synonymous with "water reuse."

Reverse osmosis (RO) A membrane process for desalting water using applied pressure to drive the feedwater (source water) through a semipermeable membrane.

Rule Of or pertaining to the District's regulatory programs, which are set forth in various rules and criteria.

Runoff That component of rainfall, which is not absorbed by soil, intercepted and stored by surface water bodies, evaporated to the atmosphere, transpired and stored by plants, or infiltrated to groundwater, but which flows to a watercourse as surface water flow.

Saline water An aqueous solution with a chloride concentration greater than 250 mg/L and less than that of seawater.

Saline water interface or saltwater interface The hypothetical surface of chloride concentration between fresh water and seawater where the chloride concentration is 250 mg/L at each point on the surface.

Saline water intrusion or saltwater intrusion The invasion of a body of fresh water by a body of salt water due to its greater density. It can occur either in surface water or groundwater bodies. The term is applied to the flooding of freshwater marshes by seawater, the upward migration of seawater into rivers and navigation channels, and the movement of seawater into freshwater aquifers along coastal regions.

Salinity Of or relating to chemical salts usually measured in "parts per thousand" (ppm), milligrams per lit (mg/L), or practical salinity units.

Salt water (see *Seawater or salt water*)

SEAWAT A program developed to simulate three-dimensional, variable-density, transient groundwater flow in porous media. The source code for SEAWAT was developed by combining MODFLOW and MT3DMS into a single program that solves the coupled flow and solute-transport equations.

Seawater or **Salt water** Water with a chloride concentration at or above 19,000 mg/L.

Secondary wastewater treatment Treatment that follows primary wastewater treatment. It involves the biological process of reducing suspended, colloidal, and dissolved organic matter in effluent from primary treatment systems, which generally removes 80 to 95 percent of the oxygen-demanding substances and suspended matter. Secondary wastewater treatment may be accomplished by biological or chemical-physical methods. Activated sludge and trickling filters are two of the most common means of secondary treatment. Treatment is accomplished by bringing together waste, bacteria, and oxygen in trickling filters or in the activated sludge process. Disinfection is the final stage of secondary treatment.

Sedimentation (1) The action or process of forming or depositing sediment. (2) The removal, transport, and deposition of detached soil particles by flowing water or wind. Accumulated organic and inorganic matter on the lake bottom. Sediment includes decaying algae and weeds, precipitated calcium carbonate (marl), and soil and organic matter eroded from the lake's watershed.

Seepage The passage of water or other fluid through a porous medium, such as the passage of water through an earth embankment or masonry wall. Groundwater emerging on the face of a stream bank; the slow movement of water through small cracks, pores, Interstices, etc., of a material into or out of a body of surface or subsurface water. The Interstitial movement of water that may take place through a dam, its foundation or its abutments. The loss of water by infiltration into the soil from a canal, ditches, laterals, watercourse, reservoir, storage facilities, or other body of water, or from a field. Seepage is generally expressed as flow volume per unit of time. During the process of priming (a field during initial irrigation), the loss is called Absorption Loss.

Seepage irrigation Irrigation that conveys water through open ditches. Water is either applied to the soil surface (possibly in furrows) and held for a period of time to allow infiltration, or is applied to the soil subsurface by raising the water table to wet the root zone.

Seepage irrigation system A means to artificially supply water for plant growth that relies primarily on gravity to move the water over and through the soil, and does not rely on emitters, sprinklers, or any other type of device to deliver water to the vicinity of expected plant use.

Self-supply The water used to satisfy a water need, not supplied by a public water supply utility.

Semi-confined aquifer A completely saturated aquifer that is bounded above by a semi-pervious layer, which has a low, though measurable permeability, and below by a layer that is either impervious or semi-pervious.

Sensitivity analysis An analysis of alternative results based on variations in assumptions (a “what if” analysis).

Serious harm As defined in Chapter 40E-8, F.A.C., the long-term, irreversible, or permanent loss of water resource functions resulting from a change in surface water or groundwater hydrology.

Service Area The geographical region in which a water supplier has the ability and the legal right to distribute water for use.

Significant harm As defined in Chapter 40E-8, F.A.C., the temporary loss of water resource functions, which result from a change in surface water or groundwater hydrology, that takes more than two years to recover, but which is considered less severe than serious harm.

Storm water Water that does not infiltrate, but accumulates on land as a result of storm runoff, snowmelt runoff, irrigation runoff, or drainage from areas, such as roads and roofs.

Stormwater discharge Precipitation and snowmelt runoff from roadways, parking lots, roof drains that is collected in gutters and drains; a major source of nonpoint source pollution to water bodies and a challenge to sewage treatment facilities in municipalities where the storm water is combined with the flow of domestic wastewater (sewage) before entering the wastewater treatment facility.

Stormwater Treatment Area (STA) A system of constructed water quality treatment wetlands that use natural biological processes to reduce levels of nutrients and pollutants from surface water runoff.

Substrate (1) The substances used for food by microorganisms in liquid suspension, as in wastewater treatment. (2) The physical surface upon which an organism lives; the natural or artificial surface upon which an organism grows or to which it is attached. (3) The layer of material beneath the surface soil.

Surface water Water above the soil or substrate surface, whether contained in bounds, created naturally or artificially, or diffused.

Surficial aquifer system (SAS) Often the principal source of water for urban uses within certain areas of south Florida. This aquifer is unconfined, consisting of varying amounts of limestone and sediments that extend from the land surface to the top of an intermediate confining unit.

Tailwater that is typically of lower elevation or on the discharge side of the structure.

Time series A statistical process analogous to the taking of data at intervals of time.

Treatment facility Any plant or other works used for the purpose of treating, stabilizing, or holding wastewater.

Tributary A stream that flows into a larger stream or other body of water.

Turbidity The measure of water clarity caused by suspended material in a liquid.

Unconfined aquifer A permeable geologic unit or units only partly filled with water and overlying a relatively impervious layer. Its upper boundary is formed by a free water table or phreatic surface under atmospheric pressure. Also referred to as water table aquifer.

Upconing Upward migration of mineralized or saline water as a result of a pressure variation caused by withdrawals.

U.S. Army Corps of Engineers (USACE) As part of the Department of the Army, the Corps has responsibilities in civil and military areas. In civil works, the USACE has authority for approval of dredge and fill permits in navigable waters and tributaries thereof; the USACE enforces wetlands regulations, and constructs and operates a variety of water resources projects, mostly notably levee, dams, and locks.

U.S. Fish and Wildlife Service (USFWS) The USFWS is a bureau within the Department of the Interior. Its mission is to work with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people.

U.S. Geological Survey (USGS) The Federal Agency chartered in 1879 by Congress to classify public lands, and to examine the geologic structure, mineral resources, and products of the national domain. As part of its mission, the USGS provides information and data on the nation's rivers and streams that are useful for mitigation of hazards associated with floods and droughts.

User/Customer Demand (see *Net water demand*)

Use of reclaimed water (see *Reuse*)

Utilities of Concern Utilities that have wellfields near the saltwater interface, which have a western wellfield, and/or an alternative source that is not threatened by saltwater intrusion.

Utilities at Risk Utilities with wellfields near the saltwater interface that do not have a western wellfield, have not developed alternative sources of water, and have limited ability to meet user needs through interconnects with other utilities.

Utility Any legal entity responsible for supplying potable water for a defined service area.

Violation (MFL) As defined in Rule 40E-8.021(18), F.A.C., to fall below an adopted minimum flow or level criterion for a duration and frequency greater than specified for the MFL water body. Unless otherwise specified herein, in determining the frequency with which water flows and levels fall below an established MFL for purposes of determining an MFL violation, a "year" mans 365 days from the last day of the previous MFL exceedance.

Valued ecosystem component (VEC) Any part of the environment that is considered important by the proponent, public, scientists or government involved in the assessment process. For the purpose of SFWMD studies, the VEC approach is based on the concept that management goals for the natural system can best be achieved by providing suitable environmental conditions that will support certain key species, or key groups of species, that inhabit the natural system.

Wastewater The combination of liquid and water-carried pollutants from residences, commercial buildings, industrial plants and institutions together with any groundwater, surface runoff, or leachate that may be present.

Water budget An accounting of total water use or projected water use for a given location or activity.

Water conservation The permanent, long-term reduction of daily water use. Permanent water use reduction requires the implementation of water saving technologies and measures that reduce water use while satisfying consumer needs. Water conservation is considered a water source option because it reduces the need for future expansion of the water supply infrastructure (see *Demand management*).

Water Conservation Areas (WCAs) Part of the original Everglades ecosystem that is now diked and hydrologically controlled for flood control and water supply purposes. These are located in the western portions of Miami-Dade, Broward and Palm Beach counties, and preserve over 1,350 square miles, or about 50 percent of the original Everglades.

Water conservation rate structure A water rate structure designed to conserve water. Examples of conservation rate structures include, but are not limited to, increasing block rates, seasonal rates, and quantity-based surcharges.

Water management The general application of practices to obtain added benefits from precipitation, water or water flow in any of a number of areas, such as irrigation, drainage, wildlife and recreation, water supply, watershed management, and water storage in soil for crop production. Watershed management is the analysis, protection, development, operation, or maintenance of the land, vegetation, and water resources of a drainage basin for the conservation of all its resources for the benefit of its residents. Watershed management for water production is concerned with the quality, quantity and timing of the water which is produced.

Water quality (1) A term used to describe the chemical, physical, and biological characteristics of water, usually in respect to its suitability for a particular purpose. (2) The physical, chemical, and biological condition of water as applied to a specific use. Federal and state guidelines set water quality standards based on the water's intended use, which is, whether it is for recreation, fishing, drinking, navigation, shellfish harvesting, or agriculture.

Water Reservation A water reservation is a legal mechanism to set aside water for the protection of fish and wildlife or the public health and safety from consumptive water use. The reservation is composed of a quantification of the water to be protected, which includes a seasonal and a location component.

Water Resources Advisory Commission (WRAC) The SFWMD Water Resources Advisory Commission serves as an advisory body to the Governing Board. The WRAC is the primary forum for conducting workshops, presenting information, and receiving public input on water resource issues affecting central and south Florida.

Water resource development The formulation and implementation of regional water resource management strategies, including the collection and evaluation of surface water and groundwater data; structural and nonstructural programs to protect and manage the water resources; the development of regional water resource implementation programs; the construction, operation and maintenance of major public works facilities to provide for flood control, surface and groundwater storage, and groundwater recharge augmentation; and, related technical assistance to local governments and to government-owned and privately owned water utilities (Section 373.019, F.S.).

Water reuse (see *Reuse*)

Watershed A region or area bounded peripherally by a water parting and draining ultimately to a particular watercourse or body of water. Watersheds conform to federal hydrologic unit code (HUC) standards and can be divided into sub-watershed and further divided into catchments, the smallest water management unit recognized by SFWMD Operations. Unlike Drainage Basins, which are defined by Rule, watersheds are continuously evolving as the drainage network evolves.

Water Shortage Plan This effort includes provisions in Chapters 40E-21 and 40E-22, F.A.C., and identifies how water supplies are allocated to users during declared water shortages. The plan allows for supply allotments and cutbacks to be identified on a weekly basis based on the water level within the lake, demands, time of year and rainfall forecasts.

Water supply development The planning, design, construction, operation and maintenance of public or private facilities for water collection, production, treatment, transmission or distribution for sale, resale, or end use. (Section 373.019, F.S.)

Water Supply Plan (see *Regional Water Supply Plan*)

Water table The surface of a body of unconfined groundwater at which the pressure is equal to that of the atmosphere; defined by the level where water within an unconfined aquifer stands in a well.

Water use Any use of water that reduces the supply from which it is withdrawn or diverted.

Water Use Permitting The issuance of permits by the South Florida Water Management District, under the authority of Chapter 40E-2, F.A.C., allowing withdrawal of water for consumptive use.

Wellfield One or more wells producing water from a subsurface source. A tract of land that contains a number of wells for supplying a large municipality or irrigation district.

Wetland An area that is inundated or saturated by surface water or groundwater with vegetation adapted for life under those soil conditions (e.g., swamps, bogs, and marshes).

Wild and Scenic River A river as designated under the authority of the of Public Law 90-542, the *Wild and Scenic Rivers Act,* as amended, is a means to preserve selected free-flowing rivers in their natural condition and protect the water quality of such rivers. A portion of the Northwest Fork of the Loxahatchee River was federally designated as the first Wild and Scenic River in Florida on May 17, 1985.

Withdrawal Water removed from a ground- or surface-water source for use.

Withdrawal demand (see *Raw water demand*)

Yield The quantity of water (expressed as rate of flow or total quantity per year) that can be collected for a given use from surface or groundwater sources.

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Meeting South Florida's water supply needs
while safeguarding its natural systems requires
innovative solutions, cohesive planning,
and a shared vision.

South Florida Water Management District

Committed to managing and protecting our region's water resources

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